Appendix F

USFWS

Loggerhead sea turtle hatchlings

Biological Opinion on monitoring and management practices for piping plover, loggerhead sea turtle, green sea turtle, leatherback sea turtle, and seabeach amaranth on Chincoteague NWR

United States Department of the Interior

FISH AND WILDLIFE SERVICE
Ecological Services
6669 Short Lane
Gloucester, VA 23061

September 10, 2008

Memorandum

To: Refuge Manager, Chincoteague National Wildlife Refuge

From: Supervisor, Virginia Field Office

Subject: Biological Opinion on monitoring and management practices for piping plover (*Charadrius melodus*), loggerhead sea turtle (*Caretta caretta*), green sea turtle (*Chelonia mydas*), leatherback sea turtle (*Dermochelys coriacea*), and seabeach amaranth (*Amaranthus pumilus*) on Chincoteague National Wildlife Refuge, Virginia

This document transmits the U.S. Fish and Wildlife Service's (Service) biological opinion on the proposed species monitoring, piping plover and sea turtle nest exclosures, predator control, hunting program, public beach use, and off-road vehicle (ORV) use within all units of the Chincoteague National Wildlife Refuge (CNWR), Accomack County, Virginia, and the effects of these activities on the endangered green sea turtle (*Chelonia mydas*), and leatherback sea turtle (*Dermochelys coriacea*), and the threatened piping plover (*Charadrius melodus*), loggerhead sea turtle (*Caretta caretta*), and seabeach amaranth (*Amaranthus pumilus*). The final portion of your completed *Intra-Service Section 7 Biological Evaluation Form* (Enclosure 1) was received by this office on August 7, 2008.

This biological opinion is based on information provided in your *Intra-Service Section 7 Biological Evaluation Forms* (Enclosure 1), information contained within this office, conversations with CNWR staff and species experts, field investigations, and other sources of information. A complete administrative record of this consultation is on file at this office.

Consultation History

Consultation history is provided in Appendix A.

BIOLOGICAL OPINION

I. DESCRIPTION OF THE PROPOSED ACTION

The proposed actions consist of continued species monitoring, piping plover and sea turtle nest exclosures, predator control, public recreational use, off-road vehicle (ORV) use (public and government vehicles, and public horseback riding will be treated as an ORV for this consultation), hunting programs, and general management activities within the beach and dunal systems of all units of the CNWR. Tables 1 and 2 provide a detailed listing of the types of public beach use that occur on the Assateague Unit and Southern Units of CNWR, respectively. This opinion will address all activities that occur on the beaches of CNWR, as explained in detail in the enclosed *Intra-Service Section 7 Biological Evaluation Forms* (Enclosure 1) with regards to piping plovers, seabeach amaranth, and nesting sea turtles. The action area comprises all beach areas managed by the refuge. These areas are: Assateague, Assawoman, Metompkin, and Cedar Islands. This opinion supersedes the 2001 biological opinion and establishes new levels of anticipated incidental take. The proposed actions represent both updates of actions consulted on in the 2001 biological opinion and additional activities not addressed in the 2001 biological opinion. The proposed actions are expected to continue for up to five years from the issuance date of this opinion, or until CNWR completes its Comprehensive Conservation Plan (CCP) for the refuge. Once completed, the CCP will guide refuge management, and the Service expects to consult on the management actions proposed in the CCP as a new action.

II. STATUS OF THE SPECIES

PIPING PLOVER (*Charadrius melodus*)

On January 10, 1986, the piping plover was listed as endangered or threatened in various parts of its range pursuant to the ESA. Protection of the species under the ESA reflects the species precarious status range-wide. Three separate breeding populations have been identified, each with its own recovery criteria: Atlantic Coast (threatened), Great Lakes (endangered), and Northern Great Plains (threatened). No Critical Habitat has been designated or proposed for piping plovers in the Atlantic Coast breeding area.

The recovery plan for the Atlantic Coast population of the piping plover (U.S. Fish and Wildlife Service 1996a) delineates four recovery units or geographic subpopulations within the population: Atlantic Canada, New England, New York-New Jersey, and Southern (Delaware, Maryland, Virginia, and North Carolina). Recovery criteria established within the recovery plan defined population and productivity goals for each recovery unit, as well as for the population as a whole. Attainment of these goals for each recovery unit is an integral part of a piping plover recovery strategy that seeks to reduce the probability of extinction for the entire population by: (1) contributing to the population total, (2) reducing vulnerability to environmental variation (including catastrophes, such as hurricanes, oil spills, or disease), (3) increasing likelihood of genetic interchange among subpopulations, and (4) promoting recolonization of any sites that experience declines or local extirpations due to low productivity or temporary habitat succession.

Table 1. Public recreation activities on Assateague Island by season and area, Chincoteague National Wildlife Refuge, Virginia

Assateague Island Areas	Wild Beach	Public Beach		Overwash	Hook	Tom's Cove
Areas from North to South	VA state line to D-dike	D-dike to Parking Lot 1	Parking Lots 1 to 5	Parking Lot 5 to Coast Guard Station	Coast Guard Station to end of Island	NPS waters adjacent to Refuge land
Walking/Wildlife Observation	1,2,3,4	1,2,3,4	1,2,3,4	1,3,4	3,4	1,2,3,4
Sunbathing/Swimming		1,2,3,4	1,2,3,4	1,3,4	3,4	1,2,3,4
Pony Penning (2 days in July)	2	2	2			
Fishing*		1,2,3,4	1,2,3,4	1,2,3,4	3,4	1,2,3,4
ORV - public*				1,2,3,4	3,4	
ORV – LE	1,2,3,4	1,2,3,4	1,2,3,4	1,2,3,4	1,2,3,4	1,2,3,4
EE and Interpretation			1,2,3,4			
SUP – EE		1,2,3,4	1,2,3,4			
Weddings		1,2,3,4	1,2,3,4	1,3,4		
Kite flying			1,2,3,4			
Shell collecting/beach combing		1,2,3,4	1,2,3,4	1,3,4	3,4	1,2,3,4
Research w/ SUP	1,2,3,4	1,2,3,4	1,2,3,4	1,2,3,4	1,2,3,4	1,2,3,4
Beach clean-up - vehicles (1 day)	3	3	3	3	3	
Biological surveys	1,2,3,4	1,2,3,4		1,2,3,4	1,2,3,4	1,2,3,4
Shorebird management	1,2,3,4	1,2,3,4		1,2,3,4	1,2,3,4	1,2,3,4
NPS maintenance			1,2,3,4	1,3	1,3	
Picnicking		1,2,3,4	1,2,3,4,	1,3,4	3,4	1,2,3,4
Campfires			1,2,3,4			
Horseback riding				1,3,4	3,4	3,4
Big game hunting					3,4	3,4
Boat landing				3,4	3,4	1,2,3,4
Coast Guard Station - NPS				1,3,4		1,2,3,4
Other Agency activities w/SUP			1,2,3,4,	1,3,4	3,4	
Shell fishing access						1,3,4
Commercial filming - SUP			1,2,3,4			
Agency tours and Junkets	1,2,3,4	1,2,3,4	1,2,3,4	1,2,3,4	1,2,3,4	1,2,3,4
Emergency Activities	1,2,3,4	1,2,3,4	1,2,3,4	1,2,3,4	1,2,3,4	1,2,3,4
Predator Management	1,2,4	1,2,4		1,2,4	1,2,4	1,2

1 = Spring (Mar 15 - June 15)
3 = Fall (Labor Day - Thanksgiving)
2 = Summer (June 16 - Labor Day)
4 - Winter (Thanksgiving - Mar 16)

Table 2. Public recreation activities on the Southern Islands Unit by season and area, Chincoteague National Wildlife Refuge, Virginia.

Southern Islands	Assawoman	Metompkin	Cedar*
Walking/Wildlife Observation	3,4	1,2,3,4	1,2,3,4
Sunbathing/swimming	3,4	1,2,3,4	1,2,3,4
Fishing	1,2,3,4	1,2,3,4	1,2,3,4
ORV – Public	n/a	n/a	1,2,3,4
ORV – LE	1,2,3,4	n/a	n/a
Shell collecting/beach combing	3,4	1,2,3,4	1,2,3,4
Research w/ SUP	1,2,3,4	1,2,3,4	1,2,3,4
Surveys – biology	1,2,3,4	1,2,3,4	1,2,3,4
Shorebird management	1,2,3,4	1,2,3,4	1,2,3,4
Picnicking	3,4	1,2,3,4	1,2,3,4
Hunting	n/a	n/a	3,4
Boating	1,2,3,4	1,2,3,4	n/a
Other Agency use w/ SUP	1,2,3,4	1,2,3,4	1,2,3,4
Commercial filming w/ SUP	1,2,3,4	1,2,3,4	1,2,3,4
Agency Tours	1,2,3,4	1,2,3,4	1,2,3,4
Emergency Access	1,2,3,4	1,2,3,4	1,2,3,4
Predator Control	1,2,4	1,2,3,4	1,2,3,4

1 = Spring (Mar 15 - June 15)
2 = Summer (June 16 - Labor Day)
3 = Fall (Labor Day - Thanksgiving)
4 - Winter (Thanksgiving - Mar 16)

*The inability to determine ownership limits restrictions placed on the island, therefore, CNWR has limited control of public use across the entire island.

The plan further states: "A premise of this plan is that the overall security of the Atlantic Coast piping plover population is profoundly dependent upon attainment and maintenance of the minimum population levels for the four recovery units. Any appreciable reduction in the likelihood of survival of a recovery unit will also reduce the probability of persistence of the entire population." In accordance with the Endangered Species Consultation Handbook (U.S. Fish and Wildlife Service and National Marine Fisheries Service 1998), since recovery units have been established in an approved recovery plan, this Biological Opinion considers the effects of the proposed project on piping plovers in the Southern Recovery Unit, as well as the Atlantic Coast population as a whole.

Species Description - Piping plovers are small, sand-colored shorebirds, approximately 17 centimeters (cm) (7 inches) long with a wingspread of about 38 cm (15 inches) (Palmer 1967). The Atlantic Coast population, which is the focus of this Biological Opinion, breeds on sandy, coastal beaches from Newfoundland to North Carolina, and winters along the Atlantic Coast from North Carolina south, along the Gulf Coast to Texas, and in the Caribbean (U.S. Fish and Wildlife Service 1996a). Additional detailed information on the piping plover, its life history, and the population dynamics of the Atlantic population are provided in the recovery plan (U.S. Fish and Wildlife Service 1996a).

Life History - Piping plovers generally begin returning to their Atlantic Coast nesting beaches in mid-March (Coutu *et al.* 1990, Cross 1990, Goldin 1990, MacIvor 1990, Hake 1993). Males establish and defend territories and court females (Cairns 1982). Piping plovers are monogamous, but usually shift mates between years (Wilcox 1959, Haig and Oring 1988, MacIvor 1990), and less frequently between nesting attempts in a given year (Haig and Oring 1988, MacIvor 1990, Strauss 1990). Plovers are known to begin breeding as early as one year of age (MacIvor 1990, Haig 1992); however, the percentage of birds that breed in their first adult year is unknown.

Piping plovers nest on the ground above the high tide line on coastal beaches, on sand flats at the ends of sand spits and barrier islands, on gently sloping foredunes, in blowout areas behind primary dunes, and in washover areas cut into or between dunes. In the central portions of their Atlantic Coast range, the birds may also nest on areas where suitable dredge material has been deposited. Nest sites are shallow, scraped depressions in substrates ranging from fine-grained sand to mixtures of sand and pebbles, shells or cobble (Bent 1929, Burger 1987, Cairns 1982, Patterson 1988, Flemming *et al.* 1988, MacIvor 1990, Strauss 1990). Nests are usually found in areas with little or no vegetation although, on occasion, piping plovers will nest under stands of American beachgrass or other vegetation (Patterson 1988, Flemming *et al.* 1990, MacIvor 1990). Plover nests may be very difficult to detect, especially during the six to seven day egg-laying phase when the birds generally do not incubate the eggs within the nest cup (Goldin 1994).

Eggs may be present on the beach from early April through late July. Clutch size for an initial nest attempt is usually four eggs, one laid every other day. Eggs are pyriform in shape, and variable buff to greenish brown in color, marked with black or brown spots. The incubation period usually lasts 27-28 days. Full-time incubation usually begins with the completion of the clutch and is shared equally by both sexes (Wilcox 1959, Cairns 1977, MacIvor 1990). Eggs in a clutch usually hatch within four to eight hours of each other, although the hatching period of one or more eggs may be delayed by up to 48 hours (Cairns 1977, Wolcott and Wolcott 1999).

Piping plovers generally fledge only a single brood per season, but may renest several times if eggs are lost. Chicks are precocial, meaning they immediately can run from the nest cup upon hatching (Wilcox 1959, Cairns 1982). They may move with their parents hundreds of meters (m) from the nest site during their first week of life (U.S. Fish and wildlife Service 1996a), and chicks may increase their foraging range up to 1,000 meters before they fledge (are able to fly) (Loegering 1992). At CNWR, Daisey (2006) found that brood movements averaged 60.1 $\pm$ 28.0 m/day in 2004 and 68.8 m/day in 2005 (range = 5.4 – 120.8 m/day; 28.9 – 122.2 m/day, respectively). Chicks remain together with one or both parents until they fledge at 25 to 35 days of age. Depending on their date of hatching, flightless chicks may be present from mid-May until late August, although most fledge by the end of July (Patterson 1988, Goldin 1990, MacIvor 1990, Howard *et al.* 1993).

Cryptic coloration is a primary defense mechanism for this species; eggs, adults, and chicks all blend in with their typical beach surroundings. Chicks sometimes respond to vehicles and/or pedestrians by crouching and remaining motionless (Cairns 1977, Tull 1984, Goldin 1993, Hoopes 1993). Adult piping plovers also respond to intruders (avian and mammalian) in their territories by displaying a variety of distraction behaviors, including squatting, false brooding, running, and injury feigning, in an effort to lure the predators away from the nest or chicks. Distraction displays may occur at any time during the breeding season but are most frequent and intense around the time of hatching (Cairns 1977).

Plovers feed on invertebrates such as marine worms, fly larvae, beetles, crustaceans, and mollusks (Bent 1929, Cairns 1977, Nicholls 1989). Important feeding areas include intertidal portions of ocean beaches, washover areas, mudflats, sand flats, wrack lines, sparse vegetation, and shorelines of coastal ponds, lagoons, or salt marshes (Gibbs 1986, Coutu *et al.* 1990, Hoopes *et al.* 1992, Loegering 1992, Goldin 1993, Elias-Gerken 1994). Studies have shown that the relative importance of various feeding habitat types may vary by site (Gibbs 1986, Coutu, *et al.* 1990, McConnaughey *et al.* 1990, Loegering 1992, Goldin 1993, Hoopes 1993, Elias-Gerken 1994), and by stage in the breeding cycle (Cross 1990). Adults and chicks on a given site may use different feeding habitats in varying proportion (Goldin 1990). Feeding activities of chicks are particularly important to their survival. Most time budget studies reveal that chicks spend a high proportion of their time feeding. Cairns (1977) found that piping plover chicks typically tripled their weight during the first two weeks post-hatching; chicks that failed to achieve at least 60 percent of this weight gain by the twelfth day were unlikely to survive.

During courtship, nesting, and brood rearing, feeding territories are generally contiguous to nesting territories (Cairns 1977), although instances where brood-rearing areas are widely separated from nesting territories are not uncommon. Feeding activities of both adults and chicks may occur during all hours of the day and night (Burger 1993), and at all stages in the tidal cycle (Goldin 1993, Hoopes 1993).

Both spring and fall migration routes of Atlantic Coast breeders are believed to occur primarily within a narrow zone along the Atlantic Coast (U.S. Fish and Wildlife Service 1996a). Relatively little is known about migration behavior or habitat use within the Atlantic Coast breeding range (U.S. Fish and Wildlife Service 1996a), but the pattern of both fall and spring counts at migration sites along the southeastern Atlantic Coast demonstrates that many piping plovers make intermediate stopovers lasting from a few days up to one month during their migrations (National Park Service 2003, Noel *et al*. 2005, Stucker and Cuthbert 2006).

