U.S. Fish & Wildlife Service

Monomoy National Wildlife Refuge

Comprehensive Conservation Plan

Appendixes

March 2016

Front and back covers:
Sunset at Monomoy National Wildlife Refuge
USFWS

Appendixes

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Appendix A

Sarah Tanedo/USFWS

Common tern with chicks

Animal Species Known or Suspected on Monomoy National Wildlife Refuge

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Table A.1. Fish Species Known or Suspected at Monomoy National Wildlife Refuge (NWR).

Common Name	Scientific Name	Federal Status[1]	MA Legal Status[1]	Global Rarity Rank[2]	MA Rarity Rank[3]	NOAA Fisheries Listing[4]	AFS Status[5]	Spring Occurrence (%)[6]	Fall Occurrence (%)[6]	NALCC Rep. Species[15]
Lampreys – Petromyzontidae										
Sea Lamprey	*Petromyzon marinus*	-	-	G5	S4	-	-	0.2	0.0	-
Sand Tigers – Odontaspididae										
Sand Tiger Shark	*Carcharias taurus*	-	-	-	-	S	V	0.0	0.5	-
Mackerl Sharks – Lamnidae										
White Shark	*Carcharodon carcharias*		-		-	-	V	-	-	-
Requim Sharks - Charcharhinidae										
Smooth Dogfish	*Mustelus canis*	-	-	-	-	-	-	15.1	71.5	-
Dogfishes – Squalidae										
Spiny Dogfish	*Squalus acanthias*	-	-	-	-	-	-	7.5	3.4	-
Skates – Rajidae										
Thorny Skate	*Amblyraja radiata*	-	-	-	-	S	V	0.3	0.0	-
Little Skate	*Leucoraja erinacea*	-	-	-	-	-	-	78.6	61.5	-
Winter Skate	*Leucoraja ocellata*	-	-	-	-	-	-	60.9	46.5	-
Clearnose Skate	*Raja eglanteria*	-	-	-	-	-	-	0.0	0.2	-
Stingrays – Dasyatidae										
Roughtail Stingray	*Dasyatis centroura*	-	-	-	-	-	-	0.0	1.4	-
Freshwater Eels – Anguillidae										
American Eel	*Anguilla rostrata*	-	-	G5	S5	-	-	0.2	0.2	-
Congers – Congridae										
Conger Eel	*Conger oceanicus*	-	-	-	-	-	-	0.0	0.3	-
Herrings – Clupeidae										
Blueback Herring	*Alosa aestivalis*	-	-	G5	S4	S	-	2.0	0.9	-
Alewife	*Alosa pseudoharengus*	-	-	G5	SNR	S	-	12.3	1.0	-
American Shad	*Alosa sapidissima*	-	-	G5	S3	-	-	4.5	0.0	-

Common Name	Scientific Name	Federal Status[1]	MA Legal Status[1]	Global Rarity Rank[2]	MA Rarity Rank[3]	NOAA Fisheries Listing[4]	AFS Status[5]	Spring Occurrence (%)[6]	Fall Occurrence (%)[6]	NALCC Rep. Species[15]
Atlantic Menhaden	*Brevoortia tyrannus*	-	-	-	-	-	-	1.0	1.9	-
Atlantic Herring	*Clupea harengus*	-	-	-	-	-	-	9.5	2.4	-
Tunas – Scombridae										
*Atlantic Bluefin Tuna	*Thunnus thynnus*	-	-	-	-	-	-	NA	NA	-
Anchovies – Engraulidae										
Striped Anchovy	*Anchoa hepsetus*	-	-	-	-	-	-	0.0	8.9	-
Bay Anchovy	*Anchoa mitchilli*	-	-	-	-	-	-	0.7	9.4	-
Smelts – Osmeridae										
Rainbow Smelt	*Osmerus mordax*	-	-	-	-	S	-	0.2	0.2	-
Lizardfishes – Synodontidae										
Inshore Lizardfish	*Synodus foetens*	-	-	-	-	-	-	0.0	2.9	-
Lizardfish unclassified	*Synodontidae* spp.	-	-	-	-	-	-	0.0	0.5	-
Snakefish	*Trachinocephalus myops*	-	-	-	-	-	-	0.0	1.0	-
Toadfishes – Batrachoididae										
Oyster Toadfish	*Opsanus tau*	-	-	-	-	-	-	0.2	0.2	-
Goosefishes – Lophiidae										
Goosefish	*Lophius americanus*	-	-	-	-	-	-	0.2	0.0	-
Wolffish –Anarhichadidae										
*Atlantic Wolffish	*Anarhichas lupus*	-	-	-	-	-	-	NA	NA	-
Cods – Gadidae										
Fourbeard Rockling	*Enchelyopus cimbrius*	-	-	-	-	-	-	0.2	0.3	-
Atlantic Cod	*Gadus morhua*	-	-	-	-	-	V	53.4	0.2	-
Haddock	*Melanogrammus aeglefinus*	-	-	-	-	-	-	0.3	0.0	-
Silver Hake	*Merluccius bilinearis*	-	-	-	-	-	-	11.3	4.3	-
Atlantic Tomcod	*Microgadus tomcod*	-	-	-	-	-	-	0.2	0.0	-
Pollock	*Pollachius virens*	-	-	-	-	-	-	13.9	0.0	-

Common Name	Scientific Name	Federal Status[1]	MA Legal Status[1]	Global Rarity Rank[2]	MA Rarity Rank[3]	NOAA Fisheries Listing[4]	AFS Status[5]	Spring Occurrence (%)[6]	Fall Occurrence (%)[6]	NALCC Rep. Species[15]
Red Hake	*Urophycis chuss*	-	-	-	-	-	-	13.8	2.9	-
Spotted Hake	*Urophycis regia*	-	-	-	-	-	-	5.6	1.2	-
White Hake	*Urophycis tenuis*	-	-	-	-	-	-	9.3	2.2	-
Halfbeaks – Exocoetidae										
Silverstripe Halfbeak	*Hyporhamphus unifasciatus*	-	-	-	-	-	-	NA	NA	-
Needlefishes – Belonidae										
Atlantic Needlefish	*Strongylura marina*	-	-	-	-	-	-	NA	NA	-
Sauries – Scomberesocidae										
Atlantic Saury	*Scomberesox saurus*	-	-	-	-	-	-	NA	NA	-
Killifishes – Cyprinodontidae										
Rainwater Killifish	*Lucania parva*	-	-	-	-	-	-	NA	NA	-
Striped Killifish	*Fundulus majalis*	-	-	-	-	-	-	NA	NA	-
Mummichog	*Fundulus heteroclitus*	-	-	-	-	-	-	NA	NA	-
Livebearers – Poeciliidae										
Mosquitofish	*Gambusia affinis*	-	-	-	-	-	-	NA	NA	-
Silversidees – Atherinidae										
Atlantic Silverside	*Menidia menidia*	-	-	-	-	-	-	0.3	0.0	-
Cornetfishes – Fistulariidae										
Red Cornetfish	*Fistularia petimba*	-	-	-	-	-	-	0.0	0.5	-
Bluespotted Cornetfish	*Fistularia tabacaria*	-	-	-	-	-	-	0.0	4.6	-
Pipefishes – Syngnathidae										
Northern Pipefish	*Syngnathus fuscus*	-	-	-	-	-	-	7.5	17.1	-
Temperate Basses – Percichthyidae										
White Perch	*Morone americana*	-	-	-	-	-	-	NA	NA	-
Striped Bass	*Morone saxatilis*	-	-	-	-	-	-	3.3	0.3	-

Common Name	Scientific Name	Federal Status[1]	MA Legal Status[1]	Global Rarity Rank[2]	MA Rarity Rank[3]	NOAA Fisheries Listing[4]	AFS Status[5]	Spring Occurrence (%)[6]	Fall Occurrence (%)[6]	NALCC Rep. Species[15]
Sea Basses – Serranidae										
Black Sea Bass	*Centropristis striata*	-	-	-	-	-	-	30.0	81.0	-
Rock Hind	*Epinephelus adscensionis*	-	-	-	-	-	-	0.0	0.2	-
Snowy Grouper	*Epinephelus niveatus*	-	-	-	-	-	V	0.0	0.7	-
Gag	*Mycteroperca microlepis*	-	-	-	-	-	-	0.0	0.2	-
Scamp	*Mycteroperca phenax*	-	-	-	-	-	-	0.0	0.3	-
Bigeyes – Piacanthidae										
Bigeye	*Priacanthus arenatus*	-	-	-	-	-	-	0.0	4.8	-
Glasseye Snapper	*Priacanthus cruentatus*	-	-	-	-	-	-	0.0	1.9	-
Short Bigeye	*Pristigenys alta*	-	-	-	-	-	-	0.0	1.7	-
Bluefishes – Pomatomidae										
Bluefish	*Pomatomus saltatrix*	-	-	-	-	-	-	0.8	22.9	-
Jacks – Carangidae										
African Pompano	*Alectis ciliaris*	-	-	-	-	-	-	0.0	0.3	-
Yellow Jack	*Caranx bartholomaei*	-	-	-	-	-	-	0.0	0.2	-
Blue Runner	*Caranx crysos*	-	-	-	-	-	-	0.0	1.5	-
Crevalle Jack	*Caranx hippos*	-	-	-	-	-	-	NA	NA	-
Mackerel Scad	*Decapterus macarellus*	-	-	-	-	-	-	0.0	14.5	-
Round Scad	*Decapterus punctatus*	-	-	-	-	-	-	0.0	1.2	-
Permit Jack	*Trachinotus falcatus*	-	-	-	-	-	-	NA	NA	-
Rough Scad	*Trachurus lathami*	-	-	-	-	-	-	0.0	2.1	-
Bigeye Scad	*Selar crumenophthalmus*	-	-	-	-	-	-	0.0	0.9	-
Atlantic Moonfish	*Selene setapinnis*	-	-	-	-	-	-	0.0	9.2	-
Lookdown	*Selene vomer*	-	-	-	-	-	-	0.0	0.3	-
Greater Amberjack	*Seriola dumerili*	-	-	-	-	-	-	NA	NA	-
Banded Rudderfish	*Seriola zonata*	-	-	-	-	-	-	0.0	0.3	-

Common Name	Scientific Name	Federal Status[1]	MA Legal Status[1]	Global Rarity Rank[2]	MA Rarity Rank[3]	NOAA Fisheries Listing[4]	AFS Status[5]	Spring Occurrence (%)[6]	Fall Occurrence (%)[6]	NALCC Rep. Species[15]
Porgies – Sparidae										
Scup	*Stenotomus chrysops*	-	-	-	-	-	-	47.9	99.7	-
Drums – Sciaenidae										
Weakfish	*Cynoscion regalis*	-	-	-	-	-	-	0.0	0.2	-
Spot	*Leiostomus xanthurus*	-	-	-	-	-	-	0.0	0.3	-
Northern Kingfish	*Menticirrhus saxatilis*	-	-	-	-	-	-	0.7	17.1	-
Goatfishes – Mullidae										
Red Goatfish	*Mullus auratus*	-	-	-	-	-	-	0.0	1.2	-
Dwarf Goatfish	*Upeneus parvus*	-	-	-	-	-	-	0.0	0.7	-
Butterflyfishes – Chaetodontidae										
Spotfin Butterflyfish	*Chaetodon ocellatus*	-	-	-	-	-	-	0.0	0.5	-
Wrasses – Labridae										
Tautog	*Tautog onitis*	-	-	-	-	-	-	26.2	15.9	-
Cunner	*Tautogolabrus adspersus*	-	-	-	-	-	-	16.4	10.6	-
Mullets – Mugilidae										
White Mullet	*Mugil curema*	-	-	-	-	-	-	NA	NA	-
Barracudas – Sphyraenidae										
Northern Sennet	*Sphyraena borealis*	-	-	-	-	-	-	0.0	0.9	-
Guaguanche	*Sphyraena guachancho*	-	-	-	-	-	-	0.0	0.9	-
Pricklebacks – Stichaeidae										
Snakeblenny	*Lumpenus lumpretaeformis*	-	-	-	-	-	-	0.2	0.0	-
Radiated Shanny	*Ulvaria subbifurcata*	-	-	-	-	-	-	NA	NA	-
Gunnels – Pholidae										
Rock Gunnel	*Pholis gunnellus*	-	-	-	-	-	-	11.4	2.7	-

Common Name	Scientific Name	Federal Status[1]	MA Legal Status[1]	Global Rarity Rank[2]	MA Rarity Rank[3]	NOAA Fisheries Listing[4]	AFS Status[5]	Spring Occurrence (%)[6]	Fall Occurrence (%)[6]	NALCC Rep. Species[15]
Eelpouts – Zoarcidae										
Ocean Pout	*Macrozoarces americanus*	-	-	-	-	-	-	0.7	0.0	-
Sand Lances – Ammodytidae										
Northern Sand Lance	*Ammodytes dubius*	-	-	-	-	-	-	13.8	3.4	-
Gobies – Gobiidae										
Naked Goby	*Gobiosoma bosci*	-	-	-	-	-	-	NA	NA	-
Seaboard Goby	*Gobiosoma ginsburgi*	-	-	-	-	-	-	NA	NA	-
Goby unclassified	*Gobiidae* spp.	-	-	-	-	-	-	0.0	0.2	-
Mackerels – Scombridae										
Atlantic Mackerel	*Scomber scombrus*	-	-	-	-	-	-	3.3	0.0	-
Butterfishes – Stromateidae										
Butterfish	*Peprilus triacanthus*	-	-	-	-	-	-	24.7	91.8	-
Searobins – Triglidae										
Northern Searobin	*Prionotus carolinus*	-	-	-	-	-	-	68.8	65.3	-
Striped Searobin	*Prionotus evolans*	-	-	-	-	-	-	7.1	18.8	-
Sculpins – Cottidae										
Sea Raven	*Hemitripterus americanus*	-	-	-	-	-	-	11.6	0.2	-
Grubby	*Myoxocephalus aenaeus*	-	-	-	-	-	-	2.5	0.9	-
Longhorn Sculpin	*Myoxocephalus octodecemspinosus*	-	-	-	-	-	-	27.9	0.3	-
Poachers – Agonidae										
Alligatorfish	*Aspidophoroides monopterygius*	-	-	-	-	-	-	0.2	0.0	-
Lumpfishes and Snailfishes – Cyclopteridae										
Lumpfish	*Cyclopterus lumpus*	-	-	-	-	-	-	0.7	0.0	-
Atlantic Seasnail	*Liparis atlanticus*	-	-	-	-	-	-	0.3	0.0	-
Flying Gurnards – Dactylopteridae										
Flying Gurnard	*Dactylopterus volitans*	-	-	-	-	-	-	0.0	0.7	-

Common Name	Scientific Name	Federal Status[1]	MA Legal Status[1]	Global Rarity Rank[2]	MA Rarity Rank[3]	NOAA Fisheries Listing[4]	AFS Status[5]	Spring Occurrence (%)[6]	Fall Occurrence (%)[6]	NALCC Rep. Species[15]
Lefteye Flounders – Bothidae										
Gulf Stream Flounder	*Citharichthys arctifrons*	-	-	-	-	-	-	2.0	5.8	-
Spotted Whiff	*Citharichthys macrops*	-	-	-	-	-	-	NA	NA	-
Smallmouth Flounder	*Etropus microstomus*	-	-	-	-	-	-	8.3	30.4	-
Summer Flounder	*Paralichthys dentatus*	-	-	-	-	-	-	55.4	64.6	-
Fourspot Flounder	*Paralichthys oblongus*	-	-	-	-	-	-	12.8	8.0	-
Windowpane	*Scophthalmus aquosus*	-	-	-	-	-	-	79.6	32.8	-
Righteye Flounders – Pleuronectidae										
Yellowtail Flounder	*Pleuronectes ferruginea*	-	-	-	-	-	-	2.7	0.0	-
Winter Flounder	*Pseudopleuronectes America*	-	-	-	-	-	-	87.9	23.8	-
Soles – Soleidae										
Hogchoker	*Trinectes maculatus*	-	-	-	-	-	-	0.0	0.2	-
Leatherjackets – Balistidae										
Orange Filefish	*Aluterus schoepfi*	-	-	-	-	-	-	0.0	1.2	-
Scrawled Filefish	*Aluterus scriptus*	-	-	-	-	-	-	0.0	0.3	-
Gray Triggerfish	*Balistes capriscus*	-	-	-	-	-	-	0.0	0.9	-
Planehead Filefish	*Monacanthus hispidus*	-	-	-	-	-	-	0.0	10.3	-
Boxfishes – Ostraciidae										
Trunkfish	*Lactophrys trigonus*	-	-	-	-	-	-	0.0	0.2	-
Puffers – Tetraodontidae										
Northern Puffer	*Sphoeroides maculates*	-	-	-	-	-	-	0.0	11.8	-
Sunfish – Centrarchidae										
Largemouth Bass	*Micropterus salmoides*	-	-	-	-	-	-	NA	NA	-

Source: Data assembled from the Massachusetts Division of Marine Fisheries Nantucket Sound Spring and Fall Trawl Surveys from 1978 to 2010 and the Nantucket Sound Estuarine Winter Flounder Seine Surveys 1976 to 2010.

* Data assembled from the New England Fishery Management Council Essential Fish Habitat and Habitat Area of Particular Concern Designation Alternatives Draft 2012; and NOAA Fisheries Division of Highly Migratory Species Amendment 1 to the consolidated Highly Migratory Species Fishery Management Plan, June 2009.

Table A.2. Reptile Species Known or Suspected on Monomoy NWR.

Common Name	Scientific Name	Federal Status[1]	MA Legal Status[1]	Global Rarity Rank[2]	MA Rarity Rank[3]	NOAA Fisheries Listing[4]	NALCC Rep. Species[15]
Water Turtles – Emydidae							
Painted Turtle	*Chrysemys picta*	-	-	-	-	-	M
Sea Turtles – Cheloniidae							
Loggerhead Sea Turtle	*Caretta caretta*	T	T	G3	S1	P/E	M
Green Sea Turtle	*Chelonia mydas*	T	T	G3	S1	T	-
Hawksbill Sea Turtle	*Eretmochelys imbricate*	E	T	G3	S1	E	-
Kemp's Ridley Sea Turtle	*Lepidochelys kempii*	E	E	G1	S1	E	-
Sea Turtles – Dermochelyidae							
Leatherback Sea Turtle	*Dermochelys coriacea*	E	E	G3	S1S2	E	-
Colubrids – Colubridae							
Eastern Hognose Snake	*Heterodon platirhinos*	-	-	G5	S5	-	SM
Eastern Ribbon Snake	*Thamnophis sauritus*	-	-	G5	S5	-	-
Eastern Garter Snake	*Thamnophis sirtalis sirtalis*	-	-	-	-	-	-

Source: Data assembled from the Massachusetts Division of Fisheries and Wildlife, Fauna of Massachusetts Series No. 3, State Reptiles and Amphibians List—Species Distribution, in addition to staff observations of wildlife on the refuge.

Table A.3. Amphibian Species Known or Suspected on Monomoy NWR.

Common Name	Scientific Name	Federal Status[1]	MA Legal Status[1]	Global Rarity Rank[2]	MA Rarity Rank[3]	NOAA Fisheries Listing[4]	NALCC Rep. Species[15]
Toads – Bufonidae							
•Fowlers Toad	*Bufo woodhousii fowleri*	-	-	-	-	-	-

Source: Data assembled from the Massachusetts Division of Fisheries and Wildlife, Fauna of Massachusetts Series No. 3, State Reptiles and Amphibians List—Species Distribution, in addition to staff observations of wildlife on the refuge.

•Denotes species suspected to have been breeding on the refuge over the past 20 years.

Table A.4. Bird Species Known or Suspected on Monomoy NWR.

Common Name	Scientific Name	Federal Legal Status[1]	MA Legal Status[1]	Global Rarity Rank[2]	MA Rarity Rank[3]	BCC[7]	BCR 30[8]	PIF 09[9]	MANEM[10]	NAWMP[11]	NAWCP[12]	U.S. SCP[13]	Spring[14]	Summer[14]	Fall[14]	Winter[14]	NALCC Rep. Species[15]
Loons – Gaviidae																	
Red-throated Loon	*Gavia stellata*	-				R5	HH	-	HH	-	-	-	a	r	a	c	-
Common Loon	*Gavia immer*	-	SC	G5	S1	-	-	-	HH	-	-	-	a	u	a	c	
Grebes – Podicipedidae																	
Horned Grebe	*Podiceps auritus*	-				R5	H	-	HH	-	-	-	o		u	o	-
Red-necked Grebe	*Podiceps grisegena*	-	-	-	-	-	-	-	H	-	-	-	r		r	r	-
Eared Grebe	*Podiceps nigricollis*	-	-	-	-	-	-	-	-	-	-	-		x	x		-
•Pied-billed Grebe	*Podilymbus podiceps*	-	E	G5	S1	R5	-	-	HH	-	-	-	u	r	c		-
Fulmars and Shearwaters – Procellariidae																	
Cory's Shearwater	*Calonectris diomedea*	-	-	-	-	-	M	-	H	-	MC	-		o	o		-
Northern Fulmar	*Fulmarus glacialis*	-	-	-	-	-	-	-	L	-	-	-	r		r	r	-
Greater Shearwater	*Puffinus gravis*	-	-	-	-	R5	H	-	HH	-	-	-		o	o		-
Sooty Shearwater	*Puffinus griseus*	-	-	-	-	-	-	-	M	-	MC	-	o	u	r		-
Manx Shearwater	*Puffinus puffinus*	-	-	-	-	-	M	-	M	-	MC	-	r	o	r		-
Storm-petrels – Hydrobatidae																	
Leach's Storm-Petrel	*Oceanodroma leucorhoa*	-	E	G5	S1	-	-	-	M	-	LC	-	r	r	r		-
Wilson's Storm-petrel	*Oceanites oceanicus*	-	-	-	-	-	-	-	L	-	-	-		u			-
Boobies and Gannets – Sulidae																	
Northern Gannet	*Morus bassanus*	-	-	-	-	-	H	-	M	-	-	-	a	u	a	u	-
Brown Booby	*Sula leucogaster*	-	-	-	-	-	-	-	-	-	HC	-			x		-
Cormorants – Phalacrocoracidae																	
Double-crested Cormorant	*Phalacrocorax auritus*	-	-	-	-	-	-	-	L	-	LI	-	a	a	a	r	-
Great Cormorant	*Phalacrocorax carbo*	-	-	-	-	-	-	-	H	-	MC	-	c	r	c	c	-

Common Name	Scientific Name	Federal Legal Status[1]	MA Legal Status[1]	Global Rarity Rank[2]	MA Rarity Rank[3]	BCC[7]	BCR 30[8]	PIF 09[9]	MANEM[10]	NAWMP[11]	NAWCP[12]	U.S. SCP[13]	Spring[14]	Summer[14]	Fall[14]	Winter[14]	NALCC Rep. Species[15]
Frigatebirds – Fregatidae																	
Magnificent Frigatebird	*Fregata magnificens*	-	-	-	-	-	-	-	-	-	HC	-		x			-
Bitterns, Herons, and Egrets – Ardeidae																	
•Great Egret	*Ardea alba egretta*	-	-	-	-	-	-	-	M	-	NR	-	u	u	u		-
Great Blue Heron	*Ardea herodias herodias*	-	-	-	-	-	-	-	H	-	NR	-	c	u	c	u	-
American Bittern	*Botaurus lentiginosus*	-	E	G4	S2	R5	M	-	HH	-	-	-	r		o	r	S
Green Heron	*Butorides striatus*	-	-	G5	S4	-	-	-	M	-	LC	-	u	u	o		-
Cattle Egret	*Bubulcus ibis*	-	-	-	-	-	-	-	M	-	NR	-	r		r		-
Little Blue Heron	*Egretta caerulea*	-	-	-	-	-	M	-	HH	-	HC	-	o	o	o		-
Reddish Egret	*Egretta rufescens*	-	-	-	-	N	-	-	-	-	MC	-		x			-
•Snowy Egret	*Egretta thula*	-	-	G5	S1	R5	M	-	HH	-	HC	-	c	c	c		S
Tricolored Heron	*Egretta tricolor*	-	-	-	-	-	M	-	HH	-	HC	-	r	o	r		-
Least Bittern	*Ixobrychus exilis*	-	E	G5	S1	R5	M	-	HH	-	-	-	r	r			M
Yellow-crowned Night-Heron	*Nyctanassa violacea violacea*	-	-	-	-	-	M	-	H	-	MC	-		r	r		-
•Black-crowned Night-Heron	*Nycticorax nycticorax*	-	-	G5	S2	-	M	-	HH	-	MC	-	c	c	c	r	-
Ibises – Threskiornithidae																	
•Glossy Ibis	*Plegadis falcinellus*	-	-	-	-	-	H	-	HH	-	LC	-	o	u	o		-
New World Vultures – Cathartidae																	
Black Vulture	*Coragyps atratus*	-	-	-	-	-	-	-	-	-	-	-			r		-
Turkey Vulture	*Cathartes aura*	-	-	-	-	-	-		-	-	-	-	o	o	r		-
Swans, Geese, and Ducks – Anatidae																	
Wood Duck	*Aix sponsa*	-	-	-	-	-	M	-	-	H	-	-	r		r		M
•Northern Pintail	*Anas acuta acuta*	-	-	-	-	-	M	-	-	H	-	-	c	u	c	o	M
•American Wigeon	*Anas americana*	-	-	-	-	-	M	-	-	MH	-	-	c	o	c	u	-

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•Northern Shoveler	*Anas clypeata*	-	-	-	-	-	-	-	-	M	-	-	u	u	c		-
•Green-winged Teal	*Anas crecca carolinensis*	-	-	-	-	-	M	-	-	M	-	-	c	c	c	r	-
•Blue-winged Teal	*Anas discors orphan*	-	-	-	-	-	-	-	-	MH	-	-	c	u	c		-
Eurasian Wigeon	*Anas penelope*	-	-	-	-	-	-	-	-	-	-	-	c	c	c	o	-
•Mallard	*Anas platyrhynchos*	-	-	-	-	-	H	-	-	H	-	-	c	c	c	c	-
•American Black Duck	*Anas rubripes*	-	-	G5	S4	-	HH	IIC	-	H	-	-	a	c	a	a	NMS
•Gadwall	*Anas strepera*	-	-	-	-	-	M	-	-	M	-	-	c	c	c	o	-
Greater White-fronted Goose	*Anser albifrons*	-	-	-	-	-	-	-	-	-	-	-				x	-
Redhead	*Aythya american*	-	-	-	-	-	-	-	-	MH	-	-	r		r	r	-
Lesser Scaup	*Aythya affinis*	-	-	-	-	-	H	-	-	H	-	-	u		c	o	-
Ring-necked Duck	*Aythya collaris*	-	-	-	-	-	-	-	-	M	-	-	o		c	o	M
Tufted Duck	*Aythya fuligula*	-	-	-	-	-	-	-	-	-	-	-		x	x		-
Greater Scaup	*Aythya marila*	-	-	-	-	-	H	-	-	M	-	-	u		c	o	-
Canvasback	*Aythya valisineria*	-	-	-	-	-	H	-	-	MH	-	-	o		u	o	M
Canada Goose (resident)	*Branta canadensis*	-	-	-	-	-	-	-	-	AO	-	-					-
Canada Goose (Atlantic)	*Branta canadensis*	-	-	-	-	-	HH	-	-	H	-	-					-
Canada Goose (North Atlantic)	*Branta canadensis canadensis*	-	-	-	-	-	H	-	-	MH	-	-					-
Bufflehead	*Bucephala albeola*	-	-	-	-	-	H	-	-	M	-	-	c		c	c	M
Common Goldeneye	*Bucephala clangula americana*	-	-	-	-	-	M	-	-	MH	-	-	o		c	c	-
Barrow's Goldeneye	*Bucephala islandica*	-	-	-	-	-	-	-	-	M	-	-				r	-
Snow Goose	*Chen caerulescens*	-	-	-	-	-	-	-	-	AO	-	-	r		o		-
Atlantic Brant	*Circus cyaneus*	-	-	-	-	-	HH	-	-	ML	-	-	c	r	c	c	-
Long-tailed Duck	*Clangula hyemalis*	-	-	G5	SNRN	-	H	-	-	MH	-	-	c	r	a	c	N
Tundra Swan	*Cygnus columbianus columbianus*	-	-	-	-	-	H	-	-	ML	-	-			r		-

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•Mute Swan	*Cygnus olor*	-	-	-	-	-	-	-	-	-	-	-	c	c	c	c	-
Fulvous Whistling Duck	*Dendrocygna bicolor*	-	-	-	-	-	-	-	-	ML	-	-	x		x		-
Harlequin Duck	*Histrionicus histrionicus*	-	-	G4	SNRN	-	M	-	-	M	-	-			r	r	-
Hooded Merganser	*Lophotydes cucullatu*	-	-	-	-	-	M	-	-	H	-	-	o		c	o	-
Black Scoter	*Melanitta americana*	-	-	-	-	-	H	-	-	MH	-	-	c	r	c	c	M
White-winged Scoter	*Melanitta fusca*	-	-	-	-	-	H	-	-	MH	-	-	c	r	a	c	MS
Surf Scoter	*Melanitta perspicillata*	-	-	-	-	-	H	-	-	MH	-	-	c	r	c	c	-
Common Merganser	*Mergus merganser americanus*	-	-	-	-	-	-	-	-	ML	-	-	o		u	o	NS
•Red-breasted Merganser	*Mergus serrator serrator*	-	-	-	-	-	M	-	-	ML	-	-	a	o	a	a	S
•Ruddy Duck	*Oxyura jamaicensis*	-	-	-	-	-	M	-	-	ML	-	-	o	r	c	o	-
Common Eider	*Somateria mollissima*	-	-	G5	S1	-	H	-	-	H	-	-	a	u	a	a	NS
King Eider	*Somateria spectabilis*	-	-	-	-	-	-	-	-	MH	-	-	r		r	r	-
Osprey, Kites, Hawks, and Eagles – Accipitridae																	
Cooper's Hawk	*Accipiter cooperii*	-	-	-	-	-	-	-	-	-	-	-	u		u	o	-
Northern Goshawk	*Accipiter gentilis*	-	-	-	-	-	-	-	-	-	-	-	r		r	r	-
Sharp-shinned Hawk	*Accipiter striatus velox*	-	SC	G5	S3	-	-	-	-	-	-	-	u		c	o	-
Red-shouldered Hawk	*Buteo lineatus lineatus*	-	-	-	-	-	-	-	-	-	-	-	r		r		M
Red-tailed Hawk	*Buteo jamaicensis*	-	-	-	-	-	-	-	-	-	-	-	c	c	c	c	-
Rough-legged Hawk	*Buteo lagopus johannis*	-	-	-	-	-	-	-	-	-	-	-			r	r	-
Broad-winged Hawk	*Buteo platypterus*	-	-	G5	S5	-	H	-	-	-	-	-	r	r	r		-
Swainson's Hawk	*Buteo swainsoni*	-	-	-	-	N	-	-	-	-	-	-			x		-

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•Northern Harrier	*Circus cyaneus*	-	T	G5	S1	-	-	-	-	-	-	-	c	u	c	c	-
Bald Eagle	*Haliaeetus leucocephalus*	-	E	G4	S1	R5, N	M	-	-	-	-	-	o	o	o	r	-
Mississippi Kite	*Ictinia mississippiensis*	-	-	-	-	-	-	-	-	-	-	-	x				-
Osprey	*Pandion haliaetus carolinensis*	-	-	-	-	-	-	-	-	-	-	-	c	u	u		-
Falcons – Falconidae																	
Merlin	*Falco columbarius*	-	-	-	-	-	-	-	-	-	-	-	o		u	o	-
Peregrine Falcon	*Falco peregrinus*	-	E	G4	S1	R5, N	-	IIC	-	-	-	-	u		c	o	-
Gyrfalcon	*Falco rusticolus*	-	-	-	-	-	-	-	-	-	-	-			r	r	-
American Kestrel	*Falco sparverius sparverius*	-	-	G5	S4	-	-	-	-	-	-	-	u		u		-
Pheasants – Phasianidae																	
Ring-necked Pheasant	*Phasianus colchicus*	-	-	-	-	-	-	-	-	-	-	-	r		r	r	-
Quail – Odontophoridae																	
Northern Bobwhite	*Colinus virginianus*	-	-	G5	S5	-	H	-	-	-	-	-	r		r	r	-
Rails – Rallidae																	
American Coot	*Fulica americana*	-	-	-	-	-	-	-	L	-	-	-	o		c	o	-
Common Moorhen	*Gallinula chloropus cachinnans*	-	SC	G5	S1	-	-	-	H	-	-	-	r		r		-
Purple Gallinule	*Porphyrio martinica*	-	-	-	-	-	-	-	M	-	-	-			x		-
•Sora	*Porzana carolina*	-	-	G5	S3	-	M	-	H	-	-	-	o	r	o		-
King Rail	*Rallus elegans*	-	T	G4	S1	-	M	-	HH	-	-	-			r		M
•Virginia Rail	*Rallus limicola*	-	-	-	-	-	-	-	M	-	-	-	r	r	o		N
Clapper Rail	*Rallus longirostris*	-	-	-	-	-	H	-	H	-	-	-			r		M

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Cranes – Gruidae																	
Sandhill Crane	*Grus canadensis*	-	-	-	-	-	-	-	-	-	-	-			x		-
Plovers – Charadriidae																	
•Piping Plover	*Charadrius melodus*	T	T	G3	S2	-	HH	IA	-	-	-	5	u	u	u		NMS
Semipalmated Plover	*Charadrius semipalmatus*	-	-	-	-	-	M	-	-	-	-	2	u	a	c		-
Killdeer	*Charadrius vociferous*	-	-	-	-	-	M	-	-	-	-	3	u		u		-
Wilson's Plover	*Charadrius wilsonia*	-	-	-	-	R5, N	H	-	-	-	-	4	x	x			-
American Golden Plover	*Pluvialis dominica*	-	-	-	-	-	H	-	-	-	-	4	r	r	u		-
Black-bellied Plover	*Pluvialis squatarola*	-	-	-	-	-	H	-	-	-	-	3	a	c	a	o	-
Oystercatchers – Haematopodidae																	
•American Oystercatcher	*Haematopus palliatus*	-	-	G5	S2	R5, N	HH	IA	-	-	-	4	c	c	c		S
Stilts and Avocets – Recurvirostridae																	
Black-necked Stilt	*Himantopus mexicanus*	-	-	-	-	-	-	-	-	-	-	2		x			-
American Avocet	*Recurvirostra americana*	-	-	-	-	-	M	-	-	-	-	3		x	x		-
Sandpipers and Phalaropes – Scolopacidae																	
•Spotted Sandpiper	*Actitis macularia*	-	-	-	-	-	M	-	-	-	-	2	o	o	r		-
Ruddy Turnstone	*Arenaria interpres*	-	-	G5	SNA	-	HH	-	-	-	-	4	c	o	c		-
Upland Sandpiper	*Bartramia longicauda*	-	E	G5	S1	R5, N	M	IB	-	-	-	4	r	o			S
Red Knot	*Calidris canutus rufa*	C	-	G5	S2	R5, N	HH	-	-	-	-	4	c	c	c	r	M
Sanderling	*Calidris alba*	-	-	G5	SNA	-	HH	-	-	-	-	4	a	a	a	u	M
Dunlin	*Calidris alpina*	-	-	-	-	N	H	-	-	-	-	3	a	u	a	u	-
Baird's Sandpiper	*Calidris bairdii*	-	-	-	-	-	-	-	-	-	-	2			r		-
Curlew Sandpiper	*Calidris ferruginea*	-	-	-	-	-	-	-	-	-	-	-	r	r			-

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White-rumped Sandpiper	*Calidris fuscicollis*	-	-	-	-	-	H	-	-	-	-	2	u	u	u		-
Stilt Sandpiper	*Calidris himantipus*	-	-	-	-	-	-	-	-	-	-	3		u	o		-
Purple Sandpiper	*Calidris maritima*	-	-	-	-	R5, N	H	-	-	-	-	2			r		NS
Western Sandpiper	*Calidris mauri*	-	-	-	-	-	M	-	-	-	-	4		o	u		-
Pectoral Sandpiper	*Calidris melanotos*	-	-	-	-	-	-	-	-	-	-	2	r	o	c		-
Little Stint	*Calidris minuta*	-	-	-	-	-	-	-	-	-	-	-		x			-
•Least Sandpiper	*Calidris minutilla*	-	-	-	-	-	M	-	-	-	-	3	c	a	c		-
Semipalmated Sandpiper	*Calidris pusilla*	-	-	-	-	R5, N	H	-	-	-	-	3	a	a	c		NS
Red-necked Stint	*Calidris ruficollis*	-	-	-	-	-	-	-	-	-	-	-	x	x			-
•Willet	*Catoptrophorus semipalmatus*	-	-	-	-	-	H	-	-	-	-	3	c	c	u		M
Common Snipe	*Gallinago gallinago*	-	-	-	-	-	M	-	-	-	-	3	r		o		-
Wandering Tattler	*Heteroscelus incanus*	-	-	-	-	-	-	-	-	-	-	3	x				-
Short-billed Dowitcher	*Limnodromus griseus*	-	-	G5	SNA	R5, N	H	-	-	-	-	4	c	a	c		-
Long-billed Dowitcher	*Limnodromus scolopaceus*	-	-	-	-	-	-	-	-	-	-	2		o	o		-
Black-tailed Godwit	*Limosa limosa*	-	-	-	-	-	-	-	-	-	-	-		x			-
Marbled Godwit	*Limosa fedoa*	-	-	-	-	R5, N	H	-	-	-	-	4		o	u		-
Hudsonian Godwit	*Limosa haemastica*	-	-	-	-	R5, N	H	-	-	-	-	4		c	o		-
Bar-tailed Godwit	*Limosa lapponica*	-	-	-	-	N	-	-	-	-	-	4	x	x			-
Long-billed Curlew	*Numenius americanus*	-	-	-	-	N	-	-	-	-	-	5		x			-
Eurasian Curlew	*Numenius arquata*	-	-	-	-	-	-	-	-	-	-	-			x		-
Whimbrel	*Numenius phaeopus*	-	-	G5	SNA	R5, N	HH	-	-	-	-	4	r	c	c		-
Red Phalarope	*Phalaropus fulicarius*	-	-	-	-	-	M	-	-	-	-	3	r		r		-

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Red-necked Phalarope	*Phalaropus lobatus*	-	-	-	-	-	M	-	-	-	-	3	r	r	r		-
•Wilson's Phalarope	*Phalaropus tricolor*	-	-	-	-	-	H	-	-	-	-	4	r	o	r		-
Ruff	*Philomachus pugnax*	-	-	-	-	-	-	-	-	-	-	-	r	r			-
American Woodcock	*Scolopax minor*	-	-	G5	S4	-	HH	IA	-	-	-	4	r		r		N
Lesser Yellowlegs	*Tringa flavipes*	-	-	-	-	R5, N	M	-	-	-	-	3	r	c	c		-
Greater Yellowlegs	*Tringa melanleuca*	-	-	-	-	-	H	-	-	-	-	3	c	a	c		-
Solitary Sandpiper	*Tringa solitaria*	-	-	-	-	R5, N	H	-	-	-	-	4	r	r	r		-
Buff-breasted Sandpiper	*Tryngites subruficollis*	-	-	-	-	R5, N	H	-	-	-	-	4			r		-
Jaegers – Laridae																	
Long-tailed Jaeger	*Stercorarius longicaudus*	-	-	-	-	-	-	-	L	-	LC	-			r		-
Parasitic Jaeger	*Stercorarius parasiticus*	-	-	-	-	-	-	-	L	-	LC	-	o	o	u		-
Pomarine Jaeger	*Stercorarius pomarinus*	-	-	-	-	-	-	-	L	-	LC	-	r	r	o		-
Gulls, Terns, and Skimmers – Laridae																	
Black Tern	*Chlidonias niger*	-	-	-	-	-	-	-	H	-	MC	-	o	u	u		-
Black-headed Gull	*Chroicocephalus ridibundus*	-	-	-	-	-	-	-	L	-	MC	-	r	r	r		-
Gull-billed Tern	*Gelochelidon nilotica*	-	-	-	-	R5, N	HH	-	HH	-	HC	-		r			-
•Herring Gull	*Larus argentatus*	-	-	-	-	-	-	-	H	-	LC	-	a	a	a	a	-
•Laughing Gull	*Larus atricilla*	-	-	G5	S2	-	-	-	H	-	NR	-	c	a	c		-
Mew Gull	*Larus canus*	-	-	-	-	-	-	-	-	-	NR	-			x		-
Ring-billed Gull	*Larus delawarensis*	-	-	-	-	-	-	-	L	-	NR	-	c	c	c	c	-
Lesser Black-backed Gull	*Larus fuscus*	-	-	-	-	-	-	-	L	-	MC	-	r	r	u	o	-
Iceland Gull	*Larus glaucoides*	-	-	-	-	-	-	-	L	-	LC	-	r		r	o	-
Glaucous Gull	*Larus hyperboreus*	-	-	-	-	-	-	-	L	-	NR	-	r		r	r	-

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•Great Black-backed Gull	*Larus marinus*	-	-	-	-	-	-	-	L	-	NR	-	a	a	a	a	-
Little Gull	*Larus minutus*	-	-	-	-	-	-	-	M	-	HC	-	r	r	r		-
Bonaparte's Gull	*Larus philadelphia*	-	-	-	-	-	-	-	M	-	MC	-	u	o	c	o	-
Franklin's Gull	*Leucophaeus pipixcan*	-	-	-	-	-	-	-	-	-	MC	-			r		-
Bridled Tern	*Onychoprion anaethetus*	-	-	-	-	-	H	-	H	-	HC	-			x		-
Sooty Tern	*Onychoprion fuscatus*	-	-	-	-	-	-	-	-	-	MC	-		x	x		-
Ivory Gull	*Pagophila eburnea*	-	-	-	-	-	-	-	-	-	MC	-				x	-
Black-legged Kittiwake	*Rissa tridactyla*	-	-	-	-	-	-	-	L	-	NR	-	u	o	c	c	-
•Black Skimmer	*Rynchops niger*	-	-	-	-	R5, N	M	-	HH	-	HC	-	o	u	o		M
•Least Tern	*Sterna antillarum*	-	SC	G4	S3	R5, N	H	-	HH	-	HC	-	c	c			M
Caspian Tern	*Sterna caspia*	-	-	-	-	-	-	-	L	-	LC	-	r	r	r		-
•Roseate Tern	*Sterna dougallii*	E	E	G4T3	S2	-	HH	-	HH	-	HC	-	u	c	c		-
Forster's Tern	*Sterna forsteri*	-	-	-	-	-	H	-	H	-	MC	-		u	u		-
•Common Tern	*Sterna hirundo*	-	SC	G5	S3	-	M	-	HH	-	LC	-	a	a	c		NMS
Royal Tern	*Sterna maxima*	-	-	-	-	-	M	-	H	-	MC	-		o			-
•Arctic Tern	*Sterna paradisaea*	-	SC	G5	S1	R5	-	-	HH	-	HC	-	o	o			-
Sandwich Tern	*Sterna sandvicensis*	-	-	-	-	-	H	-	L	-	NR	-		r			-
Sabine's Gull	*Xema sabini*	-	-	-	-	-	-	-	L	-	LC	-	r	r	r		-
Alcids – Alcidae																	
Razorbill	*Alca torda*	-	-	-	-	-	M	-	H	-	MC	-	r		o	u	-
Dovekie	*Alle alle*	-	-	-	-	-	-	-	L	-	MC	-			r	o	-
Black Guillemot	*Cepphus grylle*	-	-	-	-	-	-	-	M	-	NR	-				r	-
Atlantic Puffin	*Fratercula arctica*	-	-	-	-	-	-	-	M	-	NR	-			r	r	-
Common Murre	*Uria aalge*	-	-	-	-	-	-	-	M	-	MC	-				r	-
Thick-billed Murre	*Uria lomvia*	-	-	-	-	-	-	-	L	-	MC	-				r	-

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Doves – Columbidae																	
Rock Dove	*Columba livia*	-	-	-	-	-	-	-	-	-	-	-	o	o	o	o	-
•Mourning Dove	*Zenaida macroura carolinensis*	-	-	-	-	-	-	-	-	-	-	-	c	c	c	c	-
Cuckoos – Cuculidae																	
Black-billed Cuckoo	*Catharus bicknelli*	-	-	-	-	-	-	IA	-	-	-	-	r	r	o		-
Yellow-billed Cuckoo	*Coccyzus americanus*	-	-	-	-	N	-	-	-	-	-	-	r	r	o		-
Owls – Tytonidae																	
Barn Owl	*Tyto alba*	-	SC	G5	S2	-	-	-	-	-	-	-	r		r		-
Owls – Strigidae																	
Northern Saw-whet owl	*Aegolius acadicus*	-	-	-	-	-	-	-	-	-	-	-			r		-
•Short-eared Owl	*Asio flammeus*	-	E	G5	S1	R5, N	-	IIC	-	-	-	-	r	r	o	r	-
Long-eared Owl	*Asio otus*	-	SC	G5	S2	-	-	-	-	-	-	-			r		-
Burrowing Owl	*Athene cunicularia*	-	-	-	-	-	-	-	-	-	-	-		x			-
•Great Horned Owl	*Bubo virginianus*	-	-	-	-	-	-	-	-	-	-	-	u	u	u	u	-
Snowy Owl	*Nyctea scandiaca*	-	-	-	-	-	-	-	-	-	-	-				r	-
Eastern Screech Owl	*Otus asio*	-	-	-	-	-	-	-	-	-	-	-			r	r	-
Goatsuckers – Caprimulgidae																	
Whip-poor-will	*Caprimulgus vociferous*	-	-	G5	S4	R5	H	-	-	-	-	-	r		r		M
Common Nighthawk	*Chordeiles minor*	-	-	-	-	-	-	-	-	-	-	-	r		r		M
Swifts – Apodidae																	
Chimney Swift	*Chaetura pelagica*	-	-	-	-	-	H	IIA	-	-	-	-	o	o	o		-

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Hummingbirds – Trochilidae																	
Ruby-throated Hummingbird	*Archilochus colubris*	-	-	-	-	-	-	-	-	-	-	-	r		u		-
Kingfishers – Alcedinidae																	
•Belted Kingfisher	*Ceryle alcyon*	-	-	-	-	-	-	-	-	-	-	-	u	u	u	r	-
Woodpeckers – Picidae																	
•Northern Flicker	*Colaptes auratus*	-	-	-	-	-	H	-	-	-	-	-	c	u	c	u	-
Red-bellied Woodpecker	*Melanerpes carolinus*	-	-	-	-	-	-	-	-	-	-	-	r		r	r	-
Red-headed Woodpecker	*Melanerpes eurythrocephalus*	-	-	-	-	R5, N	M	IIC	-	-	-	-			r		-
•Downy Woodpecker	*Picoides pubescensmedianus*	-	-	-	-	-	-	-	-	-	-	-	u	u	u	u	-
Hairy Woodpecker	*Picoides villosus*	-	-	-	-	-	-	IIA	-	-	-	-	o		o	o	-
Yellow-bellied Woodpecker	*Sphyrapicus varius*	-	-	-	-	-	-	-	-	-	-	-	r		o		-
Tyrant Flycatchers – Tyrannidae																	
Western Wood-Pewee	*Contopus sordidulus*	-	-	-	-	-	-	-	-	-	-	-			x		-
Eastern Wood-Pewee	*Contopus virens*	-	-	-	-	-	-	IIA	-	-	-	-	o	o	u		M
Alder Flycatcher	*Empidonax alnorum*	-	-	-	-	-	-	-	-	-	-	-	r		r		-
Yellow-bellied Flycatcher	*Empidonax flaviventris*	-	-	-	-	-	-	-	-	-	-	-	r		r		-
Least Flycatcher	*Empidonax minimus*	-	-	-	-	-	-	-	-	-	-	-	o		o		-
Willow Flycatcher	*Empidonax traillii*	-	-	G5	S4	N	H	-	-	-	-	-	o		o		S
Acadian Flycatcher	*Empidonax virescens*	-	-	-	-	-	-	-	-	-	-	-	r		r		-
Olive-sided Flycatcher	*Mionectes olivaceus*	-	-	-	-	R5, N	-	-	-	-	-	-	r		r		-
Ash-throated Flycatcher	*Myiarchus cinerascens*	-	-	-	-	-	-	-	-	-	-	-			x		-
Great Crested Flycatcher	*Myiarchus crinitus*	-	-	-	-	-	H	-	-	-	-	-	o	u	r		-
Eastern Phoebe	*Sayornis phoebe*	-	-	-	-	-	-	-	-	-	-	-	r		o		-

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Say's Phoebe	*Sayornis saya*	-	-	-	-	-	-	-	-	-	-	-			x		-
Scissor-tailed Flycatcher	*Tyrannus forficatus*	-	-	-	-	-	-	-	-	-	-	-			x		-
•Eastern Kingbird	*Tyranus tyranus*	-	-	-	-	-	H	-	-	-	-	-	u	u	u		-
Western Kingbird	*Tyrannus verticalis*	-	-	-	-	-	-	-	-	-	-	-		r	r		-
Cassin's Kingbird	*Tyrannus vociferans*	-	-	-	-	-	-	-	-	-	-	-			x		-
Shrikes – Laniidae																	
Northern Shrike	*Lanius excubitor*	-	-	-	-	-	-	-	-	-	-	-	r		r	R	-
Loggerhead Shrike	*Lanius ludovicianus*	-	-	-	-	R5, N	M	-	-	-	-	-			r		-
Vireos – Vireonidae																	
Yellow-throated Vireo	*Vireo flavifrons*	-	-	-	-	-	H	-	-	-	-	-			r		-
Warbling Vireo	*Vireo gilvus*	-	-	-	-	-	-	-	-	-	-	-	r		r		N
White-eyed Vireo	*Vireo griseus*	-	-	-	-	-	-	-	-	-	-	-			r		-
Red-eyed Vireo	*Vireo olivaceus*	-	-	-	-	-	-	-	-	-	-	-	o		u		-
Philadelphia Vireo	*Vireo philadelphicus*	-	-	-	-	-	-	-	-	-	-	-			o		-
Blue-headed Vireo	*Vireo solitarius*	-	-	-	-	-	-	-	-	-	-	-	r		u		-
Crows and Jays – Corvidae																	
•American Crow	*Corvus brachyrhynchos*	-	-	-	-	-	-	-	-	-	-	-	c	c	c	c	-
Fish Crow	*Corvus ossifragus*	-	-	-	-	-	-	-	-	-	-	-	r	r			-
Blue Jay	*Cyanocitta cristata*	-	-	-	-	-	-	-	-	-	-	-	c	c	c	u	-
Larks – Alaudidae																	
•Horned Lark	*Eremophila alpestris*	-	-	-	-	N	-	-	-	-	-	-	c	c	c	u	-
Swallows – Hirundinidae																	
Barn Swallow	*Hirundo rustica*	-	-	-	-	-	-	-	-	-	-	-	c	u	o		-
Purple Martin	*Progne subis*	-	-	-	-	-	-	-	-	-	-	-	r	r			-
Cave Swallow	*Petrochelidon fulva*	-	-	-	-	-	-	-	-	-	-	-			x		-

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Cliff Swallow	*Petrochelidon pyrrhonota*	-	-	-	-	-	-	-	-	-	-	-	r	r	r	r	-
Brown-chested Martin	*Progne tapera*	-	-	-	-	-	-	-	-	-	-	-		x			-
Bank Swallow	*Riparia riparia*	-	-	-	-	-	-	-	-	-	-	-	o	o			NM
•Northern Rough-winged Swallow	*Stelgidopteryx serripennis*	-	-	-	-	-	-	-	-	-	-	-	u	u			-
•Tree Swallow	*Tachycineta bicolor*	-	-	-	-	-	-	-	-	-	-	-	c	c	a		-
Chickadees and Titmice – Paridae																	
•Tufted Titmouse	*Baeolophus bicolor*	-	-	-	-	-	-	-	-	-	-	-	c	c	c	c	-
•Black-capped Chickadee	*Poecile atricapilla*	-	-	-	-	-	-	-	-	-	-	-	c	c	c	c	-
Nuthatches – Sittidae																	
Red-breasted Nuthatch	*Sitta canadensis*	-	-	-	-	-	-	-	-	-	-	-	u		u	u	-
White-breasted Nuthatch	*Sitta carolinensis*	-	-	-	-	-	-	-	-	-	-	-	u	u	u	u	-
Creepers – Certhiidae																	
Brown Creeper	*Certhia americana*	-	-	-	-	-	-	-	-	-	-	-	o		u		-
Wrens – Troglodytidae																	
Marsh Wren	*Cistothorus palustris*	-	-	-	-	-	H	-	-	-	-	-			o		MS
Sedge Wren	*Cistothorus platensis*	-	E	G5	S1	R5	M	IIC	-	-	-	-			r		-
Carolina Wren	*Thryothorus ludovicianus*	-	-	-	-	-	-	-	-	-	-	-	u	u	u	u	-
House Wren	*Troglodytes aedon*	-	-	-	-	-	-	-	-	-	-	-			r		-
Winter Wren	*Troglodytes troglodytes*	-	-	-	-	-	-	-	-	-	-	-	r		o		-
Kinglets – Regulidae																	
Ruby-crowned Kinglet	*Regulus calendula*	-	-	-	-	-	-	-	-	-	-	-	o		c		-
Golden-crowned Kinglet	*Regulus satrapa*	-	-	-	-	-	-	-	-	-	-	-	o		c	u	-

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Gnatcatchers – Sylviidae																	
Blue-gray Gnatcatcher	*Polioptila caerulea*	-	-	-	-	-	-	-	-	-	-	-	o		o		-
Thrushes – Turdidae																	
Bicknell's Thrush	*Catharus bicknelli*	-	-	-	-	R5, N	H	-	-	-	-	-	r		r		N
Veery	*Catharus fuscescens*	-	-	-	-	-	-	-	-	-	-	-	r		o		-
Hermit Thrush	*Catharus guttatus*	-	-	-	-	-	-	-	-	-	-	-	r		u		-
Gray-cheeked Thrush	*Catharus minimus*	-	-	-	-	-	-	-	-	-	-	-	r		r		-
Swainson's Thrush	*Catharus ustulatus*	-	-	-	-	-	-	-	-	-	-	-	o		u		-
Wood Thrush	*Hylocichla mustelina*	-	-	G5	S5	R5, N	HH	IA	-	-	-	-	r		r		NMS
Northern Wheatear	*Oenanthe oenanthe*	-	-	-	-	-	-	-	-	-	-	-			x		-
Eastern Bluebird	*Sialia sialis*	-	-	-	-	-	-	-	-	-	-	-	r	r	o	r	-
•American Robin	*Turdus migratorius*	-	-	-	-	-	-	-	-	-	-	-	c	c	c	u	-
Mimids – Mimidae																	
•Gray Catbird	*Dumatella carolinensis*	-	-	-	-	-	M	-	-	-	-	-	c	c	c	r	-
•Northern Mockingbird	*Mimus polyglottos*	-	-	-	-	-	-	-	-	-	-	-	u	u	u	o	-
•Brown Thrasher	*Toxostoma rufum*	-	-	G5	S5	-	H	-	-	-	-	-	r		o		M
Starlings – Sturnidae																	
•European Starling	*Sturnus vulgaris*	-	-	-	-	-	-	-	-	-	-	-	c	c	c	c	-
Pipits – Motacillidae																	
American Pipit	*Anthus rubescens*	-	-	-	-	-	-	-	-	-	-	-	o		u		-
Waxwings – Bombycillidae																	
Cedar Waxwing	*Bombycilla cedrorum*	-	-	-	-	-	-	-	-	-	-	-	u	u	c	o	-
Wood - Warblers – Parulidae																	
Black-throated Blue Warbler	*Dendroica caerulescens*	-	-	-	-	-	-	IB	-	-	-	-	r		o		-
Bay-breasted Warbler	*Dendroica castanea*	-	-	-	-	R5, N	H	-	-	-	-	-	r		o		-
Cerulean Warbler	*Dendroica cerulean*	-	-	-	-	R5, N	M	IB	-	-	-	-			r		-

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Yellow-rumped Warbler	*Dendroica coronata comata*	-	-	-	-	-	-	-	-	-	-	-	c		a	o	-
Prairie Warbler	*Dendroica discolor*	-	-	G5	S5	R5, N	HH	IA	-	-	-	-	r		o		-
Yellow-throated Warbler	*Dendroica dominica*	-	-	-	-	-	-	-	-	-	-	-			r		-
Blackburnian Warbler	*Dendroica fusca*	-	-	-	-	-	M	IIC	-	-	-	-	r		o		N
Magnolia Warbler	*Dendroica magnolia*	-	-	-	-	-	-	-	-	-	-	-	o		o		-
Palm Warbler	*Dendroica palmarum*	-	-	-	-	-	-	-	-	-	-	-	o		c		N
Chestnut-sided Warbler	*Dendroica pensylvanica*	-	-	-	-	-	-	-	-	-	-	-	r		o		NS
•Yellow Warbler	*Dendroica petechia*	-	-	-	-	-	-	-	-	-	-	-	c	c	o		-
•Pine Warbler	*Dendroica pinus*	-	-	-	-	-	-	-	-	-	-	-	u	o	o		-
Blackpoll Warbler	*Dendroica striata*	-	SC	G5	S1	-	-	-	-	-	-	-	o		u		N
Cape May Warbler	*Dendroica tigrina*	-	-	-	-	-	-	-	-	-	-	-	r		o		-
Black-throated Green Warbler	*Dendroica virens*	-	-	-	-	-	-	-	-	-	-	-	o		o		-
•Common Yellowthroat	*Geothlypis trichas*	-	-	-	-	-	-	-	-	-	-	-	c	c	c		-
Worm-eating Warbler	*Helmitheros vermivorus*	-	-	-	-	R5, N	H	IA	-	-	-	-			r		M
Yellow-breasted Chat	*Icteria virens*	-	-	-	-	-	-	-	-	-	-	-			o		-
Black-and-white Warbler	*Mniotilta varia*	-	-	-	-	-	H	IIA	-	-	-	-	u		u		M
Connecticut Warbler	*Oporornis agilis*	-	-	-	-	-	-	-	-	-	-	-			r		-
Kentucky Warbler	*Oporornis formosus*	-	-	-	-	R5, N	H	IB	-	-	-	-			r		M
Mourning Warbler	*Oporornis philadelphia*	-	SC	G5	S1	-	-	-	-	-	-	-	r		r		-
Northern Parula	*Parula americana*	-	T	G5	S2	-	-	-	-	-	-	-	o		o		-
Prothonotary Warbler	*Protonotaria citrea*	-	-	-	-	N	H	-	-	-	-	-	r		r		M
Ovenbird	*Seiurus aurocapillus*	-	-	-	-	-	-	-	-	-	-	-	r		o		NMS

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Northern Waterthrush	*Seiurus noveboracensis*	-	-	-	-	-	-	-	-	-	-	-	o		u		NS
American Redstart	*Setophaga ruticilla*	-	-	-	-	-	-	-	-	-	-	-	o		u		-
Orange-crowned Warbler	*Vermivora celata*	-	-	-	-	-	-	-	-	-	-	-			o		-
Golden-winged Warbler	*Vermivora chrysoptera*	-	-	-	-	R5, N	M	IB	-	-	-	-	r		r		-
Tennessee Warbler	*Vermivora peregrina*	-	-	-	-	-	-	-	-	-	-	-	r		o		-
Blue-winged Warbler	*Vermivora pinus*	-	-	G5	S3	R5, N	HH	IA	-	-	-	-			o		S
Nashville Warbler	*Vermivora ruficapilla*	-	-	-	-	-	-	-	-	-	-	-	r		o		-
Canada Warbler	*Wilsonia canadensis*	-	-	G5	S5	R5, N	M	IIC	-	-	-	-	r		o		-
Hooded Warbler	*Wilsonia citrina*	-	-	-	-	-	-	-	-	-	-	-			r		-
Wilson's Warbler	*Wilsonia pusilla*	-	-	-	-	-	-	-	-	-	-	-	r		o		-
Tanagers – Thraupidae																	
Scarlet Tanager	*Piranga olivacea*	-	-	-	-	-	-	IA	-	-	-	-	r		o		-
Summer Tanager	*Piranga rubra*	-	-	-	-	-	-	-	-	-	-	-	r		r		-
Emberizine Sparrows and Their Allies – Emberizidae																	
•Saltmarsh Sparrow	*Ammodramus caudacutus*	-	-	G4	S3	R5, N	HH	IA	-	-	-	-	c	c	o		MS
Henslow's Sparrow	*Ammodramus henslowii*	-	E	G4	S1	R5, N	M	IB	-	-	-	-			r		-
LeConte's Sparrow	*Ammodramus leconteii*	-	-	-	-	-	-	-	-	-	-	-			x		-
•Seaside Sparrow	*Ammodramus maritimus*	-	-	G4	S2	R5, N	HH	IA	-	-	-	-		r	r		-
Nelson's Sharp-tailed Sparrow	*Ammodramus nelsoni*	-	-	-	-	R5, N	M	-	-	-	-	-			r		N
Grasshopper Sparrow	*Ammodramus savannarum*	-	T	G5	S2	-	M	-	-	-	-	-			r		M

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Lark Bunting	*Calamospiza melanocorys*	-	-	-	-	-	-	-	-	-	-	-			r		-
Lapland Longspur	*Calcarius lapponicus*	-	-	-	-	-	-	-	-	-	-	-	u		u	o	-
Lark Sparrow	*Chondestes grammacus*	-	-	-	-	-	-	-	-	-	-	-		r	r		-
Dark-eyed Junco	*Junco hyemalis*	-	-	-	-	-	-	-	-	-	-	-	u		c	o	-
Swamp Sparrow	*Melospiza georgiana*	-	-	-	-	-	-	-	-	-	-	-	r		u		-
Lincoln's Sparrow	*Melospiza lincolnii*	-	-	-	-	-	-	-	-	-	-	-			o		-
•Song Sparrow	*Melospiza melodia*	-	-	-	-	-	-	-	-	-	-	-	c	c	c	c	-
•Savannah Sparrow	*Passerculus sandwichensis*	-	-	-	-	-	-	-	-	-	-	-	c	c	c	c	-
Fox Sparrow	*Passerella iliaca*	-	-	-	-	-	-	-	-	-	-	-			o		-
•Eastern Towhee	*Pipilo erythrophthalmus*	-	-	G5	S5	-	H	IIA	-	-	-	-	u	r	u		NM
Snow Bunting	*Plectrophenax nivalis*	-	-	-	-	-	-	-	-	-	-	-	o		c	c	-
Vesper Sparrow	*Pooecetes gramineus*	-	T	G5	S2	-	-	-	-	-	-	-			r		-
American Tree Sparrow	*Spizella arborea*	-	-	-	-	-	-	-	-	-	-	-			o	o	-
Clay-colored Sparrow	*Spizella pallida*	-	-	-	-	-	-	-	-	-	-	-			r		-
•Chipping Sparrow	*Spizella passerina*	-	-	-	-	-	-	-	-	-	-	-	u	u	u		-
Field Sparrow	*Spizella pusilla*	-	-	G5	S5	-	H	-	-	-	-	-	r		o		S
White-throated Sparrow	*Zonotrichia albicollis*	-	-	G5	S5	-	-	-	-	-	-	-	u		c		N
White-crowned Sparrow	*Zonotrichia leucophrys*	-	-	-	-	-	-	-	-	-	-	-	r		u		-
Cardinals and Grosbeaks – Cardinalidae																	
•Northern Cardinal	*Cardinalis cardinalis*	-	-	-	-	-	-	-	-	-	-	-	c	c	c	c	-
Blue Grosbeak	*Guiraca caerulea caerulea*	-	-	-	-	-	-	-	-	-	-	-	r		r		-
Painted Bunting	*Passerina ciris*	-	-	-	-	-	-	-	-	-	-	-	x		x		-

Common Name	Scientific Name	Federal Legal Status[1]	MA Legal Status[1]	Global Rarity Rank[2]	MA Rarity Rank[3]	BCC[7]	BCR 30[8]	PIF 09[9]	MANEM[10]	NAWMP[11]	NAWCP[12]	U.S. SCP[13]	Spring[14]	Summer[14]	Fall[14]	Winter[14]	NALCC Rep. Species[15]
Indigo Bunting	*Passerina cyanea*	-	-	-	-	-	-	-	-	-	-	-	o		u		-
Rose-breasted Grosbeak	*Pheuctitus ludovicianus*	-	-	-	-	-	-	IIA	-	-	-	-	o		u		-
Dickcissel	*Spiza americana*	-	-	-	-	-	-	-	-	-	-	-			r		-
Blackbirds and Orioles – Icterids																	
•Red-winged Blackbird	*Agelaius phoeniceus*	-	-	-	-	-	-	-	-	-	-	-	c	c	c		-
Bobolink	*Dolichonyx oryzivorus*	-	-	-	-	-	-	III	-	-	-	-	o		c		NS
Rusty Blackbird	*Euphagus carolinus*	-	-	-	-	R5, N	H	-	-	-	-	-			u		-
Baltimore Oriole	*Icterus galbula*	-	-	-	-	-	H	1A	-	-	-		u	u	c		-
Orchard Oriole	*Icterus spurius*	-	-	-	-	-	-	-	-	-	-	-	r	r			-
Brown-headed Cowbird	*Molothrus ater*	-	-	-	-	-	-	-	-	-	-	-	u	u	u		-
Eastern Meadowlark	*Sternella magna*	-	-	G5	S4	-	-	-	-	-	-	-	r		o		MS
•Common Grackle	*Quiscalus quiscula*	-	-	-	-	-	-	-	-	-	-	-	c	c	c		-
Yellow-headed Blackbird	*Xanthocephalus xanthocephalus*	-	-	-	-	-	-	-	-	-	-	-		r	r		-
Finches – Fringillidae																	
Common Redpoll	*Carduelis flammea*	-	-	-	-	-	-	-	-	-	-	-				r	-
•American Goldfinch	*Carduelis tristis*	-	-	-	-	-	-	-	-	-	-	-	c	c	c	c	-
Purple Finch	*Carpodacus purpureus*	-	-	-	-	-	-	2A	-	-	-	-	o		o	r	-
•House Finch	*Carpodacus mexicanus*	-	-	-	-	-	-	-	-	-	-	-	c	c	c	c	-
Evening Grosbeak	*Coccothraustes vespertinus*	-	-	-	-	-	-	-	-	-	-	-	r		r	r	-
Red Crossbill	*Loxia curvirostra*	-	-	-	-	-	-	-	-	-	-	-	r		r	r	-
White-winged Crossbill	*Loxia leucoptera*	-	-	-	-	-	-	-	-	-	-	-	r		r	r	-
Pine Grosbeak	*Pinicola enucleator*	-	-	-	-	-	-	-	-	-	-	-				r	-
Pine Siskin	*Spinus pinus*	-	-	-	-	-	-	-	-	-	-	-	r		o	r	-

Common Name	Scientific Name	Federal Legal Status[1]	MA Legal Status[1]	Global Rarity Rank[2]	MA Rarity Rank[3]	BCC[7]	BCR 30[8]	PIF 09[9]	MANEM[10]	NAWMP[11]	NAWCP[12]	U.S. SCP[13]	Spring[14]	Summer[14]	Fall[14]	Winter[14]	NALCC Rep. Species[15]
Old World Sparrows – Passeridae																	
•House Sparrow	*Passer domesticus*	-	-	-	-	-	-	-	-	-	-	-	c	c	c	c	-

Source: Data adapted from the Monomoy National Wildlife Refuge Bird List prepared with the assistance of Blair Nikula.
•Denotes species suspected to have been breeding on the refuge over the past 20 years.

Table A.5. Mammal Species Known or Suspected on Monomoy NWR.

Common Name	Scientific Name	Federal Status[1]	MA Legal Status[1]	Global Rarity Rank[2]	MA Rarity Rank[3]	NOAA Fisheries Listing[4]	NALCC Rep. Species[15]
Opossums –Didelphidae							
Virginia Opossum	*Didelphis virginiana*	-	-	-	-	-	-
Tree Squirrels and Marmots – Sciuridae							
Eastern Gray Squirrel	*Sciurus carolinensis*	-	-	-	-	-	-
Red Squirrel	*Tamiasciurus hudsonicus*	-	-	-	-	-	-
Eastern Chipmunk	*Tamias striatus*	-	-	-	-	-	-
Shrews – Soricidae							
Northern Short-tailed Shrew	*Blarina brevicauda*	-	-	-	-	-	-
Masked Shrew (Cinereus)	*Sorex cinereus*	-	-	-	-	-	-
Plainnose Bats – Vespertilionidae							
Big Brown Bat	*Eptesicus fuscus*	-	-	-	-	-	-
Eastern Red Bat	*Lasiurus borealis*	-	-	G5	S4	-	NMS
Hoary Bat	*Lasiurus cinereus*	-	-	G5	SU	-	-
Raccoons, Coatis, and Ringtails – Procyonidae							
Raccoon	*Procyon lotor*	-	-	-	-	-	-

Common Name	Scientific Name	Federal Status[1]	MA Legal Status[1]	Global Rarity Rank[2]	MA Rarity Rank[3]	NOAA Fisheries Listing[4]	NALCC Rep. Species[15]
Weasels, Mink, Martens, and Otters – Mustelidae							
North American River Otter	*Lutra canadensis*	-	-	-	-	-	-
Skunks – Mephitidae							
Striped Skunk	*Mephitis mephitis*	-	-	-	-	-	-
Dogs, Foxes, and Wolves – Canidae							
Eastern Coyote	*Canis latrans*	-	-	-	-	-	-
Red Fox	*Vulpes vulpes*	-	-	-	-	-	-
Cats – Felidae							
Domestic Cat	*Felis catus*	-	-	-	-	-	-
Hair Seals – Phocidae							
Hooded Seal	*Cystophora cristata*	-	-	-	-	-	-
Gray Seal	*Halichoerus grypus*	-	-	-	-	-	-
Harp Seal	*Pagophilus groenlandicus*	-	-	-	-	-	-
Harbor Seal	*Phoca vitulina*	-	-	-	-	-	-
Mice, Rats, Voles, and Lemmings – Cricetidae							
Meadow Vole	*Microtus pennsylvanicus*	-	-	-	-	-	-
Common Muskrat	*Ondatra zibethicus*	-	-	-	-	-	-
White-footed Mouse	*Peromyscus leucopus*	-	-	-	-	-	-
Old World Rats and Mice – Muridae							
House Mouse	*Mus musculus*	-	-	-	-	-	-
Jumping Mice – Dipodidae							
Meadow Jumping Mouse	*Zapus hudsonius*	-	-	-	-	-	-
Hares and Rabbits – Leporidae							
Eastern Cottontail	*Sylvilagus floridanus*	-	-	-	-	-	-
Deer, Elk, and Moose – Cervidae							
White-tailed Deer	*Odocoileus virginianus*	-	-	-	-	-	-

Common Name	Scientific Name	Federal Status[1]	MA Legal Status[1]	Global Rarity Rank[2]	MA Rarity Rank[3]	NOAA Fisheries Listing[4]	NALCC Rep. Species[15]
Sperm Whale – Physeteridae							
Sperm Whale	*Physeter macrocephalus*	E	E	G3G4	S1	E/D	-
Dolphins and Porpoises – Delphinidae							
Short-Beaked Common Dolphin	*Delphinus delphis*	-	-	-	-	-	-
Short-finned Pilot Whale	*Globicephala macrorhynchus*	-	-	-	-	-	-
Long-finned Dolphin	*Globicephala melas*	-	-	-	-	-	-
Risso's Dolphin	*Grampus griseus*	-	-	-	-	-	-
Atlantic White-sided Dolphin	*Lagenorhynchus acutus*	-	-	-	-	-	-
White-beaked Dolphin	*Lagenorhynchus albirostris*	-	-	-	-	-	-
Harbor Porpoise	*Phocoena phocoena*	-	-	G4G5	S4	-	-
Northern Bottlenose Dolphin	*Tursiops truncatus*	-	-	-	-	D	-
Finback Whales - Balaenopteridae							
Minke Whale	*Balaenoptera acutorostrata*	-	-	-	-	-	-
Sei Whale	*Balaenoptera borealis*	E	E	G3	S1S2	E/D	-
Blue Whale	*Balaenoptera musculus*	E	E	G3G4	S1	E/D	-
Fin Whale	*Balaenoptera physalus*	E	E	G3G4	S1S2	E/D	-
Humpback Whale	*Megaptera novaeangliae*	E	E	G3	S1S2	E/D	-
Right and Bowhead Whales - Balaenidae							
North Atlantic Right Whale	*Eubalaena glacialis*	E	E	G1	S1S2	E/D	-

Source: Data assembled from the Massachusetts Division of Fisheries and Wildlife, State Mammal List—Species Distribution, in addition to staff observations of wildlife on the refuge.

Table A.6. Butterfly and Moth Species Known or Suspected on Monomoy NWR.

Common Name	Scientific Name	Federal Status[1]	MA Legal Status[1]	Global Rarity Rank[2]	MA Rarity Rank[3]	NALCC Rep. Species[15]
Swallowtails – Papilionidae						
Eastern Tiger Swallowtail	*Papilio glaucus*	-	-	-	-	-
Black Swallowtail	*Papilio polyxenes*	-	-	-	-	-
Whites, Sulphurs, and Orange Tips – Pieridae						
Orange Sulphur	*Colias eurytheme*	-	-	-	-	-
Clouded Sulphur	*Colias philodice*	-	-	-	-	-
Cloudless Sulphur	*Phoebis sennae*	-	-	-	-	-
Cabbage White	*Pieris rapae*	-	-	-	-	-
Gossamer-winged Butterflies - Lycaenidae						
Brown Elfin	*Callophrys augustinus*	-	-	-	-	-
Spring Azure	*Celastrina ladon*	-	-	-	-	-
'Summer' Spring Azure	*Celastrina neglecta*	-	-	-	-	-
American Copper	*Lycaena phlaeas*	-	-	-	-	-
Brush-footed Butterflies – Nymphalidae						
Common Wood Nymph	*Cercyonis pegala*	-	-	-	-	-
Variegated Fritillary	*Euptoieta claudia*	-	-	-	-	-
Common Buckeye	*Junonia coenia*	-	-	-	-	-
Viceroy	*Limenitis archippus*	-	-	-	-	-
Mourning Cloak	*Nymphalis antiopa*	-	-	-	-	-
Pearl Crescent	*Phyciodes tharos*	-	-	-	-	-
Question Mark	*Polygonia interrogationis*	-	-	-	-	-
Red Admiral	*Vanessa atalanta*	-	-	-	-	-
Painted Lady	*Vanessa cardui*	-	-	-	-	-
American Lady	*Vanessa virginiensis*	-	-	-	-	-

Common Name	Scientific Name	Federal Status[1]	MA Legal Status[1]	Global Rarity Rank[2]	MA Rarity Rank[3]	NALCC Rep. Species[15]
Milkweed Butterflies - Danaidae						
Monarch	*Danaus plexippus*	-	-	-	-	-
Skippers – Hesperiidae						
Dun Skipper	*Euphyes vestris*	-	-	-	-	-
Long-tailed Skipper	*Urbanus proteus*	-	-	-	-	-

Source: Data assembled from observations of Massachusetts Butterfly Club members at Monomoy NWR from 1991 to 2010.

Table A.7. Dragonfly and Damselfly Species Known or Suspected on Monomoy NWR.

Common Name	Scientific Name	Federal Status[1]	MA Legal Status[1]	Global Rarity Rank[2]	MA Rarity Rank[3]	NALCC Rep. Species[15]
Pond Damsel – Coenagrionidae						
•Familiar Bluet	*Enallagma civile*	-	-	-	-	-
Citrine Forktail	*Ischnura hastata*	-	-	-	-	-
Fragile Forktail	*Ischnura posita*	-	-	-	-	-
Rambur's Forktail	*Ischnura ramburii*	-	-	-	-	-
•Eastern Forktail	*Ischnura verticalis*	-	-	-	-	-
Darner – Aeshnidae						
Common Green Darner	*Anax junius*	-	-	-	-	-
Swamp Darner	*Epiaeschna heros*	-	-	-	-	-
Skimmer – Libellulidae						
Calico Pennant	*Celithemis elisa*	-	-	-	-	-
Eastern Pondhawk	*Erythemis simplicicollis*	-	-	-	-	-
•Seaside Dragonlet	*Erythrodiplax berenice*	-	-	-	-	-
•Needham's Skimmer	*Libellula needhami*	-	-	-	-	-
Twelve-spotted Skimmer	*Libellula pulchella*	-	-	-	-	-
Painted Skimmer	*Libellula semifasciata*	-	-	-	-	-

Common Name	Scientific Name	Federal Status[1]	MA Legal Status[1]	Global Rarity Rank[2]	MA Rarity Rank[3]	NALCC Rep. Species[15]
Great Blue Skimmer	*Libellula vibrans*	-	-	-	-	-
Blue Dasher	*Pachydiplax longipennis*	-	-	-	-	-
Wandering Glider	*Pantala flavescens*	-	-	-	-	-
Spot-winged Glider	*Pantala hymenaea*	-	-	-	-	-
Eastern Amberwing	*Perithemis tenera*	-	-	-	-	-
Common Whitetail	*Plathemis lydia*	-	-	-	-	-
Variegated Meadowhawk	*Sympetrum corruptum*	-	-	-	-	-
•Saffron-bordered Meadowhawk	*Sympetrum costiferum*	-	-	-	-	-
Cherry-faced (Ruby) Meadowhawk	*Sympetrum internum/rubicundulum*	-	-	-	-	-
Striped Saddlebags	*Tramea calverti*	-	-	-	-	-
Carolina Saddlebags	*Tramea carolina*	-	-	-	-	-
Black Saddlebags	*Tramea lacerata*	-	-	-	-	-

Source: Data collected from observations by Blair Nikula of Odonata on the refuge.
•Denotes species suspected to have been breeding on the refuge over the past 20 years.

Table A.8. Tiger Beetle Species Known or Suspected on Monomoy NWR.

Common Name	Scientific Name	Federal Status[1]	MA Legal Status[1]	Global Rarity Rank[2]	MA Rarity Rank[3]	NALCC Rep. Species[15]
Ground Beetles, Scarab Beetles, and Tiger Beetles - Carabidae						
•Northeastern beach tiger beetle	*Cicindela dorsalis dorsalis*	T	E	G4T2	S1	-
•Hairy-necked Tiger Beetle	*Cicindela hirticollis hirticollis*	-	-	-	-	-
•Hairy-necked Tiger Beetle (subspecies)	*Cicindela hirticollis rhodensis*	-	-	-	-	-
•Saltmarsh Tiger Beetle	*Cicindela marginata*	-	-	-	-	-
Bronzed Tiger Beetle	*Cicindela repanda*					

Source: Data collected from Northeastern Beach Tiger Beetle Surveys completed by Neil Kapitulik.
•Denotes species suspected to have been breeding on the refuge over the past 20 years.

Table A.9. Crustacean Species Known or Suspected on Monomoy NWR.

Common Name	Scientific Name	Federal Status[1]	MA Legal Status[1]	Global Rarity Rank[2]	MA Rarity Rank[3]	NOAA Fisheries Listing[4]	AFS Status[5]	Spring Occurrence (%)[6]	Fall Occurrence (%)[6]	NALCC Rep. Species[15]
Mantis Shrimp										
Mantis Shrimp unclassified	Order Stomatopoda	-	-	-	-	-	-	1.5	0.7	-
Shrimp – Crangonidae										
Sand Shrimp	*Crangon septemspinosa*	-	-	-	-	-	-	NA	NA	-
Lobster – Nephropsidae										
American Lobster	*Homarus americanus*	-	-	-	-	-	-	27.7	9.7	-
Hermit Crabs – Paguridae										
Hermit Crab unclassified	*Paguroidea* spp.	-	-	-	-	-	-	NA	NA	-
Long-clawed Hermit Crab	*Pagurus longicarpus*	-	-	-	-	-	-	NA	NA	-
True Crabs – Calappidae										
Flame Box Crab	*Calappa flammea*	-	-	-	-	-	-	0	0.2	-
True Crabs – Majidae										
Spider Crab unclassified	Family Majidae	-	-	-	-	-	-	88.2	77.9	-
True Crabs – Cancridae										
Jonah Crab	*Cancer borealis*	-	-	-	-	-	-	0.5	0.5	-
Atlantic Rock Crab	*Cancer irroratus*	-	-	-	-	-	-	69	35.9	-
True Crabs – Portunidae										
Blue Crab	*Callinectes sapidus*	-	-	-	-	-	-	1.2	1	-
Green Crab	*Carcinus maenas*	-	-	-	-	-	-	NA	NA	-
Lady (Calico) Crab	*Ovalipes ocellatus*	-	-	-	-	-	-	44.3	67.5	-
Amphipods – Ampeliscidae										
-	*Ampelisca abdita*	-	-	-	-	-	-	NA	NA	-
Amphipods – Gammaridae										
Scuds	*Gammarus* spp.	-	-	-	-	-	-	NA	NA	-

Common Name	Scientific Name	Federal Status[1]	MA Legal Status[1]	Global Rarity Rank[2]	MA Rarity Rank[3]	NOAA Fisheries Listing[4]	AFS Status[5]	Spring Occurrence (%)[6]	Fall Occurrence (%)[6]	NALCC Rep. Species[15]
Amphipods – Haustoriidae										
-	*Haustorius canadensis*	-	-	-	-	-	-	NA	NA	-
-	*Acanthohaustorius millsi*	-	-	-	-	-	-	NA	NA	-
Arthropods – Diastylidae										
-	*Dastylis polita*	-	-	-	-	-	-	NA	NA	-
-	*Oxyurostylis smithi*	-	-	-	-	-	-	NA	NA	-
Arthropods – Idoteidae										
-	*Edotea triloba*	-	-	-	-	-	-	NA	NA	-
-	*Chirodotea coeca*	-	-	-	-	-	-	NA	NA	-

Source: Data assembled from the Massachusetts Division of Marine Fisheries Nantucket Sound Spring and Fall Trawl Surveys from 1978 to 2010; the Nantucket Sound Estuarine Winter Flounder Seine Surveys 1976 to 2010; Weiss 1995; and Leavitt and Peters 2005.

Table A.10. Bivalve Species Known or Suspected on Monomoy NWR.

Common Name	Scientific Name	Federal Status[1]	MA Legal Status[1]	Global Rarity Rank[2]	MA Rarity Rank[3]	NOAA Fisheries Listing[4]	AFS Status[5]	Spring Occurrence (%)[6]	Fall Occurrence (%)[6]	NALCC Rep. Species[15]
Bivalves – Mytilidae										
Northern Horse Mussel*	Modiolus modiolus	-	-	-	-	-	-	0	0.7	-
Blue Mussel*	Mytilus edulis	-	-	-	-	-	-	2.3	1.7	-
Bivalves – Pectinidae										
Bay Scallop	*Argopecten irradians*	-	-	-	-	-	-	5.1	4.8	-
Sea Scallop	*Placopecten magellanicus*	-	-	-	-	-	-	1.7	0	-
Bivalves – Articidae										
Ocean Quahog	*Artica islandica*	-	-	-	-	-	-	0.3	0.2	-

Common Name	Scientific Name	Federal Status[1]	MA Legal Status[1]	Global Rarity Rank[2]	MA Rarity Rank[3]	NOAA Fisheries Listing[4]	AFS Status[5]	Spring Occurrence (%)[6]	Fall Occurrence (%)[6]	NALCC Rep. Species[15]
Bivavles – Verneridae										
Northern Quahog	*Mercenaria mercenaria*	-	-	-	-	-	-	0.2	0.5	-
Amethyst Gem Clam	*Gemma gemma*									
Bivalves – Mactridae										
Atlantic Surf Clam	*Spisula solidissima*	-	-	-	-	-	-	3.6	3.1	-
Bivalves – Solenidae										
Razor Clam	*Ensis directus*	-	-	-	-	-	-	NA	NA	-
Bivalves – Myidae										
Softshell Clam	*Mya arenaria*	-	-	-	-	-	-	NA	NA	-
Bivalves – Tellinidae										
Baltic Clam	*Macoma balthica*	-	-	-	-	-	-	NA	NA	-
Northern Dwarf Tellin	*Tellina agilis*	-	-	-	-	-	-	NA	NA	-
Bivalves – Solemyidae										
Atlantic Awning Clam	*Solemya velum*	-	-	-	-	-	-	NA	NA	-
Bivalves – Periplomatidae										
-	*Periploma papyratium*	-	-	-	-	-	-	NA	NA	-

Source: Data assembled from the Massachusetts Division of Marine Fisheries Nantucket Sound Spring and Fall Trawl Surveys from 1978 to 2010; the Nantucket Sound Estuarine Winter Flounder Seine Surveys 1976 to 2010; Weiss 1995; and Leavitt and Peters 2005.

Table A.11. Miscellaneous Marine Invertebrate Species at Monomoy NWR.

Common Name	Scientific Name	Federal Status[1]	MA Legal Status[1]	Global Rarity Rank[2]	MA Rarity Rank[3]	NOAA Fisheries Listing[4]	AFS Status[5]	Spring Occurrence (%)[6]	Fall Occurrence (%)[6]	NALCC Rep. Species[15]
Shelled Gastropods - Melongenidae										
Channeled Whelk	*Busycotypus canaliculatus*	-	-	-	-	-	-	54.7	48.7	-
Knobbed Whelk	*Busycon carica*	-	-	-	-	-	-	26.4	53.8	-

Common Name	Scientific Name	Federal Status[1]	MA Legal Status[1]	Global Rarity Rank[2]	MA Rarity Rank[3]	NOAA Fisheries Listing[4]	AFS Status[5]	Spring Occurrence (%)[6]	Fall Occurrence (%)[6]	NALCC Rep. Species[15]
Moon Snails – Naticidae										
Northern Moonsnail	*Euspira heros*	-	-	-	-	-	-	3.2	0.5	-
Moon Snail/Shark Eye*	Family Naticidae	-	-	-	-	-	-	24.4	8.2	-
-	*Neverita (Polynices) duplicata*	-	-	-	-	-	-	NA	NA	-
Mud Snails – Nassariidae										
Eastern Mudsnail	*Illyanassa obsoletus*	-	-	-	-	-	-	NA	NA	-
Dove Snails – Columbellidae										
Dove Snails	*Anachis avara*	-	-	-	-	-	-	NA	NA	-
Mud Snails – Hydrobiidae										
-	*Hydrobia* spp.	-	-	-	-	-	-	NA	NA	-
Chalice Bubble Snails – Cylichnidae										
Channeled Barrel-bubble	*Acteocina canaliculata*	-	-	-	-	-	-	NA	NA	-
Squids and Octopuses - Loliginidae										
Longfin Squid	*Loligo pealaii*	-	-	-	-	-	-	90.5	99.8	-
Squids and Octopuses – Ommastrephidae										
Northern Shortfin Squid	*Illex illecebrosus*	-	-	-	-	-	-	0.8	0	-
Horseshoe Crabs – Limulidae										
Horseshoe Crab	*Limulus polyphemus*	-	-	-	-	-	-	20.7	23.1	MS
Sea Urchins – Strongylocentrotidae										
Sea urchin unclassified (Green Urchin)	*Strongylocentrotus drobachiensis*	-	-	-	-	-	-	0.3	0	-

Source: Data assembled from the Massachusetts Division of Marine Fisheries Nantucket Sound Spring and Fall Trawl Surveys from 1978 to 2010 and the Nantucket Sound Estuarine Winter Flounder Seine Surveys 1976 to 2010; Weiss 1995; Leavitt and Peters 2005.

Table A.12. Miscellaneous Terrestrial Invertebrates Known to be Present on Monomoy NWR.

Order/Class	Examples of species within the order that may occur on the refuge
Amphipoda	Amphipods
Arachnida	Harvestmen, mites, ticks, spiders
Diptera	Flies
Hymenoptera	Sawflies, ichneumons, chalcids, ants, wasps, bees
Neuroptera	Dobsonflies, fishflies, alderflies, lacewings, antlions
Orthoptera	Grasshoppers, crickets, cockroaches, mantids, walkingsticks
Siphonoptera	Fleas
Zoraoptera	Zorapterans

Source: Data assembled from the Effects of Herring Gulls and Great Black-backed Gulls on Breeding Piping Plovers, South Monomoy Island, Massachusetts, Keane 2002.

Table A.13. Marine Worms Known or Suspected at Monomoy NWR.

Common Name	Scientific Name
Phylum Nemertea	
Milky Ribbon Worm	*Cerebratulus lacteus*
Micruran Nemerteans	*Micrura* spp.
Phylum Annelida – Class Polychaeta – Family Capitellidae	
-	*Capitella capitata*
-	*Heteromastus filifomis*
Phylum Annelida – Class Polychaeta – Family Orbiniidae	
-	*Scoloplos fragilis*
-	*Scoloplos acutus*
-	*Scoloplos robustus*
Phylum Annelida – Class Polychaeta – Family Nereidae	
Common Clam Worm	*Nereis succinea*
-	*Nereis arenaceodonta*
Sandworm	*Nereis virens*
Phylum Annelida – Class Polychaeta – Family Chaetopteridae	
-	*Spiochaetopterus oculatus*
Phylum Annelida – Class Polychaeta – Family Maldanidae	
Bamboo Worm	*Clymenella torquata*
Phylum Annelida – Class Polychaeta – Family Glyceridae	
Common Blood Worm	*Glycera dibranchiata*
Phylum Annelida – Class Polychaeta – Family Pectinaridae	
Trumpet Worm	*Pectinaria gouldii*
Phylum Annelida – Class Polychaeta – Family Arenicolidae	
Lugworm	*Arenicola marina*

Common Name	Scientific Name
Phylum Annelida – Class Polychaeta – Family Lumbrineridae	
Thread Worms	*Lumbrineris tenuis*
Phylum Annelida – Class Polychaeta – Family Nephtyidae	
Red-Lined Worms	*Nephtys picta*
Red-Lined Worms	*Nephtys caeca*
Red-Lined Worms	*Nephtys bucera*
Phylum Annelida – Class Polychaeta – Family Phyllodocidae	
Paddle Worms	*Eteone heteropoda*
Paddle Worms	*Phyllodoce mucosa*
Phylum Annelida – Class Polychaeta – Family Spionidae	
-	*Spio setosa*
Bee Spionid	*Spiophanes bombyx*
	Strebelospio benedictii
Mud Worm	*Polydora cornuta*
-	*Scolepsis squamata*
-	*Pygospio elegans*
-	*Prionospio heterobranchia*
Phylum Annelida – Class Polychaeta – Family Oligochaeta	
-	*Phyllodrilus monospermathecus*
-	*Monophylephorus irroratus*
Phylum Annelida – Class Polychaeta – Family Echinodermata	
-	*Leptosynapta inhaerens*
Phylum Annelida – Class Polychaeta – Family Hemichordata	
Acorn Worm	*Saccoglosus kowaleskii*
Phylum Annelida – Class Polychaeta – Family Syllidae	
-	*Syllides verrilli*
-	*Brania wellfleetensis*
Phylum Annelida – Class Polychaeta – Family Cirratulidae	
Fringed Worms	*Tharyx* spp.
Phylum Annelida – Class Polychaeta – Family Paraonidae	
Paraonid Worms	*Paranois fulgens*
*Source: Weiss 1*995; and Leavitt and Peters 2005	

1 Federal and State Legal Status Codes (under Federal and Massachusetts Endangered Species Lists): E=Endangered; T=Threatened; SC=State Species of Special Concern; C=Candidate Species.

2 Natureserve Global Conservation Status Ranks: G1=Critically Imperiled; G2=Imperiled; G3=Vulnerable; G4=Apparently Secure; G5=Secure; T#=Infraspecific Taxon (MA DFG 2006).

[3] Massachusetts Rarity Rank: S =Critically Imperiled; S2=Imperiled; S3=Either very rare or uncommon, vulnerable; S4=Widespread, abundant, apparently secure; S5=Secure; SNR=Unranked; N=Non-Breeding; SNA=Not Applicable; SU=Unrankable (MA DFG 2006).

[4] NOAA Fisheries Office of Protected Resources: E=Endangered; T=Threatened; P=Proposed; C=Candidate; S=Species of Concern; F=Foreign; D=Depleted; DL=Delisted.

[5] American Fisheries Society's Marine, Estuarine, and Diadromous Fish stocks at Risk of Extinction: E=Endangered; T=Threatened; V=Vulnerable; CD=Conservation Dependent (Musick et al. 2000).

[6] NA: indicates that there is no available data on this species included in trawl report and species was identified as one that should be included anyway.

*: indicates that summary data may be incomplete (per this DMF and observations for all years and/or recorded under additional species codes in 1 or more years).

[7] U.S. Fish and Wildlife Service Division of Migratory Birds, Birds of Conservation Concern for Region 5 (Northeast) (USFWS 2008). R5=Species identified as a species of conservation concern in Region 5; N=Species identified as a species of conservation concern nationally.

[8] Bird Conservation Region 30: New England/Mid-Atlantic Coast Conservation Priority Category (ACJV 2007). HH=Highest Priority; H=High Priority; M=Moderate Priority.

[9] Partners in Flight (PIF) Bird Conservation Plan for Southern New England: Physiographic Area 09 (Dettmers and Rosenberg 2000). IA=High continental priority and high regional responsibility; IB=High continental priority and low regional responsibility; IIA=High regional concern; IIC=High regional threats; III=Additional Watch List

[10] Waterbird Conservation Plan for the Mid-Atlantic/New England/Maritimes Region: 2006-2010, MANEM Waterbird Working Group. HH=Highest conservation concern; H=High conservation concern; M=Moderate conservation concern; L=Low conservation concern.

[11] North American Waterfowl Management Plan (NAWMP), Atlantic Coast Joint Venture, Waterfowl Implementation Plan, Revision June 2005 (Draft). H=High; MH=Moderate High; M=Moderate; ML=Moderate Low; AO=Above Objective.

[12] North American Waterbird Conservation Plan (NAWCP), Categories of Conservation Concern (Kushlan et al. 2002). HI=Highly Imperiled; HC=High Concern; MC=Moderate Concern; LC=Low Concern; NR=Not Currently At Risk; IL=Information Lacking.

[13] U.S. Shorebird Conservation Plan, Conservation Category Codes (Brown et al. 2001, Clark and Niles 2000). 5=Highly imperiled; 4=Species of high concern; 3=Species of moderate concern; 2=Species of low concern; 1=Species not at risk.

[14] Spring, Summer, Fall, Winter Relative Abundance: a=abundant; c=common; u=uncommon; o=occasional; r=rare; and x=accidental.

[15] North Atlantic Landscape Conservation Cooperative Representative Species (NALCC): N=Northern; NALCC Representative; M=Mid NALCC Representative; S=Southern NALCC Representative.

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Appendix B

USFWS

Seabeach sandwort (Arenaria peploides)

Plant Species Known or Suspected on Monomoy National Wildlife Refuge

Table B.1. Plant Species Known or Suspected on Monomoy National Wildlife Refuge (NWR).

Family – Genus Species	MA Status[1]	Global Rarity Rank[2]	MA Rarity Rank[3]	Refuge Status	Synonyms
Horsetail – Equisetaceae					
Equisetum arvense L.	-	G5	S5	Rare	
Club-moss – Lycopodiaceae					
Lycopodium inundatum L.	-	G5	S5	Occasional	
Lycopodium inundatum L. var. *bigelovii* Tuckerm	-	-	S4	Occasional	
Adder's tongue – Ophioglossaceae					
Ophioglossum vulgatum L.	T	G5	S2	Rare	
Royal fern – Osmundaceae					
Osmunda regalis L.	-	G5	S5	Common	
Osmunda cinnamomea L.	-	G5	S5	Common	
Wood fern – Dryopteridaceae					
Onoclea sensibilis L.	-	G5	SNA	Common	
Dryopteris carthusiana (Vill.) H.P.Fuchs	-	G5	S4	Rare	*Dryopteris spinulosa* var. *intermedia*
Thelypterioid fern – Thelypteridaceae					
Thelypteris palustris Schott var. *pubescens* (Lawson) Fernald	-	G5T5	S5	Abundant	*Dryopteris thelypteris* (L.) Gray var. *pubescens*
Pine – Pinaceae					
*Pinus resinosa**	WL	G5	S2S3	Cultivated	
Pinus sylvestris L.*	-	GNR	SNR	Cultivated	
Pinus rigida Mill.	-	G5	S5	Occasional	
Pinus thunbergii Parl.*	-	GNR	SNR	Cultivated	
Juniperus virginiana L.	-	G5	S5	Occasional	
Arrow-grass – Juncaginaceae					
Triglochin maritima L.	-	G5	S4	Abundant	
Eel-grass – Zosteraceae					
Zostera marina L. var. *stenophylla* Aschers. & Graebn.	-	G5	S5	Abundant	
Potamogeton pectinatus L.	-	G5	S4	Abundant	*Stuckenia pectinata* (L.) Boerner
Potamogeton perfoliatus L. var. *bupleuroides*	-	G5	S5	-	
Ruppia maritima L.	-	G5	S4S5	Occasional	
Duckweed – Lemnaceae					
Spirodela polyrrhiza (L.) Schleid.	-	G5	S5	Common	
Sedge – Cyperacaea					
Cyperus diandrus Torr.	-	G5	S5	-	
Cyperus filicinus Vahl	-	G5	S4	Occasional	
Cyperus strigosus L.	-	G5	S5	Occasional	
Cyperus grayi Torr.	-	G5	S4	Occasional	

Family – Genus Species	MA Status[1]	Global Rarity Rank[2]	MA Rarity Rank[3]	Refuge Status	Synonyms
Cyperus lupulinus (Spreng.) Marcks	-	G5T5	S5	Occasional	*Cyperus filiculmis* Vahl
Eleocharis parvula (R. & S.) Link	-	G5	S4	Common	
Eleocharis halophia Fern & Brack.	-	G4	S4	Common	
Eleocharis tenuis (Willd.) Schultes	-	G5	S5	Rare	
Scirpus americanus Pers.	-	G5	S4	Common	
Schoenoplectus tabernaemontani (C.C. Gmel.) Palla	-	G5	S5	Occasional	*Scirpus validus* Vahl
Schoenoplectus robustus (Pursh) M.T. Strong	-	G5	S5	Rare	*Scripus robustus* (Pursh); *Bolboschoenus robustus* (Pursh)
Schoenoplectus maritimus (L.) Lye	-	G5	S5	-	*Scirpus paludosus* Nelson
Scirpus cyperinus (L.) Kunth	-	G5	S5	Common	
Eriophorum virginicum L.	-	G5	S5	Occasional	
Rhynchospora capitellata (Michx.) Vahl	-	G5	S5	Occasional	
Carex canescens L.	-	G5	S4	Occasional	
Carex atlantica Bailey	-	G5	S5	Occasional	
Carex seorsa Howe	-	G4	S4	Unk. Loc.	
Carex scoparia Schkuhr	-	G5	S5	Unk. Loc.	
Carex albolutescens Schwein.	-	G5	S3?	Occasional	
Carex longii Mackenz.	-	G5	S4	Occasional	
Carex silicea Olney	-	G5	S4	Common	
Carex hormathodes Fern.	-	G4G5	S5	Occasional	
Carex debilis Michx. var. *rudgei* Bailey	-	G5T5	S5	Rare	
Carex comosa Boott	-	G5	S5	Rare	
Carex lurida Wahlenb.	-	G5	S5	Occasional	
Grass – Poacea (Gramineae)					
Bromus tectorum L.	-	GNR	SNA	Occasional	
Festuca rubra L.*	-	G5	SNA	Common	
Puccinellia maritima (Hudson) Parl.	-	GNR	S4	Rare	
Eragrostis pilosa L. Beauv.*	-	G4	SNA	-	
Distichlis spicata L. Greene	-	G5	S5	Common	
*Phragmites australis**	I	G5	SNA	Common	
*Thinopyrum pycnanthum**	-	GNR	SNA	Common	*Agropyron pungens* (Pers.) R. & S.
Elymus repens (L.) Gould*	-	GNR	SNA	Occasional	*Agropyron repens* (L.) Beauv.
Elymus virginicus L. var. *halophilus* (Bickn.) Wieg.	-	G5T5	S4	Rare	
Aira caryophyllea L.*	-	GNR	SNA	Rare	
Danthonia spicata (L.) Beauv.	-	G5	S5	Rare	
Ammophila breviligulata Fern.	-	G5	S4	Abundant	
Agrostis stolonifera L.	-	G5	S5	-	
Agrostis capillaris L.*	-	GNR	SNA	-	

Family – Genus Species	MA Status[1]	Global Rarity Rank[2]	MA Rarity Rank[3]	Refuge Status	Synonyms
Agrostis hyemalis (Walt.) BSP.	-	G5	S4	Occasional	
Agrostis scabra Willd.	-	G5	S5	Occasional	
Spartina alterniflora Loisel.	-	G5	S5	Abundant	
Spartina patens (Ait.) Muhl.	-	G5	S5	Abundant	
Leersia oryzoides (L.) Sw.	-	G5	S5	Rare	
Digitaria sanguinalis (L.) Scop.*	-	G5	SNA	Rare	
Panicum dichotomiflorum Michx.	-	G5	S5	Occasional	
Panicum virgatum L.	-	G5	S5	Abundant	
Dichanthelium meridionale (Ashe) Freckmann	-	G5	S4	Common	*Panicum meridionale* Ashe
Dichanthelium acuminatum (Sw.) Gould & C.A. Clark var. *fasciculatum* (Torr.) Freckmann	-	G5T5	S5	-	*Panicum lanuginosum* Ell. var. *implicatum* (Scribn.) Fern
Dichanthelium clandestinum (L.) Gould	-	G5?	S5	Rare	*Panicum clandestinum* L.
Schizachyrium scoparium (Michx.) Nash	-	G5	S5	Common	*Andropogon scoparius* Michx.
Andropogon virginicus L. var. *virginicus*	-	G5T5	S4	Occasional	
Andropogon virginicus L. var. *abbreviatus* (Hack.) Fern. & Griscom	-	G5	S4	Occasional	
Rush – Juncaceae					
Juncus ambiguus Guss.	WL	G5	S1?	Occasional	*Juncus bufonius* L. var. *halophilus* Buchenau and Fern.
Juncus gerardii Loisel.	-	G5	S5	Abundant	
Juncus tenuis Willd.	-	G5	S5	Rare	
Juncus dichotomus Ell.	-	G5	S4	Common	
Juncus greenei Oakes and Tuckerm.	-	G5	S5	Common	
Juncus effusus L.*	-	G5	SNA	Abundant	
Juncus arcticus Willd. ssp. *littoralis* (Engelm.) Hultén	-	G5	S4	Occasional	*Juncus balticus* Willd.
Juncus canadensis J. Gay	-	G5	S5	Occasional	
Juncus subcaudatus (Engelm.) Coville and Blake	-	G5	-	Occasional	
Juncus acuminatus Michx.	-	G5	S5	Common	
Juncus articulatus L.	-	G5	S5	Rare	
Luzula multiflora (Retz.) LeJeune	-	G5	S5	Rare	
Cat-tail – Typhaceae					
Typha angustifolia L.	-	G5	S5	Abundant	
Iris – Iridaceae					
Sisyrinchium angustifolium Mill.	-	G5	S4	Occasional	
Iris prismatica Pursh	-	G4G5	S4	Rare	
Iris versicolor L.	-	G5	S5	Abundant	
Lily – Liliaceae					
Smilacina stellata (L.) Desf.	-	G5	S4	Rare	*Maianthemum stellatum* (L.) Link
Smilax rotundifolia L.	-	G5	S5	Rare	

Family – Genus Species	MA Status[1]	Global Rarity Rank[2]	MA Rarity Rank[3]	Refuge Status	Synonyms
Orchid – Orchidaceae					
Habenaria lacera (Michx.) Lodd.	-	G5	S4	Rare	*Platanthera lacera* (Michaux) G. Don
Pogonia ophioglossoides (L.) Ker	-	G5	S5	Occasional	
Spiranthes cernua (L.) Richard	-	G5	S5	Occasional	
Aster – Asteraceae (Compositae)					
Eupatorium dubium Willd.	-	G5	S5	Occasional	*Eutrochium dubium* (Willd. ex Poir.) E.E. Lamont
Eupatorium perfoliatum L.	-	G5	S5	Rare	
Pityopsis falcata (Pursh) Nutt.	-	G3G4	S4	Abundant	*Chrysopsis falcata* (Pursh) Ell.
Solidago sempervirens L.	-	G5	S5	Abundant	
Solidago rugosa Ait.	-	G5	S4	Rare	
Euthamia galetorum Greene	-	G5	S5	Common	*Solidago graminifolia* (L.) Salisb.; *Euthamia graminifolia* (L.) Nutt.
Euthamia caroliniana (L.) Greene ex Porter & Britton	-	G5	S5	Common	*Solidago tenuifolia* Pursh
Symphyotrichum pilosum (Willd.) G.L. Nesom var. *pringlei* (A. Gray) G.L. Nesom	-	G5T5	S5	Rare	*Aster pilosus* Willd. var. *demotus* Blake
Symphyotrichum ericoides (L.) G.L. Nesom var. *ericoides*	-	G5	S5	Rare	*Aster ericoides* L.
Symphyotrichum dumosum (L.) G.L. Nesom var. *dumosum*	-	G5T3T5	S5	Rare	*Aster dumosus* L.
Symphyotrichum novi-belgii (L.) G.L. Nesom var. *novi-belgii*	-	G5	S5	Occasional	*Aster novi-belgii* L.
Ionactis linariifolius (L.) Greene	-	G5	S5	Occasional	*Aster linariifolius* L.
Symphyotrichum subulatum (Michx.) G.L. Nesom	-	G5	S4	Occasional	*Aster subulatus* Michx.
Conyza canadensis (L.) Cronquist var. *canadensis*	-	G5	S5	Rare	*Erigeron canadensis* L.
Conyza canadensis (L.) Cronquist var. *pusilla* (Nutt.) Cronquist	-	G5T5	S5	Common	*Erigeron pusillus* Nutt.
Baccharis halimifolia L.	-	G5	S4	Common	
Pluchea odorata (L.) Cass. var. *odorata*	-	G5T5	S4	Common	*Pluchea purpurascens* (Sw.) DC.
Anaphalis margaritacea (L.) C. B. Clarke	-	G5	S5	Unk. Loc.	
Pseudognaphalium obtusifolium (L.)	-	G5	S5	Common	*Gnaphalium obtusifolium* L.
Iva frutescens L.	-	G5	S4	Occasional	
Ambrosia artemisiifolia L.	-	G5	S5	Occasional	
Xanthium strumarium L. var. *glabratum* (DC.) Cronquist	-	G5T5?	S4	Unk. Loc.	*Xanthium chinense* Mills.
Xanthium strumarium L.	-	G5	-	Common	
Xanthium strumarium L. var. *canadense* (Mill.) Torr. & A. Gray	-	G5T5	S5	-	*Xanthium echinatum* Murr.
Bidens cernua L.	-	G5	S5	Common	
Bidens frondosa L.	-	G5	S5	Occasional	
Achillea millefolium L.*	-	G5	SNA	Occasional	

Family – Genus Species	MA Status[1]	Global Rarity Rank[2]	MA Rarity Rank[3]	Refuge Status	Synonyms
Leucanthemum vulgare Lam.*	-	GNR	SNA	Rare	*Chrysanthemum leucanthemum* L.
Artemisia campestris L. ssp. *caudata* (Michx.) H.M. Hall & Clem.	-	G5T5	S4	Occasional	*Artemisia caudata* Michx.
Artemisia stelleriana Bess.*	-	G4?	SNA	Common	
Erechtites hieracifolia (L.) Raf.	-	G5	S5	Rare	
Senecio vulgaris L.*	-	GNR	SNA	Rare	
Cirsium vulgare (Savi) Tenore*	-	GNR	SNA	Common	
Cirsium arvense (L.) Scop.*	-	GNR	SNA	Rare	
Cichorium intybus L.*	-	GNR	SNA	Rare	
Hypochaeris radicata L.*	-	GNR	SNA	Occasional	
Taraxacum officinale Weber*	-	G5	SNA	Occasional	
Sonchus arvensis L.*	-	GNR	SNA	Rare	
Sonchus asper (L.) Hill*	-	GNR	SNA	Occasional	
Lactuca canadensis L. var. *latifolia* Ktze.	-	G5	S5	Occasional	
Lactuca biennis (Moench) Fern.	-	G5	S5	Rare	
Hieracium florentinum All.*	-	GNR	SNA	Common	*Hieracium piloselloides* Vill.
Honeysuckle – Caprifoliaceae					
Lonicera morrowii A. Gray*	I	GNR	SNA	Rare	
Viburnum dentatum L.	-	G5	S5	Occasional	
Viburnum recognitum Fern.	-	G4G5	S5	Occasional	
Gentian – Gentianaceae					
Bartonia virginica (L.) BSP.	-	G5	S4	Rare	
Mint – Lamiaceae (Labiatae)					
Teucrium canadense L.	-	G5	S4	Abundant	
Scutellaria galericulata L.	-	G5	S5	Common	*Scutellaria epilobiifolia* A. Hamilton
Scutellaria x *churchilliana* Fern.	-	GNA	-	Common	
Lycopus virginicus L.	-	G5	S5	Rare	
Lycopus uniflorus Michx.	-	G5	S5	Common	
Lycopus americanus Muhl.	-	G5	S5	Common	
Plantain – Plantaginaceae					
Plantago major L.*	-	G5	SNA	Rare	
Plantago maritima L. var. *juncoides* (Lam.) A. Gray	-	G5T5	S4S5	Occasional	*Plantago oliganthos* E. & S.
Plantago lanceolata L.*	-	G5	SNA	Occasional	
Madder – Rubiaceae					
Galium trifidum L.	-	G5	-	Abundant	
Figwort – Scrophulariaceae					
Verbascum thapsus L.*	-	GNR	SNA	Occasional	
Linaria vulgaris Hill*	-	GNR	SNA	Occasional	

Family – Genus Species	MA Status[1]	Global Rarity Rank[2]	MA Rarity Rank[3]	Refuge Status	Synonyms
Nuttallanthus canadensis (L.) D.A. Sutton	-	G5	S5	Common	*Linaria canadensis* (L.) Dumont
Limosella australis R. Br.	-	G4G5	S4	Common	*Limosella subulata* Ives
Lindernia dubia (L.) Pennell var. *anagallidea* (Michx.) Cooperr.	-	G5T4	S5	Occasional	*Lindernia anagallidea* (Michx.) Pennell
Veronica arvensis L.*	-	GNR	SNA	Rare	
Gerardia purpurea L.	-	G5	S4	Common	
Agalinis tenuifolia (Vahl) Raf.	-	G5	S4	Common	
Morning Glory – Convolvulaceae					
Calystegia sepium (L.) R. Br. ssp. *sepium**	-	G5TU	SNA	Common	*Convolvulus sepium* L.
Cuscuta compacta Juss.	-	G5	S4	Occasional	
Potato – Solanaceae					
Solanum dulcamara L.*	-	GNR	SNA	Occasional	
Solanum americanum Mill.	-	G5	S4S5	Occasional	
Solanum lycopersicum L.*	-	GNR	SNA	Rare	*Lycopersicum esculentum* Mill.
Fig-marigold – Aizoaceae					
Mollugo verticillata L.*	-	GNR	SNA	Occasional	
Pink – Caryophyllaceae					
Spergularia salina J. Presl & C. Presl	-	G5	S4	Occasional	*Spergularia marina* (L.) Griseb.
Honckenya peploides (L.) Ehrh. ssp. *diffusa* (Hornem.) Hultén	-	G5T5	S4	Common	*Arenaria peploides* L.
Stellaria media (L.) Cyrillo*	-	GNR	SNA	Occasional	
Cerastium fontanum Baumg. ssp. *vulgare* (Hartm.) Greuter & Burdet*	-	GNRTNR	SNA	Occasional	*Cerastium vulgatum* L. 1762, non 1755
Dianthus armeria L.*	-	GNR	SNA	Rare	
Goosefoot – Chenopodiaceae					
Atriplex patula L. var. hastata (L.) Gray*	-	G5	SNA	Common	
Atriplex cristata Humb. & Bonpl. ex Willd.	-	G5	S4	Common	*Atriplex arenaria* Nutt.
Salicornia bigelovii Torr.	-	G5	S4	Occasional	
Salicornia maritima Wolff & Jefferies	-	G5	S5	Common	*Salicornia europaea L.*
Salicornia virginica L.	-	G5	S5	Occasional	
Suaeda maritima (L.) Dumort.	-	G5	S4	Common	
Suaeda maritima (L.) Dumort. ssp. *richii* (Fernald) Bassett & C.W. Crompton	WL	G5T3	S2S3	Occasional	*Suaeda richii Fern.*
Suaeda calceoliformis (Hook.) Moq.	SC	G5	S2S3	Rare	*Suaeda americana* (Pers.) Fern.
Suaeda linearis (Ell.) Moq.	-	G5	S4	Rare	
Salsola kali L.	-	GNR	S4	Common	
Pokeweed – Phytolacceae					
Phytolacca americana L.	-	G5	S5	Occasional	
Leadwort – Plumbaginaceae					
Limonium carolinianum (Walt.) Britt.	-	G5	S4	Abundant	*Limonium nashii* Small

Family – Genus Species	MA Status[1]	Global Rarity Rank[2]	MA Rarity Rank[3]	Refuge Status	Synonyms
Buckwheat – Polygonaceae					
Rumex crispus L.*	-	GNR	SNA	Common	
Rumex acetosella L.*	-	GNR	SNA	Abundant	
Polygonum glaucum Nutt.	SC	G3	S3	Rare	
Polygonum pensylvanicum L. var. *nesophilum* Fern.	-	G5	S5	Occasional	
Polygonum persicaria L.*	-	G3G5	SNA	-	
Polygonum punctatum Ell. var. *leptostachyum* (Meisn.) Small	-	G5	S5	Common	
Polygonum hydropiperoides Michx.	-	G5	S5	Abundant	
Polygonum scandens. L.	-	G5	S5	Occasional	*Fallopia scandens* (L.) Holub
Polygonella articulata (L.) Meisn.	-	G5	S4	Occasional	
Mustard – Brassicaceae (Cruciferae)					
Draba verna L.*	-	GNR	SNA	Occasional	
Lepidium campestre (L.) R. Br.*	-	GNR	SNA	Occasional	
Lepidium virginicum L.	-	G5	S5	Common	
Cakile edentula (Bigel.) Hook.	-	G5	S4S5	Common	
Raphanus raphanistrum L.*	-	GNR	SNA	Occasional	
Barbarea vulgaris R. Br.*	-	GNR	SNA	Occasional	
Clethra – Clethraceae					
Clethra alnifolia L.	-	G5	S5	Occasional	
Heath – Ericaceae					
Kalmia angustifolia L.	-	G5	S5	Occasional	
Lyonia ligustrina (L.) DC.	-	G5	S5	Occasional	
Arctostaphylos uva-ursi (L.) Spreng.	-	G5	S5	Unk. Loc.	
Gaylussacia baccata (Wang.) K. Koch	-	G5	S5	Rare	
Vaccinium corymbosum L.	-	G5	S5	Occasional	
Vaccinium angustifolium Ait.	-	G5	S5	Occasional	
Vaccinium macrocarpon Ait.	-	G4	S5	Occasional	
Mallow – Malvaceae					
Hibiscus moscheutos L.	-	G5	S4	Common	*Hibiscus palustris* L.
Sundew – Droseraceae					
Drosera rotundifolia L.	-	G5	S4S5	Occasional	
Primrose – Primulaceae					
Lysimachia terrestris (L.) BSP.	-	G5	S5	Occasional	
Trientalis borealis Raf.	-	G5	S5	Rare	
Willow – Salicaceae					
Salix nigra Marsh.	-	G5	S5	Rare	
Salix bebbiana Sarg.	-	G5	S5	Occasional	
Salix discolor Muhl.	-	G5	S5	Occasional	

Family – Genus Species	MA Status[1]	Global Rarity Rank[2]	MA Rarity Rank[3]	Refuge Status	Synonyms
Mangosteen – Clusiaceae (Guttiferae)					
Hypericum boreale (Britt.) Bickn.	-	G5	S5	Common	
Hypericum canadense L.	-	G5	S5	Rare	
Triadenum virginicum (L.) Raf.	-	G5	S5	Abundant	*Hypericum virginicum* L.
Rock-rose – Cistaceae					
Hudsonia tomentosa Nutt.	-	G5	S4	Abundant	
Lechea villosa Ell.	-	G5	S5	Occasional	
Lechea maritima Leggett	-	G5	S5	Common	
Cucumber – Cucurbitaceae					
Cucurbita pepo L.*	-	G4G5	SNA	Rare	
Violet – Violaceae					
Viola macloskeyi Lloyd ssp. *pallens* (Banks ex Ging) M.S. Baker	-	G5T5	S5	Unk. Loc.	*Viola pallens* (Banks) Brainerd
Viola lanceolata L.	-	G5	S5	Occasional	
Birch – Betulaceae					
Betula populifolia Marsh.	-	G5	S5	Rare	
Beech – Fagaceae					
Quercus ilicifolia Wang.	-	G5	S5	Rare	
Bayberry – Myricaceae					
Morella pensylvanica (Mirb.) Kartesz	-	G5	S5	Abundant	*Myrica pensylvanica* Loisel.
Myrica gale L.	-	G5	S5	Rare	
Hornwort – Ceratophyllaceae					
Ceratophyllum demersum L.	-	G5	S5	Common	
Water-lily – Nymphaeaceae					
Nymphaea odorata Ait.	-	G5	S5	Common	
Poppy – Papaveraceae					
Glaucium flavum Crantz*	I	GNR	SNA	Rare	
Carrot – Apaceae (Umbelliferae)					
Ptilimnium capillaceum (Michx.) Raf.	-	G5	S4	Abundant	
Ligusticum scothicum L.	-	G5	S4	Occasional	
Daucus carota L.*	-	GNR	SNA	Rare	
Holly – Aquifoliaceae					
Ilex opaca Ait.	-	G5	S4	Cultivated	
Ilex verticillata (L.) Gray	-	G5	S5	Occasional	
Spurge – Euphorbiaceae					
Euphorbia cyparissias L.*	L	G5	SNA	Rare	
Chamaesyce polygonifolia (L.) Small	-	G5?	S4	Common	*Euphorbia polygonifolia* L.

Family – Genus Species	MA Status[1]	Global Rarity Rank[2]	MA Rarity Rank[3]	Refuge Status	Synonyms
Pea – Fabaceae (Leguminosa)					
Trifolium arvense L.*	-	GNR	SNA	Unk. Loc	
Trifolium repens L.*	-	GNR	SNA	Unk. Loc	
Trifolium aureum Pollich*	-	GNR	SNA	Unk. Loc	*Trifolium agrarium* L.
Lathyrus japonicus Willd.	-	G5	S4S5	Abundant	
Wood-sorrel – Oxalidaceae					
Oxalis stricta L.	-	G5	S5	Rare	
Flax – Linaceae					
Linum striatum Walt. var. *multijugum* Fern.	WL	G5	S2S3	Occasional	
Loosestrife – Lythraceae					
Decodon verticillatus (L.) Ell.	-	G5	S5	Common	
Decodon salicaria L.*	I	G5	SNA	Rare	*Lythrum salicaria* L.
Evening primrose – Onagraceae					
Ludwigia palustris (L.) Ell. var. *americana* (DC) Fern. & Griscom	-	G5	S5	Common	
Epilobium leptophyllum Raf.	-	G5	S4S5	Occasional	
Epilobium ciliatum Raf. ssp. *ciliatum*	-	G5T5	S5	Occasional	*Epilobium glandulosum* Lehm. var. *adenocaulon* (Haussk.) Fern.
Oenothera biennis L.	-	G5	S5	Occasional	
Oenothera parviflora L.	-	G4?	S4	Common	
Oenothera perennis L.	-	G5	S5	Occasional	
Oleaster – Elaeagnaceae					
*Elaeagnus umbellata Thunb.**	I	GNR	SNA	Cultivated	
Rose – Rosaceae					
Spiraea tomentosa L.	-	G5	S4	Common	
Pyrus communis L.*	-	G5	SNA	Cultivated	
Photinia pyrifolia (Lam.) K.R. Robertson & Phipps	-	G4G5Q	S4S5	Rare	*Pyrus arbutifolia* (L.) L. f.
Amelanchier canadensis (L.) Medic.	-	G5	S5	Occasional	
Potentilla norvegica L.	-	G5	S5	Occasional	
Potentilla simplex Michx.	-	G5	S5	Occasional	
Argentina egedii (Wormsk.) Rydb. ssp. *groenlandica* (Tratt.) A. Löve	-	G5T4T5	S4	Rare	*Potentilla egedii* Wormsk. var. *groenlandica* (Tratt.) Polunin
Rubus idaeus L. var. *strigosus* (Michx.) Maxim	-	G5T5	S5	Occasional	
Rubus hispidus L.	-	G5	S5	Common	
Rubus pensilvanicus Poir.	-	G5	S5	Occasional	
Rosa virginiana Mill.	-	G5	S5	Occasional	
Rosa carolina L.	-	G5	S5	Rare	
Rosa rugosa Thumb.*	-	GNR	SNA	Common	

Family – Genus Species	MA Status[1]	Global Rarity Rank[2]	MA Rarity Rank[3]	Refuge Status	Synonyms
Prunus maritima Marsh.	-	G4	S4	Common	
Prunus persica (L.) Batsch*	-	G5	SNA	Cultivated	
Prunus serotina Ehrh.	-	G5	S5	Occasional	
Sumac – Anacardiaceae					
Toxicodendron radicans (L.) Kuntze	-	G5	S5	Abundant	*Rhus radicans* L.

Source: Data compiled from the 1965 Plant List of Monomoy National Wildlife Refuge, the Flora of Monomoy Island, Massachusetts from 1969, and Additions to the Flora of Monomoy Island from 1985.

***** = Introduced to Barnstable County. (Introduced species identified in "The Vascular Plants of Massachusetts: A County Checklist." Each introduced species has an * at the end of the plant name. The introduced species are defined by county on the right side of the county checklist.)

1 Federal and State Legal Status Codes (under Federal and Massachusetts Endangered Species Lists): E=Endangered; T=Threatened; SC=State species of Special Concern; WL=Watch List; H=Historic; I=Invasive; L=Likely Invasive; P=Potentially Invasive.

2 NatureServe Global Conservation Status Ranks: G1=Critically Imperiled; G2=Imperiled; G3=Vulnerable; G4=Apparently Secure; G5=Secure; GNR=Unranked; G#G# =Range Rank (range of uncertainty about exact status); T# =Infraspecific Taxon; ? =Inexact Numeric Rank; Q=Questionable Taxonomy.

3 Massachusetts State Rarity Ranks: S1=Critically Imperiled; S2=Imperiled; S3=Vulnerable; S4=Apparently Secure; S5=Secure; SNR=Unranked; SX=Presumed Extirpated; SH=Historical; SNA=Not Applicable.

Literature Cited

Bailey, W. 1965. Plant List of Monomoy National Wildlife Refuge, Massachusetts. Contribution No 2, Monomoy Light Research Station. Massachusetts Audubon Society, South Wellfleet, MA.

Cullina, M.D. B. Connolly, B. Sorrie, and P. Somers. 2011. The Vascular Plants of Massachusetts: A County Checklist, First Revision. Massachusetts Natural Heritage and Endangered Species Program, Massachusetts Division of Fisheries and Wildlife, Westborough, MA.

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Appendix C

USFWS

Wetland vegetation

Vegetation Alliances and Associations of Monomoy National Wildlife Refuge

- I. Forest
- II. Woodland
- III. Shrubland
- IV. Dwarf-shrubland
- V. Herbaceous Vegetation
- VII. Sparse Vegetation

INTERNATIONAL ECOLOGICAL CLASSIFICATION STANDARD: TERRESTRIAL ECOLOGICAL CLASSIFICATIONS

Alliances and Associations of Monomoy National Wildlife Refuge

19 November 2010

by

NatureServe

1101 Wilson Blvd., 15th floor
Arlington, VA 22209

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Boston, MA 02111-1736

This subset of the International Ecological Classification Standard covers vegetation alliances and associations of Monomoy National Wildlife Refuge. This classification has been developed in consultation with many individuals and agencies and incorporates information from a variety of publications and other classifications. Comments and suggestions regarding the contents of this subset should be directed to Mary J. Russo, Central Ecology Data Manager, Durham, NC <mary_russo@natureserve.org> and Lesley A. Sneddon, Senior Regional Ecologist, Boston, MA <lesley_sneddon@natureserve.org>.

Citations:

The following citation should be used in any published materials which reference ecological system and/or International Vegetation Classification (IVC hierarchy) and association data:

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This document may be generally cited as follows:
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[1] NatureServe is an international organization including NatureServe regional offices, a NatureServe central office, U.S. State Natural Heritage Programs, and Conservation Data Centres (CDC) in Canada and Latin America and the Caribbean. Ecologists from the following organizations have contributed the development of the ecological systems classification:

United States

Central NatureServe Office, Arlington, VA; Eastern Regional Office, Boston, MA; Midwestern Regional Office, Minneapolis, MN; Southeastern Regional Office, Durham, NC; Western Regional Office, Boulder, CO; Alabama Natural Heritage Program, Montgomery AL; Alaska Natural Heritage Program, Anchorage, AK; Arizona Heritage Data Management Center, Phoenix AZ; Arkansas Natural Heritage Commission Little Rock, AR; Blue Ridge Parkway, Asheville, NC; California Natural Heritage Program, Sacramento, CA; Colorado Natural Heritage Program, Fort Collins, CO; Connecticut Natural Diversity Database, Hartford, CT; Delaware Natural Heritage Program, Smyrna, DE; District of Columbia Natural Heritage Program/National Capital Region Conservation Data Center, Washington DC; Florida Natural Areas Inventory, Tallahassee, FL; Georgia Natural Heritage Program, Social Circle, GA; Great Smoky Mountains National Park, Gatlinburg, TN; Gulf Islands National Seashore, Gulf Breeze, FL; Hawaii Natural Heritage Program, Honolulu, Hawaii; Idaho Conservation Data Center, Boise, ID; Illinois Natural Heritage Division/Illinois Natural Heritage Database Program, Springfield, IL; Indiana Natural Heritage Data Center, Indianapolis, IN; Iowa Natural Areas Inventory, Des Moines, IA; Kansas Natural Heritage Inventory, Lawrence, KS; Kentucky Natural Heritage Program, Frankfort, KY; Louisiana Natural Heritage Program, Baton Rouge, LA; Maine Natural Areas Program, Augusta, ME; Mammoth Cave National Park, Mammoth Cave, KY; Maryland Wildlife & Heritage Division, Annapolis, MD; Massachusetts Natural Heritage & Endangered Species Program, Westborough, MA; Michigan Natural Features Inventory, Lansing, MI; Minnesota Natural Heritage & Nongame Research and Minnesota County Biological Survey, St. Paul, MN; Mississippi Natural Heritage Program, Jackson, MI; Missouri Natural Heritage Database, Jefferson City, MO; Montana Natural Heritage Program, Helena, MT; National Forest in North Carolina, Asheville, NC; National Forests in Florida, Tallahassee, FL; National Park Service, Southeastern Regional Office, Atlanta, GA; Navajo Natural Heritage Program, Window Rock, AZ; Nebraska Natural Heritage Program, Lincoln, NE; Nevada Natural Heritage Program, Carson City, NV; New Hampshire Natural Heritage Inventory, Concord, NH; New Jersey Natural Heritage Program, Trenton, NJ; New Mexico Natural Heritage Program, Albuquerque , NM; Maryland Natural Heritage Program, Latham, NY; North Carolina Natural Heritage Program, Raleigh, NC; North Dakota Natural Heritage Inventory, Bismarck, ND; Ohio Natural Heritage Database, Columbus, OH; Oklahoma Natural Heritage Inventory, Norman, OK; Oregon Natural Heritage Program, Portland, OR; Pennsylvania Natural Diversity Inventory, PA; Rhode Island Natural Heritage Program, Providence, RI; South Carolina Heritage Trust, Columbia, SC; South Dakota Natural Heritage Data Base, Pierre, SD; Tennessee Division of Natural Heritage, Nashville, TN; Tennessee Valley Authority Heritage Program, Norris, TN; Texas Conservation Data Center, San Antonio, TX; Utah Natural Heritage Program, Salt Lake City, UT; Vermont Nongame & Natural Heritage Program, Waterbury, VT; Virginia Division of Natural Heritage, Richmond, VA; Washington Natural Heritage Program, Olympia, WA; West Virginia Natural Heritage Program, Elkins, WV; Wisconsin Natural Heritage Program, Madison, WI; Wyoming Natural Diversity Database, Laramie, WY

Canada

Alberta Natural Heritage Information Centre, Edmonton, AB, Canada; Atlantic Canada Conservation Data Centre, Sackville, New Brunswick, Canada; British Columbia Conservation Data Centre, Victoria, BC, Canada; Manitoba Conservation Data Centre. Winnipeg, MB, Canada; Ontario Natural Heritage Information Centre, Peterborough, ON, Canada; Quebec Conservation Data Centre, Quebec, QC, Canada; Saskatchewan Conservation Data Centre, Regina, SK, Canada; Yukon Conservation Data Centre, Yukon, Canada

Latin American and Caribbean

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Table of Contents

I. Forest

I.B.2.N.a. Lowland or submontane cold-deciduous forest

Amelanchier canadensis - *Viburnum* spp. - *Morella pensylvanica* Scrub Forest (CEGL006379)
Canadian Serviceberry - Viburnum species - Northern Bayberry Scrub Forest
Northern Tall Maritime Shrubland **Classif. Resp.: East**

ELEMENT CONCEPT

Summary: This tall maritime shrubland or scrub forest community characteristically replaces maritime forests that have been cleared. The community is variable in composition and generally includes *Amelanchier canadensis, Prunus serotina, Sassafras albidum, Nyssa sylvatica, Acer rubrum, Juniperus virginiana* in the canopy. The oaks *Quercus velutina, Quercus stellata, Quercus alba* may or may not be present. The shrubs *Morella pensylvanica (= Myrica pensylvanica), Photinia* spp. (= *Aronia* spp.), *Viburnum* spp. may form an understory or contribute substantial cover to the canopy. Vines are often prevalent, including *Smilax* spp., *Vitis* spp., *Toxicodendron radicans, Parthenocissus quinquefolia*. The herbaceous layer is generally sparse. These shrublands are usually very dense, and often maintained in their current state by constant winds and salt spray.

ELEMENT DESCRIPTION

Environment: This tall maritime shrubland or scrub forest community characteristically replaces maritime forests that have been cleared. It occurs at former agricultural sites on sandy loam soils. These shrublands are usually very dense and often maintained in their current state by constant winds and salt spray.
Vegetation: This tall shrubland community is variable in composition and generally includes *Amelanchier canadensis, Prunus serotina, Sassafras albidum, Nyssa sylvatica, Acer rubrum*, and *Juniperus virginiana* in the canopy. The oaks *Quercus velutina, Quercus stellata*, and *Quercus alba* may or may not be present. The shrubs *Morella pensylvanica, Photinia* spp., *Viburnum* spp., and *Gaylussacia baccata* may form an understory or contribute substantial cover to the canopy. Vines are often prevalent, including *Smilax* spp., *Vitis* spp., *Toxicodendron radicans*, and *Parthenocissus quinquefolia*. The herbaceous layer is generally sparse.
Dynamics: This tall maritime shrubland community characteristically replaces maritime forests that have been cleared. Successional relationships with maritime forest associations need to be determined.
Related Concepts:

- Coastal dune shrubland (Breden 1989) ?
- Coastal dune woodland (Breden 1989) ?
- SNE coastal rocky headland community (Rawinski 1984) ?

Conservation Ranking
GRank: GNR (1-Dec-1997) **Reasons**:

ELEMENT DISTRIBUTION

Range:
Nations: CA, US
Subnations: CT, MA, ME?, NH, NJ, NY, RI, QC
Distribution with Crosswalk data:

ELEMENT SOURCES

References: Breden 1989, Breden et al. 2001, Eastern Ecology Working Group n.d.*, Edinger et al. 2002, Metzler and Barrett 2001, NRCS 2001b, Rawinski 1984, Reschke 1990, Swain and Kearsley 2001

II. Woodland

II.A.4.N.a. Rounded-crowned temperate or subpolar needle-leaved evergreen woodland

Pinus rigida Woodland Alliance (A.524)

Pitch Pine Woodland Alliance

Alliance Summary: This alliance includes evergreen woodlands of rock outcrops, summits, exposed slopes or, less frequently, sandy soils. In the southeastern United States, associations are dominated by *Pinus rigida* with or without an admixture of *Pinus virginiana*. In the northeastern United States, associated canopy species include *Pinus resinosa,*

Pinus strobus, and *Pinus banksiana*, sometimes with an understory of *Quercus ilicifolia*. In the northeastern United States, associations in this alliance occur on xeric, sandy terraces within the Coastal Plain from southern Maine to Cape Henlopen, Delaware, including paleodunes and other habitats of the New Jersey pine barrens. Examples also occur on coastal acidic rock outcrops and rocky summits of southern Maine, eastern New York, and Cape Cod, Massachusetts. Other possible habitats include sand plains, flat glacial outwash plains, sand dunes and glacial till. In the North Atlantic Coast ecoregion, stands are on sandy soils, which are typically well-drained and nutrient-poor. The habitats are fire-maintained or with a maritime influence. In the southeastern United States, associations in this alliance occur at low elevations in the Ridge and Valley, and Cumberland Mountains, on sites outside the geographic range of *Pinus pungens*. Fire plays an important role in maintaining these communities, but on the most extreme sites, these communities are maintained by topo-edaphic conditions.

Pinus rigida / Quercus ilicifolia / Morella pensylvanica Woodland (CEGL006315)

Pitch Pine / Bear Oak / Northern Bayberry Woodland
Coastal Pitch Pine / Scrub Oak Barrens

ELEMENT CONCEPT

Summary: These woodlands of pine barrens in the North Atlantic Coast ecoregion are characterized by droughty, fire-prone vegetation, sandy soils and maritime influence. *Pinus rigida* is strongly dominant in the canopy. *Quercus ilicifolia* forms a dense, 1- to 2-m tall shrub layer with occasional *Quercus prinoides*. Dwarf-shrubs such as *Gaylussacia baccata, Morella pensylvanica (= Myrica pensylvanica), Vaccinium pallidum*, and *Vaccinium angustifolium* intermingle with the tall shrubs. Herbs tend to be sparse, although more open areas may support patches of *Schizachyrium scoparium* and *Deschampsia flexuosa*, or *Carex pensylvanica* and *Carex swanii*. Additional scattered herbs include *Comptonia peregrina, Pteridium aquilinum, Gaultheria procumbens*, and *Arctostaphylos uva-ursi*. Diagnostic characteristics include the presence of *Morella pensylvanica* to indicate coastal setting.

Environment: These woodlands of pine barrens in the North Atlantic Coast ecoregion are characterized by droughty, fire-prone vegetation, sandy soils and maritime influence. Soils are acidic and well-drained.

Vegetation: *Pinus rigida* is strongly dominant in the canopy. *Quercus ilicifolia* forms a dense, 1- to 2-m tall shrub layer with occasional *Quercus prinoides*. Dwarf-shrubs such as *Gaylussacia baccata, Morella pensylvanica, Vaccinium pallidum*, and *Vaccinium angustifolium* intermingle with the tall shrubs. Herbs tend to be sparse, although more open areas may support patches of *Schizachyrium scoparium* and *Deschampsia flexuosa*, or *Carex pensylvanica* and *Carex swanii*. Additional scattered herbs include *Comptonia peregrina, Pteridium aquilinum, Gaultheria procumbens*, and *Arctostaphylos uva-ursi*. Diagnostic characteristics include the presence of *Morella pensylvanica* to indicate coastal setting.

Dynamics: These are fire-maintained systems.

Related Concepts:

- CNE Mesic hardwood Forest on acidic bedrock / till (Rawinski 1984) B
- Maritime forest (Rawinski 1984) B
- Maritime forest, dune subtype (Rawinski 1984) ?
- New England pitch pine/scrub oak barrens (Rawinski 1984) ?
- SNE dry oak/pine forest on sandy/gravelly soils (Rawinski 1984) B
- SNE dry oak/pine forests on acidic bedrock or till (Rawinski 1984) B
- Southern New England oak / pine forest on sandy / gravelly soils (Rawinski 1984) B

CONSERVATION RANKING

GRank: G3 (1997-12-1) **Reasons**:

ELEMENT DISTRIBUTION

Range: Occurs in coastal areas of Massachusetts, Rhode Island, New York, and New Jersey.
Subnations: CT, MA, NJ, NY, RI
TNC Ecoregions: 61:C, 62:C
USFS Ecoregions: 221Ab:CCC, 221Ac:CCP, 221B:CC, 232Aa:CCC, 232Ab:CCC
Federal Lands: NPS (Cape Cod); USFWS (Massasoit?, Monomoy, Parker River)

ELEMENT SOURCES

References: Breden et al. 2001, Eastern Ecology Working Group n.d., Lundgren et al. 2000, Motzkin and Foster 2002, Rawinski 1984, Swain and Kearsley 2001

III. Shrubland

III.B.2.N.a. Temperate cold-deciduous shrubland

Morella pensylvanica - (Prunus maritima) Shrubland Alliance (A.902)

Northern Bayberry - (Beach Plum) Shrubland Alliance

Alliance Summary: This alliance includes maritime shrublands and dune thickets of the Mid-Atlantic Coast dominated by *Morella pensylvanica (= Myrica pensylvanica)*, with *Baccharis halimifolia, Rhus copallinum*, and stunted individuals of *Pinus taeda*. *Prunus maritima* is characteristic of this community from Maryland to the north. The constant movement of sand in this community limits the herbaceous cover. Typical herbaceous species include *Ammophila breviligulata, Cenchrus tribuloides, Chamaesyce polygonifolia, Cyperus grayi, Dichanthelium acuminatum, Diodia teres, Hudsonia tomentosa, Lechea maritima, Oenothera humifusa, Panicum amarum var. amarulum, Parthenocissus quinquefolia, Rumex acetosella, Solidago sempervirens, Spartina patens, Toxicodendron radicans*, and *Triplasis purpurea*. This maritime shrubland usually occupies the intermediate areas between the very unstable oceanward portions of the dunes and the more protected backdunes, where it forms partially open to dense shrub thickets. The substrate is sand with no soil profile development, and with variable amounts of accumulated leaf litter. Where this community occupies the lee side of foredunes, greater exposure to winds and storms contributes to a shorter stature and more open aspect of the vegetation. Here there are large patches of open unvegetated or sparsely vegetated sand.

Morella pensylvanica - Prunus maritima Shrubland (CEGL006295)

Northern Bayberry - Beach Plum Shrubland
Northern Bayberry Dune Shrubland

ELEMENT CONCEPT

Summary: This association comprises maritime dune shrublands of protected slopes and hollows of dry, stabilized maritime backdunes along the northern Atlantic Coast. It is dominated by *Morella pensylvanica (= Myrica pensylvanica)* and *Prunus maritima*. Additional shrubs that are commonly present but with low cover can include *Rosa carolina, Rosa rugosa, Baccharis halimifolia, Rhus typhina*, or *Juniperus virginiana*. Although *Rosa rugosa* is not a native species, it is naturalized and is nearly restricted to this vegetation, where it grows in similar habit and physiognomy as the other two shrubs characteristic of this vegetation. The herbaceous layer tends to be sparse and low, particularly where shrub growth is dense, and can include dune grassland or adjacent upland species such as *Ammophila breviligulata, Solidago sempervirens, Hudsonia tomentosa, Lechea maritima, Juncus greenei, Carex silicea, Polygonella articulata, Symphyotrichum subulatum (= Aster subulatus), Solidago rugosa, Achillea millefolium, Oenothera parviflora, Euthamia* spp., *Cyperus grayi, Cyperus polystachyos, Schizachyrium scoparium*, and others. Typical vine associates are *Toxicodendron radicans, Parthenocissus quinquefolia*, and *Smilax* spp. Large patches of open unvegetated or sparsely vegetated sand are present in some examples. Depending on exposure, these shrublands range from over 2 m tall in sheltered areas to less than 1 m tall in areas with greater exposure to winds and storms.

Environment: This association occurs on protected slopes and hollows of dry, stabilized maritime backdunes where the water table is greater than 1 m from the surface.

Vegetation: This shrubland vegetation is dominated by *Morella pensylvanica (= Myrica pensylvanica)* and *Prunus maritima*. Additional shrubs that are commonly present but with low cover can include *Rosa carolina, Rosa rugosa, Baccharis halimifolia, Rhus copallinum, Rhus typhina*, or *Juniperus virginiana*. The herbaceous layer tends to be sparse and can include dune grassland or adjacent upland species such as *Ammophila breviligulata, Solidago sempervirens, Hudsonia tomentosa, Lechea maritima, Juncus greenei, Carex silicea, Polygonella articulata, Symphyotrichum subulatum (= Aster subulatus), Solidago rugosa, Achillea millefolium, Oenothera parviflora, Euthamia* spp., *Cyperus grayi, Cyperus polystachyos, Schizachyrium scoparium*, and others. Typical vine associates are *Toxicodendron radicans, Parthenocissus quinquefolia*, and *Smilax* spp. Large patches of open unvegetated or sparsely vegetated sand are present in some examples. Depending on exposure, these shrublands range from over 2 m tall in sheltered areas to less than 1 m tall in areas with greater exposure to winds and storms.

Dynamics: This vegetation can be a probable intermediate in succession between beach dune and sunken forest; further dune development and protection from salt spray allows development of sunken forest vegetation (Art 1976).

Similar Associations:

- *Morella pensylvanica / Diodia teres* Shrubland (CEGL003881)
- *Prunus serotina - Rhus typhina* Scrub Forest (CEGL006399)

Related Concepts:
- *Myrica* thicket (Chrysler 1930) ?
- Coastal dune community (Rawinski 1984) ?
- Dune shrubland (Breden 1989) ?
- Low dune thicket (Martin 1959b) ?
- Maritime Shrubland on Dunes (Lundgren 2000) ?
- Rose - Bayberry Maritime Shrubland (Gawler 2002) B
- SNE coastal rocky headland community (Rawinski 1984) ?
- Short shrub thicket (Dunlop and Crow 1985) ?

Classification Comments: This vegetation is compositionally similar to maritime rocky headland, *Prunus serotina - Rhus typhina* Scrub Forest (CEGL006399). *Morella pensylvanica / Diodia teres* Shrubland (CEGL003881) is the southern analog of this association.

CONSERVATION RANKING
GRank: G4 (1997-12-1) **Reasons**:

ELEMENT DISTRIBUTION
Range: This association occurs from Maine to New Jersey.
Subnations: CT, DE?, MA, ME, NH, NJ, NY, RI
TNC Ecoregions: 62:C
USFS Ecoregions: 221Ab:CCC, 221Ac:CCC, 221Ad:CCC, 221Ak:CCC, 232Aa:CCC, 232Ab:CCC, 232Ac:CCC
Federal Lands: NPS (Cape Cod, Fire Island, Gateway); USFWS (E.B. Forsythe, Monomoy, Muskeget Island, Nomans Land Island, Parker River)

ELEMENT SOURCES
References: Art 1976, Breden 1989, Breden et al. 2001, Chrysler 1930, Conard 1935, Dunlop and Crow 1985, Eastern Ecology Working Group n.d., Edinger et al. 2002, Enser 1999, Gawler 2001, Gawler 2002, Lundgren 2000, Martin 1959b, McDonnell 1979, Metzler and Barrett 2001, Metzler and Barrett 2004, Moul 1969, NRCS 2001b, Nelson and Fink 1980, Nichols 1920, Rawinski 1984, Reschke 1990, Sneddon and Lundgren 2001, Sperduto 1997b, Sperduto 2000a, Swain and Kearsley 2001

III.B.2.N.e. Seasonally flooded cold-deciduous shrubland

Morella (cerifera, pensylvanica) - *Vaccinium formosum* Seasonally Flooded Shrubland Alliance (A.1010)

(Wax-myrtle, Northern Bayberry) - Southern Blueberry Seasonally Flooded Shrubland Alliance

Alliance Summary: This alliance includes shrub wetlands of mid-Atlantic barrier islands. The two most characteristic shrubs are *Morella cerifera (= Myrica cerifera)* and *Vaccinium corymbosum*. *Rosa palustris* and *Morella pensylvanica (= Myrica pensylvanica)* are two other common shrub associates. Unlike the *Morella cerifera* wetland alliance, this alliance is of generally shorter stature and total shrub cover; and, although quite variable, is usually considerably more open. Herbaceous composition is variable, but *Panicum virgatum, Andropogon virginicus, Schizachyrium scoparium*, and other grasses are common. Other herbs include *Juncus* spp., *Pluchea foetida, Triadenum virginicum, Drosera intermedia*, and *Osmunda regalis*. Standing water is commonly found in the spring, but water levels may drop substantially toward the end of the summer. The southern range limit of this alliance is not well known, but it is confined to barrier islands from Delaware south.

Morella pensylvanica – Toxicodendron / Typha latifolia Shrubland (CEGL006444)
Northern Bayberry – Poison Ivy / Cattail Shrubland
Bayberry Shrub Wetland

ELEMENT CONCEPT
Summary: This shrub wetland of shallow basins occurs in coastal southern New England. It occurs in interdunal swales of barrier beaches, or in wetlands of regions underlain by morainal deposits. The dominant shrub is *Morella pensylvanica*, which can achieve heights of 2.5m on the periphery of the wetland. Associated shrubs may include *Vaccinium corymbosum, Clethra alnifolia, Decodon verticillatus,* and *Toxicodendron radicans.* The herbaceous layer is variable, but generally includes *Typha latifolia* or *Typha angustifolia, Thelypteris palustris, Osmunda cinnamomea,*

Euthamia tenuifolia, and *Triadenum virginicum.* Other associated herbs may include *Vaccinium macrocarpon, Lysimachia terrestris, Scirpus cyperinus,* and species of *Polygonum.* The substrate is usually peat of variable depth overlying sand. This association is known from Cape Cod, Massachusetts, and Block Island, Rhode Island and may occur elsewhere.
Environment: This community occurs in interdunal depressions of barrier island dunes or in areas underlain by morainal deposits. The substrate is peat of variable depth.
Vegetation: The dominant shrub is *Morella pensylvanica*, which can achieve heights of 2.5m on the periphery of the wetland. Associated shrubs may include *Vaccinium corymbosum, Clethra alnifolia, Decodon verticillatus,* and *Toxicodendron radicans*. The herbaceous layer is variable, but generally includes *Typha latifolia* or *Typha angustifolia, Thelypteris palustris, Osmunda cinnamomea, Euthamia tenuifolia,* and *Triadenum virginicum.* Other associated herbs may include *Vaccinium macrocarpon, Lysimachia terrestris, Scirpus cyperinus,* and species of *Polygonum.*
Dynamics:
Similar Associations:
(Morella cerifera) - Panicum virgatum - Spartina patens Herbaceous Vegetation (CEGL004129)
Related Concepts:
- Mesic shrub thicket (Martin 1959b) ?

Classification Comments:

CONSERVATION RANKING
GRank: GNR **Reasons**: this association has not yet been ranked.

ELEMENT DISTRIBUTION
Range: This association is known from Massachusetts and Rhode Island, and may occur elsewhere.
Subnations: MA, RI
TNC Ecoregions: 62:C
USFS Ecoregions: 221Ab:CCC, 232Aa:CCC
Federal Lands: USFWS (Monomoy, Nomans Land Island)

ELEMENT SOURCES
References: Hadjian 1995; Sneddon 2010

IV. Dwarf-shrubland

IV.A.1.N.a. Cespitose needle-leaved or microphyllous evergreen dwarf-shrubland

Hudsonia tomentosa Dwarf-shrubland Alliance (A.1062)

Woolly Beach-heather Dwarf-shrubland Alliance
Alliance Summary: This alliance consists of sandy or rocky areas dominated by *Hudsonia tomentosa*. This alliance is largely confined to maritime interdunes. This alliance occurs on well-drained sands of back dunes and interdunes, and is documented from Assateague Island; it is a maritime dwarf-shrubland characterized by *Hudsonia tomentosa*, a species adapted to sand burial. *Hudsonia tomentosa* is dominant, occurring as discrete patches that may coalesce into a dense mat on older, more stabilized dunes. A number of other shrubs, such as *Morella pensylvanica (= Myrica pensylvanica), Morella cerifera (= Myrica cerifera), Pinus taeda* saplings, and *Prunus maritima*, may occur but are low in abundance and cover. *Morella pensylvanica* shrubs and *Pinus taeda* saplings are almost non-existent but can occur as scattered individuals. Herbaceous vegetation is also quite sparse (less than 5% cover) but may include scattered individuals of *Panicum amarum var. amarulum, Panicum amarum var. amarum, Solidago sempervirens, Nuttallanthus canadensis, Lechea maritima, Ammophila breviligulata, Pseudognaphalium obtusifolium (= Gnaphalium obtusifolium), Schizachyrium littorale (= Schizachyrium scoparium ssp. littorale), Dichanthelium acuminatum, Oenothera humifusa, Cyperus grayi, Artemisia stelleriana, Chamaesyce polygonifolia*, and *Diodia teres*. *Toxicodendron radicans* is a common vine. Scattered vines of *Smilax rotundifolia* and canes of *Rubus argutus* are occasional. The unstable substrate is influenced by wind-deposited sand and supports no soil development; large patches of sparsely vegetated or unvegetated sand are common.

Hudsonia tomentosa - Arctostaphylos uva-ursi Dwarf-shrubland (CEGL006143)

Woolly Beach-heather - Kinnikinnick or Bearberry Dwarf-shrubland
Northern Beach-heather Dune Shrubland

ELEMENT CONCEPT

Summary: This association comprises dune heathlands of the north Atlantic coast from southern Maine to Long Island, New York, dominated by *Hudsonia tomentosa*. It occurs in well-developed dune systems in the lee side of primary dunes or on secondary dunes with active sand deposition and movement. *Hudsonia tomentosa* is a dominant as well as keystone species of this community, binding sand in place and forming more suitable habitat for other plants to become established. Associated herbs generally occur in low abundance and include *Polygonella articulata, Lechea maritima, Deschampsia flexuosa, Minuartia caroliniana, Ionactis linariifolius, Solidago sempervirens, Lathyrus japonicus, Artemisia stelleriana, Carex silicea, Chamaesyce polygonifolia, Cyperus polystachyos*, and scattered *Ammophila breviligulata*. Older, more stabilized dunes tend to have greater species diversity and less sand deposition. In these areas *Arctostaphylos uva-ursi* can displace *Hudsonia tomentosa* or codominate, and Asteraceae species and *Cladina* spp. are common. Scattered individuals of *Morella pensylvanica (= Myrica pensylvanica), Rosa rugosa, Prunus maritima*, or *Gaylussacia baccata* may occur within this community.

Environment: This association occurs in well-developed sand dune systems in the lee side of primary dunes or on secondary dunes with active sand deposition and movement. Conditions are xeric; plants must be adapted to low moisture, high surface temperature, and high light intensity.

Vegetation: This dwarf-shrubland is dominated by *Hudsonia tomentosa*. Associated species generally occur in low abundance and include *Polygonella articulata, Lechea maritima, Minuartia caroliniana, Ionactis linariifolius, Solidago sempervirens, Lathyrus japonicus, Artemisia stelleriana, Carex silicea, Chamaesyce polygonifolia, Cyperus polystachyos*, and scattered *Ammophila breviligulata*. Older, more stabilized dunes tend to have greater species diversity and less sand deposition. In these areas *Arctostaphylos uva-ursi* can displace *Hudsonia tomentosa* or codominate, and Asteraceae species and *Cladina* spp. are common. Scattered individuals of *Morella pensylvanica (= Myrica pensylvanica), Rosa rugosa, Prunus maritima*, or *Gaylussacia baccata* may occur within this community.

Dynamics: This association occurs in large dune systems with active sand deposition and movement. This association grades into dune grasslands dominated by *Ammophila breviligulata* or into maritime shrub thickets.

Similar Associations:

- *Ammophila breviligulata - Lathyrus japonicus* Herbaceous Vegetation (CEGL006274)
- *Hudsonia tomentosa / Panicum amarum var. amarulum* Dwarf-shrubland (CEGL003950)
- *Hudsonia tomentosa* Dune Dwarf-shrubland (CEGL004024)

Related Concepts:

- Coastal dune community (Rawinski 1984) ?
- Dune heath (Johnson 1985b) ?
- Interdune (McDonnell 1979) ?
- New England heath sand barrens / coastal heathland (Rawinski 1984) ?
- Pitch Pine Dune Woodland (Gawler 2002) B

Classification Comments: *Hudsonia tomentosa / Panicum amarum var. amarulum* Dwarf-shrubland (CEGL003950) is a southern analog of this association.

CONSERVATION RANKING

GRank: G2G3 (2007-1-30) **Reasons:** This small-patch community is restricted to coastal sand dunes from southern Maine to Long Island, New York, and is faced with threats to most coastal areas of the Northeast in general: commercial and residential development, trampling by beach users, and beach stabilization in particular. An estimated 70 occurrences covering 1000-1300 acres in total exist rangewide.

ELEMENT DISTRIBUTION

Range: This association is restricted to coastal sand dunes from southern Maine to Long Island, New York.
Subnations: CT, MA, ME, NJ, NY, QC, RI
TNC Ecoregions: 62:C
USFS Ecoregions: 221Ab:CCC, 221Ac:CCC, 221Ad:CCC, 221Ak:CCC, 232Aa:CCC
Federal Lands: NPS (Cape Cod, Fire Island, Gateway); USFWS (Monomoy, Parker River)

ELEMENT SOURCES

References: Conard 1935, Dowhan and Rozsa 1989, Dunlop and Crow 1985, Eastern Ecology Working Group n.d., Edinger et al. 2002, Enser 1999, Gawler 2002, Godfrey et al. 1978, Gwilliam unpubl. data 1998, Johnson 1985b, Lundgren 1998, Lundgren et al. 2000, McDonnell 1979, Metzler and Barrett 2001, NRCS 2001b, Nelson and Fink 1980, Rawinski 1984, Reschke 1990, Robichaud and Buell 1973, Swain and Kearsley 2001, Van Luven 1990, Zaremba 1989

IV.A.1.N.G. Saturated needle-leaved or microphyllous evergreen dwarf-shrubland

Vaccinium macrocarpon Saturated Dwarf-shrubland Alliance (A.1094)

Large Cranberry Saturated Dwarf-shrubland Alliance

Alliance Summary: This alliance, found in parts of the northeastern United States, contains vegetation found in maritime dune-swale communities and mountain bogs of Central Appalachians (beyond the range of *Chamaedaphne calyculata*), as well as cranberry bogs in Ohio. Further information is needed to characterize this alliance.

Cladium mariscoides / Vaccinium macrocarpon - Morella pensylvanica Dwarf-shrubland (CEGL006141)

Smooth Sawgrass / Large Cranberry - Northern Bayberry Dwarf-shrubland
Northern Interdunal Cranberry Swale

ELEMENT CONCEPT

Summary: This association is a small-patch seasonally flooded wetland within low swales behind backdunes of major dune systems of the northeastern coast. Vegetation is characterized by *Vaccinium macrocarpon, Sphagnum* spp., and scattered *Morella pensylvanica (= Myrica pensylvanica), Myrica gale*, and/or *Vaccinium corymbosum*. *Vaccinium macrocarpon* is generally dominant, but a number of rushes, sedges, grasses, and forbs co-occur and often obscure the low-growing *Vaccinium macrocarpon*. *Morella pensylvanica*, although a minor component of the vegetation and generally restricted to the wetland edge, characterizes this community as coastal. The wetland is seasonally flooded and is often dry on the surface late in the growing season. A shallow layer of peat overtops deep sand deposits. Associated species commonly include *Juncus* spp. (*Juncus canadensis, Juncus greenei, Juncus balticus, Juncus biflorus, Juncus scirpoides, Juncus pelocarpus* and/or others), *Cladium mariscoides, Xyris torta, Xyris difformis, Rhynchospora capitellata, Rhynchospora alba, Cyperus* spp., *Drosera rotundifolia, Drosera intermedia, Drosera filiformis, Pogonia ophioglossoides*, and scattered clumps of *Schoenoplectus pungens* or *Scirpus cyperinus* in small wet pockets. *Sphagnum* spp. (*Sphagnum rubellum, Sphagnum compactum*, and possibly others) cover the surface. Species occurring less frequently can include *Linum striatum, Lycopodiella inundata (= Lycopodium inundatum), Polygala cruciata, Calopogon* spp., *Platanthera* spp., *Utricularia subulata, Triadenum* sp., and others. Floristics can vary among swales due to hydrology, soils, or disturbance regime.

Environment: This association occurs in small, low, wet swales between coastal backdunes. These wet swales occur where the dune surface intersects fresh groundwater lens. These swales are seasonally flooded and often surficially dry by late summer. The duration of flooding is long enough to prevent extensive shrub establishment and to allow carpets of *Sphagnum* to develop. Substrate is shallow peat over sand.

Vegetation: Species composition can vary considerably between swales. This association comprises a later successional phase of freshwater coastal swale development. Vegetation is characterized by *Vaccinium macrocarpon, Sphagnum* spp., and scattered *Morella pensylvanica, Myrica gale*, and/or *Vaccinium corymbosum*. *Vaccinium macrocarpon* can have up to 90% cover, but can be obscured by taller herbs. Associated species commonly include *Juncus* spp. (*Juncus canadensis, Juncus greenei, Juncus balticus, Juncus biflorus, Juncus pelocarpus*, and/or others), *Cladium mariscoides, Xyris torta, Xyris difformis, Rhynchospora capitellata, Rhynchospora scirpoides, Rhynchospora alba, Cyperus* spp., *Drosera rotundifolia, Drosera intermedia, Drosera filiformis, Pogonia ophioglossoides*, and scattered clumps of *Schoenoplectus pungens* or *Scirpus cyperinus* in small wet pockets. *Sphagnum* spp. (*Sphagnum rubellum, Sphagnum compactum*, and possibly others) cover the surface. Species occurring less frequently can include *Linum striatum, Lycopodiella inundata (= Lycopodium inundatum), Polygala cruciata, Calopogon* spp., *Platanthera* spp., *Utricularia subulata, Triadenum* sp., and others. Floristics can vary between swales due to hydrology, soils, or disturbance regime.

Dynamics: This association occurs in wet swales where the dune surface intersects fresh groundwater lens. Water table fluctuations depend on precipitation, which is the primary water input, and the rate of subsurface drainage. Short-term dynamics in vegetation composition are driven by water level fluctuations; drought conditions allow tree and shrub

colonization, which can shade out herbs, while increased flooding favors herbaceous species and eliminates shrubs. This vegetation can grade into mesic shrubland or dune grassland vegetation.

Similar Associations:

- *Myrica gale - Morella pensylvanica* Saturated Shrubland (CEGL006339)
- *Pinus rigida / Vaccinium macrocarpon* Woodland (CEGL006127)
- *Vaccinium oxycoccos - (Vaccinium macrocarpon) / Rhynchospora alba - Drosera rotundifolia / Sphagnum* spp. Dwarf-shrubland (CEGL007856)

Related Concepts:

- *Cladium mariscoides* Herbaceous Vegetation (Clancy 1996) F
- *Vaccinium macrocarpon* - Mixed orchid / *Sphagnum* (McAvoy and Clancy 1994) ?
- *Vaccinium macrocarpon* Dwarf-shrubland (Clancy 1996) F
- Coastal interdunal marsh/swale (Rawinski 1984) ?
- Cranberry bog (Martin 1959b) ?
- Cranberry marsh (Johnson 1985b) ?
- Cranberry swale (Lundgren 2000) ?
- Cranberry swale (McDonnell 1979) ?
- Interdunal swales (Breden 1989) ?
- Wet poor fen (Dowhan and Rozsa 1989) ?
- Wet swale (Dunlop and Crow 1985) ?

CONSERVATION RANKING

GRank: G2G3 (2007-1-31) **Reasons:** This association is a small-patch community with occurrences confined to low areas that are influenced by the water table between sand dunes. This vegetation is naturally limited by the intersection of two features: (1) swales dominated by large cranberry, which as a vegetation type occurs from Cape Henlopen, Delaware, north to Massachusetts; and (2) major dune systems of relatively broad extent that are characterized by dune and swale microtopography, a landform within that limited range that is restricted to Cape Cod, Long Island, and the barrier islands of New Jersey. The vegetation is restricted to large dune systems because it requires habitat to allow for the extirpation and re-creation of individual occurrences that may be naturally extirpated by coastal storms and overwash. Average size of this community is usually less than one acre, ranging to no more than a few acres at maximum. Fewer than 100 occurrences are estimated in five states, totaling no more than 125 acres. Coastal systems in general are severely threatened due to habitat loss imposed by housing expansion, and by foot traffic created by recreation seekers on beaches.

ELEMENT DISTRIBUTION

Range: This community is confined to major dune systems of the northeastern coast (over an estimated 350 square km). Most occurrences are found in Massachusetts, New York, New Jersey, with occasional occurrences in Rhode Island and Delaware. There is one degraded occurrence in New Hampshire. There are no known occurrences in Connecticut.
Subnations: DE, MA, NH, NJ, NY, QC, RI
TNC Ecoregions: 58:C, 62:C
USFS Ecoregions: 221Ab:CCC, 221Ac:CCC, 221Ak:CCC, 232Aa:CCC, 232Bz:CCC
Federal Lands: NPS (Cape Cod, Fire Island); USFWS (Monomoy?, Nomans Land Island?, Parker River)

ELEMENT SOURCES

References: Benedict 1977a, Bowman 2000, Breden 1989, Breden et al. 2001, Clancy 1996, Conard 1935, Dowhan and Rozsa 1989, Dunlop and Crow 1985, Eastern Ecology Working Group n.d., Edinger et al. 2002, Johnson 1981b, Johnson 1985b, Lundgren 1998, Lundgren 2000, Martin 1959b, McAvoy and Clancy 1994, McDonnell 1979, Moul 1969, Rawinski 1984, Sperduto 2000a, Sperduto 2000b, Swain and Kearsley 2001

V. Herbaceous Vegetation

V.A.5.N.C. Medium-tall sod temperate or subpolar grassland

Ammophila breviligulata Herbaceous Alliance (A.1207)

American Beachgrass Herbaceous Alliance

Alliance Summary: This dune grassland alliance occurs almost exclusively on sandy, unstable, droughty substrates with no soil profile development. Eolian processes cause active sand deposition and erosion. The sand substrate is usually

visible, and litter accumulation from plant debris is nearly absent. This alliance generally occurs on foredunes that receive the force of wind and salt spray but is beyond the influence of most storm tides. It includes maritime dune grasslands dominated by *Ammophila breviligulata, Panicum amarum var. amarum*, and *Panicum amarum var. amarulum*. Plant cover is variable, ranging from 10-75%, but is usually low. Other associated species include *Solidago sempervirens, Strophostyles helvula, Triplasis purpurea, Cenchrus tribuloides, Chamaesyce polygonifolia, Oenothera humifusa, Schoenoplectus pungens (= Scirpus pungens)* (where overwashed by sand), *Diodia teres, Cakile edentula ssp. edentula, Nuttallanthus canadensis, Salsola kali ssp. kali (= Salsola caroliniana), Lechea maritima*, and *Spartina patens*. Sparse individuals of stunted *Morella pensylvanica (= Myrica pensylvanica)* shrubs and seedlings may occur, but make up less than 2% of the total vegetation cover. Diagnostic species are *Ammophila breviligulata, Solidago sempervirens, Panicum amarum var. amarulum*, and *Oenothera humifusa*.

Ammophila breviligulata - *Lathyrus japonicus* Herbaceous Vegetation (CEGL006274)

American Beachgrass - Beach Pea Herbaceous Vegetation
Northern Beachgrass Dune

ELEMENT CONCEPT

Summary: This dune grassland of maritime beaches occurs along the North Atlantic coast from New Jersey north to central Maine. This association primarily occurs on active maritime dunes, on both foredunes that are exposed to onshore winds and salt spray as well as more protected interdunes. The substrate is wind-deposited sand with no soil development. *Ammophila breviligulata* is the dominant species, often occurring monotypically. *Lathyrus japonicus* is a common associate and can be codominant. Other associated species include *Solidago sempervirens, Lechea maritima, Aristida tuberculosa, Schizachyrium scoparium, Carex silicea, Polygonella articulata*, and *Artemisia stelleriana*. Dwarf-shrubs, such as *Hudsonia tomentosa*, can occur sporadically and form locally dominant patches. Vegetation cover is often sparse, and bare sand is usually evident.

Environment: This association primarily occurs on active maritime dunes, on both foredunes that are exposed to onshore winds and salt spray as well as more protected interdunes. This grassland generally occurs beyond the influence of storm tides. Substrate is sand with no soil profile development.

Vegetation: This association is characterized and dominated by *Ammophila breviligulata*, which can occur monotypically, especially on foredunes or other areas of active and rapid sand deposition. *Lathyrus japonicus* is the most common associate and can be codominant. Other associated species include *Solidago sempervirens, Lechea maritima, Aristida tuberculosa, Schizachyrium scoparium, Carex silicea, Polygonella articulata*, and *Artemisia stelleriana*. Dwarf-shrubs, such as *Hudsonia tomentosa, Rosa rugosa, Morella pensylvanica (= Myrica pensylvanica)*, or stunted *Prunus maritima*, can occur sporadically and form locally dominant patches within the grassland.

Dynamics: This association occurs on the shifting sands of active dune systems. Sand is wind-deposited and tends to accumulate where vegetation slows the surface wind velocity (Martin 1959b). Rhizomes of *Ammophila breviligulata* stabilize the dunes, growing upward through layers of sand deposition. *Ammophila breviligulata* tends to grow best where there is relatively rapid sand deposition; it can grow through one meter of sand accumulation (Zaremba and Leatherman 1984). Species diversity of this association tends to increase landward in more protected areas where the substrate is more stable. This dune grassland can merge into beach strand vegetation seaward and maritime heath communities landward.

Similar Associations:

- *Ammophila breviligulata - Panicum amarum var. amarum* Herbaceous Vegetation (CEGL004043)
- *Hudsonia tomentosa* - Arctostaphylos uva-ursi Dwarf-shrubland (CEGL006143)

Related Concepts:

- Coastal dune community (Rawinski 1984) ?
- Coastal dune grass community (Breden 1989) B
- Dune Grassland (Gawler 2002) =
- Dune grass community (Nelson and Fink 1980) =
- Dunegrass (Martin 1959b) ?

Classification Comments: The southern analog of this dune grassland association is *Ammophila breviligulata - Panicum amarum var. amarum* Herbaceous Vegetation (CEGL004043), which is differentiated by having *Panicum amarum* as a codominant species in addition to the presence of more southern species such as *Cenchrus tribuloides* and *Oenothera humifusa*, plus the absence of *Lathyrus japonicus*. These two *Ammophila breviligulata*-dominated associations overlap geographically in New Jersey. This association is often adjacent to *Hudsonia tomentosa* dwarf-shrublands and they have much species overlap; when dwarf-shrub cover exceeds 25%, the community is considered *Hudsonia tomentosa - Arctostaphylos uva-ursi* Dwarf-shrubland (CEGL006143).

CONSERVATION RANKING
GRank: G4? (1997-12-1) **Reasons:**

ELEMENT DISTRIBUTION
Range: This association occurs along the northern Atlantic Coast from Maine to New Jersey.
Subnations: CT, DE?, MA, ME, NH, NJ, NY, QC, RI
TNC Ecoregions: 62:C, 63:C
USFS Ecoregions: 212Cb:CCC, 212Db:CCC, 212Dc:CCC, 221Aa:CCC, 221Ab:CCC, 221Ac:CCC, 221Ad:CCC, 221Ak:CCC, 232Aa:CCC, 232Ab:CCC, 232Ac:CCC
Federal Lands: NPS (Acadia, Boston Harbor Islands, Cape Cod, Fire Island, Gateway, Sagamore Hill); USFWS (E.B. Forsythe, Monomoy, Muskeget Island, Nomans Land Island, Parker River)

ELEMENT SOURCES
References: Breden 1989, Breden et al. 2001, Dowhan and Rozsa 1989, Eastern Ecology Working Group n.d., Edinger et al. 2002, Enser 1999, Gawler 2001, Gawler 2002, Johnson 1981b, Johnson 1985b, Martin 1959b, Metzler and Barrett 2001, Moul 1969, NRCS 2001b, Nelson and Fink 1980, Rawinski 1984, Reschke 1990, Sperduto 1997a, Swain and Kearsley 2001, Zaremba and Leatherman 1984

V.A.5.N.e. Short sod temperate or subpolar grassland

Spartina patens - (*Schoenoplectus pungens*) Herbaceous Alliance (A.1274)

Saltmeadow Cordgrass - (Common Threesquare) Herbaceous Alliance

Alliance Summary: This alliance includes upland dune grassland of barrier islands of the Mid-Atlantic and Gulf coasts. *Spartina patens* and *Schoenoplectus pungens (= Scirpus pungens)* are characteristically dominant, though other graminoids such as *Schoenoplectus pungens, Sporobolus virginicus, Cenchrus spinifex (= Cenchrus incertus), Cenchrus tribuloides*, and *Paspalum distichum* may be codominant or prominent within their respective ranges. In parts of the range of this alliance, *Spartina patens* is dominant and *Schoenoplectus pungens* may be absent. This community characteristically occupies overwash terraces or low dunes, less well-developed than those dominated by *Uniola paniculata* (from North Carolina south and west to Texas and Tamaulipas, Mexico) or by *Ammophila breviligulata* (from North Carolina northwards). Total vegetation cover is variable, ranging from quite sparse (25% cover) to dense. Bare sand is often visible through the vegetation, and there is no soil profile development. Species diversity is variable; although it may be quite low and confined to the nominal species in the northern part of the range, it may be of greater diversity. Other components of this vegetation include *Strophostyles helvula, Solidago sempervirens, Cenchrus tribuloides, Setaria parviflora, Distichlis spicata, Sabatia stellaris, Ammophila breviligulata, Suaeda linearis, Bassia hirsuta* (an exotic), *Atriplex patula, Polygonum glaucum, Spergularia salina (= Spergularia marina), Salicornia bigelovii, Salicornia virginica, Fimbristylis castanea*, and *Cakile edentula ssp. edentula*. Woody species may include scattered individuals of *Toxicodendron radicans, Solidago sempervirens, Lythrum lineare, Kosteletzkya virginica*, and seedlings of *Baccharis halimifolia*. The plants of this community are influenced by sand deposited by storm surges. Storm overwash is a prevalent natural disturbance to this community. This community appears to be successional between interdunal herbaceous wetlands and interdunal herbaceous/shrub uplands.

Spartina patens - *Schoenoplectus pungens* - *Solidago sempervirens* Herbaceous Vegetation (CEGL004097)

Saltmeadow Cordgrass - Common Threesquare - Seaside Goldenrod Herbaceous Vegetation
Overwash Dune Grassland

ELEMENT CONCEPT
Summary: This community is an upland dune grassland or overwash area of Atlantic barrier islands on embryo dunes or back sides of beaches forming from overwash terraces ranging from Massachusetts to North Carolina. It forms a drier, later successional phase beginning from water-deposited sand of storm overwash. Sand movement, plant burial, and dune formation rates are not so high as to form *Ammophila breviligulata*-dominated primary dunes, but can be found as a fringe around the outer edge of those dunes. *Spartina patens* is dominant, ranging from quite sparse (25% cover) to dense, and can be monotypic in early-successional expressions. As the vegetation develops, common associated species can include *Schoenoplectus pungens (= Scirpus pungens)* or *Solidago sempervirens*. Less common associates can include *Cyperus grayi, Cenchrus tribuloides, Setaria parviflora, Festuca rubra, Schizachyrium littorale, Pseudognaphalium obtusifolium (= Gnaphalium obtusifolium)*, and occasional scattered individuals of *Toxicodendron radicans* and seedlings of *Baccharis*

halimifolia. Bare sand is often visible through the vegetation, and there is no soil profile development. *Ammophila breviligulata* or *Uniola paniculata* may invade from the surrounding dunes. This community appears to be a successional step between interdunal herbaceous wetlands and interdunal herbaceous/shrub uplands.

Environment: This community is an upland dune grassland or overwash area of Atlantic barrier islands on embryo dunes or back sides of beaches forming from overwash terraces. The plants of this community are influenced by water-deposited sand caused by storm surges. They differ ecologically from dune grasslands dominated by *Ammophila breviligulata* or *Uniola paniculata*, which are primarily impacted by wind-deposited sand. Storm overwash is a prevalent natural disturbance to this community.

