UNITED STATES GOVERNMENT
MEMORANDUM

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Memorandum

To: Assistant Regional Director, Ecological Services, Hadley, Massachusetts

July 8, 2016

From: Field Supervisor, New England Fish and Wildlife Office, Concord, New Hampshire

Subject: Biological Opinion on the Application for an Incidental Take Permit submitted by the Massachusetts Division of Fisheries & Wildlife for a Habitat Conservation Plan for Piping Plover

This document transmits the U.S. Fish and Wildlife Service's (Service) biological opinion based on our review of the proposed section 10(a)(1)(B) incidental take permit (hereinafter referred to as an ITP) to the Massachusetts Division of Fisheries and Wildlife (MADFW) and its effects on the federally threatened piping plover (*Charadrius melodus*) in accordance with section 7 of the Endangered Species Act (ESA) of 1973, as amended (16 U.S.C. 1531 et seq.). The ITP will authorize implementation of the "Massachusetts Division of Fisheries & Wildlife (DFW) Habitat Conservation Plan For Piping Plover" (hereinafter referred to as the HCP), dated April 2016. The MADFW submitted the HCP as a component of their application for an ITP for take that may occur as a result of deviations from State and Federal guidelines (MADFW 1993; USFWS 1994; USFWS 2015) for recreational management and beach operations on beaches where piping plovers occur.

Section 7(b)(3)(A) of the ESA requires that the Secretary of the Interior issue biological opinions on Federal agency actions that may affect listed species or critical habitat. Biological opinions determine if the action proposed by the action agency is likely to jeopardize the continued existence of listed species or destroy or adversely modify critical habitat. Section 7(b)(3)(A) of the ESA also requires the Secretary to suggest reasonable and prudent alternatives to any action that is found likely to jeopardize the continued existence of listed species or result in an adverse modification of critical habitat, if any has been designated. This biological opinion assesses only impacts to federally listed species and does not address the overall environmental impacts of the proposed action.

This biological opinion is based on information from many sources, including the MADFW's HCP (MADFW 2016), the Environmental Assessment (EA) (USFWS 2016), scientific literature and information provided in meetings with the MADFW and interested stakeholders during the

development of the HCP. A record of this consultation is available at the New England Field Office.

SPECIES NOT LIKELY TO BE ADVERSELY AFFECTED BY THE PROPOSED ACTION

In addition to piping plovers, three other federally listed species occur on beaches in Massachusetts at which the HCP may be implemented. These species are the federally threatened rufa red knot (*Calidris canutus rufa*), endangered roseate tern (*Sterna dougallii dougallii*), and threatened northeastern beach tiger beetle (*Cicindela dorsalis dorsalis*). Critical habitat has not been designated for any of these species.

Rufa red knot

Rufa red knots breed in the Arctic, but may be present on Massachusetts beaches during their northward and southward migrations. Migratory red knots in Massachusetts use dynamic and ephemeral coastal habitats, including sand spits, islets, shoals, and sandbars, often associated with inlets (USFWS 2014) during their fall migration, although they have also been documented to roost and forage along rocky shorelines and in mud flats associated with salt marsh. There is some overlap between piping plover breeding habitat and red knot migratory or staging habitat. However, the peak staging season for red knots passing through Massachusetts during fall migration is in mid-August through late September (S. Koch, USFWS pers. comm. 2016), subsequent to the piping plover nesting season. In the absence of breeding plovers, no measures to avoid adverse effects from recreational and beach operation activities in the vicinity of red knots have been recommended. At this time, based on the most recent scientific information available, these activities are considered to have insignificant effects on migrating red knots.

Historically, red knots migrating through Massachusetts used mainland and coastal areas for migratory stopover sites, primarily by red knots having Patagonian destinations (Harrington et al. 2010a). Recent information indicates that Cape Cod locations are increasingly used by red knots wintering in the southeastern United States, and that the more heavily concentrated sites may shift as foraging habitat, particular clam flats, shift. Harrington et al. (2010a) tracked changes in red knot staging areas from the western side of Cape Cod Bay, with high numbers in the 1960s through the 1990s to very low numbers by 2004. They noted that numbers at sites at outer Cape Cod had increased significantly, averaging from the low hundreds in mid-July, to low thousands by mid-August and around 500 knots in September (Harrington et al. 2010a).

Recently, the Pleasant Bay/Monomoy region of outer Cape Cod has been documented to host large concentrations during the extended fall migration (mid-July through September) as females and later males and juveniles migrate south (Harrington et al. 2010b; USFWS 2014). Monomoy National Wildlife Refuge and South Beach in particular have been documented as consistently having hundreds of red knots present during fall migration (Harrington et al. 2010b; Burger et al. 2012). Both of these large staging areas are closed to over-sand vehicle (OSV) use and have limited pedestrian recreation.

Some beaches open to OSV and pedestrian use, such as North Beach, Chatham, may periodically host hundreds of red knots. At sites where OSVs are permitted, roosting red knots are largely confined to intertidal bayside flats closed to OSVs for foraging, although they may roost above

the high tide line in the vicinity of OSVs, especially if there are large symbolically fenced areas that are vehicle and pedestrian free (S. Koch, pers. comm. 2016).

A reduction in symbolic fencing, or the access of OSVs to red knot roosting habitat resulting from the covered activities outlined in the HCP (allowing OSVs to pass in the vicinity of unfledged chicks) could result in disturbance to roosting red knots. Passing OSVs and pedestrians may cause red knots to move away from the disturbance to another nearby location, or move to another beach entirely. At this time, disturbance from recreational activities to roosting migratory red knots is considered to cause some minor energetic demands on the birds as they move away from the disturbance, but the effects are considered to be insignificant (the impact is not anticipated to rise to the level of take because of the short duration of the impact and availability of nearby suitable foraging and roosting habitat). Therefore, any additional, limited disturbance to red knots from the covered activities is considered to be insignificant as well.

Therefore, on the basis of the best available information, we conclude that the covered activities are not likely to adversely affect the red knot. The MADFW has stated that a regional or site-specific HCP would be pursued for this species if it is later determined that covered activities adversely affect rufa red knots. Meanwhile, under the HCP, the MADFW would not issue Certificates of Inclusion (COIs) for activities that could result in take of the red knot (see HCP section 1.2.3).

Roseate tern

In general, there is little overlap of piping plover and roseate tern breeding habitat in the study area, although periodically these species may nest in the vicinity of each other on Martha's Vineyard (two small locations). Neither of these sites are regularly used by nesting roseates and Little Beach, Martha's Vineyard has little to no recreational use. Potential overlap of staging roseate terns and breeding piping plovers may occur on beaches where roseate tern adults and young of the year are concentrated prior to fall migration, particularly at the tips of barrier beaches adjacent to inlets. These areas are generally symbolically fenced in the spring to protect nesting piping plovers and often the fences are in place as roseate terns begin to stage in July. Occasionally, roseate terns may roost within the symbolically fenced area, but more often they roost above the tide line or in exposed intertidal sand flats.

Date, time of year, and/or tide are thought to influence the abundance of roseate terns (and common terns since the species co-occur) at large staging sites. Roseate terns may switch staging areas in July and August from year to year if prey availability changes, predators or other forms of disturbance consistently impact the terns, or the beach changes configuration. In 2008, South Beach, Chatham and Sandy Neck, Barnstable were major roosting sites, while Coast Guard Beach, Eastham was a major staging area (Blake 2010). Currently, Race Point and Hatches Harbor have been documented to host thousands of staging roseate and common terns, while South Beach has very few (USFWS files). Hence, staging site use may differ by site, time of the post-breeding period and between years (Blake 2010), making it difficult to predict when and where roseate terns may stage. The extent to which disturbance may influence staging habitat use is currently unknown. Roosting roseate terns respond to disturbance from OSV and recreational users by taking flight. As a result of the disturbance, roseate terns may temporarily

abandon the beach, or move farther afield from their original resting spot. Roseate terns may also take flight for no apparent reason and it is sometimes difficult to ascertain the cause of the flight behavior.

Until research indicates otherwise, to date, based on the best available science, the effects of limited periodic disturbance from pedestrians and OSVs have been determined to be insignificant. However, the Cape Cod National Seashore (CACO) is currently researching the effects of disturbance by categorizing and quantifying both naturally occurring and human-related disturbances and estimating time-activity budgets of hatch year roseate terns, and the potential effects of disturbances on the hatch year birds and on the cohesiveness of parent-offspring groups (NPS 2013). Therefore, this determination may be reconsidered upon the completion of the research.

The MADFW would not issue a COI under the current HCP for any covered activity that would cause take of roseate terns (see HCP section 1.2.3). Covered activities that could cause take of roseate terns would require separate take authorization or an amendment of the HCP to include the roseate tern as a covered species.

Northeastern beach tiger beetle

The northeastern beach tiger beetle has a very restricted distribution in Massachusetts and covered activities are not anticipated to occur in occupied northeastern beach tiger beetle habitat. As described in the HCP (section 1.2.3), the MADFW would not issue COIs for activities that could result in take of the northeastern beach tiger beetle. On the basis of the best available information, we conclude that the covered activities are not likely to adversely affect the northeastern beach tiger beetle.

Potential Impacts from Proposed Mitigation

The proposed off-site mitigation may occur on piping plover breeding sites used by post-breeding roseate terns, migrating rufa red knots and possibly northeastern beach tiger beetles. Selective predator management activities to benefit piping plovers are conducted before and during the plover breeding season. These activities are unlikely to occur when roseate terns are present or when southward migrating rufa red knots are present. Practices that are routinely employed by qualified predator management specialists to avoid causing disturbance or other adverse effects to breeding piping plovers will also serve to avoid disturbances to any northward migrating rufa red knots or transient pre-breeding roseate terns that might be present. Light foot traffic, such as would occur during selective predator management, does not adversely affect northeastern beach tiger beetles, and OSV use is not anticipated to occur concurrent with selective predator management in northeastern beach tiger beetle habitat (primarily Monomoy islands complex where OSVs are excluded and privately owned beach parcels on Martha's Vineyard). Predator management activities are otherwise not anticipated to adversely affect northeastern beach tiger beetles.

