Appendix D

USFWS

*Red knot*

# Findings of Appropriateness and Compatibility Determinations

## Findings of Appropriateness and Compatibility Determinations

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

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

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

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

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

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

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

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

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

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

**FWS Form 3-2319**
**02/06**

## FINDING OF APPROPRIATENESS OF A REFUGE USE

**Refuge Name:** Monomoy National Wildlife Refuge

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

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

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

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

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

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

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

**Not Appropriate** ✔ **Appropriate** _____

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

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

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

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

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

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

**603 FW 1**
**Exhibit 1**
**Page 2**

## JUSTIFICATION FOR A FINDING OF APPROPRIATENESS OF A REFUGE USE

**Refuge Name:** Monomoy National Wildlife Refuge

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

## NARRATIVE:

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

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

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

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

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

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

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

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

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

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

## LITERATURE CITED:

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

Knight, R. and K. Gutzwiller. 1995. Wildlife and recreationists coexistence through management and research. Washington, DC.: Island Press.

Martín, B., S. Delgado, A. de la Cruz, S. Tirado, and M. Ferrer. 2015. Effects of human presence on the long-term trends of migrant and resident shorebirds: evidence of local population declines. Anim Conserv, 18: 73–81. doi:10.1111/acv.12139.

**FWS Form 3-2319**
**02/06**

## FINDING OF APPROPRIATENESS OF A REFUGE USE

**Refuge Name:** Monomoy National Wildlife Refuge

**Use:** Bicycling

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

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

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

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

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

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

**Not Appropriate** ✔ **Appropriate** _____

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

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

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

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

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

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

**603 FW 1**
**Exhibit 1**
**Page 2**

## JUSTIFICATION FOR A FINDING OF APPROPRIATENESS OF A REFUGE USE

**Refuge Name:** Monomoy National Wildlife Refuge

**Use:** Bicycling

## NARRATIVE:

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

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

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

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

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**02/06**

## FINDING OF APPROPRIATENESS OF A REFUGE USE

**Refuge Name:** Monomoy National Wildlife Refuge

**Use:** Camping

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

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

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

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

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

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

**Not Appropriate** ✔ **Appropriate** _____

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

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

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

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

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

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

**603 FW 1**
**Exhibit 1**
**Page 2**

## JUSTIFICATION FOR A FINDING OF APPROPRIATENESS OF A REFUGE USE

**Refuge Name:** Monomoy National Wildlife Refuge

**Use:** Camping

## NARRATIVE:

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

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

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

**FWS Form 3-2319**
**02/06**

## FINDING OF APPROPRIATENESS OF A REFUGE USE

**Refuge Name:** Monomoy National Wildlife Refuge

**Use:** Fires

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

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

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

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

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

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

**Not Appropriate** ✔ **Appropriate** _____

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

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

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

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

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

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

**603 FW 1**
**Exhibit 1**
**Page 2**

## JUSTIFICATION FOR A FINDING OF APPROPRIATENESS OF A REFUGE USE

**Refuge Name:** Monomoy National Wildlife Refuge

**Use:** Fires

## NARRATIVE:

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

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

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

**FWS Form 3-2319**
**02/06**

## FINDING OF APPROPRIATENESS OF A REFUGE USE

**Refuge Name:** Monomoy National Wildlife Refuge

**Use:** Fireworks

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

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

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

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

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

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

**Not Appropriate** ✔ **Appropriate** _____

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

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

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

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

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

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

**603 FW 1**
**Exhibit 1**
**Page 2**

## JUSTIFICATION FOR A FINDING OF APPROPRIATENESS OF A REFUGE USE

**Refuge Name:** Monomoy National Wildlife Refuge

**Use:** Fireworks

## NARRATIVE:

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

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

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

**FWS Form 3-2319**
**02/06**

## FINDING OF APPROPRIATENESS OF A REFUGE USE

**Refuge Name:** Monomoy National Wildlife Refuge

**Use:** Horseshoe Crab Harvesting

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

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

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

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

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

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

**Not Appropriate** ✔ **Appropriate** _____

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

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

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

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

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

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

**603 FW 1**
**Exhibit 1**
**Page 2**

## JUSTIFICATION FOR A FINDING OF APPROPRIATENESS OF A REFUGE USE

**Refuge Name:** Monomoy National Wildlife Refuge

**Use:** Horseshoe Crab Harvesting

## NARRATIVE:

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

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

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

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

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

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

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

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

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

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

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

## LITERATURE CITED:

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

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

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

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

Koch, S.L. 2010. Shorebird migration ecology at Monomoy National Wildlife Refuge. Unpublished Ph.D. dissertation. University of Rhode Island, Kingston, Rhode Island. 138 pp.

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

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

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

**FWS Form 3-2319**
**02/06**

## FINDING OF APPROPRIATENESS OF A REFUGE USE

**Refuge Name:** Monomoy National Wildlife Refuge

**Use:** Jet Skiing (Personal Watercraft)

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

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

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

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

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

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

**Not Appropriate** ✔ **Appropriate** _____

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

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

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

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

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

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

**603 FW 1**
**Exhibit 1**
**Page 2**

## JUSTIFICATION FOR A FINDING OF APPROPRIATENESS OF A REFUGE USE

**Refuge Name:** Monomoy National Wildlife Refuge

**Use:** Jet Skiing (Personal Watercraft)

## NARRATIVE:

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

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

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

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

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

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

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

**FWS Form 3-2319**
**02/06**

## FINDING OF APPROPRIATENESS OF A REFUGE USE

**Refuge Name:** Monomoy National Wildlife Refuge

**Use:** Kiteboarding

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

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

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

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

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

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

**Not Appropriate** ✔ **Appropriate** _____

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

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

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

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

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

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

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Exhibit 1
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## JUSTIFICATION FOR A FINDING OF APPROPRIATENESS OF A REFUGE USE

**Refuge Name:** Monomoy National Wildlife Refuge

**Use:** Kiteboarding

## NARRATIVE:

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

## LITERATURE CITED:


Blodget, B.G. and S. Melvin. 1996. Massachusetts tern and piping plover handbook: a manual for stewards. Massachusetts Division of Fisheries and Wildlife. Natural Heritage and Endangered Species Program. Westborough, Massachusetts.

Cook, Jason. 2013. "Kiteboarder Rescued from Monomoy." Cape Cod Times, Hyannis, Massachusetts. Web address: *http://www.capecodtimes.com/article/20130202/NEWS11/130209943* (accessed February 5, 2015)

Ernst, Nick. 2013. Personal communication. Wildlife Biologist, U.S. Fish and Wildlife Service. Charlestown, Rhode Island.

Hake, Mary. 2015. Personal communication. Email.

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

Iaquinto, Kate. 2013-2015. Personal communication. Wildlife Biologist, U.S. Fish and Wildlife Service. Chatham, Massachusetts.

Leary, Patrick. 2015. Personal communication. Red Knot Working Group. Fernandina Beach, Florida.

Leary, D. and Leary, P. 2014. "Kite-boarding Impacts to Red Knot in NE Florida. A Report to the USFWS." Unpublished presentation.

Moyer, Desiree. 2014. Personal communication. Response to Public Comments on the Monomoy Draft CCP/EIS. Brewster, Massachusetts. Letter.

National Park Service. 2014. Cape Cod National Seashore Superintendent's Compendium. July 22, 2014. Wellfleet, Massachusetts.

National Park Service. 2012. Padre Island National Seashore Superintendent's Compendium. March 2013. Corpus Christi, Texas.

Ray, Edie. 2015. Personal communication. Massachusetts Audubon Society, Coastal Waterbird Program. Nantucket, Massachusetts.

Schwarzer, Amy. 2015. Personal communication.

Town of Chatham, Chapter 265-8 Waterways regulations. *http://ecode360.com/10426494* (last accessed September 2015)

U.S. Fish and Wildlife Service (USFWS). 1996a. Piping Plover *(Charadrius melodus)*, Atlantic Coast Population, Revised Recovery Plan. Hadley, Massachusetts. 258 pp. *http://www.fws.gov/northeast/pipingplover/recovery.html;* accessed July 2011.

**FWS Form 3-2319**
**02/06**

## FINDING OF APPROPRIATENESS OF A REFUGE USE

**Refuge Name:** Monomoy National Wildlife Refuge

**Use:** Mussel Harvesting

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

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

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

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

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

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

**Not Appropriate** ✔ **Appropriate** _____

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

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

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

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

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

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

## JUSTIFICATION FOR A FINDING OF APPROPRIATENESS OF A REFUGE USE

**Refuge Name:** Monomoy National Wildlife Refuge

**Use:** Mussel Harvesting

## NARRATIVE:

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

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

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

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

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

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

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

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

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

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

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

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

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

## LITERATURE CITED:

American Oystercatcher Working Group. 2011-12. *http://amoywg.org/american_oystercatcher/food-habits/;* accessed March 2013.

Bertness, M.D. 1984. Ribbed mussels and *Spartina alterniflora* production in a New England salt marsh. Ecology 65(6): 1794-1807.

Chesapeake Bay Program. 2012. *http://www.chesapeakebay.net/fieldguide/critter/atlantic_ribbed_mussel;* accessed January 2016.

Gosner, K.L. 1978. A Field Guide to the Atlantic Seashore from the Bay of Fundy to Cape Hatteras. Houghton Mifflin Company, New York, NY. 329 pp.

Harrington, B.A., S. Koch, L.K. Niles, and K. Kalasz. 2010. Red knots with different winter destinations: differential use of an autumn stopover area. Waterbirds 33(3): 357-363.

Massachusetts Department of Fish and Game. 2006. Massachusetts Comprehensive Wildlife Conservation Strategy. *http://www.mass.gov/eea/docs/dfg/dfw/habitat/cwcs/mass-cwcs-final.pdf*; accessed June 2015.

Neckles, H.A., F.T. Short, S. Barker, and B.S. Kopp. 2005. Disturbance of eelgrass *Zostera marina* by commercial mussel *Mytilus edulis* harvesting in Maine: dragging impacts and habitat recovery. Marine Ecology Progress Series. 285: 57-73.

Save the Bay. 1998. Adapted from *The Uncommon Guide to Common Life on Narragansett Bay. http://www.edc.uri.edu/restoration/html/gallery/invert/ribbed.htm*; accessed January 2016.

**FWS Form 3-2319**
**02/06**

## FINDING OF APPROPRIATENESS OF A REFUGE USE

**Refuge Name:** Monomoy National Wildlife Refuge

**Use:** Recreational Over-sand Vehicle Use

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

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

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

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

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

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

**Not Appropriate** ✔ **Appropriate** _____

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

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

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

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

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

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

## JUSTIFICATION FOR A FINDING OF APPROPRIATENESS OF A REFUGE USE

**Refuge Name:** Monomoy National Wildlife Refuge

**Use:** Recreational Over-sand Vehicle Use

## NARRATIVE:

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

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

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

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

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

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

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

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

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

## LITERATURE CITED:

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

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

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

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

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

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

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

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

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

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

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

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

**FWS Form 3-2319**
**02/06**

## FINDING OF APPROPRIATENESS OF A REFUGE USE

**Refuge Name:** Monomoy National Wildlife Refuge

**Use:** Organized Picnicking (includes the use of grills)

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

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

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

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

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

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

**Not Appropriate** ✔ **Appropriate** _____

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

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

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

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

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

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

**603 FW 1**
**Exhibit 1**
**Page 2**

## JUSTIFICATION FOR A FINDING OF APPROPRIATENESS OF A REFUGE USE

**Refuge Name:** Monomoy National Wildlife Refuge

**Use:** Organized Picnicking (includes the use of grills)

## NARRATIVE

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

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

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

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

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

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

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

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

## LITERATURE CITED:

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

Iaquinto, Kate. Personal communication. 2015.

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

**FWS Form 3-2319**
**02/06**

## FINDING OF APPROPRIATENESS OF A REFUGE USE

**Refuge Name:** Monomoy National Wildlife Refuge

**Use:** Stage Island Parking and Dinghy Storage

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

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

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

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

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

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

**Not Appropriate** ✔ **Appropriate** _____

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

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

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

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

Refuge Supervisor: _____ Date: March 18, 2016

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

**603 FW 1**
**Exhibit 1**
**Page 2**

## JUSTIFICATION FOR A FINDING OF APPROPRIATENESS OF A REFUGE USE

**Refuge Name:** Monomoy National Wildlife Refuge

**Use:** Stage Island Parking and Dinghy Storage

## NARRATIVE:

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

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

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

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

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

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

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

**FWS Form 3-2319**
**02/06**

## FINDING OF APPROPRIATENESS OF A REFUGE USE

**Refuge Name:** Monomoy National Wildlife Refuge

**Use:** Beachcombing

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

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

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

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

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

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

**Not Appropriate** _____ **Appropriate** ✔

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

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

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

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

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

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

**603 FW 1**
**Exhibit 1**
**Page 2**

## JUSTIFICATION FOR A FINDING OF APPROPRIATENESS OF A REFUGE USE

**Refuge Name:** Monomoy National Wildlife Refuge

**Use:** Beachcombing

## NARRATIVE:

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

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

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

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

# COMPATIBILITY DETERMINATION

## USE:

Beachcombing

## REFUGE NAME:

Monomoy National Wildlife Refuge

## DATE ESTABLISHED:

June 1, 1944

## ESTABLISHING AND ACQUISITION AUTHORITY(IES):

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

## REFUGE PURPOSE(S):

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

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

## NATIONAL WILDLIFE REFUGE SYSTEM MISSION:

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

## DESCRIPTION OF USE:

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

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

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

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

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

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

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

## AVAILABILITY OF RESOURCES:

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

## ANTICIPATED IMPACTS OF THE USE:

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

## PUBLIC REVIEW AND COMMENT:

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

## DETERMINATION (CHECK ONE BELOW):

_____Use is not compatible.

__**X**__Use is compatible with the following stipulations.

## STIPULATIONS NECESSARY TO ENSURE COMPATIBILITY:

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

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

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

## JUSTIFICATION:

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

## SIGNATURE:

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

## CONCURRENCE:

Regional Chief: Scott B Kahan (Signature) March 18, 2016 (Date)

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

## LITERATURE CITED:


Bélanger, L. and J. Bédard. 1990. Energetic cost of man-induced disturbance to staging snow geese. Journal of Wildlife Management 54(1): 36-41.

Bergstrom, P.W. 1991. Incubation temperatures of Wilson's plovers and killdeer. Condor 91: 634-641.

Boyle, S.A. and F.B. Samson. 1985. Effects of nonconsumptive recreation on wildlife: A review. Wildlife Society Bulletin 13: 110-116.

Burger, J. 1981. Effect of human activity on birds at a coastal bay. Biological Conservation 21: 231-241.

Burger, J. 1986. The effect of human activity on shorebirds in two coastal bays in northeastern United States. Biological Conservation 13: 123-130.

Burger, J. 1991. Foraging behavior and the effect of human disturbance on the piping plover *(Charadrius melodus)*. Journal of Coastal Research 7(1): 39-52.

Burger, J. and M. Gochfeld. 1981. Discrimination of the threat of direct versus tangential approach to the nest by incubating herring and great black-backed gulls. Journal of Comparative Physiological Psychology 95: 676-684.

Burger, J. and M. Gochfeld. 1998. Effects of ecotourists on bird behaviour at Loxahatchee National Wildlife Refuge, Florida. Environmental Conservation 25: 13-21.

Burger, J., M. Gochfeld, and L.J. Niles. 1995. Ecotourism and birds in coastal New Jersey: Contrasting responses of birds, tourists, and managers. Environmental Conservation 22: 56-65.

Cairns, W.E. and I.A. McLaren. 1980. Status of the piping plover on the east coast of North America. American Birds 34: 206-208.

Cape Cod National Seashore. 1993. Piping plover nest found trampled by pedestrian. News Release. Cape Cod National Seashore, South Wellfleet, Massachusetts. 2 pp.

Collazo, J.A., J.R. Walters, and J.F. Parnell. 1994. Factors Affecting Reproduction and Migration of Waterbirds on North Carolina Barrier Islands. 1993 Annual Progress Report. North Carolina State University, Raleigh, North Carolina. 57 pp.

Erwin, R. M. 1980. Breeding habitat by colonially nesting water birds in two mid-Atlantic U.S. regions under different regimes of human disturbance. Biological Conservation 18: 39-51.

Erwin, R.M. 1989. Responses to Human Intruders by Birds Nesting in Colonies: Experimental Results and Management Guidelines. Colonial Waterbirds 12(1): 104-108.

Goldin, M.R. 1993. Effects of human disturbance and off-road vehicles on piping plover reproductive success and behavior at Breezy Point, Gateway National Recreation Area, New York, M.S. Thesis. University of Massachusetts., Amherst, Massachusetts. 128 pp.

Harrington, B.A., and N. Drilling. 1996. Investigations of effects of disturbance to migratory shorebirds at migration stopover sites on the U.S. Atlantic Coast. A report to the U.S. Fish and Wildlife Service, Region 5, Migratory Bird Program. Hadley, Massachusetts. 87 pp.

Havera, S.P., L.R. Boens, M.M. Georgi, and R.T. Shealy. 1992. Human disturbance of waterfowl on Keokuk Pool, Mississippi River. Wildlife Society Bulletin 20: 290-298.

Henson, P.T. and A. Grant. 1991. The effects of human disturbance on trumpeter swan breeding behavior. Wildlife Society Bulletin 19: 248-257.

Hill, J.O. 1988. Aspects of breeding biology of Piping Plovers *(Charadrius melodus*) in Bristol County, Mass., in 1988. Unpublished report. University of Massachusetts, Amherst, Massachusetts. 44 pp.

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

Jenkins, D.C. and J. Burger. 1987. New Jersey Endangered Beach-Nesting Bird Project: 1986 Survey and Management. New Jersey Department of Environmental Protection, New Jersey. 37 pp.

Kaiser, M.S. and E.K. Fritzell. 1984. Effects of river recreationists on green-backed heron behavior. Journal of Wildlife Management 48: 561-567.

Kahl, R. 1991. Boating disturbance of canvasbacks during migration at Lake Poygan, Wisconsin. Wildlife Society Bulletin 19: 242-248.

Klein, M.L. 1993. Waterbird behavioral responses to human disturbance. Wildlife Society Bulletin 21: 31-39.

Klein, M.L., S.R. Humphrey, and H.F. Percival. 1995. Effects of ecotourism on distribution of waterbirds in a wildlife refuge. Conservation Biology 9: 1454-1465.

Knight, R.L. and D.N. Cole. 1995. Wildlife responses to recreationists. Pp. 51-69 in R.L. Knight and K.J. Gutzwiller, eds. Wildlife and recreationists: coexistence through management and research. Washington, DC, Island Press.

Korschgen, C.E., L.S. George, and W.L. Green. 1985. Disturbance of diving ducks by boaters on a migrational staging area. Wildlife Society Bulletin 13: 290-296.

Loegering, J.P. 1992. Piping Plover Breeding Biology, Foraging Ecology and Behavior on Assateague Island National Seashore, Maryland. M.S. Thesis. Virginia State Polytechnic Institute and State University, Blacksburg, Virginia. 262 pp.

McConnaughey, J.L., J.D. Fraser, S.D. Coutu, and J.P. Loegering. 1990. Piping plover distribution and reproductive success on Cape Lookout National Seashore. Unpublished report. Cape Lookout National Seashore, Morehead City, North Carolina. 83 pp.

Morton, J.M., A.C. Fowler, and R.L. Kilpatrick. 1989. Time and energy budgets of American black ducks in winter. Journal of Wildlife Management 53(2): 401-410.

Owen, M. 1973. The management of grassland areas for wintering geese. Wildfowl 24: 123-130.

Pfister, C., B.A. Harrington, and M. Lavine. 1992. The Impact of Human Disturbance on Shorebirds at a Migration Staging Area. Biological Conservation 60(2): 115-126.

Robertson, R J. and N.J. Flood. 1980. Effects of Recreational Use of Shorelines on Breeding Bird Populations. Canadian Field-Naturalist 94(2): 131-138.

Rodgers, J.A. and H.T. Smith. 1995. Set-back distances to protect nesting bird colonies from human disturbance in Florida. Conservation Biology 9: 89-99.

Rodgers, J.A. and H.T. Smith. 1997. Buffer zone distances to protect foraging and loafing waterbirds from human disturbance in Florida Wildlife Society Bulletin 25: 139-145.

Shaffer, F. and P. Laporte. 1992. Rapport synthese des recherches relatives au pluvier siffleur *(Charadrius melodus)* effectuees aux Iles-de-la-Madeleine de 1987 a 1991. Association quebecoise des groups d'ornithologues et Service canadien de la faune. 78 pp.

Strauss, E. 1990. Reproductive success, life history patterns, and behavioral variation in a population of Piping Plovers subjected to human disturbance (1982-1989). Ph.D. dissertation. Tufts University, Medford, Massachusetts.

U.S. Fish and Wildlife Service. 1985. Determination of endangered and threatened status for the piping plover. Federal Register 50: 50726-50734.

U.S. Fish and Wildlife Service. 1994. Guidelines for managing recreational activities in piping plover breeding habitat on the U.S. Atlantic coast to avoid take under Section 9 of the Endangered Species Act. Northeast Region, U.S. Department of the Interior, Fish and Wildlife Service, Hadley, Massachusetts.

U.S. Fish and Wildlife Service. 1996. Piping Plover *(Charadrius melodus),* Atlantic Coast Population, Revised Recovery Plan. Hadley, Massachusetts. 258 pp.

U. S. Fish and Wildlife Service. 2009. Piping Plover *(Charadrius melodus)*, 5-Year Review: Summary and Evaluation. U.S. Fish and Wildlife Service. Hadley, Massachusetts, and East Lansing, Michigan. 206 pp.

Ward, D.H. and R.A. Stehn. 1989. Response of Brant and other geese to aircraft disturbance at Izembek Lagoon, Alaska. U.S. Fish and Wildlife Service, Alaska Fish and Wildlife Research Center. Final report to the Minerals Management Service. Anchorage, Alaska. 193 pp.

Welty, J.C. 1982. The life of birds. Saunders College Publishing, Philadelphia, Pennsylvania. 754 pp.

Williams, G.J. and E. Forbes. 1980. The habitat and dietary preferences of dark-bellied brant geese and widgeon in relation to agricultural management. Wildfowl 31: 151-157.

**FWS Form 3-2319**
**02/06**

## FINDING OF APPROPRIATENESS OF A REFUGE USE

**Refuge Name:** Monomoy National Wildlife Refuge

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

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

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

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

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

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

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

**Not Appropriate** _____ **Appropriate** ✔

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

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

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

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

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

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

## JUSTIFICATION FOR A FINDING OF APPROPRIATENESS OF A REFUGE USE

**Refuge Name:** Monomoy National Wildlife Refuge

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

## NARRATIVE:

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

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

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

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

We do not expect pedestrian access to materially interfere with or detract from the mission of the National Wildlife Refuge System or diminish the purpose for which the refuge was established. It will not pose significant adverse effects on refuge resources, interfere with public use of the refuge, or cause an undue administrative burden. For these reasons, commercial guides, tours, outfitting, and ferry use are appropriate uses on Monomoy NWR.

# COMPATIBILITY DETERMINATION

## USE:

Commercial Tours, Ferry Service, Guided Trips, and Outfitting

## REFUGE NAME:

Monomoy National Wildlife Refuge

## DATE ESTABLISHED:

June 1, 1944

## ESTABLISHING AND ACQUISITION AUTHORITY(IES):

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

## REFUGE PURPOSE(S):

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

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

## NATIONAL WILDLIFE REFUGE SYSTEM MISSION:

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

## DESCRIPTION OF USE:

**(a) What is the use?**
This use is any fee-based service providing recreational, educational, or interpretive enjoyment of refuge lands and waters to the visiting public such as transportation, interpretation, educational materials, and programs. The services must aim to enhance the refuge visitor's knowledge and enjoyment of the key natural resources, including wilderness, and the mission of Monomoy National Wildlife Refuge (Monomoy NWR; refuge) and the U.S. Fish and Wildlife Service (Service)(USFWS), or other uses otherwise determined appropriate and compatible with the purposes for refuge establishment, including guided wildlife observation or photography, natural history or cultural history tours; transport of individual or groups (most commonly by boat) to or from refuge lands for recreational fishing, wildlife observation or photography, nature study or interpretation, and other wildlife-oriented activities, or hiking or walking to experience the naturalness or solitude of the Monomoy Wilderness; and guiding and outfitting other compatible outdoor activities on refuge lands such as, but not limited to, birding or recreational fishing and associated transportation (typically by boat) and

accommodations. Some of these typically commercial services will occur within the Monomoy Wilderness, and if so, they are determined to be necessary for realizing the recreational or other wilderness purposes of the Monomoy Wilderness. The use may be conducted by a Service conservation partner, concessionaire, or private company but will fall under the general heading of eco-tourism. In all cases, participants pay a fee to the individual guide, business, or a nonprofit organization for the unique skills, equipment, and expertise of the leader who enhances the experience of the participating individual or party on refuge lands.

**(b) Is the use a priority public use?**
Commercial tours and ferry services conducted by a concessionaire, guide, or outfitter are not priority public uses of the National Wildlife Refuge System under the National Wildlife Refuge System Administration Act of 1966 (16 U.S.C. § 668dd-668ee), as amended by the National Wildlife Refuge System Improvement Act of 1997 (Public Law 105-57). While not a priority use, this use does support several wildlife-dependent priority uses including waterfowl hunting, fishing, wildlife observation and photography, environmental education, and interpretation. The use constitutes a commercial enterprise within wilderness, however commercial services may be allowed in wilderness areas, per the Wilderness Act (Public Law 88-577), if they support recreational or other wilderness purposes.

**(c) Where would the use be conducted?**
The use would occur on any refuge lands or waters within the Declaration of Taking boundary that are open to public access, including the Monomoy Wilderness. Certain areas on Monomoy NWR are seasonally closed to public access, at the refuge manager's discretion, to protect sensitive habitats or species of concern, minimize conflicts with other refuge activities, or respond to human health and safety concerns. All commercial touring, ferry operations, guiding and outfitting activities will be restricted from access to sensitive areas prone to disturbance (e.g., sensitive vegetation areas) or degradation (e.g., soil compaction), and will be conducted in a manner that minimizes impacts to nesting birds or other breeding, feeding, or resting wildlife. Commercial ferry service, tours, guides, and outfitters transporting visitors to designated landing sites on North Monomoy Island and South Monomoy Island would originate from designated facilities either on the refuge (Morris Island), or from one or more off-refuge locations such as Outermost Harbor, Stage Harbor, Chatham Harbor, or Harwichport.

**(d) When would the use be conducted?**
The use will be largely seasonal and dictated by weather, and would occur during daylight hours when weather is appropriate generally from May through November. Monomoy NWR is open daily from 1/2-hour before sunrise to 1/2-hour after sunset, year-round. The Morris Island portion of the refuge is open for licensed recreational saltwater fishing 24 hours daily.

**(e) How would the use be conducted?**
Guided tours typically consist of an individual or group including a leader or guide walking on established trails or open refuge areas learning about plant and wildlife species, natural processes and wetlands, and cultural history such as the Monomoy Point Lighthouse and keeper's residence. For offshore tours, participants are ferried by boat to designated boat landing sites, and then hike to one or more intended destinations. Commercial guides may provide intensive, individual guidance to refuge visitors most often engaged in birding and recreational saltwater fishing, as the refuge is a prime birding, surf fishing, and fly fishing location. Guides may also be employed by individuals or groups to enhance priority public use experiences, including photography or bird watching. In all cases, participants pay a fee for the professional expertise, a unique skill or equipment, and transportation to refuge lands and waters. Tours are generally offered on a seasonal basis (seal and boat tours). Nonmotorized eco-tour outings to Monomoy via kayak, catamaran, or sailing offer future expansion potential to more fully realize recreational and other wilderness purposes, while preserving wilderness character.

All guides and tour operators would be required to obtain a permit (concession or special use), and comply with all refuge regulations and with State and Federal guidelines for terns, piping plovers, marine mammals, and coastal dune protection. Special use permits (SUP) are required for trips originating from offsite locations. Commercial fishing guides who operate only from boats and do not disembark passengers, make landfall or operate from shore are exempt from the requirement to obtain a permit prior to providing guide services to paying customers. A concession contract would be required for trips involving any exclusive use of refuge land and facilities for organizations, outfitters, and individual guides conducting tour activities on Monomoy NWR. All Monomoy NWR visitors are expected to stay apprised of and respect all closures and regulations. Information on annual, seasonal, and daily closures, known hazards, and other regulations will be disseminated from the Morris Island headquarters, and closures will be well-marked with informational signs or symbolic fencing.

**(f) Why is this use being proposed?**
Monomoy NWR is a world-renowned birding destination, a destination for seal and whale watching tours (and potentially great white shark tours), as well as the only coastal barrier complex unit in the National Wilderness Preservation System in New England, and remains a popular destination for recreational saltwater angling. A viable, local wildlife-fish tour and charter boat ecotourism industry emerged in the Chatham vicinity and established itself over the past two decades, with Monomoy as a focal point. The private sector stands willing and able to provide such services for a reasonable fee.

The refuge historically receives requests from one to five commercial operators and nonprofit organizations annually for permits to transport and guide individuals or groups of visitors on trips to Monomoy and surrounding waters within the Declaration of Taking boundary. Two permits have been issued annually, including to one company with access to parking, public restrooms, interpretive trails, and waterfront access on Morris Island (headquarters and visitor contact station). Visitation to the Morris Island site has grown as the popularity of both Monomoy NWR and the seal tour has increased over nearly two decades. Current refuge parking no longer accommodates the demand for spaces on most days during June through August, resulting in considerable traffic congestion at the Morris Island site and nearby private roadways, increased risk of vehicle-pedestrian accidents, and complaints from neighboring private property owners. There is no further opportunity to expand parking at the refuge Morris Island site. Overflow parking along the east public shoulder of Morris Island Road, while permitted by the town of Chatham, is not without hazards for motorists, pedestrians, bicyclists, and emergency responders.

Guided tours, outfitters, and ferry services are a way during daylight hours to get wildlife-dependent and fish-dependent recreation users to and from refuge destinations that are not otherwise accessible by foot. The Monomoy Wilderness offers areas with outstanding opportunities for unconfined, primitive, outdoor, day-use recreation and solitude, and the proposed use would aid wilderness users to realize those opportunities not otherwise possible. Tours and individual guided sessions will help visitors experience and engage and connect with the key resources of the refuge, including an enduring resource of wilderness. Allowing the use is expected to increase visitor understanding and appreciation of the refuge and its resources and compliance with refuge regulations. Limiting the use of refuge facilities at the headquarters site to a concessionaire will reduce congestion and provide more opportunity for other refuge visitors to find parking.

## AVAILABILITY OF RESOURCES:

The following breakdown shows the estimated amount of funds needed annually to administer the refugewide tour and ferry fee permits.

| | | |
|---|---|---|
| GS-11 Visitor Services Manager - permit issuance (concession solicitation/award and SUP processing | | |
| | 120 hours | $5,400 |
| **Total new costs** | | **$5,400** |
| GS-09 Visitor Services Assistant – permit administration, oversight and compliance checks | | |
| | 40 hours | $1,500 |
| GS-9 Biological Staff – use impact monitoring | 40 hours | $1,500 |
| Facility Maintenance | | $2,000 |
| Materials | | $1,000 |
| **Total recurring annual cost** | | **$6,000*** |

* Permit/concession fees will partially/wholly offset agency costs to administer the use.

## ANTICIPATED IMPACTS OF THE USE:

### *Commercial Tours, Guides, and Outfitting*

The access and activities resulting from the proposed use are virtually identical to those under the primary public uses, especially environmental education and interpretation, and the same levels of impacts are expected. Because the use will occur in accordance with refuge regulations and only in refuge areas open to the public, the impacts of commercial tours, ferry services, guides, and outfitters on natural resource and wilderness character will likely be minimal when conducted in accordance with refuge regulations. Possible wildlife and

fisheries impacts include disrupting nesting migratory bird populations, disrupting terns, shorebirds, and other bird populations feeding and resting near the trails during certain times of the year, trampling vegetation and soil, disrupting threatened larval northeastern beach tiger beetle populations, disturbing seals, and harvesting fish.

On Monomoy NWR, area closures are created to protect priority nesting migratory tern and shorebird species. Although these closure areas are designed to minimize human impacts, the potential exists for impacts to unobserved nesting animals. Conflicts arise when migratory birds and humans are present in the same areas (Boyle and Samson 1985). Response of wildlife to human activities includes departure from site (Owen 1973, Burger 1981, Kaiser and Fritzell 1984, Korschgen et al. 1985, Henson and Grant 1991, Kahl 1991, Klein 1993), use of suboptimal habitat (Erwin 1980, Williams and Forbes 1980), altered behavior (Burger 1981, Korschgen et al. 1985, Morton et al. 1989, Ward and Stehn 1989, Havera et al. 1992, Klein 1993), and increase in energy expenditure (Morton et al. 1989, Bélanger and Bédard 1990). Numerous studies have documented that migratory birds are disturbed by human activity on beaches. Erwin (1989) documented disturbance of common terns and skimmers and recommended that human activity be restricted to a distance of 100 meters around nesting sites. Pfister et al. (1992) found that the impact of disturbance was greater on species using the heavily disturbed front side of the beach, with the abundance of the impacted species being reduced by as much as 50 percent. In studying the effects of recreational use of shorelines on nesting birds, Robertson et al. (1980) discovered that disturbance negatively impacted species composition. Piping plovers, which intensively use the refuge, are also impacted negatively by human activity. Pedestrians on beaches may crush eggs (Jenkins and Burger 1987, Hill 1988, Shaffer and Laporte 1992, Cape Cod National Seashore 1993, Collazo et al. 1994). Other studies have shown that if pedestrians cause incubating plovers to leave their nest, the eggs can overheat (Bergstrom 1991) or the eggs can cool to the point of embryo death (Welty 1982). Pedestrians have been found to displace unfledged chicks (Strauss 1990, Burger 1991, Hoopes 1993, Loegering 1992, Goldin 1993).

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

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

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

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

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

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

Trash left on the beach, particularly food or wrappers, can attract predators that prey on nesting piping plovers and least terns or roosting shorebirds. Impacts of commercial tours, guides, and outfitters are likely to be minimal if conducted in accordance with refuge regulations. The refuge will manage refuge closures

that restrict pedestrian access to minimize disturbance to priority avian species during critical times of the year. Closures can be expanded or decreased as needed, depending on bird activity and results of further disturbance studies. The refuge is a leave-no-trace, carry-in-carry-out facility. We encourage all outfitters and guides to pack in and pack out all food containers, bottles, wrappers, trash, and other waste and refuse. Littering, dumping, and abandoning property are prohibited by Federal regulation at 50 CFR 27.93 and 50 CFR 27.94.

Foot travel for commercial tours, guides, and outfitting group trips occurs on old beach buggy trails, deer trails, and around designated closed areas for the purpose of studying plant or animal life. Trampling of some vegetation is likely.

Unmanaged hiking or walking has the potential to damage or kill plants and lead to new, unwanted, impromptu trails on the refuge that become shortcuts through more ecologically sensitive sites. Heavy use of designated, managed, or unmanaged pedestrian travel routes can ultimately lead to areas devoid of vegetation (McDonnell 1981, Vaske et al. 1992) and potentially destabilize dunes and interdunal wetlands, which are difficult to stabilize and restore to a naturally functioning condition (Kucinski and Einsenmenger 1943, Cole 2002, Goldsmith 2002, Grady 2002, O'Connell 2008).

Trampling has three initial effects: abrasion of vegetation, abrasion of surface soil organic layers, and soil compaction (Cole 2002). Plants can be crushed, sheared off, bruised, and even uprooted by trampling, leading to reduced vigor and reproduction, reduced or altered plant species composition and structure, and reduced biomass and cover (Cole 2002). Of these, abrasion of vegetation is the most common and noticeable effect observed in coastal dune communities, where little or no surface organic layer exists on the sandy soil substrate that naturally resists compaction (Fletcher 1993). All three impacts can commonly occur, however, within coastal marsh habitats where reduced wave energy allows significant accumulation of surface organic layers that are vulnerable to compaction (Fletcher 1993), which increases surface soil bulk density and reduces permeability. Increased ponding and muddy conditions tend to promote wider vegetative and soil impact zones along trails through wet areas (Cole 2002). McDonnell (1981) analyzed long-term human trampling, ranging from low to high intensity, on coastal dune vegetation at Parker River NWR in Massachusetts. All levels of trampling significantly lowered species diversity, and heavy trampling caused a drastic reduction in species diversity and total vegetation cover. Moderate trampling reduced species diversity but not cover. This was probably because moderate trampling favored some species, such as beach grass, over other, more sensitive species, such as beach-heather *(Hudsonia tomentosa)*. Trampling may result in changes in plant communities by preventing succession in interdune and backdune areas and favoring disturbance-tolerant foredune species like beach grass.

The harsh growing conditions and environment in the coastal barrier system can make for slow vegetative recovery even after pedestrian traffic is eliminated at trampled sites (Fletcher 1993). The gradient from no vegetation to normal cover levels is very narrow along refuge trails and other footpaths where trampling is more concentrated, and is wider at traditional boat landings where trampling is more dispersed. Hiking and walking are among the most primitive forms of recreation, and the trails themselves encourage users to confine their hiking or walking to narrow corridors radiating or looping outward from user focal areas such as beach access points or boat landings. Localized impacts concentrated near a small number of the most popular destinations do not pose any serious disruption to the barrier ecosystem composition, structure, and function, and are not evident at large spatial scales on Monomoy NWR.

Once established, the trails themselves are clear evidence of human presence that detracts from some users' perceptions of an otherwise untrammeled, undeveloped, or natural appearing landscape (Hendee and Dawson 2002) within the Monomoy Wilderness. Bare, exposed sand (dune areas) and potentially compacted (tidal marsh segments) trail treads and narrow zones of disturbed vegetation on either side of refuge foot trails and boat landings will be readily evident, but when trail standards are kept minimal, trails tend to be accepted or even expected by most, though not all, wilderness users (Stankey and Schreyer 1987, Cole 2002, Hendee and Dawson 2002). The majority of the Monomoy Wilderness will remain essentially unvisited and virtually undisturbed by hiking and walking. Pedestrian footpaths are not expected to substantially compromise the perception of naturalness of the Monomoy Wilderness landscape or the wilderness user's experience (Cole 2002, Hendee and Dawson 2002).

Wilderness visitors' experiences are most strongly affected by social conditions, such as other visitors and their actions, than by their perception of naturalness or ecological conditions (Hendee and Dawson 2002). Although hiking and walking are among the most primitive forms of recreation, the trails themselves tend toward

promoting a confining rather than an unconfined user experience (Hendee and Dawson 2002). With typically long sight distances across Monomoy's rolling nearly treeless coastal barrier landscape, too many individuals encountered or observed hiking or walking during visits by other Monomoy Wilderness users likely detracts from the sense of solitude experienced by wilderness users (Stankey and Schreyer 1987, Hendee and Dawson 2002). However, hiking and walking use is still currently very light in the more remote, interior portions of South Monomoy Island open to public use, where outstanding opportunities for solitude and unconfined, primitive, outdoor recreation can be experienced by other Monomoy Wilderness users.

Vegetation trampling and soil compaction impacts are a direct function of group size, which can be managed through permit or concession contract requirements. Participant safety and potential for excessive disturbance to disturbance-sensitive wildlife species also becomes more difficult for group leaders to control as the group size increases per guide or leader. The number and type of encounters by wilderness users with other users, which in part determines wilderness experience quality and solitude, also increases with increasing group size and as commercial tours, guides, and outfits gain popularity. The numbers of tours offered annually will be reviewed, evaluated, and restricted if necessary. At this time, the frequency of guided tours does not adversely impact the wilderness character of the Monomoy Wilderness.

Individuals hiking on South Monomoy Island could potentially impact the larval stage of the threatened northeastern beach tiger beetle. The recovery plan for this species describes that many of the species' habitats are threatened by human impacts such as habitat alteration and recreational activities (USFWS 1994). Larval burrows are especially susceptible to trampling, which results in excess energy expenditure and reduced hunting time for the inhabiting individual. We will continue to survey to determine the location and extent of larval beetle occurrence and habitat, and use closures and re-routing to avoid larval habitats, as warranted.

Pedestrian use also has the potential to disturb loafing seals. Gray and harbor seals haul out on the refuge year-round. We will enforce the 150-foot buffer around all seals as required by the National Oceanic Atmospheric Administration (NOAA) to ensure compliance with the Marine Mammals Protection Act.

### *Ferry Service*

The approach of a ferry, typically a 20- to 25-foot boat with an outboard engine, to pick up and discharge passengers creates a temporary disturbance to migratory birds feeding or loafing on the beach nearby. Ferry boat landing sites are designated outside of areas used heavily by nesting, feeding, and roosting terns, shorebirds, and colonial waterbirds. Any energy expended by migratory birds to avoid disturbance associated with beaching a ferry and loading and unloading passengers is negligible.

The untrammeled environment and solitude of the Monomoy Wilderness, accessible only by boat or lengthy hike along the barrier beach, make it unique among the protected areas on Cape Cod. Motorized boats operated by tour, ferry, charter guides, or outfitters approach and depart the designated shoreline landing sites through the shallows very slowly, which has the added effect of reducing engine noise and boat wake. Monomoy has an unusually low absorption capacity for human impacts. Lack of topographic relief and low vegetation mean that intrusions, including seeing and hearing other people, are often observable from a long distance. Providing visitors with a convenient way to get out to the islands may result in a diminished degree of solitude for some wilderness users, but should not adversely affect the overall wilderness character of the Monomoy Wilderness. There should be a negligible impact to fisheries as a result of commercial guiding and the fish they are harvesting.

## PUBLIC REVIEW AND COMMENT:

As part of the comprehensive conservation planning (CCP) process for the Monomoy NWR, a draft of this compatibility determination underwent a 180-day public comment period concurrent with the release of our draft CCP/Environmental Impact Statement (EIS). The compatibility determination was slightly modified and underwent a further 37-day public review period concurrent with the release of the final CCP/EIS. During this latter period, we received a comment on commercial fishing guides, and have subsequently clarified in this compatibility determination and the final CCP that the permitting requirement will not apply to commercial fishing guides who do not disembark passengers, make landfall or operate from shore.

## DETERMINATION (CHECK ONE BELOW):

_____Use is not compatible.

__X__Use is compatible with the following stipulations.

## STIPULATIONS NECESSARY TO ENSURE COMPATIBILITY:

- A fee greater than or equal to $250 will ordinarily be charged for SUPs, but may be fully or partially waived by the refuge manager. Concession contract fees will be the greater of a fixed franchise fee greater than or equal to $5,000 per year, or a percent of gross receipts greater than or equal to 5 percent and less than or equal to 20 percent.

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

- Tour, ferry, and guide boat operators will use only designated boat landing sites.

- Ferries will not operate at night or in dense fog conditions (1/4-mile visibility or less ) when a visitor could easily become disoriented and unknowingly violate a posted closed area. Regulations to ensure the safety of all participants will be included with permits or concession contracts; specific conditions that may apply to the requested activity will be addressed through the SUP or concession contract.

- All pedestrians must maintain a 150-foot buffer around all seals as required by the NOAA to ensure compliance with the Marine Mammals Protection Act. Boat operators will adhere to the Northeast Seal Watching Guidelines and other NOAA marine mammal viewing guidelines.

- Groups may be scheduled so as to avoid time or space conflicts with critical wildlife activities and each other. Currently, there is no restriction on the number of tour groups or visitors allowed on Monomoy at any one time. Refuge staff monitor public use and document any associated serious impacts.

- Refuge visitor information services and products will emphasize the importance of staying on trails and out of areas that are seasonally closed, along with providing “leave no trace” principles, practices and hiking tips. No physical items, including litter, will be placed or left on the refuge. No items will be removed from the refuge. Take only photos, leave only footprints.

- Refuge staff or volunteers will periodically qualitatively and photographically document pedestrian impacts to vegetation and soils to footpaths, boat landings, and other known user concentration points for use in drafting or updating a Monomoy Wilderness Stewardship Plan. If public use causes unacceptable environmental degradation or wildlife disturbance, we will implement appropriate limits on visitor numbers and tours.

- Tour routes will be monitored for impacts on wildlife or habitat and will be rerouted. Closed areas for wildlife sensitive to disturbance will be clearly posted, and tour group leaders will be provided with maps of the closures and refuge regulations.

## JUSTIFICATION:

Natural and cultural history activities and the ferry service that supports these activities generally support refuge purposes. The minor resource impacts attributed to these activities are generally outweighed by the benefits gained by educating present and future generations about refuge resources. Guided natural history tours are a public use management tool intended to develop a resource protection ethic within society. This tool allows us to educate refuge visitors about endangered and threatened species management, wildlife management, ecological principles, and communities. A secondary benefit of this use is that it instills a sense of ownership or stewardship in visitors, which helps reduce vandalism, littering, and poaching; it also strengthens Service visibility in the local community. Cultural history activities allow visitors to learn about the artifacts left in an area and also gain an appreciation for the lands involved and the refuge purpose. In addition, by allowing educational tours to occur on the islands, the Service is able to fulfill its obligation to maintain the Monomoy Point Light Station.

Issuing SUPs and concession permits for commercial guiding and outfitting does not significantly impact biological resources for which the refuge was established and requires no additional facilities. The administrative requirement is minimal. This activity has a positive effect on the overall interpretive, environmental education, and wildlife observation programs of the refuge, reaching a much larger audience. It would also produce a greater appreciation of wildlife resources in participants, and building relationships between the refuge and area businesses.

We do not expect pedestrian access to materially interfere with or detract from the mission of the Refuge System, nor diminish the purpose for which the refuge was established. It will not pose significant adverse effects on refuge resources, interfere with public use of the refuge, or cause an undue administrative burden. These uses would contribute to achieving refuge purposes and the Refuge System mission because they facilitate wildlife observation and photography and provide compatible recreational opportunities for visitors to observe and learn about wildlife and habitats firsthand.

Shifting channels, bars, and shoals, and strong ocean currents make boat travel between the Monomoy Islands and the mainland a challenge for even the most experienced mariner. Commercial ferries provide a safe alternative for visitors to explore beyond the mainland portion of the refuge. Visits to the islands occur during daylight hours only, particularly midday when migratory bird activity is diminished, and ferry service is offered May through September only. This activity as conducted on Monomoy NWR does not adversely affect the purposes for which this refuge was established.

**SIGNATURE:**

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

**CONCURRENCE:**

Regional Chief: Scott B. Kahan _____ March 18, 2016 _____
(Signature) (Date)

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

## LITERATURE CITED:

Bélanger, L. and J. Bédard. 1990. Energetic cost of man-induced disturbance to staging snow geese. Journal of Wildlife Management 54(1): 36-41.

Bergstrom, P.W. 1991. Incubation temperatures of Wilson's plovers and killdeer. Condor 91: 634-641.

Boyle, S.A. and F.B. Samson. 1985. Effects of non-consumptive recreation on wildlife: A review. Wildlife Society Bulletin 13:110-116.

Burger, J. 1981. The effect of human activity on birds at a coastal bay. Biological Conservation 21: 231-241.

Burger, J. 1986. The effect of human activity on shorebirds in two coastal bays in northeastern United States. Biological Conservation 13: 123-130.

Burger, J. 1991. Foraging behavior and the effect of human disturbance on the piping plover (*Charadrius melodus).* Journal of Coastal Research 7(1): 39-52.

Burger, J. and M. Gochfeld. 1981. Discrimination of the threat of direct versus tangential approach to the nest by incubating herring and great black-backed gulls. Journal of Comparative Physiological Psychology 95: 676-684.

Burger, J. and M. Gochfeld. 1998. Effects of ecotourists on bird behaviour at Loxahatchee National Wildlife Refuge, Florida. Environmental Conservation 25: 13-21.

Burger, J., M. Gochfeld, and L.J. Niles. 1995. Ecotourism and birds in coastal New Jersey: Contrasting responses of birds, tourists, and managers. Environmental Conservation 22: 56-65.

Cape Cod National Seashore. 1993. Piping plover nest found trampled by pedestrian. News Release. Cape Cod National Seashore, South Wellfleet, Massachusetts. 2 pp.

Cole, D.N. 2002. Ecological impacts of wilderness recreation and their management. Chapter 15, pp. 413-459 In J.C. Hendee and C.P. Dawson, eds. Wilderness Management: Stewardship and Protection of Resources and Values, Third Edition. Fulcrum Publishing, Golden, Colorado. 640 pp.

Collazo, J.A., J.R. Walters, and J.F. Parnell. 1994. Factors Affecting Reproduction and Migration of Waterbirds on North Carolina Barrier Islands. 1993 Annual Progress Report. North Carolina State University, Raleigh, North Carolina. 57 pp.

Erwin, R.M. 1980. Breeding habitat by colonially nesting water birds in two mid-Atlantic U.S. regions under different regimes of human disturbance. Biological Conservation 18: 39-51.

Erwin, R.M. 1989. Responses to Human Intruders by Birds Nesting in Colonies: Experimental Results and Management Guidelines. Colonial Waterbirds 12(1): 104-108.

Fletcher, P.C. 1993. Soil Survey of Barnstable County, Massachusetts. U.S. Department of Agriculture, Soil Conservation Service. 137 pp.

Goldin, M.R. 1993. Effects of human disturbance and off-road vehicles on piping plover reproductive success and behavior at Breezy Point, Gateway National Recreation Area, New York, M.S. Thesis. University of Massachusetts, Amherst, Massachusetts. 128 pp.

Goldsmith, W. 2002. History, theory and practice of bio-engineering in coastal areas. Pp. 37-59 In J.F. O'Connell, ed. Stabilizing Dunes and Coastal Banks using Vegetation and Bio-engineering: Proceedings of a Workshop held at the Woods Hole Oceanographic Institute, Woods Hole, Massachusetts. Cape Cod Cooperative Extension and Sea Grant at Woods Hole Oceanographic Institute. Technical Report WHOI-2002-11.

Grady, J. 2002. Dune vegetation planting and sand fencing: The Duxbury Beach Experience. Pp. 61-73. In J.F. O'Connell, ed. Stabilizing Dunes and Coastal Banks using Vegetation and Bio-engineering: Proceedings of a Workshop held at the Woods Hole Oceanographic Institute, Woods Hole, Massachusetts. Cape Cod Cooperative Extension and Sea Grant at Woods Hole Oceanographic Institute. Technical Report WHOI-2002-11.

Havera, S.P., L.R. Boens, M.M. Georgi, and R.T. Shealy. 1992. Human disturbance of waterfowl on Keokuk Pool, Mississippi River. Wildlife Society Bulletin 20: 290-298.

Hendee, J.C. and C.P. Dawson 2002. Wilderness Management: Stewardship and Protection of Resources and Values, Third Edition. Fulcrum Publishing, Golden, Colorado. 640 pp.

Henson, P.T. and A. Grant. 1991. The effects of human disturbance on trumpeter swan breeding behavior. Wildlife Society Bulletin 19: 248-257.

Hill, J.O. 1988. Aspects of breeding biology of Piping Plovers *(Charadrius melodus*) in Bristol County, Massachusetts, in 1988. Unpublished report. University of Massachusetts, Amherst, Massachusetts. 44 pp.

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

Jenkins, D. C. and J. Burger. 1987. New Jersey Endangered Beach-Nesting Bird Project: 1986 Survey and Management. New Jersey Department of Environmental Protection, New Jersey. 37 pp.

Kaiser, M.S. and E.K. Fritzell. 1984. Effects of river recreationists on green-backed heron behavior. Journal of Wildlife Management 48: 561-567.

Kahl, R. 1991. Boating disturbance of canvasbacks during migration at Lake Poygan, Wisconsin. Wildlife Society Bulletin 19: 242-248.

Klein, M.L. 1993. Waterbird behavioral responses to human disturbance. Wildlife Society Bulletin 21: 31-39.

Klein, M.L., S.R. Humphrey, and H.F. Percival. 1995. Effects of ecotourism on distribution of waterbirds in a wildlife refuge. Conservation Biology 9: 1454-1465.

Knight, R.L. and D.N. Cole. 1995. Wildlife responses to recreationists. Pp. 51-69 In R.L. Knight and D.N. Cole, eds. Wildlife and recreationists: coexistence through management and research. Island Press, Washington, D.C.

Knight, R.L. and K.J. Gutzwiller, eds. 1995. Wildlife and recreationalists: coexistence through management and research. Island Press, Washington, D.C. 372 pp.

Korschgen, C.E., L.S. George, and W.L. Green. 1985. Disturbance of diving ducks by boaters on a migrational staging area. Wildlife Society Bulletin 13: 290-296.

Kucinski, K.J. and W.S. Einsenmenger. 1943. Sand dune stabilization on Cape Cod. Economic Geography 19(2): 206-214.

Loegering, J.P. 1992. Piping Plover Breeding Biology, Foraging Ecology and Behavior on Assateague Island National Seashore, Maryland. M.S. Thesis. Virginia State Polytechnic Institute and State University, Blacksburg, Virginia. 262 pp.

McDonnell, M.J. 1981. Trampling effects on coastal dune vegetation in the parker river national wildlife refuge, Massachusetts, U.S.A. Biological Conservation 21(4): 289-301.

Morton, J.M., A.C. Fowler, and R.L. Kilpatrick. 1989. Time and energy budgets of American black ducks in winter. Journal of Wildlife Management 53: 401-410 (also see corrigendum in Journal of Wildlife Management 54: 683).

O'Connell, J. 2008. Coastal dune protection and restoration: using "Cape" American beachgrass and fencing. Woods Hole Sea Grant and Cape Cod Cooperative Extension. Marine Extension Bulletin. 15 pp.

Owen, M. 1973. The management of grassland areas for wintering geese. Wildfowl 24: 123-130.

Pfister, C., B.A. Harrington, and M. Lavine. 1992. The Impact of Human Disturbance on Shorebirds at a Migration Staging Area. Biological Conservation 60(2): 115-126.

Robertson, R.J. and N.J. Flood. 1980. Effects of Recreational Use of Shorelines on Breeding Bird Populations. Canadian Field-Naturalist 94(2): 131-138.

Rodgers, J.A. and H.T. Smith. 1995. Set-back distances to protect nesting bird colonies from human disturbance in Florida. Conservation Biology 9: 89-99.

Rodgers, J.A., and H.T. Smith. 1997. Buffer zone distances to protect foraging and loafing waterbirds from human disturbance in Florida. Wildlife Society Bulletin 25: 139-145.

Shaffer, F. and P. Laporte. 1992. Rapport synthese des recherches relatives au pluvier siffleur *(Charadrius melodus)* effectuees aux Iles-de-la-Madeleine de 1987 a 1991. Association quebecoise des groups d'ornithologues et Service canadien de la faune. 78 pp.

Stankey, G.H. and R. Schreyer. 1987. Attitudes toward wilderness and factors affecting visitor behavior: a state of knowledge review. In: Lucas, R.C., comp. Proceedings – National Wilderness Research Conference: Issues, State-of-Knowledge, Future Directions; July 23-26, 1985; Fort Collins, Colorado. Gen. Tech. Rep. INT-220. Ogden, Utah: U.S. Department of Agriculture, Forest Service, Intermountain Research Stations: 246-293.