Vegetation: *Spartina patens* is dominant, ranging from quite sparse (25% cover) to dense, and can be monotypic in early-successional expressions. As the vegetation develops, common associated species can include *Schoenoplectus pungens (= Scirpus pungens)* or *Solidago sempervirens*. Less common associates can include *Cyperus grayi, Cenchrus tribuloides, Setaria parviflora, Festuca rubra, Schizachyrium littorale, Pseudognaphalium obtusifolium (= Gnaphalium obtusifolium)*, and occasional scattered individuals of *Toxicodendron radicans* and seedlings of *Baccharis halimifolia*. *Ammophila breviligulata* or *Uniola paniculata* may invade from the surrounding dunes. This community is characterized by upland maritime dune grassland vegetation. *Spartina patens*, and sometimes *Schoenoplectus pungens (= Scirpus pungens)*, or both are dominant on dunes or overwash terraces. Total vegetation cover is variable, ranging from quite sparse (25% cover) to dense. Bare sand is often visible through the vegetation, and there is no soil profile development. Species diversity is variable; although it may be quite low and confined to the nominate species in the northern part of the range, it may be of greater diversity, including *Strophostyles helvula, Solidago sempervirens, Cenchrus tribuloides, Setaria parviflora, Distichlis spicata, Sabatia stellaris, Ammophila breviligulata, Suaeda linearis, Bassia hirsuta, Atriplex patula, Fimbristylis castanea*, and *Cakile edentula ssp. edentula*.

Dynamics: This association forms a drier, later successional phase of an overwash community begun from water-deposited sand of storm overwash; it appears to be a successional step between interdunal herbaceous wetlands and interdunal herbaceous/shrub uplands. Undisturbed water-deposited sand is colonized by *Spartina patens* and/or *Schoenoplectus pungens* plus additional associates like *Suaeda linearis, Bassia hirsuta, Atriplex patula*, and *Fimbristylis castanea* that have low percent cover. This wetter, early-successional phase is currently covered by *Spartina patens - Eleocharis parvula* Herbaceous Vegetation (CEGL006342). With time since overwash, sand movement, plant burial, and dune formation rates increase, but are not so high as to form *Ammophila breviligulata*-dominated primary dunes. However, this association can be found as a fringe around the lower, outer edge of those dunes.

Similar Associations:

- *Spartina patens - Eleocharis parvula* Herbaceous Vegetation (CEGL006342)
- *Spartina patens - Schizachyrium maritimum* - Solidago sempervirens Herbaceous Vegetation (CEGL008445)

Related Concepts:

- *Spartina patens - Schoenoplectus pungens - Solidago sempervirens* Herbaceous Vegetation (Bowman 2000) =
- Dry community of barrier flats (Travis and Godfrey 1976) B
- Dry maritime grassland (Lea 2002b) ?
- Dunegrass community (Higgins et al. 1971) B
- Grassland community (Baumann 1978b) =
- Low dune community (Boule 1979) =
- Maritime Dry Grassland (Schafale and Weakley 1990) ?
- Maritime Dry Grassland (Typic Subtype) (Schafale 2000) ?
- Maritime Dune Grassland (Harrison 2004) B
- Maritime Dune Grassland (Fleming and Coulling 2001) B
- Secondary dunes (Klotz 1986) B
- Wash (Hill 1986) =
- Wash (Higgins et al. 1971) =

Classification Comments: This community differs ecologically from dune grasslands dominated by *Ammophila breviligulata* or *Uniola paniculata*, which are primarily impacted by wind-deposited sand. This community is impacted by wave-deposited sand. It is drier than brackish swales and vegetation that immediately colonizes water-borne sand from storm overwash, such as *Spartina patens - Eleocharis parvula* Herbaceous Vegetation (CEGL006342). *Spartina patens - Schizachyrium maritimum - Solidago sempervirens* Herbaceous Vegetation (CEGL008445) is a southern analog of this association that occurs along the Gulf Coast.

CONSERVATION RANKING
GRank: G2G3 (1998-11-4) **Reasons:** This dune grassland community is restricted to overwash areas of major maritime dune systems. It is typically small in extent, not usually more than a few acres in size. It is best developed on barrier islands of Delaware, Maryland, Virginia, and North Carolina; it extends sporadically farther north to Massachusetts. As part of a dynamic system, the community is in a sense ephemeral, being buried over time by sand deposition, and being formed anew in other areas subjected to overwash. Because of the dynamic forces structuring the community, it requires sufficient area in large dune systems to accommodate this shifting mosaic. Although not extremely rare (an estimated 100-200 occurrence exist rangewide), the community is restricted to a specialized habitat and is threatened by a number of activities, including dune stabilization, and outright destruction of habitat through human activities.

ELEMENT DISTRIBUTION
Range: This community is an upland dune grassland or overwash area of Atlantic barrier islands from Massachusetts to North Carolina.
Subnations: DE, MA, MD, NC, NJ, NY, QC, VA
TNC Ecoregions: 57:C, 58:C, 62:C
USFS Ecoregions: 221Ab:CCC, 232Aa:CCC, 232Ab:CCC, 232Ac:CCC, 232Bz:CCC, 232Ci:CCC
Federal Lands: NPS (Assateague Island, Boston Harbor Islands, Cape Hatteras, Cape Lookout, Fire Island, Gateway, Sagamore Hill); USFWS (Back Bay?, E.B. Forsythe, Monomoy, Prime Hook)

ELEMENT SOURCES
References: Baumann 1978b, Berdine 1998, Boule 1979, Bowman 2000, Breden et al. 2001, Eastern Ecology Working Group n.d., Edinger et al. 2002, Fleming and Coulling 2001, Fleming et al. 2001, Harrison 2004, Harrison and Stango 2003, Higgins et al. 1971, Hill 1986, Klotz 1986, Lea 2002b, NRCS 2001b, Reschke 1990, Schafale 2000, Schafale 2003b, Schafale and Weakley 1990, TNC 1995c, Travis and Godfrey 1976, Zaremba and Leatherman 1984

Spartina patens - *Thinopyrum pycnanthum* Herbaceous Vegetation (CEGL006149)
Saltmeadow Cordgrass - Tick Quackgrass Herbaceous Vegetation
Salt Hay Dune

ELEMENT CONCEPT
Summary: This dune grassland of central New England occurs on the interface between upper salt marshes and sand dunes. These low dunes may be periodically flooded by storm tides, most frequently during the winter when plants are dormant. The association is characterized by a dominance of *Spartina patens (= var. monogyna), Elymus repens (= Agropyron repens)*, or *Thinopyrum pycnanthum (= Agropyron pungens)*. All three species may be present or one may occur alone. Other associates are rare, but when present may include *Ammophila breviligulata, Oenothera biennis, Artemisia campestris ssp. caudata (= Artemisia caudata), Solidago sempervirens*, and *Rosa rugosa*.
Environment: This dune grassland of central New England occurs on the interface between upper salt marshes and sand dunes. These low dunes may be periodically flooded by storm tides, most frequently during the winter when plants are dormant.
Vegetation: The association is characterized by a dominance of *Spartina patens, Elymus repens*, or *Thinopyrum pycnanthum*. All three species may be present or one may occur alone. Other associates are rare but, when present, may include *Ammophila breviligulata, Oenothera biennis, Artemisia campestris ssp. caudata, Solidago sempervirens*, and *Rosa rugosa*.
Dynamics:
Similar Associations:
Related Concepts:
Classification Comments:

CONSERVATION RANKING
GRank: GNR **Reasons:** this association has not yet been ranked.

ELEMENT DISTRIBUTION
Range: This association is documented from coastal Massachusetts.
Subnations:
TNC Ecoregions: 62:C
USFS Ecoregions: 221Ab:CCC
Federal Lands: NPS (Cape Cod); USFWS (Monomoy)
Element Sources
References: McDonnell 1979.

V.A.5.N.K. Seasonally flooded temperate or subpolar grassland

Spartina patens Seasonally Flooded Herbaceous Alliance (A.1390)

Saltmeadow Cordgrass Seasonally Flooded Herbaceous Alliance

Alliance Summary: This alliance consists of seasonally flooded (non-tidal) wetlands dominated by *Spartina patens*, occurring from northeastern United States south and west to Tamaulipas, Mexico.

Spartina patens - *Eleocharis parvula* Herbaceous Vegetation (CEGL006342)

Saltmeadow Cordgrass - Dwarf Spikerush Herbaceous Vegetation
Northeastern Atlantic Brackish Interdunal Swale

ELEMENT CONCEPT

Summary: This brackish, interdunal swale and overwash community of the northeastern Atlantic coast occurs in low areas behind primary or secondary sand dunes. The substrate is sand with little or no organic accumulation. The water source for this wetland community is variable, including seasonally high groundwater table, salt spray, and sporadic tidal overwash, resulting in widely variable salinity levels. The dominant species is generally *Spartina patens*, but it can be *Eleocharis parvula, Schoenoplectus pungens (= Scirpus pungens), Cyperus polystachyos*, and/or *Juncus articulatus*. Associated species depend on salinity and hydrology of a site and can include *Leptochloa fusca ssp. fascicularis (= Diplachne maritima), Schoenoplectus maritimus (= Scirpus maritimus), Juncus ambiguus (= Juncus bufonius var. halophila), Juncus scirpoides, Ptilimnium capillaceum, Rumex maritimus, Symphyotrichum subulatum (= Aster subulatus), Chenopodium rubrum, Pluchea odorata, Hibiscus moscheutos ssp. moscheutos (= Hibiscus palustris), Polygonum ramosissimum, Triglochin maritima, Panicum virgatum, Schoenoplectus robustus*, and *Argentina anserina (= Potentilla anserina)*. *Iva frutescens* and *Baccharis halimifolia* may occur on hummocks within the swale. Mats of blue-green and/or brown algae can proliferate across the soil surface.

Environment: This community occupies brackish interdunal swales and overwash flats between coastal sand dunes. Surface water is oligo- to mesohaline; the dune surface intersects the freshwater lens with salinity input from salt spray and/or storm tide overwash. Substrate is deep sand with or without a layer of surficial peat.

Vegetation: This association is dominated by graminoids, especially *Spartina patens, Eleocharis parvula, Schoenoplectus pungens (= Scirpus pungens), Cyperus polystachyos*, and *Juncus articulatus*, although local dominance can change from year to year. Associated species depend on salinity and hydrology of a site and can include *Leptochloa fusca ssp. fascicularis (= Diplachne maritima), Schoenoplectus maritimus (= Scirpus maritimus), Juncus ambiguus (= Juncus bufonius var. halophila), Juncus scirpoides, Ptilimnium capillaceum, Rumex maritimus, Symphyotrichum subulatum (= Aster subulatus), Chenopodium rubrum, Pluchea odorata, Hibiscus moscheutos ssp. moscheutos (= Hibiscus palustris), Polygonum ramosissimum, Triglochin maritima, Panicum virgatum, Schoenoplectus robustus*, and *Argentina anserina (= Potentilla anserina)*. *Iva frutescens* and *Baccharis halimifolia* may occur on hummocks within the swale. Mats of blue-green and/or brown algae can proliferate across the soil surface. *Phragmites australis* can readily invade in this environmental setting.

Dynamics: Brackish swale vegetation can be ephemeral or can represent early stages of salt marsh or coastal salt pond development (Reschke 1990). Overwash flats can succeed into dune grasslands with sand accumulation and plant burial.

Similar Associations:

- *Schoenoplectus pungens - Eleocharis parvula Herbaceous Vegetation (CEGL006398)*
- *Spartina patens - Schoenoplectus pungens - Solidago sempervirens* Herbaceous Vegetation (CEGL004097)

Related Concepts:

- Coastal interdunal marsh/swale (Rawinski 1984) ?
- Maritime Wet Grassland (Fleming and Coulling 2001) B
- Overwash Community (Lea 2002b) ?

Classification Comments: This association is similar to coastal salt pond vegetation, *Schoenoplectus pungens - Eleocharis parvula* Herbaceous Vegetation (CEGL006398).

CONSERVATION RANKING

GRank: GNR (1997-12-1) **Reasons:**

ELEMENT DISTRIBUTION

Range: This association is currently described from Maryland, New Jersey, New York, Massachusetts, and New Hampshire. It likely occurs in other states.

Subnations: DE, MA, MD, NH, NJ, NY, QC, VA

TNC Ecoregions: 57:?, 58:C, 62:C
USFS Ecoregions: 221Ab:CCC, 221Ac:CCC, 221Ak:CCC, 232Aa:CCC, 232Ac:CCC, 232Bz:CCC
Federal Lands: NPS (Fire Island, Gateway); USFWS (Monomoy?)

ELEMENT SOURCES
References: Breden et al. 2001, Dowhan and Rozsa 1989, Eastern Ecology Working Group n.d., Edinger et al. 2002, Fleming and Coulling 2001, Harrison 2004, Hunt 1997b, Lea 2002b, Lundgren 1998, NRCS 2001b, Rawinski 1984, Reschke 1990, Sneddon and Lundgren 2001, Sperduto 2000b, Swain and Kearsley 2001

V.A.5.N.L. Semipermanently flooded temperate or subpolar grassland

Typha (angustifolia, latifolia) - *(Schoenoplectus* spp.) Semipermanently Flooded Herbaceous Alliance (A.1436)

(Narrowleaf Cattail, Broadleaf Cattail) - (Clubrush species) Semipermanently Flooded Herbaceous Alliance

Alliance Summary: This alliance, found in virtually every state in the United States and probably most Canadian provinces, contains stands dominated by *Typha angustifolia* and/or *Typha latifolia*, either alone or in combination with other tall emergent marsh species. This alliance is found most commonly along lake margins and in shallow basins, and occasionally in river backwaters. Lacustrine cattail marshes typically have a muck-bottom zone bordering the shoreline, where cattails are rooted in the bottom substrate, and a floating mat zone, where the roots grow suspended in a buoyant peaty mat. *Typha angustifolia* can grow in deeper water compared to *Typha latifolia*, although both species reach maximum growth at a water depth of 50 cm. *Typha* often occurs in pure stands, and can colonize areas recently exposed by either natural or human causes. *Lythrum salicaria*, an exotic species from Europe, has become a common associate of many eastern *Typha* marshes. In the Southeast, this alliance is widespread and currently representative of a wide variety of mixed marshes with no clear dominants. Vegetation in this alliance may be natural or semi-natural and includes mixed stands of the nominal species, as well as essentially monospecific stands of *Typha latifolia*. These monospecific stands occur especially in artificial wetlands, such as borrow pits or ponds. This alliance occurs on hydric soils in wetlands, ditches, ponds, lakes, and rivers, as well as on shorelines and streambanks. Inundation is commonly 3-6 dm (1-2 feet) in depth. These marshes have hydric soils and are flooded with water levels ranging from several centimeters to more than 1 m for a significant part of the growing season. Occurrences may display areas of open water, but emergent vegetation dominates (80% cover). Seasonal flooding during winter and spring or flooding during heavy rains help maintain these marshes by causing water exchange which replenishes freshwater and circulates nutrients and organic debris. Soils which support this community can be mineral or organic but are saturated, flooded, or ponded long enough during the growing season to develop anaerobic conditions in the upper part. Vegetative diversity and density is highly variable in response to water depth, water chemistry, and natural forces. Associated species vary widely; in the Midwest they include many sedges such as *Carex aquatilis, Carex rostrata, Carex pellita (= Carex lanuginosa)*, bulrushes such as *Schoenoplectus americanus (= Scirpus americanus), Schoenoplectus acutus (= Scirpus acutus)*, and *Schoenoplectus heterochaetus (= Scirpus heterochaetus)*, and broad-leaved herbs such as *Thelypteris palustris, Asclepias incarnata, Impatiens capensis, Sagittaria latifolia, Scutellaria lateriflora, Sparganium eurycarpum, Hibiscus moscheutos*, and *Verbena hastata*. Floating aquatics such as *Lemna minor* may predominate in deeper zones.

Schoenoplectus pungens var. *pungens* - Juncus canadensis Herbaceous Vegetation (CEGL006935)

Common Threesquare - Canadian Rush Herbaceous Vegetation
Coastal Freshwater Marsh

ELEMENT CONCEPT
Summary: This non-tidal freshwater marsh of the coastal Northeast occupies flooded depressions and swales in coastal dunes. The substrate varies from sand to peat or muck, depending on hydrological regime. Water is present most of the year and does not typically exhibit a seasonal drawdown. The vegetation is dominated by *Schoenoplectus pungens var. pungens*, in association with *Hibiscus moscheutos ssp. moscheutos, Juncus canadensis, Juncus effusus, Eleocharis erythropoda, Osmunda regalis, Osmunda cinnamomea, Thelypteris palustris*, and *Triadenum virginicum*. *Typha latifolia* may be present, but generally only occurs at low cover. A diverse range of other forbs may also be associated with this community.
Environment: This non-tidal freshwater marsh of the coastal Northeast occupies flooded depressions and swales in coastal dunes. The substrate varies from sand to peat or muck, depending on hydrological regime. Water is present most of the year and does not typically exhibit a seasonal drawdown.

Vegetation: The vegetation is dominated by *Schoenoplectus pungens var. pungens*, in association with *Hibiscus moscheutos ssp. moscheutos, Juncus canadensis, Juncus effusus, Eleocharis erythropoda, Osmunda regalis, Osmunda cinnamomea, Thelypteris palustris*, and *Triadenum virginicum*. *Typha latifolia* may be present, but generally only occurs at low cover. A diverse range of other forbs may also be associated with this community. Shrubs may be present as sparsely distributed individuals, or more densely from the wetland edge. Typical shrubs include *Rosa rugosa, Vaccinium corymbosum*, and *Morella pensylvanica*.

Related Concepts:
Fresh marsh (Martin 1959b) ?

Classification Comments: New community described based on Gap Project sample sites ("FM1", "FM2", "FM4") at Island Beach State Park.

CONSERVATION RANKING
GRank: GNR (2000-11-8) **Reasons:**

ELEMENT DISTRIBUTION
Range: This association is known from Massachusetts and New Jersey but is likely to occur in other coastal states of the Northeast.
Subnations: MA, NJ, NY, QC
TNC Ecoregions: 62:C
USFS Ecoregions: 221Ab:CCC, 232Ab:CCC
Federal Lands: NPS (Cape Cod); USFWS (Monomoy)

ELEMENT SOURCES
References: Eastern Ecology Working Group n.d., Martin 1959b

Typha (angustifolia, latifolia) - *(Schoenoplectus* spp.) Eastern Herbaceous Vegetation (CEGL006153)

(Narrowleaf Cattail, Broadleaf Cattail) - (Clubrush species) Eastern Herbaceous Vegetation
Eastern Cattail Marsh

ELEMENT CONCEPT
Summary: These tall emergent marshes are common throughout the northeastern United States and adjacent Canadian provinces. They occur in permanently flooded basins, often as part of a larger wetland mosaic and associated with lakes, ponds, or slow-moving streams. The substrate is muck over mineral soil. Lacustrine cattail marshes typically have a muck-bottom zone bordering the shoreline, where cattails are rooted in the bottom substrate, and a floating mat zone, where the roots grow suspended in a buoyant peaty mat. Tall graminoids dominate the vegetation; scattered shrubs are often present (usually totaling less than 25% cover) and are frequently shorter than the graminoids. Trees are absent. Bryophyte cover varies and is rarely extensive; bryophytes are mostly confined to the hummocks. *Typha angustifolia, Typha latifolia*, or their hybrid *Typha X glauca* dominate, either alone or in combination with other tall emergent marsh species. Associated species vary widely; sedges, such as *Carex aquatilis, Carex lurida, Carex rostrata, Carex pellita (= Carex lanuginosa), Carex stricta, Scirpus cyperinus*, and bulrushes, such as *Schoenoplectus americanus (= Scirpus americanus)* and *Schoenoplectus acutus (= Scirpus acutus)*, occur along with patchy grasses, such as *Calamagrostis canadensis*. Broad-leaved herbs include *Thelypteris palustris, Asclepias incarnata, Onoclea sensibilis, Symplocarpus foetidus, Calla palustris, Impatiens capensis, Sagittaria latifolia, Scutellaria lateriflora, Sparganium eurycarpum*, and *Verbena hastata*. Floating aquatics, such as *Lemna minor*, may be common in deeper zones. Shrub species vary across the geographic range of this type; in the northern part of its range, *Myrica gale, Ilex verticillata*, and *Spiraea alba* are common. The invasive exotic plants *Lythrum salicaria* and *Phragmites australis* may be abundant in parts of some occurrences. This association is distinguished from other northeastern freshwater marshes by the strong dominance of *Typha* spp.
Environment: These tall emergent marshes are common throughout the northeastern United States and adjacent Canadian provinces. They occur in permanently flooded basins, often as part of a larger wetland mosaic and associated with lakes, ponds, or slow-moving streams. The substrate is muck over mineral soil. Lacustrine cattail marshes typically have a muck-bottom zone bordering the shoreline, where cattails are rooted in the bottom substrate, and a floating mat zone, where the roots grow suspended in a buoyant peaty mat. This association is often found in impounded waters.
Vegetation: Tall graminoids dominate the vegetation; scattered shrubs are often present (usually totaling less than 25% cover) and are frequently shorter than the graminoids. Trees are absent. Bryophyte cover varies and is rarely extensive; bryophytes are mostly confined to the hummocks. *Typha angustifolia, Typha latifolia*, or their hybrid *Typha*

X glauca dominate, either alone or in combination with other tall emergent marsh species. Associated species vary widely; sedges, such as *Carex aquatilis, Carex lurida, Carex rostrata, Carex pellita (= Carex lanuginosa), Carex stricta, Scirpus cyperinus*, and bulrushes, such as *Schoenoplectus americanus (= Scirpus americanus)* and *Schoenoplectus acutus (= Scirpus acutus)*, occur along with patchy grasses, such as *Calamagrostis canadensis*. Broad-leaved herbs include *Thelypteris palustris, Asclepias incarnata, Onoclea sensibilis, Symplocarpus foetidus, Calla palustris, Impatiens capensis, Sagittaria latifolia, Scutellaria lateriflora, Sparganium eurycarpum*, and *Verbena hastata*. Floating aquatics, such as *Lemna minor*, may be common in deeper zones. Shrub species vary across the geographic range of this type; in the northern part of its range, *Myrica gale, Ilex verticillata*, and *Spiraea alba* are common. The invasive plants *Lythrum salicaria* and *Phragmites australis* may be abundant in parts of some occurrences.

Dynamics: This association is often found in impounded waters.

Similar Associations:

- *Typha latifolia* Southern Herbaceous Vegetation (CEGL004150)
- *Typha* spp. - *Schoenoplectus acutus* - Mixed Herbs Midwest Herbaceous Vegetation (CEGL002229)
- *Typha* spp. - *Schoenoplectus tabernaemontani* - Mixed Herbs Southern Great Lakes Shore Herbaceous Vegetation (CEGL005112)
- *Typha* spp. Midwest Herbaceous Vegetation (CEGL002233)

Related Concepts:

- *Typha* (*angustifolia, latifolia*) - (*Scirpus* spp.) Herbaceous Vegetation (Clancy 1996) =
- Cattail Marsh (Thompson 1996) ?
- Cattail Marsh (Gawler 2002) =
- Cattail marsh (CAP pers. comm. 1998) ?
- Palustrine Narrow-leaved Persistent Emergent Wetland, Permanently Flooded (PEM5H) (Cowardin et al. 1979) ?
- Robust Emergent Marsh (Breden 1989) ?
- Southern New England nutrient-poor streamside/lakeside marsh (Rawinski 1984) ?
- Southern New England nutrient-rich streamside/lakeside marsh (Rawinski 1984) ?

Classification Comments: *Typha angustifolia* can grow in deeper water compared to *Typha latifolia*, although both species reach maximum growth at a water depth of 50 cm (Grace and Wetzel 1981). *Typha* often occurs in pure stands and can colonize areas recently exposed by either natural or human causes.

CONSERVATION RANKING

GRank: G5 (1997-12-1) Reasons:

ELEMENT DISTRIBUTION

Range: This association occurs throughout the northeastern U.S. from Maine to North Carolina.

Subnations: CT, DC?, DE, MA, MD, ME, NC, NH, NJ, NY, PA, RI, VA, VT, WV

TNC Ecoregions: 48:C, 49:C, 51:C, 52:C, 58:P, 59:C, 60:C, 61:C, 62:C, 63:C, 64:C

USFS Ecoregions: 212Cb:CCC, 212Da:CCC, 212Db:CCC, 212Fa:CCC, 212Fb:CCC, 212Fc:CCC, 212Fd:CCC, 212Ga:CCC, 212Gb:CCC, 221Aa:CCP, 221Ab:CCC, 221Ae:CCC, 221Ai:CCC, 221Al:CCC, 221Ba:CCP, 221Bb:CCC, 221Bc:CCC, 221Bd:CCC, 221Da:CCC, 221Fa:CCC, 222Ib:CCC, 222Ic:CCC, 231:C, 232Ab:CCC, 232Ac:CCC, M212A:CP, M212Bb:CCC, M212C:CP, M212D:CC, M212Ea:CCC, M212Eb:CCC, M221Aa:CCC, M221Ab:CCC, M221Ac:CCC, M221Ad:CCC, M221Ba:CCC, M221Bb:CCC, M221Bc:CCC, M221Bd:CCC, M221Be:CCC, M221Bf:CCC, M221Da:CCC, M221Db:CCP, M221Dc:CCP, M221Dd:CCP

Federal Lands: NPS (Acadia, Appalachian Trail, Blue Ridge Parkway?, Boston Harbor Islands, C&O Canal, Cape Cod, Delaware Water Gap, Johnstown Flood, Minute Man, National Capital-East, Saint-Gaudens, Saratoga, Upper Delaware); USFS (Nantahala?, Pisgah?); USFWS (Aroostook, Assabet River, Carlton Pond?, E.B. Forsythe, Erie, Great Meadows, Great Swamp, Iroquois, Monomoy, Montezuma, Moosehorn, Nomans Land Island, Nulhegan Basin, Oxbow, Pondicherry?, Prime Hook)

ELEMENT SOURCES

References: Breden 1989, Breden et al. 2001, CAP pers. comm. 1998, Clancy 1996, Cowardin et al. 1979, Eastern Ecology Working Group n.d., Edinger et al. 2002, Fike 1999, Gawler 2002, Grace and Wetzel 1981, Harrison 2004, Metzler and Barrett 2001, NRCS 2004a, Northern Appalachian Ecology Working Group 2000, Rawinski 1984, Sperduto and Nichols 2004, Swain and Kearsley 2001, Thompson 1996, Thompson and Sorenson 2000

Phragmites australis Semipermanently Flooded Herbaceous Alliance (A.1431)

Common Reed Semipermanently Flooded Herbaceous Alliance

Alliance Summary: This alliance consists of non-tidal *Phragmites* marshes with semipermanently or, rarely, seasonally flooded hydrology, occurring either in depressions or along rivers with seasonal fluctuation in water level throughout the United States and adjacent Canada. This includes semipermanently flooded marshes, ditches, impoundments, etc., which are strongly dominated by essentially monospecific stands of *Phragmites australis*, which is rapidly spreading in disturbed areas and excluding native vegetation. Stands may be composed entirely of *Phragmites australis*, with few or no other vascular plants present.

Phragmites australis Eastern North America Temperate Semi-natural Herbaceous Vegetation (CEGL004141)

Common Reed Eastern North America Temperate Semi-natural Herbaceous Vegetation
Eastern Reed Marsh

ELEMENT CONCEPT

Summary: This reed marsh type is found across the east-temperate regions of the United States and Canada. Stands occur in semipermanently flooded marshes, ditches, impoundments, etc., that have often been disturbed by human activity. The vegetation is variable, as *Phragmites australis* will often invade into existing natural or semi-natural communities present on the site. Once firmly established, this community is usually strongly dominated by *Phragmites australis*, with few or no other vascular plants present.

Environment: Stands occur in semipermanently flooded marshes, ditches, impoundments, etc. that have often been disturbed by human activity.

Vegetation: The vegetation is often variable, as *Phragmites australis* will often invade into existing natural or semi-natural communities present on the site. Once firmly established, this community is usually strongly dominated by *Phragmites australis*, with few or no other vascular plants present.

Similar Associations:

- *Phragmites australis* Tidal Herbaceous Vegetation (CEGL004187)
- Phragmites australis Western North America Temperate Semi-natural Herbaceous Vegetation (CEGL001475)

Related Concepts:

- *Phragmites australis* community (Metzler and Barrett 1992) ?
- *Phragmites australis* tidal marsh association (Clancy 1993b) ?
- Inland Emergent Marsh (Chapman et al. 1989) B
- Southern New England nutrient-poor streamside/lakeside marsh (Rawinski 1984) ?
- Southern New England nutrient-rich streamside/lakeside marsh (Rawinski 1984) ?

Classification Comments: This is not a native community but is the result of the invasion of alien *Phragmites australis* into natural or semi-natural vegetation. The vegetation has variable hydrology and, unless *Phragmites* is clearly dominant, is often treated as part of other marsh and meadow types. The geographic distribution of the type is arbitrarily limited to Bailey's Humid Temperate Domain in eastern North America (Bailey 1997, 1998). Stands in northern Minnesota and farther north in Canada may represent native stands. If so, they should be tracked as a different type. Tidal vegetation of the Gulf Coast of Louisiana and Texas dominated by *Phragmites australis* is classified in the *Phragmites australis* Tidal Herbaceous Alliance (A.1477).

CONSERVATION RANKING

GRank: GNA (invasive) (1997-11-23) **Reasons:** Although almost always occurring as a naturalized type that arises from human disturbance, some stands in northern Minnesota and further north in Canada may be native. If so, they should be tracked as a separate type.

ELEMENT DISTRIBUTION

Range: This reed marsh type is found across the east-temperate regions of the United States and Canada, ranging from Maine west to the eastern Dakotas and Manitoba, south to Texas and east to Florida.

Subnations: AL, AR, CT, DE, FL, GA, IA, IN, LA, MA, MD, ME, MI, MN, MS, NC, NH, NJ, NY, OH, ON, PA, QC, RI, SC, TX, VA, VT, WI, WV

TNC Ecoregions: 31:C, 40:C, 41:C, 42:P, 47:C, 48:C, 52:P, 53:C, 55:C, 56:C, 57:C, 59:C, 60:C, 61:C, 62:C

USFS Ecoregions: 212C:CP, 212Fc:CCC, 212Ho:CCC, 212Hw:CCC, 221Aa:CCP, 221Ab:CCC, 221Ae:CCC, 221Ai:CCC, 221Bc:CCC, 221Da:CCC, 222Ic:CCC, 222Jj:CCC, 231Fb:CCC, 232Ab:CCC, 232Ac:CCC, 232C:CC, 232Dc:CCC, 232E:CC, 232G:CC, 234A:PP, 255Dc:CCC, M212:C, M221:P

Federal Lands: NPS (Assateague Island, Boston Harbor Islands, Cape Cod, Indiana Dunes, Minute Man, Saint Croix, Saratoga, Sleeping Bear Dunes, Upper Delaware, Voyageurs); USFWS (Alligator River, Aransas, Bon Secour, Brazoria, Cape May, E.B. Forsythe, Great Dismal Swamp, Great Meadows, Great Swamp, Matagorda Island, Monomoy, Montezuma, Nomans Land Island?, Oxbow, Parker River, Prime Hook, Supawna Meadows)

ELEMENT SOURCES

References: Bailey 1997, Bailey 1998, Bell et al. 2002, Chapman et al. 1989, Clancy 1993b, Harris et al. 1996, INAI unpubl. data, Metzler and Barrett 1992, Metzler and Barrett 2001, NRCS 2004a, Nelson 1986, Rawinski 1984, Schafale and Weakley 1990, Schotz pers. comm., Southeastern Ecology Working Group n.d., Swain and Kearsley 2001

Schoenoplectus acutus - (Schoenoplectus tabernaemontani) Semipermanently Flooded Herbaceous Alliance (A.1443)

Hardstem Bulrush - (Softstem Bulrush) Semipermanently Flooded Herbaceous Alliance

Alliance Summary: This alliance is found in the midwestern and western United States and central Canada. Stands of this alliance are flooded for most or all of the growing season and can have water from 0 (exposed soil) to approximately 1.5 m deep, but usually is less than 1 m. Within a stand, water levels can vary by up to 1 m during the year. The water can be fresh to mildly saline throughout most of this alliance's range; however, in the Nebraska Sandhills, some stands occur in moderately alkaline water. Across the range of this alliance, soils are deep, poorly drained, muck, peat, or mineral. Vegetation is characterized by medium to tall graminoids which typically range from 1 to over 2 m. The vegetation is moderately dense to dense. Some stands are heavily dominated by one or two *Schoenoplectus* spp. (= *Scirpus* spp.), while others have several graminoids common throughout the stand. The most abundant species are typically *Schoenoplectus acutus (= Scirpus acutus), Schoenoplectus fluviatilis (= Scirpus fluviatilis)*, and *Schoenoplectus tabernaemontani (= Scirpus tabernaemontani)*. Species composition and abundance can vary from year to year depending mostly on water level fluctuations. In most years, typical species include *Lemna* spp., *Phragmites australis, Schoenoplectus americanus (= Scirpus americanus)* (in alkaline stands), *Triglochin maritima* (in alkaline stands), *Typha latifolia*, and *Utricularia macrorhiza*. *Potamogeton* spp. often occur in the deeper parts of stands of this alliance and where emergent species are not densely packed. Shrubs, such as *Salix* spp., are not common but may become established in shallow water areas. During droughts, species more tolerant of low water, such as *Polygonum amphibium*, may invade and alter the species composition of stands of this alliance.

Schoenoplectus (tabernaemontani, acutus) Eastern Herbaceous Vegetation (CEGL006275)

(Softstem Bulrush, Hardstem Bulrush) Eastern Herbaceous Vegetation
Bulrush Deepwater Marsh

ELEMENT CONCEPT

Summary: These deepwater bulrush marshes occur across the northeastern United States and adjacent Canadian provinces. They are found in a variety of wetland settings, most commonly in quiet-water areas along the shores of ponds, lakes, rivers, and larger streams, but also in flooded basins and ditches. The vegetation occurs in deep water (usually 0.4-1 m deep) that is present in all but the driest of conditions. Seasonal spring flooding and heavy rainstorms provide nutrient input. The substrate is usually deep muck overlying mineral soil; where wave action is more prevalent, the mineral soil may be exposed. The vegetation is dominated by bulrushes and robust graminoids, with scattered emergent forbs. Trees and shrubs are absent. Dominant species are usually *Schoenoplectus acutus (= Scirpus acutus), Schoenoplectus tabernaemontani (= Scirpus tabernaemontani)*, and/or *Schoenoplectus americanus (= Scirpus americanus)*. Associated herbs include *Scirpus cyperinus, Carex aquatilis, Carex pellita (= Carex lanuginosa), Carex utriculata, Thelypteris palustris, Typha latifolia, Asclepias incarnata, Impatiens capensis, Pontederia cordata, Sagittaria latifolia, Schoenoplectus fluviatilis (= Scirpus fluviatilis), Scutellaria lateriflora, Verbena hastata, Leersia oryzoides, Ludwigia palustris*, and others. Floating-leaved and submerged plants (such as *Potamogeton* spp., *Sparganium* spp., *Elodea canadensis, Ceratophyllum* spp.) may be scattered among the emergent plants. This association is distinguished from other northeastern standing-water marsh communities by the strong dominance of tall bulrush species.

Environment: These deepwater bulrush marshes occur across the northeastern United States and adjacent Canadian provinces. They are found in a variety of wetland settings, most commonly in quiet-water areas along the shores of ponds, lakes, rivers, and larger streams, but also in flooded basins and ditches. The vegetation occurs in deep water (usually 0.4-1 m deep) that is present in all but the driest of conditions. Seasonal spring flooding and heavy rainstorms provide nutrient input. The substrate is usually deep muck overlying mineral soil; where wave action is more prevalent, the mineral soil may be exposed.

Vegetation: The vegetation is dominated by bulrushes and robust graminoids, with scattered emergent forbs. Trees and shrubs are absent. Dominant species are usually *Schoenoplectus acutus (= Scirpus acutus), Schoenoplectus tabernaemontani (= Scirpus tabernaemontani)*, and/or *Schoenoplectus americanus (= Scirpus americanus)*. Associated herbs include *Scirpus cyperinus, Carex aquatilis, Carex pellita (= Carex lanuginosa), Carex utriculata, Thelypteris palustris, Typha latifolia, Asclepias incarnata, Impatiens capensis, Pontederia cordata, Sagittaria latifolia, Schoenoplectus fluviatilis (= Scirpus fluviatilis), Scutellaria lateriflora, Verbena hastata, Leersia oryzoides, Ludwigia palustris*, and others. Floating-leaved and submerged plants (such as *Potamogeton* spp., *Sparganium* spp., *Elodea canadensis, Ceratophyllum* spp.) may be scattered among the emergent plants.

Similar Associations:
- *Schoenoplectus acutus - (Schoenoplectus fluviatilis)* Freshwater Herbaceous Vegetation (CEGL002225)
- *Schoenoplectus acutus - Carex lasiocarpa* Herbaceous Vegetation (CEGL006358)
- Schoenoplectus tabernaemontani Temperate Herbaceous Vegetation (CEGL002623)

Related Concepts:
- *Schoenoplectus (tabernaemontani, fluviatilis)* Eastern Herbaceous Vegetation (Clancy 1996) =
- Bulrush Bed (Gawler 2002) =
- Bulrush marsh (CAP pers. comm. 1998) ?
- Deep Rush Marsh (Thompson 1996) B
- Palustrine Narrow-leaved Persistent Emergent Wetland, Permanently Flooded (PEM5H) (Cowardin et al. 1979) ?
- Spring swamp (Hill 1923) ?

CONSERVATION RANKING

GRank: GNR (1997-12-1) **Reasons:**

ELEMENT DISTRIBUTION

Range: This variable deepwater marsh community occurs in the northeastern United States and adjacent Canadian provinces.

Subnations: CT, DE, MA, MD, ME, NH, NJ, NY, PA, QC, RI, VA?, VT, WV

TNC Ecoregions: 49:C, 58:?, 59:C, 60:C, 61:C, 62:C, 63:C, 64:C

USFS Ecoregions: 212B:CP, 212Cb:CCC, 212D:CC, 212Ed:CCC, 212Fa:CCC, 212Fb:CCC, 212Fc:CCC, 212Fd:CCC, 212Ga:CCC, 212Gb:CCC, 221Ab:CCC, 221Ah:CCC, 221Bd:CCP, 221Fa:CCC, 231:P, 232:C, M212Ea:CCP, M212Eb:CCP, M221Ab:CCC, M221Ba:CCC

Federal Lands: NPS (Acadia, Assateague Island); USFWS (Assabet River, Erie, Great Meadows?, Monomoy, Oxbow, Parker River?)

ELEMENT SOURCES

References: Bartgis 1983, Bowman 2000, Breden et al. 2001, Byers et al. 2007, CAP pers. comm. 1998, Clancy 1996, Cowardin et al. 1979, Eastern Ecology Working Group n.d., Edinger et al. 2002, Fike 1999, Gawler 2002, Harrison 2004, Hill 1923, Northern Appalachian Ecology Working Group 2000, Sperduto 2000b, Swain and Kearsley 2000, Thompson 1996, Thompson and Sorenson 2000

V.A.5.N.N. Tidal temperate or subpolar grassland

Typha (angustifolia, domingensis) Tidal Herbaceous Alliance (A.1472)

(Narrowleaf Cattail, Southern Cattail) Tidal Herbaceous Alliance

Alliance Summary: Tidal marshes dominated by *Typha angustifolia* and/or *Typha domingensis*. Examples of this alliance are composed of a mixture of salt marsh and freshwater tidal marsh species. The vegetation is dense and characterized by tall graminoids such as *Typha angustifolia*, with associates including *Spartina cynosuroides, Phragmites australis* or *Schoenoplectus americanus (= Scirpus americanus), Pontederia cordata, Lilaeopsis chinensis, Hibiscus moscheutos (= Hibiscus palustris)*, and *Pluchea odorata*. Other characteristic species include *Hibiscus moscheutos, Spartina patens, Distichlis spicata, Schoenoplectus pungens (= Scirpus pungens), Lycopus americanus, Eleocharis palustris, Hydrocotyle umbellata, Eupatorium capillifolium, Ptilimnium capillaceum, Bidens* spp., and *Spartina alterniflora*. This community is typically a brackish tidal marsh occurring where water salinity ranges from 0.5-18.0 ppt. Brackish marshes are most extensive on large tidal rivers, but smaller marshes of this alliance also occur at the upper

limits of larger tidal creeks. The alliance occurs along the Atlantic coast from Maine through South Carolina and along the Gulf coast in Alabama and Texas. Alabama and Texas communities occur in oligohaline tidal marshes and are dominated by *Typha domingensis*. Further research is necessary to determine the classification, and thus the range, with confidence.

Typha angustifolia - *Hibiscus moscheutos* Herbaceous Vegetation (CEGL004201)

Narrowleaf Cattail - Eastern Rosemallow Herbaceous Vegetation
Cattail Brackish Marsh

ELEMENT CONCEPT

Summary: This community is a brackish marsh of the northern to central Atlantic coast, occurring along the margin of tidal rivers and at the upper margins of some high salt marshes and coastal salt ponds where water salinity ranges from 0.5-18.0 ppt. Brackish marshes are most extensive on large tidal rivers, but smaller marshes of this alliance also occur at the upper limits of larger tidal creeks and salt ponds. The vegetation of this tall grassland is a mixture of freshwater and saltmarsh species dominated by *Typha angustifolia*. *Phragmites australis* and/or *Typha latifolia* can be codominant. The *Phragmites australis* component is the native strain. Common associates include *Hibiscus moscheutos, Schoenoplectus pungens, Impatiens capensis, Amaranthus cannabinus, Peltandra virginica, Pontederia cordata*, and *Bidens* spp., plus *Spartina cynosuroides* in the south. Other infrequent associates include *Mikania scandens, Polygonum punctatum, Pluchea odorata, Eleocharis* spp., and *Schoenoplectus robustus*, plus *Schoenoplectus americanus* farther south. Species from adjacent high salt marsh may also be present. Substrate is muck or peat, and there is often an accumulation of *Typha* litter.

Environment: This association occurs in oligohaline to mesohaline areas of tidal marshes (0.5-18 ppt). In estuarine systems, it can occur in the uppermost zone of brackish marshes where there is freshwater influence; it receives diurnal tidal flooding of brackish water. In salt marshes behind barrier beaches it can occur in the upper reaches of larger tidal creeks within brackish areas and also at the upland border where there is significant freshwater input from the adjacent upland; here it receives irregular tidal flooding only during high spring tides. Substrate is muck or peat, and there is often an accumulation of *Typha* litter.

Vegetation: The vegetation of this tall grassland is a mixture of freshwater and saltmarsh species dominated by *Typha angustifolia*. *Phragmites australis, Typha latifolia, Spartina cynosuroides*, or *Schoenoplectus pungens* can codominate. The *Phragmites australis* component is the native strain (Saltonstall 2002). Common associates include *Hibiscus moscheutos, Schoenoplectus pungens, Impatiens capensis, Amaranthus cannabinus, Peltandra virginica, Pontederia cordata*, and *Bidens* spp., plus *Spartina cynosuroides* in the south. Other infrequent associates include *Mikania scandens, Pluchea odorata, Polygonum punctatum, Eleocharis* spp., and *Schoenoplectus robustus*, plus *Schoenoplectus americanus* farther south. Species from adjacent high salt marsh may also be present.

Dynamics: Brackish marsh complexes commonly occur as mosaics of patches dominated by a single graminoid species. Patches dominated by *Typha angustifolia* tend to occur where there is more freshwater influence near the upper reaches of estuaries or at the upland border of high salt marshes where there is freshwater input from the surrounding upland. As the marsh becomes more brackish, *Schoenoplectus pungens* or *Spartina patens* can become dominant. As the marsh becomes less brackish, *Peltandra virginica, Pontederia cordata, Acorus calamus, Schoenoplectus tabernaemontani*, and *Zizania aquatica* can become more prevalent. The pattern of alternating dominance between *Typha angustifolia* and *Phragmites australis* that can occur in these environmental settings may reflect disturbance history of the site and of the surrounding watershed.

Similar Associations:

- *Typha domingensis* Tidal Herbaceous Vegetation (CEGL008456)

Related Concepts:

- *Hibiscus* marsh (Cahoon and Stevenson 1986) ?
- *Typha (angustifolia, latifolia) - Hibiscus moscheutos* Herbaceous Vegetation (Harrison 2001) =
- *Typha angustifolia - Hibiscus moscheutos* Herbaceous Vegetation (Bowman 2000) =
- *Typha angustifolia - Hibiscus palustris* community (Metzler and Barrett 1992) ?
- *Typha angustifolia* community (Good and Good 1975b) ?
- *Typha angustifolia* type (Ferren et al. 1981) ?
- *Typha* association (Shreve et al. 1910) =
- Brackish Tidal Marsh (Rawinski 1984) ?
- Brackish Tidal Marsh (Gawler 2002) B
- Brackish marsh (Sperduto 1994) ?
- Brackish tidal marsh (Reschke 1990) ?
- Brackish tidal marsh community (MENHP 1991) ?
- Brackish tidal marsh complex (Breden 1989) ?

- Cattail Community Type (Odum et al. 1984) ?
- Fresh-brackish marsh (Klotz 1986) ?
- Narrowleaf cattail type (McCormick and Ashbaugh 1972) ?
- Tidal Freshwater Marsh (Schafale and Weakley 1990) B
- Tidal Freshwater Marsh (Narrowleaf Cattail Subtype) (Schafale 2000) ?
- Tidal Oligohaline Marsh (Harrison 2004) B
- Tidal Oligohaline Marsh (Fleming and Coulling 2001) B
- Transitional fresh marsh (Hill 1986) B

Classification Comments: A non-tidal barrier wetland documented at the Cove Point Wetland, Calvert County, Maryland (Steury 1999), appears to fit this concept.

CONSERVATION RANKING

GRank: G4G5 (2006-1-19) **Reasons:** This common small-patch community occurs in the estuarine areas of up to 13 northeastern states, several of which rank this vegetation as S4. It is threatened by pollution and by encroachment of *Phragmites australis*.

ELEMENT DISTRIBUTION

Range: This association occurs along the Atlantic coast from Maine to Virginia and possibly to South Carolina.
Subnations: CT, DE, MA, MD, ME, NC, NH, NJ, NY, RI, SC?, VA
TNC Ecoregions: 56:?, 57:C, 58:C, 61:C, 62:C, 63:C
USFS Ecoregions: 212Cb:CCC, 221Aa:CCC, 221Ab:CCC, 221Ac:CCC, 221Ad:CCC, 221Ak:CCC, 232Aa:CCC, 232Ab:CCC, 232Ac:CCC, 232Ad:CCC, 232Br:CCC, 232Bt:CCC, 232Bx:CCC, 232Bz:CCC, 232Cb:CCC, 232Ch:CCC, 232Ci:CCC
Federal Lands: NPS (Acadia, Assateague Island, Boston Harbor Islands, Cape Cod, Fire Island, Saugus Iron Works); USFWS (Back Bay?, Cape May, Chesapeake Marshlands, Chincoteague, E.B. Forsythe, Monomoy?, Parker River?, Prime Hook, Supawna Meadows)

ELEMENT SOURCES

References: Bowman 2000, Breden 1989, Breden et al. 2001, Cahoon and Stevenson 1986, Coulling 2002, Dowhan and Rozsa 1989, Eastern Ecology Working Group n.d., Edinger et al. 2002, Ferren et al. 1981, Fleming 2001a, Fleming and Coulling 2001, Fleming and Moorhead 1998, Fleming et al. 2001, Gawler 2002, Good and Good 1975b, Harrison 2001, Harrison 2004, Hill 1986, Klotz 1986, MENHP 1991, McCormick and Ashbaugh 1972, Metzler and Barrett 1992, Metzler and Barrett 2001, Odum et al. 1984, Rawinski 1984, Reschke 1990, Saltonstall 2002, Schafale 2000, Schafale 2003b, Schafale and Weakley 1990, Shreve et al. 1910, Sperduto 1994, Sperduto 1997a, Sperduto 2000b, Steury 1999, Swain and Kearsley 2001

Phragmites australis Tidal Herbaceous Alliance (A.1477)

Common Reed Tidal Herbaceous Alliance

Alliance Summary: This alliance includes both natural and invasive fresh to brackish tidal marsh communities dominated by (often essentially monospecific) *Phragmites australis*. Although *Phragmites australis* rhizomes have been noted in salt marsh sediments exceeding 3000 years in age and it is thus a native component of salt marshes in some areas of North America, the growth habit of the species in its native condition was likely to have been significantly different than the dense monotypic, invasive stands documented in this alliance. Evidence suggests that a new, more invasive genotype of *Phragmites australis* was introduced to the U. S. from the Old World. This new genotype, along with a continued increase in and variety of disturbances, may explain the heightened invasiveness of this species. Evidence suggests that along the Gulf Coast of Louisiana and Texas, the genotype found in invasive communities differs from the genotype found in natural, stable communities. Although invasive and natural communities of *Phragmites australis* are difficult to differentiate, this can be accomplished by considering the degree of disturbance at a site and observing a given stand over time to determine the degree of invasiveness. Based on observations of this nature by individuals familiar with the coastal marshes of Louisiana and Texas, apparently stable, natural communities dominated by *Phragmites australis* are present. However, the dominance of *Phragmites australis* in many tidal wetlands today often indicates human-induced disturbance, either through direct habitat manipulation or through passive introduction of reproductive material to naturally disturbed substrates.

In many areas of the southeastern United States, it is well documented that *Phragmites* is recently introduced and spreading rapidly in tidal and non-tidal situations. In invasive communities, associated species are highly variable, depending on the vegetation that has been invaded. Spreading in large colonies, *Phragmites* may eventually dominate

disturbed areas at coverage up to 100%. More typically, though, scattered individuals of other species may occur, such as sparse *Morella cerifera (= Myrica cerifera)* shrubs, *Kosteletzkya virginica, Calystegia sepium, Boehmeria cylindrica, Typha angustifolia, Apocynum cannabinum, Rosa palustris, Polygonum* sp., and *Mikania scandens*. Vines of *Toxicodendron radicans* are also frequent, but typically occur at low cover.

In areas where *Phragmites australis* is highly invasive, if *Phragmites australis* is a significant component of the vegetation but the vegetation retains sufficient species composition to retain its identity, the site is considered an unhealthy or degraded example of that vegetation type. In these same areas, if *Phragmites australis* cover is so high that native species have been excluded and the original community is no longer recognizable, then the occurrence falls within an invasive association within the *Phragmites australis* Tidal Herbaceous Alliance (A.1477). In natural communities, associated species may include *Sagittaria platyphylla, Spartina alterniflora, Schoenoplectus americanus (= Scirpus americanus), Vigna luteola, Typha* spp., and others.

Phragmites australis Tidal Herbaceous Vegetation (CEGL004187)

Common Reed Tidal Herbaceous Vegetation
Reed Tidal Marsh

ELEMENT CONCEPT

Summary: This community is a dense tall grassland indicative of disturbance. It occurs in a range of tidal wetland habitats from fresh to brackish in salinity. It is characterized by dense stands of *Phragmites australis*, a species which tends to grow in colonies of tall, stout, leafy plants often to the exclusion of all other vascular plant species. Associated species are highly variable, depending on the community that has been invaded. Spreading in large colonies, *Phragmites* eventually dominates disturbed areas at coverage up to 100%. More typically, though, scattered individuals of other species may occur, such as sparse *Morella cerifera (= Myrica cerifera)* shrubs, *Kosteletzkya virginica, Calystegia sepium, Boehmeria cylindrica, Typha angustifolia, Apocynum cannabinum, Rosa palustris, Polygonum* sp., and *Mikania scandens*. Vines of *Toxicodendron radicans* are also frequent, but typically occur at low cover. This community has a broad geographic range, including coastal areas of the eastern and southeastern United States and Canada.

Environment: This community is a dense tall grassland indicative of disturbance. It occurs in a range of tidal wetland habitats from fresh to brackish in salinity.

Vegetation: This community is a broadly defined reed-grass marsh. It is characterized by dense stands of *Phragmites australis*, a species which tends to grow in colonies of tall, stout, leafy plants often to the exclusion of all other vascular plant species. Associated species are highly variable, depending on the community that has been invaded. Spreading in large colonies, *Phragmites* eventually dominates disturbed areas at coverage up to 100%. More typically, though, scattered individuals of other species may occur, such as sparse *Morella cerifera (= Myrica cerifera)* shrubs, *Kosteletzkya virginica, Calystegia sepium, Boehmeria cylindrica, Typha angustifolia, Apocynum cannabinum, Rosa palustris, Polygonum* sp., and *Mikania scandens*. Vines of *Toxicodendron radicans* are also frequent but typically occur at low cover.

Similar Associations:

- *Phragmites australis - (Sagittaria platyphylla, Vigna luteola)* Tidal Herbaceous Vegetation (CEGL007891)
- *Phragmites australis Eastern North America Temperate Semi-natural Herbaceous Vegetation (CEGL004141)*

Related Concepts:

- *Phragmites australis* Association (Fleming 1998) ?
- *Phragmites australis* Tidal Herbaceous Vegetation (Bowman 2000) =
- *Phragmites australis* community (Metzler and Barrett 1992) ?
- *Phragmites australis* tidal marsh association (Clancy 1993b) ?
- Brackish Tidal Marsh (Rawinski 1984) ?
- Salt Marsh Complex (Breden 1989) B
- Successional / Modified Estuarine Herbaceous Vegetation (Fleming et al. 2006) ?

Classification Comments: Although *Phragmites australis* rhizomes have been noted in salt marsh sediments exceeding three thousand years in age (Niering and Warren 1977) and is thus a native component of salt marshes in some areas in North America, the growth of the species in its native condition was likely to have been significantly different than the dense monotypic stands that characterize this community in parts of its range today. The invasive, non-native strain has been labeled haplotype M (Saltonstall 2002). The presence of the *Phragmites australis* community in wetlands today generally indicates human-induced disturbance, either through direct habitat manipulation or through passive introduction of reproductive material to naturally disturbed substrates. Historically, without alteration, these sites would generally be more saline. In New England, *Phragmites* tends to invade behind artificial/man-made levees where regular salt input is

blocked, making the sites more brackish and less saline than prior to levee construction and anthropogenic modification. In cases where *Phragmites australis* is a significant component of the vegetation but the vegetation retains sufficient species composition to retain its identity, the site is considered an unhealthy or degraded example of that original community. Where *Phragmites australis* cover is so high that native species have been excluded and the original community is no longer recognizable, the occurrence is then treated as an example of *Phragmites australis* Tidal Herbaceous Vegetation (CEGL004187).

CONSERVATION RANKING
GRank: GNA (invasive) (1997-11-22) **Reasons**:

ELEMENT DISTRIBUTION
Range: This community has a broad geographic range, including coastal areas of the eastern and southeastern United States and Canada.
Subnations: AL, CT, DC?, DE, FL, GA, LA, LB?, MA, MD, ME, MS, NC, NF?, NH, NJ, NS?, NY, PA, PE?, QC, RI, SC, TX, VA
TNC Ecoregions: 53:C, 56:C, 57:C, 58:C, 62:C
USFS Ecoregions: 221Ab:CCC, 232Aa:CCC, 232Ab:CCC, 232Ac:CCC, 232Bz:CCC, 232Ch:CCC, 232Ci:CCC, 232Dc:CCC
Federal Lands: NPS (Assateague Island, Boston Harbor Islands, Cape Cod, Cape Hatteras, Colonial, Fire Island, Gateway, George Washington Birthplace, George Washington Parkway, National Capital-East, Saugus Iron Works); USFWS (Back Bay, Bon Secour, Cape May, Chesapeake Marshlands, E.B. Forsythe, Monomoy, Supawna Meadows)

ELEMENT SOURCES
References: Bell et al. 2002, Bowman 2000, Breden 1989, Clancy 1993b, Edinger et al. 2002, Fleming 1998, Fleming et al. 2006, Harrison 2001, Metzler and Barrett 1992, Metzler and Barrett 1996, Metzler and Barrett 2001, NRCS 2001b, Nelson 1986, Niering and Warren 1977, Odum et al. 1984, Rawinski 1984, Saltonstall 2002, Schafale and Weakley 1990, Schotz pers. comm., Southeastern Ecology Working Group n.d., Swain and Kearsley 2001

Spartina patens - (Distichlis spicata) Tidal Herbaceous Alliance (A.1481)

Saltmeadow Cordgrass - (Inland Saltgrass) Tidal Herbaceous Alliance

Alliance Summary: This alliance comprises "high salt marsh" vegetation dominated or codominated by *Spartina patens* along the Gulf and Atlantic coasts from Maine to Texas. The high salt marsh is irregularly flooded by tides and forms at slightly higher elevations than regularly flooded low marshes; they establish where peat accumulation raises the marsh surface above mean high tide. Landward the vegetation can transition to brackish marsh or upland vegetation. Vegetation of this alliance also occurs in mesohaline zones along lower reaches of tidal rivers.

Variation in codominant species occurs across the geographic range. From the Canadian maritime provinces south to Delaware (discontinuously south to Virginia), this alliance is characterized by the dominance of *Spartina patens, Distichlis spicata*, and *Juncus gerardii* and the presence of more northerly distributed marsh species such as *Puccinellia fasciculata, Plantago maritima*, and *Triglochin maritima*. In brackish reaches of tidal rivers, this alliance includes *Spartina patens*-dominated vegetation that may also be characterized by the presence of *Agrostis stolonifera, Festuca rubra, Symphyotrichum novi-belgii (= Aster novi-belgii), Hierochloe odorata, Carex paleacea*, or *Spartina pectinata*.

From Delaware south to Florida, this high salt marsh coastal community is dominated by *Spartina patens*, forming meadows at slightly higher elevations in relation to the adjacent *Spartina alterniflora* Tidal Herbaceous Alliance (A.1471). Diagnostic species for this community are *Spartina patens, Distichlis spicata, Borrichia frutescens, Kosteletzkya virginica*, and *Pluchea odorata*. Shrub seedlings such as *Baccharis halimifolia* and *Morella cerifera (= Myrica cerifera)* may also be present. The associated *Juncus roemerianus* Tidal Herbaceous Alliance (A.1475) often occurs as discrete patches which may reach substantial size.

This alliance also includes mesohaline to oligohaline marshes of the Gulf Coast of Texas and Louisiana. In these associations, *Spartina patens* may strongly dominate, *Distichlis spicata, Spartina alterniflora*, and *Spartina patens* may codominate, *Distichlis spicata* may form pure stands, *Paspalum vaginatum* may strongly dominate, or *Spartina patens* and *Vigna luteola* may codominate. Other characteristic species include *Juncus roemerianus, Spartina spartinae, Spartina cynosuroides* (within its range), *Schoenoplectus robustus, Schoenoplectus americanus, Sagittaria lancifolia, Phragmites australis*, and *Eragrostis* spp. Here, this alliance forms mosaics with *Spartina spartinae* and *Spartina alterniflora* marshes and saline herbaceous vegetation.

Western states have a different alliance for inland situations dominated by *Distichlis spicata,* the *Distichlis spicata* Intermittently Flooded Herbaceous Alliance (A.1332).

Schoenoplectus pungens - Eleocharis parvula Herbaceous Vegetation (CEGL006398)

Common Threesquare - Dwarf Spikerush Herbaceous Vegetation
Coastal Salt Pond Marsh

ELEMENT CONCEPT

Summary: This association encompasses the brackish marshes of coastal salt ponds of the northeastern Atlantic Coast. Coastal salt ponds are ponds separated from the ocean by a barrier beach. They generally form when a lagoon or bay is closed off from regular tidal flooding by a sand spit or other barrier. Salinity depends on the length of time since enclosure of the lake/pond; freshwater input from precipitation and overland flow dilutes the enclosed seawater resulting in meso- to oligohaline conditions. Depending on the distance from the ocean, saltwater input is infrequent and a result of tidal breaches or storm overwash, although there can be some saltwater seepage across the barrier beach. Shorelines usually have gentle slopes that magnify gradients of salinity and saturation. Depending on local water balance, ponds can draw down to a certain degree exposing mud or sand flats. Substrate ranges from sand to mud to peat. Vegetation of coastal salt ponds is highly variable both spatially and temporally given the variable nature of the habitat and processes affecting it. Although not constant, vegetation zonation often occurs along shores of coastal salt ponds along gradients of salinity and flooding or saturation. Dominant species can be variable depending on local conditions but are generally characterized by *Schoenoplectus pungens, Eleocharis parvula*, and/or *Spartina patens, Spartina pectinata*, or *Panicum virgatum*. Where salinity is less *Typha angustifolia* can be common. Mudflat habitat can develop in lower areas that tend to be exposed later in the season with *Eleocharis parvula, Eleocharis halophila, Eleocharis flavescens, Schoenoplectus maritimus, Crassula aquatica, Spergularia salina (= Spergularia marina), Cyperus filicinus*, or others. In higher zones, vegetation can be similar to high salt marsh habitat; *Panicum virgatum, Spartina patens*, or *Spartina pectinata* can be characteristic, plus *Schoenoplectus smithii, Echinochloa walteri, Cladium mariscoides, Distichlis spicata*, or *Chenopodium* spp. Species found farther south include *Ptilimnium capillaceum, Pluchea odorata, Schoenoplectus americanus, Hibiscus moscheutos*, plus scattered individuals of *Iva frutescens* or *Baccharis halimifolia*. Ponds often support aquatic plants that are tolerant of brackish/saline conditions, such as *Ruppia maritima, Stuckenia pectinata (= Potamogeton pectinatus), Potamogeton perfoliatus*, or *Zannichellia palustris*, plus some marine algal species. Several associations may be warranted in these highly variable systems; collection of further data will likely support the division of more associations.

Environment: Coastal salt ponds are ponds separated from the ocean by a barrier beach. They generally form when a lagoon or bay is closed off from regular tidal flooding by a sand spit or other barrier. However, some ponds have a permanent, often artificially maintained, inlet/outlet and thus have regular saltwater exchange. Salinity depends on the length of time since enclosure of the lake/pond; freshwater input from precipitation and overland flow dilutes the enclosed seawater resulting in meso- to oligohaline conditions. Depending on the distance from the ocean, saltwater input is infrequent and a result of tidal breaches or storm overwash, although there can be some saltwater seepage across the barrier beach. Shorelines usually have gentle slopes that magnify gradients of salinity and saturation. Depending on local water balance, ponds can draw down to a certain degree exposing mud or sand flats. Substrate ranges from sand to mud to peat. These ponds occur in glaciated areas in moraine or outwash deposits.

Vegetation: Vegetation of coastal salt ponds is highly variable both spatially and temporally given the variable nature of the habitat and processes affecting it. Although not constant, vegetation zonation often occurs along shores of coastal salt ponds along gradients of salinity and flooding or saturation. Dominant species can be variable depending on local conditions but are generally characterized by *Schoenoplectus pungens, Eleocharis parvula*, and/or *Spartina patens, Spartina pectinata*, or *Panicum virgatum*. Where salinity is less *Typha angustifolia* can be common. Mud flat habitat can develop in lower areas that tend to be exposed later in the season with *Eleocharis parvula, Eleocharis halophila, Eleocharis flavescens, Schoenoplectus maritimus, Crassula aquatica, Spergularia salina (= Spergularia marina)*, or others. In higher zones, vegetation can be similar to high salt marsh habitat; *Panicum virgatum, Spartina patens*, or *Spartina pectinata* can be characteristic, plus *Schoenoplectus smithii, Echinochloa walteri, Cladium mariscoides, Distichlis spicata*, and *Chenopodium* spp. Species found farther south include *Ptilimnium capillaceum, Pluchea odorata, Schoenoplectus americanus, Hibiscus moscheutos*, plus scattered individuals of *Iva frutescens* or *Baccharis halimifolia*. Ponds often support aquatic plants that are tolerant of brackish/saline conditions, such as *Ruppia maritima, Stuckenia pectinata (= Potamogeton pectinatus), Potamogeton perfoliatus*, or *Zannichellia palustris*, plus some marine algal species.

Dynamics: Coastal salt ponds are adjacent to ocean shores and result from the enclosure of a lagoon or bay by a sand spit or barrier. Salinity fluctuates relative to the proportion of freshwater input from precipitation and overland flow and

saltwater input from tidal breaches and storm overwash. Fluctuations can be a gradual lessening of salinity with time since enclosure where there is sufficient and continual freshwater influence or a gradual increase in salinity following evaporative concentration. Rapid changes in salinity can result from storm breaches or overwash.

Similar Associations:

- *Panicum virgatum - Spartina patens* Herbaceous Vegetation (CEGL006150)
- *Ruppia maritima* Acadian/Virginian Zone Temperate Herbaceous Vegetation (CEGL006167)
- *Schoenoplectus pungens* Tidal Herbaceous Vegetation (CEGL004188)
- *Spartina patens* - Eleocharis parvula Herbaceous Vegetation (CEGL006342)

Related Concepts:

- Brackish Tidal Marsh (Gawler 2002) B
- Coastal Salt Pond (Rawinski 1984) ?
- Coastal Salt Pond Marsh (Rawinski 1984) ?

Classification Comments: This association encompasses a highly variable and shifting vegetation mosaic in a variable and dynamic habitat. Several associations may be warranted; collection of further data will likely support the division of this type into more associations.

CONSERVATION RANKING

GRank: GNR (1997-12-1) **Reasons:**

ELEMENT DISTRIBUTION

Range: Coastal salt ponds occur in a limited geomorphological setting in New Hampshire, Massachusetts, Rhode Island, and Long Island, New York.

Subnations: MA, ME, NH, NJ, NY, RI

TNC Ecoregions: 62:C

USFS Ecoregions: 221Ab:CCC, 221Ac:CCC, 221Ad:CCP, 221Ak:CCC, 232Aa:CCC, 232Ac:CCC

Federal Lands: NPS (Boston Harbor Islands, Cape Cod, Gateway); USFWS (Monomoy)

ELEMENT SOURCES

References: Eastern Ecology Working Group n.d., Edinger et al. 2002, Elliman 2003, Gawler 2002, Island Alliance 2001, Karanaukas 2001, Lundgren 1998, Lundgren 2000, NRCS 2001b, Rawinski 1984, Reschke 1990, Sperduto 2000a, Sperduto 2000b, Swain and Kearsley 2000, Swain and Kearsley 2001, Thorne-Miller et al. 1983, Zaremba 1999

Spartina patens - Distichlis spicata - (Juncus gerardii) Herbaceous Vegetation (CEGL006006)

Saltmeadow Cordgrass - Inland Saltgrass - (Black-grass) Herbaceous Vegetation

North Atlantic High Salt Marsh

ELEMENT CONCEPT

Summary: This high salt marsh vegetation dominated by *Spartina patens* or codominated by *Distichlis spicata* forms distinct "cowlicked" meadows above low salt marsh communities. This high marsh association generally occurs behind barrier beaches along the north Atlantic coast from the Canadian maritime provinces south to New Jersey. It occupies the irregularly flooded zone extending from mean high tide landward to the limit of spring tides. The substrate is peat overlying sand, silt, or bedrock. Vegetation of this marsh community occurs in mosaics of patches generally dominated by a single graminoid species, *Spartina patens, Distichlis spicata*, or *Juncus gerardii*. Other characteristic associates that occur in low abundance include *Symphyotrichum tenuifolium (= Aster tenuifolius), Limonium carolinianum, Solidago sempervirens, Symphyotrichum subulatum (= Aster subulatus), Polygonum ramosissimum, Argentina anserina (= Potentilla anserina), Atriplex patula, Lythrum lineare*, and *Panicum virgatum*. Salt pannes are often a prominent feature within this association.

Environment: This high salt marsh association generally occurs behind barrier beaches, but also in the outer reaches of estuaries, occupying the zone extending from mean high tide landward approximately to the limit of spring tides. They are often adjacent to low salt marshes dominated by *Spartina alterniflora* (tall form), which are regularly flooded by diurnal tides. *Spartina patens*-dominated high marshes form very dense peat with high organic matter content. Peat forms over sand, silt or bedrock.

Vegetation: Vegetation of this marsh community occurs in mosaics of patches generally dominated by a single graminoid species, *Spartina patens, Distichlis spicata*, or *Juncus gerardii*. Other characteristic associates that occur in low abundance include *Symphyotrichum tenuifolium (= Aster tenuifolius), Limonium carolinianum, Solidago sempervirens, Symphyotrichum subulatum (= Aster subulatus), Polygonum ramosissimum, Argentina anserina (= Potentilla anserina), Atriplex patula, Lythrum lineare*, and *Panicum virgatum*.

Dynamics: Vegetation of this association occurs as a shifting mosaic of patches dominated by a single graminoid species. Species composition at a particular site results from the interaction of hydroperiod, nutrient availability, salinity gradients, soil oxygen, concentrations of growth inhibitors in the soil, and interspecific competition. As sedimentation increases marsh elevation, vegetation may shift to upland border communities dominated by *Panicum virgatum* and *Juncus gerardii*. Local disturbance, i.e., from ice scouring, can cause invasion by *Spartina alterniflora*, or can lead to the formation of salt pannes.

Similar Associations:

- *Spartina patens - Agrostis stolonifera* Herbaceous Vegetation (CEGL006365)
- *Spartina patens* - Distichlis spicata - (Juncus roemerianus) Herbaceous Vegetation (CEGL004197)

Related Concepts:

- *Spartina patens - Distichlis spicata* Herbaceous Vegetation (Harrison 2001) I
- Salt Marsh (Rawinski 1984) ?
- Salt marsh complex, high marsh (Breden 1989) ?
- *Spartina* Saltmarsh (Gawler 2002) B

Classification Comments: This community is differentiated from *Spartina patens - Distichlis spicata - (Juncus roemerianus)* Herbaceous Vegetation (CEGL004197) to the south by the importance of *Juncus gerardii, Plantago maritima*, and *Triglochin maritima* and absence or relatively infrequent occurrence of species of southern distribution such as *Borrichia frutescens, Kosteletzkya virginica, Fimbristylis castanea*, and *Lythrum lineare*.

CONSERVATION RANKING

GRank: G5 (1997-12-1) **Reasons:**

ELEMENT DISTRIBUTION

Range: This high salt marsh association occurs from the Canadian maritime provinces south to Delaware.
Subnations: CT, DE, MA, MD, ME, NH, NJ, NY, RI
TNC Ecoregions: 62:C, 63:C
USFS Ecoregions: 212Cb:CCC, 212Db:CCC, 212Dc:CCC, 221Ab:CCC, 221Ac:CCC, 221Ad:CCC, 221Ae:CCC, 221Ak:CCC, 221Dc:CCC, 232Aa:CCC, 232Ab:CCC, 232Ac:CCC
Federal Lands: NPS (Acadia, Boston Harbor Islands, Cape Cod, Fire Island, Gateway, Sagamore Hill); USFWS (Cape May, E.B. Forsythe, Monomoy, Moosehorn, Muskeget Island?, Parker River?, Prime Hook)

ELEMENT SOURCES

References: Bell et al. 2002, Bertness et al. 1992, Breden 1989, Breden et al. 2001, Coulling pers. comm., Dowhan and Rozsa 1989, Eastern Ecology Working Group n.d., Edinger et al. 2002, Enser 1999, Fleming 2001a, Gawler 2001, Gawler 2002, Harrison 2001, Hill 1923, Metzler and Barrett 2001, Nixon 1982, Rawinski 1984, Reschke 1990, Soil Conservation Service 1987, Sperduto 2000a, Sperduto 2000b, Swain and Kearsley 2001

Spartina alterniflora Tidal Herbaceous Alliance (A.1471)

Smooth Cordgrass Tidal Herbaceous Alliance

Alliance Summary: This alliance includes various tidal marshes dominated by *Spartina alterniflora*. The hydrology is usually regularly tidally flooded. In the northern part of its range, southern Maine to Cape Hatteras, North Carolina, this alliance is generally limited to the zone between mean sea level and the mean high water level. The habitat occurs in protected inlets behind barrier beaches or in drowned river valleys. Peat depth ranges from a few feet, if the community formed over a mudflat, to 24 m (80 feet) in drowned river valleys. *Spartina alterniflora* is limited to the low marsh zone by moderate salinity; it can withstand longer submergence than other salt marsh grasses, but still requires periodic exposure of the substrate. It also requires moderately high levels of iron (7-15 ppm). This community is commonly known as "low salt marsh," occurring as a tall grassland strongly dominated by *Spartina alterniflora*. There is little variation in vascular plant species composition across the range. It occurs in nearly pure stands, with occasional low growing species such as *Spergularia salina (= Spergularia marina), Salicornia* spp., *Suaeda maritima*, and seaweeds such as *Ulva lactuca* and other algae such as *Fucus vesiculosus* and *Ascophyllum nodosum*, which grow at the bases of the *Spartina* plants. Herbs of *Salicornia virginica* and *Salicornia bigelovii* can be quite common mixed in with the *Spartina*, often becoming more apparent later in the growing season. *Limonium carolinianum* is another characteristic herb, but only as scattered individuals. More detailed information is needed on the variability of the alliance in the southern parts of its range.

Spartina alterniflora / (Ascophyllum nodosum) Acadian/Virginian Zone Herbaceous Vegetation (CEGL004192)

Smooth Cordgrass / (Yellow Tang) Acadian/Virginian Zone Herbaceous Vegetation
North Atlantic Low Salt Marsh

ELEMENT CONCEPT

Summary: This tall grassland dominated by *Spartina alterniflora* forms the low salt marsh of the north and mid-Atlantic coast. It is diurnally flooded by tides, occurring in the intertidal zone between mean high tide and mean sea level in protected inlets behind barrier beaches or in the seaward reaches of drowned river valleys. It forms a coarse peat over sandy substrate. The low salt marsh occurs elevationally between high marsh that occurs landward and subtidal communities that occur seaward. *Spartina alterniflora* is limited to the low marsh zone by interspecific competition and by moderate salinity; it can withstand longer submergence than other salt marsh grasses but still requires periodic exposure of the substrate. *Spartina alterniflora* forms nearly monotypic stands with little variation across the geographic range of the community. Tall form *Spartina alterniflora* occurs adjacent to salt water and colonizes unvegetated flats. This association also grades into short form *Spartina alterniflora* landward. Associated species occur in low abundance and commonly include *Limonium carolinianum, Salicornia virginica, Salicornia bigelovii, Spergularia maritima, Spergularia canadensis*, and *Suaeda maritima*. Brown algae can form extensive mats at the bases of the grass culms, especially *Ascophyllum nodosum, Fucus vesiculosus, Enteromorpha* spp., and *Ulva* spp. Macroalgae associates may be sparse or absent at the southern edge of the range. This community occurs from Nova Scotia to Cape Hatteras, North Carolina. Low marshes at the northern edge of the geographic range are far less extensive in size than those farther south due to differences in geomorphology and time since last glaciation.

Environment: This low salt marsh community occurs in the regularly flooded intertidal zone, approximately from mean high tide to mean sea level; it is diurnally flooded by tides and classified as polyhaline (18-30 ppt). This low marsh occurs in areas sheltered from direct wave action, such as behind barrier beaches, as pocket marshes at the heads of bays, or in the outer reaches of estuaries. Low salt marshes occur landward of intertidal flats and subtidal communities and seaward of high salt marsh communities. Low salt marshes dominated by *Spartina alterniflora* generally occur on mucky silt to silty coarse fibrous peat, often with high organic matter content. However, peat in the low marsh is generally less dense than farther landward (Bertness 1988). Peat depth ranges from a few feet, if the community formed over a mudflat, to 80 feet in drowned river valleys at the mouths of estuaries.

Vegetation: This community is a tall grassland dominated by *Spartina alterniflora* occurring in regularly flooded intertidal zones. *Spartina alterniflora* dominates this physically stressful zone due to limited competition and its ability to tolerate salinity and flooding. It also requires moderately high levels of iron (7-15 ppm) (Adams 1963). *Spartina alterniflora* is strongly dominant, forming a nearly monotypic tallgrass layer. There is little variation in vascular plant composition across the range. Tall-form *Spartina alterniflora* occurs adjacent to saltwater and colonizes unvegetated flats. This association also grades into short-form *Spartina alterniflora* landward where tidal range is more restricted. Common associates, occurring in low abundance, include *Limonium carolinianum, Salicornia virginica, Salicornia bigelovii, Spergularia maritima, Spergularia canadensis*, and *Suaeda maritima*. *Distichlis spicata, Agalinis maritima, Symphyotrichum tenuifolium (= Aster tenuifolius)*, and *Spartina patens* can also sporadically occur, but are more common in the high salt marsh. Brown algae can form extensive mats at the bases of the grass culms, especially *Ascophyllum nodosum, Fucus vesiculosus*, and *Ulva* spp. *Enteromorpha* spp. can occur early in the growing season. Macroalgae associates may be sparse or absent at the southern edge of the range. Microscopic algae, especially diatoms, can be abundant on the marsh surface (Teal 1986).

Dynamics: Salt marshes are dynamic habitats. *Spartina alterniflora* readily colonizes soft sediments off the seaward edge of the salt marsh (Bertness 1988). Grass culms and algal mats trap sediments brought in by the tides and begin the process of marsh peat accumulation. As peat development raises marsh elevation, low marsh succeeds to high marsh communities; *Spartina alterniflora* performance declines as peat accumulates and becomes more dense. Flotsam and jetsam brought in by tides can smother local patches of vegetation and form unvegetated to sparsely vegetated pannes, a phenomenon that occurs regularly on high marshes. Tidal creeks form sinuous patterns throughout the low marsh draining the diurnal tides.

Similar Associations:

- *Spartina alterniflora - Distichlis spicata* Tidal Herbaceous Vegetation (CEGL006586)
- *Spartina alterniflora - Juncus roemerianus - Distichlis spicata* Louisianian Zone Salt Tidal Herbaceous Vegetation (CEGL004190)
- *Spartina alterniflora - Lilaeopsis chinensis* Herbaceous Vegetation (CEGL004193)
- *Spartina alterniflora* Carolinian Zone Herbaceous Vegetation (CEGL004191)

Related Concepts:
- *Spartina alterniflora* Herbaceous Vegetation (Clancy 1996) =
- *Spartina alterniflora* Tidal Herbaceous Vegetation (Harrison 2001) =
- *Spartina alterniflora* community (Metzler and Barrett 1992) ?
- *Spartina alterniflora* salt marsh (Clancy 1993b) ?
- Cordgrass saltmarsh community (MENHP 1991) ?
- Low salt marsh (Enser 1993) ?
- Low salt marsh (Reschke 1990) ?
- Low salt marsh community (Sperduto 1994) ?
- Mixed Graminoid - Forb Saltmarsh (Gawler 2002) B
- Salt Marsh (Rawinski 1984) ?
- Salt Marsh (Schafale and Weakley 1990) B
- Salt Marsh (Virginian Subtype) (Schafale 2000) ?
- Salt marsh (Higgins et al. 1971) B
- Salt marsh community (Hill 1986) B
- Salt marsh complex, low marsh (Breden 1989) ?
- Tidal Mesohaline / Polyhaline Marsh (Fleming and Coulling 2001) B
- Tidal Mesohaline Marsh (Harrison 2004) B

Classification Comments: The northern limit of this type occurs where there is a slower accumulation of silt and corresponding absence of algal species (Chapman 1937). The southern limit corresponds with the southern limit of the Virginian province of the American Atlantic Temperate Region, a transitional area harboring animal species of both southern and northern affinities (Gosner 1979, Cowardin et al. 1979). Southern occurrences, where *Ascophyllum nodosum* (yellow tang) may be sparse or absent, are placed within this type because of the associated characteristic faunal assemblage, including *Uca pugnax* (Atlantic marsh fiddler), *Littorina saxatilis* (rough periwinkle), *Littorina obtusata* (smooth periwinkle), and *Brachidontes demissus* (ribbed mussel). Analogous low salt marsh associations in other geographic areas include *Spartina alterniflora* Carolinian Zone Herbaceous Vegetation (CEGL004191) and *Spartina alterniflora - Juncus roemerianus - Distichlis spicata* Louisianian Zone Salt Tidal Herbaceous Vegetation (CEGL004190) for the Atlantic Coast of the southeastern U.S. (Cape Hatteras, North Carolina, to Florida) and the Gulf Coast (Florida to Texas), respectively [see Cowardin et al. (1979) for regional boundaries]. *Spartina alterniflora - Lilaeopsis chinensis* Herbaceous Vegetation (CEGL004193) is a *Spartina alterniflora*-dominated association occurring in the mid-tidal range of tidal rivers that have a minimum tidal range of one meter.

CONSERVATION RANKING

GRank: G5 (1997-12-1) **Reasons:**

ELEMENT DISTRIBUTION

Range: This association occurs along the Atlantic coastline from Nova Scotia and New Brunswick south to Cape Hatteras, North Carolina.

Subnations: CT, DE, MA, MD, ME, NB, NC, NH, NJ, NS, NY, QC, RI, VA

TNC Ecoregions: 57:C, 58:C, 62:C, 63:C

USFS Ecoregions: 212Cb:CCC, 212Db:CCC, 212Dc:CCC, 221Ab:CCC, 221Ac:CCC, 221Ad:CCC, 221Ak:CCC, 232Aa:CCC, 232Ab:CCC, 232Ac:CCC, 232Ad:CCC, 232Ae:CCC, 232Br:CCC, 232Bt:CCC, 232Bx:CCC, 232Bz:CCC, 232Ch:CCC, 232Ci:CCC

Federal Lands: NPS (Acadia, Assateague Island, Boston Harbor Islands, Cape Cod, Fire Island, Gateway, Sagamore Hill); USFWS (Back Bay?, Cape May, Chesapeake Marshlands, E.B. Forsythe, Monomoy, Moosehorn?, Muskeget Island, Parker River, Prime Hook)

ELEMENT SOURCES

References: Adams 1963, Bell et al. 2002, Bertness 1988, Bowman 2000, Breden 1989, Breden et al. 2001, Chapman 1937, Clancy 1993b, Clancy 1996, Cowardin et al. 1979, Eastern Ecology Working Group n.d., Edinger et al. 2002, Enser 1993, Enser 1999, Fleming and Coulling 2001, Fleming et al. 2001, Gawler 2001, Gawler 2002, Gosner 1979, Harrison 2001, Harrison 2004, Higgins et al. 1971, Hill 1986, MENHP 1991, Metzler and Barrett 1992, Metzler and Barrett 2001, Moul 1973, NRCS 2001b, Rawinski 1984, Reschke 1990, Schafale 2000, Schafale 2003b, Schafale and Weakley 1990, Soil Conservation Service 1987, Sperduto 1994, Sperduto 2000a, Sperduto 2000b, Stalter 1979, Swain and Kearsley 2001, Teal 1986

V.B.2.N.g. Tidal temperate perennial forb vegetation

Sarcocornia pacifica - (*Distichlis spicata*, *Salicornia* spp.) Tidal Herbaceous Alliance (A.1704)

Swampfire - (Inland Saltgrass, Saltwort species) Tidal Herbaceous Alliance

Salicornia (virginica, bigelovii, maritima) - *Spartina alterniflor*a Herbaceous Vegetation (CEGL004308)

(Virginia Glasswort, Dwarf Saltwort, Slender Grasswort) - Smooth Cordgrass Herbaceous Vegetation
Salt Panne (Salicornia Type)

ELEMENT CONCEPT

Summary: This association represents tidally flooded hypersaline flats or very shallow depressions (pannes) dominated by halophytic herbs, including *Salicornia virginica, Salicornia bigelovii, Salicornia maritima*, and stunted *Spartina alterniflora*, that occur in salt marshes of the Atlantic Coast. Vegetation of this association tends to develop in shallow depressions within high or salt marshes where drainage is poor. The depressions are regularly to irregularly flooded by high tides, but as the water evaporates during low tide, the salinity concentration increases forming "salt pannes." Formation of the pannes may result from ice-scouring, rafting flotsam, peat compaction, mosquito ditch levees, or erosion of tidal creek banks, which create small, sparsely vegetated to unvegetated impoundments. Bare peat and/or mucky soils are prevalent (up to 85% bare soils). Total vegetative cover is variable in pannes, from near total absence of vascular plants to a dense cover of *Salicornia virginica, Salicornia bigelovii, Salicornia maritima, Sarcocornia pacifica*, or *Spartina alterniflora* (short form). Common associates include *Limonium carolinianum, Plantago maritima var. juncoides, Triglochin maritima, Spartina patens, Suaeda maritima*, and *Atriplex* spp. Algal mats are characteristically present, visible even in densely vegetated pannes. Blue-green algae are an important component of these mats, in some cases contributing significantly more biomass to the community than do vascular species. Diagnostic species include *Salicornia bigelovii* and *Salicornia virginica*.

Environment: Vegetation of this association tends to develop in shallow depressions in salt marshes where drainage is poor. They tend to occur more frequently on the high marsh but occur within low marsh as well. Pannes form in depressions that range from 2-30 cm lower than the elevation of the marsh. The depressions are regularly to irregularly flooded by tides, and as the water evaporates during low tide, the salinity concentration increases forming "salt pannes." Substrate is soft, silty muck or peat of variable density.

Vegetation: This association includes tidally flooded hypersaline flats or very shallow depressions (pannes) dominated by halophytic herbs. Total vegetative cover is quite variable in pannes, from near total absence of vascular plants to a dense cover of *Salicornia virginica, Salicornia bigelovii, Salicornia maritima, Sarcocornia pacifica*, or *Spartina alterniflora* (short form). Common associates include *Limonium carolinianum, Plantago maritima var. juncoides, Triglochin maritima, Spartina patens, Suaeda maritima*, and *Atriplex* spp. Algal mats are characteristically present, visible even in densely vegetated pannes. Blue-green algae are an important component of these mats, in some cases contributing significantly more biomass to the community than do vascular species. The following algae were noted to occur in association with *Spartina alterniflora* in the littoral zone of a Massachusetts salt marsh: *Oscillatoria subuliformis, Oscillatoria amphibia, Lyngbea* spp., *Microcoleus chthonoplastes, Nodularia harveyana, Hydrocoleum lyngbyaceum*, and *Symploca* spp. (Webber 1967).

Dynamics: Salt pannes are part of the shifting mosaic of plant communities of the salt marsh complex. They tend to occur more frequently on the high marsh, but are present in the low marsh as well. Pannes are variable in shape and likely variable in origin. Formation can result from ice scouring or rafting flotsam that scrapes away or smothers existing vegetation, or from peat compaction, mosquito ditch levees, or tidal creek bank erosion that blocks or impedes drainage. Lack of vegetation decreases local sedimentation, which also maintains lower micro-relief (Redfield 1972). Evaporation from these poorly drained shallow depressions leads to hypersaline conditions (Bertness et al. 1992, Niering and Warren 1980). Gradients of salinity and standing water depth and duration correlate to vegetative cover and composition. The lowest portions of pannes tend to be wetter and more saline and can have little or no vegetation. As duration of wetness and salinity decreases across the micro-relief, forb-dominated species assemblages tend to dominate followed by mixed graminoid-forb assemblages at the outer, higher edges (Redfield 1972). Pannes can be ephemeral features on the marsh, and vegetation cover and composition can vary from year to year. Unvegetated, soft-bottomed pannes generally have plentiful worm and crab burrows (Godfrey et al. 1978).

Similar Associations:
- *Batis maritima - Sarcocornia pacifica* Dwarf-shrubland (CEGL003956)
- *Sarcocornia pacifica* - (*Batis maritima, Distichlis spicata*) Dwarf-shrubland (CEGL002278)
- *Spartina alterniflora - Distichlis spicata Tidal Herbaceous Vegetation (CEGL006586)*

Related Concepts:
- *Salicornia - Bassia* salt flat (Harvill 1965) =
- *Salicornia europaea - Spartina alterniflora* community (Metzler and Barrett 1992) =
- *Salicornia virginica* Tidal Dwarf Shrubland (VDNH 2003) =
- *Salicornia* tidal flat (Clovis 1968) =
- *Salicornietum ambiguae* (Conard 1935) =
- *Sarcocornia perennis - (Distichlis spicata, Spartina alterniflora)* Dwarf-shrubland (Bartgis 1986) =
- *Spartina alterniflora / Salicornia europaea* community (Clancy 1993b) =
- Pan (Nichols 1920) =
- Panne (Good 1965) =
- Panne marsh (Baumann 1978b) =
- Pans (Higgins et al. 1971) =
- Pans (Hill 1986) =
- Salt Flat (Schafale and Weakley 1990) =
- Salt Flat (Schafale 2000) =
- Salt Flat (Fleming and Coulling 2001) B
- Salt Marsh (Rawinski 1984) ?
- Salt Panne (Harrison 2004) B
- Salt Panne (Clancy 1996) =
- Salt marsh complex, pannes (Breden 1989) =
- Salt pan (Klotz 1986) =
- Salt panne (Miller and Egler 1950) =
- Salt panne (Clancy 1993b) =
- Salt panne (Reschke 1990) =
- Spartina Saltmarsh (Gawler 2002) B
- Stunted *Spartina alterniflora* community (Miller and Egler 1950) =
- Tidal Mesohaline / Polyhaline Marsh (Fleming and Coulling 2001) B

Classification Comments: This community occurs in coastal salt marshes from Nova Scotia to the Carolinas, north of the range of *Batis maritima*. Salt pannes can potentially be classified based on morphology, salinity gradients, or substrate (Godfrey et al. 1978), which may elucidate further variation.

CONSERVATION RANKING

GRank: G5 (1997-12-1) **Reasons:**

ELEMENT DISTRIBUTION

Range: This association occurs along the Mid- and North Atlantic Coast from the Canadian maritime provinces south to North Carolina and possibly South Carolina and Georgia.

Subnations: CT, DE, GA?, MA, MD, ME, NB, NC, NH, NJ, NS, NY, QC, RI, SC?, VA

TNC Ecoregions: 56:P, 57:C, 58:C, 62:C, 63:C

USFS Ecoregions: 212C:PP, 212D:PP, 221Aa:CCC, 221Ab:CCC, 221Ac:CCC, 221Ad:CCC, 221Ak:CCC, 232Aa:CCC, 232Ab:CCC, 232Ac:CCC, 232Ad:CC?, 232Bx:CCC, 232Bz:CCC, 232Ce:CCP, 232Ci:CCC

Federal Lands: NPS (Assateague Island, Boston Harbor Islands, Cape Cod, Cape Lookout, Fire Island, Fort Frederica?, Gateway); USFWS (Cape May, E.B. Forsythe, Monomoy, Parker River, Prime Hook)

ELEMENT SOURCES

References: Bartgis 1986, Baumann 1978b, Bell et al. 2002, Berdine 1998, Bertness et al. 1992, Bowman 2000, Breden 1989, Breden et al. 2001, Clancy 1993b, Clancy 1996, Clovis 1968, Conard 1935, Dowhan and Rozsa 1989, Eastern Ecology Working Group n.d., Edinger et al. 2002, Enser 1999, Fleming 2001a, Fleming and Coulling 2001, Fleming et al. 2001, Gawler 2001, Gawler 2002, Godfrey et al. 1978, Good 1965, Harrison 2004, Harvill 1965, Higgins et al. 1971, Hill 1986, Klotz 1986, Metzler and Barrett 1992, Metzler and Barrett 2001, Miller and Egler 1950, NRCS 2001b, Nichols 1920, Niering and Warren 1980, Peet et al. unpubl. data, Rawinski 1984, Redfield 1972, Reschke 1990, Schafale 2000, Schafale and Weakley 1990, Sperduto 2000b, Swain and Kearsley 2001, VDNH 2003, Webber 1967

Salicornia bigelovii - Triglochin maritima Herbaceous Vegetation (CEGL006369)

Dwarf Saltwort - Seaside Arrow-grass Herbaceous Vegetation
Salt Flat

ELEMENT CONCEPT

Summary: This sandy tidal flat is characterized by *Salicornia bigelovii, Triglochin maritima, Plantago maritima, Agalinis maritima*. Other associates include *Salicornia virginica (= Salicornia europaea), Limonium carolinianum (= Limonium nashii), Juncus gerardii, Spartina patens, Argentina anserina (= Potentilla anserina)*. Peat is drier and more shallow than that of other salt marsh panne vegetation types, and vegetation cover averages 50%.

CONSERVATION RANKING

GRank: GNR (1998-4-14) **Reasons:**

ELEMENT DISTRIBUTION

Subnations: MA, NH
TNC Ecoregions: 62:C
USFS Ecoregions: 221Ab:CCC, 221Ak:CCC
Federal Lands: USFWS (Monomoy)

ELEMENT SOURCES

References: Breeding et al. 1974, Eastern Ecology Working Group n.d., Gawler 2002

V.C.2.N.a. Permanently flooded temperate or subpolar hydromorphic-rooted vegetation

Nymphaea odorata - Nuphar spp. Permanently Flooded Temperate Herbaceous Alliance (A.1984)

American White Water-lily - Yellow Pond-lily species Permanently Flooded Temperate Herbaceous Alliance

Alliance Summary: This alliance, common throughout most of the eastern and central United States and adjacent Canadian provinces, contains vegetation which may occur in a variety of slow-moving water bodies, including rivers, millponds, blackwater rivers, streams, shallow ponds or lakes, or on shores of deeper water bodies including freshwater tidal areas. Stands of this alliance are permanently to semipermanently flooded, and water depth is generally greater than 0.5 m and up to 2 m. Stands are dominated by hydromorphic-rooted aquatic plants, typically *Nuphar* sp. (any of the North American taxa), with or without *Nymphaea odorata*. Emergent vegetation is less than 25%, and typically plant species diversity is low. Other species present may include *Utricularia* spp., *Potamogeton* spp., and others. In the north, *Brasenia schreberi* may be locally dominant. Other characteristic northern species include *Nymphaea tetragona* and *Potamogeton amplifolius*. Associates found in the Midwest include *Polygonum amphibium*. In the Southeast, examples may include the floating or emergent "pad-leaved" species *Nelumbo lutea* or *Nymphoides aquatica*. Submerged aquatic species which may be present include *Cabomba caroliniana, Ceratophyllum demersum*, and *Heteranthera dubia*.

Nuphar advena - Nymphaea odorata Herbaceous Vegetation (CEGL002386)

Broadleaf Pond-lily - American White Water-lily Herbaceous Vegetation
Water-lily Aquatic Wetland

ELEMENT CONCEPT

Summary: This rooted aquatic or open marsh community occupies shallow-water depressions, oxbow ponds, backwater sloughs of river floodplains, slow-moving streams, ponds, and small lakes throughout the central and eastern United States. It is dominated by rooted, floating-leaved aquatic species, with both submergent and emergent aquatics also present. *Nuphar advena (= Nuphar lutea ssp. advena)* and *Nymphaea odorata* are dominants, either in combination together, or each singly. Other species present include *Brasenia schreberi*, various *Potamogeton* and *Stuckenia* spp., *Eleocharis robbinsii* and other *Eleocharis* spp., *Polygonum amphibium, Polygonum amphibium var. emersum (= Polygonum coccineum), Sparganium americanum, Lemna* spp., *Spirodela polyrrhiza, Typha latifolia*, and *Saururus cernuus*. Submerged aquatics more common in the southern part of the range include *Cabomba caroliniana, Ceratophyllum demersum*, and *Heteranthera dubia*.

Environment: This community occupies shallow-water depressions, oxbow ponds, sluggish streams, and backwater sloughs of river floodplains, ponds (natural and artificial), and small lakes. In pools and slow-flowing stretches of river, at Obed River (TN), *Nuphar lutea ssp. advena* is rooted in sandy substrate (Schmalzer and DeSelm 1982).
Vegetation: This community is dominated by rooted, floating-leaved aquatic species, with both submergent and emergent aquatics also present. *Nuphar advena (= Nuphar lutea ssp. advena)* and *Nymphaea odorata* are dominants, either in combination together, or each singly. Other species present include *Brasenia schreberi*, various *Potamogeton* and *Stuckenia* spp., *Eleocharis robbinsii* and other *Eleocharis* spp., *Polygonum amphibium, Polygonum amphibium var. emersum (= Polygonum coccineum), Sparganium americanum, Lemna* spp., *Spirodela polyrrhiza, Typha latifolia*, and *Saururus cernuus* (Anderson 1982, G. Fleming pers. comm.). Submerged aquatic species more common in the southern part of the range include *Cabomba caroliniana, Ceratophyllum demersum*, and *Heteranthera dubia*. This broadly conceived type may include ponds, or zones of ponds, dominated by *Nymphaea odorata*, with or without *Nuphar advena*.

Similar Associations:
- *Equisetum fluviatile - (Eleocharis palustris)* Herbaceous Vegetation (CEGL005258)
- *Nuphar advena* Tidal Herbaceous Vegetation (CEGL004472)
- *Nuphar polysepala* Herbaceous Vegetation (CEGL002001)
- Semipermanent Impoundment (CEGL006581)

Related Concepts:
- *Nuphar advena - Nymphaea odorata* Herbaceous Vegetation (Clancy 1996) =
- Delmarva Bay (Harrison 2004) B
- Floodplain Pond / Pool (Fleming and Coulling 2001) B
- Freshwater Marsh (Nelson 1985) B
- Inland Emergent Marsh (Chapman et al. 1989) B
- L5D2aI1a. *Nuphar lutea* (Foti et al. 1994) ?
- New England coastal plain pondshore (Rawinski 1984) ?
- Open Water/Aquatic Bed Veg., Natural Impoundment Pond (Ambrose 1990a) B
- Open water marsh with floating-leaved plants (NAP pers. comm. 1998) ?
- Small Depression Pond (Schafale and Weakley 1990) B
- Water-lily - Macrophyte Aquatic Bed (Gawler 2002) B

Classification Comments: Can occur in mostly natural ponded wetlands as well as artifactual ones such as borrow pits. On the Conecuh National Forest (Alabama), vegetation of this association occurs in Gum Pond and Open Pond as a mix of *Nymphaea odorata* and *Nuphar advena*.

CONSERVATION RANKING
GRank: G4G5 (2002-10-15) **Reasons:** The dominant species in stands of this vegetation are widespread across the eastern and central United States and adjacent Canada. This is not a rare or imperiled vegetation type, even though its occurrence is poorly documented. Stands may occur in natural lakes and ponds or in artificial impoundments.

ELEMENT DISTRIBUTION
Range: This rooted aquatic community occupies shallow, quiet waters throughout the central and eastern United States, extending from Maine to Ontario and Minnesota, south to Oklahoma and east to Georgia.
Subnations: AL, AR, CT, DE, FL, GA, IA, IL, IN, KY, LA, MA, MD, ME, MI, MN, MO, MS, NC, NH, NJ, NY, OH, OK, ON, PA, RI, SC, TN, TX, VA, VT, WI, WV
TNC Ecoregions: 31:C, 32:P, 36:C, 37:C, 39:C, 40:P, 41:C, 42:C, 43:C, 44:C, 45:C, 46:C, 47:C, 48:C, 49:C, 50:C, 51:C, 52:C, 53:C, 55:P, 56:C, 57:C, 58:C, 59:C, 60:C, 61:C, 62:C, 63:C
USFS Ecoregions: 212Aa:CCC, 212Ba:CCC, 212Bb:CCC, 212Ca:CCC, 212Cb:CCC, 212Da:CCC, 212Db:CCP, 212Dc:CCC, 212Fa:CCP, 212Fb:CCP, 212Fc:CCP, 212Fd:CCP, 212Ga:CCP, 212Gb:CCP, 212Hb:CPP, 212Ja:CCP, 212Jb:CCP, 212Jc:CCP, 212Je:CCP, 212Jf:CCP, 212Jj:CCP, 212Jl:CCP, 212Jm:CCC, 212Ka:CPP, 221Aa:CCP, 221Ab:CCC, 221Ah:CCC, 221Ai:CCC, 221Al:CCC, 221Am:CCC, 221Bd:CCP, 221Da:CCC, 221Db:CCC, 221Ea:CCC, 221Ed:CC?, 221Ef:CCC, 221Fa:CCC, 221Hc:CCC, 221He:CCC, 222Ch:CCC, 222Db:CCC, 222Gc:C??, 222Ha:CCC, 222Ja:CCC, 222Jb:CCC, 222Ji:CCC, 222Jj:CCC, 222Kf:CCC, 222Kg:CCC, 222Kh:CCC, 222Kj:CCC, 222L:CC, 231Bc:CCC, 231Bd:CCC, 231Ga:CCC, 231Gb:CCC, 231Gc:CCC, 232Bf:CCC, 232C:CC, 232D:CC, 234Aa:CCC, 234Ac:CCC, 234Ad:CCC, 234Af:CCC, 234Ag:CCC, 234Ai:CCC, 234Al:CCC, 234Am:CCC, 234An:CCC, 251Cf:CCC, 251Dd:CCC, 251Dg:CCC, 251Eb:CCC, M212Af:CCC, M212Bb:CCC, M212Bc:CCC, M212Bd:CCC, M212Cb:CCC, M212Cc:CCC, M212Ea:CCP, M212Eb:CCP, M221Aa:CCC, M221Ab:CCC, M221Ac:CCC, M221Ad:CCC, M221Ba:CCC, M221Bb:CCC, M221Bc:CCC, M221Bd:CCC, M221Be:CCC, M221Bf:CCC, M221Da:CCC, M221Dc:CCC

Federal Lands: DOD (Fort Benning); NPS (Acadia, C&O Canal, Carl Sandburg Home, Effigy Mounds, George Washington Parkway, Indiana Dunes, Minute Man, Natchez Trace, Obed River, Ozark Riverways, Saint Croix, Saint-Gaudens, Shiloh); USFS (Angelina, Chequamegon, Chequamegon-Nicolet, Conecuh, Davy Crockett, Kisatchie, Nicolet, Ocala, Ozark, Sabine, Sam Houston?, Talladega, Talladega (Oakmulgee), Talladega (Talladega)); USFWS (Back Bay, Erie, Great Swamp, Monomoy, Reelfoot)

ELEMENT SOURCES

References: Ambrose 1990a, Anderson 1982, Breden et al. 2001, Chapman et al. 1989, Clancy 1996, FNAI 1990, Fike 1999, Fleming and Coulling 2001, Fleming et al. 2001, Foti et al. 1994, Gawler 2002, Harrison 2004, Hoagland 2000, Hop et al. 2005, INAI unpubl. data, Midwestern Ecology Working Group n.d., NAP pers. comm. 1998, NatureServe Ecology - Southeastern U.S. unpubl. data, Nelson 1985, Peet et al. unpubl. data, Penfound 1953, Rawinski 1984, Schafale and Weakley 1990, Schmalzer and DeSelm 1982, Schotz pers. comm., Sperduto and Nichols 2004, Swain and Kearsley 2001, TDNH unpubl. data, Thompson and Jenkins 1992, WNHIP unpubl. data, Zanoni et al. 1979

V.C.2.N.b. Permanently flooded - tidal temperate or subpolar hydromorphic-rooted vegetation

Ruppia maritima Permanently Flooded - Tidal Temperate Herbaceous Alliance (A.1769)

Beaked Ditch-grass Permanently Flooded - Tidal Temperate Herbaceous Alliance

Alliance Summary: This alliance includes communities of submerged, rooted aquatic vegetation occurring in tidal creeks, pools, and coves with brackish waters. The substrate is often mud-bottomed but may also include sand. Characteristic species include *Ruppia maritima, Vallisneria americana*, and *Stuckenia pectinata (= Potamogeton pectinatus)*. This is the most widely distributed seagrass alliance in eastern North America. It ranges around the entire Atlantic and Gulf coasts, from New England to Texas. This vegetation is patchily distributed along the Texas coast, where *Ruppia maritima* often occurs mixed with *Halodule wrightii*. *Ruppia maritima* is the only seagrass capable of growing in freshwater and is therefore often found in the oligohaline to mesohaline upper reaches of estuaries and lower reaches of tidal creeks, bayous and rivers. Because it often behaves as an annual, the distribution and abundance of *Ruppia maritima* is often shifting both spatially and temporally.

Ruppia maritima Acadian/Virginian Zone Temperate Herbaceous Vegetation (CEGL006167)

Beaked Ditch-grass Acadian/Virginian Zone Temperate Herbaceous Vegetation
Northern Atlantic Coast Beaked Ditch-grass Bed

ELEMENT CONCEPT

Summary: This brackish/saline tidal community of the central and northern Atlantic coast is dominated by *Ruppia maritima*. It occurs in large beds in estuarine bays as well as small patches within brackish tidal creeks. Substrates are sand or muck, and salinity is generally brackish. *Ruppia maritima* has a wide range of salinity tolerance and overlaps with other species, although generally not in the same locations. Common associates include *Zannichellia palustris, Stuckenia pectinata (= Potamogeton pectinatus)*, and *Potamogeton perfoliatus* in brackish/fresh areas or *Zostera marina* as waters get deeper and more saline. There can also be a diverse array of macroalgae.

Environment: This association occurs in habitats that are continuously flooded by brackish water; it occurs in subtidal situations, deepwater pools and pannes, tidal creeks, and flats within salt marshes, or along tidal rivers. It also occurs in coastal salt ponds with polyhaline to mesohaline salinity levels. Except in pannes or pools, which are more irregularly flooded, water levels fluctuate with diurnal tides and are generally less than 2 m deep at low tide, although certain areas may be exposed at extremely low tides. Substrate varies from sand to mud.

Vegetation: *Ruppia maritima* is strongly dominant in this association. It has a wide range of salinity tolerance and overlaps with other species, although generally not in the same locations. Common associates include *Zannichellia palustris, Stuckenia pectinata (= Potamogeton pectinatus)*, and *Potamogeton perfoliatus* in brackish to fresh areas and *Zostera marina* as waters get deeper and more saline. There can also be a diverse array of macroalgae. This association grades into eelgrass beds as salinity increases. As salinity decreases, *Ruppia maritima* becomes less prominent, and the community grades into fresh/brackish subtidal associations.

Dynamics: In several habitats, this association occurs where water levels and salinity can fluctuate with daily tides.

Similar Associations:
- *Ruppia maritima - Stuckenia pectinata* Herbaceous Vegetation (CEGL006370)
- *Schoenoplectus pungens - Eleocharis parvula* Herbaceous Vegetation (CEGL006398)
- *Stuckenia pectinata - Potamogeton perfoliatus - (Zannichellia palustris)* Tidal Herbaceous Vegetation (CEGL006027)
- *Zostera marina* Herbaceous Vegetation (CEGL004336)

Related Concepts:
- *Ruppia maritima* Acadian-Virginian Zone Temperate Herbaceous Vegetation (Bartgis 1986) =
- *Ruppia maritima* Herbaceous Vegetation (Bowman 2000) =
- *Ruppia maritima* Semipermanently Flooded - Tidal Herbaceous Vegetation (Fleming et al. 2006) =
- *Ruppia* Community (Moore et al. 2000) ?
- Polyhaline subtidal aquatic bed (Breden 1989) ?
- Southern New England & Gulf of Maine Saline/ Brackish Subtidal Estuarine Community (Rawinski 1984) ?
- *Spartina* Saltmarsh (Gawler 2002) B
- Tidal Mesohaline - Polyhaline Aquatic Bed (Harrison 2004) B
- Tidal Mesohaline / Polyhaline Aquatic Bed (Fleming and Coulling 2001) B

Classification Comments: *Ruppia maritima* tends to occur in shallower and slightly less saline waters than *Zostera marina* (Orth and Moore 1988). The range of this type is consistent with the "Virginian Province" and "Acadian Province" of Cowardin et al. (1979).

CONSERVATION RANKING

GRank: GNR (1997-12-1) **Reasons:**

ELEMENT DISTRIBUTION

Range: This association occurs along the mid- and north Atlantic coast from Maine to North Carolina.

Subnations: CT, DE, MA, MD, ME, NC?, NH, NJ, NY, RI, VA

TNC Ecoregions: 57:?, 58:C, 62:C, 63:C

USFS Ecoregions: 212Db:CCP, 221Aa:CCC, 221Ab:CCC, 221Ac:CCC, 221Ad:CCC, 221Ae:CCP, 221Af:CCC, 221Ak:CCC, 221Ba:CCP, 232Aa:CCC, 232Ab:CCC, 232Ac:CCC, 232Br:CCC, 232Bx:CCC, 232Bz:CCC, 232Ch:CCC, 232Ci:CC?

Federal Lands: NPS (Assateague Island, Cape Cod); USFWS (Back Bay?, Cape May, Monomoy?, Parker River?)

ELEMENT SOURCES

References: Bartgis 1986, Bowman 2000, Breden 1989, Breden et al. 2001, Cowardin et al. 1979, Eastern Ecology Working Group n.d., Edinger et al. 2002, Enser 1999, Fleming 2001a, Fleming and Coulling 2001, Fleming et al. 2001, Fleming et al. 2006, Gawler 2002, Harrison 2004, Metzler and Barrett 2001, Metzler and Barrett 2004, Moore et al. 2000, Orth and Moore 1988, Rawinski 1984, Reschke 1990, Schafale and Weakley 1990, Sperduto 2000a, Sperduto 2000b, Swain and Kearsley 2001, Thayer et al. 1984

Zostera marina Permanently Flooded - Tidal Herbaceous Alliance (A.1766)

Seawrack Permanently Flooded - Tidal Herbaceous Alliance

Alliance Summary: This alliance includes subtidal aquatic beds characterized by *Zostera marina*. These communities usually occur in quiet waters below the lowest tide level and where fluctuations in salinity are minor. Substrate ranges from soft mud to coarse sand. Light availability is the primary limiting factor in occurrences of this alliance, within the geographic, temperature, and salinity range (10-30 ppt) of *Zostera marina*. The long leaves of *Zostera marina* provide substrate for epiphytic organisms such as macroalgae, bay scallops, and other marine invertebrates, as well as nursery and/ or adult habitat for fin fish. Characteristic associate nonvascular plants (algae) include *Ulva lactuca, Enteromorpha* spp., and *Polysiphonia* spp.

Zostera marina Herbaceous Vegetation (CEGL004336)

Seawrack Herbaceous Vegetation
North Atlantic Eel-grass Bed

ELEMENT CONCEPT

Summary: These aquatic beds occur in the subtidal zone along the north Atlantic coast, south to North Carolina. *Zostera marina* is dominant and occurs most often in nearly pure stands. *Ruppia maritima* can occur sporadically in this association, especially as waters become less saline. Additional associated species include macroalgae, especially *Ulva lactuca, Enteromorpha* spp., *Cladophora* spp., and *Polysiphonia* spp. Where water is less saline, *Enteromorpha, Chaetomorpha, Gracilaria, Agardhiella, Ectocarpus*, and *Pilayella* can occur. Elevation/depth of the beds is determined by low tide level at the upper end and light penetration at the lower end, the latter being a function of water depth and turbidity. The beds generally occur in areas with only moderate wave action where salinity fluctuations are minor. Eel-grass beds tend to stabilize and enrich substrate and provide habitat for epiphytes and other marine organisms.

Environment: These aquatic beds occur in the subtidal zone of coastal habitats on substrate ranging from soft mud to coarse sand. Elevation/depth of the beds is determined by low tide level at the upper end and light penetration at the lower end, the latter being a function of water depth and turbidity. The beds generally occur in areas with only moderate wave action where salinity fluctuations are minor, and salinity levels are in the mid to high range (Thayer et al. 1984).

Vegetation: *Zostera marina* is dominant and occurs in nearly pure stands. *Ruppia maritima* can occur sporadically in this association, especially as waters become less saline. Additional associated species are macroalgae, especially *Ulva lactuca, Enteromorpha* spp., *Cladophora* spp., and *Polysiphonia* spp. Where water is less saline, *Enteromorpha, Chaetomorpha, Gracilaria, Agardhiella, Ectocarpus*, and *Pilayella* can occur.

Dynamics: Eel-grass beds tend to stabilize and enrich substrate and provide habitat for epiphytes and other marine organisms.

Similar Associations:

- *Ruppia maritima* Acadian/Virginian Zone Temperate Herbaceous Vegetation (CEGL006167)--may co-occur in some regions of the Atlantic coast, but grows almost exclusively in brackish water.

Related Concepts:

- *Zostera* Community (Moore et al. 2000) ?
- Coastal Salt Pond (Rawinski 1984) ?
- Polyhaline subtidal aquatic bed (Breden 1989) ?
- Southern New England & Gulf of Maine Saline/ Brackish Subtidal Estuarine Community (Rawinski 1984) ?
- Tidal Mesohaline - Polyhaline Aquatic Bed (Harrison 2004) B
- Tidal Mesohaline / Polyhaline Aquatic Bed (Fleming and Coulling 2001) B

Classification Comments: According to Thayer et al. (1984) *Zostera marina* has a range of approximately 3090 km along the North American Atlantic coast which may be represented as 4 smaller subregions. The bulk of the southern range corresponds with the Virginian Zone of Cowardin et al. (1979). *Zostera marina* is extirpated from Delaware.

CONSERVATION RANKING

GRank: G4G5 (2006-1-19) **Reasons:** This vegetation has a wide distribution, in coastal waters from Maine to North Carolina. It occurs in large patches in sheltered near-shore estuarine waters. This vegetation is vulnerable to pollution from coastal run-off as well as oil spills off the coast.

ELEMENT DISTRIBUTION

Range: This community occurs in subtidal habitat along the north and mid-Atlantic coast.

Subnations: CT, MA, MD, ME, NC, NH, NJ, NY, RI, VA

TNC Ecoregions: 57:C, 58:C, 62:C, 63:C

USFS Ecoregions: 212Db:CCC, 212Dc:CCC, 221Aa:CCC, 221Ab:CCC, 221Ac:CCC, 221Ad:CCC, 221Ak:CCC, 221Ba:CCP, 232Aa:CCC, 232Ab:CCC, 232Ad:CCP, 232Af:CCC, 232Br:CCC, 232Bx:CCC, 232Bz:CCC, 232Ci:CCC, 232Cj:CCC

Federal Lands: NPS (Assateague Island); USFWS (Monomoy)

ELEMENT SOURCES

References: Berdine 1998, Bowman 2000, Breden 1989, Breden et al. 2001, Cowardin et al. 1979, Eastern Ecology Working Group n.d., Edinger et al. 2002, Enser 1999, Fleming 2001a, Fleming and Coulling 2001, Fleming et al. 2001, Harrison 2004, Harrison and Stango 2003, Metzler and Barrett 2001, Metzler and Barrett 2004, Moore et al. 2000, Orth and Moore 1988, Rawinski 1984, Reschke 1990, Sperduto 2000a, Sperduto 2000b, Swain and Kearsley 2001, Thayer et al. 1984

VII. Sparse Vegetation

VII.C.1.N.a. Dunes with sparse herbaceous vegetation

Herbaceous Dunes Sparsely Vegetated Alliance (A.1855)

Herbaceous Dunes Sparsely Vegetated Alliance

Alliance Summary: This is technically not an alliance. It is a placeholder for a group of sparsely vegetated associations that do not have adequate vegetation descriptions, but do share certain substrate characteristics.

VII.C.2.N.a. Sand flats

Cakile edentula Sparsely Vegetated Alliance (A.1861)

American Searocket Sparsely Vegetated Alliance

Alliance Summary: Annual-dominated sand flats on island end flats and upper ocean beaches, within the reach of storm tides and extreme lunar tides. This alliance has less perennial species than the related *Cakile constricta* Sparsely Vegetated Alliance (A.1860), since the Atlantic Coast shoreline is a higher-energy system, and the alliance is more dynamic and more frequently disturbed. Vegetative cover is variable, depending on the amount of exposure to wave and wind action, but on average is sparse; no species can be considered dominant. Annual or biennial species more or less restricted to beach habitats are characteristic of this alliance, including *Cakile edentula ssp. edentula*, as well as *Salsola kali ssp. kali (= Salsola caroliniana), Chamaesyce polygonifolia, Honckenya peploides, Cenchrus tribuloides, Amaranthus retroflexus, Chenopodium album, Erechtites hieraciifolia*, and *Atriplex cristata (= Atriplex arenaria)*. Associated species include *Ammophila breviligulata, Chamaesyce polygonifolia, Salsola kali ssp. kali*, and *Triplasis purpurea*. At Assateague Island National Seashore, this alliance is sparsely vegetated with *Cakile edentula ssp. edentula*, covering approximately 1% of the area. Other associated species in this alliance are just as sparse and generally adapted to a low growth form, given the exposed windy conditions of their environment. The South Atlantic Coast phase of this alliance occupies the upper portion of ocean beaches in the southern part (Cape Hatteras, North Carolina, to Cape Romain, South Carolina) of the microtidal region (barrier islands with coastal geomorphology dominated by hurricane overwash rather than tidal energy). Other characteristic species include mostly annual herbs, such as *Chamaesyce polygonifolia, Chamaesyce bombensis, Sesuvium portulacastrum, Salsola kali ssp. kali*, and the rare *Amaranthus pumilus*. In addition to the two associations in the Southeast, there is also an association in the Great Lakes; in this association the dominant plant is *Cakile edentula var. lacustris*.

Cakile edentula ssp. *edentula* - *Chamaesyce polygonifolia* Sparse Vegetation (CEGL004400)

American Searocket - Northern Seaside Spurge Sparse Vegetation
North Atlantic Upper Ocean Beach

ELEMENT CONCEPT

Summary: This is a sparsely vegetated upper beach community occurring on unstable sands and often gravels and cobbles just above mean high tide on maritime beaches and foredunes along the middle and northern Atlantic coast. This association occurs at the wrack line; there is regular deposition of wave-deposited flotsam. They are irregularly flooded by spring or storm tides. Vegetation cover is variable, depending on the amount of exposure to wave and wind action, but is generally sparse and characterized by annuals and biennials. Species composition can change dramatically from year to year but frequently includes *Cakile edentula ssp. edentula*, as well as *Salsola kali ssp. kali (= Salsola caroliniana), Chamaesyce polygonifolia, Honckenya peploides, Cenchrus tribuloides, Amaranthus retroflexus, Chenopodium album, Erechtites hieraciifolia, Xanthium strumarium*, and *Atriplex cristata (= Atriplex arenaria)*. Globally rare species such as *Polygonum glaucum* and *Amaranthus pumilus* occur in this habitat. Sparse *Ammophila breviligulata* can occur sporadically as a common associate, colonizing from the adjacent beachgrass community. Diagnostic species are *Cakile edentula ssp. edentula, Salsola kali ssp. kali, Atriplex cristata (= Atriplex pentandra)*, and *Chamaesyce polygonifolia*. This community occurs in maritime coastal areas from southern Maine to Cape Hatteras, North Carolina.

Environment: This association occurs on unstable sands and often gravels and cobbles just above mean high tide on beaches and foredunes washed over by spring and storm tides and impacted by wind erosion.

Vegetation: This is a sparsely vegetated association characterized by annuals and biennials. Species composition is variable, but frequently includes *Cakile edentula ssp. edentula, Honckenya peploides, Salsola kali (= Salsola caroliniana), Atriplex patula, Cenchrus tribuloides, Chamaesyce polygonifolia, Atriplex cristata (= Atriplex arenaria, = Atriplex pentandra), Xanthium strumarium*, and *Chenopodium* spp. Globally rare species such as *Polygonum glaucum* and *Amaranthus pumilus* occur in this habitat. *Ammophila breviligulata* can occur sporadically, colonizing from the adjacent beachgrass community. Additional infrequent species can include *Chenopodium rubrum, Chenopodium album, Chenopodium berlandieri var. macrocalycium, Cyperus filicinus, Triplasis purpurea*, and *Sesuvium maritimum*. Bare substrate can comprise greater than 95% cover in this association.

Dynamics: This association occurs at the wrack line; there is regular deposition of wave-deposited flotsam. It is irregularly flooded by very high tides, scoured by storm tides, and is constantly reworked by wind. Species composition is dominated by annuals and biennials and can change dramatically from year to year. If the habitat is protected from regular disturbance, perennial-dominated dune grass communities tend to develop.

Similar Associations:

- *Cakile edentula* Great Lakes Shore Sparse Vegetation (CEGL005162)
- *Cakile edentula ssp. edentula - Mertensia maritima* Sparse Vegetation (CEGL006106)
- *Cakile edentula* ssp. harperi Sparse Vegetation (CEGL004401)

Related Concepts:

- *Cakile edentula - Chenopodium album* community (Metzler and Barrett 1992) =
- *Cakile edentula ssp. edentula* Sparse Vegetation (Clancy 1996) ?
- *Cakile edentula* ssp. *edentula - Salsola caroliniana* Sparse Vegetation (Bartgis 1986) =
- *Cakiletum edentula* (Conard 1935) =
- Beach (Higgins et al. 1971) =
- Beach (McDonnell 1979) =
- Beach (Fender 1937) =
- Beach Strand (Gawler 2002) B
- Beach community (Baumann 1978b) =
- Beach community (Johnson 1985b) ?
- Beach community (Hill 1986) =
- Beach strand community (MENHP 1991) =
- Beach vegetation (Moul 1973) =
- Coastal Beach and Overwash Flat (Harrison 2004) B
- Coastal beach strand (Sperduto 1994) =
- Coastal beach strand community (Rawinski 1984) ?
- Dune and swale community (Stalter 1990) B
- Dune community (Jenkins 1974) =
- Dune-strand area (Clovis 1968) =
- Embryo dune (Klotz 1986) =
- Marine intertidal gravel/sand beach community (Breden 1989) =
- Marine sandy beach (Clancy 1993b) =
- Maritime beach (Reschke 1990) =
- Middle beach (Shreve et al. 1910) =
- Middle beach (Nichols 1920) =
- Pioneer beach community (Boule 1979) =
- Sea-strand vegetation, beach formation (Harshberger 1900) =
- Upper Beach (Schafale and Weakley 1990) B
- Upper Beach / Overwash Flat (Fleming and Coulling 2001) B

Classification Comments: This community is common on maritime dunes of the Northeast but is vulnerable to development and shifting wave action due to jetties. J. Harrison (pers. comm. 2006): “In the Chesapeake Marshlands, in Maryland, a small patch of this vegetation was observed on South Marsh Island [see Observation Point CM-15]. Please note many of the associated “maritime” species are not present in the refuge. Although not as well-developed in estuarine environments, consider expanding concept to include narrow sandy shorelines on bay islands.”

CONSERVATION RANKING
GRank: G4G5 (1997-12-1) **Reasons:**

ELEMENT DISTRIBUTION
Range: This association ranges from southern Maine to North Carolina.
Subnations: CT, DE, MA, MD, ME, NC, NH, NJ, NY, RI, VA
TNC Ecoregions: 57:C, 58:C, 62:C
USFS Ecoregions: 221Ab:CCC, 221Ac:CCC, 221Ak:CCC, 232Aa:CCC, 232Ab:CCC, 232Ac:CCC, 232Bz:CCC, 232Ch:CCC, 232Ci:CCC
Federal Lands: NPS (Assateague Island, Boston Harbor Islands, Cape Cod, Cape Hatteras, Fire Island, Gateway, Sagamore Hill); USFWS (Back Bay, Cape May, Chesapeake Marshlands, E.B. Forsythe, Monomoy, Muskeget Island, Parker River)
Element Sources
References: Bartgis 1986, Baumann 1978b, Berdine 1998, Boule 1979, Bowman 2000, Breden 1989, Breden et al. 2001, Clancy 1993b, Clancy 1996, Clovis 1968, Conard 1935, Dowhan and Rozsa 1989, Eastern Ecology Working Group n.d., Edinger et al. 2002, Enser 1999, Fender 1937, Fleming and Coulling 2001, Fleming et al. 2001, Gawler 2001, Gawler 2002, Godfrey et al. 1978, Harrison 2004, Harshberger 1900, Higgins et al. 1971, Hill 1986, J. Harrison pers. comm., Jenkins 1974, Johnson 1985b, Klotz 1986, MENHP 1991, McDonnell 1979, Metzler and Barrett 1992, Metzler and Barrett 2001, Moul 1973, Nichols 1920, Rawinski 1984, Reschke 1990, Schafale and Weakley 1990, Shreve et al. 1910, Sperduto 1994, Sperduto 2000a, Sperduto 2000b, Stalter 1990, Swain and Kearsley 2001

Dune Blowout

ELEMENT CONCEPT
Summary: Dune blowouts are unvegetated depressions on active coastal sand dunes where high winds have removed significant portions of sand. They can be ephemeral landscape features that become revegetated, but can also persist and even grow in size if exposure to high winds persists.
Environment: This feature occurs on unstable sands of foredunes or backdunes.

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Appendix D

USFWS

Red knot

Findings of Appropriateness and Compatibility Determinations

Findings of Appropriateness and Compatibility Determinations

This appendix documents our evaluation of what uses to allow or not allow at Monomoy National Wildlife Refuge (NWR) after completing the comprehensive conservation planning process.

The first table below (table D.1) lists the uses for which the refuge had completed findings of appropriateness (FOAs) and compatibility determinations (CDs) prior to release of the draft comprehensive conservation plan and environmental impact statement (CCP/EIS) in April 2014. It then compares them to the final decisions made in the CCP. The reader will note that some uses we will continue to allow, while other existing uses have been modified or will no longer be allowed.

The second table (table D.2) lists other uses for which the refuge did not have an existing, completed FOA and/or CD prior to 2014 and indicates our decision about those uses in the CCP.

Following this table, we provide the full FOAs and CDs for all of these uses.

Table D.1. Decisions made on uses at Monomoy NWR prior to 2014 compared to the final decisions made in the CCP.*

Use	Previously Determined Compatible (pre-2014)	Previously Determined Not Compatible (pre-2014)	Changes in the CCP
Beachcombing	X		Completed FOA to accompany an updated CD. Use is found appropriate and compatible with stipulations.
Birding, Natural and Cultural History Tours of Monomoy Islands	X		New FOA and CD titled " Commercial Tours, Ferry Service, Guided Trips, and Outfitting." Includes concessionaire operations and/or others under special use permit (SUP). Uses found appropriate and compatible with stipulations.
Commercial Ferry Service	X		Combined use with new FOA and CD titled "Commercial Tours, Ferry Service, Guided Trips, and Outfitting." Uses found appropriate and compatible with stipulations.
Hiking\Backpacking	X		Combined backpacking with FOA for camping and found it not appropriate. A new FOA and CD is titled "Hiking, Walking, and Jogging" and hiking is found appropriate and compatible.
Horseshoe Crab Harvesting		X	New FOA found use not appropriate. Found not compatible in 2002.
Jogging/Walking	X		Combined jogging and walking with hiking in new FOA and CD titled "Hiking, Walking, and Jogging." Found walking and hiking appropriate and compatible. Found jogging appropriate and compatible on Morris Island only.
Mosquito Control	X		Added "monitoring" to name of CD and completed new FOA. Found appropriate and compatible with stipulations.
Pet Walking	X		New FOA and CD titled, "Dog Walking on Morris Island." Use found appropriate and compatible on Morris Island with stipulations.
Photography	X		Prepared separate commercial photography FOA and CD and combined recreational photography with wildlife observation in separate CD. Uses found appropriate and compatible with stipulations.
Picnicking	X		New FOA finds use "organized picnicking" (including grill use) not appropriate.
Recreational Fishing	X		New CD titled "Fin Fishing" covers surf fishing, fishing in freshwater ponds, and all other fishing outside of the refuge's open water. Found compatible.
Shellfishing (hand harvest of softshell clams)	X		New CD finds use compatible on refuge, but only for hand harvest of subterranean clams. Use found compatible with stipulations.
Shorebird research	X		Completed new FOA and CD titled "Research Conducted by Non-Service Personnel" which includes broader research program and not a single project. New FOA and CD finds use appropriate and compatible with stipulations.

Use	Previously Determined Compatible (pre-2014)	Previously Determined Not Compatible (pre-2014)	Changes in the CCP
Snowshoeing	X		Not addressed due to lack of weather conditions conducive to snowshoeing.
Stage Island Parking	X		FOA for parking and dinghy storage at Stage Island found use to be not appropriate.
Swimming/Beach Use	X		Completed FOA to accompany updated CD for sunbathing and swimming only. Use is found appropriate and compatible with stipulations (titled "Sunbathing and Swimming"). A separate FOA for beach use found it not appropriate.
Whimbrel Research on North Monomoy	X		Completed new FOA and CD titled "Research Conducted by Non-Service Personnel" which includes broader research program and not a single project. New CD finds use appropriate and compatible with stipulations.
Wildlife Observation	X		Expanded CD to include recreational photography. New CD finds uses compatible.

**Notes: "Existing completed" refers to compatibility determinations that were current as of December 2013. CD = compatibility determination; FOA= finding of appropriateness*

Table D.2. Uses at Monomoy NWR that had no decisions made prior to 2014, but are addressed in the CCP.

Use	Not Appropriate	Compatible	Comments
Beach Use (sports, kite-flying, grilling, and shade tents)	X		
Bicycling	X		
Camping	X		
Mussel Harvesting	X		
Fires	X		
Fireworks	X		
Jet Skiing	X		
Kiteboarding	X		
Over-sand Vehicles	X		
Motorized and Nonmotorized Boat Launching		X	Also completed FOA.
Virtual Geocaching and Letterboxing		X	Also completed FOA.
Commercial Wildlife and Landscape Photography		X	New FOA and CD applies to commercial use, distinguishing it from recreational photography.
Environmental Education and Interpretation		X	

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FINDING OF APPROPRIATENESS OF A REFUGE USE

Refuge Name: Monomoy National Wildlife Refuge

Use: Beach Use (Sports, Kite Flying, Grilling, and Shade Tents)

This form is not required for wildlife-dependent recreational uses, take regulated by the State, or uses already described in a refuge CCP or step-down management plan approved after October 9, 1997.

Decision Criteria:	**YES**	**NO**
(a) Do we have jurisdiction over the use?	✔	
(b) Does the use comply with applicable laws and regulations (Federal, State, Tribal, and local)?	✔	
(c) Is the use consistent with applicable Executive orders and Department and Service policies?	✔	
(d) Is the use consistent with public safety?	✔	
(e) Is the use consistent with goals and objectives in an approved management plan or other document?		✔
(f) Has an earlier documented analysis not denied the use or is this the first time the use has been proposed?	✔	
(g) Is the use manageable within available budget and staff?		✔
(h) Will this be manageable in the future within existing resources?		✔
(i) Does the use contribute to the public's understanding and appreciation of the refuge's natural or cultural resources, or is the use beneficial to the refuge's natural or cultural resources?		✔
(j) Can the use be accommodated without impairing existing wildlife-dependent recreational uses or reducing the potential to provide quality (see section 1.6D, 603 FW 1, for description), compatible, wildlife-dependent recreation into the future?		✔

Where we do not have jurisdiction over the use ["no" to (a)], there is no need to evaluate it further as we cannot control the use. Uses that are illegal, inconsistent with existing policy, or unsafe ["no" to (b), (c), or (d)] may not be found appropriate. If the answer is "no" to any of the other questions above, we will **generally** not allow the use.

If indicated, the refuge manager has consulted with State fish and wildlife agencies. Yes ✔ No _____.

When the refuge manager finds the use appropriate based on sound professional judgment, the refuge manager must justify the use in writing on an attached sheet and obtain the refuge supervisor's concurrence.

Based on an overall assessment of these factors, my summary conclusion is that the proposed use is:

Not Appropriate ✔ **Appropriate** _____

Refuge Manager: Elizabeth A Herlevich Date: March 18, 2016

If found to be **Not Appropriate**, the refuge supervisor does not need to sign concurrence if the use is a new use.

If an existing use is found **Not Appropriate** outside the CCP process, the refuge supervisor must sign concurrence.

If found to be **Appropriate**, the refuge supervisor must sign concurrence:

Refuge Supervisor: Richard J Taylor Date: March 18, 2016

A compatibility determination is required before the use may be allowed.

JUSTIFICATION FOR A FINDING OF APPROPRIATENESS OF A REFUGE USE

Refuge Name: Monomoy National Wildlife Refuge

Use: Beach Use (Sports, Kite Flying, Grilling, and Shade Tents)

NARRATIVE:

The U.S. Fish and Wildlife Service policy on Appropriate Refuge Uses (603 FW 1) states, "General public uses that are not wildlife-dependent recreational uses, as defined by the National Wildlife Refuge System Improvement Act and do not contribute to the fulfillment of refuge purposes or goals or objectives as described in current refuge management plans are the lowest priorities for refuge managers to consider. These uses are likely to divert refuge management resources from priority general public uses or away from our responsibilities to protect and manage fish, wildlife, and plants, and their habitats. Therefore, both law and policy have a general presumption against allowing such uses within the National Wildlife Refuge System."

Beach sports include, but are not limited to, volleyball, football, soccer, frisbee, baseball, surfing, and skim boarding. Kite flying is another beach use. These activities are determined to be inappropriate because they can disturb wildlife and increase beach erosion and habitat destruction. These uses do not contribute to quality wildlife-dependent recreational uses nor do they support the purpose for which the refuge was established.

Grilling can result in the intentional or unintentional deposition of food waste on the refuge which could be eaten by refuge wildlife. This could result in an increase of gulls or mammals who can also act as mammalian predators on bird eggs and unfledged chicks.

Nesting or staging birds such as terns, might perceive kite flying as avian predators and temporarily or permanently abandon nests or young. The sudden movement of an adult leaving the nest or young might also attract the attention of other predators that will then depredate the nest or young. The birds will continue to leave the nest exposed until the threat is gone. The eggs will not survive long exposure to the summer sun. Also, kite string that has been left on the beach or tangled tightly between trees or shrubs can be detrimental to birds by snagging and tangling their feathers. In addition, kite string, when the kite is flying, may not be visible to birds and may also snag a bird in mid-flight. In addition to their impact on tern colonies on the refuge, research on the effects of human disturbance at Cape Cod National Seashore found that plovers responded more strongly to kite-flying than other forms of human disturbance (Hoopes 1993). Kite flying is restricted on Cape Cod National Seashore, and is prohibited within 656 feet (200 meters) of shorebird nesting areas.

Extensive research has been conducted on disturbance to shorebirds from beach recreationists. Given that shorebird populations are in an overall decline, and that disturbance increases as group size increases, thereby necessitating a larger buffer distance (Martin et al, 2015), it is imperative that the refuge continue to manage its lands for migratory bird protection while balancing recreational uses. It has been documented that outdoor recreational activities have increased in recent years (Knight and Gutzwiller, 1995) and most species of shorebirds are in decline all around the world as a result of both loss of coastal wetlands and in connection with these recreational activities (Martin et al, 2015).

These uses are more appropriate in a park setting and would, if allowed, detract from the purpose of the refuge which is to protect migratory birds and provide opportunities for recreational wildlife-dependent public use. When conducted in designated wilderness, all these activities, including the use of shade tents, detract from the wilderness character of the refuge. Activities which are generally done in groups, such as beach sports and grilling, can also negatively impact the quality of solitude which is to be preserved in wilderness.

In addition to North Monomoy Island and South Monomoy Island, there are insufficient facilities at the Monomoy National Wildlife Refuge (NWR) to accommodate these uses on Morris Island. Allowing these uses to occur on Morris Island would increase parking pressure on the small parking lot at refuge headquarters.

This could result in less parking for visitors who are coming to the refuge to engage in wildlife-dependent public uses such as fishing and birding.

By removing beach activities that do not in and of themselves support a better understanding of wildlife and which may have direct or indirect impacts on wildlife, we are increasing the likelihood that refuge habitats will be less disturbed and wildlife will be able to use refuge resources to maximize productivity, sustenance and survival.

As part of the comprehensive conservation planning (CCP) process for the Monomoy NWR, a draft finding of appropriateness underwent a 180-day public comment period concurrent with the release of our draft CCP/ Environmental Impact Statement (EIS). Many comments on beach use were received, but no new substantive information was provided that would lead us to change our finding, which then underwent a further 37-day public review period concurrent with the release of the final CCP/EIS. No comments were received during the final review and the finding of appropriateness has remain unchanged. For the reasons outlined above, we find that the beach uses outlined in this finding of appropriateness are not appropriate uses at Monomoy NWR.

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Hoopes, E.M. 1993. Relationships between human recreation and piping plover foraging ecology and chick survival. Unpublished M.S. thesis. University of Massachusetts, Amherst, Massachusetts. 106 pp.

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FWS Form 3-2319
02/06

FINDING OF APPROPRIATENESS OF A REFUGE USE

Refuge Name: Monomoy National Wildlife Refuge

Use: Bicycling

This form is not required for wildlife-dependent recreational uses, take regulated by the State, or uses already described in a refuge CCP or step-down management plan approved after October 9, 1997.

Decision Criteria:	**YES**	**NO**
(a) Do we have jurisdiction over the use?	✔	
(b) Does the use comply with applicable laws and regulations (Federal, State, Tribal, and local)?	✔	
(c) Is the use consistent with applicable Executive orders and Department and Service policies?	✔	
(d) Is the use consistent with public safety?	✔	
(e) Is the use consistent with goals and objectives in an approved management plan or other document?		✔
(f) Has an earlier documented analysis not denied the use or is this the first time the use has been proposed?		✔
(g) Is the use manageable within available budget and staff?	✔	
(h) Will this be manageable in the future within existing resources?	✔	
(i) Does the use contribute to the public's understanding and appreciation of the refuge's natural or cultural resources, or is the use beneficial to the refuge's natural or cultural resources?		✔
(j) Can the use be accommodated without impairing existing wildlife-dependent recreational uses or reducing the potential to provide quality (see section 1.6D, 603 FW 1, for description), compatible, wildlife-dependent recreation into the future?		✔

Where we do not have jurisdiction over the use ["no" to (a)], there is no need to evaluate it further as we cannot control the use. Uses that are illegal, inconsistent with existing policy, or unsafe ["no" to (b), (c), or (d)] may not be found appropriate. If the answer is "no" to any of the other questions above, we will **generally** not allow the use.

If indicated, the refuge manager has consulted with State fish and wildlife agencies. Yes ✔ No _____.

When the refuge manager finds the use appropriate based on sound professional judgment, the refuge manager must justify the use in writing on an attached sheet and obtain the refuge supervisor's concurrence.

Based on an overall assessment of these factors, my summary conclusion is that the proposed use is:

Not Appropriate ✔ **Appropriate** _____

Refuge Manager: Elizabeth A. Herland Date: March 18, 2016

If found to be **Not Appropriate**, the refuge supervisor does not need to sign concurrence if the use is a new use.

If an existing use is found **Not Appropriate** outside the CCP process, the refuge supervisor must sign concurrence.

If found to be **Appropriate**, the refuge supervisor must sign concurrence:

Refuge Supervisor: Gordon W. Taylor Date: March 18, 2016

A compatibility determination is required before the use may be allowed.

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JUSTIFICATION FOR A FINDING OF APPROPRIATENESS OF A REFUGE USE

Refuge Name: Monomoy National Wildlife Refuge

Use: Bicycling

NARRATIVE:

The U.S. Fish and Wildlife Service policy on Appropriate Refuge Uses (603 FW 1) states, "General public uses that are not wildlife-dependent recreational uses, as defined by the National Wildlife Refuge System Improvement Act and do not contribute to the fulfillment of refuge purposes or goals or objectives as described in current refuge management plans are the lowest priorities for refuge managers to consider. These uses are likely to divert refuge management resources from priority general public uses or away from our responsibilities to protect and manage fish, wildlife, and plants, and their habitats. Therefore, both law and policy have a general presumption against allowing such uses within the National Wildlife Refuge System."

Monomoy National Wildlife Refuge (NWR) includes the Morris Island tract, which contains refuge administration and visitor facilities, a parking lot, and the 3/4-mile Morris Island Interpretive Trail. Visitors are allowed to access the refuge by bicycle on existing roads, but then must park the bicycle and proceed on foot. The Morris Island Trail traverses a variety of coastal habitats, including a sandy beach and salt marshes, and is not conducive to bicycling. The rest of the refuge is made up of North Monomoy Island, South Monomoy Island, Minimoy Island, and extensive tidal flats. The majority of these lands are nationally designated wilderness. Bicycling is not allowed within wilderness areas because mechanized transport, including anything with wheels, is prohibited in order to maintain wilderness character.

Bicycling on Morris Island has the potential to directly impact the quality experience of individuals engaging in priority wildlife-dependent activities such as bird watching, fishing, and photography. Bicycling also has the ability to disrupt migratory birds and other wildlife on the beach. Access by bicycle is not necessary to provide the visitor an opportunity to see wildlife throughout the refuge. Pedestrian access is sufficient to provide the public with opportunities to observe wildlife and enjoy the natural conditions on the refuge.

As part of the comprehensive conservation planning (CCP) process for the Monomoy NWR, a draft finding of appropriateness underwent a 180-day public comment period concurrent with the release of our draft CCP/ Environmental Impact Statement (EIS). No substantive new information that would lead us to reconsider our draft finding was provided at that time. The finding then underwent a further 37-day public review period concurrent with the release of the final CCP/EIS. No additional comments were received on the finding of appropriateness and it has remain unchanged. Given the difficult cycling conditions, the potential impacts to priority wildlife-dependent recreation, the potential impacts to priority wildlife, and the prohibition of mechanized transportation within the nationally designated wilderness area, bicycling is not an appropriate recreational use at Monomoy NWR.

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FINDING OF APPROPRIATENESS OF A REFUGE USE

Refuge Name: Monomoy National Wildlife Refuge

Use: Camping

This form is not required for wildlife-dependent recreational uses, take regulated by the State, or uses already described in a refuge CCP or step-down management plan approved after October 9, 1997.

Decision Criteria:	**YES**	**NO**
(a) Do we have jurisdiction over the use?	✔	
(b) Does the use comply with applicable laws and regulations (Federal, State, Tribal, and local)?	✔	
(c) Is the use consistent with applicable Executive orders and Department and Service policies?	✔	
(d) Is the use consistent with public safety?		✔
(e) Is the use consistent with goals and objectives in an approved management plan or other document?		✔
(f) Has an earlier documented analysis not denied the use or is this the first time the use has been proposed?		✔
(g) Is the use manageable within available budget and staff?		✔
(h) Will this be manageable in the future within existing resources?		✔
(i) Does the use contribute to the public's understanding and appreciation of the refuge's natural or cultural resources, or is the use beneficial to the refuge's natural or cultural resources?		✔
(j) Can the use be accommodated without impairing existing wildlife-dependent recreational uses or reducing the potential to provide quality (see section 1.6D, 603 FW 1, for description), compatible, wildlife-dependent recreation into the future?	✔	

Where we do not have jurisdiction over the use ["no" to (a)], there is no need to evaluate it further as we cannot control the use. Uses that are illegal, inconsistent with existing policy, or unsafe ["no" to (b), (c), or (d)] may not be found appropriate. If the answer is "no" to any of the other questions above, we will **generally** not allow the use.

If indicated, the refuge manager has consulted with State fish and wildlife agencies. Yes ✔ No _____.

When the refuge manager finds the use appropriate based on sound professional judgment, the refuge manager must justify the use in writing on an attached sheet and obtain the refuge supervisor's concurrence.

Based on an overall assessment of these factors, my summary conclusion is that the proposed use is:

Not Appropriate ✔ **Appropriate** _____

Refuge Manager: Elizabeth A Herlund Date: March 16, 2016

If found to be **Not Appropriate**, the refuge supervisor does not need to sign concurrence if the use is a new use.

If an existing use is found **Not Appropriate** outside the CCP process, the refuge supervisor must sign concurrence.

If found to be **Appropriate**, the refuge supervisor must sign concurrence:

Refuge Supervisor: Graham A Taylor Date: March 18, 2016

A compatibility determination is required before the use may be allowed.

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JUSTIFICATION FOR A FINDING OF APPROPRIATENESS OF A REFUGE USE

Refuge Name: Monomoy National Wildlife Refuge

Use: Camping

NARRATIVE:

The U.S. Fish and Wildlife Service policy on Appropriate Refuge Uses (603 FW 1) states, "General public uses that are not wildlife-dependent recreational uses, as defined by the National Wildlife Refuge System Improvement Act and do not contribute to the fulfillment of refuge purposes or goals or objectives as described in current refuge management plans are the lowest priorities for refuge managers to consider. These uses are likely to divert refuge management resources from priority general public uses or away from our responsibilities to protect and manage fish, wildlife, and plants, and their habitats. Therefore, both law and policy have a general presumption against allowing such uses within the National Wildlife Refuge System."

Resources needed to manage an overnight, primitive camping program that adequately provides for public and employee sanitation and safety, without disturbing or harming focal wildlife species, would divert existing and future resources from accomplishing priority refuge tasks. Primitive "backcountry" camping on Monomoy presents unacceptable levels of risk from the potential escape of campfires to wildfires and the possible disturbance to nesting shorebirds, seabirds, wading birds, and breeding northeastern beach tiger beetles. The use does not support the refuge's purpose in carrying out the national migratory bird program. This use is also not consistent with any approved refuge management plan. There would be some added benefit for the visitor to observe or photograph wildlife, or participate in nature study or recreational fishing. The remoteness of interior portions of South Monomoy Island within the Monomoy Wilderness does offer a rare, outstanding opportunity for solitude, especially at night through backcountry camping. However, these priority uses and wilderness experience can be adequately provided for through daylight-hour day use and without overnight camping.

As part of the comprehensive conservation planning (CCP) process for the Monomoy National Wildlife Refuge (NWR), a draft finding of appropriateness underwent a 180-day public comment period concurrent with the release of our draft CCP/Environmental Impact Statement (EIS). No substantive new information that would lead us to reconsider our draft finding was provided at that time. It underwent a further 37-day public review period concurrent with the release of the final CCP/EIS. No comments were received on the finding of appropriateness and it has remain unchanged. Allowing camping on the refuge, given the lack of staff and financial resources to manage the use, the conflict it would cause with other users, as well as the impact on refuge plant and wildlife resources, makes this an inappropriate use at Monomoy NWR.

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FINDING OF APPROPRIATENESS OF A REFUGE USE

Refuge Name: Monomoy National Wildlife Refuge

Use: Fires

This form is not required for wildlife-dependent recreational uses, take regulated by the State, or uses already described in a refuge CCP or step-down management plan approved after October 9, 1997.

Decision Criteria:	**YES**	**NO**
(a) Do we have jurisdiction over the use?	✔	
(b) Does the use comply with applicable laws and regulations (Federal, State, Tribal, and local)?	✔	
(c) Is the use consistent with applicable Executive orders and Department and Service policies?		✔
(d) Is the use consistent with public safety?		✔
(e) Is the use consistent with goals and objectives in an approved management plan or other document?		✔
(f) Has an earlier documented analysis not denied the use or is this the first time the use has been proposed?		✔
(g) Is the use manageable within available budget and staff?		✔
(h) Will this be manageable in the future within existing resources?		✔
(i) Does the use contribute to the public's understanding and appreciation of the refuge's natural or cultural resources, or is the use beneficial to the refuge's natural or cultural resources?		✔
(j) Can the use be accommodated without impairing existing wildlife-dependent recreational uses or reducing the potential to provide quality (see section 1.6D, 603 FW 1, for description), compatible, wildlife-dependent recreation into the future?		✔

Where we do not have jurisdiction over the use ["no" to (a)], there is no need to evaluate it further as we cannot control the use. Uses that are illegal, inconsistent with existing policy, or unsafe ["no" to (b), (c), or (d)] may not be found appropriate. If the answer is "no" to any of the other questions above, we will **generally** not allow the use.

If indicated, the refuge manager has consulted with State fish and wildlife agencies. Yes ✔ No _____.

When the refuge manager finds the use appropriate based on sound professional judgment, the refuge manager must justify the use in writing on an attached sheet and obtain the refuge supervisor's concurrence.

Based on an overall assessment of these factors, my summary conclusion is that the proposed use is:

Not Appropriate ✔ **Appropriate** _____

Refuge Manager: Elizabeth A Herland Date: March 18, 2016

If found to be **Not Appropriate**, the refuge supervisor does not need to sign concurrence if the use is a new use.

If an existing use is found **Not Appropriate** outside the CCP process, the refuge supervisor must sign concurrence.

If found to be **Appropriate**, the refuge supervisor must sign concurrence:

Refuge Supervisor: Richard W Taylor Date: March 18, 2016

A compatibility determination is required before the use may be allowed.

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JUSTIFICATION FOR A FINDING OF APPROPRIATENESS OF A REFUGE USE

Refuge Name: Monomoy National Wildlife Refuge

Use: Fires

NARRATIVE:

The U.S. Fish and Wildlife Service policy on Appropriate Refuge Uses (603 FW 1) states, "General public uses that are not wildlife-dependent recreational uses, as defined by the National Wildlife Refuge System Improvement Act and do not contribute to the fulfillment of refuge purposes or goals or objectives as described in current refuge management plans are the lowest priorities for refuge managers to consider. These uses are likely to divert refuge management resources from priority general public uses or away from our responsibilities to protect and manage fish, wildlife, and plants, and their habitats. Therefore, both law and policy have a general presumption against allowing such uses within the National Wildlife Refuge System."

Fires are not necessary for visitors to engage in any of the approved public uses on the refuge, including the priority public uses. Fires can disturb nesting and staging shorebirds, seabirds, and wading birds that use the refuge. Fires also have the potential to spread and endanger plants, wildlife, and public safety. Fires are associated with non-wildlife dependent forms of recreation, some of which have been found to be not appropriate. Furthermore, the refuge does not have the resources needed to manage this activity, and any increases in staff would be targeted to enhance population and habitat management, priority public uses, and resource and visitor safety. The use does not support the refuge's establishing purpose to provide for migratory birds.

As part of the comprehensive conservation planning (CCP) process for the Monomoy National Wildlife Refuge (NWR), this finding of appropriateness underwent a 180-day public comment period concurrent with the release of our draft CCP/Environmental Impact Statement (EIS). No substantive new information that would lead us to reconsider our draft finding was provided at that time. It underwent a further 37-day public review period concurrent with the release of the final CCP/EIS. No comments were received on the finding of appropriateness and it has remain unchanged. For the reasons described above, we find that fires are not an appropriate recreational use at Monomoy NWR.

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FINDING OF APPROPRIATENESS OF A REFUGE USE

Refuge Name: Monomoy National Wildlife Refuge

Use: Fireworks

This form is not required for wildlife-dependent recreational uses, take regulated by the State, or uses already described in a refuge CCP or step-down management plan approved after October 9, 1997.

Decision Criteria:	**YES**	**NO**
(a) Do we have jurisdiction over the use?	✔	
(b) Does the use comply with applicable laws and regulations (Federal, State, Tribal, and local)?		✔
(c) Is the use consistent with applicable Executive orders and Department and Service policies?		✔
(d) Is the use consistent with public safety?		✔
(e) Is the use consistent with goals and objectives in an approved management plan or other document?		✔
(f) Has an earlier documented analysis not denied the use or is this the first time the use has been proposed?	✔	
(g) Is the use manageable within available budget and staff?		✔
(h) Will this be manageable in the future within existing resources?		✔
(i) Does the use contribute to the public's understanding and appreciation of the refuge's natural or cultural resources, or is the use beneficial to the refuge's natural or cultural resources?		✔
(j) Can the use be accommodated without impairing existing wildlife-dependent recreational uses or reducing the potential to provide quality (see section 1.6D, 603 FW 1, for description), compatible, wildlife-dependent recreation into the future?		✔

Where we do not have jurisdiction over the use ["no" to (a)], there is no need to evaluate it further as we cannot control the use. Uses that are illegal, inconsistent with existing policy, or unsafe ["no" to (b), (c), or (d)] may not be found appropriate. If the answer is "no" to any of the other questions above, we will **generally** not allow the use.

If indicated, the refuge manager has consulted with State fish and wildlife agencies. Yes ✔ No _____.

When the refuge manager finds the use appropriate based on sound professional judgment, the refuge manager must justify the use in writing on an attached sheet and obtain the refuge supervisor's concurrence.

Based on an overall assessment of these factors, my summary conclusion is that the proposed use is:

Not Appropriate ✔ **Appropriate** _____

Refuge Manager: Elizabeth A Harlan Date: March 18, 2016

If found to be **Not Appropriate**, the refuge supervisor does not need to sign concurrence if the use is a new use.

If an existing use is found **Not Appropriate** outside the CCP process, the refuge supervisor must sign concurrence.

If found to be **Appropriate**, the refuge supervisor must sign concurrence:

Refuge Supervisor: Richard E Taylor Date: March 18, 2016

A compatibility determination is required before the use may be allowed.

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JUSTIFICATION FOR A FINDING OF APPROPRIATENESS OF A REFUGE USE

Refuge Name: Monomoy National Wildlife Refuge

Use: Fireworks

NARRATIVE:

The U.S. Fish and Wildlife Service policy on Appropriate Refuge Uses (603 FW 1) states, "General public uses that are not wildlife-dependent recreational uses, as defined by the National Wildlife Refuge System Improvement Act and do not contribute to the fulfillment of refuge purposes or goals or objectives as described in current refuge management plans are the lowest priorities for refuge managers to consider. These uses are likely to divert refuge management resources from priority general public uses or away from our responsibilities to protect and manage fish, wildlife, and plants, and their habitats. Therefore, both law and policy have a general presumption against allowing such uses within the National Wildlife Refuge System."

Fireworks pose significant impacts to wildlife and habitat, especially during the summer and early fall when shorebirds, seabirds, and wading birds nest and stage on the refuge. In addition, fireworks are a public safety risk that could start wildfires or cause injury to refuge visitors. This use does not support the refuge's establishing purpose to provide habitat for migratory birds.

As part of the comprehensive conservation planning (CCP) process for the Monomoy National Wildlife Refuge (NWR), a draft of this finding of appropriateness underwent a 180-day public comment period concurrent with the release of our draft CCP/Environmental Impact Statement (EIS). No substantive new information that would lead us to reconsider our draft finding was provided at that time. It underwent a further 37-day public review period concurrent with the release of the final CCP/EIS. No comments were received on the finding of appropriateness and it has remain unchanged. For the reasons described above, we find that fireworks are not an appropriate use at Monomoy NWR.

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FINDING OF APPROPRIATENESS OF A REFUGE USE

Refuge Name: Monomoy National Wildlife Refuge

Use: Horseshoe Crab Harvesting

This form is not required for wildlife-dependent recreational uses, take regulated by the State, or uses already described in a refuge CCP or step-down management plan approved after October 9, 1997.

Decision Criteria:	**YES**	**NO**
(a) Do we have jurisdiction over the use?	✔	
(b) Does the use comply with applicable laws and regulations (Federal, State, Tribal, and local)?	✔	
(c) Is the use consistent with applicable Executive orders and Department and Service policies?		✔
(d) Is the use consistent with public safety?	✔	
(e) Is the use consistent with goals and objectives in an approved management plan or other document?		✔
(f) Has an earlier documented analysis not denied the use or is this the first time the use has been proposed?		✔
(g) Is the use manageable within available budget and staff?		✔
(h) Will this be manageable in the future within existing resources?		✔
(i) Does the use contribute to the public's understanding and appreciation of the refuge's natural or cultural resources, or is the use beneficial to the refuge's natural or cultural resources?		✔
(j) Can the use be accommodated without impairing existing wildlife-dependent recreational uses or reducing the potential to provide quality (see section 1.6D, 603 FW 1, for description), compatible, wildlife-dependent recreation into the future?	✔	

Where we do not have jurisdiction over the use ["no" to (a)], there is no need to evaluate it further as we cannot control the use. Uses that are illegal, inconsistent with existing policy, or unsafe ["no" to (b), (c), or (d)] may not be found appropriate. If the answer is "no" to any of the other questions above, we will **generally** not allow the use.

If indicated, the refuge manager has consulted with State fish and wildlife agencies. Yes ✔ No _____.

When the refuge manager finds the use appropriate based on sound professional judgment, the refuge manager must justify the use in writing on an attached sheet and obtain the refuge supervisor's concurrence.

Based on an overall assessment of these factors, my summary conclusion is that the proposed use is:

Not Appropriate ✔ **Appropriate** _____

Refuge Manager: Elizabeth A. Harlan Date: March 18, 2016

If found to be **Not Appropriate**, the refuge supervisor does not need to sign concurrence if the use is a new use.

If an existing use is found **Not Appropriate** outside the CCP process, the refuge supervisor must sign concurrence.

If found to be **Appropriate**, the refuge supervisor must sign concurrence:

Refuge Supervisor: Graham A. Taylor Date: March 18, 2016

A compatibility determination is required before the use may be allowed.

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JUSTIFICATION FOR A FINDING OF APPROPRIATENESS OF A REFUGE USE

Refuge Name: Monomoy National Wildlife Refuge

Use: Horseshoe Crab Harvesting

NARRATIVE:

The U.S. Fish and Wildlife Service (Service) policy on Appropriate Refuge Uses (603 FW 1) states, "General public uses that are not wildlife-dependent recreational uses, as defined by the National Wildlife Refuge System Improvement Act and do not contribute to the fulfillment of refuge purposes or goals or objectives as described in current refuge management plans are the lowest priorities for refuge managers to consider. These uses are likely to divert refuge management resources from priority general public uses or away from our responsibilities to protect and manage fish, wildlife, and plants, and their habitats. Therefore, both law and policy have a general presumption against allowing such uses within the National Wildlife Refuge System (Refuge System)."

The Atlantic States Marine Fisheries Commission has implemented a fishery management plan to regulate the harvest of horseshoe crabs with the goal of ensuring sustainable population levels. The science, quotas, and harvest regulations of horseshoe crab management are not the primary issues that the Service must address. Policy and law requires that "uses" taking place on national wildlife refuge lands and waters must be determined to be both "appropriate" and "compatible" with the primary purposes for which the refuge was established and the Refuge System.

Horseshoe crab harvesting is not identified as a priority public use of the Refuge System under the National Wildlife Refuge System Administration Act of 1966 (16 U.S.C. 668dd-668ee), as amended by the National Wildlife Refuge System Improvement Act of 1997 (Public Law 105-57).

The horseshoe crabs' reproductive strategy makes them vulnerable to overharvest. Horseshoe crabs are slow to mature and are easily collected in large quantities during spawning periods. Horseshoe crabs collected from the subtidal areas of Monomoy National Wildlife Refuge (NWR) during spawning are likely adults, and because horseshoe crabs do not mature for nearly a decade, a heavily exploited population will recover slowly (Loveland et al. 1996 [AR, 5A, 411-418]).

Declines in horseshoe crab populations have been observed in Massachusetts. A recent study in Bourne, Massachusetts, found that the population had declined by more than 80 percent and spawning activity decreased by 95 percent from 1984 to 1999. In addition, the spawning period had shortened from 56 to 11 days. Researchers also found a substantial decrease in the number of spawning individuals at Stage Harbor, Chatham, Massachusetts, over a 5-year period, suggesting that the decline of horseshoe crab populations on Cape Cod may be widespread (Widener and Barlow 1999 [AR, 5A, 578-579]).

Studies have documented the importance of horseshoe crab eggs to the survival of many shorebird species in Delaware. Many of the shorebird species that use Monomoy NWR during migration have been documented feeding on horseshoe crab eggs in other areas, such as Delaware Bay. These species are present on Monomoy NWR during horseshoe crab spawning periods, or soon enough after spawning that horseshoe crab eggs would be an available food item (Veit and Petersen 1993; James-Pirri et al. 2005; Stephanie Koch, personal communication 2001; Koch and Paton 2009; Koch 2010). Further, the United States Shorebird Conservation Plan considers many of these shorebird species to be species of high concern (Brown et al. 2001).

In 2002, after extensive analysis and research demonstrating that refuge shorebirds eat horseshoe crab eggs, the harvesting of horseshoe crabs from the waters of Monomoy NWR was found to be not compatible.

Based on policy preventing the take or disturbance of wildlife on a refuge, continued documented declines in horseshoe crab populations, new information about the length of time that red knots are staging at Monomoy NWR during migration, and the importance of horseshoe crabs in general to priority migratory bird species, horseshoe crab harvesting is not appropriate on Monomoy NWR.

Monomoy NWR was established under the Migratory Bird Conservation Act "…for use as an inviolate sanctuary or for any other management purpose, for migratory birds" (16 U.S.C. § 715d). The harvesting of horseshoe crabs would directly contribute to a decline of spawning horseshoe crabs on the refuge. A decline in horseshoe crabs, and in particular horseshoe crab eggs, would adversely impact use of the refuge by shorebirds.

As part of the comprehensive conservation planning (CCP) process for the Monomoy NWR, this finding of appropriateness underwent a 180-day public comment period concurrent with the release of our draft CCP/ Environmental Impact Statement. No substantive new information that would lead us to reconsider our draft finding was provided at that time. It underwent a further 37-day public review period concurrent with the release of the final CCP/EIS. We received support from several commenters for the continued prohibition of horseshoe crab harvesting on the Monomoy NWR.

This use would not contribute to the achievement of the national wildlife refuge purposes or the Refuge System mission. A compatibility determination does not need to be prepared to find this an incompatible use, as it has already been found to be incompatible and, by virtue of this document, is now found to be inappropriate.

LITERATURE CITED:

Brown, S.C., C. Hickey, B. Harrington, and R. Gill, eds. 2001. The U.S. Shorebird Conservation Plan, second ed. Manomet Center for Conservation Sciences, Manomet, Massachusetts. 60 pp.

James-Pirri, M.J., K. Tuxbury, S. Fish Marino, S. Koch. 2005. Spawning densities, egg densities, size structure, and movement patterns of spawning horseshoe crabs, *Limulus Polyphemus*, within four coastal embayments on Cape Cod, Massachusetts. Estuaries 28: 296-313.

Koch, Stephanie. 2000-2002 and 2006-2007. Personal communication. Supervisory Wildlife Biologist, U.S. Fish and Wildlife Service. Sudbury, Massachusetts.

Koch, S. L. and P.W.C. Paton. 2009. Shorebird migration chronology at a stopover site in Massachusetts. Wader Study Group Bulletin 116 (3): 167-174.

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Loveland, R.E., M. L. Botton and C.N. Shuster, Jr. 1996. Life history of the American horseshoe crab (*Limulus polyphemus*) in Delaware Bay and its importance as a commercial resource. In Proceedings of the horseshoe crab forum, status of the resource. University of Delaware, Lewes, Delaware. [AR, 5A 411-418].

Veit, R.R. and W.R. Petersen. 1993. Birds of Massachusetts. Massachusetts Audubon Society. 514 pp.

Widener, J.W. and R.B. Barlow. 1999. Decline of a horseshoe crab population on Cape Cod. Biological Bulletin 197: 300-301 [AR, 5A, 578-579].

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FINDING OF APPROPRIATENESS OF A REFUGE USE

Refuge Name: Monomoy National Wildlife Refuge

Use: Jet Skiing (Personal Watercraft)

This form is not required for wildlife-dependent recreational uses, take regulated by the State, or uses already described in a refuge CCP or step-down management plan approved after October 9, 1997.

Decision Criteria:	**YES**	**NO**
(a) Do we have jurisdiction over the use?	✔	
(b) Does the use comply with applicable laws and regulations (Federal, State, Tribal, and local)?		✔
(c) Is the use consistent with applicable Executive orders and Department and Service policies?		✔
(d) Is the use consistent with public safety?		✔
(e) Is the use consistent with goals and objectives in an approved management plan or other document?		✔
(f) Has an earlier documented analysis not denied the use or is this the first time the use has been proposed?	✔	
(g) Is the use manageable within available budget and staff?		✔
(h) Will this be manageable in the future within existing resources?		✔
(i) Does the use contribute to the public's understanding and appreciation of the refuge's natural or cultural resources, or is the use beneficial to the refuge's natural or cultural resources?		✔
(j) Can the use be accommodated without impairing existing wildlife-dependent recreational uses or reducing the potential to provide quality (see section 1.6D, 603 FW 1, for description), compatible, wildlife-dependent recreation into the future?		✔

Where we do not have jurisdiction over the use ["no" to (a)], there is no need to evaluate it further as we cannot control the use. Uses that are illegal, inconsistent with existing policy, or unsafe ["no" to (b), (c), or (d)] may not be found appropriate. If the answer is "no" to any of the other questions above, we will **generally** not allow the use.

If indicated, the refuge manager has consulted with State fish and wildlife agencies. Yes ✔ No _____.

When the refuge manager finds the use appropriate based on sound professional judgment, the refuge manager must justify the use in writing on an attached sheet and obtain the refuge supervisor's concurrence.

Based on an overall assessment of these factors, my summary conclusion is that the proposed use is:

Not Appropriate ✔ **Appropriate** _____

Refuge Manager: Elizabeth A Harland Date: March 18, 2016

If found to be **Not Appropriate**, the refuge supervisor does not need to sign concurrence if the use is a new use.

If an existing use is found **Not Appropriate** outside the CCP process, the refuge supervisor must sign concurrence.

If found to be **Appropriate**, the refuge supervisor must sign concurrence:

Refuge Supervisor: Gladys W. Taylor Date: March 18, 2016

A compatibility determination is required before the use may be allowed.

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JUSTIFICATION FOR A FINDING OF APPROPRIATENESS OF A REFUGE USE

Refuge Name: Monomoy National Wildlife Refuge

Use: Jet Skiing (Personal Watercraft)

NARRATIVE:

The U.S. Fish and Wildlife Service policy on Appropriate Refuge Uses (603 FW 1) states, "General public uses that are not wildlife dependent recreational uses, as defined by the National Wildlife Refuge System Improvement Act and do not contribute to the fulfillment of refuge purposes or goals or objectives as described in current refuge management plans are the lowest priorities for refuge managers to consider. These uses are likely to divert refuge management resources from priority general public uses or away from our responsibilities to protect and manage fish, wildlife, and plants, and their habitats. Therefore, both law and policy have a general presumption against allowing such uses within the National Wildlife Refuge System."

Personal watercraft are small vessels that use an inboard motor to power a water jet pump as the primary source of power. These machines are operated by persons sitting, standing, or kneeling on the vessel. "Jet ski" is a commonly used trademark name for one type of personal watercraft. Personal watercraft are different from conventional boats in terms of design, operation, and use; their shallow draft design allows them to be operated at high speeds in shallow waters and close to shore. They are highly maneuverable and capable of speeds exceeding 75 miles per hour. Common operating practices such as weaving between vessels, jumping wakes, spinning doughnuts, and radically changing course. Some personal watercraft that have a two-stroke engine have a fuel efficiency rating of 1 to 5 miles per gallon of unleaded fuel.

This type of watercraft is increasing in numbers during the summer months. This corresponds with the time of year thousands of migratory birds, including the federally threatened piping plover and the federally endangered roseate tern, use the Monomoy Islands to nest, rest, and feed. It is critical that the refuge takes action to minimize disturbance to this important habitat, which includes minimizing disturbance within the intertidal zone. The intertidal zone, also known as the littoral zone, is the land on a coastline that is above the water at low tide and underwater at high tide. Animals and organisms that live in the intertidal zone are an important food source for migratory birds.

Since the shallow draft of a personal watercraft allows it to operate in as little as 1-foot of water, this allows operators to come close to nesting areas and enter shallow feeding areas within the intertidal zone. Studies have revealed that the noise caused by the engine, along with the movements and spray associated with the operation of personal watercraft, cause disturbance to feeding and resting wildlife. It had also been documented that, when operating in shallow waters, the jet engines can damage submerged aquatic vegetation, a food source for some ducks and geese and other wildlife.

Most (86 percent) of the land lying above mean low water is congressionally designated wilderness, including much of the intertidal lands on the refuge. Operating personal watercraft within wilderness is not allowed due to the restriction on mechanized transport within wilderness areas. Additionally, personal watercraft use would have an adverse effect on this pristine natural area because of the level of air, water, and noise pollution personal watercraft emit. Jet ski use and other personal watercraft use would have a negative impact on the wilderness character at Monomoy National Wildlife Refuge.

As part of the comprehensive conservation planning (CCP) process for the Monomoy National Wildlife Refuge (NWR), this finding of appropriateness underwent a 180-day public comment period concurrent with the release of our draft CCP/Environmental Impact Statement (EIS). No substantive new information that would have lead us to reconsider our draft finding was provided at that time. It underwent a further 37-day public review period concurrent with the release of the final CCP/EIS. No comments were received on the finding of appropriateness.

For impacts to refuge wildlife and to wilderness, the use of jet skis and other personal watercraft is not appropriate. This use does not contribute to quality wildlife-dependent recreational use nor does it support the purpose for which the refuge was established. For the reasons described above, we find that jet skis are not an appropriate use at Monomoy NWR.

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02/06

FINDING OF APPROPRIATENESS OF A REFUGE USE

Refuge Name: Monomoy National Wildlife Refuge

Use: Kiteboarding

This form is not required for wildlife-dependent recreational uses, take regulated by the State, or uses already described in a refuge CCP or step-down management plan approved after October 9, 1997.

Decision Criteria:	**YES**	**NO**
(a) Do we have jurisdiction over the use?	✔	
(b) Does the use comply with applicable laws and regulations (Federal, State, Tribal, and local)?	✔	
(c) Is the use consistent with applicable Executive orders and Department and Service policies?	✔	
(d) Is the use consistent with public safety?	✔	
(e) Is the use consistent with goals and objectives in an approved management plan or other document?		✔
(f) Has an earlier documented analysis not denied the use or is this the first time the use has been proposed?	✔	
(g) Is the use manageable within available budget and staff?		✔
(h) Will this be manageable in the future within existing resources?		✔
(i) Does the use contribute to the public's understanding and appreciation of the refuge's natural or cultural resources, or is the use beneficial to the refuge's natural or cultural resources?		✔
(j) Can the use be accommodated without impairing existing wildlife-dependent recreational uses or reducing the potential to provide quality (see section 1.6D, 603 FW 1, for description), compatible, wildlife-dependent recreation into the future?		✔

Where we do not have jurisdiction over the use ["no" to (a)], there is no need to evaluate it further as we cannot control the use. Uses that are illegal, inconsistent with existing policy, or unsafe ["no" to (b), (c), or (d)] may not be found appropriate. If the answer is "no" to any of the other questions above, we will **generally** not allow the use.

If indicated, the refuge manager has consulted with State fish and wildlife agencies. Yes ✔ No _____.

When the refuge manager finds the use appropriate based on sound professional judgment, the refuge manager must justify the use in writing on an attached sheet and obtain the refuge supervisor's concurrence.

Based on an overall assessment of these factors, my summary conclusion is that the proposed use is:

Not Appropriate ✔ **Appropriate** _____

Refuge Manager: Elizabeth A Herland Date: March 18, 2016

If found to be **Not Appropriate**, the refuge supervisor does not need to sign concurrence if the use is a new use.

If an existing use is found **Not Appropriate** outside the CCP process, the refuge supervisor must sign concurrence.

If found to be **Appropriate**, the refuge supervisor must sign concurrence:

Refuge Supervisor: Graham W Taylor Date: March 18, 2016

A compatibility determination is required before the use may be allowed.

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JUSTIFICATION FOR A FINDING OF APPROPRIATENESS OF A REFUGE USE

Refuge Name: Monomoy National Wildlife Refuge

Use: Kiteboarding

NARRATIVE:

The U.S. Fish and Wildlife Service policy on Appropriate Refuge Uses (603 FW 1) states, "General public uses that are not wildlife dependent recreational uses, as defined by the National Wildlife Refuge System Improvement Act and do not contribute to the fulfillment of refuge purposes or goals or objectives as described in current refuge management plans are the lowest priorities for refuge managers to consider. These uses are likely to divert refuge management resources from priority general public uses or away from our responsibilities to protect and manage fish, wildlife, and plants, and their habitats. Therefore, both law and policy have a general presumption against allowing such uses within the National Wildlife Refuge System."

Kiteboarding is a surface water activity that has been described as combining wakeboarding, windsurfing, surfing, paragliding, and gymnastics into one sport. The terms kiteboarding, kitesurfing, and kiting are interchangeable. Kiteboarding harnesses the power of the wind to propel a rider across the water on a small board. Kites ranging in size from 5 to 14-square meters (Desiree Moyer, personal communication 2014) are used to propel the rider and the board across the water. Some riders perform acrobatic stunts as they are being propelled, such as gaining altitude from the surface of the water and jumping objects such as waves and small land masses. Most kiteboarding takes place along ocean shores, usually off beaches.

Since kiteboarding relies heavily on favorable, consistent wind conditions, certain locations tend to become popular and sought out by kiteboarders. Several of these locations have been identified in the shallow waters off the west and east sides of Monomoy National Wildlife Refuge (NWR). These areas within and adjacent to the refuge boundary have favorable winds and adequate water. The refuge is also attractive to kiteboarders as they have access to nearby dry land to stage their gear and equipment and take a rest from the physically demanding activity. Websites provide information about kiteboarding locations in Chatham, including areas that are along and within the intertidal waters of the refuge (*http://www.mychatham.com/kitesurfing.html*, accessed January 2015). Kiteboarders often arrive at the refuge by launching from Hardings Beach in Chatham, Massachusetts or by motorboat, anchoring just off shore or directly on the beach often adjacent to areas closed for wildlife.