In summary, we find that the proposed action is not likely to adversely affect the rufa red knot, the roseate tern, or the northeastern beach tiger beetle. These species are not considered further in this biological opinion.

BIOLOGICAL OPINION

DESCRIPTION OF THE PROPOSED ACTION

As defined in the ESA section 7 regulations (50 CFR 402.02), "action" means "all activities or programs of any kind authorized, funded, or carried out, in whole or in part, by Federal agencies in the United States or upon the high seas." The direct and indirect effects of the action must be considered in conjunction with the effects of other past and present Federal, state, or private activities, as well as the cumulative effects of reasonably certain future state or private activities within the action area.

In this case, the proposed action is the Service's issuance of a 26-year ITP to the MADFW. The ITP will authorize take of piping plovers for the first 25 years of the permit. The 26th year is solely for implementation of outstanding mitigation needed to ensure that the take has been fully offset. The ITP issuance is predicated upon the Service's approval of the MADFW's HCP.

The proposed ITP would address take resulting from covered activities which are fully described in the HCP and are incorporated by reference into this biological opinion. The following provides a summary of key aspects of the MADFW's HCP, including covered activities, avoidance and minimization measures, mitigation, monitoring, reporting, and changed circumstances.

The MADFW proposes to authorize deviations from the State "Guidelines for Managing Recreational Use of Beaches to Protect Piping Plovers, Terns and Their Habitats in Massachusetts" (MADFW 1993; hereinafter referred to as the State guidelines), and the Service's "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" (USFWS 1994, hereinafter referred to as the Federal guidelines) for some recreational and beach operation activities on Massachusetts beaches during the piping plover nesting season to approved beach management entities or landowners (plan participants). These deviations increase the potential for reduced productivity resulting from the take of piping plover territories, nests, broods, and to a very limited extent, adult mortality. The MADFW's HCP serves as an umbrella HCP whereby plan participants can receive incidental take coverage by opting into the HCP via COIs to implement one or more covered activities (described below). The MADFW is requesting a 26-year permit to provide a predictable framework for the MADFW and plan participants for permitting of covered activities and implementation of the HCP.

Covered activities in the HCP identify the mechanisms under which take will occur and incorporate minimization and avoidance measures to reduce the exposure to impacts. Each covered activity has an associated monitoring component to document if take occurs (in the form of mortality for example), identify adaptive management measures to further reduce impacts, and ensure compliance with the implementation of the covered activity; see section 3.2 of the HCP for details on monitoring requirements for each covered activity. To reduce the effects of reduced productivity on the local population (e.g., at the site level) and the statewide level, the MADFW limits take exposure both at the site level and statewide. On the statewide level, the HCP proposes a sliding scale of take, dependent on the statewide population (three prior years' population average). The statewide allocated take would never be allowed to exceed 7 percent

for years when the population exceeds 655 breeding pairs, and would phase out to zero take allocated should the population decrease to less than 500 pairs[1] (Table 1). Take exposure at any one site, including all covered activities combined, is generally limited to exposure of 15 percent of the breeding pairs that were present at a site in the previous year, although the MADFW may increase the allowable exposure to 30 percent at up to five sites while still adhering to the 7% or less limitation for statewide take exposure. For sites with less than 7 breeding pairs, one take exposure is allowed annually.

Table 1. Estimate of take correlated to statewide population.

MA Breeding Population Size Prior 3–year Average	Maximum Broods, Nests or Territories to be Exposed to Potential Take (percent of population)	Fledglings to be Taken; Upper Bound Estimate
>655	45 +[2] (7%)	3.4%
625–655	37–39 (6%)	3.0%
594–624	29–31 (5%)	2.5%
563–593	22–23 (4%)	2.0%
532–562	10–11 (2%)	1.0%
500–531	5 (1%)	0.5%
<500	0	0.0%

Plan participants are required to develop Impact Avoidance and Minimization Plans (IAMPs) for approval by the MADFW that describe the covered activities and avoidance and minimization measures that will be implemented to reduce the level of take. The IAMPs also include information about the technical staff responsible for preparing, implementing and updating the IAMP, the level of training for each staff position, describe the plover and/or enforcement monitoring components, and describe the mitigation to offset the take resulting from the covered activity (see section 5.2.2.3 of the HCP for a complete list of IAMP components). The MADFW must be notified 24 hours in advance of initiating any activity authorized under a COI.

Covered Activities:

1. use of roads and parking lots in the vicinity of unfledged (i.e., unable to fly) chicks;
2. recreation and beach operations:
    a. associated with reduced symbolic fencing around nests;
    b. associated with reduced proactive symbolic fencing of piping plover habitat; and
    c. at piping plover nest sites with nest moving; and
3. OSV use in the vicinity of unfledged piping plover chicks.

[1] Should the population reach 500, no take will be allocated the following year.

Use of roads and parking lots in the vicinity of unfledged piping plover chicks
Road and parking lot use occurs in association with summer recreational beach access. Under the State and Federal guidelines, roads and parking lots may be closed in order to avoid take of chicks or adults tending their broods. This covered activity would allow driving on improved roads and parking lots when adult plovers and unfledged chicks are present.

The covered activity of driving on improved roads and continued use of parking lots in the presence of unfledged piping plover chicks would include one or more of the following minimization measures dependent on site-specific needs:

1. Barriers: Barriers such as a limited length of silt fencing may be deployed to prevent chicks from crossing a road or accessing a parking lot. These barriers may be placed at "hot spots," areas where adults and their broods consistently cross a road or access a parking lot.[2] Longer barriers may also be used at sites with little or no bay side foraging habitat where adults and broods may travel more inconsistently across roads.
2. Signage: Signage alerting motorists to watch for crossing birds and to obey speed limits may be strategically deployed. At some sites, signs may be used to alert motorists and beach goers to contact staff if they observe piping plovers in or near a road or parking lot.
3. Staff training: Shorebird monitors and parking attendants must receive adequate training prior to implementing measures to allow vehicles to access roads and parking lots in the presence of unfledged piping plover chicks.
4. Traffic management: Beach managers must design protocols to manage vehicular traffic on roads and parking lots when chicks and tending adults are present. These protocols might include temporarily rerouting traffic away from a section of a parking lot with chicks, having a monitor or parking attendant "herd" chicks out of a parking lot or across a road, reduced speed limits, or temporary road closures to allow chicks to pass. The distance between chicks and the parking lot or road that triggers a brief closure will be made on a case-by-case basis.

Communication procedures between staff are required for this covered activity. Procedures should identify how communications will: 1) relay adult and chick locations; 2) relay specific traffic management protocols; and 3) respond to motorists or pedestrians alerting management to the presence of chicks.

A MADFW-approved site-specific monitoring plan must be implemented to reduce the risk of take by allowing the beach manager to adaptively manage the parking lot or road for piping plovers. Monitoring intensity above what is recommended in the State and Federal guidelines would increase for nests and broods observed less than 100 yards from a parking lot or road. Monitoring intensity would also increase with the frequency that chicks are observed within the

[2] Barriers could reduce the likelihood of chick mortality by preventing chicks from accessing a parking lot or road and guiding them to a safer route for crossing between bayside and beachfront foraging habitats. As discussed in the Effects of the Action section of this biological opinion, the Service believes that the role of barriers in reducing the risk of direct mortality due to vehicle collisions outweighs the risks from preventing access to cover or foraging resources.

vicinity of a parking lot or road (see HCP section 3.2.1). Information obtained relative to brood movements and behavior as a result of the increased monitoring allows the beach manager to implement appropriate traffic management actions or place barriers in areas more likely to deter chicks from crossing the road or entering parking lots.

Recreation and Beach Operations Associated With Reduced Symbolic Fencing Around Nests
The HCP proposes to reduce the buffer to less than 50 yards (approximately 50 meters) for nests that significantly reduce recreational access or use. State and Federal guidelines recommend a minimum 50-meter (approximately 50 yards) buffer around piping plover nests to avoid adverse effects to incubating adults from harassment by recreational users or beach operations (MADFW 1993; USFWS 1994).

A reduction in the symbolic fencing around nests would require the following measures be implemented to reduce adverse effects:

1. Fencing will be reduced to the extent necessary to achieve specific recreational or beach operation objectives (e.g., opening a specific beach access trail) and should be a minimum of 10 yards (9 meters) from the nest. Limited exceptions may be allowed with MADFW approval.
2. A fenced buffer larger than the target buffer will be established initially and maintained during egg laying and through at least the first 24 hours after clutch completion.
3. Fencing distance from the nest will be gradually reduced until the final buffer has been reached, in increments of approximately 10 yards (9 meters), no more than once daily.

A site-specific MADFW-approved monitoring plan is required to document the effectiveness of the reduced buffer during the early nesting phase to provide protection from disturbance at a minimum during the first 24 hours after a clutch has been completed.

Recreation and Beach Operations Associated With Reduced Proactive Fencing of Habitat
State and Federal guidelines recommend that beaches that receive heavy recreational use should be symbolically fenced by April 1 to prevent disruption of territorial displays and courtship, prevent harassment of egg-laying and incubating plovers, and protect undetected or unexclosed nests from crushing by pedestrian or vehicular traffic. The guidelines recommend that all suitable piping plover nesting habitat be delineated with symbolic fencing (posts, twine or rope and signage).

The HCP proposes to deviate from the State and Federal guidelines by allowing plan participants to reduce the proactive symbolic fencing of suitable piping plover habitat particularly in sections of beach near major access points that tend to have high recreational use. Conditions designed to minimize impacts include:

- The covered activity will be limited to 10 percent or 2 acres of available nesting habitat at a given breeding site, whichever is less, as a minimization measure to reduce impacts to breeding piping plovers on the local level.
- The number of breeding pairs that may be exposed to the reduced proactive fencing at a given site is generally limited to 15 percent of breeding pairs present during the previous

breeding season. Sites with less than 7 breeding pairs are allowed one take exposure annually.