A growing body of information shows that habitats on overwash beaches, accessible bayside flats, unstabilized and recently healed inlets, and moist sparsely vegetated barrier flats are especially important to piping plover productivity and carrying capacity in the New York-New Jersey and Southern recovery units.

In New Jersey, Burger (1994) studied piping plover foraging behavior and habitat use at three sites that offered the birds access to ocean, dune, and backbay habitats. The primary focus of the study was on the effect of human disturbance on habitat selection, and it found that both habitat selection and foraging behavior correlated inversely with the number of people present. In the absence of people on an unstabilized beach, plovers fed in ocean and bayside habitats in preference to the dunes.

Loegering and Fraser (1995) found that chicks on Assateague Island, Maryland, that were able to reach bayside beaches and the island interior had significantly higher fledgling rates than those that foraged solely on the ocean beach. Higher foraging rates, percentage of time spent foraging, and abundance of terrestrial arthropods on the bay beach and interior island habitats supported their hypothesis that foraging resources in interior and bayside habitats are key to reproductive rates on that site. Their management recommendations stressed the importance of sparsely vegetated cross-island access routes maintained by overwash, and the need to restrict or mitigate human activities that reduce natural disturbance during storms.

Dramatic increases in plover productivity and breeding population on Assateague since the 1991-1992 advent of large overwash events corroborate Loegering and Fraser's conclusions. Piping plover productivity on Assateague, which had averaged 0.77 chicks per pair during the five years before the overwash events, averaged 1.67 chicks/pair in 1992-96. The nesting population on the northern five miles of the island also grew rapidly, doubling by 1995 and tripling by 1996, when 61 pairs nested there (MacIvor 1996). Habitat use is primarily on the interior and bayside of this island.

In Virginia, Watts *et al*. (1996) found that piping plovers nesting on 13 barrier islands between 1986 and 1988 were not evenly distributed along the islands. Beach segments used by plovers had wider and more heterogeneous beaches, fewer stable dunes, greater open access to bayside foraging areas, and proximity to mudflats. They note that characteristics of beaches selected by plovers are maintained by frequent storm disturbance.

At Cape Lookout National Seashore in North Carolina, 13 to 45 pairs of plovers have nested on North and South Core Banks each year since 1992 (National park Service, 2007). While these unstabilized barrier islands total 44 miles long, nesting distribution is patchy, with all nests clustered on the dynamic ends of the barrier islands, recently closed and sparsely vegetated "old inlets," expansive barrier mudflats, or new ocean-to-bay overwashes. During a 1990 study, 96 percent of brood observations were on bay tidal flats, even though broods had access to both bay and ocean beach habitats (McConnaughey *et al*. 1990).

At Cape Hatteras National Seashore, distribution of nesting piping plovers is also “clumped,” with nesting areas characterized by a wide beach, relatively flat intertidal zone, brackish ponds, and temporary pools formed by rainwater and overwash (Coutu *et al*. 1990).

Notwithstanding the importance of bayside (soundside) flats, ephemeral pools, and sparsely vegetated barrier flats for piping plover nest site selection and chick foraging, ocean intertidal zones are also used by adults and chicks of all ages. For example, between 1993 and 1996 on the Maryland end of Assateague Island, 4 to 12 percent of annual observations of plover broods occurred on the ocean beach (National Park Service and Maryland Department of Natural Resources 1993-1996). A three-year study of piping plover chick foraging activity at six sites on four Virginia barrier islands (Cross and Terwilliger 2000) documented chick use of the ocean intertidal zone at three of six study sites. Intensive observations at Chincoteague National Wildlife Refuge Overwash Zone in 2004, where chicks had unimpeded access to a large undisturbed bayside flat, documented occasional visits to the ocean intertidal zone by six of eleven broods ranging in age from one to 24 days (Hecht 2004 *in litt*.).

<u>Population Dynamics/Status and Distribution</u> - Historical population trends for the Atlantic Coast piping plover have been reconstructed from scattered, largely qualitative records. Nineteenth-century naturalists, such as Audubon and Wilson, described the piping plover as a common summer resident on Atlantic Coast beaches (Haig and Oring 1987). However, by the beginning of the 20th Century, egg collecting and uncontrolled hunting, primarily for the millinery trade, had greatly reduced the population, and, in some areas along the Atlantic Coast, the piping plover was close to extirpation. Following passage of the Migratory Bird Treaty Act (40 Stat. 775; 16 U.S.C. 703-712) in 1918, and changes in the fashion industry that no longer exploited wild birds for feathers, piping plover numbers recovered to some extent (Haig and Oring 1985).

Available data suggest that the most recent population decline began in the late 1940s or early 1950s (Haig and Oring 1985). Starting in 1972, the National Audubon Society's “Blue List” of birds with deteriorating status included the piping plover (Tate 1981). Johnsgard (1981) described the piping plover as “. . . declining throughout its range and in rather serious trouble.” The Canadian Committee on the Status of Endangered Wildlife in Canada designated the piping plover as "Threatened" in 1978 and elevated the species status to "Endangered" in 1985 (Canadian Wildlife Service 1989).

Reports of local or statewide declines between 1950 and 1985 are numerous and many are summarized by Haig and Oring (1985). While Wilcox (1939) estimated more than 500 pairs of piping plovers on Long Island, New York, the 1989 population estimate was 191 pairs (U.S. Fish and Wildlife Service 2004). There was little focus on gathering quantitative data on piping plovers in Massachusetts through the late 1960s because the species was commonly observed and presumed to be secure. However, numbers of piping plover breeding pairs declined 50 to 100 percent at seven Massachusetts sites between the early 1970s and 1984 (Griffin and Melvin 1984). Recent experience of biologists surveying piping plovers has shown that counts of these cryptically colored birds sometimes go up with increased census effort, suggesting that some historic counts of piping plover numbers by one or a few observers, who often recorded occurrences of many avian species simultaneously, may have underestimated the piping plover population. Thus, the magnitude of the species' decline may have been more severe than available numbers imply.

Table 3 summarizes nesting pair counts for the Atlantic Coast piping plover population since listing in 1986 through 2007. Final range-wide numbers for the 2008 breeding season are not yet available, and 2007 data are considered preliminary at this time. The apparent increase in numbers of plover pairs between 1986 and 1989 is thought, at least partially, to reflect the effects of increased survey efforts following the proposed listing of the species in 1986.

The Atlantic Coast population has increased from 790 pairs since listing to a preliminary estimate of 1,887 pairs in 2007 (U.S. Fish and Wildlife Service 2008a) (final 2006 estimate of 1,749 pairs, U.S. Fish and Wildlife Service 2006). Population growth has been greatest in the New England and New York-New Jersey recovery units, with a more modest and recent increase in the Southern unit and an even smaller increase in Atlantic Canada.

Productivity - Productivity needed to maintain a stable population for Atlantic Coast piping plovers is estimated at 1.24 fledged chicks per pair (Melvin and Gibbs 1994). Small populations may be highly vulnerable to extirpation due to variability in productivity and survival rates. The average productivity needed for a stable population may be insufficient to assure a high probability of species survival. To compensate for small populations, the recovery plan establishes productivity goals needed to assure a secure 2,000-pair population at 1.5 chicks per pair in each of the four recovery units, based on data from at least 90 percent of each recovery unit's population.

Table 4 provides a summary of piping plover productivity from 1987 to 2007. Both regional population trends and productivity rates have been uneven. The 10-year (1997-2007) average productivity for piping plovers on the U.S. Atlantic Coast is below the recovery target of 1.5 chicks per pair. Peak productivity in the U.S. occurred in 1994 when average productivity exceeded the recovery plan goal of 1.5 chicks per pair. In most years, average productivity across the Atlantic population remained below the target. While weather events were contributors to egg and chick losses in some years (U.S. Fish and Wildlife Service 1998, 2002a), such periodic natural events are inevitable, and they underscore the need to reduce the species' vulnerability by increasing the breeding population and protecting the species against human caused factors that affect productivity.

Refuge Manager, Chincoteague National Wildlife Refuge 10

TABLE 3. Estimated abundance of breeding pairs of Atlantic Coast piping plovers, 1986 – 2007. Parentheses denote preliminary estimates.

State/ RECOVERY UNIT	Pairs																					
	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
Maine	15	12	20	16	17	18	24	32	35	40	60	47	60	56	50	55	65	61	55	49	40	35
New Hampshire												5	5	6	6	7	7	7	4	3	3	3
Massachusetts	139	126	134	137	140	160	213	289	352	441	454	483	495	501	496	495	538	511	(490)	(475)	482	(557)
Rhode Island	10	17	19	19	28	26	20	31	32	40	50	51	46	39	49	52	58	71	70	69	72	73
Connecticut	20	24	27	34	43	36	40	24	30	31	26	26	21	22	22	32	31	37	40	34	37	36
NEW ENGLAND	184	179	200	206	228	240	297	376	449	552	590	612	627	624	623	641	699	687	(659)	(630)	634	(704)
New York	106	135	172	191	197	191	187	193	209	249	256	256	245	243	289	309	369	386	384	374	422	(455)
New Jersey	102	93	105	128	126	126	134	127	124	132	127	115	93	107	112	122	138	144	135	111	116	129
NY-NJ	208	228	277	319	323	317	321	320	333	381	383	371	338	350	401	431	507	530	519	485	538	(584)
Delaware	8	7	3	3	6	5	2	2	4	5	6	4	6	4	3	6	6	6	7	8	9	9
Maryland	17	23	25	20	14	17	24	19	32	44	61	60	56	58	60	60	60	59	66	63	64	64
Virginia	100	100	103	121	125	131	97	106	96	118	87	88	95	89	96	119	120	114	152	192	202	199
North Carolina	30	30	40	55	55	40	49	53	54	50	35	52	46	31	24	23	23	24	20	37	46	61
South Carolina	3		0		1	1		1			0					0						0
SOUTHERN	158	160	171	199	201	194	172	181	186	217	189	204	203	182	183	208	209	203	245	300	321	333
U.S. TOTAL	550	567	648	724	752	751	790	877	968	1150	1162	1187	1168	1156	1207	1280	1415	1420	(1423)	(1415)	1493	(1621)
ATLANTIC CANADA*	240	223	238	233	230	252	223	223	194	200	202	199	211	236	230	250	274	256	237	217	256	(266)
ATLANTIC COAST TOTAL*	790	790	886	957	982	1003	1013	1100	1162	1350	1364	1386	1379	1392	1437	1530	1689	1676	(1660)	(1632)	1749	(1887)

* Includes minor revisions to 1990-2002 Atlantic Canada estimates made by Canadian Wildlife Service in 2005.

TABLE 4. Estimated productivity of Atlantic Coast piping plovers, 1987 – 2007. Parentheses denote preliminary estimates.

State/RECOVERY UNIT	Chicks fledged/pair																				
	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
Maine	1.75	0.75	2.38	1.53	2.50	2.00	2.38	2.00	2.38	1.63	1.98	1.47	1.63	1.60	1.98	1.40	1.28	1.45	0.55	1.35	1.06
New Hampshire											0.60	2.40	2.67	2.33	2.14	0.14	1.00	1.00	0.00	0.67	0.33
Massachusetts	1.10	1.29	1.59	1.38	1.72	2.03	1.92	1.81	1.62	1.35	1.33	1.50	1.60	1.09	1.49	1.14	1.26	(1.30)	(1.00)	1.33	1.25
Rhode Island	1.12	1.58	1.47	0.88	0.77	1.55	1.80	2.00	1.68	1.56	1.34	1.13	1.79	1.20	1.50	1.95	1.03	1.50	1.43	1.03	1.48
Connecticut	1.29	1.70	1.79	1.63	1.39	1.45	0.38	1.47	1.35	1.31	1.69	1.05	1.45	1.86	1.22	1.87	1.30	1.35	1.62	2.14	1.92
NEW ENGLAND avg.	1.19	1.32	1.68	1.38	1.62	1.91	1.85	1.81	1.67	1.40	1.39	1.46	1.62	1.18	1.53	1.26	1.24	(1.33)	(1.04)	1.34	1.30
New York	0.90	1.24	1.02	0.80	1.09	0.98	1.24	1.34	0.97	1.14	1.36	1.09	1.35	1.11	1.27	1.62	1.15	1.46	1.44	1.55	(1.15)
New Jersey	0.85	0.94	1.12	0.93	0.98	1.07	0.93	1.16	0.98	1.00	0.39	1.09	1.34	1.40	1.29	1.17	0.92	0.61	0.77	0.84	0.67
NY-NJ avg.	0.86	1.03	1.08	0.88	1.04	1.02	1.08	1.25	0.97	1.07	1.02	1.09	1.35	1.19	1.28	1.49	1.07	1.23	1.28	1.36	(1.03)
Delaware		0.00	2.33	2.00	1.60	1.00	0.50	2.50	2.00	0.50	1.00	0.83	1.50	1.67	1.50	1.17	2.33	1.14	1.50	1.44	1.33
Maryland	1.17	0.52	0.90	0.79	0.41	1.00	1.79	2.41	1.73	1.49	1.02	1.30	1.09	0.80	0.92	1.85	1.56	1.86	1.25	1.06	0.78
Virginia		1.02	1.16	0.65	0.88	0.59	1.45	1.66	1.00	1.54	0.71	1.01	1.21	1.42	1.52	1.19	1.90	2.23	1.52	1.19	1.16
North Carolina			0.59	0.43	0.07	0.41	0.74	0.36	0.45	0.86	0.23	0.61	0.48	0.54	0.50	0.17	0.46	0.65	0.92	0.87	0.26
SOUTHERN avg.	1.17	0.85	0.88	0.72	0.68	0.62	1.18	1.37	1.05	1.34	0.68	0.99	1.04	1.09	1.22	1.27	1.63	1.95	1.38	1.12	0.92
U.S. average	1.04	1.11	1.28	1.06	1.22	1.35	1.47	1.56	1.35	1.30	1.16	1.27	1.45	1.17	1.40	1.34	1.24	(1.40)	(1.20)	1.30	(1.13)
ATLANTIC CANADA		1.65	1.58	1.62	1.07	1.55	0.69	1.25	1.69	1.72	2.10	1.84	1.74	1.47	1.77	1.18	1.62	1.93	1.82	1.82	(1.14)

Southern Recovery Unit Status and Distribution - The Southern Recovery Unit (a portion of the Atlantic Coast population) includes Delaware, Maryland, Virginia, and North Carolina. Some limited plover nesting has occurred in South Carolina. There were approximately 158 plover pairs in the Southern Recovery Unit in 1986 and approximately 333 pairs in 2007 (Table 3). The 2007 total is the highest recorded within the Southern Recovery Unit to date. However, the Southern Recovery Unit, which includes CNWR, continues to fall short of its recovery goal of 400 pairs. During the period of monitoring, the population size has declined in some years, but has consistently rebounded following declines. The numbers have shown a dramatic increase over the last five years, from 204 pairs in 2003 to 333 pairs in 2007 (U.S. Fish and Wildlife Service 2008; Table 3).

In the Southern Recovery Unit, productivity has varied substantially over the past 5 years, with a low of 0.92 chicks per pair recorded in 2007 and a high of 1.96 in 2004 (Table 4). Overall, plover productivity has generally increased in Virginia and throughout the Southern Recovery Unit since 1999, despite declines in some years. High productivity in Virginia from 2000 to 2005 has contributed to population increases in Virginia and in the Southern Recovery Unit (U.S. Fish and Wildlife Service 2008). Continued productivity at or above levels identified in the Recovery plan are attainable with ongoing intensive management efforts, and are expected to result in additional increases in plover populations.

Threats - Intensive management measures to protect piping plovers from disturbance by beach recreationists and their pets have been implemented for the Atlantic population at many nesting sites in recent years. In 2004, about 30 percent of the U.S. Atlantic Coast population of piping plovers nested on federally owned beaches where some protection is afforded under section 7 of the ESA (within the Southern Recovery unit, the majority of plovers occur on public or private conservation lands). The remaining 70 percent of the birds nested on state, town, or privately-owned beaches where plover managers are implementing protections in the face of increasing disturbance from recreation and development. Recreational activities and public use of some federally owned beaches have also increased. Pressure on Atlantic Coast beach habitat from development and human disturbance continues (U.S. Fish and Wildlife Service 1996a). Piping plover protection is dependent on the efforts of Federal, State, and local government agencies, conservation organizations, and private landowners.