Strauss, E. 1990. Reproductive success, life history patterns, and behavioral variation in a population of Piping Plovers subjected to human disturbance (1982-1989). Ph.D. dissertation. Tufts University, Medford, Massachusetts.

United States Fish and Wildlife Service (USFWS). 1994. Northeastern Beach Tiger Beetle *(Cincindela dorsalis dorsalis* Say) Recovery Plan. U.S. Fish and Wildlife Service, Hadley, Massachusetts. 6 pp.

Vaske J.V., R.D. Deblinger, and M.P. Donnelly. 1992. Barrier beach impact management planning: Findings from three locations in Massachusetts. Canadian Water Resources Assoc. Journal 17: 278-290.

Ward, D.H. and R.A. Stehn. 1989. Response of brant and other geese to aircraft disturbance at Izembek Lagoon, Alaska. U.S. Fish and Wildlife Service, Alaska Fish and Wildlife Research Center. Final report to the Minerals Management Service. Anchorage, Alaska. 193 pp.

Welty, J.C. 1982. The life of birds. Saunders College Publishing, Philadelphia, Pennsylvania. 754 pp.

Williams, G.J. and E. Forbes. 1980. The habitat and dietary preferences of dark-bellied brant geese and widgeon in relation to agricultural management. Wildfowl 31: 151-157.

**FWS Form 3-2319**
**02/06**

## FINDING OF APPROPRIATENESS OF A REFUGE USE

**Refuge Name:** Monomoy National Wildlife Refuge

**Use:** Commercial Wildlife and Landscape Filming and Photography

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

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

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

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

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

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

**Not Appropriate** _____ **Appropriate** ✔

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

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

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

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

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

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

**603 FW 1**
**Exhibit 1**
**Page 2**

## JUSTIFICATION FOR A FINDING OF APPROPRIATENESS OF A REFUGE USE

**Refuge Name:** Monomoy National Wildlife Refuge

**Use:** Commercial Wildlife and Landscape Filming and Photography

## NARRATIVE:

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

Although commercial filming and photography is not a priority public use, it can support interpretation which is a priority public use identified by the National Wildlife Refuge System Improvement Act of 1997. Commercial photography could support the mission of the National Wildlife Refuge System (Refuge System) by promoting an understanding and appreciation of natural and cultural resources and their management within a national system of refuges. Commercial filming and photography will reach many segments of the public to expand support for the Refuge System, including those who may never actually be able to visit the refuge.

Service Wilderness policy generally prohibits commercial photography in wilderness areas unless we determine it is necessary to provide educational information about wilderness uses and values and does not degrade the wilderness character of the area. In cases where we allow commercial photography, we manage the use through an audiovisual productions permit. Due to the difficulty accessing the more remote sections of the refuge, commercial filming and photography could directly support interpretation and education as well as promote wilderness character.

We do not expect limited commercial photography access to materially interfere with or detract from the mission of the Refuge System, nor diminish the purpose for which the refuge was established. It will not pose significant adverse effects on refuge resources, interfere with public use of the refuge, or cause an undue administrative burden.

Commercial filming and photography will have little to no affect on wilderness character when conducted in accordance with wilderness requirements, such as no motorized equipment or mechanical transport and only when necessary to provide educational information about wilderness uses and values. This activity does not alter the natural, scenic condition of the land and will not occur at a scale large enough to diminish the environment for native plants and animals. The most probable wilderness impact will be to other visitors whose solitude could be impacted by commercial photographers.

When conducted under a special permit with stipulations, and in compliance with refuge and wilderness, commercial wildlife and landscape filming and photography, both still and motion, are appropriate uses on Monomoy National Wildlife Refuge.

# COMPATIBILITY DETERMINATION

## USE:

Commercial Wildlife and Landscape Filming and Photography

## REFUGE NAME:

Monomoy National Wildlife Refuge

## DATE ESTABLISHED:

June 1, 1944

## ESTABLISHING AND ACQUISITION AUTHORITY(IES):

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

## REFUGE PURPOSE(S):

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

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

## NATIONAL WILDLIFE REFUGE SYSTEM MISSION:

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

## DESCRIPTION OF USE:

**(a) What is the use? Is the use a priority public use?**
The use is commercial photography, filming (including videography), and audio recording (collectively called "recording" for the purposes of this compatibility determination). This use has occurred in the past and we anticipate additional requests in the future. The use typically involves filming natural landscapes or wildlife or recording natural sounds for commercial or educational purposes. The primary focus of the production should be wildlife-related and provide educational information about wilderness uses and values (610 FW 2.12, Wilderness Stewardship Policy). Commercial photography would be allowed by special use permit (SUP) only when there is a direct benefit to the refuge or the U.S. Fish and Wildlife Service (Service); and in wilderness, only when necessary to provide educational information about wilderness uses and values and in a manner which does not degrade wilderness. The final creation would be produced for sale as a commercial product.

This use is regulated by Refuge Manual (RM) Part 8, Chapter 16 and the Code of Federal Regulations (CFR), Title 43, Subtitle A, Section 5.1. This is not a priority public use (National Wildlife Refuge System Improvement Act of 1997 (Refuge Improvement Act); Public Law 105-57); however, it may support and enhance other priority public uses.

**(b) Where would the use be conducted?**
This use could occur in any area of the refuge including wilderness. This could included parts of the refuge that are normally closed to public use.

**(c) When would the use be conducted?**
The use may occur during daylight hours during the year, unless otherwise specified in an SUP .

**(d) How would the use be conducted?**
Commercial filming requests will first be evaluated to determine whether an SUP should be granted. We generally prohibit commercial photography in wilderness unless we determine it is necessary to provide education information about wilderness uses and values. An evaluation of the necessity to conduct commercial wildlife and landscape filming and photography in the Monomoy Wilderness will be completed as part of the SUP, in compliance with 610 FW 2.

If permission is given to proceed, it will include stipulations to minimize the impact on cultural or natural resources or interference with other visitors to the area and to ensure compliance with wilderness policy. Requests must be submitted in writing to the refuge manager no less than 60 days prior to the requested date(s). Each request will be reviewed on a case-by-case basis and will require an SUP. There is a fee for issuance of commercial photography SUPs; the fee is adjusted on a case-by-case basis depending on the specific details of each permit. Commercial photographers will be required to use temporary or portable blinds to minimize disturbance to wildlife and to ensure wilderness character is not impacted.

**(e) Why is this use being proposed?**
Monomoy NWR and its designated wilderness is a scenic and beautiful landscape with tremendous opportunities for wildlife and landscape photography. It is not uncommon for refuge staff to receive requests to conduct commercial filming or commercial still photography on the refuge. Each request is evaluated on an individual basis, using a number of Department of the Interior, Service, and Refuge System policies (for example, 43 CFR Part 5, 50 CFR Part 7, 8 RM 16). In addition, much of the refuge is designated wilderness area.

## AVAILABILITY OF RESOURCES:

In general, the refuge will normally incur no expense except administrative costs for review of applications, issuance of a SUP, and staff time to conduct compliance checks. Commercial wildlife and landscape filming and photography would need to be managed in coordination with the existing staff, which is anticipated to be sufficient for the expected permitting workload.

| **Recurring annual costs:** | | | |
|---|---|---|---|
| GS-11 Visitor Services Manager | 1 staff | 40 hours | $1,800 |
| GS-9 Visitor Services Specialist | 1 staff | 20 hours | $ 750 |
| GS-11 Law Enforcement | 1 staff | 10 hours | $ 450 |
| **Total recurring annual costs:** | | | **$3,000** |

## ANTICIPATED IMPACTS OF THE USE:

Public uses, such as commercial photography, can produce short-term, negative, direct or indirect impacts on wildlife or habitats. However, we believe the long-term benefits from the conservation nature of the products could be greater. Projects will be conducted at the appropriate time of year and conditions to minimize disturbances and incorporate other best management practices.

The majority of the impact from commercial photography will be disturbance caused to resting, feeding, or nesting migratory birds and resting seals or the handling of horseshoe crabs in the waters off Morris Island. There will be some trampling of vegetation. On Morris Island, with use restricted to designated trails and other refuge structures, we predict the impacts will be confined to small areas and in areas already affected.

Permittees may be authorized to utilize new structures located outside the Monomoy Wilderness. These structures will be located to minimize the long-term consequences and cumulative impacts to wildlife and habitats. Most of the new structures proposed, e.g., kiosks, observation platforms, photography blinds, would each result in habitat losses of less than 1/4-acre.

Permittees engaged in commercial filming and photography have a vested interest in minimizing disturbance to the wildlife they wish to observe and photograph. However, photographers are known to disturb wildlife in an attempt to get closer looks or higher quality images of their subjects. Any SUPs issued by the refuge manager will clearly state the parameters of access and, if these conditions are found to be violated, the permit will be immediately voided and the permittee denied any future permits. On North Monomoy Island and South Monomoy Island in particular, pedestrians have the potential of impacting shorebird, waterfowl, and other migratory bird populations feeding and resting on beaches and tidal flats. Pedestrians can also impact seals resting on the beach if they get too close. Conflicts arise when migratory birds and humans are present in the same areas (Boyle and Samson 1985). Response of wildlife to human activities includes departure from site (Owen 1973, Burger 1981, Kaiser and Fritzell 1984, Korschgen et al. 1985, Henson and Grant 1991, Kahl 1991, Klein 1993), use of sub-optimal habitat (Erwin 1980, Williams and Forbes 1980), altered behavior (Burger 1981, Korschgen et al. 1985, Morton et al. 1989, Ward and Stehn 1989, Havera et al. 1992, Klein 1993), and increase in energy expenditure (Morton et al. 1989, Bélanger and Bédard 1990).

Numerous studies have documented that migratory birds are disturbed by human activity on beaches. Erwin (1989) documented disturbance of common terns and skimmers and recommended that human activity be restricted to a distance of 100 meters around nesting sites. In studying waterbird response to human disturbance, Klein (1993) found that, as intensity of disturbance increased, avoidance response by the birds increased, and found out-of-vehicle activity to be more disruptive than vehicular traffic. Pfister et al. (1992) found the impact of disturbance was greater on species using the heavily disturbed front side of the beach, with the abundance of the impacted species being reduced by as much as 50 percent. In studying the effects of recreational use of shorelines on nesting birds, Robertson et al. (1980) discovered that disturbance negatively impacted species composition. Piping plovers, which intensively use the refuge, are also impacted negatively by human activity. Pedestrians on beaches may crush eggs (Jenkins and Burger 1987, Hill 1988, Shaffer and Laporte 1992, Cape Cod National Seashore 1993, Collazo et al. 1994). Dogs may chase plovers (McConnaughey et al. 1990), destroy nests (Hoopes 1993), and kill chicks (Cairns and McLaren 1980). Other studies have shown that if pedestrians cause incubating plovers to leave their nest, the eggs can overheat (Bergstrom 1991) or can cool to the point of embryo death (Welty 1982). Pedestrians have been found to displace unfledged chicks (Strauss 1990, Burger 1991, Hoopes 1993, Loegering 1992, Goldin 1993).

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

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

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

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

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

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

The proposed use has the potential of intermittently interrupting the feeding habits of a variety of shorebirds, gulls, and terns, but encounters between pedestrians and migratory birds will be temporary. Refuge staff will manage public and permittee access via seasonal closures to minimize disturbance to nesting, resting, and foraging waterbirds on the refuge.

Permit holders could potentially impact the larval stage of the threatened northeastern beach tiger beetle. The recovery plan for this species describes that many of the species' habitats are threatened by human impacts such as habitat alteration and recreational activities (USFWS 1994). Larval burrows are especially susceptible to trampling; for the inhabiting individual, this results in excess energy expenditure and reduced time hunting. We will continue to survey to determine the location and extent of larval beetle occurrence and habitat, and use closures and re-routing to avoid larval habitats, as warranted.

Commercial wildlife and landscape filming and photography also has the potential to disturb loafing seals. Gray and harbor seals haul out on the refuge year-round. A 150-foot buffer around all seals is required by the National Oceanic Atmospheric Administration to ensure compliance with the Marine Mammals Protection Act.

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

When conducted under an SUP, commercial wildlife and landscape filming and photography will have little to no affect on wilderness character. This activity does not alter the natural, scenic condition of the land and will not occur at a scale large enough to diminish the environment for native plants and animals. The most likely wilderness impact will be to other visitors who witness the photography. Since the refuge will be utilizing an SUP process for all commercial filming and photography, the manager may revoke or deny any permits or applications if there is any question on disturbance to wildlife or if a permittee violates permit stipulations.

## PUBLIC REVIEW AND COMMENT:

As part of the comprehensive conservation planning (CCP) process for the Monomoy NWR, a draft of this compatibility determination underwent a 180-day public comment period concurrent with the release of our draft CCP/Environmental Impact Statement (EIS). The determination was slightly revised and underwent a further 37-day public review period concurrent with the release of the final CCP/EIS. No comments were received on this compatibility determination and it has remained unchanged.

## DETERMINATION (CHECK ONE BELOW):

_____Use is not compatible.

__X__Use is compatible with the following stipulations.

## STIPULATIONS NECESSARY TO ENSURE COMPATIBILITY:

- Only commercial filming and photography in support of conservation, refuge purposes, and the Refuge System Mission. If proposed for wilderness, we must determine it is necessary to provide educational information about wilderness uses and values and does not degrade the wilderness character of the area. Mechanized transport or motorized equipment will rarely be allowed, and only if determined to be the minimum necessary to preserve wilderness character and safely administer the refuge.

- Stipulations are listed as "Special Conditions" in the SUP. All permit holders must follow refuge regulations.

- Commercial wildlife and landscape filming and photography is administered through an SUP issued on a case-by-case basis. A fee will be charged and must be paid before the SUP will be issued. Prior to issuing an SUP, the refuge manager is required to submit an audiovisual production permit request through the Service's regional office. All activities must comply with 8 RM 16 and 43 CFR, Subtitle A, Section 5.1 and may require completion of a Commercial Audio-Visual Production Application and posting of a bond.

- All commercial filming and photography activities will avoid sensitive areas prone to disturbance (e.g., sensitive vegetation areas) or degradation (e.g., soil compaction), and will be designed to minimize impacts to nesting birds or other breeding, feeding, or resting wildlife. There are certain times of the year when the refuge is critically important to migratory birds, including threatened and endangered species. The location of the most important nesting, staging and migratory stopover (foraging and resting) habitat varies depending on a number of natural factors (e.g., weather, landform, prey distribution and abundance, and predator presence) as well as human disturbance at other sites. Refuge staff will evaluate the disturbance pressure to migratory birds caused by the presence of individuals engaged in this use. To ensure that this use remains compatible, meaning it does not materially interfere with or detract from the migratory bird purpose of the refuge, it may be necessary to restrict access through the implementation of seasonal and/or area closures. The location and size of these closures are not fixed and will vary over time.

- Access to the refuge in areas and at times not permitted to the general public may be granted in the SUP depending upon the needs of the production, the availability of suitable location(s), and refuge operations and resources. All areas and times not specifically permitted are off-limits for recording. Permittees must follow the conditions outlined in the permit, which normally includes notification of refuge personnel each time any activity occurs in closed areas. Use of a closed area will be heavily restricted to reduce disturbance to wildlife. Sites for photo shoots will be submitted in advance and approved by the refuge manager.

- Activities will be held on designated sites where only minimal direct and short-term impacts are predicted. No commercial filming activity should result in long-term negative alterations to species' behavior (e.g. result in wildlife leaving previously occupied areas for a long term; modifying their habitat use within their range; or, causing nest or young abandonment). No project should degrade wildlife habitat, including vegetation, soils, and water. Nest, dens, and burrows must not be harmed. No commercial filming activities should result in soil compaction or erosion, degrade water quality, remove or destroy vegetation, involve off-road vehicle use, or result in collection and removal of animals or whole native plants.

- Periodic evaluations will be done to insure that permittees are not causing unacceptable adverse impacts. If evidence of unacceptable impacts occur, access would be modified or curtailed as deemed necessary by the refuge manager.

- Permittees must use approved modes of access, for example, on foot or by ferry, boats, or paddling.

- All work with endangered species will require the proper permits from Federal or State government. Any commercial filming activities involving federally listed species may require Section 7 consultation under the Endangered Species Act. Any research involving ground disturbance may require historic preservation consultation with the Regional Historic Preservation Officer and/or State Historic Preservation Officer.

- Blinds will be required for all areas that are not open to the public. No sound-making or lighting devices will be permitted.

- Prior to recording, the permittee will provide the refuge manager with a copy of their current liability insurance policy. The refuge must be named as an additional insured on the policy for the duration of the production.

- Permittees must have the SUP in their possession at all times while on the refuge. A copy of the permit must also be prominently displayed on the dash of permittee's vehicle(s) at all times while on the refuge. The permit must be presented to refuge officials upon request.

- The permit is not transferable.

- Occasional law enforcement patrol and regular staff presence should minimize potential violations. The refuge is open 1/2- hour before sunrise to 1/2-hour after sunset. These restrictions will be maintained. Refuge regulations will be posted and enforced.

- The refuge is a leave-no-trace, carry in-carry out facility. All food containers, bottles, and other waste and refuse must be taken out. Littering, dumping, and abandoning property are prohibited by Federal regulation at 50 CFR 27.93 and 50 CFR 27.94.

## JUSTIFICATION:

Commercial photography can provide educational information about wilderness uses and values, and support the mission of the Refuge System by promoting an understanding and appreciation of natural and cultural resources and their management within a national system of refuges. Commercial photography will reach many segments of the public to expand support for the refuge system, including those who may never actually be able to visit the refuge. Individual refuge programs will be consistent with, and fully support, the goals and objectives in the Monomoy NWR Comprehensive Conservation Plan.

We do not expect commercial filming and still photography access to degrade the wilderness character of the area, materially interfere with or detract from the mission of the Refuge System, nor diminish the purpose for which the refuge was established. It will not pose significant adverse effects on refuge resources, interfere with public use of the refuge, or cause an undue administrative burden. These uses would contribute to achieving refuge purposes and the Refuge System mission because they facilitate wildlife photography and interpretation and promote compatible recreational opportunities for visitors to observe and learn about wildlife and habitats firsthand and secondhand.

This program as described is determined to be compatible. Any potential negative impacts of commercial wildlife and nature photography activities on refuge resources will be minimized by the restrictions included in the conditions of the SUP. In addition, the activities associated with commercial photography will be regulated and monitored by refuge staff.

The Service permits commercial wildlife and landscape filming and photography where it would further outreach, education, or public understanding of the natural environment, refuge resources and management, wilderness, or the Refuge System and Service's missions. No approvals for a permit would occur until the refuge manager can insure those benefits would result.

As such, all approved commercial wildlife and landscape filming and photography will contribute to the goals of the refuge and Refuge System, and will not materially interfere with or detract from the mission of the Refuge System or the purposes for which the refuge was established.

**SIGNATURE:**

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

**CONCURRENCE:**

Regional Chief: Scott B. Kahan (Signature) March 18, 2016 (Date)

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

**LITERATURE CITED:**

Bélanger, L. and J. Bédard. 1990. Energetic cost of man-induced disturbance to staging snow geese. Journal of Wildlife Management. 54: 36.

Bergstrom, P.W. 1991. Incubation temperatures of Wilson's plovers and killdeer. Condor. 91: 634-641.

Boyle, S.A. and F.B. Samson. 1985. Effects of nonconsumptive recreation on wildlife: A review. Wildlife Society Bulletin. 13: 110.

Burger, J. 1981. The effect of human activity on birds at a coastal bay. Biological Conservation. 21: 231-241.

Burger, J. 1986. The effect of human activity on shorebirds in two coastal bays in northeastern United States. Biological Conservation 13: 123-130.

Burger, J. 1991. Foraging behavior and the effect of human disturbance on the piping plover (*Charadrius melodus*). Journal of Coastal Research, 7(1): 39-52.

Burger, J. and M. Gochfeld. 1981. Discrimination of the threat of direct versus tangential approach to the nest by incubating herring and great black-backed gulls. Journal of Comparative Physiological Psychology. 95: 676-684.

Burger, J., M. Gochfeld, and L.J. Niles. 1995. Ecotourism and birds in coastal New Jersey: Contrasting responses of birds, tourists, and managers. Environmental Conservation 22: 56-65.

Burger, J. and M. Gochfeld. 1998. Effects of ecotourists on bird behaviour at Loxahatchee National Wildlife Refuge, Florida. Environmental Conservation 25: 13-21.

Cairns, W.E. and I.A. McLaren. 1980. Status of the piping plover on the east coast of North America. American Birds. 34: 206-208.

Cape Cod National Seashore. 1993. Piping plover nest found trampled by pedestrian. News Release. Cape Cod National Seashore, South Wellfleet, Massachusetts. 2 pp.

Collazo, J.A., J.R. Walters, and J.F. Parnell. 1994. Factors Affecting Reproduction and Migration of Waterbirds on North Carolina Barrier Islands. 1993 Annual Progress Report. North Carolina State University, Raleigh, North Carolina. 57 pp.

Erwin, R.M. 1980. Breeding habitat by colonially nesting water birds in two mid-Atlantic U.S. regions under different regimes of human disturbance. Biological Conservation. 18: 39-51.

Erwin, R.M. 1989. Responses to Human Intruders by Birds Nesting in Colonies: Experimental Results and Management Guidelines. Colonial Waterbirds 12(1): 104-108.

Goldin, M.R. 1993. Effects of human disturbance and off-road vehicles on piping plover reproductive success and behavior at Breezy Point, Gateway National Recreation Area, New York, M.S. Thesis. University of Massachusetts, Amherst, Massachusetts. 128 pp.

Havera, S.P., L.R. Boens, M.M. Georgi, and R.T. Shealy. 1992. Human disturbance of waterfowl on Keokuk Pool, Mississippi River. Wildlife Society Bulletin. 20: 290-298.

Henson, P.T. and A. Grant. 1991. The effects of human disturbance on trumpeter swan breeding behavior. Wildlife Society Bulletin 19: 248-257.

Hill, J.O. 1988. Aspects of breeding biology of Piping Plovers (*Charadrius melodus*) in Bristol County, Massachusetts, in 1988. Unpublished report. University of Massachusetts, Amherst, Massachusetts. 44 pp.

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

Jenkins, D.C. and J. Burger. 1987. New Jersey Endangered Beach-Nesting Bird Project: 1986 Survey and Management. New Jersey Department of Environmental Protection, New Jersey. 37 pp.

Kaiser, M.S. and E.K. Fritzell. 1984. Effects of river recreationists on green-backed heron behavior. Journal of Wildlife Management. 48: 561-567.

Kahl, R. 1991. Boating disturbance of canvasbacks during migration at Lake Poygan, Wisconsin. Wildlife Society Bulletin. 19: 242-248.

Klein, M.L. 1993. Waterbird behavioral responses to human disturbance. Wildlife Society Bulletin. 21: 31-39.

Klein, M.L., S.R. Humphrey, and H.F. Percival. 1995. Effects of ecotourism on distribution of waterbirds in a wildlife refuge. Conservation Biology 9: 1454-1465.

Knight, R.L. and D.N. Cole. 1995. Wildlife responses to recreationists. Pp. 51-69 in R.L. Knight and K.J. Gutzwiller, eds. Wildlife and recreationists: coexistence through management and research. Washington, DC, Island Press.

Korschgen, C.E., L.S. George, and W.L. Green. 1985. Disturbance of diving ducks by boaters on a migrational staging area. Wildlife Society Bulletin. 13: 290-296.

Loegering, J.P. 1992. Piping Plover Breeding Biology, Foraging Ecology and Behavior on Assateague Island National Seashore, Maryland. M.S. Thesis. Virginia State Polytechnic Institute and State University, Blacksburg, Virginia. 262 pp.

McConnaughey, J.L., J.D. Fraser, S.D. Coutu, and J.P. Loegering. 1990. Piping plover distribution and reproductive success on Cape Lookout National Seashore. Unpublished report. Cape Lookout National Seashore, Morehead City, North Carolina. 83 pp.

Morton, J.M., A.C. Fowler, and R.L. Kilpatrick. 1989. Time and energy budgets of American black ducks in winter. Journal of Wildlife Management. 53: 401-410 (also see corrigendum in Journal of Wildlife Management. 54: 683).

Owen, M. 1973. The management of grassland areas for wintering geese. Wildfowl. 24:123-130.

Pfister, C., B.A. Harrington, and M. Lavine. 1992. The Impact of Human Disturbance on Shorebirds at a Migration Staging Area. Biological Conservation 60(2): 115-126.

Robertson, R.J. and N.J. Flood. 1980. Effects of Recreational Use of Shorelines on Breeding Bird Populations. Canadian Field-Naturalist 94(2): 131-138.

Rodgers, J.A. and H.T. Smith. 1995. Set-back distances to protect nesting bird colonies from human disturbance in Florida. Conservation Biology 9: 89-99.

Rodgers, J.A., and H.T. Smith. 1997. Buffer zone distances to protect foraging and loafing waterbirds from human disturbance in Florida. Wildlife Society Bulletin 25: 139-145.

Shaffer, F. and P. Laporte. 1992. Rapport synthese des recherches relatives au pluvier siffleur (*Charadrius melodus*) effectuees aux Iles-de-la-Madeleine de 1987 a 1991. Association quebecoise des groups d'ornithologues et Service canadien de la faune. 78 pp.

Strauss, E. 1990. Reproductive success, life history patterns, and behavioral variation in a population of Piping Plovers subjected to human disturbance (1982-1989). Ph.D. dissertation. Tufts University, Medford, Massachusetts.

United States Fish and Wildlife Service (USFWS). 1994. Northeastern Beach Tiger Beetle (*Cincindela dorsalis dorsalis* Say) Recovery Plan. U.S. Fish and Wildlife Service, Hadley, Massachusetts. 6pp.

Ward, D.H. and R.A. Stehn. 1989. Response of brant and other geese to aircraft disturbance at Izembek Lagoon, Alaska. U.S. Fish and Wildlife Service, Alaska Fish and Wildlife Research Center. Final report to the Minerals Management Service. Anchorage, Alaska. 193 pp.

Welty, J.C. 1982. The life of birds. Saunders College Publishing, Philadelphia, Pennsylvania. 754 pp.

Williams, G.J. and E. Forbes. 1980. The habitat and dietary preferences of Dark-Bellied Brent Geese and Widgeon in relation to agricultural management. Wildfowl. 31: 151-157.

**FWS Form 3-2319**
**02/06**

## FINDING OF APPROPRIATENESS OF A REFUGE USE

**Refuge Name:** Monomoy National Wildlife Refuge

**Use:** Dog Walking on Morris Island

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

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

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

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

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

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

**Not Appropriate** _____ **Appropriate** ✔

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

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

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

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

Refuge Supervisor: Gretchen Taylor Date: March 18, 2016

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

## JUSTIFICATION FOR A FINDING OF APPROPRIATENESS OF A REFUGE USE

**Refuge Name:** Monomoy National Wildlife Refuge

**Use:** Dog Walking on Morris Island

## NARRATIVE:

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

Dog walking (on leash) has been authorized on the Morris Island area of Monomoy National Wildlife Refuge (NWR, refuge) for many years. The Service will continue to allow dogs on leash on Morris Island only from September 16 to April 30. This is consistent with town of Chatham regulations and is a time period when less wildlife is found on the Morris Island part of the refuge. We will not allow dogs on any other sections of the refuge at any time of the year. Many people who enjoy walking on refuge trails and along the beachfront bring their canine companions along with them. Although dogs can increase disturbance to wildlife, the refuge enforces a leash restriction to keep the dog localized and under control at all times by the pedestrian. Limiting dog walking to Morris Island trails will also keep potential disturbance to a minimum.

As part of our rationale for not allowing dogs on North Monomoy and South Monomoy Island, it has been demonstrated that dogs can have a significant impact on wildlife. Jones and Stokes (1977) demonstrated that domesticated dogs have serious detrimental impacts on local concentrated nesting bird populations. Studies have demonstrated that dogs can, and do, flush incubating birds from nests with possible serious consequences to declining bird populations (Yalden and Yalden 1990, Soluri 1994, Gill 1994). Further, the presence of domesticated dogs can disrupt breeding displays (Baydack 1986), disrupt foraging activity in shorebirds (Hoopes 1993), and disturb roosting activity in ducks (Keller 1991). Other studies have shown that even when dogs are restrained on leash, they have the ability to displace native migratory bird species from natural habitats and cause a depauperate local bird fauna (Banks and Bryan 2007).

Additionally, a study of shorebird disturbance from humans and dogs found that gulls recovered faster from disturbance than did smaller shorebird species (Burger et al. 2007). This rapid recovery time could give competitive advantage to gulls for prime habitat over other shore birds that are a focus of refuge management goals. In winter, the energy expenditure used by birds to avoid dogs, which are seen as potential predators, is unnecessary and avoidable and could contribute to reduced survivability. Dog waste is unsightly for refuge visitors, and can transmit diseases that may threaten the health of some wildlife and other domesticated animals. The refuge does not provide receptacles for animal waste, which if left along the refuge's single small trail, diminishes the quality of the visitor's wildlife recreational experience. Domestic dogs can potentially introduce various diseases (distemper, parvovirus, rabies) and transport parasites into wildlife habitats (Sime 1999). Additionally, not all refuge visitors are pet friendly, and unrestrained dogs can disturb refuge visitors.

Continuing to allow this use will provide the public with additional options for enjoying the great outdoors and possibly introduce new people to Monomoy NWR and the priority use of wildlife observation. For these reasons, we have determined that allowing dog walking on the refuge is consistent with the Service's policy on the appropriateness of refuge uses (603 FW 1).

## LITERATURE CITED

Banks, P.B. and J. V. Bryant. 2007. Four-legged friend or foe? Dog walking displaces native birds from natural areas. Biology Letters 3: 611-613.

Baydack, R.K. 1986. Sharp-tailed grouse response to lek disturbance in the Carberry Sand Hills of Manitoba. Colorado State University, Fort Collins, Colorado.

Burger, J., S.A. Carlucci, C.W. Jeitner, and L. Niles. 2007. Habitat Choice, Disturbance, and Management of Foraging Shorebirds and Gulls at a Migratory Stopover. Journal of Coastal Research. 23: 1159-1166.

Gill, M. 1994. Bird Flushing by Dogs at Proposed Eastshore State Park: Can They All Just Get Along? In Contemporary Topics in Environmental Sciences. D. Sloan, E. Edlund, M. Christensen, K. Taylor, eds. University of California, Berkeley, Berkeley, California.

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

Jones and Stokes Associates. 1977. Dog Depredation on Wildlife and Livestock in California. California Department of Fish and Game. Jones and Stokes, Sacramento, California. 64 pp.

Keller, V. 1991. Effects of human disturbance on eider ducklings *Somateria mollissima* in estuarine habitat in Scotland. Biological Conservation 58: 213-228.

Sime, C.A. 1999. Domestic Dogs in Wildlife Habitats. Pp. 8.1-8.17 in G. Joslin and H. Youmans, coords. Effects of recreation on Rocky Mountain wildlife: A Review for Montana. Committee on Effects of Recreation on Wildlife, Montana Chapter of the Wildlife Society.

Soluri, P.M. 1994. Bird Flushing at Hoffman Marsh. In Contemporary Topics in Environmental Sciences. D. Sloan, E. Edlund, M. Christensen, K. Taylor, eds. University of California, Berkeley, Berkeley, California.

# COMPATIBILITY DETERMINATION

## USE:

Dog Walking on Morris Island

## REFUGE NAME:

Monomoy National Wildlife Refuge

## DATE ESTABLISHED:

June 1, 1944

## ESTABLISHING AUTHORITIES:

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

## PURPOSE(S) FOR WHICH ESTABLISHED:

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

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

## MISSION OF THE NATIONAL WILDLIFE REFUGE SYSTEM:

"To administer a national network of lands and waters for the conservation, management, and where appropriate, restoration of the fish, wildlife, and plant resources and their habitats within the United States for the benefit of present and future generations of Americans." (16 U.S.C. 668dd-668ee) (National Wildlife Refuge System Administration Act of 1966).

## DESCRIPTION OF USE:

**(a) What is the use? Is the use a priority public use?**
The use is dog walking. Dog walking is not a priority public use of National Wildlife Refuge System (Refuge System) under the National Wildlife Refuge System Administration Act of 1966 (16 U.S.C. 668dd-668ee), as amended by the National Wildlife Refuge System Improvement Act of 1997 (Refuge Improvement Act) (Public Law 105-57).

**(b) Where will the use be conducted?**
Dog walking (on leash) will be permitted on the Morris Island area of Monomoy National Wildlife Refuge (NWR). We will not allow dogs on any other sections of the refuge including North Monomoy Island, South Monomoy Island, and Minimoy Island at any time of the year.

**(c) When will the use be conducted?**
The Service will continue to allow dogs on leash on Morris Island only from September 16 to April 30, during the refuge's normal open hours. The refuge is open daily sunrise to sunset. This is consistent with town of Chatham regulations and is a time period when less wildlife is found on the Morris Island part of the refuge.

**(d) How will the use be conducted?**
Dog walkers will be allowed to walk their dogs only when the dog is attached to a 6-foot (or shorter) leash and the dog walker is in control of the leash and dog at all times. This leash requirement will be enforced to minimize wildlife and visitor disturbance. All dog walkers with properly leashed dogs will be restricted to Morris Island refuge trails.

**(e) Why is the use being proposed?**
This is an ongoing use of the refuge, and has been occurring without any evidence that it is disruptive or causing any damage. The Service will continue to allow dogs on leash on Morris Island only from September 16 to April 30, during the refuge's normal open hours. It has been a long time tradition for residents of the local community to use these portions of the refuge for this activity building strong local support and allowing an excellent opportunity to educate dog walkers about the refuge and the Refuge System.

## AVAILABLITY OF RESOURCES:

Except for maintaining and periodically updating existing signs explaining the regulations, minimal costs will be involved. Monitoring of the site for compliance will continue, but will not require significantly more resources beyond those already necessary to patrol the area for compliance with current regulations. Compliance with the leash law is within the regular duties of the Refuge's Law Enforcement Officer. The financial and staff resources necessary to provide and administer this use at its current level and at the level described in the final Comprehensive Conservation Plan (CCP) are now available and we expect them to be available in the future. The annualized cost associated with the administration of pedestrian travel on the refuge is estimated below:

| | |
|---|---|
| Providing information to the public and administration needs | $1,000 |
| Resource impacts and monitoring | $1,000 |
| **Estimated Total:** | $2,000 |

Based on a review of the budget allocated for management of this activity, funding is adequate to ensure compatibility, and to administer and manage the use listed. Our existing staff and budget have provided sufficient resources to manage this use historically.

## ANTICIPATED IMPACTS OF THE USE:

The presence of dogs may flush incubating birds from nests (Yalden and Yalden 1990), disrupt breeding displays (Baydack 1986), disrupt foraging activity in shorebirds (Hoopes 1993), and disturb roosting activity in ducks (Keller 1991). Many of these authors indicated that people with dogs on a leash provoked more disturbance than people walking without a dog, and loose dogs provoked the most pronounced disturbance reactions from their study animals. The greatest stress reaction results from unanticipated disturbance. Animals show greater flight response to humans moving unpredictably than to humans following a distinct path (Gabrielsen and Smith 1995). Despite thousands of years of domestication, dogs still maintain instincts to hunt and chase. The appropriate stimulus can trigger those instincts. Dogs that are unleashed or not under the control of their owners may disturb or threaten the lives of some wildlife. In effect, off-leash dogs increase the radius of human recreational influence or disturbance beyond what it will be in the absence of a dog.

The role of dogs in wildlife diseases is poorly understood. However, dogs can host endo- and ecto-parasites, and can contract diseases from or transmit diseases to wild animals. In addition, dog waste is known to transmit diseases that may threaten the health of some wildlife and other domesticated animals. Domestic dogs potentially can introduce various diseases and transport parasites into wildlife habitats (Sime 1999).

Because the use of the trail system is relatively light, and dog walking will be restricted to public trails where disturbance may already occur due to other public use activities, the potential impacts to wildlife and their

habitats are expected to be minimal. In addition, the requirement for dogs to be kept on a 6-foot leash will minimize the impacts to other users and wildlife.

We do not anticipate any impacts to water quality, soils, or vegetation other than those impacts from normal trail use as described in our wildlife observation compatibility determination. The use will be confined to existing trails and no new construction or vegetation clearing is required. Impacts on wildlife will be minimal since the trails are not close to wildlife concentration areas and the dogs will be leashed. Short-term disturbance may occur to wildlife directly adjacent to the trail.

User conflicts are unlikely to occur since trails are lightly used and dogs will be on-leash and so prevented from annoying others. Dog waste is unsightly for refuge visitors, and can transmit diseases that may threaten the health of some wildlife and other domesticated animals. The refuge does not provide receptacles for animal waste, which if left on the refuge, diminishes the quality of the visitor's wildlife recreational experience. These impacts may be minimized by encouraging people to pick-up their dog's waste.

In particular, we are concerned about the direct or indirect impacts of dogs on staging, nesting and/or foraging migratory birds including common terns and American oystercatchers, and to federally listed, threatened or endangered species including piping plovers, roseate terns, and red knots. Additionally, we are concerned about other wildlife such as seals that use refuge beaches for hauling out.

## PUBLIC REVIEW AND COMMENT:

As part of the comprehensive conservation planning (CCP) process for the Monomoy NWR, a draft of this compatibility determination underwent a 180-day public comment period concurrent with the release of our draft CCP/Environmental Impact Statement (EIS). It underwent a further 37-day public review period concurrent with the release of the final CCP/EIS. During that period, we received a comment requesting that we allow leashed dogs on the refuge year round. No substantive new information was provided that would lead us to reconsider our determination in the final CCP/EIS that this use is compatibile with the stipulations noted below.

## DETERMINATION (CHECK ONE BELOW):

_____Use is not compatible.

__X__Use is compatible with the following stipulations.

## STIPULATIONS NECESSARY TO ENSURE COMPATIBILITY:

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

- We will continue to allow dogs on leash on Morris Island only from September 16 to April 30. This is consistent with town of Chatham regulations and is a time period when less wildlife is found on the Morris Island section of the refuge.

- Only leashed dogs will be allowed on the refuge. The leash must be no more than 6 feet long. Dog walkers will be required to maintain control of their animal while on the refuge, thereby reducing the potential and severity of impacts to wildlife and must refrain from entering closed areas.

- Dog walkers must pick up after their dog(s) and remove or properly dispose of pet waste.
- Agency and public awareness will be increased through interpretive or educational materials about responsible pet ownership in the context of wildlife disturbance during all outdoor recreational pursuits.
- If a high number of reports of negative dog-wildlife or dog-people interactions on Morris Island and refuge trails are reported, the refuge will reassess the use.
- If a high number of off-leash incidents are documented, we may consider eliminating dog walking from the refuge altogether.
- Restricting dog walking to Morris Island will reduce the potential disturbance of wildlife.

## JUSTIFICATION:

Although dogs can increase disturbance to wildlife, the refuge will strictly enforce a leash law to keep dogs and disturbances localized with the pedestrian. This is an existing use at Monomoy NWR, and there have been numerous documented violations of the leash requirement occurring annually. There are no documented incidents of domestic dog-wildlife disturbances, nor of dog-human conflicts. The majority of dog walkers are likely local residents who regularly visit the refuge for wildlife dependent recreation and who understand our policy. The Service and the Refuge System maintain goals of providing opportunities to view wildlife. Allowing the use of Morris Island by persons engaging in dog walking may facilitate wildlife observation. These users may take the time to learn more about the refuge and become, or already be, supporters of the Refuge System.

Allowing dog walking at Monomoy NWR will not materially interfere with, or detract from, the mission of the Refuge System of the purposes for which the refuge was established. As listed in the purposes section of this compatibility determination, the refuge was established and subsequently land was acquired for one main purpose. As discussed under the section on anticipated impacts above, dog walking is an historic use of Monomoy NWR. Because this use is restricted to Morris Island from September 16 to April 30, we anticipate that this use will have only negligible, minor, and temporary impacts on refuge resources. Because of this, it is consistent with the wildlife and habitat aspects of the refuge's purposes, the Service policy on compatible uses, the Refuge Improvement Act, and the broad management objectives of the Refuge System. Dog walking will not materially interfere with or detract from the endangered species aspect of the refuge's purposes, because there are no federally listed threatened or endangered species known to occur on the refuge. Therefore, no significant adverse effects from dog walking are anticipated. This activity will not materially interfere with or detract from the mission of the Refuge System, because of the limited impacts to refuge resources, because it facilitates priority public uses, and because of the stipulations specified above.

## SIGNATURE:

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

## CONCURRENCE:

Regional Chief: Scott B. Kahan (Signature) March 18, 2016 (Date)

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

## LITERATURE CITED:

Baydack, R.K. 1986. Sharp-tailed grouse response to lek disturbance in the Carberry Sand Hills of Manitoba. Colorado State University, Fort Collins, Colorado.

Gabrielson, G.W., and E.N. Smith. 1995. Physiological responses of wildlife to disturbance. Pages 95-107 in R.L. Knight and K.J. Gutzwiller, ed. Wildlife and Recreationists: coexistence through management and research. Island Press, Washington, D.C. 372pp.

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

Keller, V. 1991. Effects of human disturbance on eider ducklings *Somateria mollissima* in an estuarine habitat in Scotland. Biological Conservation 58:213-228.

Sime, C.A. 1999. Domestic Dogs in Wildlife Habitats. Pp. 8.1-8.17 in G. Joslin and H. Youmans, coordinators. Effects of recreation on Rocky Mountain wildlife: A Review for Montana. Committee on Effects of Recreation on Wildlife, Montana Chapter of The Wildlife Society.

Yalden, P.E., and D. Yalden. 1990. Recreational disturbance of breeding golden plovers *(Pluvialis apricarius)*. Biological Conservation 51:243-262.

# COMPATIBILITY DETERMINATION

## USE:

Environmental Education and Interpretation

## REFUGE NAME:

Monomoy National Wildlife Refuge

## DATE ESTABLISHED:

June 1, 1944

## ESTABLISHING AND ACQUISITION AUTHORITY(IES):

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

## REFUGE PURPOSE(S):

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

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

## NATIONAL WILDLIFE REFUGE SYSTEM MISSION:

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

## DESCRIPTION OF USE:

**(a) What is the use? Is the use a priority public use?**
Environmental education and interpretation are priority public uses of the National Wildlife Refuge System (Refuge System) under the National Wildlife Refuge System Administration Act of 1966 (16 U.S.C. 668dd-668ee) and the National Wildlife Refuge System Improvement Act of 1997 (Refuge Improvement Act) (Public Law 105-57). Both environmental education and interpretation activities seek to increase public knowledge and understanding of fish and wildlife resources and the value of habitat protection and management in protecting and conserving these resources. Environmental education is curriculum-based and typically includes teacher or staff-guided onsite field trips, offsite programs in classrooms, and nature study such as teacher and student workshops. Interpretation consists of guided natural or cultural history programs, special events such as the Chatham Fourth of July parade, interpretative signs, self-guided nature trails, lectures, and kiosks that serve as a source of information for refuge visitors. Interpretation includes developing

and publishing brochures, managing a refuge web site, using social media such as Facebook and Twitter, and installing information signs. Interpretation occurs both onsite and offsite.

**(b) Where would the use be conducted?**
The majority of this use will be conducted on the Morris Island part of Monomoy National Wildlife Refuge (NWR) and offsite in classrooms and local community facilities. Brochures and informational signs could be placed offsite within the town of Chatham, at Cape Cod National Seashore, or at other locations accessible to local residents or potential refuge visitors. Both uses can occur in any area open to the public, although permanent structures are generally not allowed in wilderness areas, so no interpretative panels and only minor information signs will be located in the Monomoy Wilderness. Certain areas on Monomoy NWR are seasonally closed to public access at the refuge manager's discretion to protect sensitive habitats or species of concern, minimize conflicts with other refuge activities, or respond to human health and safety concerns. All environmental education and interpretation activities will avoid sensitive areas prone to disturbance (e.g., sensitive vegetation areas) or degradation (e.g., soil compaction), and will be designed to minimize impacts to nesting birds or other breeding, feeding, or resting wildlife.

Refuge environmental education and interpretation will primarily occur on Morris Island, generally on the shoreline and beach, within 50 meters of existing trails, and at other facilities such as the refuge headquarters and visitor contact station and viewing platforms. Self-guided interpretation could occur in the Monomoy Wilderness, as could interpretative tours. Due to logistical constraints, fewer environmental education opportunities will occur on North Monomoy Island or South Monomoy Island.

We will provide interpretation of habitat and wildlife values at the Morris Island Trail trailhead kiosks and along the trail. We will continue to maintain a seasonally staffed refuge visitor contact station at the existing headquarters until a new off-refuge visitor contact station can be established. Additional off-site locations for providing brochures or interpretative panels could be established in conjunction with partners or local businesses. Some possible locations for delivering interpretive information could include the Morris Island Road causeway overflow parking, other visitor satellite parking lots and transit stops, the Marconi Maritime Museum, local boat ramps and marinas, the Chatham Fish Pier, Cape Cod Rail Trail parking lots, Chatham Bars Inn and Resort, Cape Cod Natural History Museum, Wellfleet Bay Sanctuary, Cape Cod National Seashore's Salt Pond Visitor Center, and the Lighthouse Beach overlook.

**(c) When would the use be conducted?**
Environmental education will occur year-round during daylight hours when the refuge is open; however, most of the field programs would be associated with the fall and spring school terms.

Interpretive activities will be conducted year-round, primarily during daylight hours when the refuge is open. Occasional staff-led or volunteer-led night programs would occur during the year. Interpretive activities would increase during the summer months, when the refuge receives peak visitation and has summer interns.

**(d) How would the use be conducted?**
Refuge staff, local teachers, volunteers, and conservation partners will conduct environmental education and interpretation on and off the refuge. Most curriculum-based environmental education programs at Monomoy NWR are conducted by others, such as the Friends of Monomoy, Massachusetts Audubon Society, Cape Cod Natural History Museum, and local school districts, primarily at Morris Island. Teacher-led school group trips also occur on the refuge with several of the teacher-leaders already serving as refuge volunteers. Onsite refuge activities will primarily include teacher-led or staff-guided field trips exploring topics requested by teachers, teach-the-teacher workshops, or more structured curriculum-based programs specifically designed for use on the refuges. Students will learn about nature from designated refuge trails, viewing platforms on Morris Island, and in the Monomoy Wilderness. Environmental education activities could utilize interpretive infrastructure such as kiosks, sign panels, and displays in the visitor contact station.

Interpretation activities on Monomoy NWR will be both self-guided and staff-led or volunteer-led. Interpretive information will be delivered through kiosks at refuge trailheads, refuge trail guides, brochures, interpretive panels at observation platforms and self-guided tour stops on trails, and interpretive displays in the refuge visitor contact station and at local community special events. Staff-led and volunteer-led programs would, over time, become more diverse and allow for more interaction with visitors. A significant amount of interpretive information will also be available through the Internet.

Offsite activities will primarily include offering refuge staff assistance to local partners who are interested in working with the Service to expand our efforts into local classrooms and the occasional refuge attendance at special events, such as a career day.

Environmental education and guided interpretation conducted in the wilderness area on North and South Monomoy Islands can provide information about the Monomoy Wilderness to ensure activities are conducted appropriately and raise awareness about the National Wilderness Preservation System (NWPS). We will conduct a minimum requirements analysis for proposed environmental education and interpretation activities held within the Monomoy Wilderness. Access for environmental education and interpretation activities would be on foot, or by boat or kayak. Motorized equipment is not allowed within the Monomoy Wilderness, which includes the majority of the lands comprising the refuge.

**(e) Why is this use being proposed?**
The Refuge Improvement Act states that priority, wildlife-dependent public uses should receive enhanced consideration in planning and be facilitated on refuges to the extent they are compatible.

Environmental education and interpretation promotes public understanding and appreciation of the Refuge System, the NWPS, and the Monomoy NWR. The migratory birds, threatened and endangered species, other U.S. Fish and Wildlife Service (Service) trust resources and habitats on which they depend, and wilderness values within the Monomoy Wilderness will benefit from Service efforts to cooperate with environmental education partners to educate the public on the impacts to native salt marsh and dune vegetation and harmful wildlife disturbance from inappropriate public uses.

## AVAILABILITY OF RESOURCES:

Environmental education and interpretation are currently provided on a small scale by existing refuge staff. The refuge manager, wildlife refuge specialist and wildlife biologist each dedicate approximately 0.2 full time employees to these public use programs. For the environmental education and interpretation to be more fully realized, additional visitor services staff would be needed to plan, implement, and monitor the public use programs on Monomoy NWR, including administration of the refuge visitor contact station. New and recurring costs to conduct an environmental education and interpretation program are presented below.

| | | | |
|---|---|---|---|
| **New construction and renovation estimated costs:** | | | |
| Construct and install two new kiosks on Morris Island | | | $ 6,000 |
| Construct and install one new accessible platform on Morris Island | | | $ 15,000 |
| Construct and install one new photography blind on Morris Island | | | $ 3,000 |
| Renovate Morris Island trail for handicapped accessibility | | | $100,000 |
| Renovate exhibits in existing visitor contact station | | | $250,000 |
| Renovate or construct new off-site visitor contact station | | | $250,000+ |
| **Total new costs:** | | | **$374,000** |
| **Recurring annual costs:** | | | |
| GS-9 Visitor Services Specialist | 1 staff | 200 hours | $ 7,500 |
| GS-11 Law Enforcement | 1 staff | 40 hours | $ 2,000 |
| GS-9 Law Enforcement | 1 staff | 100 hours | $ 4,500 |
| Ferry service to islands and bus transportation to refuge | | | $ 5,000 |
| Regular maintenance of visitor centers | | | $25,000 |
| Regular maintenance of kiosks, platforms, photo blinds, trails, public restrooms | | | $15,000 |
| Equipment, vehicles, and supplies (including brochures/trail guides | | | $22,000 |
| **Total recurring annual costs:** | | | **$81,000** |

## ANTICIPATED IMPACTS OF THE USE:

Impacts of environmental education and interpretation will be minimal if conducted in accordance with refuge regulations and policies. Possible impacts include disturbing and displacing wildlife, removing or trampling vegetation, littering, and vandalism. Overall, we expect the adverse impacts to be short-term and confined.

New structures will be sited outside the Monomoy Wilderness, with consideration of the long-term consequences and cumulative impacts to wildlife and habitats. Most of the new structures proposed, e.g. kiosks, observation platforms, photography blinds, would each result in habitat losses of less than 1/4-acre. Placement of kiosks, interpretative panels, blinds, and observation platforms may impact small areas of vegetation. Kiosks will be placed where minimal disturbance will occur from both the structures and visitors using them.

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

Numerous studies have documented that migratory birds are disturbed by human activity on beaches. Erwin (1989) documented disturbance of common terns and skimmers and recommended that human activity be restricted to a distance of 100 meters around nesting sites. Klein (1993) in studying waterbird response to human disturbance found that, as intensity of disturbance increased, avoidance response by the birds increased, and found that non-vehicle based activities were more disruptive than vehicular traffic. Pfister et al. (1992) found that the impact of disturbance was greater on species using the heavily disturbed front side of the beach, with the abundance of the impacted species being reduced by as much as 50 percent. In studying the effects of recreational use of shorelines on nesting birds, Robertson et al. (1980) discovered that disturbance negatively impacted species composition. Piping plovers, which intensively use the refuge, are also impacted negatively by human activity. Pedestrians on beaches may crush eggs (Jenkins and Burger 1987, Hill 1988, Shaffer and Laporte 1992, Cape Cod National Seashore 1993, Collazo et al. 1994). Dogs may chase plovers (McConnaughey et al. 1990), destroy nests (Hoopes 1993), and kill chicks (Cairns and McLaren 1980). Other studies have shown that if pedestrians cause incubating plovers to leave their nest, the eggs can overheat (Bergstrom 1991) or can cool to the point of embryo death (Welty 1982). Pedestrians have been found to displace unfledged chicks (Strauss 1990, Burger 1991, Hoopes 1993, Loegering 1992, Goldin 1993).

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

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

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

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

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

The proposed use has the potential of intermittently interrupting the feeding habits of a variety of shorebirds, gulls, and terns, but encounters between pedestrians and migratory birds will be temporary. Refuge staff will manage visitor access via seasonal closures to minimize disturbance to nesting, resting, and foraging waterbirds on the refuge.

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

Construction or renovation of a new visitor contact station off Morris Island will result in short-term noise and air pollution. Debris from the construction site will be recycled to the extent possible, with the remainder placed in a landfill. There could be traffic congestion at the visitor contact station site from visitors. If an alternative transportation system is established with parking at the visitor contact station for shuttle access, the number of cars travelling to the refuge headquarters on Morris Island could decrease, reducing vehicle emissions and noise.

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

Environmental education and interpretation will not affect wilderness character. These activities do not alter the natural, scenic condition of the land and will not occur at a scale large enough to diminish the environment for native plants and animals.

Large groups have the potential to negatively infringe on the wilderness experience for those visitors who come to the refuge specifically to have a wilderness experience. This will generally be a short-term impact to a wilderness visitor.

## PUBLIC REVIEW AND COMMENT:

As part of the comprehensive conservation planning (CCP) process for the Monomoy NWR, a draft of this compatibility determination underwent a 180-day public comment period concurrent with the release of our draft CCP/Environmental Impact Statement (EIS). This final compatibility determination resulted from that public review and comment process. It underwent a further 37-day public review period concurrent with the release of the final CCP/EIS. No comments were received on the compatibility determination and it remained unchanged.

## DETERMINATION (CHECK ONE BELOW):

_____Use is not compatible.

__X__ Use is compatible with the following stipulations.

## STIPULATIONS NECESSARY TO ENSURE COMPATIBILITY:

- All environmental education and interpretation activities will avoid sensitive areas prone to disturbance (e.g., sensitive vegetation areas) or degradation (e.g., soil compaction), and will be designed to minimize impacts to nesting birds or other breeding, feeding, or resting wildlife. Access for environmental education and interpretation activities will be on foot. Access by kayak and canoe or boat will be necessary to get to North Monomoy Island and South Monomoy Island.

- Activities will be held on designated sites where only minimal direct and short-term impacts are predicted, and adverse long-term, cumulative impacts are not anticipated. Self-guided and guided interpretive activities in the wilderness can occur anytime when the refuge is open, except in areas that are seasonally closed to protect wildlife.

- Occasional law enforcement patrol and regular staff and conservation partner presence should minimize potential violations. We will maintain the current refuge hours (open 1/2 hour before sunrise to 1/2 hour after sunset) and restrict entry after daylight hours. We will post and enforce refuge regulations.

- Periodic evaluations will be done to insure that visitors and programs are not causing unacceptable adverse impacts. Areas open to these uses will be evaluated on an ongoing basis to ensure visitor safety, compliance with State and Federal tern and plover guidelines, compliance with National Marine Fisheries Service marine mammal regulations, and to minimize impacts on vegetation and wildlife.