- At up to five sites statewide, the MADFW may allow reduced proactive fencing of up to 20 percent of habitat or 4 acres, whichever is less (see section 5.2.2.3 of the HCP) and will authorize exposure to take for up to 30 percent of the number of breeding pairs while still maintaining the 7% or less limitation on statewide take allocation.
- The MADFW will limit the number of authorizations for this covered activity in a given year to no more than 50 percent of the statewide allowable take exposure authorizations for all covered activities, for any year in which more than 10 take exposures would be authorized statewide (see HCP section 3.3.2.1). The 50 percent limit would not apply in any year when 10 or fewer take exposures are available statewide.

Under this activity, the MADFW will allow beach raking or the temporary placement of material such as boards on the beach to minimize the risk of breeding pairs and nests being exposed to high recreational use in unfenced areas that could lead to nest scrape destruction, nest abandonment and loss of eggs if an undetected nest is crushed inadvertently. These activities may discourage piping plovers from establishing nests in these areas thus preventing the likely renesting and an increase in the energetic demands on the breeding piping plovers if they lose nest scrapes or eggs. However, should piping plovers nest despite the lack of symbolic fencing, plan participants would immediately need to install symbolic fencing around the nest to limit disturbance and prevent the destruction of eggs, and implement the covered activity of reducing fencing buffers around nests (see above).

Monitoring associated with this covered activity will be consistent with the State and Federal guidelines to detect breeding activity or nesting within the unfenced area, and facilitate immediate protection of nests if detected outside of the fenced habitat.

Recreation and Beach Operations at Piping Plover Nests with Nest Moving

Moving nests may result in take through harm, harassment or nest loss. The MADFW would authorize moving a nest if piping plovers nest in a parking lot, major beach access trail, OSV corridor or other high use recreational area (e.g., the site of an annual beach festival), and if reducing symbolic fencing would not allow a recreational activity to occur (e.g., access to a beach, parking lot or event). There may be occasions whereupon reduced symbolic fencing may not provide the best minimization measure for piping plovers, for example, maintaining a small area of reduced fencing around a nest in the middle of a parking lot could present a greater risk than attempting to move the nest out of or to the edge of a parking lot. If the MADFW determines that nest moving is the best alternative to allow a specific recreational use to occur at a given site, nest moving may be implemented with the following minimization measures to reduce the risk of take:

1. Nests will not be moved until at least 48 hours after the clutch is completed.
2. Nests will not be moved during inclement weather, in extreme heat, or during evening hours.[3]

[3] Two hours prior to sunset or later.

3. An appropriate relocation site will be chosen in suitable habitat that minimizes the movement distance to the extent practicable.[4]
4. Nests will be moved using the "cylinder/plate/platform method" (Gordon and Kruse 1999; see HCP section 3.2.2.3 for more detail).
5. Nests will be moved gradually to reduce the risk of abandonment. The first move will generally be less than 15 feet; however, distances may vary site by site.
6. If incubation is not resumed within 1.5 hours, the nest will be moved halfway back to the original nest location and monitored for signs of incubation.
7. If incubation is observed at the relocated nest, the nest should be monitored for 90 minutes to ensure consistent incubation behavior before attempting to move the nest a second time.
8. The nest may then be moved up to two additional times per day (the following day), in 10-20-foot increments following this monitoring procedure. The MADFW may allow up to three movements per day once procedures for repeated nest moving have been tested and proven.
9. If inconsistent incubation or significant distress behavior is observed, nest movement should be halted and resumed the next day.
10. If the first attempt to move the nest is unsuccessful, nest moving may be attempted again the following day.
11. In cases where parent birds fail to accept the moved nest, the MADFW should be consulted to determine the best course of action.

Nests that are moved will be more intensively monitored initially to confirm acceptance and incubation in accordance with the activities outlined above and to allow for adaptive management implementation if necessary (e.g., Nos. 6, 9, 10 and 11 above). Once the adults have returned to the nest and accepted the new location, monitoring will proceed according to existing State and Federal guidelines.

OSV Use in Vicinity of Unfledged Chicks

State and Federal guidelines allow OSVs to pass by nesting piping plovers prior to hatching if suitable habitat has been delineated with symbolic fencing to prevent vehicle access into or through nesting habitat. Vehicles may also park outside delineated nesting habitat if beach width and configuration and tidal conditions allow. In accordance with the guidelines, OSV corridors and parking areas should be moved, constricted or temporarily closed if territorial, courting, or nesting plovers are disturbed by passing or parked vehicles, or if disturbance is anticipated because of unusual tides or expected increases in vehicle use during weekends, holidays or special events (MADFW 1993; USFWS 1994).

[4] The MADFW may approve a greater movement distance in order to minimize disturbance to the nest after relocation, or disruption of breeding by adjacent pairs. For example, it may be preferable to move the nest a greater distance to a site that is visually isolated from other plovers or the activity, or farther away from an OSV corridor.

The HCP will deviate from the State and Federal guidelines by allowing limited, escorted driving of non-essential[5] OSVs within a 100-meter (100 yards) or greater OSV buffer when in the presence of unfledged chicks. This covered activity is applicable for OSV beaches that are intensively monitored and is subject to the implementation of a detailed site-specific impact avoidance and minimization plan. The following conditions will apply to escorted OSV travel in the vicinity of unfledged piping plover chicks:

1. Travel in the vicinity of unfledged chicks will be restricted to a single, clearly demarcated vehicle travel corridor less than 5 yards wide.
2. Parking will not be allowed within 200 meters (218 yards) of unfledged chicks during the first week after hatching, and in no event will parking be permitted within 100 meters (approximately 100 yards) of unfledged chicks.
3. A restricted parking zone considerably farther than 100 yards from unfledged chicks may be required in order to reduce the need for constant monitoring of chicks and readjustment of vehicle parking during the course of the day.
4. OSV travel in the vicinity of unfledged chicks will be restricted to no more than 6 hours per day and may only occur in two to three travel periods during daylight hours.
5. Vehicles may be escorted by:
    a. a passenger who walks in front of each vehicle (self-escorting), scanning for chicks;
    b. a single escort who walks in front of a caravan of 50 vehicles, scanning for chicks; or
    c. the MADFW may approve a qualified shorebird monitor to lead a caravan in an open-top OSV at a speed of 5 miles per hour or less in lieu of a single pedestrian caravan escort.
6. Vehicle escorting will begin at least 200 feet from the closest chick and terminate no less than 200 feet past the last chick in a given brood.
7. Measures must be implemented to address enforcement of restricted driving hours and escorting procedures, including specific procedures for temporarily halting traffic if brood monitors observe chicks approaching the travel corridor, communication among monitors, beach access attendants, law enforcement and other staff, and protocols for escorting vehicles off of the beach in the event of an emergency must be approved by the MADFW and in place prior to implementing the OSV escort program.
8. Tire ruts must be smoothed out either by hand or mechanically at least once daily in the travel corridor at the end of the travel period.
9. Detailed information on site-specific thresholds for temporarily halting traffic must be provided in the IAMP.

A MADFW-approved site-specific monitoring plan must be implemented to ensure the self-escort program is being correctly implemented (compliance monitoring) and to describe how brood monitoring will be implemented. The MADFW must be notified 24 hours in advance of initiating any covered activity, therefore escorting may not be initiated until after chicks are 24 hours old. A qualified monitor must follow each brood during the implementation of the self-

[5] Essential OSVs are defined as those used by shorebird monitors, law enforcement, beach homeowners, or others as described in the guidelines.

escort program. Monitors must also locate broods prior to and after the daily self-escorting sessions. Based on brood location and behavior information provided by the brood monitors, a compliance monitor may adaptively manage the escort program, including temporarily halting traffic, based on the information provided by the brood monitors.

Mitigation

Selective predator management is the primary component of the HCP's mitigation strategy to offset the incidental take and increase piping plover productivity. Predator management will be designed to benefit 2.5 breeding pairs for every brood, nest, or territory exposed to take from covered activities. This mitigation will occur even if actual take is not observed or documented. In the event that the covered activity being implemented is "Use of Roads and Parking Lots in the Vicinity of Unfledged Chicks," selective predator management to benefit an additional 0.05 adult breeding pairs will be required.

Site-specific mitigation plans will focus management on the predator species and/or individuals that evidence indicates are the most prevalent sources of predation. The preferred management approach is to selectively remove individual predators, particularly those predators that have become focused on plover nests, chicks, or adults. Predator removal efforts would use approved lethal techniques for wildlife damage management (USDA 2003, 2004, 2011) and in accordance with Massachusetts law (MGL c.131 section 80A: Regulations 321 Code of Massachusetts Regulations [CMR] 2.08). Mammalian predators would be humanely euthanized with the exception of feral cats. Cat removal would be coordinated with local animal shelters. All captured cats either would be returned to the cat's owner (if proper identification can be determined) or taken to an animal shelter for health evaluation and, if possible, adoption. The final disposition of a feral cat would be determined by the animal shelter in consultation with the MADFW.

In addition to trapping, shooting of nocturnal mammalian predators, such as coyote (*Canis latrans*) and fox (*Vulpes vulpes*), would be employed. The predators would be located at night using spotlights or thermal imaging equipment and then shot with suppressed rifles or shotguns (USDA 2011). Avian predators would also be removed, using firearms employing a silencing device. Approved toxicants, such as DRC-1339 (3-chloro p-toluidine hydrochloride) may be applied to eggs and placed in plover exclosures to remove American crows (*Corvus brachyrhynchos*) known to target plover nests. Studies have demonstrated that when appropriately applied, DRC-1339 poses a minimal risk of primary or secondary poisoning of non-target animals (Eisemann et. al. 2001). By applying the toxicant to eggs placed in exclosures, the risk of impacting non-target mammalian or avian predators is significantly reduced.

Predator removal activities are typically implemented at times of the year (late winter and early spring) and times of the day (evening) when human use of the beaches is greatly reduced or absent. Piping plovers would be absent during most winter and early spring predator management activities. Activities such as placing baited eggs in dummy exclosures generally occur away from territorial or nesting piping plovers if occurring when plovers are present.