Refuge staff has observed increasing numbers of kiteboarders utilizing the refuge since 2006. This activity has a negative impact on the ability of refuge staff to provide areas undisturbed by human activity for the benefit of migratory birds due to the disturbance it causes. Kiteboarding occurs frequently during the summer months in areas adjacent to many of the closures on both the east and west sides of the refuge islands (Kate Iaquinto, personal communication 2013). Kiteboarding also occurs outside of the breeding season when disturbance to other species, including sea ducks, that use the refuge during migration and the non-breeding season is possible. The actions of the kiteboarders maneuvering on top of the water column adjacent to the beach/intertidal zone may negatively affect the behavior of birds engaged in foraging, nesting, or resting. Often there are groups of five or more kiteboarders using a small area at the same time (Kate Iaquinto, personal communication 2015).

We acknowledge that there are no peer reviewed scientific papers that have studied kiteboarding and its impact on birds. However, peer-reviewed scientific information is not required to prohibit a use on a national wildlife refuge. In fact, all refuges are closed to all uses until each use has been found appropriate (unless is it a priority public use) and compatible. We rely on our experience and actual observations, sound professional judgment, and information gathered from others in the conservation field to support findings of appropriateness and compatibility. That process was used to develop and confirm (after review of comments from the public), the following statements. The large sails on the kiteboard may be perceived by nesting birds such as piping plovers or American oystercatchers as large avian predators especially if the kite or its shadow passes over the nesting area. Nesting birds may leave their nests in an effort to lure the perceived predator away from the now exposed

eggs. An exposed nest cannot survive long in the summer heat and/or has the potential to be sanded in if left exposed in high winds. An exposed nest is also more likely to be lost to predators. The nest could be lost before the threat is gone and the adult returns to incubate. Efforts are made by refuge staff engaged in management activities to reduce disturbance times to piping plovers during conditions of high winds or high temperatures, either of which may be optimal conditions for kiteboarding.

In addition to nesting shorebirds, disturbance to the common and roseate tern colony has been witnessed by refuge staff and others. Kiteboarders have been documented using the areas in between the refuge islands near the common tern colony, and inadvertently causing the entire colony to flush, leaving chicks and eggs unprotected (Kate Iaquinto, personal communication 2015).

Research on the effects of human disturbance at Cape Cod National Seashore has found that plovers responded more strongly to kite flying than other forms of human disturbance (Hoopes 1993). While the actions of a recreational kite and a kite that is attached to a kiteboard are different, and the research was based on a small sample size, the thesis is cited widely as evidence to disallow kite flying on nesting beaches, including in the 1996 Piping Plover Recovery Plan. The State of Massachusetts Tern and Piping Plover Handbook of 1996 also states that kite flying is disruptive to nesting plovers. Kite flying is restricted on Cape Cod National Seashore and is not allowed on Monomoy NWR. Based on these observations, we concur that piping plovers and terns react to recreational kite and kites from kiteboarding in a similar manner.

All refuge islands and waters provide important breeding, migrating, and wintering habitat for a variety of shorebirds and seabirds, including the federally threatened piping plover and the federally endangered roseate tern, which are present on the refuge between March and September annually (USFWS unpublished reports). The refuge establishes seasonal closures for breeding birds in several locations to protect the habitat and minimize disturbance to these sensitive wildlife populations. Seasonal closures are established as the birds arrive in April and are usually taken down by September, however, these nesting species are present on the refuge for a longer period, and utilize many areas outside of the closures for foraging, staging, and raising young.

Though the disturbance to breeding birds has been most documented, disturbance to staging, foraging, and resting birds is a major concern as well. The refuge and surrounding lands are important during August and September when much of the roseate tern population of the northeast comes to the outer cape to stage prior to southward migration. Staging areas are not always located within closures as they tend to vary in location from day to day and tide to tide. The intertidal zone and open waters of the refuge are also an important foraging and resting area for migratory birds, particularly shorebirds including the federally threatened red knot and sea ducks including common eider and white-winged scoter. These birds often use areas outside of closures whether it is foraging or resting on the flats for shorebirds, or foraging or resting on the open water for sea ducks. Migratory shorebirds like the red knot are present in large numbers during fall migration which is much of the time period between July and November (Koch and Paton 2009). Sea ducks are present on the refuge during their non-breeding season. They begin to arrive in October and stay on the refuge until they migrate to the tundra to breed in early spring (Veit and Petersen 1993). There are protected bird species that use the waters and lands of the refuge during every month of the year in all locations within the boundary and therefore seasonal closures and buffer distances have been removed from consideration.

Disturbance to the federally threatened red knot has been well documented in northeast Florida. “Our observations inform us that red knot adversely respond to kite-boarders, principally due to the radical motion of the large kites. Typically, this is manifested by sharp rises and drops in the structures as they approach the knots. Perhaps this motion mimics the sudden appearance of natural predators (falcons) but regardless the association, the knots do not become conditioned to the kites despite repeated exposure. In close proximity to kites, their motion produces loud noises that exacerbate the disturbance affect. Because kite boarders travel parallel to exposed shoals, they frequently disturb foraging knots in a sequential and linear manner. The knots will flush and shift away from an approaching kite, but become subject to recurring disturbances as the kite boarder(s) approach, newly-occupied, habitat” (Leary and Leary, 2014; see figure D.1). Although this documentation is from Florida, red knots observed there in mid-May are migrating birds, rather than wintering birds (Patrick Leary, personal communication 2015; Amy Schwarzer, personal communication 2015). Therefore, we believe the response of the birds described above is also representative of the response of migrating red knots here in Massachusetts. Further, it is also reasonable to conclude that this reaction is not confined to just red knots. It is likely that kiteboarding also elicits a similar reaction from many other species of shorebirds that rely on Monomoy NWR for migrating stop-over habitat and are dependent on disturbance free areas where they can forage and rest.

Figure D.1. Photo taken May 15, 2007 by Patrick Leary at Fort George Inlet, Duval County, Florida.

In June of 2012, biologist Edie Ray, then employed by the Massachusetts Audubon Society, took a series of photographs that documented disturbance of kiteboarders to nesting least terns at Eel Point in Nantucket, Massachusetts. She documented a kiteboarder travelling back and forth along the north side of the tern colony at that location. Figure D.2 documents the kite passing over the nesting terns and then flushing the birds (Edie Ray, personal communication 2014).

Figure D.2. Flushing flocks of nesting least terns on Nantucket, documented by Edie Ray of Mass Audubon on June 27, 2012.

Kiteboarding and similar activities listed as, "hang gliding, parasailing, paragliding, ultra-lights, and car sailing" are prohibited within the Padre Island National Seashore (National Park Service (NPS) 2012) due to potential disturbance to birds. "Determination: Objects of this size, configuration, and movement are known to frighten and disturb birds causing disruption of normal foraging, reproduction and nesting behaviors. Several species, including threatened shore nesting species like the least tern and snowy plover, are vulnerable to this type of disturbance at Padre Islands National Seashore. Use of these devices is new and all their effects remain unknown. They may possess qualities adversely affecting park resources that may only be revealed in the future to the detriment of park resources if the use is allowed to continue and proliferate in the park." Closer to Monomoy NWR, the Cape Cod National Seashore began a seasonal ban in 2014 to prohibit kiteboarding to protect nesting and migrating/staging shorebirds (Mary Hake, personal communication 2015) between March 15 and October 15 within their boundary which extends into the waters of Cape Cod Bay, Nantucket Sound, and the Atlantic Ocean (NPS 2014).

There are also some concerns about the safety of kiteboarding, which has resulted in closures or other restrictions elsewhere in the country. Chatham prohibits kiteboards in marked channels and near swimming areas (Town of Chatham 2015). We have determined that some of these concerns are not as relevant to Monomoy NWR because we do not have beach use by large numbers of visitors. While we have knowledge of instances in which kiteboarders have been at risk themselves and have needed to be rescued, we have

determined that safety concerns are not enough of a factor at Monomoy NWR to impact the finding of appropriateness.

Rather, our best professional judgment indicates that kiteboarding has the potential to disturb birds in a variety of ways including while they are on the shore or on the water. Closures cannot be used to create buffers since they are temporary and do not provide protection to non-nesting birds. Closures are not used for non-nesting birds because the areas that they inhabit change regularly depending on the conditions and the behaviors of the birds in question. Regulating uses is the best way to prevent disturbance to birds when closures are not possible. This ban is consistent with the management on all national wildlife refuges.

As part of the comprehensive conservation planning (CCP) process for the Monomoy NWR, a draft of this finding of appropriateness underwent a 180-day public comment period concurrent with the release of our draft CCP/Environmental Impact Statement. It underwent a further 37-day public review period concurrent with the release of the final CCP/EIS. We received many comments from kiteboard enthusiasts, and made some changes in this final finding of appropriateness to reflect some of the comments, particularly concerning the safety of kiteboarding. However, we did not receive any new substantive information during the final review period that would lead us to reconsider our findings on the impact of this activity on migratory birds. We do not have the capacity to manage this use, and it is not beneficial to the refuge's natural, cultural or wilderness resources. Therefore, we find kiteboarding to be not appropriate at Monomoy NWR.

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FWS Form 3-2319
02/06

FINDING OF APPROPRIATENESS OF A REFUGE USE

Refuge Name: Monomoy National Wildlife Refuge

Use: Mussel Harvesting

This form is not required for wildlife-dependent recreational uses, take regulated by the State, or uses already described in a refuge CCP or step-down management plan approved after October 9, 1997.

Decision Criteria:	**YES**	**NO**
(a) Do we have jurisdiction over the use?	✔	
(b) Does the use comply with applicable laws and regulations (Federal, State, Tribal, and local)?	✔	
(c) Is the use consistent with applicable Executive orders and Department and Service policies?		✔
(d) Is the use consistent with public safety?	✔	
(e) Is the use consistent with goals and objectives in an approved management plan or other document?		✔
(f) Has an earlier documented analysis not denied the use or is this the first time the use has been proposed?		✔
(g) Is the use manageable within available budget and staff?		✔
(h) Will this be manageable in the future within existing resources?		✔
(i) Does the use contribute to the public's understanding and appreciation of the refuge's natural or cultural resources, or is the use beneficial to the refuge's natural or cultural resources?		✔
(j) Can the use be accommodated without impairing existing wildlife-dependent recreational uses or reducing the potential to provide quality (see section 1.6D, 603 FW 1, for description), compatible, wildlife-dependent recreation into the future?		✔

Where we do not have jurisdiction over the use ["no" to (a)], there is no need to evaluate it further as we cannot control the use. Uses that are illegal, inconsistent with existing policy, or unsafe ["no" to (b), (c), or (d)] may not be found appropriate. If the answer is "no" to any of the other questions above, we will **generally** not allow the use.

If indicated, the refuge manager has consulted with State fish and wildlife agencies. Yes ✔ No _____.

When the refuge manager finds the use appropriate based on sound professional judgment, the refuge manager must justify the use in writing on an attached sheet and obtain the refuge supervisor's concurrence.

Based on an overall assessment of these factors, my summary conclusion is that the proposed use is:

Not Appropriate ✔ **Appropriate** _____

Refuge Manager: Elizabeth A Herland Date: March 18, 2016

If found to be **Not Appropriate**, the refuge supervisor does not need to sign concurrence if the use is a new use.

If an existing use is found **Not Appropriate** outside the CCP process, the refuge supervisor must sign concurrence.

If found to be **Appropriate**, the refuge supervisor must sign concurrence:

Refuge Supervisor: Graham A Taylor Date: March 18, 2016

A compatibility determination is required before the use may be allowed.

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Exhibit 1
Page 2

JUSTIFICATION FOR A FINDING OF APPROPRIATENESS OF A REFUGE USE

Refuge Name: Monomoy National Wildlife Refuge

Use: Mussel Harvesting

NARRATIVE:

The U.S. Fish and Wildlife Service (Service) policy on Appropriate Refuge Uses (603 FW 1) states, "General public uses that are not wildlife-dependent recreational uses, as defined by the National Wildlife Refuge System Improvement Act and do not contribute to the fulfillment of refuge purposes or goals or objectives as described in current refuge management plans are the lowest priorities for refuge managers to consider. These uses are likely to divert refuge management resources from priority general public uses or away from our responsibilities to protect and manage fish, wildlife, and plants, and their habitats. Therefore, both law and policy have a general presumption against allowing such uses within the National Wildlife Refuge System."

The National Wildlife Refuge System Improvement Act of 1997 (P.L. 105-57) identifies six uses of wildlife refuges as priority public uses: environmental education, interpretation, hunting, fishing, wildlife observation, and wildlife photography. These recreational uses depend on healthy wildlife populations. Where these uses are determined to be compatible, they are to receive enhanced consideration above other uses in planning and management.

The Town of Chatham defines mussels in their shellfish regulations as blue mussels (*Mytilus edulis*) and brown or ribbed mussels (*Modiolus demissus* [now *Geukensia demissa*]). Blue mussel harvesting occurs in nearshore open waters, in accordance with State and local regulations, along North Monomoy Island and the western shore of South Monomoy Island, within the Monomoy National Wildlife Refuge's (NWR) Declaration of Taking boundary. Ribbed mussels use different habitat than blue mussels and are generally found in saltmarshes, often associated with salt marsh cordgrass (*Spartina alterniflora*; Bertness 1984).

Mussel harvesting of either species is not consistent with goals and objectives in any refuge management plan. Blue mussels are an important food source for many migratory birds. We would be providing additional protection for priority wildlife species by not allowing harvest of this species. For example, blue mussels are the most important food item during the winter for common eiders, a Service focal species, congregating in Nantucket Sound (Massachusetts Department of Fish and Game 2006). Blue mussel spat is one of the most important food items of southward migrating red knots, a threatened species under the Endangered Species Act, using Cape Cod from July through October (Harrington et al. 2010). Several species of mussels (including blue and ribbed mussels) are also a common food of American oystercatchers, which typically visually sight these prey in slightly submerged shellfish beds *(http://amoywg.org/american-oystercatcher/food-habits/;* accessed March 2013).

The most common harvest techniques for non-subterranean shellfish (such as dragging and mechanical and hydraulic dredging) are so efficient that blue mussel beds can be depleted very quickly. Dragging can have severe impacts on subtidal habitat structure by removing large areas of vegetation, such as eelgrass (Neckles 2005). The Town of Chatham manages their fisheries in a manner that minimizes and avoids damage to eelgrass beds.

Ribbed mussels are filter feeders that are rich in organic bacteria, and are therefore generally not eaten by people. They are generally harvested at high tide, because at low tide they close up and thus retain a lot of toxins. Ribbed mussels are important to saltmarsh health, as they process organic nutrients into inorganic matter which are then recycled back into the mud, contributing to salt marsh growth (*http://www.edc.uri.edu/restoration/html/gallery/invert/ribbed.htm*, accessed January 2016, *http://www.chesapeakebay.net/fieldguide/critter/atlantic_ribbed_mussel, accessed January 2016*). Although ribbed mussels may not be as important a food source to birds of conservation concern as blue mussels, ribbed mussels are very important to saltmarsh health. According to Bertness (1984), "In the natural habitat, mussel density is positively correlated with increased grass height, biomass, and flowering, and experimental removal and addition of mussels in these

habitats demonstrates that mussels stimulate both aboveground and belowground *S. alterniflora* production." He also notes that "The relationship between *S. alterniflora* and *G. demissa* appears to represent a facultative mutualism that leads to increased marsh net primary production and stability." We are concerned that harvesting ribbed mussels would be disruptive to saltmarsh health at Monomoy Refuge. Additionally, because ribbed mussels attach to saltmarsh grass by byssal threads (Bertness 1984) and are often partially buried in the substrate among the roots of saltmarsh grass (Gosner 1978), harvest of this species could be physically disruptive to the saltmarsh habitat.

The Service has statutory authority under the National Wildlife Refuge System Administration Act of 1966 to regulate activities that occur on water bodies within refuge units. In addition, the nearshore open waters and subtidal bottoms within the Declaration of Taking boundary are owned by the United States.

Commercial mussel harvesting as practiced around Monomoy NWR is considered an economic use of a national wildlife refuge and is guided by the following policies:

16 U.S.C. 668dd, 50 CFR 27.97, "Private Operations. Soliciting business or conducting a commercial enterprise on any national wildlife refuge is prohibited except as may be authorized by special permit."

16 U.S.C. 668dd, 50 CFR, Subpart A, 29.1, Allowing Economic Uses on National Wildlife Refuges

"We may only authorize public or private economic use of the natural resources of any national wildlife refuge, in accordance with 16 U.S.C. 715s, where we determine that the use contributes to the achievement of the national wildlife refuge purposes or the National Wildlife Refuge System mission…"

As part of the comprehensive conservation planning (CCP) process for the Monomoy NWR, a draft of this finding of appropriateness underwent a 180-day public comment period concurrent with the release of our draft CCP/Environmental Impact Statement (EIS). It underwent a further 37-day public review period concurrent with the release of the final CCP/EIS. We received several comments supporting mussel harvest on the refuge, as well as a comment noting that there is a critical distinction between ribbed and blue mussels. This finding of appropriateness was amended to include information about ribbed mussels. Appendix K in the CCP provides additional details on resource impacts and the distinction between the species. We do not believe significant new substantive information was provided during the final review period that would lead us to reconsider our finding on the impacts of this activity to migratory birds. Therefore, our position on the appropriateness of mussel harvesting did not change and mussel harvesting is determined to be not appropriate at Monomoy NWR.

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FWS Form 3-2319
02/06

FINDING OF APPROPRIATENESS OF A REFUGE USE

Refuge Name: Monomoy National Wildlife Refuge

Use: Recreational Over-sand Vehicle Use

This form is not required for wildlife-dependent recreational uses, take regulated by the State, or uses already described in a refuge CCP or step-down management plan approved after October 9, 1997.

Decision Criteria:	**YES**	**NO**
(a) Do we have jurisdiction over the use?	✔	
(b) Does the use comply with applicable laws and regulations (Federal, State, Tribal, and local)?		✔
(c) Is the use consistent with applicable Executive orders and Department and Service policies?		✔
(d) Is the use consistent with public safety?	✔	
(e) Is the use consistent with goals and objectives in an approved management plan or other document?		✔
(f) Has an earlier documented analysis not denied the use or is this the first time the use has been proposed?		✔
(g) Is the use manageable within available budget and staff?		✔
(h) Will this be manageable in the future within existing resources?		✔
(i) Does the use contribute to the public's understanding and appreciation of the refuge's natural or cultural resources, or is the use beneficial to the refuge's natural or cultural resources?		✔
(j) Can the use be accommodated without impairing existing wildlife-dependent recreational uses or reducing the potential to provide quality (see section 1.6D, 603 FW 1, for description), compatible, wildlife-dependent recreation into the future?		✔

Where we do not have jurisdiction over the use ["no" to (a)], there is no need to evaluate it further as we cannot control the use. Uses that are illegal, inconsistent with existing policy, or unsafe ["no" to (b), (c), or (d)] may not be found appropriate. If the answer is "no" to any of the other questions above, we will **generally** not allow the use.

If indicated, the refuge manager has consulted with State fish and wildlife agencies. Yes ✔ No _____.

When the refuge manager finds the use appropriate based on sound professional judgment, the refuge manager must justify the use in writing on an attached sheet and obtain the refuge supervisor's concurrence.

Based on an overall assessment of these factors, my summary conclusion is that the proposed use is:

Not Appropriate ✔ **Appropriate** _____

Refuge Manager: Elizabeth A Harlund Date: March 18, 2016

If found to be **Not Appropriate**, the refuge supervisor does not need to sign concurrence if the use is a new use.

If an existing use is found **Not Appropriate** outside the CCP process, the refuge supervisor must sign concurrence.

If found to be **Appropriate**, the refuge supervisor must sign concurrence:

Refuge Supervisor: Richard E Taylor Date: March 18, 2016

A compatibility determination is required before the use may be allowed.

603 FW 1
Exhibit 1
Page 2

JUSTIFICATION FOR A FINDING OF APPROPRIATENESS OF A REFUGE USE

Refuge Name: Monomoy National Wildlife Refuge

Use: Recreational Over-sand Vehicle Use

NARRATIVE:

The U.S. Fish and Wildlife Service (USFWS) policy on Appropriate Refuge Uses (603 FW 1) states, "General public uses that are not wildlife dependent recreational uses, as defined by the National Wildlife Refuge System Improvement Act and do not contribute to the fulfillment of refuge purposes or goals or objectives as described in current refuge management plans are the lowest priorities for refuge managers to consider. These uses are likely to divert refuge management resources from priority general public uses or away from our responsibilities to protect and manage fish, wildlife, and plants, and their habitats. Therefore, both law and policy have a general presumption against allowing such uses within the National Wildlife Refuge System."

The majority of Monomoy National Wildlife Refuge (NWR) uplands were included in the Monomoy Wilderness designated in 1970 (P.L. 91-504) as part of the National Wilderness Preservation System. The Wilderness Act of prohibits the use of motorized equipment and mechanized transport within designated wilderness. An exception for the use of aircraft and motorboats in areas where that use was previously established and deemed desirable by the Secretary to continue does apply to Monomoy NWR, but does not extend to motorized vehicles. The Wilderness Act does provide an exception for emergencies involving the health and safety of persons within the wilderness area.

At Monomoy, visitors wishing to use oversand vehicles (OSV) would travel both on the beach and through the inland portion of the refuge. This would be potentially damaging to four main groups of wildlife; nesting and roosting shorebirds and seabirds, northeastern beach tiger beetle adults and larvae, and marine mammals, all of which use the beach and intertidal areas as a critical part of their habitat. More specifically, the use of OSVs on Monomoy NWR is not consistent with the Piping Plover, Northeastern Beach Tiger Beetle, and Roseate Tern Recovery Plans.

The piping plover is a federally threatened species that relies on Monomoy's beaches for nesting. OSVs can significantly degrade piping plover habitat (Wheeler 1979) or disrupt the birds' normal behavior patterns (Zonick 2000). The 1996 Atlantic Coast Recovery Plan cites tire ruts crushing wrack into the sand, making it unavailable as cover or as foraging substrate (Hoopes 1993, Goldin 1993a). The plan also notes that the magnitude of the threat from off-road vehicles is particularly significant, because vehicles extend impacts to remote stretches of beach where human disturbance would otherwise be very slight (USFWS 2009, USFWS 1996). The common tern colony on the refuge is very sensitive to human disturbance as well, and intrusion into the colony by OSVs would result in temporary and/or permanent nest abandonment and direct mortality of unfledged chicks or unhatched eggs.

The northeastern beach tiger beetle recovery plan also sites impacts to beetles, particularly in the larval stage, from OSVs. The plan states that vehicles may physically compact the beach substrate and/or disrupt thermal and moisture microhabitat gradients that are important for larvae (Schultz 1988). In a survey on Assateague Island, Maryland (Knisley and Hill 1992), tiger beetle adults and larvae of *Cicindela dorsalis media* were absent from a section of beach that received heavy OSV use, but present on either side of the OSV zone (USFWS 1994). The extirpation of the northeastern beach tiger beetle from most of its range has been attributed primarily to destruction and disturbance of natural beach habitat from shoreline developments, beach stabilization structures, and high recreational use, all of which are thought to affect the larval stage (Knisley et al. 1987). In addition, extensive surveys completed prior to listing indicated that this tiger beetle was rarely found on beaches with heavy public use or OSV access. Studies have also shown that mortality of early instars increases in direct proportion to the level of human use, including foot traffic (USFWS 1994).

OSVs also pose a threat to staging roseate terns that use South Beach and South Monomoy Island in large numbers. The 2010 5-Year Review of the Caribbean Roseate Tern and North Atlantic Roseate Tern (*Sterna dougallii dougallii*) Recovery Plan (USFWS 2010) states, "Although they generally congregate at the ends of barrier beaches or at other sites that are relatively remote from human activity, they are regularly disturbed there by pedestrians, dogs and vehicles (Trull et al. 1999; MAS and J. Spendelow, unpubl. data). They do not allow such close approach at the staging sites as they do at the breeding sites, and consequently spend much time flying, especially at high tides when space is limited for both birds and humans."

Seals that are loafing on the beach are subjected to harassment and will abandon their resting sites upon the approach of an OSV. This would be a violation of the Marine Mammal Protection Act.

Allowing the use of OSVs on the refuge is not a priority public use, but a general use. This use does not, as a standalone activity, contribute to the fulfillment of refuge purposes, and would detract from the refuge staff's responsibilities to protect and manage fish, wildlife, and plants and their habitats, as well as detract from administering priority uses. The use of OSVs is not consistent with two executive orders, E.O. 11644 and E.O. 11989, which require that refuges promote safety, minimize conflicts among users, monitor effects of OSV use if allowed, and close areas to use of OSVs if they will cause adverse effects on soil, vegetation, wildlife, habitat or cultural or historic resources. Potential impacts include: soil compaction and erosion, trampling and mortality of fragile plant communities, habitat loss/deterioration, a shift in plant communities along trails, wildlife disturbance, and a concern for safety due to excessive speed of OSV users. This use is not consistent with any approved refuge management plan and would divert existing and future resources from accomplishing priority tasks. We do not believe it would contribute to public appreciation or understanding of refuge resources and we believe it could cause conflicts with priority public uses. It would be a violation of the Wilderness Act as well. The refuge does not have the facilities or staff to manage this use.

As part of the comprehensive conservation planning (CCP) process for the Monomoy NWR, this finding of appropriateness underwent a 180-day public comment period concurrent with the release of our draft CCP/ Environmental Impact Statement (EIS). No substantive new information that would lead us to reconsider our draft finding was provided at that time. It underwent a further 37-day public review period concurrent with the release of the final CCP/EIS. No comments were received on the finding of appropriateness. For the reasons described above, the general use of OSVs is determined to be not appropriate at Monomoy NWR.

LITERATURE CITED:

Goldin, M.R. 1993a. Piping plover *(Charadrius melodus)* management, reproductive ecology, and chick behavior at Goosewing and Briggs Beaches, Little Compton, Rhode Island, 1993. The Nature Conservancy, Providence, Rhode Island.

Hoopes, E.A. 1993. Relationships between human recreation and piping plover foraging ecology and chick survival. M.S. Thesis. University of Massachusetts. 106 pp.

Knisley, C.B., J.I. Luebke, and D.R. Beatty. 1987. Natural history and population decline of the coastal tiger beetle, *Cicindela dorsalis dorsalis* Say (Coleoptera: Cicindelidae). Virginia Journal of Science 38: 293-303

Knisley, C.B. and J.M. Hill. 1992. Effects of habitat change from ecological succession and human impact on tiger beetles. Virginia J. Sci. 43: 133-142.

Schultz, T.D. 1988. Destructive effects of off-road vehicles on tiger beetle habitat in central Arizona. Cicindela 20: 25-29

Trull, P., S. Hecker, M.J. Watson, and I.C.T. Nisbet. 1999. Staging of roseate terns *Sterna dougallii* in the post-breeding period around Cape Cod, Massachusetts, United States. Atlantic Seabirds 1: 145 to 158.

USFWS. 1994. Northeastern Beach Tiger Beetle (Cicindela dorsalis dorsalis). Recovery Plan. September 1994. Hadley, Massachusetts.

USFWS. 1996. Piping Plover *(Charadrius melodus).* Atlantic coast population revised recovery plan. May 1996. Hadley, Massachusetts.

USFWS. 2009. Piping Plover *(Charadrius melodus).* 5-Year Review: Summary and Evaluation. September 2009. Hadley, Massachusetts.

USFWS. 2010. Caribbean Roseate Tern and North Atlantic Roseate Tern *(Sterna dougallii dougallii)* 5-Year Review: Summary and Evaluation. September 2010. Concord, New Hampshire.

Wheeler, N.R. 1979. Effects of off-road vehicles on the infauna of Hatches Harbor, Cape Cod National Seashore, Massachusetts. University of Massachusetts/National Parks Service Cooperative Research Unit Report No. 28. 47 p.

Zonick, C.A. 2000. The winter ecology of the piping plover *(Charadrius melodus)* along the Texas Gulf Coast. Ph.D. Dissertation. University of Missouri, Columbia, Missouri.

FWS Form 3-2319
02/06

FINDING OF APPROPRIATENESS OF A REFUGE USE

Refuge Name: Monomoy National Wildlife Refuge

Use: Organized Picnicking (includes the use of grills)

This form is not required for wildlife-dependent recreational uses, take regulated by the State, or uses already described in a refuge CCP or step-down management plan approved after October 9, 1997.

Decision Criteria:	**YES**	**NO**
(a) Do we have jurisdiction over the use?	✔	
(b) Does the use comply with applicable laws and regulations (Federal, State, Tribal, and local)?	✔	
(c) Is the use consistent with applicable Executive orders and Department and Service policies?	✔	
(d) Is the use consistent with public safety?	✔	
(e) Is the use consistent with goals and objectives in an approved management plan or other document?		✔
(f) Has an earlier documented analysis not denied the use or is this the first time the use has been proposed?		✔
(g) Is the use manageable within available budget and staff?		✔
(h) Will this be manageable in the future within existing resources?		✔
(i) Does the use contribute to the public's understanding and appreciation of the refuge's natural or cultural resources, or is the use beneficial to the refuge's natural or cultural resources?		✔
(j) Can the use be accommodated without impairing existing wildlife-dependent recreational uses or reducing the potential to provide quality (see section 1.6D, 603 FW 1, for description), compatible, wildlife-dependent recreation into the future?		✔

Where we do not have jurisdiction over the use ["no" to (a)], there is no need to evaluate it further as we cannot control the use. Uses that are illegal, inconsistent with existing policy, or unsafe ["no" to (b), (c), or (d)] may not be found appropriate. If the answer is "no" to any of the other questions above, we will **generally** not allow the use.

If indicated, the refuge manager has consulted with State fish and wildlife agencies. Yes ✔ No _____.

When the refuge manager finds the use appropriate based on sound professional judgment, the refuge manager must justify the use in writing on an attached sheet and obtain the refuge supervisor's concurrence.

Based on an overall assessment of these factors, my summary conclusion is that the proposed use is:

Not Appropriate ✔ **Appropriate** _____

Refuge Manager: Elizabeth A Harland Date: March 18, 2016

If found to be **Not Appropriate**, the refuge supervisor does not need to sign concurrence if the use is a new use.

If an existing use is found **Not Appropriate** outside the CCP process, the refuge supervisor must sign concurrence.

If found to be **Appropriate**, the refuge supervisor must sign concurrence:

Refuge Supervisor: Gala a Taylor Date: March 18, 2016

A compatibility determination is required before the use may be allowed.

JUSTIFICATION FOR A FINDING OF APPROPRIATENESS OF A REFUGE USE

Refuge Name: Monomoy National Wildlife Refuge

Use: Organized Picnicking (includes the use of grills)

NARRATIVE

The U.S. Fish and Wildlife Service policy on Appropriate Refuge Uses (603 FW 1) states, "General public uses that are not wildlife-dependent recreational uses, as defined by the National Wildlife Refuge System Improvement Act and do not contribute to the fulfillment of refuge purposes or goals or objectives as described in current refuge management plans are the lowest priorities for refuge managers to consider. These uses are likely to divert refuge management resources from priority general public uses or away from our responsibilities to protect and manage fish, wildlife, and plants, and their habitats. Therefore, both law and policy have a general presumption against allowing such uses within the National Wildlife Refuge System."

Organized picnicking is the social gathering of people for meals and drink, usually in an area with picnic tables and grills, generally for the purpose of fun, relaxation, celebration, or companionship. It is not a priority public use in the National Wildlife Refuge System Improvement Act of 1997. The Monomoy National Wildlife Refuge (NWR) does not provide amenities for any large-scale or organized gatherings for this activity. While organized picnicking is traditionally thought about as occurring in a fixed location where amenities are provided by the landowner, such as a park, it can also include large gatherings in a more unstructured setting where portable grills and gear are brought by the participants to the picnicking site. While some aspect of this use is also considered in the beach use finding of appropriateness, this activity is being considered here because it pertains to all of the refuge, including the areas that are not specifically on the beach.

Not allowing organized picnicking does not mean that visitors cannot bring food and drink with them to the refuge. We understand that those participating in most permitted uses of the refuge will bring food and drink for consumption while on the refuge, and we take this into account in analyzing the impacts of those uses. The refuge is a leave-no-trace, carry-in-carry-out facility. All food containers, bottles, and other waste and refuse must be taken out. Littering, dumping, and abandoning property are prohibited by Federal regulation at 50 CFR 27.93 and 50 CFR 27.94.

Organized picnicking will detract from the enjoyment of refuge visitors who are participating in wildlife-dependent recreation and impact the wilderness experience for visitors in the Wilderness Area. Visitors looking to enjoy the wilderness character of Monomoy NWR would be subjected to the indirect consequences of large group gatherings including loud noise. Prohibiting organized picnicking will likely limit group size of gatherings on the refuge, which will thereby decrease disturbance to both wildlife and other visitors.

We are concerned that the introduction of food to the beach ecosystem would encourage scavengers, especially gulls, and likely impact the natural balance of the food chain, potentially causing harm to priority species the refuge seeks to protect. Gulls are considered predators within the common tern colony and other nesting areas on the refuge in most years (Kate Iaquinto, personal communication 2015). We actively managed gulls in some parts of the refuge following our predator management protocols (see appendix J). The attraction of gulls to large picnic areas to scavenge on food left at the site (or the intentional feeding of wildlife) is likely to perpetuate the very issues refuge staff is trying to combat. Gulls are opportunistic and once they detect a new food source, they will continue to loaf in that area, possibly in large concentrations, which has the potential to create a variety of health concerns and may lead to the annoyance of other refuge visitors (Holland, 2014). It has been documented through observation that gulls can adapt to the presence of recreationists and over time may even see humans as a lineage to a food source when they are picnicking (Laux, 2014).

In addition to organized picnicking, the use of grills is not allowed at the refuge. Grilling can result in the intentional or unintentional deposition of food waste on the refuge which could be eaten by refuge wildlife. This could result in an increased number of gulls or mammals who can also act as predators on bird eggs and unfledged chicks. We are also concerned about the refuse from grilling, such as grease and food remnants being left on the beach which can attract predators or the dumping of hot coals on refuge property. The use of grills is considered to be a typical part of organized picnicking and contributes to the concerns listed above. There are alternate recreation sites in the Chatham area such as Hardings Beach and Chase Park that offer these types of non-wildlife dependent uses where visitors and residents can partake in these popular activities.

We have deemed that organized picnicking and grilling could have potential adverse impacts on refuge wildlife and habitats and would require monitoring by refuge staff above refuge resource capacity. In addition, the use detracts from the mission of the Refuge System and potentially diminishes the purpose for which the refuge was established.

As part of the comprehensive conservation planning (CCP) process for the Monomoy NWR, a draft of this finding of appropriateness underwent a 180-day public comment period concurrent with the release of our draft CCP/Environmental Impact Statement (EIS). No substantive new information that would lead us to reconsider our draft finding was provided at that time. The finding underwent a further 37-day public review period concurrent with the release of the final CCP/EIS. No comments were received during the last review and the finding of appropriateness remains unchanged. For the reasons described above, organized picnicking is determined to be not appropriate at Monomoy NWR.

LITERATURE CITED:

Holland, Jennifer S. "Gulls Be Gone: 10 Ways to Get Rid of Pesky Birds." National Geographic News. National Geographic Society, June 10, 2014. February 4, 2015. *http://news.nationalgeographic.com/news/2014/06/140610-birds-seagulls-deterrent-pollution-disease-sheepdog-raptor-beach/* (accessed in February 2015).

Iaquinto, Kate. Personal communication. 2015.

Laux, Vern. "When Gulls Look at Humans, They See a Free Lunch (With Chips)." WCAI Weekly Bird Report. WCAI, July 16, 2014. February 4, 2015. *http://capeandislands.org/post/when-gulls-look-humans-they-see-free-lunch-chips* (accessed in February 2015).

FWS Form 3-2319
02/06

FINDING OF APPROPRIATENESS OF A REFUGE USE

Refuge Name: Monomoy National Wildlife Refuge

Use: Stage Island Parking and Dinghy Storage

This form is not required for wildlife-dependent recreational uses, take regulated by the State, or uses already described in a refuge CCP or step-down management plan approved after October 9, 1997.

Decision Criteria:	**YES**	**NO**
(a) Do we have jurisdiction over the use?	✔	
(b) Does the use comply with applicable laws and regulations (Federal, State, Tribal, and local)?	✔	
(c) Is the use consistent with applicable Executive orders and Department and Service policies?	✔	
(d) Is the use consistent with public safety?	✔	
(e) Is the use consistent with goals and objectives in an approved management plan or other document?		✔
(f) Has an earlier documented analysis not denied the use or is this the first time the use has been proposed?	✔	
(g) Is the use manageable within available budget and staff?		✔
(h) Will this be manageable in the future within existing resources?		✔
(i) Does the use contribute to the public's understanding and appreciation of the refuge's natural or cultural resources, or is the use beneficial to the refuge's natural or cultural resources?		✔
(j) Can the use be accommodated without impairing existing wildlife-dependent recreational uses or reducing the potential to provide quality (see section 1.6D, 603 FW 1, for description), compatible, wildlife-dependent recreation into the future?	✔	

Where we do not have jurisdiction over the use ["no" to (a)], there is no need to evaluate it further as we cannot control the use. Uses that are illegal, inconsistent with existing policy, or unsafe ["no" to (b), (c), or (d)] may not be found appropriate. If the answer is "no" to any of the other questions above, we will **generally** not allow the use.

If indicated, the refuge manager has consulted with State fish and wildlife agencies. Yes ✔ No _____.

When the refuge manager finds the use appropriate based on sound professional judgment, the refuge manager must justify the use in writing on an attached sheet and obtain the refuge supervisor's concurrence.

Based on an overall assessment of these factors, my summary conclusion is that the proposed use is:

Not Appropriate ✔ **Appropriate** _____

Refuge Manager: Elizabeth A Harland Date: March 18, 2016

If found to be **Not Appropriate**, the refuge supervisor does not need to sign concurrence if the use is a new use.

If an existing use is found **Not Appropriate** outside the CCP process, the refuge supervisor must sign concurrence.

If found to be **Appropriate**, the refuge supervisor must sign concurrence:

Refuge Supervisor: _____ Date: March 18, 2016

A compatibility determination is required before the use may be allowed.

603 FW 1
Exhibit 1
Page 2

JUSTIFICATION FOR A FINDING OF APPROPRIATENESS OF A REFUGE USE

Refuge Name: Monomoy National Wildlife Refuge

Use: Stage Island Parking and Dinghy Storage

NARRATIVE:

The U.S. Fish and Wildlife Service policy on Appropriate Refuge Uses (603 FW 1) states, "General public uses that are not wildlife-dependent recreational uses, as defined by the National Wildlife Refuge System Improvement Act and do not contribute to the fulfillment of refuge purposes or goals or objectives as described in current refuge management plans are the lowest priorities for refuge managers to consider. These uses are likely to divert refuge management resources from priority general public uses or away from our responsibilities to protect and manage fish, wildlife, and plants, and their habitats. Therefore, both law and policy have a general presumption against allowing such uses within the National Wildlife Refuge System."

Tract 7b is a small (100-foot by 75-foot lot with a 20-foot-wide right-of-way) waterfront parcel located on Stage Harbor in Chatham. Access to this small parcel for vehicle parking and dinghy storage on Stage Harbor has been granted to private individuals (by permit only) since at least 1984. Tract 7b access to Stage Harbor is controlled by a chain gate with combination padlock. The Stage Harbor lot is predominantly a non-vegetated, improved gravel parking lot (maximum capacity—8 vehicles) that grades gently down to a narrow strip of unimproved, natural sand beach and intertidal zone fronting 75 feet on Stage Harbor.

Dinghy storage, launching and landing, and associated vehicle parking at Stage Harbor Lot 7b are not priority public uses of the National Wildlife Refuge System, nor do they facilitate the priority public uses of wildlife observation, wildlife photography, environmental education, interpretation, or fishing.

Use of this parcel for vehicle parking and dinghy storage provides an economic benefit to a small, select group of private individuals. Several commercial shellfish harvesters have renewed their permits annually to access the Stage Harbor waterfront or their nearby boat moorings (locations assigned by the town of Chatham Harbormaster). The remaining permit holders are property owners in the Stage Island and Quitnesset neighborhoods who have boats moored near the Stage Harbor lot. The economic benefit to these permittees comes largely in the form of time and fuel savings when accessing their private boats and moorings. Economic uses of the refuge by private individuals must contribute to the purposes of the refuge. No benefits to the refuge wildlife or wilderness stewardship purposes are provided by allowing this use to continue. The $35 annual permit fee collected from 5 to 10 permits annually fell well short of refuge costs for administering and enforcing the permit system. Permits were not issued in 2014 and 2015.

Monomoy NWR currently receives no funding for managing wildlife-dependent recreational uses and has no positions dedicated to managing such uses. Providing for this use is not possible within the available budget or staffing now or into the future with existing refuge resources. This administrative burden on refuge resources impairs rather than benefits refuge natural and cultural resource management.

Refuge staff require unencumbered access to the waterfront and the entire Stage Harbor lot for daily operational refuge management purposes. Our use of this lot has increased with the siltation of the Morris Island Channel. Having privately owned parked vehicles and dinghies stored on this small parcel results in congestion and potential safety conflicts between refuge vehicles, boats, equipment, and personnel and private vehicles and waterfront storage space. This conflict is avoidable by eliminating all private use of this refuge parcel. Alternative public and private boat access, storage, and vehicle parking sites are available off refuge lands along the shoreline of Stage Harbor at Stage Harbor Marine near the Mitchell River Bridge, at the town of Chatham Harbormaster's offices, and for carry-in boat access from the Morris Island Road Causeway.

As part of the comprehensive conservation planning (CCP) process for the Monomoy NWR, a draft of this finding of appropriateness underwent a 180-day public comment period concurrent with the release of our draft CCP/Environmental Impact Statement (EIS). No substantive new information that would lead us to reconsider our draft finding was provided at that time. The finding underwent a further 37-day public review period concurrent with the release of the final CCP/EIS. No comments were received during the last review and the finding of appropriateness remains unchanged. For the reasons described above, Stage Island parking and dinghy storage is determined to be not appropriate at Monomoy NWR.

FWS Form 3-2319
02/06

FINDING OF APPROPRIATENESS OF A REFUGE USE

Refuge Name: Monomoy National Wildlife Refuge

Use: Beachcombing

This form is not required for wildlife-dependent recreational uses, take regulated by the State, or uses already described in a refuge CCP or step-down management plan approved after October 9, 1997.

Decision Criteria:	**YES**	**NO**
(a) Do we have jurisdiction over the use?	✔	
(b) Does the use comply with applicable laws and regulations (Federal, State, Tribal, and local)?	✔	
(c) Is the use consistent with applicable Executive orders and Department and Service policies?	✔	
(d) Is the use consistent with public safety?	✔	
(e) Is the use consistent with goals and objectives in an approved management plan or other document?	✔	
(f) Has an earlier documented analysis not denied the use or is this the first time the use has been proposed?	✔	
(g) Is the use manageable within available budget and staff?	✔	
(h) Will this be manageable in the future within existing resources?	✔	
(i) Does the use contribute to the public's understanding and appreciation of the refuge's natural or cultural resources, or is the use beneficial to the refuge's natural or cultural resources?	✔	
(j) Can the use be accommodated without impairing existing wildlife-dependent recreational uses or reducing the potential to provide quality (see section 1.6D, 603 FW 1, for description), compatible, wildlife-dependent recreation into the future?	✔	

Where we do not have jurisdiction over the use ["no" to (a)], there is no need to evaluate it further as we cannot control the use. Uses that are illegal, inconsistent with existing policy, or unsafe ["no" to (b), (c), or (d)] may not be found appropriate. If the answer is "no" to any of the other questions above, we will **generally** not allow the use.

If indicated, the refuge manager has consulted with State fish and wildlife agencies. Yes ✔ No _____.

When the refuge manager finds the use appropriate based on sound professional judgment, the refuge manager must justify the use in writing on an attached sheet and obtain the refuge supervisor's concurrence.

Based on an overall assessment of these factors, my summary conclusion is that the proposed use is:

Not Appropriate _____ **Appropriate** ✔

Refuge Manager: Elizabeth A Harland Date: March 18, 2016

If found to be **Not Appropriate**, the refuge supervisor does not need to sign concurrence if the use is a new use.

If an existing use is found **Not Appropriate** outside the CCP process, the refuge supervisor must sign concurrence.

If found to be **Appropriate**, the refuge supervisor must sign concurrence:

Refuge Supervisor: Graham Taylor Date: March 18, 2016

A compatibility determination is required before the use may be allowed.

603 FW 1
Exhibit 1
Page 2

JUSTIFICATION FOR A FINDING OF APPROPRIATENESS OF A REFUGE USE

Refuge Name: Monomoy National Wildlife Refuge

Use: Beachcombing

NARRATIVE:

The U.S. Fish and Wildlife Service (Service) policy on Appropriate Refuge Uses (603 FW 1) states, "General public uses that are not wildlife-dependent recreational uses, as defined by the National Wildlife Refuge System Improvement Act of 1997 (Refuge Improvement Act) and do not contribute to the fulfillment of refuge purposes or goals or objectives as described in current refuge management plans are the lowest priorities for refuge managers to consider. These uses are likely to divert refuge management resources from priority general public uses or away from our responsibilities to protect and manage fish, wildlife, and plants, and their habitats. Therefore, both law and policy have a general presumption against allowing such uses within the National Wildlife Refuge System (Refuge System)."

Beachcombing is not specifically identified as a priority public use in the Refuge Improvement Act but beachcombing often leads to wildlife observation and interpretation, which are priority public uses.

Beachcombing must be conducted in accordance with refuge regulations, including seasonal closures. Beachcombing would be limited to the collection of up to 1 quart/person/day of seashells, stones, and other beach debris for personal use and enjoyment. The collection of living plants or animals, or shells that have living organisms in them, would not be allowed. While this activity can have negative impacts on wildlife and habitat, as invertebrates that are a food source for shorebirds are at times attached to shells and other pieces of marine debris, it will not be conducted in areas being used by resting, nesting, or feeding wildlife. Visitor use will be restricted in time and place to minimize disturbance to wildlife, if the number of people engaged in this activity exceeds our relatively low expectation.

Allowing visitors to beachcomb will contribute to public appreciation of Monomoy National Wildlife Refuge (NWR). Costs associated with administering these uses and likely visitor impacts are both minimal. These uses will not materially interfere with or detract from the mission of the Refuge System or the purpose of Monomoy NWR. Therefore, it is the determination of the Service that beachcombing is an appropriate use of the refuge.

COMPATIBILITY DETERMINATION

USE:

Beachcombing

REFUGE NAME:

Monomoy National Wildlife Refuge

DATE ESTABLISHED:

June 1, 1944

ESTABLISHING AND ACQUISITION AUTHORITY(IES):

Migratory Bird Conservation Act (16 U.S.C. § 715d) Public Law 91-504, 16 USC § 1132(c)

REFUGE PURPOSE(S):

"…for use as an inviolate sanctuary, or for any other management purpose, for migratory birds." (16 U.S.C. § 715d).

"…wilderness areas…shall be administered for the use and enjoyment of the American people in such a manner as will leave them unimpaired for future use and enjoyment as wilderness, and so as to provide for the protection of these areas, the preservation of their wilderness character, and for the gathering and dissemination of information regarding their use and enjoyment as wilderness. (P.L. 88-577 §2(a), Wilderness Act; as referenced in P.L. 91-504 § 1(g), An Act to Designate Certain Lands as Wilderness).

NATIONAL WILDLIFE REFUGE SYSTEM MISSION:

To administer a national network of lands and waters for the conservation, management, and where appropriate, restoration of the fish, wildlife, and plant resources and their habitats within the United States for the benefit of present and future generations of Americans.

DESCRIPTION OF USE:

(a) What is the use?
This use involves walking along the beach and picking up shells, stones, and other beach debris for personal use and enjoyment. The collection of living plants or animals, or shells that have living organisms in them, would not be allowed. A limit of 1 quart/person/day is allowed.

(b) Is the use a priority public use?
Beachcombing is not specifically identified as a priority public use in the National Wildlife Refuge System Improvement Act of 1997, but beachcombing often leads to wildlife observation and interpretation, which are priority public uses.

(c) Where would the use be conducted?
Beachcombing could occur on any areas of Monomoy National Wildlife Refuge (NWR) that are open to public access. Public access is dictated by wildlife use and presence of sensitive vegetation. In general, much of the intertidal area through the dune system is open for much of the year. Some areas of beach berm are closed

seasonally to protect seals, nesting shorebirds, and seabirds. Visitors should contact Monomoy NWR staff for up-to-date information on seasonal closures. Information about closures will also be available on the refuge web site.

(d) When would the use be conducted?
Beachcombing could occur any time of the year in any areas open to public access during regular refuge hours. Use for these activities is likely to be highest in the summer and early fall. Monomoy NWR is open daily from 1/2-hour before sunrise to 1/2-hour after sunset, year-round. The Morris Island non-wilderness portion of the refuge is open for recreational saltwater fishing 24 hours daily.

(e) How would the use be conducted?
Beachcombing must be conducted in accordance with refuge regulations, including seasonal closures. Beachcombing would be limited to the collection of up to 1 quart of seashells, stones, or other beach debris per person/per day, mainly done during the low tide cycle. The collection of living plants or animals or shells that have living organisms in them would not be allowed.

(f) Why is this use being proposed?
Beachcombing has historically occurred on Monomoy NWR. Affording opportunities for public enjoyment by collecting small amounts of shells, stones, and other beach debris through beachcombing will increase visitor appreciation of Monomoy NWR and foster a greater awareness of the importance of this site to the Refuge System.

AVAILABILITY OF RESOURCES:

Beachcombing is often one of many incidental activities that refuge visitors engage in when on the refuge. As such, we do not anticipate refuge costs associated with this activity alone.

ANTICIPATED IMPACTS OF THE USE:

The proposed use is anticipated to have the same level of impacts as priority public uses, because the access and activities are very similar. These activities occur only in open areas of the refuge, therefore, natural resource and wilderness character impacts of beachcombing will likely be minimal if conducted in accordance with refuge regulations. Possible impacts include disturbing wildlife, trampling of plants, littering, and vandalism. Beachcombing may intermittently interrupt the feeding habits of a variety of shorebirds, gulls, and terns. The removal of shells, wrack, and other natural debris from the beach may indirectly affect wildlife by reducing food availability and microhabitat used by invertebrates, which are preyed upon by shorebirds. Seals could be flushed into the water from their loafing spots on the beach, which could result in a slight increase in energy expenditure by the seals.

Pedestrian travel has the potential of impacting seals, shorebird, waterfowl, and other migratory bird populations feeding and resting on beaches during certain times of the year. Conflicts arise when migratory birds and humans are present in the same areas (Boyle and Samson 1985). Response of wildlife to human activities includes departure from site (Owen 1973, Burger 1981, Kaiser and Fritzell 1984, Korschgen et al. 1985, Henson and Grant 1991, Kahl 1991, Klein 1993), use of sub-optimal habitat (Erwin 1980, Williams and Forbes 1980), altered behavior (Burger 1981, Korschgen et al. 1985, Morton et al. 1989, Ward and Stehn 1989, Havera et al. 1992, Klein 1993), and increase in energy expenditure (Morton et al. 1989, Bélanger and Bédard 1990).

Numerous studies have documented that migratory birds are disturbed by human activity on beaches. Erwin (1989) documented disturbance of common terns and skimmers and recommended that human activity be restricted to a distance of 100 meters around nesting sites. In studying waterbird response to human disturbance, Klein (1993) found that, as intensity of disturbance increased, avoidance response by the birds increased, and found out-of-vehicle activity to be more disruptive than vehicular traffic. Pfister et al. (1992) found the impact of disturbance was greater on species using the heavily disturbed front side of the beach, with the abundance of the impacted species being reduced by as much as 50 percent. In studying the effects of recreational use of shorelines on nesting birds, Robertson et al. (1980) discovered that disturbance negatively

impacted species composition. Piping plovers, which intensively use the refuge, are also impacted negatively by human activity. Pedestrians on beaches may crush eggs (Jenkins and Burger 1987, Hill 1988, Shaffer and Laporte 1992, Cape Cod National Seashore 1993, Collazo et al. 1994). Dogs may chase plovers (McConnaughey et al. 1990), destroy nests (Hoopes 1993), and kill chicks (Cairns and McLaren 1980). Other studies have shown that if pedestrians cause incubating plovers to leave their nest, the eggs can overheat (Bergstrom 1991) or can cool to the point of embryo death (Welty 1982). Pedestrians have been found to displace unfledged chicks (Strauss 1990, Burger 1991, Hoopes 1993, Loegering 1992, Goldin 1993).

Several studies have examined the effects on birds of recreation using shallow water habitats adjacent to trails and roads through wildlife refuges and coastal habitats in the eastern United States (Burger 1981, 1986, Klein 1993, Burger et al. 1995, Klein et al. 1995, Rodgers and Smith 1995, 1997, Burger and Gochfeld 1998). Overall, the existing research clearly demonstrates that disturbance from recreational activities always has at least temporary effects on the behavior and movement of birds within a habitat or localized area (Burger 1981, 1986, Klein 1993, Burger et al. 1995, Klein et al. 1995, Rodgers and Smith 1997, Burger and Gochfeld 1998). The findings that were reported in these studies are summarized as follows in terms of visitor activity and avian response to disturbance.

Presence: Birds avoided places where people were present and when visitor activity was high (Burger 1981, Klein et al. 1995, Burger and Gochfeld 1998).

Distance: Disturbance increased with decreased distance between visitors and birds (Burger 1986), though exact measurements were not reported.

Approach Angle: Visitors directly approaching birds on foot caused more disturbance than visitors driving by in vehicles, stopping vehicles near birds, and stopping vehicles and getting out without approaching birds (Klein 1993). Direct approaches may also cause greater disturbance than tangential approaches to birds (Burger and Gochfeld 1981, Burger et al. 1995, Knight and Cole 1995, Rodgers and Smith 1995, 1997).

Type and Speed of Activity: Joggers and landscapers caused birds to flush more than fishermen, clammers, sunbathers, and some pedestrians, possibly because the former groups move quickly (joggers) or create more noise (landscapers). The latter groups tend to move more slowly or stay in one place for longer periods, and thus birds likely perceive these activities as less threatening (Burger 1981, 1986, Burger et al. 1995, Knight and Cole 1995). Alternatively, birds may tolerate passing by with unabated speed, but may flush if the activity stops or slows (Burger et al. 1995).

Noise: Noise caused by visitors resulted in increased levels of disturbance (Burger 1986, Klein 1993, Burger and Gochfeld 1998), though noise was not correlated with visitor group size (Burger and Gochfeld 1998).

Beachcombing will be restricted to minimize disturbance through beach closures or allowing the use during certain hours of the day. Although some disturbance to migratory birds will occur, it should be minimal due to the location of the activity. Much of the beach area would not be impacted and closures are in place to protect nesting, resting, and foraging piping plovers, other shorebirds, staging terns, and other waterbirds. In the event of persistent disturbance to habitat or wildlife, these activities will be further restricted or discontinued.

Pedestrians are required to observe a 150-foot buffer around all seals. At Monomoy NWR, seal haulout locations regularly change; given the amount of shoreline accessible to seals, it is not practical to erect symbolic fencing to separate visitors from the seals. Compliance with the buffer, which was established to protect the seals under the Marine Mammal Protection Act, will decrease impacts to seals.

Heavy beach use can dry out the sand and contribute to beach erosion. Trash left on the beach, particularly food or wrappers, can attract predators that prey on nesting piping plovers and least terns or roosting shorebirds. Impacts of walking are likely to be minimal if conducted in accordance with refuge regulations. We will manage refuge closures to minimize pedestrian disturbance to priority avian species during critical times of the year. Closures can be expanded or contracted as needed depending on bird activity and results of further disturbance studies. The refuge is a leave-no-trace, carry-in-carry-out facility. All food containers, bottles, and other waste and refuse must be taken out. Littering, dumping, and abandoning property are prohibited by Federal regulation at 50 CFR 27.93 and 50 CFR 27.94.

All of North Monomoy Island and most of South Monomoy Island are designated wilderness and are part of the National Wilderness Preservation System. Wilderness, in contrast with those areas where humans and their works dominate the landscape, is an area where the Earth and its community of life are untrammeled by humans, where humans are visitors who do not remain. Preserving wilderness character requires that we maintain both the visible and invisible aspects of wilderness. Aspects of wilderness character include maintaining the natural, scenic condition of the land; providing environments for native plants and animals, including those threatened or endangered; maintaining watersheds and airsheds in a healthy condition; maintaining natural night skies and soundscapes; retaining the primeval character of and influence on the land; serving as a benchmark for ecological studies; and providing opportunities for solitude, primitive and unconfined outdoor recreation, risk, adventure, education, personal growth experiences, a sense of connection with nature and values beyond one's self, a link to our American cultural heritage, and mental and spiritual restoration in the absence of urban pressures. We provide opportunities for appropriate and compatible use and enjoyment of wilderness areas in a manner that will preserve their wilderness character and "leave them unimpaired for future use and enjoyment as wilderness."

Beachcombing is consistent with the enjoyment and preservation of wilderness, as long as only small amounts of seashells and stones are collected. Beachcombing does not alter the natural, scenic condition of the land and will not occur at a scale big enough to diminish the environment for native plants and animals. Beachcombing is usually conducted in a solitary manner or in a very small group. It specifically provides opportunities for individuals to connect with nature and wildlife. Given the few number of visitors at the refuge who engage in beachcombing within the wilderness area, no negative impacts on wilderness character are anticipated.

PUBLIC REVIEW AND COMMENT:

As part of the comprehensive conservation planning (CCP) process for the Monomoy NWR, a draft of this compatibility determination underwent a 180-day public comment period concurrent with the release of our draft CCP/Environmental Impact Statement (EIS). No substantive new information that would lead us to reconsider our draft finding was provided at that time. The finding underwent a further 37-day public review period concurrent with the release of the final CCP/EIS. During that period, we received a comment on the quantity of shells, stones, and other beach debris that could be collected on a daily basis. We subsequently reduced the quantity of shells that could be collected from 1 gallon per person per day to 1 quart per person per day and revised this compatibility determination to reflect that change.

DETERMINATION (CHECK ONE BELOW):

_____Use is not compatible.

__X__Use is compatible with the following stipulations.

STIPULATIONS NECESSARY TO ENSURE COMPATIBILITY:

- Beachcombing will only be allowed on sections of the beach that are open for public use. There are certain times of the year when the refuge is critically important to migratory birds, including threatened and endangered species. The location of the most important nesting, staging and migratory stopover (foraging and resting) habitat varies depending on a number of natural factors (e.g., weather, landform, prey distribution and abundance, and predator presence) as well as human disturbance at other sites. Refuge staff will evaluate the disturbance pressure to migratory birds caused by the presence of individuals engaged in this use. To ensure that this use remains compatible, meaning it does not materially interfere with or detract from the migratory bird purpose of the refuge, it may be necessary to restrict access through the implementation of seasonal and/or area closures. The location and size of these closures are not fixed and will vary over time. Visitors will be expected to comply with closures. Updates on closures will be available at the Monomoy NWR Headquarters and on the refuge web site.

- Visitors will be limited to collecting up to 1 quart per person/per day for personal use and enjoyment (non-commercial uses).

- Occasional law enforcement patrol and regular staff or partner presence should minimize potential violations. Refuge regulations will be posted and enforced.
- Visitors will be provided information to ensure that they understand the value of shells, wildlife, stones, and plants on the refuge, particularly in the wrack line. Visitors will be informed as to why only small amounts of shells, stones, and other beach debris is allowed for collection. The collection of plants, living animals, and archaeological and historical artifacts will not be permitted.
- Periodic evaluations will be done to ensure that visitors are not causing unacceptable adverse impacts. Areas open to these uses will be evaluated on an annual basis depending on geomorphology and wildlife use.

JUSTIFICATION:

Allowing visitors to collect up to 1 quart per person/per day of shells, stones, and other beach debris while beachcombing will contribute to public appreciation of Monomoy NWR. Costs associated with administering these uses and likely visitor impacts are both minimal. These uses will not materially interfere with or detract from the mission of the Refuge System or the purpose of Monomoy NWR. Therefore, it is the determination of the Service that beachcombing is a compatible use of the refuge.

SIGNATURE:

Refuge Manager: Elizabeth A Herlevich (Signature) March 18, 2016 (Date)

CONCURRENCE:

Regional Chief: Sam B Hamilton (Signature) March 18, 2016 (Date)

MANDATORY 10 YEAR RE-EVALUATION DATE: March 18, 2026

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FWS Form 3-2319
02/06

FINDING OF APPROPRIATENESS OF A REFUGE USE

Refuge Name: Monomoy National Wildlife Refuge

Use: Commercial Tours, Ferry Service, Guided Trips, and Outfitting

This form is not required for wildlife-dependent recreational uses, take regulated by the State, or uses already described in a refuge CCP or step-down management plan approved after October 9, 1997.

Decision Criteria:	**YES**	**NO**
(a) Do we have jurisdiction over the use?	✔	
(b) Does the use comply with applicable laws and regulations (Federal, State, Tribal, and local)?	✔	
(c) Is the use consistent with applicable Executive orders and Department and Service policies?	✔	
(d) Is the use consistent with public safety?	✔	
(e) Is the use consistent with goals and objectives in an approved management plan or other document?	✔	
(f) Has an earlier documented analysis not denied the use or is this the first time the use has been proposed?	✔	
(g) Is the use manageable within available budget and staff?	✔	
(h) Will this be manageable in the future within existing resources?	✔	
(i) Does the use contribute to the public's understanding and appreciation of the refuge's natural or cultural resources, or is the use beneficial to the refuge's natural or cultural resources?	✔	
(j) Can the use be accommodated without impairing existing wildlife-dependent recreational uses or reducing the potential to provide quality (see section 1.6D, 603 FW 1, for description), compatible, wildlife-dependent recreation into the future?	✔	

Where we do not have jurisdiction over the use ["no" to (a)], there is no need to evaluate it further as we cannot control the use. Uses that are illegal, inconsistent with existing policy, or unsafe ["no" to (b), (c), or (d)] may not be found appropriate. If the answer is "no" to any of the other questions above, we will **generally** not allow the use.

If indicated, the refuge manager has consulted with State fish and wildlife agencies. Yes ✔ No _____.

When the refuge manager finds the use appropriate based on sound professional judgment, the refuge manager must justify the use in writing on an attached sheet and obtain the refuge supervisor's concurrence.

Based on an overall assessment of these factors, my summary conclusion is that the proposed use is:

Not Appropriate _____ **Appropriate** ✔

Refuge Manager: Elizabeth A Harland Date: March 18, 2016

If found to be **Not Appropriate**, the refuge supervisor does not need to sign concurrence if the use is a new use.

If an existing use is found **Not Appropriate** outside the CCP process, the refuge supervisor must sign concurrence.

If found to be **Appropriate**, the refuge supervisor must sign concurrence:

Refuge Supervisor: Graham W Taylor Date: March 18, 2016

A compatibility determination is required before the use may be allowed.

JUSTIFICATION FOR A FINDING OF APPROPRIATENESS OF A REFUGE USE

Refuge Name: Monomoy National Wildlife Refuge

Use: Commercial Tours, Ferry Service, Guided Trips, and Outfitting

NARRATIVE:

The U.S. Fish and Wildlife Service (Service) policy on Appropriate Refuge Uses (603 FW 1) states, "General public uses that are not wildlife-dependent recreational uses, as defined by the National Wildlife Refuge System Improvement Act and do not contribute to the fulfillment of refuge purposes or goals or objectives as described in current refuge management plans are the lowest priorities for refuge managers to consider. These uses are likely to divert refuge management resources from priority general public uses or away from our responsibilities to protect and manage fish, wildlife, and plants, and their habitats. Therefore, both law and policy have a general presumption against allowing such uses within the National Wildlife Refuge System."

Commercial guiding and outfitting, and natural and cultural history guide and tour activities generally support refuge purposes and have positive effects on the overall interpretive, environmental education, and wildlife observation programs of the refuge. Some of these commercial services will occur within the Monomoy Wilderness. Commercial services may be performed in wilderness areas, per the Wilderness Act (Public Law 88-577), when they are proper for realizing the recreational or other wilderness purposes of the wilderness area, which is the case with this use at Monomoy NWR. The minor resource impacts attributed to these activities are generally outweighed by the benefits gained by educating present and future generations about refuge resources. Guided natural history tours are a public use management tool intended to develop a resource protection ethic within society. This tool allows us to educate refuge visitors about endangered and threatened species management, wildlife management, ecological principles and communities, and wilderness values and ethics. A secondary benefit of this use is that it instills an ownership or stewardship mentality in visitors, which helps reduce vandalism, littering, and poaching; it also strengthens Service visibility in the local community. Cultural history activities allow visitors to learn about the artifacts left in an area and gain an appreciation for the lands involved and the refuge purpose.

Issuing special use permits and concession permits for commercial guiding and outfitting does not significantly impact biological resources for which the refuge was established and requires no additional facilities. The administrative requirement is minimal. This activity has a positive effect on the overall interpretive, environmental education, and wildlife observation programs of the refuge, reaching a much larger audience. This use would contribute to the mission of the refuge by increasing the audience that receives the message of the Service, producing a greater appreciation of wildlife resources in participants, and building relationships between the refuge and area businesses.

Shifting channels, bars, and shoals, and strong ocean currents make boat travel between the Monomoy Islands and the mainland a challenge for even the most experienced mariner. Commercial ferries provide a safe alternative for visitors to explore beyond the mainland portion of the refuge. Visits to the islands occur during daylight hours only, particularly midday when migratory bird activity is diminished, and ferry service is offered May through September only. Guided tours for recreational saltwater fishing enhance the experience of many anglers, particularly those who are not familiar with Monomoy National Wildlife Refuge (NWR) and the Monomoy Wilderness or do not have the means to get to prime fishing spots on their own. Ferry service provided by a concession or an off-site ferry provider facilitates several priority public uses and allows visitors to access certain locations on the refuge that are otherwise challenging to get to on foot.

We do not expect pedestrian access to materially interfere with or detract from the mission of the National Wildlife Refuge System or diminish the purpose for which the refuge was established. It will not pose significant adverse effects on refuge resources, interfere with public use of the refuge, or cause an undue administrative burden. For these reasons, commercial guides, tours, outfitting, and ferry use are appropriate uses on Monomoy NWR.

COMPATIBILITY DETERMINATION

USE:

Commercial Tours, Ferry Service, Guided Trips, and Outfitting

REFUGE NAME:

Monomoy National Wildlife Refuge

DATE ESTABLISHED:

June 1, 1944

ESTABLISHING AND ACQUISITION AUTHORITY(IES):

Migratory Bird Conservation Act (16 U.S.C. § 715d) Public Law 91-504, 16 USC § 1132(c)

REFUGE PURPOSE(S):

"…for use as an inviolate sanctuary, or for any other management purpose, for migratory birds…" 16 U.S.C. § 715d (Migratory Bird Conservation Act).

"…wilderness areas…shall be administered for the use and enjoyment of the American people in such a manner as will leave them unimpaired for future use and enjoyment as wilderness, and so as to provide for the protection of these areas, the preservation of their wilderness character, and for the gathering and dissemination of information regarding their use and enjoyment as wilderness. (PL 88-577 § 2(a), Wilderness Act; as referenced in P.L. 91-504 § 1(g), An Act to Designate Certain Lands as Wilderness).

NATIONAL WILDLIFE REFUGE SYSTEM MISSION:

To administer a national network of lands and waters for the conservation, management, and where appropriate, restoration of the fish, wildlife, and plant resources and their habitats within the United States for the benefit of present and future generations of Americans.

DESCRIPTION OF USE:

(a) What is the use?
This use is any fee-based service providing recreational, educational, or interpretive enjoyment of refuge lands and waters to the visiting public such as transportation, interpretation, educational materials, and programs. The services must aim to enhance the refuge visitor's knowledge and enjoyment of the key natural resources, including wilderness, and the mission of Monomoy National Wildlife Refuge (Monomoy NWR; refuge) and the U.S. Fish and Wildlife Service (Service)(USFWS), or other uses otherwise determined appropriate and compatible with the purposes for refuge establishment, including guided wildlife observation or photography, natural history or cultural history tours; transport of individual or groups (most commonly by boat) to or from refuge lands for recreational fishing, wildlife observation or photography, nature study or interpretation, and other wildlife-oriented activities, or hiking or walking to experience the naturalness or solitude of the Monomoy Wilderness; and guiding and outfitting other compatible outdoor activities on refuge lands such as, but not limited to, birding or recreational fishing and associated transportation (typically by boat) and

accommodations. Some of these typically commercial services will occur within the Monomoy Wilderness, and if so, they are determined to be necessary for realizing the recreational or other wilderness purposes of the Monomoy Wilderness. The use may be conducted by a Service conservation partner, concessionaire, or private company but will fall under the general heading of eco-tourism. In all cases, participants pay a fee to the individual guide, business, or a nonprofit organization for the unique skills, equipment, and expertise of the leader who enhances the experience of the participating individual or party on refuge lands.

(b) Is the use a priority public use?
Commercial tours and ferry services conducted by a concessionaire, guide, or outfitter are not priority public uses of the National Wildlife Refuge System under the National Wildlife Refuge System Administration Act of 1966 (16 U.S.C. § 668dd-668ee), as amended by the National Wildlife Refuge System Improvement Act of 1997 (Public Law 105-57). While not a priority use, this use does support several wildlife-dependent priority uses including waterfowl hunting, fishing, wildlife observation and photography, environmental education, and interpretation. The use constitutes a commercial enterprise within wilderness, however commercial services may be allowed in wilderness areas, per the Wilderness Act (Public Law 88-577), if they support recreational or other wilderness purposes.

(c) Where would the use be conducted?
The use would occur on any refuge lands or waters within the Declaration of Taking boundary that are open to public access, including the Monomoy Wilderness. Certain areas on Monomoy NWR are seasonally closed to public access, at the refuge manager's discretion, to protect sensitive habitats or species of concern, minimize conflicts with other refuge activities, or respond to human health and safety concerns. All commercial touring, ferry operations, guiding and outfitting activities will be restricted from access to sensitive areas prone to disturbance (e.g., sensitive vegetation areas) or degradation (e.g., soil compaction), and will be conducted in a manner that minimizes impacts to nesting birds or other breeding, feeding, or resting wildlife. Commercial ferry service, tours, guides, and outfitters transporting visitors to designated landing sites on North Monomoy Island and South Monomoy Island would originate from designated facilities either on the refuge (Morris Island), or from one or more off-refuge locations such as Outermost Harbor, Stage Harbor, Chatham Harbor, or Harwichport.

(d) When would the use be conducted?
The use will be largely seasonal and dictated by weather, and would occur during daylight hours when weather is appropriate generally from May through November. Monomoy NWR is open daily from 1/2-hour before sunrise to 1/2-hour after sunset, year-round. The Morris Island portion of the refuge is open for licensed recreational saltwater fishing 24 hours daily.

(e) How would the use be conducted?
Guided tours typically consist of an individual or group including a leader or guide walking on established trails or open refuge areas learning about plant and wildlife species, natural processes and wetlands, and cultural history such as the Monomoy Point Lighthouse and keeper's residence. For offshore tours, participants are ferried by boat to designated boat landing sites, and then hike to one or more intended destinations. Commercial guides may provide intensive, individual guidance to refuge visitors most often engaged in birding and recreational saltwater fishing, as the refuge is a prime birding, surf fishing, and fly fishing location. Guides may also be employed by individuals or groups to enhance priority public use experiences, including photography or bird watching. In all cases, participants pay a fee for the professional expertise, a unique skill or equipment, and transportation to refuge lands and waters. Tours are generally offered on a seasonal basis (seal and boat tours). Nonmotorized eco-tour outings to Monomoy via kayak, catamaran, or sailing offer future expansion potential to more fully realize recreational and other wilderness purposes, while preserving wilderness character.

All guides and tour operators would be required to obtain a permit (concession or special use), and comply with all refuge regulations and with State and Federal guidelines for terns, piping plovers, marine mammals, and coastal dune protection. Special use permits (SUP) are required for trips originating from offsite locations. Commercial fishing guides who operate only from boats and do not disembark passengers, make landfall or operate from shore are exempt from the requirement to obtain a permit prior to providing guide services to paying customers. A concession contract would be required for trips involving any exclusive use of refuge land and facilities for organizations, outfitters, and individual guides conducting tour activities on Monomoy NWR. All Monomoy NWR visitors are expected to stay apprised of and respect all closures and regulations. Information on annual, seasonal, and daily closures, known hazards, and other regulations will be disseminated from the Morris Island headquarters, and closures will be well-marked with informational signs or symbolic fencing.

(f) Why is this use being proposed?
Monomoy NWR is a world-renowned birding destination, a destination for seal and whale watching tours (and potentially great white shark tours), as well as the only coastal barrier complex unit in the National Wilderness Preservation System in New England, and remains a popular destination for recreational saltwater angling. A viable, local wildlife-fish tour and charter boat ecotourism industry emerged in the Chatham vicinity and established itself over the past two decades, with Monomoy as a focal point. The private sector stands willing and able to provide such services for a reasonable fee.

The refuge historically receives requests from one to five commercial operators and nonprofit organizations annually for permits to transport and guide individuals or groups of visitors on trips to Monomoy and surrounding waters within the Declaration of Taking boundary. Two permits have been issued annually, including to one company with access to parking, public restrooms, interpretive trails, and waterfront access on Morris Island (headquarters and visitor contact station). Visitation to the Morris Island site has grown as the popularity of both Monomoy NWR and the seal tour has increased over nearly two decades. Current refuge parking no longer accommodates the demand for spaces on most days during June through August, resulting in considerable traffic congestion at the Morris Island site and nearby private roadways, increased risk of vehicle-pedestrian accidents, and complaints from neighboring private property owners. There is no further opportunity to expand parking at the refuge Morris Island site. Overflow parking along the east public shoulder of Morris Island Road, while permitted by the town of Chatham, is not without hazards for motorists, pedestrians, bicyclists, and emergency responders.

Guided tours, outfitters, and ferry services are a way during daylight hours to get wildlife-dependent and fish-dependent recreation users to and from refuge destinations that are not otherwise accessible by foot. The Monomoy Wilderness offers areas with outstanding opportunities for unconfined, primitive, outdoor, day-use recreation and solitude, and the proposed use would aid wilderness users to realize those opportunities not otherwise possible. Tours and individual guided sessions will help visitors experience and engage and connect with the key resources of the refuge, including an enduring resource of wilderness. Allowing the use is expected to increase visitor understanding and appreciation of the refuge and its resources and compliance with refuge regulations. Limiting the use of refuge facilities at the headquarters site to a concessionaire will reduce congestion and provide more opportunity for other refuge visitors to find parking.

AVAILABILITY OF RESOURCES:

The following breakdown shows the estimated amount of funds needed annually to administer the refugewide tour and ferry fee permits.

GS-11 Visitor Services Manager - permit issuance (concession solicitation/award and SUP processing	120 hours	$5,400
Total new costs		**$5,400**
GS-09 Visitor Services Assistant – permit administration, oversight and compliance checks	40 hours	$1,500
GS-9 Biological Staff – use impact monitoring	40 hours	$1,500
Facility Maintenance		$2,000
Materials		$1,000
Total recurring annual cost		**$6,000***

* Permit/concession fees will partially/wholly offset agency costs to administer the use.

ANTICIPATED IMPACTS OF THE USE:

Commercial Tours, Guides, and Outfitting
The access and activities resulting from the proposed use are virtually identical to those under the primary public uses, especially environmental education and interpretation, and the same levels of impacts are expected. Because the use will occur in accordance with refuge regulations and only in refuge areas open to the public, the impacts of commercial tours, ferry services, guides, and outfitters on natural resource and wilderness character will likely be minimal when conducted in accordance with refuge regulations. Possible wildlife and

fisheries impacts include disrupting nesting migratory bird populations, disrupting terns, shorebirds, and other bird populations feeding and resting near the trails during certain times of the year, trampling vegetation and soil, disrupting threatened larval northeastern beach tiger beetle populations, disturbing seals, and harvesting fish.

On Monomoy NWR, area closures are created to protect priority nesting migratory tern and shorebird species. Although these closure areas are designed to minimize human impacts, the potential exists for impacts to unobserved nesting animals. Conflicts arise when migratory birds and humans are present in the same areas (Boyle and Samson 1985). Response of wildlife to human activities includes departure from site (Owen 1973, Burger 1981, Kaiser and Fritzell 1984, Korschgen et al. 1985, Henson and Grant 1991, Kahl 1991, Klein 1993), use of suboptimal habitat (Erwin 1980, Williams and Forbes 1980), altered behavior (Burger 1981, Korschgen et al. 1985, Morton et al. 1989, Ward and Stehn 1989, Havera et al. 1992, Klein 1993), and increase in energy expenditure (Morton et al. 1989, Bélanger and Bédard 1990). Numerous studies have documented that migratory birds are disturbed by human activity on beaches. Erwin (1989) documented disturbance of common terns and skimmers and recommended that human activity be restricted to a distance of 100 meters around nesting sites. Pfister et al. (1992) found that the impact of disturbance was greater on species using the heavily disturbed front side of the beach, with the abundance of the impacted species being reduced by as much as 50 percent. In studying the effects of recreational use of shorelines on nesting birds, Robertson et al. (1980) discovered that disturbance negatively impacted species composition. Piping plovers, which intensively use the refuge, are also impacted negatively by human activity. Pedestrians on beaches may crush eggs (Jenkins and Burger 1987, Hill 1988, Shaffer and Laporte 1992, Cape Cod National Seashore 1993, Collazo et al. 1994). Other studies have shown that if pedestrians cause incubating plovers to leave their nest, the eggs can overheat (Bergstrom 1991) or the eggs can cool to the point of embryo death (Welty 1982). Pedestrians have been found to displace unfledged chicks (Strauss 1990, Burger 1991, Hoopes 1993, Loegering 1992, Goldin 1993).

Several studies have examined the effects of recreation on birds using shallow water habitats adjacent to trails and roads through wildlife refuges and coastal habitats in the eastern United States (Burger 1981, 1986, Klein 1993, Burger et al. 1995, Klein et al. 1995, Rodgers and Smith 1995, 1997, Burger and Gochfeld 1998). Overall, the existing research clearly demonstrates that disturbance from recreational activities always has at least temporary effects on the behavior and movement of birds within a habitat or localized area (Burger 1981, 1986, Klein 1993, Burger et al. 1995, Klein et al. 1995, Rodgers and Smith 1997, Burger and Gochfeld 1998). The findings that were reported in these studies are summarized as follows in terms of visitor activity and avian response to disturbance.

Presence: Birds avoided places where people were present and when visitor activity was high (Burger 1981, Klein et al. 1995, Burger and Gochfeld 1998).

Distance: Disturbance increased with decreased distance between visitors and birds (Burger 1986), though exact measurements were not reported.

Approach Angle: Visitors directly approaching birds on foot caused more disturbance than visitors driving by in vehicles, stopping vehicles near birds, and stopping vehicles and getting out without approaching birds (Klein 1993). Direct approaches may also cause greater disturbance than tangential approaches to birds (Burger and Gochfeld 1981, Burger et al. 1995, Knight and Cole 1995, Rodgers and Smith 1995, 1997).

Type and Speed of Activity: Joggers and landscapers caused birds to flush more than fishermen, clammers, sunbathers, and some pedestrians, possibly because the former groups move quickly (joggers) or create more noise (landscapers). The latter groups tend to move more slowly or stay in one place for longer periods, and birds likely perceive these activities as less threatening (Burger 1981, 1986, Burger et al. 1995, Knight and Cole 1995). Alternatively, birds may tolerate passing by with unabated speed, but may flush if the activity stops or slows (Burger et al. 1995).

Noise: Noise caused by visitors resulted in increased levels of disturbance (Burger 1986, Klein 1993, Burger and Gochfeld 1998), though noise was not correlated with visitor group size (Burger and Gochfeld 1998).

Trash left on the beach, particularly food or wrappers, can attract predators that prey on nesting piping plovers and least terns or roosting shorebirds. Impacts of commercial tours, guides, and outfitters are likely to be minimal if conducted in accordance with refuge regulations. The refuge will manage refuge closures

that restrict pedestrian access to minimize disturbance to priority avian species during critical times of the year. Closures can be expanded or decreased as needed, depending on bird activity and results of further disturbance studies. The refuge is a leave-no-trace, carry-in-carry-out facility. We encourage all outfitters and guides to pack in and pack out all food containers, bottles, wrappers, trash, and other waste and refuse. Littering, dumping, and abandoning property are prohibited by Federal regulation at 50 CFR 27.93 and 50 CFR 27.94.

Foot travel for commercial tours, guides, and outfitting group trips occurs on old beach buggy trails, deer trails, and around designated closed areas for the purpose of studying plant or animal life. Trampling of some vegetation is likely.

Unmanaged hiking or walking has the potential to damage or kill plants and lead to new, unwanted, impromptu trails on the refuge that become shortcuts through more ecologically sensitive sites. Heavy use of designated, managed, or unmanaged pedestrian travel routes can ultimately lead to areas devoid of vegetation (McDonnell 1981, Vaske et al. 1992) and potentially destabilize dunes and interdunal wetlands, which are difficult to stabilize and restore to a naturally functioning condition (Kucinski and Einsenmenger 1943, Cole 2002, Goldsmith 2002, Grady 2002, O'Connell 2008).

Trampling has three initial effects: abrasion of vegetation, abrasion of surface soil organic layers, and soil compaction (Cole 2002). Plants can be crushed, sheared off, bruised, and even uprooted by trampling, leading to reduced vigor and reproduction, reduced or altered plant species composition and structure, and reduced biomass and cover (Cole 2002). Of these, abrasion of vegetation is the most common and noticeable effect observed in coastal dune communities, where little or no surface organic layer exists on the sandy soil substrate that naturally resists compaction (Fletcher 1993). All three impacts can commonly occur, however, within coastal marsh habitats where reduced wave energy allows significant accumulation of surface organic layers that are vulnerable to compaction (Fletcher 1993), which increases surface soil bulk density and reduces permeability. Increased ponding and muddy conditions tend to promote wider vegetative and soil impact zones along trails through wet areas (Cole 2002). McDonnell (1981) analyzed long-term human trampling, ranging from low to high intensity, on coastal dune vegetation at Parker River NWR in Massachusetts. All levels of trampling significantly lowered species diversity, and heavy trampling caused a drastic reduction in species diversity and total vegetation cover. Moderate trampling reduced species diversity but not cover. This was probably because moderate trampling favored some species, such as beach grass, over other, more sensitive species, such as beach-heather *(Hudsonia tomentosa)*. Trampling may result in changes in plant communities by preventing succession in interdune and backdune areas and favoring disturbance-tolerant foredune species like beach grass.

The harsh growing conditions and environment in the coastal barrier system can make for slow vegetative recovery even after pedestrian traffic is eliminated at trampled sites (Fletcher 1993). The gradient from no vegetation to normal cover levels is very narrow along refuge trails and other footpaths where trampling is more concentrated, and is wider at traditional boat landings where trampling is more dispersed. Hiking and walking are among the most primitive forms of recreation, and the trails themselves encourage users to confine their hiking or walking to narrow corridors radiating or looping outward from user focal areas such as beach access points or boat landings. Localized impacts concentrated near a small number of the most popular destinations do not pose any serious disruption to the barrier ecosystem composition, structure, and function, and are not evident at large spatial scales on Monomoy NWR.

Once established, the trails themselves are clear evidence of human presence that detracts from some users' perceptions of an otherwise untrammeled, undeveloped, or natural appearing landscape (Hendee and Dawson 2002) within the Monomoy Wilderness. Bare, exposed sand (dune areas) and potentially compacted (tidal marsh segments) trail treads and narrow zones of disturbed vegetation on either side of refuge foot trails and boat landings will be readily evident, but when trail standards are kept minimal, trails tend to be accepted or even expected by most, though not all, wilderness users (Stankey and Schreyer 1987, Cole 2002, Hendee and Dawson 2002). The majority of the Monomoy Wilderness will remain essentially unvisited and virtually undisturbed by hiking and walking. Pedestrian footpaths are not expected to substantially compromise the perception of naturalness of the Monomoy Wilderness landscape or the wilderness user's experience (Cole 2002, Hendee and Dawson 2002).

Wilderness visitors' experiences are most strongly affected by social conditions, such as other visitors and their actions, than by their perception of naturalness or ecological conditions (Hendee and Dawson 2002). Although hiking and walking are among the most primitive forms of recreation, the trails themselves tend toward

promoting a confining rather than an unconfined user experience (Hendee and Dawson 2002). With typically long sight distances across Monomoy's rolling nearly treeless coastal barrier landscape, too many individuals encountered or observed hiking or walking during visits by other Monomoy Wilderness users likely detracts from the sense of solitude experienced by wilderness users (Stankey and Schreyer 1987, Hendee and Dawson 2002). However, hiking and walking use is still currently very light in the more remote, interior portions of South Monomoy Island open to public use, where outstanding opportunities for solitude and unconfined, primitive, outdoor recreation can be experienced by other Monomoy Wilderness users.

Vegetation trampling and soil compaction impacts are a direct function of group size, which can be managed through permit or concession contract requirements. Participant safety and potential for excessive disturbance to disturbance-sensitive wildlife species also becomes more difficult for group leaders to control as the group size increases per guide or leader. The number and type of encounters by wilderness users with other users, which in part determines wilderness experience quality and solitude, also increases with increasing group size and as commercial tours, guides, and outfits gain popularity. The numbers of tours offered annually will be reviewed, evaluated, and restricted if necessary. At this time, the frequency of guided tours does not adversely impact the wilderness character of the Monomoy Wilderness.

Individuals hiking on South Monomoy Island could potentially impact the larval stage of the threatened northeastern beach tiger beetle. The recovery plan for this species describes that many of the species' habitats are threatened by human impacts such as habitat alteration and recreational activities (USFWS 1994). Larval burrows are especially susceptible to trampling, which results in excess energy expenditure and reduced hunting time for the inhabiting individual. We will continue to survey to determine the location and extent of larval beetle occurrence and habitat, and use closures and re-routing to avoid larval habitats, as warranted.

Pedestrian use also has the potential to disturb loafing seals. Gray and harbor seals haul out on the refuge year-round. We will enforce the 150-foot buffer around all seals as required by the National Oceanic Atmospheric Administration (NOAA) to ensure compliance with the Marine Mammals Protection Act.

Ferry Service

The approach of a ferry, typically a 20- to 25-foot boat with an outboard engine, to pick up and discharge passengers creates a temporary disturbance to migratory birds feeding or loafing on the beach nearby. Ferry boat landing sites are designated outside of areas used heavily by nesting, feeding, and roosting terns, shorebirds, and colonial waterbirds. Any energy expended by migratory birds to avoid disturbance associated with beaching a ferry and loading and unloading passengers is negligible.

The untrammeled environment and solitude of the Monomoy Wilderness, accessible only by boat or lengthy hike along the barrier beach, make it unique among the protected areas on Cape Cod. Motorized boats operated by tour, ferry, charter guides, or outfitters approach and depart the designated shoreline landing sites through the shallows very slowly, which has the added effect of reducing engine noise and boat wake. Monomoy has an unusually low absorption capacity for human impacts. Lack of topographic relief and low vegetation mean that intrusions, including seeing and hearing other people, are often observable from a long distance. Providing visitors with a convenient way to get out to the islands may result in a diminished degree of solitude for some wilderness users, but should not adversely affect the overall wilderness character of the Monomoy Wilderness. There should be a negligible impact to fisheries as a result of commercial guiding and the fish they are harvesting.

PUBLIC REVIEW AND COMMENT:

As part of the comprehensive conservation planning (CCP) process for the Monomoy NWR, a draft of this compatibility determination underwent a 180-day public comment period concurrent with the release of our draft CCP/Environmental Impact Statement (EIS). The compatibility determination was slightly modified and underwent a further 37-day public review period concurrent with the release of the final CCP/EIS. During this latter period, we received a comment on commercial fishing guides, and have subsequently clarified in this compatibility determination and the final CCP that the permitting requirement will not apply to commercial fishing guides who do not disembark passengers, make landfall or operate from shore.

DETERMINATION (CHECK ONE BELOW):

_____Use is not compatible.

__X__Use is compatible with the following stipulations.

STIPULATIONS NECESSARY TO ENSURE COMPATIBILITY:

- A fee greater than or equal to $250 will ordinarily be charged for SUPs, but may be fully or partially waived by the refuge manager. Concession contract fees will be the greater of a fixed franchise fee greater than or equal to $5,000 per year, or a percent of gross receipts greater than or equal to 5 percent and less than or equal to 20 percent.

- All hiking or walking will be done only in areas that are open to the public. There are certain times of the year when the refuge is critically important to migratory birds, including threatened and endangered species. The location of the most important nesting, staging and migratory stopover (foraging and resting) habitat varies depending on a number of natural factors (e.g., weather, landform, prey distribution and abundance, and predator presence) as well as human disturbance at other sites. Refuge staff will evaluate the disturbance pressure to migratory birds caused by the presence of individuals engaged in this use. To ensure that this use remains compatible, meaning it does not materially interfere with or detract from the migratory bird purpose of the refuge, it may be necessary to restrict access through the implementation of seasonal and/or area closures. The location and size of these closures are not fixed and will vary over time. Visitors will be expected to comply with closures. Updates on closures will be available at the Headquarters and on the refuge web site. Ferry operators will inform unguided ferry passengers of closed areas before they are left on their own to explore the island.

- Tour, ferry, and guide boat operators will use only designated boat landing sites.

- Ferries will not operate at night or in dense fog conditions (1/4-mile visibility or less) when a visitor could easily become disoriented and unknowingly violate a posted closed area. Regulations to ensure the safety of all participants will be included with permits or concession contracts; specific conditions that may apply to the requested activity will be addressed through the SUP or concession contract.

- All pedestrians must maintain a 150-foot buffer around all seals as required by the NOAA to ensure compliance with the Marine Mammals Protection Act. Boat operators will adhere to the Northeast Seal Watching Guidelines and other NOAA marine mammal viewing guidelines.

- Groups may be scheduled so as to avoid time or space conflicts with critical wildlife activities and each other. Currently, there is no restriction on the number of tour groups or visitors allowed on Monomoy at any one time. Refuge staff monitor public use and document any associated serious impacts.

- Refuge visitor information services and products will emphasize the importance of staying on trails and out of areas that are seasonally closed, along with providing "leave no trace" principles, practices and hiking tips. No physical items, including litter, will be placed or left on the refuge. No items will be removed from the refuge. Take only photos, leave only footprints.

- Refuge staff or volunteers will periodically qualitatively and photographically document pedestrian impacts to vegetation and soils to footpaths, boat landings, and other known user concentration points for use in drafting or updating a Monomoy Wilderness Stewardship Plan. If public use causes unacceptable environmental degradation or wildlife disturbance, we will implement appropriate limits on visitor numbers and tours.

- Tour routes will be monitored for impacts on wildlife or habitat and will be rerouted. Closed areas for wildlife sensitive to disturbance will be clearly posted, and tour group leaders will be provided with maps of the closures and refuge regulations.

JUSTIFICATION:

Natural and cultural history activities and the ferry service that supports these activities generally support refuge purposes. The minor resource impacts attributed to these activities are generally outweighed by the benefits gained by educating present and future generations about refuge resources. Guided natural history tours are a public use management tool intended to develop a resource protection ethic within society. This tool allows us to educate refuge visitors about endangered and threatened species management, wildlife management, ecological principles, and communities. A secondary benefit of this use is that it instills a sense of ownership or stewardship in visitors, which helps reduce vandalism, littering, and poaching; it also strengthens Service visibility in the local community. Cultural history activities allow visitors to learn about the artifacts left in an area and also gain an appreciation for the lands involved and the refuge purpose. In addition, by allowing educational tours to occur on the islands, the Service is able to fulfill its obligation to maintain the Monomoy Point Light Station.

Issuing SUPs and concession permits for commercial guiding and outfitting does not significantly impact biological resources for which the refuge was established and requires no additional facilities. The administrative requirement is minimal. This activity has a positive effect on the overall interpretive, environmental education, and wildlife observation programs of the refuge, reaching a much larger audience. It would also produce a greater appreciation of wildlife resources in participants, and building relationships between the refuge and area businesses.

We do not expect pedestrian access to materially interfere with or detract from the mission of the Refuge System, nor diminish the purpose for which the refuge was established. It will not pose significant adverse effects on refuge resources, interfere with public use of the refuge, or cause an undue administrative burden. These uses would contribute to achieving refuge purposes and the Refuge System mission because they facilitate wildlife observation and photography and provide compatible recreational opportunities for visitors to observe and learn about wildlife and habitats firsthand.

Shifting channels, bars, and shoals, and strong ocean currents make boat travel between the Monomoy Islands and the mainland a challenge for even the most experienced mariner. Commercial ferries provide a safe alternative for visitors to explore beyond the mainland portion of the refuge. Visits to the islands occur during daylight hours only, particularly midday when migratory bird activity is diminished, and ferry service is offered May through September only. This activity as conducted on Monomoy NWR does not adversely affect the purposes for which this refuge was established.

SIGNATURE:

Refuge Manager: Elizabeth A Harlan (Signature) March 18, 2016 (Date)

CONCURRENCE:

Regional Chief: Scott B. Kahan (Signature) March 18, 2016 (Date)

MANDATORY 10 YEAR RE-EVALUATION DATE: March 18, 2026

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FWS Form 3-2319
02/06

FINDING OF APPROPRIATENESS OF A REFUGE USE

Refuge Name: Monomoy National Wildlife Refuge

Use: Commercial Wildlife and Landscape Filming and Photography

This form is not required for wildlife-dependent recreational uses, take regulated by the State, or uses already described in a refuge CCP or step-down management plan approved after October 9, 1997.

Decision Criteria:	**YES**	**NO**
(a) Do we have jurisdiction over the use?	✔	
(b) Does the use comply with applicable laws and regulations (Federal, State, Tribal, and local)?	✔	
(c) Is the use consistent with applicable Executive orders and Department and Service policies?	✔	
(d) Is the use consistent with public safety?	✔	
(e) Is the use consistent with goals and objectives in an approved management plan or other document?	✔	
(f) Has an earlier documented analysis not denied the use or is this the first time the use has been proposed?	✔	
(g) Is the use manageable within available budget and staff?	✔	
(h) Will this be manageable in the future within existing resources?	✔	
(i) Does the use contribute to the public's understanding and appreciation of the refuge's natural or cultural resources, or is the use beneficial to the refuge's natural or cultural resources?	✔	
(j) Can the use be accommodated without impairing existing wildlife-dependent recreational uses or reducing the potential to provide quality (see section 1.6D, 603 FW 1, for description), compatible, wildlife-dependent recreation into the future?	✔	

Where we do not have jurisdiction over the use ["no" to (a)], there is no need to evaluate it further as we cannot control the use. Uses that are illegal, inconsistent with existing policy, or unsafe ["no" to (b), (c), or (d)] may not be found appropriate. If the answer is "no" to any of the other questions above, we will **generally** not allow the use.

If indicated, the refuge manager has consulted with State fish and wildlife agencies. Yes ✔ No _____.

When the refuge manager finds the use appropriate based on sound professional judgment, the refuge manager must justify the use in writing on an attached sheet and obtain the refuge supervisor's concurrence.

Based on an overall assessment of these factors, my summary conclusion is that the proposed use is:

Not Appropriate _____ **Appropriate** ✔

Refuge Manager: Elizabeth A Herkert Date: March 18, 2016

If found to be **Not Appropriate**, the refuge supervisor does not need to sign concurrence if the use is a new use.

If an existing use is found **Not Appropriate** outside the CCP process, the refuge supervisor must sign concurrence.

If found to be **Appropriate**, the refuge supervisor must sign concurrence:

Refuge Supervisor: Date: March 18, 2016

A compatibility determination is required before the use may be allowed.

603 FW 1
Exhibit 1
Page 2

JUSTIFICATION FOR A FINDING OF APPROPRIATENESS OF A REFUGE USE

Refuge Name: Monomoy National Wildlife Refuge

Use: Commercial Wildlife and Landscape Filming and Photography

NARRATIVE:

The U.S. Fish and Wildlife Service (Service) policy on Appropriate Refuge Uses (603 FW 1) states, "General public uses that are not wildlife-dependent recreational uses, as defined by the National Wildlife Refuge System Improvement Act and do not contribute to the fulfillment of refuge purposes or goals or objectives as described in current refuge management plans are the lowest priorities for refuge managers to consider. These uses are likely to divert refuge management resources from priority general public uses or away from our responsibilities to protect and manage fish, wildlife, and plants, and their habitats. Therefore, both law and policy have a general presumption against allowing such uses within the National Wildlife Refuge System."

Although commercial filming and photography is not a priority public use, it can support interpretation which is a priority public use identified by the National Wildlife Refuge System Improvement Act of 1997. Commercial photography could support the mission of the National Wildlife Refuge System (Refuge System) by promoting an understanding and appreciation of natural and cultural resources and their management within a national system of refuges. Commercial filming and photography will reach many segments of the public to expand support for the Refuge System, including those who may never actually be able to visit the refuge.

Service Wilderness policy generally prohibits commercial photography in wilderness areas unless we determine it is necessary to provide educational information about wilderness uses and values and does not degrade the wilderness character of the area. In cases where we allow commercial photography, we manage the use through an audiovisual productions permit. Due to the difficulty accessing the more remote sections of the refuge, commercial filming and photography could directly support interpretation and education as well as promote wilderness character.

We do not expect limited commercial photography access to materially interfere with or detract from the mission of the Refuge System, nor diminish the purpose for which the refuge was established. It will not pose significant adverse effects on refuge resources, interfere with public use of the refuge, or cause an undue administrative burden.

Commercial filming and photography will have little to no affect on wilderness character when conducted in accordance with wilderness requirements, such as no motorized equipment or mechanical transport and only when necessary to provide educational information about wilderness uses and values. This activity does not alter the natural, scenic condition of the land and will not occur at a scale large enough to diminish the environment for native plants and animals. The most probable wilderness impact will be to other visitors whose solitude could be impacted by commercial photographers.

When conducted under a special permit with stipulations, and in compliance with refuge and wilderness, commercial wildlife and landscape filming and photography, both still and motion, are appropriate uses on Monomoy National Wildlife Refuge.

COMPATIBILITY DETERMINATION

USE:

Commercial Wildlife and Landscape Filming and Photography

REFUGE NAME:

Monomoy National Wildlife Refuge

DATE ESTABLISHED:

June 1, 1944

ESTABLISHING AND ACQUISITION AUTHORITY(IES):

Migratory Bird Conservation Act (16 U.S.C. § 715d) Public Law 91-504, 16 USC § 1132(c)

REFUGE PURPOSE(S):

"…for use as an inviolate sanctuary, or for any other management purpose, for migratory birds." (16 U.S.C. § 715d).

"…wilderness areas…shall be administered for the use and enjoyment of the American people in such a manner as will leave them unimpaired for future use and enjoyment as wilderness, and so as to provide for the protection of these areas, the preservation of their wilderness character, and for the gathering and dissemination of information regarding their use and enjoyment as wilderness. (PL 88-577 § 2(a), Wilderness Act; as referenced in P.L. 91-504 § 1(g), An Act to Designate Certain Lands as Wilderness).

NATIONAL WILDLIFE REFUGE SYSTEM MISSION:

To administer a national network of lands and waters for the conservation, management, and where appropriate, restoration of the fish, wildlife, and plant resources and their habitats within the United States for the benefit of present and future generations of Americans.

DESCRIPTION OF USE:

(a) What is the use? Is the use a priority public use?
The use is commercial photography, filming (including videography), and audio recording (collectively called "recording" for the purposes of this compatibility determination). This use has occurred in the past and we anticipate additional requests in the future. The use typically involves filming natural landscapes or wildlife or recording natural sounds for commercial or educational purposes. The primary focus of the production should be wildlife-related and provide educational information about wilderness uses and values (610 FW 2.12, Wilderness Stewardship Policy). Commercial photography would be allowed by special use permit (SUP) only when there is a direct benefit to the refuge or the U.S. Fish and Wildlife Service (Service); and in wilderness, only when necessary to provide educational information about wilderness uses and values and in a manner which does not degrade wilderness. The final creation would be produced for sale as a commercial product.

This use is regulated by Refuge Manual (RM) Part 8, Chapter 16 and the Code of Federal Regulations (CFR), Title 43, Subtitle A, Section 5.1. This is not a priority public use (National Wildlife Refuge System Improvement Act of 1997 (Refuge Improvement Act); Public Law 105-57); however, it may support and enhance other priority public uses.

(b) Where would the use be conducted?
This use could occur in any area of the refuge including wilderness. This could included parts of the refuge that are normally closed to public use.

(c) When would the use be conducted?
The use may occur during daylight hours during the year, unless otherwise specified in an SUP .

(d) How would the use be conducted?
Commercial filming requests will first be evaluated to determine whether an SUP should be granted. We generally prohibit commercial photography in wilderness unless we determine it is necessary to provide education information about wilderness uses and values. An evaluation of the necessity to conduct commercial wildlife and landscape filming and photography in the Monomoy Wilderness will be completed as part of the SUP, in compliance with 610 FW 2.

If permission is given to proceed, it will include stipulations to minimize the impact on cultural or natural resources or interference with other visitors to the area and to ensure compliance with wilderness policy. Requests must be submitted in writing to the refuge manager no less than 60 days prior to the requested date(s). Each request will be reviewed on a case-by-case basis and will require an SUP. There is a fee for issuance of commercial photography SUPs; the fee is adjusted on a case-by-case basis depending on the specific details of each permit. Commercial photographers will be required to use temporary or portable blinds to minimize disturbance to wildlife and to ensure wilderness character is not impacted.

(e) Why is this use being proposed?
Monomoy NWR and its designated wilderness is a scenic and beautiful landscape with tremendous opportunities for wildlife and landscape photography. It is not uncommon for refuge staff to receive requests to conduct commercial filming or commercial still photography on the refuge. Each request is evaluated on an individual basis, using a number of Department of the Interior, Service, and Refuge System policies (for example, 43 CFR Part 5, 50 CFR Part 7, 8 RM 16). In addition, much of the refuge is designated wilderness area.

AVAILABILITY OF RESOURCES:

In general, the refuge will normally incur no expense except administrative costs for review of applications, issuance of a SUP, and staff time to conduct compliance checks. Commercial wildlife and landscape filming and photography would need to be managed in coordination with the existing staff, which is anticipated to be sufficient for the expected permitting workload.

Recurring annual costs:			
GS-11 Visitor Services Manager	1 staff	40 hours	$1,800
GS-9 Visitor Services Specialist	1 staff	20 hours	$ 750
GS-11 Law Enforcement	1 staff	10 hours	$ 450
Total recurring annual costs:			**$3,000**

ANTICIPATED IMPACTS OF THE USE:

Public uses, such as commercial photography, can produce short-term, negative, direct or indirect impacts on wildlife or habitats. However, we believe the long-term benefits from the conservation nature of the products could be greater. Projects will be conducted at the appropriate time of year and conditions to minimize disturbances and incorporate other best management practices.

The majority of the impact from commercial photography will be disturbance caused to resting, feeding, or nesting migratory birds and resting seals or the handling of horseshoe crabs in the waters off Morris Island. There will be some trampling of vegetation. On Morris Island, with use restricted to designated trails and other refuge structures, we predict the impacts will be confined to small areas and in areas already affected.

Permittees may be authorized to utilize new structures located outside the Monomoy Wilderness. These structures will be located to minimize the long-term consequences and cumulative impacts to wildlife and habitats. Most of the new structures proposed, e.g., kiosks, observation platforms, photography blinds, would each result in habitat losses of less than 1/4-acre.

Permittees engaged in commercial filming and photography have a vested interest in minimizing disturbance to the wildlife they wish to observe and photograph. However, photographers are known to disturb wildlife in an attempt to get closer looks or higher quality images of their subjects. Any SUPs issued by the refuge manager will clearly state the parameters of access and, if these conditions are found to be violated, the permit will be immediately voided and the permittee denied any future permits. On North Monomoy Island and South Monomoy Island in particular, pedestrians have the potential of impacting shorebird, waterfowl, and other migratory bird populations feeding and resting on beaches and tidal flats. Pedestrians can also impact seals resting on the beach if they get too close. Conflicts arise when migratory birds and humans are present in the same areas (Boyle and Samson 1985). Response of wildlife to human activities includes departure from site (Owen 1973, Burger 1981, Kaiser and Fritzell 1984, Korschgen et al. 1985, Henson and Grant 1991, Kahl 1991, Klein 1993), use of sub-optimal habitat (Erwin 1980, Williams and Forbes 1980), altered behavior (Burger 1981, Korschgen et al. 1985, Morton et al. 1989, Ward and Stehn 1989, Havera et al. 1992, Klein 1993), and increase in energy expenditure (Morton et al. 1989, Bélanger and Bédard 1990).

Numerous studies have documented that migratory birds are disturbed by human activity on beaches. Erwin (1989) documented disturbance of common terns and skimmers and recommended that human activity be restricted to a distance of 100 meters around nesting sites. In studying waterbird response to human disturbance, Klein (1993) found that, as intensity of disturbance increased, avoidance response by the birds increased, and found out-of-vehicle activity to be more disruptive than vehicular traffic. Pfister et al. (1992) found the impact of disturbance was greater on species using the heavily disturbed front side of the beach, with the abundance of the impacted species being reduced by as much as 50 percent. In studying the effects of recreational use of shorelines on nesting birds, Robertson et al. (1980) discovered that disturbance negatively impacted species composition. Piping plovers, which intensively use the refuge, are also impacted negatively by human activity. Pedestrians on beaches may crush eggs (Jenkins and Burger 1987, Hill 1988, Shaffer and Laporte 1992, Cape Cod National Seashore 1993, Collazo et al. 1994). Dogs may chase plovers (McConnaughey et al. 1990), destroy nests (Hoopes 1993), and kill chicks (Cairns and McLaren 1980). Other studies have shown that if pedestrians cause incubating plovers to leave their nest, the eggs can overheat (Bergstrom 1991) or can cool to the point of embryo death (Welty 1982). Pedestrians have been found to displace unfledged chicks (Strauss 1990, Burger 1991, Hoopes 1993, Loegering 1992, Goldin 1993).

Several studies have examined the effects on birds of recreation using shallow water habitats adjacent to trails and roads through wildlife refuges and coastal habitats in the eastern United States (Burger 1981, 1986, Klein 1993, Burger et al. 1995, Klein et al. 1995, Rodgers and Smith 1995, 1997, Burger and Gochfeld 1998). Overall, the existing research clearly demonstrates that disturbance from recreation activities always has at least temporary effects on the behavior and movement of birds within a habitat or localized area (Burger 1981, 1986, Klein 1993, Burger et al. 1995, Klein et al. 1995, Rodgers and Smith 1997, Burger and Gochfeld 1998). The findings reported in these studies are summarized as follows in terms of visitor activity and avian response to disturbance.

Presence: Birds avoided places where people were present and when visitor activity was high (Burger 1981, Klein et al. 1995, Burger and Gochfeld 1998).

Distance: Disturbance increased with decreased distance between visitors and birds (Burger 1986), though exact measurements were not reported.

Approach Angle: Visitors directly approaching birds on foot caused more disturbance than visitors driving by in vehicles, stopping vehicles near birds, and stopping vehicles and getting out without approaching birds (Klein 1993). Direct approaches may also cause greater disturbance than tangential approaches to birds (Burger and Gochfeld 1981, Burger et al. 1995, Knight and Cole 1995, Rodgers and Smith 1995, 1997).

Type and Speed of Activity: Joggers and landscapers caused birds to flush more than fishermen, clammers, sunbathers, and some pedestrians, possibly because the former groups move quickly (joggers) or create more noise (landscapers). The latter groups tend to move more slowly or stay in one place for longer periods, and birds likely perceive these activities as less threatening (Burger 1981, 1986, Burger et al. 1995, Knight and Cole 1995). Alternatively, birds may tolerate passing by with unabated speed, but may flush if the activity stops or slows (Burger et al. 1995).

Noise: Noise caused by visitors resulted in increased levels of disturbance (Burger 1986, Klein 1993, Burger and Gochfeld 1998), though noise was not correlated with visitor group size (Burger and Gochfeld 1998).

The proposed use has the potential of intermittently interrupting the feeding habits of a variety of shorebirds, gulls, and terns, but encounters between pedestrians and migratory birds will be temporary. Refuge staff will manage public and permittee access via seasonal closures to minimize disturbance to nesting, resting, and foraging waterbirds on the refuge.

Permit holders could potentially impact the larval stage of the threatened northeastern beach tiger beetle. The recovery plan for this species describes that many of the species' habitats are threatened by human impacts such as habitat alteration and recreational activities (USFWS 1994). Larval burrows are especially susceptible to trampling; for the inhabiting individual, this results in excess energy expenditure and reduced time hunting. We will continue to survey to determine the location and extent of larval beetle occurrence and habitat, and use closures and re-routing to avoid larval habitats, as warranted.

Commercial wildlife and landscape filming and photography also has the potential to disturb loafing seals. Gray and harbor seals haul out on the refuge year-round. A 150-foot buffer around all seals is required by the National Oceanic Atmospheric Administration to ensure compliance with the Marine Mammals Protection Act.

All of North Monomoy Island and most of South Monomoy Island are designated wilderness and are part of the National Wilderness Preservation System. Wilderness, in contrast to those areas where humans and their works dominate the landscape, is an area where the Earth and its community of life are untrammeled by humans, where humans visitors do not remain. Preserving wilderness character requires that we maintain both the tangible and intangible aspects of wilderness. Aspects of wilderness character include maintaining the natural, scenic condition of the land; providing environments for native plants and animals, including those threatened or endangered; maintaining watersheds and airsheds in a healthy condition; maintaining natural night skies and soundscapes; retaining the primeval character of and influence on the land; serving as a benchmark for ecological studies; and providing opportunities for solitude, or primitive and unconfined outdoor recreation, for risk, adventure, education, personal growth experiences, a sense of connection with nature and values beyond one's self, a link to our American cultural heritage, and mental and spiritual restoration in the absence of urban pressures. We provide opportunities for appropriate and compatible use and enjoyment of wilderness areas in a manner that will preserve their wilderness character and "leave them unimpaired for future use and enjoyment as wilderness."

When conducted under an SUP, commercial wildlife and landscape filming and photography will have little to no affect on wilderness character. This activity does not alter the natural, scenic condition of the land and will not occur at a scale large enough to diminish the environment for native plants and animals. The most likely wilderness impact will be to other visitors who witness the photography. Since the refuge will be utilizing an SUP process for all commercial filming and photography, the manager may revoke or deny any permits or applications if there is any question on disturbance to wildlife or if a permittee violates permit stipulations.

PUBLIC REVIEW AND COMMENT:

As part of the comprehensive conservation planning (CCP) process for the Monomoy NWR, a draft of this compatibility determination underwent a 180-day public comment period concurrent with the release of our draft CCP/Environmental Impact Statement (EIS). The determination was slightly revised and underwent a further 37-day public review period concurrent with the release of the final CCP/EIS. No comments were received on this compatibility determination and it has remained unchanged.

DETERMINATION (CHECK ONE BELOW):

_____Use is not compatible.

__X__Use is compatible with the following stipulations.

STIPULATIONS NECESSARY TO ENSURE COMPATIBILITY:

- Only commercial filming and photography in support of conservation, refuge purposes, and the Refuge System Mission. If proposed for wilderness, we must determine it is necessary to provide educational information about wilderness uses and values and does not degrade the wilderness character of the area. Mechanized transport or motorized equipment will rarely be allowed, and only if determined to be the minimum necessary to preserve wilderness character and safely administer the refuge.

- Stipulations are listed as "Special Conditions" in the SUP. All permit holders must follow refuge regulations.

- Commercial wildlife and landscape filming and photography is administered through an SUP issued on a case-by-case basis. A fee will be charged and must be paid before the SUP will be issued. Prior to issuing an SUP, the refuge manager is required to submit an audiovisual production permit request through the Service's regional office. All activities must comply with 8 RM 16 and 43 CFR, Subtitle A, Section 5.1 and may require completion of a Commercial Audio-Visual Production Application and posting of a bond.

- All commercial filming and photography activities will avoid sensitive areas prone to disturbance (e.g., sensitive vegetation areas) or degradation (e.g., soil compaction), and will be designed to minimize impacts to nesting birds or other breeding, feeding, or resting wildlife. There are certain times of the year when the refuge is critically important to migratory birds, including threatened and endangered species. The location of the most important nesting, staging and migratory stopover (foraging and resting) habitat varies depending on a number of natural factors (e.g., weather, landform, prey distribution and abundance, and predator presence) as well as human disturbance at other sites. Refuge staff will evaluate the disturbance pressure to migratory birds caused by the presence of individuals engaged in this use. To ensure that this use remains compatible, meaning it does not materially interfere with or detract from the migratory bird purpose of the refuge, it may be necessary to restrict access through the implementation of seasonal and/or area closures. The location and size of these closures are not fixed and will vary over time.

- Access to the refuge in areas and at times not permitted to the general public may be granted in the SUP depending upon the needs of the production, the availability of suitable location(s), and refuge operations and resources. All areas and times not specifically permitted are off-limits for recording. Permittees must follow the conditions outlined in the permit, which normally includes notification of refuge personnel each time any activity occurs in closed areas. Use of a closed area will be heavily restricted to reduce disturbance to wildlife. Sites for photo shoots will be submitted in advance and approved by the refuge manager.

- Activities will be held on designated sites where only minimal direct and short-term impacts are predicted. No commercial filming activity should result in long-term negative alterations to species' behavior (e.g. result in wildlife leaving previously occupied areas for a long term; modifying their habitat use within their range; or, causing nest or young abandonment). No project should degrade wildlife habitat, including vegetation, soils, and water. Nest, dens, and burrows must not be harmed. No commercial filming activities should result in soil compaction or erosion, degrade water quality, remove or destroy vegetation, involve off-road vehicle use, or result in collection and removal of animals or whole native plants.

- Periodic evaluations will be done to insure that permittees are not causing unacceptable adverse impacts. If evidence of unacceptable impacts occur, access would be modified or curtailed as deemed necessary by the refuge manager.

- Permittees must use approved modes of access, for example, on foot or by ferry, boats, or paddling.

- All work with endangered species will require the proper permits from Federal or State government. Any commercial filming activities involving federally listed species may require Section 7 consultation under the Endangered Species Act. Any research involving ground disturbance may require historic preservation consultation with the Regional Historic Preservation Officer and/or State Historic Preservation Officer.

- Blinds will be required for all areas that are not open to the public. No sound-making or lighting devices will be permitted.

- Prior to recording, the permittee will provide the refuge manager with a copy of their current liability insurance policy. The refuge must be named as an additional insured on the policy for the duration of the production.

- Permittees must have the SUP in their possession at all times while on the refuge. A copy of the permit must also be prominently displayed on the dash of permittee's vehicle(s) at all times while on the refuge. The permit must be presented to refuge officials upon request.

- The permit is not transferable.

- Occasional law enforcement patrol and regular staff presence should minimize potential violations. The refuge is open 1/2- hour before sunrise to 1/2-hour after sunset. These restrictions will be maintained. Refuge regulations will be posted and enforced.

- The refuge is a leave-no-trace, carry in-carry out facility. All food containers, bottles, and other waste and refuse must be taken out. Littering, dumping, and abandoning property are prohibited by Federal regulation at 50 CFR 27.93 and 50 CFR 27.94.

JUSTIFICATION:

Commercial photography can provide educational information about wilderness uses and values, and support the mission of the Refuge System by promoting an understanding and appreciation of natural and cultural resources and their management within a national system of refuges. Commercial photography will reach many segments of the public to expand support for the refuge system, including those who may never actually be able to visit the refuge. Individual refuge programs will be consistent with, and fully support, the goals and objectives in the Monomoy NWR Comprehensive Conservation Plan.

We do not expect commercial filming and still photography access to degrade the wilderness character of the area, materially interfere with or detract from the mission of the Refuge System, nor diminish the purpose for which the refuge was established. It will not pose significant adverse effects on refuge resources, interfere with public use of the refuge, or cause an undue administrative burden. These uses would contribute to achieving refuge purposes and the Refuge System mission because they facilitate wildlife photography and interpretation and promote compatible recreational opportunities for visitors to observe and learn about wildlife and habitats firsthand and secondhand.

This program as described is determined to be compatible. Any potential negative impacts of commercial wildlife and nature photography activities on refuge resources will be minimized by the restrictions included in the conditions of the SUP. In addition, the activities associated with commercial photography will be regulated and monitored by refuge staff.

The Service permits commercial wildlife and landscape filming and photography where it would further outreach, education, or public understanding of the natural environment, refuge resources and management, wilderness, or the Refuge System and Service's missions. No approvals for a permit would occur until the refuge manager can insure those benefits would result.

As such, all approved commercial wildlife and landscape filming and photography will contribute to the goals of the refuge and Refuge System, and will not materially interfere with or detract from the mission of the Refuge System or the purposes for which the refuge was established.

SIGNATURE:

Refuge Manager: Elizabeth A Herland (Signature) March 18, 2016 (Date)

CONCURRENCE:

Regional Chief: Scott B. Kahan (Signature) March 18, 2016 (Date)

MANDATORY 10 YEAR RE-EVALUATION DATE: March 18, 2026

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FWS Form 3-2319
02/06

FINDING OF APPROPRIATENESS OF A REFUGE USE

Refuge Name: Monomoy National Wildlife Refuge

Use: Dog Walking on Morris Island

This form is not required for wildlife-dependent recreational uses, take regulated by the State, or uses already described in a refuge CCP or step-down management plan approved after October 9, 1997.

Decision Criteria:	**YES**	**NO**
(a) Do we have jurisdiction over the use?	✔	
(b) Does the use comply with applicable laws and regulations (Federal, State, Tribal, and local)?	✔	
(c) Is the use consistent with applicable Executive orders and Department and Service policies?	✔	
(d) Is the use consistent with public safety?	✔	
(e) Is the use consistent with goals and objectives in an approved management plan or other document?	✔	
(f) Has an earlier documented analysis not denied the use or is this the first time the use has been proposed?	✔	
(g) Is the use manageable within available budget and staff?	✔	
(h) Will this be manageable in the future within existing resources?	✔	
(i) Does the use contribute to the public's understanding and appreciation of the refuge's natural or cultural resources, or is the use beneficial to the refuge's natural or cultural resources?	✔	
(j) Can the use be accommodated without impairing existing wildlife-dependent recreational uses or reducing the potential to provide quality (see section 1.6D, 603 FW 1, for description), compatible, wildlife-dependent recreation into the future?	✔	

Where we do not have jurisdiction over the use ["no" to (a)], there is no need to evaluate it further as we cannot control the use. Uses that are illegal, inconsistent with existing policy, or unsafe ["no" to (b), (c), or (d)] may not be found appropriate. If the answer is "no" to any of the other questions above, we will **generally** not allow the use.

If indicated, the refuge manager has consulted with State fish and wildlife agencies. Yes ✔ No _____.

When the refuge manager finds the use appropriate based on sound professional judgment, the refuge manager must justify the use in writing on an attached sheet and obtain the refuge supervisor's concurrence.

Based on an overall assessment of these factors, my summary conclusion is that the proposed use is:

Not Appropriate _____ **Appropriate** ✔

Refuge Manager: Elizabeth A Herland Date: March 18, 2016

If found to be **Not Appropriate**, the refuge supervisor does not need to sign concurrence if the use is a new use.

If an existing use is found **Not Appropriate** outside the CCP process, the refuge supervisor must sign concurrence.

If found to be **Appropriate**, the refuge supervisor must sign concurrence:

Refuge Supervisor: _____ Date: March 18, 2016

A compatibility determination is required before the use may be allowed.

603 FW 1
Exhibit 1
Page 2

JUSTIFICATION FOR A FINDING OF APPROPRIATENESS OF A REFUGE USE

Refuge Name: Monomoy National Wildlife Refuge

Use: Dog Walking on Morris Island

NARRATIVE:

The U.S. Fish and Wildlife Service (Service) policy on Appropriate Refuge Uses (603 FW 1) states, "General public uses that are not wildlife-dependent recreational uses, as defined by the National Wildlife Refuge System Improvement Act and do not contribute to the fulfillment of refuge purposes or goals or objectives as described in current refuge management plans are the lowest priorities for refuge managers to consider. These uses are likely to divert refuge management resources from priority general public uses or away from our responsibilities to protect and manage fish, wildlife, and plants, and their habitats. Therefore, both law and policy have a general presumption against allowing such uses within the National Wildlife Refuge System."

Dog walking (on leash) has been authorized on the Morris Island area of Monomoy National Wildlife Refuge (NWR, refuge) for many years. The Service will continue to allow dogs on leash on Morris Island only from September 16 to April 30. This is consistent with town of Chatham regulations and is a time period when less wildlife is found on the Morris Island part of the refuge. We will not allow dogs on any other sections of the refuge at any time of the year. Many people who enjoy walking on refuge trails and along the beachfront bring their canine companions along with them. Although dogs can increase disturbance to wildlife, the refuge enforces a leash restriction to keep the dog localized and under control at all times by the pedestrian. Limiting dog walking to Morris Island trails will also keep potential disturbance to a minimum.

As part of our rationale for not allowing dogs on North Monomoy and South Monomoy Island, it has been demonstrated that dogs can have a significant impact on wildlife. Jones and Stokes (1977) demonstrated that domesticated dogs have serious detrimental impacts on local concentrated nesting bird populations. Studies have demonstrated that dogs can, and do, flush incubating birds from nests with possible serious consequences to declining bird populations (Yalden and Yalden 1990, Soluri 1994, Gill 1994). Further, the presence of domesticated dogs can disrupt breeding displays (Baydack 1986), disrupt foraging activity in shorebirds (Hoopes 1993), and disturb roosting activity in ducks (Keller 1991). Other studies have shown that even when dogs are restrained on leash, they have the ability to displace native migratory bird species from natural habitats and cause a depauperate local bird fauna (Banks and Bryan 2007).

Additionally, a study of shorebird disturbance from humans and dogs found that gulls recovered faster from disturbance than did smaller shorebird species (Burger et al. 2007). This rapid recovery time could give competitive advantage to gulls for prime habitat over other shore birds that are a focus of refuge management goals. In winter, the energy expenditure used by birds to avoid dogs, which are seen as potential predators, is unnecessary and avoidable and could contribute to reduced survivability. Dog waste is unsightly for refuge visitors, and can transmit diseases that may threaten the health of some wildlife and other domesticated animals. The refuge does not provide receptacles for animal waste, which if left along the refuge's single small trail, diminishes the quality of the visitor's wildlife recreational experience. Domestic dogs can potentially introduce various diseases (distemper, parvovirus, rabies) and transport parasites into wildlife habitats (Sime 1999). Additionally, not all refuge visitors are pet friendly, and unrestrained dogs can disturb refuge visitors.

Continuing to allow this use will provide the public with additional options for enjoying the great outdoors and possibly introduce new people to Monomoy NWR and the priority use of wildlife observation. For these reasons, we have determined that allowing dog walking on the refuge is consistent with the Service's policy on the appropriateness of refuge uses (603 FW 1).

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COMPATIBILITY DETERMINATION

USE:

Dog Walking on Morris Island

REFUGE NAME:

Monomoy National Wildlife Refuge

DATE ESTABLISHED:

June 1, 1944

ESTABLISHING AUTHORITIES:

Migratory Bird Conservation Act (16 U.S.C. 715d) Public Law 91-504, 16 USC § 1132(c)

PURPOSE(S) FOR WHICH ESTABLISHED:

"…for use as an inviolate sanctuary, or for any other management purpose, for migratory birds." (16 U.S.C. §715d).

"…wilderness areas…shall be administered for the use and enjoyment of the American people in such a manner as will leave them unimpaired for future use and enjoyment as wilderness, and so as to provide for the protection of these areas, the preservation of their wilderness character, and for the gathering and dissemination of information regarding their use and enjoyment as wilderness. (PL 88-577 §2(a), Wilderness Act; as referenced in P.L. 91-504 § 1(g), An Act to Designate Certain Lands as Wilderness).

MISSION OF THE NATIONAL WILDLIFE REFUGE SYSTEM:

"To administer a national network of lands and waters for the conservation, management, and where appropriate, restoration of the fish, wildlife, and plant resources and their habitats within the United States for the benefit of present and future generations of Americans." (16 U.S.C. 668dd-668ee) (National Wildlife Refuge System Administration Act of 1966).

DESCRIPTION OF USE:

(a) What is the use? Is the use a priority public use?
The use is dog walking. Dog walking is not a priority public use of National Wildlife Refuge System (Refuge System) under the National Wildlife Refuge System Administration Act of 1966 (16 U.S.C. 668dd-668ee), as amended by the National Wildlife Refuge System Improvement Act of 1997 (Refuge Improvement Act) (Public Law 105-57).

(b) Where will the use be conducted?
Dog walking (on leash) will be permitted on the Morris Island area of Monomoy National Wildlife Refuge (NWR). We will not allow dogs on any other sections of the refuge including North Monomoy Island, South Monomoy Island, and Minimoy Island at any time of the year.

(c) When will the use be conducted?
The Service will continue to allow dogs on leash on Morris Island only from September 16 to April 30, during the refuge's normal open hours. The refuge is open daily sunrise to sunset. This is consistent with town of Chatham regulations and is a time period when less wildlife is found on the Morris Island part of the refuge.

(d) How will the use be conducted?
Dog walkers will be allowed to walk their dogs only when the dog is attached to a 6-foot (or shorter) leash and the dog walker is in control of the leash and dog at all times. This leash requirement will be enforced to minimize wildlife and visitor disturbance. All dog walkers with properly leashed dogs will be restricted to Morris Island refuge trails.

(e) Why is the use being proposed?
This is an ongoing use of the refuge, and has been occurring without any evidence that it is disruptive or causing any damage. The Service will continue to allow dogs on leash on Morris Island only from September 16 to April 30, during the refuge's normal open hours. It has been a long time tradition for residents of the local community to use these portions of the refuge for this activity building strong local support and allowing an excellent opportunity to educate dog walkers about the refuge and the Refuge System.

AVAILABLITY OF RESOURCES:

Except for maintaining and periodically updating existing signs explaining the regulations, minimal costs will be involved. Monitoring of the site for compliance will continue, but will not require significantly more resources beyond those already necessary to patrol the area for compliance with current regulations. Compliance with the leash law is within the regular duties of the Refuge's Law Enforcement Officer. The financial and staff resources necessary to provide and administer this use at its current level and at the level described in the final Comprehensive Conservation Plan (CCP) are now available and we expect them to be available in the future. The annualized cost associated with the administration of pedestrian travel on the refuge is estimated below:

Providing information to the public and administration needs	$1,000
Resource impacts and monitoring	$1,000
Estimated Total:	$2,000

Based on a review of the budget allocated for management of this activity, funding is adequate to ensure compatibility, and to administer and manage the use listed. Our existing staff and budget have provided sufficient resources to manage this use historically.

ANTICIPATED IMPACTS OF THE USE:

The presence of dogs may flush incubating birds from nests (Yalden and Yalden 1990), disrupt breeding displays (Baydack 1986), disrupt foraging activity in shorebirds (Hoopes 1993), and disturb roosting activity in ducks (Keller 1991). Many of these authors indicated that people with dogs on a leash provoked more disturbance than people walking without a dog, and loose dogs provoked the most pronounced disturbance reactions from their study animals. The greatest stress reaction results from unanticipated disturbance. Animals show greater flight response to humans moving unpredictably than to humans following a distinct path (Gabrielsen and Smith 1995). Despite thousands of years of domestication, dogs still maintain instincts to hunt and chase. The appropriate stimulus can trigger those instincts. Dogs that are unleashed or not under the control of their owners may disturb or threaten the lives of some wildlife. In effect, off-leash dogs increase the radius of human recreational influence or disturbance beyond what it will be in the absence of a dog.

The role of dogs in wildlife diseases is poorly understood. However, dogs can host endo- and ecto-parasites, and can contract diseases from or transmit diseases to wild animals. In addition, dog waste is known to transmit diseases that may threaten the health of some wildlife and other domesticated animals. Domestic dogs potentially can introduce various diseases and transport parasites into wildlife habitats (Sime 1999).

Because the use of the trail system is relatively light, and dog walking will be restricted to public trails where disturbance may already occur due to other public use activities, the potential impacts to wildlife and their

habitats are expected to be minimal. In addition, the requirement for dogs to be kept on a 6-foot leash will minimize the impacts to other users and wildlife.

We do not anticipate any impacts to water quality, soils, or vegetation other than those impacts from normal trail use as described in our wildlife observation compatibility determination. The use will be confined to existing trails and no new construction or vegetation clearing is required. Impacts on wildlife will be minimal since the trails are not close to wildlife concentration areas and the dogs will be leashed. Short-term disturbance may occur to wildlife directly adjacent to the trail.

User conflicts are unlikely to occur since trails are lightly used and dogs will be on-leash and so prevented from annoying others. Dog waste is unsightly for refuge visitors, and can transmit diseases that may threaten the health of some wildlife and other domesticated animals. The refuge does not provide receptacles for animal waste, which if left on the refuge, diminishes the quality of the visitor's wildlife recreational experience. These impacts may be minimized by encouraging people to pick-up their dog's waste.

In particular, we are concerned about the direct or indirect impacts of dogs on staging, nesting and/or foraging migratory birds including common terns and American oystercatchers, and to federally listed, threatened or endangered species including piping plovers, roseate terns, and red knots. Additionally, we are concerned about other wildlife such as seals that use refuge beaches for hauling out.

PUBLIC REVIEW AND COMMENT:

As part of the comprehensive conservation planning (CCP) process for the Monomoy NWR, a draft of this compatibility determination underwent a 180-day public comment period concurrent with the release of our draft CCP/Environmental Impact Statement (EIS). It underwent a further 37-day public review period concurrent with the release of the final CCP/EIS. During that period, we received a comment requesting that we allow leashed dogs on the refuge year round. No substantive new information was provided that would lead us to reconsider our determination in the final CCP/EIS that this use is compatibile with the stipulations noted below.

DETERMINATION (CHECK ONE BELOW):

_____Use is not compatible.

__**X**__Use is compatible with the following stipulations.

STIPULATIONS NECESSARY TO ENSURE COMPATIBILITY:

- Dog walking will only be allowed seasonally on sections of Morris Island that are open for public use. There are certain times of the year when the refuge is critically important to migratory birds, including threatened and endangered species. The location of the most important nesting, staging and migratory stopover (foraging and resting) habitat varies depending on a number of natural factors (e.g., weather, landform, prey distribution and abundance, and predator presence) as well as human disturbance at other sites. Refuge staff will evaluate the disturbance pressure to migratory birds caused by the presence of individuals engaged in this use. To ensure that this use remains compatible, meaning it does not materially interfere with or detract from the migratory bird purpose of the refuge, it may be necessary to restrict access through the implementation of seasonal and/or area closures. The location and size of these closures are not fixed and will vary over time.

- We will continue to allow dogs on leash on Morris Island only from September 16 to April 30. This is consistent with town of Chatham regulations and is a time period when less wildlife is found on the Morris Island section of the refuge.

- Only leashed dogs will be allowed on the refuge. The leash must be no more than 6 feet long. Dog walkers will be required to maintain control of their animal while on the refuge, thereby reducing the potential and severity of impacts to wildlife and must refrain from entering closed areas.

- Dog walkers must pick up after their dog(s) and remove or properly dispose of pet waste.
- Agency and public awareness will be increased through interpretive or educational materials about responsible pet ownership in the context of wildlife disturbance during all outdoor recreational pursuits.
- If a high number of reports of negative dog-wildlife or dog-people interactions on Morris Island and refuge trails are reported, the refuge will reassess the use.
- If a high number of off-leash incidents are documented, we may consider eliminating dog walking from the refuge altogether.
- Restricting dog walking to Morris Island will reduce the potential disturbance of wildlife.

JUSTIFICATION:

Although dogs can increase disturbance to wildlife, the refuge will strictly enforce a leash law to keep dogs and disturbances localized with the pedestrian. This is an existing use at Monomoy NWR, and there have been numerous documented violations of the leash requirement occurring annually. There are no documented incidents of domestic dog-wildlife disturbances, nor of dog-human conflicts. The majority of dog walkers are likely local residents who regularly visit the refuge for wildlife dependent recreation and who understand our policy. The Service and the Refuge System maintain goals of providing opportunities to view wildlife. Allowing the use of Morris Island by persons engaging in dog walking may facilitate wildlife observation. These users may take the time to learn more about the refuge and become, or already be, supporters of the Refuge System.

Allowing dog walking at Monomoy NWR will not materially interfere with, or detract from, the mission of the Refuge System of the purposes for which the refuge was established. As listed in the purposes section of this compatibility determination, the refuge was established and subsequently land was acquired for one main purpose. As discussed under the section on anticipated impacts above, dog walking is an historic use of Monomoy NWR. Because this use is restricted to Morris Island from September 16 to April 30, we anticipate that this use will have only negligible, minor, and temporary impacts on refuge resources. Because of this, it is consistent with the wildlife and habitat aspects of the refuge's purposes, the Service policy on compatible uses, the Refuge Improvement Act, and the broad management objectives of the Refuge System. Dog walking will not materially interfere with or detract from the endangered species aspect of the refuge's purposes, because there are no federally listed threatened or endangered species known to occur on the refuge. Therefore, no significant adverse effects from dog walking are anticipated. This activity will not materially interfere with or detract from the mission of the Refuge System, because of the limited impacts to refuge resources, because it facilitates priority public uses, and because of the stipulations specified above.

SIGNATURE:

Refuge Manager: Elizabeth A. Harlan (Signature) March 18, 2016 (Date)

CONCURRENCE:

Regional Chief: Scott B. Kahan (Signature) March 18, 2016 (Date)

MANDATORY 10 YEAR RE-EVALUATION DATE: March 18, 2026

LITERATURE CITED:

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Sime, C.A. 1999. Domestic Dogs in Wildlife Habitats. Pp. 8.1-8.17 in G. Joslin and H. Youmans, coordinators. Effects of recreation on Rocky Mountain wildlife: A Review for Montana. Committee on Effects of Recreation on Wildlife, Montana Chapter of The Wildlife Society.

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COMPATIBILITY DETERMINATION

USE:

Environmental Education and Interpretation

REFUGE NAME:

Monomoy National Wildlife Refuge

DATE ESTABLISHED:

June 1, 1944

ESTABLISHING AND ACQUISITION AUTHORITY(IES):

Migratory Bird Conservation Act (16 U.S.C. § 715d) Public Law 91-504, 16 USC § 1132(c)

REFUGE PURPOSE(S):

"…for use as an inviolate sanctuary, or for any other management purpose, for migratory birds." (16 U.S.C. § 715d).

"…wilderness areas…shall be administered for the use and enjoyment of the American people in such a manner as will leave them unimpaired for future use and enjoyment as wilderness, and so as to provide for the protection of these areas, the preservation of their wilderness character, and for the gathering and dissemination of information regarding their use and enjoyment as wilderness. (PL 88-577 § 2(a), Wilderness Act; as referenced in P.L. 91-504 § 1(g), An Act to Designate Certain Lands as Wilderness).

NATIONAL WILDLIFE REFUGE SYSTEM MISSION:

To administer a national network of lands and waters for the conservation, management, and where appropriate, restoration of the fish, wildlife, and plant resources and their habitats within the United States for the benefit of present and future generations of Americans.

DESCRIPTION OF USE:

(a) What is the use? Is the use a priority public use?
Environmental education and interpretation are priority public uses of the National Wildlife Refuge System (Refuge System) under the National Wildlife Refuge System Administration Act of 1966 (16 U.S.C. 668dd-668ee) and the National Wildlife Refuge System Improvement Act of 1997 (Refuge Improvement Act) (Public Law 105-57). Both environmental education and interpretation activities seek to increase public knowledge and understanding of fish and wildlife resources and the value of habitat protection and management in protecting and conserving these resources. Environmental education is curriculum-based and typically includes teacher or staff-guided onsite field trips, offsite programs in classrooms, and nature study such as teacher and student workshops. Interpretation consists of guided natural or cultural history programs, special events such as the Chatham Fourth of July parade, interpretative signs, self-guided nature trails, lectures, and kiosks that serve as a source of information for refuge visitors. Interpretation includes developing

and publishing brochures, managing a refuge web site, using social media such as Facebook and Twitter, and installing information signs. Interpretation occurs both onsite and offsite.

(b) Where would the use be conducted?
The majority of this use will be conducted on the Morris Island part of Monomoy National Wildlife Refuge (NWR) and offsite in classrooms and local community facilities. Brochures and informational signs could be placed offsite within the town of Chatham, at Cape Cod National Seashore, or at other locations accessible to local residents or potential refuge visitors. Both uses can occur in any area open to the public, although permanent structures are generally not allowed in wilderness areas, so no interpretative panels and only minor information signs will be located in the Monomoy Wilderness. Certain areas on Monomoy NWR are seasonally closed to public access at the refuge manager's discretion to protect sensitive habitats or species of concern, minimize conflicts with other refuge activities, or respond to human health and safety concerns. All environmental education and interpretation activities will avoid sensitive areas prone to disturbance (e.g., sensitive vegetation areas) or degradation (e.g., soil compaction), and will be designed to minimize impacts to nesting birds or other breeding, feeding, or resting wildlife.

Refuge environmental education and interpretation will primarily occur on Morris Island, generally on the shoreline and beach, within 50 meters of existing trails, and at other facilities such as the refuge headquarters and visitor contact station and viewing platforms. Self-guided interpretation could occur in the Monomoy Wilderness, as could interpretative tours. Due to logistical constraints, fewer environmental education opportunities will occur on North Monomoy Island or South Monomoy Island.

We will provide interpretation of habitat and wildlife values at the Morris Island Trail trailhead kiosks and along the trail. We will continue to maintain a seasonally staffed refuge visitor contact station at the existing headquarters until a new off-refuge visitor contact station can be established. Additional off-site locations for providing brochures or interpretative panels could be established in conjunction with partners or local businesses. Some possible locations for delivering interpretive information could include the Morris Island Road causeway overflow parking, other visitor satellite parking lots and transit stops, the Marconi Maritime Museum, local boat ramps and marinas, the Chatham Fish Pier, Cape Cod Rail Trail parking lots, Chatham Bars Inn and Resort, Cape Cod Natural History Museum, Wellfleet Bay Sanctuary, Cape Cod National Seashore's Salt Pond Visitor Center, and the Lighthouse Beach overlook.

(c) When would the use be conducted?
Environmental education will occur year-round during daylight hours when the refuge is open; however, most of the field programs would be associated with the fall and spring school terms.

Interpretive activities will be conducted year-round, primarily during daylight hours when the refuge is open. Occasional staff-led or volunteer-led night programs would occur during the year. Interpretive activities would increase during the summer months, when the refuge receives peak visitation and has summer interns.

(d) How would the use be conducted?
Refuge staff, local teachers, volunteers, and conservation partners will conduct environmental education and interpretation on and off the refuge. Most curriculum-based environmental education programs at Monomoy NWR are conducted by others, such as the Friends of Monomoy, Massachusetts Audubon Society, Cape Cod Natural History Museum, and local school districts, primarily at Morris Island. Teacher-led school group trips also occur on the refuge with several of the teacher-leaders already serving as refuge volunteers. Onsite refuge activities will primarily include teacher-led or staff-guided field trips exploring topics requested by teachers, teach-the-teacher workshops, or more structured curriculum-based programs specifically designed for use on the refuges. Students will learn about nature from designated refuge trails, viewing platforms on Morris Island, and in the Monomoy Wilderness. Environmental education activities could utilize interpretive infrastructure such as kiosks, sign panels, and displays in the visitor contact station.

Interpretation activities on Monomoy NWR will be both self-guided and staff-led or volunteer-led. Interpretive information will be delivered through kiosks at refuge trailheads, refuge trail guides, brochures, interpretive panels at observation platforms and self-guided tour stops on trails, and interpretive displays in the refuge visitor contact station and at local community special events. Staff-led and volunteer-led programs would, over time, become more diverse and allow for more interaction with visitors. A significant amount of interpretive information will also be available through the Internet.

Offsite activities will primarily include offering refuge staff assistance to local partners who are interested in working with the Service to expand our efforts into local classrooms and the occasional refuge attendance at special events, such as a career day.

Environmental education and guided interpretation conducted in the wilderness area on North and South Monomoy Islands can provide information about the Monomoy Wilderness to ensure activities are conducted appropriately and raise awareness about the National Wilderness Preservation System (NWPS). We will conduct a minimum requirements analysis for proposed environmental education and interpretation activities held within the Monomoy Wilderness. Access for environmental education and interpretation activities would be on foot, or by boat or kayak. Motorized equipment is not allowed within the Monomoy Wilderness, which includes the majority of the lands comprising the refuge.

(e) Why is this use being proposed?
The Refuge Improvement Act states that priority, wildlife-dependent public uses should receive enhanced consideration in planning and be facilitated on refuges to the extent they are compatible.

Environmental education and interpretation promotes public understanding and appreciation of the Refuge System, the NWPS, and the Monomoy NWR. The migratory birds, threatened and endangered species, other U.S. Fish and Wildlife Service (Service) trust resources and habitats on which they depend, and wilderness values within the Monomoy Wilderness will benefit from Service efforts to cooperate with environmental education partners to educate the public on the impacts to native salt marsh and dune vegetation and harmful wildlife disturbance from inappropriate public uses.

AVAILABILITY OF RESOURCES:

Environmental education and interpretation are currently provided on a small scale by existing refuge staff. The refuge manager, wildlife refuge specialist and wildlife biologist each dedicate approximately 0.2 full time employees to these public use programs. For the environmental education and interpretation to be more fully realized, additional visitor services staff would be needed to plan, implement, and monitor the public use programs on Monomoy NWR, including administration of the refuge visitor contact station. New and recurring costs to conduct an environmental education and interpretation program are presented below.

New construction and renovation estimated costs:			
Construct and install two new kiosks on Morris Island			$ 6,000
Construct and install one new accessible platform on Morris Island			$ 15,000
Construct and install one new photography blind on Morris Island			$ 3,000
Renovate Morris Island trail for handicapped accessibility			$100,000
Renovate exhibits in existing visitor contact station			$250,000
Renovate or construct new off-site visitor contact station			$250,000+
Total new costs:			**$374,000**
Recurring annual costs:			
GS-9 Visitor Services Specialist	1 staff	200 hours	$ 7,500
GS-11 Law Enforcement	1 staff	40 hours	$ 2,000
GS-9 Law Enforcement	1 staff	100 hours	$ 4,500
Ferry service to islands and bus transportation to refuge			$ 5,000
Regular maintenance of visitor centers			$25,000
Regular maintenance of kiosks, platforms, photo blinds, trails, public restrooms			$15,000
Equipment, vehicles, and supplies (including brochures/trail guides			$22,000
Total recurring annual costs:			**$81,000**

ANTICIPATED IMPACTS OF THE USE:

Impacts of environmental education and interpretation will be minimal if conducted in accordance with refuge regulations and policies. Possible impacts include disturbing and displacing wildlife, removing or trampling vegetation, littering, and vandalism. Overall, we expect the adverse impacts to be short-term and confined.

New structures will be sited outside the Monomoy Wilderness, with consideration of the long-term consequences and cumulative impacts to wildlife and habitats. Most of the new structures proposed, e.g. kiosks, observation platforms, photography blinds, would each result in habitat losses of less than 1/4-acre. Placement of kiosks, interpretative panels, blinds, and observation platforms may impact small areas of vegetation. Kiosks will be placed where minimal disturbance will occur from both the structures and visitors using them.

Pedestrian travel has the potential to impact shorebird, waterfowl, and other migratory bird populations feeding and resting near the trails and on beaches during certain times of the year. Pedestrians can also impact seals resting on the beach if they get to close. Conflicts arise when migratory birds and humans are present in the same areas (Boyle and Samson 1985). Response of wildlife to human activities includes departure from site (Owen 1973, Burger 1981, Kaiser and Fritzell 1984, Korschgen et al. 1985, Henson and Grant 1991, Kahl 1991, Klein 1993), use of sub-optimal habitat (Erwin 1980, Williams and Forbes 1980), altered behavior (Burger 1981, Korschgen et al. 1985, Morton et al. 1989, Ward and Stehn 1989, Havera et al. 1992, Klein 1993), and increase in energy expenditure (Morton et al. 1989, Bélanger and Bédard 1990).

Numerous studies have documented that migratory birds are disturbed by human activity on beaches. Erwin (1989) documented disturbance of common terns and skimmers and recommended that human activity be restricted to a distance of 100 meters around nesting sites. Klein (1993) in studying waterbird response to human disturbance found that, as intensity of disturbance increased, avoidance response by the birds increased, and found that non-vehicle based activities were more disruptive than vehicular traffic. Pfister et al. (1992) found that the impact of disturbance was greater on species using the heavily disturbed front side of the beach, with the abundance of the impacted species being reduced by as much as 50 percent. In studying the effects of recreational use of shorelines on nesting birds, Robertson et al. (1980) discovered that disturbance negatively impacted species composition. Piping plovers, which intensively use the refuge, are also impacted negatively by human activity. Pedestrians on beaches may crush eggs (Jenkins and Burger 1987, Hill 1988, Shaffer and Laporte 1992, Cape Cod National Seashore 1993, Collazo et al. 1994). Dogs may chase plovers (McConnaughey et al. 1990), destroy nests (Hoopes 1993), and kill chicks (Cairns and McLaren 1980). Other studies have shown that if pedestrians cause incubating plovers to leave their nest, the eggs can overheat (Bergstrom 1991) or can cool to the point of embryo death (Welty 1982). Pedestrians have been found to displace unfledged chicks (Strauss 1990, Burger 1991, Hoopes 1993, Loegering 1992, Goldin 1993).

Several studies have examined the effects of recreation on birds using shallow water habitats adjacent to trails and roads through wildlife refuges and coastal habitats in the eastern United States (Burger 1981; Burger 1986; Klein 1993; Burger et al. 1995; Klein et al. 1995; Rodgers and Smith 1995, 1997; Burger and Gochfeld 1998). Overall, the existing research clearly demonstrates that disturbance from recreation activities always have at least temporary effects on the behavior and movement of birds within a habitat or localized area (Burger 1981,1986; Klein 1993; Burger et al. 1995; Klein et al. 1995; Rodgers and Smith 1997; Burger and Gochfeld 1998). The findings reported in these studies are summarized in terms of visitor activity and avian response to disturbance.

Presence: Birds avoided places where people were present and when visitor activity was high (Burger 1981; Klein et al. 1995; Burger and Gochfeld 1998).

Distance: Disturbance increased with decreased distance between visitors and birds (Burger 1986), though exact measurements were not reported.

Approach Angle: Visitors directly approaching birds on foot caused more disturbance than visitors driving by in vehicles, stopping vehicles near birds, and stopping vehicles and getting out without approaching birds (Klein 1993).
Direct approaches may also cause greater disturbance than tangential approaches to birds (Burger and Gochfeld 1981; Burger et al. 1995; Knight and Cole 1995; Rodgers and Smith 1995, 1997).

Noise: Noise caused by visitors resulted in increased levels of disturbance (Burger 1986; Klein 1993; Burger and Gochfeld 1998), though noise was not correlated with visitor group size (Burger and Gochfeld 1998).

The proposed use has the potential of intermittently interrupting the feeding habits of a variety of shorebirds, gulls, and terns, but encounters between pedestrians and migratory birds will be temporary. Refuge staff will manage visitor access via seasonal closures to minimize disturbance to nesting, resting, and foraging waterbirds on the refuge.

Trash left on the beach, particularly food or wrappers, can attract predators that prey on nesting piping plovers and least terns or roosting shorebirds. Impacts of walking are likely to be minimal if conducted in accordance with refuge regulations. We will manage refuge closures that restrict pedestrian access to minimize disturbance to priority avian species during critical times of the year. Closures can be expanded or contracted as needed, depending on bird activity and results of further disturbance studies. The refuge is a leave-no-trace, carry-in-carry-out facility. All food containers, bottles, and other waste and refuse must be taken out. Littering, dumping, and abandoning property are prohibited by Federal regulation at 50 CFR 27.93 and 50 CFR 27.94.

Construction or renovation of a new visitor contact station off Morris Island will result in short-term noise and air pollution. Debris from the construction site will be recycled to the extent possible, with the remainder placed in a landfill. There could be traffic congestion at the visitor contact station site from visitors. If an alternative transportation system is established with parking at the visitor contact station for shuttle access, the number of cars travelling to the refuge headquarters on Morris Island could decrease, reducing vehicle emissions and noise.

All of North Monomoy Island and most of South Monomoy Island are designated wilderness and are part of the NWPS. Wilderness, in contrast with those areas where humans and their works dominate the landscape, is an area where the Earth and its community of life are untrammeled by humans, where humans are visitors who do not remain. Preserving wilderness character requires that we maintain both the tangible and intangible aspects of wilderness. Aspects of wilderness character include maintaining the natural, scenic condition of the land; providing environments for native plants and animals, including those threatened or endangered; maintaining watersheds and airsheds in a healthy condition; maintaining natural night skies and soundscapes; retaining the primeval character of and influence on the land; serving as a benchmark for ecological studies; and providing opportunities for solitude, primitive and unconfined outdoor recreation, risk, adventure, education, personal growth experiences, a sense of connection with nature and values beyond one's self, a link to our American cultural heritage, and mental and spiritual restoration in the absence of urban pressures. We provide opportunities for appropriate and compatible use and enjoyment of wilderness areas in a manner that will preserve their wilderness character and will "leave them unimpaired for future use and enjoyment as wilderness."

Environmental education and interpretation will not affect wilderness character. These activities do not alter the natural, scenic condition of the land and will not occur at a scale large enough to diminish the environment for native plants and animals.

Large groups have the potential to negatively infringe on the wilderness experience for those visitors who come to the refuge specifically to have a wilderness experience. This will generally be a short-term impact to a wilderness visitor.

PUBLIC REVIEW AND COMMENT:

As part of the comprehensive conservation planning (CCP) process for the Monomoy NWR, a draft of this compatibility determination underwent a 180-day public comment period concurrent with the release of our draft CCP/Environmental Impact Statement (EIS). This final compatibility determination resulted from that public review and comment process. It underwent a further 37-day public review period concurrent with the release of the final CCP/EIS. No comments were received on the compatibility determination and it remained unchanged.

DETERMINATION (CHECK ONE BELOW):

_____ Use is not compatible.

__X__ Use is compatible with the following stipulations.

STIPULATIONS NECESSARY TO ENSURE COMPATIBILITY:

- All environmental education and interpretation activities will avoid sensitive areas prone to disturbance (e.g., sensitive vegetation areas) or degradation (e.g., soil compaction), and will be designed to minimize impacts to nesting birds or other breeding, feeding, or resting wildlife. Access for environmental education and interpretation activities will be on foot. Access by kayak and canoe or boat will be necessary to get to North Monomoy Island and South Monomoy Island.

- Activities will be held on designated sites where only minimal direct and short-term impacts are predicted, and adverse long-term, cumulative impacts are not anticipated. Self-guided and guided interpretive activities in the wilderness can occur anytime when the refuge is open, except in areas that are seasonally closed to protect wildlife.

- Occasional law enforcement patrol and regular staff and conservation partner presence should minimize potential violations. We will maintain the current refuge hours (open 1/2 hour before sunrise to 1/2 hour after sunset) and restrict entry after daylight hours. We will post and enforce refuge regulations.

- Periodic evaluations will be done to insure that visitors and programs are not causing unacceptable adverse impacts. Areas open to these uses will be evaluated on an ongoing basis to ensure visitor safety, compliance with State and Federal tern and plover guidelines, compliance with National Marine Fisheries Service marine mammal regulations, and to minimize impacts on vegetation and wildlife.

- Environmental education and interpretation will only be allowed on sections of the refuge that are open for public use. There are certain times of the year when the refuge is critically important to migratory birds, including threatened and endangered species. The location of the most important nesting, staging and migratory stopover (foraging and resting) habitat varies depending on a number of natural factors (e.g., weather, landform, prey distribution and abundance, and predator presence) as well as human disturbance at other sites. Refuge staff will evaluate the disturbance pressure to migratory birds caused by the presence of individuals engaged in this use. To ensure that this use remains compatible, meaning it does not materially interfere with or detract from the migratory bird purpose of the refuge, it may be necessary to restrict access through the implementation of seasonal and/or area closures. The location and size of these closures are not fixed and will vary over time. Seasonal closures will vary year to year based on wildlife use and habitat conditions. Visitors will be expected to comply with closures. Updates on closures will be available at the Headquarters and on the refuge web site.

JUSTIFICATION:

Environmental education and interpretation are priority, wildlife-dependent, public uses identified by the Refuge Improvement Act. These activities have been determined appropriate by law and, when compatible, are to be facilitated on refuges. These programs support the mission of the Refuge System by promoting an understanding and appreciation of natural and cultural resources and their management within a national system of refuges. Our programs will reach out to all segments of the public to expand support for the refuge system. Individual refuge programs will be consistent with, and fully support, the goals and objectives in the Monomoy NWR CCP.

Environmental education activities generally support refuge purposes, and impacts can largely be minimized. The minor resource impacts attributed to these activities are generally outweighed by the benefits gained by educating present and future generations about refuge resources. Environmental education is a public use management tool to develop a resource protection ethic within society. While it targets school-aged children, it is not limited to this group. This tool allows us to educate visitors about endangered and threatened species management, wildlife management, and ecological principles and communities. A secondary benefit of environmental education is that it can instill stewardship in visitors that most likely reduces vandalism, littering, and poaching. Environmental education also strengthens Service visibility in the local community.

Providing additional interpretative and educational brochures and materials may result in increased knowledge of the refuge and its resources. This awareness and knowledge may improve the willingness of the public to support refuge programs and resources and comply with regulations. Environmental education and interpretation activities that identify and explain wilderness should increase understanding and appreciation of, and compliance with, wilderness principles and policies.

We do not expect visitors engaged in environmental education or interpretation to materially interfere with or detract from the mission of the Refuge System or diminish the purpose for which the refuge was established. These activities do not pose significant adverse effects on refuge resources, interfere with public use of the refuge, or cause an undue administrative burden.

Additional funding will be needed to administer a fully developed environmental education and interpretation program. These uses will not materially interfere with or detract from the mission of the Refuge System or the purpose of Monomoy NWR. Therefore, it is the determination of the Service that these uses, at the discretion of the refuge manager, are compatible uses and contribute to the purposes for which Monomoy NWR was established.

SIGNATURE:

Refuge Manager: Elizabeth A. Herlihy (Signature) March 18, 2016 (Date)

CONCURRENCE:

Regional Chief: Wendi Weber (Signature) March 18, 2016 (Date)

MANDATORY 15 YEAR RE-EVALUATION DATE: March 18, 2031

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COMPATIBILITY DETERMINATION

USE:

Fin Fishing

REFUGE NAME:

Monomoy National Wildlife Refuge

DATE ESTABLISHED:

June 1, 1944

ESTABLISHING AND ACQUISITION AUTHORITY(IES):

Migratory Bird Conservation Act (16 U.S.C. § 715d) Public Law 91-504, 16 USC § 1132(c)

REFUGE PURPOSE(S):

"…for use as an inviolate sanctuary, or for any other management purpose, for migratory birds." (16 U.S.C. § 715d).

"…for the use and enjoyment of the American people in such manner as will leave them unimpaired for future use and enjoyment as wilderness, and… the preservation of their wilderness character…" (PL 88-577 § 2(a), Wilderness Act; as referenced in P.L. 91-504 § 1(g), An Act to Designate Certain Lands as Wilderness).

NATIONAL WILDLIFE REFUGE SYSTEM MISSION:

To administer a national network of lands and waters for the conservation, management, and where appropriate, restoration of the fish, wildlife, and plant resources and their habitats within the United States for the benefit of present and future generations of Americans.

DESCRIPTION OF USE:

(a) What is the use? Is the use a priority public use?
The use is recreational fin fishing, which includes saltwater fly fishing from shore or wading, surf fishing from shore or wading, rip fishing, and fishing in the refuge's freshwater ponds. This compatibility determination covers recreational fin fishing occurring outside the open waters lying above the submerged lands within the Declaration of Taking—fishing occurring in this open water area will be regulated by the National Marine Fisheries Service (NMFS) and the Massachusetts Division of Marine Fisheries (MA DMF). Fishing events, including Service "Take Me Fishing" programs designed to educate anglers new to the sport of fishing, will be held on the refuge. Fishing is a priority public use of the National Wildlife Refuge System under the National Wildlife Refuge System (Refuge System) Administration Act of 1966 (16 U.S.C. § 668dd-668ee), as amended by the National Wildlife Refuge System Improvement Act of 1997 (Refuge Improvement Act) (Public Law 105-57).

(b) Where would the use be conducted?
This compatibility determination only covers recreational fin fishing occurring outside the open waters lying above the submerged lands within the Declaration of Taking—fishing occurring in this open water area will be regulated by the NMFS and the MA DMF. Areas covered by this compatibility determination include the refuge shoreline, refuge's freshwater ponds on South Monomoy Island, and intertidal areas when these areas are open to public access. All fishing on the refuge occurs in accordance with Federal, State, and local regulations.

South Monomoy Island: The most productive surf fishing location is at the very southern tip of South Monomoy Island where there is a tidal rip. However, the nearest safe anchorage for boats is in the vicinity of Powder Hole; the walk one-way to the rip is more than 1/2-mile. As a result of the long walk, there is very little surf fishing from this location. Most anglers opt to fish from their boats in the rip area. Surf fishing occurs concurrently with family day-use of the beach. Most of this activity occurs on the safe anchorage and boat beaching points on the west side of South Monomoy Island.

North Monomoy: There is rarely any surf fishing conducted from this island. The majority of the island and most of the east shoreline is seasonally closed to protect nesting and roosting areas. This seasonal closure will vary year to year based on wildlife use and habitat conditions. Shallow water precludes surf fishing from the west side. Even though surf fishing is limited, fly fishing in the shallow water on the flats has been very popular in the past.

Morris Island: Because of the connection of the Morris Island to the mainland and easy vehicular access, this portion of the refuge receives the largest number of surf fishing visits. However, this area is rarely crowded with anglers. A major limiting factor to the one-time use by anglers is the 35-car parking lot at refuge headquarters. Personal observations by staff over the years have noted that there are rarely more than four anglers using the 1-mile refuge shoreline at any one time. Fishing is allowed 24 hours per day. Fish typically caught by anglers include striped bass, bluefish, flounder, and pollock. Most refuge fishing events would be held on Morris Island due to ease of access, and help minimize impacts on refuge seals, terns, plovers, and other shorebirds and seabirds.

(c) When would the use be conducted?
Monomoy National Wildlife Refuge (NWR) is open to the public from 1/2-hour before sunrise to 1/2-hour after sunset. Surf fishing is permitted 24 hours a day on Morris Island only. The gate and parking lot are open and no permit is required to fish after the refuge is closed. This is the only activity allowed at night on Monomoy NWR. Refuge fishing events would be held at times and on areas of the refuge that minimize impact to seals, terns, plovers, and other shorebirds and seabirds.

(d) How would the use be conducted?
Recreational fin fishing must be conducted in accordance with Federal and State regulations and refuge specific policies, including seasonal closures. Walking, kayaks, private motorboats, and paid access via the commercial ferry or a future concessionaire will be the most common means of access for anglers using Monomoy NWR. Refuge staff may partner with organizations to sponsor a fishing tournament designed to introduce more people to fishing on the refuge.

(e) Why is this use being proposed?
Recreational fishing is a priority, wildlife-dependent public use. The Refuge Improvement Act states that priority, wildlife-dependent, public uses should receive enhanced consideration in planning and be facilitated on refuges to the extent they are compatible.

Monomoy NWR is a premier destination for fishing and attracts visitors from across the country. A rip current at the end of South Monomoy Island makes for excellent fishing. Recreational fin fishing offers opportunities to observe wildlife at Monomoy NWR and increases visitor appreciation and awareness of the importance of this site to the Refuge System. Working with partners to hold fishing events will increase the number of people participating in this priority public use on the refuge.

AVAILABILITY OF RESOURCES:

Little effort is spent in providing opportunities for fin fishing on the refuge. Refuge staff prepare a closed area map each spring that guides all visitors to the refuge, including anglers. Signs are posted and removed each year to delineate plover, tern, and waterfowl nesting areas. Signs may be retained or relocated to protect major staging sites on the refuge. Signs and posts need to be replaced occasionally. There are expenses involved with the use of refuge boats to move equipment and conduct law enforcement to ensure compliance with refuge regulations. These expenses, for all refuge recreational uses, are approximately $40,000 per year. For fishing, this is prorated to $5,000 per year.

The cost of law enforcement patrol to conduct fishing compliance (license, creel limits), ensure visitor safety, and maintain the integrity of the closed areas will be approximately $10,000 per year.

Total recurring annual cost	**$15,000**

ANTICIPATED IMPACTS OF THE USE:

Potential impacts from fin fishing include disturbing and displacing wildlife or trampling vegetation, including salt grass, when anglers get too close to roosting birds or resting seals or when they enter closed areas. This has been a particular problem in the closed areas off North Monomoy Island. Incidences of littering and vegetation removal have occurred. Some disturbance to roosting and feeding shorebirds occurs (Burger 1981) but this is minimized when closed areas are respected. Discarded fishing line and other fishing litter can entangle migratory birds and marine mammals and cause injury and death (Gregory 1991). Litter also impacts the visual experience of other refuge visitors (Marion and Lime 1986). Conflicts with seals over fish could occur, especially if anglers are not observing the 150-foot buffer distance from seals required by the Marine Mammal Protection Act. Several enforcement issues may result from this use, including trampling vegetation following trespass into closed areas, illegal taking of fish (undersized, over limit), illegal fires, and disorderly conduct. Overall, we expect the adverse impacts to be short-term and confined to small areas.

There are impacts to refuge wildlife, vegetation, and soils from pedestrian access for visitors engaged in fishing. Pedestrian travel has the potential to impact shorebird, waterfowl, and other migratory bird populations feeding and resting near the trails and on beaches during certain times of the year. Pedestrians can also impact seals resting on the beach if they get too close. Conflicts arise when migratory birds and humans are present in the same areas (Boyle and Samson 1985). Response of wildlife to human activities includes departure from site (Owen 1973, Burger 1981, Kaiser and Fritzell 1984, Korschgen et al. 1985, Henson and Grant 1991, Kahl 1991, Klein 1993), use of sub-optimal habitat (Erwin 1980, Williams and Forbes 1980), altered behavior (Burger 1981, Korschgen et al. 1985, Morton et al. 1989, Ward and Stehn 1989, Havera et al. 1992, Klein 1993), and increase in energy expenditure (Morton et al. 1989, Bélanger and Bédard 1990).

Numerous studies have documented that migratory birds are disturbed by human activity on beaches. Erwin (1989) documented disturbance of common terns and skimmers and recommended that human activity be restricted to a distance of 100 meters (300 feet) around nesting sites. Klein (1993) in studying waterbird response to human disturbance found that, as intensity of disturbance increased, avoidance response by the birds increased, and found that out-of-vehicle activity to be more disruptive than vehicular traffic. Pfister et al. (1992) found that the impact of disturbance was greater on species using the heavily disturbed front side of the beach, with the abundance of the impacted species being reduced by as much as 50 percent. In studying the effects of recreational use of shorelines on nesting birds, Robertson et al. (1980) discovered that disturbance negatively impacted species composition. Piping plovers, which intensively use the refuge, are also impacted negatively by human activity. Pedestrians on beaches may crush eggs (Jenkins and Burger 1987, Hill 1988, Shaffer and Laporte 1992, Cape Cod National Seashore 1993, Collazo et al. 1994). Dogs may chase plovers (McConnaughey et al. 1990), destroy nests (Hoopes 1993), and kill chicks (Cairns and McLaren 1980). Other studies have shown that if pedestrians cause incubating plovers to leave their nest, the eggs can overheat (Bergstrom 1991) or can cool to the point of embryo death (Welty 1982). Pedestrians have been found to displace unfledged chicks (Strauss 1990, Burger 1991, Hoopes 1993, Loegering 1992, Goldin 1993).

Several studies have examined the effects of recreation on birds using shallow water habitats adjacent to trails and roads through wildlife refuges and coastal habitats in the eastern United States (Burger 1981, 1986, Klein

1993, Burger et al. 1995, Klein et al. 1995, Rodgers and Smith 1995, 1997, Burger and Gochfeld 1998). Overall, the existing research clearly demonstrates that disturbance from recreational activities always has at least temporary effects on the behavior and movement of birds within a habitat or localized area (Burger 1981, 1986, Klein 1993, Burger et al. 1995, Klein et al. 1995, Rodgers and Smith 1997, Burger and Gochfeld 1998). The findings that were reported in these studies are summarized as follows in terms of visitor activity and avian response to disturbance.

Presence: Birds avoided places where people were present and when visitor activity was high (Burger 1981, Klein et al. 1995, Burger and Gochfeld 1998).

Distance: Disturbance increased with decreased distance between visitors and birds (Burger 1986), though exact measurements were not reported.

Approach Angle: Visitors directly approaching birds on foot caused more disturbance than visitors driving by in vehicles, stopping vehicles near birds, and stopping vehicles and getting out without approaching birds (Klein 1993). Direct approaches may also cause greater disturbance than tangential approaches to birds (Burger and Gochfeld 1981, Burger et al. 1995, Knight and Cole 1995, Rodgers and Smith 1995, 1997).

Type and Speed of Activity: Joggers and landscapers caused birds to flush more than fishermen, clammers, sunbathers, and some pedestrians, possibly because the former groups move quickly (joggers) or create more noise (landscapers). The latter groups tend to move more slowly or stay in one place for longer periods, and birds likely perceive these activities as less threatening (Burger 1981, 1986, Burger et al. 1995, Knight and Cole 1995). Alternatively, birds may tolerate passing by with unabated speed, but may flush if the activity stops or slows (Burger et al. 1995).

Noise: Noise caused by visitors resulted in increased levels of disturbance (Burger 1986, Klein 1993, Burger and Gochfeld 1998), though noise was not correlated with visitor group size (Burger and Gochfeld 1998).

The proposed use has the potential to intermittently interrupt the feeding habits of a variety of shorebirds, gulls, and terns, but encounters between pedestrians and migratory birds will be temporary. To address the impacts posed by pedestrians, refuge staff will manage angler access via seasonal closures to minimize disturbance to nesting, resting, and foraging waterbirds on the refuge.

Visitors accessing Monomoy Island from Chatham town beaches could potentially impact the larval stage of the threatened northeastern beach tiger beetle. The recovery plan for this species describes that many of the species' habitats are threatened by human impacts such as habitat alteration and recreational activities (U.S. Fish and Wildlife Service (USFWS) 1994). Larval burrows are especially susceptible to trampling, which results in excess energy expenditure and reduced time hunting for the inhabiting individual. We will continue to survey to determine the location and extent of larval beetle occurrence and habitat, and use closures and re-routing to avoid larval habitats, as warranted.

Visitor use also has the potential to disturb loafing seals. Gray and harbor seals haul out on the refuge year-round. We will enforce or implement the 150-foot buffer around all seals as required by the National Oceanic Atmospheric Administration to ensure compliance with the Marine Mammals Protection Act.

Heavy beach use can dry out the sand and contribute to beach erosion. Trash left on the beach, particularly food or wrappers, can attract predators that prey on nesting piping plovers and least terns or roosting shorebirds. The refuge is a leave-no-trace, carry-in-carry-out facility. We encourage all outfitters and guides to pack in and pack out all food containers, bottles, wrappers, trash, and other waste and refuse. Littering, dumping, and abandoning property are prohibited by Federal regulation at 50 CFR 27.93 and 50 CFR 27.94.

There should be little impact from anglers fishing in the wilderness area. Anglers fishing from shore or just offshore within the intertidal area tend to be solitary and quiet. Carts will not be allowed to carry gear in the wilderness area. Refuge fishing events will most likely be held on Morris Island, so there would be little impact to wilderness. If an event is held in the Monomoy Wilderness, group size will be limited and the event will be

short-term, thereby minimizing impacts to other wilderness visitors. Additionally, any event held within the Monomoy Wilderness will undergo a minimum requirements analysis to ensure compliance with wilderness regulations and policies, and help ensure impacts to wilderness character are minimal.

PUBLIC REVIEW AND COMMENT:

As part of the comprehensive conservation planning (CCP) process for the Monomoy NWR, a draft of this compatibility determination underwent a 180-day public comment period concurrent with the release of our draft CCP/Environmental Impact Statement (EIS). This final compatibility determination resulted from that public review and comment process. It underwent a further 37-day public review period concurrent with the release of the final CCP/EIS. No comments were received on the compatibility determination and it has remain unchanged.

DETERMINATION (CHECK ONE BELOW):

_____Use is not compatible.

__**X**__Use is compatible with the following stipulations.

STIPULATIONS NECESSARY TO ENSURE COMPATIBILITY:

- Fin fishing will only be allowed on sections of the beach that are open for public use. There are certain times of the year when the refuge is critically important to migratory birds, including threatened and endangered species. The location of the most important nesting, staging and migratory stopover (foraging and resting) habitat varies depending on a number of natural factors (e.g., weather, landform, prey distribution and abundance, and predator presence) as well as human disturbance at other sites. Refuge staff will evaluate the disturbance pressure to migratory birds caused by the presence of individuals engaged in this use. To ensure that this use remains compatible, meaning it does not materially interfere with or detract from the migratory bird purpose of the refuge, it may be necessary to restrict access through the implementation of seasonal and/or area closures. The location and size of these closures are not fixed and will vary over time. Visitors will be expected to comply with closures. Updates on closures will be available at the Monomoy Headquarters and on the refuge web site.

- Carts or other wheeled equipment may not be used within the wilderness area on North Monomoy Island and South Monomoy Island.

- Occasional law enforcement patrol and regular staff and partner presence should minimize potential violations of refuge closures and curtail illegal fires, littering, and disorderly conduct. Periodic evaluations will be done to ensure that activities associated with the use are not causing unacceptable adverse impacts to the natural resources. Unacceptable levels of violations or disturbance may result in eliminating or restricting public fishing. Occasional law enforcement patrols and regular refuge presence should minimize potential violations of refuge closures and other regulations, e.g., prohibition of dogs.

- Public meetings with local fishing clubs and interested parties will facilitate voluntary compliance of regulations. Recreational fishing events will be held only with the sponsorship of the Service and at times, in places, and with methods deemed to comply with State and Federal wildlife regulations and other refuge regulations.

- The refuge is a leave-no-trace, carry-in-carry-out facility. All food containers, bottles, and other waste and refuse must be taken out. Littering, dumping, and abandoning property are prohibited by Federal regulation at 50 CFR 27.93 and 50 CFR 27.94.

JUSTIFICATION:

Recreational fishing is a priority public use identified in the Refuge Improvement Act, and facilitates other priority public uses such as wildlife observation and photography. Monomoy NWR is world-renowned for its offshore fish resources and allowing this use will not pose significant adverse effects on refuge resources, nor interfere with other public uses of the refuge. Area closure limitations outlined in this determination provide maximum protection to prime nesting habitat for piping plovers and terns, and minimize disturbance to staging terns and resting seals. Recreational fishing will foster a greater awareness and appreciation of the importance of this site to the Refuge System. Costs associated with administering public fishing and likely visitor impacts are minimal. This use will not materially interfere with or detract from the mission of the Refuge System or the purpose of Monomoy NWR. Therefore, it is the determination of the Service that recreational fishing, at the discretion of the refuge manager, is a compatible use and contributes to the purposes for which Monomoy NWR was established.

SIGNATURE:

Refuge Manager: Elizabeth A. Harlan (Signature) March 18, 2016 (Date)

CONCURRENCE:

Regional Chief: Scott B. Kahan (Signature) March 18, 2016 (Date)

MANDATORY 15 YEAR RE-EVALUATION DATE: March 18, 2031

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FWS Form 3-2319
02/06

FINDING OF APPROPRIATENESS OF A REFUGE USE

Refuge Name: Monomoy National Wildlife Refuge

Use: Hiking, Walking, and Jogging

This form is not required for wildlife-dependent recreational uses, take regulated by the State, or uses already described in a refuge CCP or step-down management plan approved after October 9, 1997.