Recreational activities can be a source of both direct mortality and harassment of piping plovers. Pedestrians may flush incubating plovers from nests (Flemming *et al.* 1988, Cross 1990, Cross and Terwilliger 1993), exposing eggs to predators or excessive temperatures. Repeated exposure of shorebird eggs on hot days may cause overheating, killing the embryos (Bergstrom 1991); excessive cooling may kill embryos or retard their development, delaying hatching dates (Welty 1982). Pedestrians can also disturb unfledged chicks (Strauss 1990, Burger 1991, Loegering 1992, Hoopes 1993, Goldin 1993), forcing them out of preferred habitats, decreasing available foraging time, and causing expenditure of energy.

Concentrations of pedestrians may deter piping plovers from using otherwise suitable habitat. In Jones Beach Island, New York, Elias-Gerkin (1994) found less pedestrian disturbance in areas selected by nesting piping plovers than areas unoccupied by plovers. Burger (1991, 1994) found that presence of people at several New Jersey sites caused plovers to shift their habitat use away from the ocean front to interior and bayside habitats, and that the time plovers devoted to foraging decreased and the time spent alert increased when more people were present. Burger (1991) also found that when plover chicks and adults were exposed to the same number of people, chicks spent less time foraging and more time crouching, running away from people, and being alert than did adult birds.

Fireworks are highly disturbing to piping plovers (Howard *et al.* 1993). Plovers are also intolerant of kites, particularly as compared to pedestrians, dogs, and vehicles. Biologists believe this may be because plovers perceive kites as potential avian predators, such as gulls, crows, or raptors (Hoopes 1993).

Motorized vehicle use on beaches is an extreme threat to piping plovers, as well as other shorebirds that nest on beaches and dunes. Vehicles can crush eggs, adults, and chicks (Wilcox 1959, Tull 1984, Burger 1987, Patterson *et al.* 1991). In Massachusetts and New York, 18 piping plover chicks and 2 adults were killed by off-road vehicles (ORVs) in 14 documented incidents (Melvin *et al*. 1994). Goldin (1993) compiled records of 34 chick mortalities (30 on the Atlantic Coast and 4 on the Northern Great Plains) due to vehicles. Biologists who monitor and manage piping plovers believe that vehicles kill many more chicks than are found and reported (Melvin *et al.* 1994).

Beaches used by recreational vehicles during nesting and brood-rearing periods generally have fewer breeding plovers than available nesting and feeding habitat can support. In contrast, plover abundance and productivity has increased on beaches where recreational vehicle restrictions during chick-rearing periods have been combined with protection of nests from predators (Goldin 1993).

Once hatched, piping plover broods are mobile and may not remain near the nesting area. Wire fencing placed around nests to deter predators (Rimmer and Deblinger 1990, Melvin *et al.* 1992) is ineffective in protecting chicks from vehicles because chicks typically leave the nest within a day after hatching and move extensively along the beach to feed. Typical behaviors of piping plover chicks increase their vulnerability to vehicles. Chicks frequently move between the upper berm or foredune and feeding habitat within the wrack line and intertidal zone. Chick use of the ocean intertidal zone is lower in the Southern recovery unit compared with more northerly potions of the breeding range. Data from Assateague Island Seashore in Maryland and from Chincoteague NWR demonstrates that many broods make sporadic use of this habitat (National Park Service and Maryland Department of Natural Resources 1993, Hecht 2004 *in litt.*). These movements along the beach and intertidal zone place chicks in the paths of vehicles. Chicks stand, walk, and run along tire ruts, and sometimes have difficulty crossing deep ruts or climbing out of them (Eddings *et al.* 1990, MacIvor 1990, Strauss 1990, Hoopes *et al.* 1992, Goldin 1993, Howard *et al.* 1993, Hoopes 1994). Chicks sometimes stand motionless or crouch as vehicles pass by, or do not move quickly enough to get out of the way (Tull 1984, Hoopes *et al.* 1992, Goldin 1993).

Vehicles may also significantly degrade piping plover habitat or disrupt normal behavior patterns by crushing wrack into the sand and making it unavailable as cover or a foraging substrate (Hoopes *et al.* 1992, Goldin 1993). Vehicles that are driven too close to the toe of the dune may destroy vegetation that may also provide piping plover cover habitat (Elias-Gerken 1994).

Substantial evidence shows that human activities exacerbate natural predation on piping plovers, their eggs, and chicks (U.S. Fish and Wildlife Service 1996a). Where Wilcox (1959) had observed 92 percent hatching success of nests observed between 1939-1958 on Long Island, New York, and loss of only 2 percent of nests to crows (*Corvus sp*.), Elias-Gerken (1994) documented loss of 21 percent of nests in her study area to crows in 1992-1993. Other important predators of plover eggs and chicks in the recovery unit include foxes (*Vulpes vulpes*), raccoons (*Procyon lotor*), Norway rats (*Rattus norvegicus*), herring gulls (*Larus argentatus*), great black-backed gulls (*Larus marinus*), domestic and feral dogs (*Canis familiaris*) and cats (*Felis catus*), and ghost crabs (*Ocypode quadrata*) (Riepe 1989, Jenkins and Nichols 1994, Jenkins *et al.* 1999, Canale 1997, U.S. Fish and Wildlife Service 1996a).

Predators can be a major source of loss of eggs and juvenile plovers. For example, predators accounted for over half of all piping plover nest losses in New Jersey from 1995-1998 (Jenkins *et al.* 1999). A variety of techniques have been employed to reduce predation on plovers. Most notably, the use of predator exclosures (fences around nests) has demonstrated success to reduce predation on piping plover eggs (Melvin *et al.* 1992, Rimmer and Deblinger 1990) and has been credited with an important role in population increases in some parts of their range (Jenkins and Nichols 1994, Jenkins *et al.* 1999). However, these same devices have also been associated with serious problems including entanglements of birds in the exclosure netting, and attraction of “smart” predators that have learned there is potential prey inside. The downside risks may include not only predation or nest abandonment, sometimes at rates exceeding those that might occur without exclosures, but also induced mortality of adult birds. Exclosures provide no protection for mobile plover chicks, which generally leave the exclosure within a day of hatching and move extensively along the beach to feed.

Although exclosures are contributing to improved productivity and population increases in some portions of the plover's Atlantic Coast range, problems have been noted in some localities. Loegering (1992) reported loss of six nests in exclosures without tops in Maryland in 1988, but nest loss stopped after string tops were added. Cross (1991) found that exclosed nests hatched significantly more often than unexclosed nests over three years on three sites at CNWR, but hatch rates were not significantly improved at all sites or in all years; furthermore, two instances of foxes depredating adult plovers occurred in the vicinity of exclosures. Due to the magnitude of predation threats to plovers and limitations associated with all currently available solutions, the piping plover recovery plan strongly recommends that on-site managers employ an integrated approach to predator management that considers a full range of management techniques (U.S. Fish and Wildlife Service 1996a).

SEABEACH AMARANTH (*Amarathus pumilus*)

In 1993, seabeach amaranth was added to the List of Endangered and Threatened Wildlife and Plants (50 CFR 17.12) as a threatened species. The listing was based upon the elimination of seabeach amaranth from two-thirds of its historic range, and continuing threats to the 55 populations that were known at the time (U.S. Fish and Wildlife Service 1993).

Species Description - Seabeach amaranth is an annual plant and a member of the Amaranth family (*Amaranthaceae*). Upon germination, the plant initially forms a small, unbranched sprig, but soon begins to branch profusely, forming a low-growing mat. Seabeach amaranth's fleshy stems are prostrate at the base, erect or somewhat reclining at the tips, and pink, red, or reddish in color. The leaves of seabeach amaranth are small, rounded, and fleshy, spinach-green in color, with a characteristic notch at the rounded tip. Leaves are approximately 1.3 to 2.5 cm in diameter, and clustered towards the tip of the stem (Weakley and Bucher 1992). The foliage of seabeach amaranth turns deep red in the fall (Snyder 1996). Plants often grow to 30 cm in diameter, consisting of 5 to 20 branches, but occasionally reach 90 cm in diameter, with 100 or more branches. Flowers and fruits are inconspicuous, borne in clusters along the stems. Seeds are 2.5 millimeters (mm) in diameter, dark reddish-brown, and glossy, borne in low-density, fleshy, indehiscent utricles (bladder-like seed capsules or fruits), 4 to 6 mm long (Weakley and Bucher 1992). The seed does not fill the utricle, leaving an air-filled space (U.S. Fish and Wildlife Service 1996b).

Habitat – Historically, seabeach amaranth was native to Atlantic coast barrier island beaches from Massachusetts to South Carolina. The species' primary habitat consists of overwash flats at accreting ends of barrier islands, and lower foredunes and upper strands of non-eroding beaches. This species occasionally establishes small and temporary populations in secondary habitats including sound side beaches, blowouts in foredunes, and sand or shell dredge spoil or beach nourishment material (Weakley and Bucher 1992).

Seabeach amaranth occupies a narrow beach zone that lies at elevations from 0.2 to 1.5 m above mean high tide, the lowest elevations at which vascular plants regularly occur. Seaward, the plant grows only above the high tide line, as it is intolerant of even occasional flooding during the growing season. Landward, seabeach amaranth does not occur more than approximately one meter above the beach elevation on the foredune, or anywhere behind it, except in overwash areas. The species is, therefore, dependent on a terrestrial, upper beach habitat that is not flooded during the growing season. This zone is generally absent on beaches that are experiencing high rates of erosion. Seabeach amaranth is never found on beaches where the foredune is scarped by undermining water at high or storm tides (Weakley and Bucher 1992).

Seabeach amaranth usually occurs on a pure silica sand substrate, occasionally containing shell fragments. The U.S. Natural Resources Conservation Service classifies the habitat of seabeach amaranth as either Beach-Foredune Association or Beach (occasionally flooded). Seabeach amaranth habitat occurs within a wetland system classified by Cowardin *et al.* (1979) as Marine System, Intertidal Subsystem, Unconsolidated Shore Class (Weakley and Bucher 1992).

The habitat of seabeach amaranth is sparsely vegetated with annual herbs and, less commonly, perennial herbs (mostly grasses) and scattered shrubs. The number and type of seabeach amaranth's vegetative associates have been found to vary with specific habitat type (*i.e.*, overwash flat, accreting barrier island end, or lower foredune) (Chicone undated). The most constant associates of seabeach amaranth, with which the species almost always co-occurs, are sea rocket (*Cakile edentula*) and seabeach spurge (*Chamaesyce polygonifolia*) (Weakley and Bucher 1992).

<u>Biogeography and Range</u> - Seabeach amaranth is limited by its habitat requirements to a very narrow strip of barrier islands and mainland oceanfront beach strands along the Atlantic coast. The original range of this species extended from Cape Cod in Massachusetts to central South Carolina, a stretch of coast approximately 1,600 km (994 miles) long. This stretch correlates with a geographic range of low tidal amplitude. Tidal amplitude and the relative importance of tidal versus wave energy in shaping coastal morphology are thought to limit the geographic range of seabeach amaranth, rather than availability of sandy beach substrates or sea water temperatures. The range of seabeach amaranth is characterized by islands developed by high wave energy, low tidal energy, frequent overwash, and frequent breaching by hurricanes with resulting formation of new inlets (Weakley and Bucher 1992). Some authors have observed that seabeach amaranth tends to occur on south or southeast facing coasts (Weakley and Bucher 1992, Snyder 1996), but a range-wide analysis of beach orientation has not been conducted.

Historic records of seabeach amaranth are known from nine states. Largely due to human activities, the species was eliminated from seven of these states by the 1980s, remaining only in North and South Carolina. Seabeach amaranth is still considered extirpated from two states: Massachusetts and Rhode Island. Since 1990, the species has been rediscovered in five states from which it had previously been believed to be extirpated. Table 5 gives the dates of rediscovery and the last previously known occurrence of the plant in each state.

Table 5. Rediscovery Dates of Seabeach Amaranth in Five States.		
State	**Date Rediscovered**	**Date of Last Previously Known Occurrence**
New York	July 2000	1950 (Van Schoik and Antenen, 1993)
Delaware	August 2000	1913 (U.S. Fish and Wildlife Service 1996b)
Maryland	August 1998	1875 (McAvoy 2000)
Virginia	September 2001	1973 (U.S. Fish and Wildlife Service 1996b)

To date, explanations for seabeach amaranth's rediscovery in the northern part of its range remain speculative. Sites in these five states may have been re-colonized by long-distance transport of seeds by wind or currents. At some sites, seeds may have been long buried in sediments used in beach nourishment projects. This hypothesis requires that seeds can remain viable after prolonged off-shore burial, an unknown factor. In Maryland's Assateague Island National Seashore, the NPS has allowed a previously stabilized foredune system to return to more natural conditions. This change in beach management, and the possible existence of a persistent seed bank, have been cited as factors in the species' return to the area (Ramsey *et al.* 2000).

The current known range of naturally occurring seabeach amaranth is from Water Mill Beach on Long Island, New York, south to Dewees Island in South Carolina; a few reintroduction efforts south of Dewees Island have been unsuccessful (Young 2001, Hamilton 2000a, Ed Eudaly 2008, pers. comm).

Life History

Seabeach amaranth occupies a highly specific and restricted niche as a "fugitive" species in the narrow upper beach zones of newly formed, accreting barrier island ends and non-eroding beach strands. A dynamic, early successional pioneer species, seabeach amaranth is termed a "fugitive" because its populations are constantly shifting to newly disturbed areas. The plant is eliminated from existing habitats by competition and erosion, and colonizes newly formed habitats by dispersal and (probably) long-lived seed banks. A poor competitor, seabeach amaranth is eliminated from sites where perennials have become established, probably because of root competition for scarce water and nutrient supplies (Weakley and Bucher 1992). Seabeach amaranth acts as a capable sand binder (Weakley and Bucher 1992), which is typical of pioneer beach plants. The species is not likely to be a young or recently evolved species, considering its isolation within the genus (it has no apparently close relatives) and its possession of numerous adaptations to the peculiar environment in which it grows (U.S. Fish and Wildlife Service 1996b).

Seabeach amaranth habitat exists in dynamic conditions. The same physical forces (*e.g.*, storms, extreme high tides) that create the plant's specific and ephemeral coastal habitat also destroy it. Coastal storms are probably the single most important natural limitation on the abundance of seabeach amaranth. Existing habitat is eroded away, but new habitat is created by island overwash and breaching. Therefore, seabeach amaranth requires extensive areas of barrier island beaches and inlets, functioning in a relatively natural and dynamic manner. Such conditions allow the species to move around in the landscape, occupying suitable habitat as it becomes available (U.S. Fish and Wildlife Service 1996b).

Density and Distribution - Density of seabeach amaranth is extremely variable within and between populations. The species generally occurs in a sparse to very sparse distribution pattern, even in the most suitable habitats. A typical density is 100 plants per linear km of beach, though occasionally on accreting beaches, dense populations of 1,000 plants per km can be found. Island-end sand flats generally have higher densities than oceanfront beaches (Weakley and Bucher 1992). Comparing overwash flats, accreting barrier island ends, and lower foredunes, Chicone (undated) found that seabeach amaranth plants growing in foredune habitats tended to be larger, healthier, and have fewer associates. Seabeach amaranth has been found to have a strongly clumped distribution (Hancock 1995).

Within its primary habitats, seabeach amaranth tends to be concentrated in the line of wrack material deposited by high tides (Mangels 1991, Weakley and Bucher 1992, Hancock 1995, McAvoy 2000). Observations from New Jersey and Maryland suggest that plants within the wrack line tend to be larger (U.S. Fish and Wildlife Service 2002b). Pauley *et al.* (1999), however, found that plots centered on seabeach amaranth had a lower percent area covered by litter material than random plots, suggesting that litter material may be an advantageous microhabitat for seabeach amaranth only when it contains higher levels of organic material and moisture than bare sand, as in the wrack line.