Proactive Conservation Measures

The HCP's mitigation strategy also includes other conservation measures that are considered to benefit piping plovers, but the exact benefits are difficult to quantify, and these activities would not contribute to mitigating under the ESA for take occurring through the implementation of covered activities. These conservation measures include education, outreach, increased law enforcement and nesting habitat improvement. The objectives of the proactive conservation measures are two-fold: (1) to increase awareness of and compliance with the guidelines to protect piping plovers; and (2) to conduct experimental vegetation control to improve nesting habitat, to potentially reduce competition between piping plover pairs, and/or to reduce the impacts of human disturbance by expanding suitable habitat. These measures are recognized as net benefits to the piping plover under the Massachusetts Endangered Species Act (MESA) permitting requirements.

Under the HCP, the MADFW can make these conservation measures available to applicants only in the context that on the statewide basis, the offsetting predator management mitigation obligations will be fully met annually. This means that the MADFW will ensure that mitigation is fully offset through a combination of on-site and off-site predator management. If the offsetting predator management mitigation requirements have been exceeded, the MADFW has the discretion to allow a subsequent applicant to utilize these optional measures to provide a different and additional layer of complementary conservation measures. This may be in addition to, or in lieu of, the minimum required predator management. So while these optional measures do not count towards meeting the overall mitigation requirements for the HCP, they are available to supplement those requirements at the MADFW's discretion.

The HCP considers that the proactive conservation measures may contribute to achieving the MESA compliance standard of a net benefit, even though the extent of the benefits are not quantifiable. The HCP considers that the purpose of education and outreach is to increase community support for measures to protect and manage piping plovers. As such, the HCP allows plan participants to elect to implement some or all of these conservation measures in lieu of on-site or off-site predator management to comply with MESA. For example, outreach may be directed specifically to pet owners, OSV operators, or other groups of beach users to minimize and/or avoid the likelihood of disturbance of nesting plovers. Outreach efforts may include targeted informational programs, informational signs, or printed materials. The purpose of increased law enforcement is to reduce the risk of disturbance, harassment, or mortality of piping plovers resulting from off-leash dogs or other illegal recreational activities. Increased law enforcement may include extra patrols and other enforcement operations during the piping plover breeding season.

ANALYTICAL FRAMEWORK FOR THE JEOPARDY AND ADVERSE MODIFICATION DETERMINATIONS

Section 7(a)(2) of the ESA requires that Federal agencies ensure that any action they authorize, fund, or carry out is not likely to jeopardize the continued existence of listed species. "Jeopardize the continued existence of" means "to engage in an action that reasonably would be expected, directly or indirectly, to reduce appreciably the likelihood of both the survival and

recovery of a listed species in the wild by reducing the reproduction, numbers, or distribution of that species" (50 CFR 402.02).

The jeopardy analysis in this biological opinion relies on four components: (1) the Status of the Species, which describes the range-wide condition of the piping plover, the factors responsible for that condition, and its survival and recovery needs; (2) the Environmental Baseline, which analyzes the condition of the piping plover in the action area, the factors responsible for that condition, and the relationship of the action area to the survival and recovery of the piping plover; (3) the Effects of the Action, which determines the direct and indirect impacts of the proposed Federal action and the effects of any interrelated or interdependent activities on the piping plover; and (4) the Cumulative Effects, which evaluates the effects of future, non-Federal activities that are reasonably certain to occur in the action area on the piping plover.

In accordance with policy and regulation, the jeopardy determination is made by evaluating the effects of the proposed Federal action in the context of the current status of the piping plover, taking into account any cumulative effects, to determine if implementation of the proposed action is likely to reduce appreciably the likelihood of both the survival and recovery of the piping plover in the wild by reducing the reproduction, numbers, and distribution of that species.

STATUS OF THE SPECIES

When evaluating the impacts of a proposed action on federally listed species, we consider the rangewide status of the species, the status of the species within the action area (environmental baseline), and the effects of the action on individuals, populations, and the species as a whole.

The threatened piping plover (*Charadrius melodus*; Atlantic Coast population) was added to the list of species protected under the ESA on January 10, 1986. No critical habitat has been designated or proposed for the breeding range of the Atlantic Coast piping plover population. A 5-year review of the species was completed in 2009 (USFWS 2009).

Life History, Distribution and Status, and Rangewide Threats

Information on piping plover life history, population dynamics, population status, and continuing threats is provided in the 1996 revised Atlantic Coast recovery plan for the piping plover (USFWS 1996). Continuing threats to Atlantic Coast piping plovers in the breeding portion of their range identified in the 1996 revised recovery plan include habitat loss and degradation, disturbance by humans and pets, increased predation, and oil spills (USFWS 1996). The 2009 5-Year Review updated information regarding these threats, as well as potential threats of climate change and wind turbine generators (USFWS 2009). We considered the information contained in these documents in the evaluation of this project, and they are incorporated by reference into this biological opinion. Information provided below describes the current status of the species. We also summarize information about threats most pertinent to the nature and duration of effects of the proposed action (i.e., disturbance and/or mortality due to beach recreation and predation).

Recovery criteria and strategy: The objective of the 1996 revised Atlantic Coast Recovery Plan is to assure the long-term viability of the Atlantic Coast piping plover population in the

wild, thereby allowing removal of this population from the Federal List of Endangered and Threatened Wildlife and Plants (50 CFR 17.11 and 17.12). The Atlantic Coast piping plover population may be considered for delisting when the following recovery criteria, established in the recovery plan, have been met:

1. Increase and maintain for 5 years a total of 2,000 breeding pairs, distributed among four recovery units.

Recovery Unit	Minimum Subpopulation
Atlantic (Eastern Canada)[6]	400 pairs
New England	625 pairs
New York-New Jersey	575 pairs
Southern (DE-MD-VA-NC)	400 pairs

2. Verify the adequacy of a 2,000-pair population of piping plovers to maintain heterozygosity and allelic diversity over the long term.
3. Achieve a 5-year average productivity of 1.5 fledged chicks per pair in each of the four recovery units described in criterion 1, based on data from sites that collectively support at least 90 percent of the recovery unit's population.[7]
4. Institute long-term agreements to assure protection and management sufficient to maintain the population targets and average productivity in each recovery unit.
5. Ensure long-term maintenance of wintering habitat, sufficient in quantity, quality, and distribution to maintain survival rates for a 2,000-pair population.

Attainment of subpopulation targets for each recovery unit provides resiliency and redundancy, thereby increasing the likelihood of survival and recovery of the Atlantic Coast population as a whole. As described below (see section on breeding site fidelity and dispersal), movements of piping plovers between recovery units are extremely rare. Hecht and Melvin (2009a) found significant positive relationships between productivity and population growth in the subsequent year for each of the three U.S. recovery units (but not for Eastern Canada). Hence, it is believed that abundance of piping plovers in each recovery unit population is almost entirely dependent on within-unit productivity. Dispersal of the population across its breeding range serves to protect against stochastic events such as large storms during the breeding season, oil spills, or

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[6] Recent Canadian Wildlife Service documents and published literature refer to piping plovers breeding in Nova Scotia, New Brunswick, Prince Edward Island, Quebec, and Newfoundland as the piping plover *melodus* subspecies or the "eastern Canada population." This subpopulation coincides exactly with the geographic area termed "Atlantic Canada Recovery Unit" in the Service's 1996 Recovery Plan. To reduce confusion, we refer henceforth in this status review to the Eastern Canada recovery unit.

[7] The recovery plan further states "The [population viability analysis] (PVA) shows that a population of only 2,000 pairs would remain highly vulnerable to extinction unless average productivity is sustained above 1.5 chicks per pair. However, since the PVA is based on several assumptions that *may* underestimate survival rates for some or all recovery units and/or the percentage of one-year old adults that breed, this productivity figure may be revised downward if (1) it is demonstrated that survival rates are higher in some regions, and (2) a scientifically credible, stochastic model that incorporates the best available estimates of survival and other demographic variables shows that lower productivity rates will assure a 95 percent probability of survival for 100 years (see task 3.5). Adjustments to this criterion may be applied to the population as a whole or to one or more of the four recovery units, as supported by observed productivity and population trend data (USFWS 1996 page 58)."

disease that might depress regional survival and/or productivity. Maintaining robust, well-distributed subpopulations should reduce variance in survival and productivity of the Atlantic Coast population as a whole and provide connectivity that facilitates within-recovery unit recolonization of any sites that experience declines or local extirpations due to low productivity and/or temporary habitat succession at individual sites (Gilpin 1987; Goodman 1987; Thomas 1994). The recovery units are large enough that their overall carrying capacity should be buffered from stochastic variability in the frequency of storms that naturally maintain habitat at individual nesting sites (i.e., the units represent a fairly coarse distribution requirement), while still assuring a geographically well-distributed population if habitat is not lost or artificially degraded.

Recent genetic analysis found strong genetic structure supported by significant correlations between genetic and geographic distances in both mitochondrial and microsatellite data sets for Atlantic Coast piping plovers (Miller et al. 2010). Atlantic birds showed evidence of isolation-by-distance patterns, indicating that dispersal, when it occurs, is generally associated with movement to relatively proximal breeding territories. Thus, maintaining geographically well-distributed populations also serves to conserve representation of genetic diversity and adaptations to variable environmental selective pressures. Substantial regional declines in abundance of piping plovers risk loss of genetic diversity that may be important to its long-term survival.

Attainment and maintenance of the minimum population levels for the four recovery units provide resiliency, redundancy, and representation (Schaffer and Stein 2000) that are fundamental to the overall security of the Atlantic Coast piping plover population. In the event that one recovery unit experiences temporary declines in piping plover productivity or survival that lead to a decline in numbers, the other units can provide near-term security for the species as a whole. In the event that a recovery unit population becomes sparse or is extirpated, the potential for repatriation via dispersal from adjacent recovery unit(s) is possible, but this is likely to be a slow process and any loss of genetic variation and adaptation to the regional environment may be difficult to reverse. Thus, the achievement and maintenance of the assigned population level, and the associated habitat conditions necessary to support that population level for each of the four recovery units, are necessary for both the survival and recovery of the Atlantic Coast breeding population of the piping plover.