Decision Criteria:	**YES**	**NO**
(a) Do we have jurisdiction over the use?	✔	
(b) Does the use comply with applicable laws and regulations (Federal, State, Tribal, and local)?	✔	
(c) Is the use consistent with applicable Executive orders and Department and Service policies?	✔	
(d) Is the use consistent with public safety?	✔	
(e) Is the use consistent with goals and objectives in an approved management plan or other document?	✔	
(f) Has an earlier documented analysis not denied the use or is this the first time the use has been proposed?	✔	
(g) Is the use manageable within available budget and staff?	✔	
(h) Will this be manageable in the future within existing resources?	✔	
(i) Does the use contribute to the public's understanding and appreciation of the refuge's natural or cultural resources, or is the use beneficial to the refuge's natural or cultural resources?	✔	
(j) Can the use be accommodated without impairing existing wildlife-dependent recreational uses or reducing the potential to provide quality (see section 1.6D, 603 FW 1, for description), compatible, wildlife-dependent recreation into the future?	✔	

Where we do not have jurisdiction over the use ["no" to (a)], there is no need to evaluate it further as we cannot control the use. Uses that are illegal, inconsistent with existing policy, or unsafe ["no" to (b), (c), or (d)] may not be found appropriate. If the answer is "no" to any of the other questions above, we will **generally** not allow the use.

If indicated, the refuge manager has consulted with State fish and wildlife agencies. Yes ✔ No _____.

When the refuge manager finds the use appropriate based on sound professional judgment, the refuge manager must justify the use in writing on an attached sheet and obtain the refuge supervisor's concurrence.

Based on an overall assessment of these factors, my summary conclusion is that the proposed use is:

Not Appropriate _____ **Appropriate** ✔

Refuge Manager: Elizabeth A Harlan Date: March 18, 2016

If found to be **Not Appropriate**, the refuge supervisor does not need to sign concurrence if the use is a new use.

If an existing use is found **Not Appropriate** outside the CCP process, the refuge supervisor must sign concurrence.

If found to be **Appropriate**, the refuge supervisor must sign concurrence:

Refuge Supervisor: Richard Taylor Date: March 18, 2016

A compatibility determination is required before the use may be allowed.

603 FW 1
Exhibit 1
Page 2

JUSTIFICATION FOR A FINDING OF APPROPRIATENESS OF A REFUGE USE

Refuge Name: Monomoy National Wildlife Refuge

Use: Hiking, Walking, and Jogging

NARRATIVE:

The U.S. Fish and Wildlife Service (Service) policy on Appropriate Refuge Uses (603 FW 1) states, "General public uses that are not wildlife-dependent recreational uses, as defined by the National Wildlife Refuge System Improvement Act and do not contribute to the fulfillment of refuge purposes or goals or objectives as described in current refuge management plans are the lowest priorities for refuge managers to consider. These uses are likely to divert refuge management resources from priority general public uses or away from our responsibilities to protect and manage fish, wildlife, and plants, and their habitats. Therefore, both law and policy have a general presumption against allowing such uses within the National Wildlife Refuge System (Refuge System)."

The Service and the Refuge System maintain the goal of providing opportunities to view wildlife and take part in interpretation. Allowing the use of refuge areas already open to the public, including one trail system on Morris Island, to persons hiking, walking and jogging supports this goal. Hiking, walking, and jogging are not priority public uses. Hiking and walking do facilitate priority public uses by providing visitors with the chance to view wildlife and engage in wildlife photography and interpretation, which promote public appreciation of the conservation of wildlife and habitats. Joggers are not likely to be observing wildlife but they might stop to read interpretative signs or passively observe wildlife while jogging. Hiking, walking and jogging would not materially interfere with or detract from the fulfillment of the Refuge System mission or the purpose for which the refuge was established.

Hiking, walking, and jogging are anticipated to have the same level of impacts as the primary public uses because the access and activities are very similar. Refuge staff will regulate these activities through area closures, so impacts of hiking, walking, and jogging will likely be minimal if conducted in accordance with refuge regulations. For these reasons, hiking, walking, and jogging are appropriate uses on Monomoy National Wildlife Refuge.

COMPATIBILITY DETERMINATION

USE:

Hiking, Walking, and Jogging

REFUGE NAME:

Monomoy National Wildlife Refuge

DATE ESTABLISHED:

June 1, 1944

ESTABLISHING AND ACQUISITION AUTHORITY(IES):

Migratory Bird Conservation Act (16 U.S.C. § 715d) Public Law 91-504, 16 USC § 1132(c)

REFUGE PURPOSE(S):

"…for use as an inviolate sanctuary, or for any other management purpose, for migratory birds." (16 U.S.C. § 715d).

"…wilderness areas…shall be administered for the use and enjoyment of the American people in such a manner as will leave them unimpaired for future use and enjoyment as wilderness, and so as to provide for the protection of these areas, the preservation of their wilderness character, and for the gathering and dissemination of information regarding their use and enjoyment as wilderness. (PL 88-577 § 2(a), Wilderness Act; as referenced in P.L. 91-504 § 1(g), An Act to Designate Certain Lands as Wilderness).

NATIONAL WILDLIFE REFUGE SYSTEM MISSION:

To administer a national network of lands and waters for the conservation, management, and where appropriate, restoration of the fish, wildlife, and plant resources and their habitats within the United States for the benefit of present and future generations of Americans.

DESCRIPTION OF USE:

(a) What is the use?
The use is hiking, walking or jogging.

(b) Is the use a priority public use?
This use is not a priority public use of the National Wildlife Refuge System (Refuge System); however, it supports priority public uses since it can contribute to wildlife observation, wildlife photography, and interpretation.

(c) Where would the use be conducted?
All hiking and walking will be conducted only in areas that are open to the public, including the Morris Island trail system and designated areas on Monomoy Island. Jogging will be conducted only in refuge areas that are open to the public on Morris Island. Certain areas on Monomoy National Wildlife Refuge (NWR) are seasonally

closed to public access at the refuge manager's discretion to protect sensitive habitats or species of concern, minimize conflicts with other refuge activities, or respond to human health and safety concerns. Hiking and walking have historically been concentrated along and limited to perimeter beaches, the Morris Island Trail and other traditional footpaths on Morris Island and the North Monomoy Corridor; on South Monomoy Island, hiking and walking occur on the connection to South Beach, the trail to access the Monomoy Light Station and keeper's house, and the trail between the lighthouse and Powder Hole.

(d) When would the use be conducted?
Individuals would be able to hike, walk, or jog throughout the year during regular refuge hours, unless otherwise posted by the refuge. Monomoy NWR is open daily from 1/2-hour before sunrise to 1/2-hour after sunset, year-round.

(e) How would the use be conducted?
Hiking, walking, and jogging tend to be self-regulating, with signs indicating trailheads and appropriate routes of travel, as well as seasonally closed areas. Visitors are encouraged to contact Monomoy NWR staff for up-to-date information on seasonal closures. Information about closures is also available on the refuge web site or at the visitor center, when staffed.

(f) Why is this use being proposed?
Hiking, walking, and jogging are not priority public uses. However, hiking and walking facilitate priority public uses on the refuge. Although hiking, walking are classified as non-wildlife activities, most visitors use the refuge for the wildland experience it provides. Hiking or walking in designated areas of the refuge allows visitors to engage in priority public uses such as wildlife observation, wildlife photography, or interpretation. Joggers are not likely to be observing wildlife but they might stop to read interpretative signs or passively observe wildlife while jogging.

AVAILABILITY OF RESOURCES:

The refuge has an existing, self-guided, interpretive loop trail on Morris Island and a short trail bisecting North Monomoy, traversing from the designated boat landing on the east to the salt marsh and tidal flats on the west side. Both areas are maintained for safe hiking or walking and qualitatively monitored by existing refuge staff and volunteers for natural resource impacts at a relatively low annual cost. Allowing hiking or walking within areas otherwise open to the public, and jogging only on Morris Island, will not substantially increase the maintenance or operational needs of the refuge. No entrance fees are collected.

The following breakdown shows the estimated amount of funds needed annually to administer hiking, walking, and jogging refuge wide, including the Monomoy Wilderness.

WG-6 Maintenance Worker - trail/road maintenance	1 week	$1,200
GS-9 Visitor Services Specialist - hiking information	1 week	$1,500
GS-9 Law Enforcement Officer	1 week	$1,800
Fact sheets/materials		$1,000
Total annual cost*		**$5,500***

Refuge areas that are open to the public are maintained for a variety of activities. Costs shown are a percentage of total costs for trail/road maintenance on the refuge and are reflective of the percentage of trail/road use for this activity. Volunteers account for some hiking information and trail maintenance hours and help reduce overall cost of the program.

ANTICIPATED IMPACTS OF THE USE:

The proposed use is anticipated to have the same level of impacts as the priority public uses because the access and activities are very similar. The impacts to natural resource and wilderness character from hiking, walking, or jogging will likely be minimal if conducted in accordance with refuge regulations and only in areas otherwise open to public access. Possible wildlife and fisheries impacts include disruption of nesting migratory bird

populations, terns, shorebirds, and other bird populations feeding and resting near the trails during certain times of the year, impacts to larval threatened northeastern beach tiger beetle populations, and disruption of local seal populations.

On Monomoy NWR, area closures are created to protect priority nesting migratory tern and shorebird species. Although these closure areas are designed to minimize human impacts, the potential exists for impacts to unobserved nesting animals. Conflicts arise when migratory birds and humans are present in the same areas (Boyle and Samson 1985). Response of wildlife to human activities includes departure from site (Owen 1973, Burger 1981, Kaiser and Fritzell 1984, Korschgen et al. 1985, Henson and Grant 1991, Kahl 1991, Klein 1993), use of sub-optimal habitat (Erwin 1980, Williams and Forbes 1980), altered behavior (Burger 1981, Korschgen et al. 1985, Morton et al. 1989, Ward and Stehn 1989, Havera et al. 1992, Klein 1993), and increase in energy expenditure (Morton et al. 1989, Bélanger and Bédard 1990).

Numerous studies have documented that migratory birds are disturbed by human activity on beaches. Erwin (1989) documented disturbance of common terns and skimmers and recommended that human activity be restricted to a distance of 100 meters around nesting sites. Pfister et al. (1992) found that the impact of disturbance was greater on species using the heavily disturbed front side of the beach, with the abundance of the impacted species being reduced by as much as 50 percent. In studying the effects of recreational use of shorelines on nesting birds, Robertson et al. (1980) discovered that disturbance negatively impacted species composition. Piping plovers, which intensively use the refuge, are also impacted negatively by human activity. Pedestrians on beaches may crush eggs (Jenkins and Burger 1987, Hill 1988, Shaffer and Laporte 1992, Cape Cod National Seashore 1993, Collazo et al. 1994). Other studies have shown that if pedestrians cause incubating plovers to leave their nest, the eggs can overheat (Bergstrom 1991) or can cool to the point of embryo death (Welty 1982). Pedestrians have been found to displace unfledged chicks (Strauss 1990, Burger 1991, Hoopes 1993, Loegering 1992, Goldin 1993).

Several studies have examined the effects of recreation on birds using shallow water habitats adjacent to trails and roads through wildlife refuges and coastal habitats in the eastern United States (Burger 1981, 1986, Klein 1993, Burger et al. 1995, Klein et al. 1995, Rodgers and Smith 1995, 1997, Burger and Gochfeld 1998). Overall, the existing research clearly demonstrates that disturbance from recreation activities always has at least temporary effects on the behavior and movement of birds within a habitat or localized area (Burger 1981, 1986, Klein 1993, Burger et al. 1995, Klein et al. 1995, Rodgers and Smith 1997, Burger and Gochfeld 1998). The findings that were reported in these studies are summarized as follows in terms of visitor activity and avian response to disturbance.

Presence: Birds avoided places where people were present and when visitor activity was high (Burger 1981, Klein et al. 1995, Burger and Gochfeld 1998).

Distance: Disturbance increased with decreased distance between visitors and birds (Burger 1986), though exact measurements were not reported.

Approach Angle: Visitors directly approaching birds on foot caused more disturbance than visitors driving by in vehicles, stopping vehicles near birds, and stopping vehicles and getting out without approaching birds (Klein 1993). Direct approaches may also cause greater disturbance than tangential approaches to birds (Burger and Gochfeld 1981, Burger et al. 1995, Knight and Cole 1995, Rodgers and Smith 1995, 1997).

Type and Speed of Activity: Activities where humans move quickly (e.g., jogging) or make loud noises (e.g., landscaping) cause birds to flush more than fishermen, clammers, sunbathers, and some pedestrians. The latter groups tend to move more slowly or stay in one place for longer periods, and birds likely perceive these activities as less threatening (Burger 1981, 1986, Burger et al. 1995, Knight and Cole 1995). Alternatively, birds may tolerate passing by with unabated speed, but may flush if the activity stops or slows (Burger et al. 1995).

Noise: Noise caused by visitors resulted in increased levels of disturbance (Burger 1986, Klein 1993, Burger and Gochfeld 1998), though noise was not correlated with visitor group size (Burger and Gochfeld 1998).

Trash left on the beach, particularly food or wrappers, can attract predators that prey on nesting piping plovers and least terns or roosting shorebirds. Impacts of hiking, walking, or jogging are likely to be minimal if conducted in accordance with refuge regulations and only in areas otherwise open to public access. Jogging is not suitable on North and South Monomoy Islands because of the use of these areas by nesting and staging birds and seals. We will manage refuge closures that restrict pedestrian access to minimize disturbance to priority avian species during critical times of the year. Closures can be expanded or contracted as needed, depending on bird activity and results of further disturbance studies.

Individuals hiking, walking, or jogging to Monomoy NWR could potentially impact the larval stage of the threatened northeastern beach tiger beetle on South Monomoy Island. The recovery plan for this species describes human impacts such as habitat alteration and recreational activities that threaten many of the species' habitats (U.S. Fish and Wildlife Service (USFWS) 1994). Larval burrows are especially susceptible to trampling, which results in excess energy expenditure and reduced time spent foraging by the inhabiting larva. We will continue to survey to determine the location and extent of larval beetle occurrence and habitat, and use closures and re-routing to avoid larval habitats, as warranted.

Pedestrian use also has the potential to disturb loafing seals. Gray and harbor seals haul out on the refuge year round. A 150-foot buffer around all seals is required by the National Oceanic Atmospheric Administration to ensure compliance with the Marine Mammals Protection Act.

Unmanaged hiking, walking, or jogging has the potential to damage or kill plants and lead to new, unwanted, impromptu trails on the refuge that become shortcuts through more ecologically sensitive sites. Heavy use of designated, managed, or unmanaged pedestrian travel routes can ultimately lead to areas void of vegetation (McDonnell 1981, Vaske et al. 1992) and potentially destabilize dunes and interdunal wetlands, which are difficult to stabilize and restore to a naturally functioning condition (Kucinski and Einsenmenger 1943, Cole 2002, Goldsmith 2002, Grady 2002, O'Connell 2008).

Trampling has three initial effects: abrasion of vegetation, abrasion of surface soil organic layers, and soil compaction (Cole 2002). Plants can be crushed, sheared off, bruised, and even uprooted by trampling, leading to reduced vigor and reproduction, reduced or altered plant species composition and structure, and reduced biomass and cover (Cole 2002). Of these, abrasion of vegetation is the most common and noticeable effect observed in coastal dune communities, where little or no surface organic layer exists on the sandy soil substrate that naturally resists compaction (Fletcher 1993). All three impacts can commonly occur, however, within coastal marsh habitats where reduced wave energy allows significant accumulation of surface organic layers that are vulnerable to compaction (Fletcher 1993), which increases surface soil bulk density and reduces permeability. Increased ponding and muddy conditions tend to promote wider vegetative and soil impact zones along trails through wet areas (Cole 2002). McDonnell (1981) analyzed long-term human trampling, ranging from low to high intensity, on coastal dune vegetation at Parker River NWR in Massachusetts. All levels of trampling significantly lowered species diversity, and heavy trampling caused a drastic reduction in species diversity and total vegetation cover. Moderate trampling reduced species diversity but not cover. This was probably because moderate trampling favored some species, such as beach grass over other, more sensitive species, such as beach-heather (*Hudsonia tomentosa*). Trampling may result in changes in plant communities by preventing succession in interdune and backdune areas and favoring disturbance-tolerant foredune species like beach grass.

The harsh growing conditions and environment in the coastal barrier system can make for slow vegetative recovery even after pedestrian traffic is eliminated at trampled sites (Fletcher 1993). The gradient from no vegetation to normal cover levels is very narrow along refuge trails and other footpaths where trampling is more concentrated, and is wider at traditional boat landings where trampling is more dispersed. Hiking and walking are among the most primitive forms of recreation, and the trails themselves encourage users to confine their hiking or walking to narrow corridors radiating or looping outward from user focal areas such as beach access points or boat landings. Such localized impacts, concentrated near a small number of the most popular destinations, do not pose any serious disruption to the barrier ecosystem composition, structure, and function and are not evident at large spatial scales on Monomoy NWR.

Once established, the trails themselves are clear evidence of human presence that detracts from some users' perceptions of an otherwise untrammeled, undeveloped, or otherwise natural appearing landscape (Hendee and Dawson 2002) within the Monomoy Wilderness. Bare, exposed, sand dune areas, potentially compacted

tidal marsh segments, trail treads, and narrow zones of disturbed vegetation on either side of refuge foot trails and boat landings will be readily evident, but when trail standards are kept minimal, trails tend to be accepted or even expected by most, though not all, wilderness users (Stankey and Schreyer 1987, Cole 2002, Hendee and Dawson 2002). The majority of the Monomoy Wilderness will remain essentially unvisited and virtually undisturbed by hiking and walking. Pedestrian footpaths are not expected to substantially compromise the perception of naturalness of the Monomoy Wilderness landscape or the wilderness user's experience (Cole 2002, Hendee and Dawson 2002).

Wilderness visitors' experiences are most strongly affected by social conditions, such as other visitors and their actions, than by their perception of naturalness or ecological conditions (Hendee and Dawson 2002). The trails themselves tend toward promoting a confining rather than an unconfined user experience (Hendee and Dawson 2002). With typically long sight distances across Monomoy's rolling nearly treeless coastal barrier landscape, too many individuals encountered or observed hiking or walking during visits by other Monomoy Wilderness users likely detracts from the sense of solitude experienced by wilderness users (Stankey and Schreyer 1987, Hendee and Dawson 2002). However, hiking and walking use is still currently very light in the more remote, interior portions of South Monomoy Island open to public use, where outstanding opportunities for solitude can be experienced by other Monomoy Wilderness users.

PUBLIC REVIEW AND COMMENT:

As part of the comprehensive conservation planning (CCP) process for the Monomoy NWR, a draft of this compatibility determination underwent a 180-day public comment period concurrent with the release of our draft CCP/Environmental Impact Statement (EIS). This final compatibility determination resulted from that public review and comment process. It underwent a further 37-day public review period concurrent with the release of the final CCP/EIS. No comments were received on the compatibility determination and it has remain unchanged.

DETERMINATION (CHECK ONE BELOW):

_____Use is not compatible.

__X__ Use is compatible with the following stipulations.

STIPULATIONS NECESSARY TO ENSURE COMPATIBILITY:

- All hiking, walking, and jogging will be done only in areas that are otherwise open to the public. Jogging may only be done on refuge lands on Morris Island otherwise open to public access.

- All individuals hiking, walking, or jogging must adhere to area closures and understand that certain destinations may not be available year-round. There are certain times of the year when the refuge is critically important to migratory birds, including threatened and endangered species. The location of the most important nesting, staging and migratory stopover (foraging and resting) habitat varies depending on a number of natural factors (e.g., weather, landform, prey distribution and abundance, and predator presence) as well as human disturbance at other sites. Refuge staff will evaluate the disturbance pressure to migratory birds caused by the presence of individuals engaged in this use. To ensure that this use remains compatible, meaning it does not materially interfere with or detract from the migratory bird purpose of the refuge, it may be necessary to restrict access through the implementation of seasonal and/or area closures. The location and size of these closures are not fixed and will vary over time. Visitors will be expected to comply with closures. Updates on closures will be available at the Headquarters and on the refuge web site.

- No physical items, including litter, will be placed or left on the refuge. The leave-no-trace principles and practices (e.g., pack it in and pack it out) will be implemented on a refugewide basis, including the Monomoy Wilderness.

- The Service will continue to allow dogs on leash on Morris Island only from September 16 to April 30, during the refuge's normal open hours. The refuge is open daily sunrise to sunset.
- All hikers, walkers, and joggers must maintain a 150-foot buffer around all seals as required by the National Oceanic Atmospheric Administration to ensure compliance with the Marine Mammals Protection Act.
- Refuge visitor information services and products will emphasize the importance of staying on trails and out of seasonal closure areas, along with providing leave-no-trace hiking tips.
- Refuge staff or volunteers will periodically qualitatively and photographically document pedestrian impacts to vegetation and soils to footpaths, boat landings, and other known user concentration points for use in drafting or updating a Monomoy Wilderness Stewardship Plan.

JUSTIFICATION:

The Service and the National Wildlife Refuge System (Refuge System) maintain the goal of providing opportunities to view or photograph wildlife and to take part in interpretation. Allowing the use of refuge areas that are already open to the public including, but not limited to, one interpretive trail on Morris Island, the North Monomoy Corridor; on South Monomoy Island, hiking and walking occur on the connection to South Beach, the trail to access the Monomoy Light Station and keeper's house, and the trail between the lighthouse and Powder Hole. Jogging will be conducted only in areas that are open to the public on Morris Island. Although hiking or walking are not priority public uses, they facilitate priority public uses, providing visitors with the chance to view or photograph wildlife and engage in interpretation and recreational fishing, thereby promoting public appreciation of the conservation of wildlife and habitats. Hiking, walking, or jogging at current and expected levels of use, and subject to the stipulations listed above will not materially interfere with or detract from preserving wilderness character in the Monomoy Wilderness, the fulfillment of the Refuge System mission, or the purpose for which the refuge was established.

SIGNATURE:

Refuge Manager: Elizabeth A Herland (Signature) March 18, 2016 (Date)

CONCURRENCE:

Regional Chief: Scott B. Kahan (Signature) March 18 2016 (Date)

MANDATORY 10 YEAR RE-EVALUATION DATE: March 18, 2026

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FWS Form 3-2319
02/06

FINDING OF APPROPRIATENESS OF A REFUGE USE

Refuge Name: Monomoy National Wildlife Refuge

Use: Mosquito Monitoring and Control

This form is not required for wildlife-dependent recreational uses, take regulated by the State, or uses already described in a refuge CCP or step-down management plan approved after October 9, 1997.

Decision Criteria:	**YES**	**NO**
(a) Do we have jurisdiction over the use?	✔	
(b) Does the use comply with applicable laws and regulations (Federal, State, Tribal, and local)?	✔	
(c) Is the use consistent with applicable Executive orders and Department and Service policies?	✔	
(d) Is the use consistent with public safety?	✔	
(e) Is the use consistent with goals and objectives in an approved management plan or other document?	✔	
(f) Has an earlier documented analysis not denied the use or is this the first time the use has been proposed?	✔	
(g) Is the use manageable within available budget and staff?	✔	
(h) Will this be manageable in the future within existing resources?	✔	
(i) Does the use contribute to the public's understanding and appreciation of the refuge's natural or cultural resources, or is the use beneficial to the refuge's natural or cultural resources?		✔
(j) Can the use be accommodated without impairing existing wildlife-dependent recreational uses or reducing the potential to provide quality (see section 1.6D, 603 FW 1, for description), compatible, wildlife-dependent recreation into the future?	✔	

Where we do not have jurisdiction over the use ["no" to (a)], there is no need to evaluate it further as we cannot control the use. Uses that are illegal, inconsistent with existing policy, or unsafe ["no" to (b), (c), or (d)] may not be found appropriate. If the answer is "no" to any of the other questions above, we will **generally** not allow the use.

If indicated, the refuge manager has consulted with State fish and wildlife agencies. Yes ✔ No _____.

When the refuge manager finds the use appropriate based on sound professional judgment, the refuge manager must justify the use in writing on an attached sheet and obtain the refuge supervisor's concurrence.

Based on an overall assessment of these factors, my summary conclusion is that the proposed use is:

Not Appropriate _____ **Appropriate** ✔

Refuge Manager: Elizabeth A Herland Date: March 18, 2016

If found to be **Not Appropriate**, the refuge supervisor does not need to sign concurrence if the use is a new use.

If an existing use is found **Not Appropriate** outside the CCP process, the refuge supervisor must sign concurrence.

If found to be **Appropriate**, the refuge supervisor must sign concurrence:

Refuge Supervisor: Graham A Taylor Date: March 18, 2016

A compatibility determination is required before the use may be allowed.

603 FW 1
Exhibit 1
Page 2

JUSTIFICATION FOR A FINDING OF APPROPRIATENESS OF A REFUGE USE

Refuge Name: Monomoy National Wildlife Refuge

Use: Mosquito Monitoring and Control

NARRATIVE:

The U.S. Fish and Wildlife Service policy on Appropriate Refuge Uses (603 FW 1) states, "General public uses that are not wildlife-dependent recreational uses, as defined by the National Wildlife Refuge System Improvement Act and do not contribute to the fulfillment of refuge purposes or goals or objectives as described in current refuge management plans are the lowest priorities for refuge managers to consider. These uses are likely to divert refuge management resources from priority general public uses or away from our responsibilities to protect and manage fish, wildlife, and plants, and their habitats. Therefore, both law and policy have a general presumption against allowing such uses within the National Wildlife Refuge System."

Mosquito management includes population monitoring and control, if warranted. Mosquito surveillance monitoring and control, when necessary, will be conducted in several small pools, or pannes, within a 5-acre salt marsh on the Morris Island portion of the refuge. Mosquito and mosquito-borne disease management is not a priority public use of the National Wildlife Refuge System (Refuge System) under the Refuge System Administration Act of 1966 (16 U.S.C. 668dd-668ee), as amended by the National Wildlife Refuge System Improvement Act of 1997.

Mosquito population monitoring and control would be conducted by the Cape Cod Mosquito Control Project following the protocols and best management practices identified in the Massachusetts Arbovirus Surveillance and Response Plan (Massachusetts Department of Public Health 2012) and in compliance with refuge-specific regulations. In general, we allow populations of native mosquito species to function unimpeded unless they cause a wildlife or human health threat. Mosquitoes are a natural component of most wetland ecosystems but may also represent a threat to human, wildlife, or domestic animal health. Refuges are to collaborate with Federal, State, or local public health authorities and vector control agencies to identify refuge-specific health threat categories that represent increasing levels of health risks and are based on monitoring data.

Mosquito-associated health threats will be addressed using an integrated pest management (IPM) approach, including when practical, compatible, non-pesticide actions that reduce mosquito production. Treatment options will be chosen based on our IPM policy (569 FW 1) and our Refuge System Biological Integrity Diversity and Environmental Health policy (601 FW 3), and will emphasize human safety and environmental integrity, effectiveness, and cost factors. We will use human, wildlife, or domestic animal mosquito-associated health threat determinations, combined with refuge mosquito population estimates, to determine the appropriate refuge mosquito management response. We will allow pesticide treatment to control mosquitoes on refuge lands only after evaluating all other reasonable IPM actions, based on monitoring data for the relevant mosquito life stage and only when necessary to protect human or wildlife health, when mosquitoes are detrimental to refuge management goals and objectives, and control does not interfere with achieving management goals and objectives. We will use current monitoring data for larval, pupal, and adult mosquitoes to determine the need for larvicides, pupacides, and adulticides, respectively. We will allow the use of adulticides only when there are no practical, effective alternatives to reduce a health threat during a declared public health emergency.

COMPATIBILITY DETERMINATION

USE:

Mosquito Monitoring and Control

REFUGE NAME:

Monomoy National Wildlife Refuge

DATE ESTABLISHED:

June 1, 1944

ESTABLISHING AND ACQUISITION AUTHORITY(IES):

Migratory Bird Conservation Act (16 U.S.C. § 715d) Public Law 91-504, 16 USC § 1132(c)

REFUGE PURPOSE(S):

…for use as an inviolate sanctuary, or for any other management purpose, for migratory birds… 16 U.S.C. § 715d (Migratory Bird Conservation Act)

…wilderness areas…shall be administered for the use and enjoyment of the American people in such a manner as will leave them unimpaired for future use and enjoyment as wilderness, and so as to provide for the protection of these areas, the preservation of their wilderness character, and for the gathering and dissemination of information regarding their use and enjoyment as wilderness. (PL 88-577 § 2(a), Wilderness Act; as referenced in P.L. 91-504 § 1(g), An Act to Designate Certain Lands as Wilderness)

NATIONAL WILDLIFE REFUGE SYSTEM MISSION:

The mission of the National Wildlife Refuge System (Refuge System) is to administer a national network of lands and waters for the conservation, management, and where appropriate, restoration of the fish, wildlife, and plant resources and their habitats within the United States for the benefit of present and future generations of Americans. (National Wildlife Refuge System Improvement Act of 1997 (Refuge Improvement Act), Public Law 105-57; 111 Stat. 1252).

DESCRIPTION OF USE:

(a) What is the use? Is the use a priority public use?
The use is mosquito management, which includes population monitoring and, if warranted, control. Mosquito and mosquito-borne disease management is not a priority public use of the Refuge System under the National Wildlife Refuge System Administration Act of 1966 (16 U.S.C. 668dd-668ee), as amended by the Refuge Improvement Act.

The Cape Cod Mosquito Control Project (CCMCP) will conduct mosquito population monitoring and control, following the protocols and best management practices identified in the Massachusetts Arbovirus Surveillance

and Response Plan (Massachusetts Department of Public Health 2012). The U.S. Fish and Wildlife Service (Service) recognizes that mosquitoes are a natural component of most wetland ecosystems but may also represent a threat to human, wildlife, or domestic animal health. Refuges are to collaborate with Federal, State, or local public health authorities and vector control agencies to identify refuge-specific health threat categories that represent increasing levels of health risks and are based on monitoring data. Refuges will not conduct mosquito monitoring or control, but may allow these activities under a special use permit (SUP).

(b) Where would the use be conducted?
Mosquito surveillance monitoring and control, if necessary, will be conducted in several small pools within a 5-acre salt marsh on the Morris Island portion of the Monomoy National Wildlife Refuge (Monomoy NWR). The refuge lies within the jurisdiction of the CCMCP, which has conducted mosquito control activities on Morris Island (both on and off-refuge) since the CCMCP was organized in 1930. The CCMCP controlled larval mosquitoes in these small pools from at least 1983 until August 2001, when the practice was suspended pending review of the Service's new compatibility process. In July 2003, the Service found mosquito surveillance and limited mosquito control to be compatible, and the CCMCP resumed surveillance and larvicidal mosquito control of select mosquito species.

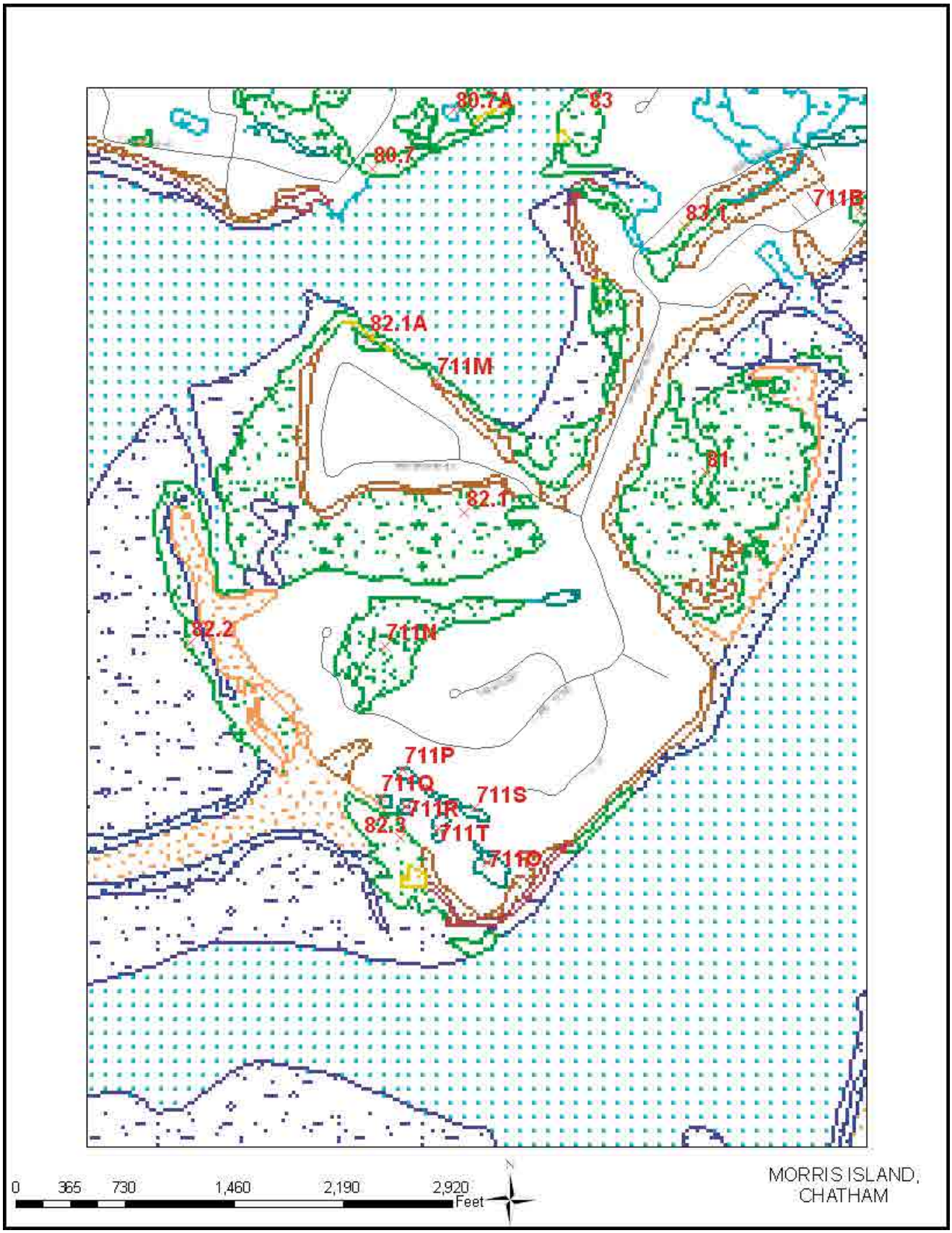
(c) When would the use be conducted?
Surveillance activities associated with this use would be conducted on the Morris Island portion of the refuge from April through October by CCMCP staff under the conditions of this compatibility determination and an SUP. Known sites of mosquito development on the refuge will be visited for monitoring and surveillance during periods of mosquito production. The timing and frequency of monitoring is based on a number of factors, including history of mosquito production, tidal cycles, precipitation levels, and available resources, but could occur as frequently as weekly throughout the season.

Mosquito control occurs irregularly when necessary to protect the health and safety of humans, wildlife, or domestic animals. Any mosquito control activities will be conducted on the basis of surveillance data. CCMCP treatment of refuge marshes using larvicides would occur only after the CCMCP has provided the refuge manager with data that shows that mosquito larvae populations are widespread within the salt marsh, and after monitoring indicates *O. cantator* and *O. sollicitans* larval counts exceed an average of 10 larvae per standard (350 ml) dipper. Other factors used to determine whether treatment would be allowed include marsh hydrology (drying versus flooding), rainfall, temperature, instar larval stages, and spray history.

Pupacides or adulticides will only be used when large numbers of mosquitoes are considered an immediate threat to human health and thresholds developed by the appropriate public health authority are met or exceeded, i.e., there is active transmission of mosquito-borne disease on the refuge from refuge-based mosquitoes.

(d) How would the use be conducted?
Mosquito-associated health threats will be addressed using an integrated pest management (IPM) approach including, when practical, compatible, non-pesticide actions that reduce mosquito production. We will choose treatment options based on our IPM policy (569 FW 1) and our Biological Integrity Diversity and Environmental Health (BIDEH) policy (601 FW 3). We will base the choice on, in order of preference: human safety and environmental integrity, effectiveness, and cost. We will use human, wildlife, or domestic animal mosquito-associated health threat determinations combined with refuge mosquito population estimates to determine the appropriate refuge mosquito management response. We will consider allowing pesticide treatment to control mosquitoes on refuge lands after we evaluate all other reasonable IPM actions. Based on monitoring data, we will determine the most appropriate pesticide treatment options for the relevant mosquito life stage. We will use current monitoring data for larval, pupal, and adult mosquitoes to determine the need for larvicides, pupacides, and adulticides, respectively. Mosquito and arbovirus surveillance, monitoring, and treatment within the refuge have historically focused on several small pools within the salt marsh along the northwest refuge boundary on Morris Island. This is shown as area 81 on map D.1. Treatment areas will be based on surveillance and monitoring results. Specific areas treated and the extent of treatment would vary from year to year depending on mosquito populations, the mosquito vector flight distance, and environmental conditions. We will allow the use of adulticides only when there are no practical, effective alternatives to reduce a health threat. We will not allow pesticide treatments for mosquito control on the refuge without current mosquito population data indicating that such actions are warranted. We require an approved pesticide use proposal (PUP) prior to an application of a pesticide on refuge lands.

Map D.1. Mosquito Harboring Locations on Morris Island and Vicinity, Chatham, Massachusetts



In Massachusetts, mosquito control activities and work are performed pursuant to the provisions of chapter 252 of the Massachusetts General Laws (*http://www.mass.gov/agr/mosquito;* accessed October 2015). The CCMCP, as one of the nine mosquito control projects authorized under chapter 252, monitors larval and adult mosquitos on the refuge *https://malegislature.gov/Laws/General Laws/Part111/TitleV/Chapter252 (*accessed October 2015) and adheres to the Massachusetts Arbovirus Surveillance and Response Plan (Massachusetts Department of Public Health 2012). Additionally, the CCMCP will conduct surveillance, monitoring, and if necessary, control measures under the conditions contained in an SUP that will be issued by the refuge manager.

Baseline mosquito management actions on Monomoy NWR will involve monitoring and surveillance of mosquito vector populations. Annual surveillance monitoring on refuge lands for arbovirus incidence in adult mosquito vectors and wildlife (especially birds) will be allowed. Mosquito vector monitoring on the refuge will document mosquito species composition to genus or species level, and estimate population size and distribution across refuge wetland habitats during the breeding season, using standard methods employed by mosquito control professionals.

Mosquito population monitoring objectives are to:

- Establish baseline data on species and abundance.
- Map breeding and harboring habitats.
- Estimate relative changes in population sizes and evaluate associated health risks.
- Use this information to guide integrated pest management of mosquito populations.

All sites identified as potential mosquito habitat have been logged and recorded in the CCMCP Geographic Information system (GIS) system. Throughout the mosquito season, CCMCP crews conduct larval surveys on two- week rotations. The CCMCP checks all sites known to harbor mosquitoes for mosquito larvae using a standard (350 ml) dipper, and may search for new larval habitats, i.e., artificial containers, on or adjacent to refuge lands. Carbon dioxide light traps are placed on the Morris Island portion of Monomoy NWR. When the traps are deployed, adult mosquitoes are collected from them weekly, taken back to the lab, identified to the species level, and counted. Landing rates of adult mosquitoes are also noted. Monitoring will be conducted by the CCMCP, primarily on foot. Use of motorized vehicles on refuge lands is not authorized unless escorted by refuge staff. To avoid harm to wildlife or habitats, access to traps and sampling stations will comply with the Stipulations Necessary to Ensure Compatibility included in this determination.

Refuge staff will work with the CCMCP to develop a mosquito management plan that will provide specifics on how and when the refuge will allow, if necessary, control of mosquitoes on refuge lands, using predetermined threat levels and mosquito vector population densities. A phased approach will be used to guide appropriate control response up to and including the use of adulticides. That will occur when Federal and State public health officials, using arbovirus monitoring and surveillance data, have determined that the refuge is in a high-risk area for mosquito-borne disease transmission, and it has been demonstrated through surveillance that refuge-based mosquitoes have been shown to carry specific diseases. A high-risk determination indicates an imminent risk of serious human disease or death.

Pesticide treatment may not be used on Monomoy NWR solely for nuisance mosquito relief, but may be considered when there is a demonstrated human or wildlife health risk and mosquito management actions will not interfere with refuge goals and objectives. Only pesticides identified in the SUP and for which a PUP has been submitted and approved will be used on the refuge. The preferred larvicide treatments for use on the refuge are *Bacillus thuringiensis israelensis* (Bti) or *Bacillus sphaericus* (Bs), because of the bacterium's limited non-target effects. Due to specificity of the effects of Bti on the insect order Diptera, Aquabac is deemed compatible for use, under the stipulations prescribed at the end of this compatibility determination. Bti is the preferred chemical control option and will be used under appropriate conditions before methoprene is considered. We favor using the larvicide that would have the least adverse impacts on non-target invertebrates, produce fewer disruptions to food webs critical for migratory birds, and reduce lethal effects on natural mosquito predators, such as larval forms of odonates, hemipterans, and coleopterans. CCMCP will conduct post-larvicide monitoring to determine effectiveness.

Treatment regimens will vary annually, depending on the current threat level; the process for determining the threat level will be clearly delineated in the Monomoy NWR Mosquito Management Plan. Because disease

threat levels vary from year to year, mosquito management on the refuge is unlikely to include all phases in any given year. Action thresholds that trigger chemical interventions will incorporate various factors listed in Service Policy 601 FW 7, Exhibit 3, as developed with refuge staff, State mosquito control section, public human health services, and vector control agencies. Thresholds must be genus and life-stage specific and be related to the refuge decision-making response matrix.

We will rarely allow CCMCP staff to undertake targeted larvicide applications (Aquabac granular Bti) to protect human safety if the mean number of *O. cantator* or *O. sollicitans* mosquito larvae is less than the threshold that is established in consultation with public human health personnel. At a minimum, the threshold will be 10/dip, with at least 10 dips taken on the same day within each source pool across the 5-acre site; this is subject to change depending on the results of future coordination with public health officials. Mosquito vector populations below this level will not be treated. The CCMCP will coordinate with the refuge manager prior to surveillance, monitoring, and control activities on the refuge.

Variations in annual permit restrictions may be necessary to accommodate wildlife breeding, roosting, and feeding activity, endangered species, administrative needs, public use management, research, or monitoring protocols. Other conflicts that may arise will be incorporated into the annual permit to ensure there are no significant adverse impacts on refuge wildlife and habitats. Because mosquito management takes place only on Morris Island, there is no need to develop restrictions or stipulations to protect wilderness character.

The CCMCP is required to provide the refuge manager with an annual quantitative summary of refuge mosquito monitoring and surveillance results, control activities on the refuge (e.g., type of pesticides applied, amount of pesticides applied, locations of application, method of application), and regional disease surveillance. All surveillance and control activities would be spatially referenced as technologies develop at CCMCP, e.g., use of global positioning satellites and GIS. Comparisons of mosquito management within and among years should be presented to permit analysis of patterns that may indicate success of habitat management efforts or suggest the need for a new management approach.

(e) Why is this use being proposed?
The use is proposed to minimize health risks to humans and wildlife from mosquito-borne disease. Two mosquito-borne viral diseases are currently endemic in Massachusetts: eastern equine encephalitis virus (EEEV) and West Nile virus (WNV). Mosquito population monitoring is necessary to detect changes that indicate increased human or wildlife health risks. In addition, surveillance for incidence of mosquito-borne disease by testing wildlife, especially birds, and adult mosquitoes for pathogens is needed to help characterize the level of health risk. There is a documented history of human WNV infections in Barnstable County and EEEV focused in eastern Massachusetts, just west of Cape Cod in Barnstable County, which warrant continuing to annually monitor mosquitoes for the foreseeable future. The goal of early mosquito larvae monitoring is rapidly detecting relative and absolute changes in population size that can indicate an increased short-term risk to human, wildlife, or domestic animal health.

CCMCP surveillance on Morris Island in Chatham since 1991, has documented the occurrence of several primary and bridge vector mosquito species associated with EEEV and WNV transmission to humans. Some of these mosquitoes are bridge vectors, meaning these species feed on birds and other animals, thereby enhancing the risk of disease transmission to people. The following table shows the presence of disease-carrying mosquitoes on the refuge. We have some historical records that show these species have been found on the refuge, with *Ochlerotatus sollicitans* and *Ochlerotatus cantator* being the most common.

Table D.3. Arbovirus Mosquito Vectors and Flight Ranges found on Monomoy NWR

Mosquito Vector	EEEV	WNV Vector	Number of years present out of 13 years for which we have data	Flight Range
Culiseta morsitans	Birds		1	
Coquillettidia perturbans	Bridge	Bridge	2	5 kilometer (km)
Ochlerotatus canadensis	Bridge	Bridge	5	2 km
Aedes vexans	Bridge	Bridge	1	>25 km

Mosquito Vector	EEEV	WNV Vector	Number of years present out of 13 years for which we have data	Flight Range
Culex pipiens	Bridge	Birds	4	2 km
Culex restuans	Bridge	Birds	1	2 km
Culex salinarius	Bridge	Bridge	2	10 km
Ochlerotatus excrusians			4	
Ochlerotatus sollicitans (Formerly Aedes sollicitans)	Bridge	Bridge	6	>25 km
Ochlerotatus cantator (Formerly Aedes contator)	Bridge	Bridge	6	>10 km
Ochlerotatus triseriatus	Bridge	Bridge	3	0.2 km

WNV was first detected in birds, mosquitoes, and humans in Barnstable County in 2003, and in mosquito pools in 2003 to 2006 (towns of Falmouth and Barnstable) and 2008 and 2009 (towns of Barnstable and Bourne). WNV was detected in dead birds (primarily corvids) in Barnstable County in 2005 (3 positive samples, including 1 from Harwich) and 2006 (9 positive samples, including 2 each from Dennis and Brewster) before testing of dead birds was discontinued in 2009. Two human WNV cases were documented in the Town of Barnstable, one case in 2003 and another in 2007. There have been no human WNV cases documented for Chatham or surrounding communities (Harwich, Dennis, Brewster, or Orleans), and WNV has not yet been detected from humans, dead birds, or mosquito pools in Chatham.

Periodic outbreaks of EEEV with an epicenter in southeastern Massachusetts just west of Cape Cod are also documented. The majority of human EEEV cases have occurred in Norfolk, Bristol, and Plymouth counties, although some cases are documented for Middlesex County, Essex County, and as far west as Worcester County. Although the historic EEEV epicenter lies just to the north and west, Cape Cod and the Islands (Martha's Vineyard and Nantucket) have no documented human EEEV cases or deaths. The first documented incidence of EEEV isolated from a Cape Cod mosquito pool was collected in Nickerson State Park in Brewster in August 2012.

Refuge pools on Morris Island are known to harbor the brown salt marsh mosquito *O. cantator* and the eastern salt marsh mosquito *O. sollicitans*, which are both bridge vectors for the transmission of both WNV and EEEV to humans. These pools have been treated in the past, although it appears the threshold for treatment can be raised given the low risk of disease occurrence on Cape Cod. According to Kilpatrick (2005), WNV transmission risk from *O. sollicitans* in Suffolk and Rockland counties, New York, was only 0.07 percent; 80 percent of the WNV transmission was from *Culex pipiens* and *Culex restuans*. *O. cantator* was not even identified as a risk species for WNV in these salt marshes. Despite the incidence and spread of WNV and EEEV in southeastern Massachusetts, and the potential for spread of other mosquito-borne diseases, portions of Monomoy NWR are still viewed as a low-remote potential mosquito-borne disease reservoir.

AVAILABILITY OF RESOURCES:

The CCMCP will conduct monitoring and control, coordinated with the refuge manager on an annual basis through the issuance of an SUP. Existing funds are available to support the refuge manager and other staff in coordinating this use (table D.4). As funding becomes available, refuge staff will take an active and, in most cases, a lead role in planning and implementing tidal circulation enhancement and wetland restoration projects aimed at improving wildlife habitat while reducing mosquito production (Adamowicz et al. 2004, James-Pirri et al. 2004) on non-wilderness portions of Monomoy NWR. Developing a mosquito management plan for the refuge will be a one-time effort that is likely to take 0.20 of a full-time employee (FTE). A notice of intent needs to be submitted to the Environmental Protection Agency (EPA) for the use of pesticides in the salt marsh, and it will be the responsibility of the CCMCP to draft a notice of intent and either acquire the permit, or provide all the information needed so the Service can obtain the permit. This will be listed as a condition for issuing an SUP for mosquito control.

Table D.4. Staffing needs to conduct use of Mosquito Management on Monomoy NWR

Position	Involvement	FTE	Cost
Refuge Manager	General oversight	0.02	$2,500
Wildlife Biologist	Field visits, mosquito management plan review and implementation; preparation of pesticide use proposal, SUP, and pesticide use report; oversight of mosquito-borne disease monitoring, vector control activities. Involvement in coordination and oversight of mosquito monitoring activities.	0.05	$3,375
Total FTE'S and Staffing Costs		0.07 FTE	$5,875

ANTICIPATED IMPACTS OF THE USE:

Direct impacts of monitoring and control include temporary disturbance to habitat and possible direct effects to non-target wildlife. Areas of vegetation may be crushed underfoot, with impacts ranging from temporary in nature to loss of habitat over time. Invasive weeds may be introduced or spread by foot. Indirect effects associated with mosquito control include reducing mosquito populations and other non-target species that serve as the base of food chains for wildlife species.

Impacts to birds as a result of physical access (trampling of vegetation, nests) for mosquito management could occur, but are unlikely, as these actions would not significantly affect bird populations of the refuge given the small size and limited bird habitat that the areas receiving mosquito management provide.

Chemical Treatment Effects on Target Mosquito Populations

The use of mosquito larvicides generally is considered preferable to the use of adulticides because larvicides prevent the appearance of the blood feeding adults; larvicides can provide up to a month of control, rather than the few hours provided by fogging with adulticides; the commonly used larvicides are less toxic than the adulticides and the application method greatly reduces human exposure; and larvicides generally are applied to smaller areas than are adulticides.

A natural soil bacterium, Bti, like other varieties of *Bacillus thuringiensis* (Bt), is a stomach poison that must be ingested by the larval form of the insect in order to be effective. Bti is an EPA toxicity class III general use pesticide and is practically non-toxic to animals (Extoxnet 1996). Bti is specific to certain primitive dipterans, especially mosquitoes, black flies, and some chironomid species (Boisvert and Boisvert 2000), and is not known to be directly toxic to non-dipteran insects; there are no toxic inert ingredients included in Bti products (Extoxnet 1996). Bti produces protein endotoxins, activated in the alkaline mid-gut of target insect species that bind to protein specific receptors of dipteran larvae species, resulting in mortality. Bti must be ingested by the target insect to be effective and is most effective on larval salt marsh mosquito instar stages 1 and 2; it is considerably less effective against instar stages 3 and 4; and has no effect on pupae or adult mosquitoes.

Methoprene is a contact insecticide that does not need to be ingested like Bti (Tomlin 1994); it ranks as a toxicity class IV, and is considered slightly to practically nontoxic (EPA 2001). Methoprene compounds like Altosid Liquid Concentrate and Altosid Single-Brood Granule all mimic the action of an insect growth hormone and interfere with the normal mosquito maturation process, acting as an insect growth regulator preventing mosquito larvae from pupating and reaching the adult stage.

Adulticides appear to effectively control adult mosquito populations and spread of mosquito-borne disease such as WNV (Carney et al. 2008), but only for a brief time, and are therefore only recommended during a disease event to break the disease transmission cycle. Adulticides kill only mosquitoes that contact insecticide droplets. The fog soon dissipates. Although the local mosquito population is reduced for a few days, fogging does not prevent mosquitoes from re-entering the sprayed area. Adulticides will be considered only in the case of a declared public health emergency. Focused timing and location of adulticide application to control mosquito disease vector source populations is essential for effectiveness (*http://wildpro.twycrosszoo.org/s/00man/WNVOverviews/wnvindtech/wnvcontrolaerialadulticides.htm;* accessed October 2015*).*

Only the pyrethroid adulticide sumithrin (Anvil 10+10) has seen recent use in Massachusetts, although Monomoy NWR was not included in that application. Neither Naled (organophosphate) nor Malathion (or any other oxon derivative) has been used for adult mosquito control at Monomoy NWR, nor do we expect they will be used.

The Ecotoxnet database (*http://extoxnet.orst.edu/;* accessed October 2015) includes the following summary of how pyrethroids act as insecticides.

"Human-made pyrethroids are based on natural pyrethrins in chrysanthemums, which is a neurotoxic chemical to insects. Pyrethroids act by inhibiting the nervous system of insects. This occurs at the sodium ion channels in the nerve cell membrane. Some type II pyrethroids also affect the action of a neurotransmitter called GABA. Pesticide products containing pyrethrins usually contain a synergist (such as piperonyl butoxide). Synergists work by restricting an enzyme that insects use to detoxify the pyrethrins. A synergist allows the insecticide to be more effective. These products are dissolved in petroleum-based products."

Pesticide Toxicity and Other Effects to Non-target Organisms

The few small refuge sites receiving pesticide application for the purpose of mosquito management typically provide limited habitat for native wildlife and plants. These areas are mostly shallow swales within the intertidal marsh plain (4 to 6 feet) that hold water for extended periods (e.g., following high tides); the area lacks tidal channels that permit drainage. These characteristics result in poor tidal hydrology and, in turn, lower biotic productivity for a variety of plant and wildlife species relative to other refuge areas with better tidal flushing (Adamowicz et al. 2004, James-Pirri et al. 2004). Bti (EPA 1998) and methoprene (EPA 2001) are non-toxic to vegetation.

Giving full consideration to the protection and integrity of non-target organisms and communities, the greatest concerns the Service has with chronic mosquito control chemical use are the subsequent degradation of biological integrity and diversity, and disruption of vital food webs. Aquatic invertebrates play important roles in wetland ecology. They aid in the breakdown of fresh and salt marsh-derived organic matter and provide important food resources for different life stages of fish, breeding and migrating birds, and other wildlife. As such, they are critically important and directly linked to the future conservation and management of refuge-specific resources of concern listed in Comprehensive Conservation Plan (CCP) goals and habitat objectives.

Impacts to birds, mammals, reptiles, or amphibian may occur as a result of ground access. However, bird and mammal impacts are considered limited because areas that need mosquito management are small in size, and provide only limited habitat. The use of pesticides for the purpose of mosquito management may directly or indirectly affect resident and migratory bird, mammal, reptile or amphibian populations of the Refuge. Direct effects may occur from direct contact with the pesticides. Indirect effects are related to the potential reduction in the invertebrate food supply. Pesticide effects on reptiles and amphibians may occur through reductions in insects that serve as a food source (Hoffman et al. 2008), through direct individual effects from pesticide application, or from trampling of individuals or habitat. Birds are often used as a surrogate for effects on reptiles, and fish as a surrogate for amphibians (Hoffman et al. 2008). Bti has practically no acute or chronic toxicity to mammals, birds, fish, or vascular plants (EPA 1998).

Migratory birds that depend on invertebrate food resources may not be mobile enough to seek alternative feeding sites, post-treatment, particularly during the breeding season. Precocial young seek food items on their own. Since they are flightless, food items must be available within a relatively small home area. Reduction of invertebrate food resources within even a small geographic area may be detrimental to breeding wetland birds and precocial young.

Altricial birds, those with young that are relatively helpless and restricted to a discrete nest site during the first few weeks of life, are solely dependent upon the parents for food. When invertebrate foods are scarce, parents may have to make more extended feeding forays and become less able to provide sufficient nutrition to all offspring potentially increasing chick mortality. Adults making extended flights into less familiar territory may be more likely to suffer predation or to experience inter- or intra-specific competition. Young subjected to extended periods at the nest without parental attention may be more likely to suffer predation or weather-related stress.

The use of larvicides and pupacides for the purpose of mosquito management is not likely to directly affect native mammal populations of the refuge. Adverse effects on mammals from Bti, methoprene, and Agnique (monomolecular film) are not expected when applied according to the label instructions. Extensive acute toxicity

studies indicated that Bti is virtually innocuous to mammals (Siegel and Shadduck 1992). These studies exposed a variety of mammalian species to Bti at moderate to high doses and no pathological symptoms, disease, or mortality were observed. Methoprene is not considered toxic to mammals. Impacts to the mammalian community as a result of reduced invertebrate populations are not expected because most mammal species that inhabit wetlands of the refuge are herbivorous and invertebrates are not a primary component of their diet. Insectivorous shrews experiencing reduced arthropod food availability may be reduced over the short-term post-treatment. Negative effects on fish populations are not expected from proposed larvicides and pupacides.

Using larvicides can adversely affect non-target insects, especially non-biting midges (Chironominae), and Bti concentration is important with regard to impacts on non-target organisms such as ecologically important non-biting midge larvae. Chironomid larvae are often the most abundant aquatic insects in freshwater, brackish and salt marsh wetland environments and represent a major component in food webs for many wetland-dependent wildlife species (Euliss et al. 1991, Helmers 1992, MacKenzie 2005, Miller 1987, Skagen and Oman 1996). Chironomids also frequently make up the largest proportion of wetland invertebrate biomass (Davis and Smith 1998, Eldridge 1992, MacKenzie 2005, Rehfisch 1994).

The effect on local populations of invertebrate species over time with periodic and continued use of Bti is unknown but potential for negative effects is a possibility. Host range and effect on non-target organisms indicates that Bti is relatively specific to the Nematocera suborder of Diptera, in particular filter-feeding mosquitoes (Culicidae) and blackflies (Simuliidae) (Glare and O'Callaghan 1998). Bti is pathogenic to some species of midges (Chironomidae) and Tipulidae, although to a lesser extent than to mosquitoes and biting flies; it is not reported to affect a large number of other invertebrate species (Glare and O'Callaghan 1998). Other factors, such as temperature, water depth, aquatic vegetation, and suspended organic matter, may act to reduce its toxicity to chironomids in the environment (Charbonneau et al. 1994, Merritt et al. 1989, Lacey and Merritt 2004). Negative impacts on chironomid density and biomass could have deleterious effects on wetland and wildlife food webs and could lower biodiversity. The effects of a single Bti application are difficult to predict because of documented differences in toxicity based on formulation, potency, application rate, and timing. Published studies (Hershey et al. 1998, Niemi et al. 1999) have examined the long-term, non-target effects of Bti. In Minnesota, 27 wetlands were sampled for macroinvertebrates over a 6-year period with no effects observed on the bird community (Niemi et al. 1999). In judging the potential for adverse ecological effects of Bti applications, one should consider the non-target aquatic organisms of concern that would be impacted from the potential loss of both mosquito and chironomid larvae.

Methoprene is considered practically non-toxic to birds (Extoxnet 1996, EPA 2001) at EPA-approved application rates. Methoprene products are more toxic than Bti products, killing a wider range of non-target larval insects. This makes methoprene more likely to cause disruptions to invertebrate food webs. Using short-term residual methoprene formulations and avoiding Briquets and other extended residual products would maintain concentrations at the low end, and mitigate any adverse impacts to non-targets in higher concentration scenarios. Altosid was found to have very little effect, if any, on 35 species of exposed non-target organisms, including earthworms, waterfleas, damselflies, snails, tadpoles, and mosquito fish when used at lower larviciding concentrations (Extoxnet 1996b). Some studies have suggested methoprene impacts other organisms that may form part of the food base for birds. McKenney and Celestial (1996) noted significant reductions in number of young produced in mysid shrimp at 2 ppb. Sub-lethal effects on the cladoceran, *Daphnia magna*, such as reduced fecundity, increased time to first brood, and reduced molt frequency, have also been observed at concentrations as low as 0.1 ppb (Olmstead and LeBlanc 2001).

As with Bti, concerns over methoprene use include potential negative impacts on chironomid larvae due to their importance in food webs. As with any pesticide, toxicity is a function of dose plus exposure. At mosquito control application rates, methoprene is present in the water at very low concentrations (4 to 10 ppb, initially). With regard to exposure, chironomid larvae occur primarily in the benthos, either within the sediments or within cases constructed of silk and detritus. Differences may exist with regard to exposure to methoprene between chironomid and mosquito larvae, as the latter occur primarily in the water column. The published literature on the effects of methoprene to chironomids is not as extensive as that for Bti. However, evidence is found for potential toxicity to chironomid and other aquatic invertebrates from methoprene treatments.

Methoprene is likely to be lethal to non-target terrestrial invertebrates, including pollinating species, in their larval stages if they come into direct contact with this chemical. Lepidopterans (butterflies and moths) may be highly susceptible. However, larval stages that develop in tree tissues or underground are unlikely to come in contact with methoprene. Methoprene and Bti both also have the potential to negatively affect the local chironomid (midge) population. The extent to which the use of Bti and methoprene will limit the food resources

for individual birds or local avian populations is unknown. Though often discounted as inefficient pollinators, some researchers have suggested that the efficiency of pollinating flies (dipterans), mosquitoes (dipterans) and midges can exceed that of bees (*http://eol.org/pages/421/entries/24921263/details#relevance_to_humans_and_ecosystems;* accessed October 2015). Further, dipterans appear to be crucial for the pollination of certain flowers in some habitats.

Monomolecular films are not known to cause direct chronic or acute toxicological effects to birds, but are potentially lethal to any aquatic insect that lives on the water surface or requires periodic contact with the air-water interface to obtain oxygen; this may result in a negative impact to the avian food base, e.g., Chironomid invertebrates (USFWS 2005). The film interferes with larval orientation at the air-water interface or increases wetting of tracheal structures, suffocating the organism. As the film spreads over the water surface, larvae tend to concentrate, which may increase mortality from crowding stress (Dale and Hulsman 1990).

Pyrethroid insecticides are subject for review as potential developmental neurotoxicants because of their mode of action on voltage-sensitive sodium channels (Lu et al. 2006). Permethrin, the most widely used pyrethroid insecticide, is suspected to be an endocrine-disrupting chemical and was classified as a potential carcinogen at high exposure levels (EPA 2006). Pyrethroids may also have a suppressive effect on the immune system and may cause lymph node and spleen damage. Pyrethroids are reported to degrade rapidly in the environment and to be broken down to nontoxic products. However, Tyler et al. (2000) and Hong Sun et al. (2007) argue that products of the metabolism of permethrin are potentially far more potent as endocrine disruptors than the parent compound because of their ability to interact with steroid hormone receptors. Pyrethrins have a slight toxicity to bird species (Extoxnet 1994, National Pesticide Information Center 1998,). Non-target effects to birds from pyrethrin application may also occur as a result of a reduced food base (e.g., Chironomid invertebrates) if non-target invertebrate populations are significantly reduced.

The application of adulticides has the potential to adversely affect fish and aquatic invertebrate populations. Pyrethrins are considered highly toxic to fish and invertebrates (EPA 2006).

Because pyrethrins are broad-spectrum insecticides, they are potentially lethal to most insects. All adulticides are very highly toxic to aquatic invertebrates in concentrations as low as one part per billion (Milam et al. 2000). Pyrethrins are known to cause acute toxicological effects to benthic invertebrates at rates used for mosquito abatement (EPA 2006). Because most adulticides can be applied over or near water when used for mosquito control, risks to aquatic invertebrates from direct deposition and runoff of the pesticides exist.

The pyrethroid insecticides are extremely toxic to fish, with 96-hour LC50 values generally below 10 ug/l. Corresponding LD50 values in mammals and birds are in the range of several hundred to several thousand mg/kg. Fish sensitivity to the pyrethroids may be explained by their relatively slow metabolism and elimination of these compounds. The half-lives for elimination of several pyrethroids by trout are all greater than 48 hours, while elimination half-lives for birds and mammals range from 6 to 12 hours. Generally, the lethality of pyrethroids to fish increases with increasing octanol/water partition coefficients. The pyrethroid resmethrin is slightly toxic to birds and highly toxic to fish and to bees. Its LD50 in California quail was greater than 2,000 mg/kg; the LC50 in mosquito fish is 0.007 ppm. The LC50 for resmethrin synergized with piperonyl butoxide in red swamp crawfish, *Procambarus clarkii*, is 0.00082 ppm. The LC50 in bluegill sunfish is 0.75 to 2.6 ug/l, and 0.28 to 2.4 ug/l in rainbow trout. DeMicco et al. (2010) found a dose-dependent increase in zebrafish embryo mortality and pericardial edema, which was consistent with mammalian studies that demonstrated slight teratogenesis at high doses. Resmethrin is highly toxic to bees, with an LD50 of 0.063 ug/bee. Adulticides (pyrethrins) may adversely affect amphibians such as tadpoles that occur within seasonal freshwater wetlands of the refuge (Gunasekara 2005).

De Guise et al. (2005) studied a die-off of lobsters following mosquito spraying with resmethrin; they found that adult lobsters are no more sensitive than other aquatic species to the lethal effects, but are very sensitive to immune and endocrine endpoints tested (sublethal effects). Modulation in immune functions could result in increased susceptibility to infectious agents, contributing to mass mortality with sufficient exposure. Weston et al. (2005) examined toxicity of run-off sediments to an amphipod *Hyalella azteca* in creeks draining a Roseville, California, single-family subdivision. Nearly all creek sediments collected caused toxicity in laboratory exposures, and about half the samples caused nearly complete mortality. The pyrethroid bifenthrin was implicated as the primary cause of the toxicity, with additional contributions to toxicity from the pyrethroids cyfluthrin and cypermethrin originating from residential (structural) pest control by professional applicators or homeowner use of insecticides, particularly lawn care products.

The small scale and low frequency in past use of adulticides suggests that any future adulticide use on the refuge is unlikely to cause significant adverse effects to fish and invertebrate populations. Application would only occur in swales and not to channels, sloughs, or other open water areas. Application would only occur during low tides to avoid potential impacts to fish that may move into the tidal marsh plain during higher high or extreme tides. Oral exposure of mammals to pyrethrins could occur through consumption of plants or plant parts that have been sprayed. A terrestrial exposure model showed no acute or chronic risks to mammal or bird species (EPA 2006).

The Service recognizes that spray drift could enter the refuge from neighboring (Morris or Stage Island, or mainland Chatham) communities. The refuge has no jurisdiction over mosquito control on lands outside the refuge boundary; therefore, no SUP is required for off-refuge mosquito management. Since the State employs best management practices and follows the EPA-approved label, the Service expects impacts to refuge resources to be minimal.

Refuge habitat management actions that increase BIDEH and avian diversity have the potential to provide a buffer against future disease outbreaks. Recent infectious disease models illustrate a suite of mechanisms that can lower incidence of disease in areas of higher disease host-diversity (defined as the dilution effect). These models are particularly applicable to human zoonoses, i.e., infectious diseases of wildlife or domestic animals that spill over into human populations (Keesing et al. 2006, Krasnov et al. 2007, Ostfeld and Keesing 2000a and 200b) such as avian influenza, anthrax, Lyme disease, and WNV.

Research conducted in the eastern U.S. in 2002 when the WNV outbreak was in full swing, found lower incidence of WNV in humans in areas with a diverse array of bird species (Swaddle and Calos 2008). This link between higher bird diversity and reduced human WNV infection is attributed to the fact that crows, jays, thrushes, and sparrows are competent (amplifying) hosts of the WNV, making them able to contract the disease and pass it on through a vector more efficiently. When bird diversity is low, competent host species tend to represent a higher proportion of the bird population, increasing the likelihood that a mosquito will encounter an infected bird and transmit the virus during its next bite. A diverse suite of bird species, with large numbers of incompetent hosts in the population, reduces the transmission rate to other birds or mammals, including humans. A similar study showed increased mammalian diversity decreased Lyme disease risk to humans (LoGiudice et al. 2003).

PUBLIC REVIEW AND COMMENT:

As part of the CCP process for the Monomoy NWR, a draft of this compatibility determination underwent a 180-day public comment period concurrent with the release of our draft CCP/Environmental Impact Statement (EIS). This final compatibility determination resulted from that public review and comment process. It underwent a further 37-day public review period concurrent with the release of the final CCP/EIS. No comments were received on the compatibility determination and it has remained unchanged.

DETERMINATION (CHECK ONE BELOW):

_____Use is not compatible.

__**X**__Use is compatible with the following stipulations.

STIPULATIONS NECESSARY TO ENSURE COMPATIBILITY:

The following stipulations are required to ensure compatibility:

- The CCMCP must apply for and receive an SUP annually from the refuge manager prior to conducting any mosquito and mosquito-borne disease surveillance and monitoring activities.
- The CCMCP will notify the refuge manager prior to monitoring and conducting disease surveillance. All personnel entering the wetlands will be oriented at the beginning of the surveillance period or escorted by refuge staff to avoid disturbance to endangered, threatened, or other sensitive species on the refuge.

- The CCMCP will be responsible for monitoring disease activity in reservoir hosts for pathogens or antibodies, and collecting adult mosquito samples in same-genus pools for virus or any other monitoring required to substantiate a high-risk disease situation on or near the refuge.
- The CCMCP will assume all monetary costs and perform all activities associated with mosquito monitoring, disease surveillance, and treatment. Service personnel may accompany CCMCP personnel to examine exact locations of heavy mosquito breeding problems to ascertain the presence of non-targets or mosquito predator species in these areas.
- Motorized access may only be used when escorted by refuge staff and no other practical means of conducting mosquito management exists.
- The CCMCP will limit the number of travel pathways used for mosquito management within the marsh.
- Caged sentinel chickens may not be used for reservoir host surveillance due to the risk of spreading disease to wild birds.
- The CCMCP will remove equipment and refuse resulting from operations on refuge lands daily, and will promptly repair all damage to government property that may result.
- All decisions for chemical interventions to control mosquitoes will be made by the refuge manager and will be based on meeting or exceeding predetermined mosquito abundance and disease thresholds.
- Current mosquito population data is necessary before mosquito larvicide treatments may be applied on the refuge.
- Only approved larvicides may be applied on refuge salt marshes within the prescribed area on Morris Island as identified in the SUP.
- The refuge manager will be contacted at least 24 hours in advance of each larvicidal application.
- The CCMCP must provide a copy of the Clean Water Act National Pollution Discharge Elimination System permit from the Environmental Protection Agency prior to conducting any chemical treatment.
- Application of chemical mosquito control measures will be conducted in accordance with approved PUPs.
- Insecticide applications will avoid areas known to contain butterfly and moth host-plants in order to conserve and protect rare or specialist insect pollinators and also ensure that adequately buffered habitat around host plants or refugia is available during and after insecticide spraying.
- Application of pesticides will be in discrete, mosquito-producing areas of the refuge and at the lowest possible dilution rate (ultra-low volume) required for effectiveness.
- The CCMCP will minimize the use of pesticides on refuge lands, and continually investigate formulations and compounds that are least damaging to fish and wildlife populations.
- The CCMCP must provide the refuge manager with monitoring and disease surveillance data demonstrating that action thresholds have been reached or exceeded before pupacides are applied. Refuge manager approval must be obtained prior to CCMCP staff elevating to the next action or response threshold.
- Only the refuge manager, in consultation with the CCMCP and public health officials, may authorize application of mosquito adulticide and only when there is evidence of refuge-based mosquitoes contributing to a declared public health emergency.
- Immediately after any pesticide application, the CCMCP will monitor mosquito vector populations to assess the effectiveness of all pesticide treatments.
- Treatment in populated areas off-refuge will be considered first.

- General mosquito control will not be allowed during high tide events in order to avoid impacts to tidal marsh species. Unless permitted by the refuge manager, pesticide application should not occur within 100 feet of natural sloughs and channels.
- A final report of all monitoring and control activities conducted on the refuge must be provided to the refuge manager before the end of the calendar year.
- The CCMCP will meet with the refuge manager during the first quarter of each calendar year as a condition of the SUP renewal for the upcoming year. Prior to that meeting, the CCMCP will review the previous year's pesticide proposals and submit to the refuge manager any changes in the pesticides or formulations of pesticides they expect to use in the upcoming year.
- No mosquito management will take place on North or South Monomoy Islands.

JUSTIFICATION:

Mosquitoes are a natural component of tidal wetlands but can pose a significant potential threat to human and wildlife health when refuge wetlands are within the known mosquito flight ranges of populated areas and refuge mosquitoes have been demonstrated to be infected with arboviruses. WNV and EEEV have been of particular concern across the United States and in the Cape Cod and Islands region. Mosquito species known as vectors of these diseases occur on the refuge.

The staff of Monomoy NWR and the CCMCP advocate an integrated approach to mosquito management that includes a range of tools to improve habitat conditions for estuarine wildlife while reducing threats to public health from mosquito species capable of transmitting disease to humans. With the continued existence of WNV and EEEV and the potential for spread of other mosquito-borne disease, pressure is increasing to manage mosquito populations that occur on lands of the Refuge System, especially in populated areas such as the Cape Cod and Islands region. Understanding the actual risk of refuge-based mosquitoes to the spread of WNV and EEEV is an important part of managing a mosquito control program on the refuge.

The use of larvicides and other pesticides, if necessary, will receive periodic compatibility review if future studies bring more information to light on the ecological impacts of mosquito control. In addition, new chemicals that may come to market in the future may be evaluated for potential use on Monomoy NWR.

The stipulations above address the Service's laws and Refuge System policies to maintain, enhance, and restore biological integrity, diversity, and environmental health, manage an IPM program, and protect the public from mosquito-borne health threats.

This activity will not materially interfere with or detract from the mission of the Refuge System or the purpose for which the refuge was established.

SIGNATURE:

Refuge Manager: Elizabeth A Herlevich (Signature) March 18, 2016 (Date)

CONCURRENCE:

Regional Chief: Scott B. Kahan (Signature) March 18, 2016 (Date)

MANDATORY 10 YEAR RE-EVALUATION DATE: March 18, 2026

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FWS Form 3-2319
02/06

FINDING OF APPROPRIATENESS OF A REFUGE USE

Refuge Name: Monomoy National Wildlife Refuge

Use: Motorized and Nonmotorized Boat Landing and Launching

This form is not required for wildlife-dependent recreational uses, take regulated by the State, or uses already described in a refuge CCP or step-down management plan approved after October 9, 1997.

Decision Criteria:	**YES**	**NO**
(a) Do we have jurisdiction over the use?	✔	
(b) Does the use comply with applicable laws and regulations (Federal, State, Tribal, and local)?	✔	
(c) Is the use consistent with applicable Executive orders and Department and Service policies?	✔	
(d) Is the use consistent with public safety?	✔	
(e) Is the use consistent with goals and objectives in an approved management plan or other document?	✔	
(f) Has an earlier documented analysis not denied the use or is this the first time the use has been proposed?	✔	
(g) Is the use manageable within available budget and staff?	✔	
(h) Will this be manageable in the future within existing resources?	✔	
(i) Does the use contribute to the public's understanding and appreciation of the refuge's natural or cultural resources, or is the use beneficial to the refuge's natural or cultural resources?	✔	
(j) Can the use be accommodated without impairing existing wildlife-dependent recreational uses or reducing the potential to provide quality (see section 1.6D, 603 FW 1, for description), compatible, wildlife-dependent recreation into the future?	✔	

Where we do not have jurisdiction over the use ["no" to (a)], there is no need to evaluate it further as we cannot control the use. Uses that are illegal, inconsistent with existing policy, or unsafe ["no" to (b), (c), or (d)] may not be found appropriate. If the answer is "no" to any of the other questions above, we will **generally** not allow the use.

If indicated, the refuge manager has consulted with State fish and wildlife agencies. Yes ✔ No _____.

When the refuge manager finds the use appropriate based on sound professional judgment, the refuge manager must justify the use in writing on an attached sheet and obtain the refuge supervisor's concurrence.

Based on an overall assessment of these factors, my summary conclusion is that the proposed use is:

Not Appropriate _____ **Appropriate** ✔

Refuge Manager: Elizabeth A Harland Date: March 18, 2016

If found to be **Not Appropriate**, the refuge supervisor does not need to sign concurrence if the use is a new use.

If an existing use is found **Not Appropriate** outside the CCP process, the refuge supervisor must sign concurrence.

If found to be **Appropriate**, the refuge supervisor must sign concurrence:

Refuge Supervisor: Graham A Taylor Date: March 18, 2016

A compatibility determination is required before the use may be allowed.

603 FW 1
Exhibit 1
Page 2

JUSTIFICATION FOR A FINDING OF APPROPRIATENESS OF A REFUGE USE

Refuge Name: Monomoy National Wildlife Refuge

Use: Motorized and Nonmotorized Boat Landing and Launching

NARRATIVE:

The U.S. Fish and Wildlife Service (Service) policy on Appropriate Refuge Uses (603 FW 1) states, "General public uses that are not wildlife-dependent recreational uses, as defined by the National Wildlife Refuge System Improvement Act and do not contribute to the fulfillment of refuge purposes or goals or objectives as described in current refuge management plans are the lowest priorities for refuge managers to consider. These uses are likely to divert refuge management resources from priority general public uses or away from our responsibilities to protect and manage fish, wildlife, and plants, and their habitats. Therefore, both law and policy have a general presumption against allowing such uses within the National Wildlife Refuge System."

Access to the Monomoy Islands is restricted to boat. Allowing the landing of motorized boats and the landing and launching of nonmotorized personal boats such as paddleboards, canoes or kayaks provides a safe means for visitors to access and explore Monomoy National Wildlife Refuge (NWR) beyond the Morris Island portion of the refuge. This access allows visitors to take part in priority wildlife-dependent recreation on the refuge, including wildlife observation, wildlife photography, and recreational fishing. Motorized and nonmotorized boat use will not interfere with the Service's work to protect and conserve natural resources. Motorized boats must land in designated areas to minimize potential impacts to wildlife. The level of use for these activities on the refuge is moderate, and the associated disturbance to wildlife is temporary and minor. Although motorized and nonmotorized boat uses are not priority public uses, they are not detrimental activities under the conditions described above. Access for waterfowl hunting, fishing, wildlife observation and photography, and environmental education and interpretation, which are priority uses, allows visitors to enjoy the outdoors and wild lands. Boating on Monomoy NWR will not materially interfere with or detract from the mission of the National Wildlife Refuge System or the purposes for which the refuge was established.

Nearly half (47 percent) of the refuge and most (86 percent) of land above mean low water is congressionally-designated wilderness, including much of the intertidal lands and waters of the refuge. Motor boats are not generally allowed in wilderness. However, Public Law 91-504, which established the Monomoy Wilderness, referenced the original Wilderness Act designation, thereby providing an exception to this prohibition, as the use of motorboats at Monomoy NWR had already been established and was deemed desirable.

For these reasons, the landing of motorized boats and the landing and launching of paddleboards, canoes or kayaks on Monomoy NWR is appropriate.

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COMPATIBILITY DETERMINATION

USE:

Motorized and Nonmotorized Boat Landing and Launching

REFUGE NAME:

Monomoy National Wildlife Refuge

DATE ESTABLISHED:

June 1, 1944

ESTABLISHING AND ACQUISITION AUTHORITY(IES):

Migratory Bird Conservation Act (16 U.S.C. § 715d) Public Law 91-504, 16 USC § 1132(c)

REFUGE PURPOSE(S):

"…for use as an inviolate sanctuary, or for any other management purpose, for migratory birds." (16 U.S.C. § 715d).

"…wilderness areas…shall be administered for the use and enjoyment of the American people in such a manner as will leave them unimpaired for future use and enjoyment as wilderness, and so as to provide for the protection of these areas, the preservation of their wilderness character, and for the gathering and dissemination of information regarding their use and enjoyment as wilderness. (PL 88-577 § 2(a), Wilderness Act; as referenced in P.L. 91-504 § 1(g), An Act to Designate Certain Lands as Wilderness).

NATIONAL WILDLIFE REFUGE SYSTEM MISSION:

To administer a national network of lands and waters for the conservation, management, and where appropriate, restoration of the fish, wildlife, and plant resources and their habitats within the United States for the benefit of present and future generations of Americans.

DESCRIPTION OF USE:

(a) What is the use? Is the use a priority public use?
The use is the landing of motorized boats and the landing and launching of non-motorized boats on Monomoy National Wildlife Refuge (NWR). The majority of the boats will be privately owned motorboats, commercial ferries, paddleboards, canoes, and kayaks. The use is not a priority public use of the National Wildlife Refuge System (Refuge System) under the National Wildlife Refuge System Administration Act of 1966 (16 U.S.C. § 668dd-668ee), as amended by the National Wildlife Refuge System Improvement Act of 1997 (Public Law

105-57). However, it does facilitate the priority public uses of wildlife observation, wildlife photography, environmental education, interpretation, waterfowl hunting, and fishing by allowing visitors to access the Monomoy Islands.

(b) Where would the use be conducted?
Motorized boat access is allowed in designated landing sites on North and South Monomoy Islands, and non-motorized boats are allowed to access any part of the refuge beach that is open to the public on both Monomoy Island and Morris Island. Public access is dictated by wildlife use. In general, much of the intertidal area is open to pedestrian traffic for most of the year. Some areas of beach are closed seasonally to protect nesting shorebirds and seabirds, and some intertidal areas are closed for loafing seals. Visitors should contact Monomoy NWR staff for up-to-date information on seasonal closures, or visit the refuge web site.

(c) When would the use be conducted?
Monomoy NWR is open to the public from 1/2-hour before sunrise to 1/2-hour after sunset. Surf fishing is permitted on Morris Island 24 hours a day; this is the only activity allowed at night on Monomoy NWR. Motorized and nonmotorized boat use would be allowed during regular refuge hours unless an individual is surf fishing.

(d) How would the use be conducted?
Motorized and nonmotorized boating will be allowed as a means to facilitate refuge public use programs, namely the priority public use programs of waterfowl hunting, fishing, wildlife observation and photography, and environmental education and interpretation. The use would be conducted in a manner consistent with refuge and State regulations, with some additional restrictions to protect fish, wildlife, and habitat. Visitors can access Monomoy Island using motorboats; however, the refuge does not provide boat trailer access. Visitors can launch nonmotorized boats in areas where the beach is open to public use. Additional opportunities to launch motorized and nonmotorized boats exist on nearby non-refuge lands.

(e) Why is this use being proposed?
Waterfowl hunting, fishing, wildlife observation and photography, and environmental education and interpretation are the six priority public uses of the Refuge System. Where these uses are determined to be compatible, they are to receive enhanced consideration over other uses. Motorized and nonmotorized boating provides a means to facilitate the priority public uses. By allowing these uses, we are providing opportunities to visitors to access most of the Monomoy Islands and facilitating refuge programs that offer high-quality, wildlife-dependent recreation and maintain the current level of fish and wildlife values.

AVAILABILITY OF RESOURCES:

This use requires that staff provide information to visitors and conduct periodic law enforcement patrols, particularly to ensure that boaters stay out of closed areas. Costs are outlined below:

GS-9 Law Enforcement Officer—3 weeks	$5,400
Sign posting and maintenance	$2,000
Total annual costs	**$7,400**

ANTICIPATED IMPACTS OF THE USE:

Allowing motorized and nonmotorized access to the refuge will result in some impacts from visitors. The approach of motorized boats to pick up and discharge passengers creates a temporary disturbance to migratory birds feeding or resting on the beach nearby. However, motorized boat landing sites are located outside areas used heavily by nesting, feeding, and roosting terns, shorebirds, and colonial waterbirds. Any energy expended by migratory birds to avoid disturbance associated with beaching a boat and loading and unloading passengers is negligible.

North and South Monomoy Islands make up the Monomoy Wilderness Area. The untrammeled environment and solitude of the Monomoy Wilderness Area, accessible by boat only, make it unique among wildland areas on Cape Cod. Motorized boating, not generally allowed in wilderness areas, is permitted at Monomoy NWR due to a provision in the National Wilderness Preservation Act and the legislation designating Monomoy Wilderness. That said, Monomoy NWR has an unusually low absorption capacity for human impacts. Lack of topographic relief and low vegetation mean that other people are often visible from a long distance. Providing visitors with a convenient way to get out to the islands will result in a diminished degree of solitude, but impacts to the wilderness character of the area will be temporary.

Access to the refuge beach and boat landing sites for the purpose of landing nonmotorized boats poses minimal impacts to plant and wildlife species. Access for paddleboarding, canoeing and kayaking is typically by individuals or small groups. While kayakers and people using stand up paddle boards can also go in shallow water, they are usually moving at a slower rate and have a much lower profile to birds on the shore. Based on biological data, conservation management plans, unreasonable harassment of wildlife, or destruction of the habitat, the refuge manager may restrict the use or close some beaches and other areas from this and other public use, if it is determined that they could have negative impacts on the resources and bird-nesting activities.

Damage to habitat by walking or dragging a paddleboard, canoe or kayak to and from the launch sites is minimal and temporary. At current levels of use, we do not expect increased from boating activities. Several enforcement issues may result from the use, including trampling vegetation, trespass into closed areas, illegal taking of fish (undersized, over limit), illegal fires, and disorderly conduct.

Popular boating seasons coincide in part with spring-early summer nesting and brood-rearing periods for many species of migratory birds. Boaters may disturb nesting birds by approaching nests too closely, causing nesting birds to flush. Flushing may expose eggs to predation or cooling, resulting in egg mortality. Both adult and flightless young birds may be injured or killed if run over by speeding boats. Some disturbance of roosting and feeding shorebirds probably occurs (Burger 1981), but will be minimized if closed areas are respected. We will continue to close refuge areas seasonally to boating around sensitive nest sites, in conjunction with our conservation partners. We will also continue our public outreach and placement of warning signs.

Pedestrian travel has the potential of impacting shorebird, waterfowl, and other migratory bird populations feeding and resting near the trails and on beaches during certain times of the year. Conflicts arise when migratory birds and humans are present in the same areas (Boyle and Samson 1985). Response of wildlife to human activities includes departure from site (Owen 1973, Burger 1981, Kaiser and Fritzell 1984, Korschgen et al. 1985, Henson and Grant 1991, Kahl 1991, Klein 1993), use of sub-optimal habitat (Erwin 1980, Williams and Forbes 1980), altered behavior (Burger 1981, Korschgen et al. 1985, Morton et al. 1989, Ward and Stehn 1989, Havera et al. 1992, Klein 1993), and increased energy expenditure (Morton et al. 1989, Bélanger and Bédard 1990).

Numerous studies have documented that migratory birds are disturbed by human activity on beaches. Erwin (1989) documented disturbance of common terns and skimmers and recommended that human activity be restricted to a distance of 100 meters around nesting sites. Klein (1993) in studying waterbird response to human disturbance found that, as intensity of disturbance increased, avoidance response by the birds increased, and found that out-of-vehicle activity to be more disruptive than vehicular traffic. Pfister et al. (1992) found that the impact of disturbance was greater on species using the heavily disturbed front side of the beach, with the abundance of the impacted species being reduced by as much as 50 percent. In studying the effects of recreational use of shorelines on nesting birds, Robertson et al. (1980) discovered that disturbance negatively impacted species composition. Piping plovers, which intensively use the refuge, are also impacted negatively by human activity. Pedestrians on beaches may crush eggs (Jenkins and Burger 1987, Hill 1988, Shaffer and Laporte 1992, Cape Cod National Seashore 1993, Collazo et al. 1994). Dogs may chase plovers (McConnaughey et al. 1990), destroy nests (Hoopes 1993), and kill chicks (Cairns and McLaren 1980). Other studies have shown that if pedestrians cause incubating plovers to leave their nest, the eggs can overheat (Bergstrom 1991) or can cool to the point of embryo death (Welty 1982). Pedestrians have been found to displace unfledged chicks (Strauss 1990, Burger 1991, Hoopes 1993, Loegering 1992, Goldin 1993).

Several studies have examined the effects of recreation on birds using shallow water habitats adjacent to trails and roads through wildlife refuges and coastal habitats in the eastern United States (Burger 1981; Burger 1986; Klein 1993; Burger et al. 1995; Klein et al. 1995; Rodgers and Smith 1995, 1997; Burger and Gochfeld 1998). Overall, the existing research clearly demonstrates that disturbance from recreation activities always have at least temporary effects on the behavior and movement of birds within a habitat or localized area (Burger 1981, 1986; Klein 1993; Burger et al. 1995; Klein et al. 1995; Rodgers and Smith 1997; Burger and Gochfeld 1998). The findings that were reported in these studies are summarized as follows in terms of visitor activity and avian response to disturbance.

Presence: Birds avoided places where people were present and when visitor activity was high (Burger 1981; Klein et al. 1995; Burger and Gochfeld 1998).

Distance: Disturbance increased with decreased distance between visitors and birds (Burger 1986), though exact measurements were not reported.

Approach Angle: Visitors directly approaching birds on foot caused more disturbance than visitors driving by in vehicles, stopping vehicles near birds, and stopping vehicles and getting out without approaching birds (Klein 1993). Direct approaches may also cause greater disturbance than tangential approaches to birds (Burger and Gochfeld 1981; Burger et al. 1995; Knight and Cole 1995; Rodgers and Smith 1995, 1997).

Noise: Noise caused by visitors resulted in increased levels of disturbance (Burger 1986; Klein 1993; Burger and Gochfeld 1998), though noise was not correlated with visitor group size (Burger and Gochfeld 1998).

As detailed above, the proposed use has the potential of intermittently interrupting the feeding habits of a variety of shorebirds, gulls, and terns, but encounters between pedestrians and migratory birds will be temporary. Refuge staff will manage access via seasonal closures to minimize disturbance to nesting, resting, and foraging waterbirds on the refuge.

Visitors accessing South Monomoy Island could potentially impact the larval stage of the threatened northeastern beach tiger beetle. The recovery plan for this species describes that many of the species' habitats are threatened by human impacts such as habitat alteration and recreational activities (U.S. Fish and Wildlife Service 1994 (Service)). Larval burrows are especially susceptible to trampling, which results in excess energy expenditure and reduced time hunting for the inhabiting individual. We will continue to survey to determine the location and extent of larval beetle occurrence and habitat, and use closures and re-routing to avoid larval habitats, as warranted.

Visitor use also has the potential to disturb loafing seals. Gray and harbor seals haul out on the refuge year-round. We will enforce a 150-foot buffer around all seals as required by the National Oceanic Atmospheric Administration to ensure compliance with the Marine Mammals Protection Act.

Trash left on the beach, particularly food or wrappers, can attract predators that prey on nesting piping plovers and least terns or roosting shorebirds. Litter also impacts the visual experience of visitors (Marion and Lime 1986). Refuge policy advocates leave-no-trace and wilderness stewardship. Impacts are likely to be minimal if conducted in accordance with refuge regulations. However, the amount of trash that is likely to be left by refuge visitors pales in comparison to the flotsam and jetsom that washes up onto the beaches.

Motorized boats generally anchor in the subtidal waters outside the Monomoy Wilderness. Motorized boats travelling offshore the Monomoy NWR impact the sense of quiet and solitude that visitors in the wilderness area seek; however, boaters coming to the refuge only temporarily impact quiet as they approach the island at slow boat speeds in order avoid running aground. Paddlers/kayakers do not produce noise and therefore have little impact on the wilderness area.

PUBLIC REVIEW AND COMMENT:

As part of the comprehensive conservation planning (CCP) process for the Monomoy NWR, a draft of this compatibility determination underwent a 180-day public comment period concurrent with the release of our draft CCP/Environmental Impact Statement (EIS). This final compatibility determination resulted from that public review and comment process. It underwent a further 37-day public review period concurrent with the release of the final CCP/EIS. No comments on the compatibility determination were received and it has remained unchanged.

DETERMINATION (CHECK ONE BELOW):

_____Use is not compatible.

__X__ Use is compatible with the following stipulations.

STIPULATIONS NECESSARY TO ENSURE COMPATIBILITY:

Landing and launching of motorized boats will only be allowed in designated areas of the Monomoy Islands. Nonmotorized boats will be allowed on sections of the beach that are open for public use. There are certain times of the year when the refuge is critically important to migratory birds, including threatened and endangered species. The location of the most important nesting, staging and migratory stopover (foraging and resting) habitat varies depending on a number of natural factors (e.g., weather, landform, prey distribution and abundance, and predator presence) as well as human disturbance at other sites. Refuge staff will evaluate the disturbance pressure to migratory birds caused by the presence of individuals engaged in this use. To ensure that this use remains compatible, meaning it does not materially interfere with or detract from the migratory bird purpose of the refuge, it may be necessary to restrict access through the implementation of seasonal and/or area closures. The location and size of these closures are not fixed and will vary over time. Visitors will be expected to comply with closures. Updates on closures will be available at the Headquarters and on the refuge web site.

- Harassment of wildlife and excessive damage to vegetation is prohibited.
- No boats, paddleboards, canoes or kayaks, or related equipment may be left overnight on the refuge unless the owner is surf fishing, which is the only authorized nighttime use.
- Providing outfitting or commercial services for motorized and nonmotorized boating on the refuge requires an special use permit issued by the refuge (see Commercial Tours and Services compatibility determination).
- Periodic evaluations will be done to insure that visitors are not causing unacceptable adverse impacts. Areas open to these uses will be evaluated on an annual basis, depending on geomorphology and wildlife use.
- The refuge is a leave-no-trace, carry-in-carry out facility. All food containers, bottles, and other waste and refuse must be taken out. Littering, dumping, and abandoning property are prohibited by Federal regulation at 50 CFR 27.93 and 50 CFR 27.94.

JUSTIFICATION:

Access to Monomoy Island is restricted to boat. Allowing the landing of motorized watercraft and the landing and launching of nonmotorized personal watercraft provides visitors with a safe alternative to access and explore Monomoy NWR beyond the mainland portion of the refuge. This access allows visitors to take part in priority wildlife-dependent recreation on the refuge, including wildlife observation, wildlife photography, and recreational fishing. Motorized and nonmotorized boat use will not interfere with the Service's work to protect and conserve natural resources. Motorized boats must land in designated areas to minimize potential impacts to wildlife. The level of use for these activities on the refuge is moderate, and the associated disturbance to wildlife is temporary and minor. Although motorized and nonmotorized boat uses are not priority public uses, under the conditions described above, they are not detrimental activities. Access for waterfowl hunting, fishing, wildlife observation and photography, and environmental education and interpretation, which are priority uses, allows visitors to enjoy the outdoors and wild lands. Boating on Monomoy NWR will not materially interfere with or detract from the mission of the Refuge System or the purposes for which the refuge was established.

SIGNATURE:

Refuge Manager: Elizabeth Gifford (Signature) March 18, 2016 (Date)

CONCURRENCE:

Regional Chief: Scott B. Kahan (Signature) March 18, 2016 (Date)

MANDATORY 10 YEAR RE-EVALUATION DATE: March 18, 2026

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COMPATIBILITY DETERMINATION

USE:

Nonmechanized Harvesting of Subterranean Shellfish (softshell clams, razor clams, sea (surf) clams, and quahogs) Without the Aid of Artificial Extraction Methods

REFUGE NAME:

Monomoy National Wildlife Refuge

DATE ESTABLISHED:

June 1, 1944

ESTABLISHING AND ACQUISITION AUTHORITY(IES):

Migratory Bird Conservation Act (16 U.S.C. § 715d) Public Law 91-504, 16 USC § 1132(c)

REFUGE PURPOSE(S):

…for use as an inviolate sanctuary, or for any other management purpose, for migratory birds… 16 U.S.C. § 715d (Migratory Bird Conservation Act)

…wilderness areas…shall be administered for the use and enjoyment of the American people in such manner as will leave them unimpaired for future use and enjoyment as wilderness, and so as to provide for the protection of these areas, the preservation of their wilderness character, and for the gathering and dissemination of information regarding their use and enjoyment as wilderness. (PL 88-577 § 2(a), Wilderness Act; as referenced in P.L. 91-504 § 1(g), An Act to Designate Certain Lands as Wilderness)

NATIONAL WILDLIFE REFUGE SYSTEM MISSION:

The mission of the National Wildlife Refuge System (Refuge System) is to administer a national network of lands and waters for the conservation, management, and where appropriate, restoration of the fish, wildlife, and plant resources and their habitats within the United States for the benefit of present and future generations of Americans (Publ. L. 105-57; 111 Stat. 1252).

DESCRIPTION OF USE:

(a) What is the use? Is the use a priority public use?
This compatibility determination is for nonmechanized harvesting of subterranean shellfish above the mean low water (MLW) line and is limited to softshell clams, razor clams, sea (surf) clams and quahogs. These are the only shellfish species we allow to be harvested on refuge tidal flats above the MLW line. Use of mechanized harvest equipment and artificial extraction methods such as salt or chlorine are not allowed. This compatibility determination does not include other shellfish species, such as mussels or scallops (which are addressed separately), and does not include eels or marine worms that are defined as shellfish by the town of Chatham (Town). All clammers operating on the refuge must comply with the town shellfish regulations and additionally with other requirements that may be instituted by the U.S. Fish and Wildlife Service (Service).

Recreational fishing is a priority public use of the Refuge System under the National Wildlife Refuge System Administration Act of 1966 (16 U.S.C. § 668dd-668ee), as amended by the National Wildlife Refuge System Improvement Act of 1997 (Refuge Improvement Act) (Public Law 105-57). Shellfishing is a type of fishing and, therefore, a wildlife-dependent public use; however, we also consider it a refuge economic use, as per §50 CFR 25.12 and §50 CFR 29.1, which must contribute to the achievement of refuge purposes or the Refuge System mission.

A person with a rake and a basket collecting clams has no different impact on the landscape if he or she eats them, or if they sell the clams they harvest, and the Service has no effective means of ensuring that clams collected are never sold.

(b) Where would the use be conducted?
The majority of shellfish harvesting in recent years (10+ years) on the refuge has occurred in intertidal habitat above mean low water primarily on the western side of North Monomoy Island, especially the southern end, the northern end of South Monomoy Island, and the eastern side of Minimoy. It also very occasionally occurs in extreme shallow subtidal areas adjacent to intertidal habitat. Shellfish harvest also occurs intermittently within the Powder Hole area in the southwest portion of South Monomoy Island. This use can occur in any intertidal area of the refuge that supports harvestable populations of these shellfish species. Sea (surf) clams, although primarily found in subtidal areas, can occasionally be found on tidal flats (Dr. Robert Duncanson, May 4, 2015 correspondence) in Chatham, and presumably the refuge. There is currently occasional harvest of sea clams in non-refuge waters that can be harvested by hand tools. Area closures may occur at any time on Monomoy National Wildlife Refuge (NWR) based on the need to protect sensitive habitats or species of conservation concern. When these conditions exist, the refuge manager is responsible for ensuring these areas are closed to all public access, including shellfish harvesters. Harvest areas may also be closed to harvest, typically seasonally due to bacterial contamination, by action of the Town. The necessity of these seasonal closures depends largely on the foraging quality of the intertidal flats, which is primarily determined by the natural forces of wind, tides, sediment transport patterns, erosion, and accretion. Areas that are open to this use will be evaluated on an annual, seasonal, and sometimes daily basis and will be influenced by beach geomorphology and wildlife use. Seasonal closures will vary year to year based on wildlife use and habitat conditions. Visitors will be expected to comply with closures. Updates on closures will be available at the Headquarters and on the refuge web site.

(c) When would the use be conducted?
Shellfish harvesting takes place during daylight hours year-round, from 1/2-hour before sunrise to 1/2-hour after sunset, with the number of harvesters peaking during the summer tourism months. Additionally, the Town prohibits any harvesting on dry ground or on shoal areas that may become dry on any days when the air temperature is below 30 degrees or does not reach 30 degrees by 11:00 a.m. (*http://www/chatham-ma.gov/public_documents/ChathamMa_shellfish/shellfishregulations120811.pdf*). Harvesters typically arrive around mid-tide on the falling tide (about 3 hours after high tide), and stay on the exposed flat for approximately 6 hours, until the midpoint of the incoming tide (about 3 hours after low tide) when their boats refloat. Arrival and departure times change approximately one hour daily, reflecting the normal daily change in tidal cycle range.

(d) How would the use be conducted?
Shellfish harvesters typically depart for the shellfish flats on and around Monomoy NWR by boat from one or more off-refuge locations such as Outermost Harbor, Stage Harbor, Chatham Harbor, or Harwichport. Shellfish harvesters at the refuge usually land their boats as near to harvest areas as possible, anchor the boat, and let it ground out with the falling tide. Softshell clam harvesters in coastal New England and on Cape Cod typically use short handled rakes and spend most of their time bent over at the waist or on hands and knees harvesting patches of shellfish. They generally traverse the exposed mudflats only to move among patches of shellfish (Burger 1981, Leavitt and Fraser 2004). Harvesters can turn over approximately 40 m^2 of sediment in a low tide event (Leavitt and Fraser 2004). Quahog harvesters similarly move at a slow pace and generally work in localized patches, but in contrast to softshell clam harvesters, they are usually standing upright and scraping the sediment surface with a long-handled rake. Quahog harvesters generally harvest in water, but in some intertidal areas of Monomoy NWR, quahog populations have established and can be harvested when the intertidal areas are exposed at lower tides.

Hand harvest methods are defined in the Town Shellfish Rules and Regulations §306 (Shellfishing Devices) as those commonly known as the long-rake, scratcher, tong, or clam-hoe. Use of shovels, pitchforks, garden spades, etc., is prohibited. Use of basket rakes attached to a T-handle is also prohibited by town regulation in any

areas that become dry at any time during the tidal cycle, e.g., intertidal or supra-tidal areas. The Service does not allow salting to assist in the of harvest clams on the refuge tidal flats. Town regulations allow salting for razor clams and sea (surf) clams "…provided there are no other species (such as soft-shelled clams or quahogs) within the inter-tidal zone of a given area. Areas of mixed species will be assessed and determined in the sole and unfettered discretion of the Shellfish Constable." Krzyzewski and Chery (2005) studying salting for razor clams in Pleasant Bay, noted that Pleasant Bay harvesters typically used a salt solution of 100-200 ppt. There is no regulation on the exact salt concentration that can be used in Chatham. We do not know if Krzyzewski and Chery (2005) accurately describes methods used by Chatham harvesters. Use of hydraulic pumping or other mechanized or motorized harvest methods, formerly permitted in subtidal areas within the Powder Hole area, was prohibited by town regulation in 2011 at the request of the Service. Use of a hand operated plunger is still permitted within the Powder Hole area under town regulations.

Town regulations require all harvesters to obtain and have a shellfish permit in their possession while harvesting shellfish. Additionally, all shellfish harvesters must comply with all refuge regulations and with State and Federal guidelines for terns, piping plover, red knots, marine mammal, and coastal dune protection. Harvesters are expected to stay apprised of and respect all closures and regulations. Information on annual, seasonal, and daily closures, known hazards, and other regulations is disseminated from refuge headquarters, and closures are marked with informational signs or symbolic fencing.

Take limits are set by the town which also provides oversight to ensure that clam populations are maintained. If the Service believes clams are being overharvested or the harvest of clams appears to be impacting refuge wildlife populations, the Service will collaborate with the Commonwealth, the town, or through refuge regulations to lower harvest levels or modify permitted harvest methods on the refuge.

(e) Why is this use being proposed?
Shellfish harvest from intertidal areas for human consumption using simple hand methods has been practiced continuously since the earliest known human occupation of the area, and remains an important part of local culture and diet (Lotze and Milewski 2004, Lotze 2010). Hand harvesting of shellfish from intertidal areas was an established subsistence use in and around Monomoy Point well before the area was established as a national wildlife refuge in 1944, and it continued through and since the evaluation and designation of the Monomoy Wilderness in 1970. The use remains a popular and significant activity to local communities. The Town began administering a traditional shellfishery in the early 1900s that still continues a century later.

The Service has consistently determined since refuge establishment that harvesting shellfish for human consumption from intertidal areas using traditional, hand harvest methods is a compatible use of the refuge. The environmental assessment for the 1988 refuge master plan included shellfish harvesting as part of the public use program, and acknowledged Monomoy NWR's importance to local shellfishers as a source of softshell clams, quahogs, and sea (surf) clams. That 1988 master plan established an index to local shellfish harvest trends by summarizing town-issued shellfish harvest permits.

In a 1994 compatibility determination, the Service found that hand harvest of shellfish (softshell clams) from intertidal areas of the refuge, conducted in accordance with Town and refuge regulations and closures, was compatible with the purposes for which Monomoy NWR was established.

Shellfish harvesting using traditional hand raking methods has coexisted for decades with migratory birds and other wildlife species of conservation concern that use the expansive and dynamic intertidal flats around Monomoy NWR. Shellfish harvest using traditional hand raking methods within the Monomoy Wilderness can provide a rare, outstanding opportunity for solitude or primitive and unconfined type of recreation in a primarily natural, undeveloped coastal barrier system landscape. Nonmechanized shellfish harvest from intertidal refuge areas affords refuge visitors an opportunity to increase their understanding and appreciation of the refuge, its resources, resource management, and refuge regulations along with traditional, local cultural practices. Commercial harvest of soft-shell clams and quahogs by private individuals on the flats predates refuge establishment by more than a century and, at a low level, does not affect the primeval landscape or interfere with the opportunities for solitude. A use of the land that was historical, does not affect the natural condition of the land, leaves the "imprint of man's work" substantially unnoticeable, and leaves unaffected opportunities for solitude or a primeval and unconfined type of recreation, should be held within the purposes to which a wilderness area may be devoted, and may be permitted despite being commercial. A person with a rake and a basket collecting clams has no different impact on the landscape if he or she eats them, or if they sell the clams, and the Service has no effective means of ensuring that clams collected are never sold. The Service has allowed clamming since refuge establishment and has determined that commercial clamming at the same

scale and in the same manner that has occurred historically is compatible under the Refuge Improvement Act (16 U.S.C. 1668dd). We have also reviewed applicable case law, and believe that commercial clamming is within the purposes of the Monomoy Wilderness, as it is an historical use, and may be permitted so long as the methods used are those historically employed, are the minimum necessary, and that the activity does not otherwise impact wilderness character.

AVAILABILITY OF RESOURCES:

The following breakdown shows the estimated amount of funds needed annually to cover costs associated with managing the hand harvest of subterranean shellfish on the refuge.

Staff Time to Administer the Program

Identifier	**Cost**
GS-12 Refuge Manager—coordinate w/ Town (4 person-days/year)	$2,000.00
GS-09/06 Law Enforcement Staff—compliance oversight (20 person-days/year)	$6,000.00
GS-11 Refuge Biological Staff—monitoring, proposing closures, producing maps, coordinating with the Town (10 person-days/year)	$4,000.00
Total recurring annual cost	**$12,000.00**

ANTICIPATED IMPACTS OF THE USE:

Background/Introduction

The magnitude and duration of both beneficial and adverse impacts on the intertidal substrate and waters, invertebrate populations, and higher trophic-level organisms, are influenced by the frequency, intensity (areal extent and depth), and efficiency of harvest effort. Actual shellfish harvest impact stems from the spatial extent and degree that the pre-disturbance and post-disturbance intertidal environments differ (Beukema 1995, Ray 2005). Impacts of hydraulic or mechanical shellfish dredges on intertidal bottom structure and benthic invertebrates are typically greater and longer lasting than those from hand harvest (Ferns et al. 2000, MacKenzie and Pikanowski 2004, Kraan et al. 2007, Peterson and Estes 2001). However, those mechanical harvest methods are not allowed on the refuge intertidal or shallow subtidal areas, and are therefore not considered further in this compatibility determination. Rigorous scientific studies evaluating the impacts of salting to extract shellfish are currently lacking. There is a scarcity of information documenting potential impacts (negative, neutral, or positive) of salting on target species, non-target species, and the benthic environment.

The following summaries of potential impacts from shellfish harvesting are focused on those derived from non-mechanical hand harvest. Harvesting shellfish can range from a single surface sediment turning event (low intensity-impact) by hand digging to a repetitive (high intensity-impact) excavation of the same location within a short (days to weeks) time period (Leavitt and Fraser 2004). For Monomoy NWR, intertidal sediment disturbance from hand digging occurs on an annual to bi-annual basis, rotating between different areas during post-harvest recovery intervals, and is therefore generally low intensity-low impact in nature.

The following impacts discussion focuses on potential and expected impacts from shellfish harvesting as they relate to the refuge's two establishment purposes and related physical and biological resources. Although the topics are interrelated, for ease of presentation, this section is organized into four main categories: substrate and water quality, benthic communities, migratory shorebirds and other species of conservation concern, and wilderness character.

We reference low, moderate, and high interest levels for shellfishing in our impacts discussion which are based on permit issuance data reported by the Town in annual reports from 1989 to 2011. Low corresponds to 0 to

350, moderate corresponds to 350 to 500, and high corresponds to more than 500 permits issued annually by the town.

Substrate and Water Quality

Nonmechanized hand harvest methods addressed in this compatibility determination include the use of rakes to harvest shellfish and the use of hand plungers in Powder Hole, but only where at least 1 foot of water depth occurs at mean low tide. The potential concern is the disturbance to bottom sediments that, in turn, can affect water quality when the sediments become re-suspended during subsequent tidal cycles. These filter-feeding shellfish also can provide significant water purification services within nearshore estuarine systems (Burke 2009, see also *http://www.ct.gov/doag/cwp/view.asp?a=1367&q=478090;* last accessed 09/19/2013).

An individual softshell clam harvester in New England can turn over approximately 40 m^2 of sediment in a single low tide event (Leavitt and Fraser 2004). Clam rakes typically penetrate just the top 12 inches or less of substrate. If there are, on average, 200 tides (days) harvested annually, then each harvester potentially disturbs approximately 8,000 m^2 (0.8 hectares or 2 acres) annually to a depth of approximately 12 inches (2 acre-feet/year/harvester). Once an area is harvested, it generally takes 1 to 3 years before harvestable clams have repopulated the flat (Brown and Wilson 1997, Leavitt et al. 2010). At historically low interest levels, approximately 250 permitted harvesters would impact 200 ha (494 acres), at moderate interest levels, approximately 450 permitted harvesters would impact 360 ha (889 acres), and at high interest levels, approximately 600 permitted harvesters would impact 480 ha (1,186 acres) of shellfish substrate throughout town-administered shellfishing beds. To put this level of potential impact into a local context, the State-designated shellfish harvest area surrounding Monomoy Island (SC47), which includes nearly 80 percent of the Town 's intertidal shellfish flats, encompasses 37,831 acres. Even if all shellfish permit-holders in Chatham harvested exclusively within SC47 during years of high interest (a worst-case impact scenario), only 3.1 percent (1,186 acres) of those 37,831 acres would be impacted annually. Current levels of interest are generally low, and there are 16 other State-designated shellfish harvest areas elsewhere in Chatham that receive some of the total annual shellfish harvest effort by residents and visitors.

When the incoming tide re-floods the exposed intertidal substrate, sediment can be re-suspended (Coen 1995, Ray 2005, Munari et al. 2006, Peterson and Estes 2001). Observed effects are typically site-specific and influenced by sediment grain size and type, hydrological conditions, faunal influences, currents, water mass size, and configuration (Hayes et al. 1984, LaSalle 1990, Barnes et al. 1991, Coen 1995). Although we are unaware of studies that specifically evaluate the impacts of nonmechanized shellfish harvesting on substrates and water quality, other studies do provide some evidence of possible impacts from sediment re-suspension.

Effects of sediment re-suspension can include reduced light available for photosynthesis, burial or smothering of benthic biota and spawning areas resulting in anoxic conditions, and negative effects on feeding and metabolic rates of intertidal organisms (Johnson 2002). Re-suspension may also impact nutrient budgets due to burial of fresh organic matter and exposure of deep anaerobic sediment, upward flux of dissolved nutrients in pore water, and changes in benthic infauna metabolism (Mayer et al. 1991, Pilskaln et al. 1998). However, the finer particles re-suspended are often quickly flushed back out of the area by tidal currents in dynamic, higher wave energy situations such as the moderate wave energy areas typical of the refuge's intertidal flats, leaving behind only heavier and coarser particles that settle out of suspension more rapidly (Leavitt et al. 2010).

Undisturbed clam flats tend to progress from dynamic sand or sand-mud textures, which are indicative of higher wave energy situations and high softshell clam productivity, toward finer silt-like sediments higher in organics and indicative of lower wave energy and lower clam productivity (Rask 1986, Leavitt and Fraser 2004, Leavitt et al. 2010). The flats surrounding Monomoy NWR are currently at the sand or sand-mud and higher clam productivity end of this gradient. Wave energy alone helps retard the natural maturing of the clam flats surrounding Monomoy NWR. Over long time frames, as undisturbed substrate texture gets finer and the organic fraction increases and decomposes, consuming oxygen in the process, dissolved oxygen levels decline (hypoxia) and can eventually lead to anaerobic or anoxic conditions within the substrate. Once decomposition shifts to anaerobic conditions, hydrogen sulfide, a known toxin for many aquatic organisms is also produced. Also, undisturbed tidal sediments can tend toward a more compact condition (Rowell and Woo 1990, Leavitt and Fraser 2004). The finer sediment particles grow closer together over time, reducing interstitial spaces (Leavitt and Fraser 2004).

Periodic disturbance of the surface sediments, such as results from hand harvesting shellfish, aerates the surface sediments and can halt or retard this very long-term tendency toward anoxic conditions, loosening

more compact (low clam productivity) substrate conditions. Such disturbances increase bottom roughness, decrease organic loading, and reduce compaction within the substrate (Leavitt and Fraser 2004).

Seston are minute living organisms and particles of nonliving matter floating in the water that contribute to turbidity. In their Maine intertidal study area, Kyte et al. (1975) found that ambient, natural seston levels (6.9 to 441 mg/1) where baitworm digging occurs using a method similar to hand raking, often met or exceeded the short-term maxima (turbidity level 584 mg/l) associated with shellfish harvesting.

Re-suspension of sediments occurs naturally during storms, or from other human activities such as operating boats in shallow estuarine areas. This relationship between naturally occurring and human-caused sediment suspension has not been studied on Cape Cod. However, Monomoy NWR is characterized by a more dynamic system of tide- and wind-driven shifting sands than the area Kyte et al. (1975) studied. Water turbidity from suspended sediments is not commonly reported as a concern for the intertidal waters surrounding the refuge. It is therefore likely that, for the refuge, natural tide-driven and wind-driven sand movements cause more sediment re-suspension than shellfish harvesting activity does.

Benthic Community

The larger size-class shellfish sought by harvesters for human consumption are part of the available mature, breeding population for shellfish species that, like many other marine organisms, exhibit sporadic and somewhat unpredictable reproductive success. For the Monomoy intertidal areas, the interval required for softshell clams to attain harvestable size from larval recruitment is approximately 1.5 to 2 years (Leavitt and Fraser 2004, citing S. Moore, personal communication), after which growth slows as energy intake is redirected to reproduction. The clams typically exhibit a patchy, uneven distribution across intertidal areas (Newell and Hidu 1986, Leavitt and Fraser 2004, Leavitt et al. 2010). Once an area is harvested of legal-sized clams, harvesters move to a new location (Leavitt et al. 2010).

Additionally, shellfish targeted by harvesters are but one component of a diverse marine invertebrate community. The invertebrate assemblage is at the base of a complex food web. Many other higher trophic level organisms dependent upon the invertebrate fauna inhabiting intertidal flats, are also valued by people or are otherwise of conservation concern. Direct and indirect mortality induced by shellfish harvest, recruitment or reproductive failures that delay population recovery, and shifts in species diversity toward smaller, short-lived and more mobile species can reduce the abundance of preferred prey items for higher trophic level predators such as amphipods, copepods, echinoderms, gastropods, crabs, fish, or birds (Piersma et al. 2001, Verhulst et al. 2004, Peterson and Estes 2001). Therefore, in this compatibility determination we also consider impacts to non-target species.

Direct Harvest Impacts

Experienced hand harvesters routinely remove a majority (84 percent according to Dow and Wallace 1957) of the largest (legal-sized) clams from a given location during a single digging event. These larger individuals are mostly reproductively active adults on which future recruitment and shellfish resource sustainability depends. In their 2004 literature review, Leavitt and Fraser state that adult softshell clam removal permits increased larval recruitment (citing Pfitzenmeyer 1962 and Peterson et al. 1987), more rapid juvenile growth (citing Turner 1951), and reduced predation (citing Boulding and Hay 1984). Evidence indicates softshell clams can saturate intertidal habitat, reaching very high densities, with intense competition for food and growing space, and substantially reduced reproductive, larval recruitment, and growth rates (Leavitt and Fraser 2004, citing Belding 1930, Turner 1953, Dow and Wallace 1957, Goshima 1982, Newell and Hidu 1986, and Ellis 1998). The net result is a dense population of smaller-sized adult clams existing nearer the surface where they are more vulnerable to predation, combined with low recruitment rates. Older, less mobile adult clams at high densities are susceptible to die-off, burial from moving sediment, or anoxia from depleted dissolved oxygen, forming "clam graveyards" (Leavitt and Fraser 2004, citing Dow and Wallace 1957), bed compaction, and reduced larval recruitment (Leavitt and Fraser 2004, citing Kyte and Chew 1975).

Direct mortality or injury of residual, unharvested/discarded shellfish (generally sub-legal sized) can occur from harvesting rakes that contact shellfish, from trampling underfoot, or from rough handling by the harvester during measuring and sorting (Heffernan 1999, Ferns et al. 2000, Johnson 2002). During shellfish harvest activities, many invertebrates are discarded and left on the intertidal flats near where they were taken,

some alive and intact, and others injured, or dead. Reasonably intact live individuals rebury themselves within a few minutes, leaving only moribund ones on the surface (Ferns et al. 2000). Kaiser et al. (2001) found hand raking for cockles led to an initial three-fold increase in the damage rate of under-sized cockles compared with control plots. In contrast to hand harvesting, mechanical harvesters, e.g., escalators, typically produce less mortality to discarded target bivalve species because physical impact damage is less likely (Kyte and Chew 1975, Peterson et al. 1983, 1987). However, hand harvesters typically harvest much smaller total quantities than more efficient mechanical methods. Thin-shelled bivalves (softshell clams, razor clams are examples at Monomoy) and soft-bodied invertebrates such as marine worms or starfish show higher damage than solid-shelled bivalves (quahogs, sea (surf) clams are examples for Monomoy) in fished areas (Rumohr and Krost 1991). Animals able to retract below the seafloor surface or living below the fishing gear penetration depth sustain less harvest damage than epibenthic organisms (mussels, bay scallops are examples for Monomoy). McLaughlin et al. (2007) found hand raking did not affect the ability of cockles (*Cerastoderma edule*) to rebury themselves at Strangford Lough, Ireland, and small cockles had a faster mean burial rate than larger cockles (51.7 percent and 31.1 percent, respectively). The research of Savage (1974-1976) on Narragansett Bay, Rhode Island, hard clams showed that, in the warm summer temperatures it took 10 to 20 minutes to burrow into the bottom after being left on the surface, while it took an hour at 10°C (50° F). This means that between mid-November and early May when temperatures were cooler, clams left on the surface by rakes or transplantation were more vulnerable to predators because of their longer surface exposure.

Harvesters cannot be certain that a targeted razor clam in a burrow meets the Chatham minimum harvestable size (4 1/2 inches), until after it has been salted, expelled itself and been measured. Undersized razor clams then become "discards." Krzyzewski and Chery (2005) studied the impacts of salting on razor clams and clam tissue in Pleasant Bay and found that high concentrations of salt solution causes mortality to razor clams. Salt solutions of 100 ppt were found to affect the cilia and cell membranes. Undersized razor clams, potentially weakened by salt exposure exceeding 100 ppt that are discarded can become easy prey to everpresent gulls preventing recruitment into the local razor clam (future) breeding population.

Indirect Harvest Impacts

The initial impact of physical disturbance associated with shellfish harvesting on intertidal flats is a reduced standing crop of most non-target species within the disturbed area (Leavitt and Fraser 2004, Leavitt et al. 2010). Many researchers have documented decreased infauna biomass following disturbance (Kyte et al. 1975, Hall et al. 1990, Hall and Harding 1997, Spencer et al. 1998, Engelhard and Withers 1999, Leavitt and Fraser 2004). Biomass loss can range from 40 percent (van den Heiligenberg 1987) to 100 percent (McLusky et al. 1983).

Benthic recovery following harvest disturbance depends on the intensity and frequency of disturbance, life history of the benthic organisms disturbed, and elapsed time since disturbance. Repopulation and recovery of disturbed areas results from migration, passive translocation from surrounding areas, and recruitment of new individuals from natural reproductive cycles (Leavitt and Fraser 2004, citing van den Heiligenberg 1987, Hall et al. 1990, Guenther 1992, Shull 1997). Large or hard-bodied organisms such as target and non-target shellfish, or sedentary bait worms such as lugworms (*Arenicola* sp.), may depend more on recruitment than immigration for post-disturbance recovery (Cryer et al. 1987, Leavitt and Fraser 2004). Due to annual periodicity of seasonal reproductive cycles, this can mean slower re-colonization of disturbed areas (Shull 1997, Leavitt and Fraser 2004).

Anoxia and hydrogen sulfide toxicity within the intertidal substrate results in the mortality of nearly all sedentary organisms, including shellfish and many other invertebrates (Evans 1967, Leavitt and Fraser 2004). Increasingly anoxic and more compact substrate conditions reduce softshell clam productivity (Leavitt and Fraser 2004). Cox (1991) noted that baitworm digging, similar to the hand harvest methods included in this compatibility determination, redistributed anaerobic sediment layers upwards to the surface, with losses of all invertebrate infauna except small species that are tolerant of anoxic conditions. Feeding invertebrates like crabs, bivalves, and crustaceans, along with marine worms and echinoderms with limited mobility, will die if oxygen is deprived for sustained periods (Peterson and Estes 2001).

Organic fractions that may be re-suspended from the intertidal sediments during hand harvesting can increase food availability for filter feeding shellfish, thereby benefitting shellfish survival, growth, and reproductive output (Leavitt and Fraser 2004). Compaction of the substrate over time in undisturbed sediments can resist benthic fauna from anchoring or burrowing in the substrate. For example, newly settled softshell clam larvae attach and anchor themselves in the substrate by means of byssal threads, important for evading predation. Loosening and roughening of the surface sediment layers that results from hand harvesting can maintain

more favorable conditions for recruitment of new individuals into the population, aiding post-harvest recovery (Turner 1951, Ellis 1998, Mullineaux et al. 1999, Leavitt and Fraser 2004, Leavitt et al. 2010). However, this impact is likely more pronounced (shorter time scale) in finer texture, high organic fraction situations than the more naturally dynamic sand-dominated substrate conditions that exist around Monomoy NWR.

Depending on the spatial scale involved, changes in bottom topography can have profound effects on benthic infauna (Ray 2005). Dernie et al. (2003) showed that a difference of only 10 cm in the amount of material removed during mechanized harvest from a sand flat in Wales, United Kingdom, resulted in a substantial decrease in benthic fauna recovery rate. Plots where 20 cm of sediment were removed required 208 days for infaunal community reestablishment; plots with 10 cm removed recovered in 64 days. While hand harvest as employed at the refuge does disturb some surface sediment in limited intertidal areas, the disturbed sandy sediment largely remains onsite, is reworked during subsequent tidal cycles, but is not removed from the site (Leavitt and Peters 2005).

In contrast, invertebrates may be inadvertently reburied at depths exceeding their ability to migrate upwards or extend filter-feeding structures into the water. Smothering with anoxic sediments during harvesting and backfilling can cause benthic invertebrate mortality (Cox 1991, Coen 1995). Logan (2005) found sediment turnover from clam hand digging in a mid-coast Maine intertidal mudflat can deposit *Corophium volutator* (an amphipod that is an important shorebird prey item) at greater depths below the sediment surface; without any connection to the sediment surface, mortality can result. In an upper Bay of Fundy intertidal mudflat, the overall density of *C. volutator* decreased by 38.8 percent in the first year of baitworm hand raking harvest due to lower juvenile recruitment and direct mortality. Juveniles were particularly susceptible to disturbance (a 55 percent decrease), and because juveniles must overwinter to become the next year's potential breeders, this decrease compounds with each subsequent year of harvesting (Shepherd and Boates 1999). Some *C. volutator* are also killed during digging. The survivors may migrate (swim) and risk death in search of better habitat, likely because the loosening of sediment and increase in water content makes re-excavation of burrows difficult (Shepherd and Boates 1999). The mud substrate in the above referenced Bay of Fundy study area is much finer textured and higher in organic content than the sand-dominated substrate present around Monomoy NWR (D. Brownlie, personal communication 2013). Bait worm harvest is also typically a more intensive and frequent disturbance than clam harvest around Monomoy NWR (Leavitt et al. 2010).

In addition to depositing *C. volutator* at greater depths below the sediment surface, clam digging disturbance in a mid-coast Maine intertidal mud flat destroyed *C. volutator* tube dwellings. The subsequent high energy demands for tube reconstruction placed on surviving individuals potentially resulted in reduced growth and reproduction or eventual mortality (Logan 2005). Mean density of *C. volutator* ranged from 89.1 ± 179.6 individuals/m^2 for weekly disturbance, to 1,522.6 ± 378.8 individuals/m^2 for undisturbed controls. *C. volutator* abundance was reduced for all disturbance frequencies in relation to control conditions, even in plots that were only disturbed on day one of the experiment. This significant decrease in abundance suggests that *C. volutator* abundance, and potentially other amphipod abundance, can be significantly reduced even by low digging frequencies.

Many relevant studies have not shown long-term significant changes to benthic communities resulting from shellfish harvest, with the exception of changes in distribution of the target (harvested) species. Coen (1995) surmised that since many small benthic organisms, e.g., crustaceans, polychaetes, mollusks, have rapid generation times, high fecundities, and excellent re-colonization capacities, it is generally accepted that this benthic community effect is only short-term (Godcharles 1971, Peterson et al. 1987, Bennett et al. 1990, Hall et al. 1990). For example, MacKenzie and Pikanowski (2004) found little to no effect on benthic communities resulting from raking in sandy, subtidal substrates, and attributed this lack of effect to invertebrates' adaptation for survival in environments where sediments are naturally re-suspended by severe storms.

Constantino et al. (2009) studied the impacts of salting in a Before-After-Control-Impact study in southern Portugal and concluded no significant impact on the sediment and no effects on the benthic communities. This study was very small scale, and only simulated salting by "covering the area with salt during low tide", potentially exaggerating or minimizing salting impacts compared with fishermen pouring salt directly into the sediment gallery excavated by the razor clam.

Sandy-bottom communities such as those around Monomoy, subjected to higher energy (more frequent natural disturbance), tend to exhibit relatively rapid rates of re-colonization and recovery compared to more sheltered, lower energy, finer textured or biogenic substrates (Munari et al. 2006, Peterson and Estes 2001). Newell et al.

(1998) point out that benthic assemblages in fine-grained sediments recover faster than those in coarse-grained sediments. Coen (1995) also cites other studies using hand and mechanical shellfish harvesting gear in diverse habitats in Florida (Godcharles 1971), Washington (Tarr 1977, Vining 1978, Goodwin and Shaul 1978 and 1980), Maine (Kyte et al. 1975), North Carolina (Peterson et al. 1983, 1987), Rhode Island (Glude and Landers 1953), Scotland (Hall et al. 1990), and Canada (Adkins et al. 1983), and all found no discernible long-term effects on local infaunal populations, with the exception of the more sedentary harvested bivalve species (compare Kyte et al. 1975, Peterson et al. 1987, Hall et al. 1990). Similarly, Logan (2005) found sediment turnover from clam digging in a mid-coast Maine intertidal mudflat did not affect the abundance of 10 benthic macroinvertebrate species, including polychaetes, crustaceans, and bivalves. However, Heffernan (1999) references Spencer's (1996) observation that a single hand-raking clam harvest caused about 50 percent reduction in species diversity, with a time frame of 8 months for site recovery.

Repeated physical disturbance can decrease productivity of affected communities (Odum 1985, Gray 1989). The effects of a single passage of a rake as is typical around Monomoy NWR may be relatively limited; chronic raking, atypical for the Monomoy NWR vicinity, may produce long-term changes in benthic communities (Jennings and Kaiser 1998). If disturbance is routine, the post-disturbance benthic communities are likely to be less abundant and diverse than in undisturbed habitats (Ray 2005). Marinelli and Woodin (2002) demonstrated that disturbing the surface of soft sediments altered sediment chemistry, making it less attractive for recruiting infauna.

Although the rate of recovery from hand raking can be highly variable in space and time, low intensity traditional harvesting appeared to have little impact on benthic communities (Kaiser et al. 2001). Kaiser et al. 2001 found that benthic communities subjected to hand raking for cockles showed community changes, compared to control plots 14 days after the initial disturbance. The small raked plots had recovered 56 days after the initial disturbance whereas the large raked plots remained in an altered state. Even in sands, recovery can be delayed (100 days to over a year) so that frequent intense harvesting will maintain the resident benthic communities in a permanently disturbed state (Peterson and Estes 2001). Kaiser et al. (2001) concluded from benthic samples collected from plots over a year after hand raking for cockles that small-scale variations in habitat heterogeneity had been altered, suggesting that, while effects of hand raking may be significant within a year, they were unlikely to persist beyond that time scale unless larger, long-lived species are present within the community.

The ability of invertebrates to recolonize depleted areas is very variable, depending heavily on recruitment of young. Many polychaetes are highly mobile and capable of colonizing depleted areas of intertidal habitat quite rapidly, while mollusks that bury more deeply, e.g. *Macoma balthica,* or tube dwellers such as *Lanice conchilega,* are capable of much more limited movement. The fact that more complex and productive intertidal communities take longer to achieve stability after disruption is not surprising. Another recovery rate factor is the longevity of the species involved. Large species such as *Arenicola marina*, softshell clams and *Ensis sp.* take several years to reach maturity and, therefore, take much longer to recover than smaller species (Beukema 1995).

Given the higher (moderate) wave energy, the dynamic sand-dominated intertidal sediments surrounding Monomoy NWR, and an abundance of expansive flats allowing a relatively low intensity-frequency of disturbance events from hand raking for shellfish, post-harvest depletion of benthic fauna biomass is expected to be a relatively short 0.5 to 12 month duration (Leavitt et al. 2010). Benthic invertebrate faunal community recovery of small invertebrate prey for migratory shorebirds to pre-disturbance levels is expected at harvested sites well before the 1.5 to 2 years required for recruits in the target shellfish species in the Monomoy NWR area to attain the minimum legal size harvesters seek (Leavitt and Peters 2005, citing S. Moore).

Migratory Shorebirds and Other Species of Conservation Concern

Migratory shorebirds and horseshoe crabs are among the predators of clams and other benthic invertebrates inhabiting the intertidal substrates around Monomoy NWR. These species benefit from abundant small-sized clams and other associated benthic invertebrates.

Protecting high-quality stopover sites, which shorebirds use while migrating long distances between breeding and non-breeding grounds, is a particularly important shorebird conservation concern (Senner and Howe 1984, Myers et al. 1987, Helmers 1992). High-quality stopover sites provide abundant food and a disturbance-

free environment, allowing shorebirds to maximize foraging time, replenish energy reserves, and continue migration in good body condition (Myers et al. 1987, Helmers 1992, Brown et al. 2001). Lower-quality stopover sites may affect shorebirds' ability to reach breeding or non-breeding grounds, and may reduce survivorship (Pfister et al. 1998, Baker et al. 2004). Monomoy NWR is an important stopover site, especially during the southbound (fall) shorebird migration.

Declining prey availability at Delaware Bay, a critical stopover site for northward shorebird migrants, has been implicated in reduced breeding success and annual survival of red knots (*Calidris canutus*) (Baker et al. 2004). Similarly, the annual return rate of semipalmated sandpipers (*Calidris pusilla*) at a southbound stopover site in Massachusetts was higher for birds with more body fat at time of departure (Pfister et al. 1998), suggesting body condition at departure was related to survival. Vulnerability to changes in habitat availability or suitability is likely amplified for migrating shorebirds because large concentrations of shorebirds rely on just a few sites (Myers 1983, Senner and Howe 1984, Myers et al. 1987). Coastal stopover sites in particular, are increasingly subjected to development and human disturbance, and loss of high- quality stopover habitat is likely one factor contributing to declines in local abundance and overall populations of shorebirds in North America (Myers et al. 1987, Pfister et al. 1992, Brown et al. 2001).

Monomoy NWR was designated a Western Hemisphere Shorebird Reserve Network Site of Regional Importance in 1999, based on a maximum one-day fall count of approximately 21,000 shorebirds (WHSRN 2006). The refuge provides habitat for significant numbers of shorebird species that are listed as: highly imperiled or high concern by the U. S. Shorebird Conservation Plan (Brown et al. 2001), as highest or high priority within Bird Conservation Region 30, New England/Mid Atlantic Coast (Atlantic Coast Joint Venture 2005), and as birds of conservation concern in Region 5 (Maine to Virginia) by the Service (2008). Some species of shorebirds, such as American oystercatcher (*Haematopus palliates*) (Veit and Petersen 1993) and the federally threatened piping plover (*Charadrius melodus)* (Hecht 1997, unpublished memo), are also extremely dependent on Monomoy NWR during the breeding season. Surveys conducted in 2006 and 2007 estimated relative abundance of all shorebird species at Monomoy NWR (Koch and Paton 2009).

Human disturbance at stopover sites can reduce habitat quality through direct impacts that may displace shorebirds or alter their behavior, or indirect impacts that have an effect on prey populations (Brown et al 2001).

Direct Impacts to Migratory Shorebirds

Human disturbance causing changes in foraging shorebird behavior and distribution of shorebirds at foraging and roosting sites has been well-documented. Sites with extensive disturbance caused by humans walking or jogging and the presence of dogs reduce foraging time for migrating common redshank (*Tringa totanus*) and Eurasian curlew (*Numenius arquata*) (Fitzpatrick and Bouchez 1998), and decrease foraging rates for migrating snowy plover (*Charadrius alexandrinus*) and sanderling (*Calidris alba*), including sanderlings on non-breeding grounds (Burger and Gochfeld 1991, Lafferty 2001a, Thomas et al. 2003). Prolonged or intense human disturbance may also cause shorebirds to expend more energy to avoid disturbances (Helmers 1992), or completely abandon a site (Furness 1973, Burger 1986, Pfister et al. 1992). Pfister et al. (1992) suggested disturbance measured by vehicle counts as a potential factor in declining numbers of southward migrating red knots and short-billed dowitchers (*Limnodromus griseus*) roosting at a stopover site in Massachusetts between 1972 and 1989.

While shorebirds reduce their foraging rates, flush more easily, and abandon areas with increased human presence (Burger 1981, Burger and Gochfeld 1991, Lafferty 2001a, Thomas et al. 2003), the degree of shorebirds' response varies with different human activities (Burger 1981, Burger 1986, Pfister et al. 1992, Lafferty 2001b). At a non-breeding site in California, stationary people along the beach disturbed shorebirds less frequently, and for fewer birds overall for each disturbance, than mobile people, and joggers disturbed twice as many shorebirds as walkers during each disturbance event (Lafferty 2001b). Similarly, fast-paced activities involving rapid movements, such as jogging, were more likely to disturb waterbirds than slow-moving activities, such as worm and clam harvesting (Burger 1981).

Despite documented changes in behavior of shorebirds exposed to human disturbance, published research establishing empirically based buffer distances to minimize disturbance to migrating shorebirds is sparse. In

2006 and 2007, we conducted experimental research on the refuge to determine flushing distances of the 11 most common migrating shorebird species. We used these empirical data to establish buffer distances that we feel minimize disturbance to migrating shorebirds (Koch and Paton 2014), and will implement these buffers in areas where shorebirds congregate and human disturbance is prevalent.

Species	Buffer Distance Range (m)
Least sandpiper	61
Semipalmated sandpiper	76
Semipalmated plover	77
Sanderling	86
Dunlin	89
Short-billed dowitcher	97
Willet	113
Red knot	124
Ruddy turnstone	125
American oystercatcher	165
Black-bellied plover	186

Indirect Impacts to Migratory Birds

As previously discussed, shellfish harvesting can alter benthic communities or reduce prey availability for shorebirds that feed on benthic organisms. For example, razor clams are an important food source to several priority species utilizing Monomoy NWR, including horseshoe crabs (Botton 1984, Walls et al. 2002) and American Oystercatchers (Nol and Humphrey 1994). Burial or mechanical (vertical) redistribution of invertebrate infauna to deeper depths in the substrate may additionally reduce the availability of invertebrate prey to predators. Many worms and crustaceans are most active and closest to the surface when the tide just covers or uncovers the sediments. For example, sediment disturbance associated with commercial harvest of bloodworms (*Glycera dibranchiata*) in the Bay of Fundy negatively impacted populations of mud snails (*Llyanassa obsolete)*, the primary prey of southward migrating semipalmated sandpipers (Shepherd and Boates 1999). Many birds and fish rely on visual cues when foraging. Turbidity due to re-suspension of intertidal sediment can significantly reduce foraging efficiency for sight-feeding predators (Vinyard and O'Brien 1976, Gradall and Swenson 1982, Gregory 1990, Servizi 1990, Peterson and Estes 2001). Decreased foraging efficiency by fall migrating semipalmated sandpipers may have been related to the obstruction of visual and tactile prey cues caused by turning and loosening of the surface sediment from intensive hand-raking for baitworms (Shepherd and Boates 1999).

Observations at Monomoy NWR in 2005 and 2006 suggested that some species of shorebirds remained farther from a standing person than from shellfish harvesters (Leavitt et al. 2010). Softshell clam harvesters in coastal New England typically use short hand rakes, spend most of their time bent over at the waist or on hands and knees harvesting patches of shellfish, and traverse the exposed mudflats only to move among patches (Burger 1981, Leavitt and Fraser 2004). Anecdotal observations of shorebirds congregating in recently shellfished areas at Monomoy NWR (Leavitt et al. 2010) suggest that sediment turnover associated with softshell clam harvesting may expose additional prey that would normally be at depths unavailable to shorebirds, thereby providing a net benefit to some species of foraging shorebirds (Leavitt and Peters 2005). Our own anecdotal observations of shorebirds in 2005 and 2006 suggested that some species of shorebirds might be attracted to areas where shellfishing had recently occurred (Koch 2011). Aspinall (1992) notes that most forms of intertidal shellfish harvesting, including manual digging, provide some initial increased feeding opportunities for some birds. Other studies have also shown that discarded or injured invertebrates or shellfish are consumed by higher trophic species, including gulls, fish, crabs, echinoderms, and gastropods (Manning 1959, Caddy 1973, van der Veer et al. 1985, Eleftheriou and Robertson 1992, Hall 1994, and Kaiser and Spencer 1994). A possible immediate increase in prey availability of some species may be ephemeral (as in Ferns et al. 2000), or may be offset by negative impacts to other prey species that are subsequently buried (as in Emerson et al. 1990).

In 2007, we conducted surveys of shorebird abundance and foraging behavior in areas that were and were not subjected to shellfish harvesting activity to determine if shellfish harvesting influenced shorebird abundance. Based on density estimates of shorebirds in the harvested and unharvested plots, shellfish harvesting activities appeared to have a positive influence on the mean density of American oystercatchers and ruddy turnstones. The reason that the buffer distances for these species is so large in the table above is because the distances were based on pedestrians in general, not harvesters. However, for most species of shorebirds studied, shellfishing activity had no apparent effect on the density of birds on study plots. No differences in the proportion of birds that were foraging in harvested and unharvested areas for all species were detected, and generally, more than 90 percent of all birds were foraging on all plots, regardless of shellfishing activity. Seven species, black-bellied plover, ruddy turnstone, semipalmated plover, sanderling, semipalmated sandpiper, dunlin, and short-billed dowitcher, were detected actively foraging in shellfish holes or the remaining adjacent sediment piles (Koch and Paton 2014).

At Monomoy NWR, we do not anticipate any substantial direct adverse long-term impacts from nonmechanized shellfish harvesting on migratory shorebirds, species fundamental to fulfilling the refuge migratory bird purpose. Further, recent surveys of shorebird abundance and foraging behavior in harvested shellfish areas show an apparent beneficial influence on American oystercatcher and ruddy turnstone densities relative to unharvested areas. In addition, shorebirds representing six additional species appear to receive short-term benefit in the form of foraging opportunities immediately following shellfish harvest disturbance, as they were observed actively foraging in shellfish holes or residual sediment piles.

Wilderness Character

North Monomoy Island and South Monomoy Island make up the Monomoy Wilderness. The untrammeled environment and solitude of the Monomoy Wilderness, accessible only by boat, make it unique among the protected areas on Cape Cod. Motorized boats operated by shellfish harvesters generally approach and depart the intertidal flats slowly through the adjoining shallows, which reduces engine noise and boat wake. Monomoy NWR has an unusually low absorption capacity for human impacts. Lack of topographic relief and low vegetation mean that intrusions, including seeing and hearing other people, are often detectable from a long distance. Shellfish harvesting on intertidal flats visible from elsewhere within the Monomoy Wilderness may result in a diminished degree of solitude for some wilderness users, but should not adversely affect the overall wilderness character of the Monomoy Wilderness.

The majority of the Monomoy Wilderness will remain essentially unvisited and virtually undisturbed by the current and expected low intensity intertidal shellfish harvesting taking place around Monomoy NWR. Visible impacts from hand digging are temporary, generally lasting a few hours before the next tidal cycle erases most traces of digging from a harvested area. These physical disturbances are most evident near shellfish harvest sites, but are not expected to substantially compromise the perception of naturalness of the Monomoy Wilderness landscape nor impact the wilderness user's experience (Cole 2002, Hendee and Dawson 2002).

Wilderness visitors' experiences are more strongly affected by social conditions, such as other visitors and their actions, than by their perception of naturalness or ecological conditions (Hendee and Dawson 2002). The wide and expansive intertidal flats and barrier beaches where most shellfish harvest takes place afford users an unconfined experience (Hendee and Dawson 2002). With typically long sight distances across the rolling, nearly treeless, intertidal and coastal barrier landscape, too many individuals encountered or observed during visits by other Monomoy Wilderness users likely detracts from the sense of solitude experienced by wilderness users (Stankey and Schreyer 1987, Hendee and Dawson 2002). However, intertidal shellfish harvest use is still relatively dispersed across those intertidal flats open to public use.

Some shellfish harvesters use carts to move harvested clams to their boats. Others use large netted bags to transport their harvested clams. The use of wheeled carts in the Monomoy Wilderness is not consistent with wilderness requirements, as mechanized transport is not allowed, and wheeled devices are considered to be mechanized transport. Eliminating the use of wheeled carts in the Monomoy Wilderness will maintain wilderness characteristics and enhance visitors' wilderness experiences.

Commercial harvest of soft-shell clams and quahogs by private individuals on the flats predates refuge establishment by more than a century and, at a low level, does not affect the primeval landscape or interfere

with the opportunities for solitude. A use of the land that was historical, does not affect the natural condition of the land, leaves the "imprint of man's work" substantially unnoticeable, and leaves unaffected opportunities for solitude or a primeval and unconfined type of recreation, should be held within the purposes to which a wilderness area may be devoted, and may be permitted despite being commercial. A person with a rake and a basket collecting clams has no different impact on the landscape if he or she eats them, or if they subsequently sell the clams, and the Service has no effective means of ensuring that clams collected are never sold. The Service has allowed clamming since refuge establishment and has determined that commercial clamming at the same scale and in the same manner that has occurred historically is compatible under the Refuge Improvement Act. We have also reviewed applicable case law, and believe that commercial clamming is within the purposes of the Monomoy Wilderness, as it is an historical use, and may be permitted so long as the methods used are those historically employed, are the minimum necessary, and that the activity does not otherwise impact wilderness character.

The current and anticipated level of intertidal shellfish harvest does not and is not expected to impact the preservation of the existing wilderness character—untrammeled wildness, undeveloped, natural, outstanding opportunity for solitude or primitive and unconfined type of recreation—that provides an enduring wilderness resource in the Monomoy Wilderness.

PUBLIC REVIEW AND COMMENT:

As part of the CCP process for the Monomoy NWR, a draft of this compatibility determination underwent a 180-day public comment period concurrent with the release of our draft CCP/Environmental Impact Statement (EIS). This final compatibility determination resulted from that public review and comment process. It underwent a further 37-day public review period concurrent with the release of the final CCP/EIS. One commenter indicated concern that shellfishing was being allowed to continue in the wilderness portions of the refuge, and suggested continued evaluation of the impact of shellfishing based on improved harvest data. Continued opposition to the prohibition on the use of wheeled carts and salting was expressed by several commenters, and some commenters questioned the restrictions on seasonal closures to benefit migrating shorebirds. However, no new substantive information was provided and the compatibility determination remained unchanged.

DETERMINATION (CHECK ONE BELOW):

_____ Use is not compatible.

__**X**__ Use is compatible with the following stipulations.

STIPULATIONS NECESSARY TO ENSURE COMPATIBILITY:

- All intertidal subterranean shellfish harvest on refuge lands must continue to be in full compliance with all Town Shellfish Rules and Regulations and refuge regulations and area closures. No items other than softshell clams, razor clams, sea (surf) clams, and quahogs, hand harvested in accord with town regulations, will be removed from the refuge.

- Only hand harvest methods will be employed on refuge intertidal lands that are open for public use. No artificial methods for extracting shellfish from the substrate such as salt for any species of clams may be used on refuge intertidal lands that are open for public use.

- No carts or other mechanized equipment with wheels may be used to transport shellfish onlands within designated wilderness.

- There are certain times of the year when the refuge is critically important to migratory birds, including threatened and endangered species. The location of the most important nesting, staging and migratory stopover (foraging and resting) habitat varies depending on a number of natural factors (e.g., weather, landform, prey distribution and abundance, and predator presence) as well as human disturbance at other sites. Refuge staff will evaluate the disturbance pressure to migratory birds caused by the presence of individuals engaged in this use. To ensure that this use remains compatible, meaning it does not materially interfere with or detract from the migratory bird purpose of the refuge, it may be necessary to restrict access through the implementation of seasonal and/or area closures. The location and size of these closures are not fixed and will vary over time. Shellfish harvesters will be expected to comply with closures. Updates on closures will be available at the Headquarters and on the refuge web site.

- Refuge staff will annually meet with the Town Shellfish Constable to review and summarize annual shellfish harvest reports, area closures, and current and planned shellfish resource stewardship measures, and discuss regulations and management actions with respect to Monomoy NWR lands and waters needed to ensure the long-term sustainability of the shellfish resource and biological integrity and ecological health of refuge habitats.

- Refuge staff, volunteers, or researchers may engage in research designed to determine shellfish harvesting impacts to migratory birds and other species of conservation concern. Should any public use, including shellfish harvest, cause unacceptable environmental degradation or wildlife disturbance, or degrade wilderness character, the Service will implement appropriate limits on user numbers.

- Refuge visitor information services and products will emphasize the importance of staying out of seasonal closure areas, along with providing leave-no-trace principles.

JUSTIFICATION:

The harvest of subterranean shellfish using traditional hand raking methods and use by migratory birds of the expansive and dynamic intertidal flats around Monomoy NWR have coexisted for decades under joint stewardship and regulation by the Town and the Service. Shellfish harvesting is a form of fishing, which is a priority, wildlife-dependent, public use on the refuge that provides visitors with an opportunity to experience wilderness. Based on our current, although limited knowledge about potential impacts of traditional hand harvest of shellfish on priority wildlife resources and habitats, combined with the relatively low level of use distributed across a large area of intertidal habitat, effects from this activity are similar or even less than other forms of human use in the intertidal area. We will monitor disturbance impacts of human presence (fin fishers, shellfishers, birders, photographers, and walkers) and will implement seasonal closures to protect migrating shorebirds and staging terns when necessary to ensure we accomplish the migratory bird purpose of the refuge by providing high-quality habitat to these migratory bird species, and marine mammals. We will also include new science as it becomes available and will continually evaluate potential impacts of shellfishing on refuge resources as funding becomes available.

We have documented a positive short-term benefit to American oystercatchers and ruddy turnstones in the form of increased food availability immediately following shellfish harvest disturbance of the intertidal substrate. Allowing continuation of low intensity, nonmechanized shellfish harvest also fulfills the Service's historical commitment to permit fishing, including clamming, to continue.

Allowing intertidal shellfish harvest using hand methods at current and anticipated harvest levels, in accordance with town and refuge regulations and closures, requires no additional facilities. The potential disturbance to migratory birds and other species of conservation concern can be addressed and mitigated through the town shellfish regulations and stewardship actions, and by refuge seasonal area closures (symbolic fencing and signs with available refuge resources and a minimal administrative requirement). Potential for over-exploitation of the shellfish resource and depletion of intertidal benthic infauna, as well as potential for human-caused disturbance to wildlife species of conservation concern, are manageable and will continue to be addressed through the town's shellfish regulations and stewardship actions, and by refuge seasonal area closures (symbolic fencing and signs.

In justifying this use, we considered the preceding evaluation of impacts to intertidal substrates and water quality, benthic intertidal communities, migratory shorebirds and other species of conservation concern, and Monomoy Wilderness character. Commercial harvest of soft-shell clams and quahogs by private individuals on the flats predates refuge establishment by more than a century and, at a low level, does not affect the primeval landscape or interfere with the opportunities for solitude. A use of the land that was historical, does not affect the natural condition of the land, leaves the "imprint of man's work" substantially unnoticeable, and leaves unaffected opportunities for solitude or a primeval and unconfined type of recreation, should be held within the purposes to which a wilderness area may be devoted, and may be permitted despite being commercial. A person with a rake and a basket collecting clams has no different impact on the landscape if he or she eats them, or if they subsequently sell the clams, and the Service has no effective means of ensuring that clams collected are never sold. The Service has allowed clamming since refuge establishment and has determined that commercial clamming at the same scale and in the same manner that has occurred historically is compatible under the Refuge Improvement Act. We have also reviewed applicable case law, and believe that commercial clamming is within the purposes of the Monomoy Wilderness, as it is an historical use, and may be permitted so long as the methods used are those historically employed, are the minimum necessary, and that the activity does not otherwise impact wilderness character.

We conclude that the use will not materially interfere with, or detract from, the Refuge System mission, refuge wilderness character, or migratory bird purposes, and that it contributes to the refuge purposes as follows:

- Shorebirds using the refuge were observed at higher densities in harvested areas versus unharvested areas due to the increased foraging opportunities resulting from harvesting activities.
- Low intensity harvest results in a periodic disturbance to the substrate, which under certain conditions can improve shellfish productivity and recruitment and increase prey availability for shorebirds.
- Our observations and related research indicate negligible impacts to Federal trust resources, based on past and expected harvest levels.
- We have not observed any impacts to, nor heard concerns from, any other wildlife-dependent users.
- Refuge visitors can experience wilderness in a manner that protects wilderness character by allowing only the use of hand tools and eliminating the use of wheeled carts.
- Our coordination with the town eliminates any undue administrative burden to refuge staff.

SIGNATURE:

Refuge Manager: Elizabeth A Harland (Signature) March 18, 2016 (Date)

CONCURRENCE:

Regional Chief: Scott B. Kahan (Signature) March 18, 2016 (Date)

MANDATORY 15 YEAR RE-EVALUATION DATE: March 18, 2031

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FWS Form 3-2319
02/06

FINDING OF APPROPRIATENESS OF A REFUGE USE

Refuge Name: Monomoy National Wildlife Refuge

Use: Research Conducted by Non-Service Personnel

This form is not required for wildlife-dependent recreational uses, take regulated by the State, or uses already described in a refuge CCP or step-down management plan approved after October 9, 1997.

Decision Criteria:	**YES**	**NO**
(a) Do we have jurisdiction over the use?	✔	
(b) Does the use comply with applicable laws and regulations (Federal, State, Tribal, and local)?	✔	
(c) Is the use consistent with applicable Executive orders and Department and Service policies?	✔	
(d) Is the use consistent with public safety?	✔	
(e) Is the use consistent with goals and objectives in an approved management plan or other document?	✔	
(f) Has an earlier documented analysis not denied the use or is this the first time the use has been proposed?	✔	
(g) Is the use manageable within available budget and staff?	✔	
(h) Will this be manageable in the future within existing resources?	✔	
(i) Does the use contribute to the public's understanding and appreciation of the refuge's natural or cultural resources, or is the use beneficial to the refuge's natural or cultural resources?	✔	
(j) Can the use be accommodated without impairing existing wildlife-dependent recreational uses or reducing the potential to provide quality (see section 1.6D, 603 FW 1, for description), compatible, wildlife-dependent recreation into the future?	✔	

Where we do not have jurisdiction over the use ["no" to (a)], there is no need to evaluate it further as we cannot control the use. Uses that are illegal, inconsistent with existing policy, or unsafe ["no" to (b), (c), or (d)] may not be found appropriate. If the answer is "no" to any of the other questions above, we will **generally** not allow the use.

If indicated, the refuge manager has consulted with State fish and wildlife agencies. Yes ✔ No _____.

When the refuge manager finds the use appropriate based on sound professional judgment, the refuge manager must justify the use in writing on an attached sheet and obtain the refuge supervisor's concurrence.

Based on an overall assessment of these factors, my summary conclusion is that the proposed use is:

Not Appropriate _____ **Appropriate** ✔

Refuge Manager: Elizabeth A Harlan Date: March 18, 2016

If found to be **Not Appropriate**, the refuge supervisor does not need to sign concurrence if the use is a new use.

If an existing use is found **Not Appropriate** outside the CCP process, the refuge supervisor must sign concurrence.

If found to be **Appropriate**, the refuge supervisor must sign concurrence:

Refuge Supervisor: Graham A Taylor Date: March 18, 2016

A compatibility determination is required before the use may be allowed.

603 FW 1
Exhibit 1
Page 2

JUSTIFICATION FOR A FINDING OF APPROPRIATENESS OF A REFUGE USE

Refuge Name: Monomoy National Wildlife Refuge

Use: Research Conducted by Non-Service Personnel

NARRATIVE:

The U.S. Fish and Wildlife Service (Service) policy on Appropriate Refuge Uses (603 FW 1) states, "General public uses that are not wildlife-dependent recreational uses, as defined by the National Wildlife Refuge System Improvement Act and do not contribute to the fulfillment of refuge purposes or goals or objectives as described in current refuge management plans are the lowest priorities for refuge managers to consider. These uses are likely to divert refuge management resources from priority general public uses or away from our responsibilities to protect and manage fish, wildlife, and plants, and their habitats. Therefore, both law and policy have a general presumption against allowing such uses within the National Wildlife Refuge System."

Research conducted by non-Service personnel is not identified as a priority public use of the National Wildlife Refuge System (Refuge System) under the National Wildlife Refuge System Administration Act of 1966 (16 U.S.C. 668dd-668ee), as amended by the National Wildlife Refuge System Improvement Act of 1997. This use is not a priority public use of the Refuge System. However, research by non-U.S. Fish and Wildlife Service (Service) personnel is often conducted by colleges, universities, Federal, State, and local agencies, non-governmental organizations, and qualified members of the general public. Research on Monomoy National Wildlife Refuge (NWR, refuge) would further the understanding of the natural environment and could be applied to management of the refuge's wildlife.

The Service encourages and supports research and management studies on refuge lands that will improve and strengthen decisions on managing natural resources. Research by other than Service personnel adds greatly to the information base for refuge managers to make proper decisions. The refuge manager encourages and seeks research that clearly relates to approved refuge objectives, improves habitat management, and promotes adaptive management. Priority research addresses information to better manage the refuge's biological and wilderness resources, or addresses management issues at Monomoy NWR. We will generally support research that addresses important management issues or demonstrates techniques for managing species or habitats that are important to agencies of the Department of the Interior, the Refuge System, and state fish and game agencies. Much of the refuge is designated national wilderness, so some constraints on how or where research is conducted may be necessary.

All research proposals are evaluated for their benefits to the refuge and the Refuge System mission. The refuge manager will issue a special use permit (SUP) for all approved research projects. All research projects require the principal investigator to provide summary reports of findings and acknowledge the refuge for their participation. At the time of request, a determination will be made by refuge staff whether the proposed research benefits the understanding of the natural environment and will contribute useful information to the Service and Refuge System. The entire refuge may be open and available for scientific research. The research location will be limited to those areas of the refuge that are absolutely necessary to conduct of the research project. The timing of each individual research project will be limited to the minimum required to complete the project. The refuge reserves the right at any time to find a specific request for a research project by non-Service personnel to be inappropriate or incompatible with the refuge's purposes, Service mission or the refuge's conservation management goals and objective established in the Comprehensive Conservation Plan and any stepped down management plan, based on each individual review and assessment of each project's research details.

Not all research may be appropriate. Some research may affect fish, wildlife, and plants in a manner neither consistent with refuge management plans nor compatible with refuge purposes or the Refuge System mission. Some research may interfere with or preclude refuge management activities, appropriate and compatible public uses, or other research. Some research may be appropriate off the refuge, but not on the refuge. Therefore, we must evaluate each research proposal independently and may deny a request for an SUP because we find the proposal to be inappropriate or incompatible.

No additional equipment, facilities, or improvements will be necessary to allow research by non-Service personnel. Staff time would be required to review research proposals and oversee permitted projects. We expect that conducting these activities will require less than one-tenth of a work-year for one staff member.

Non-Service organizations and personnel conducting research on the refuge will be required to provide the Service with all data collected and/or reports. The research organization/agency or personnel in conjunction with the Service will retain the use and ownership of all data/reports.

Disturbance to wildlife and vegetation by researchers could occur through observation, sampling, or accessing the study area. It is possible that direct mortality could result as a by-product of research activities.

Negligible impacts will occur when research projects which are previously approved in the compatibility determination are carried out according to the stipulations stated in the SUP issued for each project. Overall, however, allowing well designed and properly reviewed research to be conducted by non-Service personnel is likely to have very little impact on refuge wildlife populations. If the research project is conducted with professionalism and integrity, potential adverse impacts are likely to be outweighed by the knowledge gained about a species, habitat, or public use.

After evaluating research by non-Service personnel under Service policies, we conclude that the activity is appropriate as it contributes to and supports refuge management, purposes, and goals, and the mission of the Refuge System.

COMPATIBILITY DETERMINATION

USE:

Research Conducted by Non-Service Personnel

REFUGE NAME:

Monomoy National Wildlife Refuge

DATE ESTABLISHED:

June 1, 1944

ESTABLISHING AND ACQUISITION AUTHORITY(IES):

Migratory Bird Conservation Act (16 U.S.C. § 715d) Public Law 91-504, 16 USC § 1132(c)

REFUGE PURPOSE(S):

"…for use as an inviolate sanctuary, or for any other management purpose, for migratory birds." (16 U.S.C. § 715d).

"…wilderness areas…shall be administered for the use and enjoyment of the American people in such a manner as will leave them unimpaired for future use and enjoyment as wilderness, and so as to provide for the protection of these areas, the preservation of their wilderness character, and for the gathering and dissemination of information regarding their use and enjoyment as wilderness. (PL 88-577 § 2(a), Wilderness Act; as referenced in P.L. 91-504 § 1(g), An Act to Designate Certain Lands as Wilderness).

NATIONAL WILDLIFE REFUGE SYSTEM MISSION:

To administer a national network of lands and waters for the conservation, management, and where appropriate, restoration of the fish, wildlife, and plant resources and their habitats within the United States for the benefit of present and future generations of Americans.

DESCRIPTION OF USE:

(a) What is the use? Is the use a priority public use?
This determination covers low impact research projects; namely, those projects with methods that only have a minimal potential to adversely impact cultural resources and native wildlife and plants.

This is not an all-inclusive list, but examples of the types of research that would be allowed include: mist-netting or cannon netting for banding or tagging birds, point count surveys, horseshoe crab tagging, radio-telemetry tracking, use of cameras and recorders, use of live or other passive traps, or non-destructive searches of nests, dens, or burrows.

Research activities allowed under this determination would not result in long-term, negative alterations to species' behavior (e.g. result in wildlife leaving previously occupied areas for long periods; modifying their habitat use; or, causing nest or young abandonment). No project would degrade wildlife habitat, including vegetation, soils, and water. Research associated activities that would not be allowed include, but are not

limited to, those that would result in soil compaction or erosion, degrade water quality, remove or destroy vegetation, involve off-road vehicle use, collect and remove animals or whole native plants, cause public health or safety concerns, or result in conflicts with other compatible refuge uses.

Refuge support of research directly related to refuge goals and objectives may take the form of funding, in-kind services such as housing or use of other facilities, vehicles, boats, or equipment, direct staff assistance with the project in the form of data collection, provision of historical records, conducting of management treatments, or other assistance as appropriate.

Research conducted by non-U.S. Fish and Wildlife Service (Service) personnel is not a priority public use of the National Wildlife Refuge System (Refuge System) under the National Wildlife Refuge System Administration Act of 1966 (16 U.S.C. 668dd-668ee), and the National Wildlife Refuge System Improvement Act of 1997 (Public Law 105-57).

(b) Where would the use be conducted?
The location of the research will vary depending on the individual research project being conducted. The entire refuge is open and available for scientific research. An individual research project is usually limited to a particular habitat type, plant, or wildlife species. On occasion, research projects will encompass an assemblage of habitat types, plants, or wildlife, or may span more than one refuge or include lands outside the refuge. The research location will be limited to those areas of the refuge necessary to conduct the research project. Because of the need to close parts of the refuge spatially or temporally to protect refuge wildlife, some research may not be able to be conducted on the refuge. Much of Monomoy National Wildlife Refuge (NWR) is included in the Monomoy Wilderness, which could impact where or how we allow research to be conducted.

(c) When would the use be conducted?
The timing of the research will depend entirely on the individual research project's approved design. Scientific research will be allowed to occur on the refuge throughout the year, unless it conflicts with the protection of seals, terns, plovers, other migratory shorebirds and seabirds, invertebrates, or plants of management priority. An individual research project could be short- term in design, requiring one or two visits over the course of a few days. Other research projects could be multiple year studies that require daily visits to the study site or staying overnight on South Monomoy Island. The timing of each individual research project will be limited to the minimum required to complete the project. The refuge manager would approve the timing (e.g., project length, seasonality, time of day) of the research prior to the start of the project to minimize impacts to wildlife and habitats, ensure safety, and reduce conflicts with other compatible refuge uses.

(d) How would the use be conducted?
The methods of the research will depend entirely on the individual research project conducted. The methods and study design of each research project will be reviewed and scrutinized before the project will be allowed to occur on the refuge. No research project will be allowed if it does not have an approved scientific method, if it negatively affects endangered species, marine mammals, or migratory birds, if it cannot be conducted consistent with wilderness preservation, or if it compromises public health and safety. Only low impact research activities, such as those listed under section (a) above, are covered under this determination.

Access to Morris Island is primarily facilitated by pedestrian walking access, with access to the rest of Monomoy NWR being primarily by boat. Both these means of access are used by Service staff when conducting biological surveys, roving interpretation, and natural and cultural history tours.

Research projects must have a Service-approved study plan and protocol. A detailed research proposal that follows the refuge's study proposal guidelines (see attachment 1) is required from parties interested in conducting research on the refuge. Each research proposal request will be considered, and if determined appropriate and compatible, will be issued a special use permit (SUP) by the refuge manager that includes the stipulations in this determination. The refuge manager will use sound professional judgment and ensure that the request will have no considerable negative impacts to natural or cultural resources, or impact visitors, and does not violate refuge regulations. Before initiating a research project that involves federally listed endangered or threatened species, an interagency Section 7 consultation process should be completed.

If approved, multi-year research projects will be reviewed annually to ensure that they are meeting their intended design purposes, that reporting and communicating with refuge staff is occurring, and that projects continue to be consistent with the mission of the Refuge System and purposes for which the refuge was established.

If the refuge manager decides to deny, modify, or halt a specific research project, the refuge manager will explain the rationale and conclusions supporting their decision in writing. The denial or modification to an existing study will generally be based on evidence that the details of a particular research project may:

- Negatively impact native fish, wildlife, and habitats or cultural, archaeological, or historical resources.
- Detract from fulfilling the refuge's purposes or conflict with refuge goals and objectives.
- Raise public health or safety concerns.
- Conflict with other compatible refuge uses.
- Not be manageable within the refuge's available staff or budget time.
- Deviate from the approved study proposal such that impacts to refuge resources are more severe or extensive than originally anticipate.

(e) Why is this use being proposed?
Research by non-Service personnel is conducted by colleges, universities, Federal, state, local agencies, non-governmental organizations, and qualified members of the public to further the understanding of the natural, physical, and wilderness refuge environments and improve management of refuge natural and wilderness resources. Much of the information generated by the research is applicable to management on and near the refuge. Thorough research provides critical information for establishing baseline information on refuge resources and evaluating management effects on wildlife and habitat. Research projects may also include evaluating habitat management treatments and the associated wildlife community response, as well as, measures of impacts from public uses on refuge lands.

The Service will encourage and support research and management studies on refuge lands that improve and strengthen natural resource and wilderness management decisions. The refuge manager will encourage and seek research related to approved refuge objectives that clearly improves land management and promotes adaptive management. Priority research addresses information that is important to agencies of the Department of the Interior, Service, Refuge System, state fish and game agencies and other agencies responsible for managing natural resources.

The refuge will also consider research for other purposes that may not be directly related to refuge-specific objectives, but will contribute to the broader enhancement, protection, use, preservation and management of native populations of fish, wildlife, and plants, and their natural diversity within the region or flyway. These proposals must comply with the Service's governing laws, regulations, and policies.

The refuge will maintain a list of research needs that will be provided to prospective researchers or organizations upon request. Refuge support of research directly related to refuge objectives may take the form of funding, in-kind services such as housing or use of other facilities, direct staff assistance in the form of collecting data, providing historical records, conducting management treatments, or other assistance as appropriate.

AVAILABILITY OF RESOURCES:

The cost for research is incurred in staff time to review research proposals, coordinate with researchers, write and administer SUPs, and, in some instances boat support and fuel. At an hourly rate of approximately $50.00 for a GS-09 step 6, this totals about $11,000 annually for resources spent on outside research.

Research program administration	1 staff	160 hours	$ 8,000
Boat support	1 staff	40 hours	$ 2,000
Boat fuel and maintenance			$ 1,000
Total annual costs:			**$11,000**

ANTICIPATED IMPACTS OF THE USE:

The Service encourages approved research to further the understanding of natural resources. Research by other than Service personnel adds to the best available information base supporting management decisions. Disturbance to wildlife and vegetation by researchers could occur through direct or remote observation, telemetry, capture (mist-netting, canon netting), banding, and accessing the study area by foot or by boat. These impacts could be exacerbated by multiple concurrent research projects. It is possible that direct mortality could result as a by-product of research activities. Mist-netting, for example, can cause stress, especially when birds are captured, banded and weighed. There have been occasional mortalities to birds, when predators reach the netted birds before researchers do. Temporary installations (e.g., telemetry receivers, remote cameras or acoustic sensors, solar panels) or the visible presence of research personnel to other wilderness users can impact the sense of solitude or untrammeled wildness experienced by wilderness visitors.

Minimal impact will occur when research projects that have been approved are carried out according to the stipulations stated in this Compatibility Determination. Overall, allowing well-designed and properly reviewed research to be conducted by non-Service personnel is likely to have very little impact on refuge wildlife populations, wilderness user experiences, or wilderness character. If the research project is conducted with professionalism and integrity, potential adverse impacts are likely to be outweighed by the knowledge gained about an entire species, habitat, or public use.

Because Service or partner staff will supervise this activity, impacts of research will likely be minimal if conducted in accordance with refuge regulations, and minimum requirements analyses if within the Monomoy Wilderness. In the event of persistent disturbance to habitat or wildlife, or to wilderness character, the activity will be further restricted or discontinued.

Potential Pedestrian Impacts

Potential Direct Impacts

Pedestrian travel has the potential to impact shorebird, waterfowl, and other migratory bird populations feeding and resting near the trails and on beaches during certain times of the year. Pedestrians who get too close can also impact seals resting on the beach. Conflicts arise when migratory birds and humans are present in the same areas (Boyle and Samson 1985). Response of wildlife to human activities includes departure from site (Owen 1973, Burger 1981, Kaiser and Fritzell 1984, Korschgen et al. 1985, Henson and Grant 1991, Kahl 1991, Klein 1993), use of sub-optimal habitat (Erwin 1980, Williams and Forbes 1980), altered behavior (Burger 1981, Korschgen et al. 1985, Morton et al. 1989, Ward and Stehn 1989, Havera et al. 1992, Klein 1993), and increase in energy expenditure (Morton et al. 1989, Bélanger and Bédard 1990).

Numerous studies have documented that migratory birds are disturbed by human activity on beaches. Erwin (1989) documented disturbance of common terns and skimmers and recommended that human activity be restricted to a distance of 100 meters around nesting sites. Klein (1993) in studying waterbird response to human disturbance found that, as intensity of disturbance increased, avoidance response by the birds increased, and found that out-of-vehicle activity to be more disruptive than vehicular traffic. Pfister et al. (1992) found that the impact of disturbance was greater on species using the heavily disturbed front side of the beach, with the abundance of the impacted species being reduced by as much as 50 percent. In studying the effects of recreational use of shorelines on nesting birds, Robertson et al. (1980) discovered that disturbance negatively impacted species composition. Piping plovers, which intensively use the refuge, are also impacted negatively by human activity. Pedestrians on beaches may crush eggs (Jenkins and Burger 1987, Hill 1988, Shaffer and Laporte 1992, Cape Code National Seashore 1993, Collazo et al. 1994). Dogs may chase plovers (McConnaughey et al. 1990), destroy nests (Hoopes 1993), and kill chicks (Cairns and McLaren 1980). Other studies have shown that if pedestrians cause incubating plovers to leave their nest, the eggs can overheat (Bergstrom 1991) or can cool to the point of embryo death (Welty 1982). Pedestrians have been found to displace unfledged chicks (Strauss 1990, Burger 1991, Hoopes 1993, Loegering 1992, Goldin 1993).

Several studies have examined the effects of recreation on birds using shallow water habitats adjacent to trails and roads through wildlife refuges and coastal habitats in the eastern United States (Burger 1981; Burger 1986; Klein 1993; Burger et al. 1995; Klein et al. 1995; Rodgers and Smith 1995, 1997; Burger and Gochfeld 1998). Overall, the existing research clearly demonstrates that disturbance from recreation activities always has at least temporary effects on the behavior and movement of birds within a habitat or localized area (Burger 1981, 1986; Klein 1993; Burger et al. 1995; Klein et al. 1995; Rodgers and Smith 1997; Burger and Gochfeld 1998). The findings that were reported in these studies are summarized as follows in terms of visitor activity and avian response to disturbance.

Presence: Birds avoided places where people were present and when visitor activity was high (Burger 1981, Klein et al. 1995, Burger and Gochfeld 1998).

Distance: Disturbance increased with decreased distance between visitors and birds (Burger 1986), though exact measurements were not reported.

Approach Angle: Visitors directly approaching birds on foot caused more disturbance than visitors driving by in vehicles, stopping vehicles near birds, and stopping vehicles and getting out without approaching birds (Klein 1993). Direct approaches may also cause greater disturbance than tangential approaches to birds (Burger and Gochfeld 1981, Burger et al. 1995, Knight and Cole 1995, Rodgers and Smith 1995, 1997).

Type and Speed of Activity: Joggers and landscapers caused birds to flush more than fishermen, clammers, sunbathers, and some pedestrians, possibly because the former groups move quickly (joggers) or create more noise (landscapers). The latter groups tend to move more slowly or stay in one place for longer periods, and thus birds likely perceive these activities as less threatening (Burger 1981, 1986, Burger et al. 1995, Knight and Cole 1995). Alternatively, birds may tolerate passing by with unabated speed, but may flush if the activity stops or slows (Burger et al. 1995).

Noise: Noise caused by visitors resulted in increased levels of disturbance (Burger 1986, Klein 1993, Burger and Gochfeld 1998), though noise was not correlated with visitor group size (Burger and Gochfeld 1998).

The proposed use has the potential of intermittently interrupting the feeding habits of a variety of shorebirds, gulls, and terns, but encounters between pedestrians and migratory birds will be temporary. Refuge staff will manage researcher access via seasonal closures to minimize disturbance to nesting, resting, and foraging waterbirds on the refuge.

The recovery plan for the northeastern beach tiger beetle describes that many of the species' habitats are threatened by human impacts such as habitat alteration and recreational activities (USFWS 1994). Larval burrows are especially susceptible to trampling, which results in excess energy expenditure and reduced time hunting for the inhabiting individual. We will continue to survey to determine the location and extent of larval beetle occurrence and habitat, and use closures and re-routing to avoid larval habitats, as warranted.

Researcher use also has the potential to disturb loafing seals. Gray and harbor seals haul out on the refuge year-round. A 150-foot buffer around all seals is recommended by the National Oceanic Atmospheric Administration to ensure compliance with the Marine Mammals Protection Act.

Pedestrian Indirect Impacts

Heavy beach use can dry out the sand and contribute to beach erosion. Trash left on the beach, particularly food or wrappers, can attract predators that prey on nesting piping plovers and least terns or roosting shorebirds. Impacts of research are likely to be minimal if conducted in accordance with refuge regulations.