Life Cycle and Phenology - Individual plants live only one season, with a single opportunity to produce seed. The species over-winters entirely as seeds. Germination of seedlings begins in April and continues at least through July. In the northern part of the range, germination occurs slightly later, typically late June through early August. Reproductive maturity is determined by size rather than age, and flowering begins as soon as plants have reached sufficient size. Flowering sometimes begins as early as June in the Carolinas, but more typically commences in July and continues until the death of the plant. Seed production begins in July or August and reaches a peak in most years in September. Seed production likewise continues until the plant dies. Senescence and death occur in late fall or early winter (U.S. Fish and Wildlife Service 1996b).

Seabeach amaranth seems capable of essentially indeterminate growth (Weakley and Bucher 1992). However, predation and weather events, including rainfall, hurricanes, and temperature extremes, have significant effects on the length of the species' reproductive season. As a result of one or more of these influences, the flowering and fruiting period can be terminated as early as June or July (U.S. Fish and Wildlife Service 1993).

Reproduction - As an annual, seabeach amaranth reproduces solely by sexual reproduction by seed, with no vegetative or clonal form of reproduction. The species is monoecious (male and female flowers on the same plant), and, based on morphology of the flower and inflorescence, most likely wind pollinated. Seabeach amaranth is capable of self fertilization, an advantageous adaptation for a pioneer species, allowing the founding of a new colony by a single propagule. Self fertilization likely plays a large, probably dominant, role in seed production (Weakley and Bucher 1992). Once it reaches maturity, seabeach amaranth flowers and fruits continuously until death or senescence. Late season plants may continue flowering and fruiting with few or no leaves, sometimes producing an aberrant, dense, terminal inflorescence (Weakley and Bucher 1992). Even very small plants produce flowers under conditions of a short (12-hour) photoperiod (Jolls and Sellars 2000), likely an opportunistic adaptation to permit small, late germinating plants to reproduce at the end of the growing season. Nearly all adult seabeach amaranth plants produce seeds, and fertility is assumed to be high (Weakley and Bucher 1992). Fruit production is correlated with plant weight (Hancock 1995), and large plants are estimated to produce several thousand fertile seeds over a fruiting season (Weakley and Bucher 1992). Within the genus *Amaranthus*, this is a very low reproductive rate, but seabeach amaranth has apparently evolved a strategy of producing fewer, larger seeds than other members of its genus. Under favorable conditions, seabeach amaranth shows good reproductive success (Weakley and Bucher 1992).

Seed Dispersal - Seabeach amaranth seeds are dispersed by a variety of mechanisms. The fleshy tissues and air pocket of the utricle cause the fruit to have a lower density than the bare seed. Seeds retained in utricles are easily blown about, deposited in depressions, the lee behind plants, or in the surf. Naked seeds are also commonly encountered in the field, and are also dispersed by wind, but to a much lesser degree than seeds retained in utricles. Naked seeds tend to remain in the lee of the parent plant, or get moved to nearby depressions (Weakley and Bucher 1992). Observations from South Carolina indicate that seabeach amaranth seeds are also dispersed in the guts of birds, and deposited with their droppings (Hamilton 2000b).

Many utricles remain attached to the parent plant and are never dispersed, leading to *in situ* "planting." This phenomenon has also been observed in sea rocket, and may be an adaptation to dynamic beach conditions. If conditions remain favorable at the site of the parent plant, the seed source for retention of that site is guaranteed. If conditions become unsuitable, other seeds have been dispersed to colonize new sites (Weakley and Bucher 1992).

Germination - Fresh seabeach amaranth seeds are physiologically dormant (Baskin and Baskin 1994, 1998). The tough seedcoat requires some physical modification before germination can occur. The primary mechanism(s) for breaking seed dormancy in the field is not known, but possible factors include abrasion, cold, imbibing of water, and gradual breakdown over time (Weakley and Bucher 1992, Hamilton 2000c, Jolls and Sellars 2000, Hancock 1995; Baskin and

Baskin 1994, 1998). Once dormancy is broken, light and high temperatures (25-35^{o} C) are required for germination (Hancock 1995, Baskin and Baskin 1994, 1998). This high temperature requirement causes seabeach amaranth to germinate later in the season than other dune associates, and limits the time in which new seedlings can grow. Rainfall is also significant in promoting germination (Hancock 1995).

Initial studies have found that seabeach amaranth seedlings cannot emerge from a depth of more than one centimeter (Hancock 1995) or two centimeters (U.S. Fish and Wildlife Service 2002b). Results of these studies, combined with the finding that light is required for germination, are strong evidence that deep burial may completely prevent germination and seedling emergence (Jolls *et al.* 2001). Seabeach amaranth may have less opportunity to emerge and become established compared to other dune species such as sea rocket, as mean emergence of seedlings (growth rate of the newly sprouted seed) is less than predicted for the species' seed mass (Hancock 1995).

<u>Natural Limiting Factors</u> - Except where suitable habitat has persisted long enough for perennials to become established, the primary limiting factors of seabeach amaranth under natural conditions are abiotic. Abiotic limiting factors are expected for a fugitive species that occupies dynamic, early successional habitats. Weather is an important limiting factor, given the relatively narrow temperature and rainfall requirements for germination and seedling establishment. Flooding, drought, or unseasonable temperatures may impair seabeach amaranth survival and reproduction. Weather also limits abundance of the species through its effects on winds, which may cause burial of seeds and plants by sand. In addition to decreasing germination and seedling establishment, burial may also impact reproduction by covering adult plants prior to seed set. This effect was observed in South Carolina (Hamilton 2000b), and may have occurred in Maryland (U.S. Fish and Wildlife Service 2002b).

Under natural conditions, interspecific competition for water and nutrients, especially with perennials, may be a significant biotic limiting factor of seabeach amaranth. Weakley and Bucher (1992) cite intraspecific competition as a possible factor in the mortality of young plants, but Hancock (1995) found no evidence of intraspecific density effects. If intraspecific competition does limit seabeach amaranth abundance, its effects are likely small compared to the effects of competition with perennial species, which possess superior abilities to extract water and nutrients from the porous sand. Predators and disease are discussed below under threats.

<u>Population Dynamics</u> - Although the longevity of seabeach amaranth seeds is unknown, several lines of evidence suggest that seed banks may be an important factor in this species' life history (Weakley and Bucher 1992, Baskin and Baskin 1998). The relative roles of fresh and banked seeds are unknown (U.S. Fish and Wildlife Service 1996b). In experimental plots in Maryland, a few late-season seedlings emerged from the current year's seed crop (U.S. Fish and Wildlife Service 2002b), however the contribution of same-season seed to the current year's population and seed crop is likely small. For a sexually reproducing annual plant, natality is comprised of two components, the seed production rate (or fecundity) and the germination rate.

The viability rates of both fresh and banked seeds are uncertain; more is known about mortality of the plants. Substantial mortality of young plants occurs in some years, prior to reproduction. Hancock (1995) found only seven percent survival of seedlings to 40 days of age, with mortality caused primarily by high tide flooding. Flooding resulted in almost 100 percent mortality of propagated plants at three of six experimental transplant sites in South Carolina in 1999. At a fourth site, drifting sand covered most of the transplants, with only 10 of 196 plants (about 5 percent) surviving to produce seed (Hamilton 2000b). Burial by blowing sand may have also affected reproduction in New Jersey and Maryland in 2000 (Service observation, U.S. Fish and Wildlife Service 2002b). Unfavorable conditions early in the growing season, including drought, burial, and especially flooding and other storm damage, may reduce seed production by 90 percent (Weakley and Bucher 1992) to 98 percent (Hancock 1995).

Once past the stage of germination and early growth, mortality rates are generally lower. In the Carolinas, mortality of older plants tends to be caused primarily by webworm predation (Weakley and Bucher 1992). Larger plants may be able to withstand saltwater inundation better than smaller plants; however, prolonged salt water inundation kills almost all plants, regardless of size (Hancock 1995). Storms later in the growing season can effectively and abruptly curtail reproduction for the year (Weakley and Bucher 1992). Plants that have not died from other causes senesce and die in late fall or early winter.

Genetic Variability - Preliminary results from two initial genetic studies of seabeach amaranth suggest that the species' genetic variability is low. A study by Salisbury State University looked for genetic differences in nuclear DNA within and across three groups: propagated plants from Maryland, wild plants from Maryland, and wild plants from Delaware. Overall, genetic variability was found to be low. Wild and propagated Maryland plants were similar, as might be expected, since the propagated plants were produced from wild plants taken from the same area (U.S. Fish and Wildlife Service 2002b). Higher levels of genetic variability were found within the sample of plants from Delaware. A second study by Strand (2002) analyzed non-coding regions of nuclear and chloroplast DNA taken from seed and dry leaf samples from New York, New Jersey, North Carolina, and South Carolina. This study found no observable genetic variation among any of the samples. Although the results of these two studies are consistent, these results must be interpreted with caution. Lack of detection does not prove a lack of genetic variability, which might be present in other regions of the genome, or detectable through other techniques (Jolls and Sellars 2000, Strand 2002, U.S. Fish and Wildlife Service 2002b).

Population Status and Distribution

As might be expected for a fugitive annual plant of dynamic barrier beach habitats, populations of seabeach amaranth at any given site are extremely variable (Weakley and Bucher 1992).

Population size at a site often fluctuates by several orders of magnitude from year to year. The primary reasons for the natural variability of seabeach amaranth are the dynamic nature of its habitat, and the significant effects of stochastic factors such as weather and storms on mortality and reproductive rates. Although wide fluctuations in species populations tend to increase the risk of extinction, variable population sizes are a natural condition for seabeach amaranth, and the species is well adapted to its ecological niche.

Because variability in population size is so great among years, a single survey is a poor measure of a population's health. Assessing site-specific population trends is difficult even with several years of surveys. Weakley and Bucher (1992) suggest that a 5 to 10 year average is a more meaningful measure for assessing the vigor of a local seabeach amaranth population. However long-term, consecutive, annual data are available for only a few sites in New York. Estimates of population sizes for seabeach amaranth across its range are imprecise, given available survey data. Early (pre-1987) survey data are limited. Range-wide surveys were conducted in 1987, 1988, and 1990 (excluding states where the species was considered extirpated at the time). Annual statewide surveys have been conducted subsequently in New York, but no comprehensive surveys of North or South Carolina have been carried out since 1990. Suitable areas in New Jersey, Delaware, and Maryland were thoroughly surveyed in 2000, but these efforts did not necessarily extend state-wide. Approximately 14 locations in Virginia were surveyed in 2000, and no seabeach amaranth was found (Belden 2000). In 2001, seabeach amaranth was found on Assateague Island, Virginia, most likely the result of a restoration program in Assateague Island National Seashore in Maryland (U.S. Fish and Wildlife Service 2002b).

Over the last seven years, the number of plants in each state has fluctuated greatly (see Table 6). In Delaware the numbers have always been low, with a high count for 2002 of 423 plants. New York has always produced the highest number of plants, with the 2000 numbers also being the highest count for the state (244,608 plants). In 2006, 1,551 plants were counted in Maryland and Virginia. Of these 1,551 plants, all but 13 were found on the Maryland side of Assateague Island. Numbers of plants within CNWR (see Virginia numbers in Table 6) has experienced major fluctuations since its rediscovery in 2001.

<u>Threats</u> - *Habitat Loss and Degradation* - In the geologic past, seabeach amaranth has persisted through even relatively rapid episodes of sea level rise and barrier island retreat. A natural barrier island landscape, even a retreating one, contains localized accreting areas, especially in the vicinity of inlets (U.S. Fish and Wildlife Service 1996b).

Erosion is accelerated in many areas by human-induced factors such as reduced sediment loads reaching coastal areas due to damming of rivers, and beach stabilization structures. When the shoreline is "hardened" by artificial structures (*e.g.* seawalls, bulkheads), overwash and inlet formation are curbed. Erosion may also be increasing due to sea level rise and increased storm activity caused by global climate change (U.S. Fish and Wildlife Service 1993).

Table 6. Seabeach amaranth (*Amarathus pumilus*) numbers by year and state.

Year	New York	Delaware	New Jersey	Maryland	Virginia	North Carolina	South Carolina	TOTAL # of plants for each year
1987	0	0	0	0	0	3,395	1,341	4,736
1988	0	0	0	0	0	4,433	1,800	6,233
1989	0	0	0	0	0	0	0	0
1990	331	0	0	0	0	1,127	188	1,646
1991	2,251	0	0	0	0	1,170	0	3,421
1992	422	0	0	0	0	32,160	15	32,597
1993	195	0	0	0	0	22,214	0	22,409
1994	182	0	0	0	0	13,964	560	14,706
1995	599	0	0	0	0	33,514	6	34,119
1996	2,263	0	0	0	0	8,357	0	10,620
1997	11,918	0	0	0	0	1374	2	13,294
1998	10,699	0	0	2	0	11,490	141	22,332
1999	31,196	0	0	1	0	588	196	31,981
2000	244,608	32	1,039	4	0	103	2,312	248,098
2001	205,233	83	5,813	869	9	5037	231	217,275
2002	193,412	423	10,908	801	56	4440	0	210,040
2003	114,535	13	5,084	459	22	11,290	1,381	132,784
2004	30,942	4	6,820	531	2	11,213	2,110	51,622
2005	16,813	6	5,795	489	69	19,976	671	43,819
2006	32,553	40	6,522	1,538	13	3,190	721	44,577

Attempts to halt beach erosion through hard structures (*i.e.*, sea walls, jetties, groins, bulkheads) appear invariably to destroy habitat for seabeach amaranth. In the Carolinas, seabeach amaranth is not found on shorelines where bulkheads, sea walls, or rip rap zones have been constructed. Such armoring generally occurs in the primary habitat of the plant, and water and wind erosion lower the profile of the beach seaward of the armoring. The upper beach habitat required by seabeach amaranth (above inundation by tidal action) ceases to exist as the beach is steadily eroded. Groins have mixed effects on seabeach amaranth. Immediately updrift from a groin, accretion sometimes provides or maintains, at least temporarily, habitat for seabeach amaranth; immediately downdrift, erosion usually destroys seabeach amaranth habitat. In the long term, groins (if they are successful) stabilize updrift beaches, allowing succession to perennials, and rendering even the updrift side only marginally suitable for seabeach amaranth. Widespread construction of sea walls, jetties, and other hard stabilization structures in New Jersey, New York, and other northern states is associated with the extirpation of seabeach amaranth from the northern part of its range (U.S. Fish and Wildlife Service 1996b).

Even minor structures and non-structural beach stabilization techniques, such as sand fences and beachgrass planting, are generally detrimental to seabeach amaranth (U.S. Fish and Wildlife Service 1993). Dune stabilization and vertical sand accretion caused by sand fences appear to be detrimental to seabeach amaranth. The effects of dune stabilization by planting vegetation are similar (U.S. Fish and Wildlife Service 1996b). Seabeach amaranth only very rarely occurs when sand fences and vegetative stabilization have taken place and, in these situations, is present only as rare, scattered individuals or short-lived populations (Weakley and Bucher 1992).

Beach nourishment can have positive site-specific impacts on seabeach amaranth. Although more study is needed before the long-term impacts can be accurately assessed, seabeach amaranth has colonized several nourished beaches, and has thrived in some sites through subsequent re-applications of fill material (U.S. Fish and Wildlife Service 1993). However, on the landscape level, beach nourishment is similar to other beach stabilization efforts in that it stabilizes the shoreline and curtails the natural geophysical processes of barrier islands. These effects are detrimental to the range-wide persistence of the species. In addition, beach nourishment may cause site-specific adverse effects by crushing or burying seeds or plants, or by altering the beach profile or upper beach micro-habitats in ways not conducive to seabeach amaranth colonization or survival. Deeply burying seeds during any season can have serious effects on populations; this also applies to the placement of dredge spoil (U.S. Fish and Wildlife Service 1996b). Burial of the seed bank may be particularly detrimental to isolated populations, as no nearby seed sources are available to re-colonize the nourished site. Adverse effects of beach nourishment may be compounded if accompanied by artificial dune construction and stabilization with sand fencing and/or beach grass, or if followed by high levels of erosion and scarping of the upper beach.