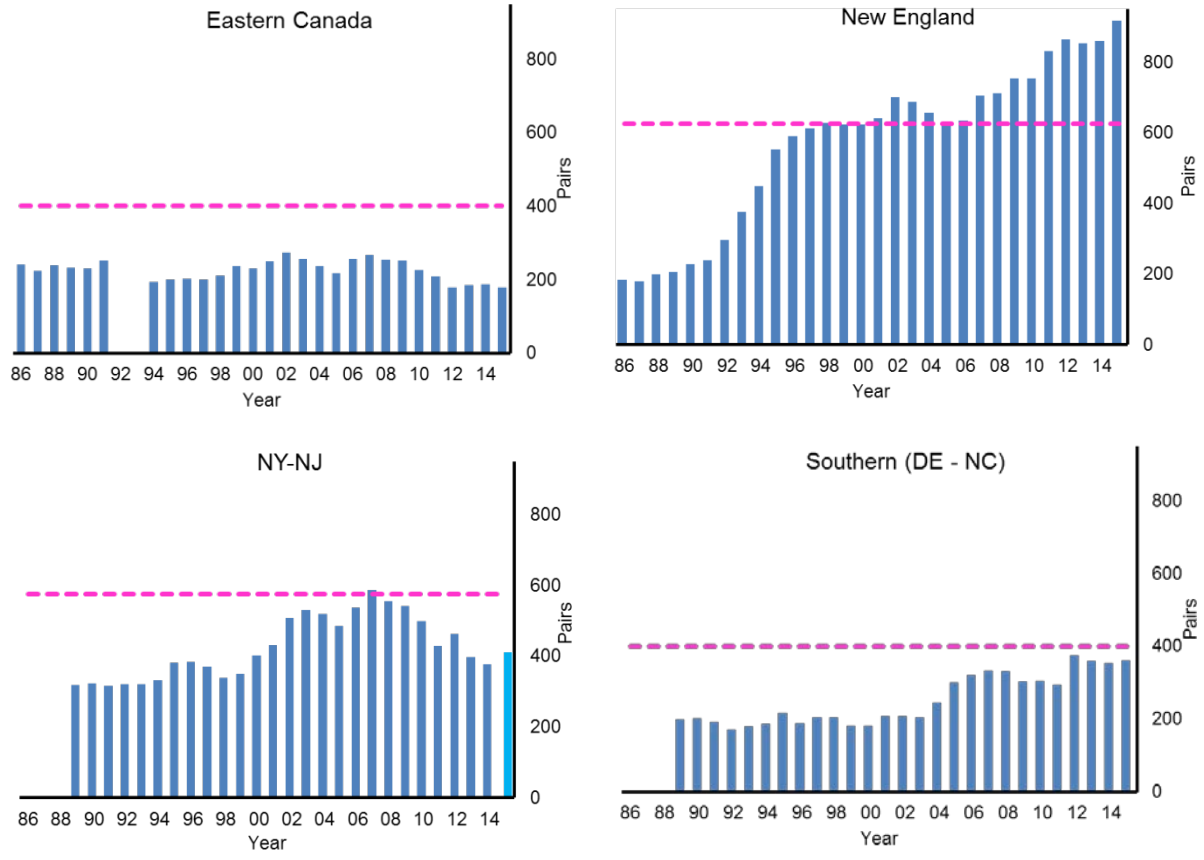
In accordance with the Endangered Species Consultation Handbook (USFWS and NMFS 1998), and since recovery units have been established in an approved recovery plan, this opinion considers the effects of the proposed project on piping plovers in the New England recovery unit, as well as the Atlantic Coast population as a whole. When an action impairs or precludes the capacity of a recovery unit from providing both the survival and recovery function assigned to it, that action may represent jeopardy to the species. This biological opinion evaluates how the proposed action affects the likelihood of survival and recovery of the New England recovery unit, as well as the relationship of the recovery unit to the survival and recovery of the listed species as a whole.

Population trends since listing under the ESA: Abundance of Atlantic Coast piping plovers is reported as numbers of breeding pairs, i.e., adult pairs that exhibited sustained (> 2 weeks)

territorial or courtship behavior at a site or were observed with nests or unfledged chicks (USFWS 1996). Annual estimates of breeding pairs of Atlantic Coast piping plovers are based on multiple surveys of almost all breeding habitat, including many currently unoccupied sites. Sites that cannot be monitored repeatedly in May and June (primarily sites with few pairs or inconsistent occupancy) are surveyed at least once during a standard nine-day count period in June (Hecht and Melvin 2009b). Figure 1 illustrates breeding pair counts for the Atlantic Coast piping plover population since listing in 1986 through 2015.[8]

The preliminary 2015 Atlantic Coast piping plover population estimate was 1,870 pairs, more than double the 1986 estimate of 790 pairs. Discounting apparent increases in New York, New Jersey, and North Carolina between 1986 and 1989, which likely were due in part to increased census effort (USFWS 1996), the population increased approximately 95 percent between 1989 and 2015.[8]

Figure 1. Estimated abundance of breeding piping plovers by recovery unit, 1986-2015. Lighter colored bars denote preliminary estimates. Dashed pink lines denote subpopulation abundance goal.



[8] Denotes preliminary estimate for 2015.

Overall, population growth is tempered by geographic and temporal variability. By far, the largest net population increase between 1989 and 2015 occurred in New England (445 percent), the Massachusetts population alone increased five-fold in that time period. Net growth in the southern recovery unit population was over 182 percent between 1989 and 2015. Most of the southern recovery unit breeding population increase occurred in 2003 to 2005 and 2011 to 2012. Abundance in the New York-New Jersey recovery unit experienced a net increase of 129 percent between 1989 and 2015,[9] but the population declined sharply from a peak of 586 pairs in 2007 and has still not recovered with only 411 pairs in 2015. In Eastern Canada, where increases have often been quickly eroded in subsequent years, the population posted a 25 percent decline between 1989 and 2015.

In addition to the ongoing declines in the New York-New Jersey and Eastern Canada recovery units, other periodic regional declines illustrate the continuing risk of rapid reversals in abundance trends. Examples include decreases of 21 percent in the Eastern Canada population in just three years (2002 to 2005) and 68 percent in the southern half of the southern recovery unit during the 7-year period from 1995 to 2001. The 64 percent decline in the Maine population between 2002 and 2008, from 66 pairs to 24 pairs, followed only a few years of decreased productivity. Intensified protection efforts between 2008 and 2013 contributed to high productivity in Maine (range = 1.52 - 2.12 chicks per pair) and the breeding population has since rebounded to 62 pairs as of 2015.

Breeding site fidelity and dispersal: Adult piping plovers generally demonstrate nest site fidelity, returning to the same breeding beach or a nearby beach in consecutive years. First-time Atlantic Coast breeders are more likely to disperse from their natal sites, but their fidelity to their natal region is very high.

Although long-distance movements between natal and breeding sites (and even between breeding years) have been documented, they are rare. On the Atlantic Coast, almost all observations of inter-year movements of birds have been within the same or adjacent states. Extensive efforts to re-sight >1,400 Atlantic Coast piping plovers color-banded in Virginia, Maryland, Massachusetts and five Eastern Canadian provinces between 1985 and 2003 resulted in only four records of plovers breeding outside the recovery unit in which they were banded (USFWS files, Amirault et al. 2005, updated by D. Amirault-Langlais and F. Shaffer, Canadian Wildlife Service in email communication to A. Hecht, 2009). Two ongoing studies have each detected one movement outside the recovery unit where the bird was banded (A. DeRose-Wilson, Virginia Tech, email communication to A. Hecht, 2016, M. Stantial, SUNY, email communication to A. Hecht, 2016).

In New York, Wilcox (1959) recaptured 39 percent of the 744 adult plovers that he banded in prior years (many were recaptured during several successive seasons and all but three of them were retrapped in the same nesting area), but recaptured only 4.7 percent of 979 plovers that he banded as chicks. He also observed that males exhibited greater fidelity to previous nest sites than females. In Massachusetts, 13 of 16 birds banded on one site were resighted the following

[9] The 2015 abundance estimate for New York-New Jersey geographic recovery unit is preliminary.

season, with 11 nesting on the same beach (MacIvor et al. 1987). Nine of the ten adults that changed sites from 1985-1987 were females (MacIvor et al. 1987). Strauss (1990) observed individuals that returned to nest in his Massachusetts study area for up to six successive years. Of 92 adults banded on Assateague Island, Maryland, and resighted the following year, 91 were seen on the same site, as were 8 of 12 first-year birds (Loegering 1992). Cross (1996) reported that 10 of 12 juveniles banded on Assateague Island, Virginia and resighted 1 and/or 2 years later were on the Virginia or Maryland portions of Assateague Island, while the other two were observed on other Virginia barrier islands. Site fidelity of banded adults on Long Island in 2002-2004 was 83 percent (Cohen et al. 2006).

Forty percent of 329 eastern Canada piping plovers banded as adults in 1998-2003 exhibited fidelity to their nesting beaches in every year that they were resighted, and only 6 of 152 recaptured adults (4 percent) moved to a different province in a subsequent year (Amirault et al. 2005, updated by D. Amirault-Langlais and F. Shaffer, CWS, pers. comm. 2009). By contrast, 5 percent of 95 plovers banded in their hatch year nested at their natal beaches and 84 percent nested in their natal province. Only 1 of 888 banded birds, however, was detected breeding outside of eastern Canada. That bird, banded as a chick on Prince Edward Island, fledged a chick in Massachusetts after unsuccessfully breeding on Long Island, New York, the previous season.