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

## JUSTIFICATION:

Environmental education and interpretation are priority, wildlife-dependent, public uses identified by the Refuge Improvement Act. These activities have been determined appropriate by law and, when compatible, are to be facilitated on refuges. These programs support the mission of the Refuge System by promoting an understanding and appreciation of natural and cultural resources and their management within a national system of refuges. Our programs will reach out to all segments of the public to expand support for the refuge system. Individual refuge programs will be consistent with, and fully support, the goals and objectives in the Monomoy NWR CCP.

Environmental education activities generally support refuge purposes, and impacts can largely be minimized. The minor resource impacts attributed to these activities are generally outweighed by the benefits gained by educating present and future generations about refuge resources. Environmental education is a public use management tool to develop a resource protection ethic within society. While it targets school-aged children, it is not limited to this group. This tool allows us to educate visitors about endangered and threatened species management, wildlife management, and ecological principles and communities. A secondary benefit of environmental education is that it can instill stewardship in visitors that most likely reduces vandalism, littering, and poaching. Environmental education also strengthens Service visibility in the local community.

Providing additional interpretative and educational brochures and materials may result in increased knowledge of the refuge and its resources. This awareness and knowledge may improve the willingness of the public to support refuge programs and resources and comply with regulations. Environmental education and interpretation activities that identify and explain wilderness should increase understanding and appreciation of, and compliance with, wilderness principles and policies.

We do not expect visitors engaged in environmental education or interpretation to materially interfere with or detract from the mission of the Refuge System or diminish the purpose for which the refuge was established. These activities do not pose significant adverse effects on refuge resources, interfere with public use of the refuge, or cause an undue administrative burden.

Additional funding will be needed to administer a fully developed environmental education and interpretation program. These uses will not materially interfere with or detract from the mission of the Refuge System or the purpose of Monomoy NWR. Therefore, it is the determination of the Service that these uses, at the discretion of the refuge manager, are compatible uses and contribute to the purposes for which Monomoy NWR was established.

## SIGNATURE:

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

## CONCURRENCE:

Regional Chief: Scott B Kahn (Signature) March 18, 2016 (Date)

## MANDATORY 15 YEAR RE-EVALUATION DATE: March 18, 2031

## LITERATURE CITED:

Bélanger, L. and J. Bédard. 1990. Energetic cost of man-induced disturbance to staging snow geese. Journal of Wildlife Management. 54: 36.

Bergstrom, P.W. 1991. Incubation temperatures of Wilson's plovers and killdeer. Condor. 91: 634-641.

Boyle, S.A. and F. B. Samson. 1985. Effects of nonconsumptive recreation on wildlife: A review. Wildlife Society Bulletin 13: 110.

Burger, J. 1981. The effect of human activity on birds at a coastal bay. Biological Conservation. 21: 231-241.

Burger, J. 1986. The effect of human activity on shorebirds in two coastal bays in northeastern United States. Biological Conservation 13: 123-130.

Burger, J. 1991. Foraging behavior and the effect of human disturbance on the piping plover (*Charadrius melodus*). Journal of Coastal Research, 7(1): 39-52.

Burger, J., M. Gochfeld, and L.J. Niles. 1995. Ecotourism and birds in coastal New Jersey: Contrasting responses of birds, tourists, and managers. Environmental Conservation 22: 56-65

Burger, J. and M. Gochfeld. 1998. Effects of ecotourists on bird behavior at Loxahatchee National Wildlife Refuge, Florida. Environmental Conservation 25: 13-21.

Cairns, W.E. and I.A. McLaren. 1980. Status of the piping plover on the east coast of North America. American Birds. 34: 206-208.

Cape Cod National Seashore. 1993. Piping plover nest found trampled by pedestrian. News Release. Cape Cod National Seashore, South Wellfleet, Massachusetts. 2 pp.

Collazo, J.A., J.R. Walters, and J.F. Parnell. 1994. Factors Affecting Reproduction and Migration of Waterbirds on North Carolina Barrier Islands. 1993 Annual Progress Report. North Carolina State University, Raleigh, North Carolina. 57 pp.

Erwin, R.M. 1980. Breeding habitat by colonially nesting water birds in two mid-Atlantic U.S. regions under different regimes of human disturbance. Biological Conservation. 18: 39-51.

Erwin, R.M. 1989. Responses to Human Intruders by Birds Nesting in Colonies: Experimental Results and Management Guidelines. Colonial Waterbirds 12 (1): 104-108.

Goldin, M.R. 1993. Effects of human disturbance and off-road vehicles on piping plover reproductive success and behavior at Breezy Point, Gateway National Recreation Area, New York, M.S. Thesis. University of Massachusetts, Amherst, Massachusetts. 128 pp.

Havera, S.P., L.R. Boens, M.M. Georgi, and R. T. Shealy. 1992. Human disturbance of waterfowl on Keokuk Pool, Mississippi River. Wildlife Society Bulletin. 20: 290-298.

Henson, P.T. and A. Grant. 1991. The effects of human disturbance on trumpeter swan breeding behavior. Wildlife Society Bulletin. 19: 248-257.

Hill, J.O. 1988. Aspects of breeding biology of Piping Plovers (*Charadrius melodus*) in Bristol County, Massachusetts, in 1988. Unpublished report. University of Massachusetts, Amherst, Massachusetts. 44 pp.

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

Jenkins, D.C. and J. Burger. 1987. New Jersey Endangered Beach-Nesting Bird Project: 1986 Survey and Management. New Jersey Department of Environmental Protection, New Jersey. 37 pp.

Kahl, R. 1991. Boating disturbance of canvasbacks during migration at Lake Poygan, Wisconsin. Wildlife Society Bulletin. 19: 242-248.

Kaiser, M.S. and E.K. Fritzell. 1984. Effects of river recreationists on green-backed heron behavior. Journal of Wildlife Management. 48: 561-567.

Klein, M.L. 1993. Waterbird behavioral responses to human disturbances. Wildlife Society Bulletin. 21: 31-39.

Klein, M.L., S.R. Humphrey, and H.F. Percival. 1995. Effects of ecotourism on distribution of waterbirds in a wildlife refuge. Conservation Biology 9: 1454-1465.

Knight, R.L. and D.N. Cole. 1995. Wildlife responses to recreationists. Pp. 51-69 In R.L. Knight and D.N. Cole, eds. Wildlife and recreationists: coexistence through management and research. Island Press, Washington, DC.

Knight, R. L. and K. J. Gutzwiller, eds. 1995. Wildlife and recreationalists: coexistence through management and research. Island Press, Washington, DC 372 pp.

Korschgen, C.E., L.S. George, and W.L. Green. 1985. Disturbance of diving ducks by boaters on a migrational staging area. Wildlife Society Bulletin. 13: 290-296.

Loegering, J.P. 1992. Piping Plover Breeding Biology, Foraging Ecology and Behavior on Assateague Island National Seashore, Maryland. M.S. Thesis. Virginia State Polytechnic Institute and State University, Blacksburg, Virginia. 262 pp.

McConnaughey, J.L., J.D. Fraser, S.D. Coutu, and J.P. Loegering. 1990. Piping plover distribution and reproductive success on Cape Lookout National Seashore. Unpublished report. Cape Lookout National Seashore, Morehead City, North Carolina. 83 pp.

Morton, J.M., A.C. Fowler, and R.L. Kilpatrick. 1989. Time and energy budgets of American black ducks in winter. Journal of Wildlife Management. 53: 401-410.

Owen, M. 1973. The management of grassland areas for wintering geese. Wildfowl. 24: 123-130.

Pfister, C., B.A. Harrington, and M. Lavine. 1992. The impact of human disturbance on shorebirds at a migration staging area. Biological Conservation. 60: 115-126.

Robertson, R.J. and N.J. Flood. 1980. Effects of Recreational Use of Shorelines on Breeding Bird Populations. Canadian Field-Naturalist 94 (2): 131-138.

Rodgers, J.A, and H.T. Smith. 1995. Set-back distances to protect nesting bird colonies from human disturbance in Florida. Conservation Biology 9: 89-99.

Rodgers, J.A. and H.T. Smith. 1997. Buffer zone distances to protect foraging and loafing waterbirds from human disturbance in Florida. Wildlife Society Bulletin 25: 139-145.

Shaffer, F. and P. Laporte. 1992. Rapport synthese des recherches relatives au pluvier siffleur (*Charadrius melodus*) effectuees aux Iles-de-la-Madeleine de 1987 a 1991. Association quebecoise des groupes d'ornithologues et Service canadien de la faune. 78 pp.

Strauss, E. 1990. Reproductive success, life history patterns, and behavioral variation in a population of Piping Plovers subjected to human disturbance (1982-1989). Ph.D. dissertation. Tufts University, Medford, Massachusetts.

Ward, D.H. and R.A. Stehn. 1989. Response of Brant and other geese to aircraft disturbance at Izembek Lagoon, Alaska. U.S. Fish and Wildlife Service, Alaska Fish and Wildlife Research Center. Final report to the Minerals Management Service. Anchorage, Alaska. 193 pp.

Welty, J.C. 1982. The life of birds. Saunders College Publishing, Philadelphia, Pennsylvania. 754 pp.

Williams, G.J. and E. Forbes. 1980. The habitat and dietary preferences of Dark-Bellied Brent Geese and Widgeon in relation to agricultural management. Wildfowl. 31: 151-157.

# COMPATIBILITY DETERMINATION

## USE:

Fin Fishing

## REFUGE NAME:

Monomoy National Wildlife Refuge

## DATE ESTABLISHED:

June 1, 1944

## ESTABLISHING AND ACQUISITION AUTHORITY(IES):

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

## REFUGE PURPOSE(S):

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

"…for the use and enjoyment of the American people in such manner as will leave them unimpaired for future use and enjoyment as wilderness, and… the preservation of their wilderness character…" (PL 88-577 § 2(a), Wilderness Act; as referenced in P.L. 91-504 § 1(g), An Act to Designate Certain Lands as Wilderness).

## NATIONAL WILDLIFE REFUGE SYSTEM MISSION:

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

## DESCRIPTION OF USE:

**(a) What is the use? Is the use a priority public use?**
The use is recreational fin fishing, which includes saltwater fly fishing from shore or wading, surf fishing from shore or wading, rip fishing, and fishing in the refuge's freshwater ponds. This compatibility determination covers recreational fin fishing occurring outside the open waters lying above the submerged lands within the Declaration of Taking—fishing occurring in this open water area will be regulated by the National Marine Fisheries Service (NMFS) and the Massachusetts Division of Marine Fisheries (MA DMF). Fishing events, including Service "Take Me Fishing" programs designed to educate anglers new to the sport of fishing, will be held on the refuge. Fishing is a priority public use of the National Wildlife Refuge System under the National Wildlife Refuge System (Refuge System) Administration Act of 1966 (16 U.S.C. § 668dd-668ee), as amended by the National Wildlife Refuge System Improvement Act of 1997 (Refuge Improvement Act) (Public Law 105-57).

**(b) Where would the use be conducted?**
This compatibility determination only covers recreational fin fishing occurring outside the open waters lying above the submerged lands within the Declaration of Taking—fishing occurring in this open water area will be regulated by the NMFS and the MA DMF. Areas covered by this compatibility determination include the refuge shoreline, refuge's freshwater ponds on South Monomoy Island, and intertidal areas when these areas are open to public access. All fishing on the refuge occurs in accordance with Federal, State, and local regulations.

South Monomoy Island: The most productive surf fishing location is at the very southern tip of South Monomoy Island where there is a tidal rip. However, the nearest safe anchorage for boats is in the vicinity of Powder Hole; the walk one-way to the rip is more than 1/2-mile. As a result of the long walk, there is very little surf fishing from this location. Most anglers opt to fish from their boats in the rip area. Surf fishing occurs concurrently with family day-use of the beach. Most of this activity occurs on the safe anchorage and boat beaching points on the west side of South Monomoy Island.

North Monomoy: There is rarely any surf fishing conducted from this island. The majority of the island and most of the east shoreline is seasonally closed to protect nesting and roosting areas. This seasonal closure will vary year to year based on wildlife use and habitat conditions. Shallow water precludes surf fishing from the west side. Even though surf fishing is limited, fly fishing in the shallow water on the flats has been very popular in the past.

Morris Island: Because of the connection of the Morris Island to the mainland and easy vehicular access, this portion of the refuge receives the largest number of surf fishing visits. However, this area is rarely crowded with anglers. A major limiting factor to the one-time use by anglers is the 35-car parking lot at refuge headquarters. Personal observations by staff over the years have noted that there are rarely more than four anglers using the 1-mile refuge shoreline at any one time. Fishing is allowed 24 hours per day. Fish typically caught by anglers include striped bass, bluefish, flounder, and pollock. Most refuge fishing events would be held on Morris Island due to ease of access, and help minimize impacts on refuge seals, terns, plovers, and other shorebirds and seabirds.

**(c) When would the use be conducted?**
Monomoy National Wildlife Refuge (NWR) is open to the public from 1/2-hour before sunrise to 1/2-hour after sunset. Surf fishing is permitted 24 hours a day on Morris Island only. The gate and parking lot are open and no permit is required to fish after the refuge is closed. This is the only activity allowed at night on Monomoy NWR. Refuge fishing events would be held at times and on areas of the refuge that minimize impact to seals, terns, plovers, and other shorebirds and seabirds.

**(d) How would the use be conducted?**
Recreational fin fishing must be conducted in accordance with Federal and State regulations and refuge specific policies, including seasonal closures. Walking, kayaks, private motorboats, and paid access via the commercial ferry or a future concessionaire will be the most common means of access for anglers using Monomoy NWR. Refuge staff may partner with organizations to sponsor a fishing tournament designed to introduce more people to fishing on the refuge.

**(e) Why is this use being proposed?**
Recreational fishing is a priority, wildlife-dependent public use. The Refuge Improvement Act states that priority, wildlife-dependent, public uses should receive enhanced consideration in planning and be facilitated on refuges to the extent they are compatible.

Monomoy NWR is a premier destination for fishing and attracts visitors from across the country. A rip current at the end of South Monomoy Island makes for excellent fishing. Recreational fin fishing offers opportunities to observe wildlife at Monomoy NWR and increases visitor appreciation and awareness of the importance of this site to the Refuge System. Working with partners to hold fishing events will increase the number of people participating in this priority public use on the refuge.

## AVAILABILITY OF RESOURCES:

Little effort is spent in providing opportunities for fin fishing on the refuge. Refuge staff prepare a closed area map each spring that guides all visitors to the refuge, including anglers. Signs are posted and removed each year to delineate plover, tern, and waterfowl nesting areas. Signs may be retained or relocated to protect major staging sites on the refuge. Signs and posts need to be replaced occasionally. There are expenses involved with the use of refuge boats to move equipment and conduct law enforcement to ensure compliance with refuge regulations. These expenses, for all refuge recreational uses, are approximately $40,000 per year. For fishing, this is prorated to $5,000 per year.

The cost of law enforcement patrol to conduct fishing compliance (license, creel limits), ensure visitor safety, and maintain the integrity of the closed areas will be approximately $10,000 per year.

| | |
|---|---|
| **Total recurring annual cost** | **$15,000** |

## ANTICIPATED IMPACTS OF THE USE:

Potential impacts from fin fishing include disturbing and displacing wildlife or trampling vegetation, including salt grass, when anglers get too close to roosting birds or resting seals or when they enter closed areas. This has been a particular problem in the closed areas off North Monomoy Island. Incidences of littering and vegetation removal have occurred. Some disturbance to roosting and feeding shorebirds occurs (Burger 1981) but this is minimized when closed areas are respected. Discarded fishing line and other fishing litter can entangle migratory birds and marine mammals and cause injury and death (Gregory 1991). Litter also impacts the visual experience of other refuge visitors (Marion and Lime 1986). Conflicts with seals over fish could occur, especially if anglers are not observing the 150-foot buffer distance from seals required by the Marine Mammal Protection Act. Several enforcement issues may result from this use, including trampling vegetation following trespass into closed areas, illegal taking of fish (undersized, over limit), illegal fires, and disorderly conduct. Overall, we expect the adverse impacts to be short-term and confined to small areas.

There are impacts to refuge wildlife, vegetation, and soils from pedestrian access for visitors engaged in fishing. Pedestrian travel has the potential to impact shorebird, waterfowl, and other migratory bird populations feeding and resting near the trails and on beaches during certain times of the year. Pedestrians can also impact seals resting on the beach if they get too close. Conflicts arise when migratory birds and humans are present in the same areas (Boyle and Samson 1985). Response of wildlife to human activities includes departure from site (Owen 1973, Burger 1981, Kaiser and Fritzell 1984, Korschgen et al. 1985, Henson and Grant 1991, Kahl 1991, Klein 1993), use of sub-optimal habitat (Erwin 1980, Williams and Forbes 1980), altered behavior (Burger 1981, Korschgen et al. 1985, Morton et al. 1989, Ward and Stehn 1989, Havera et al. 1992, Klein 1993), and increase in energy expenditure (Morton et al. 1989, Bélanger and Bédard 1990).

Numerous studies have documented that migratory birds are disturbed by human activity on beaches. Erwin (1989) documented disturbance of common terns and skimmers and recommended that human activity be restricted to a distance of 100 meters (300 feet) around nesting sites. Klein (1993) in studying waterbird response to human disturbance found that, as intensity of disturbance increased, avoidance response by the birds increased, and found that out-of-vehicle activity to be more disruptive than vehicular traffic. Pfister et al. (1992) found that the impact of disturbance was greater on species using the heavily disturbed front side of the beach, with the abundance of the impacted species being reduced by as much as 50 percent. In studying the effects of recreational use of shorelines on nesting birds, Robertson et al. (1980) discovered that disturbance negatively impacted species composition. Piping plovers, which intensively use the refuge, are also impacted negatively by human activity. Pedestrians on beaches may crush eggs (Jenkins and Burger 1987, Hill 1988, Shaffer and Laporte 1992, Cape Cod National Seashore 1993, Collazo et al. 1994). Dogs may chase plovers (McConnaughey et al. 1990), destroy nests (Hoopes 1993), and kill chicks (Cairns and McLaren 1980). Other studies have shown that if pedestrians cause incubating plovers to leave their nest, the eggs can overheat (Bergstrom 1991) or can cool to the point of embryo death (Welty 1982). Pedestrians have been found to displace unfledged chicks (Strauss 1990, Burger 1991, Hoopes 1993, Loegering 1992, Goldin 1993).

Several studies have examined the effects of recreation on birds using shallow water habitats adjacent to trails and roads through wildlife refuges and coastal habitats in the eastern United States (Burger 1981, 1986, Klein

1993, Burger et al. 1995, Klein et al. 1995, Rodgers and Smith 1995, 1997, Burger and Gochfeld 1998). Overall, the existing research clearly demonstrates that disturbance from recreational activities always has at least temporary effects on the behavior and movement of birds within a habitat or localized area (Burger 1981, 1986, Klein 1993, Burger et al. 1995, Klein et al. 1995, Rodgers and Smith 1997, Burger and Gochfeld 1998). The findings that were reported in these studies are summarized as follows in terms of visitor activity and avian response to disturbance.

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

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

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

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

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

The proposed use has the potential to intermittently interrupt the feeding habits of a variety of shorebirds, gulls, and terns, but encounters between pedestrians and migratory birds will be temporary. To address the impacts posed by pedestrians, refuge staff will manage angler access via seasonal closures to minimize disturbance to nesting, resting, and foraging waterbirds on the refuge.

Visitors accessing Monomoy Island from Chatham town beaches could potentially impact the larval stage of the threatened northeastern beach tiger beetle. The recovery plan for this species describes that many of the species' habitats are threatened by human impacts such as habitat alteration and recreational activities (U.S. Fish and Wildlife Service (USFWS) 1994). Larval burrows are especially susceptible to trampling, which results in excess energy expenditure and reduced time hunting for the inhabiting individual. We will continue to survey to determine the location and extent of larval beetle occurrence and habitat, and use closures and re-routing to avoid larval habitats, as warranted.

Visitor use also has the potential to disturb loafing seals. Gray and harbor seals haul out on the refuge year-round. We will enforce or implement the 150-foot buffer around all seals as required by the National Oceanic Atmospheric Administration to ensure compliance with the Marine Mammals Protection Act.

Heavy beach use can dry out the sand and contribute to beach erosion. Trash left on the beach, particularly food or wrappers, can attract predators that prey on nesting piping plovers and least terns or roosting shorebirds. The refuge is a leave-no-trace, carry-in-carry-out facility. We encourage all outfitters and guides to pack in and pack out all food containers, bottles, wrappers, trash, and other waste and refuse. Littering, dumping, and abandoning property are prohibited by Federal regulation at 50 CFR 27.93 and 50 CFR 27.94.

There should be little impact from anglers fishing in the wilderness area. Anglers fishing from shore or just offshore within the intertidal area tend to be solitary and quiet. Carts will not be allowed to carry gear in the wilderness area. Refuge fishing events will most likely be held on Morris Island, so there would be little impact to wilderness. If an event is held in the Monomoy Wilderness, group size will be limited and the event will be

short-term, thereby minimizing impacts to other wilderness visitors. Additionally, any event held within the Monomoy Wilderness will undergo a minimum requirements analysis to ensure compliance with wilderness regulations and policies, and help ensure impacts to wilderness character are minimal.

## PUBLIC REVIEW AND COMMENT:

As part of the comprehensive conservation planning (CCP) process for the Monomoy NWR, a draft of this compatibility determination underwent a 180-day public comment period concurrent with the release of our draft CCP/Environmental Impact Statement (EIS). This final compatibility determination resulted from that public review and comment process. It underwent a further 37-day public review period concurrent with the release of the final CCP/EIS. No comments were received on the compatibility determination and it has remain unchanged.

## DETERMINATION (CHECK ONE BELOW):

_____Use is not compatible.

__**X**__Use is compatible with the following stipulations.

## STIPULATIONS NECESSARY TO ENSURE COMPATIBILITY:

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

- Carts or other wheeled equipment may not be used within the wilderness area on North Monomoy Island and South Monomoy Island.

- Occasional law enforcement patrol and regular staff and partner presence should minimize potential violations of refuge closures and curtail illegal fires, littering, and disorderly conduct. Periodic evaluations will be done to ensure that activities associated with the use are not causing unacceptable adverse impacts to the natural resources. Unacceptable levels of violations or disturbance may result in eliminating or restricting public fishing. Occasional law enforcement patrols and regular refuge presence should minimize potential violations of refuge closures and other regulations, e.g., prohibition of dogs.

- Public meetings with local fishing clubs and interested parties will facilitate voluntary compliance of regulations. Recreational fishing events will be held only with the sponsorship of the Service and at times, in places, and with methods deemed to comply with State and Federal wildlife regulations and other refuge regulations.

- The refuge is a leave-no-trace, carry-in-carry-out facility. All food containers, bottles, and other waste and refuse must be taken out. Littering, dumping, and abandoning property are prohibited by Federal regulation at 50 CFR 27.93 and 50 CFR 27.94.

## JUSTIFICATION:

Recreational fishing is a priority public use identified in the Refuge Improvement Act, and facilitates other priority public uses such as wildlife observation and photography. Monomoy NWR is world-renowned for its offshore fish resources and allowing this use will not pose significant adverse effects on refuge resources, nor interfere with other public uses of the refuge. Area closure limitations outlined in this determination provide maximum protection to prime nesting habitat for piping plovers and terns, and minimize disturbance to staging terns and resting seals. Recreational fishing will foster a greater awareness and appreciation of the importance of this site to the Refuge System. Costs associated with administering public fishing and likely visitor impacts are minimal. This use will not materially interfere with or detract from the mission of the Refuge System or the purpose of Monomoy NWR. Therefore, it is the determination of the Service that recreational fishing, at the discretion of the refuge manager, is a compatible use and contributes to the purposes for which Monomoy NWR was established.

## SIGNATURE:

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

## CONCURRENCE:

Regional Chief: Scott B. Kahn (Signature) March 18, 2016 (Date)

## MANDATORY 15 YEAR RE-EVALUATION DATE: March 18, 2031

## LITERATURE CITED:


Bélanger, L. and J. Bédard. 1990. Energetic cost of man-induced disturbance to staging snow geese. Journal of Wildlife Management 54(1): 36-41.

Bergstrom, P.W. 1991. Incubation temperatures of Wilson's plovers and killdeer. Condor 91: 634-641.

Boyle, S.A. and F.B. Samson. 1985. Effects of nonconsumptive recreation on wildlife: A review. Wildlife Society Bulletin 13: 110-116.

Burger, J. 1981. Effect of human activity on birds at a coastal bay. Biological Conservation 21: 231-241.

Burger, J. 1986. The effect of human activity on shorebirds in two coastal bays in northeastern United States. Biological Conservation 13: 123-130.

Burger, J. 1991. Foraging behavior and the effect of human disturbance on the piping plover (*Charadrius melodus*). Journal of Coastal Research 7(1): 39-52.

Burger, J. and M. Gochfeld. 1981. Discrimination of the threat of direct versus tangential approach to the nest by incubating herring and great black-backed gulls. Journal of Comparative Physiological Psychology 95: 676-684.

Burger, J. and M. Gochfeld. 1998. Effects of ecotourists on bird behavior at Loxahatchee National Wildlife Refuge, Florida. Environmental Conservation 25: 13-21.

Burger, J., M. Gochfeld, and L.J. Niles. 1995. Ecotourism and birds in coastal New Jersey: Contrasting responses of birds, tourists, and managers. Environmental Conservation 22: 56-65.

Cairns, W.E. and I.A. McLaren. 1980. Status of the piping plover on the east coast of North America. American Birds 34: 206-208.

Cape Cod National Seashore. 1993. Piping plover nest found trampled by pedestrian. News Release. Cape Cod National Seashore, South Wellfleet, Massachusetts. 2 pp.

Collazo, J.A., J.R. Walters, and J.F. Parnell. 1994. Factors Affecting Reproduction and Migration of Waterbirds on North Carolina Barrier Islands. 1993 Annual Progress Report. North Carolina State University, Raleigh, North Carolina. 57 pp.

Erwin, R.M. 1980. Breeding habitat by colonially nesting water birds in two mid-Atlantic U.S. regions under different regimes of human disturbance. Biological Conservation 18: 39-51.

Erwin, R.M. 1989. Responses to Human Intruders by Birds Nesting in Colonies: Experimental Results and Management Guidelines. Colonial Waterbirds 12(1): 104-108.

Goldin, M.R. 1993. Effects of human disturbance and off-road vehicles on piping plover reproductive success and behavior at Breezy Point, Gateway National Recreation Area, New York, M.S. Thesis. University of Massachusetts, Amherst, Massachusetts. 128 pp.

Havera, S.P., L.R. Boens, M.M. Georgi, and R.T. Shealy. 1992. Human disturbance of waterfowl on Keokuk Pool, Mississippi River. Wildlife Society Bulletin 20: 290-298.

Henson, P.T. and A. Grant. 1991. The effects of human disturbance on trumpeter swan breeding behavior. Wildlife Society Bulletin 19: 248-257.

Hill, J.O. 1988. Aspects of breeding biology of Piping Plovers (*Charadrius melodus*) in Bristol County, Massachusetts, in 1988. Unpublished report. University of Massachusetts, Amherst, Massachusetts. 44 pp.

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

Jenkins, D.C. and J. Burger. 1987. New Jersey Endangered Beach-Nesting Bird Project: 1986 Survey and Management. New Jersey Department of Environmental Protection, New Jersey. 37 pp.

Kaiser, M.S. and E.K. Fritzell. 1984. Effects of river recreationists on green-backed heron behavior. Journal of Wildlife Management 48: 561-567.

Kahl, R. 1991. Boating disturbance of canvasbacks during migration at Lake Poygan, Wisconsin. Wildlife Society Bulletin 19: 242-248.

Klein, M.L. 1993. Waterbird behavioral responses to human disturbance. Wildlife Society Bulletin 21: 31-39.

Klein, M.L., S.R. Humphrey, and H.F. Percival. 1995. Effects of ecotourism on distribution of waterbirds in a wildlife refuge. Conservation Biology 9: 1454-1465.

Knight, R.L. and D.N. Cole. 1995. Wildlife responses to recreationists. Pp. 51-69 In R. L. Knight and D. N. Cole, eds. Wildlife and recreationists: coexistence through management and research. Island Press, Washington, DC.

Knight, R.L. and K.J. Gutzwiller, eds. 1995. Wildlife and recreationalists: coexistence through management and research. Island Press, Washington, D.C. 372 pp.

Korschgen, C.E., L.S. George, and W.L. Green. 1985. Disturbance of diving ducks by boaters on a Migrational staging area. Wildlife Society Bulletin 13: 290-296.

Loegering, J.P. 1992. Piping Plover Breeding Biology, Foraging Ecology and Behavior on Assateague Island National Seashore, Maryland. M.S. Thesis. Virginia State Polytechnic Institute and State University, Blacksburg, Virginia. 262 pp.

McConnaughey, J.L., J.D. Fraser, S.D. Coutu, and J.P. Loegering. 1990. Piping plover distribution and reproductive success on Cape Lookout National Seashore. Unpublished report. Cape Lookout National Seashore, Morehead City, North Carolina. 83 pp.

Morton, J.M., A.C. Fowler, and R.L. Kilpatrick. 1989. Time and energy budgets of American black ducks in winter. Journal of Wildlife Management 53(2): 401-410.

Owen, M. 1973. The management of grassland areas for wintering geese. Wildfowl 24: 123-130.

Pfister, C., B.A. Harrington, and M. Lavine. 1992. The Impact of Human Disturbance on Shorebirds at a Migration Staging Area. Biological Conservation 60(2): 115-126.

Robertson, R.J. and N.J. Flood. 1980. Effects of Recreational Use of Shorelines on Breeding Bird Populations. Canadian Field-Naturalist 94(2): 131-138.

Rodgers, J.A. and H.T. Smith. 1995. Set-back distances to protect nesting bird colonies from human disturbance in Florida. Conservation Biology 9: 89-99.

Rodgers, J.A. and H.T. Smith. 1997. Buffer zone distances to protect foraging and loafing waterbirds from human disturbance in Florida. Wildlife Society Bulletin 25: 139-145.

Shaffer, F. and P. Laporte. 1992. Rapport synthese des recherches relatives au pluvier siffleur (*Charadrius melodus*) effectuees aux Iles-de-la-Madeleine de 1987 a 1991. Association quebecoise des groups d'ornithologues et Service canadien de la faune. 78 pp.

Strauss, E. 1990. Reproductive success, life history patterns, and behavioral variation in a population of Piping Plovers subjected to human disturbance (1982-1989). Ph.D. dissertation. Tufts University, Medford, Massachusetts.

United States Fish and Wildlife Service (USFWS). 1994. Northeastern Beach Tiger Beetle (*Cincindela dorsalis dorsalis*) Recovery Plan. U.S. Fish and Wildlife Service, Hadley, Massachusetts. 6 pp.

Ward, D.H. and R.A. Stehn. 1989. Response of brant and other geese to aircraft disturbance at Izembek Lagoon, Alaska. U.S. Fish and Wildlife Service, Alaska Fish and Wildlife Research Center. Final report to the Minerals Management Service. Anchorage, Alaska. 193 pp.

Welty, J.C. 1982. The life of birds. Saunders College Publishing, Philadelphia, Pennsylvania. 754 pp.

Williams, G.J. and E. Forbes. 1980. The habitat and dietary preferences of Dark-Bellied Brent Geese and Widgeon in relation to agricultural management. Wildfowl 31: 151-157.

**FWS Form 3-2319**
**02/06**

## FINDING OF APPROPRIATENESS OF A REFUGE USE

**Refuge Name:** Monomoy National Wildlife Refuge

**Use:** Hiking, Walking, and Jogging

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

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

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

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

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

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

**Not Appropriate** _____ **Appropriate** ✔

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

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

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

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

Refuge Supervisor: Richard Taylor Date: March 18, 2016

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

**603 FW 1**
**Exhibit 1**
**Page 2**

## JUSTIFICATION FOR A FINDING OF APPROPRIATENESS OF A REFUGE USE

**Refuge Name:** Monomoy National Wildlife Refuge

**Use:** Hiking, Walking, and Jogging

## NARRATIVE:

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

The Service and the Refuge System maintain the goal of providing opportunities to view wildlife and take part in interpretation. Allowing the use of refuge areas already open to the public, including one trail system on Morris Island, to persons hiking, walking and jogging supports this goal. Hiking, walking, and jogging are not priority public uses. Hiking and walking do facilitate priority public uses by providing visitors with the chance to view wildlife and engage in wildlife photography and interpretation, which promote public appreciation of the conservation of wildlife and habitats. Joggers are not likely to be observing wildlife but they might stop to read interpretative signs or passively observe wildlife while jogging. Hiking, walking and jogging would not materially interfere with or detract from the fulfillment of the Refuge System mission or the purpose for which the refuge was established.

Hiking, walking, and jogging are anticipated to have the same level of impacts as the primary public uses because the access and activities are very similar. Refuge staff will regulate these activities through area closures, so impacts of hiking, walking, and jogging will likely be minimal if conducted in accordance with refuge regulations. For these reasons, hiking, walking, and jogging are appropriate uses on Monomoy National Wildlife Refuge.

# COMPATIBILITY DETERMINATION

## USE:

Hiking, Walking, and Jogging

## REFUGE NAME:

Monomoy National Wildlife Refuge

## DATE ESTABLISHED:

June 1, 1944

## ESTABLISHING AND ACQUISITION AUTHORITY(IES):

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

## REFUGE PURPOSE(S):

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

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

## NATIONAL WILDLIFE REFUGE SYSTEM MISSION:

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

## DESCRIPTION OF USE:

**(a) What is the use?**
The use is hiking, walking or jogging.

**(b) Is the use a priority public use?**
This use is not a priority public use of the National Wildlife Refuge System (Refuge System); however, it supports priority public uses since it can contribute to wildlife observation, wildlife photography, and interpretation.

**(c) Where would the use be conducted?**
All hiking and walking will be conducted only in areas that are open to the public, including the Morris Island trail system and designated areas on Monomoy Island. Jogging will be conducted only in refuge areas that are open to the public on Morris Island. Certain areas on Monomoy National Wildlife Refuge (NWR) are seasonally

closed to public access at the refuge manager's discretion to protect sensitive habitats or species of concern, minimize conflicts with other refuge activities, or respond to human health and safety concerns. Hiking and walking have historically been concentrated along and limited to perimeter beaches, the Morris Island Trail and other traditional footpaths on Morris Island and the North Monomoy Corridor; on South Monomoy Island, hiking and walking occur on the connection to South Beach, the trail to access the Monomoy Light Station and keeper's house, and the trail between the lighthouse and Powder Hole.

**(d) When would the use be conducted?**
Individuals would be able to hike, walk, or jog throughout the year during regular refuge hours, unless otherwise posted by the refuge. Monomoy NWR is open daily from 1/2-hour before sunrise to 1/2-hour after sunset, year-round.

**(e) How would the use be conducted?**
Hiking, walking, and jogging tend to be self-regulating, with signs indicating trailheads and appropriate routes of travel, as well as seasonally closed areas. Visitors are encouraged to contact Monomoy NWR staff for up-to-date information on seasonal closures. Information about closures is also available on the refuge web site or at the visitor center, when staffed.

**(f) Why is this use being proposed?**
Hiking, walking, and jogging are not priority public uses. However, hiking and walking facilitate priority public uses on the refuge. Although hiking, walking are classified as non-wildlife activities, most visitors use the refuge for the wildland experience it provides. Hiking or walking in designated areas of the refuge allows visitors to engage in priority public uses such as wildlife observation, wildlife photography, or interpretation. Joggers are not likely to be observing wildlife but they might stop to read interpretative signs or passively observe wildlife while jogging.

## AVAILABILITY OF RESOURCES:

The refuge has an existing, self-guided, interpretive loop trail on Morris Island and a short trail bisecting North Monomoy, traversing from the designated boat landing on the east to the salt marsh and tidal flats on the west side. Both areas are maintained for safe hiking or walking and qualitatively monitored by existing refuge staff and volunteers for natural resource impacts at a relatively low annual cost. Allowing hiking or walking within areas otherwise open to the public, and jogging only on Morris Island, will not substantially increase the maintenance or operational needs of the refuge. No entrance fees are collected.

The following breakdown shows the estimated amount of funds needed annually to administer hiking, walking, and jogging refuge wide, including the Monomoy Wilderness.

| | | |
|---|---|---|
| WG-6 Maintenance Worker - trail/road maintenance | 1 week | $1,200 |
| GS-9 Visitor Services Specialist - hiking information | 1 week | $1,500 |
| GS-9 Law Enforcement Officer | 1 week | $1,800 |
| Fact sheets/materials | | $1,000 |
| **Total annual cost*** | | **$5,500*** |

Refuge areas that are open to the public are maintained for a variety of activities. Costs shown are a percentage of total costs for trail/road maintenance on the refuge and are reflective of the percentage of trail/road use for this activity. Volunteers account for some hiking information and trail maintenance hours and help reduce overall cost of the program.

## ANTICIPATED IMPACTS OF THE USE:

The proposed use is anticipated to have the same level of impacts as the priority public uses because the access and activities are very similar. The impacts to natural resource and wilderness character from hiking, walking, or jogging will likely be minimal if conducted in accordance with refuge regulations and only in areas otherwise open to public access. Possible wildlife and fisheries impacts include disruption of nesting migratory bird

populations, terns, shorebirds, and other bird populations feeding and resting near the trails during certain times of the year, impacts to larval threatened northeastern beach tiger beetle populations, and disruption of local seal populations.

On Monomoy NWR, area closures are created to protect priority nesting migratory tern and shorebird species. Although these closure areas are designed to minimize human impacts, the potential exists for impacts to unobserved nesting animals. Conflicts arise when migratory birds and humans are present in the same areas (Boyle and Samson 1985). Response of wildlife to human activities includes departure from site (Owen 1973, Burger 1981, Kaiser and Fritzell 1984, Korschgen et al. 1985, Henson and Grant 1991, Kahl 1991, Klein 1993), use of sub-optimal habitat (Erwin 1980, Williams and Forbes 1980), altered behavior (Burger 1981, Korschgen et al. 1985, Morton et al. 1989, Ward and Stehn 1989, Havera et al. 1992, Klein 1993), and increase in energy expenditure (Morton et al. 1989, Bélanger and Bédard 1990).

Numerous studies have documented that migratory birds are disturbed by human activity on beaches. Erwin (1989) documented disturbance of common terns and skimmers and recommended that human activity be restricted to a distance of 100 meters around nesting sites. Pfister et al. (1992) found that the impact of disturbance was greater on species using the heavily disturbed front side of the beach, with the abundance of the impacted species being reduced by as much as 50 percent. In studying the effects of recreational use of shorelines on nesting birds, Robertson et al. (1980) discovered that disturbance negatively impacted species composition. Piping plovers, which intensively use the refuge, are also impacted negatively by human activity. Pedestrians on beaches may crush eggs (Jenkins and Burger 1987, Hill 1988, Shaffer and Laporte 1992, Cape Cod National Seashore 1993, Collazo et al. 1994). Other studies have shown that if pedestrians cause incubating plovers to leave their nest, the eggs can overheat (Bergstrom 1991) or can cool to the point of embryo death (Welty 1982). Pedestrians have been found to displace unfledged chicks (Strauss 1990, Burger 1991, Hoopes 1993, Loegering 1992, Goldin 1993).

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

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

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

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

Type and Speed of Activity: Activities where humans move quickly (e.g., jogging) or make loud noises (e.g., landscaping) cause birds to flush more than fishermen, clammers, sunbathers, and some pedestrians. The latter groups tend to move more slowly or stay in one place for longer periods, and birds likely perceive these activities as less threatening (Burger 1981, 1986, Burger et al. 1995, Knight and Cole 1995). Alternatively, birds may tolerate passing by with unabated speed, but may flush if the activity stops or slows (Burger et al. 1995).

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

Trash left on the beach, particularly food or wrappers, can attract predators that prey on nesting piping plovers and least terns or roosting shorebirds. Impacts of hiking, walking, or jogging are likely to be minimal if conducted in accordance with refuge regulations and only in areas otherwise open to public access. Jogging is not suitable on North and South Monomoy Islands because of the use of these areas by nesting and staging birds and seals. We will manage refuge closures that restrict pedestrian access to minimize disturbance to priority avian species during critical times of the year. Closures can be expanded or contracted as needed, depending on bird activity and results of further disturbance studies.

Individuals hiking, walking, or jogging to Monomoy NWR could potentially impact the larval stage of the threatened northeastern beach tiger beetle on South Monomoy Island. The recovery plan for this species describes human impacts such as habitat alteration and recreational activities that threaten many of the species' habitats (U.S. Fish and Wildlife Service (USFWS) 1994). Larval burrows are especially susceptible to trampling, which results in excess energy expenditure and reduced time spent foraging by the inhabiting larva. We will continue to survey to determine the location and extent of larval beetle occurrence and habitat, and use closures and re-routing to avoid larval habitats, as warranted.

Pedestrian use also has the potential to disturb loafing seals. Gray and harbor seals haul out on the refuge year round. A 150-foot buffer around all seals is required by the National Oceanic Atmospheric Administration to ensure compliance with the Marine Mammals Protection Act.

Unmanaged hiking, walking, or jogging has the potential to damage or kill plants and lead to new, unwanted, impromptu trails on the refuge that become shortcuts through more ecologically sensitive sites. Heavy use of designated, managed, or unmanaged pedestrian travel routes can ultimately lead to areas void of vegetation (McDonnell 1981, Vaske et al. 1992) and potentially destabilize dunes and interdunal wetlands, which are difficult to stabilize and restore to a naturally functioning condition (Kucinski and Einsenmenger 1943, Cole 2002, Goldsmith 2002, Grady 2002, O'Connell 2008).

Trampling has three initial effects: abrasion of vegetation, abrasion of surface soil organic layers, and soil compaction (Cole 2002). Plants can be crushed, sheared off, bruised, and even uprooted by trampling, leading to reduced vigor and reproduction, reduced or altered plant species composition and structure, and reduced biomass and cover (Cole 2002). Of these, abrasion of vegetation is the most common and noticeable effect observed in coastal dune communities, where little or no surface organic layer exists on the sandy soil substrate that naturally resists compaction (Fletcher 1993). All three impacts can commonly occur, however, within coastal marsh habitats where reduced wave energy allows significant accumulation of surface organic layers that are vulnerable to compaction (Fletcher 1993), which increases surface soil bulk density and reduces permeability. Increased ponding and muddy conditions tend to promote wider vegetative and soil impact zones along trails through wet areas (Cole 2002). McDonnell (1981) analyzed long-term human trampling, ranging from low to high intensity, on coastal dune vegetation at Parker River NWR in Massachusetts. All levels of trampling significantly lowered species diversity, and heavy trampling caused a drastic reduction in species diversity and total vegetation cover. Moderate trampling reduced species diversity but not cover. This was probably because moderate trampling favored some species, such as beach grass over other, more sensitive species, such as beach-heather (*Hudsonia tomentosa*). Trampling may result in changes in plant communities by preventing succession in interdune and backdune areas and favoring disturbance-tolerant foredune species like beach grass.

The harsh growing conditions and environment in the coastal barrier system can make for slow vegetative recovery even after pedestrian traffic is eliminated at trampled sites (Fletcher 1993). The gradient from no vegetation to normal cover levels is very narrow along refuge trails and other footpaths where trampling is more concentrated, and is wider at traditional boat landings where trampling is more dispersed. Hiking and walking are among the most primitive forms of recreation, and the trails themselves encourage users to confine their hiking or walking to narrow corridors radiating or looping outward from user focal areas such as beach access points or boat landings. Such localized impacts, concentrated near a small number of the most popular destinations, do not pose any serious disruption to the barrier ecosystem composition, structure, and function and are not evident at large spatial scales on Monomoy NWR.

Once established, the trails themselves are clear evidence of human presence that detracts from some users' perceptions of an otherwise untrammeled, undeveloped, or otherwise natural appearing landscape (Hendee and Dawson 2002) within the Monomoy Wilderness. Bare, exposed, sand dune areas, potentially compacted

tidal marsh segments, trail treads, and narrow zones of disturbed vegetation on either side of refuge foot trails and boat landings will be readily evident, but when trail standards are kept minimal, trails tend to be accepted or even expected by most, though not all, wilderness users (Stankey and Schreyer 1987, Cole 2002, Hendee and Dawson 2002). The majority of the Monomoy Wilderness will remain essentially unvisited and virtually undisturbed by hiking and walking. Pedestrian footpaths are not expected to substantially compromise the perception of naturalness of the Monomoy Wilderness landscape or the wilderness user's experience (Cole 2002, Hendee and Dawson 2002).

Wilderness visitors' experiences are most strongly affected by social conditions, such as other visitors and their actions, than by their perception of naturalness or ecological conditions (Hendee and Dawson 2002). The trails themselves tend toward promoting a confining rather than an unconfined user experience (Hendee and Dawson 2002). With typically long sight distances across Monomoy's rolling nearly treeless coastal barrier landscape, too many individuals encountered or observed hiking or walking during visits by other Monomoy Wilderness users likely detracts from the sense of solitude experienced by wilderness users (Stankey and Schreyer 1987, Hendee and Dawson 2002). However, hiking and walking use is still currently very light in the more remote, interior portions of South Monomoy Island open to public use, where outstanding opportunities for solitude can be experienced by other Monomoy Wilderness users.

## PUBLIC REVIEW AND COMMENT:

As part of the comprehensive conservation planning (CCP) process for the Monomoy NWR, a draft of this compatibility determination underwent a 180-day public comment period concurrent with the release of our draft CCP/Environmental Impact Statement (EIS). This final compatibility determination resulted from that public review and comment process. It underwent a further 37-day public review period concurrent with the release of the final CCP/EIS. No comments were received on the compatibility determination and it has remain unchanged.

## DETERMINATION (CHECK ONE BELOW):

_____Use is not compatible.

__X__Use is compatible with the following stipulations.

## STIPULATIONS NECESSARY TO ENSURE COMPATIBILITY:

- All hiking, walking, and jogging will be done only in areas that are otherwise open to the public. Jogging may only be done on refuge lands on Morris Island otherwise open to public access.

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

- No physical items, including litter, will be placed or left on the refuge. The leave-no-trace principles and practices (e.g., pack it in and pack it out) will be implemented on a refugewide basis, including the Monomoy Wilderness.

- The Service will continue to allow dogs on leash on Morris Island only from September 16 to April 30, during the refuge's normal open hours. The refuge is open daily sunrise to sunset.
- All hikers, walkers, and joggers must maintain a 150-foot buffer around all seals as required by the National Oceanic Atmospheric Administration to ensure compliance with the Marine Mammals Protection Act.
- Refuge visitor information services and products will emphasize the importance of staying on trails and out of seasonal closure areas, along with providing leave-no-trace hiking tips.
- Refuge staff or volunteers will periodically qualitatively and photographically document pedestrian impacts to vegetation and soils to footpaths, boat landings, and other known user concentration points for use in drafting or updating a Monomoy Wilderness Stewardship Plan.

## JUSTIFICATION:

The Service and the National Wildlife Refuge System (Refuge System) maintain the goal of providing opportunities to view or photograph wildlife and to take part in interpretation. Allowing the use of refuge areas that are already open to the public including, but not limited to, one interpretive trail on Morris Island, the North Monomoy Corridor; on South Monomoy Island, hiking and walking occur on the connection to South Beach, the trail to access the Monomoy Light Station and keeper's house, and the trail between the lighthouse and Powder Hole. Jogging will be conducted only in areas that are open to the public on Morris Island. Although hiking or walking are not priority public uses, they facilitate priority public uses, providing visitors with the chance to view or photograph wildlife and engage in interpretation and recreational fishing, thereby promoting public appreciation of the conservation of wildlife and habitats. Hiking, walking, or jogging at current and expected levels of use, and subject to the stipulations listed above will not materially interfere with or detract from preserving wilderness character in the Monomoy Wilderness, the fulfillment of the Refuge System mission, or the purpose for which the refuge was established.

## SIGNATURE:

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

## CONCURRENCE:

Regional Chief: Scott B. Kahn (Signature) March 18 2016 (Date)

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

**Literature Cited:**

Bélanger, L. and J. Bédard. 1990. Energetic cost of man-induced disturbance to staging snow geese. Journal of Wildlife Management 54(1): 36-41.

Bergstrom, P.W. 1991. Incubation temperatures of Wilson's plovers and killdeer. Condor 91: 634-641.

Boyle, S.A. and F.B. Samson. 1985. Effects of non-consumptive recreation on wildlife: A review. Wildlife Society Bulletin 13: 110-116.

Burger, J. 1981. The effect of human activity on birds at a coastal bay. Biological Conservation 21: 231-241.

Burger, J. 1986. The effect of human activity on shorebirds in two coastal bays in northeastern United States. Biological Conservation 13: 123-130.

Burger, J. 1991. Foraging behavior and the effect of human disturbance on the piping plover (*Charadrius melodus*). Journal of Coastal Research 7(1): 39-52.

Burger, J. and M. Gochfeld. 1981. Discrimination of the threat of direct versus tangential approach to the nest by incubating herring and great black-backed gulls. Journal of Comparative Physiological Psychology 95: 676-684.

Burger, J., M. Gochfeld, and L.J. Niles. 1995. Ecotourism and birds in coastal New Jersey: Contrasting responses of birds, tourists, and managers. Environmental Conservation 22: 56-65.

Burger, J. and M. Gochfeld. 1998. Effects of ecotourists on bird behaviour at Loxahatchee National Wildlife Refuge, Florida. Environmental Conservation 25: 13-21.

Cape Cod National Seashore. 1993. Piping plover nest found trampled by pedestrian. News Release. Cape Cod National Seashore, South Wellfleet, Massachusetts. 2 pp.

Cole, D. N. 2002. Ecological impacts of wilderness recreation and their management. Chapter 15, Pp. 413-459 In J.C. Hendee and C.P. Dawson, eds. Wilderness Management: Stewardship and Protection of Resources and Values, Third Edition. Fulcrum Publishing, Golden, Colorado. 640 pp.

Collazo, J.A., J.R. Walters, and J.F. Parnell. 1994. Factors Affecting Reproduction and Migration of Waterbirds on North Carolina Barrier Islands. 1993 Annual Progress Report. North Carolina State University, Raleigh, North Carolina. 57 pp.

Erwin, R.M. 1980. Breeding habitat by colonially nesting water birds in two mid-Atlantic U.S. regions under different regimes of human disturbance. Biological Conservation 18: 39-51.

Erwin, R.M. 1989. Responses to Human Intruders by Birds Nesting in Colonies: Experimental Results and Management Guidelines. Colonial Waterbirds 12(1): 104-108.

Fletcher, P.C. 1993. Soil Survey of Barnstable County, Massachusetts. U.S. Department of Agriculture, Soil Conservation Service. 137 pp.

Goldin, M.R. 1993. Effects of human disturbance and off-road vehicles on piping plover reproductive success and behavior at Breezy Point, Gateway National Recreation Area, New York, M.S. Thesis. University of Massachusetts, Amherst, Massachusetts. 128 pp.

Goldsmith, W. 2002. History, theory and practice of bio-engineering in coastal areas. Pp. 37-59. In J. F. O'Connell, ed. Stabilizing Dunes and Coastal Banks using Vegetation and Bio-engineering: Proceedings of a Workshop held at the Woods Hole Oceanographic Institute, Woods Hole, Massachusetts. Cape Cod Cooperative Extension and Sea Grant at Woods Hole Oceanographic Institute. Technical Report WHOI-2002-11.

Grady, J. 2002. Dune vegetation planting and sand fencing: The Duxbury Beach Experience. Pp. 61-73 In J. F. O'Connell, ed. Stabilizing Dunes and Coastal Banks using Vegetation and Bio-engineering: Proceedings of a Workshop held at the Woods Hole Oceanographic Institute, Woods Hole, Massachusetts. Cape Cod Cooperative Extension and Sea Grant at Woods Hole Oceanographic Institute. Technical Report WHOI-2002-11.

Havera, S.P., L.R. Boens, M.M. Georgi, and R.T. Shealy. 1992. Human disturbance of waterfowl on Keokuk Pool, Mississippi River. Wildlife Society Bulletin 20: 290-298.

Hendee, J.C. and C.P. Dawson 2002. Wilderness Management: Stewardship and Protection of Resources and Values, Third Edition. Fulcrum Publishing, Golden, Colorado. 640 pp.

Henson, P.T. and A. Grant. 1991. The effects of human disturbance on trumpeter swan breeding behavior. Wildlife Society Bulletin 19: 248-257.

Hill, J.O. 1988. Aspects of breeding biology of Piping Plovers (*Charadrius melodus*) in Bristol County, Mass., in 1988. Unpublished report. University of Massachusetts, Amherst, Massachusetts. 44 pp.

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

Jenkins, D.C. and J. Burger. 1987. New Jersey Endangered Beach-Nesting Bird Project: 1986 Survey and Management. New Jersey Department of Environmental Protection, New Jersey. 37 pp.

Kaiser, M.S. and E.K. Fritzell. 1984. Effects of river recreationists on green-backed heron behavior. Journal of Wildlife Management 48: 561-567.

Kahl, R. 1991. Boating disturbance of canvasbacks during migration at Lake Poygan, Wisconsin. Wildlife Society Bulletin 19: 242-248.

Klein, M. L. 1993. Waterbird behavioral responses to human disturbance. Wildlife Society Bulletin 21: 31-39.

Klein, M.L., S.R. Humphrey, and H.F. Percival. 1995. Effects of ecotourism on distribution of waterbirds in a wildlife refuge. Conservation Biology 9: 1454-1465.

Knight, R.L. and D.N. Cole. 1995. Wildlife responses to recreationists. Pp. 51-69 in R. L. Knight and K. J. Gutzwiller, eds. Wildlife and recreationists: coexistence through management and research. Washington, DC, Island Press.

Korschgen, C.E., L.S. George, and W.L. Green. 1985. Disturbance of diving ducks by boaters on a migrational staging area. Wildlife Society Bulletin 13: 290-296.

Kucinski, K.J. and W.S. Einsenmenger. 1943. Sand dune stabilization on Cape Cod. Economic Geography 19(2): 206-214.

Loegering, J.P. 1992. Piping Plover Breeding Biology, Foraging Ecology and Behavior on Assateague Island National Seashore, Maryland. M.S. Thesis. Virginia State Polytechnic Institute and State University, Blacksburg, Virginia. 262 pp.

McDonnell, M.J. 1981. Trampling effects on coastal dune vegetation in the Parker River National Wildlife Refuge, Massachusetts, U.S.A. Biological Conservation 21(4): 289-301.

Morton, J.M., A.C. Fowler, and R.L. Kilpatrick. 1989. Time and energy budgets of American black ducks in winter. Journal of Wildlife Management 53: 401-410 (also see corrigendum in Journal of Wildlife Management 54:683).

O'Connell, J. 2008. Coastal dune protection and restoration: using "Cape" American beachgrass and fencing. Woods Hole Sea Grant and Cape Cod Cooperative Extension. Marine Extension Bulletin. 15 pp.

Owen, M. 1973. The management of grassland areas for wintering geese. Wildfowl 24: 123-130.

Pfister, C., B.A. Harrington, and M. Lavine. 1992. The Impact of Human Disturbance on Shorebirds at a Migration Staging Area. Biological Conservation 60(2): 115-126.