As a fugitive species dependent on a dynamic landscape and large-scale geophysical processes, seabeach amaranth is vulnerable to habitat fragmentation and isolation of small populations (U.S. Fish and Wildlife Service 1993). Rendering 50 to 75 percent of a coastline permanently unsuitable may doom seabeach amaranth, because any given area will become unsuitable at some time due to natural forces. If a seed source is no longer available in the vicinity, seabeach amaranth will be unable to reestablish itself when the area once again provides suitable habitat. In this way, the species can be progressively eliminated even from generally favorable stretches of habitat surrounded by permanently unfavorable areas. Fragmentation of habitat in the northern part of the species range contributed to the regional extirpation during the last century. Areas of suitable habitat were separated from one another by distances too great to allow recolonization following natural catastrophes (Weakley and Bucher 1992).

Recreational Impacts - Intensive recreational use of beaches can threaten seabeach amaranth populations, both through direct damage and mortality of plants, and by impacting habitat. Light pedestrian traffic, even during the growing season, usually has little effect on seabeach amaranth (U.S. Fish and Wildlife Service 1993). Substantive impacts generally occur only on narrow beaches, or beaches which receive heavy recreational use. In such areas, seabeach amaranth populations are sometimes eliminated or reduced by repeated trampling. While pedestrian traffic appears to be a minor problem in the Carolinas, the heavier traffic borne by northern beaches near major population centers may have been partially responsible for the past extirpation of seabeach amaranth in those regions (U.S. Fish and Wildlife Service 1996b).

Off-road vehicle (ORV) use on the beach during the growing season can have detrimental effects on the species, as the fleshy stems of this plant are brittle and easily broken. Plants generally do not survive even a single pass by a truck tire (Weakley and Bucher 1992). Sites where vehicles are allowed to run over seabeach amaranth plants often show severe population declines. Dormant season ORV use has shown little evidence of significant detrimental effects, unless it results in massive physical erosion or degradation of the site, such as compacting or rutting of the upper beach. In some cases, winter ORV traffic may actually provide some benefits for the species by setting back succession of perennial grasses and shrubs with which seabeach amaranth cannot compete successfully. However, extremely heavy ORV use, even in winter, may have some negative impacts, including pulverization of seeds (Weakley and Bucher 1992).

Beach grooming, more common on northern beaches, may also have contributed to the previous extirpation of seabeach amaranth from that part of its range. Motorized beach rakes, which remove trash and vegetation from bathing beaches, do not allow seabeach amaranth to colonize long stretches of beach (U.S. Fish and Wildlife Service 1996b). In New Jersey, plants were found along a nearly continuous length of beach, noticeably interrupted by stretches that are routinely raked.

Herbivory - Predation by webworms (caterpillars of small moths) is a major source of mortality and lowered fecundity in the Carolinas, often defoliating plants by early fall (U.S. Fish and Wildlife Service 1993). Defoliation at this season appears to result in premature senescence and mortality, reducing seed production, the most basic and critical parameter in the life cycle of an annual plant. Webworm predation may decrease seed production by more than 50 percent (Weakley and Bucher 1992). In the Carolinas, four species of webworm collected from seabeach amaranth have been identified: beet webworm (*Loxostege similialis*), garden webworm (*Achyra rantalis*), southern beet webworm (*Herpetogramma bipunctalis*), and Hawaiian beet webworm (*Spoladea recurvalis*). Webworm herbivory of seabeach amaranth has not been documented in Delaware or Maryland. Although the five webworms so far identified on seabeach amaranth are all native species, their use of barrier islands has probably been altered by changes in the coastal plain landscape (*i.e.*, extensive agricultural use), the development of barrier islands, and the introduction of weedy plants that can also serve as host plants. All five webworms are probably much more abundant now than they were in pre-Columbian times. For this reason, the level of predation that seabeach amaranth is experiencing is likely unnaturally high (U.S. Fish and Wildlife Service 1996b). Webworm herbivory is probably a contributing, rather than a leading factor in the decline of seabeach amaranth. However, in combination with extensive habitat alteration, severe herbivory could threaten the existence of the species (Weakley and Bucher 1992).

Utilization and Collection - Seabeach amaranth is generally not threatened by over-utilization or collection, as it does not have showy flowers, and is not a component of the commercial trade in native plants. However, because the species is easily recognizable and accessible, it is vulnerable to taking, vandalism, and the incidental trampling by curiosity seekers. Seabeach amaranth is an attractive and colorful plant, with a prostrate growth habit that could lend itself to planting on beach front lots. The species' effectiveness as a sand binder could make it even more attractive for this purpose. In addition, seabeach amaranth is being investigated by the USDA and several universities and private institutes for its potential use in crop development and improvement. Over-collection and the development of genetically altered, domesticated varieties are potential, but currently unrealized, threats to the species (U.S. Fish and Wildlife Service 1993).

New Threats - New threats to seabeach amaranth have been documented since the species was listed in 1993. These factors are lesser threats than habitat modification, but may increase the risk of extinction by compounding the effects of other, more severe threats.

Several additional herbivores of seabeach amaranth have been observed including deer (*Odocoileus virginianus*), Sika deer/elk (*Cervus nippon*), eastern cottontail (*Sylvilagus floridanus*), and migratory song birds (Van Schoik and Antenen 1993), as well as feral horses in Maryland (U.S. Fish and Wildlife Service 2002b). Hancock (1995) suggests that grasshoppers may feed on seabeach amaranth, but does not indicate whether this was actually observed. There is also strong circumstantial evidence for seabeach amaranth herbivory by grasshoppers (U.S. Fish and Wildlife Service 2002b). Minor insect damage was noted on a few New Jersey plants in 2000, and larval insects were observed feeding on seabeach amaranth in 2001; to date, no species have been identified. In addition, a cluster of New Jersey plants appeared to have been damaged by a congregation of loafing gulls (*Larus* spp.), based upon feathers and droppings. As with webworms, the abundance of these newly documented predators on barrier islands is increased by human activities.

Asiatic sand sedge (*Carex kobomugi*) has been suggested as another potential threat to seabeach amaranth. This sedge is strongly rhizomatous and dune-forming (National Park Service and Maryland Natural Heritage Program 2000). Asiatic sand sedge was introduced to the east coast

(New Jersey to Virginia) from east Asia in the 1930s for erosion control and as a sand stabilizer. The species is known to crowd out native dune species (Virginia Department of Conservation and Recreation and Virginia Native Plant Society undated). Asiatic sand sedge may be detrimental to seabeach amaranth by direct competition, and by reducing habitat suitability through sand stabilization and dune building. Control programs have been implemented in managed natural areas where this species occurs.

The first known disease of seabeach amaranth was documented in South Carolina in 2000. During the 2000 growing season, a fungus (*Albugo* sp.) was observed on seabeach amaranth in several South Carolina sites (Strand and Hamilton 2000). This pathogen is a white rust or water mold. Lesions developed on the leaves during flowering, starting in July; leaves later fell off (U.S. Fish and Wildlife Service 2002b). Effects on infected individuals were significant, resulting in death of the plants two to four weeks after lesions were first observed. Anecdotal observations suggest that isolated plants tended to avoid infection (Strand and Hamilton 2000).

<u>Rangewide Trends</u> - Total population trends can disguise important regional trends. Recent population increases have occurred almost entirely in the northern part of the species range (see Table 6). Seabeach amaranth has undergone a geographic expansion, reappearing in five states over 11 years, after decades of extirpation from the entire northern portion of its range. New York sites account for virtually all of the recent increases in total population size rangewide, offsetting lower numbers in the south. Although natural population variability and survey effort must be considered, the recent trend in North Carolina appears downward. The low 1999 and 2000 plant totals in that state are especially noteworthy given the relatively high survey effort in these years (approximately 75 percent of known sites visited). In South Carolina, the species experienced a 90 percent reduction in that state following 1988 storms, including Hurricane Hugo. However, survey efforts since 1998 suggest that populations may have recovered in some areas of South Carolina.

Despite the natural variability of seabeach amaranth's population size and distribution and inconsistent survey efforts, some trends can be discerned from the available data. The species has undergone a significant geographic expansion, both in terms of the number and distribution of occupied states and counties. Since the first intensive surveys in 1987, the species' extant range has increased approximately 650 km (404 miles) to the north, but contracted about 50 km (31 miles) to the south. Numerically, the population has seen a dramatic increase. Equally notable is the geographic shift of the species' stronghold (in terms of total numbers) from North Carolina to New York.

Despite the geographic expansion and booming New York populations, seabeach amaranth is still vulnerable to local and regional extirpation. The primary threat to seabeach amaranth, habitat alteration, has not significantly diminished since the species was listed, and new threats have been subsequently discovered. Small population sizes in many locations increase the risk that seabeach amaranth will become locally extirpated. Almost 44 percent of sites documented in 2000 contained fewer than 10 plants, including more than 60 percent of sites in North Carolina (Young 2001, McAvoy 2000, National Park Service 2001a, 2001b, Jolls and Sellars 2000, U.S. Army Corps of Engineers 2001, Hamilton 2000a).

One final trend of note is the propagation of seabeach amaranth in greenhouses and laboratories, and the transplanting of propagated individuals or seed back into the wild. Such programs have been undertaken in Delaware, Maryland, North Carolina, and South Carolina (McAvoy 2000, National Park Service and Maryland Natural Heritage Program 2000, Jolls and Sellars 2000, Hamilton 2000b). These efforts have met with mixed results; thus a long term trend cannot be predicted.

LOGGERHEAD SEA TURTLE (*Caretta caretta*), GREEN SEA TURTLE (*Chelonia mydas*), and LEATHERBACK SEA TURTLE (*Dermochelys coriacea*)

Loggerhead sea turtles were listed as federally threatened in the U.S. in 1978 (National Marine Fisheries Service and U.S. Fish and Wildlife Service 1991a), the green sea turtle was listed as endangered in 1978 (National Marine Fisheries Service and U.S. Fish and Wildlife Service 1991b), and the leatherback sea turtle was listed as endangered in 1970 (National Marine Fisheries Service and U.S. Fish and Wildlife Service 1992). There is designated critical habitat outside of Virginia for the green and leatherback sea turtles, but none has been designated for the loggerhead sea turtle.

This account emphasizes sea turtle nesting and breeding biology, which is the subject of this biological opinion. Additional information about the life history of these sea turtle species and their habitat use, behavior, and survival at sea can be found in other documents, including the recovery plans (National Marine Fisheries Service and U.S. Fish and Wildlife Service 1991a, 1991b, 1992), five-year statues reviews (National Marine Fisheries Service and U.S. Fish and Wildlife Service 2007a, 2007b, 2007c), and other sources (National Research Council 1990).

Species Description - The loggerhead is the smallest of the three turtles, with a mean carapace length of 92 cm and a mean mass of 133 kg (National Marine Fisheries Service and U.S. Fish and Wildlife Service 1991a), compared to 102 cm and 136 kg for the green sea turtle (National Research Council 1990). Green sea turtles nest primarily in the tropics and are rarer nesters at higher latitudes, while loggerheads have significant nesting populations outside the tropics (National Research Council 1990). Leatherback sea turtles are the largest turtle and the largest living reptile in the world. Mature males and females can be as long as six and a half feet (2 m) and weigh almost 2000 lbs. (900 kg). The leatherback is the only sea turtle that lacks a hard, bony shell. The U.S. Caribbean, primarily Puerto Rico and the U.S. Virgin Islands, and southeast Florida support minor nesting colonies of the leatherback, but represent the most significant nesting activity within the United States (James *et al*. 2005).

Life History and Population Dynamics - Loggerhead females are believed to reach sexual maturity at a minimum age of 30 years (Snover 2002). At the start of the breeding season, they migrate from foraging areas on the continental shelf to mating areas in the waters near their nesting beaches (Schroeder *et al.*, 2003). Reproductive females exhibit the desire to return to their birthplace to lay their eggs (Miller *et al.* 2003). Females may be inseminated by multiple males (Bollmer *et al.* 1999). After mating, males return to their foraging areas while the females remain in the waters near their natal beaches to emerge onto their nesting beaches to lay eggs. The following account of nesting biology is a synopsis of Miller *et al.* (2003).

Loggerhead females tend to nest on high wave energy, sandy ocean beaches. Gravid females emerge from the swash zone and crawl toward the dune line until they encounter a suitable nest site, typically on open sand at the seaward base of a dune, but sometimes in vegetation. The female clears away surface debris with the front flippers, creating a “body pit,” then excavates a flask-shaped nest cavity with her hind flippers. Loggerheads lay an average of 112 eggs per nest. After laying, the female covers the nest with sand using all four flippers. Once the nest-covering phase is complete, she crawls back into the sea. Individual females may nest 1 to 6 times per nesting season, at intervals of 12-16 days, during the late spring to late summer. Intervals between nests shorter than 10 days indicate that the previous nest attempt was likely aborted due to disturbance. Mature loggerheads nest every two to three years, on average (Schroeder *et al.* 2003). Nest incubation period (from laying to hatching) depends on temperature, and ranges from 48 to 90 days at the extremes. Emergence of hatchlings from the nest cavity usually occurs within four days of hatch, but may take up to two weeks longer. Hatchling emergence from nests usually occurs at night when temperatures are lower and diurnal predators are inactive. Hatching success typically approaches 80%; after hatchlings leave the beaches, they typically fall prey to a variety of predators, including birds, fish, and sharks (National Research Council 1990).

Sex ratio of hatchlings depends on temperature during incubation. Below 84° Fahrenheit (29° Celsius), more males are produced than females, and above that temperature more females are produced (Carthy *et al.* 2003). Furthermore, fluctuating incubation temperatures often produce more females than stable temperatures, and temperature, hydration, and gas exchange during incubation can determine hatchling size, early swimming behavior, growth rate, and hatchling robustness (Carthy *et al.* 2003). Newly emerged hatchlings immediately head for the sea, most likely orienting toward the water by moving toward the brightest horizon and away from dark silhouettes (Lohmann and Lohmann 2003). Sea turtles are most negatively sensitive to blue and green light, and loggerheads in particular are averse to yellow light (Witherington and Martin 1996). Once in the sea, hatchling loggerheads swim into the waves and eventually enter the open ocean, where they will spend the first 6.5 to 11.5 years of their lives primarily at the top of the water column, until finally moving to foraging areas on the continental shelf (Bolten 2003).

Green sea turtles nest in two, three, or four year intervals, and may lay as many as nine clutches within a nesting season (National Marine Fisheries Service and U.S. Fish and Wildlife Service

1991b). Clutch size varies from 75-200 eggs, and incubation ranges from about 45-75 days (National Marine Fisheries Service and U.S. Fish and Wildlife Service 1991b).

Leatherback sea turtles nest in two to three year intervals, and average five to seven clutches per nesting season (National Marine Fisheries Service and U.S. Fish and Wildlife Service 1992). Leatherbacks average fewer eggs per clutch, 70-80 eggs, and incubation ranges from 55-75 days (National Marine Fisheries Service and U.S. Fish and Wildlife Service 1992).

Nesting habitat - Less is known about factors that cue nest site selection than about anthropogenic disturbances that discourage nesting (Miller *et al.* 2003). Typical nesting areas are sandy, wide, open beaches backed by low dunes, with a flat, sandy approach from the sea (Miller *et al.* 2003). Nesting is nonrandom along the shoreline, but studies of the physical characteristics associated with nests versus random or non-nesting sites on the beach have produced varying results. Some factors that have been found to determine nest selection in certain studies are beach slope (3 of 3 studies), temperature (2 of 3 studies), distance to the ocean (1 of 3 studies), sand type (2 of 2 studies), and moisture (1 of 3 studies), although the results were occasionally contradictory (Miller *et al.* 2003). Data indicates that the leatherback sea turtle prefers beaches with proximity to deep water and generally rough seas (National Marine Fisheries Service and U.S. Fish and Wildlife Service 1992). Other factors examined but not found to be significant were sand compaction, erosion, pH, and salinity. Although the process of nest site selection is not well understood, a successful nest must be laid in a low salinity, high humidity, well-ventilated substrate that is not prone to flooding or burying due to tides and storms, and where temperature is optimal for development (Miller *et al.* 2003).