Potential Impacts to Wilderness Character

All of North Monomoy Island and most of South Monomoy Island are designated wilderness and are part of the National Wilderness Preservation System. Wilderness, in contrast with those areas where humans and their works dominate the landscape, is an area where the Earth and its community of life are untrammeled by humans, where humans are visitors who do not remain. Preserving wilderness character requires that we maintain both the tangible and intangible aspects of wilderness. Aspects of wilderness character include maintaining the natural, scenic condition of the land; providing environments for native plants and animals, including those threatened or endangered; maintaining watersheds and airsheds in a healthy condition; maintaining natural night skies and soundscapes; retaining the primeval character of and influence on the land; serving as a benchmark for ecological studies; and providing outstanding opportunities for solitude or primitive and unconfined outdoor recreation, risk, adventure, education, personal growth experiences, a sense of connection with nature and values beyond one's self, a link to our American cultural heritage, and mental and spiritual restoration in the absence of urban pressures. We provide opportunities for appropriate and compatible use and enjoyment of wilderness areas in a manner that preserves their wilderness character and "leave them unimpaired for future use and enjoyment as wilderness."

There are some aspects of the wilderness character that could be affected by research conducted on the refuge. Wilderness visitors' experiences are most strongly affected by social conditions, such as other people and their actions, than by their perception of naturalness or ecological conditions (Hendee and Dawson 2002). With typically long sight distances across Monomoy's rolling nearly treeless coastal barrier landscape, too many individuals encountered during visits likely detracts from the sense of solitude experienced by wilderness users (Stankey and Schreyer 1987, Hendee and Dawson 2002).

Research may need to be conducted in areas of the island that are less traversed by wilderness users. This could lead to the establishment of new trails. Once established, the trails themselves are clear evidence of human presence that detracts from some users' perceptions of an otherwise untrammeled, undeveloped, or natural appearing landscape (Hendee and Dawson 2002) within the Monomoy Wilderness. Bare, exposed, sand dune areas, potentially compacted tidal marsh segments, trail treads, and narrow zones of disturbed vegetation on either side of refuge foot trails and boat landings will be readily evident, but when trail standards are kept minimal, trails tend to be accepted or even expected by most, but not all, wilderness users (Stankey and Schreyer 1987, Cole 2002, Hendee and Dawson 2002).

Overall, allowing well-designed, properly reviewed, low impact research to be conducted by non-Service personnel is likely to have very little negative impact on refuge wildlife populations and habitats. We anticipate research will only have negligible to minor impacts to refuge wildlife and habitats because it will only be carried out after the refuge approves a detailed project proposal and issues an SUP including the stipulations in this determination to ensure compatibility. These stipulations are designed to help ensure each project minimizes impacts to refuge cultural resources, wildlife, vegetation, soils, and water. We also anticipate only minimal impacts because Service staff will supervise this activity, and it will be conducted in accordance with refuge regulations. In the event of persistent disturbance to habitats or wildlife, the activity will be further restricted or discontinued. If the research project is conducted with professionalism and integrity, potential minor adverse impacts are likely to be outweighed by the body of knowledge contributed to our understanding of refuge resources and our management effects on those resources, as well as the opportunity to inform, strengthen, and improve future refuge management decisions.

PUBLIC REVIEW AND COMMENT:

As part of the comprehensive conservation planning (CCP) process for the Monomoy NWR, a draft of this compatibility determination underwent a 180-day public comment period concurrent with the release of our draft CCP/Environmental Impact Statement (EIS). This final compatibility determination resulted from that public review and comment process. It underwent a further 37-day public review period concurrent with the release of the final CCP/EIS. No comments were received on the compatibility determination and it has remained unchanged.

DETERMINATION (CHECK ONE BELOW):

_____Use is not compatible.

__**X**__Use is compatible with the following stipulations.

STIPULATIONS NECESSARY TO ENSURE COMPATIBILITY:

- All researchers will be required to submit a detailed research proposal following Service Policy (FWS Refuge Manual Chapter 4 Section 6, as may be amended), as well as a completed National Wildlife Refuge System Special Use Research and Monitoring Application and Permit. This can be found at *http://www.fws.gov/forms/3-1383-R.pdf;* accessed October 2015. The application can be submitted to the refuge manager via email or by fax. The refuge must be given at least 45 days to review and decide whether to approve proposals before initiation of research. If collection of wildlife is involved, the refuge must be given 60 days to review and decide whether to approve the proposal. The Service cannot guarantee that it will review or approve proposals not submitted within these timeframes.

- Only low impact projects are covered under this determination. Low impact projects, as indicated under (a) above, are those that would only have a minimal potential to impact cultural resources and native wildlife and plants. No project should result in long-term negative alterations to species' behavior (e.g. result in wildlife leaving previously occupied areas for a long term; modifying their habitat use within their range; or, causing nest or young abandonment). No project should degrade wildlife habitat, including vegetation, soils, and water. Nest, dens, and burrows must not be harmed. No research activities should result in soil compaction or erosion, degrade water quality, remove or destroy vegetation, involve off-road vehicle use, or result in collection and removal of animals or whole native plants.

- Research would only be conducted in Service-approved locations, using approved modes of access, and conducted only after the timing, season, duration, numbers of researchers, and areas open and closed is approved. Sensitive wildlife habitat areas will be avoided unless sufficient protection, approved by the Service, is implemented to limit the area and/or resources potentially impacted by the proposed research.

- There are certain times of the year when the refuge is critically important to migratory birds, including threatened and endangered species. The location of the most important nesting, staging and migratory stopover (foraging and resting) habitat varies depending on a number of natural factors (e.g., weather, landform, prey distribution and abundance, and predator presence) as well as human disturbance at other sites. Refuge staff will evaluate the disturbance pressure to migratory birds caused by the presence of individuals engaged in this use. To ensure that this use remains compatible, meaning it does not materially interfere with or detract from the migratory bird purpose of the refuge, it may be necessary to restrict access through the implementation of seasonal and/or area closures. The location and size of these closures are not fixed and will vary over time. Researchers will be expected to comply with closures. Updates on closures will be available at the Headquarters and on the refuge web site.

- In order to preserve wilderness character, research proposed to be conducted in the Monomoy Wilderness will require extra scrutiny using the minimum requirements decision guide to ensure the methods proposed are the minimum necessary for achieving the refuge purpose. Researchers may be asked to draft minimum requirement analyses to expedite review and issuance of conditions designed to protect wilderness. Proposals will be prioritized and approved based on need, benefit, compatibility, and funding required.

- Proposals will be prioritized and approved based on need, benefit to refuge resources, and the level of refuge funding required. Service experts, State agencies, or academic experts may be asked to review and comment on proposals.

- SUPs will be issued for all research conducted by non-Service personnel. The permit will list all the conditions listed here and will identify a schedule for periodic progress reports and submittal of a final report or scientific paper. The regional refuge biologists, other Service divisions, and Massachusetts State agencies may be asked to review and comment on proposals.

- Any research project may be terminated at any time for non-compliance with the conditions of the SUP, or modified, redesigned, relocated, or terminated upon determination by the refuge manager that the project is causing unanticipated adverse impacts to wildlife, wildlife habitat, wilderness character, approved priority public uses, or refuge resources of staff time, equipment, or funding.

- All work with endangered species will require the proper permits from Federal or State government. Any research involving federally listed species may require Section 7 consultation under the Endangered Species Act. Any research involving ground disturbance may require historic preservation consultation with the Regional Historic Preservation Officer and/or State Historic Preservation Officer. Researchers may also need State and Federal collection permits and may need to provide an assurance of animal care form or an institutional animal approval form, if applicable.

- Researchers will mark any survey routes, plots, and points in as visually unobtrusive a manner as practical. No permanent markers or infrastructure can be left on the refuge.

- Researchers will use every precaution and not conduct activities that would cause damage to refuge property or present hazards or significant annoyances to other refuge visitors. Any damage should be reported immediately to the refuge manager.

- Researchers must not litter, or start or use open fires on refuge lands.

- All research staff handling wildlife must be properly trained to minimize the potential for impacts to individual wildlife prior to initiating the project. In addition, a review of the U.S. Department of Agriculture's Animal Welfare Information Center website must be documented by the researcher with identification of practices that will be followed to help further minimize stress, injury, and mortality of wildlife. The website is reached at: *https://awic.nal.usda.gov/research-animals/wildlife-field-studies;* accessed October 2015.

- Researchers may not use any chemicals (e.g., herbicides to treat invasive plants) or hazardous materials without prior written consent of refuge manager (e.g., the type of chemical, timing of use, and rate of application). All activities will be consistent with Service policy and an approved refuge Pesticide Use Plan.

- Researchers will be required to take steps to ensure that invasive species and pathogens are not inadvertently introduced or transferred to the refuge and surrounding lands (e.g., cleaning equipment).

- Researchers must have the SUP in their possession when engaged in research activities and will present it to refuge officials and State and Federal law enforcement agents upon their request.

- Researchers will submit a final report to the refuge upon completion of their work. For long-term studies, interim progress reports may also be required. The refuge also expects that research findings will be published in peer-reviewed publications. The contribution of the refuge and the Service should be acknowledged in any publications. The SUP will identify a schedule for annual progress reports and the submission of a final report or scientific paper.

- Proposals will be prioritized and approved based on need, benefit to refuge resources, and the level of refuge funding required. Service experts, State agencies, or academic experts may be asked to review and comment on proposals.

JUSTIFICATION:

The Service encourages quality, scientific research because it provides critical baseline information on Federal trust and other refuge resources and helps evaluate the management effects on those resources. Research by non-Service personnel, guided by the stipulations listed above, adds greatly to the information base for refuge managers to make proper refuge management decisions. This use will potentially contribute to the refuge's concurrent purposes in carrying out migratory bird management and preserving wilderness character. While some research activities may cause minimal disturbance to wildlife or result in the loss of specific individuals, this impact will be offset by the value of the research to managers and future generations. Impacts, if they occur, would be confined in area, duration, and magnitude, with no long-term consequences predicted. Research conducted by non-Service personnel will not materially interfere with or detract from the mission of the Refuge System or the purposes for which the refuge was established.

SIGNATURE:

Refuge Manager: Elizabeth A Herland (Signature) March 18, 2016 (Date)

CONCURRENCE:

Regional Chief: Scott B. Kahan (Signature) March 18, 2016 (Date)

MANDATORY 10 YEAR RE-EVALUATION DATE: March 18, 2026

Attachment 1. Monomoy National Wildlife Refuge Study Proposal Guidelines

A study proposal is a justification and description of the work to be done, and includes cost and time requirements. Proposals must be specific enough to serve as "blueprints" for the investigative efforts. Step-by-step plans for the actual investigations must be spelled out in advance, with the level of detail commensurate with the cost and scope of the project and the needs of management. Please submit proposals electronically as a Microsoft Word document or hardcopy to the refuge manager.

The following list provides a general outline of first order headings/sections for study proposals.

- Cover Page.
- Table of Contents (for longer proposals).
- Abstract.
- Statement of Issue.
- Literature Summary.
- Objectives/Hypotheses.
- Study Area.
- Methods and Procedures.
- Quality Assurance/Quality Control.
- Specimen Collections.
- Deliverables.
- Special Requirements, Concerns, Necessary Permits.
- Literature Cited.
- Peer Review.
- Budget.
- Personnel and Qualifications.

Cover Page

The cover page must contain the following information:

- Title of Proposal.
- Current Date.
- Investigator(s): name, title, organizational affiliation, address, telephone and fax numbers and e-mail address of all investigators or cooperators.
- Proposed starting date.
- Estimated completion date.
- Total Funding Support Requested from the U.S. Fish and Wildlife Service.
- Signatures of Principal Investigator(s) and other appropriate institutional officials.

Abstract

The abstract should contain a short summary description of the proposed study, including reference to major points in the Statement of Issue, Objectives, and Methods and Procedures sections.

Statement of Issue

Provide a clear, precise summary of the problem to be addressed and the need for its solution. This section should include statements of the importance, justification, relevance, timeliness, generality, and contribution of the study. Describe how any products will be used, including any anticipated commercial use. What is the estimated probability of success of accomplishing the objective(s) within the proposed timeframe?

Literature Summary

This section should include a thorough but concise literature review of current and past research that pertains to the proposed research, especially any pertinent research conducted within the Cape Cod area, and specifically, on refuge units. A discussion of relevant legislation, policies, and refuge planning and management history, goals, and objectives should also be included.

Objectives/Hypotheses

A very specific indication of the proposed outcomes of the project should be stated as objectives or hypotheses to be tested. Project objectives should be measurable. Provide a brief summary of what information will be provided at the end of the study and how it will be used in relation to the problem. These statements should flow logically from the statement of issue and directly address the management problem.

Establish data quality objectives in terms of precision, accuracy, representativeness, completeness, and comparability as a means of describing how good the data need to be to meet the project's objectives.

Study Area

Provide a detailed description of the geographic area(s) to be studied and include a clear map delineating the proposed study area(s) and showing specific locations where work will occur.

Methods and Procedures

This section should describe as precisely as possible how the objectives will be met or how the hypotheses will be tested. Include detailed descriptions and justifications of the field and laboratory methodology, protocols, and instrumentation. Explain how each variable to be measured directly addresses the research objective/ hypothesis. Describe the experimental design, population, sample size, and sampling approach (including procedures for sub-sampling). Summarize the statistical and other data analysis procedures to be used. List the response variables and tentative independent variables or covariates. Describe the experimental unit(s) for statistical analysis. Also include a detailed project time schedule that includes initiation, fieldwork, analysis, reporting, and completion dates.

Quality Assurance/Quality Control

Adequate quality assurance/quality control (QA/QC) procedures help insure that data and results are: credible and not an artifact of sampling or recording errors; of known quality; able to stand up to external scientific scrutiny; and accompanied by detailed method documentation. Describe the procedures to be used to insure that data meet defined standards of quality and program requirements, errors are controlled in the field, laboratory, and office, and data are properly handled, documented, and archived. Describe the various steps (e.g., personnel training, calibration of equipment, data verification and validation) that will be used to identify and eliminate errors introduced during data collection (including observer bias), handling, and computer entry. Identify the percentage of data that will be checked at each step.

Specimen Collections

Clearly describe the kind (species), numbers, sizes, and locations of animals, plants, rocks, minerals, or other natural objects to be sampled, captured, or collected. Identify the reasons for collecting, the intended use of all the specimens to be collected, and the proposed disposition of collected specimens. For those specimens to be permanently retained as voucher specimens, identify the parties responsible for cataloging, preservation, and storage and the proposed repository.

Deliverables

The proposal must indicate the number and specific format of hard and/or electronic media copies to be submitted for each deliverable. The number and format will reflect the needs of the refuge and the Refuge manager. Indicate how many months after the project is initiated (or the actual anticipated date) that each deliverable will be submitted. Deliverables are to be submitted or presented to the refuge manager.

Deliverables that are required are as follows:

Reports and Publications

Describe what reports will be prepared and the timing of reports. Types of reports required in fulfillment of natural and social science study contracts or agreements include:

(1) Progress report(s) (usually quarterly, semiannually, or annually): may be required
(2) Draft final and final report(s): always required

A final report must be submitted in addition to a thesis or dissertation (if applicable) and all other identified deliverables. Final and draft final reports should follow refuge guidelines (Attachment 1a).

In addition, investigators are encouraged to publish the findings of their investigations in refereed professional, scientific publications and present findings at conferences and symposia. The Refuge manager appreciates opportunities to review manuscripts in advance of publication.

Data Files

Provide descriptions of any spatial (Geographic Information Systems; GIS) and non-spatial data files that will be generated and submitted as part of the research. Non-spatial data must be entered onto Windows CD ROMs in Access or Excel. Spatial data, which includes GPS (Global Position System)-generated files, must be in a format compatible with the refuge's GIS system (ArcGIS 8 or 9, Arcview 3.3, or e00 format). All GIS data must be in UTM 19, NAD 83.

Metadata

For all non-spatial and spatial data sets or information products, documentation of information (metadata) describing the extent of data coverage and scale, the history of where, when, and why the data were collected, who collected the data, the methods used to collect, process, or modify/ transform the data, and a complete data dictionary must also be provided as final deliverables. Spatial metadata must conform to U.S. Fish and Wildlife Service (Federal Geographic Data Committee; FDGC) metadata standards.

Oral Presentations

Three types of oral briefings should be included: pre-study, annual, and closeout.

These briefings will be presented to refuge staff and other appropriate individuals and cooperators. In addition, investigators should conduct periodic informal briefings with refuge staff throughout the study whenever an opportunity arises. During each refuge visit, researchers should provide verbal updates on project progress. Frequent dialogue between researchers and refuge staff is an essential element of a successful research project.

Specimens and Associated Project Documentation

A report on collection activities, specimen disposition, and the data derived from collections, must be submitted to the refuge following refuge guidelines.

Other:

Researchers must provide the refuge manager with all of the following:

(1) Copies of field notes/ notebooks/ datasheets.

(2) Copies of raw data (in digital format), including GIS data, as well as analyzed data.

(3) Copies of all photos, slides (digital photos preferred), videos, and films.

(4) Copies of any reports, theses, dissertations, publications or other material (such as news articles). resulting from studies conducted on refuge.

(5) Detailed protocols used in study.

(6) Aerial photographs.

(7) Maps.

(8) Interpretive brochures and exhibits.

(9) Training sessions (where appropriate).

(10) Survey forms.

(11) Value-added software, software developed, and models.

Additional deliverables may be required of specific studies.

Special Requirements, Permits, and Concerns

Provide information on the following topics where applicable. Attach copies of any supporting documentation that will facilitate processing of your application.

Refuge Assistance

Describe any refuge assistance needed to complete the proposed study, such as use of equipment or facilities or assistance from refuge staff. It is important that all equipment, facilities, services, and logistical assistance expected to be provided by the Fish and Wildlife Service be specifically identified in this section so all parties are in clear agreement before the study begins.

Ground Disturbance

Describe the type, location, area, depth, number, and distribution of expected ground- disturbing activities, such as soil pits, cores, or stakes. Describe plans for site restoration of significantly affected areas.

Proposals that entail ground disturbance may require an archeological survey and special clearance prior to approval of the study. You can help reduce the extra time that may be required to process such a proposal by including identification of each ground disturbance area on a U.S. Geological Survey (USGS) 7.5-minute topographic map.

Site Marking and/or Animal Marking

Identify the type, amount, color, size, and placement of any flagging, tags, or other markers needed for site or individual resource (e.g., trees) identification and location. Identify the length of time it is needed and who will be responsible for removing it. Identify the type, color, placement of any tags placed on animals (see SUP for requirements on marking and handling of animals).

Access to Study Sites

Describe the proposed method and frequency of travel to and within the study site(s). Explain any need to enter restricted areas. Describe duration, location, and number of participants, and approximate dates of site visits.

Use of Mechanized and Other Equipment

Describe any vehicles, boats, field equipment, markers, or supply caches by type, number, and location. You should explain the need to use these materials and if or how long they are to be left in the field.

Safety

Describe any known potentially hazardous activities, such as electro-fishing, scuba diving, whitewater boating, aircraft use, wilderness travel, wildlife capture or handling, wildlife or immobilization.

Chemical Use
Identify chemicals and hazardous materials that you propose using within the refuge.

Indicate the purpose, method of application, and amount to be used. Describe plans for storage, transfer, and disposal of these materials and describe steps to remediate accidental releases into the environment. Attach copies of Material Safety Data Sheets.

Animal Welfare
If the study involves vertebrate animals, describe your protocol for any capture, holding, marking, tagging, tissue sampling, or other handling of these animals (including the training and qualifications of personnel relevant to animal handling and care). If your institutional animal welfare committee has reviewed your proposal, please include a photocopy of their recommendations. Describe alternatives considered, and outline procedures to be used to alleviate pain or distress. Include contingency plans to be implemented in the event of accidental injury to or death of the animal. Include state and Federal permits. Where appropriate, coordinate with and inform state natural resource agencies.

Literature Cited

List all reports and publications cited in the proposal.

Peer Review

Provide the names, titles, addresses, and telephone numbers of individuals with subject-area expertise who have reviewed the research proposal. If the reviewers are associated with the investigator's research institution or if the proposal was not reviewed, please provide the names, titles, addresses, and telephone numbers of three to five potential subject-area reviewers who are not associated with the investigator's institution. These individuals will be asked to provide reviews of the proposal, progress reports, and the draft final report.

Budget

The budget must reflect both funding and assistance that will be requested from the Fish and Wildlife Service and the cooperator's contributions on an identified periodic (usually annual) basis.

Personnel Costs
Identify salary charges for principal investigator(s), research assistant(s), technician(s), clerical support, and others. Indicate period of involvement (hours or months) and pay rate charged for services. Be sure to include adequate time for data analysis and report writing and editing.

Fringe Benefits
Itemize fringe benefit rates and costs.

Travel
Provide separate estimates for fieldwork and meetings. Indicate number of trips, destinations, estimated miles of travel, mileage rate, air fares, days on travel, and daily lodging and meals charges. Vehicle mileage rate cannot exceed standard government mileage rates. Charges for lodging and meals are not to exceed the maximum daily rates set for the locality by the Federal Government.

Equipment
Itemize all equipment to be purchased or rented and provide a brief justification for each item costing more than $1,000. Be sure to include any computer-related costs. For proposals funded under Service agreement or contract, the refuge reserves the right to transfer the title of purchased equipment with unit cost of $1,000 or more to the Federal Government following completion of the study. These items should be included as deliverables.

Supplies and Materials
Purchases and rentals under $1,000 should be itemized as much as is reasonable.

Subcontract or Consultant Charges
All such work must be supported by a subcontractor's proposal also in accordance with these guidelines.

Specimen Collections
Identify funding requirements for the cataloging, preservation, storage, and analyses of any collected specimens that will be permanently retained.

Printing and Copying
Include costs for preparing and printing the required number of copies of progress reports, the draft final report, and the final report. In general, a minimum of two (2) copies of progress reports (usually due quarterly, semiannually, or as specified in agreement), the draft final report, and the final report are required.

Indirect Charges
Identify the indirect cost (overhead) rate and charges and the budget items to which the rate is applicable.

Cooperator's Contributions
Show any contributing share of direct or indirect costs, facilities, and equipment by the cooperating research institution.

Outside Funding
List any outside funding sources and amounts.

Personnel and Qualifications

List the personnel who will work on the project and indicate their qualifications, experience, and pertinent publications. Identify the responsibilities of each individual and the amount of time each will devote. A full vita or resume for each principal investigator and any consultants should be included here.

Attachment 1a. Interim Final Report Guidelines

Draft final and final reports should follow Journal of Wildlife Management format and should include the following sections:

Title Page
Abstract
Introduction/Problem statement
Study Area
Methods (including statistical analyses)
Results
Discussion
Management Implications
Management Recommendations
Literature Cited

LITERATURE CITED:

Bélanger, L. and J. Bédard. 1990. Energetic cost of man-induced disturbance to staging snow geese. Journal of Wildlife Management 54(1): 36-41.

Bergstrom, P.W. 1991. Incubation temperatures of Wilson's plovers and killdeer. Condor 91: 634-641.

Boyle, S.A. and F.B. Samson. 1985. Effects of nonconsumptive recreation on wildlife: A review. Wildlife Society Bulletin 13: 110-116.

Burger, J. 1981. Effect of human activity on birds at a coastal bay. Biological Conservation 21: 231-241.

Burger, J. 1986. The effect of human activity on shorebirds in two coastal bays in northeastern United States. Biological Conservation 13: 123-130.

Burger, J. 1991. Foraging behavior and the effect of human disturbance on the piping plover (*Charadrius melodus*). Journal of Coastal Research 7(1): 39-52.

Burger, J. and M. Gochfeld. 1981. Discrimination of the threat of direct versus tangential approach to the nest by incubating herring and great black-backed gulls. Journal of Comparative Physiological Psychology 95: 676-684.

Burger, J., M. Gochfeld, and L.J. Niles. 1995. Ecotourism and birds in coastal New Jersey: Contrasting responses of birds, tourists, and managers. Environmental Conservation 22: 56-65.

Burger, J. and M. Gochfeld. 1998. Effects of ecotourists on bird behavior at Loxahatchee National Wildlife Refuge, Florida. Environmental Conservation 25: 13-21.

Cairns, W.E. and I.A. McLaren. 1980. Status of the piping plover on the east coast of North America. American Birds 34: 206-208.

Cape Cod National Seashore. 1993. Piping plover nest found trampled by pedestrian. News Release. Cape Cod National Seashore, South Wellfleet, Massachusetts. 2 pp.

Collazo, J.A., J.R. Walters, and J.F. Parnell. 1994. Factors Affecting Reproduction and Migration of Waterbirds on North Carolina Barrier Islands. 1993 Annual Progress Report. North Carolina State University, Raleigh, North Carolina. 57 pp.

Erwin, R.M. 1980. Breeding habitat by colonially nesting water birds in two mid-Atlantic U.S. regions under different regimes of human disturbance. Biological Conservation 18: 39-51.

Erwin, R.M. 1989. Responses to Human Intruders by Birds Nesting in Colonies: Experimental Results and Management Guidelines. Colonial Waterbirds 12(1): 104-108.

Goldin, M.R. 1993. Effects of human disturbance and off-road vehicles on piping plover reproductive success and behavior at Breezy Point, Gateway National Recreation Area, New York, M.S. Thesis. University of Massachusetts, Amherst, Massachusetts. 128 pp.

Havera, S.P., L.R. Boens, M.M. Georgi, and R.T. Shealy. 1992. Human disturbance of waterfowl on Keokuk Pool, Mississippi River. Wildlife Society Bulletin 20: 290-298.

Hendee, J.C. and C.P. Dawson. 2002. Wilderness Management: Stewardship and Protection of Resources and Values, Third Edition. Fulcrum Publishing, Golden, Colorado. 640 pp.

Henson, P.T. and A. Grant. 1991. The effects of human disturbance on trumpeter swan breeding behavior. Wildlife Society Bulletin 19: 248-257.

Hill, J.O. 1988. Aspects of breeding biology of Piping Plovers (*Charadrius melodus*) in Bristol County, Massachusetts, in 1988. Unpublished report. University of Massachusetts, Amherst, Massachusetts. 44 pp.

Hoopes, E.M. 1993. Relationships between human recreation and piping plover foraging ecology and chick survival. M.S. Thesis. University of Massachusetts. 106 pp.

Jenkins, D.C. and J. Burger. 1987. New Jersey Endangered Beach-Nesting Bird Project: 1986 Survey and Management. New Jersey Department of Environmental Protection, New Jersey. 37 pp.

Kaiser, M.S. and E.K. Fritzell. 1984. Effects of river recreationists on green-backed heron behavior. Journal of Wildlife Management 48: 561-567.

Kahl, R. 1991. Boating disturbance of canvasbacks during migration at Lake Poygan, Wisconsin. Wildlife Society Bulletin 19: 242-248.

Klein, M.L. 1993. Waterbird behavioral responses to human disturbance. Wildlife Society Bulletin 21: 31-39.

Klein, M.L., S.R. Humphrey, and H. F. Percival. 1995. Effects of ecotourism on distribution of waterbirds in a wildlife refuge. Conservation Biology 9: 1454-1465.

Knight, R.L. and D.N. Cole. 1995. Wildlife responses to recreationists. Pp. 51-69 in R. L. Knight and K. J. Gutzwiller, eds. Wildlife and recreationists: coexistence through management and research. Washington, DC, Island Press. 372 pp.

Korschgen, C.E., L.S. George, and W.L. Green. 1985. Disturbance of diving ducks by boaters on a migrational staging area. Wildlife Society Bulletin 13: 290-296.

Loegering, J.P. 1992. Piping Plover Breeding Biology, Foraging Ecology and Behavior on Assateague Island National Seashore, Maryland. M.S. Thesis. Virginia State Polytechnic Institute and State University, Blacksburg, Virginia. 262 pp.

McConnaughey, J.L., J.D. Fraser, S.D. Coutu, and J.P. Loegering. 1990. Piping plover distribution and reproductive success on Cape Lookout National Seashore. Unpublished report. Cape Lookout National Seashore, Morehead City, North Carolina. 83 pp.

Morton, J.M., A.C. Fowler, and R.L. Kilkpatrick. 1989. Time and energy budgets of American black ducks in winter. Journal of Wildlife Management 53: 401-410 (also see corrigendum in Journal of Wildlife Management 54: 683).

Owen, M. 1973. The management of grassland areas for wintering geese. Wildfowl 24: 123-130.

Pfister, C., B.A. Harrington, and M. Lavine. 1992. The Impact of Human Disturbance on Shorebirds at a Migration Staging Area. Biological Conservation 60(2): 115-126.

Robertson, R.J. and N.J. Flood. 1980. Effects of Recreational Use of Shorelines on Breeding Bird Populations. Canadian Field-Naturalist 94(2): 131-138.

Rodgers, J.A. and H.T. Smith. 1995. Set-back distances to protect nesting bird colonies from human disturbance in Florida. Conservation Biology 9: 89-99.

Rodgers, J.A. and H.T. Smith. 1997. Buffer zone distances to protect foraging and loafing waterbirds from human disturbance in Florida. Wildlife Society Bulletin 25: 139-145.

Shaffer, F. and P. Laporte. 1992. Rapport synthese des recherches relatives au pluvier siffleur (*Charadrius melodus*) effectuees aux Iles-de-la-Madeleine de 1987 a 1991. Association quebecoise des groups d'ornithologues et Service canadien de la faune. 78 pp.

Stankey, G.H. and R. Schreyer. 1987. Attitudes toward wilderness and factors affecting visitor behavior: a state of knowledge review. In: Lucas, R.C., comp. Proceedings – National Wilderness Research Conference: Issues, State-of-Knowledge, Future Directions; July 23-26, 1985; Fort Collins, Colorado. Gen. Tech. Rep. INT-220. Ogden, Utah: U.S. Department of Agriculture, Forest Service, Intermountain Research Stations: 246-293.

Strauss, E. 1990. Reproductive success, life history patterns, and behavioral variation in a population of Piping Plovers subjected to human disturbance (1982-1989). Ph.D. dissertation. Tufts University, Medford, Massachusetts.

United States Fish and Wildlife Service (USFWS). 1994. Northeastern Beach Tiger Beetle (*Cincindela dorsalis dorsalis* Say) Recovery Plan. U.S. Fish and Wildlife Service, Hadley, Massachusetts. 6 pp.

Ward, D.H. and R.A. Stehn. 1989. Response of brant and other geese to aircraft disturbance at Izembek Lagoon, Alaska. U.S. Fish and Wildlife Service, Alaska Fish and Wildlife Research Center. Final report to the Minerals Management Service. Anchorage, Alaska. 193 pp.

Welty, J.C. 1982. The life of birds. Saunders College Publishing, Philadelphia, Pennsylvania. 754 pp.

Williams, G.J. and E. Forbes. 1980. The habitat and dietary preferences of Dark-Bellied Brent Geese and Widgeon in relation to agricultural management. Wildfowl 31: 151-157.

FWS Form 3-2319
02/06

FINDING OF APPROPRIATENESS OF A REFUGE USE

Refuge Name: Monomoy National Wildlife Refuge

Use: Sunbathing and Swimming

This form is not required for wildlife-dependent recreational uses, take regulated by the State, or uses already described in a refuge CCP or step-down management plan approved after October 9, 1997.

Decision Criteria:	**YES**	**NO**
(a) Do we have jurisdiction over the use?	✔	
(b) Does the use comply with applicable laws and regulations (Federal, State, Tribal, and local)?	✔	
(c) Is the use consistent with applicable Executive orders and Department and Service policies?	✔	
(d) Is the use consistent with public safety?	✔	
(e) Is the use consistent with goals and objectives in an approved management plan or other document?	✔	
(f) Has an earlier documented analysis not denied the use or is this the first time the use has been proposed?	✔	
(g) Is the use manageable within available budget and staff?	✔	
(h) Will this be manageable in the future within existing resources?	✔	
(i) Does the use contribute to the public's understanding and appreciation of the refuge's natural or cultural resources, or is the use beneficial to the refuge's natural or cultural resources?	✔	
(j) Can the use be accommodated without impairing existing wildlife-dependent recreational uses or reducing the potential to provide quality (see section 1.6D, 603 FW 1, for description), compatible, wildlife-dependent recreation into the future?	✔	

Where we do not have jurisdiction over the use ["no" to (a)], there is no need to evaluate it further as we cannot control the use. Uses that are illegal, inconsistent with existing policy, or unsafe ["no" to (b), (c), or (d)] may not be found appropriate. If the answer is "no" to any of the other questions above, we will **generally** not allow the use.

If indicated, the refuge manager has consulted with State fish and wildlife agencies. Yes ✔ No _____.

When the refuge manager finds the use appropriate based on sound professional judgment, the refuge manager must justify the use in writing on an attached sheet and obtain the refuge supervisor's concurrence.

Based on an overall assessment of these factors, my summary conclusion is that the proposed use is:

Not Appropriate _____ **Appropriate** ✔

Refuge Manager: Elizabeth A Harland Date: March 18, 2016

If found to be **Not Appropriate**, the refuge supervisor does not need to sign concurrence if the use is a new use.

If an existing use is found **Not Appropriate** outside the CCP process, the refuge supervisor must sign concurrence.

If found to be **Appropriate**, the refuge supervisor must sign concurrence:

Refuge Supervisor: Graham D Taylor Date: March 18, 2016

A compatibility determination is required before the use may be allowed.

JUSTIFICATION FOR A FINDING OF APPROPRIATENESS OF A REFUGE USE

Refuge Name: Monomoy National Wildlife Refuge

Use: Sunbathing and Swimming

NARRATIVE:

The U.S. Fish and Wildlife Service policy on Appropriate Refuge Uses (603 FW 1) states, "General public uses that are not wildlife-dependent recreational uses, as defined by the National Wildlife Refuge System Improvement Act and do not contribute to the fulfillment of refuge purposes or goals or objectives as described in current refuge management plans are the lowest priorities for refuge managers to consider. These uses are likely to divert refuge management resources from priority general public uses or away from our responsibilities to protect and manage fish, wildlife, and plants, and their habitats. Therefore, both law and policy have a general presumption against allowing such uses within the National Wildlife Refuge System."

Although Service policy does not specifically encourage sunbathing and swimming, these activities often facilitate priority uses such as wildlife observation and photography. The use is a traditional refuge activity that attracts many visitors, especially during the summer and early fall, which increases the refuge's ability to provide opportunities for the priority public uses described in the National Wildlife Refuge System Improvement Act of 1997. The use is not expected to have adverse impacts on refuge wildlife and habitat. Mainland refuge beaches are submerged for approximately 3 hours during high tide, making them inaccessible for approximately 6 hours per day. For this reason, it is unlikely that swimming and sunbathing will increase significantly as a primary public use. Extremely limited visitor parking, lack of facilities on the islands, and often rough boating conditions will also limit the numbers of visitors who go out solely for beach use, especially when there are several other local beaches that offer similar recreational opportunities and are much easier to access. Areas used heavily by migratory birds for feeding, roosting, or nesting are closed April through September, so this activity represents only a minimal disturbance factor. Additionally, the refuge is closed to many traditional beach uses such as beach volleyball, grilling, and shade tents. People who want a traditional beach experience are likely to go to many of the other beaches on Cape Cod.

Allowing swimming and sunbathing will contribute to public appreciation of Monomoy National Wildlife Refuge (NWR). Costs associated with administering these uses and likely visitor impacts are both minimal. These uses will not materially interfere with or detract from the mission of the National Wildlife Refuge System or the purpose of the Monomoy NWR. Therefore, it is the determination of the Service that swimming and sunbathing use, at the discretion of the refuge manager, is a compatible use of the Monomoy NWR.

COMPATIBILITY DETERMINATION

USE:

Sunbathing and Swimming

REFUGE NAME:

Monomoy National Wildlife Refuge

DATE ESTABLISHED:

June 1, 1944

ESTABLISHING AND ACQUISITION AUTHORITY(IES):

Migratory Bird Conservation Act (16 U.S.C. § 715d) Public Law 91-504, 16 USC § 1132(c)

REFUGE PURPOSE(S):

"…for use as an inviolate sanctuary, or for any other management purpose, for migratory birds." (16 U.S.C. § 715d).

"…wilderness areas…shall be administered for the use and enjoyment of the American people in such a manner as will leave them unimpaired for future use and enjoyment as wilderness, and so as to provide for the protection of these areas, the preservation of their wilderness character, and for the gathering and dissemination of information regarding their use and enjoyment as wilderness. (PL 88-577 § 2(a), Wilderness Act; as referenced in P.L. 91-504 § 1(g), An Act to Designate Certain Lands as Wilderness).

NATIONAL WILDLIFE REFUGE SYSTEM MISSION:

To administer a national network of lands and waters for the conservation, management, and where appropriate, restoration of the fish, wildlife, and plant resources and their habitats within the United States for the benefit of present and future generations of Americans.

DESCRIPTION OF USE:

(a) What is the use? Is the use a priority public use?
Sunbathing and swimming are not a priority public use of the National Wildlife Refuge System (Refuge System) under the National Wildlife Refuge System Administration Act of 1966 (16 U.S.C. § 668dd-668ee), as amended by the National Wildlife Refuge System Improvement Act of 1997 (Refuge Improvement Act) (Public Law 105-57). However, it is a traditional use at the refuge, mainly from June through August. Visitors engaged in this use may also find themselves observing wildlife on the refuge.

(b) Where would the use be conducted?
Although U.S. Fish and Wildlife Service (Service) policy does not encourage such use, many summer visitors come to the refuge for the primary purpose of sunbathing and swimming. Popular areas include Morris Island

and, when open to the public, the east side of North Monomoy, the sandbars between the islands, and the beach just west of Powder Hole.

Certain areas on Monomoy National Wildlife Refuge (NWR) are seasonally closed to public access at the refuge manager's discretion to protect sensitive habitats or species of concern, minimize conflicts with other refuge activities, or respond to human health and safety concerns. All sunbathing and swimming would be conducted only in areas that are open to the public and do not impact sensitive wildlife or vegetation.

(c) When would the use be conducted?
Monomoy NWR is open daily to the public from 1/2-hour before sunrise to 1/2-hour after sunset. Individuals would be able to sunbathe and swim during regular refuge hours, unless otherwise posted by the refuge.

(d) How would the use be conducted?
The use must be conducted in accordance with refuge regulations, including seasonal closures.

The use is primarily facilitated by pedestrian walking and hiking access, commercial ferry access, or boat. Boats are allowed to land anywhere along the refuge shoreline, with the exception of posted tern colonies and piping plover nesting areas. The presence of hazardous currents and shoals encourages visitors to land their boats in only a few designated locations.

In general, sunbathing and swimming are self-regulated, with signs indicating closed areas. All visitors should contact Monomoy NWR staff for up-to-date information on seasonal closures. Information about closures will also be available on the refuge web site or at the visitor contact station, when staffed.

(e) Why is this use being proposed?
Visitors come to the beaches at Monomoy NWR for a number of reasons, including sunbathing and swimming. However, these are not expected to become the primary reason for public visitation due to the lack of parking at the refuge headquarters, the limited number of hours that the beach at Morris Island is available, high tides, the lack of facilities on North Monomoy Island and South Monomoy Island, the amount of beach closed during the summer, and the inconvenience of getting to the islands. Most visitors will come to observe seals, shorebirds, and seabirds, see the Monomoy Point lighthouse, and fish. Families will come with diverse interests, and swimming and sunbathing will often be secondary to the primary reason for the family visit. The ability to sunbathe and swim will increase the number of visits by entire families, and may prolong the amount of time visitors spend on the refuge. Affording opportunities for public enjoyment by allowing this type of beach use will increase visitor appreciation and foster a greater awareness of the importance of this site to the Refuge System.

AVAILABILITY OF RESOURCES:

Few additional resources are needed to facilitate sunbathing and swimming. The estimated costs of allowing these uses are minimal because little infrastructure is involved and the administration of these uses is done in conjunction with other uses. The costs include all beach activities, including beachcombing, and costs associated with signs, law enforcement, and visitor services contacts are common to these uses.

There are labor costs for annually posting closed plover, tern, and waterfowl nesting areas; there are replacement costs for posts and signs. There are also prorata shares of the annualized cost for special open beach signs, prorata shares of administrative costs, and prorata shares of vehicle, boat, motor, and other specialized equipment costs.

Law Enforcement patrol would be necessary to ensure integrity of the closed nesting areas, especially for piping plovers.

Recurring annual costs:			
Sign replacement and posting			$ 5,000
Coordination with public and media			$ 2,000
GS-9 Law Enforcement	1 staff	40 hours	$ 1,800
Boat fuel, boat maintenance, etc.			$ 2,500
Total recurring annual costs:			**$11,300**

ANTICIPATED IMPACTS OF THE USE:

Boats are allowed to land anywhere along the refuge shoreline, with the exception of posted tern colonies and piping plover nesting areas, but the presence of hazardous currents and shoals encourages visitors to land their boats in only a few designated locations. During the peak visitation period - weekends and holidays in June through September - opportunities for solitude on the beaches of the Monomoy Wilderness Area are diminished as boaters and beach users concentrate at these sites. A possible impact of sunbathing and swimming is a temporary interruption of feeding or roosting behavior of migratory birds at the approach of beachgoers on foot or by boat. Once visitors get settled in their chosen spot on the beach, however, they tend to remain sedentary for long periods of time and migratory birds usually resume their activities just a short distance away. Other possible impacts of these activities include disrupting larval threatened beach tiger beetle populations, disrupting local seal populations, removing or trampling plants, creating new trails, littering, vandalism, and entering closed areas. Beach tents will not be allowed on North and South Monomoy Island, as their use in wilderness areas detracts from the wilderness experience that other visitors may be seeking.

On Monomoy Island, area closures are created to protect priority nesting migratory tern and shorebird species. Although these closure areas are designed to minimize human impacts, the potential exists for impacts to unobserved nesting animals or the unlawful entry of visitors into closed areas.

Conflicts arise when migratory birds and humans are present in the same areas (Boyle and Samson 1985). Response of wildlife to human activities includes departure from site (Owen 1973, Burger 1981, Kaiser and Fritzell 1984, Korschgen et al. 1985, Henson and Grant 1991, Kahl 1991, Klein 1993), use of sub-optimal habitat (Erwin 1980, Williams and Forbes 1980), altered behavior (Burger 1981, Korschgen et al. 1985, Morton et al. 1989, Ward and Stehn 1989, Havera et al. 1992, Klein 1993), and increase in energy expenditure (Morton et al. 1989, Bélanger and Bédard 1990). Numerous studies have documented that migratory birds are disturbed by human activity on beaches. Erwin (1989) documented disturbance of common terns and skimmers and recommended that human activity be restricted to a distance of 100 meters around nesting sites. Klein (1993) in studying waterbird response to human disturbance found that, as intensity of disturbance increased, avoidance response by the birds increased, and found that out-of-vehicle activity to be more disruptive than vehicular traffic. Pfister et al. (1992) found that the impact of disturbance was greater on species using the heavily disturbed front side of the beach, with the abundance of the impacted species being reduced by as much as 50 percent. In studying the effects of recreational use of shorelines on nesting birds, Robertson et al. (1980) discovered that disturbance negatively impacted species composition. Piping plovers, which intensively use the refuge, are also impacted negatively by human activity. Pedestrians on beaches may crush eggs (Jenkins and Burger 1987, Hill 1988, Shaffer and Laporte 1992, Cape Cod National Seashore 1993, Collazo et al. 1994). Dogs may chase plovers (McConnaughey et al. 1990), destroy nests (Hoopes 1993), and kill chicks (Cairns and McLaren 1980). Other studies have shown that if pedestrians cause incubating plovers to leave their nest, the eggs can overheat (Bergstrom 1991) or can cool to the point of embryo death (Welty 1982). Pedestrians have been found to displace unfledged chicks (Strauss 1990, Burger 1991, Hoopes 1993, Loegering 1992, Goldin 1993).

Several studies have examined the effects of recreation on birds using shallow water habitats adjacent to trails and roads through wildlife refuges and coastal habitats in the eastern United States (Burger 1981; Burger 1986; Klein 1993; Burger et al. 1995; Klein et al. 1995; Rodgers and Smith 1995, 1997; Burger and Gochfeld 1998). Overall, the existing research clearly demonstrates that disturbance from recreation activities always has at least temporary effects on the behavior and movement of birds within a habitat or localized area (Burger 1981, 1986; Klein 1993; Burger et al. 1995; Klein et al. 1995; Rodgers and Smith 1997; Burger and Gochfeld 1998). The findings reported in these studies are summarized as follows in terms of visitor activity and avian response to disturbance.

Presence: Birds avoided places where people were present and when visitor activity was high (Burger 1981, Klein et al. 1995, Burger and Gochfeld 1998).

Distance: Disturbance increased with decreased distance between visitors and birds (Burger 1986), though exact measurements were not reported.

Approach Angle: Visitors directly approaching birds on foot caused more disturbance than visitors driving by in vehicles, stopping vehicles near birds, and stopping vehicles and getting out without approaching birds (Klein 1993). Direct approaches may also cause greater disturbance than tangential approaches to birds (Burger and Gochfeld 1981, Burger et al. 1995, Knight and Cole 1995, Rodgers and Smith 1995, 1997).

Type and Speed of Activity: Joggers and landscapers caused birds to flush more than fishermen, clammers, sunbathers, and some pedestrians, possibly because the former groups move quickly (joggers) or create more noise (landscapers). The latter groups tend to move more slowly or stay in one place for longer periods, and thus birds likely perceive these activities as less threatening (Burger 1981, 1986, Burger et al. 1995, Knight and Cole 1995). Alternatively, birds may tolerate passing by with unabated speed, but may flush if the activity stops or slows (Burger et al. 1995).

Noise: Noise caused by visitors resulted in increased levels of disturbance (Burger 1986, Klein 1993, Burger and Gochfeld 1998), though noise was not correlated with visitor group size (Burger and Gochfeld 1998).

Heavy beach use can dry out the sand and contribute to beach erosion. Trash left on the beach, particularly food or wrappers, can attract predators that prey on nesting piping plovers and least terns or roosting shorebirds. Impacts of sunbathing and swimming are likely to be minimal if conducted in accordance with refuge regulations. We will manage refuge closures that restrict pedestrian access to minimize disturbance to priority avian species during critical times of the year. Closures can be expanded or contracted as needed, depending on bird activity and results of further disturbance studies

The recovery plan for the northeastern beach tiger beetle describes that many of the species' habitats are threatened by human impacts such as habitat alteration and recreational activities (USFWS 1994). Larval burrows are especially susceptible to trampling, which results in excess energy expenditure and reduced time hunting for the inhabiting individual. We will continue to survey to determine the location and extent of larval beetle occurrence and habitat, and use closures and re-routing to avoid larval habitats, as warranted.

Pedestrian use also has the potential to disturb loafing seals. Gray and harbor seals haul out on the refuge year-round. A 150-foot buffer around all seals is required by the National Oceanic Atmospheric Administration to ensure compliance with the Marine Mammals Protection Act.

Sunbathing and swimming have the potential to lead to new unwanted trails on the refuge, and concentrated numbers of individuals increase the chances for beach littering and vandalism. Beachgoers could choose to take shortcuts to get to destinations rather than use the marked trail or the designated pedestrian travel corridors. Frequent use of alternative routes could lead to vegetation trampling, and ultimately, areas void of vegetation where the new travel route exists.

All of North Monomoy Island and most of South Monomoy Island are designated wilderness and are part of the National Wilderness Preservation System. Wilderness, in contrast with those areas where humans and their works dominate the landscape, is an area where the Earth and its community of life are untrammeled by humans, where humans are visitors who do not remain. Preserving wilderness character requires that we maintain both the tangible and intangible aspects of wilderness. Aspects of wilderness character include maintaining the natural, scenic condition of the land; providing environments for native plants and animals, including those threatened or endangered; maintaining watersheds and airsheds in a healthy condition; maintaining natural night skies and soundscapes; retaining the primeval character of and influence on the land; serving as a benchmark for ecological studies; and providing opportunities for solitude, primitive and unconfined outdoor recreation, risk, adventure, education, personal growth experiences, a sense of connection with nature and values beyond one's self, a link to our American cultural heritage, and mental and spiritual restoration in the absence of urban pressures. We provide opportunities for appropriate and compatible use and enjoyment of wilderness areas in a manner that will preserve their wilderness character and "leave them unimpaired for future use and enjoyment as wilderness."

Swimming and sunbathing will not detract from the character of wilderness, as long as beach tents and radios are not used in the wilderness area. Swimmers and sunbathers will not alter the natural scenic condition of the land and the use will not occur at a scale large enough to diminish the environment for native plants and animals. These activities can help individuals connect with nature and with wildlife. Given the few number of visitors at the refuge who engage in swimming and sunbathing within the wilderness area, we anticipate no negative impacts on wilderness character.

PUBLIC REVIEW AND COMMENT:

As part of the comprehensive conservation planning (CCP) process for the Monomoy NWR, a draft of this compatibility determination underwent a 180-day public comment period concurrent with the release of our draft CCP/Environmental Impact Statement (EIS). This final compatibility determination resulted from that public review and comment process. It underwent a further 37-day public review period concurrent with the release of the final CCP/EIS. No comments were received on the compatibility determination and it has remained unchanged.

DETERMINATION (CHECK ONE BELOW):

_____Use is not compatible.

__**X**__Use is compatible with the following stipulations.

STIPULATIONS NECESSARY TO ENSURE COMPATIBILITY:

- All sunbathing and swimming will be done only in areas that are open to the public. There are certain times of the year when the refuge is critically important to migratory birds, including threatened and endangered species. The location of the most important nesting, staging and migratory stopover (foraging and resting) habitat varies depending on a number of natural factors (e.g., weather, landform, prey distribution and abundance, and predator presence) as well as human disturbance at other sites. Refuge staff will evaluate the disturbance pressure to migratory birds caused by the presence of individuals engaged in this use. To ensure that this use remains compatible, meaning it does not materially interfere with or detract from the migratory bird purpose of the refuge, it may be necessary to restrict access through the implementation of seasonal and/or area closures. The location and size of these closures are not fixed and will vary over time. Visitors will be expected to comply with closures. Updates on closures will be available at the Headquarters and on the refuge web site.

- Loud radios will not be allowed on the refuge.

- Beaches will be monitored for signs of overuse and sections will be closed as needed.

- No physical items, including litter, will be placed or left on the refuge.

- Fires may not be set anywhere on the refuge, including beaches.

- All beach users must maintain a 150-foot buffer around all seals as required by the National Oceanic Atmospheric Administration to ensure compliance with the Marine Mammals Protection Act.

JUSTIFICATION:

Allowing swimming and sunbathing will contribute to public appreciation of Monomoy NWR. Costs associated with administering these uses and likely visitor impacts are minimal. These uses will not materially interfere with or detract from the mission of the Refuge System or the purpose of the Monomoy NWR. Therefore, it is the determination of the Service that swimming and sunbathing use, at the discretion of the refuge manager, is a compatible use of the Monomoy NWR.

SIGNATURE:

Refuge Manager: Elizabeth A. Harland (Signature) March 18, 2016 (Date)

CONCURRENCE:

Regional Chief: Sam B. Hamilton (Signature) March 18, 2016 (Date)

MANDATORY 10 YEAR RE-EVALUATION DATE: March 18, 2026

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FWS Form 3-2319
02/06

FINDING OF APPROPRIATENESS OF A REFUGE USE

Refuge Name: Monomoy National Wildlife Refuge

Use: Virtual Geocaching and Letterboxing

This form is not required for wildlife-dependent recreational uses, take regulated by the State, or uses already described in a refuge CCP or step-down management plan approved after October 9, 1997.

Decision Criteria:	**YES**	**NO**
(a) Do we have jurisdiction over the use?	✔	
(b) Does the use comply with applicable laws and regulations (Federal, State, Tribal, and local)?	✔	
(c) Is the use consistent with applicable Executive orders and Department and Service policies?	✔	
(d) Is the use consistent with public safety?	✔	
(e) Is the use consistent with goals and objectives in an approved management plan or other document?	✔	
(f) Has an earlier documented analysis not denied the use or is this the first time the use has been proposed?	✔	
(g) Is the use manageable within available budget and staff?	✔	
(h) Will this be manageable in the future within existing resources?	✔	
(i) Does the use contribute to the public's understanding and appreciation of the refuge's natural or cultural resources, or is the use beneficial to the refuge's natural or cultural resources?	✔	
(j) Can the use be accommodated without impairing existing wildlife-dependent recreational uses or reducing the potential to provide quality (see section 1.6D, 603 FW 1, for description), compatible, wildlife-dependent recreation into the future?	✔	

Where we do not have jurisdiction over the use ["no" to (a)], there is no need to evaluate it further as we cannot control the use. Uses that are illegal, inconsistent with existing policy, or unsafe ["no" to (b), (c), or (d)] may not be found appropriate. If the answer is "no" to any of the other questions above, we will **generally** not allow the use.

If indicated, the refuge manager has consulted with State fish and wildlife agencies. Yes ✔ No _____.

When the refuge manager finds the use appropriate based on sound professional judgment, the refuge manager must justify the use in writing on an attached sheet and obtain the refuge supervisor's concurrence.

Based on an overall assessment of these factors, my summary conclusion is that the proposed use is:

Not Appropriate _____ **Appropriate** ✔

Refuge Manager: Elizabeth A Harland Date: March 18, 2016

If found to be **Not Appropriate**, the refuge supervisor does not need to sign concurrence if the use is a new use.

If an existing use is found **Not Appropriate** outside the CCP process, the refuge supervisor must sign concurrence.

If found to be **Appropriate**, the refuge supervisor must sign concurrence:

Refuge Supervisor: Graham N Taylor Date: March 18, 2016

A compatibility determination is required before the use may be allowed.

603 FW 1
Exhibit 1
Page 2

JUSTIFICATION FOR A FINDING OF APPROPRIATENESS OF A REFUGE USE

Refuge Name: Monomoy National Wildlife Refuge

Use: Virtual Geocaching and Letterboxing

NARRATIVE:

The U.S. Fish and Wildlife Service (Service) policy on Appropriate Refuge Uses (603 FW 1) states, "General public uses that are not wildlife-dependent recreational uses, as defined by the National Wildlife Refuge System Improvement Act and do not contribute to the fulfillment of refuge purposes or goals or objectives as described in current refuge management plans are the lowest priorities for refuge managers to consider. These uses are likely to divert refuge management resources from priority general public uses or away from our responsibilities to protect and manage fish, wildlife, and plants, and their habitats. Therefore, both law and policy have a general presumption against allowing such uses within the National Wildlife Refuge System."

Two of the priority public uses for national wildlife refuges–wildlife observation and interpretation–can be facilitated by geocaching. Geocaching can bring nontraditional visitors to the refuge, providing the opportunity to inform them about the mission of the Service and the National Wildlife Refuge System (Refuge System). Virtual geocaching and letterboxing activities are not priority public uses; however, they can facilitate priority public uses on the refuge. When designed carefully, these activities can be used as a form of interpretation to educate the public about the Service, the Refuge System, and the refuge. Virtual geocaching involves walking or hiking, which is allowed in designated areas of the refuge. Although hiking is not a priority public use of the Refuge System and is classified as a non-wildlife activity, most visitors hike the refuge for the wildlands experience it provides. Hiking usually occurs on designated trails through most of the year, as would virtual geocaching. These opportunities advertised on appropriate public web sites will build awareness of the Refuge System and will attract new visitors, many of whom might engage in other wildlife-dependent activities while at the refuge. Additionally, this use would encourage geocachers to stop at the visitor contact station to obtain refuge or wildlife viewing information. Letterboxing would only be allowed inside of refuge visitor contact stations and visitor centers. These activities will not materially interfere with or detract from fulfilling the Refuge System mission or the purpose for which the refuge was established.

These uses are anticipated to have similar impacts as other primary public uses such as interpretation and wildlife observation. Impacts of these uses will likely be minimal if conducted in accordance with refuge regulations.

For the reasons above, virtual geocaching and letterboxing is an appropriate use on Monomoy National Wildlife Refuge.

COMPATIBILITY DETERMINATION

USE:

Virtual Geocaching and Letterboxing

REFUGE NAME:

Monomoy National Wildlife Refuge

DATE ESTABLISHED:

June 1, 1944

ESTABLISHING AND ACQUISITION AUTHORITY(IES):

Migratory Bird Conservation Act (16 U.S.C. § 715d) Public Law 91-504, 16 USC § 1132(c)

REFUGE PURPOSE(S):

"…for use as an inviolate sanctuary, or for any other management purpose, for migratory birds." (16 U.S.C. § 715d).

"…wilderness areas…shall be administered for the use and enjoyment of the American people in such a manner as will leave them unimpaired for future use and enjoyment as wilderness, and so as to provide for the protection of these areas, the preservation of their wilderness character, and for the gathering and dissemination of information regarding their use and enjoyment as wilderness. (PL 88-577 § 2(a), Wilderness Act; as referenced in P.L. 91-504 § 1(g), An Act to Designate Certain Lands as Wilderness).

NATIONAL WILDLIFE REFUGE SYSTEM MISSION:

To administer a national network of lands and waters for the conservation, management, and where appropriate, restoration of the fish, wildlife, and plant resources and their habitats within the United States for the benefit of present and future generations of Americans.

DESCRIPTION OF USE:

(a) What is the use?
Geocaching is an outdoor activity in which the participants use a global positioning system (GPS) receiver, mobile device, or other navigational technique to find hidden containers called geocaches or caches. Geocaching has been described as a game of high-tech hide-and-seek. Variations on geocaching include virtual geocaching (e.g., Earthcaching, Trail Link, and GPS Adventure) and letterboxing. A description of each of these uses follows, based on the National Wildlife Refuge System (Refuge system), Guidance on Geocaching.

Virtual Geocaching utilizes hand-held GPS devices, but the goal of the activity is different and the activity can be enjoyed without a physical cache. Virtual caching provides GPS coordinates to existing points of interest, such as a facility, cultural feature, wayside exhibit, or object in public areas. For more information, visit *www.waymarking.com;* accessed October 2015.

Earthcaching is a type of virtual geocache. The web site lists a number of virtual caches that are educational in purpose and judged for suitability by a team supported by the Geological Society of America. For more information, visit *www.earthcache.org;* accessed October 2015.

Trail Link is a partnership between Geocaching.com and the Rails to Trails Conservancy to collect mapping data for more than 15,000 miles of trails nationwide. Members of the Rails to Trails Conservancy are encouraged to capture GPS coordinates as they hike. The GPS coordinates can be supplemented with photos and other interpretive information about particular points along the trails. For more information about the program and its possible application to Refuge System trails, visit *www.geocaching.com/railstotrails/default.aspx;* accessed October 2015.

GPS Adventures incorporates lesson plans from a number of educational programs about geography, history, science, and technology. The program includes a GPS Adventures maze to provide students with hands-on exploration of the use of GPS technology in support of school programs. For more information, visit *http://www.gpsmaze.com/index.html;* accessed October 2015.

Letterboxing involves the placement of a cache containing a stamp and an inkpad that participants use to document that they have discovered a specific location. Participants find the location by following clues offered on the web involving map coordinates or compass bearings. Letterboxing does not require leaving or removing caches as part of the challenge. For more information, visit *www.letterboxing.org;* accessed October 2015.

(b) Is the use a priority public use?
In their traditional form, these activities are not priority public uses. However, if these activities are designed and created under the guidance of appropriate refuge staff, they can be manipulated into forms of interpretation that are a priority public uses of the Refuge System under the National Wildlife Refuge System Administration Act of 1966 (16 U.S.C. 668dd-668ee) and the National Wildlife Refuge System Improvement Act of 1997 (Public Law 105-57).

(c) Where would the use be conducted?
Certain areas on Monomoy National Wildlife Refuge (NWR) are seasonally closed to public access at the refuge manager's discretion to protect sensitive habitats or species of concern, minimize conflicts with other refuge activities, or respond to human health and safety concerns. All geocaching activities would be only conducted in areas that are open to the public, including the Morris Island trail system, and designated areas on Monomoy NWR. Geocaching activities would avoid sensitive areas prone to disturbance (e.g., sensitive vegetation areas) or degradation (e.g., soil compaction), and would be designed to minimize impacts to endangered species, nesting birds or other breeding, feeding, or resting wildlife. Virtual geocaching could occur in areas open to the public throughout the refuge, including in wilderness areas. Because letterboxing requires a physical cache, it would only occur inside visitor contact stations or visitor centers.

(d) When would the use be conducted?
Monomoy NWR is open to the public from 1/2-hour before sunrise to 1/2-hour after sunset. Virtual geocaching would occur during regular refuge hours any time of the year in any areas open to public access. Use of the refuge for these activities is likely to be highest in late spring, summer, and early fall. Letterboxing would only occur when visitor contact stations or visitor centers are open.

(e) How would the use be conducted?
Virtual geocaching can be used as a tool to get people to visit the refuge and the wilderness areas. The use is primarily facilitated by pedestrian walking and hiking access, commercial ferry access, or by boat. Boats are allowed to land anywhere along the refuge shoreline, with the exception of posted tern colonies and piping plover nesting areas. The presence of hazardous currents and shoals encourages visitors to land their boats in only a few designated locations. Interpretive materials associated with geocaching give the general public an opportunity to learn about the refuge, the Refuge System, and the U.S. Fish and Wildlife Service (Service). The uses are self-regulating, with geocaching coordinates and clues designed to keep visitors on designated trails or within open public areas. Some geocaches may not be available year-round, depending on staffing and seasonal wildlife related closures. Appropriate refuge staff will approve all geocaches, and all areas where geocaching would be allowed are already managed by the refuge for other wildlife-dependent recreational activities.

(f) Why is this use being proposed?
Virtual geocaching and letterboxing are not priority public uses; however, they can facilitate priority public uses on the refuge. When designed carefully, this activity can be used as a form of interpretation to educate the public about refuge management challenges and goals, refuge missions, and priority public uses. Virtual geocaching involves hiking, which is allowed in designated areas of the refuge, and although hiking is not a priority public use of the Refuge System and is classified as a non-wildlife-dependent activity, most visitors hike the refuge for the wildlands experience it provides. Hiking usually occurs on designated trails or in the open areas of the wilderness area through most of the year, as would geocaching. Virtual geocaching opportunities advertised on appropriate public web sites will build awareness of the Refuge System and attract new visitors, who will partake in wildlife-dependent activities while at the refuge. Additionally, geocachers and people engaged in letterboxing will likely stop at the visitor center to obtain refuge or wildlife viewing information.

AVAILABILITY OF RESOURCES:

The refuge has a single trail system on Morris Island in place to support public uses. Additionally, there are many areas on Monomoy NWR that are seasonally open to public uses when not closed to protect wildlife. The estimated costs of allowing geocaching within areas open to the public are fairly low because there little infrastructure is involved. Some staff time to develop and promote the activity will be needed, as well as the procurement of materials to conduct the program. The following breakdown shows the estimated amount of funds needed to administer the program.

GS-11 Visitor Services Manager	1 staff	40 hours	$1,800
GS-11 Law Enforcement Officer	1 staff	40 hours	$1,800
Materials			$ 500
Total recurring annual costs:			**$4,100**

ANTICIPATED IMPACTS OF THE USE:

The proposed use is anticipated to have the same level of impacts as primary public uses because the access and activities are very similar. Since refuge staff will supervise these activities, the impacts of geocaching will likely be minimal if conducted in accordance with refuge regulations. Possible impacts include disruption of nesting migratory bird populations, terns, shorebirds, and other bird populations feeding and resting near the trails during certain times of the year, impacts to larval threatened northeastern beach tiger beetle populations, and disruption of local seal populations.

On Monomoy NWR, area closures are created to protect priority nesting migratory tern and shorebird species. Although these closure areas are designed to minimize human impacts, the potential exists for impacts to unobserved nesting animals. Conflicts arise when migratory birds and humans are present in the same areas (Boyle and Samson 1985). Response of wildlife to human activities includes departure from site (Owen 1973, Burger 1981, Kaiser and Fritzell 1984, Korschgen et al. 1985, Henson and Grant 1991, Kahl 1991, Klein 1993), use of sub-optimal habitat (Erwin 1980, Williams and Forbes 1980), altered behavior (Burger 1981, Korschgen et al. 1985, Morton et al. 1989, Ward and Stehn 1989, Havera et al. 1992, Klein 1993), and increase in energy expenditure (Morton et al. 1989, Bélanger and Bédard 1990).

Numerous studies have documented that migratory birds are disturbed by human activity on beaches. Erwin (1989) documented disturbance of common terns and skimmers and recommended that human activity be restricted to a distance of 100 meters around nesting sites. Pfister et al. (1992) found that the impact of disturbance was greater on species using the heavily disturbed front side of the beach, with the abundance of the impacted species being reduced by as much as 50 percent. In studying the effects of recreational use of shorelines on nesting birds, Robertson et al. (1980) discovered that disturbance negatively impacted species composition. Piping plovers, which intensively use the refuge, are also negatively impacted by human activity. Pedestrians on beaches may crush eggs (Jenkins and Burger 1987, Hill 1988, Shaffer and Laporte 1992, Cape Cod National Seashore 1993, Collazo et al. 1994). Other studies have shown that if pedestrians cause incubating plovers to leave their nest, the eggs can overheat (Bergstrom 1991) or can cool to the point of embryo death (Welty 1982). Pedestrians have been found to displace unfledged chicks (Strauss 1990, Burger 1991, Hoopes 1993, Loegering 1992, Goldin 1993).

Several studies have examined the effects of recreation on birds using shallow water habitats adjacent to trails and roads through wildlife refuges and coastal habitats in the eastern United States (Burger 1981, 1986, Klein 1993, Burger et al. 1995, Klein et al. 1995, Rodgers and Smith 1995, 1997, Burger and Gochfeld 1998). Overall, the existing research clearly demonstrates that disturbance from recreational activities always has at least temporary effects on the behavior and movement of birds within a habitat or localized area (Burger 1981, 1986, Klein 1993, Burger et al. 1995, Klein et al. 1995, Rodgers and Smith 1997, Burger and Gochfeld 1998). The findings that were reported in these studies are summarized as follows in terms of visitor activity and avian response to disturbance.

Presence: Birds avoided places where people were present and when visitor activity was high (Burger 1981, Klein et al. 1995, Burger and Gochfeld 1998).

Distance: Disturbance increased with decreased distance between visitors and birds (Burger 1986), though exact measurements were not reported.

Approach Angle: Visitors directly approaching birds on foot caused more disturbance than visitors driving by in vehicles, stopping vehicles near birds, and stopping vehicles and getting out without approaching birds (Klein 1993). Direct approaches may also cause greater disturbance than tangential approaches to birds (Burger and Gochfeld 1981, Burger et al. 1995, Knight and Cole 1995, Rodgers and Smith 1995, 1997).

Noise: Noise caused by visitors resulted in increased levels of disturbance (Burger 1986, Klein 1993, Burger and Gochfeld 1998), though noise was not correlated with visitor group size (Burger and Gochfeld 1998).

Trash left on the beach, particularly food or wrappers, can attract predators that prey on nesting piping plovers and least terns or roosting shorebirds. Impacts of geocaching are likely to be minimal if conducted in accordance with refuge regulations. We will manage refuge closures that restrict pedestrian access to minimize disturbance to priority avian species during critical times of the year. Closures can be expanded or contracted as needed, depending on bird activity and results of further disturbance studies. The refuge is a leave-no-trace, carry-in-carry-out facility. We encourage all outfitters and guides to pack in and pack out all food containers, bottles, wrappers, trash, and other waste and refuse. Littering, dumping, and abandoning property are prohibited by Federal regulation at 50 CFR 27.93 and 50 CFR 27.94.

Individuals hiking to South Monomoy Island for geocaching activities could potentially impact the larval stage of the threatened northeastern beach tiger beetle. The recovery plan for this species describes that many of the species' habitats are threatened by human impacts such as habitat alteration and recreational activities (Service 1994). Larval burrows are especially susceptible to trampling, which results in excess energy expenditure and reduced time hunting for the inhabiting individual. We will continue to survey to determine the location and extent of larval beetle occurrence and habitat, and use closures or re-routing to avoid larval habitats, as warranted.

Pedestrian use also has the potential to disturb loafing seals. Gray and harbor seals haul out on the refuge year round. We will enforce the 150-foot buffer around all seals as required by the National Oceanic Atmospheric Administration to ensure compliance with the Marine Mammals Protection Act.

Only virtual geocaching will be allowed on refuge, including in wilderness areas, thereby eliminating the erection of any signs or manmade structures to assist in the pursuit of the cache. Given the difficulty in accessing the wilderness area, lower numbers of individuals are expected to engage in virtual geocaching in the wilderness. There should be no diminishment of wilderness character or impact to other wilderness visitor if virtual geocaching is allowed in the wilderness area. All of North Monomoy Island and most of South Monomoy Island are designated wilderness and are part of the National Wilderness Preservation System. Wilderness, in contrast with those areas where humans and their works dominate the landscape, is an area where the Earth and its community of life are untrammeled by humans, where humans are visitors who do not remain. Preserving wilderness character requires that we maintain both the visible and invisible aspects of wilderness. Aspects of wilderness character include maintaining the natural, scenic condition of the land; providing environments for native plants and animals, including those threatened or endangered; maintaining watersheds and airsheds in a healthy condition; maintaining natural night skies and soundscapes; retaining the primeval character of and influence on the land; serving as a benchmark for ecological studies; and

providing opportunities for solitude, primitive and unconfined outdoor recreation, risk, adventure, education, personal growth experiences, a sense of connection with nature and values beyond one's self, a link to our American cultural heritage, and mental and spiritual restoration in the absence of urban pressures. We provide opportunities for appropriate and compatible use and enjoyment of wilderness areas in a manner that will preserve their wilderness character and "leave them unimpaired for future use and enjoyment as wilderness."

Unmanaged geocaching has the potential to damage or kill plants and lead to new, unwanted, impromptu trails on the refuge that become shortcuts through more ecologically sensitive sites. Heavy use of designated, managed, or unmanaged pedestrian travel routes can ultimately lead to areas void of vegetation (McDonnell 1981, Vaske et al. 1992) and potentially destabilize dunes and interdunal wetlands, which are difficult to stabilize and restore to a naturally functioning condition (Kucinski and Einsenmenger 1943, Cole 2002, Goldsmith 2002, Grady 2002, O'Connell 2008).

This use will not affect wilderness character. These activities do not alter the natural scenic condition of the land and will not occur at a scale large enough to diminish the environment for native plants and animals. In fact, virtual geocaching could be used to enhance a visitor's understanding and appreciation of wilderness.

PUBLIC REVIEW AND COMMENT:

As part of the comprehensive conservation planning (CCP) process for the Monomoy NWR, a draft of this compatibility determination underwent a 180-day public comment period concurrent with the release of our draft CCP/Environmental Impact Statement (EIS). This final compatibility determination resulted from that public review and comment process. It underwent a further 37-day public review period concurrent with the release of the final CCP/EIS. No comments were received on the compatibility determination and it has remained unchanged.

DETERMINATION (CHECK ONE BELOW):

_____Use is not compatible.

__X__Use is compatible with the following stipulations.

STIPULATIONS NECESSARY TO ENSURE COMPATIBILITY:

- No geocache will be created or posted on public web sites without the permission of appropriate refuge staff.
- Geocaches will be created only in areas where there is already a designated trail or in areas that are open to the public.
- Virtual geocaching would occur during regular refuge hours any time of the year in any areas open to public use.
- All individuals taking part in geocaching must adhere to area closures and understand that certain geocaches may not be available year-round. There are certain times of the year when the refuge is critically important to migratory birds, including threatened and endangered species. The location of the most important nesting, staging and migratory stopover (foraging and resting) habitat varies depending on a number of natural factors (e.g., weather, landform, prey distribution and abundance, and predator presence) as well as human disturbance at other sites. Refuge staff will evaluate the disturbance pressure to migratory birds caused by the presence of individuals engaged in this use. To ensure that this use remains compatible, meaning it does not materially interfere with or detract from the migratory bird purpose of the refuge, it may be necessary to restrict access through the implementation of seasonal and/or area closures. The location and size of these closures are not fixed and will vary over time. Visitors will be expected to comply with closures. Updates on closures will be available at the Headquarters and on the refuge web site.

- Appropriate notification must be listed on public web sites when a geocache is not available as a result of area closures.
- No physical item will be placed or left on the refuge.
- Letterboxing would only be allowed within visitor contact stations or visitor centers.
- Appropriate notification about the availability of letterboxes based on staffing and visitor contact station open hours will be posted on all public web sites.

JUSTIFICATION:

The Service and the Refuge System maintain the goal of providing opportunities to view wildlife and engage in interpretation. Allowing the use of refuge areas that are already open to the public, including one trail system on Morris Island, to persons participating in geocaching supports this goal. Geocaching would provide visitors with the chance to view wildlife and take part in interpretation about the refuge, promoting public appreciation of the conservation of wildlife and habitats. Geocaching activities are not priority public uses; however, they facilitate priority public uses on the refuge, and in some cases can be used as a form of interpretation, which is a priority public use. Virtual geocaching and letterboxing activities would not materially interfere with or detract from the fulfillment of the Refuge System mission or the purpose for which the refuge was established.

In 2009, the Service developed final guidance on geocaching. This policy can be found in at *http://www.fws.gov/ridgefieldrefuges/ridgefield/pdf/Friends%202010/Recreational%20Geocaching%20Guidance.pdf*; accessed October 2015.

The Service's wilderness management policy (610 FW 2) does not prohibit the use of GPS units within refuge wilderness areas. However, managers need to make sure that wilderness character is considered when evaluating the appropriateness of GPS recreational activities. Service policy (610 FW 2, 2.31) does state that competitive public events or contests are prohibited in wilderness, such as a large organized GPS geocaching event.

SIGNATURE:

Refuge Manager: Elizabeth A. Harland (Signature) March 18, 2016 (Date)

CONCURRENCE:

Regional Chief: Scott B. Kahan (Signature) March 18, 2016 (Date)

MANDATORY 10 YEAR RE-EVALUATION DATE: March 18, 2026

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COMPATIBILITY DETERMINATION

USE:

Wildlife Observation and Photography

REFUGE NAME:

Monomoy National Wildlife Refuge

DATE ESTABLISHED:

June 1, 1944

ESTABLISHING AND ACQUISITION AUTHORITY(IES):

Migratory Bird Conservation Act (16 U.S.C. § 715d) Public Law 91-504, 16 USC § 1132(c)

REFUGE PURPOSE(S):

"…for use as an inviolate sanctuary, or for any other management purpose, for migratory birds." (16 U.S.C. § 715d).

"…wilderness areas…shall be administered for the use and enjoyment of the American people in such a manner as will leave them unimpaired for future use and enjoyment as wilderness, and so as to provide for the protection of these areas, the preservation of their wilderness character, and for the gathering and dissemination of information regarding their use and enjoyment as wilderness. (PL 88-577 § 2(a), Wilderness Act; as referenced in P.L. 91-504 § 1(g), An Act to Designate Certain Lands as Wilderness).

NATIONAL WILDLIFE REFUGE SYSTEM MISSION:

To administer a national network of lands and waters for the conservation, management, and where appropriate, restoration of the fish, wildlife, and plant resources and their habitats within the United States for the benefit of present and future generations of Americans.

DESCRIPTION OF USE:

(a) What is the use? Is the use a priority public use?
The uses are wildlife observation and photography. Wildlife observation and photography are priority public uses of the National Wildlife Refuge System (Refuge System) under the National Wildlife Refuge System Administration Act of 1966 (16 U.S.C. 668dd-668ee) and the National Wildlife Refuge System Improvement Act of 1997 (Refuge Improvement Act) (Public Law 105-57). Commercial photography is evaluated in a separate finding of appropriateness and compatibility determination entitled, "Commercial Wildlife and Landscape Filming and Photography."

(b) Where would the use be conducted?
Certain areas on Monomoy National Wildlife Refuge (NWR) are seasonally closed to public access from April 15 to September 15 to protect sensitive habitats or species of concern. Refuge staff prepare a closed areas map

each April and make it available to the public on the refuge web site, inside the refuge visitor contact station, and at the Morris Island Trail kiosk.

Wildlife observation and photography can be conducted on Monomoy NWR anywhere that is open for public use. On Morris Island, these uses will occur on the Morris Island Interpretive Trail, at overlooks, and along the beach, including the 3/4-mile Morris Island Trail. The trail begins near the refuge headquarters/visitor contact station, goes along the top of the coastal bluff, and down a steep set of stairs to the beach, then through the sand dunes and along salt marshes and salt ponds. The public is asked to remain on this trail.

There are no official trails on North Monomoy Island, although there is a corridor crossing the island. On South Monomoy Island, there are no official trails, although there are paths that have been created over time by visitors or staff conducting management actions. Because these areas are part of the nationally designated wilderness area, these trails are not maintained, and except for seasonal closures, visitors are free to walk anywhere they wish to engage in wildlife observation or photography.

(c) When would the use be conducted?
Wildlife observation and photography would occur year-round, peaking during May 15 to October 15, during daylight hours when the refuge is otherwise open for public use, 1/2-hour before sunrise to 1/2-hour after sunset. Some activities may be allowed during non-daylight hours when the refuge is otherwise closed to public use under a special use permit (SUP) or in conjunction with refuge staff-led or volunteer-led programs.

(d) How would the use be conducted?
Visitors engaged in wildlife observation and photography tend to do so individually or in small groups, with the exception of outings by birding and photography clubs, which often have 20 or more participants in organized field trips to the refuge. Birders access both South Beach, which is managed as part of the Cape Cod National Seashore, as well as North Monomoy Island and South Monomoy Island. Due to the constant geomorphological changes that occur in this area, opportunities for excellent wildlife observation and photography can be found in both areas, with one area providing more opportunities than another at any given time. Most birders and photographers who depart from Morris Island will go to both South Beach and North and South Monomoy Islands on their trip.

Access to refuge areas other than Morris Island will be by commercial ferry, motorized boat, or nonmotorized boat. Once on refuge lands, all access for wildlife observation and photography activities will be on foot. Motorized equipment is not allowed within the Monomoy Wilderness, which encompasses the more remote portions of Monomoy NWR and includes the majority of the refuge's lands. The Morris Island portion of Monomoy NWR is accessible by motor vehicles and bicycles and parking is provided. However, outside the refuge parking lot, no motorized vehicle or bicycle operation is permitted.

In general, wildlife observation and photography activities will be self-guided. Refuge staff do not maintain trails in the Monomoy Wilderness for public use. Staff will focus maintenance efforts on the Morris Island Interpretive Trail and existing and future structures on Morris Island. Currently, there is one observation and photography platform and a coastal bluff viewing area. There is also a short boardwalk at the beginning of the Morris Island Trail, which leads to an overlook and a tiered stairway. The stairway leads visitors to the shoreline and offers high-quality visibility of North Monomoy Island and South Monomoy Island and has a bench for resting. All these existing structures must be maintained annually. There is a new observation platform and photography blind proposed for some point along the Morris Island Interpretive Trail.

New permanent human-made structures are not permitted within wilderness, and in keeping with preserving and protecting wilderness values, none are planned, except for the Morris Island non-wilderness portion of Monomoy NWR. Portable, temporary blinds are allowed in open areas of the refuge provided they are not left standing when unattended or unoccupied.

(e) Why is this use being proposed?
The Refuge Improvement Act states that priority, wildlife-dependent, public uses should receive enhanced consideration in planning and be facilitated on refuges to the extent they are compatible.

The wildlife observation and photography programs promote refuge purposes and management objectives and increase public knowledge and understanding of wildlife and the importance of habitat protection and management. Refuge visitors who participate in wildlife observation and photography will gain an understanding of the missions of the U.S. Fish and Wildlife Service, the Refuge System, and the contribution of the Monomoy NWR to this system.

AVAILABILITY OF RESOURCES:

Wildlife observation and photography currently occur with existing staff, but will be enhanced with the provision of new structures and staff. Monomoy NWR has long been one of the premier birding and photography sites in Massachusetts. Maintaining this reputation has more to do with the physical characteristics of Monomoy NWR and how the habitat changes with changes in geomorphology than it does with the existence of refuge staff and infrastructure. However, improvements in the quality of the programs will be realized with the construction of new facilities on Morris Island and two new staff positions, a portion of which will support the Monomoy NWR public use program.

New construction and renovation/estimated costs:			
Observation platform – install new, handicapped accessible platform			$ 15,000
Morris Island Trail photography blind—1 new			$ 5,000
Total new costs:		**$20,000**	
Recurring annual costs:			
Regular maintenance of platforms, photo blinds, trails			$ 5,000
Equipment and supplies		$ 5,000	
GS-11 Visitor Services Manager	1 staff	160 hours	$ 7,200
GS-9 Visitor Services Specialist	1 staff	120 hours	$ 4,500
WG-6 Maintenance Worker 1 staff	320 hours	$ 9,600	
GS-11 Law Enforcement 1 staff	160 hours	$ 7,200	
Total recurring annual costs:			**$38,500**

ANTICIPATED IMPACTS OF THE USE:

The majority of the impact from wildlife observation and photography will be disturbance to resting, feeding or nesting migratory birds and resting seals. There will be some trampling of vegetation. Incidences of littering, vegetation removal, and vandalism may increase as a result of the projected increase in visitation. On Morris Island, with use restricted to designated trails and other refuge structures, we predict the impacts will be confined to small areas and in areas already affected.

New structures will be located on the Morris Island Interpretive Trail outside the Monomoy Wilderness with consideration of the long-term consequences and cumulative impacts to wildlife and habitats. Most of the new structures proposed, e.g., kiosks, observation platforms, photography blinds, would each result in habitat losses of less than 1/4-acre.

Visitors engaged in wildlife observation and photography have a vested interest in minimizing disturbance to the wildlife they wish to observe and photograph. However, birders and photographers are known to disturb wildlife in an attempt to get closer looks at the objects of their attention. On North Monomoy Island and South Monomoy Island in particular, pedestrians have the potential of impacting shorebird, waterfowl, and other migratory bird populations feeding and resting on beaches and tidal flats. Pedestrians can also impact seals resting on the beach if they get too close. Conflicts arise when migratory birds and humans are present in the same areas (Boyle and Samson 1985). Response of wildlife to human activities includes departure from site (Owen 1973, Burger 1981, Kaiser and Fritzell 1984, Korschgen et al. 1985, Henson and Grant 1991, Kahl 1991, Klein 1993), use of sub-optimal habitat (Erwin 1980, Williams and Forbes 1980), altered behavior (Burger 1981, Korschgen et al. 1985, Morton et al. 1989, Ward and Stehn 1989, Havera et al. 1992, Klein 1993), and increase in energy expenditure (Morton et al. 1989, Bélanger and Bédard 1990).

Numerous studies have documented that migratory birds are disturbed by human activity on beaches. Erwin (1989) documented disturbance of common terns and skimmers and recommended that human activity be restricted to a distance of 100 meters around nesting sites. Klein (1993) in studying waterbird response to human disturbance found that, as intensity of disturbance increased, avoidance response by the birds increased, and found that out-of-vehicle activity to be more disruptive than vehicular traffic. Pfister et al. (1992) found that the impact of disturbance was greater on species using the heavily disturbed front side of the beach, with the abundance of the impacted species being reduced by as much as 50 percent. In studying the effects of recreational use of shorelines on nesting birds, Robertson et al. (1980) discovered that disturbance negatively impacted species composition. Piping plovers, which intensively use the refuge, are also impacted negatively by human activity. Pedestrians on beaches may crush eggs (Jenkins and Burger 1987, Hill 1988, Shaffer

and Laporte 1992, Cape Cod National Seashore 1993, Collazo et al. 1994). Other studies have shown that if pedestrians cause incubating plovers to leave their nest, the eggs can overheat (Bergstrom 1991) or can cool to the point of embryo death (Welty 1982). Pedestrians have been found to displace unfledged chicks (Strauss 1990, Burger 1991, Hoopes 1993, Loegering 1992, Goldin 1993).

Several studies have examined the effects of recreation on birds using shallow water habitats adjacent to trails and roads through wildlife refuges and coastal habitats in the eastern United States (Burger 1981, 1986, Klein 1993, Burger et al. 1995, Klein et al. 1995, Rodgers and Smith 1995, 1997, Burger and Gochfeld 1998). Overall, the existing research clearly demonstrates that disturbance from recreation activities always has at least temporary effects on the behavior and movement of birds within a habitat or localized area (Burger 1981, 1986, Klein 1993, Burger et al. 1995, Klein et al. 1995, Rodgers and Smith 1997, Burger and Gochfeld 1998). The findings that were reported in these studies are summarized as follows in terms of visitor activity and avian response to disturbance.

Presence: Birds avoided places where people were present and when visitor activity was high (Burger 1981, Klein et al. 1995, Burger and Gochfeld 1998).

Distance: Disturbance increased with decreased distance between visitors and birds (Burger 1986), though exact measurements were not reported.

Approach Angle: Visitors directly approaching birds on foot caused more disturbance than visitors driving by in vehicles, stopping vehicles near birds, and stopping vehicles and getting out without approaching birds (Klein 1993). Direct approaches may also cause greater disturbance than tangential approaches to birds (Burger and Gochfeld 1981, Burger et al. 1995, Knight and Cole 1995, Rodgers and Smith 1995, 1997).

Type and Speed of Activity: Joggers and landscapers caused birds to flush more than fishermen, clammers, sunbathers, and some pedestrians, possibly because the former groups move quickly (joggers) or create more noise (landscapers). The latter groups tend to move more slowly or stay in one place for longer periods, and thus birds likely perceive these activities as less threatening (Burger 1981, 1986, Burger et al. 1995, Knight and Cole 1995). Alternatively, birds may tolerate passing by with unabated speed, but may flush if the activity stops or slows (Burger et al. 1995).

Noise: Noise caused by visitors resulted in increased levels of disturbance (Burger 1986, Klein 1993, Burger and Gochfeld 1998), though noise was not correlated with visitor group size (Burger and Gochfeld 1998).

The proposed use has the potential to intermittently interrupt the feeding habits of a variety of shorebirds, gulls, and terns, but encounters between pedestrians and migratory birds will be temporary. Refuge staff will manage wildlife observation and photographer access via seasonal closures to minimize disturbance to nesting, resting, and foraging waterbirds on the refuge.

The recovery plan for the Northeastern Beach Tiger Beetle describes that many of the species' habitats are threatened by human impacts such as habitat alteration and recreational activities (U.S. Fish & Wildlife Service 1994). Larval burrows are especially susceptible to trampling, which results in excess energy expenditure and reduced time hunting for the inhabiting individual. We will continue to survey to determine the location and extent of larval beetle occurrence and habitat, and use closures and re-routing to avoid larval habitats, as warranted.

Visitor use also has the potential to disturb loafing seals. Gray and harbor seals haul out on the refuge year round. A 150-foot buffer zone around all seals is required by the National Oceanic Atmospheric Administration to ensure compliance with the Marine Mammals Protection Act.

Heavy beach use can dry out the sand and contribute to beach erosion. Trash left on the beach, particularly food or wrappers, can attract predators that prey on nesting and roosting shorebirds. Impacts of wildlife observation and photography are likely to be minimal if conducted in accordance with refuge regulations. We will manage refuge closures that restrict pedestrian access to minimize disturbance to priority avian species during critical times of the year. Closures can be expanded or contracted as needed, depending on bird activity and results of further disturbance studies. The refuge is a leave-no-trace, carry-in-carry-out facility. We encourage all outfitters and guides to pack in and pack out all food containers, bottles, wrappers, trash, and

other waste and refuse. Littering, dumping, and abandoning property are prohibited by Federal regulation at 50 CFR 27.93 and 50 CFR 27.94.

All of North Monomoy Island and most of South Monomoy Island are designated wilderness and are part of the National Wilderness Preservation System. Wilderness, in contrast with those areas where humans and their works dominate the landscape, is an area where the Earth and its community of life are untrammeled by humans, where humans are visitors who do not remain. Preserving wilderness character requires that we maintain both the visible and invisible aspects of wilderness. Aspects of wilderness character include maintaining the natural, scenic condition of the land; providing environments for native plants and animals, including those threatened or endangered; maintaining watersheds and airsheds in a healthy condition; maintaining natural night skies and soundscapes; retaining the primeval character of and influence on the land; serving as a benchmark for ecological studies; and providing opportunities for solitude, primitive and unconfined outdoor recreation, risk, adventure, education, personal growth experiences, a sense of connection with nature and values beyond one's self, a link to our American cultural heritage, and mental and spiritual restoration in the absence of urban pressures. We provide opportunities for appropriate and compatible use and enjoyment of wilderness areas in a manner that will preserve their wilderness character and "leave them unimpaired for future use and enjoyment as wilderness."

Wildlife observation and photography will not affect wilderness character. These activities do not alter the natural, scenic condition of the land and will not occur at a scale large enough to diminish the environment for native plants and animals.

Large groups have the potential to negatively infringe on the wilderness experience for those visitors who come to the refuge specifically to have a wilderness experience. This will generally be a short-term impact to wilderness visitors.

PUBLIC REVIEW AND COMMENT:

As part of the comprehensive conservation planning (CCP) process for the Monomoy National Wildlife Refuge, a draft of this compatibility determination underwent a 180-day public comment period concurrent with the release of our draft CCP/Environmental Impact Statement (EIS). This final compatibility determination resulted from that public review and comment process. It underwent a further 37-day public review period concurrent with the release of the final CCP/EIS. No comments were received on the compatibility determination and it has remained unchanged.

DETERMINATION (CHECK ONE BELOW):

_____Use is not compatible.

__**X**__Use is compatible with the following stipulations.

STIPULATIONS NECESSARY TO ENSURE COMPATIBILITY:

- All wildlife observation and photography activities will avoid sensitive areas prone to disturbance and will only be allowed on sections of the beach that are open for public use. There are certain times of the year when the refuge is critically important to migratory birds, including threatened and endangered species. The location of the most important nesting, staging and migratory stopover (foraging and resting) habitat varies depending on a number of natural factors (e.g., weather, landform, prey distribution and abundance, and predator presence) as well as human disturbance at other sites. Refuge staff will evaluate the disturbance pressure to migratory birds caused by the presence of individuals engaged in this use. To ensure that this use remains compatible, meaning it does not materially interfere with or detract from the migratory bird purpose of the refuge, it may be necessary to restrict access through the implementation of seasonal and/or area closures. The location and size of these closures are not fixed and will vary over time. Visitors will be expected to comply with closures. Updates on closures will be available at the Headquarters and on the refuge web site.

- Access for wildlife observation and photography activities will be on foot, or by ferry, boat, and sea kayak. No motorized vehicles will be allowed on the refuge and in the wilderness areas.
- Activities will be in public areas only (unless a special use permit is approved) where only minimal direct and short-term impacts are predicted, and adverse, long-term, cumulative impacts are not anticipated.
- Periodic evaluations will be done to insure that visitors are not causing unacceptable adverse impacts. If we have evidence of unacceptable impacts occurring, we will modify or curtail access as deemed necessary by the refuge manager.
- Occasional law enforcement patrol and regular staff presence should minimize potential violations. The refuge is open 1/2-hour before sunrise to 1/2-hour after sunset for wildlife observation and photography. These restrictions will be maintained. Refuge regulations will be posted and enforced.
- All photographers must follow refuge regulations. On a case by case basis, photographers may be issued a SUP to photograph inside closed areas. Permittees must follow the conditions outlined in the permit, which normally includes notification of refuge personnel each time any activity occurs in closed areas. Use of a closed area will be heavily restricted appropriately to reduce disturbance to wildlife.

JUSTIFICATION:

Wildlife observation and photography are priority, wildlife-dependent, public uses identified by the Refuge Improvement Act. By definition, these activities have been determined appropriate by law and, when compatible, are to be facilitated on refuges. These programs support the mission of the Refuge System by promoting an understanding and appreciation of natural and cultural resources and their management within a national system of refuges. Our programs will reach out to all segments of the public to expand support for the refuge system. Individual refuge programs will be consistent with, and fully support, the goals and objectives in the Monomoy NWR CCP.

We do not expect pedestrian access to materially interfere with or detract from the mission of the Refuge System, nor diminish the purpose for which the refuge was established. It will not pose significant adverse effects on refuge resources, interfere with public use of the refuge, or cause an undue administrative burden. These uses facilitate wildlife observation and photography, and will provide compatible recreational opportunities for visitors to observe and learn about wildlife and habitats firsthand.

SIGNATURE:

Refuge Manager: Elizabeth A Harland (Signature) March 18, 2016 (Date)

CONCURRENCE:

Regional Chief: Scott B Kahan (Signature) March 18, 2016 (Date)

MANDATORY 15 YEAR RE-EVALUATION DATE: March 18, 2031

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Appendix E

Freshwater pond on refuge

Wilderness Review of Monomoy National Wildlife Refuge

Introduction

A wilderness review is the process the U.S. Fish and Wildlife Service (Service) uses to identify and recommend lands or waters in the National Wildlife Refuge System (Refuge System) for inclusion in the National Wilderness Preservation System (NWPS). Planning policy for the System (602 FW 3) mandates conducting wilderness reviews every 15 years through the Comprehensive Conservation Planning (CCP) process. Section 610 FW 4 of the Service's Wilderness Stewardship Policy provides guidance on the wilderness review process. We may also conduct a wilderness review prior to the next planning cycle, should significant new information become available, ecological or other conditions change, or we identify a need to do so.

The wilderness review process has three phases: inventory, study, and recommendation. After first identifying lands and waters that meet the minimum criteria for wilderness, the resulting wilderness study areas (WSA) are further evaluated to determine if they merit recommendation from the Service to the Secretary of the Interior to Congress for wilderness designation.

Areas recommended for designation are managed to maintain wilderness character in accordance with management goals, objectives, and strategies outlined in the final CCP until Congress legislatively designates an area or the CCP is amended to modify or remove the wilderness proposal. A brief discussion of wilderness inventory, study, and recommendation follows.

Wilderness Inventory

The wilderness inventory consists of identifying areas that minimally meet the requirements for wilderness as defined in the Wilderness Act of 1964 (Wilderness Act).

The definition of wilderness is in section 2(c) of the Wilderness Act: "A wilderness, in contrast with those areas where man and his works dominate the landscape, is hereby recognized as an area where the earth and its community of life are untrammeled by man, where man himself is a visitor who does not remain. In this act, an area of wilderness is further defined to mean an area of undeveloped federal land retaining its primeval character and influence, without permanent improvements or human habitation, which is protected and managed so as to preserve its natural conditions and which (1) generally appears to have been affected primarily by the forces of nature, with the imprint of man substantially unnoticeable; (2) has outstanding opportunities for solitude or a primitive and unconfined type of recreation; (3) has at least five thousand acres of land or is of sufficient size as to make practicable its preservation and use in an unimpaired condition; and (4) may also contain ecological, geological, or other features of scientific, educational, scenic, or historic value."

Wilderness Study

During the study phase, lands and waters qualifying for wilderness as a result of the inventory are studied to analyze values (ecological, recreational, cultural, or symbolic), resources (e.g., wildlife, water, vegetation, minerals, or soils), public uses, and refuge management activities within the area. The analysis includes evaluation of whether the WSA can be effectively managed to preserve its wilderness character.

An "All Wilderness Alternative" and a "No Wilderness Alternative" is analyzed for each WSA to compare the benefits and impacts of managing the area as wilderness as opposed to managing the area under an alternate set of goals, objectives, and strategies that do not involve wilderness designation. The environmental analysis addresses benefits and impacts to wilderness values and other resources under each management alternative. The study evaluates how each alternative will:

- Achieve the purposes of the Wilderness Act and the NWPS.
- Affect achieving refuge or planning unit purpose(s).
- Affect that refuge's contribution toward achieving the Refuge System mission.
- Affect maintaining and, where appropriate, restoring biological integrity, diversity, and environmental health at various spatial or landscape scales.
- Meet other legal and policy mandates.

The findings of the study help determine whether to recommend the area for designation as wilderness. The information, analysis, and decisions in the CCP and associated National Environmental Policy Act (NEPA) document (in this case an Environmental Impact Statement) provide the rationale for wilderness suitability determinations and the basic source of information throughout the public, executive, and legislative review processes that follow.

Wilderness Recommendation

There is no requirement to recommend a WSA for congressional designation as wilderness. The Final CCP and Record of Decision document the Service's determination on a WSA's suitability (or unsuitability) for wilderness and decision to recommend (or not recommend) an area for designation.

For a WSA determined suitable and recommended for designation, additional steps are required including preparing a wilderness study report that presents the results of the wilderness review and a Legislative Environmental Impact Statement. Once prepared, these documents are transmitted along with the CCP, through the Secretary of Interior to the President of United States, and ultimately to the United States Congress for approval.

Wilderness Inventory of Monomoy National Wildlife Refuge

The wilderness inventory is a broad look at the CCP planning area to identify potential WSAs. WSAs are roadless areas within the refuge boundaries that meet the minimum criteria for wilderness identified in Sect. 2. (c) of the Wilderness Act. A WSA must meet the minimum size criteria (or be a roadless island), appear natural, and provide outstanding opportunities for solitude or primitive recreation. Other supplemental values are evaluated, but not required.

The wilderness inventory phase was conducted and reviewed by the CCP Planning Team. Members of the planning team are Service personnel from the Regional Office and the field, the district manager of the Massachusetts Division of Fish and Wildlife, and representatives from the Mashpee Wampanoag Tribe and the Wampanoag Tribe of Gay Head (Aquinnah). The inventory process and application of the wilderness criteria is described in the following sections and summarized in table E.1.

Evaluation of Size Criteria

The initial step to identify roadless areas and roadless islands in a planning area requires gathering land status maps, land use and road inventory data, satellite imagery, aerial photographs, and personal observations of areas within refuge boundaries. Lands and waters currently owned by the Service in fee title are evaluated. "Roadless" refers to the absence of improved roads suitable and maintained for public travel by means of motorized vehicles primarily intended for highway use.

An inventory unit meets the size criteria for a WSA if any one of the following standards applies (610 FW 4.8):

- An area with over 5,000 contiguous acres. State and private lands are not included in making this acreage determination.
- A roadless island of any size. A roadless island is defined as an area surrounded by permanent waters or that is markedly distinguished from the surrounding lands by topographical or ecological features.
- An area of less than 5,000 contiguous Federal acres that is of sufficient size as to make practicable its preservation and use in an unimpaired condition, and of a size suitable for wilderness management.
- An area of less than 5,000 contiguous Federal acres that is contiguous with a designated wilderness, recommended wilderness, or area under wilderness review by another Federal wilderness managing agency such as the Forest Service, National Park Service, or Bureau of Land Management.

Discussion

Monomoy National Wildlife Refuge (NWR) stretches for 8 miles off the elbow of Cape Cod. The7,921-acre refuge includes the barrier islands of North Monomoy, South Monomoy and Minimoy, 40 acres on Morris Island

where the headquarters and visitor contact station are located, and waters out to the mean low water line around the Monomoy Islands. The refuge is one of eight refuges in the Eastern Massachusetts NWR Complex headquartered in Sudbury, MA.

All of the lands and waters within the refuge boundary are owned by the United States, and managed by the Service. The majority (86 percent) of the refuge's land and waters lying above Mean Low Water (MLW) were designated as wilderness in 1970. At that time, the wilderness designation was estimated to encompass 2,600 acres. With the exception of excluded areas, the Monomoy Wilderness boundary includes all lands extending to MLW within the original 1944 Declaration of Taking that established Monomoy NWR. Wilderness designation does not include subtidal or open water areas below MLW. The Monomoy Wilderness is currently the only nationally designated wilderness on the densely populated southern New England coastline.

The 1970 wilderness designation excluded four parcels: (1) the 40-acre property on Morris Island which contains the refuge headquarters and visitor contact station; (2) the approximately half-acre Stage Island lot; and (3) the Inward Point and (4) Powder Hole areas on South Monomoy. In the 1970 law, these latter areas are identified as 90 acres and 170 acres, respectively. However, the boundary description of these parcels conducted in 1971 and approved by the Regional Director identifies them as 73 acres and 137 acres, respectively.

In 2000, an updated survey of the refuge was completed by Service Regional Office surveyors who identified the refuge wilderness acreage to be 3,244 acres, the Inward Point exclusion as 432 acres and the Powder Hole exclusion as 163 acres. The sizes of the wilderness area and exclusions have both changed due to accretion. For the purposes of this review, we are using the numbers derived from the 2000 survey, which was approved in 2002 by the Service's Chief Surveyor.

The 432-acre Inward Point exclusion area includes the site of the former Monomoy Brant Club and seasonal camps described below. The 163-acre Powder Hole exclusion area includes the sites for the former Whitewash Village fishing community and U.S. Life Saving Service (and subsequently U.S. Coast Guard) Monomoy Point Lifesaving Station of which little evidence remains today. In addition, the Powder Hole exclusion area also includes the "cherry stem" access trail corridor and approximately 4-acre site of the existing Monomoy Point Light Station buildings, a National Historic Register designated site.

Although these two areas were excepted from the Wilderness designation, Congress intended the Secretary of the Interior to manage the entire area consistent with the concept of Wilderness (House of Representatives, Report No. 91-1441).

The wilderness inventory units which have been identified for this review are (1) the Morris Island/Stage Island unit; (2) the Inward Point unit; and (3) the Powder Hole unit, as shown on map E.1.

Conclusion

With the exception of the Morris Island portion, Monomoy NWR is once again surrounded by permanent waters and markedly distinguished from the surrounding lands by topographical or ecological features. It is also of sufficient size as to make practicable its preservation and use in an unimpaired condition. Additionally, the Inward Point unit and the Powder Hole units meet the size criteria as they are both contiguous to existing wilderness. The Morris Island/Stage Island unit is separated from the rest of the refuge by the Morris Island channel, and is therefore not contiguous with any designated wilderness.

Evaluation of the Naturalness Criteria

To qualify as a WSA, an area must meet the naturalness criteria (610 FW 4.9). Section 2 (c) of the Wilderness Act defines wilderness as an area that "…generally appears to have been affected primarily by the forces of nature with the imprint of man's work substantially unnoticeable." The area must appear "natural" to the average visitor rather than "pristine." The presence of ecologically intact, historic landscape conditions is not required.

An area may include some manmade features and human impacts provided they are substantially unnoticeable in the unit overall. In the inventory phase, the naturalness evaluation focuses on the *existing physical impacts* of refuge management activities, refuge uses, or human-caused hazards, such as the presence of unexploded

ordnance from military activity. At this stage, we do not disqualify an area from further study solely on the basis of established or proposed activities or uses that require the use of temporary roads, motor vehicles, motorized equipment, motorboats, mechanical transport, landing of aircraft, structures, and installations generally prohibited in designated wilderness. In addition, an area may not be considered unnatural in appearance solely on the basis of "sights and sounds" of human impacts and activities outside the boundary of the unit.

Discussion

Monomoy NWR and surrounding areas have a long history of human use. The vicinity of Chatham or "Manomoyick" was occupied by the Monomoyicks, a community of Native Americans of the federally recognized Wampanoag tribe. The Mashpee Wampanoag Tribe and the Wampanoag Tribe of Gay Head (Aquinnah) used the islands perhaps as early as 5,000 years ago and the area represented a local core of Native American settlement after A.D. 1500 (Steinitz and Loparto 1987). However, no Native American sites have been recorded on South Monomoy or North Monomoy. According to the archaeological site files on record with the Massachusetts Historical Commission, two Native American sites have been identified on the southern part of Morris Island, which is not in the current wilderness area. Native Americans likely visited the 8-mile peninsula from which the Monomoy barrier islands were later formed, but exposure to the elements and a lack of vegetation has meant that local landforms were subjected to extensive erosion and movement. As a result, Native American archaeological deposits may be deeply buried on the two islands, or may have been deflated by erosion, and no longer exist.

In the 1600s, European Americans settled in the communities of present day Cape Cod. In 1686, Captain James Forster purchased Morris Island, then known as "Quitnesset." The primary occupations were farming and maritime activities. The Town of Chatham was designated as the "constablewick of Monomoy" in 1696, during which time the Monomoy peninsula was being used as pasture for sheep and cattle.

By the early eighteenth century a small fishing community (later known as Whitewash Village) had been established on the peninsula. During the early 1800s, a deep natural harbor, known as Powder Hole, attracted a sizeable settlement at Whitewash Village. As many as 50 families maintained homes there and the village featured trading stores and a pair of shipyards. This community was largely abandoned after the deep harbor was filled with sediment following a hurricane in the latter half of the 19th century, and hindered the fishing that had sustained the local economy. At its peak, Whitewash Village housed about 200 residents and featured a public school and an inn, the Monomoit House. Little evidence of the historic Whitewash Village exists on the ground surface. Historical deposits and features have likely been subject to erosion, but no formal study has been conducted to map and inventory historic or archaeological resources at the refuge.

The first Monomoy Point Lighthouse was built in 1823. The U.S. Life-Saving Service was authorized to build several lifesaving stations on outer Cape Cod, including the Monomoy peninsula in 1872. A second lifesaving station (Monomoy) was built near Hospital Pond 2 years later, and a third at Monomoy Point in 1902 served as the southernmost component in a series of 13 stations between Chatham and Provincetown (Seufert-Barr 1995). The Morris Island and the Monomoy Point stations transferred to the U.S. Coast Guard in 1915 when the Coast Guard replaced the Life-Saving Service. The Morris Island Coast Guard facility became the current site for the Monomoy NWR administrative headquarters and visitor contact station. The Coast Guard transferred use and management of their remote and difficult to access Morris Island and Stage Island facilities to the U.S. Fish and Wildlife Service following refuge establishment in 1944.

By the early 1900s, the Monomoy peninsula became a popular holiday destination where families built summer camps and waterfowl hunters visited during the fall and winter. The elite Monomoy Brant Club brought sportsmen to the remote beach near Inward Point for waterfowl hunting from 1862 to 1932, at which time the U.S. Military took over the peninsula. Remains of the Brant Club structures persisted through the mid-1950s after which a series of coastal storms destroyed the buildings, leaving behind little evidence of their prior existence.

The refuge (and existing Monomoy Wilderness) includes an area previously known as the Monomoy Island Gunnery Range. The military used the island for aerial bombardment and gunnery range from 1944 through 1950 with evidence of the munitions used still found from time to time.

In the mid-1950s dredge spoil was placed across the cut separating Morris and Stage Islands from mainland

Chatham after a storm deepened the cut but also began filling Stage Harbor with sand. This new "causeway" was paved in the late 1960s, affording all weather motor vehicle access, after which Morris and Stage Islands were "built out" for the residential land use that now surrounds and immediately adjoins existing Monomoy NWR facilities on these islands.

The Morris Island tract contains several buildings and parking areas, as well as a disjunct parcel comprised of salt marsh, small ponds, dunes and beach. The Morris Island Trail traverses this parcel; interpretative exhibits are found along the trail. The Stage Island lot is primarily a parking area and boat loading and unloading area.

The Inward Point area is now free of most permanent or manmade structures, as all the camps that were located in this area when the original wilderness was designated have now been removed. A building foundation and cistern and utility poles do remain. The Powder Hole area contains the historic Monomoy Point Light Station complex. These are the only buildings remaining on South Monomoy and include a lighthouse, a keeper's house, and former oil shed.

Conclusion

The residential land use and roads that surround or immediately adjoin Monomoy NWR lands on Morris and Stage Islands, and their close proximity to the high density development of mainland Chatham, detract from the natural characteristics and fail to satisfy the naturalness criteria for wilderness for this northernmost portion of Monomoy NWR.

Elsewhere, extant buildings and the remains of other structures such as concrete building foundations, water cisterns, and utility poles are signs of past human occupation and still serve as reminders that neither the Powder Hole nor the Inward Point non-wilderness areas have yet attained a primeval, undeveloped and natural condition.

Both the Inward Point and Powder Hole non-wilderness areas exhibit subtle but steadily diminishing evidence of the imprint of man and past habitation, since removal of the buildings on them. The overall impression is one of trending toward naturalness that may in time meet the criteria for naturalness. When on South Monomoy Island, one cannot visually tell when entering or leaving the Monomoy Wilderness surrounding the Inward Point non-wilderness area. When in the Powder Hole non-wilderness area, the historic Monomoy Point Light Station stands out as a clearly unnatural landscape feature, and other remains of past human occupation and motor vehicle use are commonly encountered. Stabilization and historic restoration of the light station buildings began in 2010, with exterior renovations substantially completed in 2012. These renovations were conducted because of the National Register status of the structures. Similar periodic in situ maintenance of the historic light station structures may require future periodic mechanized or motorized transport and equipment use and access to the worksite through the Monomoy Wilderness.

Evaluation of Outstanding Opportunities for Solitude or Primitive Recreation

In addition to meeting the size and naturalness criteria to qualify as a WSA, an area must provide outstanding opportunities for solitude or primitive recreation (610 FW 4.10). The area does not have to possess outstanding opportunities for both solitude and primitive recreation, and does not need to have outstanding opportunities on every acre. Further, an area does not have to be continuously open to public use and access to qualify under these criteria. Congress has designated a number of Refuge System wilderness areas that are closed to public access to protect ecological resource values.

Opportunity for solitude refers to the ability of a visitor to be alone and secluded from other visitors in the area. Primitive and unconfined recreation means nonmotorized, dispersed outdoor recreation activities that do not require developed facilities or mechanical transport. These primitive recreation activities may provide opportunities to experience challenge and risk, self-reliance, and adventure.

These two opportunity "elements" are not explicitly defined by the Wilderness Act but in most cases can be expected to occur together. However, an outstanding opportunity for solitude may be present in an area offering only limited primitive recreation potential. Conversely, an area may be so attractive for recreation use that experiencing solitude is not an option.

Discussion

The Morris Island/Stage Island area provides very limited opportunities to experience solitude or participate in primitive recreation. The Stage Island lot is closed to the public—it is a small lot surrounded by residential dwellings. The Morris Island parcel includes a public parking area, staff parking, a dormitory and maintenance shop, restrooms, and the refuge headquarters and visitor contact station. It is accessible by motor vehicles and receives over 30,000 visitors annually primarily from April to October. The Morris Island Interpretive Trail encompasses much of this parcel. It brings visitors to the beach, which can be heavily used by sunbathers, anglers, and dog walkers. Opportunity for solitude is largely confined to the colder months (November to March) when tourism is lower, but is still significant.

The Inward Point and the Powder Hole non-wilderness areas on South Monomoy are accessible only by boat. Although substantial motorized boating traffic is evident seasonally in the waters surrounding South Monomoy Island, boat traffic decreases progressing southward with increasing distance from mainland ports. The widening of the South Monomoy landmass around Monomoy Point along with the increased distance from mainland development and boating concentrations contribute to a greater opportunity for solitude and primitive recreation for wilderness users of interior reaches near South Monomoy's southern tip. The Monomoy light station, located within the Powder Hole area, does attract visitors, including occasional organized tours. There is a designated boat landing site at or near the northwestern edge of this non-wilderness area. Anglers and shell fishermen can be found in the intertidal areas of the Inward Point non-wilderness area.

Primitive recreation activity is currently confined to daylight hours (½ hour before sunrise to ½ hour after sunset), and is expected to remain so to protect disturbance-sensitive wildlife species. No overnight camping is allowed anywhere on the refuge. The only overnight activity permitted is saltwater angling from shore on the Morris Island portion of Monomoy NWR. There may be some seasonal closures to protect wildlife in the Inward Point and Powder Hole non-wilderness areas, but most of the refuge is open year round to visitors.

Conclusion

The Morris and Stage Island inventory unit does not provide meaningful or consistent opportunities for solitude or primitive recreation. Overall, both the Inward Point and (especially) Powder Hole non-wilderness areas meet the solitude and primitive and unconfined recreation criteria for wilderness. Both inventory units offer potential for outstanding opportunities for solitude or primitive forms of outdoor recreation.

Supplemental Values

The Wilderness Act defines supplemental values as "ecological, geological, or other features of scientific, educational, scenic, or historic value."

Discussion

Monomoy NWR is a vital and unique habitat for migratory birds along the Atlantic flyway and provides a diversity of habitat for passerines, raptors, waterfowl, and seabirds. Four federally listed endangered and threatened species (piping plover, roseate tern, northeastern beach tiger beetle, and red knot) are found on the refuge. Piping plovers are found in the Morris Island, Inward Point and Powder Hole non-wilderness areas; northeastern beach tiger beetles are also present in close proximity to the Inward Point inventory unit on its east side.

Monomoy NWR has been recognized as a Western Hemisphere Shorebird Reserve Network regional site and an Important Bird Area due to its importance to migratory shorebirds. The refuge also is a designated Marine Protected Area. Monomoy refuge's beaches provide valuable spawning habitat for horseshoe crabs, which can be found in the intertidal waters of all three inventory units. The refuge is the largest grey seal haulout site along the Atlantic seaboard, and seals can be commonly found hauled out on the east side of the Inward Point and Powder Hole inventory units. Much of the habitat in the three inventory units is maritime grassland with inclusions of maritime shrubland, which is considered rare in Massachusetts and is characterized by patches of dense shrubs with scattered more open areas of low growth or bare ground. The areas of maritime beach strand community and maritime dune community on the refuge are also considered rare in Massachusetts.

Scientific interest, such as research on coastal wildlife and fish, their habitats, and the geologic and hydrologic processes—especially in the face of global climate change and sea level rise—and potential offshore renewable energy development, is ongoing and expected to continue at Monomoy NWR in the foreseeable future.

Monomoy NWR is one of the few areas remaining where natural, dynamic, coastal barrier system geological processes still proceed largely unimpaired by man. Coastal engineering to retard erosion, such as rock armoring and beach nourishment, and dredging to maintain navigability of waterways, has already impacted Morris and Stage Islands.

Visitors are drawn to the Cape Cod region and Monomoy in particular for the scenic and historic values. Guided natural history tours with an educational focus by groups from Cape Cod Museum of Natural History, Massachusetts Audubon Society, university and school groups, and the Friends of Monomoy NWR have been, and are expected to remain, popular at Monomoy NWR.

Monomoy NWR also has significant cultural and historic supplemental values, including the Monomoy Point Light complex listed on the National Register of Historic Places.

Conclusion

All three inventory units provide supplemental wilderness values, with the Morris Island/Stage Island units providing less supplemental value than the Inward Point and Powder Hole inventory areas.

The Monomoy NWR (map E.1) was evaluated to determine suitability for designation, management, and preservation as wilderness (610 FW 4.13). Considerations in this evaluation included:

- Quality of wilderness values.
- Capability for management as wilderness (manageability) and minimum requirements/tool analysis.

This information provides a basis to compare the impacts of a range of management alternatives and determines the most appropriate management direction for each WSA.

Summary/Conclusion of Wilderness Inventory Phase

Table E.1 summarizes the quality of the three inventory units currently in a non-wilderness status for mandatory and supplemental wilderness characteristics. None of the three current non-wilderness portions of South Monomoy excluded from wilderness designation in 1970 yet meet the eligibility criteria for further detailed study as WSAs as defined by the Wilderness Act during the 15-year plan period.

The Morris Island/Stage Island inventory unit does not and is unlikely ever to meet the size criteria for wilderness. The residential land use and roads that surround or immediately adjoin refuge lands on Morris and Stage Islands and their close proximity to the high density development of mainland Chatham detract from the natural characteristics and fail to satisfy the naturalness criteria for wilderness for this northernmost portion of Monomoy NWR. The Morris and Stage Island inventory unit provides very limited opportunity to experience solitude or participate in primitive recreation due to accessibility by motor vehicles and proximity to concentrated human activity on the mainland shorelines, especially in light of the small acreage the Service manages.

Elsewhere, although the existing imprints of man are diminishing, evidence of past human occupation and use still exists, standing out as obvious detractors from the natural characteristics of the refuge. This especially pertains to the historic Monomoy Point Light complex structures located in the Powder Hole inventory unit. Remnants of old roadways and motor vehicles, building foundations or pilings, cisterns, and utility poles remain evident. On the whole, both the Inward Point and the Powder Hole inventory units do not yet appear to have been affected primarily by the forces of nature and do not yet meet the naturalness criteria for wilderness designation.

Table E.1. Wilderness Inventory Area Findings Summary for Monomoy NWR.

Refuge unit and acreage	(1) has at least 5,000 acres of land or is of sufficient size to make practicable its preservation and use in an unconfined condition, or is a roadless island;	(2) generally appears to have been affected primarily by the forces of nature, with the imprint of man's work substantially unnoticeable;	(3a) has outstanding opportunities for solitude;	(3b) has outstanding opportunities for a primitive and unconfined type of recreation;	(4) contains ecological, geological or other features of scientific, educational, scenic, or historical value.	Parcel qualifies as a wilderness study area (meets criteria 1, 2, and 3a or 3b)
Morris and Stage Island	No	No	Seasonal only	No	Yes	No
Inward Point	Yes, the area is now a roadless island, although formerly roaded and accessible by motor vehicle.	No	Yes	Yes, for daytime recreation.	Yes, the diversity of waterbirds, shorebirds, rare maritime habitat, as well as barrier beach geology feature scientific, educational, scenic, and cultural and historic values.	No
Powder Hole	No. Evidence or former roads and motor vehicle use still apparent but diminishing.	No. Existing structures and access trails for the Monomoy Point. Lighthouse complex listed on the National Register of Historic Places.	Yes	Yes, for daytime recreation.	Yes, the diversity of waterbirds, shorebirds, rare maritime habitat, as well as barrier beach geology feature scientific, educational, scenic, and cultural and historic values.	No


Monomoy National Wildlife Refuge - Comprehensive Conservation Plan
Monomoy National Wildlife Refuge
Stage Harbor
Morris Island
Refuge Headquarters
North Monomoy Island
South Beach
Minimoy Island
Exception #1 Inward Point
Refuge Boundary
South Monomoy Island
Monomoy Lighthouse
Exception #2 Powder Hole
Monomoy NWR Boundary
Easement
Fee
Wilderness Boundary
Maine
New Hampshire
Massachusetts
Map Location
Note: The refuge's eastern boundary extends to the mean low water line, which changes as a result of dynamic, coastal processes. The depiction here is an approximation based on this 2012 photography. The remainder of the refuge boundary is fixed. Other than in the exceptions, the Monomoy Wilderness extends to the mean low water line alone its entire boundary.
Sources: Refuge and Wilderness boundaries from USFWS. Background image from the Town of Chatham, 2012
0 0.5 1 2 3 Miles
0 0.5 1 2 3 4 5 Kilometers
1:70,000

Wilderness Study and CCP Alternatives for Monomoy NWR

Since the wilderness inventory phase determined that none of the three inventory units yet possess wilderness character sufficient for WSA designation, the wilderness study and recommendation phases of the Wilderness Review were not undertaken as part of this CCP cycle.

Another wilderness review in 15 years as part of the next planning cycle will reconsider WSA designation and the wilderness study and recommendation phases for the Inward Point and Powder Hole inventory units, but not the Morris Island/Stage Island inventory unit. All CCP alternatives must manage the existing Monomoy Wilderness to simultaneously secure both an enduring resource of wilderness and accomplish refuge purposes in a way that preserves wilderness character. We will also continue managing and the Inward Point and Powder Hole (currently non-wilderness) inventory units through the 15-year plan period to maintain their size, naturalness, and outstanding opportunities for solitude or primitive and unconfined recreation, to the extent that it will not prevent us from fulfilling and carrying out refuge establishing purposes and the Refuge System mission, in accord with Service wilderness stewardship policy (610 FW). We may also conduct a wilderness review prior to the next planning cycle, should significant new information become available, ecological or other conditions change, or we identify a need to do so.

E.2 Wilderness Stewardship Plan Outline (See 610 FW 3, Exhibit 1)

I. **Introduction**

a. Wilderness establishment, including contents of pertinent laws, date(s) of establishment, boundary or other legal changes, pertinent committee report discussion, and special provisions.

b. Goals and objectives for the wilderness area and its relationship to the refuge's purposes and Refuge System mission and goals, including protection of the air-quality-related values of Class I wilderness areas.

II. **Description of the Wilderness Area**

a. Legal and narrative description of the area.

b. Map displaying Service refuge boundary, wilderness area boundary, and other relevant legal, administrative, and natural boundaries.

c. A description of the baseline wilderness resource condition existing at the time of designation as well as current wilderness resource conditions, including a description of the wilderness area, natural conditions, cultural resources and values, stewardship activities, existing facilities, and public use levels and activities.

III. **Interagency and Tribal Coordination and Public Involvement.** Description of coordination with States, other Federal agencies, and tribes. Description of public involvement activities and a summary and analysis of comments received and how the plan responds to them.

IV. **Stewardship**

a. Description of stewardship strategies (administrative, natural and cultural resources, public recreation, interpretation and education, and commercial services) required to adequately administer the area.

b. Minimum requirement analyses and documentation of NEPA compliance for all refuge management activities and commercial services necessary to administer the area.

c. Descriptions of how we will manage existing private rights, existing rights-of-way, activities associated with valid mineral rights, and congressionally authorized uses to protect wilderness values.

d. An explanation of how we will coordinate with adjoining wilderness units so that the wilderness character and natural and cultural resources and values are managed in a complementary manner that minimizes impediments to visitors traveling from one wilderness area to another.

V. **Research.** Description of any past and current research and identification of research needs. Includes necessary appropriateness and compatibility determinations, minimum requirements analysis, and relevant partnership, funding, and staffing requirements.

VI. **Funds and Personnel.** A discussion of staff and funds needed to administer the wilderness.

VII. **Monitoring.** To determine if we are meeting our wilderness stewardship objectives and other refuge management objectives in wilderness, identify: monitoring requirements; associated protocols; partnership, funding, and staffing needs; indicators of change in resource conditions; standards for measuring that change; and desired conditions or thresholds that will trigger management actions to reduce or prevent impacts on the wilderness.

VIII. **Implementation Schedule.** A schedule of implementation, prioritization of action items, staff assignments, and funding requirements to adequately administer the area.

IX. **Appropriateness and Compatibility Determination**

X. **Review and Approval**

XI. **Appendix**

a. A copy of the legislation establishing, modifying the boundary of, or making other changes to the wilderness.

b. Wilderness study report for the wilderness.

c. NEPA documentation

d. Public hearing record from the wilderness study and record of review of comments received from States, other Federal agencies, tribes, and the public.

e. Congressional hearing record.

f. Congressional committee report accompanying the authorizing legislation.

E.3 Minimum Requirements Analyses Alternatives Matrix

The matrix that follows identifies management activities, by CCP alternative, that may be expected to take place within the Monomoy Wilderness (with any recommended additions) based upon the strategies and monitoring elements listed in chapter 3. Management activity-alternative combinations marked with a "Y" in the matrix are those that minimum requirements analyses must address prior to, or during, development of the Wilderness Stewardship Plan.

Management Activity within Monomoy Wilderness	Alternative A	Alternative B	Alternative C
Temporary Field Camp	**Y**	**Y**	**N**
Boating/Paddling Landing/Anchoring Watercraft	**Y**	**Y**	**Y**
Artificial Wildlife Structures			
• Nest platforms	**Y**	**Y**	**N**
• Dredge material disposal/dredging/beach renourishment	**Y**	**Y**	**N**
• Decoys/broadcast ROST calls	**Y**	**Y**	**Y**
• Artificial eggs/incubation	**Y**	**Y**	**Y**
Wildlife/Resource Inventory & Monitoring			
• Nest census survey	**Y**	**Y**	**Y**
• Nest productivity	**Y**	**Y**	**N**
• Camera traps/motion sensors	**Y**	**Y**	**Y**
• Blinds	**Y**	**Y**	**N**
• Seals	**Y**	**Y**	**N**
• Shorebird banding – cannon nets	**Y**	**Y**	**Y**
• Horseshoe crab spawning survey and tagging	**N**	**N**	**N**
• Sharks	**N**	**N**	**N**
Predator Management			
• Lethal predator control	**Y**	**Y**	**Y**
• Blinds	**Y**	**Y**	**N**
• Predator exclosures at nests	**Y**	**Y**	**Y**
• Electric fence	**Y**	**Y**	**N**
• Chick shelters	**Y**	**Y**	**N**
• Blinds	**Y**	**Y**	**N**
• Camera traps/motion sensors	**Y**	**Y**	**Y**
Vegetation/Habitat Management			
• Tern colony – prescribed burn	**Y**	**Y**	**Y**
• Invasive (non-native) plants	**Y**	**Y**	**Y**
Signage/Navigational Aids			
• Area seasonal closures – symbolic fencing	**Y**	**Y**	**Y**
• Boat landings/wilderness entry points	**Y**	**Y**	**Y**
• Maritime navigational aids	**N**	**N**	**N**
• Wilderness boundary marking	**Y**	**Y**	**Y**
Cultural/Historic Resource Protection			
• Shipwrecks	**Y**	**Y**	**Y**
• Historic light station access for preservation or mitigation	**Y**	**Y**	**Y**
Coastal Change/SLR Monitoring	**Y**	**Y**	**Y**

ARTHUR CARHART NATIONAL WILDERNESS TRAINING CENTER

MINIMUM REQUIREMENTS DECISION GUIDE

WORKSHEETS

Piping Plover Management in Monomoy Wilderness

". . . except as necessary to meet minimum requirements for the administration of the area for the purpose of this Act..."

– the Wilderness Act, 1964

Step 1: Determine if any administrative action is necessary.

Description: Briefly describe the situation that may prompt action.

In 2011, 41 piping plover pairs (threatened) nested on South Monomoy within the refuge boundary, and 85 percent of those nested within the Monomoy Wilderness. Several different management actions are required to enhance plover productivity within the Monomoy Wilderness. Through seasonal closures and predator management actions, Monomoy NWR seeks to maintain at least 1.24 chicks fledged per pair annually, and a mean of at least 1.5 chicks fledged per pair over a 5-year period, consistent with Piping Plover Recovery Plan criteria. Monomoy NWR strives to support 10 percent of the State's annual nesting population, averaged over a 5-year period. Predation (both avian and mammalian) is an important factor limiting piping plover nest productivity. Gulls are opportunistic plover nest and chick predators, and thrived during the 1960s to 1990s coincidental with rapid human development and the unlimited food supply humans represented. Gulls reached and remained at unnaturally high regional population levels. In the early 1970s, the (larger) eastern coyote immigrated to Cape Cod and the Monomoy area, adapting readily to human-induced landscape changes and exploiting a void created when other large mammalian predators were extirpated. Piping plovers in the region have not yet fully developed effective defenses against this once foreign but now resident predator. Coyotes are able to negotiate the mainland to South Monomoy for nightly round trips via the 2006 land bridge. Piping plovers (threatened) require protection under the Endangered Species Act. All high quality piping plover nesting and nearby foraging habitat on Monomoy National Wildlife Refuge is protected from disturbance and degradation.

To determine if administrative action is necessary, answer the questions listed in A–F on the following pages.

A. Describe Options Outside of Wilderness

Is action necessary within wilderness?

Yes: ☒ **No:** ☐

Explain:
On Monomoy NWR, 85 percent of piping plover pairs nests within the Monomoy Wilderness. Piping plover recovery will not be achieved without seasonal closures, population monitoring, and predator management within the Monomoy Wilderness, given that such a large proportion of plover nesting occurs within wilderness.

The U.S. Fish and Wildlife Service is responsible for protecting and assisting in the recovery of federally listed threatened and endangered species, such as the piping plover, under the ESA. The Service is charged with the responsibility for managing (threatened) piping plovers in accordance with the species recovery plan, including those that nest within or adjacent to the Monomoy Wilderness.

B. Describe Valid Existing Rights or Special Provisions of Wilderness Legislation

Is action necessary to satisfy valid existing rights or a special provision in wilderness legislation (the Wilderness Act of 1964 or subsequent wilderness laws) that allows consideration of the Section 4(c) prohibited uses? Cite law and section.

Yes: ☐ **No:** ☒ **Not Applicable:** ☐

Explain:
No special provisions are included in P.L 91-504, the 1970 Wilderness Act, establishing the Monomoy Wilderness and there are no remaining valid existing rights.

C. Describe Requirements of Other Legislation

Is action necessary to meet the requirements of other laws?

Yes: ☒ **No:** ☐ **Not Applicable:** ☐

Explain:
The refuge was established in 1944 pursuant to the Migratory Bird Conservation Act (16 U.S.C. § 715d) through a Declaration of Taking (United States vs. Commonwealth of Massachusetts, and Susie H. Kosak et al, Miscellaneous Civil No. 6340, District Court of Massachusetts) "… for use as an inviolate sanctuary, or for other management purpose, for migratory birds" and "…for the protection during the nesting season or while on their way to and from their breeding grounds…" with an emphasis on threatened, endangered, and migratory birds.

The Endangered Species Act of 1973 (16 U.S.C 1531-1544), as amended directs the Department of the Interior to identify those species of plants and animals listed as threatened, endangered, or candidates, and develop and implement plans and programs to ensure their continued survival into the future.

The piping plover is a migratory bird listed as threatened under the ESA. Piping plover *(Charadrius melodus)* nest productively and in high density along the South Monomoy beaches. Human disturbance during the critical nesting and brood rearing season can easily result in "take" under ESA provisions.

The National Wildlife Refuge System Improvement Act of 1966, as amended by the Wildlife Refuge System Improvement Act of 1997 (16 U.S.C 668dd-ee) directs the U.S. Fish and Wildlife Service "to administer a national network of lands and waters for the conservation, management, and where appropriate, restoration of the fish, wildlife, and plant resources and their habitats within the United States for the benefit of present and future

generations of Americans." The Monomoy Wilderness lies entirely within the Monomoy National Wildlife Refuge, a unit of the National Wildlife Refuge System.

D. Describe Other Guidance

Is action necessary to conform to direction contained in agency policy, unit and wilderness management plans, species recovery plans, or agreements with tribal, state and local governments or other Federal agencies?

Yes: ☒ **No:** ☐ **Not Applicable:** ☐

Explain:
The primary objective of the Atlantic Coast Piping Plover Recovery Plan (USFWS 1996) is to remove the piping plover (*Charadrius melodus*) population from the List of Endangered and Threatened Wildlife and Plants by (1) achieving well-distributed increases in numbers and productivity of breeding pairs, and (2) providing for long-term protection of breeding and wintering plovers and their habitat. The recovery plan strategies provide for the long-term viability of piping plover populations in the wild. The beach and dune edges provide vital breeding habitat for the piping plover, which nest in the beach berm and associated dune edge and washover areas, and forage on nearby intertidal flats. Monomoy NWR, including the Monomoy Wilderness, supports more than 40 nesting pairs of piping plovers.

Policy on Maintaining Biological Integrity, Diversity and Environmental Health (601 FW 3)—This policy provides guidance on maintaining or restoring the biological integrity, diversity, and environmental health of the Refuge System, including the protection of a broad spectrum of fish, wildlife, and habitat resources in refuge ecosystems. It provides refuge managers with a process for evaluating the best management direction to prevent the additional degradation of environmental conditions and restore lost or severely degraded environmental components. It also provides guidelines for dealing with external threats to the biological integrity, diversity, and environmental health of a refuge and its ecosystem. In recognition of Monomoy NWR's role as an avian diversity reservoir, the refuge was designated as a Western Hemisphere Shorebird Reserve Network (Regional) site under the auspices of the WHSRN Hemispheric Council, and an Important Bird Area (IBA) by the Audubon Society. The wetland complex and the non-wilderness beach berm, dune edges and washover areas extending northward from the Powder Hole into the Monomoy Wilderness contribute much toward local and regional biotic integrity, diversity, and environmental health.

E. Wilderness Character

Is action necessary to preserve one or more of the qualities of wilderness character including: untrammeled, undeveloped, natural, outstanding opportunities for solitude or a primitive and unconfined type of recreation, or unique components that reflect the character of this wilderness area?

Untrammeled: **Yes:** ☐ **No:** ☒ **Not Applicable:** ☐

Explain:

Undeveloped: **Yes:** ☐ **No:** ☒ **Not Applicable:** ☐

Explain:

Natural: **Yes:** ☒ **No:** ☐ **Not Applicable:** ☐

Explain:
Habitat and population management is necessary to maintain native species ecologically adapted to Monomoy NWR, including the Monomoy Wilderness, thus preserving and improving the naturalness of the Monomoy Wilderness.

Outstanding opportunities for solitude or a primitive and unconfined type of recreation:

Yes: ☒ **No:** ☐ **Not Applicable:** ☐

Explain:
Preserving and enhancing nesting piping plovers preserves outstanding opportunities to observe and photograph this native species in its natural habitat.

Other unique components that reflect the character of this wilderness:

Yes: ☒ **No:** ☐ **Not Applicable:** ☐

Explain:
Piping plovers contribute to the biotic diversity and integrity of the Monomoy Wilderness and to the unique scientific and ecological values of the area.

F. Describe Effects to the Public Purposes of Wilderness

Is action necessary to support one or more of the public purposes for wilderness (as stated in Section 4(b) of the Wilderness Act) of recreation, scenic, scientific, education, conservation, and historical use?

Recreation: **Yes:** ☐ **No:** ☒ **Not Applicable:** ☐

Explain:
Action is not necessary to support the recreation public purpose because recreational opportunities will remain as they are.

Scenic: **Yes:** ☐ **No:** ☒ **Not Applicable:** ☐

Explain:

Scientific: **Yes:** ☒ **No:** ☐ **Not Applicable:** ☐

Explain:
As one of the few existing, relatively undisturbed, nesting piping plover populations, the Monomoy piping plovers provide an important scientific benchmark; further study of the Monomoy population could add to the scientific piping plover knowledge base. Improved scientific understanding about piping plovers and their management can improve nest productivity and rangewide population recovery.

Education: **Yes:** ☐ **No:** ☒ **Not Applicable:** ☐

Explain:

Conservation: **Yes:** ☒ **No:** ☐ **Not Applicable:** ☐

Explain:
This action helps conserve a federally threatened species. Piping plover population management performed within the Monomoy Wilderness adds to the population, thereby improving prospects for species recovery and long-term population persistence.

Historical use: **Yes:** ☐ **No:** ☒ **Not Applicable:** ☐

Explain:

Step 1 Decision: **Is any administrative action necessary in wilderness?**

Yes: ☒ **No:** ☐ **Not Applicable:** ☐

Explain:
Actions providing nesting habitat, minimizing predation and human disturbance, and conducting monitoring to protect and restore piping plover on Monomoy NWR, including the Monomoy Wilderness, are necessary to achieve the migratory bird conservation purpose for which Monomoy Refuge was established in 1944; to satisfy requirements of other legislation, agency policy, and guidance; to preserve wilderness character; and to achieve the other public purposes for wilderness.

Action is necessary within the Monomoy Wilderness "…for the protection during the nesting season or while on their way to and from their breeding grounds…" of the migratory piping plover. Typically, 85 percent of Monomoy's piping plovers nest within the Monomoy Wilderness. The piping plover is also listed as threatened under the Endangered Species Act of 1973 (16 U.S.C 1531-1544). Piping plover recovery as defined in the Atlantic Coast Piping Plover Recovery Plan will not be achieved without seasonal closures, population monitoring, and predator management within the Monomoy Wilderness, given that such a large proportion of plover nesting occurs within wilderness. Piping plover (Charadrius melodus) nest productively and in high density along the South Monomoy beaches. Human disturbance during the critical nesting and brood rearing season can easily result in violating Endangered Species Act "take" provisions. Action is necessary within the Monomoy Wilderness to fulfill the National Wildlife Refuge System Improvement Act of 1966, as amended by the Wildlife Refuge System Improvement Act of 1997 (16 U.S.C 668dd-ee), directing the U.S. Fish and Wildlife Service "To administer a national network of lands and waters for the conservation, management, and where appropriate, restoration of the fish, wildlife, and plant resources and their habitats within the United States for the benefit of present and future generations of Americans." Action is also necessary within the Monomoy Wilderness to fulfill Service Policy on Maintaining Biological Integrity, Diversity and Environmental Health (601 FW 3), including the protection of a broad spectrum of fish, wildlife, and habitat resources in refuge ecosystems.

Action is necessary to preserve naturalness and outstanding opportunities for unconfined wildlife observation and photography within the Monomoy Wilderness by conserving piping plovers in their natural habitat. As one of the few relatively undisturbed nesting piping plover populations, the Monomoy piping plovers provide an important scientific benchmark, and further study of the Monomoy population could add to the scientific piping plover knowledge base. Improved scientific understanding about piping plovers and their management can improve nest productivity and prospects for regional and rangewide population recovery.

If action is necessary, proceed to Step 2 to determine the minimum activity.

Step 2: Determine the minimum activity.

Please refer to the accompanying Minimum Requirements Decision Guide *Instructions* for an explanation of the effects criteria displayed below.

Description of Alternatives

For each alternative, describe what methods and techniques will be used, when the activity will take place, where the activity will take place, what mitigation measures are necessary, and the general effects to the wilderness resource and character.

Alternative # A – Full Motor Access Option

Description:

Use motorized vehicles to access all areas of the island; install wire exclosures to protect nests; install symbolic fencing to minimize human disturbance to nesting.

Under this alternative, refuge staff travels to South Monomoy boat landings by motorboat daily from early April to Mid-August for daylight-hour fieldwork. Supplies and personnel are transported by motorboat to and from the island twice a week (weather permitting) to boat landings along or within the wilderness boundary. Prior to the nesting season, an all-terrain vehicle (ATV) is used to transport gear, supplies, and equipment through wilderness to a seasonal field base at the Monomoy Point light keeper's house, located outside wilderness. Staff also use the ATV within the Monomoy Wilderness to transport and install symbolic fencing to discourage people from entering potential nesting areas. ATV use remains within the intertidal zone (between the mean high and low tide lines) whenever possible, and fencing and predator exclosure supplies are transported on foot from the ATV in the intertidal zone to installation areas at and above the mean high tide line. During the nesting season, one staff member rides an ATV patrolling the entire length of the South Monomoy beach from the intertidal zone whenever possible, searching for plover nests and broods. The ATV patrol will monitor the nest status through mid-August. An assessment is made as to whether each nest found needs an exclosure against predators. It is expected that any nest requiring an exclosure will be fitted with one following existing plover nest exclosure protocols (typically 5 to 10 nests annually based on habitat). Staff (3 to 5) will carry the exclosure materials from the ATV to the nest location. At the end of the season, staff will remove all materials and equipment (including symbolic fencing and exclosure materials) from wilderness locations with transport by ATV and/or motorboat for storage in non-wilderness locations.

Effects:

Wilderness Character
"Untrammeled"
No Benefits
Adverse Effects

- Exclosing nests to prevent predators from preying on nests constrains the wildness of the Monomoy Wilderness predator-prey processes, and represents a trammeling.

"Undeveloped"
No Benefits
Adverse Effects

- Using motorized equipment such as ATVs and motorboats in wilderness may be perceived by some wilderness users as intruding on the primeval character of the Monomoy Wilderness. Of the options considered, this option includes the most frequent and longest duration use of motorized transport within the Monomoy Wilderness.

- Installing temporary symbolic fencing and exclosures will have a negative effect on the undeveloped quality of the wilderness identical to the other options considered.

"Natural"
Benefits

- Naturalness will improve by protecting and conserving a threatened wildlife species that is a part of the natural character of the wilderness.

Adverse Effects

- The active management to increase piping plover populations and protect their nests from predators will have a negative effect on the natural quality of the wilderness.

"Outstanding opportunities for solitude or a primitive and unconfined type of recreation"
No Benefits
Adverse Effects

- Area closures and enforcement and nest predator exclosures would be visible and confine Monomoy Wilderness visitors during the piping plover breeding season to areas without plover nests. Refuge personnel, ATVs, and motorboats would be visually and audibly evident and may be perceived as intruding on solitude by some Monomoy Wilderness users more so than for the other options considered.

Other unique components that reflect the character of this wilderness — "ecological, geological, or other features of scientific, educational, scenic, or historic value."
Benefits

- The beach/dune nesting piping plover population is a unique ecological feature with scientific, educational, and scenic value to current and future generations of Americans.

No Adverse Effects

Heritage and Cultural Resources

N/A

Maintaining Traditional Skills
No Benefits
Adverse Effects

- Use of motorized and/or mechanized transport (ATVs, motorboats, and/or wheeled carts) in the Monomoy Wilderness reduces the contrast between wilderness and non-wilderness and, of the options considered, least perpetuates the use of primitive/traditional skills.

Special Provisions

N/A

Special Provisions

N/A

Economic and Time Constraints

Benefits

- All plover nests can be checked daily by one observer using an ATV, providing higher quality and consistent nest/brood survival and loss data. This is preferable to the 2 to 4 monitors required to accomplish the same level of monitoring entirely on foot.

Adverse Effects

- Costs of ATV purchase and boat and ATV equipment operation and maintenance, personnel training, and personal protective equipment.

Additional Wilderness-specific Comparison Criteria

N/A

Safety of Visitors, Personnel, and Contractors

Benefits

- Locating injured/ill victims needing medical evacuation is easier if an ATV is an available tool. Medical emergency evacuations (allowed per Section 4(c) of the Wilderness Act) are potentially much faster with an ATV and motorboat available than emergency responders traveling overland on foot.

- Personnel riding ATVs are more mobile and therefore exposed and vulnerable to the weather and environmental hazards for shorter durations.

- To the greatest extent of the options considered, transporting all heavier or bulky supplies, equipment, and other gear over longer distances on an ATV or using a nonmotorized mechanized transport reduces physical exertion and risk for dehydration, heart attack, heat-related illnesses, or hypothermia for employees.

Adverse Effects

- Risks involved with ATV use can be partially mitigated by training, maintenance, and use of personal protective equipment (PPE), but the potential for personnel injury is increased.

Alternative # B – Partial Motor Option

Description:

Use motor boats to drop off and pick up personnel from camp; use nonmotorized mechanized transport (wheeled cart) if loads exceed 80lbs and/or exceed three trips per person on foot; install wire exclosures to protect nests; install symbolic fencing to decrease human disturbance.

Under this alternative, refuge staff travel to South Monomoy boat landings by motorboat daily from early April to Mid-August for daylight-hour fieldwork. Prior to the nesting season all gear, supplies, and equipment for the seasonal field base at the Monomoy Point light keeper's house (non-wilderness) are dropped off at a boat landing along the wilderness boundary by motorboat and then transported on foot through wilderness to the light keeper's house; If loads exceed 80 lbs per person and/or three trips each, a nonmotorized wheeled cart may be used for transport. For all plover work, supplies and personnel are transported to and from the island twice weekly (weather permitting) by motorboat to boat landings along or in the Monomoy Wilderness boundary. Staff (2 to 10) then carry, position, and set up symbolic fencing to discourage people from entering potential plover nesting areas. During the nesting season, 2 to 4 biological staff on foot will search the entire length of the South Monomoy beach to monitor nests and broods. An assessment is made as to whether each nest found needs an exclosure against predators. It is expected that any nest requiring an exclosure will be fitted with one following existing exclosure protocols (typically 5 to 10 nests annually). Staff (3 to 5), will carry nest exclosure materials to the installation site. At season's end, staff will remove all gear, materials, and equipment (including symbolic fencing and exclosures) from the Monomoy Wilderness on foot to wilderness boundary boat landings, and transport it via motorboat for overwinter storage in non-wilderness locations.

Effects:

Wilderness Character

"Untrammeled"

No Benefits

Adverse Effects

- Exclosing nests to prevent predators from preying on nests constrains the wildness of the Monomoy Wilderness predator-prey processes, representing a trammeling to the same extent as other options considered.

"Undeveloped"

No Benefits

Adverse Effects

- Using motorized and mechanized transport in the Monomoy Wilderness will intrude on the primeval character perceived by some wilderness users but to a lesser extent than alternative A, the Full Motor access option.

- Installing temporary symbolic fencing and predator exclosures will have a negative effect on the undeveloped quality of the Monomoy Wilderness from April to August each year to the same extent as other options considered.

"Natural"
Benefits

- Protecting and conserving an endemic, threatened, wildlife species population in its natural habitat helps restore a component of the natural character of the Monomoy Wilderness.

Adverse effects.

- Artificially exclosing predators from nests is intended to disrupt the natural predator-prey process during nesting season on Monomoy NWR, including the Monomoy Wilderness, in order to increase piping plover nest productivity and adult survival.

"Outstanding opportunities for solitude or a primitive and unconfined type of recreation"
No Benefits
Adverse Effects

- Area closures and enforcement and nest predator exclosures present and visible during the piping plover breeding season confine the Monomoy Wilderness users' (primitive) recreation experience to areas devoid of plover nests to the same degree as other alternatives considered. Refuge personnel and motorboats will still be visually and audibly evident even without direct contact, and may be perceived as intruding on solitude by some Monomoy Wilderness users to a somewhat lesser extent than the Full Motor access option.

"Other unique components that reflect the character of this wilderness—ecological, geological, or other features of scientific, educational, scenic, or historic value."
Benefits

- The beach/dune nesting piping plover population is a unique ecological feature with scientific, educational, and scenic value to current and future generations of Americans.

No Adverse Effects

Heritage and Cultural Resources

N/A

Maintaining Traditional Skills

No Benefits
No Adverse Effects

- Use of motorized and nonmotorized mechanized transport in wilderness does not enhance/accentuate the contrast between wilderness and non–wilderness backcountry or perpetuate the use of primitive/traditional skills to the extent that the non-motor alternative does.

Special Provisions

N/A

Economic and Time Constraints

Benefits

Adverse Effects

- Cost of boat operation and maintenance, personnel training, and personal protective equipment.
- More staff time is spent transporting/carrying supplies and materials on foot through wilderness to field base or installation locations and backhauling at the end of each nesting season than under the Full Motor access alternative.

Additional Wilderness-specific Comparison Criteria

N/A

Safety of Visitors, Personnel, and Contractors

Benefits

- Medical emergency evacuations (allowed per Section 4(c) of the Wilderness Act) are potentially much faster when a motorboat is available than emergency responders traveling overland exclusively on foot.
- Transporting heavier or bulky supplies, equipment, and other gear over longer distances using nonmotorized mechanized transport somewhat reduces physical exertion and refuge employee risk of dehydration, heart attack, heat-related illnesses, or hypothermia.

Adverse Effects

- People on foot are much less mobile and are therefore exposed and vulnerable to the weather and environmental hazards for longer durations.
- Carrying all but the heavier supplies, equipment, or other gear increases physical exertion and risk for dehydration, heart attack, heat related illnesses, or hypothermia. The higher level of physical fitness thus required can be only partially mitigated by training, personnel selection, and providing personal protective equipment and Go/No-Go criteria.

Alternative # C – No Motor Option

Description:

Use no motorized transport; nonmotorized mechanized transport (wheeled cart) will be used if loads exceed 80lbs and/or exceed three trips per person on foot; install wire exclosures to protect nests; install symbolic fencing to decrease human disturbance.

Under this alternative, refuge staff travel to South Monomoy by paddling (kayak, weather permitting) from early April to Mid-August for daylight-hour fieldwork. On reaching South Monomoy, refuge staff hike through the Monomoy Wilderness to reach a seasonal field base at the Monomoy Point light keeper's house (non-wilderness). Personnel return in the same manner at the end of their field base assignments (10-days on/4-days off schedule). Prior to the plover nesting season, symbolic fencing and nest predator exclosures are dropped off via motorboat over a one- to two-day period at boat landings along or within the Monomoy Wilderness boundary, and then transported on foot through wilderness to deployment locations within wilderness. If loads exceed 80lbs per

person and/or three trips each, a nonmotorized wheeled cart may be used for transport. All field base supplies are stored at the light keeper's house (nonwilderness) during the off-season. Motorboat operation will be timed to coincide with low tide in order to keep motorized equipment from entering wilderness and will be used only for potable water and necessary personnel health/safety supplies. Staff (2 to 10) will carry, position, and install symbolic fencing to discourage people from entering potential plover nesting areas. During the nesting season, 3 to 4 biological staff concurrently search the entire length of the South Monomoy beach on foot, performing nest monitoring duties through mid-August. Personnel carry binoculars, data sheets, and other gear (e.g., water, insect repellant, etc.). An assessment is made as to whether each nest found needs an exclosure against predators. It is expected that any nest requiring an exclosure will be fitted with one following existing exclosure protocols (typically 5 to 10 nests annually based on habitat). Staff (3 to 5), will carry and install the nest exclosure materials to the installation sites. A supply of exclosure material is kept at field base (nonwilderness). At the end of the season, staff will remove all symbolic fencing and exclosure materials from wilderness locations, backhauling them on foot or using a nonmotorized cart to the field base, or to the wilderness boundary boat landings for pick-up by motor boat and transport to overwinter storage in non-wilderness locations.

Effects:

Wilderness Character

"Untrammeled"

No Benefits

Adverse Effects

- Exclosing nests to prevent predators from preying on nests constrains the wildness of the Monomoy Wilderness predator-prey processes, representing a trammeling.

"Undeveloped"

Benefits

- This alternative uses no motorized equipment in wilderness and, of the alternatives considered, best retains the primeval character of the Monomoy Wilderness.

Adverse Effects

- Using even limited mechanized transport in the Monomoy Wilderness will intrude on the primeval character perceived by some wilderness users; this option is similar in impact to alternative B, the Partial Motor option.

- Installing temporary symbolic fencing and predator exclosures will have a negative effect on the undeveloped quality of the Monomoy Wilderness from April-August each year as in the other options considered.

Natural"

Benefits

- Protecting and conserving an endemic, threatened, wildlife species population in its natural habitat helps restore a component of the natural character of the Monomoy Wilderness.

Adverse Effects

- Artificially exclosing predators from nests is intended to disrupt the natural predator-prey process during nesting season on Monomoy NWR, including the Monomoy Wilderness, in order to increase piping plover nest productivity and adult survival to the same extent as the other options considered.

"Outstanding opportunities for solitude or a primitive and unconfined type of recreation"
No Benefits
Adverse Effects

- Area closures and enforcement and nest predator exclosures present and visible during the piping plover breeding season confine Monomoy Wilderness users' (primitive) recreation experience to areas devoid of plover nests. With larger numbers of refuge personnel required concurrently for plover monitoring, their kayaks or motorboats would be more visually and audibly evident even without direct contact, and may be perceived as intruding on solitude by some Monomoy Wilderness users more than the other options considered.

Other unique components that reflect the character of this wilderness—ecological, geological, or other features of scientific, educational, scenic, or historic value."
Benefits

- The beach/dune nesting piping plover population is a unique ecological feature with scientific, educational, and scenic value to current and future generations of Americans.

No Adverse Effects

Heritage and Cultural Resources

N/A

Maintaining Traditional Skills

Benefits

- Minimizing non–motorized transport in the Monomoy Wilderness enhances and accentuates the contrast between wilderness and non–wilderness, and perpetuates the use of primitive traditional skills to a greater extent than the other options considered.

No Adverse Effects

- Even limited nonmotorized mechanical transport (wheeled cars) use within the Monomoy Wilderness somewhat reduces the contrast between wilderness and non-wilderness and reduces use of primitive traditional skills, but to a lesser degree than the other options considered.

Special Provisions

N/A

Economic and Time Constraints

No Benefits
Adverse Effects

- Cost to train personnel on kayak use.
- Cost to hire/acquire more staff.
- Cost to obtain more kayaks and safety equipment and otherwise equip refuge personal to safely and adequately perform their job duties.
- Substantially increased numbers of plover monitoring and management staff positions and time required to travel by kayak to and from field assignments. Fewer field days with weather and sea conditions suitable for kayaking across open water available.

Additional Wilderness-specific Comparison Criteria

N/A

Safety of Visitors, Personnel, and Contractors

No Benefits

- Transporting limited supplies, equipment, and other gear over longer distances using nonmotorized mechanized transport slightly reduces physical exertion and risk for dehydration, heart attack, heat-related illnesses, or hypothermia than the options considered, due to greater use of human-powered watercraft.

Adverse Effects

- People on foot or paddling are much less mobile and therefore exposed and vulnerable to the weather, adverse sea and tidal current conditions, and environmental hazards for longer durations.
- Carrying all but the heavier supplies, equipment, or other gear increases physical exertion and risk for dehydration, heart attack, heat-related illnesses, or hypothermia. The higher level of physical fitness thus required can only be partially mitigated by training, personnel selection, and providing personal protective equipment and Go/No-Go criteria.
- Risks of kayak use include exposure, capsizing, and drowing and can only be partially mitigated by training, communications, and personal protective equipment.
- Greatest reliance on maritime aerial medical evacuation is required. This is an already scarce emergency service resource (allowed under Section 4(c) of the Wilderness Act) in the area that is not always available when needed.

Alternative # D – No Action

The piping plover is a migratory, threatened species, and its protection and recovery is mandated under the Endangered Species Act. The migratory bird purpose for which Monomoy National Wildlife Refuge was established cannot be achieved under a No Action alternative. Therefore, the No Action alternative was not analyzed further.

Comparison of Alternatives

It may be useful to compare each alternative's positive and negative effects to each of the criteria in tabular form, keeping in mind the law's mandate to "preserve wilderness character."

	Alternative A	Alternative B	Alternative C
Untrammeled	-	-	-
Undeveloped	- - - -	- - -	- -
Natural	+/-	+/-	+/-
Solitude or primitive recreation	- -	-	- -
Unique components	+	+	+
WILDERNESS CHARACTER	++/--------	++/------	++/------

	Alternative A	Alternative B	Alternative C
Heritage & Cultural Resources	NA	NA	NA
Maintaining Traditional Skills	---	+/--	++/-
Special Provisions	NA	NA	NA
Economics & Time	++/-	--	- - -
Additional Wilderness Criteria	NA	NA	NA
OTHER CRITERIA SUMMARY	++/----	+/----	++/----

	Alternative A	Alternative B	Alternative C
SAFETY	++/-	+/-	+/---

	Alternative A	Alternative B	Alternative C
OVERALL	6+'s / 12 –'s	4 +'s/ 11 –'s	5 +'s / 13 –'s

Safety Criterion
Significant personnel safety concerns associated with kayak use in open waters intermixed with motorized boat traffic in the same waters surrounding the Monomoy Wilderness in alternative C's open-water kayak use can only partially be mitigated by training and provision of PPE. The unmitigated personnel safety concerns for alternative C override impacts to wilderness character or other criteria for alternative C. Job hazard analyses for watercraft operation and for working in remote areas summarize the hazards and mitigations that are common to all alternatives analyzed.

Documentation:

Step 2 Decision: **What is the Minimum Activity?**

Selected Alternative: Alternative B — Partial Motor Option

Rationale for selecting this alternative (including documentation of safety criterion, if appropriate):
The Partial Motor option adequately protects and conserves the piping plover while safely minimizing the negative impacts to the wilderness character of the Monomoy Wilderness. It does so by limiting the use of motor vehicles and nonmotorized mechanized transport to support restricted staff time used efficiently to monitor disturbance-sensitive piping plovers. The Partial Motor option best protects wilderness character and meets the requirements of the Endangered Species Act, as well as best satisfies the other comparison criteria.

The Full Motor option has the most negative impact on wilderness character from motorized vehicle (boats and ATV) and nonmechanized transport. The Partial Motor option has slightly greater negative impact than the No Motor option on the undeveloped character of the Monomoy Wilderness with greater motorboat use. Fewer human contacts are likely for wilderness users with the smaller plover monitoring workforce presence under the Partial Motor option than the No Motor option; the Partial Motor option therefore has less adverse impact on solitude. The Partial Motor option provides a greater level of safety hazard mitigation for refuge personnel engaged in piping plover monitoring and management by minimizing hazard exposure during open-water kayak transport to/from assigned work locations that is presented in the No Motor option.

Monitoring and reporting requirements:
Monitoring and reporting of the operations associated with the nesting and protection project will continue on a yearly basis. This information will be maintained in the Monomoy NWR headquarters and will be available for review by anyone interested.

The refuge manager for Monomoy NWR will document that a review and re-validation of this programmatic minimum requirements analysis has been completed prior to April 1 each year. If at any point the refuge manager determines this analysis is no longer valid, or within 10 years (whichever comes first), a new minimum requirements analysis will be prepared and approved.

Check any Wilderness Act Section 4(c) uses approved in this alternative:

- [x] mechanical transport
- [ ] motorized equipment
- [ ] motor vehicles
- [x] motorboats
- [ ] landing of aircraft
- [ ] temporary road
- [x] structure or installation

Record and report any authorizations of Wilderness Act Section 4(c) uses according to agency procedures.

Approvals	Signature	Name	Position	Date
Prepared by:				
Recommended:				
Recommended:				
Approved:				

ARTHUR CARHART NATIONAL WILDERNESS TRAINING CENTER

MINIMUM REQUIREMENTS DECISION GUIDE

WORKSHEETS

Monomoy Refuge Banding Station

". . . except as necessary to meet minimum requirements for the administration of the area for the purpose of this Act..."

– the Wilderness Act, 1964

Step 1: Determine if it is necessary to take any action.

Description: Briefly describe the situation that may prompt action.

In support of the refuge's mission to conserve and protect migratory birds, the refuge is interested in studying how passerines utilize Monomoy NWR during fall migration.

The purpose of this study is to collect data on the use of the refuge as a stopover site for landbirds and to better manage the wildlife refuge for the benefit of those birds, in addition to seabirds and shorebirds that rely on the habitat. We are proposing to set up a banding station through partner cooperation at a site located on the refuge for the next few years to gather more data that will enable us to:

1. Determine species richness and composition of migrants traveling through the Monomoy NWR to identify critical resources.
2. Analyze the relationship between landbird use versus marine-oriented species use on the refuge
3. Provide the basis for long-term trend analysis of bird populations in the area.

To determine if administrative action is necessary, answer the questions listed in A–F on the following pages.

A. Describe Options Outside of Wilderness

Is action necessary within wilderness?

Yes: ☒ **No:** ☐

Explain:
Obtainable habitat for land bird migrants using stopover sites is only available within our wilderness. The goal of this project is to sample birds on Monomoy NWR to better understand the species richness and composition within our unique landscape and locale. In order for us to successfully sample these species, work must be done in the Monomoy Wilderness.

B. Describe Valid Existing Rights or Special Provisions of Wilderness Legislation

Is action necessary to satisfy valid existing rights or a special provision in wilderness legislation (the Wilderness Act of 1964 or subsequent wilderness laws) that allows consideration of the Section 4(c) prohibited uses? Cite law and section.

Yes: ☐ **No:** ☒ **Not Applicable:** ☐

Explain:
There are no existing valid rights or special provisions found in any wilderness legislation to sample land birds during migration on the refuge.

C. Describe Requirements of Other Legislation

Is action necessary to meet the requirements of other laws?

Yes: ☒ **No:** ☐ **Not Applicable:** ☐

Explain:
The refuge was established in 1944 pursuant to the Migratory Bird Conservation Act (16 U.S.C. § 715d) "… for use as an inviolate sanctuary, or for other management purpose, for migratory birds"; through a Declaration of Taking (United States vs. Commonwealth of Massachusetts, and Susie H. Kosak et al, Miscellaneous Civil No. 6340, District Court of Massachusetts) "…for the protection during the nesting season or while on their way to and from their breeding grounds…", with an emphasis on threatened, endangered and migratory birds. The National Wildlife Refuge System Improvement Act of 1966, as amended by the Wildlife Refuge System Improvement Act of 1997 (16 U.S.C 668dd-ee), directs the U.S. Fish and Wildlife Service "To administer a national network of lands and waters for the conservation, management, and where appropriate, restoration of the fish, wildlife, and plant resources and their habitats within the United States for the benefit of present and future generations of Americans."

D. Describe Other Guidance

Is action necessary to conform to direction contained in agency policy, unit and wilderness management plans, species recovery plans, or agreements with tribal, state and local governments or other federal agencies?

Yes: ☒ **No:** ☐ **Not Applicable:** ☐

Explain:
The preferred alternative of the Draft Monomoy NWR Comprehensive Conservation Plan states in Alternative B, Objective 1.6 that the refuge is tasked with protecting existing native maritime shrubland and evaluating use by migrating land birds of conservation concern. If patches of maritime shrubland are found to be regionally important, the refuge must maintain native species composition (including bayberry, beach plum, etc.) with less than 5 percent invasive plants. To accomplish these objectives, the refuge must engage in monitoring of land bird species using the area surrounding the Monomoy keeper's house during migration.

Policy on Maintaining Biological Integrity, Diversity and Environmental Health (601 FW 3) This policy provides guidance on maintaining or restoring the biological integrity, diversity, and environmental health of the Refuge System, including the protection of a broad spectrum of fish, wildlife, and habitat resources in refuge ecosystems. It provides refuge managers with a process for evaluating the best management direction to prevent the additional degradation of environmental conditions and to restore lost or severely degraded environmental components. It also provides guidelines for dealing with external threats to the biological integrity, diversity, and environmental health of a refuge and its ecosystem. In recognition of Monomoy NWR's role as a reservoir for avian diversity, the refuge was designated as a Western Hemisphere Shorebird Reserve Network (Regional) site under the auspices of the WHSRN Hemispheric Council, and as an Important Bird Area (IBA) by the Audubon Society.

E. Wilderness Character

Is action necessary to preserve one or more of the qualities of wilderness character including: untrammeled, undeveloped, natural, outstanding opportunities for solitude or a primitive and unconfined type of recreation, or unique components that reflect the character of this wilderness area?

Untrammeled: **Yes:** ☐ **No:** ☒ **Not Applicable:** ☐

Explain:

Undeveloped: **Yes:** ☐ **No:** ☒ **Not Applicable:** ☐

Explain:

Natural: **Yes:** ☒ **No:** ☐ **Not Applicable:** ☐

Explain:
Habitat and population management is necessary to maintain a native species ecologically adapted to Monomoy NWR, including the Monomoy Wilderness, thus preserving and improving the naturalness of the Monomoy Wilderness.

Outstanding opportunities for solitude or a primitive and unconfined type of recreation:

Yes: ☐ **No:** ☒ **Not Applicable:** ☐

Explain:

Other unique components that reflect the character of this wilderness:

Yes: ☒ **No:** ☐ **Not Applicable:** ☐

Explain:
Migrating landbirds contribute to the biotic diversity and integrity of the Monomoy Wilderness and also to the unique scientific and ecological values of the area

F. Describe Effects to the Public Purposes of Wilderness

Is action necessary to support one or more of the public purposes for wilderness (as stated in Section 4(b) of the Wilderness Act) of recreation, scenic, scientific, education, conservation, and historical use?

Recreation: **Yes:** ☐ **No:** ☒ **Not Applicable:** ☐

Explain:

Scenic: **Yes:** ☐ **No:** ☒ **Not Applicable:** ☐

Explain:

Scientific: **Yes:** ☒ **No:** ☐ **Not Applicable:** ☐

Explain:
This project will add to the scientific base of knowledge on how migrant species are using the refuge and what management could be done to improve the habitat for these species.

Education: **Yes:** ☐ **No:** ☒ **Not Applicable:** ☐

Explain:

Conservation: **Yes:** ☒ **No:** ☐ **Not Applicable:** ☐

Explain:
Understanding migrant land bird use on the refuge could help to better conservation and management for these species.

Historical use: **Yes:** ☐ **No:** ☒ **Not Applicable:** ☐

Explain:

Step 1 Decision: **Is any administrative action necessary in wilderness?**

Yes: ☒ **No:** ☐ **Not Applicable:** ☐

Explain:
Yes. Action is necessary to gain a base of scientific knowledge of how migrants are using the interior portions of the refuge as a stopover site so that appropriate actions can be taken to protect them and uphold the refuge's purpose.

If action is necessary, proceed to Step 2 to determine the minimum activity.

Step 2: Determine the minimum activity.

Description of Alternatives

For each alternative, describe what methods and techniques will be used, when the activity will take place, where the activity will take place, what mitigation measures are necessary, and the general effects to the wilderness resource and character.

Alternative # A – Full Motor Option

Description:

Use motorized vehicles to access all areas of the island (motorboats and ATVs); set up a daily banding station and erect temporary mist-nets to capture migrants; use a non-wilderness site to house staff when necessary (referred to as the Full Motor option).

Under this alternative, staff of the Monomoy Refuge Banding Station will travel to the south tip of South Monomoy daily by motorboat to perform data collection activities. Mist nets will be set up in various locations around the entire south tip interior of South Monomoy to sample all possible birds using the area. To expedite data processing, mist nets will be visited using an ATV, which will enable the data collection to be undertaken over a wide area of the refuge. The nets will be opened for 6 hours a day beginning ½ hour before sunrise. The netting period will start August 15th and end November 15th as weather and transportation allow. Following mist-netting, staff will conduct an hour-long survey each day by ATV using a set census path to count birds. At the beginning and end of the sampling period, supplies will be delivered to the south end via motorboat and transported to the Monomoy light keeper's house through wilderness to the area where the banding station will be based. ATVs will not be used on the beach or in wetland areas to avoid degradation of habitat and, instead, will be kept in areas already used as footpaths. Mist nets will also be utilized on North Monomoy Island to census various sparrow species during one week in October. ATVs will not be used on North Monomoy, but access to the island will be by motorboat. Staff of the Monomoy Refuge Banding Station will not live at the site and will travel back and forth each day for the entire sampling period.

Effects:

Wilderness Character

"Untrammeled"
No Benefits
Adverse Effects

- The action to capture migrant bird species prevents them for a temporary amount of time from moving around the refuge in a natural way.

"Undeveloped"
No Benefits
Adverse Effects

- Using motorized equipment and mechanized transportation in wilderness is inconsistent with the requirement to retain the primeval character of wilderness.

- The temporary installation of mist nets will have a negative effect on the undeveloped quality of the wilderness.

"Natural"
Benefits

- Naturalness may improve if this research leads to future habitat protection for critical migrant species, thereby helping to maintain a component of the natural character of the Monomoy Wilderness.

No Adverse Effects

"Outstanding opportunities for solitude or a primitive and unconfined type of recreation"
No Benefits
Adverse Effects

- The operation of an ATV within the wilderness will disrupt the opportunities for solitude in the wilderness.

Other unique components that reflect the character of this wilderness

- The land bird population is a unique ecological feature with scientific, educational, and scenic value to current and future generations of Americans.

Heritage and Cultural Resources

N/A

Maintaining Traditional Skills

No Benefits
Adverse Effects

- Use of motorized equipment and mechanized transportation in wilderness does not enhance the contrast between wilderness and non-wilderness or perpetuate the use of primitive traditional skills.

Special Provisions
N/A

Economic and Time Constraints
No Benefits
Adverse Effects
- Cost of ATV operation and maintenance.

Additional Wilderness-specific Comparison Criteria
N/A

Safety of Visitors, Personnel, and Contractors

No Benefits
Adverse Effects
- Risks associated with ATV use can be mitigated by training.

Alternative # B – Partial Motor Option A

Description:

Use motorboats to drop off personnel and supplies to island weekly; set up a daily banding station and erect temporary mist-nets to capture migrants; provide shelter at the Monomoy light keeper's house (referred to as Partial Motor Option A).

Under this alternative, staff of the Monomoy Refuge Banding Station will travel to the south tip of South Monomoy by motorboat to perform data collection activities. At the beginning and end of the sampling period, supplies will be delivered to the south end via motorboat and transported by foot to the Monomoy light keeper's house through wilderness to the area where the banding station will be based. The netting period will start August 15th and end November 15th as weather and transportation allow. A maximum of two boat trips per week will be conducted, if needed. Mist nets will be set up in various locations around the entire south tip interior of South Monomoy to sample all possible birds using the area. The nets will be opened for 6 hours a day, beginning ½ hour before sunrise. Following mist-netting, staff will conduct an hour-long survey each day by foot to count birds using a set census path. Mist nets will also be utilized on North Monomoy Island to census various sparrow species during one week in October; transportation will be through the use of a motorboat. Staff of the Monomoy Refuge Banding Station will live at the site in the Monomoy light keeper's house (non-wilderness) for the entire sampling period.

Effects:

Wilderness Character
"Untrammeled"
No Benefits
Adverse Effects
- The action to capture migrant bird species for study purposes prevents them from moving around the refuge in a natural way for a temporary amount of time.

"Undeveloped"
No Benefits
Adverse Effects

- Use, even limited use, of mechanized transportation in wilderness is inconsistent with the requirement to retain the primeval character of wilderness.

- The temporary installation of mist nets will have a negative effect on the undeveloped quality of the wilderness.

"Natural"
Benefits

- Naturalness may improve if this research leads to future habitat protection for critical migrant species, thereby helping to maintain a component of the natural character of the Monomoy Wilderness.

No Adverse Effects

"Outstanding opportunities for solitude or a primitive and unconfined type of recreation"
No Benefits or Adverse Effects

Other unique components that reflect the character of this wilderness

- The land bird population is a unique ecological feature with scientific, educational, and scenic value to current and future generations of Americans.

Heritage and Cultural Resources
N/A

Maintaining Traditional Skills
No Benefits
Adverse Effects

- Limited use of mechanized transportation in wilderness does not enhance the contrast between wilderness and non-wilderness or perpetuate the use of primitive traditional skills.

Special Provisions
N/A

Economic and Time Constraints
No Benefits or Adverse Effects

Additional Wilderness-specific Comparison Criteria
N/A

Safety of Visitors, Personnel, and Contractors
No Benefits or Adverse Effects

Alternative # C – Partial Motor Option B

Description:

Use motorboats to drop off personnel and supplies to the island weekly; conduct census of migrants in wilderness only (referred to as the Partial Motor Option B).

Under this alternative, staff of the Monomoy Refuge Banding Station will travel to the south tip of South Monomoy weekly by motorboat to perform data collection activities. The census period will start August 15th and end November 15th as weather and transportation allow. Each day, staff will conduct an hour-long survey by foot to count birds using a set census path. At the beginning and end of the sampling period, supplies will be delivered to the south end via motorboat and transported to the Monomoy light keeper's house through wilderness. A census will also be conducted on North Monomoy Island to survey various sparrow species during one week in October. Staff of the Monomoy Refuge Banding Station will live at the site and will have limited travel from the island during the entire census period.

Effects:

Wilderness Character

"Untrammeled"
No Benefits or Adverse Effects

"Undeveloped"
No Benefits
Adverse Effects

- Limited use of mechanized transportation in wilderness is inconsistent with the requirement to retain the primeval character of wilderness.

"Natural"
Benefits

- Naturalness may improve if this research leads to future habitat protection for critical migrant species, thereby helping to maintain a component of the natural character of the Monomoy Wilderness.

No Adverse Effects

"Outstanding opportunities for solitude or a primitive and unconfined type of recreation"
No Benefits or Adverse Effects

Other unique components that reflect the character of this wilderness

- The land bird population is a unique ecological feature with scientific, educational, and scenic value to current and future generations of Americans.

Heritage and Cultural Resources

N/A

Maintaining Traditional Skills

No Benefits

Adverse Effects

- Limited use of mechanized transportation in wilderness does not enhance the contrast between wilderness and non-wilderness or perpetuate the use of primitive traditional skills.

Special Provisions

N/A

Economic and Time Constraints

No Benefits

Adverse Effects

- More time will be spent to adequately identify land bird species by sight and sound, which may impact the overall results on how birds are using the wilderness area as a stopover site, which in turn could affect future management on Monomoy Refuge.

Additional Wilderness-specific Comparison Criteria

N/A

Safety of Visitors, Personnel, and Contractors

No Benefits or Adverse Effects

Comparison of Alternatives

It may be useful to compare each alternative's positive and negative effects to each of the criteria in tabular form, keeping in mind the law's mandate to "preserve wilderness character."

	Alternative A	Alternative B	Alternative C
Untrammeled	-	-	+
Undeveloped	---	--	-
Natural	+	+	+
Solitude or Primitive Recreation	-	+	+
Unique components	+	+	+
WILDERNESS CHARACTER	++/-----	+++/---	++++/-

	Alternative A	Alternative B	Alternative C
Heritage & Cultural Resources	N/A	N/A	N/A
Maintaining Traditional Skills	--	-	-
Special Provisions	N/A	N/A	N/A
Economics & Time	-	+	-
Additional Wilderness Criteria	N/A	N/A	N/A
OTHER CRITERIA SUMMARY	---	+/-	--

	Alternative A	Alternative B	Alternative C
SAFETY	Partially Mitigated	Mitigated	Mitigated

	Alternative A	Alternative B	Alternative C
OVERALL	2(+) / 8(-)	4(+) / 4(-)	4(+) / 3(-)

Safety Criterion
If safety issues override impacts to wilderness character or other criteria, provide documentation that the use of motorized equipment or other prohibited uses is necessary because to do otherwise would cause increased risks to workers or visitors that cannot be satisfactorily mitigated through training, use of personal protective equipment (PPE), or other requirements to alleviate the safety risk. (This documentation can take the form of agency accident-rate data tracking occurrences and severity; a project-specific job hazard analysis; research literature; or other specific agency guidelines.)