Robertson, R.J. and N.J. Flood. 1980. Effects of Recreational Use of Shorelines on Breeding Bird Populations. Canadian Field-Naturalist 94(2): 131-138.

Rodgers, J.A. and H.T. Smith. 1995. Set-back distances to protect nesting bird colonies from human disturbance in Florida. Conservation Biology 9: 89-99.

Rodgers, J.A. and H.T. Smith. 1997. Buffer zone distances to protect foraging and loafing waterbirds from human disturbance in Florida. Wildlife Society Bulletin 25: 139-145.

Shaffer, F. and P. Laporte. 1992. Rapport synthese des recherches relatives au pluvier siffleur (*Charadrius melodus*) effectuees aux Iles-de-la-Madeleine de 1987 a 1991. Association quebecoise des groups d'ornithologues et Service canadien de la faune. 78 pp.

Stankey, G.H. and R. Schreyer. 1987. Attitudes toward wilderness and factors affecting visitor behavior: a state of knowledge review. In Lucas, R.C., comp. Proceedings – National Wilderness Research Conference: Issues, State-of-Knowledge, Future Directions; July 23-26, 1985; Fort Collins, Colorado. Gen. Tech. Rep. INT-220. Ogden, Utah: U.S. Department of Agriculture, Forest Service, Intermountain Research Stations: 246-293.

Strauss, E. 1990. Reproductive success, life history patterns, and behavioral variation in a population of Piping Plovers subjected to human disturbance (1982-1989). Ph.D. dissertation. Tufts University, Medford, Massachusetts.

United States Fish and Wildlife Service (USFWS). 1994. Northeastern Beach Tiger Beetle (*Cincindela dorsalis dorsalis* Say) Recovery Plan. U.S. Fish and Wildlife Service, Hadley, Massachusetts. 6 pp.

Vaske J.V., R.D. Deblinger, and M.P. Donnelly. 1992. Barrier beach impact management planning: Findings from three locations in Massachusetts. Canadian Water Resources Assoc. Journal 17: 278-290.

Ward, D.H. and R.A. Stehn. 1989. Response of brant and other geese to aircraft disturbance at Izembek Lagoon, Alaska. U.S. Fish and Wildlife Service, Alaska Fish and Wildlife Research Center. Final report to the Minerals Management Service. Anchorage, Alaska. 193 pp.

Welty, J.C. 1982. The life of birds. Saunders College Publishing, Philadelphia, Pennsylvania. 754 pp.

Williams, G.J. and E. Forbes. 1980. The habitat and dietary preferences of dark-bellied brant geese and widgeon in relation to agricultural management. Wildfowl 31: 151-157.

**FWS Form 3-2319**
**02/06**

## FINDING OF APPROPRIATENESS OF A REFUGE USE

**Refuge Name:** Monomoy National Wildlife Refuge

**Use:** Mosquito Monitoring and Control

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

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

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

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

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

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

**Not Appropriate** _____ **Appropriate** ✔

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

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

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

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

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

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

**603 FW 1**
**Exhibit 1**
**Page 2**

## JUSTIFICATION FOR A FINDING OF APPROPRIATENESS OF A REFUGE USE

**Refuge Name:** Monomoy National Wildlife Refuge

**Use:** Mosquito Monitoring and Control

## NARRATIVE:

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

Mosquito management includes population monitoring and control, if warranted. Mosquito surveillance monitoring and control, when necessary, will be conducted in several small pools, or pannes, within a 5-acre salt marsh on the Morris Island portion of the refuge. Mosquito and mosquito-borne disease management is not a priority public use of the National Wildlife Refuge System (Refuge System) under the Refuge System Administration Act of 1966 (16 U.S.C. 668dd-668ee), as amended by the National Wildlife Refuge System Improvement Act of 1997.

Mosquito population monitoring and control would be conducted by the Cape Cod Mosquito Control Project following the protocols and best management practices identified in the Massachusetts Arbovirus Surveillance and Response Plan (Massachusetts Department of Public Health 2012) and in compliance with refuge-specific regulations. In general, we allow populations of native mosquito species to function unimpeded unless they cause a wildlife or human health threat. Mosquitoes are a natural component of most wetland ecosystems but may also represent a threat to human, wildlife, or domestic animal health. Refuges are to collaborate with Federal, State, or local public health authorities and vector control agencies to identify refuge-specific health threat categories that represent increasing levels of health risks and are based on monitoring data.

Mosquito-associated health threats will be addressed using an integrated pest management (IPM) approach, including when practical, compatible, non-pesticide actions that reduce mosquito production. Treatment options will be chosen based on our IPM policy (569 FW 1) and our Refuge System Biological Integrity Diversity and Environmental Health policy (601 FW 3), and will emphasize human safety and environmental integrity, effectiveness, and cost factors. We will use human, wildlife, or domestic animal mosquito-associated health threat determinations, combined with refuge mosquito population estimates, to determine the appropriate refuge mosquito management response. We will allow pesticide treatment to control mosquitoes on refuge lands only after evaluating all other reasonable IPM actions, based on monitoring data for the relevant mosquito life stage and only when necessary to protect human or wildlife health, when mosquitoes are detrimental to refuge management goals and objectives, and control does not interfere with achieving management goals and objectives. We will use current monitoring data for larval, pupal, and adult mosquitoes to determine the need for larvicides, pupacides, and adulticides, respectively. We will allow the use of adulticides only when there are no practical, effective alternatives to reduce a health threat during a declared public health emergency.

# COMPATIBILITY DETERMINATION

## USE:

Mosquito Monitoring and Control

## REFUGE NAME:

Monomoy National Wildlife Refuge

## DATE ESTABLISHED:

June 1, 1944

## ESTABLISHING AND ACQUISITION AUTHORITY(IES):

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

## REFUGE PURPOSE(S):

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

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

## NATIONAL WILDLIFE REFUGE SYSTEM MISSION:

The mission of the National Wildlife Refuge System (Refuge System) is to administer a national network of lands and waters for the conservation, management, and where appropriate, restoration of the fish, wildlife, and plant resources and their habitats within the United States for the benefit of present and future generations of Americans. (National Wildlife Refuge System Improvement Act of 1997 (Refuge Improvement Act), Public Law 105-57; 111 Stat. 1252).

## DESCRIPTION OF USE:

**(a) What is the use? Is the use a priority public use?**
The use is mosquito management, which includes population monitoring and, if warranted, control. Mosquito and mosquito-borne disease management is not a priority public use of the Refuge System under the National Wildlife Refuge System Administration Act of 1966 (16 U.S.C. 668dd-668ee), as amended by the Refuge Improvement Act.

The Cape Cod Mosquito Control Project (CCMCP) will conduct mosquito population monitoring and control, following the protocols and best management practices identified in the Massachusetts Arbovirus Surveillance

and Response Plan (Massachusetts Department of Public Health 2012). The U.S. Fish and Wildlife Service (Service) recognizes that mosquitoes are a natural component of most wetland ecosystems but may also represent a threat to human, wildlife, or domestic animal health. Refuges are to collaborate with Federal, State, or local public health authorities and vector control agencies to identify refuge-specific health threat categories that represent increasing levels of health risks and are based on monitoring data. Refuges will not conduct mosquito monitoring or control, but may allow these activities under a special use permit (SUP).

**(b) Where would the use be conducted?**
Mosquito surveillance monitoring and control, if necessary, will be conducted in several small pools within a 5-acre salt marsh on the Morris Island portion of the Monomoy National Wildlife Refuge (Monomoy NWR). The refuge lies within the jurisdiction of the CCMCP, which has conducted mosquito control activities on Morris Island (both on and off-refuge) since the CCMCP was organized in 1930. The CCMCP controlled larval mosquitoes in these small pools from at least 1983 until August 2001, when the practice was suspended pending review of the Service's new compatibility process. In July 2003, the Service found mosquito surveillance and limited mosquito control to be compatible, and the CCMCP resumed surveillance and larvicidal mosquito control of select mosquito species.

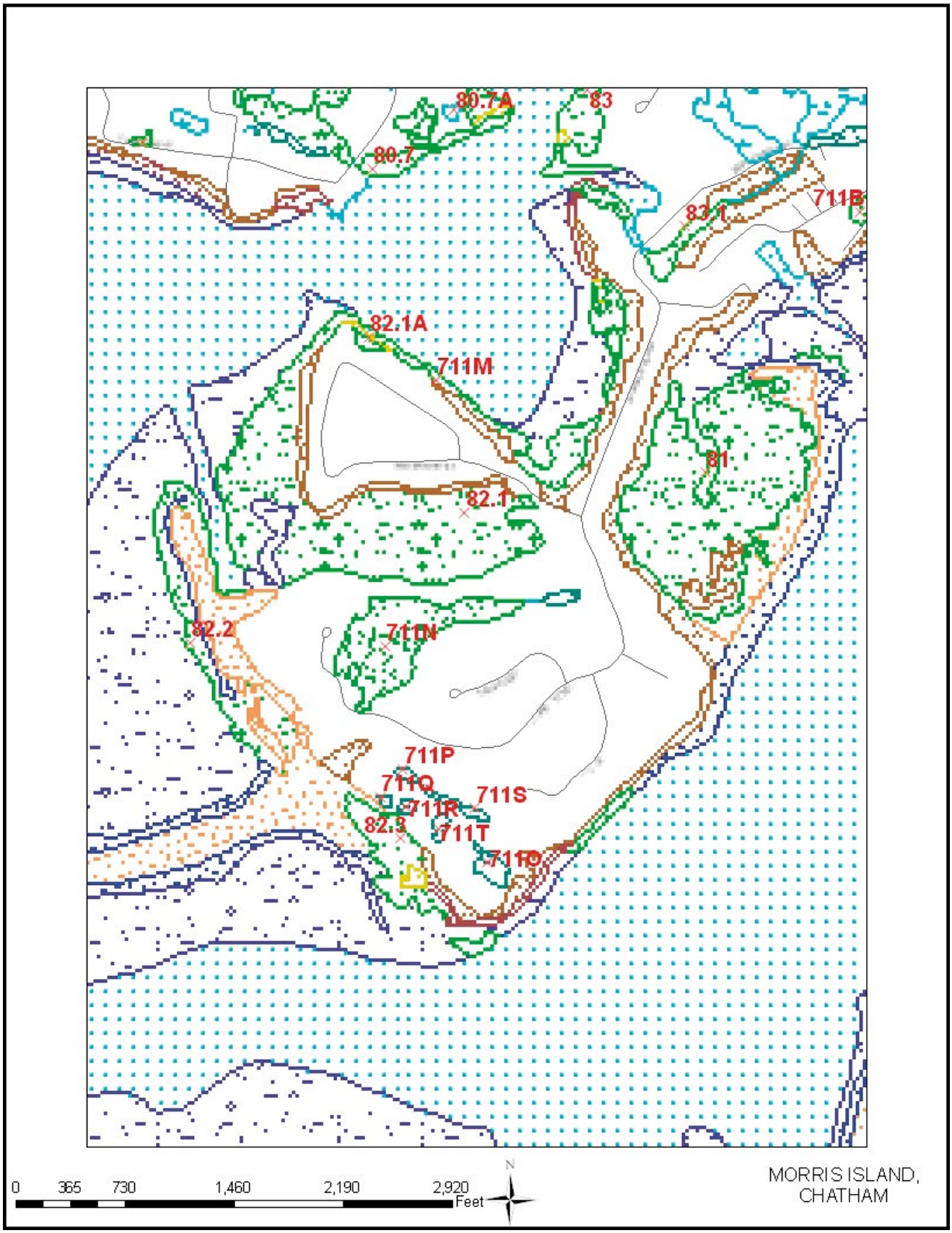
**(c) When would the use be conducted?**
Surveillance activities associated with this use would be conducted on the Morris Island portion of the refuge from April through October by CCMCP staff under the conditions of this compatibility determination and an SUP. Known sites of mosquito development on the refuge will be visited for monitoring and surveillance during periods of mosquito production. The timing and frequency of monitoring is based on a number of factors, including history of mosquito production, tidal cycles, precipitation levels, and available resources, but could occur as frequently as weekly throughout the season.

Mosquito control occurs irregularly when necessary to protect the health and safety of humans, wildlife, or domestic animals. Any mosquito control activities will be conducted on the basis of surveillance data. CCMCP treatment of refuge marshes using larvicides would occur only after the CCMCP has provided the refuge manager with data that shows that mosquito larvae populations are widespread within the salt marsh, and after monitoring indicates *O. cantator* and *O. sollicitans* larval counts exceed an average of 10 larvae per standard (350 ml) dipper. Other factors used to determine whether treatment would be allowed include marsh hydrology (drying versus flooding), rainfall, temperature, instar larval stages, and spray history.

Pupacides or adulticides will only be used when large numbers of mosquitoes are considered an immediate threat to human health and thresholds developed by the appropriate public health authority are met or exceeded, i.e., there is active transmission of mosquito-borne disease on the refuge from refuge-based mosquitoes.

**(d) How would the use be conducted?**
Mosquito-associated health threats will be addressed using an integrated pest management (IPM) approach including, when practical, compatible, non-pesticide actions that reduce mosquito production. We will choose treatment options based on our IPM policy (569 FW 1) and our Biological Integrity Diversity and Environmental Health (BIDEH) policy (601 FW 3). We will base the choice on, in order of preference: human safety and environmental integrity, effectiveness, and cost. We will use human, wildlife, or domestic animal mosquito-associated health threat determinations combined with refuge mosquito population estimates to determine the appropriate refuge mosquito management response. We will consider allowing pesticide treatment to control mosquitoes on refuge lands after we evaluate all other reasonable IPM actions. Based on monitoring data, we will determine the most appropriate pesticide treatment options for the relevant mosquito life stage. We will use current monitoring data for larval, pupal, and adult mosquitoes to determine the need for larvicides, pupacides, and adulticides, respectively. Mosquito and arbovirus surveillance, monitoring, and treatment within the refuge have historically focused on several small pools within the salt marsh along the northwest refuge boundary on Morris Island. This is shown as area 81 on map D.1. Treatment areas will be based on surveillance and monitoring results. Specific areas treated and the extent of treatment would vary from year to year depending on mosquito populations, the mosquito vector flight distance, and environmental conditions. We will allow the use of adulticides only when there are no practical, effective alternatives to reduce a health threat. We will not allow pesticide treatments for mosquito control on the refuge without current mosquito population data indicating that such actions are warranted. We require an approved pesticide use proposal (PUP) prior to an application of a pesticide on refuge lands.

*Map D.1. Mosquito Harboring Locations on Morris Island and Vicinity, Chatham, Massachusetts*



In Massachusetts, mosquito control activities and work are performed pursuant to the provisions of chapter 252 of the Massachusetts General Laws (*http://www.mass.gov/agr/mosquito;* accessed October 2015). The CCMCP, as one of the nine mosquito control projects authorized under chapter 252, monitors larval and adult mosquitos on the refuge *https://malegislature.gov/Laws/General Laws/Part111/TitleV/Chapter252 (*accessed October 2015) and adheres to the Massachusetts Arbovirus Surveillance and Response Plan (Massachusetts Department of Public Health 2012). Additionally, the CCMCP will conduct surveillance, monitoring, and if necessary, control measures under the conditions contained in an SUP that will be issued by the refuge manager.

Baseline mosquito management actions on Monomoy NWR will involve monitoring and surveillance of mosquito vector populations. Annual surveillance monitoring on refuge lands for arbovirus incidence in adult mosquito vectors and wildlife (especially birds) will be allowed. Mosquito vector monitoring on the refuge will document mosquito species composition to genus or species level, and estimate population size and distribution across refuge wetland habitats during the breeding season, using standard methods employed by mosquito control professionals.

Mosquito population monitoring objectives are to:

- Establish baseline data on species and abundance.
- Map breeding and harboring habitats.
- Estimate relative changes in population sizes and evaluate associated health risks.
- Use this information to guide integrated pest management of mosquito populations.

All sites identified as potential mosquito habitat have been logged and recorded in the CCMCP Geographic Information system (GIS) system. Throughout the mosquito season, CCMCP crews conduct larval surveys on two- week rotations. The CCMCP checks all sites known to harbor mosquitoes for mosquito larvae using a standard (350 ml) dipper, and may search for new larval habitats, i.e., artificial containers, on or adjacent to refuge lands. Carbon dioxide light traps are placed on the Morris Island portion of Monomoy NWR. When the traps are deployed, adult mosquitoes are collected from them weekly, taken back to the lab, identified to the species level, and counted. Landing rates of adult mosquitoes are also noted. Monitoring will be conducted by the CCMCP, primarily on foot. Use of motorized vehicles on refuge lands is not authorized unless escorted by refuge staff. To avoid harm to wildlife or habitats, access to traps and sampling stations will comply with the Stipulations Necessary to Ensure Compatibility included in this determination.

Refuge staff will work with the CCMCP to develop a mosquito management plan that will provide specifics on how and when the refuge will allow, if necessary, control of mosquitoes on refuge lands, using predetermined threat levels and mosquito vector population densities. A phased approach will be used to guide appropriate control response up to and including the use of adulticides. That will occur when Federal and State public health officials, using arbovirus monitoring and surveillance data, have determined that the refuge is in a high-risk area for mosquito-borne disease transmission, and it has been demonstrated through surveillance that refuge-based mosquitoes have been shown to carry specific diseases. A high-risk determination indicates an imminent risk of serious human disease or death.

Pesticide treatment may not be used on Monomoy NWR solely for nuisance mosquito relief, but may be considered when there is a demonstrated human or wildlife health risk and mosquito management actions will not interfere with refuge goals and objectives. Only pesticides identified in the SUP and for which a PUP has been submitted and approved will be used on the refuge. The preferred larvicide treatments for use on the refuge are *Bacillus thuringiensis israelensis* (Bti) or *Bacillus sphaericus* (Bs), because of the bacterium's limited non-target effects. Due to specificity of the effects of Bti on the insect order Diptera, Aquabac is deemed compatible for use, under the stipulations prescribed at the end of this compatibility determination. Bti is the preferred chemical control option and will be used under appropriate conditions before methoprene is considered. We favor using the larvicide that would have the least adverse impacts on non-target invertebrates, produce fewer disruptions to food webs critical for migratory birds, and reduce lethal effects on natural mosquito predators, such as larval forms of odonates, hemipterans, and coleopterans. CCMCP will conduct post-larvicide monitoring to determine effectiveness.

Treatment regimens will vary annually, depending on the current threat level; the process for determining the threat level will be clearly delineated in the Monomoy NWR Mosquito Management Plan. Because disease

threat levels vary from year to year, mosquito management on the refuge is unlikely to include all phases in any given year. Action thresholds that trigger chemical interventions will incorporate various factors listed in Service Policy 601 FW 7, Exhibit 3, as developed with refuge staff, State mosquito control section, public human health services, and vector control agencies. Thresholds must be genus and life-stage specific and be related to the refuge decision-making response matrix.

We will rarely allow CCMCP staff to undertake targeted larvicide applications (Aquabac granular Bti) to protect human safety if the mean number of *O. cantator* or *O. sollicitans* mosquito larvae is less than the threshold that is established in consultation with public human health personnel. At a minimum, the threshold will be 10/dip, with at least 10 dips taken on the same day within each source pool across the 5-acre site; this is subject to change depending on the results of future coordination with public health officials. Mosquito vector populations below this level will not be treated. The CCMCP will coordinate with the refuge manager prior to surveillance, monitoring, and control activities on the refuge.

Variations in annual permit restrictions may be necessary to accommodate wildlife breeding, roosting, and feeding activity, endangered species, administrative needs, public use management, research, or monitoring protocols. Other conflicts that may arise will be incorporated into the annual permit to ensure there are no significant adverse impacts on refuge wildlife and habitats. Because mosquito management takes place only on Morris Island, there is no need to develop restrictions or stipulations to protect wilderness character.

The CCMCP is required to provide the refuge manager with an annual quantitative summary of refuge mosquito monitoring and surveillance results, control activities on the refuge (e.g., type of pesticides applied, amount of pesticides applied, locations of application, method of application), and regional disease surveillance. All surveillance and control activities would be spatially referenced as technologies develop at CCMCP, e.g., use of global positioning satellites and GIS. Comparisons of mosquito management within and among years should be presented to permit analysis of patterns that may indicate success of habitat management efforts or suggest the need for a new management approach.

**(e) Why is this use being proposed?**

The use is proposed to minimize health risks to humans and wildlife from mosquito-borne disease. Two mosquito-borne viral diseases are currently endemic in Massachusetts: eastern equine encephalitis virus (EEEV) and West Nile virus (WNV). Mosquito population monitoring is necessary to detect changes that indicate increased human or wildlife health risks. In addition, surveillance for incidence of mosquito-borne disease by testing wildlife, especially birds, and adult mosquitoes for pathogens is needed to help characterize the level of health risk. There is a documented history of human WNV infections in Barnstable County and EEEV focused in eastern Massachusetts, just west of Cape Cod in Barnstable County, which warrant continuing to annually monitor mosquitoes for the foreseeable future. The goal of early mosquito larvae monitoring is rapidly detecting relative and absolute changes in population size that can indicate an increased short-term risk to human, wildlife, or domestic animal health.

CCMCP surveillance on Morris Island in Chatham since 1991, has documented the occurrence of several primary and bridge vector mosquito species associated with EEEV and WNV transmission to humans. Some of these mosquitoes are bridge vectors, meaning these species feed on birds and other animals, thereby enhancing the risk of disease transmission to people. The following table shows the presence of disease-carrying mosquitoes on the refuge. We have some historical records that show these species have been found on the refuge, with *Ochlerotatus sollicitans* and *Ochlerotatus cantator* being the most common.

**Table D.3. Arbovirus Mosquito Vectors and Flight Ranges found on Monomoy NWR**

| Mosquito Vector | EEEV | WNV Vector | Number of years present out of 13 years for which we have data | Flight Range |
|---|---|---|---|---|
| *Culiseta morsitans* | Birds | | 1 | |
| *Coquillettidia perturbans* | Bridge | Bridge | 2 | 5 kilometer (km) |
| *Ochlerotatus canadensis* | Bridge | Bridge | 5 | 2 km |
| *Aedes vexans* | Bridge | Bridge | 1 | >25 km |

| Mosquito Vector | EEEV | WNV Vector | Number of years present out of 13 years for which we have data | Flight Range |
|---|---|---|---|---|
| *Culex pipiens* | Bridge | Birds | 4 | 2 km |
| *Culex restuans* | Bridge | Birds | 1 | 2 km |
| *Culex salinarius* | Bridge | Bridge | 2 | 10 km |
| *Ochlerotatus excrusians* | | | 4 | |
| *Ochlerotatus sollicitans (Formerly Aedes sollicitans)* | Bridge | Bridge | 6 | >25 km |
| *Ochlerotatus cantator (Formerly Aedes contator)* | Bridge | Bridge | 6 | >10 km |
| *Ochlerotatus triseriatus* | Bridge | Bridge | 3 | 0.2 km |

WNV was first detected in birds, mosquitoes, and humans in Barnstable County in 2003, and in mosquito pools in 2003 to 2006 (towns of Falmouth and Barnstable) and 2008 and 2009 (towns of Barnstable and Bourne). WNV was detected in dead birds (primarily corvids) in Barnstable County in 2005 (3 positive samples, including 1 from Harwich) and 2006 (9 positive samples, including 2 each from Dennis and Brewster) before testing of dead birds was discontinued in 2009. Two human WNV cases were documented in the Town of Barnstable, one case in 2003 and another in 2007. There have been no human WNV cases documented for Chatham or surrounding communities (Harwich, Dennis, Brewster, or Orleans), and WNV has not yet been detected from humans, dead birds, or mosquito pools in Chatham.

Periodic outbreaks of EEEV with an epicenter in southeastern Massachusetts just west of Cape Cod are also documented. The majority of human EEEV cases have occurred in Norfolk, Bristol, and Plymouth counties, although some cases are documented for Middlesex County, Essex County, and as far west as Worcester County. Although the historic EEEV epicenter lies just to the north and west, Cape Cod and the Islands (Martha's Vineyard and Nantucket) have no documented human EEEV cases or deaths. The first documented incidence of EEEV isolated from a Cape Cod mosquito pool was collected in Nickerson State Park in Brewster in August 2012.

Refuge pools on Morris Island are known to harbor the brown salt marsh mosquito *O. cantator* and the eastern salt marsh mosquito *O. sollicitans*, which are both bridge vectors for the transmission of both WNV and EEEV to humans. These pools have been treated in the past, although it appears the threshold for treatment can be raised given the low risk of disease occurrence on Cape Cod. According to Kilpatrick (2005), WNV transmission risk from *O. sollicitans* in Suffolk and Rockland counties, New York, was only 0.07 percent; 80 percent of the WNV transmission was from *Culex pipiens* and *Culex restuans*. *O. cantator* was not even identified as a risk species for WNV in these salt marshes. Despite the incidence and spread of WNV and EEEV in southeastern Massachusetts, and the potential for spread of other mosquito-borne diseases, portions of Monomoy NWR are still viewed as a low-remote potential mosquito-borne disease reservoir.

## AVAILABILITY OF RESOURCES:

The CCMCP will conduct monitoring and control, coordinated with the refuge manager on an annual basis through the issuance of an SUP. Existing funds are available to support the refuge manager and other staff in coordinating this use (table D.4). As funding becomes available, refuge staff will take an active and, in most cases, a lead role in planning and implementing tidal circulation enhancement and wetland restoration projects aimed at improving wildlife habitat while reducing mosquito production (Adamowicz et al. 2004, James-Pirri et al. 2004) on non-wilderness portions of Monomoy NWR. Developing a mosquito management plan for the refuge will be a one-time effort that is likely to take 0.20 of a full-time employee (FTE). A notice of intent needs to be submitted to the Environmental Protection Agency (EPA) for the use of pesticides in the salt marsh, and it will be the responsibility of the CCMCP to draft a notice of intent and either acquire the permit, or provide all the information needed so the Service can obtain the permit. This will be listed as a condition for issuing an SUP for mosquito control.

**Table D.4. Staffing needs to conduct use of Mosquito Management on Monomoy NWR**

| Position | Involvement | FTE | Cost |
|---|---|---|---|
| Refuge Manager | General oversight | 0.02 | $2,500 |
| Wildlife Biologist | Field visits, mosquito management plan review and implementation; preparation of pesticide use proposal, SUP, and pesticide use report; oversight of mosquito-borne disease monitoring, vector control activities. Involvement in coordination and oversight of mosquito monitoring activities. | 0.05 | $3,375 |
| Total FTE'S and Staffing Costs | | 0.07 FTE | $5,875 |

## ANTICIPATED IMPACTS OF THE USE:

Direct impacts of monitoring and control include temporary disturbance to habitat and possible direct effects to non-target wildlife. Areas of vegetation may be crushed underfoot, with impacts ranging from temporary in nature to loss of habitat over time. Invasive weeds may be introduced or spread by foot. Indirect effects associated with mosquito control include reducing mosquito populations and other non-target species that serve as the base of food chains for wildlife species.

Impacts to birds as a result of physical access (trampling of vegetation, nests) for mosquito management could occur, but are unlikely, as these actions would not significantly affect bird populations of the refuge given the small size and limited bird habitat that the areas receiving mosquito management provide.

### *Chemical Treatment Effects on Target Mosquito Populations*

The use of mosquito larvicides generally is considered preferable to the use of adulticides because larvicides prevent the appearance of the blood feeding adults; larvicides can provide up to a month of control, rather than the few hours provided by fogging with adulticides; the commonly used larvicides are less toxic than the adulticides and the application method greatly reduces human exposure; and larvicides generally are applied to smaller areas than are adulticides.

A natural soil bacterium, Bti, like other varieties of *Bacillus thuringiensis* (Bt), is a stomach poison that must be ingested by the larval form of the insect in order to be effective. Bti is an EPA toxicity class III general use pesticide and is practically non-toxic to animals (Extoxnet 1996). Bti is specific to certain primitive dipterans, especially mosquitoes, black flies, and some chironomid species (Boisvert and Boisvert 2000), and is not known to be directly toxic to non-dipteran insects; there are no toxic inert ingredients included in Bti products (Extoxnet 1996). Bti produces protein endotoxins, activated in the alkaline mid-gut of target insect species that bind to protein specific receptors of dipteran larvae species, resulting in mortality. Bti must be ingested by the target insect to be effective and is most effective on larval salt marsh mosquito instar stages 1 and 2; it is considerably less effective against instar stages 3 and 4; and has no effect on pupae or adult mosquitoes.

Methoprene is a contact insecticide that does not need to be ingested like Bti (Tomlin 1994); it ranks as a toxicity class IV, and is considered slightly to practically nontoxic (EPA 2001). Methoprene compounds like Altosid Liquid Concentrate and Altosid Single-Brood Granule all mimic the action of an insect growth hormone and interfere with the normal mosquito maturation process, acting as an insect growth regulator preventing mosquito larvae from pupating and reaching the adult stage.

Adulticides appear to effectively control adult mosquito populations and spread of mosquito-borne disease such as WNV (Carney et al. 2008), but only for a brief time, and are therefore only recommended during a disease event to break the disease transmission cycle. Adulticides kill only mosquitoes that contact insecticide droplets. The fog soon dissipates. Although the local mosquito population is reduced for a few days, fogging does not prevent mosquitoes from re-entering the sprayed area. Adulticides will be considered only in the case of a declared public health emergency. Focused timing and location of adulticide application to control mosquito disease vector source populations is essential for effectiveness (*http://wildpro.twycrosszoo.org/s/00man/WNVOverviews/wnvindtech/wnvcontrolaerialadulticides.htm;* accessed October 2015*).*

Only the pyrethroid adulticide sumithrin (Anvil 10+10) has seen recent use in Massachusetts, although Monomoy NWR was not included in that application. Neither Naled (organophosphate) nor Malathion (or any other oxon derivative) has been used for adult mosquito control at Monomoy NWR, nor do we expect they will be used.

The Ecotoxnet database (*http://extoxnet.orst.edu/;* accessed October 2015) includes the following summary of how pyrethroids act as insecticides.

*"Human-made pyrethroids are based on natural pyrethrins in chrysanthemums, which is a neurotoxic chemical to insects. Pyrethroids act by inhibiting the nervous system of insects. This occurs at the sodium ion channels in the nerve cell membrane. Some type II pyrethroids also affect the action of a neurotransmitter called GABA. Pesticide products containing pyrethrins usually contain a synergist (such as piperonyl butoxide). Synergists work by restricting an enzyme that insects use to detoxify the pyrethrins. A synergist allows the insecticide to be more effective. These products are dissolved in petroleum-based products."*

### *Pesticide Toxicity and Other Effects to Non-target Organisms*

The few small refuge sites receiving pesticide application for the purpose of mosquito management typically provide limited habitat for native wildlife and plants. These areas are mostly shallow swales within the intertidal marsh plain (4 to 6 feet) that hold water for extended periods (e.g., following high tides); the area lacks tidal channels that permit drainage. These characteristics result in poor tidal hydrology and, in turn, lower biotic productivity for a variety of plant and wildlife species relative to other refuge areas with better tidal flushing (Adamowicz et al. 2004, James-Pirri et al. 2004). Bti (EPA 1998) and methoprene (EPA 2001) are non-toxic to vegetation.

Giving full consideration to the protection and integrity of non-target organisms and communities, the greatest concerns the Service has with chronic mosquito control chemical use are the subsequent degradation of biological integrity and diversity, and disruption of vital food webs. Aquatic invertebrates play important roles in wetland ecology. They aid in the breakdown of fresh and salt marsh-derived organic matter and provide important food resources for different life stages of fish, breeding and migrating birds, and other wildlife. As such, they are critically important and directly linked to the future conservation and management of refuge-specific resources of concern listed in Comprehensive Conservation Plan (CCP) goals and habitat objectives.

Impacts to birds, mammals, reptiles, or amphibian may occur as a result of ground access. However, bird and mammal impacts are considered limited because areas that need mosquito management are small in size, and provide only limited habitat. The use of pesticides for the purpose of mosquito management may directly or indirectly affect resident and migratory bird, mammal, reptile or amphibian populations of the Refuge. Direct effects may occur from direct contact with the pesticides. Indirect effects are related to the potential reduction in the invertebrate food supply. Pesticide effects on reptiles and amphibians may occur through reductions in insects that serve as a food source (Hoffman et al. 2008), through direct individual effects from pesticide application, or from trampling of individuals or habitat. Birds are often used as a surrogate for effects on reptiles, and fish as a surrogate for amphibians (Hoffman et al. 2008). Bti has practically no acute or chronic toxicity to mammals, birds, fish, or vascular plants (EPA 1998).

Migratory birds that depend on invertebrate food resources may not be mobile enough to seek alternative feeding sites, post-treatment, particularly during the breeding season. Precocial young seek food items on their own. Since they are flightless, food items must be available within a relatively small home area. Reduction of invertebrate food resources within even a small geographic area may be detrimental to breeding wetland birds and precocial young.

Altricial birds, those with young that are relatively helpless and restricted to a discrete nest site during the first few weeks of life, are solely dependent upon the parents for food. When invertebrate foods are scarce, parents may have to make more extended feeding forays and become less able to provide sufficient nutrition to all offspring potentially increasing chick mortality. Adults making extended flights into less familiar territory may be more likely to suffer predation or to experience inter- or intra-specific competition. Young subjected to extended periods at the nest without parental attention may be more likely to suffer predation or weather-related stress.

The use of larvicides and pupacides for the purpose of mosquito management is not likely to directly affect native mammal populations of the refuge. Adverse effects on mammals from Bti, methoprene, and Agnique (monomolecular film) are not expected when applied according to the label instructions. Extensive acute toxicity

studies indicated that Bti is virtually innocuous to mammals (Siegel and Shadduck 1992). These studies exposed a variety of mammalian species to Bti at moderate to high doses and no pathological symptoms, disease, or mortality were observed. Methoprene is not considered toxic to mammals. Impacts to the mammalian community as a result of reduced invertebrate populations are not expected because most mammal species that inhabit wetlands of the refuge are herbivorous and invertebrates are not a primary component of their diet. Insectivorous shrews experiencing reduced arthropod food availability may be reduced over the short-term post-treatment. Negative effects on fish populations are not expected from proposed larvicides and pupacides.

Using larvicides can adversely affect non-target insects, especially non-biting midges (Chironominae), and Bti concentration is important with regard to impacts on non-target organisms such as ecologically important non-biting midge larvae. Chironomid larvae are often the most abundant aquatic insects in freshwater, brackish and salt marsh wetland environments and represent a major component in food webs for many wetland-dependent wildlife species (Euliss et al. 1991, Helmers 1992, MacKenzie 2005, Miller 1987, Skagen and Oman 1996). Chironomids also frequently make up the largest proportion of wetland invertebrate biomass (Davis and Smith 1998, Eldridge 1992, MacKenzie 2005, Rehfisch 1994).

The effect on local populations of invertebrate species over time with periodic and continued use of Bti is unknown but potential for negative effects is a possibility. Host range and effect on non-target organisms indicates that Bti is relatively specific to the Nematocera suborder of Diptera, in particular filter-feeding mosquitoes (Culicidae) and blackflies (Simuliidae) (Glare and O'Callaghan 1998). Bti is pathogenic to some species of midges (Chironomidae) and Tipulidae, although to a lesser extent than to mosquitoes and biting flies; it is not reported to affect a large number of other invertebrate species (Glare and O'Callaghan 1998). Other factors, such as temperature, water depth, aquatic vegetation, and suspended organic matter, may act to reduce its toxicity to chironomids in the environment (Charbonneau et al. 1994, Merritt et al. 1989, Lacey and Merritt 2004 ). Negative impacts on chironomid density and biomass could have deleterious effects on wetland and wildlife food webs and could lower biodiversity. The effects of a single Bti application are difficult to predict because of documented differences in toxicity based on formulation, potency, application rate, and timing. Published studies (Hershey et al. 1998, Niemi et al. 1999) have examined the long-term, non-target effects of Bti. In Minnesota, 27 wetlands were sampled for macroinvertebrates over a 6-year period with no effects observed on the bird community (Niemi et al. 1999). In judging the potential for adverse ecological effects of Bti applications, one should consider the non-target aquatic organisms of concern that would be impacted from the potential loss of both mosquito and chironomid larvae.

Methoprene is considered practically non-toxic to birds (Extoxnet 1996, EPA 2001) at EPA-approved application rates. Methoprene products are more toxic than Bti products, killing a wider range of non-target larval insects. This makes methoprene more likely to cause disruptions to invertebrate food webs. Using short-term residual methoprene formulations and avoiding Briquets and other extended residual products would maintain concentrations at the low end, and mitigate any adverse impacts to non-targets in higher concentration scenarios. Altosid was found to have very little effect, if any, on 35 species of exposed non-target organisms, including earthworms, waterfleas, damselflies, snails, tadpoles, and mosquito fish when used at lower larviciding concentrations (Extoxnet 1996b). Some studies have suggested methoprene impacts other organisms that may form part of the food base for birds. McKenney and Celestial (1996) noted significant reductions in number of young produced in mysid shrimp at 2 ppb. Sub-lethal effects on the cladoceran, *Daphnia magna*, such as reduced fecundity, increased time to first brood, and reduced molt frequency, have also been observed at concentrations as low as 0.1 ppb (Olmstead and LeBlanc 2001).

As with Bti, concerns over methoprene use include potential negative impacts on chironomid larvae due to their importance in food webs. As with any pesticide, toxicity is a function of dose plus exposure. At mosquito control application rates, methoprene is present in the water at very low concentrations (4 to 10 ppb, initially). With regard to exposure, chironomid larvae occur primarily in the benthos, either within the sediments or within cases constructed of silk and detritus. Differences may exist with regard to exposure to methoprene between chironomid and mosquito larvae, as the latter occur primarily in the water column. The published literature on the effects of methoprene to chironomids is not as extensive as that for Bti. However, evidence is found for potential toxicity to chironomid and other aquatic invertebrates from methoprene treatments.

Methoprene is likely to be lethal to non-target terrestrial invertebrates, including pollinating species, in their larval stages if they come into direct contact with this chemical. Lepidopterans (butterflies and moths) may be highly susceptible. However, larval stages that develop in tree tissues or underground are unlikely to come in contact with methoprene. Methoprene and Bti both also have the potential to negatively affect the local chironomid (midge) population. The extent to which the use of Bti and methoprene will limit the food resources

for individual birds or local avian populations is unknown. Though often discounted as inefficient pollinators, some researchers have suggested that the efficiency of pollinating flies (dipterans), mosquitoes (dipterans) and midges can exceed that of bees (*http://eol.org/pages/421/entries/24921263/details#relevance_to_humans_and_ecosystems;* accessed October 2015). Further, dipterans appear to be crucial for the pollination of certain flowers in some habitats.

Monomolecular films are not known to cause direct chronic or acute toxicological effects to birds, but are potentially lethal to any aquatic insect that lives on the water surface or requires periodic contact with the air-water interface to obtain oxygen; this may result in a negative impact to the avian food base, e.g., Chironomid invertebrates (USFWS 2005). The film interferes with larval orientation at the air-water interface or increases wetting of tracheal structures, suffocating the organism. As the film spreads over the water surface, larvae tend to concentrate, which may increase mortality from crowding stress (Dale and Hulsman 1990).

Pyrethroid insecticides are subject for review as potential developmental neurotoxicants because of their mode of action on voltage-sensitive sodium channels (Lu et al. 2006). Permethrin, the most widely used pyrethroid insecticide, is suspected to be an endocrine-disrupting chemical and was classified as a potential carcinogen at high exposure levels (EPA 2006). Pyrethroids may also have a suppressive effect on the immune system and may cause lymph node and spleen damage. Pyrethroids are reported to degrade rapidly in the environment and to be broken down to nontoxic products. However, Tyler et al. (2000) and Hong Sun et al. (2007) argue that products of the metabolism of permethrin are potentially far more potent as endocrine disruptors than the parent compound because of their ability to interact with steroid hormone receptors. Pyrethrins have a slight toxicity to bird species (Extoxnet 1994, National Pesticide Information Center 1998,). Non-target effects to birds from pyrethrin application may also occur as a result of a reduced food base (e.g., Chironomid invertebrates) if non-target invertebrate populations are significantly reduced.

The application of adulticides has the potential to adversely affect fish and aquatic invertebrate populations. Pyrethrins are considered highly toxic to fish and invertebrates (EPA 2006).

Because pyrethrins are broad-spectrum insecticides, they are potentially lethal to most insects. All adulticides are very highly toxic to aquatic invertebrates in concentrations as low as one part per billion (Milam et al. 2000). Pyrethrins are known to cause acute toxicological effects to benthic invertebrates at rates used for mosquito abatement (EPA 2006). Because most adulticides can be applied over or near water when used for mosquito control, risks to aquatic invertebrates from direct deposition and runoff of the pesticides exist.

The pyrethroid insecticides are extremely toxic to fish, with 96-hour LC50 values generally below 10 ug/l. Corresponding LD50 values in mammals and birds are in the range of several hundred to several thousand mg/kg. Fish sensitivity to the pyrethroids may be explained by their relatively slow metabolism and elimination of these compounds. The half-lives for elimination of several pyrethroids by trout are all greater than 48 hours, while elimination half-lives for birds and mammals range from 6 to 12 hours. Generally, the lethality of pyrethroids to fish increases with increasing octanol/water partition coefficients. The pyrethroid resmethrin is slightly toxic to birds and highly toxic to fish and to bees. Its LD50 in California quail was greater than 2,000 mg/kg; the LC50 in mosquito fish is 0.007 ppm. The LC50 for resmethrin synergized with piperonyl butoxide in red swamp crawfish, *Procambarus clarkii*, is 0.00082 ppm. The LC50 in bluegill sunfish is 0.75 to 2.6 ug/l, and 0.28 to 2.4 ug/l in rainbow trout. DeMicco et al. (2010) found a dose-dependent increase in zebrafish embryo mortality and pericardial edema, which was consistent with mammalian studies that demonstrated slight teratogenesis at high doses. Resmethrin is highly toxic to bees, with an LD50 of 0.063 ug/bee. Adulticides (pyrethrins) may adversely affect amphibians such as tadpoles that occur within seasonal freshwater wetlands of the refuge (Gunasekara 2005).

De Guise et al. (2005) studied a die-off of lobsters following mosquito spraying with resmethrin; they found that adult lobsters are no more sensitive than other aquatic species to the lethal effects, but are very sensitive to immune and endocrine endpoints tested (sublethal effects). Modulation in immune functions could result in increased susceptibility to infectious agents, contributing to mass mortality with sufficient exposure. Weston et al. (2005) examined toxicity of run-off sediments to an amphipod *Hyalella azteca* in creeks draining a Roseville, California, single-family subdivision. Nearly all creek sediments collected caused toxicity in laboratory exposures, and about half the samples caused nearly complete mortality. The pyrethroid bifenthrin was implicated as the primary cause of the toxicity, with additional contributions to toxicity from the pyrethroids cyfluthrin and cypermethrin originating from residential (structural) pest control by professional applicators or homeowner use of insecticides, particularly lawn care products.

The small scale and low frequency in past use of adulticides suggests that any future adulticide use on the refuge is unlikely to cause significant adverse effects to fish and invertebrate populations. Application would only occur in swales and not to channels, sloughs, or other open water areas. Application would only occur during low tides to avoid potential impacts to fish that may move into the tidal marsh plain during higher high or extreme tides. Oral exposure of mammals to pyrethrins could occur through consumption of plants or plant parts that have been sprayed. A terrestrial exposure model showed no acute or chronic risks to mammal or bird species (EPA 2006).

The Service recognizes that spray drift could enter the refuge from neighboring (Morris or Stage Island, or mainland Chatham) communities. The refuge has no jurisdiction over mosquito control on lands outside the refuge boundary; therefore, no SUP is required for off-refuge mosquito management. Since the State employs best management practices and follows the EPA-approved label, the Service expects impacts to refuge resources to be minimal.

Refuge habitat management actions that increase BIDEH and avian diversity have the potential to provide a buffer against future disease outbreaks. Recent infectious disease models illustrate a suite of mechanisms that can lower incidence of disease in areas of higher disease host-diversity (defined as the dilution effect). These models are particularly applicable to human zoonoses, i.e., infectious diseases of wildlife or domestic animals that spill over into human populations (Keesing et al. 2006, Krasnov et al. 2007, Ostfeld and Keesing 2000a and 200b) such as avian influenza, anthrax, Lyme disease, and WNV.

Research conducted in the eastern U.S. in 2002 when the WNV outbreak was in full swing, found lower incidence of WNV in humans in areas with a diverse array of bird species (Swaddle and Calos 2008). This link between higher bird diversity and reduced human WNV infection is attributed to the fact that crows, jays, thrushes, and sparrows are competent (amplifying) hosts of the WNV, making them able to contract the disease and pass it on through a vector more efficiently. When bird diversity is low, competent host species tend to represent a higher proportion of the bird population, increasing the likelihood that a mosquito will encounter an infected bird and transmit the virus during its next bite. A diverse suite of bird species, with large numbers of incompetent hosts in the population, reduces the transmission rate to other birds or mammals, including humans. A similar study showed increased mammalian diversity decreased Lyme disease risk to humans (LoGiudice et al. 2003).

## PUBLIC REVIEW AND COMMENT:

As part of the CCP process for the Monomoy NWR, a draft of this compatibility determination underwent a 180-day public comment period concurrent with the release of our draft CCP/Environmental Impact Statement (EIS). This final compatibility determination resulted from that public review and comment process. It underwent a further 37-day public review period concurrent with the release of the final CCP/EIS. No comments were received on the compatibility determination and it has remained unchanged.

## DETERMINATION (CHECK ONE BELOW):

_____Use is not compatible.

__**X**__Use is compatible with the following stipulations.

## STIPULATIONS NECESSARY TO ENSURE COMPATIBILITY:

The following stipulations are required to ensure compatibility:

- The CCMCP must apply for and receive an SUP annually from the refuge manager prior to conducting any mosquito and mosquito-borne disease surveillance and monitoring activities.
- The CCMCP will notify the refuge manager prior to monitoring and conducting disease surveillance. All personnel entering the wetlands will be oriented at the beginning of the surveillance period or escorted by refuge staff to avoid disturbance to endangered, threatened, or other sensitive species on the refuge.

- The CCMCP will be responsible for monitoring disease activity in reservoir hosts for pathogens or antibodies, and collecting adult mosquito samples in same-genus pools for virus or any other monitoring required to substantiate a high-risk disease situation on or near the refuge.

- The CCMCP will assume all monetary costs and perform all activities associated with mosquito monitoring, disease surveillance, and treatment. Service personnel may accompany CCMCP personnel to examine exact locations of heavy mosquito breeding problems to ascertain the presence of non-targets or mosquito predator species in these areas.

- Motorized access may only be used when escorted by refuge staff and no other practical means of conducting mosquito management exists.

- The CCMCP will limit the number of travel pathways used for mosquito management within the marsh.

- Caged sentinel chickens may not be used for reservoir host surveillance due to the risk of spreading disease to wild birds.

- The CCMCP will remove equipment and refuse resulting from operations on refuge lands daily, and will promptly repair all damage to government property that may result.

- All decisions for chemical interventions to control mosquitoes will be made by the refuge manager and will be based on meeting or exceeding predetermined mosquito abundance and disease thresholds.

- Current mosquito population data is necessary before mosquito larvicide treatments may be applied on the refuge.

- Only approved larvicides may be applied on refuge salt marshes within the prescribed area on Morris Island as identified in the SUP.

- The refuge manager will be contacted at least 24 hours in advance of each larvicidal application.

- The CCMCP must provide a copy of the Clean Water Act National Pollution Discharge Elimination System permit from the Environmental Protection Agency prior to conducting any chemical treatment.

- Application of chemical mosquito control measures will be conducted in accordance with approved PUPs.

- Insecticide applications will avoid areas known to contain butterfly and moth host-plants in order to conserve and protect rare or specialist insect pollinators and also ensure that adequately buffered habitat around host plants or refugia is available during and after insecticide spraying.

- Application of pesticides will be in discrete, mosquito-producing areas of the refuge and at the lowest possible dilution rate (ultra-low volume) required for effectiveness.

- The CCMCP will minimize the use of pesticides on refuge lands, and continually investigate formulations and compounds that are least damaging to fish and wildlife populations.

- The CCMCP must provide the refuge manager with monitoring and disease surveillance data demonstrating that action thresholds have been reached or exceeded before pupacides are applied. Refuge manager approval must be obtained prior to CCMCP staff elevating to the next action or response threshold.

- Only the refuge manager, in consultation with the CCMCP and public health officials, may authorize application of mosquito adulticide and only when there is evidence of refuge-based mosquitoes contributing to a declared public health emergency.

- Immediately after any pesticide application, the CCMCP will monitor mosquito vector populations to assess the effectiveness of all pesticide treatments.

- Treatment in populated areas off-refuge will be considered first.

- General mosquito control will not be allowed during high tide events in order to avoid impacts to tidal marsh species. Unless permitted by the refuge manager, pesticide application should not occur within 100 feet of natural sloughs and channels.
- A final report of all monitoring and control activities conducted on the refuge must be provided to the refuge manager before the end of the calendar year.
- The CCMCP will meet with the refuge manager during the first quarter of each calendar year as a condition of the SUP renewal for the upcoming year. Prior to that meeting, the CCMCP will review the previous year's pesticide proposals and submit to the refuge manager any changes in the pesticides or formulations of pesticides they expect to use in the upcoming year.
- No mosquito management will take place on North or South Monomoy Islands.

## JUSTIFICATION:

Mosquitoes are a natural component of tidal wetlands but can pose a significant potential threat to human and wildlife health when refuge wetlands are within the known mosquito flight ranges of populated areas and refuge mosquitoes have been demonstrated to be infected with arboviruses. WNV and EEEV have been of particular concern across the United States and in the Cape Cod and Islands region. Mosquito species known as vectors of these diseases occur on the refuge.

The staff of Monomoy NWR and the CCMCP advocate an integrated approach to mosquito management that includes a range of tools to improve habitat conditions for estuarine wildlife while reducing threats to public health from mosquito species capable of transmitting disease to humans. With the continued existence of WNV and EEEV and the potential for spread of other mosquito-borne disease, pressure is increasing to manage mosquito populations that occur on lands of the Refuge System, especially in populated areas such as the Cape Cod and Islands region. Understanding the actual risk of refuge-based mosquitoes to the spread of WNV and EEEV is an important part of managing a mosquito control program on the refuge.

The use of larvicides and other pesticides, if necessary, will receive periodic compatibility review if future studies bring more information to light on the ecological impacts of mosquito control. In addition, new chemicals that may come to market in the future may be evaluated for potential use on Monomoy NWR.

The stipulations above address the Service's laws and Refuge System policies to maintain, enhance, and restore biological integrity, diversity, and environmental health, manage an IPM program, and protect the public from mosquito-borne health threats.

This activity will not materially interfere with or detract from the mission of the Refuge System or the purpose for which the refuge was established.

## SIGNATURE:

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

## CONCURRENCE:

Regional Chief: Scott B. Kahn (Signature) March 18, 2016 (Date)

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

## LITERATURE CITED:

Adamowicz, S.C., C.T. Roman, G. Taylor, K. O'Brien, M.J. James-Pirri. 2004. Initial Ecosystem Response of Salt Marshes to Ditch Plugging and Pool Creation at Rachel Carson National Wildlife Refuge (Maine). Ecological Restoration 22: 53-54.

Boisvert, M. and J. Boisvert. 2000. Effects of *Bacillus thuringiensis var. israelensis* on target and nontarget organisms: a review of laboratory and field experiments. Biocontrol Science and Technology 10: 517-561.

Carney, R.M., S. Husted, C. Jean, C. Glaser, and V. Kramer. 2008. Efficacy of Aerial Spraying of Mosquito Adulticide in Reducing Incidence of West Nile Virus, California, 2005. Emerging Infectious Diseases 14(5).

Centers for Disease Control. 2010. West Nile Virus Home Page. Available at *http://www.cdc.gov/ncidod/dvbid/westnile/index.htm;* accessed October 2015.

Charbonneau, C.S., R.D. Drobney, and C.F. Rabeni. 1994. Effects of *Bacillus thuringiensis var. israelensis* on nontarget benthic organisms in a lentic habitat and factors affecting the efficacy of the larvicide. Environmental Toxicology and Chemistry 13: 267-279.

Dale, P.E.R. and K. Hulsman. 1990. A critical review of salt marsh management methods for mosquito control. Review in Aquatic Sciences 3: 281-311.

Davis, C.A. and L.M. Smith. 1998. Ecology and management of migrant shorebirds in the playa lakes region of Texas. Wildlife Monographs 140: 1–45.

De Guise, S., J. Maratea, E.S. Chang, and C. Perkins. 2005. Resmethrin immunotoxicity and endocrine disrupting effects in the American lobster (*Homarus americanus*) upon experimental exposure. Journal of Shellfish Research 24(3): 781–786.

DeMicco, A., K.R. Cooper, J.R. Richardson, and L.A. White. 2010. Developmental Neurotoxicity of Pyrethroid Insecticides in Zebrafish Embryos. Toxicological Sciences 113(1): 177–186.

Eldridge, J. 1992. Management of habitat for breeding and migrating shorebirds in the Midwest. Chapter 13.2.14 *In* U.S. Fish and Wildlife Service Waterfowl Management Handbook. Washington, D.C.

Euliss, N.H., Jr., R.L. Jarvis, and D.S. Gilmer. 1991. Standing crops and ecology of aquatic invertebrates in agricultural drainwater ponds in California. Wetlands 11: 179-190.

Extension Toxicology Network (Extoxnet). 1994. Pyrethrins and Pyrethroids. Available at *http://extoxnet.orst.edu/pips/pyrethri.htm;* accessed October 2015.

Extension Toxicology Network (Extoxnet). 1996a. *Bacillus thuringiensis*. Pesticide Information Profile. Extension Toxicology Network. Available at *http://extoxnet.orst.edu/pips/bacillus.htm;* accessed October 2015.

Extension Toxicology Network (Extoxnet). 1996b. Methoprene - Pesticide Information Profile. University of California-Davis, Oregon State University, Michigan State University, Cornell University, and the University of Idaho. Available at *http://extoxnet.orst.edu/pips/methopre.htm;* accessed October 2015

Glare, T.R. and M. O'Callaghan. 1998. Environmental and health impacts of *Bacillus thuringiensis israelensis*. Report for New Zealand Ministry of Health. 58 p.

Gunasekara, A.S. 2005. Environmental Fate of Pyrethrins. California Department of Pesticide Regulation, Environmental Monitoring Branch, Sacramento, California. 19 pp.

Helmers, D.L. 1992. Shorebird Management Manual. Western Hemisphere Shorebird Reserve Network, Manomet, 58 pp.

Hershey, A.E., A.R. Lima, G.J. Niemi, and R.R. Regal. 1998. Effects of *Bacillus thuringiensis israelensis* (Bti) and methoprene on nontarget invertebrates in Minnesota wetlands. Ecological Applications 8: 41-60.

Hoffmann, M., J.L. Melendez, and M.A. Mohammed. 2008. Risk of permethrin use to the federally threatened California red-legged frog and bay checkerspot butterfly, and the federally endangered California

clapper rail, salt marsh harvest mouse, and San Francisco garter snake. Pesticide Effects Determination. Environmental Fate and Effects Division, Office of Pesticide Programs, Washington, DC.