Status and Distribution – Approximately 58,000 loggerhead nests were estimated in the U.S. Atlantic in 1983 (National Marine Fisheries Service and U.S. Fish and Wildlife Service 1991a), and between 53,000 and 92,000 nests from 1989 to 1998 (Turtle Expert Working Group 2000). Within the northern subpopulation (north Florida to Virginia), studies in South Carolina and Georgia have documented a decline in number of nests (Ehrhart *et al.* 2003). Based on genetic evidence, male loggerheads disperse freely among sites within the U.S. Atlantic population, while females are faithful to their natal sites (Bowen *et al.* 2005). Because sex ratio is determined by temperature during incubation (Miller *et al.*, 2003), the northern part of the U.S. Atlantic population, which includes Virginia, apparently provides a disproportionate number of males to the larger population (Mrosovsky *et al.* 1984, Hanson *et al.* 1998, Hawkes *et al.* in review).

"Analyses of historic and recent abundance information by the Marine Turtle Specialist Group (MTSG) indicate that extensive population declines for the green sea turtle have occurred in all major ocean basins. The MTSG analyzed population trends at 32 index nesting sites around the world and found a 48-65% decline in the number of mature females nesting annually over the past 100-150 years. The two largest nesting populations of green turtles are found at Tortuguero, on the Caribbean coast of Costa Rica, and Raine Island, on the Great Barrier Reef in Australia, where an annual average of 22,500 and 18,000 females nest per season, respectively. In the U.S., green turtles nest primarily along the central and southeast coast of Florida; present estimates range from 200 - 1,100 females nesting annually." (National Marine Fisheries Service 2008) In the southeast U.S., the majority of green turtle nesting occurs in Florida. The green turtle nesting population of Florida appears to be increasing based on 19 years (1989 – 2007) of index nesting data from throughout the State (http://research.myfwc.com/features/view_article.asp?id=27537).

"Because adult female leatherbacks frequently nest on different beaches, nesting population estimates and trends are especially difficult to monitor. In the Pacific, the World Conservation Union (IUCN) notes that most leatherback nesting populations have declined more than 80%. In other areas of the leatherback's range, observed declines in nesting populations are not as severe, and some population trends are increasing or stable. In the Atlantic, available information indicates that the largest leatherback nesting population occurs in French Guyana, but the trends are unclear. Some Caribbean nesting populations appear to be increasing, but these populations are very small when compared to those that nested in the Pacific less than 10 years ago. Nesting trends on U.S. beaches have been increasing in recent years." (National Marine Fisheries Service 2008) Similar to the green turtle, in the southeast U.S., the majority of leatherback nesting occurs in Florida. The leatherback nesting population of Florida appears to be increasing based on 19 years (1989 – 2007) of index nesting data from throughout the State (http://research.myfwc.com/features/view_article.asp?id=27537).

Threats - Threats to the loggerhead sea turtles on the nesting grounds are similar to those faced by the green and leatherback sea turtles. The following threats affect all three species, though there may be some differences in susceptibility among the three turtle species. In addition to these threats affecting turtle nesting, turtles face a variety of threats during their time at sea that affect growth and survival during all life stages. These threats are discussed in greater detail in the five-year status reviews for the three sea turtle species (National Marine Fisheries Service and U.S. Fish and Wildlife Service 2007a, 2007b, 2007c).

Weather and Tides - Storm events may erode beaches and destroy nests, or cause nest failure due to flooding or piling of eroded sand on the nest site. Beach erosion due to wave action may also decrease the availability of suitable nesting habitat (Steinetz *et al.* 1998), leading to a decline in nesting rate on a particular beach.

Predation - Predation of eggs and young by mammals, birds, and ghost crabs may eliminate up to 100% of the nests and any hatchlings that emerge on beaches where it is not managed (National Research Council 1990).

Human Activities - Crowding of nesting beaches by pedestrians can disturb nesting females and prevent laying (National Marine Fisheries Service and U.S. Fish and Wildlife Service 1991a). Furthermore, the use of flashlights and campfires may interfere with sea-finding behavior by hatchlings. Beach driving, including pedestrian traffic, ORV use, and beach cleaning, poses a risk of injury to females and live stranded turtles, can leave ruts that trap hatchlings attempting to reach the ocean (Hosier *et al.* 1981, Cox *et al*. 1994), can disturb adult females and cause them to abort nesting attempts, and can interfere with sea-finding behavior if headlights are used at night (National Marine Fisheries Service and U.S. Fish and Wildlife Service 1991a). Driving directly above incubating egg clutches can cause sand compaction, which may decrease hatching and emergence success and directly kill pre-emergent hatchlings (National Marine Fisheries Service and U.S. Fish and Wildlife Service 2007a). Artificial lighting on human structures may affect turtle behavior in a similar manner (Witherington and Martin 1996). Beach cleaning can directly destroy nests. Poaching is a problem in some countries, and occurs at a low level in the United States (National Marine Fisheries Service and U.S. Fish and Wildlife Service 2007a).

An increased human presence may also lead to an increase in the presence of domestic pets that can depredate nests, and an increase in litter that may attract wild predators (National Research Council 1990). When artificial lighting impairs sea-finding behavior of nesting females and emerging hatchlings, the affected animals face increased exposure to the elements and predation.

The rate of habitat loss due to erosion and escarpment formation may be increased when humans attempt to stabilize the shoreline, either through renourishment (Dolan *et al.* 1973), or placement of hard structures such as sea walls or pilings (Bouchard *et al.* 1998). ORV traffic may alter the beach profile, leading to steeper foredunes (Anders and Leatherman 1987), which may be unsuitable for nesting. Improperly placed erosion-control structures such as drift-fencing can act as a barrier to nesting females. Humans may also introduce exotic vegetation in conjunction with beach development, which can overrun nesting habitat, make the substrate unsuitable for digging nest cavities, invade nests and desiccate nests, or trap hatchlings.

Reduced nesting success on constructed/augmented beaches could result due to sand compaction, escarpment formation, and changes in the beach profile. Sand compaction has been shown to negatively impact sea turtles, particularly concerning beach nourishment projects. Research has shown that placement of very fine sand and/or the use of heavy machinery can cause sand compaction on nourished beaches (Nelson *et al.* 1987, Nelson and Dickerson 1988). Significant reductions in nesting success (i.e., false crawls occurred more frequently) have been documented on severely compacted nourished beaches (Nelson and Dickerson 1987, Nelson *et al.* 1987), and increased false crawls may result in increased physiological stress to nesting females. Sand compaction may also increase the length of time required to excavate nests and result in increased physiological stress (Nelson and Dickerson 1988).

III. ENVIRONMENTAL BASELINE

As defined in 50 CFR 402.02, “action” means all activities or programs of any kind authorized, funded, or carried out, in whole or in part, by federal agencies in the United States or upon the high seas. The “action area” is defined as all areas affected directly or indirectly by the federal action, and not merely the immediate area involved in the action. The direct and indirect effects of the actions and activities resulting from the federal action must be considered with the effects of other past and present federal, state, or private activities, and the cumulative effects of certain future state or private activities within the action area.

Description of the Action Area - For the purposes of this consultation, the Service has determined that the action area for this project will encompass all barrier beach units of CNWR, including Assateague, Assawoman, Metompkin, and Cedar Islands. Detailed information concerning the action area is described in the enclosed *Intra-Service Section 7 Biological Evaluation Forms* (Enclosure 1).

Status of the Species in the Action Area

Piping plover (*Charadrius melodus*): There has been an increasing trend in the number of nesting pairs of plovers at all CNWR units from 1996, when monitoring was initiated at all CNWR units, to present (Table 7). CNWR's breeding plover population increased from 32 pairs in 1988 to its high of 118 pairs in 2005. Numbers declined slightly in 2006 and 2007, but remain well above numbers recorded a decade ago. In the last five years (2003-2007) nest productivity improved and has reached a weighted average of 1.53, well above the 1.24 believed to be necessary to maintain a stable population (Melvin and Gibbs 1994), and has reached the 1.5 believed to be necessary to maintain a secure population (U.S. Fish and Wildlife Service 1996a). The increase in productivity on CNWR units can be linked to the monitoring effort, use of nest enclosures, predator control efforts, and the closure of the primary nesting areas implemented by the refuge staff. These efforts have resulted in increasing numbers, and are responsible for the significant increases shown for the Southern Recovery Unit. Understanding the highly dynamic habitat conditions of these coastal islands is a key to the long term maintenance of plovers at CNWR.

Plover habitat on CNWR has changed over time as a result of natural erosion and accretion, and the relative suitability of plover habitat in different areas has also changed as a consequence. Accretion and increasing beach elevation, particularly on the Overwash and the recreational beach areas has led to increased plover use (Hecht 2008, pers. comm.). Around 1999, coastal processes began to form suitable habitat at the northern end of the Overwash and southern end of the parking lots. Habitat suitability around the south end of the parking lot/public beach attracted a breeding pair which nested there in 2005 (Hecht 2008, pers. comm.). Suitability of habitat decreased between May 2006 and Feb 2008, but still appeared capable of supporting at least one nesting pair (Hecht. 2008 pers. comm.). Habitat suitability was probably also enhanced by the removal of the asphalt parking lot and installation of shell material (Hecht 2008, pers. comm.). As a result of natural coastal processes, the beach conditions and habitat suitability will likely continue to change, resulting in improving conditions for plovers in some areas and declining conditions in other areas.

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Table 7. Number of piping plover nesting pairs and productivity by year at Chincoteague National Wildlife Refuge, Virginia, 1988-2007.

Year	No. plover pairs	No. plover chicks fledged	Plover fledging rate (chicks/pair)
1988[a]	32	27	0.84
1989[a]	32	36	1.13
1990[a]	42	24	0.57
1991[a]	38	30	0.79
1992[a]	36	19	0.53
1993[b]	41	56	1.37
1994[b]	41	71	1.73
1995[b]	45	44	0.98
1996[c]	51	83	1.63
1997[c]	62	43	0.69
1998[c]	62	69	1.11
1999[c]	55	74	1.35
2000[c]	63	98	1.56
2001[c]	73	134	1.84
2002[c]	76	95	1.25
2003[c]	72	147	2.04
2004[c]	97	221	2.28
2005[c]	118	167	1.42
2006[c]	117	121	1.03
2007[c]	98	110	1.12

[a] Data from Assateague Island.
[b] Data from Assateague, Assawoman, and Metompkin Islands.
[c] Data from Assateague, Assawoman, Metompkin, and Cedar Islands.

Seabeach amaranth (*Amaranthus pumilus*): Seabeach amaranth was rediscovered in Virginia in 2001, the last previously known prior occurrence was in 1973 (U.S. Fish and Wildlife Service 1996b). Population numbers at CNWR have been low (Table 8), and limited primarily to the Wild Beach portion of the refuge. In 2005, there were 69 plants located in the Wild Beach section of the refuge on Assateague Island (the highest count since 2001). The numbers dropped to 13 plants in 2006. The number of plants within CNWR complex has experienced major fluctuations in numbers since its rediscovery in 2001.

Table 8. Number of seabeach amaranth (*Amaranthus pumilus*) plants and distribution by year on Assateague Island, Chincoteague National Wildlife Refuge, Virginia. There are no records of any surveys on the Southern Islands Unit.

	2001	2002	2003	2004	2005	2006
Wild Beach	9	56	22	1	69	13
Hook				1		

Loggerhead sea turtle (*Caretta caretta*), green sea turtle (*Chelonia mydas*), and leatherback sea turtle (*Dermochelys coriacea*): From 1974 to 2006, there were 17 confirmed sea turtle nests on CNWR (Table 9), all of which were loggerheads. Ten of these nests were located north of the Public Beach area in what is referred to as the Wild Beach area. The other seven nests were located south of the Public Beach area (six in the Overwash area, and one on the Hook). At this time, there has been no confirmed successful nesting by green or leatherback sea turtles within CNWR. In 2006, there were indications that a green sea turtle may have nested at CNWR. In 2006, a park biologist at Assateague Island National Seashore (Maryland) observed a nesting attempt by a leatherback sea turtle (MacPherson, 2008, pers. comm.). These events make it essential to include these two species in the biological opinion. With global warming, the refuge lands in Virginia may become more favorable climatically to both the green and leatherback sea turtles for nesting.

Table 9. Loggerhead sea turtle (*Caretta caretta*) crawl and nest distribution by area on Chincoteague National Wildlife Refuge, Virginia, 1974-2006.

	Hook	Over-wash	Wild Beach	Assawoman Island	Metompkin Island	Cedar Island	TOTAL
False Crawls	13	4	4	1	0	0	22
Nests	1	6	10	0	0	0	17
Unknown Crawl Type	1	0	0	0	0	0	1

IV. EFFECTS OF THE ACTION

The effects of beach management activities on all units of CNWR and actions the refuge will take to minimize impacts are discussed in the enclosed *Intra-Service Section 7 Biological Evaluation Forms* (Enclosure 1), and are summarized below.

Direct Effects

Piping plover (*Charadrius melodus*): Refuge management activities will continue to have an overall positive effect on plover populations. Marking and enforcing restricted public use areas and seasonal closures to protect plover nesting benefits plovers by reducing human activity during the nesting season. Active and passive predator control activities also protect the birds by offering safe havens inside the nest exclosures and by reducing the numbers of predators. This intensive management has resulted in and will continue to gather data that is assisting in the understanding of plover biology and appropriate management techniques. CNWR has been improving plover habitat within the North Wash Flats area of Assateague Island since the 1990s, by removing vegetation, and recreating nesting and foraging habitat that was lost when dunes were built on the island in the 1960s. These management efforts have been aided by improving beach habitat conditions in that area that resulted from natural beach processes. Thus, there has been an overall increase in suitable nesting habitat at the Assateague Island section of CNWR since the plover was listed in 1986. Over the last three years, the refuge has supported about 35% of the nesting population of the Southern Recovery Unit, and CNWR management has increased plover numbers and nesting success on their lands.

During plover management and monitoring, there is a small chance that CNWR staff may not find a nest, and could destroy eggs or chicks during ORV use while conducting the surveys. Such an accident happened in 2000, but revised plover monitoring protocols have ensured that this has not happened since. Likewise, an unseen nest close to or within the west side of the public Overwash zone could have the same result.

Human disturbance of nesting and foraging plovers on Assateague Island may also occur. Disturbances from pedestrian and vehicle traffic (including horseback riders) may prevent a successful breeding attempt or result in the separation of chicks from the adults, or prevent chicks from reaching feeding areas or avoiding predators. The refuge closure of nesting areas to public use (especially closures to ORVs and horseback riding), predator control measures, and general management practices have greatly reduced the likelihood of disturbance and have generally provided plovers with safe areas to nest. However, some disturbance resulting from CNWR personnel, ORVs, and pedestrian activity outside of closed areas, such as the intertidal zone of the Wild Beach, may result in disturbance to nesting plovers. Since the Assateague Island unit is opened to ORVs and other public use after the nesting season, it is likely that there is some small impact to plovers that migrate along the barrier islands during their fall migration to their wintering grounds. This impact would be from interference with foraging due to the human and ORV use of the beaches. CNWR's restrictions on access to the dunes immediately adjacent to the beaches may reduce the effects of disturbance to foraging plovers on the beach by providing a readily available refuge from disturbance.

As plover numbers have increased on Assateague Island and habitat suitability has increased north of the Overwash Zone, there is an increasing chance that plovers may attempt to nest on the Public Beach or adjacent shell/sand parking lots. There was a nest adjacent to the parking lot in 2005, which led to closure of a portion of the lot, and a plover brood briefly used the area in 2007 (Hecht 2008, pers. comm.). Nesting has not occurred to date within the parking lot since the habitat is not particularly conducive to plover nesting due to the lack of intertidal foraging habitat close to the sandy/shell beach and parking lot substrates. However, there is a small risk that plovers may attempt to nest in these areas early in the season before the parking lots and Public Beach receive intense public use. Due to the overlay of a National Seashore on the Assateague Island beach, the CNWR is presented with a dilemma in managing this scenario should it occur. Current plans would be that if a plover nest occurred on the public beach, CNWR would put an exclosure over the nest and would fence off a 25 – 50 foot buffer around the exclosure to preclude human access. If a nest would occur in the parking lot, CNWR would put an exclosure around the nest, but would not further limit human or vehicle access. These protocols are less than what is recommended in the plover management guidelines within the Recovery Plan, and would increase risk to plovers from human disturbance, crushing of nests and/or young, nest abandonment, or egg mortality resulting from exposure. If a nest is crushed, it could result in the destruction or loss of one to four eggs. Any pairs that successfully hatch chicks from nests on the recreational beach or on the parking lots may be forced to move their broods into territories of pairs already established in the Overwash Zone, inducing agonistic interactions and reducing overall chick survival. However, it has been over ten years since the parking lots were converted from a paved surface to packed shell/sand, and there has not been a confirmed attempt by a plover to nest within the parking lot during that time. Therefore, while there is a risk of take of plovers under this scenario, it remains low. CNWR has committed to evaluate whether the Public Beach could be shifted to the north into an area that does not have suitable plover nesting habitat as part of its CCP process.