Documentation:

Step 2 Decision: **What is the <u>Minimum</u> Activity?**

Selected alternative: Alternative B – Partial Motor Option A

<u>Rationale</u> for selecting this alternative (including documentation of safety criterion, if appropriate):
Alternative B, Partial Motor Option A, adequately conserves land birds. At the same time, this option safely minimizes the negative impacts to the wilderness character of the Monomoy Wilderness by limiting the use of motor vehicles and using time efficiently to survey the species. Partial Motor Option A best protects the wilderness quality, meets the requirements of the Migratory Bird Conservation Act, and best satisfies the other comparison criteria.

Alternative A (Full Motor Option) has the most negative impact on wilderness character. Alternative B has slightly greater negative impact than Alternative C on the undeveloped character of the Monomoy Wilderness. However, Alternative B provides a decreased level of economic and time constraints than Alternative C by using time more efficiently to monitor and census land birds and potentially increase habitat protection.

Monitoring and reporting requirements:
Monitoring and reporting of the operations associated with the project will continue on a yearly basis. This information will be maintained in the Monomoy NWR headquarters and will be available for review by anyone interested.

The refuge manager for Monomoy NWR will document that a review and re-validation of this programmatic minimum requirements analysis has been completed prior to April 1 each year. If at any point the refuge manager determines this analysis is no longer valid, or within 10 years (whichever comes first), a new minimum requirements analysis will be prepared and approved.

Check any Wilderness Act Section 4(c) uses approved in this alternative:

- ☐ mechanical transport
- ☐ motorized equipment
- ☐ motor vehicles
- ☐ motorboats
- ☐ landing of aircraft
- ☐ temporary road
- ☐ structure or installation

Record and report any authorizations of Wilderness Act Section 4(c) uses according to agency procedures.

Approvals	Signature	Name	Position	Date
Prepared by:				
Recommended:				
Recommended:				
Approved:				

ARTHUR CARHART NATIONAL WILDERNESS TRAINING CENTER

MINIMUM REQUIREMENTS DECISION GUIDE

WORKSHEETS

Habitat Management and Predator Control for Nesting Roseate Terns and Common Terns on South Monomoy Wilderness Area

". . . except as necessary to meet minimum requirements for the administration of the area for the purpose of this Act..."

– the Wilderness Act, 1964

Step 1: Determine if it is <u>necessary</u> to take any action.

Description: Briefly describe the situation that may prompt action.

Monomoy NWR's CCP recognizes the importance of resource management within the wilderness to insure the health of the wilderness, preserve the wilderness character and species richness, and improve nest productivity.

Since the reestablishment of a productive common tern colony on Monomoy in the late 1990s, this site has been one of the most important sites in the State, and in some years has provided nesting habitat for more than 50 percent of the State's total common tern population. The increase of nesting common terns in the first few years following the start of the reestablishment project was concomitant with a decline in the number of nesting common terns at Plymouth Beach (Massachusetts NHESP census data 1996). Birds nesting at Plymouth Beach had been subjected to predator pressures prior to abandoning that site and moving to Monomoy NWR, suggesting that Monomoy NWR was more appealing to prospecting terns at that time. Common terns were successfully nesting at Monomoy NWR and, as predator pressures remained unresolved at Plymouth Beach, many terns continued returning to Monomoy NWR to nest, attracting more common terns each year. For several years Monomoy NWR has also hosted an increasing number of roseate terns. However, the increasing nesting terns were generally nesting in a similar-sized area in successive years, although the shape of the nesting colony changed. Impacts of increased nesting density were not specifically studied, but anecdotal observations suggested increased neighbor aggression and disturbance among common terns. In addition, increased aggression was seen between common and roseate terns, which may have contributed to the decline in roseate tern numbers and

their eventual relocation to Minimoy Island, although predation may have also contributed to this shift. Storm overwash and erosion over the last several years has severely reduced available nesting space on Minimoy Island, and roseate terns have mostly abandoned this site as well.

During the last 10 years, we have experimented with various types of habitat management on a small scale, but have only recently applied management at a scale that exceeds the current nesting area, such as a prescribed burn of 30+ acres. Careful monitoring of different techniques now provides the foundation for moving forward with habitat management on a much larger scale. Providing more habitat may allow for more nesting common terns but, more importantly, would allow common terns to increase nearest neighbor distances while still maintaining the benefit of being colony members. We also expect prospecting roseate terns to find nesting space more readily within a common tern colony that is not at a saturated density. Roseate terns generally nest 7-10 days later than common terns, so prospecting roseate terns are often trying to establish a territory amid hundreds or thousands of already established common tern territories. Roseate terns are also generally a bit more skittish and less aggressive than common terns, which presents an additional challenge to prospecting roseate terns that are continually being chased by common terns. A larger habitat base would also allow terns to move around between microhabitats within the larger area, as we apply a rotational-based habitat management scheme. We plan to continue working mostly on the north end of South Monomoy, where terns have nested during the last 15 years.

We expect that by providing a larger habitat base, the number of nesting roseate terns would increase. The decline in the number of nesting roseate terns in the Northeast since 2000 is especially troubling because in most years very few sites host more than 100 pairs. In addition to providing more nesting habitat, we will actively attract prospecting roseate terns to this area. Sound systems that play recordings of roseate terns, combined with tern decoys, have been successful at luring terns to nesting sites on other islands (USFWS 2002, USFWS 2005). Placement of sound systems and playback protocols will be based initially on what has been successful at other sites, and will be modified annually to increase the effectiveness on Monomoy NWR.

To determine if administrative action is necessary, answer the questions listed in A - F on the following pages.

A. Describe Options Outside of Wilderness

Is action necessary within wilderness?

Yes: ☒ **No:** ☐

Explain:
The U.S. Fish and Wildlife Service is charged with the responsibility for successfully managing roseate terns nesting within or adjacent to the Monomoy Wilderness. On Monomoy NWR, 96% of our larger terns nest in wilderness (based on 2012 census data); however, this can vary from year to year. While some tern management performed outside of wilderness, like predator control or habitat management to improve other sites, can benefit terns in Massachusetts by creating other areas for them to nest, nesting terns benefit most when these management activities are done in close proximity to their chosen nesting areas, regardless of wilderness status. The non-wilderness areas on the refuge are either too far away from the colony or too small in size for management to benefit nesting terns. Other landowners of non-wilderness tern nesting areas are unable or unlikely to employ the full range of inter-dependent tern management activities to achieve refuge tern population and productivity objectives that we are able to conduct on the refuge.

B. Describe Valid Existing Rights or Special Provisions of Wilderness Legislation

Is action necessary to satisfy valid existing rights or a special provision in wilderness legislation (the Wilderness Act of 1964 or subsequent wilderness laws) that allows consideration of the Section 4(c) prohibited uses? Cite law and section.

Yes: ☐ **No:** ☒ **Not Applicable:** ☐

Explain:
There are no existing valid rights or special provisions found in any wilderness legislation to recover threatened or endangered species inside this wilderness.

C. Describe Requirements of Other Legislation

Is action necessary to meet the requirements of other laws?

Yes: ☒ **No:** ☐ **Not Applicable:** ☐

Explain:
The Endangered Species Act of 1973 (16 U.S.C 1531-1544), as amended, directs the Department of the Interior to identify those species of plants and animals that are threatened and endangered, and develop and implement plans and programs to ensure their survival into the future.

The refuge was established in 1944 pursuant to the **Migratory Bird Conservation Act (16 U.S.C. § 715d)** "… for use as an inviolate sanctuary, or for other management purpose, for migratory birds"; through a Declaration of Taking (United States vs. Commonwealth of Massachusetts, and Susie H. Kosak et al, Miscellaneous Civil No. 6340, District Court of Massachusetts) "…for the protection during the nesting season or while on their way to and from their breeding grounds…", with an emphasis on threatened, endangered and migratory birds. **The National Wildlife Refuge System Improvement Act of 1966, as amended by the Wildlife Refuge System Improvement Act of 1997 (16 U.S.C 668dd-ee)**, directs the U.S. Fish and Wildlife Service "To administer a national network of lands and waters for the conservation, management, and where appropriate, restoration of the fish, wildlife, and plant resources and their habitats within the United States for the benefit of present and future generations of Americans."

D. Describe Other Guidance

Is action necessary to conform to direction contained in agency policy, unit and wilderness management plans, species recovery plans, or agreements with tribal, state and local governments or other federal agencies?

Yes: ☒ **No:** ☐ **Not Applicable:** ☐

Explain:
Healthy habitat supports all CCP goals. The Roseate Tern Recovery Plan identifies specific habitat requirements for this species. This document addresses a critical preservation issue for current and future roseate tern populations. The plan lists six recovery strategies:

- Protection and stabilization of existing breeding colonies
- Determination of ecological characteristics and limiting factors
- Restoration/creation of breeding sites and enhancement of numbers
- Protection and management of terns in their winter quarters
- Administrative actions
- Public involvement

Policy on Maintaining Biological Integrity, Diversity and Environmental Health (601 FW 3)
This policy provides guidance on maintaining or restoring the biological integrity, diversity, and environmental health of the Refuge System, including the protection of a broad spectrum of fish, wildlife, and habitat resources in refuge ecosystems. It provides refuge managers with a process for evaluating the best management direction to prevent the additional degradation of environmental conditions and to restore lost or severely degraded environmental components. It also provides guidelines for dealing with external threats to the biological integrity, diversity, and environmental health of a refuge and its ecosystem. In recognition of Monomoy NWR's role as a reservoir for avian diversity, the refuge was also designated as a Western Hemisphere Shorebird Reserve Network (Regional) site under the auspices of the WHSRN Hemispheric Council, and as an Important Bird Area (IBA) by the Audubon Society.

E. Wilderness Character

Is action necessary to preserve one or more of the qualities of wilderness character including: untrammeled, undeveloped, natural, outstanding opportunities for solitude or a primitive and unconfined type of recreation, or unique components that reflect the character of this wilderness area?

Untrammeled: **Yes:** ☐ **No:** ☒ **Not Applicable:** ☐

Explain:

Undeveloped: **Yes:** ☐ **No:** ☒ **Not Applicable:** ☐

Explain:

Natural: **Yes:** ☒ **No:** ☐ **Not Applicable:** ☐

Explain:
Species management and predator control are necessary to improve the naturalness of this area and maintain native species on the island. This project contributes to the conservation of a native species that is ecologically adapted to the area.

Outstanding opportunities for solitude or a primitive and unconfined type of recreation:

Yes: ☒ **No:** ☐ **Not Applicable:** ☐

Explain:
In order to preserve the outstanding character of wildlife observation, it is necessary to preserve roseate terns and a common tern colony. Doing so preserves the opportunity to see native species in their natural habitat.

Other unique components that reflect the character of this wilderness:

Yes: ☒ **No:** ☐ **Not Applicable:** ☐

Explain:
Roseate and common terns contribute to the biotic diversity and integrity of the refuge and also provide scientific and ecological value, which are included in "other."

F. Describe Effects to the Public Purposes of Wilderness

Is action necessary to support one or more of the public purposes for wilderness (as stated in Section 4(b) of the Wilderness Act) of recreation, scenic, scientific, education, conservation, and historical use?

Recreation: **Yes:** ☐ **No:** ☒ **Not Applicable:** ☐

Explain:

Scenic: **Yes:** ☐ **No:** ☒ **Not Applicable:** ☐

Explain:

Scientific: **Yes:** ☒ **No:** ☐ **Not Applicable:** ☐

Explain:
This project could add to the scientific base of knowledge on managing a highly productive common tern colony and increasing roseate tern productivity and population recovery.

Education: **Yes:** ☐ **No:** ☒ **Not Applicable:** ☐

Explain:

Conservation: **Yes:** ☒ **No:** ☐ **Not Applicable:** ☐

Explain:
This action could help to conserve roseate tern, a federally endangered species, and could increase species success and population numbers overall.

Historical use: **Yes:** ☐ **No:** ☒ **Not Applicable:** ☐

Explain:

Step 1 Decision: **Is any administrative action necessary in wilderness?**

Yes: ☐ **No:** ☐ **Not Applicable:** ☐

Explain:
Yes. Action is necessary to protect and conserve a federally listed endangered species, roseate tern, as well as a highly productive common tern colony. Roseate and common terns contribute to the biotic diversity and integrity of the refuge and its scientific and ecological value. Since the reestablishment of a productive common tern colony on Monomoy in the late 1990s, this site has been one of the most important sites in the State, and in some years has provided nesting habitat for more than 50 percent of the State's total population of the species.

If action is necessary, proceed to Step 2 to determine the minimum activity.

Step 2: Determine the minimum activity.

Please refer to the accompanying Minimum Requirements Decision Guide *Instructions* for an explanation of the effects criteria displayed below.

Description of Alternatives

For each alternative, describe what methods and techniques will be used, when the activity will take place, where the activity will take place, what mitigation measures are necessary, and the general effects to the wilderness resource and character.

Alternative # A – Full Motor Option

Description:

Use motorized vehicles to access all areas of the island; build temporary structures and installations including field camp, blinds, symbolic fencing, nesting structures, chick shelters, sound system, decoys, productivity plots, and grid markers; conduct predator control (referred to as the Full Motor option).

Under this alternative, biological staff will travel to South Monomoy boat landing by motorboat every day from the beginning of April to mid-August and work all daylight hours. Prior to the nesting season, a motorboat would be used to carry materials to drop off all gear, supplies, and equipment to set up a temporary field camp within the wilderness boundary that would remain in place for the entire season and to establish the grid system. Staff would use an ATV to carry and set up symbolic fencing to keep people out of potential nesting areas. During this time temporary wooden nesting/chick structures (providing shade, cover, and artificial habitat), decoys, and sound system (two speakers, box containing cd player, battery, and sound equipment, and solar panel decoys) would be installed in the colony to attract nesting roseate terns during the start of the nesting season. The sound system will be operated during daylight use only and manually turned on and off by on-island staff personnel. Use of the ATV would remain below the mean high tide line where possible to reduce impacts on the upper beach, and fencing supplies would be carried from the ATV to the fencing areas on foot where possible. Motorboat operation would be used daily to transport and rotate biological staff and bring field supplies. Once reaching South Monomoy, personnel would complete tern management activities (install productivity plots and check daily) in the tern colony by foot. To minimize predator disturbance, non-lethal methods (including staffing camp 24 hours and using chick shelters within the nesting areas) and lethal methods (such as shooting) of predator control will be conducted in the colony with the use of six plywood blinds. Field camp will include four large wall tents and two small tents that provide facilities for sleeping, cooking, privacy sanitation, and storage of supplies for up to eight individuals. At the end of the season, all materials and equipment (including symbolic fencing, field camp, blinds, nesting/chick shelters, flagging and pvc from grid system) would be removed and stored in both wilderness and non-wilderness locations.

Effects:

Wilderness Character

"Untrammeled"
No Benefits
Adverse Effects

- The action to use nesting/chick shelters and prevent natural predators from preying on the nests or chicks represents a trammeling of the wilderness
- The action to use nesting shelters as artificial habitat represents a trammeling of the wilderness.
- The action of removing natural predators for the habitat represents a trammeling of the wilderness.

"Undeveloped"
No Benefits
Adverse Effects

- Using mechanized transportation in wilderness is inconsistent with the requirement to retain the primeval character of wilderness.
- The temporary installation of symbolic fencing, nesting boxes, chick shelters, field camp, blinds, and sound system will have a negative effect on the undeveloped quality of the wilderness.

"Natural"
Benefits

- Naturalness be will improved by protecting and conserving an endangered wildlife species – a part of the natural character of the wilderness.

- Manipulating the habitat through use of nesting/chick shelters will preserve native species.

No Adverse Effects

- The active management to increase roseate tern populations and protect roseate and common terns from predators will have a negative effect on the natural quality of the wilderness.

"Outstanding opportunities for solitude or a primitive and unconfined type of recreation"
No Benefits
Adverse Effects

- Area closures and enforcement and temporary structures would be present and visible during the roseate tern and common tern breeding season and may be perceived by some wilderness users as "confining" the wilderness experience. Refuge personnel, ATVs, and motorboats would be visually and audibly evident and may be perceived by some Monomoy Wilderness users as intruding on solitude.

Other unique components that reflect the character of this wilderness
Benefits

- The beach/dune nesting roseate and common tern populations are unique ecological featurea with scientific, educational, and scenic value to current and future generations of Americans.

Heritage and Cultural Resources

N/A

Maintaining Traditional Skills

No Benefits
Adverse Effects

- Using mechanized transportation in wilderness does not enhance the contracts between wilderness and non-wilderness or perpetuate the use of primitive traditional skills.

Special Provisions

N/A

Economic and Time Constraints

Benefits

- Roseate and common tern management would be conducted in a time-saving, efficient manner.

Adverse Effects

- Added costs of ATV purchase, boat and ATV equipment operation and maintenance, personnel training, and personal protective equipment.

- Cost of training personnel on lethal predator control use

Additional Wilderness-specific Comparison Criteria

N/A

Safety of Visitors, Personnel, and Contractors

Benefits

- Locating injured or ill persons needing medical evacuation is easier if an ATV is available. Medical emergency evacuations are potentially much faster when an ATV and motorboat are available (Section 4-C of Wilderness Policy).

Adverse Effects

- Risks associated with ATV use can be partially mitigated by training, maintenance, and personal protective equipment (PPE), but personnel injury could potentially increase.
- People on foot are much less mobile and are therefore exposed and vulnerable to the weather, environmental hazards, and dehydration for longer durations.
- Risks associated with predator control can be mitigated by training.

Alternative # B – Partial Motor Option A

Description:

Use motorboats to access all areas of the island; build temporary structures and installations, including field camp, blinds, symbolic fencing, nesting structures, chick shelters, sound system and decoys, productivity plots, and grid markers; conduct predator control (referred to as Partial Motor Option A).

Under this alternative, biological staff will travel to the South Monomoy boat landing by motorboat every other day from the beginning of April to mid-August, work all daylight hours, and rotate staff. Prior to the nesting season, a motorboat would be used to carry materials to drop off all gear, supplies, and equipment to set up a temporary field camp within the wilderness boundary that would remain in place for the entire season and to establish the grid system. Staff would carry and set up symbolic fencing to keep people out of potential nesting areas. During this time temporary wooden nesting/chick structures (providing shade, cover and artificial habitat), decoys, and sound system (two speakers, box containing cd player, battery and sound equipment, solar panel decoys) would be installed in the colony to attract nesting roseate terns during the start of the nesting season. The sound system will be operated during daylight use only and manually turned on and off by on-island personnel. Once reaching South Monomoy, personnel would complete tern management activities (install productivity plots and check 50 percent of plots on alternating days) in the tern colony by foot. To minimize predator disturbance, non-lethal methods (including staffing camp 24 hours and using chick shelters within the nesting areas) and lethal methods (such as shooting) of predator control will be conducted in the colony with the use of four plywood blinds. Field camp will include two large wall tents and one small tent that provide facilities for sleeping, cooking, privacy sanitation, and storage of supplies for up to six individuals. At the end of the season, all materials and equipment (including symbolic fencing, field camp, blinds, nesting/chick shelters, flagging and pvc from grid system) would be removed and stored in both wilderness and non-wilderness locations.

Effects:

Wilderness Character

"Untrammeled"
No Benefits
Adverse Effects

- The action to use nesting/chick shelters and prevent natural predators from preying on the nests or chicks represents a trammeling of the wilderness.
- The action to use nesting shelters as artificial habitat represents a trammeling of the wilderness.
- The action of removing natural predators for the habitat represents a trammeling of the wilderness.

"Undeveloped"
No Benefits
Adverse Effects

- Using motorboats in wilderness is inconsistent with the requirement to retain the primeval character of wilderness.
- The temporary installation of symbolic fencing, nesting boxes, chick shelters, field camp, blinds, and sound system will have a negative effect on the undeveloped quality of the wilderness.

"Natural"
Benefits

- Naturalness will be improved by protecting and conserving an endangered wildlife species – a part of the natural character of the wilderness.
- Manipulating the habitat through use of nesting/chick shelters will preserve native species.

No Adverse Effects

- The active management to increase roseate tern populations and protect roseate and common terns from predators will have a negative effect on the natural quality of the wilderness.

"Outstanding opportunities for solitude or a primitive and unconfined type of recreation"
No Benefits
Adverse Effects

- Area closures and enforcement and temporary structures would be present and visible during the roseate tern and common tern breeding season and may be perceived by some wilderness users as "confining" the wilderness experience. Refuge personnel and motorboats would be visually and audibly evident and may be perceived by some Monomoy Wilderness users as intruding on solitude.

Other unique components that reflect the character of this wilderness
Benefits

- The beach/dune nesting roseate and common tern populations are unique ecological features with scientific, educational, and scenic value to current and future generations of Americans.

Heritage and Cultural Resources
N/A

Maintaining Traditional Skills
Benefits
- Use of motorboats helps to maintain traditional skills throughout the wilderness.

Adverse Effects
- Use of motorboats in wilderness does not enhance the contracts between wilderness and non-wilderness or perpetuate the use of primitive traditional skills.

Special Provisions
N/A

Economic and Time Constraints
Benefits
- Roseate and common tern management would be conducted in a time-saving, efficient manner.

Adverse Effects
- Costs of boat operation and maintenance and personnel training.
- Cost to train personnel on lethal predator control.

Additional Wilderness-specific Comparison Criteria
N/A

Safety of Visitors, Personnel, and Contractors
No Benefits
Adverse Effects
- People on foot are much less mobile and are therefore exposed and vulnerable to the weather, environmental hazards, and dehydration for longer durations.
- Risks associated with predator control can be mitigated by training.

Alternative # C – Partial Motor Option B

Description:

Use motorboats to access all areas of the island; build temporary structures and installations including spike camp, blinds, symbolic fencing, nesting structures, chick shelters, sound system and decoys, productivity plots, and grid markers; conduct predator control (referred to as the Partial Motor Option B).

Under this alternative, biological staff will travel to South Monomoy boat landing by motorboat every other day from the beginning of April to mid-August and work all daylight hours. Prior to the nesting season, a motorboat

would be used to carry materials to drop off all gear, supplies, and equipment to set up a temporary field camp (non-wilderness) and a spike camp within the wilderness boundary that would remain in place for the entire season and to establish the grid system. Staff would carry and set up symbolic fencing to keep people out of potential nesting areas. During this time temporary wooden nesting/chick structures (provide shade, cover and artificial habitat), decoys, and sound system (two speakers, box containing cd player, battery and sound equipment, solar panel decoys) would be installed in the colony to attract nesting roseate terns during the start of the nesting season. The sound system will be operated during daylight use only and manually turned on and off by on-island personnel. Once reaching South Monomoy, personnel would complete tern management activities (install productivity plots and check half of the plots on alternating days) in the tern colony by foot. To minimize predator disturbance, non-lethal methods (including staffing camp 24 hours and using chick shelters within the nesting areas) and lethal methods (such as shooting) of predator control will be conducted in the colony with the use of four plywood blinds. Field camp would have unlimited staff and the spike camp will include one small tent to provide a 24 hour presence near the tern colony. At the end of the season, all materials and equipment (including symbolic fencing, field camp, "spike" camp, blinds, nest/chick shelters, flagging and pvc from grid system) would be removed and stored in both wilderness and non – wilderness locations.

Effects:

Wilderness Character

"Untrammeled"
No Benefits
Adverse Effects

- The action to use nesting/chick shelters and prevent natural predators from preying on the nests and chicks represents a trammeling of the wilderness.
- The action to use nest shelters as artificial habitat represents a trammeling of the wilderness.
- The action of removing natural predators for the habitat represents a trammeling of the wilderness.

"Undeveloped"
No Benefits
Adverse Effects

- Using motorboats in wilderness is inconsistent with the requirement to retain the primeval character of wilderness.
- The temporary installation of symbolic fencing, nesting boxes, chick shelters, spike camp, blinds, and sound system will have a negative effect on the undeveloped quality of the wilderness.

"Natural"
Benefits

- Naturalness will be improved by protecting and conserving an endangered wildlife species – a part of the natural character of the wilderness.
- Manipulating the habitat through use of nesting/chick shelters will preserve native species.

No Adverse Effects

- The active management to increase roseate tern populations and protect roseate and common terns from predators will have a negative effect on the natural quality of the wilderness.

"Outstanding opportunities for solitude or a primitive and unconfined type of recreation"
No Benefits
Adverse Effects

- Area closures and enforcement and temporary structures would be present and visible during the roseate tern and common tern breeding season and may be perceived by some wilderness users as "confining" the wilderness experience. Refuge personnel and motorboats would be visually and audibly evident and may be perceived by some Monomoy Wilderness users as intruding on solitude.

Other unique components that reflect the character of this wilderness
Benefits

- The beach/dune-nesting roseate and common tern populations are a unique ecological feature with scientific, educational, and scenic value to current and future generations of Americans.

Heritage and Cultural Resources

N/A

Maintaining Traditional Skills
Benefits

- Use of motorboats helps to maintain traditional skills throughout the wilderness

Adverse Effects

- Use of motorboats in wilderness does not enhance the contracts between wilderness and non-wilderness or perpetuate the use of primitive traditional skills.

Special Provisions

N/A

Economic and Time Constraints
Benefits

- Roseate and Common Tern management would be conducted in a time-saving, efficient manner.

Adverse Effects

- Cost of boat operation and maintenance, and personnel training.
- Cost to train personnel on lethal predator control use.

Additional Wilderness-specific Comparison Criteria

N/A

Safety of Visitors, Personnel, and Contractors

No Benefits

Adverse Effects

- People on foot are much less mobile and therefore exposed and vulnerable to the weather, environmental hazards and dehydration for longer durations.
- Risks associated with predator control can be mitigated by training.

Alternative # D – No Motor Option

Description:

Use no motor vehicles; mechanized equipment will be used if loads exceed 80lbs and/or exceed three trips per person on foot; build temporary structures and installations including field camp, blinds, symbolic fencing, nesting structures, chick shelters, sound system and decoys, productivity plots, and grid markers; conduct predator control; install symbolic fencing to decrease human disturbance; manipulate habitat; conduct predator control (referred to as the No *Motor* Option).

Under this alternative, biological staff will travel to South Monomoy by paddling kayaks from the mainland, weather permitting, from early April to mid-August and work all daylight hours. Personnel return in the same manner at the end of their field base assignment (10 days on/4-days off schedule). Prior to the nesting season, a motorboat would be used to carry materials to drop off in non-wilderness all gear, supplies, and equipment to set up a temporary field camp within the wilderness boundary that would remain in place for the entire season and to establish the grid system. If any load exceeds 80lbs and/or three trips per person on foot, a wheeled cart will be used. Staff would carry and set up symbolic fencing to keep people out of potential nesting areas. During this time temporary wooden nesting/chick structures (provide shade, cover and artificial habitat), decoys, and sound system (two speakers, box containing cd player, battery, and sound equipment, solar panel decoys) would be installed in the colony to attract nesting roseate terns during the start of the nesting season. The sound system will be operated during daylight use only and manually turned on and off by on island staff personnel. Once reaching the colony on South Monomoy, personnel would complete tern management activities (every other year install productivity plots and check daily) in the tern colony by foot. To minimize predator disturbance non-lethal methods (including staffing camp 24 hours and using chick shelters within the nesting areas) and lethal methods (such as shooting) of predator control will be conducted in the colony with the use of four pop-up blinds that are removed when not in use. Field camp will include four individual pup tents and a sanitation tent; cooking would be conducted outdoors, and use more wilderness-friendly backpacking gear. If camp is closed during the season for any reason, all gear (personal and safety) will be removed from the camp area. At the end of the season, all materials and equipment (including symbolic fencing, blinds, nesting/chick shelters, flagging, and pvc from grid system) would be removed and stored in both wilderness and non-wilderness locations.

Effects:

Wilderness Character

"Untrammeled"
No Benefits
Adverse Effects

- The action to use nesting/chick shelters and prevent natural predators from preying on the nests and chicks represents a trammeling of the wilderness.
- The action to use nest shelters as artificial habitat represents a trammeling of the wilderness.
- The action of removing natural predators for the habitat represents a trammeling of the wilderness.

"Undeveloped"
No Benefits
Adverse Effects

- The temporary installation of symbolic fencing, nesting boxes, chick shelters, field camp, and blinds will have a negative effect on the undeveloped quality of the wilderness.

"Natural"
Benefits

- Naturalness will improve by protecting and conserving an endangered wildlife species – a part of the natural character of the wilderness.
- Manipulating the habitat through use of nesting/chick shelters will preserve native species.

No Adverse Effects.

- Use of nonmotorized transportation would extend the time needed to conduct management activities in wilderness and, therefore, could negatively affect productivity and habitat improvement.

"Outstanding opportunities for solitude or a primitive and unconfined type of recreation"
No Benefits
Adverse Effects

- Area closures and enforcement and temporary structures would be present and visible during the roseate tern and common tern breeding season and may be perceived by some wilderness users as "confining" the wilderness experience.
- Refuge personnel and motorboats would be visually and audibly evident and may be perceived by some Monomoy Wilderness users as intruding on solitude.

Other unique components that reflect the character of this wilderness
Benefits

- The beach/dune-nesting roseate and common tern populations are a unique ecological feature with scientific, educational, and scenic value to current and future generations of Americans.

Heritage and Cultural Resources

N/A

Maintaining Traditional Skills

Benefits

- Use of nonmechanized modes of transportation in wilderness enhances the contrast between wilderness and non-wilderness and perpetuates the use of primitive traditional skills.

No Adverse Effects

Special Provisions

N/A

Economic and Time Constraints

No Benefits

Adverse Effects

- Cost to train personnel on kayak use.
- Cost to hire/acquire more staff.
- Cost to obtain more kayaks, safety equipment, and other personal equipment to support adequate job duty performance.
- Time required to travel by kayak to island.
- Cost to train personnel on lethal predator control use.

Additional Wilderness-specific Comparison Criteria

N/A

Safety of Visitors, Personnel, and Contractors

No Benefits

Adverse Effects

- People on foot or paddling are much less mobile and therefore exposed and vulnerable to the weather, adverse sea and tidal current conditions, and environmental hazards for longer durations.
- Carrying all gear and paddling increases one's risk for heart attack and dehydration.
- Risk associated with kayak use can be partially mitigated by training.
- A higher level of physical fitness is required. Risks can be partially mitigated by conditioning, personnel selection, and providing personal protective equipment and Go/No-Go criteria.
- Medical emergency evacuations are potentially much faster when a motorboat is available than individuals traveling on foot or paddling. Greater reliance on maritime aerial medical evacuation is required, an already scarce emergency service resource in the area that is not always available when needed (See section 4-C of Wilderness policy).

Alternative # E- No Action

The roseate tern is a listed endangered species and its protection is mandated under the Endangered Species Act. In order to successful manage for roseate terns, a common tern colony must be managed. A "no action" alternative cannot be selected in a Minimum Requirements Analysis. Therefore, this alternative was not analyzed.

Comparison of Alternatives
It may be useful to compare each alternative's positive and negative effects to each of the criteria in tabular form, keeping in mind the law's mandate to "preserve wilderness character."

	Alternative A	Alternative B	Alternative C	Alternative D
Untrammeled	- -	- -	--	- -
Undeveloped	- - - -	- - -	---	-
Natural	+/-	+/-	+/-	+/-
Solitude or primitive recreation	-	-	-	-
Unique components	+	+	+	+
WILDERNESS CHARACTER	++/--------	++/-------	++/-------	++/-----

	Alternative A	Alternative B	Alternative C	Alternative D
Heritage & Cultural Resources	NA	NA	NA	NA
Maintaining Traditional Skills	- -	+/ -	+/-	+
Special Provisions	NA	NA	NA	NA
Economics & Time	+/- -	+/- -	+/---	- - -
Additional Wilderness Criteria	NA	NA	NA	NA
OTHER CRITERIA SUMMARY	+/----	++/---	++/----	+/---

	Alternative A	Alternative B	Alternative C	Alternative D
SAFETY	Partially Mitigated	Mitigated	Mitigated	Partially Mitigated

Safety Criterion
If safety issues override impacts to wilderness character or other criteria, provide documentation that the use of motorized equipment or other prohibited uses is necessary because to do otherwise would cause increased risks to workers or visitors that cannot be satisfactorily mitigated through training, use of personal protective equipment (PPE), or other requirements to alleviate the safety risk. (This documentation can take the form of agency accident-rate data tracking occurrences and severity; a project-specific job hazard analysis; research literature; or other specific agency guidelines.)

Documentation:

Step 2 Decision: What is the Minimum Activity?

Please refer to the accompanying Minimum Requirements Decision Guide *Instructions* before describing the selected alternative and describing the rationale for selection.

Selected alternative: Alternative B - Partial Motor Option A

Rationale for selecting this alternative (including documentation of safety criterion, if appropriate):
Alternative B, Partial Motor Option A, adequately protects and conserves roseate terns and common terns while minimizing the negative impacts to the wilderness character of the Monomoy Wilderness. The alternative does so by limiting the use of motor vehicles and using time and economics efficiently to monitor roseate and common terns. The Partial Motor Option A alternative best protects the wilderness quality and meets the requirements of the Endangered Species Act, as well as best satisfies the other comparison criteria.

	Alternative A	Alternative B	Alternative C	Alternative D
Untrammeled	- -	- -	--	- -
Undeveloped	- - - -	- - -	---	-
Natural	+/-	+/-	+/-	+/-
Solitude or Primitive Recreation	-	-	-	-
Unique components	+	+	+	+
WILDERNESS CHARACTER	++/--------	++/-------	++/--------	++/-----

	Alternative A	Alternative B	Alternative C	Alternative D
Heritage & Cultural Resources	NA	NA	NA	NA
Maintaining Traditional Skills	- -	+/ -	+/-	+
Special Provisions	NA	NA	NA	NA
Economics & Time	+/- -	+/- -	+/---	- - -
Additional Wilderness Criteria	NA	NA	NA	NA
OTHER CRITERIA SUMMARY	+/----	++/---	++/----	+/---

	Alternative A	Alternative B	Alternative C	Alternative D
SAFETY	Partially Mitigated	Mitigated	Mitigated	Partially Mitigated

Monitoring and reporting requirements:
Monitoring and reporting of the operations associated with the nesting and protection project will continue on a yearly basis. This information will be maintained in the Monomoy NWR headquarters and will be available for review by anyone interested.

Check any Wilderness Act Section 4(c) uses approved in this alternative:

- [x] mechanical transport
- [ ] motorized equipment
- [ ] motor vehicles
- [x] motorboats
- [ ] landing of aircraft
- [ ] temporary road
- [ ] structure or installation

Record and report any authorizations of Wilderness Act Section 4(c) uses according to agency procedures.

Approvals	Signature	Name	Position	Date
Prepared by:				
Recommended:				
Recommended:				
Approved:				

Appendix F

Kate Iaquinto/USFWS

Prescribed burning to improve habitat

Fire Management Program Guidance

- Introduction
- The Role of Fire
- Wildland Fire and Management Policy and Guidance
- Fire Management Planning
- Fire Management Program at Monomoy National Wildlife Refuge

Introduction

The U.S. Fish and Wildlife Service's (Service) Northeast Regional Fire Program (Fire Program) helps support the mission of the National Wildlife Refuge System (refer to chapter 1 of the draft CCP/EIS) by creating and managing important wildlife habitat with prescribed fire, and protecting human safety by reducing the risk of wildfire through fire suppression. This appendix outlines guidance for fire management, explains the fire management planning process, and describes the fire management program at Monomoy National Wildlife Refuge.

There are six wildfires (unplanned, human-caused ignitions) in wildland fuels documented for Monomoy NWR during the 60-year period from 1951 to 2011, ranging in size from less than 0.1 to 6 acres. No natural (lightning) ignitions are documented during that same 60-year period. Wildfire causes included two from signal flares from boaters in distress, one unattended campfire, one arson, one grass fire during cabin disposal, and one undetermined cause.

There are at least eight planned ignitions (prescribed fires) in wildland fuels documented for Monomoy NWR during the 60-year period from 1951 to 2011, up to 43 acres in size. Refuge personnel experimented with prescribed fire to provide green forage for fall and spring migrating waterfowl during the early 1950s. Burning for wildlife habitat was discontinued after the 1954 burns on a belief that the risk from erosion outweighed the forage benefits to migrating waterfowl and the logistical difficulties of applying fire in such remote, inaccessible areas during the few suitable weather windows available each year. The refuge resumed using fire as a tool for disposing of camps during the late 1960s, and continued this use through the early 1980s. Fire was absent as a habitat management tool at Monomoy until 2002, when two small vegetation management study plots were burned within the tern colony. During the period 2002 to 2009 there were three prescribed burns executed within the tern colony on South Monomoy, with the largest on October 15, 2009, when 36 acres of primarily beach grass was prescribed burned.

The Role of Fire

Historically, natural fire and ignitions by Native American people played an important disturbance role in many ecosystems by:

- Removing fuel accumulations.
- Decreasing the impacts of insects and diseases.
- Stimulating regeneration of vegetation.
- Cycling nutrients.
- Providing a diversity of habitats for plants and wildlife.

In the heavily developed areas of the northeastern U.S., that role has been modified significantly. However, when fire is used properly it can

- Reduce hazardous fuels build-up in both wildland-urban interface[1] and other areas.
- Improve wildlife habitats by reducing the density of vegetation, or changing plant species composition.
- Sustain and increase biodiversity.
- Improve woodlands and shrublands by reducing plant density.
- Reduce the susceptibility of plants to insect and disease outbreaks.
- Assist in the control of invasive and noxious species.

[1] The wildland-urban interface is the line, area, or zone where human development and structures meet with undeveloped wildland or vegetative fuels.

Wildland Fire and Management Policy and Guidance

In 2001 the Secretaries of the Interior and Agriculture approved an update to the 1995 Federal Fire Policy. The 2001 Federal Wildland Fire Management Policy directs Federal agencies to (*http://www.nwcg.gov/branches/ppm/fpc/archives/fire_policy/index.htm*) achieve a balance between using fire suppression to protect life, property, and resources, and using wildland fire to regulate fuels and maintain healthy ecosystems. It also directs agencies to provide a management response to all wildfires that is commensurate with the values at risk, human safety, and the costs for suppression. This policy provides nine guiding principles that are fundamental to the success of the fire management program. These guiding principles are as follows:

1. Firefighter and public safety is the first priority in every fire management activity.
2. The role of wildland fire as an essential ecological process and natural change agent will be incorporated into all land management planning processes.
3. Fire management plans, programs, and activities support land and resource management plans and their implementation.
4. Sound risk management is a foundation for all fire management activities.
5. Fire management programs and activities are economically viable, based on values to be protected, costs, and land and resource management objectives.
6. Fire management plans and activities are based on the best available science.
7. Fire management plans and activities incorporate public health and environmental quality considerations.
8. Federal, State, tribal, local, interagency, and international coordination and cooperation are essential.
9. Standardization of policies and procedures among Federal agencies is an ongoing objective.

The following provide further direction on fire management decisions:

- Every fire requires a response and decision on how to respond to it.
- The Service's initial reaction to human-caused fires will be to suppress the fire while providing for firefighter and public safety, limiting damage and loss, and minimizing costs of the fire.
- The interagency nature of fire management work requires the involvement and participation of cooperators, including both State and local agencies, in planning for, and potentially responding to, wildland fire.

The Fish and Wildlife Service Fire Management Handbook provides standards for operational fire management activities, procedures, and practices based upon the above referenced current interagency, departmental, and Service policies (*http://www.fws.gov/fire/handbook/index.shtml*). The FWS Fire Management Handbook is updated annually to coincide with the Interagency Standards for Fire and Fire Aviation Operations Handbook and is incorporated by reference into the Service Manual (621 FW 1).

Fire Management Planning

The Fire Management Plan (FMP) for the Eastern Massachusetts National Wildlife Refuge Complex defines the fire management direction for Monomoy refuge and other refuges in the complex based on the objectives outlined in the comprehensive conservation plans (CCP) and habitat management plans (HMP). The FMP follows the most recent Interagency Fire Management Plan Template and applies the most recent Service-specific guidance on use of that interagency template. It provides a detailed description of how the refuge will

- Respond to wildland fires.
- Manage fuels to reduce the risk of wildland fires.
- Use prescribed burning to meet management objectives, if applicable.

In order for a refuge to use wildland fire, prescribed burning, and other hazardous fuel reduction techniques, these methods must be specified and pre-approved as appropriate management responses in the refuge's FMP.

If none of these methods are described in the FMP, the refuge's only allowable response to wildland fire is aggressive suppression. An appropriate response must be determined for any unplanned ignition. The FMP must address a full range of potential responses to wildfires and outline the potential range of strategies and limitations and constraints on tactical operations, local approvals needed, etc.

An annual review process requires the refuge/unit line officer and servicing fire management officer to review the FMP using the annual review checklist, discuss and update FMP sections as needed, and complete an amendment containing any updates.

All prescribed fires must meet all Interagency Prescribed Fire Planning and Implementation Procedures Reference Guide requirements.

Fire Management Program at Monomoy National Wildlife Refuge

Fire Management Goals

The goals and strategies of the National Wildlife Refuge System Wildland Fire Management Program Strategic Plan are consistent with Department of Interior (DOI), National Fire Plan direction, the President's Healthy Forest Initiative, the 10-year Comprehensive Strategy and Implementation Plan, National Wildfire Coordinating Group (NWCG) guidelines, initiatives of the Wildland Fire Leadership Council, and Interagency Standards for Fire and Aviation operations.

The current fire management goals for the refuge are to use prescribed fire to meet the habitat goals and objectives identified in this CCP.

Fire Management Objectives

The purpose of the fire management program is to use prescribed fire, chemical, and manual and mechanical treatment to:

- Ensure public and firefighter safety while protecting property and natural resource values from wildfire.
- Reduce the wildfire impacts to all resource management activities. Reduce the threats associated with accumulations of hazardous fuel loads in marsh, coastal dune, and maritime woodland habitats.
- Provide and enhance and protect habitats for State and Federal endangered and threatened species and species of special concern.
- Provide, maintain, enhance, and protect nesting, brood, feeding, and resting habitat that meet the requirements of migratory birds and resident wildlife.
- Maintain health and vigor of marsh and coastal dune vegetation.
- Facilitate the control of invasive and exotic species.
- Increase habitat diversity in refuge upland habitats.
- Demonstrate and educate the public about the role and benefits of wildland fire protection and prescribed fire use in natural resource management.
- Maintain current ecosystem diversity within the landscape context.
- Comply with the State Air Quality Implementation Plan to protect public respiratory health and the environment.

Fire Management Strategies

The refuge will use fire management strategies and tactics that consider public and firefighter safety, as well as resource values at risk. The FMP will provide a more detailed description of the wildfire suppression, prescribed fire, chemical, manual, and mechanical treatment methods the refuge plans to use. The FMP will also explain the timing and monitoring of the refuge's fire management strategies. The refuge will

develop prescribed fire burn plans for specific sites, following the interagency Prescribed Fire Planning and Implementation Procedures Reference Guide (2009) template.

Some fire management strategies techniques, such as prescribed burning, may impact air quality. Prescribed fire temporarily reduces air quality by diminishing visibility and releasing particulates and pollutants through combustion. However, the refuge will meet the Clean Air Act emission standards by adhering to the Massachusetts Air Quality requirements during all prescribed fire activities.

Fire Management Organization, Contracts, and Cooperation

The Service's Northeast Regional Fire Program is divided into four fire management zones, which provide technical fire management oversight to refuges. Monomoy NWR is currently within the New England fire management zone, which includes all the national wildlife refuges in Massachusetts. The primary fire management staffing and support equipment are located at the Eastern Massachusetts National Wildlife Refuge Complex, and are shared among all units. All fire management activities are conducted in a coordinated and collaborative manner with the refuge and other Federal and non-Federal partners. The New England fire management zone has also developed a close working relationship with the Massachusetts Department of Fish and Game and The Nature Conservancy.

Upon approval of this CCP, a new FMP will be developed for the refuge. The FMP may cover only Monomoy NWR, or may cover all the refuges within the Eastern Massachusetts National Wildlife Refuge Complex.

Appendix G

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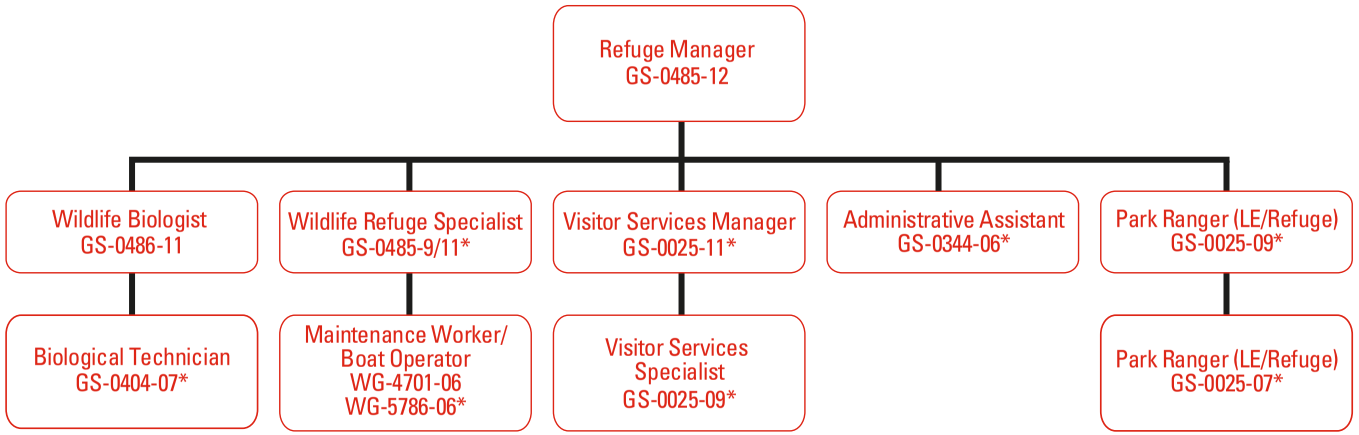
View of refuge

Refuge Staffing Chart

U.S. Fish and Wildlife Service
Northeast Region
Monomoy National Wildlife Refuge
Staffing Chart



* = New position

Appendix H

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Horseshoe crabs

Refuge Operations Needs System (RONS) and Service Asset Maintenance Management System (SAMMS)

Table H.1. RONS Projects for Monomoy National Wildlife Refuge.

Project Title	Costs ($1,000)	Refuge Rank	FTE* (personnel)
Projects			
Provide Visitor, Resource, and Facility Protection (Law Enforcement GS-09)	150	1	1
Support Biological, Visitor Services, and Law Enforcement Programs (Small Craft Operator/ Maintenance Worker GS-XX)	77.65	3	1
Implementation of Law Enforcement Program		2	
Improve Communications, Interpretation, and Education (Visitor Services Manager GS-11)	128.99	5	1
Protect Endangered, Threatened, and Rare Coastal Nesting Birds from Predation (Wildlife Biologist GS-09)		4	
Native Upland Habitat Restoration and Invasive Species Control		11	
Protect Habitats and Food Resources for Migrating Shorebirds (Temp)		11	.5
Census Nesting, Staging, Wintering, and Resident Wildlife	87.16	9	1
Manage Refuge Resources and Restore Beach Habitats	106.61	6	1
Habitat and Native Vegetation Restoration	87.16	7	1
Greet Visitors and Support Refuge Operations (Office Assistant GS-06)	78.43	12	1
Provide Visitor, Resource, and Facility Protection (Law Enforcement GS-XX)	150	13	1
Provide and Enhance Visitor Opportunities	48.42	10	1
Total	**9,543.26**		

Table H.2. SAMMS Projects for Monomoy National Wildlife Refuge.

Project Title	Costs ($1,000)	Refuge Rank
Existing Facilities		
Rehabilitate Cultural Heritage Improvement at Monomoy Lighthouse	1,399.79	9
Replace Interpretive Signs	38	8
Replace Monomoy Morris Island Entrance Signs	42	4
Rehabilitate Morris Island Erosion	522	2
Rehabilitate Historic Monomoy Lighthouse	726	6
Rehabilitate Historic Oil House/Generator Building	113	7
Rehabilitate 504 ADA Beach Trail	41	5
Rehabilitate Historic Lighthouse Quarters	647	3
Replace Stairs Public Beach Access	139.48	1

Appendix I

USFWS

View of refuge

A Geomorphological Analysis of the Monomoy Barrier System

A Geomorphological Analysis of the Monomoy Barrier System

by

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for

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1. PREFACE

This report is submitted at the request of the Eastern Massachusetts National Wildlife Refuge Complex for geomorphological research and report preparation in support of a comprehensive conservation plan for Monomoy National Wildlife Refuge. Areas of interest specified include a summary of the present understanding of outer Cape Cod coastal processes; a chronology of southeastern Chatham coastal forms using aerial photographs to illustrate changes at Monomoy; a general overview of climate change and associated sea level rise with respect to the study area; discussion of the potential benefits and problems associated with dredging around Monomoy; and discussion of potential future research to benefit Refuge management.

2. INTRODUCTION

"Monomoy" as seen on regional maps appears as an appendage to the bended arm of Cape Cod, extending southward some 15 km. from the Cape's sharp elbow at Morris Island in Chatham (e.g., Fig. 1). Depending on the map's date, Monomoy may have the form of a continuous peninsula – a barrier spit consisting of dunes, marshes and beaches with a bulbous terminus at Monomoy Point, or it may appear as a series of isolated and small barrier islands and shoals in the north leading southward to a larger island, "South Monomoy Island". However, the marine setting is similar at all dates: Monomoy is bordered on the southeast by a northeast-southwest trending channel, "Pollock Rip Channel"; on the southwest by a string on shoals known collectively as "Handkerchief Shoal" parts of which are sometimes exposed at extreme low water; and on the west by a broad shallow triangular platform, "Monomoy Flats" (Fig. 1).

3. METHODOLOGY

Cartography. Studies of the Monomoy Barrier Beach System using comparative cartographic sources began in earnest in 1871 with the work of Henry Mitchell. Mitchell, a prominent scientist and accomplished topographer with the Coast Survey, relied on the accurate field work and charts of the Coast Survey to document the movement and growth of the Monomoy

1

Spit and its offshore shoals and to investigate the potential effect of this movement on maritime commerce (Mitchell, 1871; Mitchell, 1873; Mitchell, 1874; Mitchell, 1886; and Mitchell, 1887). This present study, employing a similar methodology of chronological cartographic and aerial photograph comparisons, continues work undertaken for the Chatham Conservation Commission more than 30 years ago on the Nauset Beach System (Giese, 1978, Giese et al., 1989).

A major goal of the present study was to develop and document a chronology of the changing form of the Monomoy barrier beach system. To help achieve this goal, methodology from the Massachusetts Office of Coastal Zone Management (CZM) Historical Shoreline Mapping Project (Mapping Project) was adapted to meet the specific requirements of the current work. The Mapping Project, completed in 2007, evaluated historical cartographic documents from the 17th century through the present to establish presumptive lines of state tidelands jurisdiction for the entire coast of Massachusetts (Mague & Foster, 2008) and the methodology used to assess and apply historical cartographic documents in a contemporary mapping context is well-documented (BSC, 2007).

The methodology of this current study is based on a six-step approach: (1) research of cartographic and archival information depicting onshore and offshore historical configurations of the Monomoy barrier beach system; (2) qualitative assessment of historical information, including maps, charts, plans and narratives, to identify documents for further consideration; (3) registration of cartographic information to the North American Datum of 1983 (NAD83); (4) analysis and assessment of registered maps and charts with verifiable spatial accuracies; (5) digitization of topographic and bathymetric barrier beach features representing the location of salt marsh, mean high water (MHW) lines, mean low water (MLW) lines, and 1-, 2-, and 3-fathom lines for the following time frames: 1853-54, 1873-74, 1886-89, 1902, 1931, 1979, and 1996; and (6) compilation of figures depicting the location of these barrier beach features for each period to facilitate a comparative analysis.

As a recognized authority for the location of historical coastal features (Shalowitz, 1964), the work of the U.S. Coast Survey and in particular the information recorded on its topographic (T-sheets) and hydrographic (H-sheets) field sheets form the basis of the chronological series of figures and cartographic comparisons considered in this study.[1] Period-specific nautical charts, where necessary, were used to clarify cartographic symbology on T- and H-sheets and to fill in gaps in spatial coverage.

The horizontal accuracies of T- and H-sheets are well documented and quantifiable, making them well-suited for historical studies (Mague, 2009). When T-sheets and H-sheets are registered using archived coordinate values for Coast Survey triangulation stations (Coast Survey, 1851; Coast and Geodetic Survey, 1894) or sheet graticules translated to the project datum in accordance with accepted procedures (BSC, 2007), they have been shown to meet or exceed National Map Accuracy Standards at their respective compilation scales (BSC, 2007; Daniels & Huxford, 2001; Crowell et al, 1991). Estimates of H-sheet accuracies, with horizontal and vertical components, are more difficult to quantify. Referenced to local MLW datums frequently defined relatively short series of tidal measurements, H-sheet sounding accuracies have been estimated to range from 3 to 4± feet for 1800s to early 1900s surveys, 2 to 3± feet for mid-1900s surveys, and 0.5 to 1.0± feet for modern surveys (Byrnes, 2002; Johnston, 2003; and U.S. Coast Survey, 1878). For shallow depths (± 15 feet), small tidal ranges, and regular bottoms with minimal relief, such as much of the area surrounding Monomoy, these estimates would appear to be conservative. Future work that includes refining these uncertainties is necessary for a detailed assessment of the sediment transport systems, nearshore and offshore processes, and the calculation of sediment budgets and volumes that contribute to the formation of the extensive shoals surrounding Monomoy, particularly the triangular area extending approximately 2 miles to the west, characterized by flat relief, a tidal range of 3 ± feet, and a significant shoal area defined by the 1-, 2-, and 3-fathom lines. (Note: 1 fathom = 6 feet).

[1] The official name of the U.S. Coast Survey has evolved over time. Reference to the Coast Survey throughout this report is meant to include the U.S. Coast Survey and its successor agencies the U.S. Coast & Geodetic Survey and the current Office of Coast Survey.

Copies of the historical plans of the U.S. Coast Survey were obtained from the digital database of the Mapping Project, which contains in excess of 2,600 historical plans, maps, and charts of the Massachusetts coast (BSC, 2007). Historical charts were obtained from the Historical Map & Chart Project website of the National Oceanic & Atmospheric Administration (NOAA) Office of Coast Survey. Contemporary charts of the area were obtained from the NOAA Office of Coast Survey Nautical Charts website. A list of all historical and contemporary cartographic information considered for this study is contained in Section 11.

Information from historical and contemporary maps, charts, sketches, and orthophotos were incorporated into a project Geographic Information System (GIS), created in ArcGIS 9.3 with MassGIS, 1:5,000 scale, 2005 orthophotos as the base map, to develop figures depicting the shape and orientation of Monomoy Spit and its nearshore bathymetry out to a depth of three fathoms (18 feet), local MLW datum. Historical cartographic manuscripts were registered to the North American Datum of 1983 (NAD83) using the ESRI, ArcGIS 9.3 georeferencing extension, set for a First Order Polynomial (Affine) Transformation. Registration points consisted of Coast Survey triangulation stations or map graticules with a minimum of six points retained for each registration with the goal of minimizing the root mean square (rms) of the error associated with the registration or control points. To the extent possible, registration points were distributed equally across each manuscript to account for potential unequal distortion of the source document.

Finally, similar to the approach of Mitchell, figures depicting the historical positions and spatial orientation of Monomoy and its offshore shoals were compiled at the same scale to facilitate qualitative comparisons of geomorphic changes over the past 160 years. These figures are presented in Section 5.

Photography. A review of historic aerial photographs was completed at the Cape Cod National Seashore (CCNS) collection, and the Barnstable Service Center of the U.S. Department of Agriculture's Natural Resources Conservation Service (USDA/NRCS) office. Printed photos that

cover Monomoy from 1938 and 1960 were located at the CCNS. The 1938 set does not extend northward to the southeastern shore of Chatham. A set of 1978 aerial photos ends in Chatham; it does not extend southward to include Monomoy. A set of 1947 photos also stopped in Chatham for the printed copies of the CCNS collection, however, additional photos in this series are available and could be incorporated in to future analyses.

Black and white aerial photos available from USDA/NRCS are 1938, 1951, 1971 and 1980. A set of color infrared photos are available for 1984. Orthorectified aerial photographs were available in digital format for 2009 from the Town of Chatham. A 2002 orthophoto was provided by the Town of Chatham, which was acquired by the National Fish and Wildlife Service. Additional orthorectified aerial photos were available for 1994, 2001 and 2005 from the Massachusetts state office of Geographic Information Systems (MassGIS).

Year	Description	Source Location	Comments
1938	**B & W**	**NPS and NRCS/USDA**	**scanned and mosaiced, used for interpretation**
1947	B & W	NPS/Aerial Viewpoint	available for purchase, may be useful for future study
1951	B & W	NRCS/USDA	reviewed, may be useful for future study
1960	**B & W**	**NPS Highland Lab**	**scanned and mosaiced, used for interpretation**
1971	B & W	NRCS/USDA	reviewed, may be useful for future study
1980	B & W	NRCS/USDA	reviewed, very small scale probably not useful
1984	CIR	NRCS/USDA	reviewed, may be useful for future study
1991	B & W paper	Town of Chatham	scanned and mosaiced
1994	**Orthophoto**	**MassGIS**	**digital files used for interpretation**
1997	B & W paper	Town of Chatham	scanned and mosaiced
2001	Orthophoto	MassGIS	digital files used for interpretation
2002	Orthophoto	DFW/Town of Chatham	digital files used for interpretation
2005	**Orthophoto**	**MassGIS - Coastal**	**digital files used for interpretation**
2009	**Orthophoto**	**Town of Chatham**	**digital files used for interpretation**

Table 1 Summary of Aerial Photo Review

Blue text denotes aerial photos used in this report. Aerial photos in green text were acquired but not utilized for this study. Black text denotes other photos that are available for the study area.

The scanned aerial photos for 1938, 1960, 1991 and 1997 were cropped and compiled in Adobe Photoshop, because there were not enough common features through time to georeference each photo frame given the dynamic nature of Monomoy. Once the photos were compiled into a montage for each year they were aligned generally in ArcView 9.3 using the georeferencing toolbar resizing and adjustment tools. There were not enough common points evenly

5

distributed throughout the different time series to rectify the photos with common tie points. However, the general adjustment did allow for a basic alignment of the photos for comparison and scaling purposes.

4. REVIEW OF GEOMORPHOLOGICAL HISTORY

The genesis of Monomoy as the southern extremity of a 34 km deposition feature beginning at Coast Guard Beach in Eastham, the "Nauset-Monomoy Barrier System", has been treated in detail by Goldsmith (1972). In brief, the system is a complex of barrier beaches, barrier spits, barrier islands and associated tidal inlets consisting of sediment initially supplied by the erosion of glacial deposits exposed along the 32 km-long line of east-facing cliffs and nearshore sea bed that extends northward from Eastham to North Truro.

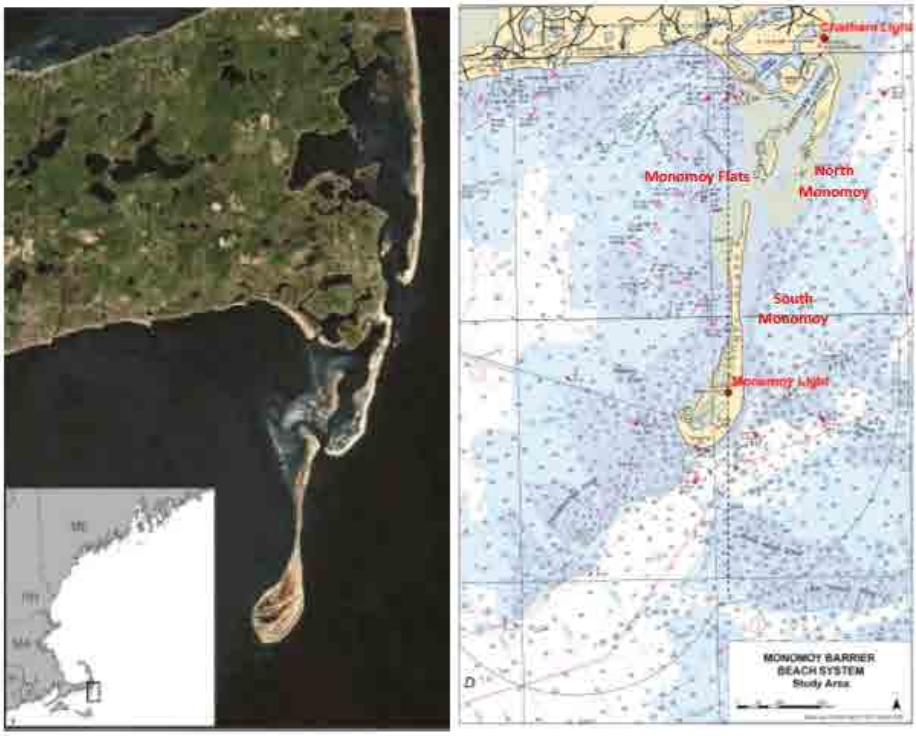


FIGURE 1

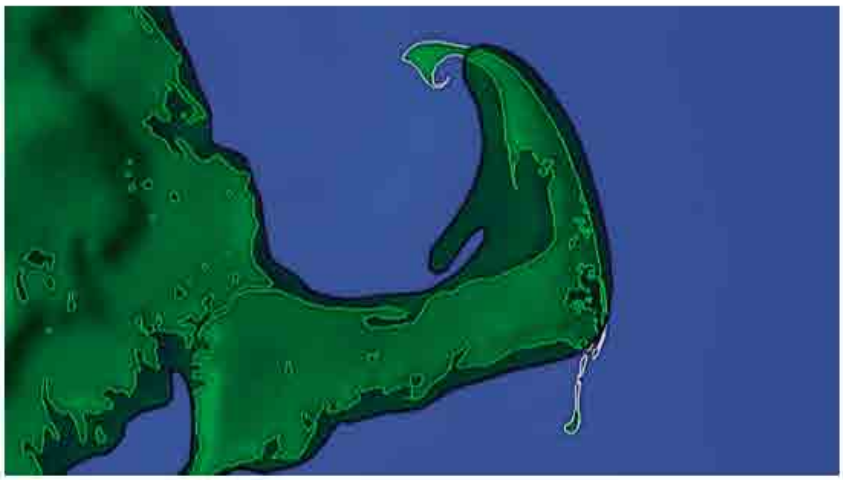
6

Early Holocene. As discussed in Section 5, historical geomorphic changes at Monomoy occur in step with those of Nauset Beach, however, before examining these processes in detail, let us review the broader scale development of the Cape Cod landmass during the Holocene Period – the approximately 12,000 year period following the most recent ("Wisconsin" stage) glaciation. At that time, sea level was some 55 m below its present level and most of the area comprising present-day Cape Cod Bay, Cape Cod, Nantucket Sound and Nantucket, and Vineyard Sound and Martha's Vineyard was part of the terrestrial borderland of the continental margin (Fig. 2).

Adapted from Uchupi, *et al.* 1996

FIGURE 2

The early Holocene was a period of rapid sea level rise. By 6,000 years B.P. (before present), sea level had risen some 45 m and was approximately 10 m below its present level. As a result of this submergence, the Cape and Islands, with their bays and sounds, became fully differentiated (Fig. 3), however, the major depositional features of outer Cape Cod, Provincetown Hook, Nauset Beach and Monomoy had not yet formed.



Adapted from Uchupi, *et al.* 1996

FIGURE 3

Late Holocene. Wave-driven sediment transport became the major process controlling shoreline evolution during the past 6,000 years. At the beginning of this period, George's Bank - until that time a gradually shrinking landmass between Cape Cod and the open Atlantic basin – became fully submerged. As a result, higher energy, open ocean waves - previously highly damped by the time they reached the coast – were capable of transporting increased amounts of sediment. According to Uchupi et al. (1996), glacial sediments eroded from the sea cliffs and nearshore bottom between North Truro and Eastham during this time period were responsible for the construction of Provincetown Hook to the north and the Nauset-Monomoy barrier system and Handkerchief Shoals to the south.

Notably, the rate of shoreline retreat accompanying these changes increased southward. Between about 6,000 and 1,000 years ago, the eroding bluff section retreated at an average rate of approximately 0.3 m/year at the northern end and 0.6 m/year in the south (Uchupi et al., 1996). A recent study (Giese and Adams, 2007) reports that contemporary century-scale bluff retreat rates continue to increase north-to-south by a factor of two, but the contemporary rates (ranging from 0.5 m/year to 1.0 m/year) are greater in magnitude, perhaps a response to

acceleration in the rate of sea level rise. Presently on-going research indicates that the southward increase in coastal retreat continues southward, past the end of the bluff section and along the length of Nauset Beach at least as far south as North Chatham. There, the century-scale average retreat exceeds 1.5 m/year, 3 times the retreat rate of the north end of the bluff section (Vaux, in press). Many local anecdotal reports confirm continual westward migration of Nauset Beach during the historical period (e.g., Nickerson, 1988).

If we assume, based on these rates of coastal retreat, that Nauset Beach lay 1 to 2 km offshore of its present location a thousand years ago, it seems unlikely that the origin of Monomoy predates that time. Geological maps of Cape Cod (e.g., Oldale and Barlow, 1986) indicate "ice contact" glacial deposits west of the northern section of Nauset Beach, and Uchupi et al. (1997) propose that the original eastern boundary of glacial Cape Cod lay just eastward of the present upland coasts of Nauset Harbor, Pleasant Bay, and Chatham Harbor. In that case, a long marine embayment lay inside Nauset Beach at 1,000 years BP, extending from the Eastham upland southward to the vicinity of Chatham.

Presently restricted basins such as Pleasant Bay, Little Pleasant Bay, and Nauset Harbor would have had free access to the embayment, while the embayment would have had a relatively unrestricted connection with the sea. Given this configuration, southward moving littoral sediment would not have reached the upland coast of south Chatham as it does today.

Recent history. By the time that accurate maps of the coast became available (e.g., Des Barres, 1764), Nauset Beach had migrated far enough westward to severely restrict tidal flow in the narrowing embayment. Even earlier (17th Century) sketches and notes by Champlain (1607) (Fig. 4) suggest that Nauset Harbor was already largely tidally-separated from the Pleasant Bay system to the south. The restriction of tidal flow between the Pleasant Bay basins and the open sea produced by changes in Nauset Beach have produced a quasi-cyclic pattern of tidal inlet/barrier island formation and barrier spit development (e.g., Mitchell, 1873; Goldsmith, 1972; Giese, 1978). In brief, this pattern consists of the following steps: 1) a breach in Nauset

Beach, 2) southwest migration of the southern barrier island (i.e., detached south end of Nauset Beach), 3) Nauset Beach elongation to the south, followed by, 4) a new breach.

Champlain, 1607

FIGURE 4

It is the second step of this pattern that concerns us here because an analysis of historical shoreline changes in the Monomoy region indicates that the detached end of Nauset Beach is the major sediment source for landforms in that region. As can be seen in Figure 5, adopted from a recent report by (Giese et al., 2009), following initiation of a new inlet referred to as "North Inlet" (Fig. 5b,) the former inlet ("South Inlet") closes (Fig. 5c) enabling littoral transport of sediment southward from the barrier island ("South Beach") to Monomoy.

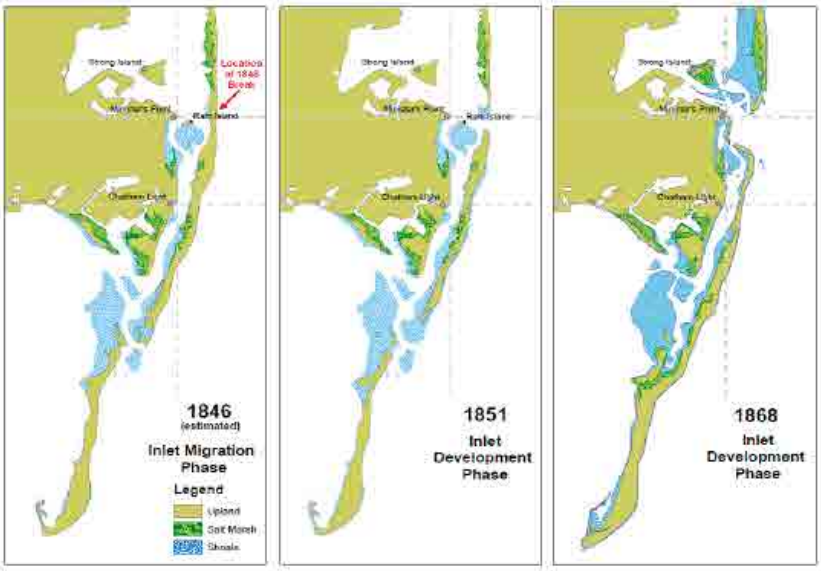


FIGURE 5 (a, b, c)

As the result of southward and westward sediment transport over the following decades (Figs. 6 and 7), Monomoy shifts westward, widens, attaches to Morris Island, and grows southward. After about a century, southward-growing Nauset Beach overlaps North Monomoy, which is deprived of incoming sediment, and begins to break-up into a group of islets and shoals. Finally, when Nauset Beach breaches again, and a new "South Beach" attaches to South Monomoy Island, a renewed sediment supply is available to nourish South Monomoy (Fig. 8c).

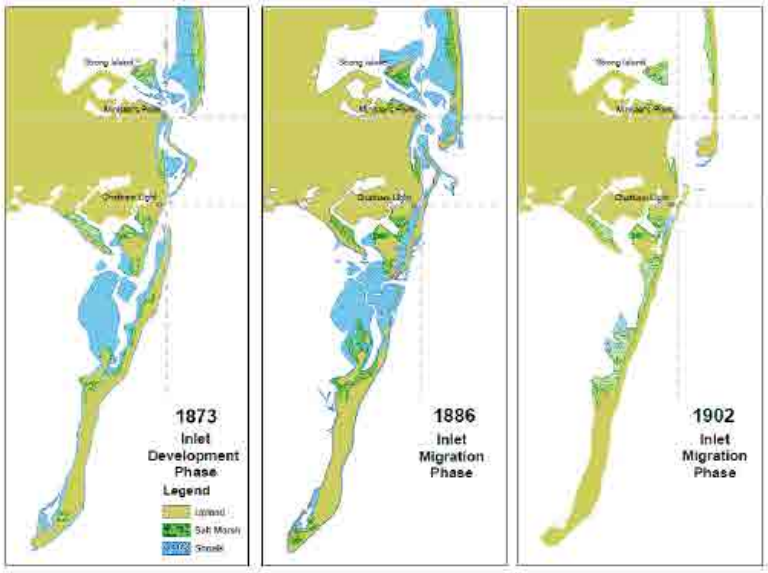


FIGURE 6 (a, b, c)

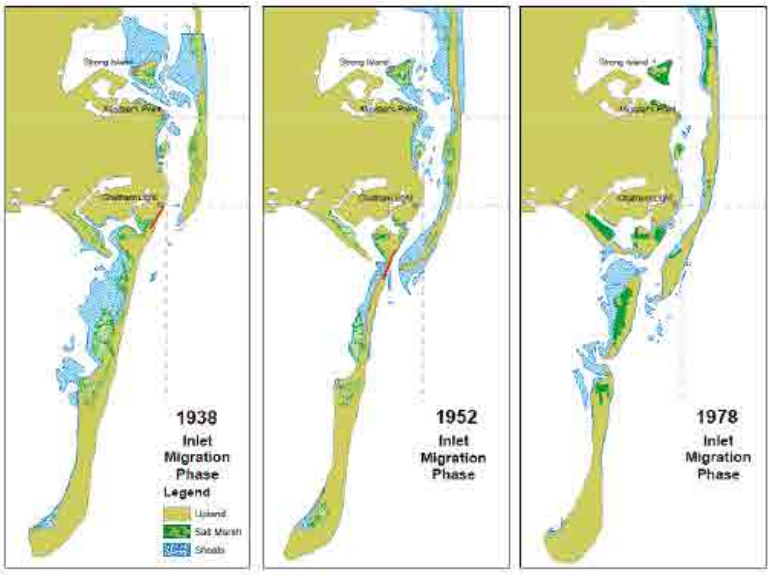


FIGURE 7 (a, b, c)

12

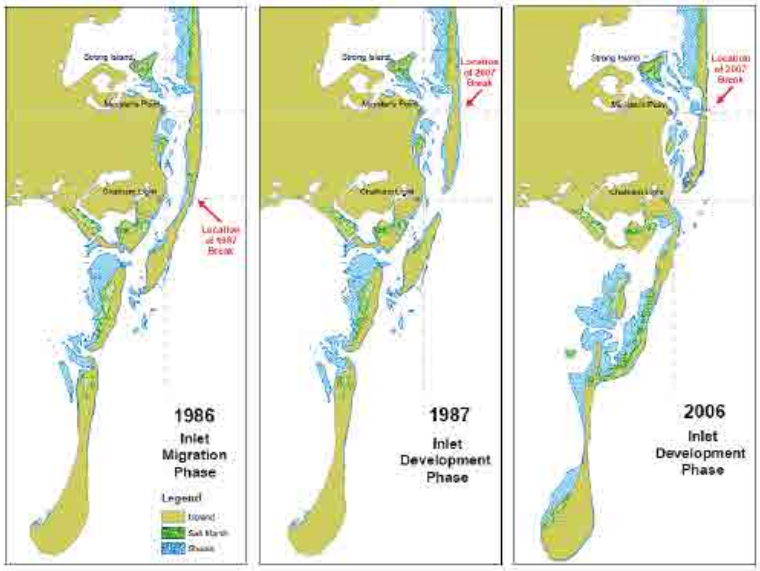


FIGURE 8 (a, b, c)

5. TIME SERIES OF MONOMOY CHANGES

The first two of the following three sub-sections present the results of cartographic and photographic research described in Section 3. The figures in *U.S Coast Survey Mapping* illustrate the general shape and position of the dominant landforms within the context of the surrounding shallow water features shown to a depth of 18 feet (3 fathoms) below mean low water. In contrast, the figures in *Aerial Photography* provide details of the changing landforms but little bathymetric information. In the third sub-section, *Discussion,* we call attention to the relationship between the landform changes and those of the surrounding bathymetry, as well as the distinction between the northern and southern sections of Monomoy.

U.S. Coast Survey Mapping.

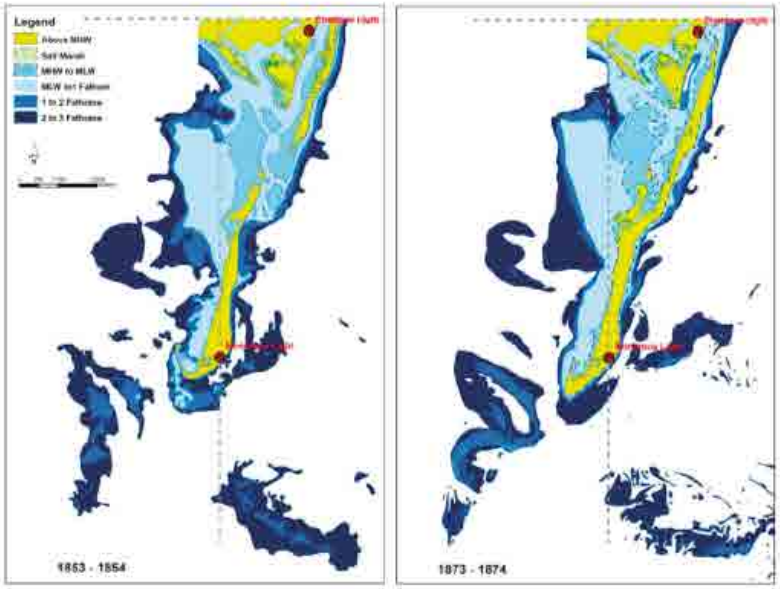


FIGURE 9 (a, b)

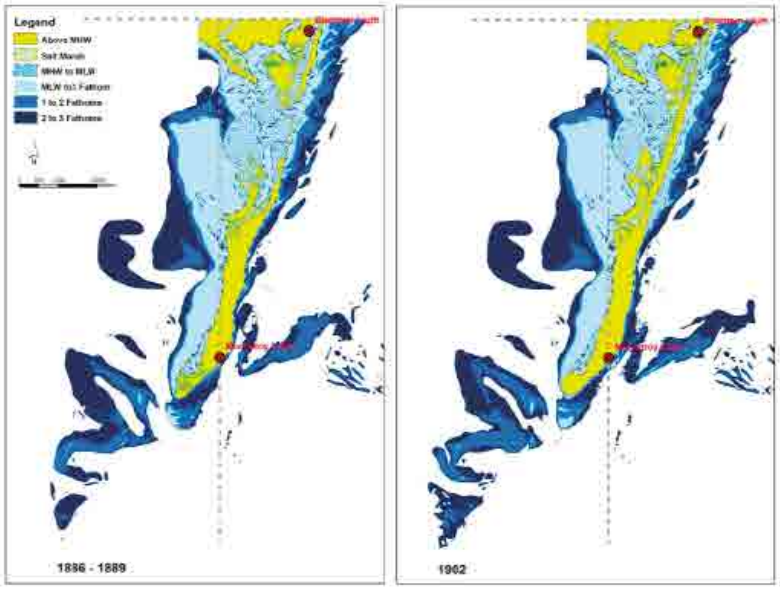


FIGURE 10 (a, b)

14

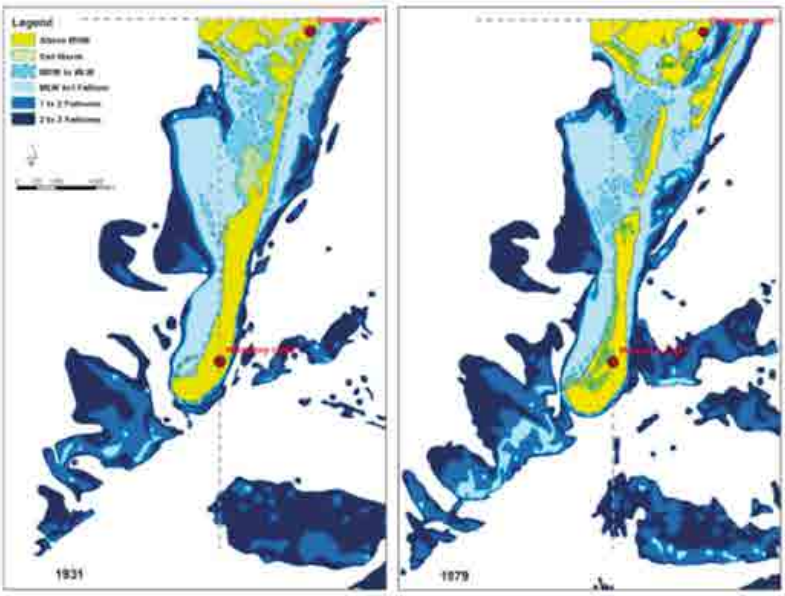


FIGURE 11 (a, b)

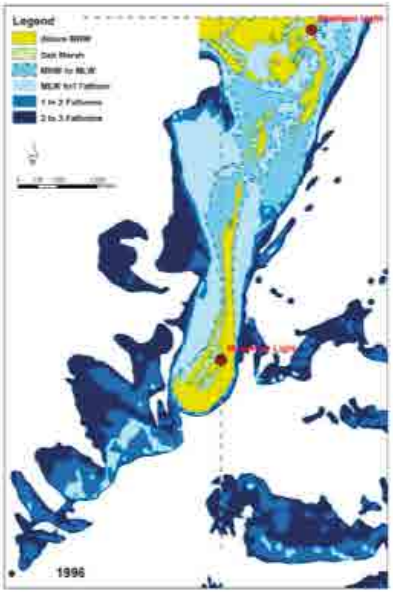


FIGURE 12

15

Aerial Photography.

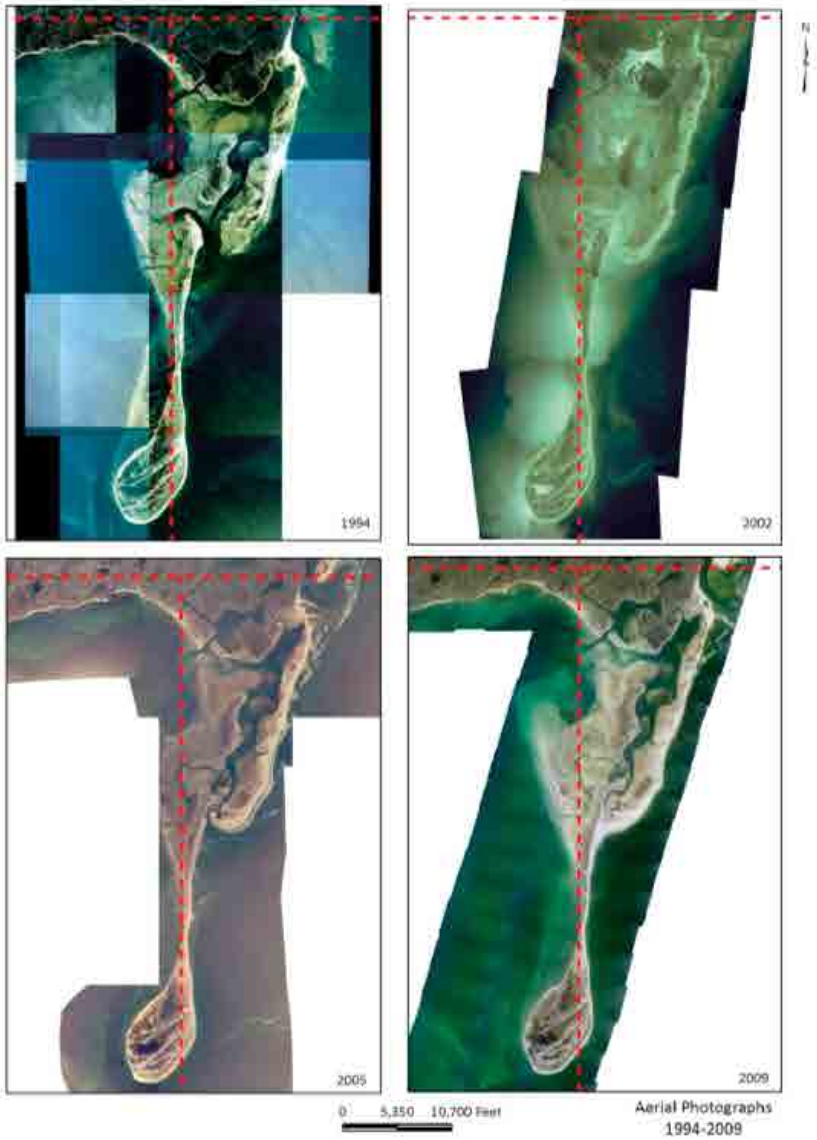


FIGURE 13

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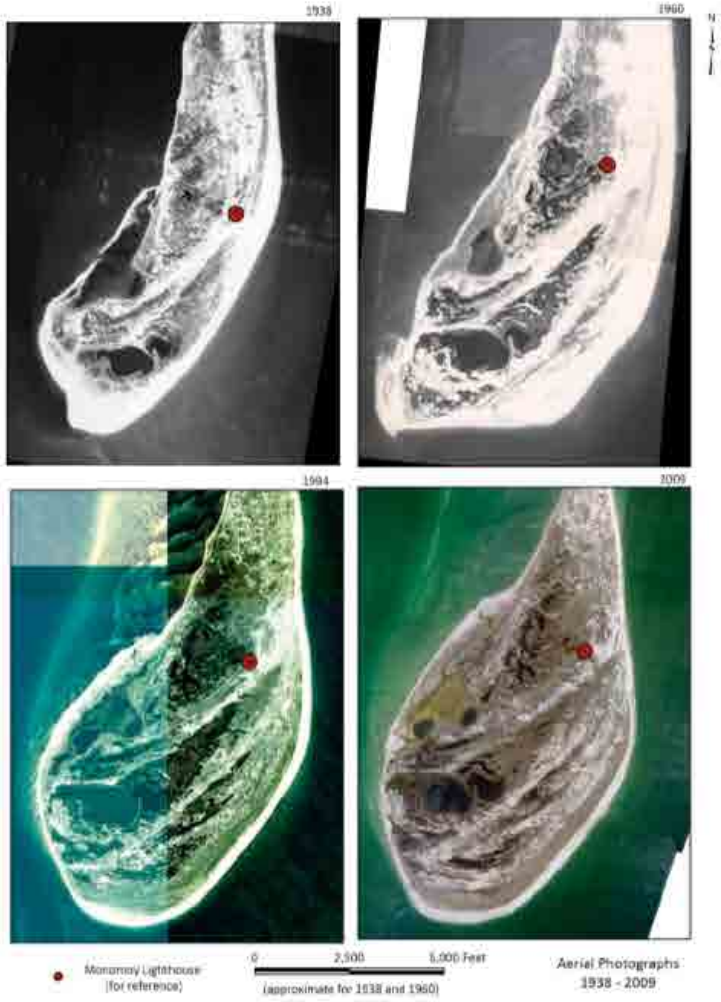

FIGURE 14

North Monomoy. Figures 9-12 reveal that Monomoy is comprised of two very distinct features. "North Monomoy" is a triangular shaped, mostly sub-tidal platform which widens northward. Subaerial landforms, when and where present, typically shift in position, size and shape. The margins of the North Monomoy Platform - well defined by the 6-foot (1 fathom) contour – appear remarkably similar in Figures 9-12 with the exception of Figure 9a, the earliest (1853-

17

1854). It is likely that the somewhat irregular form of this figure's depth contours results from less accurate navigational techniques than those employed for the later surveys. The stability of the North Monomoy Platform is illustrated in Figure 15, which compares the location of the 6-foot contour in 1873-74 with its location in 1996. Both are superimposed on a 2009 photograph. The only apparent trend is on the western (Nantucket Sound) side, with a small retreat along the southwest-facing margin, and a small advance along the north-facing margin.

FIGURE 15

18

Also apparent on Figures 9-12 is the mode of sediment transport from the eroding coast lying north of Monomoy (see Section 4), across North Monomoy Platform, to South Monomoy. A comparison of Figure 9 and Figure 5 illustrates the development of a second, more northerly tidal inlet in North Chatham that resulted in (1) closure of the inlet shown in Figure 9a, and (2) southward extension of the barrier spit to its north, leading to its welding onto South Monomoy (Figure 9b). Westward migration of the barrier across the platform is apparent in Figures 10a and b, leading to its eventual attachment to Morris Island (Figure 11a). At this stage, Monomoy was an unbroken peninsula connecting Monomoy Point to glacial upland in south Chatham.

This lasted only until southward extending Nauset Beach (Figures 6 and 7) reached the vicinity of Morris Island (Figure 11b) inhibiting wave-driven sediment transport along the Morris Island/North Monomoy coast. Deprived of a sediment supply, the peninsula broke down, first through a breach just south of Morris Island (1950's), then through a second breach (1978) (Figure 11b) separating North Monomoy from South Monomoy – each becoming a separate island. Tidal flow through the 1978 inlet produced a flood-tidal shoal near the western margin of the platform, which under the influence of the prevailing southwesterly wind waves, gave rise to the islet known as "Minimoy".

South Monomoy. "South Monomoy" is primarily a well-established and growing subaerial landform, consisting of dune, heathland, pond and marsh environments. It is a rare example of an actively accreting coastal landform along the exposed outer shore of Cape Cod, a distinction it shares only with the region near Race Point at the opposite extremity of the outer shore. Century-scale increase in area of the feature can be seen in the eastward and southward growth of the 6-foot (1 fathom) contour in Figure 15, and the southward extension of Monomoy Point since the mid-19th Century is clearly evident in Figures 9-12. Twentieth century change is shown in Figure 16 documenting a pattern of successive beach ridge development.

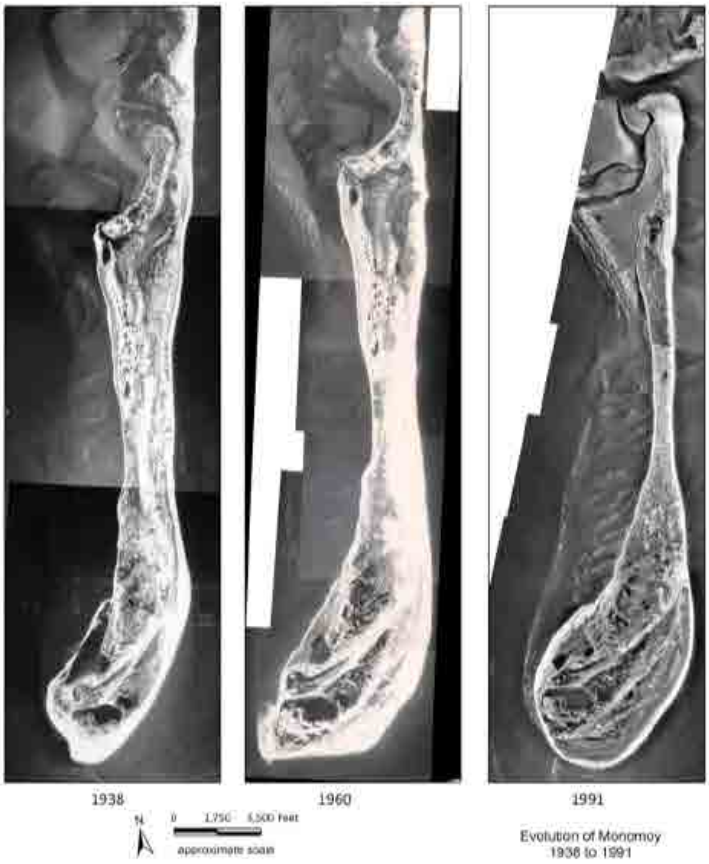

FIGURE 16

Change in location of the southern-most extremity of Monomoy Point is shown by the red vectors in Figure 17. The blue vectors in Figure 17 illustrate the change in location of the southern-most extremity of Handkerchief Shoal over the same time period. Evidently the evolution of South Monomoy is interdependent with that of Pollock Rip Channel and Handkerchief Shoal, which forms the channel's western boundary south of Butler Hole. Figure 18 shows historical locations of Monomoy Point for the years 1853, 1931, 1967, 1952 1979, and 1996, as defined by former ridge lines visible on the 2009 orthophoto.

20

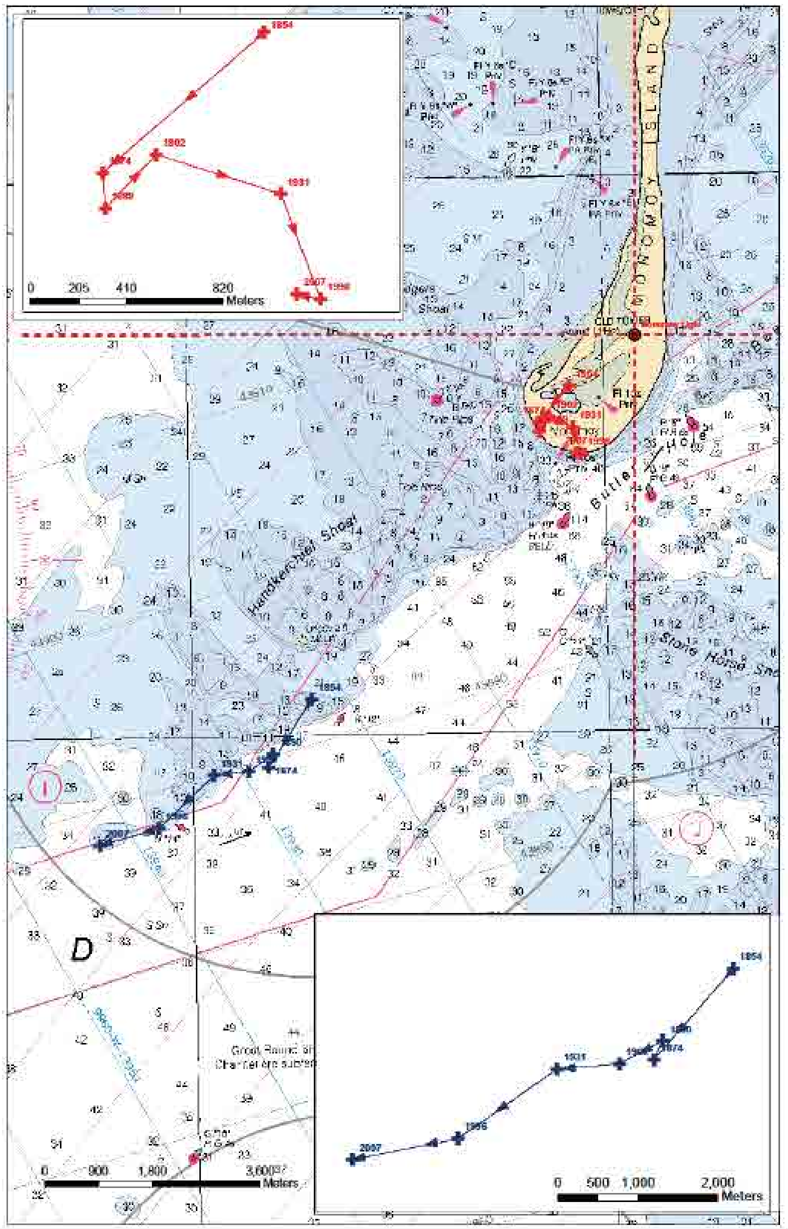
MONOMOY ISLAND
OLD TOWER
Handkerchief Shoal
Butler Hole
Stone Horse Shoal
D
1854
1902
1874
1931
1990
1998
2007
0 205 410 820 Meters
0 900 1,800 3,600 Meters
0 500 1,000 2,000 Meters

FIGURE 17

21

FIGURE 18

It is interesting to note in Figures 9-12 that Monomoy Point appears to have grown southward directly onto an adjacent portion of Handkerchief Shoal, and that at present, for the first time,– it directly abuts on the margin of Butler Hole. However, the figures also indicate that

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Handkerchief Shoal has developed considerably over the same time period. Together these observations suggest that future growth of Monomoy Point may follow a more southwesterly trajectory.

Figures 9 -12 also illustrate that some of the Nauset Beach-derived sediment that nourishes the growth of the eastern and southern South Monomoy continues around the point and forms the northward-trending spits that characterize the western shore of South Monomoy. The manner in which such spits develop into recurved spits that can eventually enclose ponds has been described by Zeigler, et al. (1965), who refer to Mitchell's (1886) account of the development of Powder Hole on South Monomoy:

> In my boyhood the Powder Hole was considered to be a very valuable harbor of refuge, but when I ran into it ... in 1856, forty fishing vessels ... packed it nearly full. Three fathoms at low water could be carried into this snug little place when our chart of 1854 was issued, but Mr. Chapin found but two feet at the time of his recent visit.

Wind waves from the southwest dominate sediment transport along the western coast of South Monomoy because of the extensive distance of fetch across Nantucket Sound. Winter prevailing northwesterly winds, in contrast, have a very limited fetch and, as a result, net sediment transport is directed to northward.

6. CLIMATE, SEA LEVEL AND 21st CENTURY MONOMOY

Small islands are particularly vulnerable to sea level rise (IPCC, 2007). However, this report shows that at the current rate of sea level rise, sediment supply from Nauset Beach to Monomoy is not only capable of maintaining the barrier complex, but of supporting ongoing accretion along the southern portion of South Monomoy Island.

Recent changes in global, or eustatic, sea level rise are largely driven by two phenomena: the thermal expansion of seawater as a result of increasing sea surface temperatures and the

melting of glacial ice (Williams and Gutierrez, 2009). The most recent report of the Intergovernmental Panel on Climate Change (IPCC) predicted future rises in sea level of 0.18 – 0.59 m by the year 2100 (Fig. 19; IPCC, 2007). However, some more recent studies include higher contributions from melting ice and suggest a global sea level rise by 2100 of 1 m or more (Rahmstorf, 2007; Rahmstorf, et al., 2007; Vermeer and Rahmstorf, 2009).

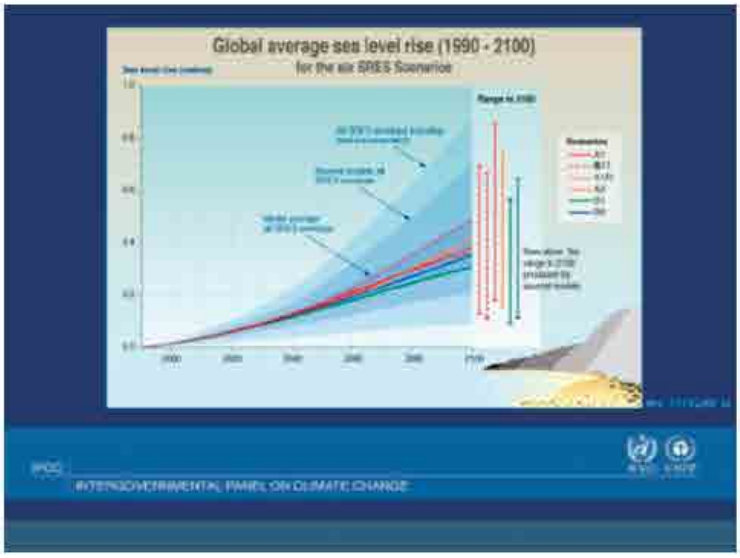

FIGURE 19

"Relative" sea level includes the augmentation or diminution by local phenomena on global sea level. Some of these phenomena include subsidence, post-glacial rebound, tectonic processes and oceanographic currents. For instance, in much of Scandinavia relative sea level is falling due to the rapid uplift of the land resulting from deglaciation since the Late Pleistocene.

Along the eastern seaboard of the U.S. researchers have identified a sea level trough maintained by the Gulf Stream and the North Atlantic Current that has kept the sea level anomalously low (Gregory, 2005; Meehl et al., 2007). Sea level in this area is 0.6 m lower than the global average and it has been shown that climate change will weaken those currents

resulting in a relative sea level change in parts of the North Atlantic. Investigators modeled several scenarios for the eastern seaboard of the United States and demonstrated that if these currents are weakened relative sea level rise could increase between 0.15 – 0.21 m along the eastern seaboard, which would be superimposed upon the global sea level rise (Yin, et al., 2009).

During the 20th Century, relative sea level in southern New England rose at a long-term rate of about 2.6 – 3 mm/year (e.g., Fig. 20) or approximately 0.3 m (one foot) , and this represented an almost three-fold acceleration of the rate that the region had experienced for many centuries (Donnelly, 2004; Fig. 21).

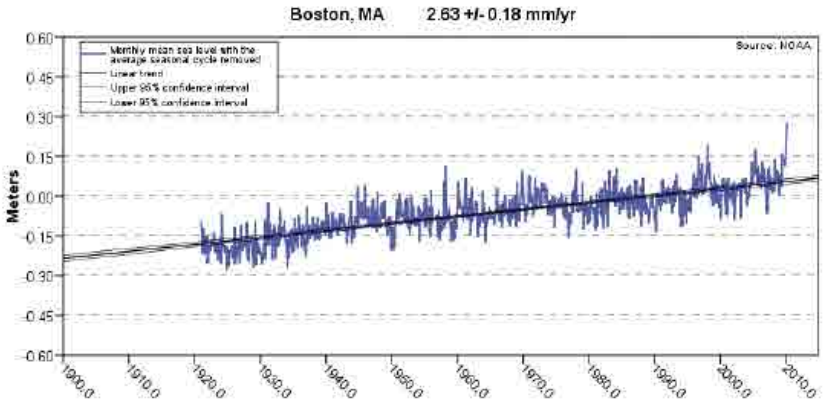

FIGURE 20

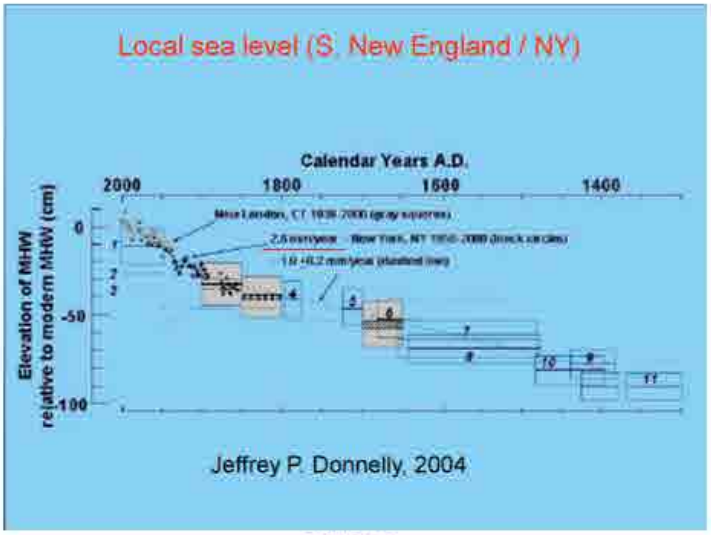

FIGURE 21

The global component of the southern New England 20th Century relative sea level rise of 0.3 m is close to the 0.18 m "low" IPCC estimate (IPCC, 2007) for the 21st Century. Therefore, under this scenario, we would expect 21st Century changes at Monomoy to follow the general patterns observed over the past century as follows:

During the 2nd and 3rd decades (2010-2030), South Beach overwashes more frequently producing washover fans on its inner (western) side; South Beach sediment moves southward along the South Monomoy outer shore; Monomoy Point grows southward/southwestward. In the 4th and 5th decades (2030-2050), South Beach overwashes thoughout its length; washover shoals reach Morris Island ending Outermost Harbor navigation; a re-curved spit, or hook, develops on southwestern side of Monomoy Point, sweeping northward. In the 3rd quarter-century (2050-2075), shoals from former South Beach end all "inside" navigation and finally connect Morris Island to South Monomoy; the Monomoy Point hook almost joins the western shore of South Monomoy. During the final quarter-century (2075-2100), Monomoy exists as peninsula for most of period, but thins south of Morris Island by close of century; Monomoy

Point extends southwestward onto nearby section of Handkerchief Shoal; and an enclosed pond forms on western shore of South Monomoy inside former re-curved spit.

This scenario for the 21st Century assumes that the major forcing factors for the period will be similar to those of the recent past, but this assumption would not be valid if global sea levels rise a half-meter or meter or more by century-end. The magnitude of relative sea level rise in that eventuality would significantly modify a number of factors affecting the evolution Monomoy, such as regional wave climate, Nantucket Sound tides, and the elevation of the ground water table.

In such a case, the resulting increase in water depths over inner- and outer continental shelf shoals, including George's Bank, could increase ocean wave energy reaching Nauset Beach and Monomoy sufficiently to markedly increase southward net sediment transport – perhaps to the extent that Chatham upland south of Minister's Point becomes directly exposed to wave action (Giese, et al., 2009). In such a case, the large amount of sediment made available between the coast and upper shoreface (c. 10 m depth) could be sufficient to maintain a permanent barrier connection between Morris Island and South Monomoy.

A marked increase in Nantucket Sound water depths could increase tidal range and currents in the eastern sound, increasing the scour of Pollock Rip Channel – an erosional trough (Uchupi, et al., 1996) – thereby adding to the bulk of Handkerchief Shoal. This, in turn, coupled with an increased supply of sediment from the north, could enhance the southwestern growth of Monomoy Point.

A large and rapid relative sea level rise would be accompanied by a similar rise in the South Momonoy water table, flooding low-lying areas and enlarging existing ponds and wetlands. Prevailing southwesterly wind waves coupled with higher sea levels could markedly increase erosion of sound-side Monomoy, narrowing the peninsula. At the same time, higher sea levels and reduced sediment supply could be expected to deepen Monomoy Flats.

In summary, while the IPCC "low" global sea level rise projection might be expected to produce patterns of change over the 21st Century that are basically similar to those of the recent past, patterns accompanying the much higher sea level rise projections would be strikingly different. As stated above, there is a general consensus in the earth science community that global sea level rise rates are increasing and will continue to increase during the 21st Century, but there is much uncertainty regarding the magnitude of that increase within the ranges discussed. Accordingly, it seems reasonable to assume that the patterns of coastal change at Monomoy during the 21st Century will follow the general trends of those experienced over the recent past, but at an accelerated pace.

7. DREDGING

Bottom sediment dredging in the vicinity of Monomoy raises question with respect to the potential negative and positive impacts of this activity on the Sanctuary. Dredging in the region is not uncommon. The entrance channel to Stage Harbor, which lies north and west of Morris Island, is a federally maintained waterway and regularly dredged. In addition, the Town of Chatham dredges to maintain safe navigation of its waters for both commercial (especially fishing) and private vessels. Past history has shown these operations to be benign with respect to local environmental impacts on water quality (e.g., turbidity, nutrients, toxins), but the need for suitable sites for dredge spoil deposition has been recognized, and the possibility of depositing such sediment within the Sanctuary has been discussed.

Such biological questions as effects of dredging activities on benthic infauna are beyond the scope of this report, but potential impacts on the physical environment can be addressed within the context of its findings. Given the history of high-energy sediment transport at North Monomoy and Monomoy Flats, the addition of suitably-sized sediment there would not appear to present difficulties. Since the potential sediment volumes involved would be small in comparison to those contributed annually by natural processes, the major impact would be to slightly increase the rate of growth of the barrier complex.

However, the suggestion of using Stage Harbor dredge spoil to create an islet, similar to "Minimoy", that would provide a suitable environment for beach nesting birds raises several concerns. First, although a northerly location on Monomoy Flats would be preferred for economic reasons, it could have negative impacts on nearby navigation channels. Second, there is the question of the lifespan of such an islet. Unlike Minimoy, which developed slowly as a flood tidal shoal over an extended period under natural conditions, a single, quickly-deposited islet would soon be reworked by waves and tides, and lacking a extended source of additional sediment, could be transformed to an inter-tidal shoal sooner than expected.

A possible alternative plan could locate a Stage Harbor dredge spoil deposition site immediately adjacent to the western shore of North Monomoy. While not providing the advantages of a separate islet, such a deposit would increase the bird nesting area and could be could be designed to be compatible in form with the existing wave-dominated shoreline.

8. FUTURE RESEARCH

Coastal Change Monitoring. Historical data discussed in this report confirm earlier suggestions that evolution of the Monomoy barrier system is closely linked to that of the Nauset Beach barrier system. Since the formation in 1987 of a new tidal inlet (now known as "South Inlet") opposite Chatham Light, the Town of Chatham has been recording annual changes in Nauset Beach using high-resolution vertical aerial photography. It would be prudent for the Sanctuary to partner with Chatham in this effort, thereby by extending the annual coverage to include all of Monomoy. Interpretation of the resulting time series of photographic images would provide invaluable guidance for Sanctuary management decision-making.

Bathymetric Analysis. The historical bathymetric data depicted on the H-sheets of the U.S. Coast Survey and its successor agencies can be an important source of information for assessing large-scale and long term coastal change in response to natural processes and human activity. When used appropriately, comparisons of H-sheets prepared at different points in time can yield important insights into changes in regional sediment transport systems, estimates of

sediment transport, and determinations of sediment budgets, which can in turn be used to study and predict geomorphic changes (Byrnes, 2002).

In order to achieve meaningful results from a comparative analysis, historical data must be translated accurately to a common, contemporary horizontal datum. Further, detailed analyses of the accuracies and uncertainties associated with the vertical data (soundings) must be conducted in order to assess the reliability of the comparative analysis for the calculation of sediment volumes. With uncertainties accounted for, these calculations may be used to quantify the net movement of sediment into and out of a study area and associated long-term net transport rates, to assess changes to sediment volumes, and to evaluate changes in nearshore bathymetry.

Recognizing the importance of the Monomoy Barrier Beach system to the local community and its significance as a coastal resource and habitat, further study of the system (beyond the scope of the current study) that incorporates a detailed and quantified assessment of historical bathymetric data depicted on the H-sheets would be an important contribution to contemporary coastal zone management decisions that will affect the long-term sustainability of areas such as the Monomoy Barrier Beach system.

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Appendix J

Malcolm Grant 2011/USFWS

Fencing exclosure to protect shorebirds from predators

Predator and Competitor Management Plan for Monomoy National Wildlife Refuge

Background and Introduction

Throughout North America, the presence of a single mammalian predator (e.g., coyote, skunk, and raccoon) or avian predator (e.g., great horned owl, black-crowned night-heron) at a nesting site can result in adult bird mortality, decrease or prevent reproductive success of nesting birds, or cause birds to abandon a nesting site entirely (Butchko and Small 1992, Kress and Hall 2004, Hall and Kress 2008, Nisbet and Welton 1984, USDA 2011). Depredation events and competition with other species for nesting space in one year can also limit the distribution and abundance of breeding birds in following years (USDA 2011, Nisbet 1975). Predator and competitor management on Monomoy refuge is essential to promoting and protecting rare and endangered beach nesting birds at this site, and has been incorporated into annual management plans for several decades. In 2000, the Service extended the *Monomoy National Wildlife Refuge Nesting Season Operating Procedure, Monitoring Protocols, and Competitor/Predator Management Plan, 1998-2000*, which was expiring, with the intent to revise and update the plan as part of the CCP process. This appendix fulfills that intent.

As presented in chapter 3, all proposed alternatives include an active and adaptive predator and competitor management program, but our preferred alternative is most inclusive and will provide the greatest level of protection and benefit for all species of conservation concern. The option to discontinue the management program was considered but eliminated due to the affirmative responsibility the Service has to protect federally listed threatened and endangered species and migratory birds. The rationale sections in alternative A, objectives 1.1 to 1.4, include information about the importance of predator management to promote nesting tern species (including federally listed roseate terns), piping plovers, and American oystercatchers. Discontinuing the predator management program would prevent us from meeting our productivity objectives for these and other high priority bird species.

Regardless of the alternative chosen, monitoring programs accompany all predator and competitor management actions; monitoring helps us evaluate the success of the management actions in meeting our objectives. The lessons we learn annually, and daily, are continually used to help us refine our future management efforts. We strive to use non-lethal methods of predator and competitor management whenever it is feasible and effective. Non-lethal methods at Monomoy refuge include, but are not limited to, predator exclosures (to protect piping plover nests from avian and mammalian predators), electric fences (to protect piping plover, least tern, and American oystercatcher nests from mammalian predators), human disturbance (to prevent gulls from nesting in tern habitat), and prescribed burning and herbicide application to improve habitat conditions for terns and deter competing laughing gulls. Often, non-lethal methods alone are not sufficient to reduce predation and competition, and lethal methods are necessary.

Although predation and competition can have a tremendous effect on beach-nesting birds, we recognize that changes in bird abundance, distribution, and reproductive success are often influenced by several other variables, including daily weather patterns, food resources, seasonal storm events, and human disturbance. We strive to manage the variables that are within our control (predator and competitor species, human disturbance) to help offset negative impacts of variables that are outside our control (weather, food resources). Monitoring programs are important, but even with careful monitoring it is sometimes difficult to make cause-effect connections between predator and competitor management efforts, and the birds' response. The collective effect of several influential variables, in addition to a lag effect of some variables, e.g., predation pressure this year can affect bird distribution in the following year, can prevent us from identifying the effect of any one variable in a given year.

However, there is a general inverse correlation on Monomoy refuge between the number of predators removed in a given year and the productivity of beach-nesting birds in that year. For example, in both 2007 and 2009, higher numbers of black-crowned night-herons, gulls, and coyote were lethally removed from the island, indicating these years were characterized by extreme predator pressure. In both years, piping plover and common tern productivity were below the threshold needed to maintain these populations and meet our biological objectives. Based on our experience and knowledge of the refuge and wildlife interactions, we believe piping plover and common tern productivity would have been lower had these predators not been removed.

The predator and competitor species discussed in this plan include all species that were addressed in the original plan, additional species that have since become prevalent on Monomoy refuge, and species that may become prevalent in the future. However, we recognize that additional species that we have not considered here may

be influential predator or competitor species in the future and may result in additional analysis to determine if management is warranted. In this appendix, we provide information about each predator and competitor species, including a summary of their population status, impacts to birds of conservation concern, proposed management techniques (lethal and non-lethal) for our most inclusive alternative presented in chapter 3 (proposed alternative), and impacts of management to targeted species. We encourage the reader to read the rationale sections in chapter 3, which additionally provide information about the role that predator and competitor species have played in limiting beach-nesting birds of conservation concern. A thorough analysis on the impacts of predator management to all avian and mammalian target predators included in this appendix has been previously discussed in an environmental assessment prepared by U.S. Department of Agriculture, Animal and Plant Health Inspection Service (USDA APHIS), Wildlife Services, in March 2011. The environmental assessment was completed in cooperation with the U.S. Fish and Wildlife Service. We encourage the reader to review this document for more detailed information, and have noted throughout this appendix relevant page numbers in that document.

Species-specific Predator and Competitor Management

1. Eastern Coyote

Population Status:
Eastern coyotes were first documented in New England in the 1930s (Richens and Hugie 1974) and in western Massachusetts in the late 1950s (Pringle 1960). They are thought to have expanded to Cape Cod by the late 1970s (Way 2002).

Eastern coyotes are now well established throughout most of Massachusetts (except Nantucket and Martha's Vineyard) and the State's population has likely been stable at about 10,000 animals since the mid-2000s. When individuals die or are lethally removed, territories are quickly filled with new generations of coyotes. The territories can be taken over by transients, i.e., individuals that do not currently maintain a territory, or by a member of the family group. Eastern coyotes are classified as a furbearer species in Massachusetts with an established hunting season. The total number of eastern coyotes harvested Statewide, and from within the southeast district (which includes Cape Cod and the islands) is in table J.1. Beginning with the 2007/2008 hunting season, the Massachusetts Division of Fisheries and Wildlife expanded the eastern coyote hunting season by 5 weeks, and the number of eastern coyotes harvested more than doubled from the 2006/2007 season. The increase in harvest numbers reported in this year may also be attributed to the increase in check stations throughout the State in 2007/2008. The number of check stations has remained stable since the initial increase in 2007/2008. Harvest has been stable between 400 to 500 coyotes (with the exception of 09/10) for the last 5 seasons. Since the 2006/2007 season, the number of eastern coyotes harvested annually from the southeast district (which includes Cape Cod and the islands) has numbered more than 100, and it is likely that the number of eastern coyotes on Cape Cod has also stabilized since the mid-2000s (Hajduk-Conlee, personal communication 2013).

Table J.1. Eastern Coyote Harvests in Massachusetts 2002 to 2013.

Hunting Season	Total # Eastern Coyotes Harvested State-wide	# Eastern Coyotes Harvested in Southeast District (% of Total)
2002 / 2003	85	19 (22%)
2003 / 2004	176	57 (32%)
2004 / 2005	190	60 (32%)
2005 / 2006	188	79 (42%)
2006 / 2007	242	103 (42%)
2007 / 2008	532	203 (38%)
2008 / 2009	513	167 (33%)
2009 / 2010	599	164 (27%)
2010 / 2011	489	174 (36%)
2011 / 2012	449	117 (26%)
2012 / 2013	470	115 (24%)

Eastern coyote tracks were first observed on Monomoy refuge on South Monomoy Island in 1996. In 1997, 3 sets of tracks were documented together, suggesting the presence of more than one individual. One dead eastern coyote was found on the west shore of South Monomoy Island in July in 1997, and in 1998 eastern coyotes were confirmed to be denning on South Monomoy Island. Since that time, eastern coyotes have denned on the refuge nearly every year. Eastern coyote presence on the island increased in the mid-2000s and has remained high since then. One reason for the increased number of eastern coyotes on the refuge, beginning in 2005, was the proximity of neighboring South Beach. Due to cyclic movement of sand in the area, the tip of South Beach extended closer to the north end of South Monomoy in 2005. At that time, the crossing was only several hundred yards wide and easy for eastern coyotes to navigate. An eastern coyote was observed exiting the channel from South Beach to South Monomoy Island in 2005 by refuge staff, and on several occasions eastern coyote tracks were seen leading to the water's edge on both South Beach (Jedrey, personal communication 2013) and South Monomoy Island, indicating regular movement across this channel. As the flats surrounding the Monomoy Islands continued to expand, crossings also become possible at several additional locations during low tide. Eastern coyotes were seen crossing from North Monomoy Island to the north tip of South Monomoy Island on several occasions, and tracks seen throughout the season indicated that crossings occurred regularly between the two islands in 2005. Eastern coyotes were also likely crossing from Morris Island to North Monomoy Island at that time. By the fall of 2006, the channel between the tip of South Beach and South Monomoy Island filled in and formed a land bridge connecting South Monomoy to the mainland, providing easy access for eastern coyotes. This land bridge formation is still intact, but in February 2013 a blizzard caused a new break in South Beach approximately 3 miles north of the land bridge, effectively separating South Monomoy from the mainland once again. During the 2013 nesting season, we observed less coyote activity on South Monomoy as a result of this break. The sediment in and around this new channel is continually shifting and the break is not likely to be permanent. Although the width of the channel can be ¼ mile wide at high tide, one storm could cause the break to abruptly fill in and reconnect South Monomoy to the mainland, or it could gradually fill back in and cause a reconnection.

Impacts to Birds of Conservation Concern:
Coyotes have been widely documented as predators on least terns (Butchko and Small 1992, Krogh and Schweitzer 1999, Adrean and Jedrey 2007), piping plovers (Adrean and Jedrey 2007), common terns (USDA 2011, Kress and Hall 2004), and American oystercatchers (Schulte et al. 2010). Management has been implemented at many sites (USDA 2011, Butchko and Small 1992, Bent and Taygan 2010). On Monomoy refuge, eastern coyotes have been documented preying on all ground-nesting birds, including least and common terns, piping plovers, American oystercatchers, gulls, and waterfowl, as well as seals and other non-focal species such as Canada goose and voles. Eastern coyote presence on Cape Cod and southeastern Massachusetts nesting sites is frequent and has increased in the last 10 to 15 years (Adrean and Jedrey 2007, USDA 2011, Monomoy field season reports, Bent and Taygan 2010).

Coyotes are problematic to nesting birds for several reasons. They are nocturnal and easily move from nest to nest in dense nesting colonies, preying on eggs, chicks, and incubating adults. In addition to direct predation, eastern coyote presence in the colony at night elicits defense-attack responses by adult terns, leaving chicks vulnerable to other opportunistic predators and inclement weather (particularly cold and rain). When eastern coyotes successfully den, adults are motivated to hunt more to provide food for their pups. When pups are old enough to travel from the denning site, adults may take pups into nesting colonies to teach them how to hunt and kill. Therefore, in years when eastern coyotes successfully raise pups, there is likely to be greater loss at nearby nesting sites.

Eastern coyotes have been the most prevalent mammalian predator on the refuge during the last 12 years, and in most years refuge staff document them depredating on terns, piping plovers, and American oystercatchers. The extent of depredation varies from year to year, however, the result in some years is significant nest loss and lowered productivity. For example, in 2002 and 2009, consistent eastern coyote depredation resulted in extensive nest loss and lowered reproductive success to nesting common terns (USFWS 2003, USFWS 2012). In most years since 1998, eastern coyotes also attempted to den on the refuge (USFWS annual field season activities reports from 1998 to present) and adult eastern coyotes have taken mobile pups hunting in the tern colony (Koch 2012 personal observation). Similarly, although not quantitatively monitored, eastern coyotes frequently prey on least tern eggs and chicks, and in some years, eastern coyote tracks are regularly seen traversing least tern nesting areas (USFWS 2012a). Eastern coyotes have been effective predators on piping plovers as well, and

were responsible for predating four plover nests (of nine lost nests for which cause of loss could be identified) in 2009 (USFWS 2012) and at least nine plover nests (the most common known cause of nest loss) in 2011 (USFWS unpublished data). Quantifying the total loss of productivity from eastern coyotes can be difficult because often no evidence of take is left behind; therefore, the observed loss is generally an underestimate of the actual loss. Coyote stomach dissection gives a general sense, however, of how catastrophic eastern coyotes can be to productivity on Monomoy refuge. For example, an eastern coyote stomach collected in 2006 contained 69 common tern chicks, likely representing one night of feeding (USFWS unpublished data.). In 2009, two coyote stomachs collectively contained 75 common tern chicks (USFWS 2012). Similarly, stomach dissection of an eastern coyote removed from another nesting site in Massachusetts in June 2010 revealed 3.4 pounds of tern chicks, which equates to 50 to 100 chicks taken in one night of hunting (USDA 2011). Eastern coyotes can frequent the tern colony dozens of nights in a season, and the number of chicks lost can quickly add up (USFWS field season reports 2001 to current).

In general, productivity of piping plovers and common terns has decreased over time, as more eastern coyotes have been observed in and around the nesting areas (USFWS field season reports). In most years, the number of eastern coyotes lethally removed from the refuge is generally positively correlated with the degree of predator pressure (table J.2); the higher the predator pressure, the lower the productivity. Therefore, it is likely if eastern coyotes were not removed from the refuge in these years, productivity would have been further suppressed.

In addition to the impact coyotes have on nesting piping plovers, American oystercatchers, and terns, they may be responsible for the precipitous decline in nesting herring and great black-backed gulls on South Monomoy in recent years. Chapter 2 contains details of nest counts of herring and great black-backed gulls through the 1900s. In recent years, complete counts of nesting gulls have been conducted on North Monomoy Island in 2000 and 2007. South Monomoy was surveyed using aerial photography in 2000, and was surveyed using a stratified random-sample transect method in 2007. In 2000, 1,609 herring gull nests and 1,018 great black-backedgull nests were counted on North Monomoy Island, but the aerial photography for South Monomoy was never full analyzed (Koch, personal communication 2013). In 2007, 1,245 herring gull nests and 683 great black-backed gull nests were counted on North Monomoy Island (USFWS 2009b), and 1,088 herring gull nests and 2,490 great black-backed gull nests were estimated on South Monomoy (Koch, personal communication 2013), for a total refugewide count of 2,333 herring gull nests and 3,173 great black-backed gull nests. In 2013, a gull census was conducted on both North Monomoy Island and South Monomoy, using the same methodology as in 2007. Data compilation is still ongoing but preliminary numbers for North Monomoy Island are 1,180 herring gull nests and 995 great black-backed gull nests. On South Monomoy, no herring gull nests were observed on transects, and the total number of great black-backed gull nests islandwide likely numbered less than 100 (Iaquinto, personal communication 2013). This sharp decline in nesting gulls on South Monomoy did not occur on North Monomoy Island, suggesting the cause was specific to South Monomoy. It also coincides with the connection of South Monomoy to South Beach, and increased presence of coyotes on South Monomoy. Evidence of coyotes preying on herring and great black-backed gulls on Monomoy refuge has been frequently observed, but not systematically documented (Koch and Iaquinto, personal communication 2013).

Current and Future Management Techniques:
The refuge employs a variety of non-lethal and lethal techniques to minimize eastern coyote depredation. Non-lethal techniques are only effective in some circumstances, and include the use of electric fencing (to protect least tern, American oystercatcher, and piping plover eggs) and individual nest exclosures (to protect piping plover eggs). These methods can also be effective in deterring other predators, and are explained in more detail in the Non-lethal Methods Common to Many Predators section of this plan.

Beginning in 1998, focused lethal eastern coyote management has been conducted annually to prevent establishment on the refuge and minimize depredation on nesting birds. We have adopted a zero tolerance policy for eastern coyotes on South Monomoy and North Monomoy Islands during the nesting season because of the impact they can have on nesting birds. Service staff or contractors shoot eastern coyotes that are present on South Monomoy or North Monomoy Island from April through August. They are not managed in other months of the year because they don't present a threat to refuge resources outside the bird nesting season. Eastern coyotes may be shot while opportunistically observed traversing the refuge, or located with the use of dogs trained

specifically to hunt coyotes. Efforts to remove eastern coyotes are especially important in the early spring to increase the chances that adults do not raise young successfully on the refuge. Any young that are found during the bird nesting season are also shot.

A total of 189 eastern coyotes (adults and pups) have been lethally removed (mostly from South Monomoy, except pups in 2009) between 1998 and 2012 as part of the predator management program (table J.2).

Table J.2. Annual Eastern Coyote Management and Bird Productivity on Monomoy NWR (1998 to 2012).

Year	# Adult Eastern Coyotes Removed	# Pups Removed	Total Piping Plover Nests Lost (% of Total Lost to Known Causes) to Eastern Coyotes	Total American Oystercatcher Nests Lost (% of Total Lost to Known Causes) to Eastern Coyotes	Common Tern Productivity
1996	0	0	0	0	1.50
1997	0	0	0	0	1.70
1998	1 female	0*	2 (15%)	No data	1.83
1999	1 female	0*	0	No data	1.61
2000	2 males	8	0	No data	1.85
2001	1 unknown	12	0	No data	1.20
2002	0	10	3 (12%)	1 (25%)	0.70
2003	4 females, 2 males	0	5 (19%)	9 (26%)	1.26
2004	11 females, 6 males	3	7 (41%)	7 (30%)	1.59
2005	1 female, 4 males	0	0	7 (18%)	1.41
2006	2 females, 6 males, 1 unknown	0	3 (33%)	2 (20%)	0.96
2007	5 females, 10 males	4	4 (44%)	5 (45%)	0.70
2008	7 females, 12 males	0	4 (18%)	4 (24%)	1.12
2009	9 females, 16 males, 1 unknown	4	4 (44%)	4 (44%)	0.35
2010	5 females, 6 males, 1 unknown	7	0 (0%)	5 (50%)	1.25
2011	3 females, 7 males, 1 unknown	2	10 (71%)	5 (36%)	1.28
2012	2 females, 5 males	7	8 (33%)	2 (12%)	1.38
Total	132	57			

**Although no pups were removed in these years, coyotes were confirmed to have pups on South Monomoy Island.*

In most years, even with an adaptive management approach, we are not able to remove all coyotes. Our level of success at removing coyotes varies depending on weather, funding, and availability of experienced personnel.

Impacts of Management to Eastern Coyote Population:
Given the Statewide estimated population of 10,000 eastern coyotes and the likely population stabilization since the mid-2000s (Hajduk-Conlee, personal communication 2013), it is not likely that the removal of 189 adults from Monomoy refuge in the last 15 years is impacting the local population any more than the annual hunting pressures. Between 2002 and 2012, 3,463 eastern coyotes have been harvested in Massachusetts through the regulated harvest seasons. During this timeframe, 164 eastern coyotes were lethally removed from Monomoy refuge, representing less than 5 percent of the total State harvest. Additionally, the maximum removed in any one year was 30 coyotes (2009); this represents 0.3 percent of the total eastern coyote population. Therefore, lethal removal on Monomoy refuge is not impacting the overall State population.

It is possible that more eastern coyotes will be removed from Monomoy refuge annually in future years. Even if 50 eastern coyotes are removed in a given year, it is still less than 1 percent of the State's population. The fact that the State has not set a limit on the number of eastern coyotes that may be taken during the State-regulated harvest seasons additionally suggests that the species is not at risk for overharvesting (USDA 2011).

2. Other Mammalian Predators Including Gray Fox, Red Fox, Virginia Opossum, Raccoon, Red Fox, Striped Skunk, Long-tailed Weasel, Short-tailed Weasel, River Otter, Mink, and Fisher

Population Status:
There are no population estimates for furbearer species (other than coyotes) in Massachusetts, but all populations are considered to be stable. The Massachusetts Division of Fisheries and Game establishes harvest seasons for red fox, gray fox, opossum, raccoon, striped skunk, weasels, mink, and river otter. Harvested gray fox, red fox, mink, and river otter are required to be reported to a check station so the State has harvest information for all animals that were taken by permit or salvage (road kill). Total harvests for the last 3 seasons are listed in table J.3 below.

Table J.3. Harvest Information for Furbearer Species in Massachusetts from 2010 to 2013.

	Gray Fox	Red Fox	Virginia Opossum	Raccoon	Striped Skunk	Weasels	River Otter	Mink
2010/2011	49	55	74	237	12	6	79	35
2011/2012	38	42	43	287	15	9	88	38
2012/2013	57	47	not yet compiled	not yet compiled	not yet compiled	not yet compiled	156	50

Impacts to Birds of Conservation Concern:
Small mammals can be a risk to beach nesting adult birds as well as their chicks and eggs (USDA 2011, Kress and Hall 2004, USFWS 1988, USFWS 1996). All the refuge focal bird species are potentially at risk from small mammal predation. Many small mammals, including opossum, are opportunistic feeders, and eggs are considered a basic part of their omnivorous diet (Burt 1976). Mammals are also often active during the night when they are less visible to incubating adults. Given their powerful sense of smell, small mammals can find nests in the dark and often take out a series of nests in one night.

It is possible that as South Monomoy grows due to sand deposition, mammalian predator populations on the island may also increase. Access to the island had become easier for land- based mammalian predators since the connection to South Beach in November 2006 and an increase had been seen in mammal activity on South Monomoy. However, the recent separation of South Beach from the mainland (refer to the Eastern Coyote section) may help reduce mammalian predation pressures on Monomoy refuge.

When the island first became isolated from the mainland, the Service removed red fox. Mammal sightings were rare through the 1980s (long-tailed weasel in 1983, Norway rats in 1985, raccoon in 1986). Red fox, Virginia opossum, raccoon, striped skunk, and river otter have all been periodically noted on the refuge since 2000. A red fox washed up on the north tip of South Monomoy in 2007, but evidence of live red fox on the island has not been documented in recent years. Virginia opossums were seen or confirmed as present most years between 2007 and 2012, though predation on beach-nesting birds was only confirmed in 2008 and 2009. In 2008, nine adult Virginia opossums were lethally removed, including four females with young. The stomachs of two of the opossums removed contained eggshells (USFWS 2009c). In 2009, one Virginia opossum was lethally removed from the tern colony. Its stomach contained eggshells and yolk. Three additional animals were found dead during this year (USFWS 2012). Raccoons were first seen on the island in recent years in 2005 when a dead animal washed up. A second animal was lethally removed this year (USFWS 2009a). From 2007 to 2009, four more animals washed up dead on the refuge but evidence of live animals (tracks) weren't documented again until 2010 and 2011 (USFWS 2009b, USFWS 2009c, USWFS 2012, USFWS unpublished data). Tracks and a raccoon carcass were observed on South Beach near the South Monomoy connection in 2012 (Iaquinto, personal communication 2013). Striped skunks were first seen on the refuge in 2000, and one animal was lethally removed. In 2001, a striped skunk was

shot and removed from the refuge. In 2011 skunk tracks were seen near the lighthouse, but no predation was observed (USFWS unpublished data). Evidence of river otter (mostly tracks) has been documented in 2005, 2007, 2009, 2011 and 2012, (USFWS 2009a, USFWS 2009b, USFWS 2012, USFWS unpublished data) and although they are a suspected predator, this has not been confirmed. Lastly, in 2009 three predated common terns were examined by the National Wildlife Health Center. Puncture wounds on all three terns indicated a canine bite, and the spacing suggested the predator was mink, fisher, or river otter (Organ, personal communication 2011). Gray fox and long- and short-tailed weasels have not been documented on the refuge in recent years of monitoring.

Current and Future Management Techniques:
Since small mammals have not been prevalent predators on the refuge in most years, efforts to remove them have been infrequent and focused. Personnel are prepared to shoot small mammals when observed during night stints in the same manner as described for coyotes and black-crowned night-herons. Signs of depredation and presence in the tern colony and around beach nesting bird areas are recorded when observed.

Several non-lethal techniques are also effective at reducing small mammal depredation on eggs, including the use of electric fencing (to protect least tern, American oystercatcher, and piping plover eggs) and individual nest exclosures (to protect piping plover eggs). These methods can be effective at deterring several predators under some circumstances, and are explained in more detail in the non-lethal section of this plan.

Preparedness for managing mammalian predators will continue and mammalian predators will be removed when appropriate. We will also continue to document impacts from mammalian predators.

Impacts of Management to Target Mammalian Predators:
Although there are no current State population estimates for any furbearer species (other than coyotes) in Massachusetts, all are considered stable, and most do not have harvest limits during the harvest seasons, suggesting they are not at risk for overharvesting (USDA 2011). Since 2000, only two striped skunk, one raccoon, and ten adult Virginia opossums have been lethally removed from the refuge and this certainly has had no impact on the State's populations.

The environmental assessment prepared by USDA APHIS in 2011 includes an effects analysis of their management actions for all small mammal predators, including Virginia opossum (pages 50 and 51), red fox (pages 54 to 56), gray fox (pages 56 to 58), raccoons (pages 58 to 60), fisher (pages 60 and 61), short-tailed weasel (pages 61 and 62), long-tailed weasel (pages 62 and 63), mink (pages 63 and 64), and striped skunk (pages 64 to 66). Because population estimates are not available for these species, APHIS estimated conservative populations based on typical species densities and amount of available habitat. They calculated the maximum of each species that they would lethally take as part of their annual management actions, and calculated the percentage of the total population that maximum take represents. For fisher and mink, maximum lethal take was compared to recent harvest numbers, instead of an estimated statewide population. This is presented in table J.4.

Table J.4. Estimates of Predator Populations and Harvest (APHIS 2011).

	Virginia Opossum	Red Fox	Gray Fox	Raccoon	Fisher	Short-tailed Weasel	Long-tailed Weasel	Mink	Striped Skunk
Most Conservative Population Estimate*	5,100 to 79,200	10,200	12,200	7,900	1,707	20,580	17,640	149	32,500
Maximum Annual Take	50	50	50	50	50	50	50	15	50
Percent of Total Population**	0.1 to 1	0.5	0.4	0.6	11.7	0.3	0.3	10	0.2

** Total harvest from 2006 to 2009 for fisher and mink*
*** Percent of total harvest from 2006 to 2009 for fisher and mink*

Mammalian predator pressure may increase in future years, resulting in higher lethal take of mammals from the refuge. While we can't predict how many predators we are likely to remove, annual take will almost certainly be below the maximum annual take in the table above, and well below 1 percent of the total population.

3. Black-crowned Night-Heron

Population Status:
Throughout the Commonwealth of Massachusetts, colonies of nesting black-crowned night-herons have generally been declining and becoming more widely dispersed, although increases have been observed in some years. Black-crowned night-herons declined from an estimated 3,300 to 3,600 pairs in 1955 through the early 1970s. Although they increased to nearly 2,000 pairs in 1977 (Erwin 1978, Erwin and Korschgen 1979), only 973 pairs were counted during a coastwide survey in 1984 (Andrews 1990). Coastwide surveys were repeated from 1994 to 1995 and 2006 to 2008, and a 45 percent decline was documented between these two surveys, with only 781 pairs counted at 14 sites most recently (Melvin 2010a). Statewide surveys of black-crowned night-herons were conducted in 2013, but survey results have not yet been compiled.

The number of nesting black-crowned night-herons on Monomoy NWR increased from 12 pairs in 1980 to 200 pairs in 1987. In most years since 1996, when annual surveys were initiated, between 150 and 250 black-crowned night-herons have nested on Monomoy refuge (see table J.5). Monomoy NWR is an important nesting site in Massachusetts and was one of only 14 nesting sites in 2008, with about 20 percent of the State's nesting total (Melvin 2010a).

Impacts to Birds of Conservation Concern:
Black-crowned night-herons are also nocturnal predators and will prey on eggs and chicks, especially beginning in late June when tern chicks are hatching and many young chicks are present. Black-crowned night-herons may also teach their young to hunt in tern colonies and we often observe juvenile black-crowned night-herons feeding in the tern colony at Monomoy refuge (USFWS 2003a, 2009d, 2007a, 2007b). Night-heron predation has been documented at other tern nesting sites as well (Collins 1970, Hunter and Morris 1976, Kress and Hall 2004), and because individual night-herons are likely specialist predators, removing these specialized individuals can significantly improve tern productivity (Hall and Kress 2008).

Black-crowned night-herons were significant predators of tern eggs in 1982, 1984 (Fitch and Folger 1983, Fitch 1985), and 1985 to 1987 (Humphrey, personal communication as in USFWS 1988). For several years in the late 1970s and early 1980s, Massachusetts Audubon Society tern biologists and Service employees held State and Federal permits to shoot individual night-herons identified as tern predators.

In 1997, removal of predatory black-crowned night-herons resumed (table J.5) due to the impact they were having on the newly established tern colony. The extent of black-crowned night-heron presence in the tern colony has varied among years, but was most extensive in 2002, 2003, and 2004. During these years, black-crowned night-herons were present in the tern colony more than 20 nights each year (table J.5). This is probably an underestimate, as visibility was often limited by weather, failed night vision equipment, dense vegetation, and the overall size and expanse of the colony. Often more than one black-crowned night-heron was in the colony on one night (USFWS 2003, USFWS 2007a, USFWS 2007b). In 2002, four black-crowned night-herons were removed on one night (USFWS 2003). Extensive egg and chick loss was documented in 2002 to 2004 (table J.5); however, the numbers of eggs and chicks taken likely represents a minimum because terns may clear their nesting area of depredated egg shells before they are checked by staff, and chicks, especially the very young, are often eaten whole. Black-crowned night-herons were dissected after removal and tern chicks were often found in the digestive tracts, with a maximum of seven chicks found in one black-crowned night-heron (2004).

Table J.5. Black-crowned Night-Heron Predation and Removal in Monomoy NWR Tern Colony (1996 to 2012).

Year	Nights in the Tern Colony	Minimum Total Eggs and Chicks Depredated	Adults Removed	Juveniles Removed	Total Nesting Black-crowned Night-herons	% of Total Adult Birds Removed
1996	0	0	0	0	460	0
1997	9	0	4	0	450	0.9
1998	0	0	0	0	364	0
1999	11	9	0	0	386	0
2000	0	0	0	0	382	0
2001	0	0	0	0	414	0
2002	36	210	7	3	498	1.4
2003	30	254	3	1	482	0.6
2004	22	404	8	1	400	2.0
2005	11	10	2	0	334	0.6
2006	4	45	0	0	316	0
2007	9	169	1	1	278	0.4
2008	6	29	0	0	300	0
2009	10	117	3	0	216	1.4
2010	1	8	0	0	296	0
2011	3	12	0	0	no data	0
2012	1	21	0	0	326	0

In addition to predation on common tern chicks and eggs, black-crowned night-herons have been documented on Monomoy refuge depredating eggs of laughing gulls, black skimmers, and American oystercatchers (USFWS 2007b), as well as an American oystercatcher chick (USFWS 2009b).

Current and Future Management Techniques:
Black-crowned night-herons observed predating in the tern colony or on other beach nesting species of conservation concern will be shot. Black-crowned night-herons observed flying over the tern colony or walking near the tern colony and not disturbing terns are not considered predatory and are not targeted (Megyesi 1997). Black-crowned night-heron removal generally occurs from dusk to dawn. Total number of black-crowned night-herons removed annually is in table J.5. No management actions will be taken to discourage nesting black-crowned night-herons, with the exception of removal of woody vegetation that is on the perimeter or within the tern nesting colony.

Impacts of Management to Black-crowned Night-Heron Population:
We recognize the importance of maintaining nesting habitat and protecting black-crowned night-herons on Monomoy NWR, given the relative importance of this site and especially the likely future loss of additional sites due to sea level rise, shoreline erosion, and increasing pressure for development and human recreation. Table J.5 includes a tally of the black-crowned night-herons removed from the tern colony annually, the total number of nesting birds (pairs x 2), and the percentage of adult birds that were lethally removed. Even during the years of the most intense predator pressure and lethal removal, no more than 2 percent of the total of nesting adults was removed in any one given year, and this is unlikely to impact the local nesting population or the Statewide population. The decline in nesting black-crowned night-herons beginning in 2005 may be attributed to eastern coyote predation on South Monomoy; wading birds have shifted from nesting primarily on South Monomoy Island to nesting almost solely on North Monomoy Island. Eastern coyotes are frequently seen resting in the woody vegetation that had been used as nesting habitat by black-crowned night-herons (Iaquinto, personal communication).

4. Laughing Gull

Population Status:
The laughing gull is primarily a southern nesting species, though sporadic colonies have existed in the Northeast (Nisbet 1971). Laughing gulls are abundant throughout their breeding range with 202,646 breeding pairs (MANEM 2006). Similar to terns and other colonial nesting waterbird species, northern laughing gull populations were almost completely extirpated in the late 1800s by the millenary trade before coming under the protection of the Migratory Bird Treaty Act of 1918 (USFWS 2008, Veit and Petersen 1993). Nesting numbers in Massachusetts immediately began to increase following the passage of the Act reaching a peak in the 1940s (Nisbet 1971), especially on Muskeget Island where approximately 20,000 pairs nested. After reaching this peak, the laughing gull population slowly declined due to the direct competition with larger gulls that were also seeing population increases (Nisbet 1971). Laughing gulls on Muskeget Island were completely wiped out in June 1972 by Hurricane Agnes (Nisbet 1976). Laughing gulls, perhaps displaced from Muskeget, first colonized Monomoy refuge in 1971 and succeeded in establishing a colony adjacent to and within the tern colony at the northern-most tip of the refuge.

Laughing gull numbers rose steadily on the refuge during the 1970s to a peak of 1,000 pairs in 1981 (USFWS 1988), but then declined and eventually stopped nesting by the mid-1990s (USFWS 1996b). This was most likely the result of continued expansion of the herring and great black-backed gull populations, which encroached on tern and laughing gull nesting areas (USFWS 1996b, USFWS unpublished reports 1985 to 1994). As the decline on Monomoy began laughing gulls were reported to be nesting with terns (Melvin 2010) on New Island in Eastham by Hecker (956 pairs in 1990) (Veit and Petersen 1993). This colony collapsed in 2001 and 2002 as the natural westward migration of Nauset Spit created a landbridge that allowed mammalian predators easier access at low tide to the nesting area (Melvin 2010). This incident at New Island was similar to what was documented after the attachment of South Beach to South Monomoy Island in 2006 (see section 1.). With the collapse of the New Island colony, increased nest destruction to prevent large gulls from nesting on Monomoy, and the beginning of lethal removal of adult herring and great black-backed gulls that began in 1996 on the refuge, the Monomoy population of laughing gulls again increased and by 2002 had reached 1,106 pairs (USFWS 2003a). The numbers of pairs on the refuge continued to increase to a high of 1,498 pairs in 2007 (figure J.1) (USFWS 2009e). Between 2002 and 2007, Monomoy refuge was the only nesting site for laughing gulls in Massachusetts. Laughing gulls began nesting on Plymouth Beach in Plymouth in 2007, two years after nest destruction began on Monomoy, and have continued to nest there since (Mostello, personal communication 2009 to 2012; Kerin McCall, personal communication 2013). No management to prevent nesting of laughing gulls has been implemented on Plymouth Beach (McCall, personal communication 2013).

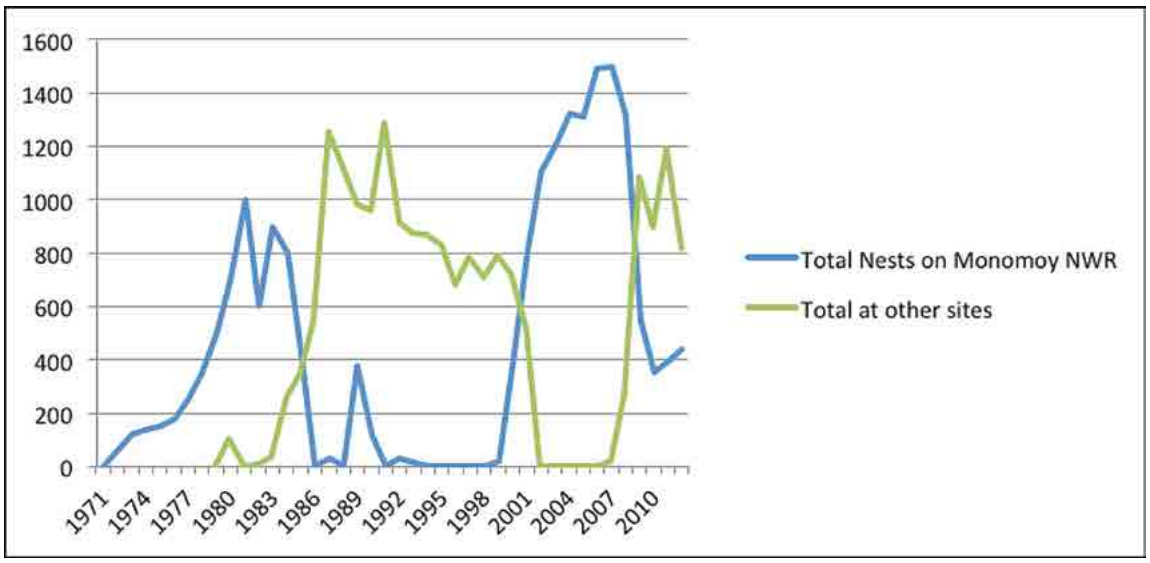

Figure J.1. Number of Nesting Laughing Gulls Counted on Monomoy National Wildlife Refuge vs. State of Massachusetts

The most recent compilation of the species as a whole in Birds of North America (Burger 1996) suggests that laughing gulls have steadily increased rangewide between 1966 and 1994.

Impacts to Birds of Conservation Concern:
The rapid increase in nesting laughing gulls on Monomoy refuge in the early 2000s resulted in direct competition with common and roseate terns for available nesting habitat, and increased rates of kleptoparasitism were documented. High densities of nesting laughing gulls within or on the immediate edge of the common tern colony increase the chances for interspecific interactions during the nesting season (harassment or direct predation). In addition, individual nesting laughing gulls that are pioneering nesting sites within the common tern colony are of concern because these pioneers may attract other prospecting laughing gulls to these areas (USFWS 2012). Laughing gulls have been documented preying on common tern chicks and eggs most years they have been present within the nesting colony on Monomoy. Eastern Egg Rock, Petit Manan Island, and Matinicus Rock in the Gulf of Maine have all reported that laughing gull predation on common, Arctic, and roseate tern eggs and chicks has directly reduced productivity rates in the terns (USFWS 2008). Documentation of this predation is likely underestimated since the events happen quickly and can be difficult to see within the dense vegetation in which laughing gulls nest.

In addition to displacing nesting terns by occupying their habitat and directly preying on tern eggs and chicks, laughing gulls frequently steal fish from terns returning to the colony from feeding; this is referred to as kleptoparasitism. Kleptoparasitism of tern by laughing gulls has been documented on the refuge extensively. Systematic recording of kleptoparasitism began in 2001, when this behavior was increasingly seen within the tern colony. Efforts increased from 68 hours in 2005 to more than 100 hours in 2008 to achieve a more accurate snapshot of laughing gull and common tern interactions. Between 2001 and 2012, a total of 859 hours has been spent documenting 15,022 attempts of laughing gulls to steal fish from terns. During each kleptoparasitism event, the maximum number of laughing gulls involved in a pursuit, victor, time, and location were recorded. Overall in the surveys conducted on Monomoy since 2001, laughing gulls were successful in stealing the fish from the tern between 32 and 57 percent of the time (USFWS unpublished and annual reports 2002 to 2013, and Johnson 2003). A study to monitor the effects of laughing gull kleptoparasitism rates on the seabird colony conducted on Matinicus Rock (Bishop unpublished data 1996 as in USFWS 2008) found that laughing gulls were successful in 38.5 percent of their attempts to steal fish from terns. A similar study conducted on Eastern Egg Rock by the National Audubon Society (NAS) found that groups of gulls were successful 44 percent of the time in their attempts to steal food from terns (NAS unpublished data 2006 as in USFWS 2008). Kleptoparasitism decreases food deliveries from tern adults to chicks, therefore decreasing the growth rate of tern chicks and overall increasing energetic demands on adults; this has the potential to reduce overall productivity in the tern colony (USFWS 2008).

Current and Future Management Techniques:
Each year on Monomoy refuge, laughing gulls are censused in conjunction with the annual tern census. Due to the increasing population of laughing gulls within the tern colony on South Monomoy Island, in 2004 we conducted a prescribed burn in the nesting area. A combination of prescribed fire and herbicide was used to create more suitable habitat for terns and discourage laughing gull nesting. The laughing gull population continued to rise. In 2004, there had only been a few instances of documented common tern chick depredation by laughing gulls, however, as the number of gulls increased annually, the instances of depredation increased as well as instances of kleptoparasitism. The refuge proposed and gained permission from the State to destroy laughing gull nests to keep the population managed at about 1,000 to 1,100 pairs beginning in the 2005 field season. Laughing gull nests and eggs (not chicks) were destroyed in late June and early July in areas where they were encroaching on tern nesting habitat within the nesting area on South Monomoy. Nonlethal management of laughing gulls was initiated for the first time in 2005 (USFWS 2009a) and was continued annually through 2009. Laughing gull nesting numbers were immediately reduced due to the nest destruction activities. When numbers were at a low of 355 pairs in 2010 (USFWS unpublished data), nest destruction was discontinued mid-season since the population was well below 1,100 pairs. Although nest destruction has not been conducted in recent years, if the laughing gull pair numbers increase beyond 1,000, it will be resumed to maintain a low population. See Figure J.2 for a comparison of nesting numbers to the number of nests destroyed between 2004 and 2012. In 2009 and 2012, subsequent burns were performed to continue to manage the colony habitat to promote a mosaic of sand and grass that is more favorable to terns and less favorable to laughing gulls. Vegetation within the tern colony and numbers of nesting laughing gulls will be monitored in the future to determine the management actions that are most successful at creating habitat for nesting terns.

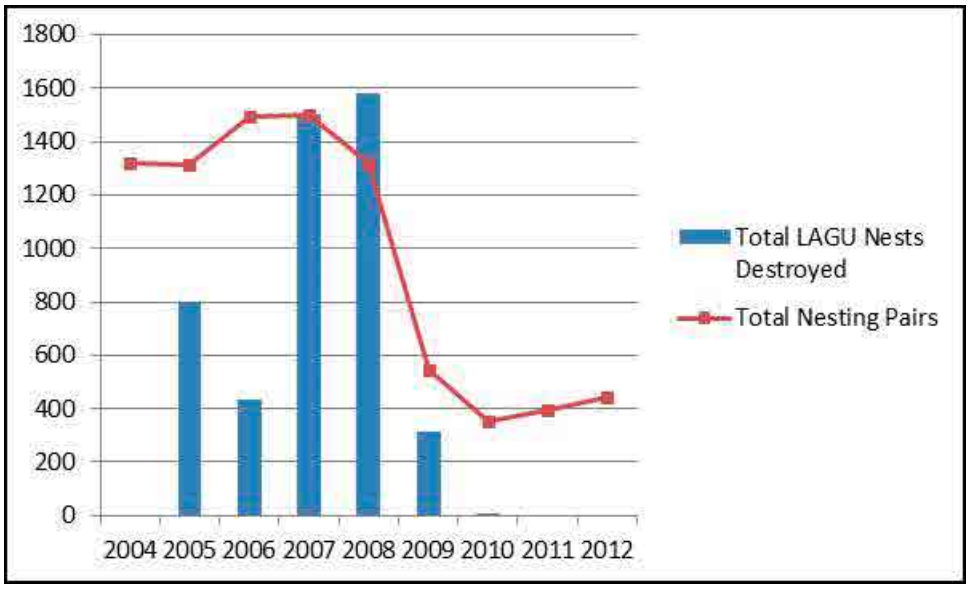

Figure J.2. Laughing Gull Nests Destroyed Between 2006 and 2012. (No nests were destroyed in 2004, 2011, or 2012.)

Impacts of Management to Laughing Gull Population:
Though laughing gull nest destruction on Monomoy has directly impacted the number of gulls nesting within our colony, the number of nesting laughing gulls in Massachusetts has steadily increased since the early 1990s. Plymouth Beach has seen increasing numbers of laughing gulls nesting in recent years, while Monomoy numbers have been low though we have not implemented any predator management to discourage nesting (Kerin McCall 2013). In areas where there is control of larger gulls like great black-backed gulls and herring gulls, it is likely that laughing gulls would out-compete terns for habitat and continue to increase as they did in the early 2000s before control was initiated on the refuge.

5. Great Black-backed and Herring Gull (Large Gulls)

Population Status:
Great black-backed and herring gulls are East Coast species, with herring gull being year-round residents of these areas. Historically both great black-backed and herring gulls have been expanding their range southward since the 1960s, at the expense of laughing gull populations (Pierotti and Good 1994, Good 1998). Both species are abundant throughout their breeding range with breeding pairs at 37,372 and 90,734 respectively (MANEM 2006).

In May and June of 2006 through 2008, a coastwide survey of nesting colonial waterbirds was completed in Massachusetts; 9,725 pairs of herring gulls were counted at 55 colonies and 9,054 pairs of great black-backed gulls were counted at 49 colonies (Melvin 2010). For both species of large gulls, North Monomoy Island and South Monomoy were listed as being two of the largest three colonies Statewide, with Muskeget Island being the second-largest nesting site for great black-backed gulls and Penikese Island being the third-largest nesting site for herring gulls. Herring gulls declined by 42.2 percent, from 15,812 to 9,143 pairs, between 1994 and 1995 and 2006 to 2008 surveys, based on comparable counts at 54 of 73 (74 percent) sites surveyed (Melvin 2010). Great black-backed gulls declined by 40.0 percent between 1994 and 1995 and 2006 to 2008, from 14,616 to 8,774 pairs, based on counts at 56 of 71 (79 percent) sites that were surveyed using comparable methods (Melvin 2010). This survey was replicated in 2013 and preliminary numbers suggest that the populations of herring and great black-backed gulls in the State have continued to decline (Melvin, personal communication 2013).

Herring gulls were first seen nesting on Monomoy Island in 1924 (Forbush 1925). The recent history of herring gull nesting on Monomoy NWR started with five pairs in 1963 (Kadlec and Drury 1968). The colony growth in

successive years was spectacular, with 75 pairs in 1964, 420 pairs in 1965, 1,000 pairs in 1966, 8,000 pairs in 1969, and more than 15,000 pairs in 1980; but in 1995 only 5,200 pairs of herring gulls were found on the refuge. This drop in herring gull numbers may be correlated to the closing of landfills and poor census methods used during the census in 1995. Great black-backed gulls moved onto Monomoy soon after the herring gulls did; there were 75 to 80 pairs in 1965 and 1966 and about 175 pairs in 1972. By 1980, the great black-backed population had reached 3,300 pairs and in 1995 had reached a total of 7,350 pairs, for a combined count of more than 13,000 pairs of the two large gull species (USFWS 1996b).

These counts (through the mid-1990s) are estimates however, and uncertainty and inconsistency in methodology among years reduces their reliability. In recent years, complete counts of nesting gulls have been conducted on North Monomoy Island in 2000 and 2007 (refer to table J.6) In 2000, South Monomoy was surveyed using aerial photography, and in 2007 it was surveyed using a stratified random-sample transect method. In 2000, 1,018 great black-backed gull nests and 1,609 herring gull nests were counted on North Monomoy Island, but the aerial photography for South Monomoy was never fully analyzed. In 2007, 1,245 herring gull nests and 683 great black-backed gull nests were counted on North Monomoy Island. An additional 1,088 herring gull nests and 2,490 great black-backed gull nests were estimated on South Monomoy, for a total refugewide count of 2,333 herring gull nests and 3,173 great black-backed gull nests.

Table J.6. Great Black-backed Gull and Herring Gull Nests Counted in Areas A and B During May Gull Censuses in 1996 to 2007* on South Monomoy.

Year	Great Black-backed Gull		Herring Gull		Empty		Total		
	Area A	Area B	Area A	Area B	Area A	Area B	Area A	Area B	Total
1996	307	652	544	178	859	322	1710	1152	2862
1997	78	356	26	51	262	147	366	554	920
1998	7	259	0	10	6	99	13	368	381
1999	2	195	0	35	1	98	3	328	331
2000	0	139	0	33	0	86	0	258	258
2001	3	115	0	28	3	55	6	198*	204*
2002	3	114	0	56	0	47	3	217	220
2003	1	79	0	32	0	47	1	158	159
2004	4	59	0	14	0	104	4	177	181
2005	0	39	0	18	0	61	0	118	118
2006	0	12	0	3	0	43	0	58	58
2007	0	13	0	5	0	17	0	35	35

**No gull census took place in 2008 through 2012.*

Gull census was again performed in 2013, concurrent with a regionwide effort to count all colonial nesting waterbird colonies. As stated in section 1, data compilation is still ongoing, but preliminary numbers for North Monomoy Island are 1,180 herring gull nests and 995 great black-backed gull nests. On South Monomoy, no herring gull nests were observed on transects, and great black-backed gull nests likely numbered fewer than 10 (Iaquinto, personal communication). This sharp decline in nesting gulls on South Monomoy did not occur on North Monomoy Island, suggesting the cause was specific to South Monomoy.

Impacts to Birds of Conservation Concern:
The overall increases in the northeastern populations of herring and great black-backed gulls have led to declines in tern populations (Cavanagh and Griffin 1993) through competition for nest sites and predation on chicks and eggs (Burger 1979, Morris and Hunter 1976). Herring and great black-backed gulls (large gulls) have been documented taking eggs, chicks, or fledglings from terns (Hatch 1970, Donehower et al. 2009, Kress and Hall

2004), oystercatchers (Schulte et al. 2010), and plovers (USFWS 1996) on Monomoy refuge (USFWS unpublished reports 1996 to 2013) and other locations in the Gulf of Maine where these species are present.

On Monomoy NWR, increases in nesting gulls were matched with precipitous declines in nesting terns. Common terns declined from a high of 4,000 pairs in 1970 to only hundreds of pairs by 1985. Roseate terns on Monomoy NWR declined from a high of 900 pairs in 1966 to fewer than 100 pairs in 1981 (USFWS 1996b). During most years from the early 1980s through 2000, no roseate terns nested. Further, predators (Nisbet and Welton 1984, Nisbet and Forster 1980), storm tides, and loss of habitat resulted in virtually zero productivity between 1980 and 1994 (Fitch 1985, USFWS unpublished reports 1985 to 1994).

Great black-backed gulls are both nocturnal (Nocera and Kress 1996) and diurnal predators in tern colonies. At Monomoy refuge we have observed them preying on eggs and chicks at night and during the day, as well as preying on fledged chicks and adults during the day as terns preen and stage on the sand flats. McNicholl (1973) suggested frequent tern mobbings of herring gulls may decrease common tern productivity by reducing time spent incubating, brooding, and guarding eggs and chicks. Herring gulls and northern harriers are generally only seen preying in the tern colony during the day. Herring gulls will prey on eggs and chicks, including large chicks, and northern harriers generally prey on fledged chicks or adults (USFWS unpublished reports 1996 to present).

Predator visits are monitored opportunistically throughout the season, and it is documented when large gulls enter and disturb the colony. Gull tracks in plover and oystercatcher nesting areas are documented as well. Gulls are considered predators when they are actively depredating nests or disturbing and being chased by terns or other birds. The following table reflects the interactions gulls have had in the colony since 1998 when data collection started, numbers of plover and oystercatcher nests taken by gulls, and the total number of herring and great black-backed gulls taken each year.

Table J.7. Large Gulls selectively removed from the Tern Colony on South Monomoy and Depredation by Gulls in these years 1998-2012

Year	# Great Black-backed Gulls Removed	# Herring Gulls Removed	Total Piping Plover Nests Lost (% of Total Lost to Known Causes) to Eastern Coyotes	Total American Oystercatcher Nests Lost (% of Total Lost to Known Causes)
1998	0	1	2 (15%)	nd
1999	0	0	2 (17%)	nd
2000	0	0	0	nd
2001	nd	nd	0	nd
2002	7	1	2 (8%)	0
2003	1	0	3 (12%)	6 (18%)
2004	3	0	2 (12%)	6 (26%)
2005	19	4	1 (6%)	7 (18%)
2006	12	0	0	0
2007	19	5	2 (22%)	0
2008	37	7	2 (9%)	3 (18%)
2009	0	0	1 (11%)	2 (22%)
2010	12	3	4 (57%)	4 (40%)
2011	0	0	0	1 (7%)
2012	0	0	3 (13%)	1 (6%)
Total	110	21	24 (11%)	30 (16%)

Though gulls directly impact nesting species on the refuge by consuming their chicks and eggs, a major factor for terns has been large gulls using habitat that would be preferred by terns. Once gulls were removed from nesting areas on South Monomoy during the initiation of the avian diversity project in 1996, habitat was available for terns to nest and they began nesting in this habitat in the same year. Gulls have predated plover and oystercatcher nests in most years, though they have caused only about 11 percent on average of the total nest loss. For piping plovers, 2010 was an outlier year, with exceptionally high productivity, so the percentage of nests taken by gulls is very high since very few nests were lost throughout the season (USFWS unpublished reports 1996 to present).

Current and Future Management Techniques:
In 1979, the Service made a preliminary effort to protect a large tern colony on North Monomoy Island (the only colony remaining on the refuge at that time) from encroaching herring and great black-backed gulls. Active gull nests were sprayed with an oil-formaldehyde mixture, which inhibits egg hatching, and at least 45 adult herring gulls were shot in a buffer zone adjacent to the nesting terns (USFWS 1988). In 1980, a more comprehensive program was initiated. In addition to targeting nesting gulls from a buffer zone around the terns, the plan called for the creation of a 130-acre alternate tern nesting area at a former colony site on South Monomoy using avicide DRC 1339 to lethally remove gulls from the area. The first of two planned annual avicide applications was administered in June 1980, and reduction in the number of nesting herring and great black-backed gulls was achieved. However, the avicide program was suspended after the first treatment due to the negative public reaction (USFWS 1988).

Subsequently, control efforts from 1980 to 1984 were focused on reducing the number of nesting gulls on North Monomoy Island only, using shooting, hazing devices, scarecrows, and nest destruction methods. While this program did prevent gulls from expanding their colony, it was unsuccessful in reducing gull populations (Lortie et al. 1985).

Maintenance of existing gull-free habitat between 1988 and 1992 was attempted through the destruction of gull nests and eggs. In 1993 and 1994, Migratory Bird Treaty Act permits were issued for the taking of herring and great black-backed gulls (using selective shooting) within a 210-acre area, with the objective of removing up to 5,000 birds (combined species total). Due to the fact that these gulls quickly adapt to stay beyond shooting range, this method resulted in an effective take of less than 1,500 birds in 1993 and less than 200 birds in 1994. Observations of large numbers of herring and great black-backed gulls nesting and loafing in the vicinity of less abundant nesting species prompted reconsideration of management alternatives following the 1994 field season (USFWS 1996b).

In accordance with tasks outlined in the Piping Plover Recovery Plan, Roseate Tern Recovery Plan, Endangered Species Act of 1973 and the goals of the National Wildlife Refuge System, which direct national wildlife refuge units to "preserve, restore, and enhance in their natural ecosystem (when practicable) all species of animals and plants that are endangered or threatened with becoming endangered," the Service proposed to strengthen ongoing efforts to manage habitat for nesting species on Monomoy NWR. The avian diversity project began in 1996, and a contiguous 169.5-acre area (67.7 ha) was chosen on the north end of South Monomoy (designated Areas A and B) to provide gull-free nesting habitat. An additional 175 acres immediately to the south of Area B was delineated as a control area, Area C (map 2.5) (USFWS 1996b).

The Service baited approximately 2,850 well-formed herring and great black-backed gull nests (both those with and without eggs) twice in this area in May 1996 using the avicide DRC 1339 (see USFWS 1996 for details). The avicide applications resulted in an almost 80 percent reduction in the number of territorial birds in Area A and a 50 percent reduction in Area B. The use of DRC 1339 on Monomoy NWR was later suspended after a public outcry when more than 600 of the birds died at freshwater roosting sites on the mainland rather than on South Monomoy. A total of 448 adult herring and great black-backed gulls were shot in the treatment area (map 2.5: Areas A and B; Megyesi 1996).


Monomoy National Wildlife Refuge - Comprehensive Conservation Plan
Gull Management Areas
NATIONAL WILDLIFE REFUGE SYSTEM
Area A
Minimoy Island
Refuge Boundary
Area B
Area C
South Monomoy Island
Sources:
Refuge and Wilderness boundaries from USFWS.
Background image from the Town of Chatham, 2012
0
0.5
1
Miles
0
0.5
1
Kilometers
1:24,000
N
W
E
S

In 1997, nonlethal harassment, which involves discouraging territorial gulls from establishing territories and destroying any nests that are found, was used. Selective shooting took place in Area A when territorial gulls were discovered attending nests with eggs (refer to Megyesi 1997 for a complete description). Nonlethal harassment was performed in 1998, 1999, and 2000 in Areas A and B. Decline in nesting gulls has been documented in both of these areas. Area A experienced a decrease from 1,710 in 1996 to zero in 2000; Area B had 1,152 nesting gulls in 1996 and 258 in 2000 (USFWS 1996 and USFWS unpublished data).

Area A has been successfully maintained as a gull-free zone, while Area B has had minimal nesting. From 2001 to 2007, nest destruction and non-lethal harassment efforts were implemented each season to maintain low populations of herring and great black-backed gulls and prevent them from encroaching on the common and roseate tern colony. In 2008, these actions were deemed unnecessary due to the low numbers of gulls censused in Area B during the 2007 census, and non-lethal harassment only has been conducted sporadically since then to maintain Areas A as gull-free.

The start of the avian diversity project in 1996, when thousands of nesting great black-backed and herring gulls were removed from potential tern nesting areas, marked the beginning of nesting tern population increases that have been largely sustained for the last 15 years on Monomoy NWR. Nesting common terns increased from just a few hundred pairs in 1995 to more than 2,000 pairs in 1998 and more than 10,000 pairs by 2003. Maintaining gull-free areas for terns has also proven to be effective in restoring large numbers of nesting terns in Maine (Kress 1983, USFWS 2005b) and other Massachusetts sites (Blodget and Henze 1992).

Since the recent peak nesting years (2003 to 2006), numbers have fluctuated in response to habitat changes, predator pressures, and nesting habitat quality at other nearby sites. Monomoy NWR remains one of the most important common tern nesting sites in the State, and one of just a few sites that support roseate terns. However, the long term continued success of this project depends on a flexible adaptive management approach that incorporates annual management actions focused on habitat manipulations and management of predator and competitor species. We also carefully monitor habitat and birds' responses to the management actions, which leads to informed adaptations of strategies for the following year.

In recent years since regular gull harassments have been discontinued, the refuge has continued to closely monitor nesting gulls on the refuge and destroy nests that are placed in close proximity to nesting plovers, terns, and oystercatchers as soon as they are found. We have also continued to shoot predatory great black-backed and herring gulls that are actively preying on plover or oystercatcher eggs, chicks, or adults in the nesting area or actively preying on fledged chicks and adults on the adjacent staging flats (USFWS unpublished reports 1996 to present).

Impacts of Management to Great Black-backed and Herring Gull Population:
It is unlikely that management at Monomoy refuge has had a significant effect on the East Coast population of gulls, despite their recent decline locally. Massachusetts gulls have been declining in recent years for a variety of reasons; nest destruction and gull removal on the refuge has been very small compared to the size of the overall decline. As stated in section 1, evidence of coyotes preying on herring and great black-backed gulls on Monomoy refuge has been frequently observed, but not systematically documented (Koch and Iaquinto, personal communiction). This sharp decline in nesting gulls on South Monomoy did not occur on North Monomoy Island, suggesting the cause was specific to South Monomoy. It also coincides with the connection of South Monomoy to South Beach, and increased presence of coyotes on South Monomoy. It is likely that the most powerful force in the declining gull population on Monomoy in recent years may be eastern coyote depredation.

6. Great Horned Owl

Population Status:

Breeding Bird Atlas [1] (BBA) data for Massaschusetts shows great horned horned owls are likely increasing in the State as they take advantage of increasing surburban habitats and maturing forest (*http://www.massaudubon.org/StateoftheBirds/species_account.php?spc=GHOW*, MassAudubon 2011, Joan Walsh, personal communication July 2013). Great horned owls were detected[2] in 27 percent of the blocks (263 blocks) during Atlas 1(Petersen and Meservey 2003) and 42 percent of the blocks (435 blocks) during Atlas 2. After correcting for differences in block survey effort[3], it appears great horned owl presence has increased by about 40 percent (Walsh, personal communication July 2013). At the time of the first BBA, great horned owls were considered widespread but uncommon, and although they were common in the southern coastal regions, they were absent from the islands (Petersen and Meservey 2003). They are now considered to be fairly widespread (Walsh, personal communication July 2013), and are present on some of the islands (*http://www.pwrc.usgs.gov/bba/index.cfm?fa=explore.ResultsBySpecies*).

Great horned owls were first confirmed nesting on Monomoy NWR when a nest with owlets was found in 2000. Since that time, a pair has probably nested in some years on South Monomoy (adults are frequently seen on the south end of the island in the spring) but no census or nest searching has been conducted (Iaquinto, personal communication 2011). Great horned owls also nest on Morris Island (Iaquinto, personal communication).

Impacts to Birds of Conservation Concern:
Great horned owl has been the most sporadic of all the avian predators at Monomoy refuge in recent years, and most years there is very little evidence of their presence. However, in years when great horned owls are present at Monomoy refuge as well as at other tern colonies, complete abandonment of the tern colony until the following morning is often observed, leaving eggs and chicks exposed to inclement weather and other predators (Holt 1994, Fisk 1974, Nisbet and Welton 1984, Morris and Wiggins 1986). Additional consequences of nocturnal abandonment include prolonged incubation periods for chicks and sometimes inattentiveness to eggs during the day, which can leave them vulnerable to diurnal predators (Mostello 2007). The adult terns' decision to either abandon their nest and young or stay and attack a predator is likely based on the perceived risk of the predator to the adult itself. Owls are skilled at catching and preying on adult terns and large chicks, but have also been reported preying on small chicks (Nisbet and Welton 1984). Many other avian predators, however, are most likely to target eggs and smaller chicks (Collins 1970, Nisbet and Welton 1984, Shealer and Kress 1991, USFWS annual field season activities reports from 1996 to present). At Monomoy refuge we often observe nocturnal abandonment in conjunction with great horned owl presence, but we have also occasionally observed groups of terns attacking an owl that is present in the colony (Koch, personal communication 2012).

Great horned owls have been an influential predator on Monomoy refuge since the 1970s. A 1979 study of common tern nesting on Monomoy (Nisbet and Welton 1984) suggested that great horned owls were a major factor in tern nesting failure in the 1970s. The owls were responsible not only for direct predation on tern chicks but, more importantly, caused night desertion of the colony by adult terns, thereby exposing eggs and chicks to attacks by ants, predation by black-crowned night-herons, and chilling. Great horned owl visits ceased after 1983.

In more recent years and since active management for terns began in 1996, great horned owls were first observed preying in the tern colony on the north end of South Monomoy in 1999. In that year, they were documented in

[1] The first Massachusetts BBA was conducted from 1974 to 1979 and the second was conducted from 2007 to 2011. The entire state was divided into 1,134 blocks; 969 blocks were surveyed in Atlas 1 and 1,037 blocks were surveyed in Atlas 2 (Walsh, personal communication July 2013). Detailed information on the methodology and analyses can be found at *http://www.massaudubon.org/birdatlas/bbaportal/index.php*

[2] Detected birds include those classified as confirmed, probable, or possible breeders

[3] Some blocks were removed from analysis when calculating % change in block detection between survey windows because of differences in survey effort (Walsh personal communication July 2013)

the colony on 17 nights, took a minimum of 15 to 20 common tern adults, and caused nocturnal abandonment every night until the end of June (USFWS 2000). In 2000, great horned owls were documented in the tern colony early in the nesting season. As a result, the tern colony was abandoned every night from May 11 to June 14, at which point common tern chicks started nesting; for a total of 3 weeks there was full abandonment, and for 1 to 2 weeks there was partial abandonment. The decline in nesting roseate tern numbers observed in 2000 from 1999 is likely attributed to great horned owl presence in the colony during tern nest establishment (Koch, personal communication). In 2001, great horned owl was again present in the colony early in the season and nocturnal abandonment occurred throughout May and then again at the end of June, which resulted in the death of many small chicks. Great horned owl presence in the tern colony has been documented in most years since 2001, but in many years the impact was likely insignificant (USFWS annual field season activities reports from 2001to present). However, great horned owl caused repeated nocturnal abandonment in 2003 (USFWS 2007a) and 2009 (USFWS 2012). Direct loss of adults and chicks from great horned owls is not easy to quantify because carcasses are not always found, and it is often difficult to identify a kill resulting from great horned owls from that of other avian predators.

Current and Future Management Techniques:
Great horned owls have been frequently removed from other tern colonies in Maine where they are posing a threat (Kress and Hall 2004). In addition, "owl predation is unpredictable; an individual may return to the colony on successive nights, but may also be absent for two or more weeks before returning (Kress and Hall 2004). Several techniques were used in 1999 to 2001 on Monomoy refuge to try to capture great horned owls in the tern colony, but none were successful.

Personnel have been prepared annually to shoot great horned owls that are actively preying in the tern colony (though this also hasn't been successful in recent years) at night, and will continue to be prepared. In 2002, the refuge began using triangular shaped "area closed" signs, instead of square or rectangular shaped signs, around the perimeter of the tern colony in an effort to reduce perching opportunities for hunting owls. We will continue to use these signs.