Hong S., X.L. Xu, L.C. Xu, L. Song, X. Hong, J.F. Chen, L.B. Cui, X.R. Wang. 2007. Antiandrogenic activity of pyrethroid pesticides and their metabolite in reporter gene assay. Chemosphere 66: 474–479.

James-Pirri, M.J., R.M. Erwin, D.J. Prosser, and J. Taylor. 2004. Monitoring salt marsh responses to open marsh water management at U.S. Fish and Wildlife coastal refuges. Ecological Restoration 22: 55-56.

Keesing, F., R.D. Holt, and R.S. Ostfeld. 2006. Effects of species diversity on disease risk. Ecology Letters 9(4) 485-498.

Kilpatrick, A.M., L.D. Kramer, S.R. Campbell, E.O. Alleyne, A.P. Dobson, and P. Daszak. 2005. West Nile Virus Risk Assessment and the Bridge Vector Paradigm. Emerging Infectious Diseases 11(3): 425-429. *www.cdc.gov/eid*.

Krasnov, B.R., M. Stanko, and S. Morand. 2007. Host community structure and infestation by ixodid ticks: repeatability, dilution eVect and ecological specialization. Oecologia 154: 185–194

Lacey, L.A. and R.W. Merritt. 2004. The safety of bacterial microbial agents used for black fly and mosquito control in aquatic environments. Kluwer Academic Publishers Netherlands. Appears in: Environmental Impacts of Microbial Insecticides: Need and methods for Risk Assessment.

LoGiudice,K., R.S. Ostfeld, K.A. Schmidt, and F. Keesing. 2003. The Ecology of Infectious Disease: Effects of Host Diversity and Community Composition on Lyme Disease Risk. Proceedings of the National Academy of Sciences 100(2): 567-571.

Lu, C., D.B. Barr, M. Pearson, S. Bartell, and R. Bravo. 2006. A Longitudinal Approach to Assessing Urban and Suburban Children's Exposure to Pyrethroid Pesticides. Environmental Health Perspectives Vol. 114 (9): 1419-1423.

MacKenzie, R.A. 2005. Spatial and temporal patterns in insect emergence from a southern Maine salt marsh. American Midland Naturalist 153: 257-269.

Massachusetts Department of Public Health. 2012. Massachusetts Arbovirus Surveillance and Response Plan. 22 pp.

McKenney, C.L. and D.M. Celestial. 1996. Modified survival, growth and reproduction in an estuarine mysid (*Mysidopsis bahia*) exposed to a juvenile hormone analogue through a complete life cycle. Aquatic Toxicology 35: 11-20.

Merritt, R.W., E.D. Walker, M.A. Wilzbach, K.W. Cummins, and W.T. Morgan. 1989. A broad evaluation of Bti for black fly (Diptera: Simuliidae) control in a Michigan river: Efficacy, carry and nontarget effects on invertebrates and fish. Journal of the American Mosquito Control Association 5: 397-415.

Milam, C.D., J.L. Farris, and J.D. Wilhide. 2000. Evaluating Mosquito Control Pesticides for Effect on Target and Non-target Organisms. Archives of Environmental Contamination and Toxicology 39: 324-328.

Miller, M.R. 1987. Fall and winter foods of northern pintails in the Sacramento Valley, California. *Journal of Wildlife Management* 51: 403–412.

National Pesticide Information Center. 1998. Pyrethrins & Pyrethroids. Available at *http://npic.orst.edu/factsheets/pyrethrins.pdf;* accessed October 2015.

Niemi, G.J., A.E. Hershey, L. Shannon, J.M. Hanowski, A. Lima, R.P. Axler, and R.R. Regal. 1999. Ecological effects of mosquito control on zooplankton, insects, and birds. Environmental Toxicology and Chemistry. 18(3): 549-559.

Ostfeld, R.S. and F. Keesing. 2000a. The function of biodiversity in the ecology of vector-borne zoonotic diseases. Canadian Journal of Zoology 78: 2061–2078.

Ostfeld, R.S. and F. Keesing. 2000b. Biodiversity and Disease Risk: The Case of Lyme Disease. Conservation Biology 14(3): 722-728.

Olmstead. A.W. and G.L. LeBlanc. 2001. Low exposure concentration effects of methoprene on endocrine-regulated processes in the crustacean Daphnia magna. Toxicological Sciences 62: 268-273.

Rehfisch, M.M. (1994) Man-made lagoons and how their attractiveness to waders might be increased by manipulating the biomass of an insect benthos. Journal of Applied Ecology 31: 383–401.

Siegel, Joel, P. and J.A. Shadduck. 1992. Mammalian safety of *Bacillus thuringiensis israelensis* and *Bacillus sphaericus*. Pp. 202-217 in de Barjac, Huguette and Donald J. Sutherland, eds. Bacterial control of mosquitos and blackflies: biochemistry, genetics, and applications of *Bacillus thuringiensis israelensis* and *Bacillus sphaericus*. Kluwer Academic.

Skagen, S.K. and H.D. Oman. 1996. Dietary flexibility of shorebirds in the western hemisphere. Canadian Field-Naturalist 110(3): 419-444.

Swaddle, J.P. and S.E. Calos. 2008. Increased Avian Diversity Is Associated with Lower Incidence of Human West Nile Infection: Observation of the Dilution Effect. PLoS ONE e2488 3(6): 1-8.

Tomlin, C. 1994. The Pesticide Manual. Farnham: British Crop Protection Council/Cambridge: Royal Society of Chemistry.

Tyler, C.R., N. Beresford, M. van der Woning, J.P. Sumpter, and K. Thorpe. 2000. Metabolism and environmental degradation of pyrethroid insecticides produce compounds with endocrine activities. Environmental Toxicity and Chemistry 19: 801-809.

U.S. Environmental Protection Agency. 1998. Re-registration eligibility document. *Bacillus thuringiensis*. Office of Prevention, Pesticides and Toxic Substances. EPA738-R-98-004.

U.S. Environmental Protection Agency. 2001. Methoprene: pesticide fact sheet. Environmental Protection Agency. 9 pp.

U.S. Environmental Protection Agency. 2006. Permethrin Facts: Reregistration Eligibility Decision Fact Sheet. Available at *http://www.epa.gov/oppsrrd1/REDs/factsheets/permethrin_fs.htm;* accessed October 2015.

U.S. Fish and Wildlife Service (USFWS). 2005. Interim Guidance for Mosquito Management on National Wildlife Refuges. 20 pp.

Weston, D.P., R.W. Holmes, J. You, and J. Lydy. 2005. Aquatic toxicity due to residential use of pyrethroid insecticides. Environmental Science and Technology.

**FWS Form 3-2319**
**02/06**

## FINDING OF APPROPRIATENESS OF A REFUGE USE

**Refuge Name:** Monomoy National Wildlife Refuge

**Use:** Motorized and Nonmotorized Boat Landing and Launching

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

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

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

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

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

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

**Not Appropriate** _____ **Appropriate** ✔

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

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

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

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

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

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

**603 FW 1**
**Exhibit 1**
**Page 2**

## JUSTIFICATION FOR A FINDING OF APPROPRIATENESS OF A REFUGE USE

**Refuge Name:** Monomoy National Wildlife Refuge

**Use:** Motorized and Nonmotorized Boat Landing and Launching

## NARRATIVE:

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

Access to the Monomoy Islands is restricted to boat. Allowing the landing of motorized boats and the landing and launching of nonmotorized personal boats such as paddleboards, canoes or kayaks provides a safe means for visitors to access and explore Monomoy National Wildlife Refuge (NWR) beyond the Morris Island portion of the refuge. This access allows visitors to take part in priority wildlife-dependent recreation on the refuge, including wildlife observation, wildlife photography, and recreational fishing. Motorized and nonmotorized boat use will not interfere with the Service's work to protect and conserve natural resources. Motorized boats must land in designated areas to minimize potential impacts to wildlife. The level of use for these activities on the refuge is moderate, and the associated disturbance to wildlife is temporary and minor. Although motorized and nonmotorized boat uses are not priority public uses, they are not detrimental activities under the conditions described above. Access for waterfowl hunting, fishing, wildlife observation and photography, and environmental education and interpretation, which are priority uses, allows visitors to enjoy the outdoors and wild lands. Boating on Monomoy NWR will not materially interfere with or detract from the mission of the National Wildlife Refuge System or the purposes for which the refuge was established.

Nearly half (47 percent) of the refuge and most (86 percent) of land above mean low water is congressionally-designated wilderness, including much of the intertidal lands and waters of the refuge. Motor boats are not generally allowed in wilderness. However, Public Law 91-504, which established the Monomoy Wilderness, referenced the original Wilderness Act designation, thereby providing an exception to this prohibition, as the use of motorboats at Monomoy NWR had already been established and was deemed desirable.

For these reasons, the landing of motorized boats and the landing and launching of paddleboards, canoes or kayaks on Monomoy NWR is appropriate.

## LITERATURE CITED

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

Jenkins, D.C. and J. Burger. 1987. New Jersey Endangered Beach-Nesting Bird Project: 1986 Survey and Management. New Jersey Department of Environmental Protection, New Jersey. 37 pp.

Knight, R.L. and D.N. Cole. 1995. Wildlife responses to recreationists. Pp. 51-69 in R. L. Knight and K. J. Gutzwiller, eds. Wildlife and recreationists: coexistence through management and research. Washington, DC, Island Press.

# COMPATIBILITY DETERMINATION

## USE:

Motorized and Nonmotorized Boat Landing and Launching

## REFUGE NAME:

Monomoy National Wildlife Refuge

## DATE ESTABLISHED:

June 1, 1944

## ESTABLISHING AND ACQUISITION AUTHORITY(IES):

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

## REFUGE PURPOSE(S):

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

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

## NATIONAL WILDLIFE REFUGE SYSTEM MISSION:

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

## DESCRIPTION OF USE:

**(a) What is the use? Is the use a priority public use?**
The use is the landing of motorized boats and the landing and launching of non-motorized boats on Monomoy National Wildlife Refuge (NWR). The majority of the boats will be privately owned motorboats, commercial ferries, paddleboards, canoes, and kayaks. The use is not a priority public use of the National Wildlife Refuge System (Refuge System) under the National Wildlife Refuge System Administration Act of 1966 (16 U.S.C. § 668dd-668ee), as amended by the National Wildlife Refuge System Improvement Act of 1997 (Public Law

105-57). However, it does facilitate the priority public uses of wildlife observation, wildlife photography, environmental education, interpretation, waterfowl hunting, and fishing by allowing visitors to access the Monomoy Islands.

**(b) Where would the use be conducted?**
Motorized boat access is allowed in designated landing sites on North and South Monomoy Islands, and non-motorized boats are allowed to access any part of the refuge beach that is open to the public on both Monomoy Island and Morris Island. Public access is dictated by wildlife use. In general, much of the intertidal area is open to pedestrian traffic for most of the year. Some areas of beach are closed seasonally to protect nesting shorebirds and seabirds, and some intertidal areas are closed for loafing seals. Visitors should contact Monomoy NWR staff for up-to-date information on seasonal closures, or visit the refuge web site.

**(c) When would the use be conducted?**
Monomoy NWR is open to the public from 1/2-hour before sunrise to 1/2-hour after sunset. Surf fishing is permitted on Morris Island 24 hours a day; this is the only activity allowed at night on Monomoy NWR. Motorized and nonmotorized boat use would be allowed during regular refuge hours unless an individual is surf fishing.

**(d) How would the use be conducted?**
Motorized and nonmotorized boating will be allowed as a means to facilitate refuge public use programs, namely the priority public use programs of waterfowl hunting, fishing, wildlife observation and photography, and environmental education and interpretation. The use would be conducted in a manner consistent with refuge and State regulations, with some additional restrictions to protect fish, wildlife, and habitat. Visitors can access Monomoy Island using motorboats; however, the refuge does not provide boat trailer access. Visitors can launch nonmotorized boats in areas where the beach is open to public use. Additional opportunities to launch motorized and nonmotorized boats exist on nearby non-refuge lands.

**(e) Why is this use being proposed?**
Waterfowl hunting, fishing, wildlife observation and photography, and environmental education and interpretation are the six priority public uses of the Refuge System. Where these uses are determined to be compatible, they are to receive enhanced consideration over other uses. Motorized and nonmotorized boating provides a means to facilitate the priority public uses. By allowing these uses, we are providing opportunities to visitors to access most of the Monomoy Islands and facilitating refuge programs that offer high-quality, wildlife-dependent recreation and maintain the current level of fish and wildlife values.

## AVAILABILITY OF RESOURCES:

This use requires that staff provide information to visitors and conduct periodic law enforcement patrols, particularly to ensure that boaters stay out of closed areas. Costs are outlined below:

| | |
|---|---|
| GS-9 Law Enforcement Officer—3 weeks | $5,400 |
| Sign posting and maintenance | $2,000 |
| **Total annual costs** | **$7,400** |

## ANTICIPATED IMPACTS OF THE USE:

Allowing motorized and nonmotorized access to the refuge will result in some impacts from visitors. The approach of motorized boats to pick up and discharge passengers creates a temporary disturbance to migratory birds feeding or resting on the beach nearby. However, motorized boat landing sites are located outside areas used heavily by nesting, feeding, and roosting terns, shorebirds, and colonial waterbirds. Any energy expended by migratory birds to avoid disturbance associated with beaching a boat and loading and unloading passengers is negligible.

North and South Monomoy Islands make up the Monomoy Wilderness Area. The untrammeled environment and solitude of the Monomoy Wilderness Area, accessible by boat only, make it unique among wildland areas on Cape Cod. Motorized boating, not generally allowed in wilderness areas, is permitted at Monomoy NWR due to a provision in the National Wilderness Preservation Act and the legislation designating Monomoy Wilderness. That said, Monomoy NWR has an unusually low absorption capacity for human impacts. Lack of topographic relief and low vegetation mean that other people are often visible from a long distance. Providing visitors with a convenient way to get out to the islands will result in a diminished degree of solitude, but impacts to the wilderness character of the area will be temporary.

Access to the refuge beach and boat landing sites for the purpose of landing nonmotorized boats poses minimal impacts to plant and wildlife species. Access for paddleboarding, canoeing and kayaking is typically by individuals or small groups. While kayakers and people using stand up paddle boards can also go in shallow water, they are usually moving at a slower rate and have a much lower profile to birds on the shore. Based on biological data, conservation management plans, unreasonable harassment of wildlife, or destruction of the habitat, the refuge manager may restrict the use or close some beaches and other areas from this and other public use, if it is determined that they could have negative impacts on the resources and bird-nesting activities.

Damage to habitat by walking or dragging a paddleboard, canoe or kayak to and from the launch sites is minimal and temporary. At current levels of use, we do not expect increased from boating activities. Several enforcement issues may result from the use, including trampling vegetation, trespass into closed areas, illegal taking of fish (undersized, over limit), illegal fires, and disorderly conduct.

Popular boating seasons coincide in part with spring-early summer nesting and brood-rearing periods for many species of migratory birds. Boaters may disturb nesting birds by approaching nests too closely, causing nesting birds to flush. Flushing may expose eggs to predation or cooling, resulting in egg mortality. Both adult and flightless young birds may be injured or killed if run over by speeding boats. Some disturbance of roosting and feeding shorebirds probably occurs (Burger 1981), but will be minimized if closed areas are respected. We will continue to close refuge areas seasonally to boating around sensitive nest sites, in conjunction with our conservation partners. We will also continue our public outreach and placement of warning signs.

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

Numerous studies have documented that migratory birds are disturbed by human activity on beaches. Erwin (1989) documented disturbance of common terns and skimmers and recommended that human activity be restricted to a distance of 100 meters around nesting sites. Klein (1993) in studying waterbird response to human disturbance found that, as intensity of disturbance increased, avoidance response by the birds increased, and found that out-of-vehicle activity to be more disruptive than vehicular traffic. Pfister et al. (1992) found that the impact of disturbance was greater on species using the heavily disturbed front side of the beach, with the abundance of the impacted species being reduced by as much as 50 percent. In studying the effects of recreational use of shorelines on nesting birds, Robertson et al. (1980) discovered that disturbance negatively impacted species composition. Piping plovers, which intensively use the refuge, are also impacted negatively by human activity. Pedestrians on beaches may crush eggs (Jenkins and Burger 1987, Hill 1988, Shaffer and Laporte 1992, Cape Cod National Seashore 1993, Collazo et al. 1994). Dogs may chase plovers (McConnaughey et al. 1990), destroy nests (Hoopes 1993), and kill chicks (Cairns and McLaren 1980). Other studies have shown that if pedestrians cause incubating plovers to leave their nest, the eggs can overheat (Bergstrom 1991) or can cool to the point of embryo death (Welty 1982). Pedestrians have been found to displace unfledged chicks (Strauss 1990, Burger 1991, Hoopes 1993, Loegering 1992, Goldin 1993).

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

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

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

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

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

As detailed above, the proposed use has the potential of intermittently interrupting the feeding habits of a variety of shorebirds, gulls, and terns, but encounters between pedestrians and migratory birds will be temporary. Refuge staff will manage access via seasonal closures to minimize disturbance to nesting, resting, and foraging waterbirds on the refuge.

Visitors accessing South Monomoy Island could potentially impact the larval stage of the threatened northeastern beach tiger beetle. The recovery plan for this species describes that many of the species' habitats are threatened by human impacts such as habitat alteration and recreational activities (U.S. Fish and Wildlife Service 1994 (Service)). Larval burrows are especially susceptible to trampling, which results in excess energy expenditure and reduced time hunting for the inhabiting individual. We will continue to survey to determine the location and extent of larval beetle occurrence and habitat, and use closures and re-routing to avoid larval habitats, as warranted.

Visitor use also has the potential to disturb loafing seals. Gray and harbor seals haul out on the refuge year-round. We will enforce a 150-foot buffer around all seals as required by the National Oceanic Atmospheric Administration to ensure compliance with the Marine Mammals Protection Act.

Trash left on the beach, particularly food or wrappers, can attract predators that prey on nesting piping plovers and least terns or roosting shorebirds. Litter also impacts the visual experience of visitors (Marion and Lime 1986). Refuge policy advocates leave-no-trace and wilderness stewardship. Impacts are likely to be minimal if conducted in accordance with refuge regulations. However, the amount of trash that is likely to be left by refuge visitors pales in comparison to the flotsam and jetsom that washes up onto the beaches.

Motorized boats generally anchor in the subtidal waters outside the Monomoy Wilderness. Motorized boats travelling offshore the Monomoy NWR impact the sense of quiet and solitude that visitors in the wilderness area seek; however, boaters coming to the refuge only temporarily impact quiet as they approach the island at slow boat speeds in order avoid running aground. Paddlers/kayakers do not produce noise and therefore have little impact on the wilderness area.

## PUBLIC REVIEW AND COMMENT:

As part of the comprehensive conservation planning (CCP) process for the Monomoy NWR, a draft of this compatibility determination underwent a 180-day public comment period concurrent with the release of our draft CCP/Environmental Impact Statement (EIS). This final compatibility determination resulted from that public review and comment process. It underwent a further 37-day public review period concurrent with the release of the final CCP/EIS. No comments on the compatibility determination were received and it has remained unchanged.

## DETERMINATION (CHECK ONE BELOW):

_____Use is not compatible.

__X__ Use is compatible with the following stipulations.

## STIPULATIONS NECESSARY TO ENSURE COMPATIBILITY:

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

- Harassment of wildlife and excessive damage to vegetation is prohibited.
- No boats, paddleboards, canoes or kayaks, or related equipment may be left overnight on the refuge unless the owner is surf fishing, which is the only authorized nighttime use.
- Providing outfitting or commercial services for motorized and nonmotorized boating on the refuge requires an special use permit issued by the refuge (see Commercial Tours and Services compatibility determination).
- Periodic evaluations will be done to insure that visitors are not causing unacceptable adverse impacts. Areas open to these uses will be evaluated on an annual basis, depending on geomorphology and wildlife use.
- The refuge is a leave-no-trace, carry-in-carry out facility. All food containers, bottles, and other waste and refuse must be taken out. Littering, dumping, and abandoning property are prohibited by Federal regulation at 50 CFR 27.93 and 50 CFR 27.94.

## JUSTIFICATION:

Access to Monomoy Island is restricted to boat. Allowing the landing of motorized watercraft and the landing and launching of nonmotorized personal watercraft provides visitors with a safe alternative to access and explore Monomoy NWR beyond the mainland portion of the refuge. This access allows visitors to take part in priority wildlife-dependent recreation on the refuge, including wildlife observation, wildlife photography, and recreational fishing. Motorized and nonmotorized boat use will not interfere with the Service's work to protect and conserve natural resources. Motorized boats must land in designated areas to minimize potential impacts to wildlife. The level of use for these activities on the refuge is moderate, and the associated disturbance to wildlife is temporary and minor. Although motorized and nonmotorized boat uses are not priority public uses, under the conditions described above, they are not detrimental activities. Access for waterfowl hunting, fishing, wildlife observation and photography, and environmental education and interpretation, which are priority uses, allows visitors to enjoy the outdoors and wild lands. Boating on Monomoy NWR will not materially interfere with or detract from the mission of the Refuge System or the purposes for which the refuge was established.

## SIGNATURE:

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

## CONCURRENCE:

Regional Chief: Scott B. Kahn (Signature) March 18, 2016 (Date)

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

## LITERATURE CITED:


Bélanger, L. and J. Bédard. 1990. Energetic cost of man-induced disturbance to staging snow geese. Journal of Wildlife Management 54(1): 36-41.

Bergstrom, P.W. 1991. Incubation temperatures of Wilson's plovers and killdeer. Condor 91: 634-641.

Boyle, S.A. and F.B. Samson. 1985. Effects of nonconsumptive recreation on wildlife: A review. Wildlife Society Bulletin 13: 110-116.

Burger, J. 1981. Effect of human activity on birds at a coastal bay. Biological Conservation 21: 231-241.

Burger, J. 1986. The effect of human activity on shorebirds in two coastal bays in northeastern United States. Biological Conservation 13: 123-130.

Burger, J. 1991. Foraging behavior and the effect of human disturbance on the piping plover (*Charadrius melodus*). Journal of Coastal Research 7(1): 39-52.

Burger, J. and M. Gochfeld. 1981. Discrimination of the threat of direct versus tangential approach to the nest by incubating herring and great black-backed gulls. Journal of Comparative Physiological Psychology 95: 676-684.

Burger, J., M. Gochfeld, and L.J. Niles. 1995. Ecotourism and birds in coastal New Jersey: Contrasting responses of birds, tourists, and managers. Environmental Conservation 22: 56-65.

Burger, J. and M. Gochfeld. 1998. Effects of ecotourists on bird behaviour at Loxahatchee National Wildlife Refuge, Florida. Environmental Conservation 25: 13-21.

Cairns, W.E. and I.A. McLaren. 1980. Status of the piping plover on the east coast of North America. American Birds 34: 206-208.

Collazo, J.A., J.R. Walters, and J.F. Parnell. 1994. Factors Affecting Reproduction and Migration of Waterbirds on North Carolina Barrier Islands. 1993 Annual Progress Report. North Carolina State University, Raleigh, North Carolina. 57 pp.

Erwin, R.M. 1980. Breeding habitat by colonially nesting water birds in two mid-Atlantic U.S. regions under different regimes of human disturbance. Biological Conservation 18: 39-51.

Erwin, R.M. 1989. Responses to Human Intruders by Birds Nesting in Colonies: Experimental Results and Management Guidelines. Colonial Waterbirds 12(1): 104-108.

Goldin, M.R. 1993. Effects of human disturbance and off-road vehicles on piping plover reproductive success and behavior at Breezy Point, Gateway National Recreation Area, New York, M.S. Thesis. University of Massachusetts, Amherst, Massachusetts. 128 pp.

Havera, S.P., L.R. Boens, M.M. Georgi, and R.T. Shealy. 1992. Human disturbance of waterfowl on Keokuk Pool, Mississippi River. Wildlife Society Bulletin 20: 290-298.

Henson, P.T. and A. Grant. 1991. The effects of human disturbance on trumpeter swan breeding behavior. Wildlife Society Bulletin 19: 248-257.

Hill, J.O. 1988. Aspects of breeding biology of Piping Plovers (*Charadrius melodus*) in Bristol County, Massachusetts, in 1988. Unpublished report. University of Massachusetts, Amherst, Massachusetts. 44 pp.

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

Jenkins, D.C. and J. Burger. 1987. New Jersey Endangered Beach-Nesting Bird Project: 1986 Survey and Management. New Jersey Department of Environmental Protection, New Jersey. 37 pp.

Kaiser, M.S. and E.K. Fritzell. 1984. Effects of river recreationists on green-backed heron behavior. Journal of Wildlife Management 48: 561-567.

Kahl, R. 1991. Boating disturbance of canvasbacks during migration at Lake Poygan, Wisconsin. Wildlife Society Bulletin 19: 242-248.

Klein, M.L. 1993. Waterbird behavioral responses to human disturbance. Wildlife Society Bulletin 21: 31-39.

Klein, M.L., S.R. Humphrey, and H.F. Percival. 1995. Effects of ecotourism on distribution of waterbirds in a wildlife refuge. Conservation Biology 9: 1454-1465.

Knight, R.L. and D.N. Cole. 1995. Wildlife responses to recreationists. Pp. 51-69 in R.L. Knight and K.J. Gutzwiller, eds. Wildlife and recreationists: coexistence through management and research. Washington, DC, Island Press.

Korschgen, C.E., L.S. George, and W.L. Green. 1985. Disturbance of diving ducks by boaters on a migrational staging area. Wildlife Society Bulletin 13: 290-296.

Loegering, J.P. 1992. Piping Plover Breeding Biology, Foraging Ecology and Behavior on Assateague Island National Seashore, Maryland. M.S. Thesis. Virginia State Polytechnic Institute and State University, Blacksburg, Virginia. 262 pp.

McConnaughey, J.L., J.D. Fraser, S.D. Coutu, and J.P. Loegering. 1990. Piping plover distribution and reproductive success on Cape Lookout National Seashore. Unpublished report. Cape Lookout National Seashore, Morehead City, North Carolina. 83 pp.

Marion, J.L. and D.W. Lime. 1986. Recreational Resource Impacts: Visitor Perceptions and Management Responses. Pp. 229-235. Kulhavy, D. L. and R. N. Conner, eds. In Wilderness and Natural Areas in the Eastern United States: A Management Challenge. Center for Applied Studies, Austin State University, Nacogdochesz, Texas. 416 pp.

Morton, J.M., A.C. Fowler, and R. L. Kilpatrick. 1989. Time and energy budgets of American black ducks in winter. Journal of Wildlife Management 53: 401-410 (also see corrigendum in Journal of Wildlife Management 54: 683).

Owen, M. 1973. The management of grassland areas for wintering geese. Wildfowl 24: 123-130.

Pfister, C., B.A. Harrington, and M. Lavine. 1992. The Impact of Human Disturbance on Shorebirds at a Migration Staging Area. Biological Conservation 60(2): 115-126.

Robertson, R.J. and N.J . Flood. 1980. Effects of Recreational Use of Shorelines on Breeding Bird Populations. Canadian Field-Naturalist 94(2): 131-138.

Rodgers, J.A. and H.T. Smith. 1995. Set-back distances to protect nesting bird colonies from human disturbance in Florida. Conservation Biology 9: 89-99.

Rodgers, J.A. and H.T. Smith. 1997. Buffer zone distances to protect foraging and loafing waterbirds from human disturbance in Florida. Wildlife Society Bulletin 25: 139-145.

Shaffer, F. and P. Laporte. 1992. Rapport synthese des recherches relatives au pluvier siffleur (*Charadrius melodus*) effectuees aux Iles-de-la-Madeleine de 1987 a 1991. Association quebecoise des groups d'ornithologues et Service canadien de la faune. 78 pp.

Strauss, E. 1990. Reproductive success, life history patterns, and behavioral variation in a population of Piping Plovers subjected to human disturbance (1982-1989). Ph.D. dissertation. Tufts University, Medford, Massachusetts.

United States Fish and Wildlife Service (USFWS). 1994. Northeastern Beach Tiger Beetle (*Cincindela dorsalis dorsalis*) Recovery Plan. U.S. Fish and Wildlife Service, Hadley, Massachusetts. 6 pp.

Ward, D.H. and R.A. Stehn. 1989. Response of brant and other geese to aircraft disturbance at Izembek Lagoon, Alaska. U.S. Fish and Wildlife Service, Alaska Fish and Wildlife Research Center. Final report to the Minerals Management Service. Anchorage, Alaska. 193 pp.

Welty, J.C. 1982. The life of birds. Saunders College Publishing, Philadelphia, Pennsylvania. 754 pp.

Williams, G.J. and E. Forbes. 1980. The habitat and dietary preferences of Dark-Bellied Brent Geese and Widgeon in relation to agricultural management. Wildfowl 31: 151-157.

# COMPATIBILITY DETERMINATION

## USE:

Nonmechanized Harvesting of Subterranean Shellfish (softshell clams, razor clams, sea (surf) clams, and quahogs) Without the Aid of Artificial Extraction Methods

## REFUGE NAME:

Monomoy National Wildlife Refuge

## DATE ESTABLISHED:

June 1, 1944

## ESTABLISHING AND ACQUISITION AUTHORITY(IES):

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

## REFUGE PURPOSE(S):

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

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

## NATIONAL WILDLIFE REFUGE SYSTEM MISSION:

The mission of the National Wildlife Refuge System (Refuge System) is to administer a national network of lands and waters for the conservation, management, and where appropriate, restoration of the fish, wildlife, and plant resources and their habitats within the United States for the benefit of present and future generations of Americans (Publ. L. 105-57; 111 Stat. 1252).

## DESCRIPTION OF USE:

**(a) What is the use? Is the use a priority public use?**
This compatibility determination is for nonmechanized harvesting of subterranean shellfish above the mean low water (MLW) line and is limited to softshell clams, razor clams, sea (surf) clams and quahogs. These are the only shellfish species we allow to be harvested on refuge tidal flats above the MLW line. Use of mechanized harvest equipment and artificial extraction methods such as salt or chlorine are not allowed. This compatibility determination does not include other shellfish species, such as mussels or scallops (which are addressed separately), and does not include eels or marine worms that are defined as shellfish by the town of Chatham (Town). All clammers operating on the refuge must comply with the town shellfish regulations and additionally with other requirements that may be instituted by the U.S. Fish and Wildlife Service (Service).

Recreational fishing is a priority public use of the Refuge System under the National Wildlife Refuge System Administration Act of 1966 (16 U.S.C. § 668dd-668ee), as amended by the National Wildlife Refuge System Improvement Act of 1997 (Refuge Improvement Act) (Public Law 105-57). Shellfishing is a type of fishing and, therefore, a wildlife-dependent public use; however, we also consider it a refuge economic use, as per §50 CFR 25.12 and §50 CFR 29.1, which must contribute to the achievement of refuge purposes or the Refuge System mission.

A person with a rake and a basket collecting clams has no different impact on the landscape if he or she eats them, or if they sell the clams they harvest, and the Service has no effective means of ensuring that clams collected are never sold.

**(b) Where would the use be conducted?**
The majority of shellfish harvesting in recent years (10+ years) on the refuge has occurred in intertidal habitat above mean low water primarily on the western side of North Monomoy Island, especially the southern end, the northern end of South Monomoy Island, and the eastern side of Minimoy. It also very occasionally occurs in extreme shallow subtidal areas adjacent to intertidal habitat. Shellfish harvest also occurs intermittently within the Powder Hole area in the southwest portion of South Monomoy Island. This use can occur in any intertidal area of the refuge that supports harvestable populations of these shellfish species. Sea (surf) clams, although primarily found in subtidal areas, can occasionally be found on tidal flats (Dr. Robert Duncanson, May 4, 2015 correspondence) in Chatham, and presumably the refuge. There is currently occasional harvest of sea clams in non-refuge waters that can be harvested by hand tools. Area closures may occur at any time on Monomoy National Wildlife Refuge (NWR) based on the need to protect sensitive habitats or species of conservation concern. When these conditions exist, the refuge manager is responsible for ensuring these areas are closed to all public access, including shellfish harvesters. Harvest areas may also be closed to harvest, typically seasonally due to bacterial contamination, by action of the Town. The necessity of these seasonal closures depends largely on the foraging quality of the intertidal flats, which is primarily determined by the natural forces of wind, tides, sediment transport patterns, erosion, and accretion. Areas that are open to this use will be evaluated on an annual, seasonal, and sometimes daily basis and will be influenced by beach geomorphology and wildlife use. Seasonal closures will vary year to year based on wildlife use and habitat conditions. Visitors will be expected to comply with closures. Updates on closures will be available at the Headquarters and on the refuge web site.

**(c) When would the use be conducted?**
Shellfish harvesting takes place during daylight hours year-round, from 1/2-hour before sunrise to 1/2-hour after sunset, with the number of harvesters peaking during the summer tourism months. Additionally, the Town prohibits any harvesting on dry ground or on shoal areas that may become dry on any days when the air temperature is below 30 degrees or does not reach 30 degrees by 11:00 a.m. (*http://www/chatham-ma.gov/public_documents/ChathamMa_shellfish/shellfishregulations120811.pdf*). Harvesters typically arrive around mid-tide on the falling tide (about 3 hours after high tide), and stay on the exposed flat for approximately 6 hours, until the midpoint of the incoming tide (about 3 hours after low tide) when their boats refloat. Arrival and departure times change approximately one hour daily, reflecting the normal daily change in tidal cycle range.

**(d) How would the use be conducted?**
Shellfish harvesters typically depart for the shellfish flats on and around Monomoy NWR by boat from one or more off-refuge locations such as Outermost Harbor, Stage Harbor, Chatham Harbor, or Harwichport. Shellfish harvesters at the refuge usually land their boats as near to harvest areas as possible, anchor the boat, and let it ground out with the falling tide. Softshell clam harvesters in coastal New England and on Cape Cod typically use short handled rakes and spend most of their time bent over at the waist or on hands and knees harvesting patches of shellfish. They generally traverse the exposed mudflats only to move among patches of shellfish (Burger 1981, Leavitt and Fraser 2004). Harvesters can turn over approximately 40 $m^2$ of sediment in a low tide event (Leavitt and Fraser 2004). Quahog harvesters similarly move at a slow pace and generally work in localized patches, but in contrast to softshell clam harvesters, they are usually standing upright and scraping the sediment surface with a long-handled rake. Quahog harvesters generally harvest in water, but in some intertidal areas of Monomoy NWR, quahog populations have established and can be harvested when the intertidal areas are exposed at lower tides.

Hand harvest methods are defined in the Town Shellfish Rules and Regulations §306 (Shellfishing Devices) as those commonly known as the long-rake, scratcher, tong, or clam-hoe. Use of shovels, pitchforks, garden spades, etc., is prohibited. Use of basket rakes attached to a T-handle is also prohibited by town regulation in any

areas that become dry at any time during the tidal cycle, e.g., intertidal or supra-tidal areas. The Service does not allow salting to assist in the of harvest clams on the refuge tidal flats. Town regulations allow salting for razor clams and sea (surf) clams "…provided there are no other species (such as soft-shelled clams or quahogs) within the inter-tidal zone of a given area. Areas of mixed species will be assessed and determined in the sole and unfettered discretion of the Shellfish Constable." Krzyzewski and Chery (2005) studying salting for razor clams in Pleasant Bay, noted that Pleasant Bay harvesters typically used a salt solution of 100-200 ppt. There is no regulation on the exact salt concentration that can be used in Chatham. We do not know if Krzyzewski and Chery (2005) accurately describes methods used by Chatham harvesters. Use of hydraulic pumping or other mechanized or motorized harvest methods, formerly permitted in subtidal areas within the Powder Hole area, was prohibited by town regulation in 2011 at the request of the Service. Use of a hand operated plunger is still permitted within the Powder Hole area under town regulations.

Town regulations require all harvesters to obtain and have a shellfish permit in their possession while harvesting shellfish. Additionally, all shellfish harvesters must comply with all refuge regulations and with State and Federal guidelines for terns, piping plover, red knots, marine mammal, and coastal dune protection. Harvesters are expected to stay apprised of and respect all closures and regulations. Information on annual, seasonal, and daily closures, known hazards, and other regulations is disseminated from refuge headquarters, and closures are marked with informational signs or symbolic fencing.

Take limits are set by the town which also provides oversight to ensure that clam populations are maintained. If the Service believes clams are being overharvested or the harvest of clams appears to be impacting refuge wildlife populations, the Service will collaborate with the Commonwealth, the town, or through refuge regulations to lower harvest levels or modify permitted harvest methods on the refuge.

**(e) Why is this use being proposed?**

Shellfish harvest from intertidal areas for human consumption using simple hand methods has been practiced continuously since the earliest known human occupation of the area, and remains an important part of local culture and diet (Lotze and Milewski 2004, Lotze 2010). Hand harvesting of shellfish from intertidal areas was an established subsistence use in and around Monomoy Point well before the area was established as a national wildlife refuge in 1944, and it continued through and since the evaluation and designation of the Monomoy Wilderness in 1970. The use remains a popular and significant activity to local communities. The Town began administering a traditional shellfishery in the early 1900s that still continues a century later.

The Service has consistently determined since refuge establishment that harvesting shellfish for human consumption from intertidal areas using traditional, hand harvest methods is a compatible use of the refuge. The environmental assessment for the 1988 refuge master plan included shellfish harvesting as part of the public use program, and acknowledged Monomoy NWR's importance to local shellfishers as a source of softshell clams, quahogs, and sea (surf) clams. That 1988 master plan established an index to local shellfish harvest trends by summarizing town-issued shellfish harvest permits.

In a 1994 compatibility determination, the Service found that hand harvest of shellfish (softshell clams) from intertidal areas of the refuge, conducted in accordance with Town and refuge regulations and closures, was compatible with the purposes for which Monomoy NWR was established.

Shellfish harvesting using traditional hand raking methods has coexisted for decades with migratory birds and other wildlife species of conservation concern that use the expansive and dynamic intertidal flats around Monomoy NWR. Shellfish harvest using traditional hand raking methods within the Monomoy Wilderness can provide a rare, outstanding opportunity for solitude or primitive and unconfined type of recreation in a primarily natural, undeveloped coastal barrier system landscape. Nonmechanized shellfish harvest from intertidal refuge areas affords refuge visitors an opportunity to increase their understanding and appreciation of the refuge, its resources, resource management, and refuge regulations along with traditional, local cultural practices. Commercial harvest of soft-shell clams and quahogs by private individuals on the flats predates refuge establishment by more than a century and, at a low level, does not affect the primeval landscape or interfere with the opportunities for solitude. A use of the land that was historical, does not affect the natural condition of the land, leaves the "imprint of man's work" substantially unnoticeable, and leaves unaffected opportunities for solitude or a primeval and unconfined type of recreation, should be held within the purposes to which a wilderness area may be devoted, and may be permitted despite being commercial. A person with a rake and a basket collecting clams has no different impact on the landscape if he or she eats them, or if they sell the clams, and the Service has no effective means of ensuring that clams collected are never sold. The Service has allowed clamming since refuge establishment and has determined that commercial clamming at the same

scale and in the same manner that has occurred historically is compatible under the Refuge Improvement Act (16 U.S.C. 1668dd). We have also reviewed applicable case law, and believe that commercial clamming is within the purposes of the Monomoy Wilderness, as it is an historical use, and may be permitted so long as the methods used are those historically employed, are the minimum necessary, and that the activity does not otherwise impact wilderness character.

## AVAILABILITY OF RESOURCES:

The following breakdown shows the estimated amount of funds needed annually to cover costs associated with managing the hand harvest of subterranean shellfish on the refuge.

**Staff Time to Administer the Program**

| Identifier | Cost |
|---|---|
| GS-12 Refuge Manager—coordinate w/ Town (4 person-days/year) | $2,000.00 |
| GS-09/06 Law Enforcement Staff—compliance oversight (20 person-days/year) | $6,000.00 |
| GS-11 Refuge Biological Staff—monitoring, proposing closures, producing maps, coordinating with the Town (10 person-days/year) | $4,000.00 |
| **Total recurring annual cost** | **$12,000.00** |

## ANTICIPATED IMPACTS OF THE USE:

### *Background/Introduction*

The magnitude and duration of both beneficial and adverse impacts on the intertidal substrate and waters, invertebrate populations, and higher trophic-level organisms, are influenced by the frequency, intensity (areal extent and depth), and efficiency of harvest effort. Actual shellfish harvest impact stems from the spatial extent and degree that the pre-disturbance and post-disturbance intertidal environments differ (Beukema 1995, Ray 2005). Impacts of hydraulic or mechanical shellfish dredges on intertidal bottom structure and benthic invertebrates are typically greater and longer lasting than those from hand harvest (Ferns et al. 2000, MacKenzie and Pikanowski 2004, Kraan et al. 2007, Peterson and Estes 2001). However, those mechanical harvest methods are not allowed on the refuge intertidal or shallow subtidal areas, and are therefore not considered further in this compatibility determination. Rigorous scientific studies evaluating the impacts of salting to extract shellfish are currently lacking. There is a scarcity of information documenting potential impacts (negative, neutral, or positive) of salting on target species, non-target species, and the benthic environment.

The following summaries of potential impacts from shellfish harvesting are focused on those derived from non-mechanical hand harvest. Harvesting shellfish can range from a single surface sediment turning event (low intensity-impact) by hand digging to a repetitive (high intensity-impact) excavation of the same location within a short (days to weeks) time period (Leavitt and Fraser 2004). For Monomoy NWR, intertidal sediment disturbance from hand digging occurs on an annual to bi-annual basis, rotating between different areas during post-harvest recovery intervals, and is therefore generally low intensity-low impact in nature.

The following impacts discussion focuses on potential and expected impacts from shellfish harvesting as they relate to the refuge's two establishment purposes and related physical and biological resources. Although the topics are interrelated, for ease of presentation, this section is organized into four main categories: substrate and water quality, benthic communities, migratory shorebirds and other species of conservation concern, and wilderness character.

We reference low, moderate, and high interest levels for shellfishing in our impacts discussion which are based on permit issuance data reported by the Town in annual reports from 1989 to 2011. Low corresponds to 0 to

350, moderate corresponds to 350 to 500, and high corresponds to more than 500 permits issued annually by the town.

### *Substrate and Water Quality*

Nonmechanized hand harvest methods addressed in this compatibility determination include the use of rakes to harvest shellfish and the use of hand plungers in Powder Hole, but only where at least 1 foot of water depth occurs at mean low tide. The potential concern is the disturbance to bottom sediments that, in turn, can affect water quality when the sediments become re-suspended during subsequent tidal cycles. These filter-feeding shellfish also can provide significant water purification services within nearshore estuarine systems (Burke 2009, see also *http://www.ct.gov/doag/cwp/view.asp?a=1367&q=478090;* last accessed 09/19/2013).

An individual softshell clam harvester in New England can turn over approximately 40 $m^2$ of sediment in a single low tide event (Leavitt and Fraser 2004). Clam rakes typically penetrate just the top 12 inches or less of substrate. If there are, on average, 200 tides (days) harvested annually, then each harvester potentially disturbs approximately 8,000 $m^2$ (0.8 hectares or 2 acres) annually to a depth of approximately 12 inches (2 acre-feet/year/harvester). Once an area is harvested, it generally takes 1 to 3 years before harvestable clams have repopulated the flat (Brown and Wilson 1997, Leavitt et al. 2010). At historically low interest levels, approximately 250 permitted harvesters would impact 200 ha (494 acres), at moderate interest levels, approximately 450 permitted harvesters would impact 360 ha (889 acres), and at high interest levels, approximately 600 permitted harvesters would impact 480 ha (1,186 acres) of shellfish substrate throughout town-administered shellfishing beds. To put this level of potential impact into a local context, the State-designated shellfish harvest area surrounding Monomoy Island (SC47), which includes nearly 80 percent of the Town 's intertidal shellfish flats, encompasses 37,831 acres. Even if all shellfish permit-holders in Chatham harvested exclusively within SC47 during years of high interest (a worst-case impact scenario), only 3.1 percent (1,186 acres) of those 37,831 acres would be impacted annually. Current levels of interest are generally low, and there are 16 other State-designated shellfish harvest areas elsewhere in Chatham that receive some of the total annual shellfish harvest effort by residents and visitors.

When the incoming tide re-floods the exposed intertidal substrate, sediment can be re-suspended (Coen 1995, Ray 2005, Munari et al. 2006, Peterson and Estes 2001). Observed effects are typically site-specific and influenced by sediment grain size and type, hydrological conditions, faunal influences, currents, water mass size, and configuration (Hayes et al. 1984, LaSalle 1990, Barnes et al. 1991, Coen 1995). Although we are unaware of studies that specifically evaluate the impacts of nonmechanized shellfish harvesting on substrates and water quality, other studies do provide some evidence of possible impacts from sediment re-suspension.

Effects of sediment re-suspension can include reduced light available for photosynthesis, burial or smothering of benthic biota and spawning areas resulting in anoxic conditions, and negative effects on feeding and metabolic rates of intertidal organisms (Johnson 2002). Re-suspension may also impact nutrient budgets due to burial of fresh organic matter and exposure of deep anaerobic sediment, upward flux of dissolved nutrients in pore water, and changes in benthic infauna metabolism (Mayer et al. 1991, Pilskaln et al. 1998). However, the finer particles re-suspended are often quickly flushed back out of the area by tidal currents in dynamic, higher wave energy situations such as the moderate wave energy areas typical of the refuge's intertidal flats, leaving behind only heavier and coarser particles that settle out of suspension more rapidly (Leavitt et al. 2010).

Undisturbed clam flats tend to progress from dynamic sand or sand-mud textures, which are indicative of higher wave energy situations and high softshell clam productivity, toward finer silt-like sediments higher in organics and indicative of lower wave energy and lower clam productivity (Rask 1986, Leavitt and Fraser 2004, Leavitt et al. 2010). The flats surrounding Monomoy NWR are currently at the sand or sand-mud and higher clam productivity end of this gradient. Wave energy alone helps retard the natural maturing of the clam flats surrounding Monomoy NWR. Over long time frames, as undisturbed substrate texture gets finer and the organic fraction increases and decomposes, consuming oxygen in the process, dissolved oxygen levels decline (hypoxia) and can eventually lead to anaerobic or anoxic conditions within the substrate. Once decomposition shifts to anaerobic conditions, hydrogen sulfide, a known toxin for many aquatic organisms is also produced. Also, undisturbed tidal sediments can tend toward a more compact condition (Rowell and Woo 1990, Leavitt and Fraser 2004). The finer sediment particles grow closer together over time, reducing interstitial spaces (Leavitt and Fraser 2004).

Periodic disturbance of the surface sediments, such as results from hand harvesting shellfish, aerates the surface sediments and can halt or retard this very long-term tendency toward anoxic conditions, loosening

more compact (low clam productivity) substrate conditions. Such disturbances increase bottom roughness, decrease organic loading, and reduce compaction within the substrate (Leavitt and Fraser 2004).

Seston are minute living organisms and particles of nonliving matter floating in the water that contribute to turbidity. In their Maine intertidal study area, Kyte et al. (1975) found that ambient, natural seston levels (6.9 to 441 mg/1) where baitworm digging occurs using a method similar to hand raking, often met or exceeded the short-term maxima (turbidity level 584 mg/l) associated with shellfish harvesting.

Re-suspension of sediments occurs naturally during storms, or from other human activities such as operating boats in shallow estuarine areas. This relationship between naturally occurring and human-caused sediment suspension has not been studied on Cape Cod. However, Monomoy NWR is characterized by a more dynamic system of tide- and wind-driven shifting sands than the area Kyte et al. (1975) studied. Water turbidity from suspended sediments is not commonly reported as a concern for the intertidal waters surrounding the refuge. It is therefore likely that, for the refuge, natural tide-driven and wind-driven sand movements cause more sediment re-suspension than shellfish harvesting activity does.

### *Benthic Community*

The larger size-class shellfish sought by harvesters for human consumption are part of the available mature, breeding population for shellfish species that, like many other marine organisms, exhibit sporadic and somewhat unpredictable reproductive success. For the Monomoy intertidal areas, the interval required for softshell clams to attain harvestable size from larval recruitment is approximately 1.5 to 2 years (Leavitt and Fraser 2004, citing S. Moore, personal communication), after which growth slows as energy intake is redirected to reproduction. The clams typically exhibit a patchy, uneven distribution across intertidal areas (Newell and Hidu 1986, Leavitt and Fraser 2004, Leavitt et al. 2010). Once an area is harvested of legal-sized clams, harvesters move to a new location (Leavitt et al. 2010).

Additionally, shellfish targeted by harvesters are but one component of a diverse marine invertebrate community. The invertebrate assemblage is at the base of a complex food web. Many other higher trophic level organisms dependent upon the invertebrate fauna inhabiting intertidal flats, are also valued by people or are otherwise of conservation concern. Direct and indirect mortality induced by shellfish harvest, recruitment or reproductive failures that delay population recovery, and shifts in species diversity toward smaller, short-lived and more mobile species can reduce the abundance of preferred prey items for higher trophic level predators such as amphipods, copepods, echinoderms, gastropods, crabs, fish, or birds (Piersma et al. 2001, Verhulst et al. 2004, Peterson and Estes 2001). Therefore, in this compatibility determination we also consider impacts to non-target species.

### Direct Harvest Impacts

Experienced hand harvesters routinely remove a majority (84 percent according to Dow and Wallace 1957) of the largest (legal-sized) clams from a given location during a single digging event. These larger individuals are mostly reproductively active adults on which future recruitment and shellfish resource sustainability depends. In their 2004 literature review, Leavitt and Fraser state that adult softshell clam removal permits increased larval recruitment (citing Pfitzenmeyer 1962 and Peterson et al. 1987), more rapid juvenile growth (citing Turner 1951), and reduced predation (citing Boulding and Hay 1984). Evidence indicates softshell clams can saturate intertidal habitat, reaching very high densities, with intense competition for food and growing space, and substantially reduced reproductive, larval recruitment, and growth rates (Leavitt and Fraser 2004, citing Belding 1930, Turner 1953, Dow and Wallace 1957, Goshima 1982, Newell and Hidu 1986, and Ellis 1998). The net result is a dense population of smaller-sized adult clams existing nearer the surface where they are more vulnerable to predation, combined with low recruitment rates. Older, less mobile adult clams at high densities are susceptible to die-off, burial from moving sediment, or anoxia from depleted dissolved oxygen, forming "clam graveyards" (Leavitt and Fraser 2004, citing Dow and Wallace 1957), bed compaction, and reduced larval recruitment (Leavitt and Fraser 2004, citing Kyte and Chew 1975).

Direct mortality or injury of residual, unharvested/discarded shellfish (generally sub-legal sized) can occur from harvesting rakes that contact shellfish, from trampling underfoot, or from rough handling by the harvester during measuring and sorting (Heffernan 1999, Ferns et al. 2000, Johnson 2002). During shellfish harvest activities, many invertebrates are discarded and left on the intertidal flats near where they were taken,

some alive and intact, and others injured, or dead. Reasonably intact live individuals rebury themselves within a few minutes, leaving only moribund ones on the surface (Ferns et al. 2000). Kaiser et al. (2001) found hand raking for cockles led to an initial three-fold increase in the damage rate of under-sized cockles compared with control plots. In contrast to hand harvesting, mechanical harvesters, e.g., escalators, typically produce less mortality to discarded target bivalve species because physical impact damage is less likely (Kyte and Chew 1975, Peterson et al. 1983, 1987). However, hand harvesters typically harvest much smaller total quantities than more efficient mechanical methods. Thin-shelled bivalves (softshell clams, razor clams are examples at Monomoy) and soft-bodied invertebrates such as marine worms or starfish show higher damage than solid-shelled bivalves (quahogs, sea (surf) clams are examples for Monomoy) in fished areas (Rumohr and Krost 1991). Animals able to retract below the seafloor surface or living below the fishing gear penetration depth sustain less harvest damage than epibenthic organisms (mussels, bay scallops are examples for Monomoy). McLaughlin et al. (2007) found hand raking did not affect the ability of cockles (*Cerastoderma edule*) to rebury themselves at Strangford Lough, Ireland, and small cockles had a faster mean burial rate than larger cockles (51.7 percent and 31.1 percent, respectively). The research of Savage (1974-1976) on Narragansett Bay, Rhode Island, hard clams showed that, in the warm summer temperatures it took 10 to 20 minutes to burrow into the bottom after being left on the surface, while it took an hour at 10°C (50° F). This means that between mid-November and early May when temperatures were cooler, clams left on the surface by rakes or transplantation were more vulnerable to predators because of their longer surface exposure.

Harvesters cannot be certain that a targeted razor clam in a burrow meets the Chatham minimum harvestable size (4 1/2 inches), until after it has been salted, expelled itself and been measured. Undersized razor clams then become "discards." Krzyzewski and Chery (2005) studied the impacts of salting on razor clams and clam tissue in Pleasant Bay and found that high concentrations of salt solution causes mortality to razor clams. Salt solutions of 100 ppt were found to affect the cilia and cell membranes. Undersized razor clams, potentially weakened by salt exposure exceeding 100 ppt that are discarded can become easy prey to everpresent gulls preventing recruitment into the local razor clam (future) breeding population.

### Indirect Harvest Impacts

The initial impact of physical disturbance associated with shellfish harvesting on intertidal flats is a reduced standing crop of most non-target species within the disturbed area (Leavitt and Fraser 2004, Leavitt et al. 2010). Many researchers have documented decreased infauna biomass following disturbance (Kyte et al. 1975, Hall et al. 1990, Hall and Harding 1997, Spencer et al. 1998, Engelhard and Withers 1999, Leavitt and Fraser 2004). Biomass loss can range from 40 percent (van den Heiligenberg 1987) to 100 percent (McLusky et al. 1983).

Benthic recovery following harvest disturbance depends on the intensity and frequency of disturbance, life history of the benthic organisms disturbed, and elapsed time since disturbance. Repopulation and recovery of disturbed areas results from migration, passive translocation from surrounding areas, and recruitment of new individuals from natural reproductive cycles (Leavitt and Fraser 2004, citing van den Heiligenberg 1987, Hall et al. 1990, Guenther 1992, Shull 1997). Large or hard-bodied organisms such as target and non-target shellfish, or sedentary bait worms such as lugworms (*Arenicola* sp.), may depend more on recruitment than immigration for post-disturbance recovery (Cryer et al. 1987, Leavitt and Fraser 2004). Due to annual periodicity of seasonal reproductive cycles, this can mean slower re-colonization of disturbed areas (Shull 1997, Leavitt and Fraser 2004).

Anoxia and hydrogen sulfide toxicity within the intertidal substrate results in the mortality of nearly all sedentary organisms, including shellfish and many other invertebrates (Evans 1967, Leavitt and Fraser 2004). Increasingly anoxic and more compact substrate conditions reduce softshell clam productivity (Leavitt and Fraser 2004). Cox (1991) noted that baitworm digging, similar to the hand harvest methods included in this compatibility determination, redistributed anaerobic sediment layers upwards to the surface, with losses of all invertebrate infauna except small species that are tolerant of anoxic conditions. Feeding invertebrates like crabs, bivalves, and crustaceans, along with marine worms and echinoderms with limited mobility, will die if oxygen is deprived for sustained periods (Peterson and Estes 2001).