CNWR's Southern Units (Assawoman, Metompkin, and Cedar Islands) are not permanently staffed and are accessible to the public only by boat. Cedar and Assawoman Islands are currently staffed several days per week from April through August, and CNWR and The Nature Conservancy personnel visit Metompkin Island at least weekly during the nesting season. Future staffing levels are subject to change as a result of changing Refuge budgets. Assawoman and Metompkin Units are open to the public for daytime use, and the public may only access a limited area at the tips of the islands within the intertidal zone. However, since refuge enforcement staffing is limited, some unauthorized public use may occur at any time of the year. Members of the boating public have been known to stop at these and other islands for breaks from fishing, picnicking, or solitude. Unauthorized pedestrian activities (including dogs) may harass adults or chicks or may crush eggs. The extent of unauthorized use of the southern islands is unknown, but is believed to have been reduced over time due to better public information and patrols by Service and State staff (Ruth Boettcher 2008, pers. comm.). Plover productivity rates on Assawoman and Metompkin Islands are such that the Service does not believe unauthorized human use is a severe problem. Cedar Island has more human use since parts of the island are in private ownership, and there are some unregulated ORVs on that islan. However, plover nesting rates on Cedar Island also do not indicate that human disturbance is a significant issue on that island at the present time. Development of intermixed private land could increase human disturbance.

While each of the management practices and human activities at CNWR units will result in low risks to plovers, taken together, it is anticipated that there will still be some adverse effects on nesting plovers. Such effects may be due to incidental human disturbance of nesting and foraging adults and their young, or due to the accidental loss of eggs or chicks from nesting pairs that have not been seen by drivers of ORVs (official vehicles or the public). These effects are most likely to occur within the Public Beach and Overwash zones on Assateague Island and on the southern units of Assawoman, Metompkin, and Cedar Islands. It is anticipated that up to five pairs of nesting plovers on CNWR units over the next five years may have their productivity (number of fledged young per year) reduced by these human actions.

To evaluate the overall significance of this level of take, a comparison with what is considered to be the normal productivity at CNWR is warranted. Over the past five years (2001 – 2006), the average plover productivity rate for all CNWR units was 1.6 chicks per pair. This is one of the highest productivity rates within the Atlantic Coast recovery population, and is due to the intensive management conducted by the refuge. Using this average plover productivity rate for CNWR (which indicates the rate of loss for eggs and nestlings), five nesting pairs would be expected to produce approximately 21 eggs (based on the 2001-2006 average, including clutches of less than four eggs and renesting), and of these, eight chicks would be expected to fledge. Human disturbance and ORV use is anticipated to result in the loss of five of these eight chicks (although actual mortality could occur during either the egg or the pre-fledgling stages). This would be a decrease of approximately 0.7% of the plover chicks that would otherwise be expected to fledge at CNWR units over a five year period. Notwithstanding the special importance of protecting plovers in the limited suitable habitats in the Southern Recovery Unit, this loss is considered sustainable over the short-term life of this consultation and biological opinion, and will not significantly affect the status of the overall population of the Southern Recovery Unit. The Refuge plans to completes its CCP in about five years. During the CCP process, the refuge has committed to evaluate other options to situate intensive recreational use away from suitable plover habitat and to continue to implement plover nesting habitat enhancement within the Wash Flats area.

Seabeach amaranth (*Amaranthus pumilus*): Activities by CNWR staff for management and protection of nesting plovers and sea turtles have a net positive effect on seabeach amaranth. Seabeach amaranth occurrences are often located during these other management activities, which result in better protection of the plants. The CNWR staff annually surveys for the plant and records any locations. If plants are found in public use or ORV use areas, signs and symbolic fencing will provide protection and reduce the risk of inadvertent disturbance to plants. As a result of closure of nesting areas for protection of the plover and sea turtles, seabeach amaranth that occur in these areas can complete most of its life cycle removed from the threat of crushing from public ORV use. Some recreationists walk on the Wild Beach, though most stay close to the parking lots. These pedestrians may knowingly or unknowingly walk over plants if they use the beach above the tidal zone in potential seabeach amaranth habitat. Horses that are herded over the dunes to the beach during the annual pony penning in July may potentially crush plants, but refuge efforts to mark each plant, plover, or turtle nest along the route and use staff and volunteers to watch each area should prevent this from happening. Crushing of a plant or plants by the public, staff, horses, or ORVs may occur in some circumstances, but is unlikely due to the actions taken by the refuge to protect the dune and beach areas. CNWR's restrictions on walking on the upper beach, prohibitions on ORV use in the dunes, and efforts to educate the public should decrease trampling in almost all cases. This form of take is considered insignificant.

Loggerhead sea turtle (*Caretta caretta*), green sea turtle (*Chelonia mydas*), and leatherback sea turtle (*Dermochelys coriacea*): The effects of refuge management activities and public use on sea turtles are primarily limited to the Assateague Island unit, since no turtles have been known to nest on Assawoman, Metompkin or Cedar Islands since 1974. Management activities on Assateague should have a net positive effect on sea turtle nesting due primarily to *in situ* protection of nests. Active and passive predator control, conducted primarily for plover nest protection, will also help nesting sea turtles by reducing the number of potential sea turtle nest predators on the refuge. All sea turtle nests will be left in place and protected from threats as outlined in the attached *Intra-Service Section 7 Biological Evaluation Form* (Enclosure 1). Following the protocols established in Enclosure 1, CNWR staff will make a determination of how to provide protection to each nest based on the nest timing, location, and any possible site-specific issues. All turtle nests on Assateague will be excavated to confirm the presence of eggs. While this excavation process has a slight possibility of damage to the eggs, it is a standard procedure recommended and used by all sea turtle experts in the United States. The nests will then be protected by predator exclosures and symbolic fencing to prevent public trespass. Any turtle nests that occur in the Overwash zone when that area is re-opened to vehicles after the end of the plover nesting season (generally about September 1), will also be protected with a light barrier. In addition to the barriers, human nest sitters (staff or volunteers) will be used at night during the hatch window to protect nests in areas where the location of the nest and the width of the beach is such that an ORV cannot pass landward of the nest. The nest sitters will prevent vehicles from passing seaward of turtle nests while hatchling turtles are on the beach to prevent injury to hatchling turtles.

The approach to sea turtle protection used by the refuge in management of the species will allow for natural nesting on all CNWR units. While this approach will reduce anthropogenic effects on turtle nesting, some nests may still be affected by storm tides, erosion, and other natural processes that affect turtle nesting. The *in situ* protection and proposed management of nests on Assateague Island makes it unlikely that eggs and hatchling turtles will be lost due to crushing by ORVs or entrapment in vehicle ruts, unless unseen turtle nests occur, ORV drivers disobey protocols, and/or nest sitters are not available each night during the hatch window due to unforeseen circumstances. Disturbance to nesting turtles can still occur prior to egg-laying. ORV use by CNWR personnel and by recreational users outside of closure areas and periods for nesting plovers, may compact beach sand and/or disturb female turtles attempting to nest, potentially resulting in false crawls or fewer nests on Assateague Island beaches. Because the beach closure to ORVs for the plover nesting period generally coincides with the peak of turtle nesting, the risk of ORV disturbance is relatively low.

Indirect Effects

Indirect effects to piping plovers and sea turtles could include an increased predation rate due to human activity. Human activity on the islands may result in trash on the ground, which could both attract predators and increase the carrying capacity of the predators due to increased food availability. The increased numbers of predators may increase risk of disturbance, nest loss, and adult mortality of plovers and increase losses of sea turtle eggs and nests. Plovers may expend more energy in predator surveillance and avoidance, and that energy expenditure could decrease overall fitness. This risk is low because recreational use of these sites is light, except at the Overwash zone. In the Overwash zone, recreational use of the beach is allowed prior to plover hatching season and it is intensively supervised. Activities on the beaches by CNWR personnel may have some similar effects, but the risk is relatively low. Continued ORV use on the beaches may also increase ruts, compact sand, and destabilize some portions of the beach.

Interrelated and Interdependent Actions - An interrelated activity is an activity that is part of the proposed action and depends on the proposed action for its justification. An interdependent activity is an activity that has no independent utility apart from the action under consultation. No activities that are interrelated to or interdependent with the proposed action are known at this time.

V. CUMULATIVE EFFECTS

Cumulative effects include the effects of future State, tribal, local or private actions that are reasonably certain to occur in the action area considered in this biological opinion. Future federal actions that are unrelated to the proposed action are not considered in this section because they require separate consultation pursuant to section 7 of the Act.

Future federal, State, local or private actions that are anticipated to occur within the action area, (i.e., units of CNWR) will either be carried out by, or will require a permit from, the Service. These actions will therefore require a section 7 consultation. The Service is not aware of any future State, local or private actions that could occur within the action area that would not be subject to a section 7 review. However, there are private lands on Cedar Island that may not be subject to a section 7 review, including private activities such house construction, and ORV and other human beach use. Likewise, on the section of Metompkin Island not owned by the

Service, public use restrictions may be different than those established by the Service. Based on the distribution and productivity of piping plovers on these islands (Enclosure 1, Table 1, of *Piping Plover Intra-Service Section 7 Biological Evaluation Form*), it would appear that nesting success of plovers is affected more by habitat suitability than on the limited human use of Cedar or Metompkin Islands.

VI. CONCLUSION

Piping plover (*Charadrius melodus*): After reviewing the status of the piping plover, the environmental baseline for the action area, and the effects of the proposed actions, it is the Service's biological opinion that these activities, as proposed, are not likely to jeopardize the continued existence of the piping plover. The 117 pairs counted in 2006 and the 98 counted in 2007 on CNWR units represent a significant portion of the Southern Recovery Unit numbers (over 30 percent). Adverse effects are of very limited geographic scope and/or magnitude, and the refuge is developing options to further reduce them. Plovers in the Southern Recovery Unit are still imperiled; however, the management activities at CNWR will provide a net benefit to the plovers and aid in the recovery of the plover in this recovery unit. No critical habitat exists within the action area; therefore, none will be affected.

Seabeach amaranth (*Amarathus pumilus*): After reviewing the status of seabeach amaranth, the environmental baseline for the action area, and the effects of the proposed actions, it is the Service's biological opinion that these activities, as proposed, are not likely to jeopardize the continued existence of seabeach amaranth. No critical habitat has been designated for this species; therefore, none will be affected.

The Service bases this determination on the low level of anticipated adverse effects coupled with the protection gained by the management activities and the broad distribution and relative size of the range-wide seabeach amaranth population.

Loggerhead sea turtle (*Caretta caretta*), green sea turtle (*Chelonia mydas*), and leatherback sea turtle (*Dermochelys coriacea*): After reviewing the status of the three sea turtles, the environmental baseline for the action area, and the effects of the proposed actions, it is the Service's biological opinion that these activities, as proposed, are not likely to jeopardize the continued existence of loggerhead, green or leatherback sea turtles. No critical habitat has been designated for the loggerhead sea turtle, and no critical habitat for either the green or leatherback sea turtles occurs within the action area; therefore, none will be affected.

The Service bases this determination of no jeopardy on the low level of anticipated adverse effects coupled with the protection gained by the management activities. Furthermore, there is a low level of nesting use by sea turtles relative to the total population size nesting within the broader region, and the likelihood that any nest would suffer direct impacts is small. The management activities at CNWR should provide a net benefit to the turtles.

INCIDENTAL TAKE STATEMENT

Section 9 of the Act and federal regulations pursuant to section 4(d) of the Act prohibit the take of endangered and threatened species, respectively, without special exemption. Take is defined as to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture or collect, or to attempt to engage in any such conduct. Harm is further defined by the Service to include significant habitat modification or degradation that results in death or injury to listed species by significantly impairing essential behavioral patterns, including breeding, feeding or sheltering. Harass is defined by the Service as intentional or negligent actions that create the likelihood of injury to listed species to such an extent as to significantly disrupt normal behavior patterns that include, but are not limited to, breeding, feeding or sheltering. Incidental take is defined as take that is incidental to, and not the purpose of, carrying out of an otherwise lawful activity. Under the terms of section 7(b)(4) and section 7(o)(2), taking that is incidental to and not intended as part of the agency action is not considered to be prohibited taking under the Act provided that such taking is in compliance with the terms and conditions of this Incidental Take Statement.

The measures described below are non-discretionary, and must be undertaken by CNWR for the exemption in section 7(o)(2) to apply. CNWR has the continuing duty to regulate the activities covered by this incidental take statement. If CNWR (1) fails to assume and implement the terms and conditions, or (2) fails to require any permittee or other party to adhere to the terms and conditions of the incidental take statement through enforceable terms that are added to any permit or grant document, the protective coverage of section 7(o)(2) may lapse. In order to monitor the impact of incidental take, CNWR must report the progress of the action and its impact as specified in the incidental take statement [50 CFR 402.14(i)(3)].

Section 7(b)(4) and 7(o)(2) of the ESA generally do not apply to listed plants species. However, limited protection of listed plants from take is provided to the extent that the ESA prohibits the removal and reduction to possession of federally listed endangered plants or the malicious damage of such plants on areas under Federal jurisdiction, or the destruction of endangered plants on non-Federal areas in violation of state law or regulations or in the course of any violation of a state criminal trespass law.

AMOUNT OR EXTENT OF TAKE

Piping plover (*Charadrius melodus*):

> The Service anticipates that up to five pairs of nesting plovers on CNWR units over the next five years may have their productivity (number of fledged young per year) reduced by human actions. Of this number, no more than one nest or brood is expected to be taken in any one year as a result of the proposed actions. Take, in the form of harassment of adults and/or young may interfere with breeding, feeding, or sheltering. This is most likely to

occur if plovers nest in the Public Beach Area, where reduced buffers will provide limited protection. Take of eggs or young may be caused directly by a vehicle crushing a plover egg or chick, or by entrapment of chicks due to creation of ruts in sand that impede chick movements. Though unlikely, any unauthorized pedestrian use may prevent plovers from using the beach and intertidal areas for foraging. Detection of mortality or injury to piping plover eggs and chicks is extremely difficult due to their small size, and because their coloration blends with the beach substrate. Dead chicks and eggs may be covered with wind-blown sand, washed away by tides, or consumed by scavengers. Because detection of take of piping plovers is difficult, the discovery of a single crushed egg or chick due to suspected human causes is considered to indicate the level of anticipated annual take has been reached.

This level of incidental take is expected to continue until CNWR completes the CCP for the refuge (approximately five years from this Opinion), at which time the proposed action is expected to be replaced by revised management, which will be subject to a reinitiation of consultation.

Loggerhead sea turtle (*Caretta caretta*), green sea turtle (*Chelonia mydas*), and leatherback sea turtle (*Dermochelys coriacea*):

The Service expects incidental take of all species of sea turtles will be difficult to detect for the following reasons: (1) turtles nest primarily at night and all nests are not found due to natural factors, such as rainfall, wind, and tides that may obscure crawls, and human-caused factors, such as pedestrian and vehicular traffic, which may obscure crawls and result in nests being destroyed because they were missed during a nesting survey and nest protection program; (2) the total number of hatchlings and the reduction in hatching and emergence success due to disturbance of nests is difficult to determine; (3) impacts to nesting females in the form of harassment are not likely to be noticed and recorded; and 4) locating individual hatchling sea turtles that have been injured or killed is unlikely.