Impacts of Management to Great Horned Owl Population:
To date, no great horned owls have been removed from Monomoy refuge, so there has been no negative impact from our management actions to the great horned owl population. It is unlikely that more than three great horned owls would ever be removed in one year, so the anticipated impact of our management actions on the great horned owl population in the State is inconsequential.

7. Short-eared Owl

Population Status:
Short-eared owls are a State-endangered species and BBA data shows a strong decline between the two survey periods in Massachusetts. Short-eared owls were detected in 1 percdent of the blocks (13 blocks) during Atlas 1(Petersen and Meservey 2003) and less than 0.5 percent of the blocks (3 blocks) during Atlas 2. After correcting for differences in block survey effort, it appears short-eared owl presence has decreased by about 85 percent (Walsh, personal communication July 2013). At the time of the first BBA, short-eared owls were only documented breeding on Monomoy refuge, Martha's Vineyard, and Nantucket, Tuckernuck, and Muskeget Islands (Petersen and Meservey 2003). In 1985, 20 to 25 pairs of short-eared owls were estimated breeding at these sites and Pochet Marsh, Orleans (Veit and Petersen 1993). They did not nest at all in 2011 on Tuckernuck Island, which is the last known nesting site (*http://www.massaudubon.org/StateoftheBirds/species_account.php?spc=SEOW*) and have essentially been extirpated from the State (Walsh, personal communication July 2013). Short-eared owls only breed in three other states in the Northeast (New York, Pennsylvania, and Vermont), and incidences of short-eared owls there are even less than in Massachusetts (*http://www.mass.gov/eea/docs/dfg/nhesp/species-and-conservation/nhfacts/asio-flammeus.pdf*).

On Monomoy refuge, five pairs of short-eared owls nested in 1986 and two nesting pairs were confirmed in 1987. During this time, Monomoy's short-eared owls represented about one-quarter of the State's population. Holt and Melvin (1986) suspected that habitat loss and human disturbance have been the primary factors contributing to the decline of short-eared owl in Massachusetts. Short-eared owls are ground-nesters, and small mammals are

their major prey. Lortie et al. (1985) speculated that failure of short-eared owls to breed successfully on North Monomoy in 1983 and 1984 may be partially attributable to early season gull harassment efforts coinciding with owl nest site selection and courtship activities. Fitch (1985) reported that a late short-eared owl nesting attempt on North Monomoy Island in 1984 was abandoned, possibly due to its proximity to an access trail frequented by the public.

Impacts to Birds of Conservation Concern:
Short-eared owls can cause similar nocturnal disturbances in tern colonies as great horned owls. On Monomoy refuge, short-eared owls have been documented killing common tern adults and chicks and causing nocturnal abandonment, which led to prolonged incubation periods and chick mortality. "Night desertion allowed other predators and inclement weather to kill eggs, nestlings, and dispersed chicks incapable of flight." (Holt 1994). Short-eared owls have not been identified as a predator in recent years on Monomoy refuge.

Current and Future Management Techniques:
Because of the State-listed status of short-eared owls and likely extirpation from the State, we do not implement management of this species, nor do we actively discourage them from hunting in the common tern colony. Signs of depredation and presence in the colony are recorded when observed.

Impacts of Management to Short-eared Owl Population:
Short-eared owls are not actively managed on Monomoy refuge so there is no impact to their population.

8. Northern Harrier

Population Status:
BBA data for Massachusetts shows northern harriers are strongly increasing (Joan Walsh, personal communication July 2013). Northern harriers were detected in 4 percent of the blocks (36 blocks) during Atlas 1(Petersen and Meservey 2003) and 10 percent of the blocks (72 blocks) during Atlas 2. After correcting for differences in block survey effort, it appears northern harrier presence has increased by about 97 percent, or nearly doubled (Walsh, personal communication July 2013). However, northern harriers are a State-threatened species, and while BBA data shows a strong increase, their population is still at risk as open habitats are lost (*http://www.massaudubon.org/StateoftheBirds/species_account.php?spc=NOHA*).

Northern harriers have been nesting on Monomoy refuge since at least the mid 1980s when three nests were confirmed in 1985 and one nest confirmed in 1986 (USFWS 1988). In recent years, northern harriers have been observed nesting on the refuge: at least four nests in 1997, three nests in 1998, one nest in 1999, and three nests in 2000. The refuge has never been systematically searched for nesting northern harriers, but frequent observations of adults in most years suggest they are still nesting on the refuge (Iaquinto, personal communication).

Impacts to Birds of Conservation Concern:
Northern harriers have been active predators of piping plovers on Monomoy refuge and adjacent South Beach. In 2002, a northern harrier was most likely to blame for the death of an adult female plover in an exclosure (placed on piping plover nests to prevent nest predation) on the northeast tip of South Monomoy (USFWS 2003). In 2004, an adult female plover was found dead inside an exclosure with injuries consistent with those inflicted by a northern harrier in the same area (USFWS 2007b). Refuge staff removed exclosures on the northeast tip of South Monomoy following this event. Three adult piping plover mortalities due to avian predators were reported on South Beach during 2004 as well, although it was suspected that a peregrine falcon was the cause of at least one of these mortalities (Jedrey, personal communication 2004). None of the South Beach mortalities during 2004 were associated with exclosures. In addition, during 2001-2003, northern harriers were thought responsible for most of the 15 known plover fatalities at exclosed nests on South Beach (Melvin and Mostello 2002, 2003; Jedrey, personal communication 2004).

Northern harriers have also been active predators in the tern colony on Monomoy refuge and other sites (Burger and Gochfeld 1991). They likely nest within 1 mile of the Monomoy tern colony, and in most years, make frequent visits into the tern colony to hunt (Koch, personal communication, USFWS annual field season reports 1998 to present, and unpublished data). It is difficult to quantify the total number of chicks and adults taken by northern

harriers, but a minimum tally of loss is in table J.8 below.

Table J.8. Northern Harrier on Monomoy NWR Tern Colony.

Year	# Times Seen Hunting in the Colony (# Days)	# Tern Chicks Taken	# Adult Terns Taken
1998	15 (13)	>3	nd
1999	92 (33)	5	6
2000	nd	nd	nd
2001	nd	nd	nd
2002	87 (32)	27	4
2003	37 (24)	6	13
2004	40 (29)	11	9
2005	24 (nd)	1	3
2006	13 (nd)	13	2
2007	5 (5)	1	7
2008	21 (17)	3	1
2009	nd (5)	nd	nd
2010	nd (4)	nd	nd
2011	nd	0	0
2012	nd	0	0
Total		67	45

Current and Future Management Techniques:
Because of the State-listed status of northern harriers and concern for population stability in Massachusetts, we do not implement management of this species, nor do we actively discourage northern harriers from hunting in the common tern colony. Signs of depredation and presence in the colony are recorded when observed.

Impacts of Management to Northern Harrier Population:
Northern harriers are not actively managed on Monomoy refuge so there is no impact to their population.

9. American Kestrel, Merlin, and Peregrine Falcon

Population Status:
BBA data for Massachusetts shows American kestrels are strongly declining (Joan Walsh, pers. comm., July 2013). American kestrels were detected in 51 percent of the blocks (498 blocks) during Atlas 1 (Petersen and Meservey 2003) and 21 percent of the blocks (215 blocks) during Atlas 2. After correcting for differences in block survey effort, it appears American kestrel presence has decreased by about 62 percent (Walsh, personal communication July 2013).

BBA data for Massachusetts shows merlins are strongly declining (Joan Walsh, pers. comm., July 2013). Merlins were not detected during Atlas 1(Petersen and Meservey 2003) and were detected in 1 percent of the blocks (10 blocks) during Atlas 2. Merlins were detected in too few blocks to assign trend information (Walsh, personal communication July 2013).

Peregrine falcons are a State-endangered species and BBA data for Massachusetts shows their population is strongly increasing (Joan Walsh, pers. comm., July 2013). Peregrine falcons were not detected during Atlas 1 (Petersen and Meservey 2003) and were detected in 2 percent of the blocks (25 blocks) during Atlas 2 (Walsh, personal communication July 2013).

Impacts to Birds of Conservation Concern:

"Terns usually mob hawks such as buteos, accipiters and ospreys, driving them far from nesting islands. They are less likely to effectively defend against falcons. Peregrines, merlins, American kestrels, and an occasional gyrfalcon sometimes frequent tern colonies. Falcons can arrive at any time during the nesting season, but usually move on after a few days. While present, they can be extremely disruptive. For example, a single American kestrel killed more than 200 least terns over a 10-day period (J. Atwood, personal communication)" (Kress and Hall 2004). A peregrine falcon was also responsible for killing at least 36 roseate terns and 18 common terns on Bird Island in Massachusetts when it took up residence early in the nesting season (Nisbet 1992).

Current and Future Management Techniques:
Because of the State-listed status of peregrine falcon (State-listed endangered) and concern for population stability of American kestrel and merlin, we do not implement management of these species, nor do we actively discourage them from hunting in the common tern colony. Signs of depredation and presence in the colony are recorded when observed.

Impacts of Management to American Kestrel, Merlin, and Peregrine Falcon Populations:
American kestrels, merlins, and peregrine falcons are not actively managed on Monomoy refuge so there is no impact to their population.

10. American Crow, Fish Crow, and Common Grackle

Population Status:
In the U.S., American crow and fish crow have been protected by the Migratory Bird Treaty Act since 1971, but hunting is allowed in some locations. Individual states set hunting seasons (not to exceed 124 days) that exclude the nesting season (Clapp and Banks 1993). Crows are hunted on specific days in Massachusetts except during April 11 to June 30 (*www.mass.gov* 2013).

Massachusetts Audubon Society Breeding Bird Atlas (BBA2) data shows American crows are stable in Massachusetts (Walsh, personal communication July 2013). American crows were detected in 89 percent of the blocks (870 blocks) during Atlas 1 (Petersen and Meservey 2003) and 95 percent of the blocks (990 blocks) during Atlas 2. After correcting for differences in block survey effort, it appears American crow presence has increased by about 4 percent, or stayed relatively the same. Additionally, American crows are nearly ubiquitous in Massachusetts (Walsh, personal communication July 2013).

BBA2 data for Massachusetts shows fish crows are strongly increasing in Massachusetts (Walsh, personal communication July 2013). Fish crows were detected in 3 percent of the blocks (27 blocks) during Atlas 1 (Petersen and Meservey 2003) and 18 percent of the blocks (183 blocks) during Atlas 2. After correcting for differences in block survey effort, it appears fish crow presence has increased by about 530 percent (Walsh, personal communication July 2013).

BBA2 data for Massachusetts shows common grackles are stable in Massachusetts (Walsh July 2013 personal communication). Common grackles were detected in 92 percent of the blocks (896 blocks) during Atlas 1(Petersen and Meservey 2003) and 95 percent of the blocks (984 blocks) during Atlas 2. After correcting for differences in block survey effort, it appears common grackle presence has increased by about 2 percent, or stayed relatively the same. Additionally, common grackles are nearly ubiquitous in Massachusetts (Walsh, personal communication July 2013).

A brood of crows was banded by June A. Chamberlain-Auger in 1992 on North Monomoy Island. In recent years, American crows were first recorded as being seen on South Monomoy Island in April 2003. American crows were seen early in the season in 2011, though little impact was documented and crows were not seen on the island through the season. 2012 was the first nesting season in which crows and grackles were documented taking piping plover nests. Fish crows have been heard on the refuge though no documentation of their presence exists and no predation is directly attributed to them. Common grackles have been common on the refuge for many years, as they nest in the freshwater wetlands surrounding the Monomoy Light, though there is no data to quantify this presence since surveys have not been done and predator visits have not been recorded for this species (Iaquinto, personal communication). Common grackles had been commonly seen feeding on dead seal carcasses on the

refuge beaches, especially on the southern end of South Monomoy (Iaquinto, personal communication). In 2013, a pair of American crows nested and hatched chicks just outside the main tern nesting area before being detected. Three additional crows were seen flying, perching, and walking around the island and many piping plover nests were lost to them.

Impacts to Birds of Conservation Concern:
Corvids are generally egg and nest predators; however, there are some examples of crows taking least tern chicks (Burger and Gochfeld 1991, Kress and Hall 2004). Corvids are intelligent predators that can learn to associate fencing or exclosures with nests of terns and plovers and are therefore attracted to nesting areas because they know there are potential meals there (Blodget and Melvin 1996). These species (American and fish crow) have earned a reputation for eating other birds' eggs and nestlings, and common grackles occasionally kill and consume adult birds (Verbeek and Caffrey 2002, Mcgowan 2001). Some sites, including Crane Beach and the Cape Cod National Seashore (CACO) have had issues with American crows learning to target piping plover nests that are in exclosures. Predators, especially crows and coyotes, have a significant impact on the reproductive success of piping plovers, least terns, and other shorebirds nesting at the national seashore (CACO fact sheet).

On Monomoy refuge, three lost piping plover nests were attributed to grackle depredation and one lost nest was attributed to crow depredation during the 2012 nesting season. None of these nests were exclosed. As of 26 July 2013, crow and grackle predation increased dramatically and became a serious problem. A total of 28 nests were either determined to be lost to or suspected to have been lost to American crow and common grackle on South Monomoy this year (12 nests determined predated by American crow, 4 nests determined predated by common grackle, 10 nests possibly predated by American crow, 2 nests possibly predated by common grackle). It was often difficult to determine the exact cause of the nest loss, but tracks were measured carefully. As with all predation on the refuge, unless it is witnessed, it is often difficult to tell what predator actually depredated the nest. A document compiled by refuge staff outlines how the cause of nest loss was identified. Tracks were often more difficult to distinguish based on length alone, as tracks made in sand appear enlarged after time and after rain and weather events. In general, most common grackle tracks measured 2 ¼ to 2 ½ inches long, while almost all American crow tracks measured above 2 ¾ inches in length. American crow tracks had very noticeable bulges at the toes.

In 2013, nests determined to be depredated by American crow occasionally had broken eggs or large egg fragments near or at the nest. Nests found depredated by common grackle did not exhibit this. In all cases of known or suspected American crow and common grackle predation, nests had significant amounts of yolk pieces in or near nest bowl. Yolk pieces were usually found dried and in clumps. In many cases of depredation, plover tracks were found surrounding the nest, replacing any sign of American crow or common grackle tracks within about 2 feet of nest. Because exclosures have been targeted at other sites by crows and grackles, the refuge staff was hesitant to use them this year to deal with this predation. Loss of adult plovers or making nests a target would be much worse than losing nests as crows and grackles found them opportunistically. Two false exclosures with fake wooden eggs in the center were erected in areas where grackles had been seen (lighthouse boat landing and plover beach). In both cases, grackle tracks were documented entering the exclosure and approaching the nest within. In one case, a fake egg was removed from the exclosure and later found on the beach approximately 40 feet from the exclosure. No evidence of grackles or crows were found surrounding the exclosures with actual plover nests, though these were not located in areas with lots of evidence of crow or grackles predation. More nests were not exclosed for a variety of reasons, including poor weather conditions that did not allow for exclosures to be erected and nests being located in areas that would be deemed as inappropriate for exclosure use. Data for the 2013 season is still in draft and should be considered preliminary.

Current and Future Management Techniques:
A common depredation order stands for the removal of any species of crows, grackles, and blackbirds when they are in direct competition with federally endangered species (50 CFR 21 Migratory Bird Permits § 21.43). In 2013, 4 adult American crows and 4 chicks were removed from South Monomoy Island. One pair of crows was found to be nesting in a shrub close to the common tern nesting area. The refuge plans to remove the small trees and

shrubs from this area before nesting season 2014 to discourage any future nesting in this area.

Crane Beach initiated a crow removal program in 2008 using toxicants to target individual crows foraging in piping plover nesting areas. False, open-topped exclosures were constructed in nesting areas and pre-baited with hard-boiled chicken eggs. Once the crows ate the eggs, USDA APHIS contractors baited the exclosures once more with hard-boiled chicken eggs laced with the DRC-1339. This is the same toxicant used for gull removal on Monomoy in the 1990s. Crow activity was monitored using point counts, and the program had an immediate and lasting effect on crow abundance and activity within the nesting areas (Crane Beach 2008 and 2009 annual report). While only three carcasses were recovered in 2008, it is estimated that the program removed at most 30 crows. The program is credited with significantly increasing piping plover nest success and chick survival at Crane Beach in 2008 and 2009 (Crane Beach 2008 and 2009 annual report).

If crow and grackle predation continues to be a problem for nesting piping plovers, terns, or oystercatchers, we will consider using toxicants and shooting to remove predatory American crows and grackles. If fish crows were deemed a predator on the refuge, they would be treated in the same way as American crows.

Impacts of Management to Crow Population:
Given the widespread distribution of American crows and common grackles in Massachusetts, and their stable population status, lethal removal of a small number of predatory individuals at Monomoy refuge would not have an impact on the overall population.

Non-lethal Methods Common to Many Predators

At Monomoy NWR, we have been utilizing a variety of non-lethal management techniques to reduce impacts of predator and competitor species during different times of the breeding season. A description of these techniques follows; we propose continuing to use all these methods under our preferred alternative.

1. Maintaining a Staffed Field Camp

"This is the primary technique for displacing small gull colonies (up to 300 pairs) that occupy islands of 2 ha (7 acres) or less. The technique is also useful for preventing gulls from reclaiming former breeding grounds up to 20 ha (49 acres), where lethal control has previously lowered gull numbers. The technique requires a team of resident stewards camping in a conspicuous location adjacent to tern habitat. For new restoration projects at well-established gull colonies, set up the field camp before egg laying begins (in Maine and New Hampshire, during the third week of April). After several years, the season may be pushed back to mid-May, but more breaking of gull eggs may be necessary. Daily visits by mainland-based stewards to large, well-established colonies (e.g., Bird and Ram Islands in Buzzards Bay) are sufficient to deter gull nesting, with occasional breaking of gull eggs. However, depending on proximity to the mainland, landing conditions and other logistic constraints can make daily visits more difficult than staffing resident camps." (Kress and Hall 2004).

Since 1998, refuge staff have maintained a field camp on South Monomoy adjacent to the tern colony for at least June and July, and sometimes from May to August. Maintaining a human presence on the island most of the time has successfully prevented nesting herring and great black-backed gulls from reestablishing territories in close proximity to tern nesting habitat. It has also greatly facilitated our ability to manage other predators and collect data about predator visits and impacts.

2. Using Rectangular Signs to Reduce Perching

Refuge staff noticed that great horned owls were perching on square and rectangular "Area Closed" and "Beach Closed" signs that were around the perimeter of the tern colony. In 2002 refuge staff began using triangular signs around the perimeter of the tern colony in an effort to eliminate perches for great horned owls. This technique has been successful, but great horned owls will also hunt from the ground, so this is not a complete solution. However, using these signs might reduce perching by other avian predators as well.

3. Habitat Management

Habitat management can be an effective method for controlling competitor species and minimizing risk of predators. For example, prescribed burning has been used at Monomoy refuge to reduce habitat suitability for nesting laughing gulls (a competitor species of terns), increase habitat for nesting terns, and reduce shrubby vegetation that provides shelter for mammalian predators.

4. Chick Shelters

Wooden tern chick shelters are placed throughout the tern colony, especially in areas devoid of natural vegetation, to provide additional shelter from weather and predators. Shelters are designed to minimize the chances that black-crowned night-herons can reach chicks, but their effectiveness at minimizing coyote depredation is uncertain.

5. Electric Fencing

Electric fencing has been successful on the refuge in flat, sparsely vegetated areas that are free of the risk of overwash. If the fence is placed in areas where it may be overwashed by salt water, electrical shorts may occur and destroy the fence for future electrified use. Erecting the fence in thick vegetation is very difficult and the vegetation needs to be trimmed, causing potential habitat damage, increased staff labor, and drawing more attention to the fenced area. Currently the energizers used at the refuge can only support fences of up to 12 panels or a circumference of 1,800 feet. When the fencing is used in areas with a varying elevation, predators can more easily breach the fence by jumping in from a higher area. This was observed on the refuge in both 2008 and 2009. For these reasons, enclosing the entire common and roseate tern colony is not practical. Nesting least terns and piping plovers have benefited from areas protected by electric fence on the refuge. However, electric fencing does not reduce avian predation.

6. Non-electric Fence

Funding provided by the National Fish and Wildlife Foundation in 2009 allowed us to test the effectiveness of 6-foot-tall non-electrified wire fencing on the refuge to protect American oystercatcher eggs and chicks from mammalian predators. The tall wire fencing was deemed impractical to set up in the field without causing considerable disturbance to the target nesting American oystercatchers and was discontinued.

7. Predator Exclosures on Piping Plover Nests

Studies have shown that predator exclosures can help minimize predation or reduce nest abandonment (Rimmer and Deblinger 1990, Vaske et al. 1994, Mabee and Estelle 2000), and they are actively being utilized on the refuge. Though exclosures are a useful tool, they may be inappropriate under certain conditions, including habitat that is too steep, highly vegetated, or susceptible to predators that may use exclosures to target nesting birds (refer to Blodget and Melvin 1996 for more information about appropriateness of use). All exclosures placed on the refuge are monitored frequently to ensure they are safely protecting the nests and birds within them and not putting the adults at risk. In some years, raptors have targeted adults on exclosed nests (see the Northern Harrier section), but exclosures are still an effective management tool when monitored carefully. However, exclosures only protect eggs, and do not provide protection for piping plover chicks, which leave the nest bowl soon after hatching.

Appendix K

USFWS

Refuge staff conducting wildlife survey

Summary of Public Comments and Service Responses on the Draft Comprehensive Conservation Plan and Environmental Impact Statement for Monomoy National Wildlife Refuge

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Table Listings

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Introduction

In April 2014, the U.S. Fish and Wildlife Service (Service, USFWS, FWS, we, our) released for public review the draft comprehensive conservation plan and environmental impact assessment (draft CCP/EIS) for Monomoy National Wildlife Refuge (NWR, refuge). The draft CCP/EIS outlined three alternatives for managing the refuge. Alternative B was identified as the "Service-preferred alternative."

We initially released the draft CCP/EIS for 60 days of public review and comment from April 10 to June 9, 2014. In response to several requests, we subsequently extended the public comment period through October 10, 2014. In total, the comment period was 6 months long. During the comment period, we held five public meetings in the town of Chatham (Town), Massachusetts: one public hearing and four open houses. We also spoke to the Chatham Summer Residents Advisory Committee, at their request, at a televised meeting. We evaluated all the letters and e-mails sent to us during the comment period, along with comments recorded at our public hearing. This document summarizes all of the substantive comments we received and provides our responses to them.

Based on our analysis in the draft CCP/EIS and our evaluation of those comments, we have modified alternative B, which remains our preferred alternative in the final CCP/EIS. Our modifications include additions, corrections, clarifications, and changes to our preferred management action. We have also determined that none of those modifications warrants our publishing a revised or amended draft before publishing the final CCP/EIS.

Summary of Comments Received

After the comment period ended, we compiled all of the comments we received, including all letters, e-mails, and comments recorded at public meetings. In total, we received 255 separate written responses (some letters had multiple signatures), and 39 oral comments from the public hearing. Of the 255 written comments, 41 were a form letter. We also received two petitions: one signed by approximately 650 individuals (Petition A, cited in this appendix as comment #239) and the other by approximately 1,576 individuals (Petition B-*Moveon.org,* cited in this appendix as comment #240). We noted that some individuals signed both petitions.

We received a variety of letters from local, State, and Federal Governmental agencies, including the following:

- U.S. Environmental Protection Agency (EPA)
- Massachusetts Department of Fish and Game (MA DFG)
  - Massachusetts Division of Marine Fisheries (MA DMF)
  - Massachusetts Division of Fisheries and Wildlife (MA DFW)
  - Massachusetts Division of Fisheries and Wildlife—Natural Heritage & Endangered Species Program (NHESP)
- Massachusetts Office of Attorney General
- State Representative Sarah Peake
- Town of Bourne, Massachusetts
- Town of Brewster, Massachusetts
- Town of Chatham, Massachusetts (Town)
- Town of Eastham, Massachusetts
- Town of Harwich, Massachusetts
- Town of Mashpee, Massachusetts
- Town of Nantucket, Massachusetts
- Town of Orleans, Massachusetts
- Town of Truro, Massachusetts
- Town of Wellfleet, Massachusetts
- Town of Yarmouth, Massachusetts
- Chatham Summer Residents Advisory Committee
- Chatham South Coast Harbor Plan Committee
- Ipswich Shellfish Constable
- Rowley Shellfish Commissioner
- Weymouth Harbormaster/Shellfish Constable

We also received comments signed by representatives from the following organizations:

- Association to Preserve Cape Cod
- Cape Cod Commercial Fishermen's Alliance

- Cape Cod & Islands Group—Massachusetts Sierra Club
- Cape Cod Marine Trades Association
- Center for Coastal Studies
- Funseekers.org
- Horseshoe Crab Conservation Association
- Mass Audubon
- Massachusetts Committee for the Preservation of Horseshoe Crabs
- National Wildlife Refuge Association
- Northwest Atlantic Marine Alliance
- Quitnesset Associates, Inc.
- Wilderness Watch
- Woods Hole Sea Grant and Cape Cod Cooperative Extension

We have prepared a table which reflects the major issues identified during the comment period and indicates if and how our preferred alternative changed as a result of our review of the comments and information provided. This table is followed by a detailed summary of the comments and our responses.

Table K.1. Highlights of Proposals under Alternative B (Service-preferred alternative) in Draft and Final CCP/EIS by Major Issue

Major Issue	Proposal under Alternative B in Draft CCP/EIS	Proposal under Alternative B in Final CCP/EIS
Refuge's eastern boundary – Nauset/South Beach	Refuge boundary would include 717 acres of Nauset/South Beach. The refuge would manage this area as part of the Monomoy Wilderness Area.	**Change**: Most of Nauset/South Beach would continue to be managed by the Town. The refuge and Town have signed a MOU (Final CCP/EIS appendix L) which administratively determined a management boundary line. The Service will manage lands west of this line, and the Town will manage lands east. None of the lands that will be managed by the Town are part of the Monomoy Wilderness.
Refuge jurisdiction over open waters and submerged lands within 1944 Declaration of Taking	Refuge's western boundary extends beyond mean low water (MLW) out to the 1944 Declaration of Taking line.	**No change**: We still claim management authority over the submerged lands and open waters in the Declaration of Taking.
Fin fishing	Prohibit any fishing activity using techniques or gear that disturbs the bottom. Allow fishing in the open waters, above submerged lands, under State and Federal regulations.	**Change**: We determined that existing State and Federal fishing regulations adequately protect eelgrass beds so we do not propose to further regulate fin fishing at this time.
Fish Weirs	Prohibit fish weirs.	**Change**: We determined that existing State and Town regulations adequately regulate fish weirs so we do not propose to further regulate fish weirs at this time.
Shellfishing – Softshell clams, razor clams, and quahogs	Prohibit mechanized equipment for harvesting quahogs. Allow non-mechanized harvest of subterranean shellfish (softshell clams, razor clams, and quahogs).	**Change**: We determined that existing State and Town shellfishing regulations adequately protect eelgrass beds so we do not propose to further regulate shellfishing for these species below the MLW line at this time. Continue to allow only non-mechanized hand harvest of subterranean shellfish across the refuge above MLW.
Salting for razor clam and sea clam harvesting	Prohibit salting for shellfish harvesting.	**No change**: We still propose to prohibit salting above MLW based on the potential for negative impacts to non-target species and undersized razor clams.
Shellfishing – Scallop harvesting	Prohibit non-hand harvest of scallops.	**Change**: We now propose to allow scalloping according to Town regulations. We believe that existing regulations are sufficient to protect eelgrass beds at this time.

Major Issue	Proposal under Alternative B in Draft CCP/EIS	Proposal under Alternative B in Final CCP/EIS
Shellfishing – Sea clams	Sea clams were not addressed in the draft CCP/EIS as there is no current fishery on the refuge. However, several commenters included sea clams in their comments on the draft CCP/EIS.	**Change**: Currently, there is not a viable sea clam fishery on the refuge. However, if in the future there is, we propose to allow sea clamming in accordance with Town regulations except for salting above MLW, and will allow the hand harvest of sea clams on tidal flats.
Shellfishing – Wheeled carts in Monomoy Wilderness Area	Prohibit wheeled carts in Monomoy Wilderness Area.	**No change**: We still propose to prohibit wheeled carts in the wilderness area because they violate the Wilderness Act (16 U.S.C. 1131-1136) and Service wilderness policies (610 FW 1).
Mussel harvesting	Prohibit mussel harvesting.	**No change**: We still propose to prohibit mussel harvesting because mussels are an important food for federally threatened red knots, as well as common eiders, other sea ducks, and American oystercatchers.
Moorings	Prohibit moorings.	**Change**: We now propose to evaluate the installation of conservation boat moorings on a case-by-case basis, and allow if found appropriate and compatible.
Kiteboarding	Prohibit kiteboarding.	**No change**: We still propose to prohibit kiteboarding on the refuge due to concerns about impacts on nesting and staging birds, including common terns, least terns, federally endangered roseate terns, and federally threatened red knots and piping plovers.
Dog walking	Prohibit dog walking.	**Change**: We now propose to allow leashed dogs on Morris Island from September 16 to April 30. A seasonal closure from May 1 to September 15 is consistent with Town regulations and will minimize impacts to wildlife and conflicts between visitors. Dogs and other pets would not be allowed elsewhere on the refuge at any time. We would require that pets be on a 6-foot leash and that owners remove pet waste from the refuge.

In the discussions below, we address and respond to the substantive comments we received. Generally, a substantive comment meets at least one of the following criteria:

- It challenges the accuracy of information presented.
- It challenges the adequacy, methodology, or assumptions of our analysis and supporting rationale.
- It presents new information relevant to the analysis.
- It presents reasonable alternatives, including mitigation, other than those presented in the document.

In order to facilitate our responses, we grouped similar comments together and organized them by subject heading. Directly beneath each subject heading, you will also see a list of unique letter ID numbers. Table K.2 at the end of this appendix relates each letter ID number to the name of the individual, agency, or organization that submitted the comment.

In several instances, we refer to specific text in the draft CCP/EIS and indicate how the final CCP/EIS was changed in response to comments. The full versions of both the draft CCP/EIS and the final CCP/EIS are available online at: *http://www.fws.gov/refuge/Monomoy/what_we_do/conservation.html* (accessed October 2015). For a CD-ROM or a print copy, please contact staff at Monomoy NWR:

Monomoy National Wildlife Refuge
30 Wikis Way
Chatham, MA 02633
Phone: 508/945-0594

Service Responses to Comments by Subject

1. Refuge's Eastern Boundary

Boundary at Nauset/South Beach—Opposition to Refuge Addition

(ID# 51, 53, 56, 57, 63, 64, 65, 73, 75, 78, 79, 80, 86, 90, 91, 94, 95, 97, 98, 99, 101, 102, 104, 106, 107, 108, 114, 119, 121, 122, 124, 125, 126, 127, 128, 129, 130, 132, 134, 136, 138, 139, 140, 142, 146, 148, 150, 153, 157, 164, 168, 176, 181, 182, 184, 187, 194, 195, 196, 197, 201, 202, 203, 204, 207, 209, 210, 213, 217, 220, 223, 229, 232, 237, 238, 240, 241, 245, 247, 248, 250, 252, 253, 254, 255, 256, 258, 261, 263, 265, 268, 269, 273, 275, 279, 281, 282, 284, 285, 286, 287, 291, 292, 293, 294, 296, 301)

Comment: The majority of comments on the draft CCP/EIS were focused on our interpretation of the refuge's boundary and the Service's jurisdiction, as detailed in the draft CCP/EIS (Chapter 2, Affected Environment). Many individuals, organizations, and towns expressed strong opposition to our assertion that the refuge's eastern boundary now includes 717 acres of Nauset/South Beach. The main reasons cited for this opposition were:

- There is no legal basis for a different boundary interpretation.
- The Town is already effectively managing the area and is a good environmental steward.
- The proposed restrictions on public use and recreation would "threaten Chatham's very historical, cultural, and economic identity that has endured for centuries."

Regarding concerns about the legal basis for the boundary interpretation, several provided case law to support their comments. The Town letter provided the widest range and greatest detail about the eastern boundary concerns. The Town indicated their rights to South Beach derive from the deed of Joshua Nickerson in 1951, which is also bounded by water—the Atlantic Ocean and Chatham Harbor. The Town does not believe the Service is "entitled to the unilateral application of the doctrine of accretion" while ignoring the Town's right to apply that same doctrine. They go on to say, "Furthermore…even if the FWS is entitled to apply the doctrine of accretion, the amount of South Beach it claims to have obtained is grossly excessive. In making its claim, the FWS has failed to apply the principles that govern scenarios where competing land masses accrete into each other…the principle of equitable division." They continue, "the Town contends that no reasonable person and no Court could sensibly conclude that the [boundary proposed in the draft CCP/EIS] is equitable in nature." The three cases the Town cites are: Siesta Properties, Inc. v. Hart, 122 So.2d. 218, 221 (Fla. Dist. Ct. App. 1960), Lorusso v. Acapesket Improvement Association 408 Mass. 772, 781-782 (1990), and Hartigan 464 Mass 400 (2013) at 407. One commenter referred to Section 6 of the 1997 National Wildlife Refuge System (Refuge System) Improvement Act regarding expansion of the refuge.

Response: Between the southward-growing lands of Nauset/South Beach, belonging to the Town, and the lands of the United States, there formerly existed a narrow channel below MLW (the "Southway") that has begun to fill in, and has entirely filled in at the southern end, filling the space between lands of the United States and of the Town. Until 2006, the two properties did not have any boundary in common, when a portion of the channel between them filled in to above MLW. There is a point, towards what was then the south-easternmost point of the Nauset/South Beach spit, at which the two landforms first touched. Land has subsequently been formed filling in between the two landforms, and the ownership of that land must be apportioned between the Town and the United States.

Because of the shifting landforms and the imprecise location of the boundary, we recognize that it may be costly and time-consuming for the Service and the Town to settle the boundary location. For this reason, we have entered into a Memorandum of Understanding (MOU) with the Town that established management boundary on Nauset/South Beach. The MOU is provided in appendix L of the draft CCP/EIS. Lands and waters that are located or accrete west of this management boundary will be managed by the Service as part of the Monomoy NWR; lands that are located or accrete to the east of this management boundary will be managed by the Town. The Service's management extends to MLW.

The general principles in the MOU do not resolve for practical management purposes precisely where the "point of first contact" lies, and the precise boundary. We do want to clarify that we are not engaged in

"revising the boundary" in the sense of adding or subtracting legal parcels of land from the boundary. The boundary was established by the 1944 Declaration of Taking. The only issue the Service must wrestle with now is what present-day lands belong to the United States as a result of that Declaration of Taking. Natural processes of accretion, erosion, and avulsion may have changed the landforms, but the Service is not proposing to "add new lands to the project boundary" that would not belong to the United States by virtue of the Declaration of Taking. We intend to pursue discussions with the Town to precisely locate this boundary during the period of the agreement. A boundary line agreement or other vehicle may be necessary to clarify the boundary going forward.

Boundary at Nauset/South Beach—Support for Refuge Addition

(ID# 72, 96, 227, 244, 276, 289)

Comment: The National Wildlife Refuge Association, Cape Cod and Islands Group of the Sierra Club, and several individuals agreed with the Service that 717 acres of Nauset/South Beach are in the refuge's boundary. The National Wildlife Refuge Association agrees that case law supports our position, noting that there are other refuges in the Refuge System that have both gained and lost acreage due to shifting sands. The Cape Cod and Islands Group of the Sierra Club provided an extensive timeline of the changing shoreline of Nauset Beach. One individual shared an 1890 map that they believe, "show[s] that South Beach has, in the past, been entirely attached to Monomoy and what is now the Monomoy NWR. This is the same stretch of beach (700 plus or minus acres) that the Town is claiming is "a taking." This confirms the [refuge's] statements that ownership of this stretch of barrier beach, because of shifting sands, breakthroughs, and connections, is reasonable and is best determined by the approach which you are taking." Other commenters support the new boundary as it would protect habitats and wildlife and preserve wilderness characteristics.

Response: We thank these organizations and individuals for their support. It is true that Nauset/South Beach has likely repeatedly accreted and breached, leading to the establishment of Monomoy as either island or peninsula over the course of time. The Declaration of Taking set the ownership of what was then Monomoy Peninsula with an ambulatory eastern boundary set at MLW. Owners of lands with ambulatory boundaries recognize that boundaries may change due to the risk of erosion and the chance of accretion. As the "Southway" filled in, the area bounded by MLW changed, necessitating the equitable apportionment of the newly accreted land. Because of the uncertainty of how to determine the equitable apportionment, and for the other reasons identified above, we have agreed on a management boundary which will allow most of Nauset/South Beach to stay under the management of the Town until a final boundary is determined. Please see the discussion above for more information.

Memorandum of Understanding with Town and National Park Service

(ID# 64, 134, 153, 155, 241, 244)

Comment: The Town provided extensive comments on the 2007 MOU among the Town, National Park Service (NPS), and the Service. The MOU had established administrative boundaries for the three parties in the area of where the Cape Cod National Seashore jurisdiction overlaid the Nauset/South Beach connected with South Monomoy Island. The Town felt that the MOU was mischaracterized in the CCP as "temporary only for the purpose of resolving jurisdiction issues between FWS and NPS." They indicated that the MOU helped the three parties "work cooperatively towards resolving this very complicated boundary issue." The Town also noted that "the planning, community outreach, and cooperation envisioned by all three parties to the MOU did not materialize." One commenter indicated that we failed to effectively collaborate and cooperate with the NPS including developing a plan for shared Federal resources. Several commenters called for the development of a new memorandum between the FWS and the Town that would reflect the concerns of both parties (protection of wildlife and the traditional and historic rights of citizens). Mass Audubon supported cooperation with the Town and the NPS and other stakeholders "to coordinate and optimize the outcomes for myriad public interests associated with the natural resources across all the public coastal lands and nearshore waters in the area in and around the refuge." Cooperative management could help reduce disturbance to waterbirds from visitors and provide for more consistent and stronger protection for beach-nesting birds. The Cape and Islands Group of the Sierra Club suggested that we might want to address our jurisdictional boundaries in this area. Another commenter suggested that we obtain assistance from the Department of the Interior Office of Collaborative Action and Dispute Resolution to address issues resulting from poor communication with the Town.

Response: The FWS originally approached the NPS in 2005 to discuss Cape Cod National Seashore's overlapping boundary over Monomoy NWR, where some land and waters were subject to regulations and policies of two different bureaus within the Department of the Interior. The original intent of the MOU is correctly stated in the draft CCP/EIS and is retained in the final CCP/EIS. In fact, the MOU stated "that a permanent resolution of the overlapping boundary issue must be attained in order to provide for adequate long-term management."

As a result of initial discussions with the NPS, it was agreed that the Town needed to be part of the discussion as well. By January 2008, the FWS, NPS, and the Town had signed an MOU that established an "administrative boundary" which "serves as an interim tool to ensure that appropriate and complete resource protection, protection of public safety, and management of resource values is maintained during the interim planning process." This language is drawn directly from the MOU, which also stated that "the administrative boundary does not supersede existing legislative boundary definitions or land ownership."

The MOU called for all parties "to render all reasonable assistance to the other, consistent with their respective statutory authorities, whenever necessary to accomplish the goals" of the agreement. It is our opinion that this aspect of the MOU has been successfully implemented. We have maintained open communication with the Town regarding the management of Nauset/South Beach and South Monomoy Island. We conducted red knot surveys on South Beach and supported Mass Audubon's Coastal Waterbird Program, which carries out piping plover management on South Beach and is partially funded by the Town. We also cooperated on northeast beach tiger beetle surveys and emergency response. We have a good relationship with Cape Cod National Seashore staff as well.

It is also clear that none of the parties, including the FWS, undertook the efforts necessary to engage in the long-term planning process to clarify jurisdictional overlap and boundary questions. Furthermore, new maps "depicting the location of the administrative boundary" were not "developed annually or as changing natural conditions warrant," with the agreement of all parties. In fact, no discussion of changes to this boundary ever occurred, and no new maps were ever made. Also, the MOU had a 5-year term ending in January 2013.

On June 9, 2015, we entered into a new MOU with the Town that determines, for administrative purposes, the management authority over the area where Nauset/South Beach join to one another, without the need for a judicial determination of the boundary. The MOU is provided in appendix L of the final CCP/EIS. We will work together to define a permanent boundary before the MOU expires in 2030. We have also updated the Refuge Administration section of chapter 2 and the Actions Common to All Alternatives in chapter 3 of the CCP to further address the Monomoy/Cape Cod National Seashore jurisdictional overlap. The NPS is not a party to the 2015 MOU because their jurisdiction is not impacted by the management boundary.

We have a good relationship with both the Town and the NPS and will continue to work effectively together in the future.

Boundary at Nauset/South Beach—Request for Map

(ID# 293)

Comment: One individual suggested that we should have included a map showing what the eastern boundary was prior to our determination that South Beach was part of the refuge, writing, "It is interesting that there is no map available that shows the eastern shore line boundary prior to this depiction. It is not right to base a boundary revision without prior delineation. Moreover, rapidly shifting sands over a period of 3 years should never lead the CCP to conclude a boundary revision of this magnitude. Is the refuge willing to revisit and perhaps revise the boundary every 3 years?"

Response: Given the establishment of a management boundary in the MOU with the Town (described above), we do not believe it is necessary to provide a map in the final CCP that depicts the eastern boundary prior to our determination that Nauset/South Beach is part of the refuge. The commenter is correct that changes in this dynamic environment will continue to reshape the landforms enclosed within the project boundary. We have updated the aerial photo upon which the new management boundary is overlaid, and will continue to do so over time to depict the management boundary, when there is a major change in the landform and clarity is needed on the location of the management boundary.

2. Refuge's Western Boundary

1944 Declaration of Taking—Disagreement with Service Interpretation

(ID# 53, 63, 64, 65, 73, 78, 94, 95, 98, 99, 101, 102, 106, 107, 119, 124, 125, 126, 128, 129, 138, 139, 142, 146, 148, 150, 153, 168, 176, 181, 182, 184, 187, 188, 194, 196, 197, 199, 201, 202, 203, 204, 207, 209, 213, 217, 218, 220, 223, 233, 237, 238, 239, 240, 241, 245, 247, 248, 250, 253, 255, 258, 263, 268, 269, 281, 285, 286, 287, 290, 291, 301)

Comment: The Massachusetts Office of the Attorney General, the Town, several neighboring towns, and many individuals and organizations expressed strong opposition to our assertion the Service has jurisdiction in the submerged lands and waters within the 1944 Declaration of Taking. The main reasons cited for this opposition were:

- Disagreement that the Declaration of Taking language gives the Service absolute ownership over submerged lands and waters in the Declaration of Taking boundary. Most believe the Service only has jurisdiction above MLW, which was substantiated by subsequent case law.
- The proposed restrictions on certain types of shellfishing and fin fishing in the Declaration of Taking would have significant negative impacts on the local fishing industry and economy.
- The Service has never exerted jurisdiction over these lands and waters, and Town and State regulations already effectively manage and protect the resources.

Similar to the eastern boundary, the Town and Massachusetts Attorney General letters provided the widest range and greatest detail about the western boundary concerns and cited case law supporting their position. There was also concern expressed about the re-installation of buoys to mark the boundary.

One commenter from the Town indicated that he did not believe we have the legal authority to manage these waters and cited Service documents from 1941, 1945, 1955, and 1967 that indicated we would continue to allow commercial fishing within the waters of the refuge.

Response: We have carefully considered the question of Service jurisdiction over submerged lands and waters within the refuge's western boundary. We have concluded that the refuge is bounded by MLW on the eastern side, and by a fixed boundary that includes submerged lands and waters within a western boundary defined by the 1944 Declaration of Taking. This conclusion is driven by the text of the original acquisition documents. Some additional explanation is provided to help readers follow our reasoning.

Monomoy NWR was acquired by a Declaration of Taking approved by the U.S. District Court on February 10, 1944, and filed in Federal court with immediate effect on June 1, 1944. The Declaration of Taking includes a detailed written description of an extensive area containing upland, intertidal flats, and submerged ocean waters, as well as a map generally outlining those exterior limits and describing them as the "Limits of Area to be Taken." The Declaration of Taking states that "the above-described area … is to be acquired." The Declaration of Taking contains five discrete descriptors of monuments and features to be acquired and a perimeter line described in the Declaration of Taking as the "exterior limits." We read this list as five discrete sentences, so that named geographic points, geomorphic features or habitats (islands, islets, sand bars, and tidal flats), and the MLW line, can all be identified within the exterior limits line. The exterior limits ran partially along the ambulatory MLW line along the eastern boundary, and by identified survey coordinates along the western boundary. Thus, we draw our conclusion that the proper boundary of Monomoy NWR is the area delimited as the "described exterior limits" in the text of the Declaration of Taking, which was generally configured as the "Limits of Area to be Taken" on the map accompanying the Declaration of Taking.

In making this determination, we examined historical documents describing the pre- and circa 1944 actions establishing the refuge. This includes the Service's 1938 "Chief's Approval" package (Salyer II 1938) recommending creation of the refuge, which includes a redlined map taken from the U.S. Coast & Geodetic Survey (USC & GS) chart which was initially used to develop the outline for the "Limits of Area to be Taken." The Chief's Approval also includes the biological justification for acquiring the land and waters within these exterior limits (Griffith 1938). The Chief's Approval package includes a key memorandum from the Chief of Wildlife Refuges, which was approved by the Chief of the Bureau of Biological Survey (predecessor title to the

Director of the FWS). The Chief's Approval explicitly approves acquisition of the water and shoal areas west of the upland spine of Monomoy Island to allow them to be closed as needed for wildlife. The proposed refuge boundary outlined by the redline tracing is quite similar to the one on the Declaration of Taking map. The package repeatedly highlights the presence of submerged aquatic vegetation (SAV) valuable as a food source for migratory waterfowl as one of the important resources of the proposed refuge. The species of SAV they describe (including eelgrass-*Zostera*, widgeongrass-*Ruppia*, and sea lettuce-*Ulva* and *Entermorpha*) only grow in areas that are entirely covered by water during all portions of the tidal cycle. The resource values of the submerged habitats, observed by the Service's initial reconnaissance biologists and highlighted in the Chief's Approval package, remain critical to the mission and purposes of the refuge today. We believe that the Chief's Approval package gives us clear information about the intended boundary.

A second key reference document is the March 1941 "Development Plan for the Monomoy National Wildlife Refuge," (Salyer II 1941) which also emphasizes the extensive eelgrass beds of *Zostera*. Monomoy NWR previously had one of the largest such stands on the Atlantic Coast and the Service intended to replant and re-establish these submerged plants, recognized as an 'essential' food source for wintering waterfowl. Thus, both the 1938 Chief's Approval letter and the 1941 development plan show that the Service intended to acquire and manage the submerged lands and waters west of the upland areas.

While some discrepancies exist amongst early maps, the essential intent of the Service regarding a management boundary can clearly be traced from the Chief's Approval in 1938, to the 1941 Development Plan, to the written text of the 1944 Declaration of Taking.

In addition to those early documents, the inclusive western boundary line is consistent with the official 1970 Wilderness Area map, which was provided to Congress and incorporated into that legislation, and represents the only congressionally approved map of the refuge. The boundary is also consistent with the litigation position of the United States and the map produced by the Service in 2002 in response to the *Associates of Cape Cod* Remand Order.

Deeds are to be interpreted consistently with the framer's intent, and cases involving Federal property are to be strictly interpreted to support the intent of the United States for its acquisition or reservation of Federal property. As such, after examining the intent of the Service in creating this refuge, and using supporting documentation from the 1970 Wilderness designation and Associates of Cape Cod opinion, we conclude that the refuge's correct western boundary is the area delimited as the "Limits of Area to be Taken" on the map accompanying the Declaration of Taking, and that the refuge's correct eastern boundary is defined by the MLW line.

We emphasize to commenters that we are not proposing to expand Service jurisdiction–our conclusion is that this analysis reflects the present state of Federal land ownership. For this reason, we do not propose management alternatives with different refuge boundaries–the Service is not proposing to alter the area of the refuge, but merely seeking to be clear about its current area.

Regarding the concern about impacts to commercial and recreational fishing within the waters of the Declaration of Taking, we have modified our Service-preferred alternative B in the final CCP/EIS to reflect that, with a few exceptions (re: table K.1), we have no compelling reason at this time to further regulate fishing and shellfishing in this area beyond existing Federal, State, and Town regulations.

Regarding the Town's concern with the placement of buoys along the western Declaration of Taking boundary, we will be happy to consult with Town officials to better understand their concerns.

1944 Declaration of Taking—Support for Service Interpretation

(ID# 85, 244)

Comment: The Cape Cod and Islands Group of the Sierra Club and one other individual generally agree with the Monomoy NWR boundaries presented by the draft CCP/EIS.

Response: The comment is noted that there is support of the boundary depicted in the draft CCP/EIS. However, as noted in our response above, the final CCP/EIS includes the outcome of a 2015 MOU establishing a management agreement boundary along Nauset/South Beach.

Submerged Lands Act—Disagreement with Service Interpretation

(ID# 64, 241, 245, 258)

Comment: The Town, the Massachusetts Attorney General, and another commenter disagreed with our interpretation of the Submerged Lands Act (SLA). "The Town's position is that the Supreme Court's Supplemental Decree of 1996 definitively applies the SLA as affirmation for the Commonwealth's title to all of Nantucket Sound within 3 miles of shore, including Monomoy islands. And, under the legal doctrine of collateral estoppel, the United States and the FWS are now precluded from arguing a contrary proposition." All cited the case of *United States of America versus Winthrop E. Taylor* as support for their contention that the U.S. Government (i.e. Service) does not have authority to prohibit activities below MLW.

Response: Despite the urging of the Attorney General and others, we do not believe that the situation created by the Declaration of Taking was altered by the SLA, 43 USC §1301 *et seq.* The SLA was passed in 1953 and relinquished the rights of the United States in the submerged lands within the territorial sea to the coastal states after the U. S. Supreme Court ruled in 1947 that such submerged lands were not owned by the coastal states but subject to the paramount rights of the United States. The SLA did not relinquish submerged lands already reserved or acquired by the Federal Government, expressly including submerged lands acquired by condemnation. The Commonwealth of Massachusetts had been formally notified of the condemnation action of the Declaration of Taking on January 4, 1945. It did not file a claim and the Court defaulted all notified potential claimants who did not file claims. Therefore, the submerged lands encompassed by the Declaration of Taking were excepted from the SLA's 1953 transfer of lands to the Commonwealth. Furthermore, in subsequent SLA litigation involving many of the coastal states to establish the location of the states' internal waters and the baseline for measuring the 3-mile boundaries, Massachusetts claimed all of the waters of Nantucket Sound, which includes the waters west of Monomoy. The Supreme Court expressly held that the submerged lands west of Monomoy Point were not Massachusetts' internal waters at the time of the formation of the Union. Therefore, the submerged lands within the exterior perimeter lines were already acquired as Federal land, excepted from the SLA, and subject to Federal jurisdiction and control when the State received any surrounding lands in 1953.

The Taylor decision is not the definitive finding on the Monomoy boundary. At the time of the Taylor incident, the property interests of the United States were not at issue in the matter, as the case was about unleashed dogs on the refuge. The judge provided a finding based on an incorrect understanding of the Service's authority. New evidence has come to light since then concerning the background to the Declaration of Taking, as discussed above. The decision in Taylor is also inconsistent with the Court's decision in *Associates of Cape Cod v. Babbitt*, (D. Mass. 2001), which enjoined FWS from prohibiting harvest of crabs outside the wilderness areas–as the only areas relevant that would be outside the wilderness areas would be those below MLW.

3. Fisheries

Fin Fisheries Jurisdiction in the 1944 Declaration of Taking

(ID# 63, 64, 65, 78, 91, 94, 95, 97, 98, 99, 101, 102, 104, 106, 107, 119, 124, 125, 126, 128, 129, 138, 139, 140, 142, 146, 148, 150, 157, 231, 235, 239, 240, 242, 243, 248, 252, 255, 259, 266, 299)

Comment: Many commenters expressed opposition to any efforts by the Service to manage fin fisheries within the Declaration of Taking. The Town, MA DMF, the Cape Cod Commercial Fisherman's Alliance, and many others disagreed that the Service has jurisdiction over fin fishing in the open waters and submerged lands in the 1994 Declaration of Taking area. Rather, they felt that the State and Town have jurisdiction over all fisheries in this area. Some recognized that we were not proposing management actions for fishing that uses demersal longlines, hook, and line/rod and reel and they thanked us for that position. Other commenters are opposed to commercial fishing in the waters off Monomoy. One person felt that commercial fishing would be a disaster. Another felt that Monomoy should be a sanctuary for fish so that fish populations can increase.

Response: We maintain our position that we have the authority to manage all fishing activities within the Declaration of Taking, as we describe above in section 2 of this appendix. We agree that all existing fin fisheries can be conducted within the waters of the refuge according to State and Federal regulations as we have no compelling biological or other management interest in these activities at this time. This represents a change from the draft CCP. We describe specific fin fisheries below in more detail.

Fin Fishing with Bottom-Disturbing Gear

(ID# 64, 210, 241, 242, 243, 257, 267, 291, 293)

Comment: The Town, the Cape Cod Fisherman's Alliance, the MA DMF, and many others disagreed with the proposal to ban fin fishing with bottom-tending gear (e.g., otter trawls) in the Declaration of Taking. They felt that the ban was based on inaccurate information because the draft CCP/EIS describes gear and techniques that are not used locally and that have far greater impacts on eelgrass beds and other benthic communities. They also stated that existing State and Town fishing regulations are adequate for protecting eelgrass beds and other marine communities.

For example, the Town wrote "The [draft] CCP/EIS states: 'In an effort to protect eelgrass beds and other sensitive bottom-dwelling communities, no fishing…activities that use bottom-disturbing gear and techniques will be allowed under any alternatives in the Declaration of Taking.' While this statement might seem instinctively true, it is not supported by any scientific studies conducted in the area or involving the size and type of bottom-tending gear utilized by local fishermen." They go on to say, "The Town does not believe that the methods and nature of Chatham's small boat inshore fisheries, as guided by the regulatory safeguards established by the Town and State, cause the level of impacts to benthic marine habitat assumed by the FWS." The Town provided additional information and scientific citations about the types of gear used locally to help support their comment.

Similarly, the MA DMF wrote, "The draft CCP/EIS does not contain sufficiently supported justification for the USFWS' determination that the long-standing fishing activities in the NWR adversely impact eelgrass beds."

The MA DMF and Cape Cod Commercial Fishermen's Alliance urged us to not issue a blanket ban on all types of bottom-tending fishing gear. The Alliance wrote "We recognize the need to protect seafloor habitats and that some of these gears may not be appropriate for all areas at all times, but we think an outright prohibition is the wrong approach. We ask that you consider these gears individually and recognize the significant differences among them."

Response: After compiling public comments, new information, and speaking with local experts, we have changed our position on fin fishing with the type of bottom-disturbing gear currently used in the waters off the Monomoy Islands and do not plan to regulate their use within refuge waters at this time. We agree that the information that we used in the draft was not as applicable to the current fisheries equipment being operated within the refuge boundary as we believed it to be. It is understood that the majority of the habitat in the submerged waters within the refuge's boundary is a high energy sandy substrate which is the most resilient and least vulnerable habitat to fishing (Northeast Fisheries Management Council (NEFMC), NEFMC 2011). Many of the benthic organisms that reside in this habitat are adapted to disturbed environments such as frequent storms, which may cause more disturbance than bottom-tending fin fishing gear.

The MA DMF currently has seasonal regulations in place to limit the impact of mobile bottom fin fishing gear on eelgrass. Per State guidelines, mobile bottom-fishing gear would not be allowed in inshore waters between May 1 and October 1 as to not impact eelgrass during its growing period. With this new information, we feel that the State and Town have appropriate regulations in place to minimize the impact to the subtidal community. Our decision to not impose additional restrictions on this fishery is consistent with the other open water fisheries where we believe there is no or little conflict with refuge wildlife resources and there is oversight by the State of the fishery.

We will request an annual meeting with the Town and the MA DMF to discuss both refuge and fishery management. Any changes in either refuge or fishing techniques or fishery management can be discussed at this annual meeting. This will assist us in minimizing impacts to both the refuge and the fishing community.

Fish Weirs

(ID# 63, 64, 89, 104, 140, 141, 145, 152, 153, 225, 241, 242, 243, 246, 248, 252, 273, 279)

Comment: The MA DMF, Town, and several individuals asked that the refuge rethink the proposed ban on fish weirs on the refuge. They commented that we incorrectly described the types of fish weirs used in near Monomoy NWR and inaccurately analyzed their impacts in the draft CCP/EIS. Some also felt we failed to consider benefits from fish weirs to marine wildlife (e.g., foraging locations for seabirds and other predators, mussels growing on anchor lines) and grossly overstated or mischaracterized negative impacts (e.g., to benthic communities, eelgrass, and sea turtles). Others stated that we did not provide adequate scientific basis in the draft CCP/EIS to support a ban. One wrote, "I find no science in the draft CCP which has analyzed the [impacts of placing weir poles in the bottom types that occur in the] waters adjacent to Monomoy, and any suggestion that the practice is, or has been responsible for the degradation, or loss of eelgrass habitat, or beds, is without merit." Several commenters went on to provide additional information on fish weirs and encouraged the refuge to talk to the local fishing community to learn more about the types of fish weirs used locally.

Response: After compiling public comments, obtaining new information, and speaking with local experts, we have changed our position on fish weirs and do not plan to regulate the use of them within refuge waters at this time as they are adequately regulated by the MA DMF and the Town. We agree that the data we used in the draft to make our decision was not applicable to the current trap fishery being operated in Chatham. Fish weirs used in the Chatham area are very different from those used in the mid-Atlantic region where much of our research cited was based.

In response to comments raised that we inaccurately described the types of traps used locally, we have modified language describing fish weirs/traps within the CCP using information we received from commenters and additional research. Please refer to chapter 2 to see the updated descriptive text.

The potential damage caused by the physical placement of the weir poles is unclear. We remain concerned about potential damage to eelgrass beds, although we have been informed by the MA DMF that none of the four permitted weir locations within the Declaration of Taking are on eelgrass beds. We do not know whether or not it is possible to place weirs in areas with eelgrass, and if they can be, then what the impacts to the eelgrass beds may be. Due to the sandy dynamic nature of the Monomoy area and assuming that the eelgrass habitat is similar to that of Duck Harbor, which has been extensively monitored by NPS staff at the Cape Cod National Seashore (Neckles and Bayley 2014), it is possible that eelgrass is present in an area one year and then not present the next. Due to this variability, it is important to be careful where nets are placed. We would like to work with the MA DMF to develop a monitoring plan for eelgrass on the refuge to more fully understand the areas that are most important to protect, and then ensure that fish weir operations (as well as other activities) occur outside those areas or in a manner where there is no impact to the eelgrass. We believe an annual meeting with the Town, the MA DMF, and other relevant stakeholders to discuss fishing activities within the Declaration of Taking boundary will help us achieve this goal. This could include collaboration with the Town regarding the location of established trap grant areas to prevent potential damage to eelgrass.

Regarding the capture of target and non-target species, fish weir operators require a permit from the Town, the MA DMF, and the U.S. Army Corps of Engineers, and we feel that these agencies have and will continue to responsibly manage this fishery. We wish to explore the possibility of collaboration with fishermen, and other organizations like Mass Audubon, when sea turtles are caught in fish weirs. Turtles that are temporarily captured in the nets provide a unique opportunity for research, and while in the net can be tagged or sampled for other scientific purposes. The refuge may play a critical role in helping scientists access the captured turtle in the net as we generally have boats in the water when the nets are in operation and could respond quickly. We are also interested in discussing with fishermen the use of impact lessening devices like modified leaders to minimize sea turtle bycatch (Silva et al. 2011).

We have not been able to find literature to support comments that we received regarding the biological benefits of the weir (with the exception of seals feeding in them), but we would be interested in working with the fishermen to learn more about how the weir is benefiting refuge wildlife.

Shellfisheries Jurisdiction in the 1944 Declaration of Taking

(ID# 50, 51, 63, 64, 78, 121, 133, 136, 157, 164, 183, 198, 211, 229, 239, 240, 253, 255, 262, 266, 267, 273, 280, 284, 290, 291, 294, 300)

Comment: Several individuals and the Town expressed appreciation that clamming using traditional non-mechanical methods would be allowed to continue. One commenter requested that we delegate management authority for the subtidal bottom shellfishery to the Town. However, many individuals and many Cape Cod municipalities did not agree that the Service has jurisdiction over shellfishing in the open waters and submerged lands in the Declaration of Taking. They were concerned that Service jurisdiction over shellfishing would negatively impact the local economy and Town's culture. Several individuals and the Town commented that the Town has successfully managed these resources and should continue to have jurisdiction over shellfishing (e.g., harvest methods, seasons, aquaculture, etc.). The Town wrote: "by maintaining healthy, sustainable wild shellfish stocks outside Monomoy NWR, the Town has taken pressure off shellfish resources within the refuge and contributed to the overall abundance of shellfish stocks. Another individual wrote that "shell fishing and fin fishing are well regulated by the Town and the Commonwealth of Massachusetts. Both jurisdictions have gone above and beyond to make sure that shell fishing and fin fishing are done in ways to preserve and promote the growth of eelgrass and in ways that protect the resource."

Response: We maintain our position that we have the authority to manage all fishing activities within the Declaration of Taking, as we describe above in section 2 of this appendix. We agree that many existing shellfisheries can be conducted within the waters of the refuge according to State and Town regulations, with little impact to refuge resources, and have made some changes from the draft CCP/EIS to reflect this. However, we still have compelling biological interest in some shellfisheries at this time. We describe specific shellfisheries below in more detail.

Non-mechanized Hand-harvest of Subterranean Shellfish

(ID# 64, 86, 111, 157, 242, 243, 244, 250, 252, 256, 273, 296)

Comment: The Town, MA DMF, and a few other commenters were generally pleased with the proposal to continue to allow non-mechanized hand-harvest of subterranean shellfish (softshell clams, quahogs, and razor clams) because of its importance to the local economy and culture. However, they were disappointed in the ban of wheeled carts in the wilderness area because carts are an important way for shellfishermen to transport their harvest. They also had concerns about our proposed prohibition on salting as a harvest tool for razor clams. One commenter is concerned that we are reserving "the right at any time to change the rules regarding hand digging of shellfish from the tidal flats." He wants language put in place so that people from Chatham will always be able to dig clams and quahogs. Another wants no limitations to hand harvest of all shellfish at all. One commenter wanted clamming open to all U.S. citizens, not just Chatham residents.

Response: We appreciate the comments supporting the permitted use of non-mechanized hand-harvest of subterranean shellfish on the refuge. We are committed to working cooperatively with the Town and the State to have the most compatible access possible for clammers on the Monomoy tidal flats. For our response on wheeled carts, see the section "Wilderness Area Management" in this appendix. Our response on salting follows later in this section.

Shellfishing with Bottom-Disturbing Gear

(ID# 51, 63, 64, 86, 91, 134, 136, 140, 153, 164, 210, 229, 233, 234, 241, 242, 243, 244, 249, 250, 252, 256, 259, 261, 264, 267, 293, 297)

Comment: The Town and many organizations and individuals disagreed with the proposed ban on shellfishing using bottom-disturbing gear (e.g., scallop and mussel dredging and hydraulic quahoging). Reasons given for opposition include: potential negative impacts to the local economy from the ban, disagreement about the types and severity of impacts to benthic communities from shellfishing, and the belief that existing Town and State regulations already adequately protect eelgrass beds, migratory birds, and other marine species and communities. While the Town acknowledges that eelgrass beds are declining, they feel "there has been no indication or scientific evidence to suggest this decline is related to traditional fishing activities or methods." The Town and others provided additional information and scientific citations about the types of shellfishing gear used in the area. Some commenters agreed that shellfishing is a traditional activity that has occurred for hundreds of years but should be limited to hand tools only.

Response: After compiling public comments, new information, and speaking with local experts, we have established our position on shellfishing for softshell clams, scallops, quahogs, and sea clams, and do not plan to further regulate the harvest of these species below the MLW line within the refuge boundary at this time. The existing State and Town regulations adequately protect eelgrass beds. We have not changed our position prohibiting the harvest of mussels. We have addressed the use of mechanized equipment for sea clams and scallops in more detailed responses below.

We have revised the final CCP/EIS to reflect this position. We will also request an annual meeting with the Town and the MA DMF to discuss proposed changes in both refuge and fishery management. This will assist us in minimizing impacts to both the refuge and the fishing community.

Please also see our more detailed responses about individual types of shellfishing below.

Non-hand Harvest of Scallops

(ID# 63, 64, 77, 86, 136, 157, 164, 210, 229, 241, 242, 243, 248, 250, 252, 256, 259, 261, 262, 264, 267)

Comment: One individual wrote in support of banning the non-hand harvest of scallops because they felt it negatively impacts the sea floor. However, many others, including the Town, MA DMF, and the Cape Cod Commercial Fisherman's Alliance, disagreed with the ban on non-hand harvest of scallops because they felt that the scallop harvesting techniques used in the area did not significantly impact eelgrass beds and other benthic communities and the ban would negatively impact local shellfishermen. They stated that we inaccurately described the scallop harvest methods used in the area and instead described methods that have far greater impacts on eelgrass beds, benthic communities, and shellfish. The Town and a few other commenters included scientific citations and other additional information on the scallop harvesting techniques used locally. They feel the methods actually used in the area have very little impact on these resources. Several also stated that existing Town shellfish regulations adequately protect eelgrass beds and shellfish, "For example, the Town has prohibited teeth or rakes on scallop…dredges to protect eelgrass and allows only seasonal harvesting of bay scallops during the eelgrass dormant period…" A local scallop harvester echoes this, writing, "Eelgrass…dies in the fall and early winter and grows back in the warm weather. We scallop in the late fall and winter, we use light dredges, and that don't disturb the bottom so much to dig up the eelgrass roots. We don't hurt the eelgrass."

Response: After reviewing comments, new information, and speaking with local experts, we have changed our position on the use of non-hand harvest equipment for scallop harvesting inside the refuge's boundary. During our review process for the draft CCP, we documented the impacts of large New Bedford style scallop dredges that are not used within the refuge's boundary. It was brought to our attention that Chatham inshore fisherman employ a lightweight dredge that is pulled at low speeds with small skiffs. Chatham shellfish regulations state the dredge frames may not measure more than 36 inches in width, must be of light construction type, and no "rakes" shall be attached to the dredge frame. The impacts to eelgrass from this size and type of dredge are considerably less than the much larger scallop dredges used offshore. It is also noted that the harvest of bay scallops in Chatham only occurs from November 1 to March 31, when eelgrass is predominantly dormant. This seasonal restriction is narrower than the State regulations, which allow the harvesting of bay scallops from October 1 to May 1. We have revised the final CCP/EIS to reflect that we have no compelling reason to further regulate scalloping at this time beyond Town regulations. We will also request an annual meeting with the Town and the MA DMF to discuss proposed changes in both refuge and fishery management. This will assist us in minimizing impacts to both the refuge and the fishing community.

Hydraulic Quahoging

(ID# 63, 64, 83, 157, 241, 242, 243, 259, 264, 267)

Comment: The Town and several commenters disagree with the proposed ban on hydraulic quahoging. Reasons given for opposition include: potential negative impacts to the local economy from the ban, disagreement about the types and severity of impacts to benthic communities from shellfishing, and the belief that existing Town and State regulations already adequately protect eelgrass beds, migratory birds, and other marine species and communities. One commenter expressed concern about the destruction of benthic habitat caused by modern commercial harvesting techniques and other fisherman expressed support for a ban on the use of hydraulic pumps to harvest shellfish.

Response: After compiling public comments, new information, and speaking with local experts, we have changed our position on hydraulic quahoging and do not plan to regulate this use within refuge waters below MLW at this time. We feel that the current regulations that the State and Town have in place minimize disturbance to eelgrass beds. The Town has approved two hydraulic dredging areas, one which is partially inside the southwest corner of the refuge's boundary. This area will remain open to hydraulic dredging per State and Town regulations.

We have revised the final CCP/EIS to reflect this use below MLW according to State and Town regulations. Our decision to not impose additional restrictions on this fishery is consistent with our position on the other open water fisheries, where we believe there is currently no or little conflict with refuge wildlife resources, there is adequate oversight by the State and Town of the fishery, and therefore, there is no compelling reason for further regulation of this fishery by the Service at this time. We will also request an annual meeting with the Town and the MA DMF to discuss proposed changes in both refuge and fishery management. This will assist us in minimizing impacts to both the refuge and the fishing community over the long term.

Sea (Surf) Clamming

(ID# 51, 63, 64, 164, 229, 233, 241, 256, 264)

Comment: The Town and several other commenters requested that we not limit sea clamming on the refuge because the draft CCP/EIS does not provide adequate scientific justification for prohibiting it and a ban would have negative impacts on local fishermen. The Town writes, "It is…unclear how or if the FWS is proposing to regulate the State regulated sea clam fishery. While not currently occurring [in the Declaration of Taking], this can be a very important fishery to local fisherman. The Town would not support any limitations [on sea clam harvest] if the opportunity presents itself." One commenter stated that salting for sea clams should be allowed.

Response: Sea clams can occasionally be found on tidal flats (Duncanson 2015). There is currently occasional harvest of sea clams in some Town waters that can be harvested by hand tools. We noted in the draft CCP/EIS that the harvesting of sea (surf) clams is not occurring within the refuge boundary at this time. We acknowledge that this could change if the sea clam population were to increase. Therefore, we have amended the compatibility determination for the hand harvest of subterranean clams above MLW to include sea clams. Most often sea clams are found in deeper waters. The Town has two approved hydraulic dredging areas, one which is partially inside the refuge's boundary. This area will remain open to the use of inshore hydraulic clam dredges to harvest sea clams. If the sea clam population were to increase inside the refuge's boundary we will work with the Town Shellfish Office to identify new or additional areas that would need to be open to hydraulic dredging. Harvest of sea clams below MLW is outside the Monomoy Wilderness and need not be restricted to hand tools. The Service sees no compelling reason at this time to further regulate this use. We will also request an annual meeting with the Town and the MA DMF to discuss proposed changes in both refuge and fishery management. A change in the location of harvestable sea clams would be a topic of discussion that would assist us in minimizing impacts to both the refuge and the fishing community.

For our response on salting above MLW, see below.

Mussel Harvesting—Opposition to Ban

(ID# 51, 63, 64, 86, 136, 153, 157, 164, 210, 229, 233, 241, 242, 243, 248, 252, 256, 261, 264, 279, 293, 294, 297, 300)

Comment: Many commenters, including the Town and the MA DMF, disagreed with the ban on mussel harvesting. Reasons for opposition provided by commenters are summarized below:

- Mussel harvesting is a traditional use of the subtidal waters and mussels are an inexpensive food source. A prohibition will impact the livelihood and income of Chatham shellfishermen that rely on this cyclical and valuable resource.

- Mussel harvesting should be controlled by the Town. The existing mussel regulations in Chatham (e.g., no rakes or teeth on mussel dredges; minimum harvest size of 2 inches; must immediately return smaller mussels) provide adequate food resources for birds as well as shellfishermen.

- There is no scientific basis for the ban on mussel harvesting and there is no evidence to show that mussel harvesting has ever had negative impacts to eiders or other migratory birds, or small dredges or other low-tech methods of harvesting damage mussel beds or eelgrass beds. Specific related comments include:
  - Mussels do not "set" in eelgrass.
  - Mussels grow prolifically in the intertidal and sub-tidal zones around Monomoy NWR.
  - The total area discussed in the CCP is small compared to the total coastal acreage available to eiders, and the blue mussel habitat is "smaller still," so it is unreasonable to claim that mussel harvesting on this small area will impact eiders.
  - References provided to support the ban are insufficient. The Town specifically wrote "…However, the four references that were cited in Appendix D and presented as supporting scientific literature fail to provide a cogent scientific basis for such a ban. Indeed, some of the statements in Appendix D have no supporting evidence to justify their conclusions, and the citations that are provided do not support the statements or have questionable conclusions. Overall, the review commissioned by the Town concluded that the information provided in the CCP/EIS fails to provide any scientific basis which would warrant a full ban on mussel harvesting." They discuss their specific points of contention for the four references in a separate Appendix.
- There is no competition between birds and mussel harvesters.
  - Mussels that are legal harvest size (2 inches) are too large for birds to consume. The Town writes, "The 2-inch limit debunks the contention that fishermen and shorebirds compete for the same mussels as small shorebirds forage for 'spat' or 'seed mussel." Smaller mussels are returned to the water alive for birds (such as eiders and red knots) to consume, and are the size that eiders prefer.
  - One commenter who opposed the ban submitted follow up comments and noted that although they discovered eiders will eat mussels larger than 2 inches, thinning of mussel beds is beneficial (see below).
  - One commenter also noted that "Migrating sea ducks are able to feed on mussels in deeper water where it is difficult for harvesters to access."
- Mussel harvesting benefits birds.
  - One commenter noted "Smaller mussels are culled onboard the harvesting skiffs and returned alive to the water. Significantly, many of these returned mussels, which have been separated from the dense mat they grow in, tumble in the tide and can travel considerable distance before the energy of the current dissipates and they settle to the bottom where they can reattach and become the nucleus for a new mussel bed. This, in fact, is a direct benefit to Eider as it leads to a broader distribution of mussels and the development of new feed-plots for the birds." This commenter also notes that "…Eider are big strong ducks and fly great distances on a daily basis as they trade back and forth along the coast from loafing areas to feeding spots…The dispersal of feeding locations over a broad area is positively impacted by the harvest of mussels (as discussed above), and it provides greater opportunity for unmolested feeding because it does not concentrate the feeding ducks over single large mussel beds."
  - One commenter noted that overcrowding of mussels (in aquaculture settings) is detrimental and can impact their access to food and water, interfere with waste removal, and encourage growth of harmful organisms. Aquaculturists go to great lengths to spread mussels out and "…it makes sense that it is beneficial for the mussels to be 'thinned' by harvesters when they are growing in the wild. The harvesters in this case would be both eider ducks and people, and their harvesting activities would be mutually beneficial." This commenter also noted that oysters and scallops similarly grow better when they are not overcrowded.

Several commenters also noted that an outright prohibition was not appropriate. The MA DMF recommended that the Service work with them, other State regulatory agencies, and the Town to implement additional measures, such as seasonal restrictions, area management, gear restrictions, and quotas, to limit impacts and ensure that mussel harvesting could continue on the refuge. One commenter noted that hand harvesting of mussels should at least be allowed, and another noted that dredging gear "may not be appropriate for all areas at all times…"

Additionally, during the review period for the final comprehensive conservation plan and environmental impact statement, we received comments from the Commonwealth of Massachusetts, Department of Fish and Game, regarding the lack of distinction between impacts resulting from blue mussel harvesting and impacts resulting from ribbed mussel (*Geukensia demissa*) harvesting. In response to this comment, we have further modified our response to the opposition towards the mussel harvesting ban by distinguishing between blue and ribbed mussels. We believe that most (possibly all) commenters that originally noted their opposition to banning mussel harvesting in the draft comprehensive conservation plan were referring to blue mussels, however, we have added a section at the end of this topic which also addresses ribbed mussels.

Response: We recognize that Chatham fishermen and residents feel strongly about the ban on mussel harvesting and want to have continued access to this resource. While mussel harvesting is considered a traditional use of refuge waters, our position on the appropriateness and compatibility of any use of the refuge is based on the potential impacts of that activity to biological resources of concern. We can make decisions about uses of refuges and prohibit, restrict, and/or regulate activities even when there are economic impacts associated with our decisions, as long as these can be explained in our planning documents.

We also understand the sentiment that blue mussel harvesting has been occurring concurrent with bird use on Monomoy NWR for years with "no impact" and that the Service has no scientific basis for banning mussel harvesting. Although there are gaps in the available scientific information regarding mussel ecology in Massachusetts, and the relationships between blue mussel beds and bird use, we feel there is enough information to inform our decision-making process. We received many comments that dually note that we had no scientific basis for a ban on mussel harvesting and that mussel harvesting had no impacts on birds or the substrate, but no commenters provided any additional resources or references to support the latter claim. One new reference was cited by the Town relative to blue mussel spawning (Newell and Moran 1989; we believe this should be cited as Newell 1989). One new reference was also cited by the Town relative to American oystercatchers (Hand et al. 2010). The collective content of the comments we received showed that we failed to adequately present the entirety of our justification. We have reanalyzed the references we originally cited in the draft CCP, which the Town claims are insufficient, as well as numerous additional resources (including Newell 1989 and Hand et al. 2010), and provide a more thorough justification below.

In our final decision-making process, we considered all the comments we received as well as information on (1) the life cycle of blue mussels and the importance of maintaining blue mussel beds with highly reproductive size classes; (2) potential damage to eelgrass and blue mussel beds, and; (3) the importance of the refuge to avian resources and the importance of blue mussels to, and size selection by, those avian resources. We focus on common eiders, other seaducks (white-winged scoters, black scoters, long-tailed ducks), American oystercatchers, and red knots, but also acknowledge here that other species of birds feed on blue mussels. In the avian sections below, many of the prey sizes are given in millimeters, and we note that 50.8 mm = 2 inch (in). Finally, we address the relationship between ribbed mussels and saltmarsh health, and provide justification for not allowing ribbed mussel harvesting.

Maintaining Reproducing Blue Mussel Populations

We recognize that blue mussel populations on Monomoy NWR are cyclical and somewhat unpredictable given the highly dynamic system of wave and wind energy, and shifting sands. We cannot find evidence that blue mussels grow prolifically on the intertidal and subtidal zones of Monomoy NWR, as one commenter suggested, but would appreciate receiving additional information regarding this. In chapter 2, we note that mussel dragging occurred along the northwestern and eastern flats of North Monomoy Island from 2008 to 2011, but that harvesters redirected their efforts to mussel beds in Chatham Harbor in 2012. Refuge staff also documented blue mussel harvesting on the northeastern end of North Monomoy Island in 2006 (USFWS unpublished information 2006). Refuge staff have not systematically surveyed blue mussel bed locations or sizes, and we welcome additional information regarding past locations of blue mussel beds and mussel harvest activity on the refuge.

When blue mussel beds naturally form on Monomoy NWR, we feel it is important to maintain and protect a diversity of sizes and ages which are fed on by a variety of avian species (as discussed below). We believe protecting highly reproductive size classes of blue mussels will also provide a resource of smaller mussels. The Town noted that the 2-inch minimum size will "…ensure a sustainable fishery by allowing mussels to reach sexual maturity and provide a number of spawns before reaching legal size for the harvest" and they cite Newell and Moran (1989). Newell (1989) provides a very detailed species profile of blue mussel but we do not find information in this report to corroborate the statement that blue mussels at Monomoy NWR will provide a "number of spawns" before reaching legal size for harvest. Newell (1989) notes great variability with respect to growth rates, reproductive cycles, and spawning strategies, the difficulty in predicting these, and the importance of environmental factors, including food supply (see also Newell et al. 1982 and Seed 1976 for further discussion and review of these factors). Newell (1989) notes that "Mussels generally produce gametes and are ready to spawn by the time they are one year old; however, when adverse environmental conditions (e.g., prolonged periods of exposure to air) cause a slow rate of growth, sexual maturity is sometimes not attained until the second year." Seed (1976) provides a review of historic literature of blue mussel spawning periods and settlement periods, including several sites on the North American east coast, which generally suggests spawning from April through August and settlement from June through September, depending on the location, but it is clear from this review that there is a tremendous amount of local variability, and generalizations to additional locales are not appropriate. This is further confounded by the fact that blue mussels have two settlement periods: (1) a primary settlement of early juveniles which attach to a filamentous substrate away from the mussel bed using byssus threads, and (2) secondary settlement of later plantigrades that release from their filamentous substrate when they are about 1.5 mm, and reestablish on existing mussel beds by producing new byssus threads (Seed 1976, Bayne 1976). Seed (1976) also provides a review and summary of growth rates of blue mussels from several different studies and localities, which shows tremendous variability ranging from one population attaining 100 mm shell length in 2 years to another population attaining only 10 mm shell length in 6 years (see Seed 1976 for graph and references to these other studies).

We are not aware of information for naturally occurring blue mussel beds that is specific to Monomoy NWR (or outer Cape Cod), and without information regarding how fast mussels grow, and when and how often they spawn, the number of spawning events that occur at Monomoy NWR mussel beds prior to reaching a 2-inch minimum size is simply unknown. Further, if our purpose is to maintain blue mussel beds with a diversity of ages and sizes, we need to consider that there is evidence of changes in the reproductive potential of mature blue mussels through time. In a study of blue mussels in Newfoundland, Thompson (1984) found that reproductive effort "was an increasing function of age" which reached a maximum in 12-year old mussels for this particular population. They conclude that gamete production increased throughout the mussel's life span, even though they found somatic (non-reproducing parts) production gradually decreased in mussels older than 6 years. They also considered residual reproductive value, which is the future reproductive potential of an organism (and thus incorporates survival probabilities) and found that mussels of intermediate age possessed the greatest residual reproductive value. Although we cannot assume gamete production and residual reproductive values found in this study in Newfoundland are replicated at Monomoy NWR, this certainly suggests that harvest of blue mussels that have just reached the 2-inch size could result in harvest of mussels that have not yet reached their maximum reproduction potential, especially if blue mussels on and around Monomoy NWR grow quickly. This could in turn impact the longevity of localized blue mussel beds and the availability of a variety of size classes for avian resources.

Given the likely cyclical and ephemeral nature of blue mussels on Monomoy NWR, we are also concerned about other potential pressures on mussels. For example, blue mussel declines are now being reported in the Gulf of Maine, especially in Casco Bay. Potential causes include warming ocean temperatures, invasive predators, ocean acidification, disease, and over-harvesting (*http://www.theforecaster.net/news/print/2015/01/22/mussel-weakness-massive-decline-casco-bay-poses-qu/222678* ; last accessed February 2015).

In summary, we do not have enough information about blue mussel settlement and growth at Monomoy NWR to confirm that the 2-inch size limit is sufficient to sustain highly productive populations where they naturally occur. Further, there is evidence to suggest that allowing blue mussels to grow longer, may actually increase overall productivity, and thus provide longer-term benefits to the birds that utilize them. If studies about naturally occurring blue mussel beds at Monomoy NWR, or this general region of Cape Cod, become available, we hope they will be brought to our attention so we can further evaluate this issue.

Potential Damage to Eelgrass and Blue Mussel Beds

Contrary to a comment that was submitted that "mussels do not set in eelgrass," we find evidence in the literature that blue mussels do use eelgrass in the northeastern US (Bologna et al. 2005, Neckles et al. 2005, Disney et al. 2011). Several commenters cited lack of evidence of impacts of mussel harvesting on eelgrass and mussel beds. The Town specifically noted that Neckles (2005), which we believe is Neckles et al. (2005), does not provide justification for banning mussel harvesting. The Town's mussel harvesting regulations prohibit hydraulic dredging for mussels, which may be an attempt to minimize disruption to the sediment and benthic communities. However, they do allow tooth dredges and we are concerned about disruption to entire blue mussel beds as a result of this harvesting technique. Although several commenters noted that undersized mussels are returned to the area, we find no evidence or studies that show that these smaller mussels survive, and find no studies regarding the likelihood of these mussels reattaching at the original site.

Additionally, in the draft finding of appropriateness for mussel harvesting (appendix D), we noted that the most common harvest techniques for non-subterranean shellfish (such as dragging and mechanical dredging) are so efficient that mussel beds can be depleted very quickly. We acknowledge that this claim is not supported by the Town, and perhaps others. However, refuge staff have observed this exact occurrence on Monomoy NWR before. In July 2006, a mussel harvester was observed harvesting blue mussels on the northeastern end of North Monomoy Island. The majority of the blue mussel bed was harvested in a very short period of time, such that only a strip of mussels, which may have been mistakenly missed by the harvester, remained visible less than 2 weeks later (Figure K-1; USFWS unpublished data 2006).

Figure K.1. The remnants of a blue mussel bed on the northeastern end of North Monomoy Island on July 18, 2006, following harvesting activity. (Photo credits: Stephanie Koch, USFWS)

Common Eiders

In chapters 2 and 3, we briefly noted the importance of the waters on and around Monomoy NWR to common eiders, and referenced mid-winter waterfowl surveys conducted from 2005 to 2012 (Klimstra 2012, see table 2.6 in final CCP/EIS). We also pointed the reader to the Massachusetts Comprehensive Wildlife Conservation Plan (MA DFG 2006; *http://www.mass.gov/eea/docs/dfg/dfw/habitat/cwcs/mass-cwcs-final.pdf*; last accessed June 2015), which the Town noted was insufficient regarding the importance of mussels to common eiders in Massachusetts. Thus, we elaborate on common eiders in Massachusetts and provide more detailed information about blue mussels as a food item here. Our management efforts are not directed to protecting common eiders so that they can be hunted. Our intention is to protect habitat to sustain healthy eider populations, although population levels are used to determine bag limits and hunting seasons. See our response to the larger question about our management efforts and waterfowl hunting in Section 6 of this appendix.

The Service conducted surveys of wintering sea ducks on more than 200 transects from 2008 to 2011 to characterize their winter distribution from Maine to Florida (Silverman et al. 2013; these surveys targeted more habitat than the mid-winter waterfowl surveys cited in chapter 2) and found that "Densities of the two species with the most northerly distribution, white-winged scoter and common eider, were highest near Cape Cod and Nantucket." Beuth (2013) also documents the importance of southern New England to wintering common eiders. Although the population of common eiders appears to be stable, they are listed as High Relative Conservation Priority by the Sea Duck Joint Venture (2007), and we believe there is still reason to be concerned about this species and potential impacts from human activities, environmental changes, or disease. For example, cyclic common eider mortality events have been documented along the coast of Cape Cod for over 15 years, and researchers suspect a new orthomyxovirus (termed Wellfleet Bay virus) is the cause. "Between 1998 and 2013, 12 separate mortality events were documented in common eiders (*Somateria mollissima*) along

the coast of Cape Cod, MA, USA. The number of sick or dead eiders observed during these outbreaks typically averaged between 200 and 600 birds; however, a mortality event involving approximately 3,000 eiders was documented from August to October 2007." (Allison et al. 2015).

"Common Eiders are diurnal feeders and dive to pick mollusks and crustaceans from the sea bottom in water depths generally ranging from 10 to 20 meters" (Goudie et al. 2000). However, they will also feed in shallow areas "where wave action and tide result in relatively extensive intertidal zones" (Goudie et al. 2000). The importance of blue mussels as a prey to common eiders on the northeast U.S. coast and elsewhere, and the means by which eiders consume mussels (swallowed whole and ground by gizzard) has been well documented (Cottam 1939, Madsen 1954, McGilvrey 1967, Guillemette et al. 1996, Goudie et al. 2000). For example, Cottam (1939) dissected 96 eider adults collected in January, February, July, November, and December, from Rhode Island, Massachusetts, Maine, and Nova Scotia northward to Labrador and Hudson Bay to determine food percentages. He found that mollusks comprised 82 percent of food items, and blue mussels specifically comprised 67 percent of food items. He writes "This bivalve enters into the diet of all species of coastal waterfowl, and no other marine or coastal animal species is so important as a food for American waterfowl, yet with no other bird is it of such great value as with our common east coast eider duck, comprising as it does more than two-thirds of its total food. In fact, no other duck subsists to such an extent upon any single food species." Similarly, McGilvrey (1967) examined gizzards of 70 common eiders from Maine, New Hampshire, Massachusetts, Connecticut, and New York (including 45 collected from waters adjacent to Monomoy NWR) and reported that blue mussels were found in 87 percent and comprised 70 percent of the total volume.

Literature regarding prey size selection of blue mussels varies widely. We acknowledge that there is ample literature showing that common eiders prey on mussels smaller than 2 inches (Cottam 1939, Bustnes and Erikstad 1990, Guillemette et al. 1996, Higerloh and Pfeifer 2011). For example, Cottam (1939) notes in his analysis of 96 adult eiders that "Although mussels of nearly all sizes from tiny young to mature shells were consumed, it is apparent that shells up to three-fourths mature size were most frequently taken…" and "The gullet of another bird contained 11 entire mussels ranging from 1 1/8 by 5/8 inches to 1 9/16 by 3/4 inches; and the stomach or gizzard of the same bird, 6 entire mussels from 7/8 by 1/2 inch to 1 1/2 by 3/4 inches and remains of 7 more." As another example, Guillemette et al. (1996) analyzed gizzards and esophagi of 234 eiders collected between mid-December and late April in Quebec, Canada, and found blue mussel "…ranged from 1 to 25 mm in shell length with a mode at 7-8 mm (n=5600)…"

Although published literature provides evidence for selection of smaller blue mussels by common eiders, there is also evidence of selection of blue mussels approaching the 2-inch length size, or even larger. In fact, blue mussels measuring 8 cm (over 3 inches) were documented in eider stomachs collected in Denmark primarily from October to February in 1941 (Madsen 1954). We acknowledge that ingestion of mussels greater than 3 inches may not be common, but it corroborates our assertion that eiders do not only eat small mussels. Hamilton et al. (1999) studied size selection of blue mussels by common eiders in New Brunswick, Canada, during all four seasons. Their study was a controlled study and only four length classes of blue mussels were made available to eiders (10 to 19 mm, 19 to 28 mm, 28 to 37 mm, and 37 to 50 mm). The authors found that larger blue mussels were selected specifically in the winter time. The authors note that at one of the study sites, ducks fed on the two smallest length classes, but not the largest length class, for most of the year. However, in the winter "The largest mussels (37 to 50 mm) were the most preferred, although others were also selected, probably after all large mussels had been removed…" The authors suggest that the preference for larger prey in the winter time may be related to "changes in the costs and benefits of feeding on prey of different lengths at different times of the year…" In the winter time, there is not much variation in shell mass relative to length, resulting in more mussel meat per shell in larger mussels in the winter time, compared to other times of year. "Ducks selected prey that allowed them to minimize shell ingestion when large differences between length classes were evident (most of the year). However, when shell mass was least variable among mussel length classes, common eiders appeared to switch tactics in an attempt to maximize short-term energy intake by taking large mussels." It is possible that if blue mussels greater than 50 mm had been made available in this study, they would have also been selected by foraging common eiders. Importantly, these authors also note that their results emphasize the need to consider prey selection within the context of prey availability (including abundance of undesirable prey), seasonality, and local habitat conditions.

Although we are unable to find any published literature regarding blue mussel size selection by common eiders on Cape Cod, photo documentation of common eiders with large blue mussels in their mouth exists for Chatham. For example, on January 23, 2014, a male eider was observed in the waters off the Chatham Fish Pier, Chatham, MA consuming a very large blue mussel (Figure K-2). A female eider was similarly observed with a very large mussel that same day. Measurements from an adult male common eider specimen show that the length from the gape to the tip of the lower mandible is approximately 2.75 inches (Mark Faherty personal communication 2015, Mass Audubon Wellfleet, MA), providing evidence that common eiders can and do eat mussels greater than 2 inches in length. Similar photos of eiders with very large mussels in their mouths (from other locations) abound on the internet.

Figure K.2. A male common eider consumes a large blue mussel in the waters off the Chatham Fish Pier, Chatham, Massachusetts, on January 23, 2014. (Photo credit: Mark Faherty, Massachusetts Audubon Society)

In response to the comment regarding eiders being "big strong ducks" that "fly great distances on a daily basis as they trade back and forth along the coast from loafing areas to feeding spots," and the additional comment that dispersal of foraging areas over a larger area "provides greater opportunity for unmolested feeding because it does not concentrate the feeding ducks over single large mussel beds," we do not find scientific evidence to validate these claims. In fact, Guillemette (1998) states that "In winter, they forage non-stop from one foraging cycle to the other with only a few roosting bouts breaking this pattern during the day." This study, conducted on the northern Gulf of Saint Lawrence, Quebec, Canada, found that the percentage of time that common eiders feed is higher in mid-winter (56 percent of the day) versus spring (33 percent of day). The author also notes that "When facing reduced daylight eiders may first decrease the proportion of resting bouts within a foraging cycle."

Finally, studies on the impacts of commercial bivalve harvesting on wintering birds have shown alarming consequences. For example, researchers in the Dutch Wadden Sea found that large scale blue mussel harvesting impacted wintering common eider populations. When comparing periods of high blue mussel biomass availability to low biomass availability, they found "blue mussels declined in the Eiders diet, numbers of Eiders with empty stomachs increased and the mean length of blue mussel taken by Eiders decreased (Laursen et al. 2009)." Although the overall blue mussel biomass and scale of harvesting in this study may be much greater than at Monomoy NWR, the study illustrates the impacts that overharvest can have on common eiders.

In summary, despite the lack of published scientific information that common eiders regularly eat blue mussels larger than 2 inches in length at Monomoy NWR, there is sufficient information proving that they can and do eat blue mussels greater than 2 inches. Although the frequency of this has not been studied, the occurrence is great enough for it to be photographed and documented in some literature. This evidence, combined with the importance of Cape Cod and Monomoy NWR to wintering common eiders, recent concerns regarding Wellfleet Bay virus on the wintering population, and evidence of blue mussel harvesting impacting common eiders elsewhere, provide sufficient justification for protecting blue mussels of all sizes for common eiders at Monomoy NWR.

Other Sea Ducks—White-winged Scoters, Black Scoters, and Long-tailed Ducks

Scoter species and long-tailed ducks were briefly mentioned in chapter 2 of the draft CCP/EIS, but the importance of Cape Cod and Nantucket (and southern New England in general) to wintering white-winged scoters, black scoters, and long-tailed ducks was not specifically discussed. As noted in the discussion of common eiders above, the Service conducted surveys of wintering sea ducks on more than 200 transects from 2008 to 2011 to characterize their winter distribution from Maine to Florida (Silverman et al. 2013) and found

that "Densities of the two species with the most northerly distribution, white-winged scoter and common eider, were highest near Cape Cod and Nantucket." Additionally, Silverman et al. (2013) found that wintering long-tailed ducks were "most abundant around Cape Cod, Nantucket Shoals, and in Chesapeake Bay." Loring et al. (2014) also confirms the importance of southern New England to wintering black scoters. White-winged scoters, black scoters, and long-tailed ducks are all likely declining and the Atlantic wintering populations of all three of these species are listed as High Relative Conservation Priority by the Sea Duck Joint Venture (2007).

The importance of blue mussels to seaducks is also well established, especially for scoters. On wintering areas, mollusks (especially blue mussels) are an important food item for white-winged and black scoters (Cottam 1939, McGilvrey 1967, Bordage and Savard 1995, Brown and Fredrickson 1997). Cottam (1939) dissected 819 white-winged scoters collected in all months except June and September, from 16 States and 5 Canadian Provinces (though 83 percent were from the Massachusetts and Washington coasts). Mollusks comprised 75 percent of all food, and blue mussels (and other Mytilidae) comprised nearly 12 percent of all foods. Cottam (1939) also dissected 124 black scoters collected in all months except April and August from 9 states and 4 Canadian Provinces. Mollusks comprised 65 percent of all food, and blue mussels comprised 24 percent of all foods. Cottam (1939) notes that blue mussels "…entered into the diet of about half the birds, ranging from a trace to 100 percent of the meal, and one stomach contained 78 of these abundant mussels. Other bivalves were freely taken, however, often in large numbers, suggesting that availability rather than choice is the principal factor governing their consumption." McGilvrey (1967) examined gizzards of 124 white-winged scoters collected from Maine, New Hampshire, Massachusetts, Connecticut, and New York and reported that overall, blue mussels were found in 11 percent and comprised 8 percent of the total volume. However, among Massachusetts birds, blue mussels were found in 33 percent of the birds and comprised 34 percent of the total volume. Only 17 black scoter gizzards were analyzed in this study, but almost 50 percent contained blue mussels, and blue mussels comprised more than half of the total volume. Although mollusks, and blue mussels in particular, were found to be less prevalent in the diet of long-tailed ducks compared to white-winged and black scoters (Cottam 1939, McGilvrey 1967), they were still found to be a food item (Cottam 1939). Additionally, Madsen (1954) found that mollusks were the most frequently eaten food in a study of 113 long-tailed ducks collected from saltwater localities in Denmark. Further, 44 percent of these birds had been feeding on blue mussels.

In addition to information regarding the importance of this region to seaducks, and the importance of blue mussels as a prey item, there is literature to support the notion that some seaducks will prey on bivalves that are 2 inches or longer in length. We were not able to find information specific to Monomoy NWR or Chatham, but Anderson et al. (2008) synthesized past diet studies and collected additional specimens of white-winged scoters, and found that the overall mean length of bivalves eaten was approximately 25 to 30 mm, while the overall maximum length was approximately 55 mm. We acknowledge that blue mussels smaller than 2 inches are most prevalent in seaduck diets, but for reasons discussed above, we believe protecting blue mussels of all size classes for white-winged scoters, black scoters, and long-tailed ducks (in addition to common eiders) is justified.

American Oystercatchers

We have already noted the importance of Monomoy NWR to nesting and post-breeding staging American oystercatchers in chapters 2 and 3. We also noted that mussels are a common food source for American oystercatchers and pointed the reader to the American Oystercatcher Working Group's webpage on the food habitats of oystercatchers: *http://amoywg.org/american-oystercatcher/food-habits/*; (last accessed June 2015). The information on this page comes from the recently updated Birds of North America Species Account (Nol and Humphrey 2012), and provides numerous references regarding food habits of this species. Thus, we disagree with the Town's assertion that this is a "light review." Nol and Humphrey (2012) do include information (and citations, many of which are available at the American Oystercatcher Working Group website above) for food habits throughout the species range, not just in Massachusetts. Specifically, from Massachusetts to New Jersey, the webpage notes that prey includes (but is not limited to) bivalves such as blue mussels, ribbed mussels, soft-shell clams, surf clams (*Spisula solidissima*), stout razor clams (*Tagelus plebeius*), razor clams (*Ensis directus*), and hard clams (*Mercenaria mercenaria*). In more southerly areas (Virginia, North Carolina, South Carolina, Georgia, and Florida), they also feed on invertebrate species that have ranges overlapping in the south, as well as additional bivalves such as oysters (*Crassostrea virginica*); for a full review of prey items and associated references, see Nol and Humphrey 2012 or *http://amoywg.org/american-oystercatcher/food-habits/*. The Town's reference to Hand et al. (2010) and quoted text, "which states mussels comprise just 4% of total oystercatcher diet in South Carolina" as a means for suggesting that mussels are not an important part of oystercatchers' diet in Massachusetts is inappropriate and out of context. This study in South Carolina was conducted during the nonbreeding season when American oystercatchers are concentrated in areas with

expansive oyster reefs (Hand 2008; Hand personal communication 2015, South Carolina Department of Natural Resources, Green Pond, SC).

American oystercatchers feed on bivalves in a different manner than eiders and scoters, and this is described in detail in Nol and Humphrey (1994). "When feeding on mussels or oysters, they locate food visually, wading through slightly submerged shellfish beds…When a bivalve with open valves is located, the oystercatcher employs a technique known as 'stabbing,' whereby it quickly inserts its knife-like bill into the open valves, and with several quick thrusts severs the adductor chain that holds the two valves together. The bird then cleans out and consumes the soft parts." American oystercatchers also feed by taking an individual mussel from a bed and using a "hammering" technique, which is also described by Nol and Humphrey (1994). "They orient it properly with their bill and begin hammering at the point where the adductor chain lies inside the shell. Once they have broken through the shell, they quickly sever the adductor chain, allowing the 2 halves of the bivalve to separate. The soft parts are then consumed completely."

Although there are no scientific studies for Massachusetts that quantify the relative abundance of blue mussels in American oystercatchers' diets, we know mussels are an important food source where they overlap the oystercatchers range (Newell 1989, and see Nol and Humphrey 1994 as discussed above). Additionally, documentation of American oystercatchers feeding on blue mussel beds in Massachusetts are easily found on the internet, including this video from Wellfleet, MA, *https://www.youtube.com/watch?v=Sg6taSYIilE* (last accessed February 2015).

Although we do not have scientific studies quantifying the sizes of blue mussels that are eaten by American oystercatchers, there is sufficient evidence to support the notion that they can and do eat blue mussels (and other mollusks) that are 2 inches or larger in length. For example, Figure K-3 shows a juvenile American oystercatcher feeding on a blue mussel at Tern Island, Chatham, MA, on August 27, 2012. This juvenile originally hatched from Kalmus Beach in Hyannis, Massachusestts, on approximately June 5, 2012, and would have had a bill length the size of an adult by the end of August (Shiloh Schulte personal communication 2015, Manomet Center for Conservation Sciences, Manomet, MA). Adult male and female American oystercatchers have an average exposed bill length of 83 mm and 92 mm, respectively (Nol and Humphrey 1994). From this photo the reader can see that the blue mussel is approximately 80 percent the length of the juvenile's bill, so even if we assume that the bill is only 80 mm long, the blue mussel must be approximately 64 mm long, which is well over 2 inches.

Figure K.3. A juvenile American oystercatcher feeding on a blue mussel, Tern Island, Chatham, Massachusetts (Photo credit: Mark Faherty, Massachusetts Audubon Society)

Similarly, observations from field biologists at other sites provide evidence that American oystercatchers can and do eat mollusks larger than 2 inches in length. For example, biological staff in Virginia found ribbed mussels larger than 2 inches that have been cracked open by adults and fed to American oystercatcher chicks (Pamela Denmon, personal communication 2015.) Among species of bivalves actually measured at American oystercatcher middens in Virginia from 1981 to 1983, northern horsemussels (*Modiolus modiolus*) averaged 85 mm in length and razor clams (*Ensis* species) averaged 125 mm in length (Nol 1984; Erica Nol personal

communication 2015, Trent University, Peterborough, Ontario). Similarly, in southeastern North Carolina, biological staff monitoring 85 to 90 nesting pairs of American oystercatchers regularly find ribbed mussels at the nest sites where parents are feeding their chicks. Observed ribbed mussels are nearly all longer than 2 inches, and staff estimate an approximate average length of 3 inches or greater. Razor clams (*Tagelus* species) exceeding 2 inches in length are also brought by adult American oystercatchers to theses nest sites in North Carolina (Lindsay Addison personal communication 2015, Audubon North Carolina, Wilmington, NC). Although we do not have published documentation that American oystercatchers eat blue mussels (or ribbed mussels) larger than 2 inches in length at Monomoy NWR, we feel there is sufficient documentation of American oystercatchers eating blue mussels and other mollusks greater than 2 inches in length throughout their range to reasonably conclude that this also occurs on Monomoy NWR. We feel this, combined with the overall importance of the refuge to American oystercatchers during the breeding season and post breeding staging period, warrants protection of mussel beds with a variety of size classes, including those larger than 2 inches in length.

Red Knots
We have already noted the importance of Monomoy NWR and this region of Cape Cod to migrating red knots in Chapters 2 and 3. We also note the importance of blue mussel spat to red knots migrating through the area and reference Harrington et al. (2010b). Although this paper does not contain scientific analysis of red knot gut contents, and was based on observations, we disagree with the Town's opinion, and feel that this reference is completely appropriate as supporting documentation for the importance of blue mussel spat (i.e. juvenile stages) to red knots migrating through Cape Cod. This reference has been published in a well-respected peer reviewed journal, and the lead author has decades of experience studying red knots in southeastern Massachusetts. Moreover, several hundreds of birds were frequently counted and observed during observation days in this study, so we disagree with the Town's comment that "The number of knots observed is very low."

On December 11, 2014 (after the draft CCP was released for public review), red knots were listed as a Federal threatened species under the Endangered Species Act (ESA). Given the importance of Monomoy NWR and Cape Cod to southward migrating red knots, we need to be even more cautious about protecting the habitats they rely on while foraging and resting here. The Final Rule published in the Federal Register for the listing of the red knot can be reviewed here: *http://www.fws.gov/northeast/redknot/pdf/2014_28338_fedregisterfinalrule.pdf* (accessed October 2015). A supplemental document to the listing was also made available (Rufa Red Knot Background Information and Threats Assessment) and can be found here: *http://www.fws.gov/northeast/redknot/pdf/20141125_REKN_FL_supplemental_doc_FINAL.pdf* (accessed October 2015).

The supplemental document (USFWS 2014) provides a very thorough account of peer reviewed literature regarding feeding ecology and food preferences, and we point the reader there for specific details and dozens of references. For example, on page 14 of the supplemental document, the authors note that red knots are "specialized molluscivores" that swallow mollusks whole and provide numerous references relevant to foraging ecology and food preferences. Specifically:

> "Across all (six) subspecies, *Calidris canutus* is a specialized molluscivore, eating hard-shelled mollusks, sometimes supplemented with easily accessed softer invertebrate prey, such as shrimp- and crab-like organisms, marine worms, and horseshoe crab eggs (Piersma and van Gils 2011, p. 9; Harrington 2001, pp. 9–11). The mollusk prey is swallowed whole and crushed in the gizzard, which in *C. canutus* is the largest (relative to body size) among any shorebird species evaluated (Piersma and van Gils 2011, pp. 9–11). Large gizzards are among this species' adaptations to a mollusk diet, allowing *C. canutus* to grind the hard shells of its prey. *Calidris canutus* prefer thin-shelled to thick-shelled prey species because they are easier to digest and provide a more favorable meat to mass ratio (higher prey quality) (van Gils et al. 2005a, p. 2611; Harrington 2001, p. 11; Zwarts and Blomert 1992, p. 113). From studies of other subspecies, Zwarts and Blomert (1992, p. 113) concluded that *C. canutus* cannot ingest prey with a circumference greater than 1.2 in. (30 millimeters (mm)). For rufa red knots, prey lengths of 0.16 to 0.79 in. (4 to 20 mm) have been observed (Cohen et al. 2010b, pp. 359–360; González *et al.* 1996, p. 575). Foraging activity is largely dictated by tidal conditions, as *C. canutus* rarely wade in water more than 0.8 to 1.2 in. (2 to 3 cm) deep (Harrington 2001, p. 10). Due to bill morphology, *C. canutus* is limited to foraging on only shallow-buried prey, within the top 0.8 to

> 1.2 in. (2 to 3 cm) of sediment (Gerasimov 2009, p. 227; Zwarts and Blomert 1992, p. 113). Along the U.S. coast, *Donax* and *Mulinia* clams and blue mussel (*Mytilus edulis*) spat are key prey items. A prominent departure from typical prey items occurs each spring when red knots feed on the eggs of horseshoe crabs (*Limulus polyphemus*), particularly during the key migration stopover within the Delaware Bay. Delaware Bay serves as the principal spring migration staging area for the red knot because of the abundance and availability of horseshoe crab eggs (Clark et al. 2009, p. 85; Harrington 2001, pp. 2,7; Harrington 1996, pp. 76–77; Morrison and Harrington 1992, pp. 76–77). In Delaware Bay, horseshoe crab eggs are a superabundant source of easily digestible food."

On pages 70 and 71 of the supplemental document, the authors provide more information regarding prey and size selection, along with references. Specifically:

> "*Calidris canutus* prefer thin-shelled to thick-shelled prey species because they are easier to digest and provide a more favorable meat to mass ratio (higher prey quality) (Harrington 2001, p. 11; Zwarts and Blomert 1992, p. 113). From studies of other subspecies, Zwarts and Blomert (1992, p. 113) concluded that *C. canutus* cannot ingest prey with a circumference greater than 1.2 in. (30 millimeters (mm)). Rufa red knots in San Antonio Oeste, Argentina, were found to select mussels between 0.20 and 0.79 in. (5 and 20 mm) long out of an available range of 0.04 to 1.10 in. (1 to 28 mm) (Cohen et al. 2010b, p. 360; González et al. 1996, p. 575). In Virginia, the length of *Donax* clams averaged 0.16 in. (4.12 mm) in red knot foraging habitat during the peak of spring migration, and red knot flock sizes were positively correlated with mean *Donax* length (Cohen et al. 2010b, pp. 359–360). Foraging activity is largely dictated by tidal conditions, as *C. canutus* rarely wade in water more than 0.8 to 1.2 in. (2 to 3 cm) deep (Harrington 2001, p. 10). Due to bill morphology, *C. canutus* is limited to foraging on only shallow-buried prey, within the top 0.8 to 1.2 in. (2 to 3 cm) of sediment (Gerasimov 2009, p. 227; Zwarts and Blomert 1992, p. 113). 71
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> Table 1 gives prey items that have been reported for rufa red knots in wintering and migration areas. Though eaten by *C. canutus* at one location in Cape Cod, Massachusetts (*rufa*) and one site in California (*roselaari*), the thick, hard-shelled gem clam is rarely eaten despite its abundance in other red knot nonbreeding areas, including western Cape Cod Bay (fall migration) and Delaware Bay (spring migration) (Harrington et al. 2010b, pp. 361–362; Harrington 2001, p. 11). During fall migration in Cape Cod, Massachusetts, Harrington et al. (2010b, p. 361) found prey differences between northern-wintering (gem clams) and southern-wintering (blue mussels, *Mytilus edulis*) red knots; see Migration—Differences in Migration Strategy by Wintering Area.
>
> Red knots and other shorebirds that are long-distance migrants must take advantage of seasonally abundant food resources at migration stopovers to build up fat reserves for the next nonstop, long-distance flight (Clark et al. 1993, p. 694). During the migration period, although foraging red knots can be found widely distributed in small numbers within suitable habitats, birds tend to concentrate in those areas where abundant food resources are consistently available from year to year. The spatial distribution of red knots in Argentina, Georgia, South Carolina, Virginia, the Atlantic coast of New Jersey, and Delaware Bay stopover areas has been correlated with the distribution of the primary prey species (Georgia Department of Natural Resources 2013; Thibault and Levisen 2013, p. 6; South Carolina Department of Natural Resources 2013, p. 37; Musmeci et al. 2011; Fraser et al. 2010, p. 97; Cohen et al. 2010b, p. 355; Cohen et al. 2010a, pp. 659, 660–661; Niles et al. 2008, pp. 17, 19; Smith et al. 2008, p. 15; Karpanty et al. 2006, p. 1706; Botton et al. 1994, p. 605)."

The extensive literature review in this supplemental document presents the most recent, comprehensive compilation of information relative to red knot foraging ecology. The importance of Monomoy NWR to red knots is well established in the literature. The importance of blue mussels as a prey item is also well established in the literature. The small size classes of mussels that red knots depend upon only occur if healthy, productive mussel beds also occur. Red knot is a Federal listed species, and we believe protection of blue mussel beds on Monomoy NWR, through a ban on human harvest, is absolutely justified.

Ribbed Mussels, Saltmarsh, and Potential Harvesting Impacts
Ribbed mussels use different habitat than blue mussels and are generally found in saltmarshes, often associated with salt marsh cordgrass; attaching to vegetation with byssal threads (*Spartina alterniflora*; Bertness 1984) and partially buried in the substrate among the roots of the vegetation (Gosner 1978). Ribbed mussels are filter feeders that are rich in organic bacteria, and are therefore, as we understand, generally not eaten by people. They are generally harvested at high tide, because at low tide they close up and thus retain toxins.

Ribbed mussels are important to saltmarsh health, as they process organic nutrients into inorganic matter which are then recycled back into the mud, contributing to salt marsh growth (*http://www.edc.uri.edu/restoration/html/gallery/invert/ribbed.htm*, accessed January 2016, *http://www.chesapeakebay.net/fieldguide/critter/atlantic_ribbed_mussel, accessed January 2016*). According to Bertness (1984), "In the natural habitat, mussel density is positively correlated with increased grass height, biomass, and flowering, and experimental removal and addition of mussels in these habitats demonstrates that mussels stimulate both aboveground and belowground *S. alterniflora* production". He also notes that "The relationship between *S. alterniflora* and *G. demissa* appears to represent a facultative mutualism that leads to increased marsh net primary production and stability".

Refuge staff have not surveyed ribbed mussels on Monomoy NWR, and we are not aware of any harvesting activity on the refuge. We confirmed that the ribbed mussel fishery is minimal in Chatham (R. Gagne, personal communication, 2016).We welcome information regarding location and extent of ribbed mussels, and any harvesting efforts to date. We also do not have much information regarding the importance of ribbed mussels to birds of conservation concern (though we suspect they are eaten by American oystercatchers that nest in the saltmarsh habitat). However, we are very concerned that ribbed mussel harvesting could impact saltmarsh health and be physically disruptive to saltmarsh vegetation at Monomoy NWR.

Summary
In conclusion, we have decided not to change our original proposal to ban mussel harvesting on Monomoy NWR, and we clarify that this includes blue and ribbed mussels. We believe blue mussel beds on Monomoy NWR are likely cyclical and ephemeral. We have not found sufficient information regarding blue mussel growth, reproduction, and settlement to determine the impacts of harvesting 2-inch mussels on the longevity and persistence of mussel beds. We have found an abundance of literature to support our position that several species of conservation concern rely on blue mussel beds as a food source. We are additionally concerned about impacts of ribbed mussel harvesting to saltmarsh health and vegetation structure. We acknowledge the lack of scientific information with respect to certain aspects of this decision making process, but contrary to commenters, we conclude that this uncertainty provides added justification for protecting these mussel beds until more information is presented and the uncertainty is reduced. We have updated text throughout the CCP to incorporate the additional justification presented in this response.

Mussel Harvesting—Support for Ban
(ID# 234)

Comment: One individual wrote in support of limits on mussel harvesting because of the importance of mussels to migrating red knots. "Protecting mussel populations in and around the refuge, so that a large set of mussel spat can occur annually is very important…Protecting food sources (mussel spat and horseshoe crab eggs) along the migratory track is essential."

Response: We agree that protecting and maintaining productive mussel beds (where they naturally occur) is important. We have decided to maintain a ban on mussel harvesting on Monomoy NWR and have provided a detailed justification for this decision under the section "Mussel Harvesting—Opposition to Ban" in this appendix. We have also updated text in the final CCP/EIS to reflect the additional justification we provide in this appendix.

Salting—Opposition to Ban
(ID# 64, 91, 136, 164, 229, 250, 273, 294)

Comment: The Town and several other commenters did not support our proposal to ban the use of salt to harvest razor clams, and multiple commenters noted that salt should be allowed to harvest sea (surf) clams as well.

Reasons for opposing the ban on salt included:

- Razor clams are a valuable target species for commercial harvesters.
- There are no scientific studies showing salting is detrimental or that there are adverse effects on local habitat or refuge resources. One commenter also noted that very little information is available about razor clams. Additionally, the Town cited research conducted by Constantine et al. (2008) and Krzyewski et al. (2005) as evidence that there are "no effects to the benthic community" and that the "marine environments are adaptable to fluctuating salinity levels."
- The ban on salting is not needed because the Town already has regulations in place that were based on science, and these regulations maintain and promote the species while protecting habitat. Specific regulations and restrictions noted by commenters included:
  - Harvesting of razor clams and sea clams by salting is only allowed where there are no other species (such as softshell clams or quahogs) present. Areas of mixed species are determined by the Shellfish Constable.
  - Salting has been defined by the Town as a "saline solution derived solely from table salt and water."
  - Only a diluted saline solution is allowed; dry salting and broadcast salting (spreading dry salt) are not allowed.
- The MA DMF has no regulations about razor clams and most Towns do not even mention razor clams in their shellfish regulations.

Response: We understand and appreciate the desire for access to the razor clam fishery on the refuge. We also appreciate the proactive efforts of the Town and the Shellfish Advisory Committee to enact regulations for razor clam harvesting, and agree that these regulations may help protect this valuable shellfishery throughout the Town. However, we have decided to maintain a ban on salting for all shellfish harvested above MLW on the refuge for several reasons, as explained below.

We agree that rigorous scientific studies evaluating the impacts of salting are currently lacking. There is a scarcity of information documenting potential negative impacts of salting on target species, non-target species, and the benthic environment. However, the same statement applies to information documenting no negative impacts. Constantino et al. (2009) studied the impacts of salting in a Before-After-Control-Impact study in southern Portugal and concluded no significant impact on the sediment and no effects on the benthic communities. However, there are several aspects of this study which may fall short of corroborating the opinion that salting for razor clams (and sea clams) has no impact to the resource or benthic communities at Monomoy NWR. For example, the study only utilized three control and three experimental plots, each of which was only 2 m by 3 m. This study was very small scale. The researchers also simulated salting by "covering the area with salt during low tide," but note that "the simulation of harvesting with salt was exaggerated, since generally the fishermen only pour salt into the sediment gallery excavated by the razor clam, instead of covering all the area with salt." We note that this simulation may also have minimized the possible impacts to the target species. While this study provides some evidence that could allow the reader to infer that salting at Monomoy NWR may not cause significant impact to the benthic community, it is not compelling enough and does not sufficiently allay our concerns.

In particular, the study conducted by Constantino et al. (2009) does not consider the impact to the target species. The Town shellfishing regulations specify a minimum harvest size of 4 ½ inches for razor clams (Town regulation Section 305 G). Our understanding is that a harvester cannot be certain of the size of the razor clam in a burrow, until it has been salted, and the clam has expelled itself and can be measured. Thus, we are additionally concerned about impacts of salting to undersized (and thus discarded) razor clams. Krzyewski et al. (2005) studied the impacts of salting on razor clams and clam tissue in Pleasant Bay and found that high concentrations of salt solution causes mortality to razor clams. Salt solutions of 100 parts per trillion (ppt) were found to affect the cilia and cell membranes. Additionally, the study notes that harvesters typically use a salt solution of 100 to 200 ppt. We do not know if this accurately describes methods used by Chatham harvesters, but we do know that despite the requirement that salt be diluted with water, there is no regulation on the exact concentration of salt that can be used in Chatham.

Town shellfish regulations note that salting for razor clams and sea clams is only "…allowable provided there are no other species (such as softshell clams or quahogs) within the inter-tidal zone of a given area. Areas of mixed species will be assessed and determined in the sole and unfettered discretion of the Shellfish Constable" (Town regulation Section 402 A). The Town noted in their comments on the draft CCP/EIS that this was a "precautionary approach" and we therefore presume this regulation addresses their concern about potential impacts to non-target species that are also valuable to harvesters. However, the regulations currently do not relieve our concerns about impacts of salting to other species sharing this ecosystem, or to undersized razor clams.

In addition to being a valued resource to people, razor clams are an important food source to several priority species utilizing Monomoy NWR, including horseshoe crabs (Botton 1984, Walls et al. 2002) and American oystercatchers (Nol and Humphrey 1994). The importance of the refuge to these species is described in great detail in chapters 2 and 3. Impacts to the razor clam population (either inadvertent or direct harvesting pressure) could impact these species as well. We are concerned that the efficiency of harvesting with salt could lead to increased pressure on this resource and this, combined with our understanding that there are no daily limits for commercial harvesters, could result in the depopulation of razor clam beds.

Finally, we recognize that, although not as efficient as salting, it is still possible to harvest razor clams with hand tools, and hand tools are adequate for harvesting the maximum allowable weekly recreational limit of one 12-quart pail. For example, in Oregon and Washington, razor clams *(Silqua patula)* are harvested with clam shovels or clam tubes (guns) (*http://www.dfw.state.or.us/resources/fishing/docs/ClammingFlyer.pdf*, *http://wdfw.wa.gov/fishing/shellfish/razorclams/howto_dig.html*). Although this is a different species from our razor clam, it is similarly a fast moving and deep digging clam. Clam tubes can be homemade or purchased through a variety of common retailers. Limiting the harvest of razor clams and sea clams on the mudflats to only hand tools is also consistent with our efforts to maintain the quality of our wilderness character.

We appreciate the comments regarding salting, and understand that we did not provide enough clear justification for our proposed ban in the draft CCP. We also were not aware that salting was a viable method for harvesting sea clams. We have made changes to the text of the final CCP/EIS in several places to clarify our position. The most significant additions are below:

- We have modified Objective B2.6 (Shellfishing) in chapter 3 to include sea clams.
- We have added a summary of the justification for the ban on salting above MLW in the Rationale section for this objective.
- We have modified the strategy under this objective to include sea clams.
- We have added sea clams to the compatibility determination "Non-mechanized harvesting of subterranean shellfish above MLW without the aid of artificial extraction methods."
- We have added the detailed justification for the ban on salting to this same compatibility determination.

Salting and Other Artificial Means of Extraction—Support for Ban

(ID# 82, 267)

Comment: The Horseshoe Crab Conservation Association supported the proposed ban on salt and chlorine, and also suggested that we add vinegar to the list of example substances that are not allowed. They subsequently retracted that suggestion as they could not confirm the efficacy of vinegar from within the fishing community. Support for the ban was also expressed by a commercial shellfisherman.

Response: As stated in the draft CCP/EIS, we proposed to ban artificial methods of extracting razor clams, including salt and chlorine. In the final CCP/EIS, we have updated both objective B2.6 (Shellfishing) in chapter 3 and the compatibility determination for the non-mechanized harvesting of subterranean shellfish in appendix D to be explicit that this ban includes any and all artificial methods for all subterranean shellfish that are harvestable from the refuge above MLW. The hand harvest of razor clams would still be allowed.

Oyster Farming
(ID# 71)

Comment: A concern was expressed about oyster farming. The commenter stated, "Lastly, recognizing this is outside the present plan, we still wish to comment that we have reservations with oyster farming. These structures are being built on public 'land' displacing marine life and public recreation. While we understand these farms may have their place on Cape Cod, the recent expansion in the number of locations and expanse of individual structures is concerning."

Response: No oyster farming has occurred or is planned on the refuge. Should a proposal be made, we would evaluate the appropriateness and compatibility of this use with refuge purposes, including the concern that the placement of an oyster farm may have the potential to displace marine life and public recreation. Within the final CCP/EIS, we address oyster farming in chapter 3 of the final CCP/EIS under aquaculture in objective B 1.11 (Nearshore Marine Open Water).

Lobster, Crab, and Whelk Harvesting
(ID# 234, 235, 242)

Comment: The Cape Cod Fisherman's Alliance agreed with the proposal to continue to allow lobster, whelk, and crab harvesting. Other commenters oppose any commercial fishing or are concerned that it be regulated as there are potentially many possible impacts on the refuge.

Response: Similar to the draft CCP/EIS, the final plan includes the proposal to allow lobster, whelk, and crab harvesting under Federal and State regulations. We propose to work with the MA DMF and the Town on an annual basis to review all fishing occurring on the refuge to ensure that fishing does not interfere with refuge resources or management. We will recommend changes to any fishing practice if we feel it is necessary to do so.

Horseshoe Crab Harvesting—Support for Ban
(ID# 72, 82, 155, 235)

Comment: Mass Audubon, the Massachusetts Committee for the Preservation of Horseshoe Crabs, and the Horseshoe Crab Conservation Association wrote in support of the continued prohibition on horseshoe crab harvesting. Collectively, commenters noted that the following points which support continued protection: (1) this protected horseshoe crab population has rebounded and is increasing while other populations on Cape Cod are still low or declining; (2) the area is successfully serving as a nursery (based on "frequent observations of many thousands of juvenile crabs"); (3) the area in and around Monomoy is now a protected source population that is contributing to horseshoe crab harvest elsewhere in Town, and; (4) horseshoe crab eggs are important to migratory shorebirds.

Response: Similar to the draft CCP/EIS, our final plan maintains a ban on horseshoe crab harvesting. Appendix D includes a finding that horseshoe crab harvest is not appropriate on the refuge.

4. Wilderness Management

Wilderness Management
(ID# 153, 155)

Comment: The Association to Preserve Cape Cod criticized several aspects about our approach to wilderness management on the refuge. Specifically, they believe we failed to properly assess, inventory, and delineate uses established prior to adoption of the Wilderness Act designation. They indicated that the priorities in the Refuge System Improvement Act overlooks the unique characteristics and challenges of Monomoy NWR and that we are advocating for a hybrid of wilderness status and public recreation. They believe the focus on "high quality visitor services" is incompatible with a designated wilderness. They indicated that we acknowledge the wilderness designation but do not properly respect it. They further stated that wilderness area boundaries subject to erosion, accretion, and reliction should be adjusted. Mass Audubon indicated that the role of Monomoy NWR's wilderness is "vitally significant and should play a central role in associated management plans and actions."

Response: Our management of wilderness on Monomoy NWR has evolved as Service wilderness policy has been revised (610 FW 1 to 4). We have a strong dedication to protecting wilderness and believe we can make more visitors and local residents aware of the designation through outreach programs. We participated in a Monomoy Wilderness Character Monitoring Review in 2013 which was very helpful to us, and are continuing this monitoring to ensure that visitors to the wilderness area have a wilderness experience. This may in fact mean limiting group size and it certainly means restricting certain activities that otherwise might be found on a beach and elsewhere on the refuge as they are not consistent with wilderness character. This in turn has led to other criticism. The use of concessionaires is helpful to both limit group sizes in the wilderness and to ensure that visitors receive wilderness awareness information.

Our wilderness boundary, with the exception of the excluded areas and Morris Island, is MLW. The area encompassed by wilderness will expand or retract based on the acreage of the refuge that is located above MLW. And even though the excluded areas on South Monomoy Island are not officially wilderness, we manage them as if they are.

We recognize that there are some uses of the refuge that are generally excluded from wilderness that we allow. One is the use of motorboats. This is explained in the CCP as an authorized use. Another use we allow is the hand harvest of subterranean shellfish. We believe the harvest of subterranean shellfish using harvest methods that were in place when the wilderness was designated is a traditional use that is compatible with wilderness character and is compatible with the management of wildlife.

Because we are also a national wildlife refuge that supports several Federal listed endangered and threatened species, and we have other Federal laws that we must comply with, we have an affirmative responsibility to manage our wildlife populations and their habitat as well as respect and manage wilderness character. We realize at times that some may not agree that managing habitat is consistent with wilderness management. There is no consensus about the appropriate level of management that can or should occur within wilderness areas. We have two co-equal missions—refuge management and wilderness management. Refuge management includes wildlife conservation and compatible public uses. We conduct our activities in a manner which preserves wilderness character. Our plan presents a way to achieve both.

Addition of Nauset/South Beach to Wilderness

(ID# 64, 90, 241, 264, 296)

Comment: The Town disagreed that Nauset/South Beach should be treated as federally designated wilderness simply because it joined to existing wilderness. They stated that designating additional wilderness on the refuge would require a public process, writing "The very open and public process of the initial Monomoy NWR wilderness designation and the boundary modification process required by the Wilderness Act of 1964 stand in stark contrast to how the FWS unilaterally claimed the 717-acre parcel of Nauset/South Beach as wilderness. The FWS should have initiated a public process and sought the views of the Town and our local community." The Town expressed their opinion that the modification of the wilderness boundary needed to follow the process outlined in the Wilderness Act. Additionally, the Town was concerned that certain uses of Nauset/South Beach, such as beach sports, grilling, and kite flying" would no longer be allowed because of the wilderness designation.

Another individual wrote, "The 'taking' and or further restricting of the southern portion of South Beach, part of Morris Island and the 'Southway' and designating portions as wilderness under the control of the refuge is unreasonable and should be left to the citizens of Chatham to oversee with a designation less than wilderness through Town Meeting policy setting, consistent with Federal and State legislation and regulation."

Response: Much of the opposition to the expansion of the Monomoy Wilderness Area onto Nauset/South Beach is no longer an issue, as the lands east of the management boundary established in the MOU between the Service and the Town will be managed by the Town and will not be designated as wilderness. All lands to MLW west of the management boundary are Federal wilderness, as this is the designation made by Congress. We are not seeking to designate a new wilderness area and therefore do not need to follow the process outlined in the Wilderness Act for designation of new areas or adding excluded lands to existing areas. Updating the description of lands designated as wilderness because the boundary has changed through accretion or erosion is not the same as adding new areas, such as the excluded areas from the original designation.

Generally, when an ambulatory boundary (here it is MLW) is established, the upland land owner gains with accretion and loses land with erosion. As coastal islands and landforms gain and lose land all the time, a contrary rule would be impossible to use—it might literally require re-surveying day-to-day. Whatever area was encompassed within the wilderness area in 1970 has been dramatically altered by the changes which have occurred since. However, only Federal lands may be designated wilderness. If the Federal land were joined to other land by accretion, the non-Federal land would not thereby become wilderness. This is our understanding of what has happened in the Nauset/South Beach area, as discussed above. The part of Nauset/South Beach that is owned by the Town is not within the wilderness boundary, and the lands to the north and east of the management boundary are not being designated as wilderness either.

Designation of Excluded Lands and Additional Waters as Wilderness
(ID# 63, 153, 244, 264)

Comment: The Cape Cod and the Islands Group Sierra Club felt that the refuge should expand the wilderness area to include the current exclusions and marine areas, writing, "In Plan B, the USFWS chooses to leave two sections on Monomoy out of Wilderness designation. These areas should be managed to become as much as possible under the designation. The USFWS should pursue marine wilderness designation within all of it's western boundary, not just on land. Protection of the benthic environment, including submerged aquatic vegetation, such as eelgrass, should be a priority." The Town through its Chairman indicated that maintaining Inward Point and Powder Hole as designated non-wilderness was an issue of potential concern. We read this comment to mean that designating these areas as wilderness would be a concern.

Response: We believe that the two exclusion parcels will be formally designated as wilderness in the future, when they fully meet the criteria established by Congress in the Wilderness Act. Until that time, we will treat them as if they are wilderness to the maximum extent possible. We do not agree that lands below the MLW line but within the Declaration of Taking should be included in the Monomoy Wilderness.

Predator Control Structures in Wilderness Area
(ID# 192)

Comment: Wilderness Watch was concerned that the installation of predator control structures (e.g., fencing, nesting platform, etc.) would violate the Wilderness Act. They wrote, "The final CCP and EIS must adequately address whether the structures proposed for predator control are "necessary to meet minimum requirements for the administration of the area for the purposes of [the Wilderness] Act."

Response: We manage Monomoy NWR both for its wildlife and wilderness purposes. These are co-equal purposes which sometimes can be at odds with one another. Much of Monomoy NWR is not actively managed by refuge staff. Our passive management allows for natural processes to occur in the majority of the wilderness area, and for wildlife to interact with each other in the habitat. However, at certain times of year, and in certain parts of the refuge, we take specific actions to protect and conserve our most imperiled and important trust resources –federally and State-listed fauna and other wildlife of major conservation concern. Included in this is the need to protect piping plovers from predators and enhance nest success for roseate terns, both of which are threatened and endangered species. The temporary physical structures we use are relatively innocuous and are only in place for a few months. Tern shelters, which are small and unobtrusive, are only used on the part of the refuge which is seasonally closed to the public to protect the tern colony. We do acknowledge that the plover exclosures are more visible and more likely to be seen by refuge visitors. We include the use of these structures for the purpose of protecting and conserving these species in our Minimum Requirements Decision Guide. Please see Appendix E in the final CCP/EIS for more information.

Limit Commercial and Recreational Uses in Wilderness Area
(ID# 192, 276)

Comment: Wilderness Watch wrote, "Commercial activities, like commercial shell-fishing, are prohibited in the Monomoy Wilderness under the…Wilderness Act…The U.S. Fish and Wildlife Service must adequately examine this violation of the Wilderness Act…and block this illegal activity with the final CCP and EIS." Another individual wrote, "I do think it is quite appropriate to significantly limit commercial and recreational human activities within this [federally designated wilderness] area."

Response: We are committed to the preservation of wilderness character in Monomoy Wilderness. Not only have we have modified how we conduct refuge management activities, but we are proposing modifications to visitor use in an effort to ensure that wilderness values are considered and achieved to the greatest extent possible. Some traditional recreational beach uses are not allowed because they are not appropriate or compatible with the management of refuge resources. This prohibition also supports preservation of wilderness character. We propose to institute a concessionaire system which will help support compatible recreation on the refuge. The concessionaire will provide interpretation about Monomoy Wilderness and will help ensure that visitors who access the refuge through the concessionaire are distributed throughout the refuge in a manner to preserve wilderness character.

We believe we can permit shellfishing under the Wilderness Act as long as it is compatible with refuge purposes and can be conducted in a minimally intrusive manner using hand tools and without mechanical transport or motorized equipment, and in a manner which preserves wilderness character. The Wilderness Act states that "…each agency administering any area designated as wilderness shall be responsible for preserving the wilderness character of the area and so shall administer such area for such other purposes for which it may have been established as also to preserve its wilderness character. Except as otherwise provided in this chapter, wilderness areas shall be devoted to the public purposes of recreational, scenic, scientific, educational, conservation, and historical use" 16 U.S.C. 1133(b). An historical use occurring since well before designation may accordingly be within the purposes to which a wilderness area may be devoted. The Act goes on to state that "except as specifically provided for in this chapter…there shall be no commercial enterprise and no private road within any wilderness area…" 16 U.S.C. 1133(c). However, the purpose of historical use is specifically called out in §1133(b), leading to a question of when, if ever, a historical use that is commercial might be nonetheless allowable under the Act. "A wilderness area is an area of Federal land retaining its primeval character and influence, without permanent improvements or human habitation, which is protected and managed so as to preserve its natural conditions and which (1) generally appears to have been affected primarily by the forces of nature, with the imprint of man's work substantially unnoticeable; (2) has outstanding opportunities for solitude or a primeval and unconfined type of recreation…" 16 U.S.C. § 1131. We conclude that a historical use that does not disturb the wilderness character of an area may be permitted, even if commercial in nature, as such historical uses are within the purposes of the Act.

Commercial harvest of soft-shell clams and quahogs by private individuals on the flats predates refuge establishment by more than a century and, at a low level, does not affect the primeval landscape or interfere with the opportunities for solitude. A use of the land that was historical, does not affect the natural condition of the land, leaves the "imprint of man's work" substantially unnoticeable, and leaves unaffected opportunities for solitude or a primeval and unconfined type of recreation, should be held within the purposes to which a wilderness area may be devoted, and may be permitted despite being commercial. A person with a rake and a basket collecting clams has no different impact on the landscape if he or she eats them, or if they subsequently sell the clams, and the Service has no effective means of ensuring that clams collected are never sold. The Service has allowed clamming since refuge establishment and has determined that commercial clamming at the same scale and in the same manner that has occurred historically is compatible under the Refuge System Improvement Act (16 U.S.C. 1668dd). We have also reviewed applicable case law, and believe that commercial clamming is within the purposes of the Monomoy Wilderness, as it is an historical use, and may be permitted so long as the methods used are those historically employed, are the minimum necessary, and that the activity does not otherwise impact wilderness character.

Wheeled Carts in Wilderness—Opposition to Ban

(ID# 59, 64, 86, 164, 181, 242, 243, 256, 259, 261, 266, 267, 279, 294, 296)

Comment: The Town, the MA DMF, and several others were concerned with the proposed restriction on the use of wheeled carts in the Monomoy Wilderness. Most felt that the ban will have a significant negative impact on local shellfisherman and that there was insufficient discussion in the draft CCP/EIS of how the prohibition on the use of carts will affect shellfishermen and the local economy. Others disagreed with our interpretation of the Wilderness Act and its ban on mechanized transport. One commenter said that "Congress did not have in mind someone pulling a simple hand cart to transport shellfish" and that Congress did not define "mechanical transport." This same individual cites 36 CFR Sec 293.6(a) which identifies mechanical transport as any contrivance which travels over ground, snow, or water on wheels…and is propelled by a nonliving power source." He feels that the hand carts are not propelled by a non-living power source and there fore their continued use should be allowed. Others felt that wheeled carts do not cause damage to refuge's biological

resources and/or will not detract from wilderness character. One commenter writes, "Today's hand cart incorporates inflatable tires which effectively distribute the weight without causing harm to the resource. With two flood tides per day, any evidence left by hand cart use, much like footprints, is nonexistent." Some were concerned that alternative forms of transportation (e.g., using sleds, dragging bags) are more likely to detract from wilderness character and damage refuge resources. The Town writes, "Without hand trucks, shellfish fishermen would have to make many trips to their skiffs, thereby leaving a larger footprint on the tidal flats."

Response: Congress did not merely mention "motorized transport" but added "other forms of mechanized transport" to the ban, thus implying that the ban should encompass transport that was "mechanized," or mechanical, but not necessarily "motorized," or dependent on some motor. See 16 U.S.C. § 1133(c). When Congress passes a law, regulations are often promulgated to implement that law if it needs further interpretation to be applied. Often, Federal agencies then develop policy to further explain how that agency will comply with the law and its regulations. The Federal regulation that is cited above applies to wilderness in national forests. It does not apply to wilderness area on national wildlife refuges. The FWS defines mechanical transport as "any device for moving people or material on, over, or through land, water, or air that has moving parts, provides a mechanical advantage to the user, and is powered by a living or nonliving power source. This includes, but is not limited to, sailboats, hang gliders, parachutes, bicycles, carts, and wagons." It does not include sleds, travois, or similar devices (*http://www.fws.gov/policy/610fw1.html*, accessed March 2015). Our policy further explains that the Wilderness Act generally prohibits the use of motorized vehicles, motorized equipment (including motorized portable tools), and mechanical transport in wilderness, and therefore we also generally prohibit these uses for refuge management activities in wilderness unless we determine they are: (a) the minimum requirement for administering the area as wilderness and necessary to accomplish the purposes of the refuge, including Wilderness Act purposes, (b) an existing private right, (c) authorized by the designated legislation, or (d) required to respond to a human emergency, damage to property, violations of civil and criminal law, or other emergencies within the wilderness area. Our policy allows us to make exceptions to the generally prohibited uses for refuge management activities if the prohibited uses are the minimum requirement for administering the area as wilderness and are necessary to accomplish the purposes of the refuge, including Wilderness Act purposes (*http://www.fws.gov/policy/610fw2.html*, accessed March 2015). We cannot find that the use of carts by shellfishermen in the Monomoy Wilderness is necessary to either administer the area as wilderness or to accomplish the purposes of the refuge. We do not agree that there will be impacts to refuge resources if sleds or travois or other non-mechanical means are used in the Monomoy Wilderness. Therefore, our position on the use of wheeled carts has not changed. For more information on wilderness, readers are referred to *http://www.wilderness.net* (accessed March 2015).

Wilderness Access Pass

(ID# 86, 131)

Comment: One individual wrote, "I am somewhat wary of the wilderness permit requirement. I had a permit for parking lot 7b and dinghy storage for about 25 years. That ended. I had special use permits for being allowed to access clam flats behind closed area signs. That ended. Now we will be required to get a wilderness permit to be present in the wilderness area. What is to stop that permit from ending like the others? I would like some kind of guarantee."

Response: Our final CCP/EIS proposes that, over the next few years, we explore the feasibility of requiring a wilderness pass. That evaluation will include consideration of its purpose, what would be allowed under the pass, who it would apply to, when it would be needed, etc. We indicate in the final CCP/EIS that its purpose would be to help educate the public about the wilderness designation of the refuge, refuge wildlife and our management actions and to inform visitors about appropriate use while in the wilderness. If there is a need to limit the number of people in the wilderness at any one time in order to maintain the solitude character of Monomoy Wilderness, we can use the access pass to help us achieve that. Solitude is one of aspect of wilderness character which we are required by law to preserve.

We will be preparing a Wilderness Stewardship Plan (WSP) in the next few years, as required by Service wilderness policy (see *www.fws.gov/policy/610fw3.html*; accessed March 2015). The WSP, which is a step-down management plan, must identify the strategies and actions we will use to preserve the wilderness resource. It must also clarify the linkage between those strategies and actions and the wilderness goals and objectives identified in the CCP. Additionally, the WSP must contain indicators, standards, conditions, or thresholds that define adverse impacts on wilderness character and values that will trigger stewardship actions to reduce or prevent those impacts. If we believe it is necessary to use a wilderness access pass as a means to

preserve wilderness character, we will propose a system that provides for maximum compatible public use while protecting wildlife resources and wilderness character. We can develop this pass with participation from the public. If we determine that we will charge a fee for this pass, there is an additional process that must be conducted. There will be many opportunities for public involvement should we decide that a wilderness access pass is necessary.

This is quite a bit different from the permit that we issued for years to private individuals to use the Stage Island lot for parking and dinghy storage. That was never a guaranteed use but was something that we allowed because it did not interfere with refuge operations. As our needs changed, we re-evaluated that use and determined that at times private use of the lot impeded refuge operations. While we never gave any permit holder the impression that they had a lifetime use of the lot, it is understandable that there would be concern when the use was no longer allowed, especially for those who had the privilege of using it for about 25 years. We are sure those who did have access to the lot are grateful for the opportunity and the benefit that we provided to them for all those years.

5. Biological Environment

Migratory Birds—Opposition to Closures for Shellfishing

(ID# 136, 162, 164, 256, 261, 267)

Comment: Several commenters expressed opposition to closures and restricted beach access, specific to shellfish harvesters. One commenter noted that "The south beach area has been an important fishery for local shell fishermen. It would be irresponsible for the management of this area to exclude the human factor." Another commenter noted that the Town works with staff from several partner organizations and "shorebirds are well-protected by the Town and there is no need to change the existing system." Two commenters also noted that shellfishing activity disturbs the substrate, thus providing a benefit to birds. Finally, one commenter noted that shellfish harvesters should be exempt from the proposed expansion of the temporary seasonal closures to protect migratory shorebirds along the intertidal and saltmarsh interface. This commenter noted that "the USFWS recognizes that shellfishing is a passive activity that is not detrimental but beneficial to shorebirds. In fact, I have personally witnessed red knots feeding through the disturbed substrate where I have been raking for quahogs. So although the aim of the USFWS is to protect wildlife within these areas by banning access to the visiting public, it should welcome shellfishing and allow harvesters access during these seasonal closures."

Response: We appreciate the comments relative to shellfishing access, but will continue to implement seasonal closures to benefit migrating shorebirds, and closures established for migrating shorebirds will apply to all pedestrians. We discussed the importance of Monomoy NWR to migrating shorebirds in chapter 2 and the importance of providing stopover sites that provide abundant food and a relatively disturbance-free environment for migrating shorebirds in chapter 3. Research we conducted on Monomoy NWR suggests that implementing a buffer of 61 to 97 meters at important foraging sites that are subject to frequent disturbance should benefit smaller shorebirds, but larger buffer distances (113 to 186 meters) should be implemented to benefit larger shorebirds including red knots and American oystercatchers (Koch and Paton 2014). We acknowledge that it is not currently practical, nor necessary, to close all of the intertidal foraging areas to pedestrian access. However, we will annually identify important areas that consistently support foraging and staging shorebirds and close areas that are subject to high levels of disturbance. The saltmarsh-intertidal interface on portions of Monomoy NWR is frequently an area of shorebird concentration, as shorebirds try to maximize their foraging time on the flats as they are becoming exposed with a receding tide (first foraging opportunities after high tide), or alternatively becoming covered by an incoming tide (last foraging opportunities before high tide). This interface is also often characterized by more disturbances because there is less habitat available to shorebirds during this time. Therefore, we may implement a small expansion to the closures around the saltmarsh, to provide a buffer to foraging shorebirds maximizing their foraging time, as well as to ensure an adequate buffer for shorebirds that roost in the saltmarsh during the high tide period. Additionally, we plan to initiate an outreach campaign to provide information to all visitors about the importance of minimizing disturbance to migrating shorebirds and hope to increase self compliance during lower tides when the majority of the intertidal flats are exposed.

We also acknowledge that our research did show that microhabitats with recent shellfishing activity had a positive influence on the density of two species (ruddy turnstone and American oystercatcher), while the presence of shellfishermen did not appear to affect the density of other species of shorebirds we monitored (Koch and Paton 2014). These conclusions are largely based on observation of shorebirds and shellfishermen located on the intertidal flats at lower tides, not at higher tides nearer the saltmarsh-intertidal interface. In addition, shellfishermen density was relatively low during the study. Therefore, although this supports our position of not needing to close the entire intertidal habitat area at this time, it does not provide support for allowing shellfishermen in closed areas where shorebirds may be more concentrated and more vulnerable.

Emphasis on Protection of Birds

(ID# 54, 155, 234, 244, 272)

Comment: Mass Audubon, the MA DFW, and two individual commenters all expressed support for placing increased emphasis on protecting priority coastal bird species collectively noting piping plovers, roseate, common, and least terns, migratory shorebirds including red knots, migrating falcons, and, northern harriers. Mass Audubon stated that given the wilderness mandate, "…the USFWS' charge to manage refuge lands for wildlife conservation, and the regional importance of the site to birds, Mass Audubon urges that the final CCP provide the greatest possible protection of coastal and migratory birds." The MA DFW also stated that "Monomoy NWR is a site of Statewide and regional importance for State-and federally listed coastal waterbirds, including the Piping Plover, Roseate Tern, Common Tern, and Least Tern. Its size, location, and habitat quality provide the basic foundation to support these vulnerable species, yet the site must be thoughtfully, intensively, and consistently managed in order to provide the appropriate conditions to allow nesting birds to successfully raise young." They further added that "Because the site is actively accreting, while many other coastal waterbird nesting sites are eroding, the refuge's responsibility to protect and enhance beach nesting birds is likely to grow in the future." Further supporting this statement, Mass Audubon noted that "Additional support and expanded scope (spatially and programmatically) should be placed on increased wildlife management and protection as the primary objective." The MA DFW also noted the importance of managing a network of important sites to safeguard against environmental disasters, predation, or unexpected events. Mass Audubon noted the importance of managing South Beach and South Monomoy Island as one unit, which will result "in more consistent and stronger protection for beach-nesting birds," including implementation of predator removal (not currently allowed on town-owned land). The Cape Cod Group of the Massachusetts Chapter of the Sierra Club also commended our bird protection efforts.

Two of these commenters also submitted substantial support for protecting intertidal foraging areas and high-tide roost sites used by migrating shorebirds on Monomoy NWR. One commenter supported limiting shellfish harvesting to reduce human presence and loss of breeding-age shellfish, and the other commenter suggested that even though human disturbance may not be an issue presently in intertidal habitats, it could become so in the future. It was also noted by a commenter that the western refuge boundary excludes some key foraging habitat of red knots and other shorebirds on flats northwest of Minimoy Island.

Lastly, one commenter noted that the draft CCP did not adequately describe and address the importance of the refuge during higher tides as a resting site for migrating shorebirds, including red knots and whimbrels. Specifically, the commenter stated "…Monomoy NWR lands serve as high tide and nocturnal resting locations for migrant shorebirds, many of which travel far off refuge lands during their foraging periods." The commenter further notes "…the major high tide resting locations of shorebirds on all of Cape Cod are within the boundaries of Monomoy NWR. Other suitable resting areas such as North Beach or North Beach Island have higher disturbance rates from humans; flight lines of shorebirds can be seen passing these locales enroute to Monomoy NWR."

Response: We appreciate the support for our continued focus on the management and protection of coastal waterbird species, and also acknowledge the importance of collectively managing a network of sites with partners to benefit these species now and in the future. We are happy to share our expertise and assistance with partners to protect shorebirds in this area. Within this entire area, predator management is integral to successful management of coastal nesting birds. We discuss our commitment to this in detail in the final CCP/EIS appendix J.

While management for nesting northern harriers is not a top priority at Monomoy NWR, we believe protection of the coastal dune system, continued awareness by refuge staff that take care in minimizing their disturbance to nesting adults, and support for a thriving common tern colony (we do not manage harriers that are preying on terns), are all beneficial to northern harriers. We have also added a strategy in chapter 3, under Objective B1.1 (Dune Grasslands) to facilitate future survey efforts by the MA DFW. We also appreciate the support for the protection of migrating falcons. Although we do not actively manage to benefit falcons, we acknowledge that they utilize habitat in and around the refuge, and we participate in migration surveys when we can.

We also appreciate feedback regarding management of intertidal areas as it relates to migratory shorebird protection. With respect to limiting shellfish harvesting, we agree. Seasonal closures that incorporate intertidal and saltmarsh habitat for migratory shorebirds will certainly coincide with areas of shellfish populations. These closures will apply to all human access, including access by shellfishermen. Further, the refuge will not allow mussel harvesting anywhere on the refuge to protect this resource for red knots, common eiders, and other waterbirds.

With respect to minimizing human disturbance to migratory shorebirds, we also agree. We discuss the importance of the refuge to migratory shorebirds, with an emphasis on intertidal areas in chapter 2. We discuss this further in the context of management at Monomoy NWR in the rationale sections of Objectives A1.7 and B1.7. Specifically, we note "Given the levels of pedestrian traffic at Monomoy NWR in recent years, we think a small expansion of the current seasonal closures described in alternative A is sufficient to reduce most disturbance to migratory shorebirds using this stopover site. However, if the amount of pedestrian traffic were to increase substantially, we may need to adjust closures further during peak migration periods." Thus, we agree that levels of human disturbance must be monitored, and we reserve the right to implement closures in the future if deemed necessary to provide relatively disturbance-free foraging and roosting areas for migrating shorebirds.

We also agree that we did not adequately describe and emphasize the importance of the high tide roosting habitat which Monomoy NWR provides to migrating shorebirds. We appreciate the references the commenter submitted. We have updated the text in chapter 2 (Birds Section, Migratory Birds Subsection) to address these omissions. We have also updated the strategies in Objectives B1.7 (Intertidal) and B1.9 (Salt Marsh) to better incorporate shorebirds.

Predator Control—Opposition to Lethal Control

(ID# 59, 132, 164, 238, 244, 261, 264, 267, 273)

Comment: A number of individuals opposed lethal predator control and stated disagreement with the methods that the refuge is currently proposing or has used in the past. The Cape Cod and Islands Group of the Sierra Club and several individuals requested that we find a non-lethal means of controlling predators. The Sierra Club specifically stated that they oppose "the use of non-selective and often mis-used predator control techniques such as poisons, bounties, and aerial shooting" and "predator control aimed at creating artificial surpluses of other wildlife species." One individual writes, "…I disapprove of the practice of lethal predator management. I understand the need to protect nesting birds, but there must be a way to defend the sites without fatally targeting predatory species. I do not think it is morally right to kill one species to promote another." One commenter stated that, "If you are not one of the few species [the refuge is] protecting, the wildlife is shot or killed."

Response: We tried to make clear the importance of predator control in appendix J, knowing that many individuals and some organizations are opposed to any form of lethal control. We share a dislike for lethal control, but believe it is sometimes necessary. As we stated in appendix J, "Throughout North America, the presence of a **single** (emphasis added) mammalian predator (e.g., coyote, skunk, and raccoon) or avian predator (e.g., great horned owl, black-crowned night-heron) at a nesting site can result in adult bird mortality, decrease or prevent reproductive success of nesting birds, or cause birds to abandon a nesting site entirely (Butchko and Small 1992, Kress and Hall 2004, Hall and Kress 2008, Nisbet and Welton 1984, U.S. Department of Agriculture (USDA) 2011). Depredation events and competition with other species for nesting space in 1 year can also limit the distribution and abundance of breeding birds in following years (USDA 2011, USFWS 1998-2009). Predator and competitor management on Monomoy NWR is essential to promoting and protecting rare and endangered beach nesting birds at this site, and has been incorporated into annual management plans for several decades."

We employ many different predator management techniques on the refuge, most of which have been outlined in the draft CCP. Non-lethal measures consist of maintaining a staffed field camp or human presence, using triangular signs, habitat management, placement of chick shelters, use of electric and non-electric net fencing, and use of piping plover nest exclosures. These techniques will continue to be deployed as often as possible as a first attempt to control predator populations through non-lethal means.

As described in the final CCP/EIS, appendix J, native species are only targeted when they are actively depredating resources of concern including federally listed species. Non-native species, including eastern coyotes, are controlled lethally when present on the refuge during the nesting season (between April and September). We reject accusations that the Service kills any species that is not one of the few we protect. In fact, it is quite the opposite. The refuge has a specific list of species that are considered predators (see appendix J in the final CCP/EIS) and what behaviors they must be exhibiting to fall into this category. We do not kill any species without proof of direct impacts to focal species. We protect all other species on the refuge regardless of whether we have specific management objectives that apply to them or not.

We understand that many commenters still disagree with the management of gulls that took place on the refuge in the 1980s and 1990s involving the toxicant DRC1339. Those comments were addressed in the April 1996 environmental assessment. We learned from our past successes and challenges in gull management, and have adapted our predator management program as a result.

We recognize that there is a certain amount of complete opposition to lethal control and we do the minimum necessary to protect our trust resources including federally listed species. All lethal techniques used are selective and are performed by trained personnel, and target species are removed in a way that is as humane as possible. We are not currently using non-selective means and we do not have goals of creating artificial surpluses of any wildlife species, including federally protected species.

Predator Control—Support for Selective Predator Management

(ID# 155, 227)

Comment: One commenter stated specifically that they support our program to selectively control predator populations for the protection of beach nesting bird species. Additionally, Mass Audubon provided support for the expansion of predator management onto South Beach to benefit nesting species.

Response: Predator management has become a necessary part of our management efforts for native species and we believe that it is an important tool. We are willing to share our expertise with the Town so that predator control efforts could be employed on South Beach to protect nesting species. We have made some minimal changes to the predator management appendix; please refer to appendix J.

Predator Control—Impacts to Non-target Species

(ID# 261, 264)

Comment: Two individual commenters questioned the decline in the refuge deer population and whether or not this was related to predator control on the refuge or toxicants used to kill gulls in the nineties.

Response: No culling of deer or any management actions to either promote deer populations or remove deer from the islands has taken place. We do not intend to manage deer in the future. There have been deer on the islands in recent years, though numbers are down. There have been no poisons or avicides used on the refuge since 1996. We believe that the recent decline in deer numbers is not related to toxicants of any kind.

Northeastern Beach Tiger Beetle

(ID# 84, 244)

Comment: The Cape Cod Group of the Massachusetts Chapter of the Sierra Club "applaud(ed) the success of our Northeastern Beach Tiger Beetle program."

Response: We are excited about the results associated with our beach tiger beetle program. Objective B1.5 in the final CCP/EIS includes details of our proposal to maintain the program.

Gray Seals
(ID# 90, 162, 210, 251, 260, 268, 269)

Comment: Several individuals felt that the draft CCP/EIS did not adequately address the issue of gray seals. In particular, individuals were concerned that the growing gray seal population would negatively impact other marine resources, fisherman, nesting, and migrating bird species, as well as limit other public uses (e.g., closing of beaches due to increase in great white sharks, which are seal predators). Comments also questioned data presented in the report, stating that the seal numbers are in the millions and are out of control. Some commenters suggested that the refuge attempt to control the seal population.

Response: We do not have any information to date that suggests the number of seals using the refuge is negatively impacting marine resources, fisherman, or nesting, migrating, and wintering bird species but we welcome the sharing of reports or data that address these concerns. Increasing seal numbers on the refuge are not necessarily indicative of an increasing population of seals in the Northeast, as local seal haul-out sites can change seasonally and between years. The National Oceanic and Atmospheric Administration (NOAA) conducts aerial flights that are used to track seal numbers and distribution, and these surveys provide a sense of overall importance of Monomoy NWR compared to other sites in Massachusetts. Currently, there is not an accurate estimate of the total population. As stated in the CCP, the most recent count was 10,600 individuals hauled out on the refuge in March 2011.

We are not proposing lethal control of the seal population on the refuge. Gray seals are federally protected by the Marine Mammal Protection Act (MMPA) and management of seals lies primarily with NOAA. The FWS has an affirmative responsibility to protect wildlife and comply with Federal laws on the refuge. When seals are present on refuge lands above mean low tide, they fall under the jurisdiction of the Service but are still protected under the MMPA. We are currently managing seals in a manner that is consistent the MMPA, specifically to educate visitors and boaters to maintain a 150-foot minimum distance from seals.

The increase in seal numbers on the refuge and the increase in great white shark numbers in the area may not be related (Bradford 2013). The Woods Hole-based Northwest Atlantic Seal Research Consortium, which included many partners along with refuge staff, is a good resource for people interested in this relationship. Visit *http://nasrc.whoi.edu/research/sharks* for more information on the relationship between sharks and seals (accessed 30 January 2015).

In 2009, Kristen Ampela completed a Master's thesis at the City University of New York that studied the diet of Gray Seals by analyzing scat samples collected on Monomoy NWR (The Diet and Foraging Ecology of Gray Seals (*Halichoerus grypus*) in United States Waters). The intention of the research was not to quantify interactions between gray seals and commercial fisheries, but it provided information on exactly what the seals in the area surrounding the refuge are eating. This may be helpful to commenters interested in the diet of gray seals. Sand lance, a main prey item of common and roseate terns, was also shown to be an important part of the gray seal diet (Ampela 2009). Impacts to this fishery would be of high importance to the refuge, but currently based on number and productivity of terns in recent years, there does not seem to be a negative impact from seals on the sand lance population (Iaquinto 2015, personal communication). The refuge would be interested in future research on this topic. Seals may have an impact on other fisheries (the winter flounder fishery was mentioned in the thesis as possibly being impacted by seals), but the extent is unknown (Ampela, 2009).

Commenters may be interested to know that a group of scientists and fishermen have been collaborating to identify the impacts that seals have on commercial fisheries. During a meeting in 2009 and 2011, some of the needs of these parties were identified and compiled in a report titled, "Gulf of Maine Seal—Fisheries Interactions and Integrated Research" (Nichols et al. 2011). This document provides information that will be helpful to commenters concerned about the impact of seals and can be accessed online at the following website (*http://www.whoi.edu/fileserver.do?id=129565&pt=2&p=41026*; accessed 2 February 2015). Staff from the refuge participated in this meeting and look forward to being part of a dialogue with fishermen and other local stakeholders in the future on this issue.

Regarding comments that stated seals cause water pollution, we have provided the most current research in chapter 2 of the CCP regarding the presence and absence of entercocci bacteria on beaches near haulouts used by seals. This is the most recent local research available. Commenters are encouraged to submit research that states otherwise.

State-listed Species
(ID# 155, 272)

Comment: The MA DFW and Mass Audubon both submitted comments noting the importance of Monomoy NWR to State listed species. The NHESP comments noted that Monomoy NWR is mapped as Priority and Estimated Habitat in the 13th edition of the Massachusetts Natural Heritage Atlas for seven species of birds, two species of plants, and one species of invertebrate. Mass Audubon also noted that although the CCP emphasizes federally listed species, the refuge is also important for State listed species, and these "should be explicitly acknowledged and protected as well."

Response: We appreciate the comments reiterating the importance of the refuge to State-listed species, and the additional information regarding State-listed species for which Monomoy NWR is designated Priority and Estimated Habitat. "Priority Habitat is based on the known geographical extent of habitat for all State-listed rare species, both plants and animals, and is codified under the Massachusetts ESA. Habitat alteration within Priority Habitats may result in a take of a State-listed species, and is subject to regulatory review by the NHESP. Estimated Habitats are a sub-set of the Priority Habitats, and are based on the geographical extent of habitat of State-listed rare wetlands wildlife and is codified under the Wetlands Protection Act, which does not protect plants. State-listed wetland wildlife species are protected under the Massachusetts ESA as well as the Wetlands Protection Act." (*http://www.mass.gov/eea/agencies/dfg/dfw/natural-heritage/regulatory-review/regulatory-maps-priority-and-estimated-habitats/*; accessed February 2015).

Several State-listed species for which the refuge is designated Priority and Estimated Habitat (common terns, roseate terns, least terns, piping plovers, and northeastern beach tiger beetle) are already incorporated into the biological objectives of our preferred alternative because of their federally listed status and/or the regional importance of Monomoy NWR to these species. Other species (arctic tern, northern harrier, pied-billed grebe) are noted in the draft CCP but not explicitly incorporated into biological objectives because we felt the biological contribution of the refuge to these species was less important than to other species. Finally, the two State-listed plant species (oysterleaf and American sea-blite) were inadvertently not discussed in the draft CCP. In addition to State-listed species for which the refuge is Priority and Estimated Habitat, additional State-listed species utilize Monomoy NWR regularly. We acknowledge that we did not include a section on State-listed Species in chapter 2, Affected Environment where the importance of the refuge could be highlighted to all State-listed species. Therefore, we have added a section in chapter 2, following the "Federally Listed Endangered or Threatened Species," and address all state listed species in this new section. We have also added several new strategies under the appropriate habitat-based objectives in chapter 3 to facilitate future survey efforts of these priority State-listed species.

Fowler's Toads
(ID# 54)

Comment: One commenter brought to our attention research that was conducted in the 1960s on Fowler's toads on Monomoy NWR. The commenter suggested that the researcher, W. Tordoff, who was a student at University of Massachusetts at the time, may have shown that the Fowler's toads on the refuge represented a unique subspecies.

Response: We always appreciate receiving information about work that was conducted on the refuge, especially in years that predate the current staff's time. We have located a report which is an Honors Thesis titled "Some aspects of the biology of Fowler's toad, *Bufo woodhousei fowleri*, Hinckley, on Monomoy Island, Chatham, Massachusetts" (Tordoff 1965). This study focused on documenting the breeding behavior, phenology, growth, and breeding pond habitat variables (such as salinity and temperature) of Fowler's toads on the south end of South Monomoy Island. However, we do not find any indication in this report that suggests Fowler's toads on Monomoy NWR represent a unique subspecies.

We also inquired with the NHESP to determine if they had information regarding the Fowler's toads. Following is their response: "The taxonomic history of Fowlers Toad is confused because naturalist S.P. Fowler reported on the discovery of a new species of toad from Danvers, MA, at a meeting of the Essex Institute in 1858, and F.W. Putnam referred to it as *Bufo fowleri* in the Proceedings of the Essex Institute, but without any description. Putnam intended to publish a description but never did. At least two other naturalists did publish

brief descriptions that were intended to describe how to distinguish this species from the American Toad. However, a description of the tadpoles of frogs and toads from Milton, MA (the Blue Hills), published in 1882 by M.H. Hinkley, is now considered the original description of the Fowlers Toad. The Fowlers Toad was soon considered a subspecies of the Woodhouse Toad from farther west. It was known as *Bufo woodhousii fowleri* until they were separated into different species in 2002. No subspecies of Fowlers Toad were ever described. So, the Fowlers Toads of Monomoy are *Anaxyrus fowleri* with no subspecific recognition." (French, personal communication 2015). We have updated the scientific name of Fowler's toad to *Anaxyrus fowleri* in Appendix A, Table A.3. We have not made any further additions to the text at this time, but we welcome any additional information regarding the potential unique subspecies on Monomoy NWR in the future.

Invasive Species
(ID# 225, 244)

Comment: The Cape Cod and Island Group of the Sierra Club and one individual encouraged the refuge to work to eradicate and control invasive species. The Sierra Club urged, "the USFWS to manage invasive species vegetation with a strong lean toward elimination. A plan to gradually reduce non-natives, such as Rosa Rugosa, Japanese Black Pine, Scotch pine and Red Pine, should be developed and native species be encouraged or, in some places, planted."

Response: We agree that invasive plant control and removal are very important and reflect that in our final CCP/EIS. We propose to have a greater focus in the future on invasive species control. In Objectives 1.9 through B1.11, invasive species is a main focus, including encouraging native species and maintaining less than 10 percent invasive species. Unfortunately, successfully achieving these objectives will only be possible if we are able to hire additional staff in the future.

Prescribed Burning
(ID# 90, 261)

Comment: One commenter stated that burning the beach grass on the refuge destroys the plant itself which is critical to maintaining the island and preventing erosion. At the public hearing, the same commenter stated that the refuge staff is trampling beach grass to enter the dunes every day and that the Town has managed South Beach the right way since they have not burned habitat amongst other things. Another commenter indicated a control burn is still a burn but used to beneficial effect.

Response: We reject the implication that we are destroying the dune habitat by trampling and burning beach grass. The refuge staff makes every effort possible to minimize impacts to beach grass. For example, we use two main paths of entry to access the tern colony from the beach and one trail to access the colony from our field camp. This minimizes disturbance to nesting terns. In addition, we travel by beach when at all possible to get from place to place on the refuge. We specifically stick to established trails so that habitat is not trampled. Bird disturbance in the tern colony is limited to that is necessary for data collection. Blinds are used for most observations and birds are only disturbed while staff is entering and exiting the colony.

Prescribed burning can be used very successfully to maintain early successional habitat (i.e. grasslands) and prevent the encroachment of woody vegetation. In particular, the refuge has utilized prescribed fire to maintain nesting habitat for common and roseate terns. Our management efforts have focused on reducing the abundance and height of woody species such as the non-native rugosa rose and bayberry. Prescribed burns are conducted in the fall, after the departure of nesting seabirds and the plants have gone dormant for the winter.

The commenter stated that burning beach grass destroys the root system of that plant. This is incorrect. It is not true that burning beach grass kills it and prevents it from protecting the island from erosion. Beach grass is known for having particularly strong underground stems called rhizomes that spread beneath the sand and give rise to new plants (Miller and Peterson 2006). These rhizomes can survive deep under the sand and continue to sprout new growths despite being buried (Miller and Peterson 2006). Rhizomes under the sand are able to survive even severe burns during the dormant season and will regenerate rapidly once the growing season resumes (Brown et al. 2000).

Climate Change
(ID# 136, 208, 235, 244, 252)

Comment: A few individuals expressed concerns about climate change and its potential impact on the refuge and its wildlife. One said that they are heartened to see that the Service has been reviewing this subject, and urge increased focus on the issues. One noted that global warming with its attendant rise in sea level and an increasing intensity of storms poses a danger of increased washovers on Monomoy which would prove to be tremendously disruptive to the migrating and nesting birds. Another thought that, "with the corrosive effects of climate change and sea level rise inevitable, don't add to them with plans for increasing human impact." The need for more research on ocean acidification, warming seawater and other environmental factors was noted.

Lastly, one commenter expressed concern that nowhere in the CCP/EIS does it discuss the alternative of governmental actions to reduce significantly the rate of sea level rise. This commenter specifically mentioned the use of solar radiation management to reduce sea level rise. He further stated that we need to address this in the final CCP/EIS in order to comply with the National Environmental Policy Act (NEPA), as "The case of NRDC v. Morton, 458 F.2d 827 (D.C. Cir. 1972), holds that an EIS must discuss all reasonably available alternatives, whether or not their implementation is within the jurisdiction of the agency proposing the action that is the subject of the EIS."

Response: Identifying the impacts of climate change and how to address these impacts through mitigation or adaptation can be an overwhelming task. We support the President's Climate Action Plan and the Department of the Interior's climate change efforts. The FWS has established a Climate Adaptation Network which we can tap into to learn more about ways to address climate change in our work and on our lands. Executive Order 13653 defines adaptation as an adjustment in natural or human systems in anticipation of, or response to, a changing environment in a way that effectively uses beneficial opportunities or reduces negative effects. For the Service, adaptation to climate change involves planned, science-based management actions that we take to prepare for and reduce the negative impacts of climate change on fish, wildlife, plants, and their habitats (056 FW 1), as well as ecosystems, cultural resources, and facilities.

At Monomoy NWR, climate change including warming water temperatures has been identified by the Service as a serious management concern, as detailed in chapter 2. Sea level rise is also a concern, but less so as models show we are likely to gain salt marsh as a result of sea level rise. We are currently researching salt marsh elevations on the refuge as part of a regional coastal resiliency effort. We have spent less time discussing ocean acidification but agree that it merits additional thought, and would happily participate in regional research as resources allow. The ability of the waters on and adjacent to the refuge to continue to support the marine life that sustains the seabirds, shorebirds, and seals on the refuge is of paramount importance to refuge staff.

Chatham and the Monomoy Islands in particular have been constantly changing in form and structure in a cyclical timeframe and the islands change every year. Whether the intensity of the storms affecting Monomoy NWR is increasing due to climate change is beyond our capability to address. However, we are concerned about the impacts that major storms have on habitat for nesting and staging birds. The tern nesting area has remained fairly stable overtime so that it is available for the terns to nest. Certainly, if a washover occurred during the nesting season in the tern nesting area, we could lose a significant number of nests for that year. For other migrating birds, the impact of a washover would be less because of the large undisturbed beach and inland areas on North and South Monomoy for the birds to use. There can also be benefits to washovers as they can alter habitat making it more attractive to certain species of birds.

The Monomoy Islands are fragile, are routinely impacted by storm events, and may be imperceptibly stressed by climate change in ways we have not yet quantified. However, in addition to protecting nesting birds and endangered species, another part of our mission is to provide appropriate and compatible opportunities for wildlife-dependent public use. We will continue to manage these uses and allow them to continue as long as they do not detract from the primary purposes of migratory bird conservation and preservation of wilderness character.

We recognize that there are several technologies that could be available in the future to offset global warming. Solar radiation management, the act of introducing particles to the atmosphere to reflect sunlight or solar energy back into space, is one of them. This implementation of this technology is beyond the scope of this EIS so we did not address this issue. For further detail please view chapter 2, where we discuss global climate change and sea level rise, water quality, and other environmental factors. In chapter 4, we describe the direct,

indirect, short-term, and cumulative effects likely to occur in regard to climate change, water quality, and other environmental factors if the refuge management alternatives are implemented. Controlling sea level rise by introducing small particles into the stratosphere to reduce solar radiation and the Earth's temperature is beyond the scope of this EIS so we did not address this issue. We also do not agree that NEPA requires us to address solar radiation management in this CCP/EIS.

6. Priority Public Uses

Brochures and "Rack Cards"

(ID# 58, 90)

Comment: One individual requested that we put a Quick Response (QR) code on rack cards and place these cards in the Chamber of Commerce booth, and make information available to the public regarding access. Another commenter said that "brochures are so last millennium" and suggested that videos from refuge users, including some that we propose to prohibit.

Response: The Service has been utilizing QR codes in some instances at multiple refuges. We have been selected as a pilot site and have been using them for several trail guides at other refuges within the Complex. We will be requesting to use these types of tools as part of our outreach at Monomoy. We agree that videos can be an effective way to reach new audiences and have and will continue to use them on our refuges.

Recreational Fishing

(ID# 47, 236, 280, 284, 291)

Comment: Several individuals commented that they would like the refuge to continue to allow recreational fishing, with no additional restrictions or regulations. Also, one individual was concerned about proposed fishing hours, saying, "Hours of permitted use, 1/2 hour before sunrise to 1/2 hour after sunset! Mass State Regulation, which 'Refuge' pledges to abide by, does not set limited hours on salt water fishing."

Response: The State's regulations provide a framework that we work within, and we are pleased to continue to provide access to saltwater fishing 24 hours a day on Morris Island. Given the remoteness of the refuge lands (excluding Morris Island), we believe it is necessary to close North and South Monomoy and Minimoy Islands at night for resource protection and visitor safety, including for fishing. This closure has been in place for years on the refuge and does not constitute a change in public access. Some of these areas are also closed to public use seasonally to protect nesting or staging migratory birds. We do have the authority to set restrictions on refuge property for management reasons, and have done so and propose to continue so, for the reasons cited above.

Environmental Education and Interpretation

(ID# 59, 96,155, 210, 234, 235, 244, 270, 275)

Comment: Two commenters wrote, "…we find it commendable that the U.S. Fish and Wildlife Service wishes to upgrade their educational component and bring information about the area into schools. If funding is provided, more guided programs and informational self-guided tours would be wonderful." Some commenters liked these programs and believe they are great for visitors; others are concerned that they might come at the cost of our wildlife management programs or that that there could be unintended consequences of using the refuge to death. One commenter liked curriculum-based school programs and teacher workshops, but expressed concerns about geocaching. Another thought more programs seemed at odds with wildlife and habitat conservation. This commenter suggested more virtual tours, and that markers be erected at historic locations on the refuge. Mass Audubon stated their understanding that public visitation and use can advance conservation objectives, but cautioned that these uses be managed to cause no adverse impacts to wildlife. Others just expressed general support for more interpretative programs. The National Wildlife Refuge Association strongly supported actions which emphasize wilderness stewardship.

Response: We appreciate the support from some for an increase in our educational programs. We also appreciate the thoughtful insight from a few commenters about expanding our visitor services program, including environmental education and interpretation.

We have found virtual geocaching and letterboxing to be an appropriate use on the refuge. The opposition to utilizing geocaching is understood, however, we are proposing non-traditional geocaching where no items will be buried or kept in certain spots to find. Virtual geocaching can be enjoyed without a physical cache. All geocaching activities will be conducted only in areas that are open to the public, including the Morris Island Trail system, and designated areas on Monomoy NWR. Geocaching activities would also avoid sensitive areas prone to disturbance (e.g., sensitive vegetation areas) or degradation (e.g., soil compaction), and would be designed to minimize impacts to endangered species, nesting birds, or other breeding, feeding, or resting wildlife. We also have concerns about digging on the refuge or people going into environmentally sensitive areas that are not open to the public, and a virtual geocaching program addresses those concerns. We do not anticipate any additional impact to refuge resources from this use.

We appreciate the suggestion to erect markers to denote historic locations on the refuge. While we will not erect markers on the islands, because most of these locations are now in the Monomoy Wilderness, we will explore ways to share information about these sites to preserve them "virtually." This idea is consistent with one of our interpretation strategies in B2.2.