More recent studies provide quantitative estimates of dispersal distances. Rioux et al. (2011) compared effects of prior-year hatching success on the inter-annual dispersal movements of adult piping plovers in eastern Canada (n=86, range=0.01 – 217.33 kilometers [0.006 to 135 miles]). The mean for 15 plovers experiencing hatching failure the previous year was 17.8 kilometers (11 miles) versus 5.8 kilometers (3.6 miles) for 71 birds hatching at least one egg. Stantial (email communication to A. Hecht, 2016) reported a mean dispersal distance of 1.84 kilometers (1.14 miles) between breeding years for adults banded in Massachusetts, 1.35 kilometers (0.84 miles) in New Jersey (n =19 and 12, respectively). Dispersal from natal site to first breeding location for a small sample (n=6) included one long distance movement (582.32 kilometers [361.84 miles]) and a mean dispersal distance of 20.64 kilometers (12.83 miles) for the other five birds (Stantial, pers. comm. 2016).

Information from the Missouri River demonstrates similar patterns of overall high fidelity, larger movements between natal sites and first breeding sites than between years for established breeders, and rare long distance movements. Median inter-annual distance for 556 movements by 443 adults was 153 meters, and overall fidelity was higher in males than females (Friedrich et al. 2015). When adult plovers moved to a different sandbar in a subsequent breeding season, the mean distance was 20.16 kilometers (12.5 miles) versus 25.70 kilometers (15.97 miles) from the natal site for first-year breeders (Catlin et al. 2015). Dispersal from natal sites decreased when habitat availability increased (Catlin et al. 2015).

Genetic evidence is consistent with observed dispersal patterns described above. Miller et al. (2010) found strong genetic structure, supported by significant correlations between genetic and geographic distances in both mitochondrial and microsatellite data sets for Atlantic Coast piping plovers. Atlantic birds showed evidence of isolation-by-distance patterns, indicating that dispersal, when it occurs, is generally associated with movement to relatively proximal breeding

territories. Furthermore, weaker genetic structure among Interior birds (Great Lakes and Great Plains populations) may reflect lower natal- and breeding-site fidelity (Miller et al. 2010), indicating that dispersal distances observed on the Missouri River may be larger than those occurring in the Atlantic Coast population.

In summary, piping plovers demonstrate high fidelity to their natal and breeding regions. Established males make smaller inter-annual movements than females, and first-time breeders disperse more than adults. Notwithstanding rare long-distance movements, population growth and stability are heavily dependent on survival and productivity of local populations.

Threats from beach recreation: Threats from human beach-users were cited in the final listing rule and described in detail in the 1996 revised Atlantic Coast recovery plan. Threats to breeding piping plovers from both motorized and non-motorized beach recreation activities are relatively well understood, and recommended management options are described in the Federal guidelines (USFWS 1994).[10] Newer threats include the increasing popularity of "extreme sports," such as kite-buggies and surf kites (also called "kite boards"), which accidentally land in and near breeding habitat.

Sufficiency of restrictions on dogs in piping plover nesting areas and consistency of enforcement are continuing concerns of biologists monitoring Atlantic Coast piping plovers (e.g., M. Bartlett in litt. 2008; NPS 2008; Goldenrod Foundation 2008; L. Zicari, USFWS in litt. 2013). Literature on closely related beach-nesting plover species provides additional evidence of adverse effects on breeding activities from both leashed and unleashed dogs (Lord et al. 2001; Weston and Elgar 2007).

Management activities to protect habitat, nests, and unfledged chicks from impacts of pedestrian recreation include symbolic fencing of courtship and nesting habitat, leashing or prohibition of pets during the breeding season, buffers between breeding piping plovers and fireworks, informational and interpretive signing, public education, and law enforcement patrols. On sites where OSVs are allowed to operate during the breeding season, protection requires additional closures of the lower beach and intertidal zone during periods when unfledged chicks are present. These management activities are predicated on frequent monitoring of individual breeding pairs during territory establishment and courtship, nesting, and chick-rearing periods. For example, periodic adjustment of buffers established with warning signs and symbolic fencing to protect piping plover courtship habitat, nests, and incubation behavior requires regular observations of breeding activity. Minimizing the spatial extent and duration of restrictions on use of OSVs is contingent on precise hatching date predictions and daily verification of brood locations (USFWS 1996). Effectiveness of these management measures to avoid or reduce threats is contingent on skilled monitoring and timely implementation and enforcement of adequate buffers to protect piping plover courtship, nesting, and brood-rearing. All of these labor-intensive actions require continued implementation to counter threats that are present every year.

[10] A March, 2015 addendum to the Federal guidelines provides information about occasional occurrences of early hatching and delayed fledging of piping plover chicks that may affect the timing of protections needed to avoid take associated with management of motor vehicles (USFWS 2015).

Threat from beach-raking: As described in the revised recovery plan, beach-raking machines remove the plovers' wrack line foraging habitat and pose mortality risks due to crushing or sweeping up eggs and chicks (USFWS 1996; USFWS 2009). Several studies (Elias et al. 2000; Cohen et al. 2009) have confirmed the importance of wrack as a foraging habitat. Jones (1997) suggested presence of wrack as a primary factor explaining breeding success of piping plovers without bayside access at CACO in Massachusetts. Jones (1997) also cited potential for beach-cleaning operations to degrade habitat, since piping plovers often place their nests near cobble, wrack, or other natural debris.

Threats from predation: The final listing rule identified predation by pets, feral dogs and cats, skunks, and raccoons as threats on the plover's Atlantic Coast range. The 1996 revised recovery plan provides a more thorough discussion of predation threats, and recommends specific tasks to be implemented in an integrated approach to predator management that employ a full range of management techniques.

Research and reports indicate that predation poses a continuing (and perhaps intensifying threat) to Atlantic Coast piping plovers. Erwin et al. (2001) found a marked increase in the range of raccoons and foxes on the Virginia barrier islands between the mid-1970s and 1998, and concurrent declines in colonies of beach-nesting terns and black skimmers. Boettcher et al. (2007) identified predation as "the primary threat facing plovers in Virginia." Review of egg losses from natural and artificial nests at Breezy Point, New York, found that gulls, crows, and rats were major predators (Lauro and Tanacredi 2002). Recommendations included removal of crow nests to complement ongoing removal of gull eggs and nests. Modeling by Seymour et al. (2004) using red fox movement data from northern England indicated that risk of fox predation on ground-nesting bird species in long, linear habitats increased with narrowing habitat width, and was sensitive to changes in habitat width of even a few meters. Free-roaming domestic and feral cats, particularly those associated with human-subsidized feral cat colonies, appear to be an increasing threat to piping plovers and other beach-nesting birds (USFWS 2009).

Although predator numbers are undiminished or increasing, effectiveness of predator exclosures (wire cages placed around nests, a key management tool in the early years of the recovery program) has declined. Cohen et al. (2009) found that exclosures improved nest survival, but not overall reproductive output on Westhampton Island, New York study sites, a result that has been echoed by studies of other plover species (e.g., Neuman et al. 2004). Episodes of systematic harassment of incubating piping plovers (primarily by foxes (*Vulpes vulpes*), coyotes (*Canis latrans*), and American crows (*Corvus brachyrhynchos*) and depredation at exclosures, elevated rates of nest abandonment, and incidents of adult mortalities associated with exclosed piping plover nests on the Atlantic Coast (Mostello and Melvin 2002; Melvin and Mostello 2003) and on the Northern Great Plains (Murphy et al. 2003) prompted managers to use exclosures more selectively. A Structured Decision Making Workshop in December 2013 developed and tested a prototype decision-support model with potential to increase the efficacy of exclosures and identify site-specific environmental factors that affect the demographic benefits and risks of exclosures (Hecht et al. 2014).

As effectiveness of exclosures has declined, managers have increased selective predator removal activities at many sites throughout the U.S. Atlantic Coast range (e.g., USDA 2006; NPS 2007; Cohen et al. 2009). Recent predator removal efforts have focused on mammalian predators such as fox, skunks and coyotes, and avian predators, primarily gulls and crows (e.g., Brady and Inglefinger 2008; USFWS 2007; USDA 2008; USDA 2013; USDA 2014; Davis 2015). Information about the effectiveness of predator removal activities is provided in the section on the effects of the proposed mitigation (below).

Predation is a widespread and continuing threat to breeding Atlantic Coast piping plovers. Implementation of conservation measures for addressing predation threats is time-consuming and costly. Although site-specific predator pressures vary from year to year, predator management is a recurring need.

Wind Energy: Wind turbine generators have emerged as a potential threat to piping plovers since the 1996 revised recovery plan. The primary potential threat to piping plovers posed by wind turbine generators is that of collisions. Impacts may vary with the specific size, number, and configuration of proposed onshore wind turbine generators and site-specific factors such as juxtaposition of nesting, roosting, and foraging habitats and weather patterns. In the offshore environment, the primary risk occurs during migration, when routes and flight altitudes are largely unknown.

In 2008, the USFWS completed formal consultation with the Minerals Management Service on a proposal by Cape Wind Associates to construct 130 wind turbine generators approximately 5 miles off the coast of Cape Cod, Massachusetts (USFWS 2008). To date, the wind energy development has not been constructed. A permit application for six turbines 2.8 miles off the coast of New Jersey with provisions for shut downs during low visibility conditions during March 15-June 15 and August 1-October 31 was determined not likely to adversely affect piping plovers (E. Davis USFWS, in litt. 2012). The USFWS also concurred with a Corps of Engineers determination that five turbines authorized for construction approximately 3 miles southeast of Block Island, Rhode Island are not likely to adversely affect the piping plover (T. Chapman USFWS, in litt. 2013). The USFWS has also provided technical assistance and preliminary comments regarding proposals (in various stages of development) for one to two wind turbine generators to the U.S. Department of Agriculture in Maine, the U.S. Coast Guard and National Guard Training Center in New Jersey, and the National Aeronautics and Space Administration in Virginia, and concurred with the Minerals Management Service's determination that leases for single meteorological towers in seven potential wind turbine generator lease blocks located 8-17 miles off the coast of Delaware and New Jersey are not likely to adversely affect piping plovers (USFWS 2009). While analysis of the best available information indicates that risk from the Cape Wind project is low (USFWS 2008), the prospect of multiple large wind turbine generator projects along potential migration routes poses greater concern.