Organic fractions that may be re-suspended from the intertidal sediments during hand harvesting can increase food availability for filter feeding shellfish, thereby benefitting shellfish survival, growth, and reproductive output (Leavitt and Fraser 2004). Compaction of the substrate over time in undisturbed sediments can resist benthic fauna from anchoring or burrowing in the substrate. For example, newly settled softshell clam larvae attach and anchor themselves in the substrate by means of byssal threads, important for evading predation. Loosening and roughening of the surface sediment layers that results from hand harvesting can maintain

more favorable conditions for recruitment of new individuals into the population, aiding post-harvest recovery (Turner 1951, Ellis 1998, Mullineaux et al. 1999, Leavitt and Fraser 2004, Leavitt et al. 2010). However, this impact is likely more pronounced (shorter time scale) in finer texture, high organic fraction situations than the more naturally dynamic sand-dominated substrate conditions that exist around Monomoy NWR.

Depending on the spatial scale involved, changes in bottom topography can have profound effects on benthic infauna (Ray 2005). Dernie et al. (2003) showed that a difference of only 10 cm in the amount of material removed during mechanized harvest from a sand flat in Wales, United Kingdom, resulted in a substantial decrease in benthic fauna recovery rate. Plots where 20 cm of sediment were removed required 208 days for infaunal community reestablishment; plots with 10 cm removed recovered in 64 days. While hand harvest as employed at the refuge does disturb some surface sediment in limited intertidal areas, the disturbed sandy sediment largely remains onsite, is reworked during subsequent tidal cycles, but is not removed from the site (Leavitt and Peters 2005).

In contrast, invertebrates may be inadvertently reburied at depths exceeding their ability to migrate upwards or extend filter-feeding structures into the water. Smothering with anoxic sediments during harvesting and backfilling can cause benthic invertebrate mortality (Cox 1991, Coen 1995). Logan (2005) found sediment turnover from clam hand digging in a mid-coast Maine intertidal mudflat can deposit *Corophium volutator* (an amphipod that is an important shorebird prey item) at greater depths below the sediment surface; without any connection to the sediment surface, mortality can result. In an upper Bay of Fundy intertidal mudflat, the overall density of *C. volutator* decreased by 38.8 percent in the first year of baitworm hand raking harvest due to lower juvenile recruitment and direct mortality. Juveniles were particularly susceptible to disturbance (a 55 percent decrease), and because juveniles must overwinter to become the next year's potential breeders, this decrease compounds with each subsequent year of harvesting (Shepherd and Boates 1999). Some *C. volutator* are also killed during digging. The survivors may migrate (swim) and risk death in search of better habitat, likely because the loosening of sediment and increase in water content makes re-excavation of burrows difficult (Shepherd and Boates 1999). The mud substrate in the above referenced Bay of Fundy study area is much finer textured and higher in organic content than the sand-dominated substrate present around Monomoy NWR (D. Brownlie, personal communication 2013). Bait worm harvest is also typically a more intensive and frequent disturbance than clam harvest around Monomoy NWR (Leavitt et al. 2010).

In addition to depositing *C. volutator* at greater depths below the sediment surface, clam digging disturbance in a mid-coast Maine intertidal mud flat destroyed *C. volutator* tube dwellings. The subsequent high energy demands for tube reconstruction placed on surviving individuals potentially resulted in reduced growth and reproduction or eventual mortality (Logan 2005). Mean density of *C. volutator* ranged from 89.1 ± 179.6 individuals/m$^2$ for weekly disturbance, to 1,522.6 ± 378.8 individuals/m$^2$ for undisturbed controls. *C. volutator* abundance was reduced for all disturbance frequencies in relation to control conditions, even in plots that were only disturbed on day one of the experiment. This significant decrease in abundance suggests that *C. volutator* abundance, and potentially other amphipod abundance, can be significantly reduced even by low digging frequencies.

Many relevant studies have not shown long-term significant changes to benthic communities resulting from shellfish harvest, with the exception of changes in distribution of the target (harvested) species. Coen (1995) surmised that since many small benthic organisms, e.g., crustaceans, polychaetes, mollusks, have rapid generation times, high fecundities, and excellent re-colonization capacities, it is generally accepted that this benthic community effect is only short-term (Godcharles 1971, Peterson et al. 1987, Bennett et al. 1990, Hall et al. 1990). For example, MacKenzie and Pikanowski (2004) found little to no effect on benthic communities resulting from raking in sandy, subtidal substrates, and attributed this lack of effect to invertebrates' adaptation for survival in environments where sediments are naturally re-suspended by severe storms.

Constantino et al. (2009) studied the impacts of salting in a Before-After-Control-Impact study in southern Portugal and concluded no significant impact on the sediment and no effects on the benthic communities. This study was very small scale, and only simulated salting by "covering the area with salt during low tide", potentially exaggerating or minimizing salting impacts compared with fishermen pouring salt directly into the sediment gallery excavated by the razor clam.

Sandy-bottom communities such as those around Monomoy, subjected to higher energy (more frequent natural disturbance), tend to exhibit relatively rapid rates of re-colonization and recovery compared to more sheltered, lower energy, finer textured or biogenic substrates (Munari et al. 2006, Peterson and Estes 2001). Newell et al.

(1998) point out that benthic assemblages in fine-grained sediments recover faster than those in coarse-grained sediments. Coen (1995) also cites other studies using hand and mechanical shellfish harvesting gear in diverse habitats in Florida (Godcharles 1971), Washington (Tarr 1977, Vining 1978, Goodwin and Shaul 1978 and 1980), Maine (Kyte et al. 1975), North Carolina (Peterson et al. 1983, 1987), Rhode Island (Glude and Landers 1953), Scotland (Hall et al. 1990), and Canada (Adkins et al. 1983), and all found no discernible long-term effects on local infaunal populations, with the exception of the more sedentary harvested bivalve species (compare Kyte et al. 1975, Peterson et al. 1987, Hall et al. 1990). Similarly, Logan (2005) found sediment turnover from clam digging in a mid-coast Maine intertidal mudflat did not affect the abundance of 10 benthic macroinvertebrate species, including polychaetes, crustaceans, and bivalves. However, Heffernan (1999) references Spencer's (1996) observation that a single hand-raking clam harvest caused about 50 percent reduction in species diversity, with a time frame of 8 months for site recovery.

Repeated physical disturbance can decrease productivity of affected communities (Odum 1985, Gray 1989). The effects of a single passage of a rake as is typical around Monomoy NWR may be relatively limited; chronic raking, atypical for the Monomoy NWR vicinity, may produce long-term changes in benthic communities (Jennings and Kaiser 1998). If disturbance is routine, the post-disturbance benthic communities are likely to be less abundant and diverse than in undisturbed habitats (Ray 2005). Marinelli and Woodin (2002) demonstrated that disturbing the surface of soft sediments altered sediment chemistry, making it less attractive for recruiting infauna.

Although the rate of recovery from hand raking can be highly variable in space and time, low intensity traditional harvesting appeared to have little impact on benthic communities (Kaiser et al. 2001). Kaiser et al. 2001 found that benthic communities subjected to hand raking for cockles showed community changes, compared to control plots 14 days after the initial disturbance. The small raked plots had recovered 56 days after the initial disturbance whereas the large raked plots remained in an altered state. Even in sands, recovery can be delayed (100 days to over a year) so that frequent intense harvesting will maintain the resident benthic communities in a permanently disturbed state (Peterson and Estes 2001). Kaiser et al. (2001) concluded from benthic samples collected from plots over a year after hand raking for cockles that small-scale variations in habitat heterogeneity had been altered, suggesting that, while effects of hand raking may be significant within a year, they were unlikely to persist beyond that time scale unless larger, long-lived species are present within the community.

The ability of invertebrates to recolonize depleted areas is very variable, depending heavily on recruitment of young. Many polychaetes are highly mobile and capable of colonizing depleted areas of intertidal habitat quite rapidly, while mollusks that bury more deeply, e.g. *Macoma balthica,* or tube dwellers such as *Lanice conchilega,* are capable of much more limited movement. The fact that more complex and productive intertidal communities take longer to achieve stability after disruption is not surprising. Another recovery rate factor is the longevity of the species involved. Large species such as *Arenicola marina*, softshell clams and *Ensis sp.* take several years to reach maturity and, therefore, take much longer to recover than smaller species (Beukema 1995).

Given the higher (moderate) wave energy, the dynamic sand-dominated intertidal sediments surrounding Monomoy NWR, and an abundance of expansive flats allowing a relatively low intensity-frequency of disturbance events from hand raking for shellfish, post-harvest depletion of benthic fauna biomass is expected to be a relatively short 0.5 to 12 month duration (Leavitt et al. 2010). Benthic invertebrate faunal community recovery of small invertebrate prey for migratory shorebirds to pre-disturbance levels is expected at harvested sites well before the 1.5 to 2 years required for recruits in the target shellfish species in the Monomoy NWR area to attain the minimum legal size harvesters seek (Leavitt and Peters 2005, citing S. Moore).

### *Migratory Shorebirds and Other Species of Conservation Concern*

Migratory shorebirds and horseshoe crabs are among the predators of clams and other benthic invertebrates inhabiting the intertidal substrates around Monomoy NWR. These species benefit from abundant small-sized clams and other associated benthic invertebrates.

Protecting high-quality stopover sites, which shorebirds use while migrating long distances between breeding and non-breeding grounds, is a particularly important shorebird conservation concern (Senner and Howe 1984, Myers et al. 1987, Helmers 1992). High-quality stopover sites provide abundant food and a disturbance-

free environment, allowing shorebirds to maximize foraging time, replenish energy reserves, and continue migration in good body condition (Myers et al. 1987, Helmers 1992, Brown et al. 2001). Lower-quality stopover sites may affect shorebirds' ability to reach breeding or non-breeding grounds, and may reduce survivorship (Pfister et al. 1998, Baker et al. 2004). Monomoy NWR is an important stopover site, especially during the southbound (fall) shorebird migration.

Declining prey availability at Delaware Bay, a critical stopover site for northward shorebird migrants, has been implicated in reduced breeding success and annual survival of red knots (*Calidris canutus*) (Baker et al. 2004). Similarly, the annual return rate of semipalmated sandpipers (*Calidris pusilla*) at a southbound stopover site in Massachusetts was higher for birds with more body fat at time of departure (Pfister et al. 1998), suggesting body condition at departure was related to survival. Vulnerability to changes in habitat availability or suitability is likely amplified for migrating shorebirds because large concentrations of shorebirds rely on just a few sites (Myers 1983, Senner and Howe 1984, Myers et al. 1987). Coastal stopover sites in particular, are increasingly subjected to development and human disturbance, and loss of high- quality stopover habitat is likely one factor contributing to declines in local abundance and overall populations of shorebirds in North America (Myers et al. 1987, Pfister et al. 1992, Brown et al. 2001).

Monomoy NWR was designated a Western Hemisphere Shorebird Reserve Network Site of Regional Importance in 1999, based on a maximum one-day fall count of approximately 21,000 shorebirds (WHSRN 2006). The refuge provides habitat for significant numbers of shorebird species that are listed as: highly imperiled or high concern by the U. S. Shorebird Conservation Plan (Brown et al. 2001), as highest or high priority within Bird Conservation Region 30, New England/Mid Atlantic Coast (Atlantic Coast Joint Venture 2005), and as birds of conservation concern in Region 5 (Maine to Virginia) by the Service (2008). Some species of shorebirds, such as American oystercatcher (*Haematopus palliates*) (Veit and Petersen 1993) and the federally threatened piping plover (*Charadrius melodus)* (Hecht 1997, unpublished memo), are also extremely dependent on Monomoy NWR during the breeding season. Surveys conducted in 2006 and 2007 estimated relative abundance of all shorebird species at Monomoy NWR (Koch and Paton 2009).

Human disturbance at stopover sites can reduce habitat quality through direct impacts that may displace shorebirds or alter their behavior, or indirect impacts that have an effect on prey populations (Brown et al 2001).

### Direct Impacts to Migratory Shorebirds

Human disturbance causing changes in foraging shorebird behavior and distribution of shorebirds at foraging and roosting sites has been well-documented. Sites with extensive disturbance caused by humans walking or jogging and the presence of dogs reduce foraging time for migrating common redshank (*Tringa totanus*) and Eurasian curlew (*Numenius arquata*) (Fitzpatrick and Bouchez 1998), and decrease foraging rates for migrating snowy plover (*Charadrius alexandrinus*) and sanderling (*Calidris alba*), including sanderlings on non-breeding grounds (Burger and Gochfeld 1991, Lafferty 2001a, Thomas et al. 2003). Prolonged or intense human disturbance may also cause shorebirds to expend more energy to avoid disturbances (Helmers 1992), or completely abandon a site (Furness 1973, Burger 1986, Pfister et al. 1992). Pfister et al. (1992) suggested disturbance measured by vehicle counts as a potential factor in declining numbers of southward migrating red knots and short-billed dowitchers (*Limnodromus griseus*) roosting at a stopover site in Massachusetts between 1972 and 1989.

While shorebirds reduce their foraging rates, flush more easily, and abandon areas with increased human presence (Burger 1981, Burger and Gochfeld 1991, Lafferty 2001a, Thomas et al. 2003), the degree of shorebirds' response varies with different human activities (Burger 1981, Burger 1986, Pfister et al. 1992, Lafferty 2001b). At a non-breeding site in California, stationary people along the beach disturbed shorebirds less frequently, and for fewer birds overall for each disturbance, than mobile people, and joggers disturbed twice as many shorebirds as walkers during each disturbance event (Lafferty 2001b). Similarly, fast-paced activities involving rapid movements, such as jogging, were more likely to disturb waterbirds than slow-moving activities, such as worm and clam harvesting (Burger 1981).

Despite documented changes in behavior of shorebirds exposed to human disturbance, published research establishing empirically based buffer distances to minimize disturbance to migrating shorebirds is sparse. In

2006 and 2007, we conducted experimental research on the refuge to determine flushing distances of the 11 most common migrating shorebird species. We used these empirical data to establish buffer distances that we feel minimize disturbance to migrating shorebirds (Koch and Paton 2014), and will implement these buffers in areas where shorebirds congregate and human disturbance is prevalent.

| Species | Buffer Distance Range (m) |
|---|---|
| Least sandpiper | 61 |
| Semipalmated sandpiper | 76 |
| Semipalmated plover | 77 |
| Sanderling | 86 |
| Dunlin | 89 |
| Short-billed dowitcher | 97 |
| Willet | 113 |
| Red knot | 124 |
| Ruddy turnstone | 125 |
| American oystercatcher | 165 |
| Black-bellied plover | 186 |

## Indirect Impacts to Migratory Birds

As previously discussed, shellfish harvesting can alter benthic communities or reduce prey availability for shorebirds that feed on benthic organisms. For example, razor clams are an important food source to several priority species utilizing Monomoy NWR, including horseshoe crabs (Botton 1984, Walls et al. 2002) and American Oystercatchers (Nol and Humphrey 1994). Burial or mechanical (vertical) redistribution of invertebrate infauna to deeper depths in the substrate may additionally reduce the availability of invertebrate prey to predators. Many worms and crustaceans are most active and closest to the surface when the tide just covers or uncovers the sediments. For example, sediment disturbance associated with commercial harvest of bloodworms (*Glycera dibranchiata*) in the Bay of Fundy negatively impacted populations of mud snails (*Llyanassa obsolete)*, the primary prey of southward migrating semipalmated sandpipers (Shepherd and Boates 1999). Many birds and fish rely on visual cues when foraging. Turbidity due to re-suspension of intertidal sediment can significantly reduce foraging efficiency for sight-feeding predators (Vinyard and O'Brien 1976, Gradall and Swenson 1982, Gregory 1990, Servizi 1990, Peterson and Estes 2001). Decreased foraging efficiency by fall migrating semipalmated sandpipers may have been related to the obstruction of visual and tactile prey cues caused by turning and loosening of the surface sediment from intensive hand-raking for baitworms (Shepherd and Boates 1999).

Observations at Monomoy NWR in 2005 and 2006 suggested that some species of shorebirds remained farther from a standing person than from shellfish harvesters (Leavitt et al. 2010). Softshell clam harvesters in coastal New England typically use short hand rakes, spend most of their time bent over at the waist or on hands and knees harvesting patches of shellfish, and traverse the exposed mudflats only to move among patches (Burger 1981, Leavitt and Fraser 2004). Anecdotal observations of shorebirds congregating in recently shellfished areas at Monomoy NWR (Leavitt et al. 2010) suggest that sediment turnover associated with softshell clam harvesting may expose additional prey that would normally be at depths unavailable to shorebirds, thereby providing a net benefit to some species of foraging shorebirds (Leavitt and Peters 2005). Our own anecdotal observations of shorebirds in 2005 and 2006 suggested that some species of shorebirds might be attracted to areas where shellfishing had recently occurred (Koch 2011). Aspinall (1992) notes that most forms of intertidal shellfish harvesting, including manual digging, provide some initial increased feeding opportunities for some birds. Other studies have also shown that discarded or injured invertebrates or shellfish are consumed by higher trophic species, including gulls, fish, crabs, echinoderms, and gastropods (Manning 1959, Caddy 1973, van der Veer et al. 1985, Eleftheriou and Robertson 1992, Hall 1994, and Kaiser and Spencer 1994). A possible immediate increase in prey availability of some species may be ephemeral (as in Ferns et al. 2000), or may be offset by negative impacts to other prey species that are subsequently buried (as in Emerson et al. 1990).

In 2007, we conducted surveys of shorebird abundance and foraging behavior in areas that were and were not subjected to shellfish harvesting activity to determine if shellfish harvesting influenced shorebird abundance. Based on density estimates of shorebirds in the harvested and unharvested plots, shellfish harvesting activities appeared to have a positive influence on the mean density of American oystercatchers and ruddy turnstones. The reason that the buffer distances for these species is so large in the table above is because the distances were based on pedestrians in general, not harvesters. However, for most species of shorebirds studied, shellfishing activity had no apparent effect on the density of birds on study plots. No differences in the proportion of birds that were foraging in harvested and unharvested areas for all species were detected, and generally, more than 90 percent of all birds were foraging on all plots, regardless of shellfishing activity. Seven species, black-bellied plover, ruddy turnstone, semipalmated plover, sanderling, semipalmated sandpiper, dunlin, and short-billed dowitcher, were detected actively foraging in shellfish holes or the remaining adjacent sediment piles (Koch and Paton 2014).

At Monomoy NWR, we do not anticipate any substantial direct adverse long-term impacts from nonmechanized shellfish harvesting on migratory shorebirds, species fundamental to fulfilling the refuge migratory bird purpose. Further, recent surveys of shorebird abundance and foraging behavior in harvested shellfish areas show an apparent beneficial influence on American oystercatcher and ruddy turnstone densities relative to unharvested areas. In addition, shorebirds representing six additional species appear to receive short-term benefit in the form of foraging opportunities immediately following shellfish harvest disturbance, as they were observed actively foraging in shellfish holes or residual sediment piles.

### *Wilderness Character*

North Monomoy Island and South Monomoy Island make up the Monomoy Wilderness. The untrammeled environment and solitude of the Monomoy Wilderness, accessible only by boat, make it unique among the protected areas on Cape Cod. Motorized boats operated by shellfish harvesters generally approach and depart the intertidal flats slowly through the adjoining shallows, which reduces engine noise and boat wake. Monomoy NWR has an unusually low absorption capacity for human impacts. Lack of topographic relief and low vegetation mean that intrusions, including seeing and hearing other people, are often detectable from a long distance. Shellfish harvesting on intertidal flats visible from elsewhere within the Monomoy Wilderness may result in a diminished degree of solitude for some wilderness users, but should not adversely affect the overall wilderness character of the Monomoy Wilderness.

The majority of the Monomoy Wilderness will remain essentially unvisited and virtually undisturbed by the current and expected low intensity intertidal shellfish harvesting taking place around Monomoy NWR. Visible impacts from hand digging are temporary, generally lasting a few hours before the next tidal cycle erases most traces of digging from a harvested area. These physical disturbances are most evident near shellfish harvest sites, but are not expected to substantially compromise the perception of naturalness of the Monomoy Wilderness landscape nor impact the wilderness user's experience (Cole 2002, Hendee and Dawson 2002).

Wilderness visitors' experiences are more strongly affected by social conditions, such as other visitors and their actions, than by their perception of naturalness or ecological conditions (Hendee and Dawson 2002). The wide and expansive intertidal flats and barrier beaches where most shellfish harvest takes place afford users an unconfined experience (Hendee and Dawson 2002). With typically long sight distances across the rolling, nearly treeless, intertidal and coastal barrier landscape, too many individuals encountered or observed during visits by other Monomoy Wilderness users likely detracts from the sense of solitude experienced by wilderness users (Stankey and Schreyer 1987, Hendee and Dawson 2002). However, intertidal shellfish harvest use is still relatively dispersed across those intertidal flats open to public use.

Some shellfish harvesters use carts to move harvested clams to their boats. Others use large netted bags to transport their harvested clams. The use of wheeled carts in the Monomoy Wilderness is not consistent with wilderness requirements, as mechanized transport is not allowed, and wheeled devices are considered to be mechanized transport. Eliminating the use of wheeled carts in the Monomoy Wilderness will maintain wilderness characteristics and enhance visitors' wilderness experiences.

Commercial harvest of soft-shell clams and quahogs by private individuals on the flats predates refuge establishment by more than a century and, at a low level, does not affect the primeval landscape or interfere

with the opportunities for solitude. A use of the land that was historical, does not affect the natural condition of the land, leaves the "imprint of man's work" substantially unnoticeable, and leaves unaffected opportunities for solitude or a primeval and unconfined type of recreation, should be held within the purposes to which a wilderness area may be devoted, and may be permitted despite being commercial. A person with a rake and a basket collecting clams has no different impact on the landscape if he or she eats them, or if they subsequently sell the clams, and the Service has no effective means of ensuring that clams collected are never sold. The Service has allowed clamming since refuge establishment and has determined that commercial clamming at the same scale and in the same manner that has occurred historically is compatible under the Refuge Improvement Act. We have also reviewed applicable case law, and believe that commercial clamming is within the purposes of the Monomoy Wilderness, as it is an historical use, and may be permitted so long as the methods used are those historically employed, are the minimum necessary, and that the activity does not otherwise impact wilderness character.

The current and anticipated level of intertidal shellfish harvest does not and is not expected to impact the preservation of the existing wilderness character—untrammeled wildness, undeveloped, natural, outstanding opportunity for solitude or primitive and unconfined type of recreation—that provides an enduring wilderness resource in the Monomoy Wilderness.

## PUBLIC REVIEW AND COMMENT:

As part of the CCP process for the Monomoy NWR, a draft of this compatibility determination underwent a 180-day public comment period concurrent with the release of our draft CCP/Environmental Impact Statement (EIS). This final compatibility determination resulted from that public review and comment process. It underwent a further 37-day public review period concurrent with the release of the final CCP/EIS. One commenter indicated concern that shellfishing was being allowed to continue in the wilderness portions of the refuge, and suggested continued evaluation of the impact of shellfishing based on improved harvest data. Continued opposition to the prohibition on the use of wheeled carts and salting was expressed by several commenters, and some commenters questioned the restrictions on seasonal closures to benefit migrating shorebirds. However, no new substantive information was provided and the compatibility determination remained unchanged.

## DETERMINATION (CHECK ONE BELOW):

_____Use is not compatible.

__X__Use is compatible with the following stipulations.

## STIPULATIONS NECESSARY TO ENSURE COMPATIBILITY:

- All intertidal subterranean shellfish harvest on refuge lands must continue to be in full compliance with all Town Shellfish Rules and Regulations and refuge regulations and area closures. No items other than softshell clams, razor clams, sea (surf) clams, and quahogs, hand harvested in accord with town regulations, will be removed from the refuge.

- Only hand harvest methods will be employed on refuge intertidal lands that are open for public use. No artificial methods for extracting shellfish from the substrate such as salt for any species of clams may be used on refuge intertidal lands that are open for public use.

- No carts or other mechanized equipment with wheels may be used to transport shellfish onlands within designated wilderness.

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

- Refuge staff will annually meet with the Town Shellfish Constable to review and summarize annual shellfish harvest reports, area closures, and current and planned shellfish resource stewardship measures, and discuss regulations and management actions with respect to Monomoy NWR lands and waters needed to ensure the long-term sustainability of the shellfish resource and biological integrity and ecological health of refuge habitats.

- Refuge staff, volunteers, or researchers may engage in research designed to determine shellfish harvesting impacts to migratory birds and other species of conservation concern. Should any public use, including shellfish harvest, cause unacceptable environmental degradation or wildlife disturbance, or degrade wilderness character, the Service will implement appropriate limits on user numbers.

- Refuge visitor information services and products will emphasize the importance of staying out of seasonal closure areas, along with providing leave-no-trace principles.

## JUSTIFICATION:

The harvest of subterranean shellfish using traditional hand raking methods and use by migratory birds of the expansive and dynamic intertidal flats around Monomoy NWR have coexisted for decades under joint stewardship and regulation by the Town and the Service. Shellfish harvesting is a form of fishing, which is a priority, wildlife-dependent, public use on the refuge that provides visitors with an opportunity to experience wilderness. Based on our current, although limited knowledge about potential impacts of traditional hand harvest of shellfish on priority wildlife resources and habitats, combined with the relatively low level of use distributed across a large area of intertidal habitat, effects from this activity are similar or even less than other forms of human use in the intertidal area. We will monitor disturbance impacts of human presence (fin fishers, shellfishers, birders, photographers, and walkers) and will implement seasonal closures to protect migrating shorebirds and staging terns when necessary to ensure we accomplish the migratory bird purpose of the refuge by providing high-quality habitat to these migratory bird species, and marine mammals. We will also include new science as it becomes available and will continually evaluate potential impacts of shellfishing on refuge resources as funding becomes available.

We have documented a positive short-term benefit to American oystercatchers and ruddy turnstones in the form of increased food availability immediately following shellfish harvest disturbance of the intertidal substrate. Allowing continuation of low intensity, nonmechanized shellfish harvest also fulfills the Service's historical commitment to permit fishing, including clamming, to continue.

Allowing intertidal shellfish harvest using hand methods at current and anticipated harvest levels, in accordance with town and refuge regulations and closures, requires no additional facilities. The potential disturbance to migratory birds and other species of conservation concern can be addressed and mitigated through the town shellfish regulations and stewardship actions, and by refuge seasonal area closures (symbolic fencing and signs with available refuge resources and a minimal administrative requirement). Potential for over-exploitation of the shellfish resource and depletion of intertidal benthic infauna, as well as potential for human-caused disturbance to wildlife species of conservation concern, are manageable and will continue to be addressed through the town's shellfish regulations and stewardship actions, and by refuge seasonal area closures (symbolic fencing and signs.

In justifying this use, we considered the preceding evaluation of impacts to intertidal substrates and water quality, benthic intertidal communities, migratory shorebirds and other species of conservation concern, and Monomoy Wilderness character. Commercial harvest of soft-shell clams and quahogs by private individuals on the flats predates refuge establishment by more than a century and, at a low level, does not affect the primeval landscape or interfere with the opportunities for solitude. A use of the land that was historical, does not affect the natural condition of the land, leaves the "imprint of man's work" substantially unnoticeable, and leaves unaffected opportunities for solitude or a primeval and unconfined type of recreation, should be held within the purposes to which a wilderness area may be devoted, and may be permitted despite being commercial. A person with a rake and a basket collecting clams has no different impact on the landscape if he or she eats them, or if they subsequently sell the clams, and the Service has no effective means of ensuring that clams collected are never sold. The Service has allowed clamming since refuge establishment and has determined that commercial clamming at the same scale and in the same manner that has occurred historically is compatible under the Refuge Improvement Act. We have also reviewed applicable case law, and believe that commercial clamming is within the purposes of the Monomoy Wilderness, as it is an historical use, and may be permitted so long as the methods used are those historically employed, are the minimum necessary, and that the activity does not otherwise impact wilderness character.

We conclude that the use will not materially interfere with, or detract from, the Refuge System mission, refuge wilderness character, or migratory bird purposes, and that it contributes to the refuge purposes as follows:

- Shorebirds using the refuge were observed at higher densities in harvested areas versus unharvested areas due to the increased foraging opportunities resulting from harvesting activities.
- Low intensity harvest results in a periodic disturbance to the substrate, which under certain conditions can improve shellfish productivity and recruitment and increase prey availability for shorebirds.
- Our observations and related research indicate negligible impacts to Federal trust resources, based on past and expected harvest levels.
- We have not observed any impacts to, nor heard concerns from, any other wildlife-dependent users.
- Refuge visitors can experience wilderness in a manner that protects wilderness character by allowing only the use of hand tools and eliminating the use of wheeled carts.
- Our coordination with the town eliminates any undue administrative burden to refuge staff.

**SIGNATURE:**

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

**CONCURRENCE:**

Regional Chief: Scott B. Kahn (Signature) March 18, 2016 (Date)

**MANDATORY 15 YEAR RE-EVALUATION DATE:** March 18, 2031

## LITERATURE CITED:

Adkins, B.E., R.M. Harbo, and N. Bourne. 1983. An evaluation and management considerations of the use of a hydraulic clam harvester on intertidal clam populations in British Columbia. Canadian Manuscript Report of Fisheries and Aquatic Sciences. No. 1716, 38 pp.

Aspinall, S. 1992. Dunlin feeding on bait-digging spoil. Wader Study Group Bulletin 64:39.

Atlantic Coast Joint Venture. 2008. New England/Mid Atlantic Coast Bird Conservation Region (BCR 30) Implementation Plan. *http://www.acjv.org/BCR_30/BCR30_June_23_2008_final.pdf*. Accessed 19 Mar 2012.

Baker, A.J., P.M. Gonzalez, T. Piersma, L.J. Niles, I.L. Serrano do Nascimento, P.W. Atkinson, N.A. Clark, C.D.T. Minton, M.K. Peck, and G. Aarts. 2004. Rapid population decline in red knots: fitness consequences of decreased refuelling rates and late arrival in Delaware Bay. Proceedings of Royal Society London B 271: 875–882.

Barnes, D., K. Chytalo, and S. Hendrickson. 1991. Final Policy and Generic Environmental Impact Statement on Management of Shellfish in Uncertified Areas Program. New York Department of Environmental Conservation. 79 pp.

Belding, D. 1930. The softshell clam fishery of Massachusetts. Marine Fisheries Series No. 1. Division of Fisheries and Game, Commonwealth of Massachusetts. 65 pp.

Bennett, D.H., J.A. Chandler, L.K. Dunsmoor, and T. Barila. 1990. Use of dredged material to enhance fish habitat in Lower Granite reservoir, Idaho-Washington. In C.A. Simenstad, ed., Effects of dredging on anadromous Pacific coast fishes, pp. 132-143. Workshop Proceedings, University of Washington and Washington Sea Grant Program.

Beukema, J.J. 1995. Long-term effects of mechanical harvesting of lugworms *Arenicola marina* on the zoobenthic community of a tidal flat in the Wadden Sea. Netherlands Journal of Sea Research. 33: 219–227.

Botton, M.L. 1984. Diet and food preferences of the adult horseshoe crab *Limulus polyphemus* in Delaware Bay, New Jersey, USA. Marine Biology 81: 199-207.

Boulding, E. and T. Hay. 1984. Crab response to prey density can result in density-dependent mortality of clams. Canadian Journal of Fisheries and Aquatic Sciences. 41: 521-525.

Brown, B. and W.H. Wilson. 1997. The role of commercial digging of mudflats as an agent for change of infaunal intertidal populations. Journal of Experimental Marine Biology and Ecology. 218: 49-61.

Brown, S.C., C. Hickey, B. Harrington, and R. Gill, eds. 2001. The U.S. shorebird conservation plan. Second edition. Manomet Center for Conservation Sciences, Manomet, Massachusetts, U.S.A.

Burger, J. 1981. Effect of human activity on birds at a coastal bay. Biological Conservation. 21: 231-241.

Burger, J. 1986. The effect of human activity on shorebirds in two coastal bays in the northeastern United States. Biological Conservation 13: 123-130.

Burger, J. and M. Gochfeld. 1991. Human activity influence and diurnal and nocturnal foraging in sanderlings (*Calidris alba*). Condor 93: 259–265.

Burke, S. 2009. Estimating water quality benefits from shellfish harvesting; a case study in Oakland Bay, Washington. Technical Memorandum, Pacific Shellfish Institute. 15 pp.

Caddy, J.F., 1973. Underwater observations on tracks of dredges and trawls and some effects of dredging on a scallop ground. Journal of the Fisheries Research Board of Canada. 30, pp. 173-180.

Coen, L.D. 1995. A review of the potential impacts of mechanical harvesting on subtidal and intertidal shellfish resources. South Carolina Department of Natural Resources Marine Resources Research Institute. 46 pp.

Cole, D.N. 2002. Ecological impacts of wilderness recreation and their management. Chapter 15, Pp. 413-459 In J.C. Hendee and C.P. Dawson, eds. Wilderness Management: Stewardship and Protection of Resources and Values, Third Edition. Fulcrum Publishing, Golden, Colorado. 640 pp.

Constantino, R., M.B. Gaspar, F. Pereira, S. Carvalho, J. Curdia, D. Matias, and C.C. Monteiro. 2009. Environmental impact of razor clam harvesting using salt in Ria Formosa lagoon (Southern Portugal) and

subsequent recovery of associated benthic communities. Aquatic Conservation: Marine and Freshwater Ecosystems. 19:542-553.

Cox , J. 1991. Dredging for the American hardshell clam: the implications for nature conservation. ECOS 12(2): 50-54.

Cryer, M., G.N. Whittle and R. Williams. 1987. The impact of bait collection by anglers on marine intertidal invertebrates. Biological Conservation. 42: 83-93.

Dernie, K. M., Kaiser, M. J., Richardson, E. A., and Warwick, R. M. 2003. Recovery of soft sediment communities and habitats following physical disturbance, Journal of Experimental Marine Biology and Ecology : 285-286, 415-434.

Dow, R. and D. Wallace. 1957. The Maine clam (*Mya arenaria*). Bulletin of the Department of Sea and Shore Fisheries, Augusta, Maine. 35 pp.

Eleftheriou, A. and M.R. Robertson. 1992. The effects of experimental scallop dredging on the fauna and physical environment of a shallow sandy community. Netherlands Journal of Sea Research. 30: 289-299.

Ellis, K. 1998. The Maine Clam Handbook. Publication MSG-TR-98-1. Maine-New Hampshire Sea Grant Program. Orono, Maine. 74 pp.

Emerson, C.W., J. Grant, and T.W. Rowell.1990. Indirect effects of clam digging on the viability of softshell clams, *Mya arenaria* L. Netherlands Journal of Sea Research. 27: 109-118.

Engelhard, T. and K. Withers. 1997. Biological effects of mechanical beach raking in the upper intertidal zone on Padre Island National Seashore, Texas, Gulf Research Reports. 10: 73-74.

Evans, C.L. 1967. The toxicity of hydrogen sulfides and other sulfides. Quarterly Journal of Experimental Physiology. 52: 231-248.

Ferns, P.N., D.M. Rostron, and H.Y. Siman. 2000. Effects of mechanical cockle harvesting on intertidal communities. Journal of Applied Ecology. 37: 464-474.

Fitzpatrick, S. and B. Bouchez. 1998. Effects of recreational disturbance on the foraging behaviour of waders on a rocky beach. Bird Study 45: 157–171.

Furness, R.W. 1973. Roost selection by waders. Scottish Birds 7: 281-287.

Glude, J.B. and W.S. Landers. 1953. Biological effects on hard clams of hand raking and power dredging. U.S. Fish and Wildlife Service Special Report. 110, 43 pp.

Godcharles, M.F., 1971. A study of the effects of a commercial hydraulic clam dredge on benthic communities in estuarine areas. State of Florida Department of Natural Resources Technical Ser. No. 64, 151.

Goodwin, L. and W. Shaul. 1978. Some effects of the mechanical escalator harvester on a subtidal clam bed in Puget Sound, Washington. State of Washington, Department of Fisheries, Progress Report No. 53, 23 pp.

Goodwin, L. and W. Shaul. 1980. Studies of mechanical clam harvest on an intertidal beach near Port Townsend, Washington. State of Washington, Department of Fisheries, Progress Report No. 119, 26 pp.

Goshima, S. 1982. Population dynamics of the soft clam, *Mya arenaria* L., with special reference to its life history pattern. Amakusa Marine Biological Laboratory. 6: 119-165.

Gradall, K.S. and W.A. Swenson. 1982. Responses of brook trout and creek chubs to turbidity. Transactions of the American Fisheries Society. 111, 392-395.

Gray, J.S. 1989. Effects of environmental stress on species rich assemblages. Biological Journal of the Linnean Society (London) 37: 19-32.

Gregory, R.S. 1990. Effects of turbidity on benthic foraging and predation risk in juvenile chinook salmon. In C.A. Simenstad, ed. Effects of dredging on anadromous Pacific coast fishes, pp. 64-73. Workshop Proceedings, University of Washington and Washington Sea Grant Program.

Gunther, C.P. 1992. Dispersal of intertidal invertebrates: a strategy to react to disturbances of different scales? Netherlands Journal of Sea Research. 30: 45-56.

Hall, S.J. 1994. Physical disturbance and marine benthic communities: life in unconsolidated sediments. Oceanographic and Marine Biology Annual Review. 32: 179-239.

Hall, S.J., D.J. Basford, and M.R. Roberts.1990. The impact of hydraulic dredging for razor clams *Ensis* spp. on an infaunal community. Netherlands Journal of Sea Research. 27: 119-125.

Hall, S.J. and M.J. Harding. 1997. Physical disturbance and marine benthic communities: the effects of mechanical harvesting of cockles on non-target benthic infauna. Journal of Applied Ecology. 34: 497-517.

Hayes, D.F., G.L. Raymond, and T.N. McLellan. 1984. Sediment re-suspension from dredging activities. Proceedings of the American Society of Civil Engineers Specialty Conference Dredging '84 Clearwater, Florida. Pp. 72-82.

Hecht, A. 1997, unpublished USFWS memo.

Heffernan, M.L. 1999. A review of the ecological implications of mariculture and intertidal harvesting in Ireland. Irish Wildlife Manuals, No. 7. 156 pp.

Helmers, D.L. 1992. Shorebird Management Manual. Western Hemisphere Shorebird Reserve Network, Manomet, Massachusetts. 58 pp.

Hendee, J.C. and C.P. Dawson 2002. Wilderness Management: Stewardship and Protection of Resources and Values, Third Edition. Fulcrum Publishing, Golden, Colorado. 640 pp.

Jennings, S. and M.J. Kaiser. 1998. The effects of fishing on marine ecosystems. Advances in Marine Biology 34: 201-352.

Johnson, K.A. 2002. A review of national and international literature on the effects of fishing on benthic habitats. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, NOAA Technical memorandum NMFS-F/SPO-57. 77 pp.

Kaiser, M.J. and B.E. Spencer. 1994. Fish scavenging behaviour in recently trawled areas. Marine Ecology Progress Series. 112, 41-49.

Kaiser, M.J., G. Broad, and S.J. Hall. 2001. Disturbance of intertidal soft-sediment benthic communities by cockle hand-raking. Journal of Sea Research. 45: 119-130.

Koch, S.L. 2010. Shorebird migration ecology at Monomoy National Wildlife Refuge. Ph.D. Dissertation, University of Rhode Island, Kingston, Rhode Island, U.S.A.

Koch, S.L. and P.W.C. Paton.2014. Assessing anthropogenic disturbances to develop buffer zones for shorebirds using a stopover site. Journal of Wildlife Management. 78(1):58-67.

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

Kraan, C., T. Piersma, A. Dekinga, A. Koolhaas, and J. Van der Meer. 2007. Dredging for edible cockles *Cerastoderma edule* on intertidal flats: short-term consequences of fishermen's patch-choice decisions for target and non-target benthic fauna. ICES Journal of Marine Science. 64: 1735–1742.

Krzyzewski, P. and J. Chery. 2005. The Effects of "Salting" on Razor Clams. A Major Qualifying Project Report: submitted to the Faculty of the Worcester Polytechnic Institute in partial fulfillment of the requirements for the Degree of Bachelor of Science. Worcester Polytechnic Institute, Worcester, MA. 19 pp.

Kyte, M. and K. Chew. 1975. A review of the hydraulic escalator shellfish harvester and its known effects in relation to the softshell clam, *Mya arenaria*. Washington Sea Grant Program, WSG 75-2. University of Washington, Seattle, Washington. 32 pp.

Kyte, M., P. Averill, and T. Hendershott. 1975. The impact of the hydraulic escalator shellfish harvester on an intertidal softshell clam flat in the Harraseeket River, Maine. Department of Marine Resources, Augusta, Maine, Project Completion Report. 54 pp.

Lafferty, K.D. 2001*a*. Disturbance to wintering western snowy plovers. Biological Conservation 101: 315–325.

Lafferty, K.D. 2001*b*. Birds at a southern California beach: seasonality, habitat use, and disturbance by human activity. Biodiversity and Conservation 10: 1949–1962.

LaSalle, M.A. 1990. Physical and chemical alterations associated with dredging. In C.A. Simenstad, ed. Effects of dredging on anadromous Pacific coast fishes, Pp. 1-12. Workshop Proceedings, University of Washington and Washington Sea Grant Program.

Leavitt, D.F. and J.D. Fraser. 2004. Softshell clam management in the Monomoy National Wildlife Refuge. Report to the Town of Chatham. 34 pages.

Leavitt, D.F. and K. Peters. 2005. Softshell clams, migratory shorebirds and the Monomoy National Wildlife Refuge. Unpublished report to U. S. Fish and Wildlife Service, Sudbury, Massachusetts, U.S.A.

Leavitt, D.F., A. Matsick, C. Mott, P. Trull, and J.M. Reed. 2010. A study of factors associated with the interaction of migratory shorebirds and shellfish harvesters within the Monomoy National Wildlife Refuge: Final Report submitted to the Town of Chatham. 56 pp.

Logan, J.M. 2005. Effects of clam digging on benthic macro-invertebrate community structure in a Maine mudflat. Northeastern Naturalist, 12(3): 315-324.

Lotze, H.K. 2010. Historical reconstruction of human-induced changes in U.S. estuaries. Oceanography and Marine Biology: An Annual Review, 48: 267-338.

Lotze, H.K. and I. Milewski, 2004. Two centuries of multiple human impacts and successive changes in a North Atlantic food web. Ecological Applications 14: 1428–1447.

MacKenzie C.L. and R. Pikanowski. 2004. Gear effects on marine habitats: harvesting northern quahogs in a shallow sandy bed at two levels of intensity with a short rake. North American Journal of Fisheries Management, 24(4): 1221-1227.

Manning, J.H. 1959. Commercial and biological uses of the Maryland soft clam dredge. Proceedings of the Gulf and Caribbean Fisheries Institute. 12: 61-67.

Marinelli, R.L. and Woodin, S.A. 2002. Experimental evidence for linkages between infaunal recruitment, disturbance, and sediment surface chemistry, Limnology and Oceanography 47: 221-229.

Mayer, L.M., D.F. Schick, R.H. Findlay, and D.L. Rice. 1991. Effects of commercial dragging on sedimentary organic matter. Marine Environmental Research 31: 249-261.

McLaughlin, E., A. Portig, and M.P. Johnson. 2007. Can traditional harvesting methods for cockles be accommodated in a Special Area of Conservation? ICES Journal of Marine Science. 64: 309–317.

McLusky, D.S., F.E. Anderson, and S. Wolfe-Murphy. 1983. Distribution and population recovery of *Arenicola marina* and other benthic fauna after bait digging. Marine Ecology Progress Series. 11: 173-179.

Mullineaux, L., R. Dunn, S. Mills, H. Hunt and L. Gulmann. 1999. Biological influences on transport of postlarval softshell clams (*Mya arenaria*). *In* Coastal Ocean Processes Symposium: a Tribute to William D. Grant, Woods Hole Oceanographic Institute Technical Report. WHOI-99-04. Pp. 155-162.

Munari, C., E. Balasso, R. Rossi, and M. Mistri. 2006. A comparison of the effect of different types of clam rakes on non target, subtidal benthic fauna. Italian Journal of Zoology. 73(1): 75-82.

Myers, J.P. 1983. Conservation of migrating shorebirds: staging areas, geographic bottlenecks, and regional movements. American Birds. 37(1): 23-25.

Myers J.P., R.G. Morrison, P.Z. Antas, B.A. Harrington, T. E. Lovejoy, M. Sallaberry, S. E. Senner, and A. Tarak. 1987. Conservation strategy for migratory species. American Scientist. 75: 18–26.

Newell, R.C., Seiderer, L.J. and Hitchcock, D. R. 1998. The impact of dredging works in coastal waters: A review of the sensitivity to disturbance and subsequent recovery of biological resources of the sea bed, Oceanography and Marine Biology: An Annual Review. 36: 127-178.

Newell, C. and H. Hidu. 1986. Species profiles: life histories and environmental requirements of coastal fishes and invertebrates (North Atlantic) – soft shell clam. U.S. Fish and Wildlife Service Biological Report. 82 (11.53). U.S. Army Corps of Engineers, TR EL-82-4. 19 pp.

Nol, E. and R.C. Humphrey. 1994. American Oystercatcher (*Haematopus palliatus*). *In* The Birds of North America, No. 82 (A. Poole and F. Gill, eds.). The Birds of North America, Inc., Philadelphia, PA.Nol, E., B. Truitt, D. Allen, B. Winn, and T. Murphy. 2000. A survey of wintering American Oystercatchers from Georgia to Virginia, U.S.A., 1999. International Wader Study Group Bulletin 93: 46-50. *http://amoywg.org/wp-content/uploads/2011/11/Nol-et-al-1999-survey-wintering-AMOY.pdf*; accessed July 2012.

Odum, E.P. 1985. Trends expected in stressed ecosystems, Bioscience. 35: 419-422.

Peterson, C.H. and J.A. Estes. 2001. Conservation and Management of Marine Communities. Marine community ecology 18: 469-507.

Peterson, C.H., H.C. Sunimerson, S.R. Fegley. 1983. Relative efficiency of two clam rakes and their contrasting impacts on seagrass biomass. Fisheries Bulletin. 81: 429-434.

Peterson, C., H. Summerson, and S. Fegley. 1987. Ecological consequences of mechanical harvesting of clams. Fisheries Bulletin. 85: 291-298.

Pfister, C., B.A. Harrington, and M. Lavine. 1992. The impact of human disturbance on shorebirds at a migration staging area. Biological Conservation 60(2): 115-126.

Pfister, C., M. Kasprzyk, and B. Harrington. 1998. Body-fat levels and annual return in migrating semipalmated sandpipers. Auk 115: 904–915.

Pfitzenmeyer, H. 1962. Periods of spawning and setting of the softshell clam, *Mya arenaria*, at Solomons, Maryland. Chesapeake Science. 3: 114-120.

Piersma, T., A. Koolhaas, A. Dekinga, J.J. Beukema, R. Dekker, and K. Essink. 2001. Long-term indirect effects of mechanical cockle-dredging on intertidal bivalve stocks in the Wadden Sea. Journal of Applied Ecology. 38: 976–990.

Pilskaln, C.H., J.H. Churchill, and L.M. Mayer. 1998. Resuspension of sediment by bottom trawling in the Gulf of Maine and potential geochemical consequences. Conservation Biology 12(6): 1223-1229.

Rask, H. 1986. The effect of hydraulic harvesting on sediment characteristics related to shellfish abundance. Report to Cape Cod Cooperative Extension, Barnstable, Massachusetts. 9 pp.

Ray, G.L. 2005. Ecological functions of shallow, unvegetated estuarine habitats and potential dredging impacts (with emphasis on Chesapeake Bay), WRAP Technical Notes Collection (ERDC TN-WRAP-05-3), U. S. Army Engineer Research and Development Center, Vicksburg, Mississippi. *http://el.erdc.usace.army.mil/wrap;* accessed October 2015.

Rumohr, H. and P. Krost. 1991. Experimental evidence of damage to benthos by bottom trawling with special reference to *Arctica islandica*. Meeresforschung 33(4): 340-345.

Rowell, T. and P. Woo. 1990. Predation by the nemertean worm, *Cerebratulus lacteus* Verrill, on the softshell clam, *Mya arenaria* Linnaeus, 1758, and its apparent role in the destruction of a clam flat. Journal of Shellfish Research. 9: 291-297.

Savage, N.B. 1974. Responses of selected bivalve mollusks to temperature and dissolved oxygen. Ph.D. Thesis. University of Rhode Island, Kingston, Rhode Island. 129 pp.

Savage, N.B. 1976. Burrowing activity in *Mercenaria mercenaria* (L.) and *Spisula solidissima* (Dillwyn) as a function of temperature and dissolved oxygen. Marine Behavioral Physiology. 3: 221-234.

Senner, S.E. and M.A. Howe. 1984. Conservation of Nearctic shorebirds. Pp. 379-421 In J. Burger and B.L. Olla, eds. Shorebirds: breeding behavior and populations. Plenum Press, New York.

Servizi, J.A., 1990. Sublethal effects of dredged sediments on juvenile salmon. Pp. 57-63 In C.A. Simenstad, ed. Effects of dredging on anadromous Pacific coast fishes. Workshop Proceedings, University of Washington and Washington Sea Grant Program.

Shepherd, P.C.F. and J.S. Boates. 1999. Effects of commercial baitworm harvest on semipalmated sandpipers and their prey in the Bay of Fundy Hemispheric Shorebird Reserve. Conservation Biology. 13: 347-356.

Shull, D.H. 1997. Mechanisms of infaunal polychaete dispersal and colonization in an intertidal sandflat. Journal of Marine Research. 55: 153-179.

Spencer, B.E., 1996. Clam cultivation: localised environmental effects: results of an experiment in the River Exe, Devon (1991-1995). Report prepared for Directorate of Fisheries Research, Fisheries Laboratory, Conwy, LL32 8UB.10p.

Spencer, B.E., M.J. Kaiser, and D.B. Edwards. 1998. Intertidal clam harvesting: benthic community change and recovery. Aquaculture Research. 29: 429-437.

Stankey, G.H. and R. Schreyer. 1987. Attitudes toward wilderness and factors affecting visitor behavior: a state of knowledge review. In Lucas, R.C., comp. Proceedings – National Wilderness Research Conference: Issues, State-of-Knowledge, Future Directions; July 23-26, 1985; Fort Collins, Colorado. Gen. Tech. Rep. INT-220. Ogden, Utah: U.S. Department of Agriculture, Forest Service, Intermountain Research Stations: 246-293.

Tarr, M., 1977. Some effects of hydraulic clam harvesting on water quality in Kilisut Harbor, Port Susan, and Agate Pass, Washington. State of Washington, Department of Fisheries, Progress Report No. 22, 82 pp.

Thomas, K., R.G. Kvitek, and C. Bretz. 2003. Effects of human activity on the foraging behavior of sanderlings *Calidris alba*. Conservation Biology 109: 67–71.

Turner, H. Jr. 1951. Fourth report on investigations of the shellfisheries of Massachusetts. Division of Marine Fisheries, Commonwealth of Massachusetts, Boston, Massachusetts. 21 pp.

Turner, H. Jr. 1953. Growth and survival of soft clams in densely populated areas. Pp. 29-34 In Sixth report on investigations of the shellfisheries of Massachusetts. Division Marine Fisheries, Commonwealth of Massachusetts, Boston, Massachusetts.

U.S. Fish and Wildlife Service. 2008. Birds of conservation concern 2008. Unpublished report, United States Fish and Wildlife Service, Arlington, Virginia, U.S.A.

van den Heiligenberg, T. 1987. Effects of mechanical and manual harvesting of lugworms, *Arenicola marina* L. on the benthic fauna of the tidal flats in the Dutch Wadden Sea. Biological Conservation. 39: 165-177.

van der Veer, H.W., M.J.N. Bergmann, J.J. Beukema, J.J., 1985. Dredging activities in the Dutch Wadden Sea: effects on macrobenthic infauna. Netherlands Journal of Sea Research. 19: 183-190.

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

Verhulst, S., K. Oosterbeek, A.L. Rutten, and B.J. Ens. 2004. Shellfish fishery severely reduces condition and survival of oystercatchers despite creation of large marine protected areas. Ecology and Society. 9(1): 17. *http://www.ecologyandsociety.org/vol9/iss1/art17;* accessed October 2015.

Vining, R., 1978. Final environmental impact statement for the commercial harvesting of subtidal hardshell clams with a hydraulic escalator shellfish harvester. State of Washington, Department of Natural Resources. 57 pp.

Vinyard, G.L., and W.J. O'Brien. 1976. Effects of light and turbidity on reactive distance of bluegill (*Lepomis macrochirus*). Journal of Fisheries Research Board of Canada. 33: 2845-2849.

Walls, E.A., J. Berkson, and S.A. Smith. 2002. The Horseshoe Crab, *Limulus Polyphemus*: 200 Million Years of Existence, 100 Years of Study. Reviews in Fisheries Science, 10(1): 39-73.

Western Hemisphere Shorebird Reserve Network. 2009. <*http://www.whsrn.org/site-profile/monomoy-nwr*>. Accessed March 2012.

**FWS Form 3-2319**
**02/06**

## FINDING OF APPROPRIATENESS OF A REFUGE USE

**Refuge Name:** Monomoy National Wildlife Refuge

**Use:** Research Conducted by Non-Service Personnel

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

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

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

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

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

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

**Not Appropriate** _____ **Appropriate** ✔

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

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

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

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

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

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

**603 FW 1**
**Exhibit 1**
**Page 2**

## JUSTIFICATION FOR A FINDING OF APPROPRIATENESS OF A REFUGE USE

**Refuge Name:** Monomoy National Wildlife Refuge

**Use:** Research Conducted by Non-Service Personnel

## NARRATIVE:

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

Research conducted by non-Service personnel is not identified as a priority public use of the National Wildlife Refuge System (Refuge System) under the National Wildlife Refuge System Administration Act of 1966 (16 U.S.C. 668dd-668ee), as amended by the National Wildlife Refuge System Improvement Act of 1997. This use is not a priority public use of the Refuge System. However, research by non-U.S. Fish and Wildlife Service (Service) personnel is often conducted by colleges, universities, Federal, State, and local agencies, non-governmental organizations, and qualified members of the general public. Research on Monomoy National Wildlife Refuge (NWR, refuge) would further the understanding of the natural environment and could be applied to management of the refuge's wildlife.

The Service encourages and supports research and management studies on refuge lands that will improve and strengthen decisions on managing natural resources. Research by other than Service personnel adds greatly to the information base for refuge managers to make proper decisions. The refuge manager encourages and seeks research that clearly relates to approved refuge objectives, improves habitat management, and promotes adaptive management. Priority research addresses information to better manage the refuge's biological and wilderness resources, or addresses management issues at Monomoy NWR. We will generally support research that addresses important management issues or demonstrates techniques for managing species or habitats that are important to agencies of the Department of the Interior, the Refuge System, and state fish and game agencies. Much of the refuge is designated national wilderness, so some constraints on how or where research is conducted may be necessary.