We are sensitive to concerns that our visitor opportunities might be over promoting Monomoy. There is often a fine line between protecting wildlife and providing access and programs for the public so that people can learn about the refuge and what we do. It is in our mission to provide opportunities for the American people to connect with our lands. Part of the refuge's outreach goal is to make a broader audience aware that the refuge exists and ensure citizens recognize they are welcomed to visit. And while we do not promote the refuge for economic purposes, we are pleased that there is an economic benefit to our host town as a result of our location in Chatham.

Photography
(ID# 236)

Comment: One individual supported limited photography on the beach or on trails, with no offtrail access into the brush.

Response: Wildlife photography is a priority public use which we accommodate in areas that are open to the public. Commercial photographers routinely request permission to access the refuge. Agency policies require a special use permit, and restrictions about the use of motorized equipment or mechanical transport in wilderness, as well as seasonal restrictions and closed areas to minimize disturbance to wildlife, will be stipulated in any permit issued for commercial purposes. Additionally, any commercial photography conducted in the wilderness area is not generally permitted by policy. It must be directly connected to and support the wilderness purpose of the refuge in order for a special use permit to be issued.

Waterfowl Hunting
(ID# 60, 63, 110, 153, 164, 231, 234, 235, 241, 243, 244, 265, 295)

Comment: Several commenters were concerned about or opposed the proposal to open the refuge to waterfowl hunting. Reasons cited included: concern over firearms and visitor public safety, concern that other wildlife (particularly shorebirds and raptors) might be disturbed by hunting, and the feeling that hunting "does not promote sound ecological management" and does not "fall within the guidelines of protecting the wilderness resources." One commenter was concerned that some waterfowl might be non-lethally injured by hunters and that harvested waterfowl might not always be retrieved. Another commenter requested that the proposal to allow waterfowl hunting receive further review and discussion. Similarly, the Association for the Protection of Cape Cod wrote, "The plan outlines efforts to enhance certain waterfowl populations for the apparent sole purpose of enhancing hunting targets. Hunting for waterfowl essentially for sport does not promote sound ecological management" and "that this seems to be a contradiction of the basic premise of the Migratory Bird Conservation Act…There appears to be no means of actively monitoring and managing the impacts of hunting on the protected resources…such monitoring should be integral to the overall management plan." The Cape Cod Group of the Massachusetts Chapter of the Sierra Club acknowledged that hunting can occur on refuges and requested that future planning receive further review and discussion. Others, including the MA DFG, supported waterfowl hunting. One commenter pointed out that, "Any provision to allow hunting must also contemplate and permit the presence and use of dogs on [Monomoy Refuge] during waterfowl season."

Response: Waterfowl hunting is a long-established recreational use on Cape Cod. The Refuge System Improvement Act of 1997 requires us to provide wildlife orientated recreation opportunities, which include consumptive uses such as hunting and fishing, when compatible with the purpose of the refuge. The Migratory Bird Treaty Act does not prohibit hunting, but in keeping with the Act, only 40 percent of the refuge is open to waterfowl hunting, thereby providing sanctuary areas on the refuge where waterfowl and other species can rest and feed relatively undisturbed.

Hunting on the refuge will be monitored to determine any adverse impacts to refuge resources, and we will adjust the hunt program if necessary to address any identified impacts. Federal and State waterfowl biologists monitor waterfowl populations and use national flyway data to help states set hunting season dates and limits on specific species to ensure a sustainable activity. Additionally, the Wilderness Act does not prohibit hunting, and offering a waterfowl hunt program will not diminish Monomoy NWR's wilderness character. We are aware that some disturbance to other wildlife by this activity will occur from time to time, however we believe that disturbance is very minimal and at an acceptable level to find this activity compatible with the purpose of the refuge. All waterfowl hunters, by law, must make a reasonable effort to retrieve all taken waterfowl. We encourage the use of retrieval aids such as watercraft and trained dogs as these greatly increase the hunter's ability to retrieve downed birds.

Before a waterfowl hunt program is established, we will complete an Environmental Assessment (EA) and develop a detailed hunt management plan. The hunt management plan will define areas, discuss methods, and propose refuge specific regulations that will ensure a safe environment for hunters and non-hunters and provide for a quality hunt. We expect every hunter to make a reasonable effort to retrieve downed game as required by law and encourage the use of trained retrieval dogs and watercraft to ensure all harvested birds are retrieved. Hunters are required to register with the State's Harvest Information Program (HIP) and obtain an individual HIP number which surveys hunters on season harvest numbers. We will require that all commercial guides obtain a special use permit from the refuge. Federal and State law enforcement officers will monitor and check hunters for compliance with Federal and State hunting laws. We are confident that we can offer a quality waterfowl hunting opportunity on the refuge that will be enjoyed by hunters without interfering with or impacting other uses of the refuge.

Firearms for Waterfowl Hunting

(ID# 86, 229)

Comment: Quitnesset Associates, Inc. wrote, "While we do not oppose [the] plan to officially open [the] refuge to waterfowl hunting, we note that…firearms are prohibited on Morris Island, as stated on the sign on Tisquantum Road. We will not tolerate the transport of firearms and ammunition over our property. Before any portion of the refuge is opened up for waterfowl hunting, [the refuge] must ensure that hunters with firearms approach the opened areas by means other than travel on Morris Island roads." Another commenter questioned whether guns are mechanical contraptions, and wondered why they could be used in wilderness when wheeled carts are not.

Response: The waterfowl hunting area on the Monomoy NWR is accessible by boat only. There are no authorized boat launches on Morris Island that hunters can use to access these areas. The hunt management plan that will be written before any establishment of a hunt program will further evaluate access including the role, if any, of guided waterfowl hunting under the auspices of a refuge-based concessionaire. It is only in this case where there is a possibility of hunters travelling to refuge headquarters with firearms. If so, then all hunters must have their firearms unloaded and properly cased for transport in compliance with State law.

The Service's policy on Wilderness Administration and Resource Stewardship (*http://www.fws.gov/policy/610fw2.html*, accessed August 2015), is clear that hunting is allowed in national wilderness areas. The policy is silent on the use of firearms, but since firearms are the main tools used by hunters to harvest game, it is clear that refuge hunters may use firearms when waterfowl hunting on the refuge.

7. Non-priority Public Uses

General Beach Activities

(ID# 62, 64, 84, 91, 94, 95, 98, 99, 101, 102, 119, 124, 125, 126, 128, 129, 138, 139, 142, 146, 148, 150, 155, 164, 168, 176, 181, 182, 184, 187, 194, 195, 197, 201, 203, 204, 207, 209, 210, 213, 217, 220, 223, 237, 239, 240, 258, 264, 273, 291)

Comment: Most of the comments we received on the issue of beach use stemmed from the changes that would take place on Nauset/South Beach. The Town and numerous individuals assert that general beach uses—such as sunbathing, swimming, beach sports, games, grilling, and kite flying—should continue in designated areas and times, as they are currently regulated by the Town's Beach and Park Rules and Regulations. While many people support wildlife conservation, they do not agree that their activities impact wildlife. Some specifically questioned the lack of scientific studies documenting impacts, especially has many of these activities have taken place for decades. One commenter specifically indicated that low to no impact activities such as family reunions, football on the beach, barbeques, paddle ball, frisbees, bocce ball on sand flats, etc., are being banned for no supported reason. This individual believes that piping plovers have co-existed with boating and recreational activities on beaches for centuries and that there is no peer-reviewed science suggesting anything other than human users seem to further the preservation goals to protect critical habitat.

Another commenter indicated his strong belief that the Service should not have the authority to determine where people go or what they do, and that visitors should be able to have the freedom to continue enjoying the refuge without further unnecessary restrictions.

Additionally, some commenters are concerned about the impact of visitors and beach use on wildlife and wildlife habitat. For example, Mass Audubon said "public visitation and use can in fact advance conservation objectives, through enhanced understanding and appreciation…it is important that uses be managed to cause no adverse impacts to wildlife" and that "on South Beach, our biggest concern (aside from predators) is disturbance by often well-meaning but nonetheless damaging intrusions by public visitors. Because the habitat is so vast, it's difficult to adequately install symbolic fencing around all occupied habitat. Repeatedly, beachgoers, kayakers, and others have inadvertently disturbed nesting birds or disregarded signage and fencing."

Response: There is often a difficult balance between wildlife conservation and public use, and the direct and indirect impacts that occur even from refuge users who are sensitive to the concern about disturbance to wildlife. With the establishment of a new management boundary on Nauset/South Beach, as depicted in the new MOU between the Service and the Town, the concerns that commenters had about changes to most of South Beach should be satisfied. We have agreed that the Town will manage land to the east of the management boundary, which encompasses most of Nauset/South Beach. The changes to non-priority public uses that we proposed in the draft CCP will now only apply to Service lands west of the management boundary.

We understand the frustration one commenter feels that the Service should not have the authority to determine where people go or what they do, and that visitors should be able to have the freedom to continue enjoying the refuge without further unnecessary restrictions. However, this position is not supported by Federal law. The Improvement Act of 1997, which was passed by Congress with only one opposing vote, very clearly states the mission of the Refuge System and gives the employees of the Service not only the authority but the obligation to conserve a diversity of fish, wildlife, and plants and their habitats for the benefit of current and future generations. We also are required to provide wildlife-dependent public uses on our refuges and to examine every use that is occurring on a national wildlife refuge and authorize only those uses deemed compatible. Since there are other locations in the Chatham area recreationists can enjoy these uses, and knowing the impact these uses can have on shorebirds and listed species we are mandated to protect, they are not appropriate on Monomoy NWR. For more information, readers are referred to 601FW 1, the National Wildlife Refuge System Mission, Goals, and Refuge Purposes, found at *http://www.fws.gov/policy/601fw1.html* (accessed February 2015).

Below, we provide a response about individual beach uses in an effort to further explain the justification for the actions being proposed by the Service.

Beach sports: Beach sports include, but are not limited to, volleyball, football, soccer, frisbee, baseball, surfing, skim boarding, and kite flying. These uses are more appropriate in a park setting and would, if allowed, detract from the purpose of the refuge which is to protect migratory birds and provide opportunities for recreational wildlife-dependent public use. When conducted in designated wilderness, all these activities detract from the wilderness character of the refuge. Activities which are generally done in groups, such as beach sports, can also negatively impact the quality of solitude which is to be preserved in wilderness.

While one comment was made that low to no impact occurs by these activities and there is no supported reason for banning them, no data or research was provided to support this statement. On the contrary, extensive research has been conducted on disturbance to shorebirds from beach recreationists. Given that shorebird populations are in an overall decline, and that disturbance increases as group size increases, thereby necessitating a larger buffer distance (Martin et al. 2015) it is imperative that the refuge continue to manage its lands for migratory bird protection while balancing recreational uses. We fully understand that these types of activities are enjoyed by people who are on family vacations, participating in a family reunion, or just general outdoor enthusiasts, and that there is a sentiment that these uses and conservation have co-existed. It has been documented that outdoor recreational activities has increased in recent years (Knight and Gutziller 1995) and most species of shorebirds are in decline all around the world as a result of both loss of coastal wetlands and in connection with these recreational activities (Martin et al. 2015).

In addition to their impact on tern colonies on the refuge, research on the effects of human disturbance at Cape Cod National Seashore found that plovers responded more strongly to kite-flying than other forms of human disturbance (Hoopes 1993). Kite flying is restricted on Cape Cod National Seashore, and is prohibited within 656 feet (200 meters of shorebird nesting areas, as identified in the May 15, 2015 Superintendent's Compendium to 36 CFR 1. Kite surfing is prohibited from March 15 to October 15. By removing beach activities that do not in and of themselves support a better understanding of wildlife and which may have direct or indirect impacts on wildlife, we are increasing the likelihood that refuge habitats will be less disturbed and wildlife will be able to use refuge resources to maximize productivity, sustenance, and survival.

Shade tents: Shade tents will be allowed only on Morris Island, and will be prohibited within a 100 meters of closed areas designed to protect nesting birds. Shade tents will not be allowed on the island, primarily because these areas are mostly designated wilderness. Shade tents will detract from the experience of visitors seeking wilderness.

Swimming and sunbathing: These uses are being proposed as allowed uses on the refuge with the exception of seasonally closed areas, in order to minimize disturbance to wildlife.

Jogging, dog walking, boating, and organized picnicking have been addressed separately. Please see our response to the comments about these uses in this section.

Please see the findings of appropriateness and compatibility determinations in the final CCP/EIS, appendix D, for more information on these specific uses.

Boating

(ID# 96, 192, 254, 275, 291, 294, 299)

Comment: Several individuals and the Cape Cod Marine Trades Association were concerned that the refuge might ban motorized boat use. They felt that it is an appropriate, compatible, and a traditional use that was important to local residents and visitors that had little impact on refuge wildlife and habitats. Two commenters, the National Wildlife Refuge Association and Wilderness Watch, expressed concern or outright opposition to the use of motorboats by visitors and staff. Wilderness Watch wrote, "allowing extensive administrative motorboat use will make it impossible to preserve that wilderness character" while the Refuge Association said the "use of motorized boats in Wilderness areas could be inconsistent with the objectives of the Wilderness Act."

Response: The majority of the refuge's lands and waters are only accessible by boat. Motorboats have traditionally been used to access the refuge by both staff and visitors. As the channels fill in and alter due to shifting sands and storms, it is getting more difficult to access the northernmost parts of the refuge by boat, and kayaking is occurring more frequently. Nevertheless, motorboats are the only safe way to access most of the refuge. It is our intention to continue to allow access to the refuge via motorboat in order to ensure the safety of refuge visitors and staff.

The concern about motorized boats in the Monomoy Wilderness is an understandable one. Motorboats can be loud and can disrupt the sense of wildness many refuge visitors seek. We will do more to try to promote non-motorized access to the refuge when and where it can be conducted safely. Refuge staff paddle to Minimoy Island from South Monomoy on a regular basis to conduct wildlife surveys, and we have strategies in our plan that would further reduce recreational motorized visitor use. However, we do not believe that a total ban on staff or visitor use of motorboats is safe or practical, nor is it inconsistent with the Wilderness Act.

Section 4(d) of the Wilderness Act expressly permitted motorboat use to continue in areas where the use had already become established. The Act gave the Secretary of the Interior the authority to allow motorboat use to continue, and to impose restrictions if desirable to control that use. Furthermore, Section 5 of the legislation establishing the Monomoy Wilderness specifically referred back to Section 4(d) of the Wilderness Act, thereby specifically granting us the authority to continue to allow this use.

Our recommended boat landing areas provide the safest places to anchor a boat to get onto the refuge's beaches or to walk to the Monomoy lighthouse and elsewhere on the islands. However, boaters may anchor anywhere and access any area that is not seasonally closed for migratory bird protection. It is possible that some commenters thought our original proposal to ban mooring included anchoring. That is not the case. Mooring is covered in a separate section of the document and does not include anchoring; for more details please reference that specific portion of the Response to Comments and the Finding of Appropriateness and Compatibility Determination.

Bicycling

(ID# 64, 241)

Comment: One individual and the Town disagree with our finding that bicycles are not appropriate on the refuge. The Town writes, "The Town does not agree with the premise that bicycling would cause significant disruption within the Refuge and would compromise refuge goals or priority wildlife-dependent recreation. We ask the FWS to consider permitting this low impact and popular use in designated areas and at designated times within the Refuge."

Response: The Service is maintaining its position that bicycling is not an appropriate use on Monomoy NWR. Bicycles are a form of mechanized transport and have wheels, which are not allowed in the Monomoy Wilderness. We have concerns about the use of bicycles on Morris Island Trail, which is outside the wilderness area. Bicycle use is likely to create erosion on fragile beach grass habitat and conflict with other users participating in wildlife-dependent recreation on the narrow Morris Island Trail.

The finding of appropriateness in appendix D of the draft and final CCP/EIS stipulates that bicycling to access the refuge office/visitor facilities parking lot may continue. Bicycling would not be allowed elsewhere on the refuge, including the Morris Island Trail. For visitors who participate in other activities while at the refuge, bicycles can be locked in the bike rack at the visitor contact station. Bicycling is not a priority public use, and is not necessary to facilitate wildlife observation by refuge visitors. Therefore, bicycles will be limited to the refuge parking lot.

There are many alternate locations residents and visitors alike can bicycle on Cape Cod to enjoy the outdoors. The refuge staff will have information available in the office for refuge visitors who are looking for places to bicycle.

Kiteboarding—Support for Ban

(ID# 96, 109, 155, 228, 234)

Comment: Mass Audubon and several individuals support the proposal in the draft CCP/EIS to prohibit kiteboarding at Monomoy Refuge. One individual writes, "As an enthusiastic birder, I strongly support the proposed ban on kiteboarding on Monomoy Island and nearby South Beach. I have visited South Beach and seen first-hand how easy it is to disturb nesting shore birds. The habitat for Piping Plovers decreases each year and quality locations like Monomoy Island need stronger protection." Mass Audubon writes, "Mass Audubon's Coastal Waterbird Program field crews observed at least five instances of kiteboarding near coastal waterbird nesting beaches in Massachusetts in 2014. Distances varied. In one instance, a colony of Least Terns was disturbed by deployed kiteboards, while in another case gear placed on a beach was problematic. We also know of at least two additional instances, at South Beach, of kiteboard disturbance of large numbers of roosting migratory shorebirds and terns, including Red Knots and Roseate Terns (one observation by Mass Audubon staff and the other by USFWS staff). While these observations are anecdotal, even infrequent disturbances of nesting birds can impact breeding success and survival, depending on the timing and duration of the disturbance and in relation to all the other stresses the birds must endure."

Response: After review of all the comments, we have affirmed our decision to ban kiteboarding within refuge waters as it is an inappropriate activity that detracts from the purposes of the refuge. For your reference we have included additional information in our Finding Of Appropriateness which can be found in appendix D of the final CCP/EIS. The Town has also recognized the increase in kiteboarding activity and modified their Waterways Bylaw in 2015 to prohibit the use of kiteboards and other similar watersport craft in order to minimize conflicts with boaters and other beach and water-based activities.

Kiteboarding—Opposition to Ban

(ID# 46, 69, 70, 74, 115, 120, 123, 135, 137, 143, 147, 149, 151, 156, 161, 167, 171, 186, 205, 206, 212, 214, 216, 219, 226, 240, 274)

Comment: Numerous individuals commented that kiteboarding should continue at Monomoy Refuge. Reasons cited included:

- There was inadequate scientific evidence and justification in the draft CCP/EIS for banning kiteboarding, including the use of research that was 20 years old about the impact of kites on birds.
- Kiteboarding is an environmentally friendly, low-impact sport because it does not use motorized equipment and creates no noise or emissions. Many compared kiteboarding to kayaking or sailing.
- Kiteboarders passionately love nature, are dedicated stewards of the wildlife and habitats at Monomoy, and use the sport to connect with nature.
- Kiteboarding and piping plovers coexist at other locations in Massachusetts (e.g., West Dennis and Revere Beach).

Many of the commenters were very open to sensible restrictions on the use if it was allowed to continue (e.g., time of year restrictions, requiring permits for access, requiring education regarding sensitive species, designating certain areas as open and closing sensitive areas, establishing minimum distances from nesting/resting birds, and banning launching and landing near sensitive habitats).

Response: We appreciate the time and effort that was put forth by the kiteboarding community in providing comments on this topic. We understand that kiteboarders are both passionate about their sport and the environment and are willing to make concessions should we allow the sport to continue within the refuge boundary. After very thoughtful consideration, we have decided to maintain our original position that kiteboarding is not an appropriate activity within the boundary of Monomoy NWR.

We have used the best available science and our professional judgment to make this determination, which we believe is best for wildlife. There are very few studies that have looked at the impact of kiteboarders on nesting, foraging, and staging birds. This may be due to the fact that the activity is fairly new, or it may be due to the fact that the activity varies widely depending on the conditions at each individual site. In reality, the impacts are probably very different from site to site based on the use of that site by kiteboarders (wind direction, proximity of shallow water to nesting birds, boat traffic and channels, etc.). We did, however, speak with biologists from the NPS, Mass Audubon, and other refuges within the FWS and they concurred that the activity was disruptive to birds as they had witnessed it in the field. Kite boarding (kite surfing) is prohibited at the Cape Cod National Seashore on all ocean and bayside open waters from March 15 to October 15 for the protection of shorebirds (NPS, Cape Cod National Seashore Superintendent's Compendium, 36 CFR 1, 2015).

As a response to several comments, we have added or removed language within the chapters and we have made some significant changes to the FOA. Currently kiteboarding is not allowed within the boundary of any national wildlife refuge in Region 5. In reevaluating our FOA, we have determined the following:

1. Kiteboarding is not consistent with goals and objectives in this CCP/EIS or another document guiding refuge management.
2. Kiteboarding is not manageable within available budget and staff now or into the future.
3. Kiteboarding cannot be accommodated without impairing existing wildlife-dependent, recreational uses or reducing the potential to provide quality, compatible, wildlife-dependent recreation into the future.

Please see the updated finding of appropriateness in appendix D of the final CCP/EIS for more information on the above items.

Many commenters suggested that the refuge implement seasonal closures to kiteboarding or buffer distances around important bird areas. Our best professional judgment indicates that kiteboarding has the potential to disturb birds in a variety of ways including while they are on the shore or on the water. Closures cannot be used to create buffers since they are temporary and do not provide protection to non-nesting birds. Closures are not used for non-nesting birds because the areas that they inhabit change regularly depending on the conditions and the behaviors of the birds in question. Regulating uses is the most effective way to prevent disturbance to birds when closures are not possible. During the nesting season, terns nest in specific areas which we close for their protection, but they forage on the open water for sand lance; shallow areas that could easily be used by kiteboarders. These areas could be offshore or close to shore and vary based on weather and currents. In the fall, migratory shorebirds use many areas of the refuge that are not marked with closures for feeding and roosting. In the winter, the refuge provides important feeding and resting habitat for seaducks that rarely use the refuge lands, spending most of their time on the open water. It would be impossible to both allow kiteboarding within the boundary and to prevent disturbance to these important avian resources. While boaters also have the potential to disturb birds using these areas, the time that they spend in one area is usually very short, passing through and the moving on, while kiteboarders occupy one area for a period of time while the winds are good, leading to concentrated disturbance in the area of use (Kate Iaquinto, personal communication 2015).

Several commenters noted that we cited a thesis by E. Hoopes that was completed at the University of Massachusetts in 1993. This thesis includes information on the relationship between the success of nesting piping plover and human disturbance on Cape Cod National Seashore. While the thesis was not peer reviewed or published, it has been cited widely when discussing plover disturbance, most notably in the piping plover recovery plan (USFWS 1996a). We have not been able to find or cite research that is more current or appropriate but we would encourage commenters to submit such data. We would support research in the future regarding the possible avian disturbances related to kiteboarding. In the Finding of Appropriateness we present anecdotal evidence that we have used to determine that kiteboarding does in fact disturb birds at the refuge and in similar areas. We have changed some of the language in the FOA regarding the Hoopes thesis as its inclusion has been controversial with commenters.

Many commenters stated that because kiteboarding has little to no environmental impact based on the fact that it produces no emissions and little to no noise pollution, that it should be encouraged on the refuge. They also compared it to sailing. While it is similar to sailing in some respects, wind driven and quiet, it is not similar in that the kite travels high above the ground and kiteboards can be used in very shallow water. The problem with kiteboards is the sometimes erratic movement of the kite, the shadow cast by it, and the fact that the boarders themselves can come very close to shore in shallow water on flats, travelling at high speeds, where shorebirds may be feeding or resting. While kayakers and people using stand up paddle boards can also go in shallow water, they are usually moving at a slower rate and have a much lower profile to birds on the shore. We do appreciate however that the sport is relatively environmentally friendly from an air pollution perspective.

We also appreciate the fact that many kiteboarders are nature lovers and use their kiteboards to experience the refuge. However, kiteboards can disrupt other people's ability to observe wildlife on the refuge and surrounding beaches. Large flocks of staging terns can be observed on the refuge, but if they are flushed by a kiteboarder, they may leave the site to stage elsewhere. Currently, there is a graduate student from the State University of New York, College of Environmental Science and Forestry that is studying disturbance to staging terns on the outer cape, mostly within the boundary of the National Seashore. Results from that study will inform future management.

We received several comments that mentioned how kiteboarders are collaborating with beach managers at West Dennis Beach and Revere Beach to lessen the impact to nesting birds. We believe the comparison to West Dennis and Revere Beach, while understandable, is not appropriate. These beaches are heavily used by the public with thousands of visitors annually, and the plovers nesting there are exposed to constant disturbance by humans and the activities that they bring to the beach with them including kiteboards, radios, pets, umbrellas, Frisbees, and other forms of recreation. From a biological perspective, the amount of disturbance that these birds tolerate is very different than the birds nesting at Monomoy who see humans once a week. Most of the human interaction with nesting birds on the refuge is with our staff who are very careful to minimize disturbance to the plovers as they perform their nest checks. Nesting piping plovers, as well as other birds

using the refuge to forage, roost, or stage, have a much lower tolerance to human disturbance (Kate Iaquinto 2015, personal communication). In fact, the low levels of public disturbance may be one of the reasons that the refuge is so heavily used by such a variety of bird species.

Dog walking—Opposition to Proposed Ban

(ID# 60, 62, 64, 75, 164, 241, 256, 291)

Comment: The Town and several individuals requested that we continue to allow dog walking on the refuge, particularly on South Beach. The Town suggested that we allow dog walking seasonally, similar to their Town Beach regulations. The Town letter states, "[We have] fully addressed this issue in the Town's Beach and Parks Rules and Regulations: dogs, cats, horses, and all other pets and animals are prohibited on Town beaches and beach areas from May 1–September 15 to avoid conflicts with humans and wildlife. However dog walking is an important activity for many local residents, particularly during the offseason. The Town disagrees with the FWS conclusion regarding the presence of dogs and asks it to consider allowing dog walking in designated areas at designated times, requiring, and enforcing that they are restrained by a leash." Another commenter asked that dogs be allowed on a 30-foot leash and off leash below low tide. Another commenter found it odd that we use dogs for predator control, but do not allow dogs (or people) all over the refuge.

Response: The Service has re-examined its position on dog walking. Instead of a permanent closure to dogs and other pets, we will continue to allow dogs on leash on Morris Island but only from September 16 to April 30. This is consistent with Town regulations and is a time period when less wildlife is found on the Morris Island part of the refuge. We will not allow dogs on any other sections of the refuge at any time of the year. Since the Town will be managing most of the lands on Nauset/South Beach, our policies limiting dogs to Morris Island should not be a concern to the commenters who were thinking of South Beach when they identified this activity as a concern.

While we understand the desire for visitors to have their dog with them on a hike or trip to the beach, the refuge was established for migratory bird protection, and the presence of dogs, even leashed, impacts wildlife. The impact of dogs on wildlife has been described in many scientific literature reports. In particular, we are concerned about the impact of dogs on staging, nesting, and/or foraging migratory birds, including but not limited to piping plovers, common terns, roseate terns, red knots, and American oystercatchers, as well as other wildlife such as seals that use refuge beaches for hauling out. It is precisely because dogs are good at finding wildlife that we use them selectively for coyote management. These dogs are under the control of a trained wildlife professional. There is no correlation between when and how we use dogs for predator management and access on the refuge by people with or without their dogs.

Dogs must be on a 6-foot leash and waste is to be picked up by dog walker and taken off refuge property as we are a "carry in, carry out" location. Refuge staff considered a request to allow unleashed dogs below low tide and to allow a longer 30-foot leash. This request will not be accommodated, as the mere presence of a dog can impact bird behavior. It is also difficult to control a dog on a 30-foot leash. If piping plovers or other birds attempt to nest on the refuge before May 1, a temporary closure will be established around the nest site to minimize disturbance and increase the chance of nesting success.

Many refuge visitors now routinely fail to keep their dog leashed when on Morris Island, and dogs are occasionally found on South Monomoy Island. We will continue to monitor compliance and will revoke the seasonal dog walking privilege if there is significant non-compliance and/or a change in biological resources. For additional information about this use, please see the Compatibility Determination in appendix D.

Dog walking—Support for Ban

(ID# 77, 244)

Comment: The Cape Cod and Islands Group of the Sierra Club agreed that dog walking should not occur on the refuge because they feel it can interfere with wildlife and "creates an unpleasant experience for other users." One individual wrote, "I like the idea that you will manage much more of the land including the low tide water areas as we all know that this is some of the more important habitat for all wildlife...Please keep dogs out of this area as much as possible."

Response: The refuge staff believes that keeping dogs on a 6-foot leash on Morris Island during the off season will minimize impacts on wildlife. We will also establish temporary closures around potential nest sites if nesting behavior is observed. If it is determined that the impacts are more significant to wildlife, if new wildlife uses occur which are impacted by dogs, or if there is significant non-compliance with refuge policies, then we will reassess this activity. A re-assessment could lead to a permanent closure of Morris Island to all dogs at all times.

Jogging

(ID# 64, 84, 91, 94, 95, 98, 99, 101, 102, 119, 124, 125, 126, 128, 129, 138, 139, 142, 146, 148, 150, 168, 176, 181, 182, 184, 187, 194, 195, 197, 201, 203, 204, 207, 209, 213, 217, 220, 223, 234, 237, 244)

Comment: The Cape Cod and Islands Group of the Sierra Club expressed their opinion that the jogging should not occur on Morris Island lowlands. The Town indicated that jogging is low impact and should not be constricted or prohibited. Numerous individuals stated that jogging has been enjoyed by the public on Nauset/South Beach for years and should not be prohibited there now as proposed in the draft CCP/EIS or is an unnecessary thing to consider.

Response: Jogging will be restricted to the portions of Morris Island that are open to the public. This area is more heavily used by refuge visitors and is less used by sensitive wildlife (perhaps because it is so heavily used by people). Because it is connected to private and Town land, it would be very challenging to stop visitors who are jogging on abutting properties and crossing onto the refuge, especially since other non-wildlife-dependent uses are also occurring on the Morris Island Trail.

We have not changed our position about jogging on North Monomoy, South Monomoy, and Minimoy Islands. These areas are sensitive nesting and staging areas for wildlife. In addition to disturbance to birds, jogging on South Monomoy Island could potentially impact the larval stage of the threatened northeastern beach tiger beetle. Larval burrows are especially susceptible to trampling, which results in excess energy expenditure and reduced hunting time for the inhabiting individual. Joggers exert more ground pressure with each step than the average walker. Pedestrian use also has the potential to disturb loafing seals. We realize that some people will be disappointed that they will no longer be able to jog on the refuge outside of Morris Island, but we believe the impacts to refuge wildlife and habitat are too great to allow it elsewhere on the refuge.

Individuals interested in jogging have numerous opportunities outside the refuge, including on adjacent Chatham town beaches and the Cape Cod National Seashore. Given the likely impacts on wildlife and wildlife-dependent recreation, and the numerous opportunities available to support jogging and walking off the refuge, this use is determined to be not appropriate on Monomoy NWR other than on the Morris Island Trail. Please see the Finding of Appropriateness and Compatibility Determination in appendix D for more information and cited literature.

Organized Picnicking

(ID# 64, 84, 91, 94, 95, 98, 99, 101, 102, 119, 124, 125, 126, 128, 129, 138, 139, 142, 146, 148, 150, 168, 176, 181, 182, 184, 187, 194, 195, 197, 201, 203, 204, 207, 209, 213, 217, 220, 223, 237, 258, 264)

Comment: The Town and numerous individuals disagreed with our finding that organized picnicking is not an appropriate use of the refuge. The Town wrote, "The [draft] CCP/EIS identifies potential concerns with organized picnicking and does not find it to be an appropriate activity for the refuge. Concerns include an increase in pests and scavengers and a need for increased monitoring and refuge resources. The Town could not disagree more strongly with this conclusion. Picnicking has been found to be an appropriate refuge activity in the past and has been allowed in the refuge for many decades. The Town contends that this activity should be allowed to continue with the stipulation outlined in the CCP/EIS: "leave-no-trace, carry-in/carry-out all food containers, bottles, and other waste and refuse must be taken out." The Town further asserts that it would be more reasonable to limit the activity to designated areas and times as is specified in the Town's Beach and Park Rules and Regulations." Many other individuals said that a ban on picnicking would prohibit them from enjoying South Beach as they had in the past.

Response: The refuge staff understands the interest by the community and visitors to be able to have a place to picnic and congregate on the beach. Town regulations will apply to Nauset/South Beach east of the management boundary established by the MOU, so picnicking will be able to continue there.

Our primary concern with large amounts of food on the refuge is the attraction it poses for gulls. Gulls are considered predators within the common tern colony and other nesting areas on the refuge in most years (Kate Iaquinto, personal communication 2015). We work very hard on the refuge to manage gull populations and behavior to reduce the impact of gulls as predators (see Appendix J). The attraction of gulls to large picnic areas to scavenge on food left at the site (or the intentional feeding of wildlife) is likely to perpetuate the very issues refuge staff are trying to combat. Gulls are opportunistic and once they detect a new food source, they will continue to loaf in that area, possibly in large concentrations. Gulls readily adapt to the presence of recreationists and over time may even see humans as a food source when they are picnicking (Laux 2014). Another important concern we have is that large groups picnicking on the refuge, especially when grills are being use, diminishes wilderness character and negatively impacts visitors to the Monomoy Wilderness who are looking for solitude and naturalness. For these reasons, organized picnicking (which includes the use of grills) has been found to be an inappropriate use and will not be permitted on the refuge.

Our previous approval of picnicking on the refuge is not the same as the organized picnicking that we are discussing in this plan. We have previously found picnicking that occurs as a secondary use to another refuge purpose, such as wildlife observation which is often a multi-hour to all-day visit, to be a compatible use. We are not banning all food and drink on the refuge, as we understand that those who are visiting the refuge to participate in wildlife-dependent uses, such as fishing, birding, and photography, will bring a small amount of food and drink for personal consumption. Organized picnicking, where the primary purpose of the refuge visit is to gather with friends and family with a focus on food and drink, has not been an approved use in the past. We currently contend with litter and debris on the refuge quite often despite being a leave-no-trace, carry-in-carry-out facility. If large-scale picnicking was allowed, it is reasonable to assume that littering would only become more severe and occur more regularly.

Please refer to the Finding of Appropriateness in appendix D of the final CCP/EIS for more information.

Camping
(ID# 64)

Comment: The Town agreed with our finding that camping is not appropriate at Monomoy NWR. This is consistent with their town beach regulations which prohibit camping.

Response: Thank you for your comment. Our justification for this prohibition can be found in the Finding of Appropriateness in appendix D of the final CCP/EIS.

Jetskiing
(ID# 64, 155, 234)

Comment: The Town and Mass Audubon agreed with our finding that jetskiing is not appropriate at Monomoy NWR. This is consistent with Town bylaws which prohibit jetskiing. Another commenter said that jet skis have a negative impact on loafing birds and vegetation.

Response: Thank you for your comment. Our justification for this prohibition can be found in the Finding of Appropriateness in appendix D of the final CCP/EIS.

Over-sand Vehicles
(ID# 64)

Comment: The Town agreed with our finding that over-sand vehicles are not appropriate at Monomoy NWR. This is consistent with their town beach regulations which prohibit over sand vehicles.

Response: Thank you for your comment. Our justification for this prohibition can be found in the Finding of Appropriateness in appendix D of the final CCP/EIS.

Fires and Fireworks
(ID# 64, 236)

Comment: The Town and one individual agreed with our finding that fires and fireworks are not appropriate at Monomoy NWR. This is consistent with Town beach regulations which prohibit open fires and fireworks. It is also illegal to possess or use fireworks under Massachusetts State law.

Response: Thank you for your comment. Our justification for this prohibition can be found in the Finding of Appropriateness in appendix D of the final CCP/EIS.

Commercial Fishing Guide Permits
(ID# 64, 235, 243)

Comment: The MA DMF suggested that the refuge should only require a commercial fishing guide permit for those for-hire guide services that come ashore with a vessel or use the upland habitat. They feel it is "impractical and unenforceable" to require the permit for all commercial fishing guides. Another commenter believes that commercial fishing guides increase traffic in the wilderness with inevitable adverse effects. The Town indicated this is an issue worthy of future discussion and review.

Response: We believe our proposal, which is limited to commercial guides who take anglers onto refuge lands and into intertidal waters for recreational fishing activities such as surf fishing, is consistent with this suggestion. It is our intention that these guides would be working through a future concessionaire. We do not intend to regulate guided fishing tours that are operating in the submerged waters within the refuge boundary. We have had a number of instances of commercial guides bringing anglers into closed areas. It is possible that these individuals are not aware of seasonal refuge closures. Teaching people how to surf fish, facilitating that use by providing equipment, or helping recreational anglers find great fishing spots in the refuge's wilderness increases the recreational fishing opportunities for many. This is consistent with the mandate of the Improvement Act of 1997 and is consistent with provisions of the Wilderness Act. Requiring the guides to have permits will ensure that they understand the refuge's wildlife and wilderness purposes and will result in less inadvertent impact on these resources. It will also help us better understand how many people are fishing on the refuge and where, so we can better adjust our management actions to allow this use as much as possible while protecting nesting and staging grounds for migratory birds.

Commercial Tours, Ferries, Guided Trips, and Outfitting
(ID# 64, 71,155, 234, 235, 236, 273)

Comment: The comments on tours ranged from no tours at all, to no expansion of tours (people can use their own boat to get to the islands), to a request from the Town that multiple service providers be allowed. There is a concern that commercial tours increase traffic in wilderness areas and adverse effects will occur. One person wanted to ensure that kayak tours are located and regulated so that breeding and loafing birds are not impacted. Mass Audubon expressed concern that new or expanded recreational opportunities be carefully managed so that staff and funding resources be adequate to manage the increased recreation without detracting from efforts to protect wildlife. Two commenters had questions about Rip Ryder, the current permittee operating out of refuge headquarters on Morris Island. One of the questions asked if Rip Ryder is "presently compensating the USFWS for the use of public land to operate his business and provide parking for his customers? If not, why is this an appropriate subsidy to this individual business?" Another individual suggested that if Rip Ryder is allowed to continue operating from the refuge, then this business should find a satellite location to pick up and drop off its customers as one means of reducing parking congestion.

Response: We believe guided tours operated through a concessionaire are an appropriate way to increase visitation, awareness, and appreciation of the refuge and its resources while minimizing, and possibly reducing, the impact of visitors on the refuge wildlife. We propose to conduct an open bidding and solicitation process to attract multiple vendors to bid on a concessionaire contract that provides interpretation, outfitting, and transportation. The selected concessionaire would likely coordinate with local individual businesses for each particular service which would result in multiple service providers at the refuge. This process will address several issues including better opportunity for potential vendors to compete for a contract, better messaging to visitors about the refuge and our resource management and wilderness protection mandates, and more opportunity for visitors to get onto the refuge to fish, observe wildlife, or take wildlife photos. We do believe that having a concessionaire provides for wildlife-dependent recreational opportunities under the overall guidance of refuge staff and will enhance rather than detract from our mission.

The Improvement Act requires us to provide wildlife-dependent public uses on refuges, when compatible with the refuge purpose. Monomoy NWR is difficult to access without a boat, and we believe limiting access to only those that have a private boat or the ability to charter one individually is a failure to public service and would create a disconnect from the general public to the refuge. Because of this, in the late 1990's, special use permits were issued to three companies to bring visitors to the Monomoy Islands while certain non-profit groups were allowed to conduct guided tours for birding and natural history. Monomoy Island Ferry (Rip Ryder) and Outermost Harbor Marine both still have special use permits to provide ferry services to refuge visitors. Both pay an annual fee to the FWS for the permit. Monomoy Island Ferry has approval to operate out of the refuge headquarters but did not do so in 2015 due to the shallow waters off the refuge.

Once a competitive, multi-year concession is implemented, the existing special use permits will terminate. Current permit holders can compete for the concession contract along with other potential vendors, or could possibly work through the concessionaire to provide specific services. We do anticipate allowing the concessionaire to operate from refuge headquarters, should the water conditions allow, but we will require that visitors be shuttled from an off-refuge parking site to Morris Island. Use of shuttle vans will reduce vehicular traffic to Morris Island and reduce parking congestion. We believe in the long run that refuge visitors, neighbors, and wildlife resources will all benefit by a comprehensive, well managed concession program.

Commercial Photography
(ID# 64)

Comment: The Town commented that regulating commercial photography under the proposed permitting structure is over-burdensome and too general to be effective.

Response: Public Law 106-206 governs the use of commercial photography and filming on national wildlife refuges. We must comply with Federal law and regulations and ensure we operate under the guidance of Service policy in the administration of this use. We provide more information about this policy and how we will administer this program in the compatibility determination located in the final CCP/EIS, appendix D.

8. Other Water-based Activities

Dredging
(ID# 63, 64, 153, 244)

Comment: The Town commented that "the CCP is unclear as to whether it is the intention of the FWS to now claim sole authority over public dredging projects, including those where permits have already been approved. The Town would strongly oppose such an effort by FWS if that is the intent. With respect to the placement of dredged materials, the Town would welcome the opportunity to discuss placement within the refuge from Town sponsored dredging projects. This material could be used for erosion protection, habitat enhancement or other similar purposes." The Cape Cod Group of the Massachusetts Chapter of the Sierra Club urged us to be involved with dredging discussions in Outermost Harbor as well as any future revetment installations in order to protect the Service's long term interests. The Association to Preserve Cape Cod criticized us for failure to engage the harbormaster concerning navigational maintenance dredging.

Response: We maintain our jurisdiction regarding dredging projects within the waters of the Declaration of Taking. We have, and will continue to, work closely with the Town and the U.S. Army Corps of Engineers on the review and approval of dredging projects and the deposition of dredge materials. We understand and support the need to keep the navigable waterway open to the entrance to Stage Harbor, which bisects the Northwest corner of the refuge's boundary. The right to maintain that channel has been established for Stage Harbor and we support the maintenance dredging which occurs within the refuge boundary. We do have concerns about dredging the Morris Island Cut but realize it is now a permitted project. Therefore, we will seek to use the dredged material from this or other permitted projects in a beneficial manner on refuge lands on Morris Island. We will continue to participate in reviews and discussions with the U.S. Army Corps of Engineers, the Town, and other stakeholders on future dredging projects within the refuge's boundary. Our interests will focus on minimizing impact on submerged aquatic vegetation and benthic communities, the impact of dredging on the geomorphology of Morris Island and the Monomoy Islands, as well as the possible use of dredge material for habitat enhancement and erosion protection.

Moorings
(ID# 63, 64)

Comment: The Town wrote that they do not support the proposed outright prohibition of mooring placement within the Declaration of Taking's open water. There are currently no permits for moorings in these waters, but they felt they should have jurisdiction over any future requests. They stated that "new technologies [can] minimize or eliminate the likelihood of mooring tackle impacting eelgrass meadows and benthic communities."

Response: During our initial review process we documented the impacts of conventional mooring systems on the benthic community and eelgrass beds. It was brought to our attention that there is a new mooring technology that is being developed and deployed in sensitive marine environments which are referred to as "conservation moorings." Conservation moorings are designed to minimize habitat impacts between the mooring components and the seafloor (Urban Harbors Institute, 2013). It is our understanding that there is research being conducted in several harbors on Cape Cod that are assessing the impacts of conservation moorings on submerged aquatic vegetation. There could be some potential environmental impacts caused by conservation moorings but at this time the results have not been published. The results of this study, and the recommendation it provides, will guide us in our review of mooring placement within the refuge's boundary.

In our revised alternative B in the final CCP/EIS, we will evaluate the placement of moorings within the refuge boundary on a case-by-case basis. We will work with the Town Harbormaster's office and conduct a finding of appropriateness and, if found appropriate, write a compatibility determination which must undergo public review, before making a final decision about the placement of any moorings in Monomoy NWR waters.

9. Refuge Administration and Infrastructure

Staffing
(ID# 63, 64, 90, 103, 155, 202, 231, 234, 268, 272)

Comment: Three individuals commented that additional staff will be needed to enforce new regulations, given the regional importance of the refuge to the recovery of endangered species. Another individual commented that the staff should not be focusing on visitor services, but instead on nesting and staging areas for migratory birds; and a minimum of four full-time staff is required. On the other hand, another individual suggested that we add a Visitor Services Specialist position to the current approved staff for outreach to schools, scouts, seniors, and the community as well as on the refuge. The Town indicated that additional staffing for the refuge, and accommodations for increased staff levels, was worthy of future discussion and review. One person felt the lack of a Federal commitment for staffing was restrictive. Another commenter opposed any additional staffing at the refuge.

Response: Additional staff will be needed to completely accomplish the additional workload associated with the expanded objectives under the Service-preferred alternative. Within the next 15 years, if funding is available, we would like to fill two Park Ranger (Law Enforcement) positions to enforce refuge regulations, with a primary emphasis on resource protection and visitor safety. Until then, we will continue to recruit and employ seasonal and term biological, visitor services, wilderness staff, interns, and volunteers to assist in all refuge activities including the protection of endangered species.

We understand the tension between visitor services and resource protection, particularly as it relates to determining the most needed positions to fill. Some activities, such as wildlife observation or fishing, are considered priority public uses because they are wildlife-dependent. According to our guiding legislation, the Improvement Act of 1997, we are to facilitate these uses when compatible. As shown on the staffing charts in appendix G, we currently have no visitor services staff. So, in the coming years, we hope to recruit new visitor services staff in addition to more biologists. A strong visitor services program will educate visitors and schoolchildren, build understanding and support for the refuge, and provide a meaningful connection to nature. We think both biology and public use is important and will strive to maintain a good balance between these programs on the refuge.

Budget and Costs
(ID# 112, 261)

Comment: One individual asked how the refuge's "overall budget can be increased to include 7 additional full-time employees" during a time of government budget cutbacks? They further noted that there is no need for 10 year-round full-time positions, but rather that these positions should be seasonal. A second commenter asked how much Monomoy NWR has spent writing the plan over the past 9 or 15 years.

Response: The President and Congress establish spending priorities for the Federal Government. Whether and/or when our budget would result in the employment of additional permanent staff remains is uncertain. In this plan, we identify our need for additional staffing based on the workload we feel is necessary and appropriate for sound management of the refuge. Our desired staffing level is consistent with a 2008 national staffing model for the Refuge System which indicated that Monomoy NWR, due to its location, size, number of visitors, and complexity of its biological program, should have a permanent staff of nine full-time employees. It is unlikely that we will be able to hire all the staff we need, but it is important to identify the full-time workload need should Federal priorities change in the future. In the meantime, we will continue to recruit seasonal and term staff, interns, and build up our volunteer program.

The cost to operate the refuge includes annual salaries for the full-time employees which were approximately $180,000 and approximately $40,000 for the seasonal workers in 2013. Additional support came from the refuge complex headquarters in Sudbury. It is difficult to quantify the support costs specific to Monomoy NWR, as the refuge complex includes eight refuges. It is difficult to determine how much it has cost us to write the comprehensive plan, as both staff and contractors have contributed to it over the years. Writing plans is part of the work we do when managing all our refuges, including Monomoy NWR. Specifically, in fiscal year 2013, the refuge spent approximately $70,000 on materials and services to operate the refuge. Many of these expenses were direct expenditures in Chatham and surrounding towns, including boat and vehicle fuel, boat, and vehicle maintenance, contractors, maintenance, and office supplies.

The refuge contributes locally as visitors seek lodging, dining, shopping, and other tourist related spending opportunities. Many visiting anglers hire fishing guides and take seal tours. This also contributes financially to the Town. The Town also receives approximately $22,500 annually in Refuge Revenue Sharing payments. We estimate, based on studies of refuge visitors and national information, the total direct expenditures associated with refuge visits in 2012 was more than $1 million. Over 95 percent of these expenditures were from non-residents.

While it does cost the government, and therefor the taxpayers, money to operate Monomoy refuge, there is also a significant local economic contribution as a result of the work we do and the public use opportunities that we provide.

Proposed Downtown Visitor Contact Station
(ID# 59, 64, 234, 244, 261)

Comment: Three individuals made comments that a satellite visitor contact station/information booth would be a great resource. The Town indicated that the visitor contact station was worthy of further discussion and review. One commenter noted that the current office is small and cramped. One questioned where the funding would come from to build a visitor center.

Response: We believe a downtown visitor contact station would be an asset to the Town for several reasons. It would be a draw for visitors and would help bring people to downtown where they might also shop and eat. Parking at the visitor center could reduce traffic congestion if a shuttle brought people to the refuge from the visitor contact station. Programs held at the visitor contact station could also be of interest to Chatham and other Cape community residents, as well as visitors. We recognize the importance of being a part of the community. A future location to interact with people off-site will ensure we are conducting broader outreach to residents and visitors about the refuge. We hope to gain the support of the Town for this facility, and look forward to seeking funding in order to make it a reality. While would prefer to locate a visitor contact station in Town, we will also consider locations in the Town of Harwich if we can gain the support of that town, and a good location can be found there.

Roads and Right-of-Ways

(ID# 52, 63, 64, 81, 85, 100, 229, 244, 250, 286)

Comment: Concerns about both the Morris Island causeway and the right-of-way over Tisquantum Road and Wikis Way were expressed by several commenters, including the Quitnesset Associates and the Town. Comments on the causeway focused on an opposition to the widening of Morris Island or causeway roads. Built on dredge spoils over 50 years ago, the Cape Cod Group of the Massachusetts Chapter of the Sierra Club indicated that the causeway has naturalized and become a unique dwarf-shrubland coastal dune community and should not be altered. At least one commenter does not believe a wider causeway is safe as it will increase the speed of vehicles where pedestrians are present. This individual is willing to yield to oncoming vehicles which slow passage on the road. This is a sentiment held by some residents of Morris and Stage Islands. It is believed that additional traffic to the refuge, either due to a shuttle service or private automobiles, presents an extreme over-burdening on the private roads that are owned by Morris Island residents. Residents are concerned about the issue of road maintenance paid for by the residents, liability and other insurance issues, and finally, for all residents having to deal with the increase in traffic coming on and off the island. Quitnesset Associates believe that traffic congestion on Morris Island is not a function of inadequate parking space but rather of inadequate notification of refuge visitors when the parking lot is full. Another comment suggested that the reason we support widening the causeway was to accommodate a shuttle. One commenter indicated the private roads are not designed for people walking or for cars passing, and were never intended for the public.

The Town commented that "the legal implications regarding liability over FWS's right-of-way into the refuge headquarters on Morris Island is an ongoing and unresolved issue that should be determined before implementation." Quitnesset Associates and another individual indicated that they do not believe the refuge has a properly vested right-of-way to authorize public access to its headquarters over Morris Island roads.

However, another individual commented that the "United States of America, acting through the FWS, is the sole holder of an easement from the dike to the refuge because the Town failed to set out its right-of-way during the late 1950s. This easement is 33 feet in width though Wikis Way is now restricted to roughly 20-21 feet, fence to fence. The FWS deserves the thanks of all who use the refuge for defending the public's historic right-of-way. The FWS should make clear to all parties that the public's ROW as agreed to in the 1980 relocation agreement with Quitnesset Associates, Inc. and Edward Noyes, Jr. will not be relinquished or degraded."

Response: It is acknowledged by all that the Morris Island Causeway holds approximately 80 to 85 cars and can reach up to 85 percent capacity during the summer months. The Causeway has no shoulder, requiring vehicles to park partially in the travel lane, which effectively reduces the roadway to 1.5 lanes. According to Service staff, emergency responders have reported problems responding to residential and refuge needs when the causeway parking is filled. One of the alternatives in the Volpe Transportation Study, which was commissioned by the Service, is to relocate and reinstall the existing fencing to provide more space for parked cars. Although the area would not be paved, it would allow more space for cars to pull out of the travel lane when parking. This would improve causeway safety and allow more space for emergency vehicles to travel across the Causeway, even when vehicles are parked there. In addition, it would also be safer for people unloading and loading kayaks, shellfishermen, and refuge visitors. We do not agree that pedestrians are more at risk walking in a narrow road with passing vehicles and parked vehicles than a wider road. Concerns about speeding can be addressed through posting of a slow speed limit and municipal enforcement. Seasonal speed bumps could also be used to slow traffic. The benefits of a wider causeway are completely independent from shuttle service, and neither is contingent upon the other.

We signed a grant agreement on November 17, 2012, with the Town that provides up to $150,000 in grant funds to the Chatham Department of Public Works (DPW) to improve the parallel roadside parking situation along the east shoulder of the Morris Island causeway. The Town is still working on the design and the acquisition of permits for this project.

We do agree that signage needs to be improved along the right-of-way, both so that visitors know that they are on the correct route to the Visitor Center, and also to protect the privacy of Morris and Stage Island residents. We are confident that we can design and install some signage that will help achieve both of these outcomes, and look forward to working with Quitnesset Associates on this issue.

When the refuge was established, there were no homes on Morris Island. All the homes have been built since the establishment of the refuge, including a home directly next to the office. Everyone who purchased or built a home on Morris Island knew the refuge office is there and that we have visitors who will be travelling on the private roads to get to the beach, trails, and office. The Service's legal 33-foot right-of-way over Tisquantum Road and Wikis Way to access the refuge headquarters on Morris Island is defined in the Agreement to Relocate Rights-of Way on Morris Island between Quitnesset Associates, Inc. and the Service dated February 11, 1980. It is the responsibility of the Service to maintain the legal bounds of this right-of-way so that it is safe for both vehicles and pedestrians. We have twice asked Quitnesset Associates to provide the documentation to uphold their claim that our right-of-way is not properly vested. We do not agree with them and will continue to use the right-of-way and keep it accessible for refuge operations and visitors alike.

We do understand that refuge operations and visitors cause wear on the roads, and we have offered twice in the past to pursue how we may contribute to the maintenance of these roads. The Refuge Roads Program within the Service offers funding opportunities to maintain roads that lead to a national wildlife refuge. If Quitnesset Associates confirms that they would accept some assistance, we will be happy to investigate how these funds might be used for road maintenance on Morris Island and Stage Island.

Proposed Shuttle Service

(ID# 63, 81, 229, 234, 235, 236, 244, 250, 261, 286)

Comment: Several individuals expressed concern about and opposition to the proposed shuttle service, suggesting it would be an additional burden on private roads, it is unnecessary given the number of visitors, and the real issue is not lack of parking on the causeway, but the problem is traffic congestion. One individual suggested that the refuge find suitable satellite parking and utilize narrow vans, rather than wide busses. At least one felt that busses from Chatham would encourage more visitors, and having more visitors on the refuge seems to be at odds with the outstanding plans proposed for wildlife and habitat conservation in the draft plan. Another commenter thought a shuttle might be a "bit much" but thought a schedule of hourly trips using the Cape transport system would be a good option.

Quitnesset Associates opposes a seasonal visitor shuttle traversing privately owned residential roads. They said a shuttle every 20 minutes, 10 hours per day would impose an unconscionable additional burden on the already overburdened right-of-way easement, and that it is "unnecessary because the data relied upon in the Volpe proposal does not support the need for shuttle service." Quitnesset Associates also stated that the Volpe study predicts that the shuttle will only transport 132 passengers per day. "Under these circumstances, it is plain to see that the proposed shuttle system is unnecessary, for it is not backed by cogent evidence of a parking problem that needs to be alleviated by frequent bus trips carrying few passengers and would merely compound existing traffic congestion on Morris Island and its approaches."

One individual asked about the status of the grant given to Chatham and the refuge to establish and operate "peak season" shuttle service.

Response: In response to concerns expressed in large part by Quitnesset Associates, we contracted with the U.S. Department of Transportation's Volpe: The National Transportation System Center in 2007 to look at ways we could reduce the amount of cars coming to the refuge headquarters and visitor contact station. The Volpe report, known as the "Alternative Transportation Study: Monomoy National Wildlife Refuge" (U.S. Department of Transportation 2010), recommended a multilayered or interconnected approach to accomplish this. This includes relieving traffic congestion in downtown Chatham and the Morris Island area; alleviating capacity issues at existing Town parking lots; expanding transportation options such as the shuttle; and reducing or eliminating confusion/unawareness of travel options by using variable message signs.

Volpe specifically recommended a shuttle system be implemented in order to reduce congestion at the refuge and along the Morris Island causeway. Use of a shuttle by refuge visitors would also reduce the number of vehicles travelling on Tisquantum Road and Wikis Way. A seasonal shuttle service was deemed possible because in part of the location of several potential satellite parking areas outside of downtown Chatham which would allow visitors to leave vehicles and utilize the shuttle to get to the refuge. The transportation experts at Volpe estimated a shuttle which ran every 20 minutes is the level of service required to encourage visitors to choose the shuttle instead of driving to the refuge. This study also identified several different types of vehicles, ranging from vans to 16-passenger mini-busses, capable of safely traversing the narrow roads of Chatham.

We followed up on the Volpe recommendation and secured funding for a shuttle, in partnership with the Town, to address parking and traffic congestion in Town as well as on the refuge. The Town has decided to develop their shuttle independently, so we will separately pursue the purchase of a shuttle to be operated by refuge staff, volunteers, a concessionaire or a contractor.

We believe that the Volpe staff better understand how to estimate and predict transportation needs and impacts than refuge managers or the general public. When we get our shuttle system operating, we can explore the optimal times for shuttle service and the frequency of shuttle operations. It is possible that we will run the shuttle less frequently if it is not part of a Town shuttle. We will certainly adapt our shuttle management to reflect demand and our ability to meet that demand.

Entrance Fees
(ID# 85, 249)

Comment: One commenter opposed an entrance fee, and another asked if an entrance fee is established, would the FWS "consider a seasonal pass as provided at the Cape Cod National Seashore?"

Response: A parking fee is not the same as an entrance fee. It is not our preferred option to establish an entrance fee for the refuge. However, if we did, we would strongly consider the suggestion for a seasonal pass as we move forward with the development of the refuge's recreational fee program. At Great Meadows NWR, which is a part of the same complex as Monomoy NWR, there is an annual pass that is available to visitors who visit refuge trails in Concord. We will explore a similar option for Monomoy NWR if we decide to move forward with an entrance fee. Also, if we establish an entrance fee, holders of a current Federal Duck Stamp, or the Interagency America the Beautiful National Parks and Federal Recreational Lands Pass (Annual Pass, Annual-Military Pass, Annual Volunteer Pass, or lifetime Senior Pass or Access Pass) would not have to pay an additional fee to visit the refuge.

Parking Fees
(ID# 48, 55, 57, 59, 60, 63, 64, 71, 131, 234, 236,241, 279, 288)

Comment: Several individuals made comments about the proposed parking fee. Most were opposed and felt that parking should remain free or that we accepted voluntary donations. For example, one wrote, "I suggest parking…be free as it is now [but] be limited to 2 hours…Free parking would be appreciated…and would encourage use that otherwise might not happen." One specifically felt it would undermine public relations in the community, but acknowledged that the NPS charges for the use of national seashore facilities. Some, including a number of recreational fishermen from England, said they might go elsewhere if they had to pay a parking fee. The Town indicated that this was an issue worthy of further discussion and review. Others expressed support for the proposal or made suggestions that parking should be limited to non-resident visitors, or that the FWS should work with the Town regarding its Resident Beach Parking sticker. One commenter thought it was fine as he assumes the annual parks pass can be used to pay the parking fee. Another wanted clarification on how the fee would work for recreational anglers coming to the refuge early or late in the day.

Response: We understand that instituting a parking fee, however minor it would be, is opposed by some. It may not have been clear to many commenters that paid parking would be limited both seasonally and temporally. June 1 to September 15 is our peak visitation. During that time period, a parking fee would be required from 9 a.m. to 6 p.m. daily and there would be a 4-hour time limit during. Parking would be free at other times, and the parking lot would remain open 24 hours daily for Morris Island anglers, who are the only users who are permitted on Morris Island before sunrise and after sunset. These seasonal and daily time restraints will not impact the anglers who come to the refuge in the spring or fall seasons. However, all visitors who come to the refuge during the dates and times that a parking fee is in place will need to pay, regardless of whether or not they have an Interagency Pass, Senior Pass, Access Pass, or Duck Stamp. This is not an entrance fee, it is a parking fee. People who walk in or bicycle to the refuge will not have to pay the parking fee.

The main reason we feel a parking fee is necessary is to provide access to more visitors during the peak season. Even though we are pursuing a shuttle that would reduce the reliance on private vehicular access, we understand that many people want the flexibility that comes with their own vehicle. We have some vehicles parked all day in our lot during the height of the season, and we have observed people using the refuge and

then being picked up by boats to go off refuge. This reduces easy access to the refuge for visitors and increases congestion on the Morris Island causeway. The suggestion of a time limit is appreciated although a 2-hour limit may not be sufficient for visitors who want to fish or take a nice, slow walk on the Morris Island trail or walk on the beach. Because it requires additional staff time and resources to provide peak-season parking and facility access at the refuge, we believe a nominal fee will assist in covering these costs. We will be happy to talk with the Town and see if they have some other suggestions we could consider to help us achieve our goal of increased access to refuge visitors during the peak season.

Aircraft Ceiling
(ID# 63)

Comment: One commenter representing the Town indicated that our intention to work with the Federal Aviation Administration to increase pilot awareness of a 2,000-foot ceiling restriction for aircraft was an area of potential concern.

Response: Maintaining a 2,000-foot ceiling over national wildlife refuges is commonly taken to protect wildlife from the noise of aircraft and from the visual disturbance that low flying aircraft can inadvertently cause. Refuge visitors engaged in wildlife observation and other activities benefit from the absence of low-flying aircraft. At Monomoy NWR, the sensitivity of the migratory bird populations throughout the year, whether during migration, breeding or wintering periods, as well as the wilderness designation of much of the refuge, strongly warrant the designation of this advisory ceiling and Service efforts to achieve compliance.

Wind Turbine
(ID# 63, 64, 100, 229, 231)

Comment: We received two letters expressing opposition to the possibility of installing a wind turbine on Morris Island. Both comments were from Morris Island residents. These comments stated that the installation of wind turbines or other "green energy" measures to increase the proportion of Monomoy NWR electricity consumption derived from clean, renewable sources should not come at the expense of the very birds and bats the refuge was created to protect. Opposition to a wind turbine at Morris Island headquarters was also based on the presence of several private homes adjacent to the refuge headquarters, and dangers relating to noise and light emissions, ice dispersal, hurricane breakage, and avian harm. The Town indicated that a proposed wind turbine at refuge headquarters was an issue worthy of future discussion and review. One commenter said that it was a bad idea to put up a wind turbine in a Wilderness Area on a flyway that endangered birds utilize for breeding and migration.

Response: The draft CCP/EIS stated that we had looked at two possible locations for wind turbines to produce clean electricity on the refuge—the Morris Island Headquarters and Monomoy Point Light Station on South Monomoy Island. We clearly eliminated a possible wind turbine at the Monomoy Point Light Station after conducting bird and bat surveys. This site is not part of the Monomoy Wilderness, and we would not have considered erecting a wind turbine in wilderness, but would have considered the impacts on nearby wilderness if we had decided to further pursue that project.

We already have solar panels at our Morris Island headquarters, but will now consider the feasibility of utilizing more solar and possibly geothermal in addition to wind. We will evaluate improvements in technology over the next 15 years to ensure that we select efficient, cost-effective methods that do not adversely affect birds and bats. We will conduct additional NEPA analysis as appropriate. We have modified the final CCP to reflect this change.

Operations and Maintenance
(ID# 64, 90)

Comment: One individual commented that the "Service's lack of a Federal commitment for staffing, upgrades, operations, and maintenance is restrictive. Your infrastructure is already deteriorating. This D-EIS proposes no floodgates, better drains or coastal defense to respond and recover from multi-hazard threats. The CCP is without prevention and post disaster reconstruction." The Town identified many changes in refuge infrastructure and operations worthy of future discussion and review.

Response: The Town's comments have been addressed elsewhere in this section, as has staffing. The Service has upgraded our facilities at Monomoy NWR and is committed to further upgrades and maintenance. We understand, because we are bounded by Nantucket Sound and the Atlantic Ocean, that the refuge is susceptible to potential multi-hazard threats. In order to prepare for potential hazards at the refuge, we annually update our Hurricane Action Plan and Continuity of Operations Plan, and we take steps to protect our equipment and facilities during weather-related events. In the event that post-disaster reconstruction is necessary, we will rely on our Regional Office staff to provide a multitude of support functions to help us get back into full operation as quickly as possible.

Monomoy Point Light Station
(ID# 231, 236)

Comment: One individual commented that the Monomoy Lighthouse and associated buildings are on the National Historic Register and as proposed in Alternative C, to "detail its history and then let it continue to deteriorate is against all standards established in the Historic Sites, Buildings, and Antiquities Act."

Another commenter said, "Let's talk about money. We have a lighthouse down there that was restored. You guys could make money by having tourists down there." Support for turning the lighthouse into a staffed visitor center was expressed.

Response: The Service will preserve the Monomoy Point Light Station as much as feasible, both for its cultural value, its use as a base for our seasonal biological staff, and its potential contribution to our visitor services program. It is our intention to maintain the National Register light station structures in place in perpetuity, which requires annual maintenance and periodic major repairs and refurbishments. In order to help protect the buildings, we feel it is necessary to have access to electricity in the lighthouse keeper's house, which is why the final CCP/EIS contains strategies to look at the possible role of solar power. We understand that the natural processes of erosion and decay may, over time, result in the destruction of the light station structures at the site. The NHPA provides for mitigation of these foreseeable adverse effects on National Historical Register sites. The mitigation program would be developed in consultation with the SHPO and in accordance with the cultural resource provisions of the NHPA and the Wilderness Act. If necessary, we will document the lighthouse and the keeper's house following NHPA standards and then let the buildings decay. However, that is not in alternative B, our preferred alternative, and is not the path we wish to take.

A tour of the lighthouse and keeper's house could be part of a new interpretive opportunity provided by a concessionaire. We have no plans to staff the lighthouse as a visitor center due to its remoteness and difficulty of access.

Trash and Debris Management
(ID# 75, 100, 210, 259, 261, 275)

Comment: Comments were received about trash, marine debris, and materials such as sign posts used in refuge operations. One complained about beer cans on the refuge. Another that huge bags of plaster were left in the dunes for weeks waiting for pick up during the renovation of the lighthouse. Some of their contents had been strewn across the beach. Another commenter expressed concern about missing sign posts.

Response: The refuge is a leave-no-trace, carry in-carry-out facility, and we find the amount of trash at our Morris Island headquarters has decreased with the implementation of this policy. We encourage all refuge visitors to pack in and pack out all food containers, bottles, wrappers, trash, and other waste and refuse. Unfortunately, it is impossible to gain 100 percent compliance, as some people are inconsiderate of the impact that debris has on refuge wildlife, visitors, staff, and occasionally neighbors. This is true of all places where the public is allowed, including shopping centers and parking lots.

We acknowledge that the lighthouse renovation produced a lot of trash and debris. During the season following the renovation, we attempted to remove all the trash. Because Monomoy is a wilderness, everything has to be taken by hand across the island to the boat landing. This is very labor intensive and is totally dependent on the weather for us to get a crew there. We have removed all the surface debris from the lighthouse renovation project but recognize that shifting sands continuously expose debris, so we will continue to cleanup this site as necessary. Every spring and fall, we work with refuge volunteers to conduct a beach clean-up and would like to expand this effort with the help of additional volunteers. These clean-ups focus on offshore marine debris which floats onto the beach.

In response to the comment about refuge signs, we do recognize that we lose some signs every year. The loss of some signs cannot be avoided—this is a marine environment that sometimes experiences high winds and surf. We try our hardest to recover signs and remove them from the island, but as mentioned before, everything needs to be done by hand as this is a wilderness area, and we need sufficient staff, volunteers, and boat support within good weather windows in order to successfully remove all signs.

Stage Island Lot and Parking

(ID# 63, 64, 86, 97, 64)

Comment: Commenters expressed concern that refuge staff no longer issue and renew permits for parking and storage of dinghies on the Service owned Lot 7B on Stage Island. Other commenters expressed concern about the storage of equipment on the site, its general unkempt appearance, and that a building might be constructed on the lot. The Town indicated that acquisition of the lot adjacent to Lot 7B for Service use only was worthy of future discussion and review.

Response: Since the 1980s we have allowed a small number of private individuals who have no specific connection to the refuge to park their vehicles and store dinghies on Service land on Stage Island. We stopped issuing permits to new individuals many years ago, and beginning in the mid-2000s, we only renewed permits for individuals who had obtained one the previous year. This approach led to a gradual reduction in the number of permits issued to private individuals. In 2012, we notified all remaining permit holders that we would be ending use of the lot by non-refuge personnel, and in 2013, we notified the remaining 12 permit holders that their permit would not be renewed in 2014. Only 9 of the 12 individuals chose to renew their permits that year. No parking permits were issued in 2014 or 2015.

We recognize that failure to allow private parking on this lot is at best inconvenient to the former permit holders, and that finding another good site to park, store, and launch dinghies is not easy. We realize that our decision may adversely affect some individuals. However, for many years the permit holders benefitted from the use of Federal lands for a nominal fee. As this is no longer in the best interests of the refuge, we are upholding our decision to no longer allow non-Service related use of the Stage Island lot.

Our need for unencumbered refuge access to the waterfront and our entire Stage Harbor lot for daily operational refuge management purposes is the primary reason for this change. Non-Service parking and dinghy storage was occasionally interfering with refuge operations (although it may not have been obvious to permit holders), as our use of this lot has changed in the past few years. Having privately owned parked vehicles and dinghies stored on this small parcel resulted in occasional congestion and potential safety conflicts between refuge vehicles, boats, equipment, and personnel and private vehicles, and waterfront storage space. This conflict has been eliminated by terminating all private use of this refuge parcel.

While we do not use the Stage Island lot daily at this time, we envision a time when the lot will be more frequently used. Even now, as sand slowly moves into the Morris Island channel, it is expected that all of the refuge's day to day boating operations will move to the Stage Island lot once the tide and sand bars restrict us from using the Morris Island channel. We have also increased its use for storage as we now attempt to remove all non-permanent structures from the Monomoy Wilderness annually. This includes closed area signs, predator control structures, and tern chick shelters to name a few. This was being done with respect to the wilderness character of Monomoy. This material is moved to and from the island via the Stage Island lot, and some materials may be temporarily stored on the lot for several weeks to months at a time.

We have a need for more storage on the refuge, and hope to build an attractive storage building either on our existing Stage Island lot, on the adjacent lot (should we be able to purchase it), or at another location in Chatham. Purchase of another site might also allow us to provide housing for full-time staff, as the high cost of housing in Chatham and on the Cape sometimes impacts our ability to attract or retain talented staff. We understand the Town would like to discuss the potential acquisition of the Stage Island lot with us, and that most Stage Island residents would probably be opposed to our acquisition of this additional lot. It is our responsibility, however, to ensure our ability to access refuge lands and waters via boat and increase operational efficiency, while minimizing disturbance to refuge neighbors. At this time, we have no funds to acquire the adjacent lot and recognize that we may never be able to do so. Furthermore, should we be able to acquire dock, parking, and storage at a different, but convenient location in Chatham, we would consider an exchange or sale of the Stage Island lot.

10. Planning Process

Compliance with National Environmental Policy Act
(ID# 64, 180, 241)

Comment: The Town and a few individuals commented that the draft CCP/EIS failed to provide adequate NEPA analysis regarding the Eastern boundary. Another commented that the USFWS failed to include anyone who is experienced or familiar with shallow water New England fisheries during the preparation of the draft plan and cited NEPA language encouraging harmony between man and the environment and the value of fish, shellfish, and wildlife resources.

Response: We developed the best assessment we could with the information available to us at the time, but acknowledge that we were missing some local data, particularly regarding fishing. We did consult with the MA DMF in the development of the draft plan, and had them on our planning team, but their involvement did not guarantee that we would anticipate all the concerns of local shellfishermen. As a result of the public comment process, we have learned more about the fishing techniques and equipment used by local fishermen, as well as other concerns by residents, local officials, and organizations. We are making some changes in our Service-preferred alternative B, and have modified the final CCP/EIS better reflect the impact of our alternatives.

We acknowledge the value of our nation's fish and wildlife resources, and are pleased that we provide opportunities for public access to these resources while meeting our legal responsibilities under the Improvement Act of 1997 to manage the lands and waters of Monomoy NWR for wildlife and wildlife-dependent public use as part of the Refuge System.

The effect of the ambulatory eastern boundary has been considered and incorporated in the analysis of all the environmental consequences. We believe that the impacts of our alternatives are appropriately addressed in Chapter 4 of the CCP/EIS. The determination of where the refuge boundary lies is not an "action" subject to NEPA but rather a matter of law. The boundary lies where it lies, and while currently there may be uncertainty or disagreement about precisely where that is, different legal interpretations are not different actions or alternatives within Service management direction. They are in fact different understandings of the background facts against which we must make decisions about how to manage the refuge. In this vein, the MOU between the Service and the Town established a management boundary in the Nauset/South Beach area, and therefore reduced the area where active management will be taken by the Service. We have modified chapter 4 in the final CCP/EIS as necessary to reflect the establishment of the MOU.

The EPA, which is charged with reviewing draft impact statements to determine compliance with the NEPA, had no objections to the plan and rated it as "LO-1" which stands for "Lack of Objections –Adequate."

Step-down Management Plans
(ID# 64)

Comment: The Town suggested that the FWS is relying too much on step-down plans and, as such, did not adequately describe the management alternatives, which prevents a full analysis of the cumulative impacts of management actions. They acknowledge that the Service has authority to employ step-down management planning, but does not want this process to avoid complying with the Administrative Procedure Act (APA) or NEPA. They contend the CCP/EIS does not provide the level of detail required to obtain public input and analyze issues to be addressed in the many purportedly forthcoming step-down plans. The Habitat Management Plan was specifically mentioned by the Town, as they do not believe this was adequately addressed in the draft CCP/EIS. The Town stated "merely appending a completed description of an agency action to a final EIS at some subsequent point in time, when it is not included in the draft for public review, is not permissible under NEPA." The town also believes that the compatibility determinations (CDs) are so limited in their scientific analysis that they fail NEPA's "hard look" standard, as they do not consider options that could accommodate reasonable uses or reasonable modifications of uses to preclude an incompatibility determination. The Fisheries Harvest Using Bottom Disturbing Gear finding was provided as an example.

Response: We do not agree with most of the assertions made by the town regarding how we have complied with the APA or NEPA in our step-down plans and compatibility determinations. We have met the requirements of the APA by developing an EIS and giving notice to the public of its availability and public comment period in the Federal Register. We extended the public comment period twice at the request of local municipalities and the public, for an unprecedented 6-month comment period. We held four open houses where the public could

come and discuss any aspect of the CCP with refuge staff. We responded to requests for meetings, including a televised question and answer period held by the Chatham Summer Residents Advisory Committee. And we held a public hearing attended by over 200 people, all of whom were given the opportunity to speak. Further, as required under APA, we have considered all of the comments that were submitted prior to issuing a final EIS. The public comment period also included input from the public on the findings of appropriateness and compatibility determinations in the draft CCP/EIS. These were themselves unsigned drafts published for the sole purpose of soliciting public input. Input was received from the public, including some scientific information we were not aware of, and as a direct result, we have made several changes in both our preferred alternative and the Findings of Appropriateness and compatibility determinations. Not only have we adequately complied with both APA and NEPA, but the process worked exactly as it was intended by Congress when they passed both Federal laws. This process will be complete when we have a signed Record of Decision and sign the findings of appropriateness and compatibility determinations.

The CCP is the umbrella NEPA document that presents an overview of all actions proposed or being undertaken on Monomoy NWR. We have identified very specific objectives and strategies in three alternatives, and we have described the impacts of these objectives and strategies in the draft and final EIS. This plan is sufficient NEPA compliance for most of the activities that we propose to undertake in the next 15 years on Monomoy NWR.

We agree that development of CCPs and step-down plans, new public use programs such as the waterfowl hunt program we propose in this plan, development of a new visitor contact station, and development of compatibility determinations for new proposed uses are all actions that are often considered major Federal actions and, are therefore' subject to NEPA. We also agree that we must apply NEPA to the development of step-down management plans. In fact, all refuge management activities and refuge actions require some level of NEPA compliance, and possibly compliance with other environmental laws and regulations. We review our proposed actions to determine their effects on the human environment (the natural and physical environment and the relationship of people with that environment). The anticipated significance of the impacts then dictates the NEPA process that will be followed (USFWS, NEPA Handbook for the National Wildlife Refuge System, 2014, *http://www.fws.gov/policy/NEPARefugesHandbook.pdf*, accessed February 2015).

Most daily activities on refuges qualify for categorical exclusion (CatEx) and do not require further NEPA analysis. CatEx's are classes of actions which do not individually or cumulatively have a significant effect on the human environment. We have a list of actions that fall under the CatEx provision. This is published in 516 DM 8. An Environmental Action Statement or a memo to the file outlining the reasons why the proposed action qualifies for exclusion from further NEPA documentation can be prepared but is not necessary to achieve compliance. Some step-down plans are for very simple management actions, and therefore fall under the CatEx provision. Step-down management plans that typically fall in the CatEx provision include Sign, Emergency Action, Safety, and Continuity of Operations Plans.

Other refuge actions may require either the preparation of an environmental assessment or an EIS, depending on whether the action *significantly* affects the quality of the human environment. We develop step-down management plans following the planning process guidance in 602 FW 1 and 602 FW 3. Rarely, if ever, does a step-down management plan trigger the development of an EIS. As stated above, we have provided a clear direction in our objectives and strategies, and the public comment period for the draft CCP/EIS satisfies the requirement for NEPA compliance. Only if we prepare a step-down management plan that deviates substantially from the objectives and strategies included in the CCP, or if we develop new proposals, would additional NEPA compliance be necessary, and then it would most often be in the form of an environmental assessment. We have provided detailed information in the alternatives in this plan and therefore conclude that we are in full compliance with NEPA on the development of an Inventory and Monitoring Plan (IMP), Habitat Management Plan (HMP), Visitor Services Plan (VSP), and Cultural Resources Plan. We had hoped to append the HMP to the final CCP/EIS, but it is not yet complete. The CCP indicates what we want to do and why, and analyzes the known or expected impacts. The HMP provides more details about how and when these actions will take place (prescriptions), and identifies triggers and helps prioritize the actions. The HMP, like many other plans, tiers off of the alternatives, objectives, and strategies, and we do not believe that an additional level of analysis is required for us to achieve NEPA compliance.

While we believe our NEPA analysis is sufficient, we do agree that there are improvements in communication that we can make, and are happy to do so. First, we will be sure to contact affected agencies and State, Tribal, and the Town when initiating new actions subject to NEPA. We recognize the interests of the Town, its residents and our neighbors, local businesses and organizations in refuge operations. We will continue to

communicate, and work to improve and increase our communication as necessary, to ensure that the public is fully aware of the plans we are preparing and has the opportunity to provide meaningful and timely feedback. We will make step-down management plans that do not require additional NEPA analysis, including the IMP, HMP and VSP, available for public review and comment, and will post our completed plans on our website so the public always has an opportunity to learn more about what we are doing and why. We may not always agree, but generally communication leads to better decision documents and better decisions, and we look forward to future dialogue with the Town and other stakeholders.

There will be some additional NEPA compliance conducted for specific proposed management actions. For example, we are required to officially open refuges to hunting through the Federal Register process, and this involves preparation of an environmental assessment with a formal public comment period. Should we decide to move forward with the installation of a wind turbine on Morris Island, the construction of a downtown visitor contact station, or propose to implement actions which are not consistent with the objectives and strategies in our proposed alternative, then we will undertake additional NEPA compliance in the form of an environmental assessment, each of which is subject to additional impact analysis and formal public review and comment.

We do not agree with the assertion of the Town that we had inadequate NEPA analysis for our compatibility determinations. Findings of appropriateness and/or compatibility determinations are completed for all proposed and on-going public uses on the refuge. Each determination is prepared for the actions that would take place under the preferred alternative, the impacts of which are analyzed in the NEPA document associated with the CCP. We have incorporated the best available scientific literature and information at the time of decision making. When available, we back up our findings in the justification section of the finding of appropriateness with a scientific literature review of pertinent information relating to the use. Often, this literature is also cited in the CCP itself. We believe that analysis of impacts in the CCP is sufficient.

The Town specifically mentioned the finding of appropriateness for "Fisheries Harvest Using Bottom Disturbing Gear." We have addressed this comment in the fisheries section of this appendix and refer the reader to that response.

Decision-making/NEPA

(ID# 50)

Comment: One individual commented that the final decision by the Service's "Regional Administrator" is a conflict of interest and that the final decision should be made by an independent scientific body.

Response: The Director of the Service has delegated authority to the Regional Director to sign CCP's along with the accompanying environmental assessment or EIS. Our Regional Director oversees all of the responsibilities of the Service in the northeast region, not just the Refuge System, of which Monomoy NWR is a part. She must uphold Federal law and ensure this plan is consistent with Federal policy. She has the legal authority to make the final decision about this plan, and in fact is the best qualified person to do so. Independent scientific bodies do not have the knowledge to ensure our compliance with Federal laws, regulations, and policies, nor do they have the authority to make decisions about Federal lands.

Comment Process

(ID# 64, 65, 67, 68, 119, 153, 232)

Comment: There were several requests to extend the public comment period to allow for more time to assess the proposals contained in the draft CCP/EIS. We were also invited to speak before the Chatham Summer Residents Advisory Committee to answer questions. One commenter encouraged us to look for other formats that would allow more discussion and collaboration. One commenter did not agree that communication and collaboration was being demonstrated by limiting speakers to three minutes each at the public hearing. One commenter said that refuge staff, "view most of this as a waste of your time and an impediment to your view of your limitless powers."

Response: Recognizing the concerns of many individuals and agencies regarding the complexity of the CCP/EIS and the timing of its release, we extended the comment period twice, for a total period of 6 months. This is the longest comment period that has ever been provided for a draft refuge comprehensive plan and enabled us to receive over 260 written and verbal comments as well as two petitions. We held four open houses and

engaged in discussion that was often compelling and useful, and we found the comments provided at the public hearing to be quite informative as well. We did limit the amount of time that people could speak so that we could accommodate all who wished to speak at the public meeting. We also participated in a televised meeting of the Chatham Summer Residents Advisory Committee. We believe the public comment period effectively enabled us to learn both the concerns and the support from the public about the draft plan. We have in fact made many changes in our proposed alternative as a result of information and feedback we received.

Scientific Information—Quality of Data Used

(ID# 64, 73, 152, 164, 205, 212, 219, 229, 238, 241, 243, 249, 250, 252, 254, 262, 265, 291)

Comment: Many commenters, across several different categories (including fisheries management, biological management, and recreational activity management), felt the studies and documentation relied upon in the CCP for our preferred alternative were not sufficient because they did not constitute "science," were not peer-reviewed, were methodologically of poor quality, did not fit the situation at Monomoy, or were only observational. Some commenters, including the Town, provided literature citations for our use. Others suggested we do scientific studies to determine real, rather than "perceived" effects. Many indicated there was no data and therefore we should not be making decisions to ban access without any data. One person found it appalling that we would look "at this kind of extensive plan" with "no objective evidence that this is going to improve the life of the migratory waterfowl."

Response: We address comments made regarding lack of credible, sufficient, or peer-reviewed science within each category-specific response where appropriate. In most instances, commenters challenged the reports, studies, and references we are relying on, yet failed to offer any new subject matter for consideration. In instances where commenters have submitted additional resources, we have reviewed and incorporated them as appropriate. We acknowledge that in some instances, there is not sufficient scientific information to lead to a clear decision, and in some scenarios, we have erred on the side of caution to benefit our priority biological resources. Throughout the CCP, we made every attempt to conduct literature reviews, consult with subject matter experts, and use the most up-to-date information when considering our range of alternatives. Following the public review period, we conducted additional literature reviews and consultations in light of the comments we received in order to better articulate the scientific justification for some of our decisions.

We disagree with commenters questioning the scientific basis for our proposals, including those where we draw upon observations our trained biological staff have documented in the field. Our sound professional judgment is an appropriate component of our decision making process. We are intimately familiar with the behavior of refuge wildlife and the needs of these fauna throughout the course of the year. We understand the interdependencies between species and their habitats, and have observed the impact of human-caused disturbance. We apply lessons learned from the experiences of other land managers when appropriate. We use peer-reviewed science when available, but we are not required to only use peer-reviewed science as a basis for our proposals and decisions.

Basing our decisions on sound science is a hallmark of the FWS. In December 2000, Congress required Federal agencies to publish their own guidelines for ensuring and maximizing the quality, objectivity, utility, and integrity of information that they disseminate to the public (44 U.S.C. 3502). The FWS guidelines, which were updated in June 2012, establish FWS policy and procedures for reviewing, substantiating, and correcting the quality of information it disseminates to the public. We have complied with this guidance and fully support our preferred alternative on the basis of field experience, sound professional judgment, and scientific literature.

Scientific Information—Shellfish and Fin fish

(ID# 136, 145, 238, 241, 249, 250, 254)

Comment: Several commenters indicated that the proposals regarding fishing in the draft CCP/EIS were not based on accurate information. One commenter said "the draft proposal issued by the Service is replete with scientific errors and inconsistencies and regrettably does very little to confirm that this government department possesses even the most rudimentary knowledge of shellfish, shellfish harvesting, shellfish gear identification and/or shellfish habitat management." Many people acknowledged that we understand Monomoy's wildlife but indicated that we do not understand fishing and fishing techniques, including fish weirs, in Monomoy's waters.

Another person wrote that "For decades the wildlife and people have co-existed. There has been no substantial scientific documentation provided that proves these activities cannot co-exist." To the contrary, there is concrete science that does support that human activity helps birds, especially when they forage on the worms, crabs, and juvenile shellfish that get displaced through clamming using traditional methods."

Response: We acknowledge that our knowledge of fishing and fishing techniques in general is not as well developed as our knowledge of refuge wildlife and population and habitat management. We are very familiar with the non-mechanized gear used and harvesting techniques for softshell clams. The original research we conducted on the impact of hand harvest of softshell clams on migratory birds, which was published in peer reviewed journals, is part of the scientific information supporting our proposed alternative. We coordinated with the Town on shellfish research they conducted on the refuge. However, for most offshore fishing activities, particularly those in submerged waters, we had a lot to learn. As a result of conversations with fishermen from our open houses, public comments, and further discussion with the Town and the Division of Marine Resources, we received new information and used this to modify several fishing-related alternatives in the final CCP/EIS.

Cape Wind
(ID# 252, 264, 298)

Comment: Two commenters remarked that the Cape Wind project would likely kill many birds yet the project is supported by the FWS. They found it ironic that we would impose restrictions on how the refuge is used to protect birds while allowing this other activity that will kill birds.

Response: In chapter 1 of the final CCP/EIS, we have added the Cape Wind project to the section "Issues Outside the Scope of this Analysis" and we explain our rationale for doing so.

Additional Information/Corrections
(ID# 85, 224)

Comment: One individual pointed out that the Stage Harbor Entrance Relocation Project took place in 1965, not between 1944 and 1958, as the Draft CCP/EIS wrote; and the causeway was constructed across Stage Harbor in 1957 to close the Little Beach cut-through and re-establish land access to Monomoy. Another individual asked how we will address overall ecological health on a larger scale than just through the boundaries of the refuge.

Response: Thank you for the information on the Stage Harbor relocation. The text has been modified. On the question of larger scale ecological health, our jurisdiction is confined to the lands and waters within our boundaries. However, we exert an influence on a larger area through our many partnerships and through our education and interpretative activities. While we do not have a specific plan that addresses overall ecological health in a larger scale, we recognize that the health of the wildlife habitat on the refuge is dependent on the larger environment. Much of the scientific research that is conducted on Monomoy NWR is relevant to areas outside the refuge as well. We will continue to allow and support research, work with conservation partners, and stay actively informed about events and system changes outside the refuge.

11. Consultation and Coordination

Coordination with Town of Chatham
(ID# 59, 63, 64, 86, 91, 94, 95, 96, 98, 99, 101, 102, 106, 107, 108, 119, 124, 125, 126, 128, 129, 132, 133, 134, 136, 138, 139, 142, 146, 148, 150, 153, 155, 162, 164, 168, 176, 181, 182, 183, 184, 187, 194, 196, 197, 201, 203, 204, 207, 209, 213, 217, 220, 223, 237, 238, 241, 242, 243, 248, 252, 258, 259, 269, 266, 279, 285, 296, 299)

Comment: The Town and numerous other commenters expressed that the refuge should have done more to include the Town in the CCP planning process, and should do more to cooperate and coordinate efforts with the Town in writing and implementing the final CCP. One commenter said that addressing, explaining, and compromising would go a long way to creating a better relationship between Monomoy and the people who live here. Many commenters specifically indicated that the Town has indicated their willingness to work with us and should be seen as a partner and not an adversary. Some indicated the Town has done an excellent job protecting shorebirds. Some suggested we talk with the Town if we think that the Town "could do better" managing lands and waters. Mass Audubon supported good management of the natural resources of the entire area to benefit coastal waterbirds and native wildlife and supported open cooperation with the Town and other

stakeholders. One suggested we utilize the U.S. Department of the Interior's Office of Collaborative Action and Dispute Resolution to engage in communication and conflict resolution with the Town. Another commenter indicated that we have not been communicating and collaborating for several years.

Response: In the development of CCPs, the refuge planning team always includes representatives of the state fish and wildlife agency and federally recognized Tribes. We provide opportunities for stakeholders to participate through the scoping process. In the development of this final CCP/EIS, we had additional coordination with the Town, particularly regarding research related to shellfishing on the refuge. For several years, we held monthly conference calls with the Town. Town officials met with the Deputy Director of the FWS in 2010 to discuss key CCP issues. We held additional briefings, with the last being in March 2013 before the release of the draft CCP in April 2014. We consulted further with the MA DFG as we prepared our final CCP/EIS, and they provided valuable comments that were based in part on a strong understanding of fisheries issues in Chatham. We also met with the Town prior to the release of the draft CCP/EIS and after the end of the public comment period, and we worked together to establish a management boundary on Nauset/South Beach (appendix L). The 2015 MOU between the Town and the Service will facilitate additional cooperation and consultation as we work together to protect wildlife resources while maintaining some public access. We look forward to continued communication and coordination with the Town, and have added the MA DMF to our planning team to ensure additional information sharing on marine issues of concern to the State and the Town. It is the responsibility of the planning team to develop the final CCP/EIS, which will go out for a final 30-day review before the final CCP is written and released to the public.

Preparing a comprehensive plan is just one of many management activities that have occurred at the refuge. We have a solid history of working cooperatively with the Town and other partners on natural resource management, contrary to what some may believe. We look forward to working with the Town and its citizens as we implement the CCP. Please see our response to the comment about the MOU in section 1 of this appendix for more discussion about cooperation between the Town and the Service.

Coordination with State and Town Enforcement Agencies

(ID# 64, 202, 243)

Comment: The Town and the MA DMF requested that the Service improve coordination with State and local enforcement agencies to ensure enforcement of natural resource regulations, such as those for fishing and shellfishing. One commenter requested no increased enforcement.

Response: Our Federal Wildlife Officers stationed at the refuge complex are committed to public safety and resource protection and have the legal responsibility to protect wildlife and visitor safety. We believe that improvements can always be made with respect to enhancing the flow of information and strengthening relationships between Federal, State, and Local enforcement agencies. We will work to improve our communication with other enforcement agencies that hold jurisdiction in and around Monomoy. This includes the Massachusetts Environmental Police, U.S. Coast Guard, NOAA, Chatham Police Department, Chatham Shellfish Constable and Harbormaster, and Cape Cod National Seashore. This coordination will help develop and maintain a continuity of enforcement. The sharing of information and resources between agencies are vital components of law enforcement that will greatly increase public safety and the protection of our natural resources.

12. Socioeconomic Impacts

Impacts on Local Economy

(ID# 63, 64, 81, 91, 127, 238, 241, 243, 248, 249, 259, 260, 261, 267, 268, 283, 296)

Comment: The Town and many individuals felt we did not adequately describe, consider, and analyze the impacts of the proposals in the draft CCP/EIS on the local and regional economy and culture. Many commenters felt that our proposal would have a significant negative socioeconomic impact. Common concerns raised by stakeholders included:

- The impact to the local fishing industry and community from restrictions on fin fishing and shellfishing in the open waters and submerged lands of the Declaration of Taking.

- The impact to Chatham residents and visitors from various recreational restrictions on public use at the refuge, particularly on Nauset/South Beach.

- The impact to local shellfishermen from the ban on wheeled carts in the Wilderness Area.
- The impact to Chatham residents and visitors from proposed changes to refuge infrastructure and operations (e.g., new downtown visitor center, shuttle service, additional directional and informational signage, increases in staffing, new docks, exploration of pedestrian/bike path on causeway).
- The impact to local tourism from the ban on kiteboarding.
- Our failure to include "fishing" in our description of Chatham as a "resort, retirement, and artistic community" could show that we do not understand that Chatham is a community rooted in marine and fisheries endeavors.

For example, we received a letter from one individual stating, "I vehemently oppose the draft CCP/EIS for Monomoy NWR as well as the unilateral Federal annexation of 717 acres of Chatham's property on South Beach both of which menace, threaten, and imperil this community's historical, cultural, and seafaring identity and furthermore could, if unwisely implemented, precipitate irreversible disaster and destruction laying waste to our vital maritime economy." Similarly, a form letter sent in by many individuals says, "If implemented, these changes [proposed in the draft plan] would have a substantial adverse effect on Chatham and its citizens and would likely cause reverberating effects through all the Cape communities."

Many commenters spoke specifically with concerns about impacts to the local economy from restrictions on fishing and shellfishing. For example, the Town stated, "The direct value of the Town's commercial fish catch alone is approximately $15 to $20 million annually, and it has wide-reaching economic benefits as those dollars flow through the local and regional economies. The Cape Cod Commercial Fishermen's Alliance recommends [using] an economic multiplier of 3.16 when assessing the true value of commercial fishing landings. This would equate to…$45 to 60 million [annually]."

Commenters noted that shellfishermen have been working the low tidal and sub tidal areas for decades using traditional methods. It was a concern these areas could become under control of the Service, which can restrict access to the working areas at the most productive time of the year causing financial hardship to hard working, tax paying families.

Other commenters were concerned about how recreational restrictions could affect tourism and noted that Chatham supports a large number of hotels, restaurants, shops, and rental properties that depend on the influx of tourists for a significant portion of their business revenues.

Response: We are well aware of the importance of fishing both economically and culturally in Chatham, and agree that Chatham is more than a resort, retirement, or artistic community. While unfortunately we failed to include the word "fishing" in that sentence, the rest of the socioeconomic overview, starting on page 2-94 of the draft CCP/EIS, focused exclusively on fisheries.

We have determined that several types of fishing can continue to occur within refuge waters as a result of comments from the State, Town, and others, which will therefore reduce the level of economic impact that was discussed in our draft CCP/EIS once the final plan is implemented. We acknowledge that there remains the potential for some economic impact under our final plan but as discussed in our final CCP/EIS we believe these impacts will be relatively minor. Additionally, while we appreciate Chatham's maritime history and the role that all shellfish, including the less rarely harvested shellfish, play in that history, we make decisions about the appropriateness and compatibility of uses based on the potential impacts of those activities to biological resources of concern. We can make decisions about uses of refuges and prohibit, restrict, and/or regulate activities even when there are economic impacts associated with our decisions, as long as these are explained in our planning documents.

The final CCP/EIS indicates that we will ban mussel harvesting, prohibit salting, and prohibit the use of wheeled carts. Horseshoe crab harvesting is currently prohibited within the refuge boundary so there is no additional impact to local fishermen. As previously discussed in Section 5 of this appendix, mussels are a highly important food resource for migratory birds. As noted by one commenter, mussel harvesting has not consistently taken place on the refuge and therefore the impact to mussel harvesters of a ban on mussel harvesting will likely be minimal.

There is very little history of razor clam harvesting on the refuge, therefore, the impact of not allowing salting as a harvest technique for razor clams is minimal. Lastly, based on our daily observations, we estimate that at this time, only about 20 percent of softshell clam harvesters use wheeled carts. We recognize that if other tidal flats are harvested, the use of carts might increase if the harvest areas are farther away from the water. Shellfish and harvesting equipment can be carried to and from a boat using other types of non-mechanical transport such as sleds. We acknowledge that there is likely to be a cost to obtain another mode of transportation. It is possible that some shellfishers will carry their harvest to their boats instead of using something other than a wheeled cart, and that could result in a minor decrease in harvest because more time is spent in transport instead. It is difficult, however, to provide a credible estimate for this scenario. Since fishing is a priority public use for national wildlife refuges, we will make every effort possible to accommodate fishing on the refuge when it does not hinder our compliance with Federal law to protect migratory birds and other federally listed species, preserve wilderness character, or protect cultural or historic resources.

We do not believe that our ban on kiteboarding will have much of a socio-economic impact, as the activity continues to be allowed off of Harding's Beach, a major launch site, and other Nantucket Sound beaches. This is discussed in more detail in Section 10 of this appendix.

Changes to refuge infrastructure and operations (e.g., new downtown visitor center, shuttle service, additional directional and informational signage, staffing increases, and exploration of pedestrian/bike path on causeway) are all proposed to assist the public with accessing and using Monomoy NWR. Maintaining and possibly increasing the current level of public access to the refuge and promoting compatible, wildlife-dependent public uses will minimize socio-economic impacts to Cape Cod residents and visitors. We will continue to work towards making the refuge easier to access while continuing our primary responsibility to protect wildlife, preserve wilderness character, and promote wildlife conservation.

13. Alternatives

Support for Alternative A

(ID# 81, 86, 87, 88, 89, 116, 117, 131, 144, 148, 154, 165, 166, 169, 170, 172, 173, 174, 175, 177, 178, 179, 185, 189, 190, 191, 199, 202, 210, 241, 248, 270, 291, 295)

Comment: Numerous individuals expressed support for alternative A because they would like to see the refuge continue to be managed as it is now. The majority of those in favor of alternative A specifically only supported continuing current refuge management, without the proposed changes to the refuge's boundary. There is a lot of support for the work we do on the refuge, but many commenters strongly feel that the Town and State are adequately managing South Beach and the waters adjacent to the existing refuge boundary very well. Many of these people value Monomoy for its beauty and its wildlife and in general have few concerns with the way we currently manage the refuge. However, there was considerable opposition to any expansion of our jurisdiction. Even though we indicated in the Draft EIS that our boundary interpretation was not an alternative, we believe the strong support for alternative A and the comments we received reflect a concerted opposition to any refuge expansion. Many commenters do not agree that the south part of South Beach should be part of the refuge, and they believe that the restrictions and additional regulations that the FWS would impose with increased jurisdiction are unnecessary and overly restrictive.

One commenter preferred alternative A, but hopes that the Service will compromise and come up with a plan that is a hybrid of alternatives A and B.

Response: We believe the reason so many people supported alternative A is the perception is that there would be no change in refuge boundaries under this alternative. If the boundaries did not change, there would be no changes in fisheries management, kiteboarding would not be prohibited, and visitor use on the southern part of Nauset/South Beach would not change.

We have proposed changes to alternative B, and it is likely that many of these modifications may be favorably received by some people who supported Alternative A.

Support for Alternative B

(ID# 71, 76, 77, 82, 83, 96, 118, 155, 158, 159, 160, 225, 227, 235, 244, 272, 276, 278)

Comment: The National Wildlife Refuge Association, Cape Cod and Islands Group of the Sierra Club, and several other groups and many individuals expressed their support for alternative B, or for certain actions proposed under alternative B. The reasons cited for support included: conservation of wildlife and habitats, protection of wilderness characteristics, increased visitor services, hunting opportunities, increased monitoring of refuge species and habitats especially related to the effects of climate change, creating a new detailed habitat management plan could only be beneficial, proposed invasive species control and clarification of the refuge boundaries. Incorporation of the public more into the activities of the refuge could help produce a pro-conservation attitude in the public if managed correctly, such as wildlife photography and fishing and further research.

Another commenter said that the increased plans for wildlife and habitat conservation are outstanding, but the plans for increased visitor participation including shuttle busses, more parking, more programs, and geocaching seem at odds with those very plans. Geocaching whether on Monomoy or Morris Island is foot intensive and can lead to damage of marsh and dune grasses. Another commenter said that alternative B should be refined to focus more on management activities that are essential to protecting the resources of the refuge and perhaps somewhat less on enhanced visitor services.

Response: In the final CCP/EIS, alternative B remains the Service-preferred alternative. The recent establishment of a management boundary on Nauset/South Beach where lands east of the boundary are managed by the Town, and the decision to not further regulate fish weirs and scallop harvest, reflect changes to alternative B. The revised alternative B still represents an extension and progression of all areas of refuge management including expanding management activities that are essential to protecting the resources of the refuge. While wildlife conservation is our highest priority, we believe we can appropriately manage visitor use in a balanced manner that minimizes impacts on wildlife and wilderness.

Opposition to Alternative B

(ID#: 55, 291)

Comment: The Cape Cod Marine Trades Association and one individual reject alternative B because it bans dogs and beach activities. They also interpreted alternative B as "banning rather than managing fishing and shellfishing" activities." Another commenter from Europe is concerned about the proposals to limit parking, access, and number of visitors to the Monomoy NWR. If these changes restricting the way that the refuge can be accessed for fishing are put into place, I would have no choice but to take my holidays elsewhere.

Response: The Service has re-examined its position on dog walking and will continue to allow dogs on leash on Morris Island only from September 16 to April 30. This is consistent with Town regulations and is a time period when less wildlife is found on the Morris Island part of the refuge. We will not allow dogs on any other sections of the refuge at any time of the year.

Beach sports activities are determined to be inappropriate because they can disturb wildlife. Beach sports include, but are not limited to, volleyball, football, soccer, Frisbee, baseball, surfing, and skim boarding. Kite-related activities include kite flying, kite surfing, and kite boarding. These uses do not contribute to quality wildlife-dependent recreational uses nor do they support the purpose for which the refuge was established. When conducted in designated wilderness, these activities can detract from wilderness character. Beach activities that are allowed include beachcombing, and swimming and sunbathing.

Alternative B does not ban fishing and shellfishing, instead we allow and manage these activities. Alternative B allows refuge visitors to harvest subterranean shellfish (softshell clams, quahogs, razor clams and sea clams) using non-mechanized hand raking tools only and no artificial means of extraction above MLW (such as salt and chlorine), otherwise in accordance with Town Shellfishing Rules and Regulations or additional refuge regulations.

Since fishing is a priority use, every effort will be made to accommodate fishing when it does not hinder our compliance with Federal law to protect migratory birds and other listed species, preserve wilderness character, or protect cultural or historic resources. Fishing now includes fin fishing, lobster, crab, and whelk pot

harvesting, fish weirs, and scallops in the open waters lying above the submerged lands within the Declaration of Taking. There are very few changes that would restrict the way that the refuge can be accessed for fishing. We will continue to allow fin fishing from all refuge lands from ½ hour before sunrise to ½ hour after sunset and allow anglers to fish on Morris Island 24 hours per day in accordance with all Federal and State fishing regulations. We will also allow freshwater fishing in the ponds on South Monomoy during daylight hours.

Support for Alternative C

(ID# 110, 155)

Comment: One individual wrote in support of alternative C, saying that they liked its main philosophy of leaving the area alone. Mass Audubon indicated that "an emphasis on non-motorized access to the Monomoy Wilderness… may be preferable to protect resources."

Response: Alternative C proposes less intensive management, with a theme of allowing natural succession of habitats to progress, to the extent that the refuge purposes and goals are not compromised. While this is a viable alternative, it is not our preferred alternative because we believe in more active management of habitats for wildlife, more active population management, and we wish to encourage respectful and compatible use of the refuge by the public.

Opposition to Alternative C

(ID# 55, 254, 291)

Comment: The Cape Cod Marine Trades Association and one individual felt that alternative C should be eliminated from consideration because it bans beach activities and motorized boat use. They write that banning these uses "provides no value to the continued preservation of resources within the boundaries of the refuge, particularly where so many visitors accessing the refuge by motorized vessel are participating in appropriate and compatible recreational uses and have done so without species impact for more than one hundred years. These low- to no-impact activities are banned along with the traditional access, for no supported reason. The only endangered species, the piping plover, has co-existed with boating and recreational activity on beaches for centuries and thrives in the current refuge with this respectful coexistence." Another commenter from Europe is concerned about the proposals to limit parking, access, and number of visitors to the Monomoy NWR. He stated, "If these changes restricting the way that the refuge can be accessed for fishing are put into place, I would have no choice but to take my holidays elsewhere."

Response: We are required under NEPA to evaluate a reasonable range of alternatives and we believe the three alternatives evaluated in the final CCP/EIS meet that requirement. In our opinion, alternative C is a reasonable alternative to consider and evaluate fully, although we do not propose it as the Service-preferred alternative. We expected that there would be opposition to alternative C, and believe a lot of that opposition is due to the motorboat restrictions. Because alternative C gives primary consideration to wildlife and to wilderness character protection and public safety, alternative C proposes to prohibit motorized boat landings along the Monomoy Wilderness shoreline, including the tidal flats and beaches. Refuge visitors would be able to access the refuge by kayak, canoes, rowed boats, paddleboards, and sail boats, or through our concession operating a motorized ferry access system from the refuge headquarters. The proposed concessionaire would be encouraged to manage guide services that facilitate the six priority refuge uses in order to promote a wilderness experience.

As with alternatives A and B, beach sports activities are determined to be inappropriate under alternative C as well because of disturbance to wildlife. These uses do not contribute to quality wildlife-dependent recreational uses nor do they support the purpose for which the refuge was established. When conducted in designated wilderness, these activities detract from the wilderness character.

We do not agree with the Cape Cod Marine Trades Association that the plover "thrives in the refuge with this respectful co-existence." The piping plover has co-existed with boating and recreational activity, however, because we have closed nesting areas to public use and used exclosures to protect the nest from predators and human activity. Plovers have certainly not thrived on the refuge. They have done well, but we have not come close to the potential estimated capacity of 94 nesting pairs. Disturbance from people is just one cause of lower productivity but it is one that we can more easily manage.

Proposed New Alternative
(ID# 64, 90, 130, 205)

Comment: One individual disagreed with our interpretation of the definition of "no action" alternative. They wrote, "This Conservation Plan should propose a true 'No Action' alternative as alternative D. Alternative D would be titled 'No Action' and mean no active management by the Department of Interior. This alternative should be utilized as the baseline alternative from which other alternatives are compared." Another suggestion for an alternative D would be one that allows the removal of seals from the refuge.

Another individual wrote, "the analysis [in the draft CCP/EIS] is incomplete because it does not consider the reasonable alternative that the Service not pursue authority to regulate the disputed land and waters, but rather to leave the regulation as it now stands…" Specifically, the Town contends that changing the refuge's eastern boundary is a "major Federal action" subject to NEPA. They feel that including this boundary interpretation in all alternatives fails to follow NEPA requirements. They feel that this boundary interpretation will have a significant impact on the human environment, thus we should have analyzed at least one alternative that did not include this boundary interpretation. In their opinion this "is precisely the type of action for which environmental review and public comment are most critical."

Response: Alternative A satisfies the NEPA requirement of a "no-action" alternative, which we define as continuing the status quo, or continuing current management. It describes our existing management priorities, activities, and available resources, and serves as a baseline for comparing and contrasting alternatives B and C.

We have a reasonable range of alternatives in this final CCP/EIS, and do not believe there is any need for an additional alternative because of an administratively determined boundary. The Declaration of Taking established a fixed boundary on the western side of the Monomoy Islands. The eastern refuge boundary is defined as MLW and is a shifting boundary. As stated in Section10 of this appendix, the EPA, which has the responsibility of reviewing EISs for adequacy, found that our draft EIS achieves the requirements for an EIS.

Chapter 4 of the final CCP/EIS contains a detailed assessment of the impact of all the alternatives. Alternative A serves to adequately provide a comparison of impacts from the other two alternatives, and therefore fulfills NEPA.

Lastly, we cannot propose an alternative which violates Federal law, so adding one that would remove the gray seals from Federal protection is not appropriate. Individuals who believe that seals should be removed from protection are free to petition Congress or the National Marine Fisheries Service to try to achieve that goal.

List of Commenters

Table K.2. List of Commenters with Identification Number*

ID Number	Name	Organization (if applicable)
46	Jean Dunoyer	
47	John Taylor	
48	Paul Jennings	
50	John Garey	
51	Domenic Santaro	
52	P.V. Gryska	
53	Keith Hutchings	
54	Brian Harrington	
55	Rupert McArt	
57	Joanne Hinesley	

ID Number	Name	Organization (if applicable)
58	William Bystrom	
59	Mike Page	
60	John Beckley	
61	Frank Messina	
62	Kevin McNally	
63	Florence Seldin	Chatham Selectman
64	Board of Selectmen	Town of Chatham
65	Sarah K. Peake	State Representative
67	Martha Stone	Town of Chatham South Coast Harbor Plan Committee
68	Joel Rottner	Chatham Summer Residents Advisory Committee
69	Sean Clark	
70	Dylan Dobbyn	
71	David Langan	
72	Hoyt and Deborah Ecker	Massachusetts Committee for the Preservation of Horseshoe Crabs
73	Alana J. Donohoe	
74	Kerri Tarpey	
75	Jennifer Hicks	
76	Lewis Stringer	
77	Ryan Bates	
78	Carol E. Garey	
79	James Botsolis	
80	Pamela E. Wise	
81	Douglas E. Blackwell	
82	Brenda J. Boleyn	Horseshoe Crab Conservation Association
83	David MacAdam	
85	Douglas Doe	
86	John A. Bustard	
87	Brian Killen	
88	Tyler P. Hoffman	
90	Beverly M. Carney	
91	Barry Greco	
94	Paul L. Milone	Weymouth Harbormaster/Shellfish Constable
95	Board of Selectmen	Town of Orleans
96	David Houghton	National Wildlife Refuge Association
97	Ian Hoffman-Terry	

ID Number	Name	Organization (if applicable)
98	Board of Selectmen	Town of Wellfleet
99	Paul Faugere	
100	Barbara and Earl Lewis	
101	Board of Selectmen	Town of Eastham
102	Fred and Dianne Connelly	
103	Joseph M. Samela, Jr.	
104	Hugh G. Moulton	
106	Board of Selectmen	Town of Mashpee
107	Board of Selectmen	Town of Truro
108	Colette B. Trailor	
109	Nancy Monaghan	
110	Jean Public	
111	Joshua Etsten	
112	Marie Sherman	
113	Joyce I. Keay	
114	J. Thaddeus Eldredge	
115	Lauren LaFortune	
116	Dillon Murphy	
117	Jeff Coccoro	
118	Billie Bates	
119	Stephen Buckley	
120	Liam Dalton	
121	Edward C. and Patricia A. Eldridge	
122	Rachel Nickerson Luna	
123	Bradford Cranston	
124	Taylor Armour	
125	Donna Wald	
126	Melinda Richards	
127	Kate Murdoch	
128	Jean Vaczek	
129	Joseph Vaczek	
130	Michael Waters	
131	Michael C. Archer	
132	Suzanna Nickerson	

ID Number	Name	Organization (if applicable)
133	Diane C. Murphy	Woods Hole Sea Grant and Cape Cod Cooperative Extension
134	Michael Westgate	Town of Chatham South Coastal Harbor Management Plan
135	Tom Kearney	
136	Suzanne Phillips	
137	Jeff Marshall	
138	Andrew Meincke, Jr.	
139	Alison Barabe	
140	Russell Kingman	
141	Shannon Eldredge	
142	Carole M. Somol	
143	Luke Hinkle	
144	Christopher Lage	
145	Ernest R. Eldredge	Monomoy Trap Company, Inc
146	Darrel Coddington	
147	Eric Fernandez	
148	Chad Coddington	
149	Jim Canniff	
150	Barbara Coddington	
151	Peter van Amson	
152	Owen Nichols	Center for Coastal Studies
153	Edward J. DeWitt	The Association to Preserve Cape Cod
154	Owen Nichols	
155	John Clarke	Mass Audubon
156	Susan Shepherd	
157	Robert F. Denn	
158	Joanna W. Stevens	
159	Aimee J. Eckman	
160	William Coleman	
161	Joshua Lamborghini	
162	Michael J. Jacobs	
164	David C. Likos	
165	Gary Brooke	
166	Adele Saletta	
167	Brian Sampson	

ID Number	Name	Organization (if applicable)
168	Donald R. Knepper	
169	Jonathan Buck	
170	Michael Conan W. French	
171	Greg Maier	
172	Justin Dalby	
173	John Arsenault	
174	Paul Trojano	
175	John Moretti	
176	Brett Tolley	Northwest Atlantic Marine Alliance
177	Brian Davies	
178	Kevin Carroll	
179	Richard Miller	
180	H. Curtis Spalding	U.S. Environmental Protection Agency
181	Marie Williams	
182	Stephen W. Williams	
183	Fred and Cora Greco	
184	Cynthia and Louis Petti	
185	Katherine Carscallen	
186	Jeremy Reger	
187	Ian D. Ford	
188	Jeanne Branson	
189	Charlene Pearl	
190	Amy McHugh	
191	Erica Mitchell	
192	Kevin Proescholdt	Wilderness Watch
194	Kenneth McIntire	
195	Judith Pennington-Watts	
196	Gloria M. Freeman	
197	Kathleen Connelly	
198	Scott LaPreste	Ipswich Shellfish Constable
199	Brian Woodward	
201	George Olmsted	
202	Darren Saletta	
203	Brenda Palumbo	

ID Number	Name	Organization (if applicable)
204	Deborah Hayward Norris	
205	Desiree Moyer	
206	Matt Dellelo	
207	Emily Greco	
208	Carol F. and Thomas B. Stoel, Jr.	
209	Jim and Lynn Estabrook	
210	Mary and Fred Taubert	
211	John Grundstrom	Rowley Shellfish Commissioner
212	Eric Gustafson	Funseekers.org
213	Board of Selectmen	Town of Nantucket
214	Steve Cooper	
216	Frank Campbell	
217	Sarah B. Griscom	
218	Charles Bonanno	
219	Steven Kassakian	
220	Board of Selectmen	Town of Yarmouth
223	Board of Selectmen	Town of Harwich
224	Jennifer Daoulas	
225	Sharon M. Steriti	
226	Coleen Boisvert	
227	Robert P. Cook	
228	Ellen M. Freda	
229	Marjorie G. Blackwell	Quitnesset Associates, Inc.
230	Ron LaBonte	
231	Erin Wood	
232	John L. Rafuse	
233	John Richards	Chatham Shellfish Co.
234	David Clapp	
235	Lee Stephanie Roscoe	
236	Peter F. Readel	
237	Board of Selectman	Town of Brewster
238	Jamie Bassett	
239	Citizen Petition A	
240	Citizen Petition B (moveon.org)	

ID Number	Name	Organization (if applicable)
241	Seth Taylor	Chatham Selectman
242	John Pappalardo	Cape Cod Commercial Fishermen's Alliance
243	Mary Griffin, Paul Diodati, and Wayne MacCallum	Massachusetts Department of Fish and Game
244	David Dow	Cape Cod Group of the Massachusetts Chapter of the Sierra Club
245	Seth Schofield	Massachusetts Office of the Attorney General
246	Shareen Davis	
247	Meri Ratzel	
248	Timothy Roper	Chatham Selectman
249	Sean Summers	Chatham Selectman
250	Michael Corrigan	Quitnesset Associates, Inc.
251	Everett Eldredge	
252	Jeff Dykens	Chatham Selectman
253	Richard Hosmer	
254	Cliff Berner	Cape Cod Marine Trades Association
255	Ted Keon	Chatham Department of Coastal Resources
256	William Barabe	
257	Robert Duncanson	Chatham Department of Health & Environment
258	Norman and Carol Pacun	
259	Wendy Homer	
260	Bill Giokas	
261	Barry D. Homer, Jr.	
262	Renee Gagne	Chatham Shellfish Constable
263	Jeff Lang	
264	Virginia T. Nickerson	
265	John Raye	
266	Ron Bergstrom	Former Chatham Selectman
267	Theodore J. Ligenza	
268	Jim Woods	
269	John Hallgren	
270	Tim Dinge	
271	Jeffrey Hahner	
272	Thomas W. French	Massachusetts Division of Fisheries and Wildlife
273	Cheryl Grady	

ID Number	Name	Organization (if applicable)
274	Chris Lamborghini	
275	Alyson and Marty Taubert	
276	David King	
278	Gabriela Fleury	
279	Roz Coleman	
280	Andrew Dunne III	
281	Bill Cullinane	
282	Jennifer A. Douglas	
283	M. Donna Weir	
284	Thomas J. Hartnett	
285	Francis R. Michonski	
286	George and Lori Meaney	
287	John E. Lynch	
288	Bob Champlin	
289	Yana Orlen	
290	David Kelley	
291	Todd Walker	Cape Cod Marine Trades Association/Nauset Marine, Inc
292	Amelia Griese	
293	Kent Bonney	
294	Jim and Judy Goddard	
295	Susan Jones	
296	Frederick T. Miller	
297	Daniel A. Sylver	
298	John F. Huether	
299	Martha Meier	
300	Christine Odrages	
301	Board of Selectmen	Town of Bourne

**Note: The ID number was assigned automatically by our database. Numbering starts at 46. Any other missing numbers represent letters that were removed from the database because they were either duplicates, or did not contain comments but rather information such as request to be taken off mailing list or address changes.*

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Appendix L

Kate Iaquinto/USFWS

Powder Hole on Monomoy National Wildlife Refuge

Memorandum of Understanding with Town of Chatham

MEMORANDUM OF UNDERSTANDING

Between

U.S. Fish and Wildlife Service
Monomoy National Wildlife Refuge

And

Town of Chatham, Massachusetts

Whereas, the United States, by a Declaration of Taking in 1944 (Miscellaneous Civil No. 6340 -, United States of America v 3,000 acres, more or less of land situate in Barnstable County, Commonwealth of Massachusetts, Susie H. Kosak, et. al, signed on February 10, 1944 by Secretary of the Interior Harold L. Ickes) acquired lands for management as Monomoy National Wildlife Refuge (Monomoy NWR), and;

Whereas, the U.S. Fish and Wildlife Service, herein referred to as the Service, has the responsibility for the protection and management of lands and resources within the boundaries of Monomoy NWR, which is situated within the Town of Chatham, and;

Whereas, the Town of Chatham, herein referred to as the Town, acquired land in Nauset/South Beach from Nickerson (Deed from Joshua A. Nickerson to the Inhabitants of the Town of Chatham, signed May 19, 1951), and;

Whereas, the Town has responsibility for the protection and management of Town resources, and;

Whereas, the lands included within Monomoy NWR and Nauset/South Beach were formerly separated by land below mean low water belonging to neither the United States nor the Town but belonging to the Commonwealth of Massachusetts, and;

Whereas, due to shifting landforms in the areas now known as Nauset/South Beach and South Monomoy Island, the two landforms have become joined, and accordingly, a boundary has developed between lands owned by the United States and those owned by the Town, and;

Whereas the precise location of said boundary is unsettled and resolution of title may be time-consuming and expensive for both parties, and;

Whereas, there is a mutual desire of both Parties to work cooperatively and jointly for the purposes of resource protection and management on the upland portions of the area known as Nauset/South Beach, and;

Whereas, it is understood by both Parties that the underlying principle of this agreement is that public access, public use, and resource protection will be served best by the joint, coordinated, and mutual efforts of both Parties hereto, and;

Therefore, the Parties agree to the following terms for the coordination and exchange of resource management services between the Parties in the area as defined below.

ARTICLE I – Authority

Authority for the execution of this agreement is contained in 16 U.S.C. § 668dd,

ARTICLE II – Statement of Cooperative Effort

1. Both Parties hereto agree to establish a boundary between their respective lands in the dynamic area between Nauset/South Beach and Monomoy Islands. The administratively determined boundary (Exhibit 1: Point A to Point B) between the Parties will follow:

> Bearings, distances, and coordinates in the following description are based on the Massachusetts Mainland State Plane Coordinates System NAD 83 (1996).
>
> Beginning at the intersection of the easterly mean low water line of Morris Island and the extension of the southerly boundary of a tract of land that was revested to Samuel Cabot and Elizabeth C. Lyman by stipulation recorded at the Barnstable County Registry of Deeds, Barnstable, Massachusetts in Deed Book 886, Page 508, having a coordinate value in U. S. Survey Feet of N 2,702,924.62, E 1,076,675.08 (Point A), from which a concrete monument found at the westerly end of said revested tract bears
> N66° 43' 58"W, 2,361.87 feet and from which "Chatham USCG," a published mark of the National Geodetic Survey Integrated Database, having a Permanent Identifier of AB2630, bears N26° 29' 15"E, 6,754.78 feet;
>
> Thence from the Point of Beginning, S13° 19' 17"W, generally through the channel commonly referred to as the "Southway," (See Exhibit 1) 19,165.95 feet to the easterly mean low water line under current geomorphic conditions, having a coordinate value in U.S. Survey Feet of N 2,684,274.37, E 1,072,259.03, being the southerly terminus of the Administratively Determined Boundary (Point B), from which "Monomoy Point Lighthouse," a published mark of the National Geodetic Survey Integrated Database, having a Permanent Identifier of UT0581, which mark is coincident with the present location of said lighthouse, bears S13° 19' 17"W, 16,635.22 feet.

In the event of a conflict between the above coordinates and the description thereof on Exhibit 1, the above coordinates shall control.

Service management of lands and resources extends to the mean low water line of the Atlantic Ocean South of the southerly terminus of the administratively determined boundary (Exhibit 1, Point B).

The mean low water line described above is relative to the Tidal Datum at Chatham, MA, Stage Harbor, Station ID 8447505, Tidal Epoch 1983-2001, established by the U.S. Department of Commerce, National Oceanic and Atmospheric Administration, National Ocean Service.

The Service will manage lands west of this administratively determined line (Point A to Point B) as part of the Monomoy NWR, and the Town will manage lands east of this line as Town lands. The Town, in accordance with Massachusetts General Law, will continue to manage shellfish resources 1) above mean low water in and around the "Southway" as depicted on Exhibit 1 subject to Refuge regulations and policies; 2) below mean low water in the "Southway" not subject to Refuge regulation and policies, and; 3) east of the administratively determined boundary line (A-B) not

subject to Refuge regulation and policies. This administrative boundary does not supersede existing legislative boundary definitions or land ownership. This boundary will remain in place as the points of physical connection at mean low water fill in with sand and become dry at higher stages of the tide. See Exhibit 1 illustrating the location of the administrative boundary on May 4, 2015 (Point A to Point B).

2. Both Parties hereto agree to render all reasonable assistance to the other, consistent with their respective statutory authorities, whenever necessary to accomplish the goals of this agreement. This agreement is formulated to support and strengthen the protection of natural resources important to both Parties.

3. Both parties hereto agree to negotiate in good faith during the term of this agreement towards a boundary line agreement to formally resolve the boundary between their lands on the eastern shore of Monomoy.

ARTICLE III – Term of Agreement

This agreement shall have a term of 15 years. Prior to the expiration date of this agreement it shall be reviewed to determine whether or not it should be renewed, modified, or terminated. If all Parties agree that the agreement should be renewed and it does not need to be modified, renewal may be accomplished by a simple memorandum of reaffirmation. If a reaffirmation memorandum is signed, the agreement is automatically continued another 15 years.

ARTICLE IV – Key Officials

The Project Leader, Eastern Massachusetts National Wildlife Refuge Complex, 73 Weir Hill Road, Sudbury, MA 01773, 978-443-4661, and the Board of Selectmen of the Town of Chatham, 549 Main Street, Chatham, MA 02633, 508-945-5105, are the key officials for this Memorandum of Understanding. Any required notices hereunder shall be addressed to the "key officials."

ARTICLE V – Effective Date and Termination

This agreement shall become effective when signed by both Parties hereto and shall continue in force for its term unless terminated by mutual agreement or by either party, upon 60 days written notice to the others of its intent to do so.

V – Special Provisions

The following Special Provisions apply to this agreement:

1. Officials Not to Benefit. No member of Congress, or Resident Commissioner, shall be admitted to any share or part of this Agreement or to any benefit that may arise there from, but this provision shall not be construed to extend this Agreement if made with a corporation for its general benefit.

2. Liability. Both Parties agree that it will be responsible for its own acts and the results thereof and shall not be responsible for the acts of the other party and the results thereof. Each party therefore agrees that it will assume all risk and liability to itself, its agents or employees, for any injury to persons or property resulting in any manner from conduct of its own operations, and the operations of its agents, or employees, under this Agreement, and for any loss, cost, damage, or

expense resulting at any time from any and all causes due to any act or acts, negligence, or the failure to exercise proper precautions, of or by itself or its own agents or its own employees, while occupying or visiting the premises under and pursuant to this agreement.

3. Anti-Deficiency Act. This Agreement and the obligations of the Service hereunder shall be subject to the availability of funding, and nothing herein contained shall be construed as binding the Service to expend in any one fiscal year any sum in excess of appropriations made by Congress or administratively allocated for the purpose of this Agreement for the fiscal year, or to involve the Service in any contract or other obligation for the further expenditure of money in excess of such appropriations or allocations. This Agreement is subject to the laws, regulations, and policies governing the Service whether now in force or hereafter enacted.

4. This MOU represents an accommodation between the parties and, nothing herein may be construed to operate as a waiver or admission with respect to the parties' respective positions on the boundary between federal and municipal lands. This MOU may not be introduced by either party in any administrative or judicial proceeding to determine the legal boundaries between property held by the Town and the United States on the eastern side of Monomoy NWR.

5. Nothing in this MOU may be construed as an agreement, waiver or admission with respect to the parties' continuing dispute over boundaries and rights on the western side of Monomoy NWR.

IN WITNESS WHEREOF, both Parties have caused this instrument to be executed by their respective duly authorized representatives on the day and year indicated below.

Project Leader
Eastern Massachusetts National Wildlife
Refuge Complex
Region 5, U.S. Fish and Wildlife Service

6/9/2015
Date

Chair, Board of Selectmen
Town of Chatham, MA

6/9/15
Date

Board of Selectmen
Town of Chatham, MA

09-June-2015
Date

Board of Selectmen
Town of Chatham, MA

6-9-15
Date

Board of Selectmen
Town of Chatham, MA

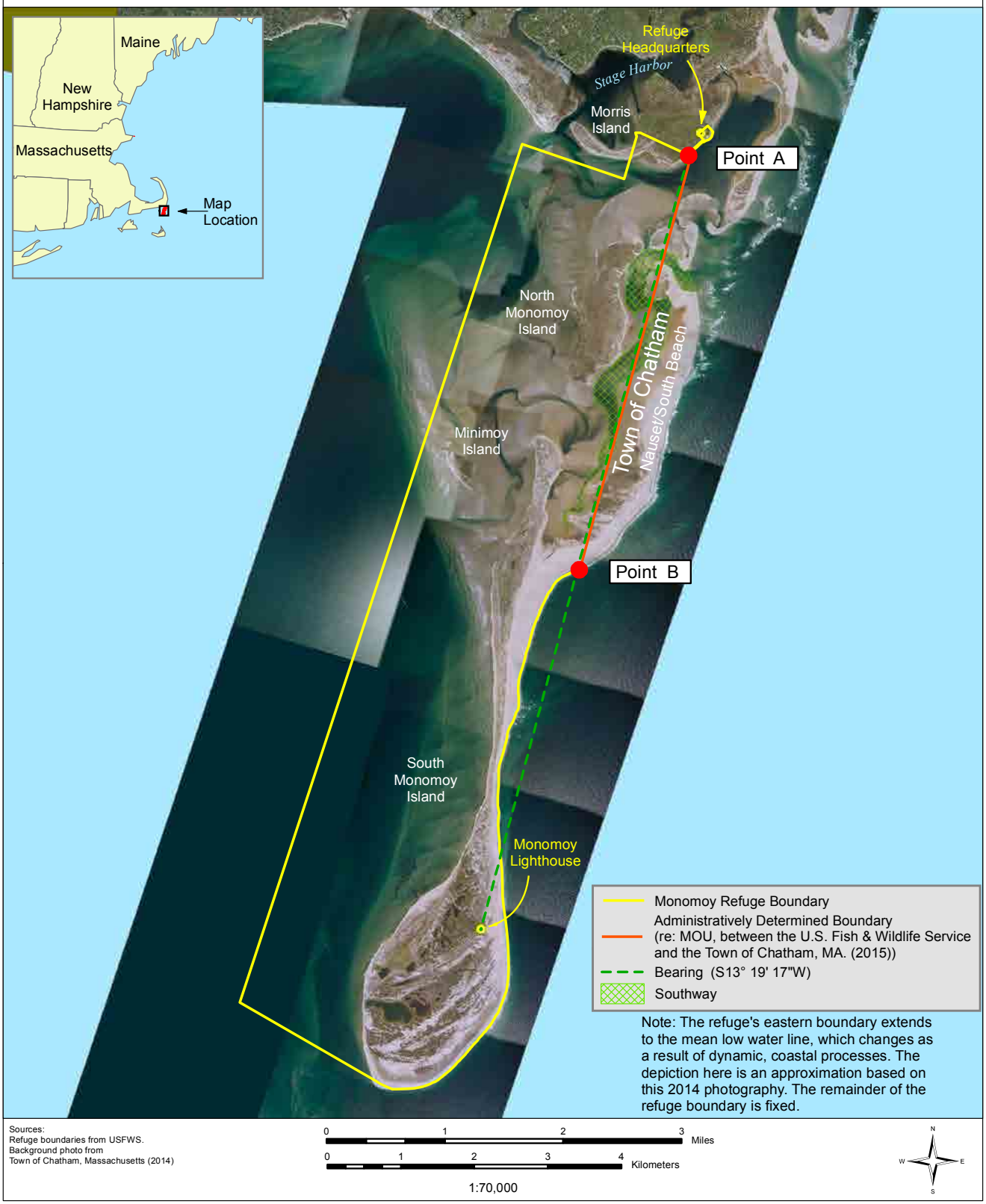
Date

Board of Selectmen
Town of Chatham, MA

Date

Monomoy National Wildlife Refuge

Exhibit 1 - Memorandum of Understanding between the U.S. Fish & Wildlife Service (USFWS) and the Town of Chatham, Massachusetts (2015)



Appendix M

USFWS

Monomoy Lighthouse

Federal Compliance Documents

THE COMMONWEALTH OF MASSACHUSETTS
EXECUTIVE OFFICE OF ENERGY AND ENVIRONMENTAL AFFAIRS
OFFICE OF COASTAL ZONE MANAGEMENT
251 Causeway Street, Suite 800, Boston, MA 02114-2136
(617) 626-1200 FAX: (617) 626-1240

December 22, 2015

Carl Melberg
U.S. Department of the Interior
Fish and Wildlife Service
Eastern Massachusetts National Wildlife Refuge Complex
73 Weir Hill Road
Sudbury, MA 01776-1420

Re: CZM Federal Consistency Review of the 15 year-Comprehensive Conservation Plan for the Monomoy National Wildlife Refuge; Chatham.

Dear Mr. Melberg:

The Massachusetts Office of Coastal Zone Management (CZM) has completed its review of the proposed 15 year-Comprehensive Conservation Plan for Monomoy National Wildlife Refuge in Chatham.

Based upon our review of applicable information, we concur with your certification and find that the activity as proposed is consistent with CZM enforceable program policies.

If the above-referenced project is modified in any manner, including any changes resulting from permit, license or certification revisions, including those ensuing from an appeal, or the project is noted to be having effects on coastal resources or uses that are different than originally proposed, it is incumbent upon the proponent to notify CZM, submit an explanation of the nature of the change pursuant to 15 CFR 930, and submit any modified state permits, licenses, or certifications. CZM will use this information to determine if further federal consistency review is required.

Thank you for your cooperation with CZM.

Sincerely,

Bruce K. Carlisle
Director

BKC/rlb
CZM#15319

cc: Steve McKenna
CZM Cape and Islands Regional Coordinator

INTRA-SERVICE SECTION 7 BIOLOGICAL EVALUATION FORM

Originating Person: Stephanie Koch, Wildlife Biologist, Eastern Massachusetts NWR Complex

Telephone Number: 978-443-4661, x24

Date: August 10, 2015

I. R5

II. Service Activity (Program): Refuges
We are proposing inventories, monitoring, and management to benefit roseate terns, piping plovers, red knots (*rufa* subspecies; hereafter referred to as red knots), and northeastern beach tiger beetles, as described in the Monomoy NWR Comprehensive Conservation Plan (CCP).

III. Pertinent Species and Habitat:

A. Listed species and/or their critical habitat within the action area:
1. Roseate Tern (*Sterna dougallii dougallii*) / No critical habitat designated
2. Piping Plover (*Charadrius melodus*) / No critical habitat designated
3. Red Knot (*Calidris canutus rufa*) / No critical habitat designated
4. Northeastern Beach Tiger Beetle / No critical habitat designated

B. Proposed species and/or proposed critical habitat within the action area:
None.

C. Candidate species within the action area:
None.

IV. Geographic area or station name and action:
The proposed actions are inventories, monitoring, and management for roseate terns, piping plovers, red knots, and northeastern beach tiger beetles at Monomoy NWR.

V. Location (attach map):

A. County and State: Barnstable County, MA

B. Section, township, and range (or latitude and longitude): The attached map (Attachment 1) shows the location of Monomoy NWR.

C. Distance (miles) and direction to nearest town: Monomoy NWR is located in the Town of Chatham.

D. Species/habitat occurrence:
A summary of species occurrence on Monomoy NWR is included below. More

details of species occurrence and habitat use can be found in Chapters 2 and 3 of the Monomoy NWR CCP.

1. Roseate Tern:

The first 20th century report of common and roseate terns nesting on Monomoy NWR occurred in 1961 (Nisbet 1980). The tern colony increased rapidly to 2,000 pairs by 1963, and from 1963 to 1984, Monomoy supported one of the largest tern colonies in the Northeast. Several hundred pairs of roseate terns were found nesting on Monomoy NWR during these years. In 1978, tern reproductive success began to decline on the refuge and the numbers of nesting roseate terns began decreasing in the early 1980s, eventually declining to just 1 nesting pair in 1988, down from 400 nesting pairs in 1980 (USFWS 1998a). Following active management and predator control efforts as part of the avian diversity project which began in 1996, nesting roseate terns returned to Monomoy NWR. In 1998 and 1999, more than 20 pairs of roseate terns nested on the north end of South Monomoy with good to average productivity, but in 2000 nesting numbers declined dramatically. The decline in numbers observed in 2000 may have been due to predator presence or the loss of traditional nesting areas. It's possible these birds nested on Minimoy Island in 2002, but this site was not surveyed until 2003. From 2003 to 2008, Minimoy Island hosted between 10 and 43 pairs of roseate terns. Erosion of the western side of Minimoy Island in recent years resulted in decreasing habitat for roseate terns, until virtually no suitable habitat was available by 2009. Beginning in 2009, refuge staff attempted to attract roseate terns back to the main common tern nesting colony on South Monomoy by placing nesting structures, decoys, and a sound system in suitable habitat. In 2009, no roseate terns nested on the refuge, but they have nested every year again since 2010 (see Table 2.3 in Chapter 2 of the CCP for detailed information about nesting numbers).

The potential for a large breeding roseate tern colony at Monomoy NWR is great. All roseate terns in the Northeast nest in close association with large, productive common tern colonies; one of the largest of these is on the refuge (USFWS 1998a). In general, common terns prefer slightly less dense vegetation, approximately 30 percent vegetation with 70 percent open sand, than do roseate terns. Roseate terns tend to prefer the opposite configuration, with about 70 percent vegetation to 30 percent open (Koch 2013 personal comment). Monomoy NWR has the potential to support a large nesting site again if we can control predation and are able to successfully provide the optimal habitat. Predator management is an important part of the roseate and common tern restoration efforts on South Monomoy. The presence of a single mammalian predator (e.g., coyote, skunk, and raccoon) or avian predator (e.g., great horned owl, black-crowned night-heron) in a tern colony can decrease productivity or cause the terns to abandon the site entirely. Predation can limit the distribution and abundance of breeding terns and their reproductive success (Kress and Hall 2004, USFWS 2010a). Habitat management to benefit nesting terns includes vegetation management such as prescribed burns to remove grasses and duff, or plantings to

provide the appropriate mix of open sandy areas and vegetative cover.

2. Piping Plover:

Early documentation of piping plover on the refuge are scattered, but the species was nesting on the refuge prior to listing, as early as 1953. Griscom and Snyder (1955) reported 15 pairs of piping plovers on Monomoy NWR in 1955. Beginning in 1983, piping plovers were counted and monitored annually on Monomoy NWR. In February 1988, a master plan (USFWS 1988) was completed for Monomoy NWR, which stipulated that all piping plover nesting sites be closed seasonally to the public. Starting that year, these nesting sites were closed to the public from April through August to help protect the birds, their nests, and their habitat on the refuge, and that effort has continued to the present time. In recent years, the refuge has had a low of four nesting pairs of piping plover in 1993, with recorded numbers greatly expanding after the initiation of the avian diversity program in 1996 (although part of this increase may represent increased monitoring efforts). While plovers successfully nest on Monomoy NWR, current numbers (39 pairs in 2012) are generally lower than the potential capacity estimated for Monomoy NWR (94 pairs; USFWS 1996b; see map 2.3 of the CCP). Table 2.2 in Chapter 2 of the CCP shows the number of nesting piping plover pairs and productivity tabulated over the last 16 years (1996 to 2012). In recent years, piping plovers have nested throughout the beach shoreline and dune edges especially on South Monomoy and Minimoy. They also occasionally nest on North Monomoy Island.

3. Red Knot:

Red knots undertake one of the longest migrations known, traveling from their furthest wintering ground at the tip of South America to their Arctic breeding grounds and back again each year, an estimated 16,000-mile round trip. Their migration also includes some of the longest non-stop flights in the bird world, an estimated 5,000 miles over a 6-day period (Niles et al. 2010). Protection of breeding, migration, and wintering habitat is critical to this species' recovery (Niles et al. 2008). Southeastern Massachusetts, and Monomoy Refuge in particular, are likely to provide one of the most important sites for adult and juvenile red knots during their southward migration (Koch and Paton 2009, Harrington et al. 2010a, Harrington et al. 2010b). Research has shown that this region supports red knots bound for different winter destinations. North American wintering birds exhibit different migration chronology, flight feather molt, and even foraging habits than South American wintering birds (Harrington et al. 2010b). In recent years, red knots have been using intertidal areas throughout the refuge for foraging, especially Minimoy Island and the north end of South Monomoy Island. They also often roost on the beach edges or saltmarshes on higher tides, especially on South Beach, the Connection Beach on South Monomoy Island, and Minimoy Island. It is not uncommon to observe groups of several hundred red knots at a time at these sites.

4. Northeastern Beach Tiger Beetle:

This tiger beetle occurred historically "in great swarms" on beaches along the Atlantic coast from Cape Cod to central New Jersey, and along Chesapeake Bay beaches in Maryland and Virginia. In 1994, only two small populations remained on the Atlantic coast. Searches on Monomoy NWR in the 1980s failed to locate the northeastern beach tiger beetle, but the structure of the habitat seemed favorable. Federal ownership, the occurrence of historic collection records labeled "Chatham" (the town in which the refuge is located), and the desire of State wildlife officials to retain Massachusetts beetles within the State all combined to make Monomoy the leading candidate as an introduction site (USFWS 1994). The first larval beetle transplant occurred in May 2000, when 23 third instar tiger beetle larvae were moved from Martha's Vineyard to the refuge. Adult beetles generally emerge from their sandy burrows in July and August, and that year, five adult tiger beetles emerged and were found on the refuge. Introduction continued to occur from 2001 through 2003 with 34, 33, and 23 larvae transplanted, respectively. In 2001, approximately 24 adults were found; in 2002, 27 adults were found; and in 2003, 19 adults were found. Table 2.4 in Chapter 2 of the CCP shows the number of northeastern beach tiger beetle larvae translocated and the number of adults captured and marked on the refuge between 2000 and 2012.

Currently, northeastern beach tiger beetles are generally found on the beaches on the eastern side of South Monomoy Island and also on South Beach, spanning several miles. On beaches where they occur, adults are most active on warm, sunny days along the water's edge, where they are commonly seen feeding, mating, or basking (thermoregulation). The number of adult beetles active on rainy or cool, cloudy days is very low, probably because the beetles need to maintain high body temperatures for maximal predatory activity. Adults tend to be concentrated in wider sections of beach, and occur in smaller numbers or may even be absent from nearby areas of narrow beach. Larvae occur in a relatively narrow band of the upper intertidal to high drift zone, but may relocate their burrows throughout their development to adapt to environmental and seasonal changes in the beach ecosystem (USFWS 1994).

VI. Description of proposed action (attach additional pages as needed):

Below we identify and describe the inventory/monitoring and management actions on roseate terns, piping plovers, red knots, and northeastern beach tiger beetles that we have proposed in the CCP. All of these actions support our biological objectives. We are not addressing strategies or monitoring elements in the CCP that are not "direct actions", including, but not limited to: conducting outreach and interpretation, closing areas with symbolic fencing, patrolling, assessing habitat, or passive monitoring / observations. However, all our strategies and monitoring elements can found in Chapter 3 of the CCP.

1. Roseate Terns

Inventory / Monitor:

- Nesting roseate terns are identified and monitored throughout the nesting season

by trained and authorized personnel, with an emphasis on the State census window of June 5-20. To minimize disturbance, nest searching is conducted from blinds located throughout the colony when practical, and while personnel are sitting in blinds, nesting birds are not disturbed. There is some minor disturbance to nesting birds while personnel are entering and exiting blinds, but approach routes are kept constant (to allow for habituation), and the colony is not disturbed during inclement weather (such as heavy winds, dense fog, extreme temperatures, rain). Any confirmed roseate tern nests are monitored throughout the nesting season to determine reproductive parameters and measure reproductive success. Nests are checked in conjunction with other colony monitoring work to minimize additional disturbance. Additionally, there is some disturbance to roseate terns while common tern monitoring is conducted, but staff move quickly and keep a low profile while working in the colony, such that the disturbed area is generally confined to a 25 meter radius area, and disturbance impacts are insignificant.

- Trained and authorized personnel (covered as a BBL permittee) trap banded adult roseate terns, and band any unbanded adults that are captured, as well as all chicks. This contributes to better fledge success estimates, helps document nesting site fidelity, and contributes to metapopulation studies. Only bands that have been vetted and widely approved by the Roseate Tern Recovery Team are used, and nests are monitored following banding efforts to confirm that adults resume normal incubation / chick rearing activities, and that the short disturbances and handling times are insignificant.

Management:

- Several structures and infrastructure are used at Monomoy NWR to enhance inventory and monitoring efforts, as well as improve the habitat for nesting roseate terns. For example, Refuge staff establish and staff a temporary field camp from early May until early August to maintain a human presence 24 hours per day for the purpose of providing predator management and facilitating data collection. The camp is established on the periphery of the tern colony (though nesting common terns often "move in" to the camp area once it is established) and is established prior to tern nesting. Staff also erect temporary, hard-sided blinds within the tern nesting areas to facilitate the identification of possible limiting factors to reproductive success, including diet composition and impacts of kleptoparasitism, and to further facilitate nesting studies and predator management. Lastly, staff place temporary wooden nesting structures, wooden chick shelters, decoys, and sound systems to attract nesting roseate terns during the start of the nesting season. Because the structures and infrastructure are either placed prior to tern nesting, or are "fixed" through the season, the terns quickly habituate to their presence and they do not cause any disturbance or impact. In fact, the increased efficiency in predator control, and improved habitat conditions, are likely to benefit roseate terns.
- Competitor and predator management is conducted throughout the Refuge to minimize impacts to roseate terns. Throughout the 125-acre gull management area, non-lethal harassment of great black-backed and herring gulls is conducted to prevent gull nesting. Staff also destroy all nests by scattering nesting materials

and removing eggs. Lethal control is also conducted throughout the nesting season, with an emphasis on all mammalian predators (such as coyotes), as well as selective control of avian predators (such as black-crowned night-herons) and competitor species (laughing gulls). Appendix J of the Monomoy NWR CCP includes detailed descriptions of predator control approaches that are incorporated at Monomoy NWR. When predator control is deemed necessary in areas and during times when roseate terns are also present, every precaution is taken to avoid disturbance. All staff are trained prior to entering nesting areas. Predator control occurring within the nesting colony, is primarily conducted from wooden blinds at a distance from nesting roseate terns to minimize disturbance so that effects are insignificant.

- Vegetation management is conducted in selected areas using mechanical methods, herbicide, and rotational prescribed burning during the time of year when roseate terns are not present; therefore avoiding adverse effects. Vegetation management is implemented to improve habitat for terns and discourage nesting by competitor species, including laughing gulls. Vegetation management may also include planting native species, such as goldenrod, to further enhance and benefit roseate tern nesting habitat. A separate Section 7 is also conducted in conjunction with each Burn Plan that is developed for Monomoy NWR.

2. Piping Plovers

Inventory / Monitor:

- Nesting piping plovers are identified and monitored throughout the nesting season by trained and authorized personnel, beginning in mid-March. Much of the nest searching is conducted from within nesting habitat, but all staff are carefully trained prior to entering nesting areas. There is some minor disturbance to nesting birds while personnel are confirming nest locations but nest searching is not conducted during inclement weather (such as heavy winds, dense fog, extreme temperatures, rain). Any confirmed piping plovers nests are monitored throughout the nesting season to determine reproductive parameters and measure reproductive success. Nests are often checked from a distance to confirm incubation, and when nests are approached to confirm clutch size or hatching, it is done very quickly, generally resulting in less than 2 minutes of disturbance, which is deemed insignificant. Additionally, staff use high powered spotting scopes to monitor and confirm chick survival from a distance which further minimizes disturbance.

Management:

- Predator management is conducted throughout the Refuge to minimize impacts to piping plovers (see bullet below about predator exclosures). Lethal control is also conducted throughout the nesting season, with an emphasis on all mammalian predators (such as coyotes), as well as selective control of avian predators (such as grackles). Appendix J of the Monomoy NWR CCP includes detailed descriptions of predator control approaches that are incorporated at Monomoy NWR. When predator control is deemed necessary in areas and during times

when piping plovers are also present, every precaution is taken to avoid disturbance. For example, predator control would not take place in piping plover nesting areas during inclement weather.

- Authorized and trained personnel install temporary predator exclosures on piping plover nests that are located in sparsely vegetated areas with nothing obstructing the view of the bird or inhibiting the bird's ability to detect predators. Piping plovers may be disturbed for up to 15 minutes during installation of an exclosure (plus an additional few minutes for the bird to resume incubation), but staff take all precautions to minimize disturbance including: having at least 4 trained persons doing the installation; avoiding inclement weather; insuring the nest is actively being incubated prior to installation, and; confirming the pair resumes incubation immediately after installation.

3. Red Knot

Inventory / Monitor:

- Authorized and highly trained personnel will continue to monitor red knots and learn more about habitat use at various scales (local and flyway-wide). In recent years, cannon nets have been used to capture red knots so they can be outfitted with geolocators (for flyway-wide information) and nanotags (for more refined location information). This work may be conducted on an annual basis, only after obtaining the appropriate recovery permits and conducting a separate section 7 consultation. Various measures are put in place to ensure that impacts to red knots are minimized including strict adherence to guidelines regarding cannon netting operation safety, ensuring enough trained staff are available to handle and process birds, and keeping birds in cool, dark holding spaces, and monitoring behavior until they are processed and released.

4. Northeastern Beach Tiger Beetles

Inventory / Monitor:

- Trained and authorized staff may conduct adult beetle spawning surveys from late June to late August period. During these visits, beetles are observed at close distances, but for a very short period of time (with insignificant disturbance). Occasionally, staff may perform low intensity mark and resight efforts to estimate the population and calculate survival probability. When these activities occur, handling time is short, and there is no significant effect.

Management:

- Maintain vehicle closures on refuge lands to protect habitat and allow for continued population growth; cooperate with the Town of Chatham, State of Massachusetts, U.S. Coast Guard, and other partners involved in emergency and public safety operations to protect tiger beetles and habitat when vehicle access is deemed essential to protect human life. This includes increased monitoring when vehicles are present to minimize habitat degradation and mortality by OSVs.
- Facilitate and expand research opportunities on the refuge to fill data gaps that

will promote tiger beetle recovery including, but not limited to, genetic work to determine differences between beetle populations in Massachusetts and Chesapeake Bay. Work with the New England Ecological Services Field Office to utilize Monomoy refuge as a donor population for newly identified sites (after obtaining the appropriate recovery permits and conducting a separate section 7 consultation), while ensuring that the Monomoy population is not adversely impacted.

VII. Determination of effects:

A. Explanation of effects of the action on species and critical habitats in items III.A, B, and C (attach additional pages as needed):

The proposed actions will take place from March 15 – November 15, which encompasses the piping plover and roseate tern nesting season, the northeastern beach tiger beetle breeding season, and the red knot staging and migration periods. The proposed actions will be conducted by authorized and experienced Refuge biological staff, experienced partners, or trained interns that are familiar with our protocols and species ecology. We expect our proposed actions to be either "not likely to adversely affect", or "may affect / beneficial effects", depending on the species and action (See VIIIA below).

B. Explanation of actions to be implemented to reduce adverse effects:

In all situations, we make every effort to minimize effects and maximize beneficial effects. Avoidance measures include restricting actions to the time of year when listed species are not present, or avoiding inclement weather when species are present, implementing actions at a distance from nesting roseate terns and piping plovers to reduce disturbance to the level that effects will not reach the scale where take occurs (insignificant effects) or where take is unlikely to occur (discountable effects) and avoiding impacts to larval northeastern beach tiger beetle habitat during the implementation of management actions. See preceding management discussion for details.

VIII. Effect determination and response requested: [* optional]

A. Listed species/critical habitat:

Determination	Response requested
no effect (species: _____)	___*Concurrence
is not likely to adversely affect (species: roseate terns, piping plovers, red knots, northeastern beach tiger beetles [inventory / monitoring of all species])	✓ Concurrence

is likely to adversely affect
(species: _____) ___Formal consultation

may affect; beneficial effect
(species: roseate terns, piping plovers, northeastern beach tiger beetles [management of all species]) ✓ Concurrence

Elizabeth A Herland
Project Leader, Eastern Massachusetts NWR Complex

8/10/2015
Date

IX. Reviewing ESO Evaluation: susi von Oettingen reviewed and concurs

A. Concurrence ✓ Non-concurrence _____

B. Formal consultation required _____

C. Conference required _____

D. Remarks (attach additional pages as needed):

Signature Acting for Tom Chapman

8/11/15
Date

The Commonwealth of Massachusetts
William Francis Galvin, Secretary of the Commonwealth
Massachusetts Historical Commission

May 18, 2015

Carl Melberg
Natural Resource Planner
US Fish & Wildlife Service
Eastern Mass. NWR Complex
73 Weir Hill Road
Sudbury MA 01776-1420

RE: Monomoy National Wildlife Refuge, Great Point, Chatham, MA. MHC #RC.16744.

Dear Mr. Melberg:

Thank you for providing the Massachusetts Historical Commission (MHC), office of the State Historic Preservation Officer, with a copy of the *Monomoy National Wildlife Refuge Draft Comprehensive Conservation Plan and Draft Environmental Impact Statement* (DCCP/DEIS).

Review of the Inventory of Historic and Archaeological Assets of the Commonwealth indicates that there are several recorded historical and archaeological individual properties within the refuge, including the Old Monomoy Lighthouse complex (MHC # CHA.LS), listed in the State and National Registers of Historic Places. Several ancient Native American archaeological sites are recorded in the MHC's Inventory for Morris Island, within and adjacent to refuge property. The MHC recommends that USFW incorporate historic and archaeological information from other sources and repositories during its current and future planning and survey efforts for cultural resources. Inventories and files maintained by others within information on historical and archaeological resources within and adjacent to the refuge could include the MHC, Massachusetts Board of Underwater Archaeological Resources, the National Park Service, Cape Cod National Seashore, the Cape Cod Museum of Natural History and the Massachusetts Archaeological Society.

The MHC notes that one proposed project alternative includes comprehensive archaeological survey of the refuge. The MHC is able to review and comment on the proposed research design and methodology for the survey as the survey project proceeds. The dynamic sand dune topography of the refuge would periodically expose then bury any archaeological deposits and features that may be present.

Ancient and historical period Native American sites would be most likely located in close proximity to areas that once had fresh water springs or ponds, and navigational features within former marine landscapes among the waterways of Morris Island and North and South Monomoy Islands. Occupation and resource gathering activities by Native Americans such as marine fishing, harvesting beached marine mammals, hunting, and plant gathering may have occurred in the refuge in ancient and historical times, including Paleo-Indian occupations during the early Holocene period. Archaeological resources associated with historical period activities are also expected within the refuge, including wrecking, boatbuilding, marine resource harvesting (e.g. fishing, shellfishing and whaling), and waterfowl hunting.

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The 18th through early 20th century maritime community of Whitewash Village on the former Powder Hole anchorage on South Monomoy is noted as a focus of future research under several of the proposed management alternatives, and the MHC would appreciate receiving information on this interesting historical maritime community.

An important aspect of ongoing cultural resource management within the refuge in support of Refuge Goal #5 (e.g. pg. 3-68) is the coordination of public outreach and refuge interpretative programs with staff cultural resource management efforts. Methods for the identification, documentation and protection of archaeological resources within the refuge by pedestrian visitors may include the development and implementation of identification forms and educational materials, modeled on the Massachusetts Board of Underwater Archaeological Resources SHIPS Initiative, for newly identified archaeological resources. Publication of cultural resources management information to local charter boat operators, and at local and regional marinas, boat launches and water access points, would facilitate communication of cultural resources management practices to the substantial numbers of water-borne refuge visitors.

The MHC agrees that the typical activities involved in the management and interpretation of the refuge are undertakings that have "no potential to cause effects" (36 CFR 800.3(a)(1)) to historical and archaeological properties. If the US Fish & Wildlife Service proposes any projects that involve new construction, demolition, or other activities that impact the ground surface or subsurface, please provide information to the MHC for review and comment in compliance with 36 CFR 800, as outlined in the DCCP/DEIS. The MHC would also appreciate the opportunity to review and comment on draft planning documents, including cultural resource management plans and historic properties management plans, including a plan for the Old Monomoy Lighthouse complex.

Thank you again for the opportunity to provide comments. Please contact me if you have any questions.

Sincerely,

Jonathan K. Patton
Staff Archaeologist/ Preservation Planner
Massachusetts Historical Commission

xc: Tim Binzen, USFW
Victor Mastone, MBUAR

Appendix N

Kate Iaquinto/USFWS

View of Monomoy National Wildlife Refuge

Record of Decision

Monomoy National Wildlife Refuge

Barnstable County, Massachusetts

Record of Decision

for the

Final Comprehensive Conservation Plan and Environmental Impact Statement

U.S. Fish and Wildlife Service

March 2016

U.S. Fish and Wildlife Service

Monomoy National Wildlife Refuge

Barnstable County, Massachusetts

The Department of the Interior, U.S. Fish and Wildlife Service (Service; we, our), has prepared this "Record of Decision" (ROD) on the final Comprehensive Conservation Plan (CCP) for Monomoy National Wildlife Refuge (NWR, refuge), which lies in the town of Chatham, Massachusetts, in Barnstable County. This ROD includes a summary of the alternatives we considered in the Final CCP and Environmental Impact Statement (EIS), a description of the environmentally preferable alternative, an overview of public and partner involvement in the decision-making process, our basis for selecting alternative B for the CCP, and a summary of the practicable measures to minimize environmental harm. The Monomoy NWR CCP will provide guidance for conserving the refuge's natural, cultural, and wilderness resources, and for managing public use activities, for the next 15 years.

Management Alternatives Considered in the Final CCP/EIS

We evaluated three management alternatives in the final CCP/EIS for Monomoy NWR. Below is a summary of the key features of each alternative. More detailed information on the alternatives can be found in chapter 3 of the final CCP/EIS.

Alternative A (Current Management): Alternative A would simply extend the way we now manage the refuge over the next 15 years. Resource management priorities and actions, and public use opportunities, would not change. This alternative provides a baseline for comparing alternatives B and C. This serves as the "no action" alternative required by regulations under the National Environmental Policy Act (NEPA; 42 U.S.C. 4321 et seq.).

Alternative B (Enhanced Management of Habitat and Public Uses): This alternative is the one we believe would best meet the purposes and need set out in the EIS. In the view of the Service, it is the alternative that will most effectively achieve refuge purposes, vision, and goals. It represents an extension and progression of all areas of refuge management. Under alternative B, new biological program activities would be initiated. Special emphasis would be placed on obtaining baseline data on wildlife populations and habitat conditions, or filling in information gaps as needed. The new information would be used to develop more detailed step-down plans. Wildlife population and habitat monitoring surveys and inventories would continue to provide data needed to evaluate the effectiveness of refuge programs and practices, and to adapt management as warranted to achieve long-range refuge goals and objectives.

Under alternative B, new compatible wildlife-dependent recreational opportunities would be provided consistent with the refuge's designation as part of the National Wilderness Preservation System. Emphasis would be placed on providing enhanced, but sustainable, opportunities for all six priority wildlife-dependent recreational uses defined in the National Wildlife Refuge System Administration Act of 1966, as amended by the National Wildlife Refuge System Improvement Act of 1997 (Refuge System Improvement Act; 16 U.S.C. 688dd-688ee). Most existing refuge uses would continue and a few new uses are proposed. However, some uses currently occurring on the refuge would be curtailed to preserve wilderness character in the federally designated Monomoy Wilderness. Staffing would be modestly increased to accommodate new programs and activities. Proposed new visitor contact facilities would provide better access to information and support quality educational and interpretive programs. In addition, a seasonal parking fee would be instituted.

Alternative C (Natural Processes): This alternative proposes less intensive management on all refuge lands. It would be guided by a philosophy of allowing natural processes and succession of habitats to progress, consistent with preserving wilderness character, and to the extent that it does not compromise refuge purposes and goals. Generally, wildlife and habitat management, and inventory and monitoring efforts, would be reduced from those planned under alternative A. Under alternative C, there would be fewer interpretation and environmental education programs conducted on and off the refuge compared to current levels, less emphasis would be placed on providing wildlife observation and photography opportunities, fewer visitor facilities would be constructed, and the Monomoy light station would not be maintained. In addition to the uses that would not be allowed under alternative B, motorized boat use would be eliminated. Fewer refuge staff would be hired since refuge lands, in particular the Monomoy Wilderness, would be managed less intensively.

Other Alternatives or Actions Considered but Eliminated From Further Study: In addition to the three alternatives discussed above, we considered several other alternatives and actions, but eliminated them from detailed analysis. These alternatives or actions include:

- Managing the refuge strictly based on wilderness designation and no active management.
- Closing the refuge to clamming.
- Discontinuing the predator management program.
- Allowing horseshoe crab harvesting.
- Installing a wind turbine at Monomoy Point Light Station.

The full rationale for eliminating these alternatives or actions can be found in chapter 3 of the final CCP/EIS.

Environmentally Preferable Alternative

The Service, in accordance with the Department of the Interior's NEPA Code of Federal Regulations (43 CFR part 46) and the Council on Environmental Quality's Forty Most Asked Questions, defines the environmentally preferable alternative (or alternatives) as the alternative that "causes the least damage to the biological and physical environment and best protects, preserves, and enhances historical, cultural, and natural resources" (43 CFR 46.30). NEPA does not require the decisionmaker to select the environmentally preferable alternative or prohibit adverse environmental effects. Indeed, Federal agencies often have other concerns and policy considerations to take into account in the decision-making process, such as social, economic, technical, or national security interests. NEPA requires decision-makers be informed of the environmental consequences of their decisions.

After considering the environmental consequences of the three management alternatives, including consequences to the human environment, we have concluded that alternative B is the environmentally preferable alternative. Alternative B prioritizes management actions to conserve federally listed and other regionally significant wildlife, as well as protecting wilderness resources. Some of these priority species require active management to sustain them, including predator management and the use of fire and other mechanical means to promote certain habitat characteristics. We would also increase efforts to reduce invasive species and restore native vegetation in uplands and saltmarsh, and work closely with partners to restore eelgrass beds and submerged aquatic vegetation in and surrounding refuge waters. Alternative B would also increase inventory and monitoring activities to better evaluate the effectiveness of our management and assess climate change impacts. Under alternative B, we would implement all of these actions following development of detailed step-down management plans. Adaptive management would be the framework for evaluating and responding to what we learn from our actions. No major construction is planned, although there could be a small expansion of the refuge's facilities footprint for a visitor station. All cultural resources would be protected and maintained. Additionally, this alternative eliminates several public use activities that are not appropriate or not compatible to ensure the year-round protection of species of concern and the refuge's wilderness values.

Public and Partner Involvement

Public and partner involvement has occurred throughout the planning process in numerous ways. Opportunities for outreach and engagement has occurred through public informational meetings, public hearings, technical expert exchanges, planning update mailings, media releases, and meetings with local community organizations. **Federal Register** (FR) notices were published several times during the development of this CCP (64 FR 9166, February 24, 1999; 66 FR 10506, February 15, 2001; 69 FR 72210, December 13, 2004; 79 FR 19920, April 14, 2014; 80 FR 66928, October 30, 2015). Early in the planning process, the public and partner comments and concerns that we received were used to identify issues and draft preliminary management alternatives. Meetings with experts, stakeholders, and State and Federal agency partners helped us refine those alternatives and prepare a draft CCP/EIS. An extensive review process occurred when the draft CCP/EIS was released for public comment. The public comment period ran from April 10 to October 10, 2014. During this period, we held one public hearing and four open house meetings. In total we received 39 oral comments

at the hearing and 255 separate written comments. We also received 2 petitions with 1,576 and 650 individual signatures, respectively. The comments came from a range of sources, including numerous national, State, and local organizations, the town of Chatham, State agencies, neighboring landowners, user groups, and a number of interested citizens. We evaluated all letters and e-mails sent to us during that comment period, along with comments recorded at our public hearing. A summary of all comments, and our responses to them, was included in appendix K in the final CCP/EIS.

Based on comments we received, we made several modifications to alternative B in the final CCP/EIS. All substantive issues raised in the comments on the draft CCP/EIS were addressed through revisions incorporated into the final CCP/EIS text, or in our responses contained in appendix K of the final CCP/EIS.

Comments Received On the Final CCP/EIS

The final CCP/EIS was distributed for a 37-day review period from October 30 to December 7, 2015. We received 35 responses from sources that included local organizations, State agencies, State elected officials, the town of Chatham, local residents, user groups, and other individuals. In our review and evaluation of these comments, we categorized them into the 14 topic areas listed below:

(1) Kiteboarding.

(2) Service jurisdiction within the 1944 Declaration of Taking boundary's open waters and submerged lands.

(3) Shellfishing.

(4) Commercial guiding.

(5) Horseshoe crab harvesting.

(6) Wilderness management.

(7) Dogwalking.

(8) Dredging.

(9) Right-of-way.

(10) Socio-economic impacts.

(11) Law enforcement.

(12) Submerged aquatic vegetation.

(13) Hunting.

(14) Beachcombing.

None of the comments received on these topics are significant new issues, nor require significant changes to either our proposed action or our analysis of impacts. All substantive comments were previously addressed in appendix K of the final CCP/EIS. However, in response to some of these final CCP/EIS comments, we clarify our rationale for certain management strategies in the CCP as indicated below.

- With regards to the comments that we misinterpreted the Colonial Ordinances of 1641 and 1647 which bestow public access for fishing, fowling, and navigation, in chapter 2 of the CCP, we clarify that the Federal Government has authority to regulate the exercise of these State-law rights under the Supremacy Clause of the Constitution. State law rights may only be exercised if not prohibited by the Federal laws governing national wildlife refuges and wilderness areas designated under the Wilderness Act (16 U.S.C. 1131-1136, 78 Stat. 890).

- With regards to the comment that we should distinguish ribbed from blue mussels and allow some harvest, in appendix D of the CCP we clarify in our finding of appropriateness for this activity our concerns with harvest of either species.

- With regards to the comment that it is impractical to require commercial fishing guides operating on the refuge to obtain refuge permits, we clarify that our intent is require refuge permits for only those commercial fishing guides landing on the refuge or allowing people to disembark from their boat above mean low water. This clarification is made in the CCP in appendix D in our compatibility determination for "Commercial Tours, Ferry Service, Guided Trips, and Outfitting," and in chapter 4 as a strategy under goal 2, objective 2.5.

- With regards to the comment that we have too high an allowance for beachcombing on the refuge, in appendix D of the CCP we clarify the limits in our compatibility determination for this activity.

Decision to Select Alternative B for the CCP

Alternative B is the Service's selected alternative. Alternative B was also specified as the Service-preferred alternative in the final CCP/EIS. Alternative B is the most effective alternative at addressing the key issues and concerns identified during the planning process and will best achieve the purpose and need for developing the CCP, the purposes and goals of the refuge, and the mission and goals of the National Wildlife Refuge System (Refuge System) and the National Wilderness Preservation System. It is also the environmentally preferable alternative as discussed above. Implementation of the CCP will occur over the next 15 years, as funding permits.

The decision includes adoption of stipulations and measures referenced in the "Measures to Minimize Environmental Harm" section below. It also includes all the changes made between draft and final CCP/EIS's, in appendix K of the final CCP/EIS, and the clarifications referenced above in "Comments Received in the Final CCP/EIS."

The required "wait period" before approval of the ROD was initiated on November 6, 2015, with the Environmental Protection Agency's **Federal Register** notification of the filing of the final CCP/EIS. This ROD is not the final agency action for those elements of the selected action that require promulgation of regulations to be effective. Promulgation of such regulations will constitute the final agency action for such elements of the selected action, including the implementation of a waterfowl hunt program.

Factors Considered in Making the Decision

This decision to adopt alternative B for implementation was made after considering the follow factors:

- How well the alternative achieves the stated purpose and need for a CCP and the six goals presented in chapter 1 of the final CCP/EIS.

- How well the alternative addresses the relevant issues, concerns, and opportunities identified in the planning process and summarized in chapter 1 of final CCP/EIS.

- The results of public, partner, town of Chatham, Federal and State agency, and other stakeholder comments on the draft and final CCP/EISs.

- The projected impacts identified in chapter 4 of the final CCP/EIS.

- Other relevant factors, including fulfilling the purposes for which the refuge was established, contributing to the mission and goals of the Refuge System and National Wilderness Preservation System, and statutory and regulatory guidance.

Compared to the alternative A and C, alternative B includes the suite of actions that best meet the factors above using the most balanced, reasonable, practicable, and integrated approach, and with due consideration for impacts on both the biological and human environment. The refuge's establishment purposes emphasize

the conservation of migratory birds and the protection of wilderness character and values; thus, protecting those resources on Monomoy NWR is paramount. These resources are enhanced the most under alternative B. Alternative B will best fulfill the refuge's biological goal with expanded management for migratory birds and other Federal trust species and habitats that are of national and regional conservation concern. Alternative B targets more acres for active habitat management to benefit a wider array of species of conservation concern, compared to alternatives A and C. In addition, alternative B specifically strives to increase the number of breeding migratory birds, and increase their productivity, more than the other two alternatives. Alternative B also includes a more extensive inventory and monitoring program that will help the most in evaluating the effectiveness of our actions and ensuring our management into the future is adaptive and strategic, including considerations of the impacts of climate change.

Alternative B best balances the long-term protection and management of wilderness resources with consideration of historic and traditional uses. It would not eliminate motor boat access as proposed in alternative C, but would impose a new restriction on the use of wheeled carts for harvesting shellfish. Alternative B also includes the most actions to engage and educate people about Monomoy Wilderness.

Alternative B is best at promoting high-quality, wildlife-dependent recreation on the refuge, while providing sufficient protection for wildlife and wilderness resources. Compared to alternative A, there are enhanced or increased opportunities for our priority public uses: hunting, fishing, wildlife observation, wildlife photography, environmental education, and interpretation. Directional signage will also be improved from what exists today, and we will work with town officials to explore opportunities for a visitor contact facility, additional parking, a shuttle service, and safer pedestrian and bicycle access to the refuge from town. Alternative B will also expand existing American Disabilities Act-compliant facilities. Compared to alternative C, alternative B provides more options for access to refuge islands since motorized boat use will not be eliminated. Under alternative B, we have also determined that there are some public use activities that are not appropriate or not compatible with resource protection and will not be allowed. Some of these activities may be occurring today. Our rationale for allowing certain activities, and not allowing others, are detailed in appendix D.

Alternative B best recognizes how important Monomoy NWR is to the local community and the larger social and economic region of the Outer Cape. It includes the most strategies for improving communications and coordination with the town of Chatham, State fish, wildlife, and marine agency officials, and the National Park Service, who collectively represent the other entities with management authority in the area surrounding the refuge. Alternative B objectives and strategies also specifically identify actions to improve outreach and engagement with residents in the local community, and to increase appreciation and enjoyment of the refuge.

Alternative B complies with all major Federal laws that apply to this type of Federal action, including those noted below under "Findings Required by Other Laws and Executive Orders." The final CCP/EIS was developed to comply with the NEPA. The CCP/EIS was developed with sufficient detail to account for the greatest potential impacts that could result from proposed actions identified under all alternatives. However, additional NEPA analysis will be necessary for certain types of actions, even once we adopt a final CCP. We identified some of the actions we anticipate will require further NEPA analysis and public involvement in chapter 3 of the final CCP/EIS. Appendix N in the CCP includes documentation of compliance with the Coastal Zone Management Act (Public Law 92-583, as amended); Endangered Species Act (ESA) (Public Law 93-205, as amended); and, National Historic Preservation Act (NHPA) (Public Law 89-665).

In summary, we selected alternative B for implementation because it best meets the factors identified above when compared to alternatives A and C. Alternative B provides the greatest number of opportunities for Monomoy NWR to contribute to the conservation of fish, wildlife, habitat, and wilderness resources at local, regional, and national levels. It will also increase our capacity to meet refuge purposes and contribute to the Refuge System mission, enhance visitor use and enjoyment, and will provide the means to better respond to changing ecological conditions within the surrounding environment.

Measures to Minimize Environmental Harm

Congress charged the Service with the mission of the Refuge System "to administer a national network of lands and waters for the conservation, management, and where appropriate, restoration of the fish, wildlife, and plant resources and their habitats within the United States for the benefit of present and future generations

of Americans" (Refuge System Improvement Act). Furthermore, the Service is directed to "ensure that the biological integrity, diversity, and environmental health of the Refuge System are maintained for the benefit of present and future generations of Americans." As a result, the Service routinely evaluates and implements measures to minimize harm whenever conditions occur that could adversely affect the biological integrity, diversity, and environmental health of refuge resources.

All practicable measures to avoid or minimize environmental impacts that could result from implementation of alternative B have been identified and incorporated into chapter 3 (Alternatives Considered, including the Service-preferred Alternative), chapter 4 (Environmental Consequences), and appendix D (Findings of Appropriateness and Compatibility Determinations) of the final CCP/EIS. The findings of appropriateness and the stipulations identified in the compatibility determinations in appendix D ensure that refuge uses and visitor activities are appropriate and compatible with the purposes for which the refuge was established. The compatibility determination stipulations and other mitigation measures identified for alternative B in chapters 3 and 4 are adopted in this ROD and will be followed or enforced by refuge staff or their designee.

Findings Required by Other Laws and Executive Orders

The final CCP/EIS complies with all Federal laws and Executive Orders (EO) related to the planning process and Monomoy Refuge. These include, but are not limited to, the Refuge System Improvement Act; NEPA; the ESA; Marine Mammal Protection Act (16 U.S.C. 1361-1407); the NHPA; Archeological Resources Protection Act (16 U.S.C. 470aa-4701); the Coastal Zone Management Act; the Wilderness Act; EO 12898, Environmental Justice; EO 11988, Floodplain Management; EO 11990, Protection of Wetlands; EO 12372, Intergovernmental Review; EO 13186, Protection of Migratory Birds; and EO 13175, Consultation and Coordination with Indian Tribal Governments.

For Further Information

For further information, contact Elizabeth Herland, Project Leader, Eastern Massachusetts NWR Complex, 73 Weir Hill Road, Sudbury, MA 01776, phone (978) 443-4661, ext. 11. Copies of the final CCP/EIS and the CCP may be viewed at the Eastern Massachusetts NWR Complex (see Project Leader's address); at Monomoy NWR, 30 Wikis Way, Chatham, MA 02633, phone (508) 945-0594; and, at the Eldredge Public Library, 564 Main Street, Chatham, MA 02633, phone (508) 945-5170. The CCP and this ROD will be available for viewing and downloading online at: *http://www.fws.gov/refuge/Monomoy/what_we_do/conservation.html*

Wendi Weber
Regional Director, Region 5

March 18, 2016
Date

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