Wind turbine generators pose a threat to piping plovers in the foreseeable future, but understanding the magnitude of this threat requires information about piping plover movements. Collision risk modeling using piping plover flight behavior data from six Massachusetts and New Jersey sites predicted that mortality from turbines situated on or adjacent to breeding sites would vary with turbine size and habitat configuration (Stantial 2014). Studies underway using

nanotag technology and expanding deployment of receivers along the Atlantic coast offer promise for improved risk assessments for future offshore wind energy proposals (Loring et al. 2016).

It should be noted that some Massachusetts coastal communities have developed land-based wind energy ordinances to direct wind energy facilities to appropriate land-based locations and incorporating visual, environmental and safety impacts in the permit review process (see Town of Barnstable ordinance, http://www.ecode360.com/6559517?highlight=wind accessed 02/23/2016; Town of Dennis ordinance, http://www.town.dennis.ma.us/Pages/DennisMA_Building/bylaw.pdf, accessed 02/23/2016; Town of Duxbury, http://www.town.duxbury.ma.us/Public_Documents/DuxburyMA_Planning/zoning%20bylaws/ARTICLE%20600%20-%2003-13-10%20TC.pdf, accessed 02/23/2016). Although there may be no Federal nexus requiring section 7 consultation, the permitting processes outlined in the town ordinances generally take into consideration impacts to the environment and require that a proposed wind facility complies with applicable Federal and State standards or regulations.

Climate change: A recent IPCC summary report (IPCC 2014) notes that recent climate changes have had widespread impacts on human and natural systems. Furthermore, the IPCC stated that it is evident that the atmosphere and oceans have warmed and sea level has risen as a result of the warming of the climate system. In addition to sea-level rise, the climate-related extremes, including more frequent and energetic storms and extreme storm surges have increased and are widely recognized climate change-related concerns for coastal regions (IPCC 2014).

Potential effects of accelerating sea-level rise on coastal beaches, including piping plover nesting and foraging habitats, may be highly variable and potentially severe. Important factors influencing future habitat losses and gains include the amount of sea-level rise, which may vary regionally due to subsidence or uplift and the specific landforms occurring within a region (Galbraith et al. 2005; Gutierrez et al. 2007). Gutierrez et al. (2007) predicted varying responses of spits, headlands, wave-dominated barriers, and mixed-energy barriers for four sea-level rise scenarios in the U.S. mid-Atlantic region (overlapping most of the piping plover's New York-New Jersey and southern recovery units). Development and testing of models linking predictions of sea-level rise, changes in beach geomorphology, and piping plover nesting habitat is currently in progress (Gutierrez et al. 2011; Gieder et al. 2014; Gutierrez et al. 2015).

Human responses, especially coastal armoring, will play key roles in the effects of sea-level rise on the quantity, quality, and distribution of piping plover habitats. The U.S. Climate Change Science Program (CCSP 2009), for example, stated that "To the degree that developed shorelines result in erosion of ocean beaches, and to the degree that stabilization is undertaken as a response to sea-level rise, piping plover habitat will be lost. In contrast, where beaches are able to migrate landward, piping plovers may find newly available habitat." A review of impacts of sea-level rise and climate change on the coastal zone of southeastern New Brunswick reached similar conclusions, stating that "…coastal ecosystems have a natural capacity to respond to climate and water-level variability … [but] future impacts of sea-level rise and climate change could be exacerbated by development pressures or infrastructure protection projects." (Environment Canada 2006). Recent modeling by Lentz et al. (2016) further illustrates the importance of dynamic response mechanisms to maintaining the resiliency of barrier beaches under

accelerating sea-level rise. Timing and spatial distribution of habitat gains and losses will also be critical (Galbraith et al. 2002); demographically vulnerable species such as piping plovers will be especially susceptible to lags between habitat loss and formation.

Increased coastal storm activity is a second climate change-related threat to piping plovers in their Atlantic Coast breeding range. Although there is uncertainty about whether and how storm frequency or intensity will change relative to 20th century trends (CCSP 2009), sea-level rise alone will increase coastal flooding during storm surges and amplify rates of habitat change on coastal beaches. Increased numbers and intensity of storms during the breeding season could directly affect piping plover breeding success by increasing long-term rates of nest inundation, nest abandonment, or chick mortality due to harsh weather.

Although poorly understood and not discussed further, we do not discount the potential for other climate change-related effects on piping plovers (e.g., changes in predator communities, emergence of new diseases, increases in competition for nesting territories with other beach-nesting bird species on a reduced habitat base).

ENVIRONMENTAL BASELINE

Action Area

The implementing regulations for section 7(a)(2) of the ESA define the "action area" as all areas to be affected directly or indirectly by the Federal action and not merely the immediate area involved in the action (50 Code of Federal Regulations 402.02). The action area for this biological opinion is the area identified in the HCP as the "plan area" (see section 2.2.1 of the HCP) and includes an approximately 300-yard-wide zone along almost the entire coastline of Massachusetts, with the exception of one small area in Mount Hope Bay. The action area incorporates approximately 1,774 linear miles of coastline (see figure 2-1 in the HCP). The action area includes all currently and recently occupied piping plover habitat delineated as priority habitat[11] by the MADFW, as well as other beach and dune areas that could support breeding piping plovers in the future. This area is intended to capture all currently suitable Massachusetts piping plover breeding habitat, as well as the area within which additional plover breeding habitat could develop in the foreseeable future due to the dynamic nature of the coastline. It includes the coastal portions of the following counties: Essex, Suffolk, Norfolk, Plymouth, Barnstable, Bristol, Dukes, and Nantucket.

The action area covers approximately 150,000 acres of land, of which approximately 29,000 acres are currently classified as beach and coastal dune, the land cover types most associated with piping plover breeding. It contains approximately 43,531 acres of current or recently occupied piping plover breeding and foraging habitat delineated by the MADFW. Managed recreational beaches and associated facilities including (but not limited to) buildings, parking

[11] Priority habitat for piping plover was delineated by the MADFW in accordance with State regulations at 321 CMR 10.12. Priority habitat encompasses all currently and recently occupied piping plover habitat and includes all suitable nesting habitat associated with piping plover breeding observations, as well as associated feeding and sheltering habitat.

lots, access pathways, access roads, improved roads and OSV travel corridors are found in the action area in addition to wild and semi-wild beaches (e.g., the designated Wilderness Area on Monomoy National Wildlife Refuge in Chatham) and tidal marshes and inlets.

Habitat Characteristics of the Action Area

The northern coastline from the New Hampshire border to northern Plymouth County is dominated by glacial till with occasional bedrock outcrops. There are a few substantial beaches such as Plum Island in Newburyport, Crane Beach in Ipswich, and Revere Beach in Revere that provide habitat for larger concentrations of piping plovers. Interspersed between the rocky outcrops and larger beaches are smaller, sandy areas of suitable habitat that provide habitat for one pair to less than ten pairs of piping plovers, such as Winthrop Beach, Winthrop or Third Cliff, Scituate. The southern coast from central Plymouth County south through Barnstable County (comprising all of Cape Cod) is dominated by larger sandy beaches.

The Massachusetts coastline has been significantly altered by hard structures that affect the development and maintenance of many of the piping plover beaches. According to a recent summary of pre-Hurricane Sandy Massachusetts coastal habitat, approximately 47. 6 miles of armored coastline showed evidence that sandy beaches would be present if the shoreline was not armored. Rock revetments, jetties, seawalls and breakwaters affect sand transport and may starve or build up beaches, depending on the location of the structure. In response, many beaches receive periodic nourishment from channel maintenance dredging projects. The towns of Chatham and Mashpee, for example, have developed 10-year maintenance and beach nourishment plans that include the renourishment of many smaller beaches in these towns. The renourished beaches are configured to maintain or enhance piping plover habitat and will provide suitable nesting habitat for plovers as long as the sand remains on the nourished beaches and these beaches continue to be managed for piping plovers.

Massachusetts coastal beaches are affected by tidal action, currents, and storms creating breaches, overwash areas and reconfiguring barrier and mainland beaches. Overwash areas and creation of sand spits from breaches create optimal plover nesting habitat if left unaltered (e.g., no filling of the breach or overwash areas). North Beach Island and the Monomoy Islands and South Beach Island complex in Chatham are examples of natural barrier beaches that have not been altered by fill or dredging in more than 25 years that combined, host over 100 pairs of breeding plovers (based on 2015 population data).

The HCP's covered activities and conservation actions are expected to occur nearly exclusively on beaches, with the potential to extend into intertidal areas. However, the plan area includes a 300-yard inland buffer adjacent to suitable piping plover habitat (e.g., the delineated piping plover priority habitat) to allow for potential changes in habitat and piping plover distributions over time (see section 2.2.1 of the HCP).

Existing Conditions of the Action Area

Statewide, piping plovers nest on private- and government (municipal, State and Federal)-owned beaches. Many of these beaches are heavily used for recreation during the summer months when

plovers are present and breeding. State guidelines (MADFW 1993) for managing piping plovers have been in place since 1993, although intensive management of beaches was initiated prior to their publication. In 1994, the Service developed guidelines (USFWS 1994) for managing recreational activities on piping plover habitat and avoiding violations of the ESA. Management at most Massachusetts sites conforms to both State and Federal guidelines.

Two State laws regulate activities occurring on Massachusetts beaches: the MESA (321 CMR 10.00) and the Massachusetts Wetlands Protection Act (310 CMR 10.00) (MWPA). The MESA protects rare species and their habitats by prohibiting the take[12] of any plant or animal species listed as endangered, threatened, or of special concern by the MADFW. Disruption of nesting, breeding, feeding, or migratory activity may result from, but is not limited to, the modification, degradation, or destruction of habitat. Permits for "taking" rare species for scientific, educational, conservation, or management purposes can be granted by the MADFW. The MESA and its implementing regulations outline project review filing requirements for projects or activities that are located within a Priority Habitat of Rare Species (http://www.mass.gov/eea/agencies/dfg/dfw/natural-heritage/regulatory-review/mass-endangered-species-act-mesa/, accessed 02/23/2016). As part of the process of obtaining a COI under the HCP, plan participants would be required to achieve compliance by obtaining a separate MESA conservation and management permit (see HCP section 1.1.1).