All research proposals are evaluated for their benefits to the refuge and the Refuge System mission. The refuge manager will issue a special use permit (SUP) for all approved research projects. All research projects require the principal investigator to provide summary reports of findings and acknowledge the refuge for their participation. At the time of request, a determination will be made by refuge staff whether the proposed research benefits the understanding of the natural environment and will contribute useful information to the Service and Refuge System. The entire refuge may be open and available for scientific research. The research location will be limited to those areas of the refuge that are absolutely necessary to conduct of the research project. The timing of each individual research project will be limited to the minimum required to complete the project. The refuge reserves the right at any time to find a specific request for a research project by non-Service personnel to be inappropriate or incompatible with the refuge's purposes, Service mission or the refuge's conservation management goals and objective established in the Comprehensive Conservation Plan and any stepped down management plan, based on each individual review and assessment of each project's research details.

Not all research may be appropriate. Some research may affect fish, wildlife, and plants in a manner neither consistent with refuge management plans nor compatible with refuge purposes or the Refuge System mission. Some research may interfere with or preclude refuge management activities, appropriate and compatible public uses, or other research. Some research may be appropriate off the refuge, but not on the refuge. Therefore, we must evaluate each research proposal independently and may deny a request for an SUP because we find the proposal to be inappropriate or incompatible.

No additional equipment, facilities, or improvements will be necessary to allow research by non-Service personnel. Staff time would be required to review research proposals and oversee permitted projects. We expect that conducting these activities will require less than one-tenth of a work-year for one staff member.

Non-Service organizations and personnel conducting research on the refuge will be required to provide the Service with all data collected and/or reports. The research organization/agency or personnel in conjunction with the Service will retain the use and ownership of all data/reports.

Disturbance to wildlife and vegetation by researchers could occur through observation, sampling, or accessing the study area. It is possible that direct mortality could result as a by-product of research activities.

Negligible impacts will occur when research projects which are previously approved in the compatibility determination are carried out according to the stipulations stated in the SUP issued for each project. Overall, however, allowing well designed and properly reviewed research to be conducted by non-Service personnel is likely to have very little impact on refuge wildlife populations. If the research project is conducted with professionalism and integrity, potential adverse impacts are likely to be outweighed by the knowledge gained about a species, habitat, or public use.

After evaluating research by non-Service personnel under Service policies, we conclude that the activity is appropriate as it contributes to and supports refuge management, purposes, and goals, and the mission of the Refuge System.

# COMPATIBILITY DETERMINATION

## USE:

Research Conducted by Non-Service Personnel

## REFUGE NAME:

Monomoy National Wildlife Refuge

## DATE ESTABLISHED:

June 1, 1944

## ESTABLISHING AND ACQUISITION AUTHORITY(IES):

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

## REFUGE PURPOSE(S):

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

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

## NATIONAL WILDLIFE REFUGE SYSTEM MISSION:

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

## DESCRIPTION OF USE:

**(a) What is the use? Is the use a priority public use?**
This determination covers low impact research projects; namely, those projects with methods that only have a minimal potential to adversely impact cultural resources and native wildlife and plants.

This is not an all-inclusive list, but examples of the types of research that would be allowed include: mist-netting or cannon netting for banding or tagging birds, point count surveys, horseshoe crab tagging, radio-telemetry tracking, use of cameras and recorders, use of live or other passive traps, or non-destructive searches of nests, dens, or burrows.

Research activities allowed under this determination would not result in long-term, negative alterations to species' behavior (e.g. result in wildlife leaving previously occupied areas for long periods; modifying their habitat use; or, causing nest or young abandonment). No project would degrade wildlife habitat, including vegetation, soils, and water. Research associated activities that would not be allowed include, but are not

limited to, those that would result in soil compaction or erosion, degrade water quality, remove or destroy vegetation, involve off-road vehicle use, collect and remove animals or whole native plants, cause public health or safety concerns, or result in conflicts with other compatible refuge uses.

Refuge support of research directly related to refuge goals and objectives may take the form of funding, in-kind services such as housing or use of other facilities, vehicles, boats, or equipment, direct staff assistance with the project in the form of data collection, provision of historical records, conducting of management treatments, or other assistance as appropriate.

Research conducted by non-U.S. Fish and Wildlife Service (Service) personnel is not a priority public use of the National Wildlife Refuge System (Refuge System) under the National Wildlife Refuge System Administration Act of 1966 (16 U.S.C. 668dd-668ee), and the National Wildlife Refuge System Improvement Act of 1997 (Public Law 105-57).

**(b) Where would the use be conducted?**
The location of the research will vary depending on the individual research project being conducted. The entire refuge is open and available for scientific research. An individual research project is usually limited to a particular habitat type, plant, or wildlife species. On occasion, research projects will encompass an assemblage of habitat types, plants, or wildlife, or may span more than one refuge or include lands outside the refuge. The research location will be limited to those areas of the refuge necessary to conduct the research project. Because of the need to close parts of the refuge spatially or temporally to protect refuge wildlife, some research may not be able to be conducted on the refuge. Much of Monomoy National Wildlife Refuge (NWR) is included in the Monomoy Wilderness, which could impact where or how we allow research to be conducted.

**(c) When would the use be conducted?**
The timing of the research will depend entirely on the individual research project's approved design. Scientific research will be allowed to occur on the refuge throughout the year, unless it conflicts with the protection of seals, terns, plovers, other migratory shorebirds and seabirds, invertebrates, or plants of management priority. An individual research project could be short- term in design, requiring one or two visits over the course of a few days. Other research projects could be multiple year studies that require daily visits to the study site or staying overnight on South Monomoy Island. The timing of each individual research project will be limited to the minimum required to complete the project. The refuge manager would approve the timing (e.g., project length, seasonality, time of day) of the research prior to the start of the project to minimize impacts to wildlife and habitats, ensure safety, and reduce conflicts with other compatible refuge uses.

**(d) How would the use be conducted?**
The methods of the research will depend entirely on the individual research project conducted. The methods and study design of each research project will be reviewed and scrutinized before the project will be allowed to occur on the refuge. No research project will be allowed if it does not have an approved scientific method, if it negatively affects endangered species, marine mammals, or migratory birds, if it cannot be conducted consistent with wilderness preservation, or if it compromises public health and safety. Only low impact research activities, such as those listed under section (a) above, are covered under this determination.

Access to Morris Island is primarily facilitated by pedestrian walking access, with access to the rest of Monomoy NWR being primarily by boat. Both these means of access are used by Service staff when conducting biological surveys, roving interpretation, and natural and cultural history tours.

Research projects must have a Service-approved study plan and protocol. A detailed research proposal that follows the refuge's study proposal guidelines (see attachment 1) is required from parties interested in conducting research on the refuge. Each research proposal request will be considered, and if determined appropriate and compatible, will be issued a special use permit (SUP) by the refuge manager that includes the stipulations in this determination. The refuge manager will use sound professional judgment and ensure that the request will have no considerable negative impacts to natural or cultural resources, or impact visitors, and does not violate refuge regulations. Before initiating a research project that involves federally listed endangered or threatened species, an interagency Section 7 consultation process should be completed.

If approved, multi-year research projects will be reviewed annually to ensure that they are meeting their intended design purposes, that reporting and communicating with refuge staff is occurring, and that projects continue to be consistent with the mission of the Refuge System and purposes for which the refuge was established.

If the refuge manager decides to deny, modify, or halt a specific research project, the refuge manager will explain the rationale and conclusions supporting their decision in writing. The denial or modification to an existing study will generally be based on evidence that the details of a particular research project may:

- Negatively impact native fish, wildlife, and habitats or cultural, archaeological, or historical resources.
- Detract from fulfilling the refuge's purposes or conflict with refuge goals and objectives.
- Raise public health or safety concerns.
- Conflict with other compatible refuge uses.
- Not be manageable within the refuge's available staff or budget time.
- Deviate from the approved study proposal such that impacts to refuge resources are more severe or extensive than originally anticipate.

**(e) Why is this use being proposed?**
Research by non-Service personnel is conducted by colleges, universities, Federal, state, local agencies, non-governmental organizations, and qualified members of the public to further the understanding of the natural, physical, and wilderness refuge environments and improve management of refuge natural and wilderness resources. Much of the information generated by the research is applicable to management on and near the refuge. Thorough research provides critical information for establishing baseline information on refuge resources and evaluating management effects on wildlife and habitat. Research projects may also include evaluating habitat management treatments and the associated wildlife community response, as well as, measures of impacts from public uses on refuge lands.

The Service will encourage and support research and management studies on refuge lands that improve and strengthen natural resource and wilderness management decisions. The refuge manager will encourage and seek research related to approved refuge objectives that clearly improves land management and promotes adaptive management. Priority research addresses information that is important to agencies of the Department of the Interior, Service, Refuge System, state fish and game agencies and other agencies responsible for managing natural resources.

The refuge will also consider research for other purposes that may not be directly related to refuge-specific objectives, but will contribute to the broader enhancement, protection, use, preservation and management of native populations of fish, wildlife, and plants, and their natural diversity within the region or flyway. These proposals must comply with the Service's governing laws, regulations, and policies.

The refuge will maintain a list of research needs that will be provided to prospective researchers or organizations upon request. Refuge support of research directly related to refuge objectives may take the form of funding, in-kind services such as housing or use of other facilities, direct staff assistance in the form of collecting data, providing historical records, conducting management treatments, or other assistance as appropriate.

## AVAILABILITY OF RESOURCES:

The cost for research is incurred in staff time to review research proposals, coordinate with researchers, write and administer SUPs, and, in some instances boat support and fuel. At an hourly rate of approximately $50.00 for a GS-09 step 6, this totals about $11,000 annually for resources spent on outside research.

| | | | |
|---|---|---|---|
| Research program administration | 1 staff | 160 hours | $ 8,000 |
| Boat support | 1 staff | 40 hours | $ 2,000 |
| Boat fuel and maintenance | | | $ 1,000 |
| **Total annual costs:** | | | **$11,000** |

## ANTICIPATED IMPACTS OF THE USE:

The Service encourages approved research to further the understanding of natural resources. Research by other than Service personnel adds to the best available information base supporting management decisions. Disturbance to wildlife and vegetation by researchers could occur through direct or remote observation, telemetry, capture (mist-netting, canon netting), banding, and accessing the study area by foot or by boat. These impacts could be exacerbated by multiple concurrent research projects. It is possible that direct mortality could result as a by-product of research activities. Mist-netting, for example, can cause stress, especially when birds are captured, banded and weighed. There have been occasional mortalities to birds, when predators reach the netted birds before researchers do. Temporary installations (e.g., telemetry receivers, remote cameras or acoustic sensors, solar panels) or the visible presence of research personnel to other wilderness users can impact the sense of solitude or untrammeled wildness experienced by wilderness visitors.

Minimal impact will occur when research projects that have been approved are carried out according to the stipulations stated in this Compatibility Determination. Overall, allowing well-designed and properly reviewed research to be conducted by non-Service personnel is likely to have very little impact on refuge wildlife populations, wilderness user experiences, or wilderness character. If the research project is conducted with professionalism and integrity, potential adverse impacts are likely to be outweighed by the knowledge gained about an entire species, habitat, or public use.

Because Service or partner staff will supervise this activity, impacts of research will likely be minimal if conducted in accordance with refuge regulations, and minimum requirements analyses if within the Monomoy Wilderness. In the event of persistent disturbance to habitat or wildlife, or to wilderness character, the activity will be further restricted or discontinued.

### *Potential Pedestrian Impacts*

#### Potential Direct Impacts

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

Numerous studies have documented that migratory birds are disturbed by human activity on beaches. Erwin (1989) documented disturbance of common terns and skimmers and recommended that human activity be restricted to a distance of 100 meters around nesting sites. Klein (1993) in studying waterbird response to human disturbance found that, as intensity of disturbance increased, avoidance response by the birds increased, and found that out-of-vehicle activity to be more disruptive than vehicular traffic. Pfister et al. (1992) found that the impact of disturbance was greater on species using the heavily disturbed front side of the beach, with the abundance of the impacted species being reduced by as much as 50 percent. In studying the effects of recreational use of shorelines on nesting birds, Robertson et al. (1980) discovered that disturbance negatively impacted species composition. Piping plovers, which intensively use the refuge, are also impacted negatively by human activity. Pedestrians on beaches may crush eggs (Jenkins and Burger 1987, Hill 1988, Shaffer and Laporte 1992, Cape Code National Seashore 1993, Collazo et al. 1994). Dogs may chase plovers (McConnaughey et al. 1990), destroy nests (Hoopes 1993), and kill chicks (Cairns and McLaren 1980). Other studies have shown that if pedestrians cause incubating plovers to leave their nest, the eggs can overheat (Bergstrom 1991) or can cool to the point of embryo death (Welty 1982). Pedestrians have been found to displace unfledged chicks (Strauss 1990, Burger 1991, Hoopes 1993, Loegering 1992, Goldin 1993).

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

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

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

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

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

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

The proposed use has the potential of intermittently interrupting the feeding habits of a variety of shorebirds, gulls, and terns, but encounters between pedestrians and migratory birds will be temporary. Refuge staff will manage researcher access via seasonal closures to minimize disturbance to nesting, resting, and foraging waterbirds on the refuge.

The recovery plan for the northeastern beach tiger beetle describes that many of the species' habitats are threatened by human impacts such as habitat alteration and recreational activities (USFWS 1994). Larval burrows are especially susceptible to trampling, which results in excess energy expenditure and reduced time hunting for the inhabiting individual. We will continue to survey to determine the location and extent of larval beetle occurrence and habitat, and use closures and re-routing to avoid larval habitats, as warranted.

Researcher use also has the potential to disturb loafing seals. Gray and harbor seals haul out on the refuge year-round. A 150-foot buffer around all seals is recommended by the National Oceanic Atmospheric Administration to ensure compliance with the Marine Mammals Protection Act.

### Pedestrian Indirect Impacts

Heavy beach use can dry out the sand and contribute to beach erosion. Trash left on the beach, particularly food or wrappers, can attract predators that prey on nesting piping plovers and least terns or roosting shorebirds. Impacts of research are likely to be minimal if conducted in accordance with refuge regulations.

### Potential Impacts to Wilderness Character

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

There are some aspects of the wilderness character that could be affected by research conducted on the refuge. Wilderness visitors' experiences are most strongly affected by social conditions, such as other people and their actions, than by their perception of naturalness or ecological conditions (Hendee and Dawson 2002). With typically long sight distances across Monomoy's rolling nearly treeless coastal barrier landscape, too many individuals encountered during visits likely detracts from the sense of solitude experienced by wilderness users (Stankey and Schreyer 1987, Hendee and Dawson 2002).

Research may need to be conducted in areas of the island that are less traversed by wilderness users. This could lead to the establishment of new trails. Once established, the trails themselves are clear evidence of human presence that detracts from some users' perceptions of an otherwise untrammeled, undeveloped, or natural appearing landscape (Hendee and Dawson 2002) within the Monomoy Wilderness. Bare, exposed, sand dune areas, potentially compacted tidal marsh segments, trail treads, and narrow zones of disturbed vegetation on either side of refuge foot trails and boat landings will be readily evident, but when trail standards are kept minimal, trails tend to be accepted or even expected by most, but not all, wilderness users (Stankey and Schreyer 1987, Cole 2002, Hendee and Dawson 2002).

Overall, allowing well-designed, properly reviewed, low impact research to be conducted by non-Service personnel is likely to have very little negative impact on refuge wildlife populations and habitats. We anticipate research will only have negligible to minor impacts to refuge wildlife and habitats because it will only be carried out after the refuge approves a detailed project proposal and issues an SUP including the stipulations in this determination to ensure compatibility. These stipulations are designed to help ensure each project minimizes impacts to refuge cultural resources, wildlife, vegetation, soils, and water. We also anticipate only minimal impacts because Service staff will supervise this activity, and it will be conducted in accordance with refuge regulations. In the event of persistent disturbance to habitats or wildlife, the activity will be further restricted or discontinued. If the research project is conducted with professionalism and integrity, potential minor adverse impacts are likely to be outweighed by the body of knowledge contributed to our understanding of refuge resources and our management effects on those resources, as well as the opportunity to inform, strengthen, and improve future refuge management decisions.

## PUBLIC REVIEW AND COMMENT:

As part of the comprehensive conservation planning (CCP) process for the Monomoy NWR, a draft of this compatibility determination underwent a 180-day public comment period concurrent with the release of our draft CCP/Environmental Impact Statement (EIS). This final compatibility determination resulted from that public review and comment process. It underwent a further 37-day public review period concurrent with the release of the final CCP/EIS. No comments were received on the compatibility determination and it has remained unchanged.

## DETERMINATION (CHECK ONE BELOW):

_____Use is not compatible.

__X__Use is compatible with the following stipulations.

## STIPULATIONS NECESSARY TO ENSURE COMPATIBILITY:

- All researchers will be required to submit a detailed research proposal following Service Policy (FWS Refuge Manual Chapter 4 Section 6, as may be amended), as well as a completed National Wildlife Refuge System Special Use Research and Monitoring Application and Permit. This can be found at *http://www.fws.gov/forms/3-1383-R.pdf;* accessed October 2015. The application can be submitted to the refuge manager via email or by fax. The refuge must be given at least 45 days to review and decide whether to approve proposals before initiation of research. If collection of wildlife is involved, the refuge must be given 60 days to review and decide whether to approve the proposal. The Service cannot guarantee that it will review or approve proposals not submitted within these timeframes.

- Only low impact projects are covered under this determination. Low impact projects, as indicated under (a) above, are those that would only have a minimal potential to impact cultural resources and native wildlife and plants. No project should result in long-term negative alterations to species' behavior (e.g. result in wildlife leaving previously occupied areas for a long term; modifying their habitat use within their range; or, causing nest or young abandonment). No project should degrade wildlife habitat, including vegetation, soils, and water. Nest, dens, and burrows must not be harmed. No research activities should result in soil compaction or erosion, degrade water quality, remove or destroy vegetation, involve off-road vehicle use, or result in collection and removal of animals or whole native plants.

- Research would only be conducted in Service-approved locations, using approved modes of access, and conducted only after the timing, season, duration, numbers of researchers, and areas open and closed is approved. Sensitive wildlife habitat areas will be avoided unless sufficient protection, approved by the Service, is implemented to limit the area and/or resources potentially impacted by the proposed research.

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

- In order to preserve wilderness character, research proposed to be conducted in the Monomoy Wilderness will require extra scrutiny using the minimum requirements decision guide to ensure the methods proposed are the minimum necessary for achieving the refuge purpose. Researchers may be asked to draft minimum requirement analyses to expedite review and issuance of conditions designed to protect wilderness. Proposals will be prioritized and approved based on need, benefit, compatibility, and funding required.

- Proposals will be prioritized and approved based on need, benefit to refuge resources, and the level of refuge funding required. Service experts, State agencies, or academic experts may be asked to review and comment on proposals.

- SUPs will be issued for all research conducted by non-Service personnel. The permit will list all the conditions listed here and will identify a schedule for periodic progress reports and submittal of a final report or scientific paper. The regional refuge biologists, other Service divisions, and Massachusetts State agencies may be asked to review and comment on proposals.

- Any research project may be terminated at any time for non-compliance with the conditions of the SUP, or modified, redesigned, relocated, or terminated upon determination by the refuge manager that the project is causing unanticipated adverse impacts to wildlife, wildlife habitat, wilderness character, approved priority public uses, or refuge resources of staff time, equipment, or funding.

- All work with endangered species will require the proper permits from Federal or State government. Any research involving federally listed species may require Section 7 consultation under the Endangered Species Act. Any research involving ground disturbance may require historic preservation consultation with the Regional Historic Preservation Officer and/or State Historic Preservation Officer. Researchers may also need State and Federal collection permits and may need to provide an assurance of animal care form or an institutional animal approval form, if applicable.

- Researchers will mark any survey routes, plots, and points in as visually unobtrusive a manner as practical. No permanent markers or infrastructure can be left on the refuge.

- Researchers will use every precaution and not conduct activities that would cause damage to refuge property or present hazards or significant annoyances to other refuge visitors. Any damage should be reported immediately to the refuge manager.

- Researchers must not litter, or start or use open fires on refuge lands.

- All research staff handling wildlife must be properly trained to minimize the potential for impacts to individual wildlife prior to initiating the project. In addition, a review of the U.S. Department of Agriculture's Animal Welfare Information Center website must be documented by the researcher with identification of practices that will be followed to help further minimize stress, injury, and mortality of wildlife. The website is reached at: *https://awic.nal.usda.gov/research-animals/wildlife-field-studies;* accessed October 2015.

- Researchers may not use any chemicals (e.g., herbicides to treat invasive plants) or hazardous materials without prior written consent of refuge manager (e.g., the type of chemical, timing of use, and rate of application). All activities will be consistent with Service policy and an approved refuge Pesticide Use Plan.

- Researchers will be required to take steps to ensure that invasive species and pathogens are not inadvertently introduced or transferred to the refuge and surrounding lands (e.g., cleaning equipment).

- Researchers must have the SUP in their possession when engaged in research activities and will present it to refuge officials and State and Federal law enforcement agents upon their request.

- Researchers will submit a final report to the refuge upon completion of their work. For long-term studies, interim progress reports may also be required. The refuge also expects that research findings will be published in peer-reviewed publications. The contribution of the refuge and the Service should be acknowledged in any publications. The SUP will identify a schedule for annual progress reports and the submission of a final report or scientific paper.

- Proposals will be prioritized and approved based on need, benefit to refuge resources, and the level of refuge funding required. Service experts, State agencies, or academic experts may be asked to review and comment on proposals.

## JUSTIFICATION:

The Service encourages quality, scientific research because it provides critical baseline information on Federal trust and other refuge resources and helps evaluate the management effects on those resources. Research by non-Service personnel, guided by the stipulations listed above, adds greatly to the information base for refuge managers to make proper refuge management decisions. This use will potentially contribute to the refuge's concurrent purposes in carrying out migratory bird management and preserving wilderness character. While some research activities may cause minimal disturbance to wildlife or result in the loss of specific individuals, this impact will be offset by the value of the research to managers and future generations. Impacts, if they occur, would be confined in area, duration, and magnitude, with no long-term consequences predicted. Research conducted by non-Service personnel will not materially interfere with or detract from the mission of the Refuge System or the purposes for which the refuge was established.

## SIGNATURE:

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

## CONCURRENCE:

Regional Chief: Scott B. Kahn (Signature) March 18, 2016 (Date)

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

# Attachment 1. Monomoy National Wildlife Refuge Study Proposal Guidelines

A study proposal is a justification and description of the work to be done, and includes cost and time requirements. Proposals must be specific enough to serve as "blueprints" for the investigative efforts. Step-by-step plans for the actual investigations must be spelled out in advance, with the level of detail commensurate with the cost and scope of the project and the needs of management. Please submit proposals electronically as a Microsoft Word document or hardcopy to the refuge manager.

The following list provides a general outline of first order headings/sections for study proposals.

- Cover Page.
- Table of Contents (for longer proposals).
- Abstract.
- Statement of Issue.
- Literature Summary.
- Objectives/Hypotheses.
- Study Area.
- Methods and Procedures.
- Quality Assurance/Quality Control.
- Specimen Collections.
- Deliverables.
- Special Requirements, Concerns, Necessary Permits.
- Literature Cited.
- Peer Review.
- Budget.
- Personnel and Qualifications.

## Cover Page

The cover page must contain the following information:

- Title of Proposal.
- Current Date.
- Investigator(s): name, title, organizational affiliation, address, telephone and fax numbers and e-mail address of all investigators or cooperators.
- Proposed starting date.
- Estimated completion date.
- Total Funding Support Requested from the U.S. Fish and Wildlife Service.
- Signatures of Principal Investigator(s) and other appropriate institutional officials.

## Abstract

The abstract should contain a short summary description of the proposed study, including reference to major points in the Statement of Issue, Objectives, and Methods and Procedures sections.

## Statement of Issue

Provide a clear, precise summary of the problem to be addressed and the need for its solution. This section should include statements of the importance, justification, relevance, timeliness, generality, and contribution of the study. Describe how any products will be used, including any anticipated commercial use. What is the estimated probability of success of accomplishing the objective(s) within the proposed timeframe?

## Literature Summary

This section should include a thorough but concise literature review of current and past research that pertains to the proposed research, especially any pertinent research conducted within the Cape Cod area, and specifically, on refuge units. A discussion of relevant legislation, policies, and refuge planning and management history, goals, and objectives should also be included.

## Objectives/Hypotheses

A very specific indication of the proposed outcomes of the project should be stated as objectives or hypotheses to be tested. Project objectives should be measurable. Provide a brief summary of what information will be provided at the end of the study and how it will be used in relation to the problem. These statements should flow logically from the statement of issue and directly address the management problem.

Establish data quality objectives in terms of precision, accuracy, representativeness, completeness, and comparability as a means of describing how good the data need to be to meet the project's objectives.

## Study Area

Provide a detailed description of the geographic area(s) to be studied and include a clear map delineating the proposed study area(s) and showing specific locations where work will occur.

## Methods and Procedures

This section should describe as precisely as possible how the objectives will be met or how the hypotheses will be tested. Include detailed descriptions and justifications of the field and laboratory methodology, protocols, and instrumentation. Explain how each variable to be measured directly addresses the research objective/hypothesis. Describe the experimental design, population, sample size, and sampling approach (including procedures for sub-sampling). Summarize the statistical and other data analysis procedures to be used. List the response variables and tentative independent variables or covariates. Describe the experimental unit(s) for statistical analysis. Also include a detailed project time schedule that includes initiation, fieldwork, analysis, reporting, and completion dates.

## Quality Assurance/Quality Control

Adequate quality assurance/quality control (QA/QC) procedures help insure that data and results are: credible and not an artifact of sampling or recording errors; of known quality; able to stand up to external scientific scrutiny; and accompanied by detailed method documentation. Describe the procedures to be used to insure that data meet defined standards of quality and program requirements, errors are controlled in the field, laboratory, and office, and data are properly handled, documented, and archived. Describe the various steps (e.g., personnel training, calibration of equipment, data verification and validation) that will be used to identify and eliminate errors introduced during data collection (including observer bias), handling, and computer entry. Identify the percentage of data that will be checked at each step.

## Specimen Collections

Clearly describe the kind (species), numbers, sizes, and locations of animals, plants, rocks, minerals, or other natural objects to be sampled, captured, or collected. Identify the reasons for collecting, the intended use of all the specimens to be collected, and the proposed disposition of collected specimens. For those specimens to be permanently retained as voucher specimens, identify the parties responsible for cataloging, preservation, and storage and the proposed repository.

## Deliverables

The proposal must indicate the number and specific format of hard and/or electronic media copies to be submitted for each deliverable. The number and format will reflect the needs of the refuge and the Refuge manager. Indicate how many months after the project is initiated (or the actual anticipated date) that each deliverable will be submitted. Deliverables are to be submitted or presented to the refuge manager.

Deliverables that are required are as follows:

### *Reports and Publications*

Describe what reports will be prepared and the timing of reports. Types of reports required in fulfillment of natural and social science study contracts or agreements include:

(1) Progress report(s) (usually quarterly, semiannually, or annually): may be required
(2) Draft final and final report(s): always required

A final report must be submitted in addition to a thesis or dissertation (if applicable) and all other identified deliverables. Final and draft final reports should follow refuge guidelines (Attachment 1a).

In addition, investigators are encouraged to publish the findings of their investigations in refereed professional, scientific publications and present findings at conferences and symposia. The Refuge manager appreciates opportunities to review manuscripts in advance of publication.

### *Data Files*

Provide descriptions of any spatial (Geographic Information Systems; GIS) and non-spatial data files that will be generated and submitted as part of the research. Non-spatial data must be entered onto Windows CD ROMs in Access or Excel. Spatial data, which includes GPS (Global Position System)-generated files, must be in a format compatible with the refuge's GIS system (ArcGIS 8 or 9, Arcview 3.3, or e00 format). All GIS data must be in UTM 19, NAD 83.

### *Metadata*

For all non-spatial and spatial data sets or information products, documentation of information (metadata) describing the extent of data coverage and scale, the history of where, when, and why the data were collected, who collected the data, the methods used to collect, process, or modify/ transform the data, and a complete data dictionary must also be provided as final deliverables. Spatial metadata must conform to U.S. Fish and Wildlife Service (Federal Geographic Data Committee; FDGC) metadata standards.

### *Oral Presentations*

Three types of oral briefings should be included: pre-study, annual, and closeout.

These briefings will be presented to refuge staff and other appropriate individuals and cooperators. In addition, investigators should conduct periodic informal briefings with refuge staff throughout the study whenever an opportunity arises. During each refuge visit, researchers should provide verbal updates on project progress. Frequent dialogue between researchers and refuge staff is an essential element of a successful research project.

### *Specimens and Associated Project Documentation*

A report on collection activities, specimen disposition, and the data derived from collections, must be submitted to the refuge following refuge guidelines.

### *Other:*

Researchers must provide the refuge manager with all of the following:

(1) Copies of field notes/ notebooks/ datasheets.

(2) Copies of raw data (in digital format), including GIS data, as well as analyzed data.

(3) Copies of all photos, slides (digital photos preferred), videos, and films.

(4) Copies of any reports, theses, dissertations, publications or other material (such as news articles). resulting from studies conducted on refuge.

(5) Detailed protocols used in study.

(6) Aerial photographs.

(7) Maps.

(8) Interpretive brochures and exhibits.

(9) Training sessions (where appropriate).

(10) Survey forms.

(11) Value-added software, software developed, and models.

Additional deliverables may be required of specific studies.

## Special Requirements, Permits, and Concerns

Provide information on the following topics where applicable. Attach copies of any supporting documentation that will facilitate processing of your application.

### *Refuge Assistance*

Describe any refuge assistance needed to complete the proposed study, such as use of equipment or facilities or assistance from refuge staff. It is important that all equipment, facilities, services, and logistical assistance expected to be provided by the Fish and Wildlife Service be specifically identified in this section so all parties are in clear agreement before the study begins.

### *Ground Disturbance*

Describe the type, location, area, depth, number, and distribution of expected ground- disturbing activities, such as soil pits, cores, or stakes. Describe plans for site restoration of significantly affected areas.

Proposals that entail ground disturbance may require an archeological survey and special clearance prior to approval of the study. You can help reduce the extra time that may be required to process such a proposal by including identification of each ground disturbance area on a U.S. Geological Survey (USGS) 7.5-minute topographic map.

### *Site Marking and/or Animal Marking*

Identify the type, amount, color, size, and placement of any flagging, tags, or other markers needed for site or individual resource (e.g., trees) identification and location. Identify the length of time it is needed and who will be responsible for removing it. Identify the type, color, placement of any tags placed on animals (see SUP for requirements on marking and handling of animals).

### *Access to Study Sites*

Describe the proposed method and frequency of travel to and within the study site(s). Explain any need to enter restricted areas. Describe duration, location, and number of participants, and approximate dates of site visits.

### *Use of Mechanized and Other Equipment*

Describe any vehicles, boats, field equipment, markers, or supply caches by type, number, and location. You should explain the need to use these materials and if or how long they are to be left in the field.

### *Safety*

Describe any known potentially hazardous activities, such as electro-fishing, scuba diving, whitewater boating, aircraft use, wilderness travel, wildlife capture or handling, wildlife or immobilization.

### *Chemical Use*
Identify chemicals and hazardous materials that you propose using within the refuge.

Indicate the purpose, method of application, and amount to be used. Describe plans for storage, transfer, and disposal of these materials and describe steps to remediate accidental releases into the environment. Attach copies of Material Safety Data Sheets.

### *Animal Welfare*
If the study involves vertebrate animals, describe your protocol for any capture, holding, marking, tagging, tissue sampling, or other handling of these animals (including the training and qualifications of personnel relevant to animal handling and care). If your institutional animal welfare committee has reviewed your proposal, please include a photocopy of their recommendations. Describe alternatives considered, and outline procedures to be used to alleviate pain or distress. Include contingency plans to be implemented in the event of accidental injury to or death of the animal. Include state and Federal permits. Where appropriate, coordinate with and inform state natural resource agencies.

## Literature Cited
List all reports and publications cited in the proposal.

## Peer Review
Provide the names, titles, addresses, and telephone numbers of individuals with subject-area expertise who have reviewed the research proposal. If the reviewers are associated with the investigator's research institution or if the proposal was not reviewed, please provide the names, titles, addresses, and telephone numbers of three to five potential subject-area reviewers who are not associated with the investigator's institution. These individuals will be asked to provide reviews of the proposal, progress reports, and the draft final report.

## Budget
The budget must reflect both funding and assistance that will be requested from the Fish and Wildlife Service and the cooperator's contributions on an identified periodic (usually annual) basis.

### *Personnel Costs*
Identify salary charges for principal investigator(s), research assistant(s), technician(s), clerical support, and others. Indicate period of involvement (hours or months) and pay rate charged for services. Be sure to include adequate time for data analysis and report writing and editing.

### *Fringe Benefits*
Itemize fringe benefit rates and costs.

### *Travel*
Provide separate estimates for fieldwork and meetings. Indicate number of trips, destinations, estimated miles of travel, mileage rate, air fares, days on travel, and daily lodging and meals charges. Vehicle mileage rate cannot exceed standard government mileage rates. Charges for lodging and meals are not to exceed the maximum daily rates set for the locality by the Federal Government.

### *Equipment*
Itemize all equipment to be purchased or rented and provide a brief justification for each item costing more than $1,000. Be sure to include any computer-related costs. For proposals funded under Service agreement or contract, the refuge reserves the right to transfer the title of purchased equipment with unit cost of $1,000 or more to the Federal Government following completion of the study. These items should be included as deliverables.

### *Supplies and Materials*
Purchases and rentals under $1,000 should be itemized as much as is reasonable.

*Subcontract or Consultant Charges*
All such work must be supported by a subcontractor's proposal also in accordance with these guidelines.

*Specimen Collections*
Identify funding requirements for the cataloging, preservation, storage, and analyses of any collected specimens that will be permanently retained.

*Printing and Copying*
Include costs for preparing and printing the required number of copies of progress reports, the draft final report, and the final report. In general, a minimum of two (2) copies of progress reports (usually due quarterly, semiannually, or as specified in agreement), the draft final report, and the final report are required.

*Indirect Charges*
Identify the indirect cost (overhead) rate and charges and the budget items to which the rate is applicable.

*Cooperator's Contributions*
Show any contributing share of direct or indirect costs, facilities, and equipment by the cooperating research institution.

*Outside Funding*
List any outside funding sources and amounts.

**Personnel and Qualifications**

List the personnel who will work on the project and indicate their qualifications, experience, and pertinent publications. Identify the responsibilities of each individual and the amount of time each will devote. A full vita or resume for each principal investigator and any consultants should be included here.

# Attachment 1a. Interim Final Report Guidelines

Draft final and final reports should follow Journal of Wildlife Management format and should include the following sections:

Title Page
Abstract
Introduction/Problem statement
Study Area
Methods (including statistical analyses)
Results
Discussion
Management Implications
Management Recommendations
Literature Cited

## LITERATURE CITED:

Bélanger, L. and J. Bédard. 1990. Energetic cost of man-induced disturbance to staging snow geese. Journal of Wildlife Management 54(1): 36-41.

Bergstrom, P.W. 1991. Incubation temperatures of Wilson's plovers and killdeer. Condor 91: 634-641.

Boyle, S.A. and F.B. Samson. 1985. Effects of nonconsumptive recreation on wildlife: A review. Wildlife Society Bulletin 13: 110-116.

Burger, J. 1981. Effect of human activity on birds at a coastal bay. Biological Conservation 21: 231-241.

Burger, J. 1986. The effect of human activity on shorebirds in two coastal bays in northeastern United States. Biological Conservation 13: 123-130.

Burger, J. 1991. Foraging behavior and the effect of human disturbance on the piping plover (*Charadrius melodus*). Journal of Coastal Research 7(1): 39-52.

Burger, J. and M. Gochfeld. 1981. Discrimination of the threat of direct versus tangential approach to the nest by incubating herring and great black-backed gulls. Journal of Comparative Physiological Psychology 95: 676-684.

Burger, J., M. Gochfeld, and L.J. Niles. 1995. Ecotourism and birds in coastal New Jersey: Contrasting responses of birds, tourists, and managers. Environmental Conservation 22: 56-65.

Burger, J. and M. Gochfeld. 1998. Effects of ecotourists on bird behavior at Loxahatchee National Wildlife Refuge, Florida. Environmental Conservation 25: 13-21.

Cairns, W.E. and I.A. McLaren. 1980. Status of the piping plover on the east coast of North America. American Birds 34: 206-208.

Cape Cod National Seashore. 1993. Piping plover nest found trampled by pedestrian. News Release. Cape Cod National Seashore, South Wellfleet, Massachusetts. 2 pp.

Collazo, J.A., J.R. Walters, and J.F. Parnell. 1994. Factors Affecting Reproduction and Migration of Waterbirds on North Carolina Barrier Islands. 1993 Annual Progress Report. North Carolina State University, Raleigh, North Carolina. 57 pp.

Erwin, R.M. 1980. Breeding habitat by colonially nesting water birds in two mid-Atlantic U.S. regions under different regimes of human disturbance. Biological Conservation 18: 39-51.

Erwin, R.M. 1989. Responses to Human Intruders by Birds Nesting in Colonies: Experimental Results and Management Guidelines. Colonial Waterbirds 12(1): 104-108.

Goldin, M.R. 1993. Effects of human disturbance and off-road vehicles on piping plover reproductive success and behavior at Breezy Point, Gateway National Recreation Area, New York, M.S. Thesis. University of Massachusetts, Amherst, Massachusetts. 128 pp.

Havera, S.P., L.R. Boens, M.M. Georgi, and R.T. Shealy. 1992. Human disturbance of waterfowl on Keokuk Pool, Mississippi River. Wildlife Society Bulletin 20: 290-298.

Hendee, J.C. and C.P. Dawson. 2002. Wilderness Management: Stewardship and Protection of Resources and Values, Third Edition. Fulcrum Publishing, Golden, Colorado. 640 pp.

Henson, P.T. and A. Grant. 1991. The effects of human disturbance on trumpeter swan breeding behavior. Wildlife Society Bulletin 19: 248-257.

Hill, J.O. 1988. Aspects of breeding biology of Piping Plovers (*Charadrius melodus*) in Bristol County, Massachusetts, in 1988. Unpublished report. University of Massachusetts, Amherst, Massachusetts. 44 pp.

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

Jenkins, D.C. and J. Burger. 1987. New Jersey Endangered Beach-Nesting Bird Project: 1986 Survey and Management. New Jersey Department of Environmental Protection, New Jersey. 37 pp.

Kaiser, M.S. and E.K. Fritzell. 1984. Effects of river recreationists on green-backed heron behavior. Journal of Wildlife Management 48: 561-567.

Kahl, R. 1991. Boating disturbance of canvasbacks during migration at Lake Poygan, Wisconsin. Wildlife Society Bulletin 19: 242-248.

Klein, M.L. 1993. Waterbird behavioral responses to human disturbance. Wildlife Society Bulletin 21: 31-39.

Klein, M.L., S.R. Humphrey, and H. F. Percival. 1995. Effects of ecotourism on distribution of waterbirds in a wildlife refuge. Conservation Biology 9: 1454-1465.

Knight, R.L. and D.N. Cole. 1995. Wildlife responses to recreationists. Pp. 51-69 in R. L. Knight and K. J. Gutzwiller, eds. Wildlife and recreationists: coexistence through management and research. Washington, DC, Island Press. 372 pp.

Korschgen, C.E., L.S. George, and W.L. Green. 1985. Disturbance of diving ducks by boaters on a migrational staging area. Wildlife Society Bulletin 13: 290-296.

Loegering, J.P. 1992. Piping Plover Breeding Biology, Foraging Ecology and Behavior on Assateague Island National Seashore, Maryland. M.S. Thesis. Virginia State Polytechnic Institute and State University, Blacksburg, Virginia. 262 pp.

McConnaughey, J.L., J.D. Fraser, S.D. Coutu, and J.P. Loegering. 1990. Piping plover distribution and reproductive success on Cape Lookout National Seashore. Unpublished report. Cape Lookout National Seashore, Morehead City, North Carolina. 83 pp.

Morton, J.M., A.C. Fowler, and R.L. Kilkpatrick. 1989. Time and energy budgets of American black ducks in winter. Journal of Wildlife Management 53: 401-410 (also see corrigendum in Journal of Wildlife Management 54: 683).

Owen, M. 1973. The management of grassland areas for wintering geese. Wildfowl 24: 123-130.

Pfister, C., B.A. Harrington, and M. Lavine. 1992. The Impact of Human Disturbance on Shorebirds at a Migration Staging Area. Biological Conservation 60(2): 115-126.

Robertson, R.J. and N.J. Flood. 1980. Effects of Recreational Use of Shorelines on Breeding Bird Populations. Canadian Field-Naturalist 94(2): 131-138.

Rodgers, J.A. and H.T. Smith. 1995. Set-back distances to protect nesting bird colonies from human disturbance in Florida. Conservation Biology 9: 89-99.

Rodgers, J.A. and H.T. Smith. 1997. Buffer zone distances to protect foraging and loafing waterbirds from human disturbance in Florida. Wildlife Society Bulletin 25: 139-145.

Shaffer, F. and P. Laporte. 1992. Rapport synthese des recherches relatives au pluvier siffleur (*Charadrius melodus*) effectuees aux Iles-de-la-Madeleine de 1987 a 1991. Association quebecoise des groups d'ornithologues et Service canadien de la faune. 78 pp.

Stankey, G.H. and R. Schreyer. 1987. Attitudes toward wilderness and factors affecting visitor behavior: a state of knowledge review. In: Lucas, R.C., comp. Proceedings – National Wilderness Research Conference: Issues, State-of-Knowledge, Future Directions; July 23-26, 1985; Fort Collins, Colorado. Gen. Tech. Rep. INT-220. Ogden, Utah: U.S. Department of Agriculture, Forest Service, Intermountain Research Stations: 246-293.

Strauss, E. 1990. Reproductive success, life history patterns, and behavioral variation in a population of Piping Plovers subjected to human disturbance (1982-1989). Ph.D. dissertation. Tufts University, Medford, Massachusetts.

United States Fish and Wildlife Service (USFWS). 1994. Northeastern Beach Tiger Beetle (*Cincindela dorsalis dorsalis* Say) Recovery Plan. U.S. Fish and Wildlife Service, Hadley, Massachusetts. 6 pp.

Ward, D.H. and R.A. Stehn. 1989. Response of brant and other geese to aircraft disturbance at Izembek Lagoon, Alaska. U.S. Fish and Wildlife Service, Alaska Fish and Wildlife Research Center. Final report to the Minerals Management Service. Anchorage, Alaska. 193 pp.

Welty, J.C. 1982. The life of birds. Saunders College Publishing, Philadelphia, Pennsylvania. 754 pp.

Williams, G.J. and E. Forbes. 1980. The habitat and dietary preferences of Dark-Bellied Brent Geese and Widgeon in relation to agricultural management. Wildfowl 31: 151-157.

**FWS Form 3-2319**
**02/06**

## FINDING OF APPROPRIATENESS OF A REFUGE USE

**Refuge Name:** Monomoy National Wildlife Refuge

**Use:** Sunbathing and Swimming

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

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

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

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

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

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

**Not Appropriate** _____ **Appropriate** ✔

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

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

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

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

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

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

**603 FW 1**
**Exhibit 1**
**Page 2**

## JUSTIFICATION FOR A FINDING OF APPROPRIATENESS OF A REFUGE USE

**Refuge Name:** Monomoy National Wildlife Refuge

**Use:** Sunbathing and Swimming

## NARRATIVE:

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

Although Service policy does not specifically encourage sunbathing and swimming, these activities often facilitate priority uses such as wildlife observation and photography. The use is a traditional refuge activity that attracts many visitors, especially during the summer and early fall, which increases the refuge's ability to provide opportunities for the priority public uses described in the National Wildlife Refuge System Improvement Act of 1997. The use is not expected to have adverse impacts on refuge wildlife and habitat. Mainland refuge beaches are submerged for approximately 3 hours during high tide, making them inaccessible for approximately 6 hours per day. For this reason, it is unlikely that swimming and sunbathing will increase significantly as a primary public use. Extremely limited visitor parking, lack of facilities on the islands, and often rough boating conditions will also limit the numbers of visitors who go out solely for beach use, especially when there are several other local beaches that offer similar recreational opportunities and are much easier to access. Areas used heavily by migratory birds for feeding, roosting, or nesting are closed April through September, so this activity represents only a minimal disturbance factor. Additionally, the refuge is closed to many traditional beach uses such as beach volleyball, grilling, and shade tents. People who want a traditional beach experience are likely to go to many of the other beaches on Cape Cod.

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

# COMPATIBILITY DETERMINATION

## USE:

Sunbathing and Swimming

## REFUGE NAME:

Monomoy National Wildlife Refuge

## DATE ESTABLISHED:

June 1, 1944

## ESTABLISHING AND ACQUISITION AUTHORITY(IES):

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

## REFUGE PURPOSE(S):

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

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

## NATIONAL WILDLIFE REFUGE SYSTEM MISSION:

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

## DESCRIPTION OF USE:

**(a) What is the use? Is the use a priority public use?**
Sunbathing and swimming are not a priority public use of the National Wildlife Refuge System (Refuge System) under the National Wildlife Refuge System Administration Act of 1966 (16 U.S.C. § 668dd-668ee), as amended by the National Wildlife Refuge System Improvement Act of 1997 (Refuge Improvement Act) (Public Law 105-57). However, it is a traditional use at the refuge, mainly from June through August. Visitors engaged in this use may also find themselves observing wildlife on the refuge.

**(b) Where would the use be conducted?**
Although U.S. Fish and Wildlife Service (Service) policy does not encourage such use, many summer visitors come to the refuge for the primary purpose of sunbathing and swimming. Popular areas include Morris Island

and, when open to the public, the east side of North Monomoy, the sandbars between the islands, and the beach just west of Powder Hole.

Certain areas on Monomoy National Wildlife Refuge (NWR) are seasonally closed to public access at the refuge manager's discretion to protect sensitive habitats or species of concern, minimize conflicts with other refuge activities, or respond to human health and safety concerns. All sunbathing and swimming would be conducted only in areas that are open to the public and do not impact sensitive wildlife or vegetation.

**(c) When would the use be conducted?**
Monomoy NWR is open daily to the public from 1/2-hour before sunrise to 1/2-hour after sunset. Individuals would be able to sunbathe and swim during regular refuge hours, unless otherwise posted by the refuge.

**(d) How would the use be conducted?**
The use must be conducted in accordance with refuge regulations, including seasonal closures.

The use is primarily facilitated by pedestrian walking and hiking access, commercial ferry access, or boat. Boats are allowed to land anywhere along the refuge shoreline, with the exception of posted tern colonies and piping plover nesting areas. The presence of hazardous currents and shoals encourages visitors to land their boats in only a few designated locations.

In general, sunbathing and swimming are self-regulated, with signs indicating closed areas. All visitors should contact Monomoy NWR staff for up-to-date information on seasonal closures. Information about closures will also be available on the refuge web site or at the visitor contact station, when staffed.

**(e) Why is this use being proposed?**
Visitors come to the beaches at Monomoy NWR for a number of reasons, including sunbathing and swimming. However, these are not expected to become the primary reason for public visitation due to the lack of parking at the refuge headquarters, the limited number of hours that the beach at Morris Island is available, high tides, the lack of facilities on North Monomoy Island and South Monomoy Island, the amount of beach closed during the summer, and the inconvenience of getting to the islands. Most visitors will come to observe seals, shorebirds, and seabirds, see the Monomoy Point lighthouse, and fish. Families will come with diverse interests, and swimming and sunbathing will often be secondary to the primary reason for the family visit. The ability to sunbathe and swim will increase the number of visits by entire families, and may prolong the amount of time visitors spend on the refuge. Affording opportunities for public enjoyment by allowing this type of beach use will increase visitor appreciation and foster a greater awareness of the importance of this site to the Refuge System.

## AVAILABILITY OF RESOURCES:

Few additional resources are needed to facilitate sunbathing and swimming. The estimated costs of allowing these uses are minimal because little infrastructure is involved and the administration of these uses is done in conjunction with other uses. The costs include all beach activities, including beachcombing, and costs associated with signs, law enforcement, and visitor services contacts are common to these uses.

There are labor costs for annually posting closed plover, tern, and waterfowl nesting areas; there are replacement costs for posts and signs. There are also prorata shares of the annualized cost for special open beach signs, prorata shares of administrative costs, and prorata shares of vehicle, boat, motor, and other specialized equipment costs.

Law Enforcement patrol would be necessary to ensure integrity of the closed nesting areas, especially for piping plovers.

| **Recurring annual costs:** | | | |
|---|---|---|---|
| Sign replacement and posting | | | $ 5,000 |
| Coordination with public and media | | | $ 2,000 |
| GS-9 Law Enforcement | 1 staff | 40 hours | $ 1,800 |
| Boat fuel, boat maintenance, etc. | | | $ 2,500 |
| **Total recurring annual costs:** | | | **$11,300** |

## ANTICIPATED IMPACTS OF THE USE:

Boats are allowed to land anywhere along the refuge shoreline, with the exception of posted tern colonies and piping plover nesting areas, but the presence of hazardous currents and shoals encourages visitors to land their boats in only a few designated locations. During the peak visitation period - weekends and holidays in June through September - opportunities for solitude on the beaches of the Monomoy Wilderness Area are diminished as boaters and beach users concentrate at these sites. A possible impact of sunbathing and swimming is a temporary interruption of feeding or roosting behavior of migratory birds at the approach of beachgoers on foot or by boat. Once visitors get settled in their chosen spot on the beach, however, they tend to remain sedentary for long periods of time and migratory birds usually resume their activities just a short distance away. Other possible impacts of these activities include disrupting larval threatened beach tiger beetle populations, disrupting local seal populations, removing or trampling plants, creating new trails, littering, vandalism, and entering closed areas. Beach tents will not be allowed on North and South Monomoy Island, as their use in wilderness areas detracts from the wilderness experience that other visitors may be seeking.

On Monomoy Island, area closures are created to protect priority nesting migratory tern and shorebird species. Although these closure areas are designed to minimize human impacts, the potential exists for impacts to unobserved nesting animals or the unlawful entry of visitors into closed areas.

Conflicts arise when migratory birds and humans are present in the same areas (Boyle and Samson 1985). Response of wildlife to human activities includes departure from site (Owen 1973, Burger 1981, Kaiser and Fritzell 1984, Korschgen et al. 1985, Henson and Grant 1991, Kahl 1991, Klein 1993), use of sub-optimal habitat (Erwin 1980, Williams and Forbes 1980), altered behavior (Burger 1981, Korschgen et al. 1985, Morton et al. 1989, Ward and Stehn 1989, Havera et al. 1992, Klein 1993), and increase in energy expenditure (Morton et al. 1989, Bélanger and Bédard 1990). Numerous studies have documented that migratory birds are disturbed by human activity on beaches. Erwin (1989) documented disturbance of common terns and skimmers and recommended that human activity be restricted to a distance of 100 meters around nesting sites. Klein (1993) in studying waterbird response to human disturbance found that, as intensity of disturbance increased, avoidance response by the birds increased, and found that out-of-vehicle activity to be more disruptive than vehicular traffic. Pfister et al. (1992) found that the impact of disturbance was greater on species using the heavily disturbed front side of the beach, with the abundance of the impacted species being reduced by as much as 50 percent. In studying the effects of recreational use of shorelines on nesting birds, Robertson et al. (1980) discovered that disturbance negatively impacted species composition. Piping plovers, which intensively use the refuge, are also impacted negatively by human activity. Pedestrians on beaches may crush eggs (Jenkins and Burger 1987, Hill 1988, Shaffer and Laporte 1992, Cape Cod National Seashore 1993, Collazo et al. 1994). Dogs may chase plovers (McConnaughey et al. 1990), destroy nests (Hoopes 1993), and kill chicks (Cairns and McLaren 1980). Other studies have shown that if pedestrians cause incubating plovers to leave their nest, the eggs can overheat (Bergstrom 1991) or can cool to the point of embryo death (Welty 1982). Pedestrians have been found to displace unfledged chicks (Strauss 1990, Burger 1991, Hoopes 1993, Loegering 1992, Goldin 1993).

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

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

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

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

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

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

Heavy beach use can dry out the sand and contribute to beach erosion. Trash left on the beach, particularly food or wrappers, can attract predators that prey on nesting piping plovers and least terns or roosting shorebirds. Impacts of sunbathing and swimming are likely to be minimal if conducted in accordance with refuge regulations. We will manage refuge closures that restrict pedestrian access to minimize disturbance to priority avian species during critical times of the year. Closures can be expanded or contracted as needed, depending on bird activity and results of further disturbance studies

The recovery plan for the northeastern beach tiger beetle describes that many of the species' habitats are threatened by human impacts such as habitat alteration and recreational activities (USFWS 1994). Larval burrows are especially susceptible to trampling, which results in excess energy expenditure and reduced time hunting for the inhabiting individual. We will continue to survey to determine the location and extent of larval beetle occurrence and habitat, and use closures and re-routing to avoid larval habitats, as warranted.

Pedestrian use also has the potential to disturb loafing seals. Gray and harbor seals haul out on the refuge year-round. A 150-foot buffer around all seals is required by the National Oceanic Atmospheric Administration to ensure compliance with the Marine Mammals Protection Act.

Sunbathing and swimming have the potential to lead to new unwanted trails on the refuge, and concentrated numbers of individuals increase the chances for beach littering and vandalism. Beachgoers could choose to take shortcuts to get to destinations rather than use the marked trail or the designated pedestrian travel corridors. Frequent use of alternative routes could lead to vegetation trampling, and ultimately, areas void of vegetation where the new travel route exists.

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

Swimming and sunbathing will not detract from the character of wilderness, as long as beach tents and radios are not used in the wilderness area. Swimmers and sunbathers will not alter the natural scenic condition of the land and the use will not occur at a scale large enough to diminish the environment for native plants and animals. These activities can help individuals connect with nature and with wildlife. Given the few number of visitors at the refuge who engage in swimming and sunbathing within the wilderness area, we anticipate no negative impacts on wilderness character.

## PUBLIC REVIEW AND COMMENT:

As part of the comprehensive conservation planning (CCP) process for the Monomoy NWR, a draft of this compatibility determination underwent a 180-day public comment period concurrent with the release of our draft CCP/Environmental Impact Statement (EIS). This final compatibility determination resulted from that public review and comment process. It underwent a further 37-day public review period concurrent with the release of the final CCP/EIS. No comments were received on the compatibility determination and it has remained unchanged.

## DETERMINATION (CHECK ONE BELOW):

_____Use is not compatible.

__X__Use is compatible with the following stipulations.

## STIPULATIONS NECESSARY TO ENSURE COMPATIBILITY:

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

- Loud radios will not be allowed on the refuge.

- Beaches will be monitored for signs of overuse and sections will be closed as needed.

- No physical items, including litter, will be placed or left on the refuge.

- Fires may not be set anywhere on the refuge, including beaches.

- All beach users must maintain a 150-foot buffer around all seals as required by the National Oceanic Atmospheric Administration to ensure compliance with the Marine Mammals Protection Act.