Incidental take in the form of injury or death of loggerhead sea turtle eggs, hatchlings, and nesting turtles, as well as harm and harassment of both adult and hatchling turtles may result from the proposed action. Incidental take may include collisions with nesting turtles resulting in injury or death, crushing an undetected turtle nest by either staff- or civilian-operated ORVs, creation of ruts in sand that impede hatchlings from moving from nest to water, interference with sea-finding behavior in hatchling turtles leading to disorientation resulting from artificial and vehicle lighting, and impacts to nests resulting from sand compaction or vibration caused by ORV use. The *in situ* management of nests is expected to reduce take since no nests will be moved and nests will be protected from potential human disturbance. No more than three loggerhead sea turtle nests are expected to be taken or lost due to direct or indirect impacts during the five year period covered by this biological opinion, and no more than one loggerhead sea turtle nest is expected to be taken in any one year. No adult turtles are anticipated to be killed due to the intensive monitoring program for piping plovers during the majority of the sea turtle egg laying period, and no incidental take of adult sea turtles in the form of death or injury from ORV use is authorized. No green sea turtle or leatherback sea turtle nest loss is expected to occur due to their rarity, and no incidental take of these species is authorized.

EFFECT OF THE TAKE

In the accompanying biological opinion, the Service determined that this level of anticipated take is not likely to result in jeopardy to the species or destruction or adverse modification of critical habitat. The action area encompasses a relatively small portion of the rangewide habitat of each of the species addressed in this opinion, and a small portion of each species' population. The proposed action includes a variety of protective measures that are intended to minimize incidental take. For these reasons, the effect of the take anticipated in this biological opinion is not expected to significantly affect any of the species considered.

REASONABLE AND PRUDENT MEASURES

The Service believes the following reasonable and prudent measures are necessary and appropriate to minimize the likelihood of incidental take of piping plovers, seabeach amaranth, and sea turtles:

1. Proposed activities and access to plover and sea turtle nesting areas, must be timed and conducted to minimize impacts to the species.

2. Monitoring of the species' populations on CNWR units, as well as the effectiveness of the protection measures.

TERMS AND CONDITIONS

In order to be exempt from the prohibitions of section 9 of the Act, CNWR must comply with the following terms and conditions, which implement the reasonable and prudent measures described above and outline required reporting/monitoring requirements. These terms and conditions are non-discretionary. The proposed action represents an interim plan anticipated to be in place for five years as the refuge works on its CCP. The proposed action, and the provisions of this biological opinion, including terms and conditions, are expected to be replaced by another section 7 consultation on the actions proposed by the CCP once it is completed.

Refuge Management Actions

1. Human activities, both pedestrian and vehicular, shall be restricted in all piping plover and sea turtle nesting areas, and known locations of seabeach amaranth, on all CNWR

units in accordance with the plans developed in *the Intra-Service Section 7 Biological Evaluation Forms* (Enclosure 1). Pedestrian and vehicle corridors shall be moved, constricted, or temporarily closed if territorial, courting, nesting, or brooding plovers or sea turtle nests may be disturbed by human activities, or if disturbance is anticipated because of unusual tides. The exception to this is the Overwash zone on Assateague Island (see Condition #2) and the Public Beach Area.

2. The Overwash zone on Assateague Island is divided into two areas: (1) the plover nesting area, and 2) the Off-road Recreational Vehicle (ORV) access corridor (see Enclosure 1, Figure 3, of the P*iping Plover Intra-Service Section 7 Biological Evaluation Form*). The plover nesting area is closed from March 15 through August 31 or until all plovers have fledged, but the ORV corridor seaward of this area stays open until two days before the first expected plover hatch date, and the closure continues until all plover chicks in the area have fledged. The area that shall be closed will be 200 meters north of the northern-most plover brood.

3. In the event that plovers nest on the Public Beach or adjacent parking lots on Assateague Island, the refuge will at a minimum exclose a twenty-five foot radius buffer zone around the nest to protect the nest, and will notify the Virginia Field Office (VAFO) within 24 hours or the next work day. It is important that the refuge complete its Comprehensive Conservation Plan (CCP) by the end of the five year period anticipated in this Biological Opinion. Within the CCP shall be alternative management methods to reduce the potential take of plovers in these public use areas and the Overwash zone.

4. During the plover breeding and sea turtle nesting seasons, official vehicle use (FWS and NPS) of the Assateague Island unit beach shall be limited to that considered essential in the judgment of the Refuge Manager. Official vehicle use will be confined to daylight hours when possible. Vehicle speed shall not exceed ten miles an hour. Vehicles should avoid creating deep ruts that could impede plover chick or sea turtle hatchling movements. If vehicles are creating deep ruts that could impede hatchlings, CNWR shall take appropriate measures to correct the situation as outlined in the *Intra-Service Section 7 Biological Evaluation Forms* (Enclosure 1), and these measures shall be taken at least five days prior to the anticipated hatch date.

5. Personnel who monitor plovers shall maintain and regularly update a log of the locations of nests and unfledged plover chicks and sea turtle nests on the Assateague Island unit. Drivers of official vehicles (FWS and NPS) and public ORV users shall be kept up-to-date by CNWR staff regarding the most current information on locations of nests and unfledged plovers and sea turtles.

6. Night use of the beach by official vehicles during the plover and sea turtle breeding season shall be limited to the greatest extent possible. Except in extreme emergencies,

during night trips a person with a flashlight should walk ahead of the vehicle while within this 400-meter area to look for plovers.

7. The refuge shall insure that the local fire department continues to maintain the fence line to prevent horses from being on the dunes and beach areas to prevent take of plovers, seabeach amaranth, or sea turtle nests. The refuge will take all precautions to insure that during the annual pony penning event, the public and horses while on the Wild Beach do not impact any listed species (if plover chicks and/or turtle nests are present the horses and public will be routed away from them).

Monitoring and Notification

1. Sea turtle crawl and nest searches will be conducted June through the end of September. Surveys for seabeach amaranth will be conducted in conjunction with piping plover and sea turtles.

2. If nesting of green or leatherback sea turtles are confirmed on the Assateague Island unit, CNWR staff shall notify the VAFO within 24 hours (or the next work day) to discuss appropriate management actions to ensure that no take of the eggs or hatchlings of these species occur, due to the rarity of these species at the northern end of their ranges and because no incidental take of these species has been anticipated.

3. A log shall be maintained by CNWR that records the date, time, permit number, and purpose of each vehicle trip (government and private vehicles) through all Assateague beach segments when unfledged plover chicks or sea turtle nests are present.

4. CNWR prepares annual monitoring/survey reports on piping plover productivity, sea turtle nesting activity, and seabeach amaranth locations. These reports shall be submitted to VAFO and the national piping plover and sea turtle coordinators no later than December 1 of each year. Reports shall be sent to VAFO via electronic transmission or at the address below, and to the appropriate addresses for the national coordinators:

   Supervisor
   Virginia Field Office
   U.S. Fish and Wildlife Service
   6669 Short Lane
   Gloucester, Virginia 23061
   (804) 693-6694

5. The CNWR must notify the Virginia Field Office at the address and phone number above within 24 hours (or next work day) of any deaths, nests impacted, or other impacts to the species addressed in this opinion as a result of human activity. Any reports of mortality

or injury due to vehicles shall be accompanied by the vehicle log or monitoring log of the day and previous day that impact occurred. Care must be taken in handling dead specimens of any proposed or listed species that are found to preserve biological material in the best possible state. In conjunction with the preservation of any dead specimens, the finder has the responsibility to ensure that evidence intrinsic to determining the cause of death of the specimen is not unnecessarily disturbed. The finding of dead specimens does not imply enforcement proceedings pursuant to the Act. The reporting of dead specimens is required to enable the Service to determine if the approved take has been reached or exceeded and to ensure that the terms and conditions are appropriate and effective.

CONSERVATION RECOMMENDATIONS

Section 7(a)(1) of the Act directs federal agencies to use their authorities to further the purposes of the Act by carrying out conservation programs for the benefit of endangered and threatened species. Conservation recommendations are discretionary agency activities taken to minimize or avoid adverse effects of a proposed action on listed species or critical habitat, to help implement recovery plans, or to develop information.

CNWR can take the following actions to improve management of the three listed species that utilize the beaches of the refuge, and aid in the management and recovery of these species:

1. Within the Public Beach zone and adjacent parking lots on Assateague Island, should any plovers attempt to nest in these areas, follow the Piping Plover Recovery Plan guidelines on protection distances, which are substantially greater than 25 – 50 feet (U.S. Fish and Wildlife Service, 1996).

2. Expedite the evaluation of alternate transportation and alternate public beach options on Assateague Island in a period shorter than five years, in conjunction with the National Park Service. Flexibility to respond to natural habitat formation by moving the Public Beach to portions of the barrier island where habitat conditions are currently unsuitable (or only marginally suitable) for piping plover breeding, closure of the beach parking lots and the Overwash zone during the summer and fall shorebird and sea turtle nesting and migration periods, and providing a new parking area with tram service to the beach are measures that could be taken to further reduce incidental take.

3. Over the last two years there has been limited nesting by plovers on the Wild Beach. In the 1960s, overwash habitat here and elsewhere on Assateague Island was lost in this area when the extensive artificial sand dune system was created. The refuge should continue and expand the restoration of the dynamic beach and overwash system that existed in the Wild Beach and elsewhere prior to the dune construction. This would restore natural processes to an extensive

area that would be isolated from high public use and act as a safe zone for the plover, sea turtles, and other nesting shorebirds.

4. Monitor the use of CNWR beach by piping plovers (and other shorebirds) during the fall migration period to determine the extent and locations of important foraging areas with the refuge. See for example National Park Service (2003).

5. To further reduce the impacts of unauthorized public use of the southern islands (Assawoman, Metompkin, and Cedar), the refuge should increase staff presence to three days a week during the nesting season, including weekend patrols.

6. As part of the CCP process, the refuge should assess all management activities to determine if there are additional management actions that could be taken to reduce and avoid the take of beach dwelling listed species. The pony operation on the refuge should also be evaluated for its impacts on refuge resources.

7. Within constraints of available staff time and other refuge priorities, continue to facilitate piping plover research. For example, a 2007 pilot study using harnesses to attach radio transmitters to piping plovers (Cohen *et al*. 2007), hosted by CNWR on short notice, provided valuable information for future research on effects of off-shore wind turbines on Atlantic Coast piping plovers. Other past studies with broad benefits for rangewide piping plover recovery have included investigations of seabird colony effects on piping plover fledging success and brood movement (Daisey 2006), research on effects of ghost crabs on piping plover breeding success conducted on the Wild Beach (Wolcott and Wolcott 1999), and breeding ecology (Cross 1996).

In order for VAFO to be kept informed of actions minimizing or avoiding adverse effects or benefitting listed species or their habitats, VAFO requests notification of the implementation of any conservation recommendations not included in the description of the proposed action or biological opinion.

REINITIATION NOTICE

This concludes formal consultation on the actions outlined in the Intra-Service consultation form. As provided in 50 CFR 402.16, reinitiation of formal consultation is required where discretionary federal agency involvement or control over the action has been retained or is authorized by law and if: (1) the amount or extent of incidental take is exceeded; (2) new information reveals effects of the agency action that may affect listed species or critical habitat in a manner or to an extent not considered in this opinion; (3) the agency action is subsequently modified in a manner that it causes an effect to the listed species or critical habitat not considered in this opinion; or (4) a new species is listed or designated critical habitat that may be affected by the action. In instances where the amount or extent of incidental take is exceeded, any operations causing such take must cease pending reinitiation.

VAFO appreciates this opportunity to work with CNWR on the proposed actions. Please contact Mike Drummond at (804) 693-6694, extension 114 if you require additional information.

Karen L. Mayne

Enclosures

cc: Superintendent, Assateague Island National Seashore, Berlin, MD (Scott Bentley)
USFWS, Sudbury, MA (Anne Hecht)
CBFO, Annapolis, MD (Andy Moser)
Virginia Department of Game and Inland Fisheries (Ruth Boettcher)
ARD, ES, Region 5, Hadley, MA (Michael Thabault)
Chief, Refuges, Region 5, Hadley, MA (Tony Leger)
Endangered Species Coordinator, Region 5, Hadley, MA (Martin Miller)

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APPENDIX A – CONSULTATION HISTORY

12/15/06	Initial email contact between CNWR and VAFO about the need to initiate an *Intra-Service Section 7 Consultation* for management activities not covered under the 2001 Biological Opinion.
01/23/07	VAFO staff conduct a site visit to CNWR to discuss management activities and public use issues.
02/23/07	Email from Sandy MacPherson (Service sea turtle coordinator) to VAFO regarding concerns about sea turtle nest relocation as a conservation tool.
02/28/07	Email from CNWR to VAFO providing a table showing monthly management activities for Assateague Island, and the Southern Island Unit (Assawoman, Metompkin, and Cedar Islands).
02/26/07	Email from CNWR to VAFO providing 2006 seabeach amaranth survey data.
04/03/07	Email from CNWR to VAFO providing the portion of the *Intra-Service Section 7 Biological Evaluation Form* for management of nesting sea turtles on the refuge.
04/03/07	Email from CNWR to VAFO providing the portion of the *Intra-Service Section 7 Biological Evaluation Form* for management of piping plover on the refuge.
04/19/07	Email from CNWR to VAFO providing the final portion of the *Intra-Service Section 7 Biological Evaluation Form* for management of seabeach amaranth on the refuge.
04/23/07	Email from CNWR to VAFO providing an updated version of the *Intra-Service Section 7 Biological Evaluation Form* for sea turtles and piping plovers.
04/23/07	VAFO sent email notice to CNWR of the receipt of final *Intra-Service Section 7 Biological Evaluation Form* and the initiation of formal consultation.
05/17/07	Email from Service piping plover coordinator, Anne Hecht, to VAFO and CNWR concerning the possible issue of piping plovers nesting on the public beach parking lots.
05/30/07	Email from CNWR to VAFO providing modifications to the *Intra-Service Section 7 Biological Evaluation Form* on management of piping plovers.
06/19/07	Email from Service piping plover coordinator, Anne Hecht, to VAFO and CNWR providing more data concerning the possible issue of piping plovers nesting on the public beach parking lots.

06/20/07	Email from CNWR acting refuge manager, Susan Rice, to VAFO providing input to the possible use of beach parking lots by nesting piping plovers.
06/20/07 - 09/20/07	Period of discussion between VAFO and CNWR regarding plover issues, and how to handle sea turtle nesting at the refuge. CNWR agrees to develop a supplement to the *Intra-Service Section 7 Biological Evaluation Form* showing how it will manage turtle nesting and ORV use at the refuge.
09/21/07	VAFO via email, requested Service sea turtle coordinator, Sandy MacPherson, provide input on how to determine acceptable take levels for CNWR.
10/18/07	VAFO sent copy of the draft Terms and Conditions section of the biological opinion to CNWR for comments.
10/18/07	VAFO sent draft copy of biological opinion to Anne Hecht for review and comments.
10/07 - 2/08	Period of discussion between VAFO and CNWR on plover take and turtle management actions.
02/12/08	Meeting at CNWR between refuge staff (Lou Hinds, Kim Halpin, Sue Rice, Amanda Daisey, Eva Savage), VAFO staff (Karen Mayne, Mike Drummond), and the Service piping plover coordinator (Anne Hecht) to discuss issues of refuge operations and possible impacts to listed species. The outcome of this meeting was the agreement that this consultation would be comprehensive for all activities that impact piping plovers, seabeach amaranth and sea turtles on all units of the refuge. It was agreed that the previous 2001 biological opinion had not addressed the issue of possible nesting by plovers on the public beach parking lots. This opinion will be comprehensive, it will include all activities covered in the 2001 biological opinion, and also the parking lot issue.
02/13/08 - 04/24/08	Period of discussion between VAFO, CNWR, and species experts regarding the updated *Intra-Service Section 7 Biological Evaluation Forms* submitted by the refuge. The main focus of these discussions was the protection of sea turtle nests from ORV use at the refuge.
04/03/08	Email from CNWR to VAFO providing the final portion of the *Intra-Service Section 7 Biological Evaluation Form* for management of piping plovers on the refuge.
05/23/08	Email from CNWR staff to VAFO providing the final portion of the *Intra-Service Section 7 Biological Evaluation Form* for management of sea turtles on the refuge.

08/07/08 E-mail from CNWR to VAFO providing a revised Intra-Service Biological Assessment on sea turtles to correct the wording of the proposed action.

Enclosure 1

MDrummond: 6/27/2008
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