## JUSTIFICATION:

Allowing swimming and sunbathing will contribute to public appreciation of Monomoy NWR. Costs associated with administering these uses and likely visitor impacts are minimal. These uses will not materially interfere with or detract from the mission of the Refuge System or the purpose of the Monomoy NWR. Therefore, it is the determination of the Service that swimming and sunbathing use, at the discretion of the refuge manager, is a compatible use of the Monomoy NWR.

## SIGNATURE:

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

## CONCURRENCE:

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

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

## LITERATURE CITED:


Bélanger, L. and J. Bédard. 1990. Energetic cost of man-induced disturbance to staging snow geese. Journal of Wildlife Management 54(1): 36-41.

Bergstrom, P.W. 1991. Incubation temperatures of Wilson's plovers and killdeer. Condor 91: 634-641.

Boyle, S.A. and F.B. Samson. 1985. Effects of nonconsumptive recreation on wildlife: A review. Wildlife Society Bulletin 13: 110-116.

Burger, J. 1981. Effect of human activity on birds at a coastal bay. Biological Conservation 21: 231-241.

Burger, J. 1986. The effect of human activity on shorebirds in two coastal bays in northeastern United States. Biological Conservation 13: 123-130.

Burger, J. 1991. Foraging behavior and the effect of human disturbance on the piping plover (*Charadrius melodus*). Journal of Coastal Research 7(1): 39-52.

Burger, J. and M. Gochfeld. 1981. Discrimination of the threat of direct versus tangential approach to the nest by incubating herring and great black-backed gulls. Journal of Comparative Physiological Psychology 95: 676-684.

Burger, J., M. Gochfeld, and L.J. Niles. 1995. Ecotourism and birds in coastal New Jersey: Contrasting responses of birds, tourists, and managers. Environmental Conservation 22: 56-65.

Burger, J. and M. Gochfeld. 1998. Effects of ecotourists on bird behavior at Loxahatchee National Wildlife Refuge, Florida. Environmental Conservation 25: 13-21.

Cairns, W.E. and I.A. McLaren. 1980. Status of the piping plover on the east coast of North America. American Birds 34: 206-208.

Cape Cod National Seashore. 1993. Piping plover nest found trampled by pedestrian. News Release. Cape Cod National Seashore, South Wellfleet, Massachusetts. 2 pp.

Collazo, J.A., J.R. Walters, and J.F. Parnell. 1994. Factors Affecting Reproduction and Migration of Waterbirds on North Carolina Barrier Islands. 1993 Annual Progress Report. North Carolina State University, Raleigh, North Carolina. 57 pp.

Erwin, R.M. 1980. Breeding habitat by colonially nesting water birds in two mid-Atlantic U.S. regions under different regimes of human disturbance. Biological Conservation 18: 39-51.

Erwin, R.M. 1989. Responses to Human Intruders by Birds Nesting in Colonies: Experimental Results and Management Guidelines. Colonial Waterbirds 12(1): 104-108.

Goldin, M.R. 1993. Effects of human disturbance and off-road vehicles on piping plover reproductive success and behavior at Breezy Point, Gateway National Recreation Area, New York, M.S. Thesis. University of Massachusetts, Amherst, Massachusetts. 128 pp.

Havera, S.P., L.R. Boens, M.M. Georgi, and R.T. Shealy. 1992. Human disturbance of waterfowl on Keokuk Pool, Mississippi River. Wildlife Society Bulletin 20: 290-298.

Henson, P.T. and A. Grant. 1991. The effects of human disturbance on trumpeter swan breeding behavior. Wildlife Society Bulletin 19: 248-257.

Hill, J.O. 1988. Aspects of breeding biology of Piping Plovers (*Charadrius melodus*) in Bristol County, Massachusetts, in 1988. Unpublished report. University of Massachusetts, Amherst, Massachusetts. 44 pp.

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

Jenkins, D.C. and J. Burger. 1987. New Jersey Endangered Beach-Nesting Bird Project: 1986 Survey and Management. New Jersey Department of Environmental Protection, New Jersey. 37 pp.

Kaiser, M.S. and E.K. Fritzell. 1984. Effects of river recreationists on green-backed heron behavior. Journal of Wildlife Management 48: 561-567.

Kahl, R. 1991. Boating disturbance of canvasbacks during migration at Lake Poygan, Wisconsin. Wildlife Society Bulletin 19: 242-248.

Klein, M.L. 1993. Waterbird behavioral responses to human disturbance. Wildlife Society Bulletin 21: 31-39.

Klein, M.L., S.R. Humphrey, and H.F. Percival. 1995. Effects of ecotourism on distribution of waterbirds in a wildlife refuge. Conservation Biology 9: 1454-1465.

Knight, R.L. and D.N. Cole. 1995. Wildlife responses to recreationists. Pp. 51-69 In R. L. Knight and D. N. Cole, eds. Wildlife and recreationists: coexistence through management and research. Island Press, Washington, DC.

Knight, R.L. and K.J. Gutzwiller, eds. 1995. Wildlife and recreationalists: coexistence through management and research. Island Press, Washington, D.C. 372 pp.

Korschgen, C.E., L.S. George, and W.L. Green. 1985. Disturbance of diving ducks by boaters on a migrational staging area. Wildlife Society Bulletin 13: 290-296.

Loegering, J.P. 1992. Piping Plover Breeding Biology, Foraging Ecology and Behavior on Assateague Island National Seashore, Maryland. M.S. Thesis. Virginia State Polytechnic Institute and State University, Blacksburg, Virginia. 262 pp.

McConnaughey, J.L., J.D. Fraser, S.D. Coutu, and J.P. Loegering. 1990. Piping plover distribution and reproductive success on Cape Lookout National Seashore. Unpublished report. Cape Lookout National Seashore, Morehead City, North Carolina. 83 pp.

Morton, J. M., A.C. Fowler, and R.L. Kilpatrick. 1989. Time and energy budgets of American black ducks in winter. Journal of Wildlife Management 53: 401-410.

Owen, M. 1973. The management of grassland areas for wintering geese. Wildfowl 24: 123-130.

Pfister, C., B.A. Harrington, and M. Lavine. 1992. The Impact of Human Disturbance on Shorebirds at a Migration Staging Area. Biological Conservation 60(2): 115-126.

Robertson, R.J. and N.J. Flood. 1980. Effects of Recreational Use of Shorelines on Breeding Bird Populations. Canadian Field-Naturalist 94(2): 131-138.

Rodgers, J.A. and H.T. Smith. 1995. Set-back distances to protect nesting bird colonies from human disturbance in Florida. Conservation Biology 9: 89-99.

Rodgers, J.A. and H.T. Smith. 1997. Buffer zone distances to protect foraging and loafing waterbirds from human disturbance in Florida. Wildlife Society Bulletin 25: 139-145.

Shaffer, F. and P. Laporte. 1992. Rapport synthese des recherches relatives au pluvier siffleur (*Charadrius melodus*) effectuees aux Iles-de-la-Madeleine de 1987 a 1991. Association quebecoise des groups d'ornithologues et Service canadien de la faune. 78 pp.

Strauss, E. 1990. Reproductive success, life history patterns, and behavioral variation in a population of Piping Plovers subjected to human disturbance (1982-1989). Ph.D. dissertation. Tufts University, Medford, Massachusetts.

United States Fish and Wildlife Service (USFWS). 1994. Northeastern Beach Tiger Beetle (*Cincindela dorsalis dorsalis*) Recovery Plan. U.S. Fish and Wildlife Service, Hadley, Massachusetts. 6 pp.

Ward, D.H. and R.A. Stehn. 1989. Response of brant and other geese to aircraft disturbance at Izembek Lagoon, Alaska. U.S. Fish and Wildlife Service, Alaska Fish and Wildlife Research Center. Final report to the Minerals Management Service. Anchorage, Alaska. 193 pp.

Welty, J. C. 1982. The life of birds. Saunders College Publishing, Philadelphia, Pennsylvania. 754 pp.

Williams, G.J. and E. Forbes. 1980. The habitat and dietary preferences of Dark-Bellied brent Geese and Widgeon in relation to agricultural management. Wildfowl 31: 151-157.

**FWS Form 3-2319**
**02/06**

## FINDING OF APPROPRIATENESS OF A REFUGE USE

**Refuge Name:** Monomoy National Wildlife Refuge

**Use:** Virtual Geocaching and Letterboxing

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

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

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

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

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

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

**Not Appropriate** _____ **Appropriate** ✔

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

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

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

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

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

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

**603 FW 1**
**Exhibit 1**
**Page 2**

## JUSTIFICATION FOR A FINDING OF APPROPRIATENESS OF A REFUGE USE

**Refuge Name:** Monomoy National Wildlife Refuge

**Use:** Virtual Geocaching and Letterboxing

## NARRATIVE:

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

Two of the priority public uses for national wildlife refuges–wildlife observation and interpretation–can be facilitated by geocaching. Geocaching can bring nontraditional visitors to the refuge, providing the opportunity to inform them about the mission of the Service and the National Wildlife Refuge System (Refuge System). Virtual geocaching and letterboxing activities are not priority public uses; however, they can facilitate priority public uses on the refuge. When designed carefully, these activities can be used as a form of interpretation to educate the public about the Service, the Refuge System, and the refuge. Virtual geocaching involves walking or hiking, which is allowed in designated areas of the refuge. Although hiking is not a priority public use of the Refuge System and is classified as a non-wildlife activity, most visitors hike the refuge for the wildlands experience it provides. Hiking usually occurs on designated trails through most of the year, as would virtual geocaching. These opportunities advertised on appropriate public web sites will build awareness of the Refuge System and will attract new visitors, many of whom might engage in other wildlife-dependent activities while at the refuge. Additionally, this use would encourage geocachers to stop at the visitor contact station to obtain refuge or wildlife viewing information. Letterboxing would only be allowed inside of refuge visitor contact stations and visitor centers. These activities will not materially interfere with or detract from fulfilling the Refuge System mission or the purpose for which the refuge was established.

These uses are anticipated to have similar impacts as other primary public uses such as interpretation and wildlife observation. Impacts of these uses will likely be minimal if conducted in accordance with refuge regulations.

For the reasons above, virtual geocaching and letterboxing is an appropriate use on Monomoy National Wildlife Refuge.

# COMPATIBILITY DETERMINATION

## USE:

Virtual Geocaching and Letterboxing

## REFUGE NAME:

Monomoy National Wildlife Refuge

## DATE ESTABLISHED:

June 1, 1944

## ESTABLISHING AND ACQUISITION AUTHORITY(IES):

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

## REFUGE PURPOSE(S):

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

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

## NATIONAL WILDLIFE REFUGE SYSTEM MISSION:

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

## DESCRIPTION OF USE:

**(a) What is the use?**
Geocaching is an outdoor activity in which the participants use a global positioning system (GPS) receiver, mobile device, or other navigational technique to find hidden containers called geocaches or caches. Geocaching has been described as a game of high-tech hide-and-seek. Variations on geocaching include virtual geocaching (e.g., Earthcaching, Trail Link, and GPS Adventure) and letterboxing. A description of each of these uses follows, based on the National Wildlife Refuge System (Refuge system), Guidance on Geocaching.

*Virtual Geocaching* utilizes hand-held GPS devices, but the goal of the activity is different and the activity can be enjoyed without a physical cache. Virtual caching provides GPS coordinates to existing points of interest, such as a facility, cultural feature, wayside exhibit, or object in public areas. For more information, visit *www.waymarking.com;* accessed October 2015.

*Earthcaching* is a type of virtual geocache. The web site lists a number of virtual caches that are educational in purpose and judged for suitability by a team supported by the Geological Society of America. For more information, visit *www.earthcache.org;* accessed October 2015.

*Trail Link* is a partnership between Geocaching.com and the Rails to Trails Conservancy to collect mapping data for more than 15,000 miles of trails nationwide. Members of the Rails to Trails Conservancy are encouraged to capture GPS coordinates as they hike. The GPS coordinates can be supplemented with photos and other interpretive information about particular points along the trails. For more information about the program and its possible application to Refuge System trails, visit *www.geocaching.com/railstotrails/default.aspx;* accessed October 2015.

*GPS Adventures* incorporates lesson plans from a number of educational programs about geography, history, science, and technology. The program includes a GPS Adventures maze to provide students with hands-on exploration of the use of GPS technology in support of school programs. For more information, visit *http://www.gpsmaze.com/index.html;* accessed October 2015.

*Letterboxing* involves the placement of a cache containing a stamp and an inkpad that participants use to document that they have discovered a specific location. Participants find the location by following clues offered on the web involving map coordinates or compass bearings. Letterboxing does not require leaving or removing caches as part of the challenge. For more information, visit *www.letterboxing.org;* accessed October 2015.

**(b) Is the use a priority public use?**
In their traditional form, these activities are not priority public uses. However, if these activities are designed and created under the guidance of appropriate refuge staff, they can be manipulated into forms of interpretation that are a priority public uses of the Refuge System under the National Wildlife Refuge System Administration Act of 1966 (16 U.S.C. 668dd-668ee) and the National Wildlife Refuge System Improvement Act of 1997 (Public Law 105-57).

**(c) Where would the use be conducted?**
Certain areas on Monomoy National Wildlife Refuge (NWR) are seasonally closed to public access at the refuge manager's discretion to protect sensitive habitats or species of concern, minimize conflicts with other refuge activities, or respond to human health and safety concerns. All geocaching activities would be only conducted in areas that are open to the public, including the Morris Island trail system, and designated areas on Monomoy NWR. Geocaching activities would avoid sensitive areas prone to disturbance (e.g., sensitive vegetation areas) or degradation (e.g., soil compaction), and would be designed to minimize impacts to endangered species, nesting birds or other breeding, feeding, or resting wildlife. Virtual geocaching could occur in areas open to the public throughout the refuge, including in wilderness areas. Because letterboxing requires a physical cache, it would only occur inside visitor contact stations or visitor centers.

**(d) When would the use be conducted?**
Monomoy NWR is open to the public from 1/2-hour before sunrise to 1/2-hour after sunset. Virtual geocaching would occur during regular refuge hours any time of the year in any areas open to public access. Use of the refuge for these activities is likely to be highest in late spring, summer, and early fall. Letterboxing would only occur when visitor contact stations or visitor centers are open.

**(e) How would the use be conducted?**
Virtual geocaching can be used as a tool to get people to visit the refuge and the wilderness areas. The use is primarily facilitated by pedestrian walking and hiking access, commercial ferry access, or by boat. Boats are allowed to land anywhere along the refuge shoreline, with the exception of posted tern colonies and piping plover nesting areas. The presence of hazardous currents and shoals encourages visitors to land their boats in only a few designated locations. Interpretive materials associated with geocaching give the general public an opportunity to learn about the refuge, the Refuge System, and the U.S. Fish and Wildlife Service (Service). The uses are self-regulating, with geocaching coordinates and clues designed to keep visitors on designated trails or within open public areas. Some geocaches may not be available year-round, depending on staffing and seasonal wildlife related closures. Appropriate refuge staff will approve all geocaches, and all areas where geocaching would be allowed are already managed by the refuge for other wildlife-dependent recreational activities.

**(f) Why is this use being proposed?**
Virtual geocaching and letterboxing are not priority public uses; however, they can facilitate priority public uses on the refuge. When designed carefully, this activity can be used as a form of interpretation to educate the public about refuge management challenges and goals, refuge missions, and priority public uses. Virtual geocaching involves hiking, which is allowed in designated areas of the refuge, and although hiking is not a priority public use of the Refuge System and is classified as a non-wildlife-dependent activity, most visitors hike the refuge for the wildlands experience it provides. Hiking usually occurs on designated trails or in the open areas of the wilderness area through most of the year, as would geocaching. Virtual geocaching opportunities advertised on appropriate public web sites will build awareness of the Refuge System and attract new visitors, who will partake in wildlife-dependent activities while at the refuge. Additionally, geocachers and people engaged in letterboxing will likely stop at the visitor center to obtain refuge or wildlife viewing information.

## AVAILABILITY OF RESOURCES:

The refuge has a single trail system on Morris Island in place to support public uses. Additionally, there are many areas on Monomoy NWR that are seasonally open to public uses when not closed to protect wildlife. The estimated costs of allowing geocaching within areas open to the public are fairly low because there little infrastructure is involved. Some staff time to develop and promote the activity will be needed, as well as the procurement of materials to conduct the program. The following breakdown shows the estimated amount of funds needed to administer the program.

| | | | |
|---|---|---|---|
| GS-11 Visitor Services Manager | 1 staff | 40 hours | $1,800 |
| GS-11 Law Enforcement Officer | 1 staff | 40 hours | $1,800 |
| Materials | | | $ 500 |
| **Total recurring annual costs:** | | | **$4,100** |

## ANTICIPATED IMPACTS OF THE USE:

The proposed use is anticipated to have the same level of impacts as primary public uses because the access and activities are very similar. Since refuge staff will supervise these activities, the impacts of geocaching will likely be minimal if conducted in accordance with refuge regulations. Possible impacts include disruption of nesting migratory bird populations, terns, shorebirds, and other bird populations feeding and resting near the trails during certain times of the year, impacts to larval threatened northeastern beach tiger beetle populations, and disruption of local seal populations.

On Monomoy NWR, area closures are created to protect priority nesting migratory tern and shorebird species. Although these closure areas are designed to minimize human impacts, the potential exists for impacts to unobserved nesting animals. Conflicts arise when migratory birds and humans are present in the same areas (Boyle and Samson 1985). Response of wildlife to human activities includes departure from site (Owen 1973, Burger 1981, Kaiser and Fritzell 1984, Korschgen et al. 1985, Henson and Grant 1991, Kahl 1991, Klein 1993), use of sub-optimal habitat (Erwin 1980, Williams and Forbes 1980), altered behavior (Burger 1981, Korschgen et al. 1985, Morton et al. 1989, Ward and Stehn 1989, Havera et al. 1992, Klein 1993), and increase in energy expenditure (Morton et al. 1989, Bélanger and Bédard 1990).

Numerous studies have documented that migratory birds are disturbed by human activity on beaches. Erwin (1989) documented disturbance of common terns and skimmers and recommended that human activity be restricted to a distance of 100 meters around nesting sites. Pfister et al. (1992) found that the impact of disturbance was greater on species using the heavily disturbed front side of the beach, with the abundance of the impacted species being reduced by as much as 50 percent. In studying the effects of recreational use of shorelines on nesting birds, Robertson et al. (1980) discovered that disturbance negatively impacted species composition. Piping plovers, which intensively use the refuge, are also negatively impacted by human activity. Pedestrians on beaches may crush eggs (Jenkins and Burger 1987, Hill 1988, Shaffer and Laporte 1992, Cape Cod National Seashore 1993, Collazo et al. 1994). Other studies have shown that if pedestrians cause incubating plovers to leave their nest, the eggs can overheat (Bergstrom 1991) or can cool to the point of embryo death (Welty 1982). Pedestrians have been found to displace unfledged chicks (Strauss 1990, Burger 1991, Hoopes 1993, Loegering 1992, Goldin 1993).

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

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

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

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

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

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

Individuals hiking to South Monomoy Island for geocaching activities could potentially impact the larval stage of the threatened northeastern beach tiger beetle. The recovery plan for this species describes that many of the species' habitats are threatened by human impacts such as habitat alteration and recreational activities (Service 1994). Larval burrows are especially susceptible to trampling, which results in excess energy expenditure and reduced time hunting for the inhabiting individual. We will continue to survey to determine the location and extent of larval beetle occurrence and habitat, and use closures or re-routing to avoid larval habitats, as warranted.

Pedestrian use also has the potential to disturb loafing seals. Gray and harbor seals haul out on the refuge year round. We will enforce the 150-foot buffer around all seals as required by the National Oceanic Atmospheric Administration to ensure compliance with the Marine Mammals Protection Act.

Only virtual geocaching will be allowed on refuge, including in wilderness areas, thereby eliminating the erection of any signs or manmade structures to assist in the pursuit of the cache. Given the difficulty in accessing the wilderness area, lower numbers of individuals are expected to engage in virtual geocaching in the wilderness. There should be no diminishment of wilderness character or impact to other wilderness visitor if virtual geocaching is allowed in the wilderness area. All of North Monomoy Island and most of South Monomoy Island are designated wilderness and are part of the National Wilderness Preservation System. Wilderness, in contrast with those areas where humans and their works dominate the landscape, is an area where the Earth and its community of life are untrammeled by humans, where humans are visitors who do not remain. Preserving wilderness character requires that we maintain both the visible and invisible aspects of wilderness. Aspects of wilderness character include maintaining the natural, scenic condition of the land; providing environments for native plants and animals, including those threatened or endangered; maintaining watersheds and airsheds in a healthy condition; maintaining natural night skies and soundscapes; retaining the primeval character of and influence on the land; serving as a benchmark for ecological studies; and

providing opportunities for solitude, primitive and unconfined outdoor recreation, risk, adventure, education, personal growth experiences, a sense of connection with nature and values beyond one's self, a link to our American cultural heritage, and mental and spiritual restoration in the absence of urban pressures. We provide opportunities for appropriate and compatible use and enjoyment of wilderness areas in a manner that will preserve their wilderness character and "leave them unimpaired for future use and enjoyment as wilderness."

Unmanaged geocaching has the potential to damage or kill plants and lead to new, unwanted, impromptu trails on the refuge that become shortcuts through more ecologically sensitive sites. Heavy use of designated, managed, or unmanaged pedestrian travel routes can ultimately lead to areas void of vegetation (McDonnell 1981, Vaske et al. 1992) and potentially destabilize dunes and interdunal wetlands, which are difficult to stabilize and restore to a naturally functioning condition (Kucinski and Einsenmenger 1943, Cole 2002, Goldsmith 2002, Grady 2002, O'Connell 2008).

This use will not affect wilderness character. These activities do not alter the natural scenic condition of the land and will not occur at a scale large enough to diminish the environment for native plants and animals. In fact, virtual geocaching could be used to enhance a visitor's understanding and appreciation of wilderness.

## PUBLIC REVIEW AND COMMENT:

As part of the comprehensive conservation planning (CCP) process for the Monomoy NWR, a draft of this compatibility determination underwent a 180-day public comment period concurrent with the release of our draft CCP/Environmental Impact Statement (EIS). This final compatibility determination resulted from that public review and comment process. It underwent a further 37-day public review period concurrent with the release of the final CCP/EIS. No comments were received on the compatibility determination and it has remained unchanged.

## DETERMINATION (CHECK ONE BELOW):

_____Use is not compatible.

__X__Use is compatible with the following stipulations.

## STIPULATIONS NECESSARY TO ENSURE COMPATIBILITY:

- No geocache will be created or posted on public web sites without the permission of appropriate refuge staff.
- Geocaches will be created only in areas where there is already a designated trail or in areas that are open to the public.
- Virtual geocaching would occur during regular refuge hours any time of the year in any areas open to public use.
- All individuals taking part in geocaching must adhere to area closures and understand that certain geocaches may not be available year-round. There are certain times of the year when the refuge is critically important to migratory birds, including threatened and endangered species. The location of the most important nesting, staging and migratory stopover (foraging and resting) habitat varies depending on a number of natural factors (e.g., weather, landform, prey distribution and abundance, and predator presence) as well as human disturbance at other sites. Refuge staff will evaluate the disturbance pressure to migratory birds caused by the presence of individuals engaged in this use. To ensure that this use remains compatible, meaning it does not materially interfere with or detract from the migratory bird purpose of the refuge, it may be necessary to restrict access through the implementation of seasonal and/or area closures. The location and size of these closures are not fixed and will vary over time. Visitors will be expected to comply with closures. Updates on closures will be available at the Headquarters and on the refuge web site.

- Appropriate notification must be listed on public web sites when a geocache is not available as a result of area closures.
- No physical item will be placed or left on the refuge.
- Letterboxing would only be allowed within visitor contact stations or visitor centers.
- Appropriate notification about the availability of letterboxes based on staffing and visitor contact station open hours will be posted on all public web sites.

## JUSTIFICATION:

The Service and the Refuge System maintain the goal of providing opportunities to view wildlife and engage in interpretation. Allowing the use of refuge areas that are already open to the public, including one trail system on Morris Island, to persons participating in geocaching supports this goal. Geocaching would provide visitors with the chance to view wildlife and take part in interpretation about the refuge, promoting public appreciation of the conservation of wildlife and habitats. Geocaching activities are not priority public uses; however, they facilitate priority public uses on the refuge, and in some cases can be used as a form of interpretation, which is a priority public use. Virtual geocaching and letterboxing activities would not materially interfere with or detract from the fulfillment of the Refuge System mission or the purpose for which the refuge was established.

In 2009, the Service developed final guidance on geocaching. This policy can be found in at *http://www.fws.gov/ridgefieldrefuges/ridgefield/pdf/Friends%202010/Recreational%20Geocaching%20Guidance.pdf*; accessed October 2015.

The Service's wilderness management policy (610 FW 2) does not prohibit the use of GPS units within refuge wilderness areas. However, managers need to make sure that wilderness character is considered when evaluating the appropriateness of GPS recreational activities. Service policy (610 FW 2, 2.31) does state that competitive public events or contests are prohibited in wilderness, such as a large organized GPS geocaching event.

## SIGNATURE:

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

## CONCURRENCE:

Regional Chief: Scott B. Kahn (Signature) March 18, 2016 (Date)

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

## LITERATURE CITED:

Bélanger, L. and J. Bédard. 1990. Energetic cost of man-induced disturbance to staging snow geese. Journal of Wildlife Management. 54: 36.

Bergstrom, P.W. 1991. Incubation temperatures of Wilson's plovers and killdeer. Condor. 91: 634-641.

Boyle, S.A. and F.B. Samson. 1985. Effects of nonconsumptive recreation on wildlife: A review. Wildlife Society Bulletin. 13: 110.

Burger, J. 1981. Effect of human activity on birds at a coastal bay. Biological Conservation. 21: 231-241.

Burger, J. 1986. The effect of human activity on shorebirds in two coastal bays in northeastern United States. Biological Conservation 13: 123-130.

Burger, J. 1991. Foraging behavior and the effect of human disturbance on the piping plover (*Charadrius melodus*). Journal of Coastal Research, 7(1): 39-52.

Burger, J. and M. Gochfeld. 1981. Discrimination of the threat of direct versus tangential approach to the nest by incubating herring and great black-backed gulls. Journal of Comparative Physiological Psychology. 95: 676-684.

Burger, J., M. Gochfeld, and L.J. Niles. 1995. Ecotourism and birds in coastal New Jersey: Contrasting responses of birds, tourists, and managers. Environmental Conservation 22: 56-65.

Burger, J. and M. Gochfeld. 1998. Effects of ecotourists on bird behavior at Loxahatchee National Wildlife Refuge, Florida. Environmental Conservation 25: 13-21.

Collazo, J.A., J.R. Walters, and J.F. Parnell. 1994. Factors Affecting Reproduction and Migration of Waterbirds on North Carolina Barrier Islands. 1993 Annual Progress Report. North Carolina State University, Raleigh, North Carolina. 57 pp.

Cole, D.N. 2002. Ecological impacts of wilderness recreation and their management. Chapter 15, pp. 413-459 In J. C. Hendee and C.P. Dawson, eds. Wilderness Management: Stewardship and Protection of Resources and Values, Third Edition. Fulcrum Publishing, Golden, Colorado. 640 pp.

Erwin, R.M. 1980. Breeding habitat by colonially nesting water birds in two mid-Atlantic U.S. regions under different regimes of human disturbance. Biological Conservation. 18: 39-51.

Erwin, R.M. 1989. Responses to Human Intruders by Birds Nesting in Colonies: Experimental Results and Management Guidelines. Colonial Waterbirds 12(1): 104-108.

Goldin, M.R. 1993. Effects of human disturbance and off-road vehicles on piping plover reproductive success and behavior at Breezy Point, Gateway National Recreation Area, New York, M.S. Thesis. University of Massachusetts, Amherst, Massachusetts. 128 pp.

Goldsmith, W. 2002. History, theory and practice of bio-engineering in coastal areas. Pp. 37-59 In J. F. O'Connell, ed. Stabilizing Dunes and Coastal Banks using Vegetation and Bio-engineering: Proceedings of a Workshop held at the Woods Hole Oceanographic Institute, Woods Hole, Massachusetts. Cape Cod Cooperative Extension and Sea Grant at Woods Hole Oceanographic Institute. Technical Report WHOI-2002-11.

Grady, J. 2002. Dune vegetation planting and sand fencing: The Duxbury Beach Experience. Pp. 61-73. In J. F. O'Connell, ed. Stabilizing Dunes and Coastal Banks using Vegetation and Bio-engineering: Proceedings of a Workshop held at the Woods Hole Oceanographic Institute, Woods Hole, Massachusetts. Cape Cod Cooperative Extension and Sea Grant at Woods Hole Oceanographic Institute. Technical Report WHOI-2002-11.

Havera, S.P., L.R. Boens, M.M. Georgi, and R.T. Shealy. 1992. Human disturbance of waterfowl on Keokuk Pool, Mississippi River. Wildlife Society Bulletin. 20: 290-298.

Henson, P.T. and A. Grant. 1991. The effects of human disturbance on trumpeter swan breeding behavior. Wildlife Society Bulletin 19: 248-257.

Hill, J.O. 1988. Aspects of breeding biology of Piping Plovers (*Charadrius melodus*) in Bristol County, Massachusetts, in 1988. Unpublished report. University of Massachusetts, Amherst, Massachusetts. 44 pp.

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

Jenkins, D. C. and J. Burger. 1987. New Jersey Endangered Beach-Nesting Bird Project: 1986 Survey and Management. New Jersey Department of Environmental Protection, New Jersey. 37 pp.

Kaiser, M.S. and E.K. Fritzell. 1984. Effects of river recreationists on green-backed heron behavior. Journal of Wildlife Management. 48: 561-567.

Kahl, R. 1991. Boating disturbance of canvasbacks during migration at Lake Poygan, Wisconsin. Wildlife Society Bulletin. 19: 242-248.

Klein, M.L. 1993. Waterbird behavioral responses to human disturbance. Wildlife Society Bulletin. 21: 31-39.

Klein, M.L., S.R. Humphrey, and H. F. Percival. 1995. Effects of ecotourism on distribution of waterbirds in a wildlife refuge. Conservation Biology 9: 1454-1465.

Knight, R.L. and D.N. Cole. 1995. Wildlife responses to recreationists. Pp. 51-69 in R. L. Knight and K. J. Gutzwiller, eds. Wildlife and recreationists: coexistence through management and research. Washington, DC, Island Press.

Korschgen, C.E., L.S. George, and W.L. Green. 1985. Disturbance of diving ducks by boaters on a migrational staging area. Wildlife Society Bulletin. 13: 290-296.

Kucinski, K.J. and W.S. Einsenmenger. 1943. Sand dune stabilization on Cape Cod. Economic Geography 19(2): 206-214.

Loegering, J.P. 1992. Piping Plover Breeding Biology, Foraging Ecology and Behavior on Assateague Island National Seashore, Maryland. M.S. Thesis. Virginia State Polytechnic Institute and State University, Blacksburg, Virginia. 262 pp.

McDonnell, M.J. 1981. Trampling effects on coastal dune vegetation in the parker river national wildlife refuge, Massachusetts, U.S.A. Biological Conservation 21(4): 289-301.

Morton, J.M., A.C. Fowler, and R.L. Kilpatrick. 1989. Time and energy budgets of American black ducks in winter. Journal of Wildlife Management. 53: 401-410 (also see corrigendum in Journal of Wildlife Management. 54: 683).

O'Connell, J. 2008. Coastal dune protection and restoration: using "Cape" American beachgrass and fencing. Woods Hole Sea Grant and Cape Cod Cooperative Extension. Marine Extension Bulletin. 15 pp.

Owen, M. 1973. The management of grassland areas for wintering geese. Wildfowl. 24: 123-130.

Pfister, C., B.A. Harrington, and M. Lavine. 1992. The Impact of Human Disturbance on Shorebirds at a Migration Staging Area. Biological Conservation 60(2): 115-126.

Robertson, R.J. and N.J. Flood. 1980. Effects of Recreational Use of Shorelines on Breeding Bird Populations. Canadian Field-Naturalist 94(2): 131-138.

Rodgers, J.A. and H.T. Smith. 1995. Set-back distances to protect nesting bird colonies from human disturbance in Florida. Conservation Biology 9: 89-99.

Rodgers, J.A. and H.T. Smith. 1997. Buffer zone distances to protect foraging and loafing waterbirds from human disturbance in Florida. Wildlife Society Bulletin 25: 139-145.

Shaffer, F. and P. Laporte. 1992. Rapport synthese des recherches relatives au pluvier siffleur (*Charadrius melodus*) effectuees aux Iles-de-la-Madeleine de 1987 a 1991. Association quebecoise des groups d'ornithologues et Service canadien de la faune. 78 pp.

Strauss, E. 1990. Reproductive success, life history patterns, and behavioral variation in a population of Piping Plovers subjected to human disturbance (1982-1989). Ph.D. dissertation. Tufts University, Medford, Massachusetts.

United States Fish and Wildlife Service (USFWS). 1994. Northeastern Beach Tiger Beetle (*Cincindela dorsalis dorsalis* Say) Recovery Plan. U.S. Fish and Wildlife Service, Hadley, Massachusetts. 6pp.

Vaske J.V., R.D. Deblinger, and M.P. Donnelly. 1992. Barrier beach impact management planning: Findings from three locations in Massachusetts. Canadian Water Resources Assoc. Journal 17: 278-290.

Ward, D.H. and R.A. Stehn. 1989. Response of brant and other geese to aircraft disturbance at Izembek Lagoon, Alaska. U.S. Fish and Wildlife Service, Alaska Fish and Wildlife Research Center. Final report to the Minerals Management Service. Anchorage, Alaska. 193 pp.

Welty, J.C. 1982. The life of birds. Saunders College Publishing, Philadelphia, Pennsylvania. 754 pp.

Williams, G.J. and E. Forbes. 1980. The habitat and dietary preferences of Dark-Bellied Brent Geese and Widgeon in relation to agricultural management. Wildfowl. 31: 151-157.

# COMPATIBILITY DETERMINATION

## USE:

Wildlife Observation and Photography

## REFUGE NAME:

Monomoy National Wildlife Refuge

## DATE ESTABLISHED:

June 1, 1944

## ESTABLISHING AND ACQUISITION AUTHORITY(IES):

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

## REFUGE PURPOSE(S):

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

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

## NATIONAL WILDLIFE REFUGE SYSTEM MISSION:

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

## DESCRIPTION OF USE:

**(a) What is the use? Is the use a priority public use?**
The uses are wildlife observation and photography. Wildlife observation and photography are priority public uses of the National Wildlife Refuge System (Refuge System) under the National Wildlife Refuge System Administration Act of 1966 (16 U.S.C. 668dd-668ee) and the National Wildlife Refuge System Improvement Act of 1997 (Refuge Improvement Act) (Public Law 105-57). Commercial photography is evaluated in a separate finding of appropriateness and compatibility determination entitled, "Commercial Wildlife and Landscape Filming and Photography."

**(b) Where would the use be conducted?**
Certain areas on Monomoy National Wildlife Refuge (NWR) are seasonally closed to public access from April 15 to September 15 to protect sensitive habitats or species of concern. Refuge staff prepare a closed areas map

each April and make it available to the public on the refuge web site, inside the refuge visitor contact station, and at the Morris Island Trail kiosk.

Wildlife observation and photography can be conducted on Monomoy NWR anywhere that is open for public use. On Morris Island, these uses will occur on the Morris Island Interpretive Trail, at overlooks, and along the beach, including the 3/4-mile Morris Island Trail. The trail begins near the refuge headquarters/visitor contact station, goes along the top of the coastal bluff, and down a steep set of stairs to the beach, then through the sand dunes and along salt marshes and salt ponds. The public is asked to remain on this trail.

There are no official trails on North Monomoy Island, although there is a corridor crossing the island. On South Monomoy Island, there are no official trails, although there are paths that have been created over time by visitors or staff conducting management actions. Because these areas are part of the nationally designated wilderness area, these trails are not maintained, and except for seasonal closures, visitors are free to walk anywhere they wish to engage in wildlife observation or photography.

**(c) When would the use be conducted?**
Wildlife observation and photography would occur year-round, peaking during May 15 to October 15, during daylight hours when the refuge is otherwise open for public use, 1/2-hour before sunrise to 1/2-hour after sunset. Some activities may be allowed during non-daylight hours when the refuge is otherwise closed to public use under a special use permit (SUP) or in conjunction with refuge staff-led or volunteer-led programs.

**(d) How would the use be conducted?**
Visitors engaged in wildlife observation and photography tend to do so individually or in small groups, with the exception of outings by birding and photography clubs, which often have 20 or more participants in organized field trips to the refuge. Birders access both South Beach, which is managed as part of the Cape Cod National Seashore, as well as North Monomoy Island and South Monomoy Island. Due to the constant geomorphological changes that occur in this area, opportunities for excellent wildlife observation and photography can be found in both areas, with one area providing more opportunities than another at any given time. Most birders and photographers who depart from Morris Island will go to both South Beach and North and South Monomoy Islands on their trip.

Access to refuge areas other than Morris Island will be by commercial ferry, motorized boat, or nonmotorized boat. Once on refuge lands, all access for wildlife observation and photography activities will be on foot. Motorized equipment is not allowed within the Monomoy Wilderness, which encompasses the more remote portions of Monomoy NWR and includes the majority of the refuge's lands. The Morris Island portion of Monomoy NWR is accessible by motor vehicles and bicycles and parking is provided. However, outside the refuge parking lot, no motorized vehicle or bicycle operation is permitted.

In general, wildlife observation and photography activities will be self-guided. Refuge staff do not maintain trails in the Monomoy Wilderness for public use. Staff will focus maintenance efforts on the Morris Island Interpretive Trail and existing and future structures on Morris Island. Currently, there is one observation and photography platform and a coastal bluff viewing area. There is also a short boardwalk at the beginning of the Morris Island Trail, which leads to an overlook and a tiered stairway. The stairway leads visitors to the shoreline and offers high-quality visibility of North Monomoy Island and South Monomoy Island and has a bench for resting. All these existing structures must be maintained annually. There is a new observation platform and photography blind proposed for some point along the Morris Island Interpretive Trail.

New permanent human-made structures are not permitted within wilderness, and in keeping with preserving and protecting wilderness values, none are planned, except for the Morris Island non-wilderness portion of Monomoy NWR. Portable, temporary blinds are allowed in open areas of the refuge provided they are not left standing when unattended or unoccupied.

**(e) Why is this use being proposed?**
The Refuge Improvement Act states that priority, wildlife-dependent, public uses should receive enhanced consideration in planning and be facilitated on refuges to the extent they are compatible.

The wildlife observation and photography programs promote refuge purposes and management objectives and increase public knowledge and understanding of wildlife and the importance of habitat protection and management. Refuge visitors who participate in wildlife observation and photography will gain an understanding of the missions of the U.S. Fish and Wildlife Service, the Refuge System, and the contribution of the Monomoy NWR to this system.

## AVAILABILITY OF RESOURCES:

Wildlife observation and photography currently occur with existing staff, but will be enhanced with the provision of new structures and staff. Monomoy NWR has long been one of the premier birding and photography sites in Massachusetts. Maintaining this reputation has more to do with the physical characteristics of Monomoy NWR and how the habitat changes with changes in geomorphology than it does with the existence of refuge staff and infrastructure. However, improvements in the quality of the programs will be realized with the construction of new facilities on Morris Island and two new staff positions, a portion of which will support the Monomoy NWR public use program.

| | | | |
|---|---|---|---|
| **New construction and renovation/estimated costs:** | | | |
| Observation platform – install new, handicapped accessible platform | | | $ 15,000 |
| Morris Island Trail photography blind—1 new | | | $ 5,000 |
| **Total new costs:** | | **$20,000** | |
| **Recurring annual costs:** | | | |
| Regular maintenance of platforms, photo blinds, trails | | | $ 5,000 |
| Equipment and supplies | | $ 5,000 | |
| GS-11 Visitor Services Manager | 1 staff | 160 hours | $ 7,200 |
| GS-9 Visitor Services Specialist | 1 staff | 120 hours | $ 4,500 |
| WG-6 Maintenance Worker 1 staff | 320 hours | $ 9,600 | |
| GS-11 Law Enforcement 1 staff | 160 hours | $ 7,200 | |
| **Total recurring annual costs:** | | | **$38,500** |

## ANTICIPATED IMPACTS OF THE USE:

The majority of the impact from wildlife observation and photography will be disturbance to resting, feeding or nesting migratory birds and resting seals. There will be some trampling of vegetation. Incidences of littering, vegetation removal, and vandalism may increase as a result of the projected increase in visitation. On Morris Island, with use restricted to designated trails and other refuge structures, we predict the impacts will be confined to small areas and in areas already affected.

New structures will be located on the Morris Island Interpretive Trail outside the Monomoy Wilderness with consideration of the long-term consequences and cumulative impacts to wildlife and habitats. Most of the new structures proposed, e.g., kiosks, observation platforms, photography blinds, would each result in habitat losses of less than 1/4-acre.

Visitors engaged in wildlife observation and photography have a vested interest in minimizing disturbance to the wildlife they wish to observe and photograph. However, birders and photographers are known to disturb wildlife in an attempt to get closer looks at the objects of their attention. On North Monomoy Island and South Monomoy Island in particular, pedestrians have the potential of impacting shorebird, waterfowl, and other migratory bird populations feeding and resting on beaches and tidal flats. Pedestrians can also impact seals resting on the beach if they get too close. Conflicts arise when migratory birds and humans are present in the same areas (Boyle and Samson 1985). Response of wildlife to human activities includes departure from site (Owen 1973, Burger 1981, Kaiser and Fritzell 1984, Korschgen et al. 1985, Henson and Grant 1991, Kahl 1991, Klein 1993), use of sub-optimal habitat (Erwin 1980, Williams and Forbes 1980), altered behavior (Burger 1981, Korschgen et al. 1985, Morton et al. 1989, Ward and Stehn 1989, Havera et al. 1992, Klein 1993), and increase in energy expenditure ( Morton et al. 1989, Bélanger and Bédard 1990).

Numerous studies have documented that migratory birds are disturbed by human activity on beaches. Erwin (1989) documented disturbance of common terns and skimmers and recommended that human activity be restricted to a distance of 100 meters around nesting sites. Klein (1993) in studying waterbird response to human disturbance found that, as intensity of disturbance increased, avoidance response by the birds increased, and found that out-of-vehicle activity to be more disruptive than vehicular traffic. Pfister et al. (1992) found that the impact of disturbance was greater on species using the heavily disturbed front side of the beach, with the abundance of the impacted species being reduced by as much as 50 percent. In studying the effects of recreational use of shorelines on nesting birds, Robertson et al. (1980) discovered that disturbance negatively impacted species composition. Piping plovers, which intensively use the refuge, are also impacted negatively by human activity. Pedestrians on beaches may crush eggs (Jenkins and Burger 1987, Hill 1988, Shaffer

and Laporte 1992, Cape Cod National Seashore 1993, Collazo et al. 1994). Other studies have shown that if pedestrians cause incubating plovers to leave their nest, the eggs can overheat (Bergstrom 1991) or can cool to the point of embryo death (Welty 1982). Pedestrians have been found to displace unfledged chicks (Strauss 1990, Burger 1991, Hoopes 1993, Loegering 1992, Goldin 1993).

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

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

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

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

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

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

The proposed use has the potential to intermittently interrupt the feeding habits of a variety of shorebirds, gulls, and terns, but encounters between pedestrians and migratory birds will be temporary. Refuge staff will manage wildlife observation and photographer access via seasonal closures to minimize disturbance to nesting, resting, and foraging waterbirds on the refuge.

The recovery plan for the Northeastern Beach Tiger Beetle describes that many of the species' habitats are threatened by human impacts such as habitat alteration and recreational activities (U.S. Fish & Wildlife Service 1994). Larval burrows are especially susceptible to trampling, which results in excess energy expenditure and reduced time hunting for the inhabiting individual. We will continue to survey to determine the location and extent of larval beetle occurrence and habitat, and use closures and re-routing to avoid larval habitats, as warranted.

Visitor use also has the potential to disturb loafing seals. Gray and harbor seals haul out on the refuge year round. A 150-foot buffer zone around all seals is required by the National Oceanic Atmospheric Administration to ensure compliance with the Marine Mammals Protection Act.

Heavy beach use can dry out the sand and contribute to beach erosion. Trash left on the beach, particularly food or wrappers, can attract predators that prey on nesting and roosting shorebirds. Impacts of wildlife observation and photography are likely to be minimal if conducted in accordance with refuge regulations. We will manage refuge closures that restrict pedestrian access to minimize disturbance to priority avian species during critical times of the year. Closures can be expanded or contracted as needed, depending on bird activity and results of further disturbance studies. The refuge is a leave-no-trace, carry-in-carry-out facility. We encourage all outfitters and guides to pack in and pack out all food containers, bottles, wrappers, trash, and

other waste and refuse. Littering, dumping, and abandoning property are prohibited by Federal regulation at 50 CFR 27.93 and 50 CFR 27.94.

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

Wildlife observation and photography will not affect wilderness character. These activities do not alter the natural, scenic condition of the land and will not occur at a scale large enough to diminish the environment for native plants and animals.

Large groups have the potential to negatively infringe on the wilderness experience for those visitors who come to the refuge specifically to have a wilderness experience. This will generally be a short-term impact to wilderness visitors.

## PUBLIC REVIEW AND COMMENT:

As part of the comprehensive conservation planning (CCP) process for the Monomoy National Wildlife Refuge, a draft of this compatibility determination underwent a 180-day public comment period concurrent with the release of our draft CCP/Environmental Impact Statement (EIS). This final compatibility determination resulted from that public review and comment process. It underwent a further 37-day public review period concurrent with the release of the final CCP/EIS. No comments were received on the compatibility determination and it has remained unchanged.

## DETERMINATION (CHECK ONE BELOW):

_____Use is not compatible.

__**X**__Use is compatible with the following stipulations.

## STIPULATIONS NECESSARY TO ENSURE COMPATIBILITY:

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

- Access for wildlife observation and photography activities will be on foot, or by ferry, boat, and sea kayak. No motorized vehicles will be allowed on the refuge and in the wilderness areas.
- Activities will be in public areas only (unless a special use permit is approved) where only minimal direct and short-term impacts are predicted, and adverse, long-term, cumulative impacts are not anticipated.
- Periodic evaluations will be done to insure that visitors are not causing unacceptable adverse impacts. If we have evidence of unacceptable impacts occurring, we will modify or curtail access as deemed necessary by the refuge manager.
- Occasional law enforcement patrol and regular staff presence should minimize potential violations. The refuge is open 1/2-hour before sunrise to 1/2-hour after sunset for wildlife observation and photography. These restrictions will be maintained. Refuge regulations will be posted and enforced.
- All photographers must follow refuge regulations. On a case by case basis, photographers may be issued a SUP to photograph inside closed areas. Permittees must follow the conditions outlined in the permit, which normally includes notification of refuge personnel each time any activity occurs in closed areas. Use of a closed area will be heavily restricted appropriately to reduce disturbance to wildlife.

## JUSTIFICATION:

Wildlife observation and photography are priority, wildlife-dependent, public uses identified by the Refuge Improvement Act. By definition, these activities have been determined appropriate by law and, when compatible, are to be facilitated on refuges. These programs support the mission of the Refuge System by promoting an understanding and appreciation of natural and cultural resources and their management within a national system of refuges. Our programs will reach out to all segments of the public to expand support for the refuge system. Individual refuge programs will be consistent with, and fully support, the goals and objectives in the Monomoy NWR CCP.

We do not expect pedestrian access to materially interfere with or detract from the mission of the Refuge System, nor diminish the purpose for which the refuge was established. It will not pose significant adverse effects on refuge resources, interfere with public use of the refuge, or cause an undue administrative burden. These uses facilitate wildlife observation and photography, and will provide compatible recreational opportunities for visitors to observe and learn about wildlife and habitats firsthand.

## SIGNATURE:

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

## CONCURRENCE:

Regional Chief: Scott B Kahn (Signature) March 18, 2016 (Date)

## MANDATORY 15 YEAR RE-EVALUATION DATE: March 18, 2031

## LITERATURE CITED:

Bélanger, L. and J. Bédard. 1990. Energetic cost of man-induced disturbance to staging snow geese. Journal of Wildlife Management. 54: 36.

Bergstrom, P.W. 1991. Incubation temperatures of Wilson's plovers and killdeer. Condor. 91: 634-641.

Boyle, S.A. and F.B. Samson. 1985. Effects of nonconsumptive recreation on wildlife: A review. Wildlife Society Bulletin. 13: 110.

Burger, J. 1981. The effect of human activity on birds at a coastal bay. Biological Conservation. 21: 231-241.

Burger, J. 1986. The effect of human activity on shorebirds in two coastal bays in northeastern United States. Biological Conservation 13:1 23-130.

Burger, J. 1991. Foraging behavior and the effect of human disturbance on the piping plover (*Charadrius melodus*). Journal of Coastal Research, 7(1): 39-52.

Burger, J. and M. Gochfeld. 1981. Discrimination of the threat of direct versus tangential approach to the nest by incubating herring and great black-backed gulls. Journal of Comparative Physiological Psychology. 95: 676-684.

Burger, J., M. Gochfeld, and L.J. Niles. 1995. Ecotourism and birds in coastal New Jersey: Contrasting responses of birds, tourists, and managers. Environmental Conservation 22: 56-65.

Burger, J. and M. Gochfeld. 1998. Effects of ecotourists on bird behavior at Loxahatchee National Wildlife Refuge, Florida. Environmental Conservation 25: 13-21.

Cape Cod National Seashore. 1993. Piping plover nest found trampled by pedestrian. News Release. Cape Cod National Seashore, South Wellfleet, Massachusetts. 2 pp.

Collazo, J.A., J.R. Walters, and J.F. Parnell. 1994. Factors Affecting Reproduction and Migration of Waterbirds on North Carolina Barrier Islands. 1993 Annual Progress Report. North Carolina State University, Raleigh, North Carolina. 57 pp.

Erwin, R.M. 1980. Breeding habitat by colonially nesting water birds in two mid-Atlantic U.S. regions under different regimes of human disturbance. Biological Conservation. 18: 39-51.

Erwin, R.M. 1989. Responses to Human Intruders by Birds Nesting in Colonies: Experimental Results and Management Guidelines. Colonial Waterbirds 12(1): 104-108.

Goldin, M.R. 1993. Effects of human disturbance and off-road vehicles on piping plover reproductive success and behavior at Breezy Point, Gateway National Recreation Area, New York, M.S. Thesis. University of Massachusetts, Amherst, Massachusetts. 128 pp.

Havera, S.P., L.R. Boens, M.M. Georgi, and R.T. Shealy. 1992. Human disturbance of waterfowl on Keokuk Pool, Mississippi River. Wildlife Society Bulletin. 20: 290-298.

Henson, P.T. and A. Grant. 1991. The effects of human disturbance on trumpeter swan breeding behavior. Wildlife Society Bulletin 19: 248-257.

Hill, J.O. 1988. Aspects of breeding biology of Piping Plovers (*Charadrius melodus*) in Bristol County, Massachusetts, in 1988. Unpublished report. University of Massachusetts, Amherst, Massachusetts. 44 pp.

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

Jenkins, D.C. and J. Burger. 1987. New Jersey Endangered Beach-Nesting Bird Project: 1986 Survey and Management. New Jersey Department of Environmental Protection, New Jersey. 37 pp.

Kaiser, M.S. and E.K. Fritzell. 1984. Effects of river recreationists on green-backed heron behavior. Journal of Wildlife Management. 48: 561-567.

Kahl, R. 1991. Boating disturbance of canvasbacks during migration at Lake Poygan, Wisconsin. Wildlife Society Bulletin. 19: 242-248.

Klein, M.L. 1993. Waterbird behavioral responses to human disturbance. Wildlife Society Bulletin. 21: 31-39.

Klein, M.L., S.R. Humphrey, and H. F. Percival. 1995. Effects of ecotourism on distribution of waterbirds in a wildlife refuge. Conservation Biology 9: 1454-1465.

Knight, R.L. and D.N. Cole. 1995. Wildlife responses to recreationists. Pp. 51-69 in R.L. Knight and K.J. Gutzwiller, eds. Wildlife and recreationists: coexistence through management and research. Washington, DC, Island Press. Korschgen, C.E., L.S. George, and W.L. Green. 1985. Disturbance of diving ducks by boaters on a migrational staging area. Wildlife Society Bulletin. 13: 290-296.

Loegering, J.P. 1992. Piping Plover Breeding Biology, Foraging Ecology and Behavior on Assateague Island National Seashore, Maryland. M.S. Thesis. Virginia State Polytechnic Institute and State University, Blacksburg, Virginia. 262 pp.

Morton, J.M., A.C. Fowler, and R.L. Kilpatrick. 1989. Time and energy budgets of American black ducks in winter. Journal of Wildlife Management. 53: 401-410 (also see corrigendum in Journal of Wildlife Management. 54: 683).

Owen, M. 1973. The management of grassland areas for wintering geese. Wildfowl. 24: 123-130.

Pfister, C., B.A. Harrington, and M. Lavine. 1992. The Impact of Human Disturbance on Shorebirds at a Migration Staging Area. Biological Conservation 60(2): 115-126.

Robertson, R.J. and N.J. Flood. 1980. Effects of Recreational Use of Shorelines on Breeding Bird Populations. Canadian Field-Naturalist 94(2): 131-138.

Rodgers, J.A. and H.T. Smith. 1995. Set-back distances to protect nesting bird colonies from human disturbance in Florida. Conservation Biology 9: 89-99.

Rodgers, J.A. and H.T. Smith. 1997. Buffer zone distances to protect foraging and loafing waterbirds from human disturbance in Florida. Wildlife Society Bulletin 25: 139-145.

Shaffer, F. and P. Laporte. 1992. Rapport synthese des recherches relatives au pluvier siffleur (*Charadrius melodus*) effectuees aux Iles-de-la-Madeleine de 1987 a 1991. Association quebecoise des groups d'ornithologues et Service canadien de la faune. 78 pp.

Strauss, E. 1990. Reproductive success, life history patterns, and behavioral variation in a population of Piping Plovers subjected to human disturbance (1982-1989). Ph.D. dissertation. Tufts University, Medford, Massachusetts.

United States Fish and Wildlife Service (USFWS). 1994. Northeastern Beach Tiger Beetle (*Cincindela dorsalis dorsalis* Say) Recovery Plan. U.S. Fish and Wildlife Service, Hadley, Massachusetts. 6 pp.

Ward, D.H., and R.A. Stehn. 1989. Response of brant and other geese to aircraft disturbance at Izembek Lagoon, Alaska. U.S. Fish and Wildlife Service, Alaska Fish and Wildlife Research Center. Final report to the Minerals Management Service. Anchorage, Alaska. 193 pp.

Welty, J.C. 1982. The life of birds. Saunders College Publishing, Philadelphia, Pennsylvania. 754 pp.

Williams, G.J., and E. Forbes. 1980. The habitat and dietary preferences of Dark-Bellied Brent Geese and Widgeon in relation to agricultural management. Wildfowl. 31: 151-157.