The MWPA regulates activities in wetland resource areas such as dunes, beaches, tidal flats, and coastal banks. The local agency responsible for enforcing the MWPA and its accompanying regulations is a town's or city's conservation commission. The local conservation commission implements the regulations as overseen by the Massachusetts Department of Environmental Protection's Division of Wetlands and Waterways. For activities proposed in coastal wetland resource areas, the conservation commission may decide that the proposed activity would not endanger the resource, as long as the activity proceeds subject to certain conditions. If this is the conservation commission's determination, it issues an Order of Conditions, which is the permit for the proposed activity. Orders of Conditions regulate proposed activities to minimize or prohibit impacts on wetland resource areas. Some of the covered activities require an Order of Conditions (e.g., OSV use and beach raking) or are expected to require an Order of Conditions to implement them (e.g., nesting habitat improvement).

All current nesting beaches and most historical or potential sites in Massachusetts are surveyed each year. In 2008, 84 percent of breeding pairs of piping plovers in Massachusetts were surveyed more than 30 times between May 1 and July 31 (USFWS unpublished data). Since 1995, estimates of productivity were obtained for more than 95 percent of all breeding pairs in the State. Hecht and Melvin (2009b) estimated that an average of 83 hours of paid staff time were expended per pair for on-site monitoring and management of piping plovers, data compilation, report preparation, and planning in Massachusetts in 2002.

[12] Take, in reference to animals, means to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, collect, process, disrupt the nesting, breeding, feeding or migratory activity or attempt to engage in any such conduct, or to assist such conduct. In reference to plants, take means to collect, pick, kill, transplant, cut or process or attempt to engage or to assist in any such conduct.

On most Massachusetts beaches where nests are potentially threatened by pedestrian activities, nests are protected with buffers delineated by symbolic fencing and warning signs. Although State and Federal guidelines recommend that pets be leashed and under control of their owners at all times from April 1 through August 31 on beaches where piping plovers are present or have traditionally nested, enforcement of leash requirements is a continuing management problem on many Massachusetts piping plover sites. Management of OSVs at major beaches in Massachusetts conforms to most components of State and Federal guidelines. Beginning in early April, and extending until the first egg hatches, OSVs are restricted to discrete travel corridors along the outer edges of suitable plover nesting habitat. The guidelines call for sections of beach where unfledged plover chicks are present to be completely closed to recreational vehicles until chicks are observed in sustained flight. By permitting the activity through an Order of Conditions to avoid short- and long-term adverse effects on the habitat of listed species, the Massachusetts Wetlands Protection Act provides an effective regulatory tool to protect plover habitat from degradation caused by OSVs and dune building activities.

Beach raking occurs on a limited number of beaches in Massachusetts and is regulated under the MWPA to avoid mortality of piping plovers and adverse effects to the habitat. Conditions required under State regulations for implementing beach raking include a variety of measures to avoid take, including limits on the frequency, duration, and areal extent of raking, intensive monitoring of adults and chicks by qualified shorebird monitors during raking operations, a monitor walking in front of the beach rake, maintenance of setbacks between raking equipment and unfledged chicks, and retention of beach wrack and vegetation.

Increasing predation pressure, particularly from coyote, fox, cats, and avian predators, including crows and gulls, has affected productivity at many Massachusetts beaches. To reduce predation of eggs, nests are sometimes protected with wire predator exclosures (see earlier discussion of benefits and risks associated with exclosures). In 2015, approximately 10 percent of piping plover nests in Massachusetts were exclosed (J. Regosin MADFW, electronic email dated June 13, 2016). A number of beaches have implemented selective predator removal to increase productivity if predation was determined to be the primary cause of poor nest or chick survival.

Previous Consultations in the Action Area

The Service issued an ITP effective April 16, 2015 to the Town of Orleans, Massachusetts for implementation of the Town's Over-Sand Vehicle Habitat Conservation Plan. The ITP authorized incidental take of piping plovers that would occur during escorting of OSVs past up to two broods of unfledged piping plover chicks on or after July 15. The ITP was a 3-year permit renewable after April 30, 2018. The Service anticipated that over the life of the permit, a maximum of 12 unfledged piping plover chicks would be killed.

The Town of Orleans implemented their Over-Sand Vehicle Habitat Conservation Plan in 2015 when one brood of piping plovers was present in the OSV escort area. Vehicles were escorted past the unfledged brood of three chicks for 15 days. All three chicks died prior to fledging, at least two mortalities were attributed to predation, the third chick was never found (Orleans 2016). No chicks were confirmed to have been killed by escorted vehicles (they were not found in or near the vehicle travel corridor). The Town of Orleans implemented non-lethal on-site

predator management (Orleans 2016) and provided funds for off-site selective predator management as mitigation.

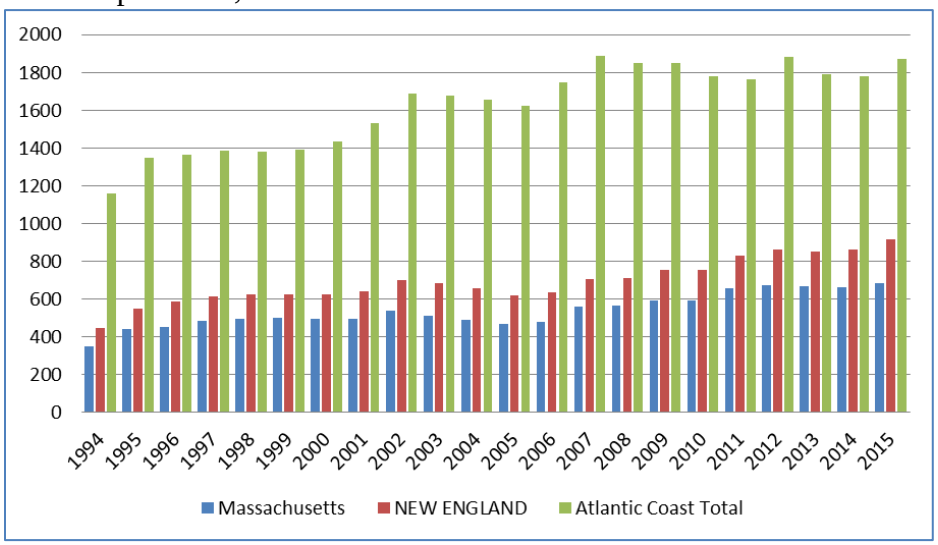
In 2010, the Service completed a non-jeopardy biological opinion on flexible management, entailing potential exclusion of up to 400 meters of suitable nesting habitat from symbolic fencing on narrow pedestrian lifeguarded beaches at the CACO. The biological opinion was amended in 2012 and 2015 to extend the time frame for implementation of flexible management options. Flexible management for a reduction in symbolic fencing of one nest was implemented in 2010, but the nest was subsequently lost to flooding. Flexible management was not necessary and hence not implemented in 2011 through 2015. Therefore, to date no take has accrued for this biological opinion.

Ten non-jeopardy formal consultations were completed for projects within New England between 1997 and 2009, including the formal consultation for the Cape Wind project. Six of the consultations were with the U.S. Coast Guard for marine event permits for fireworks events in coastal areas of Connecticut (3) and Massachusetts (3). These activities occurred once a year and required follow-up reporting to assess take. No loss of nests, chicks or adults was documented. The fireworks events that received incidental take permits are now incorporating conservation measures to avoid adverse effects.

Status of the Species in the Action Area

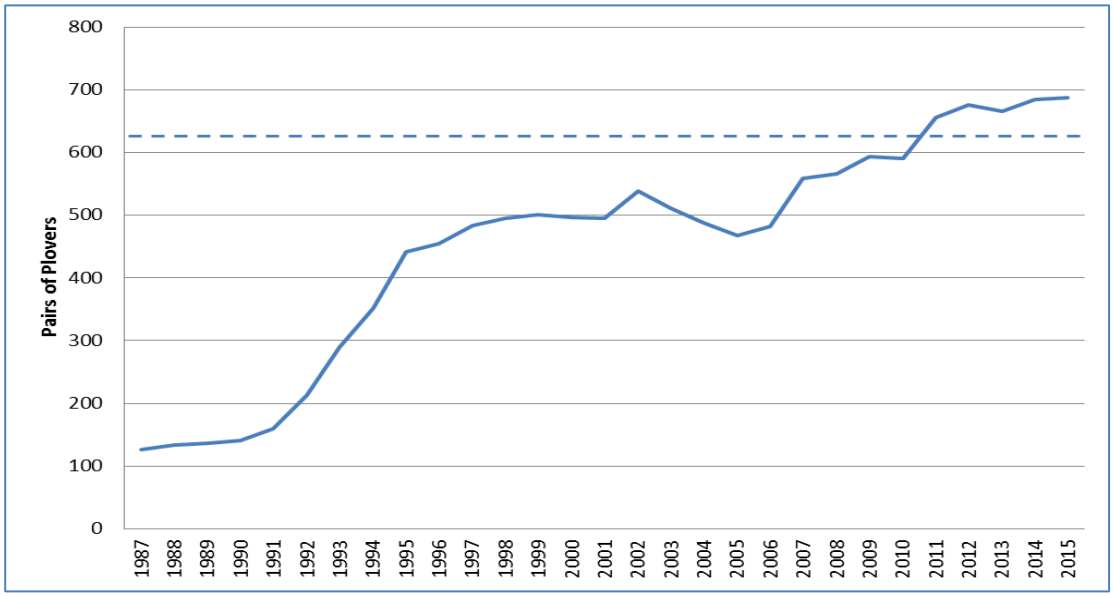
Beginning in 1994, the Massachusetts population has comprised 32 to 43 percent of the U.S. population, and 74 to 80 percent of the entire New England plover population (Figure 2). During the last five years, the Massachusetts population alone has exceeded the recovery goal of 625 pairs for the New England Recovery Unit (Figure 3).

Figure 2. Massachusetts Piping Plover Population vs. New England Recovery Unit and Atlantic Coast Populations, 1986 – 2015.[13]



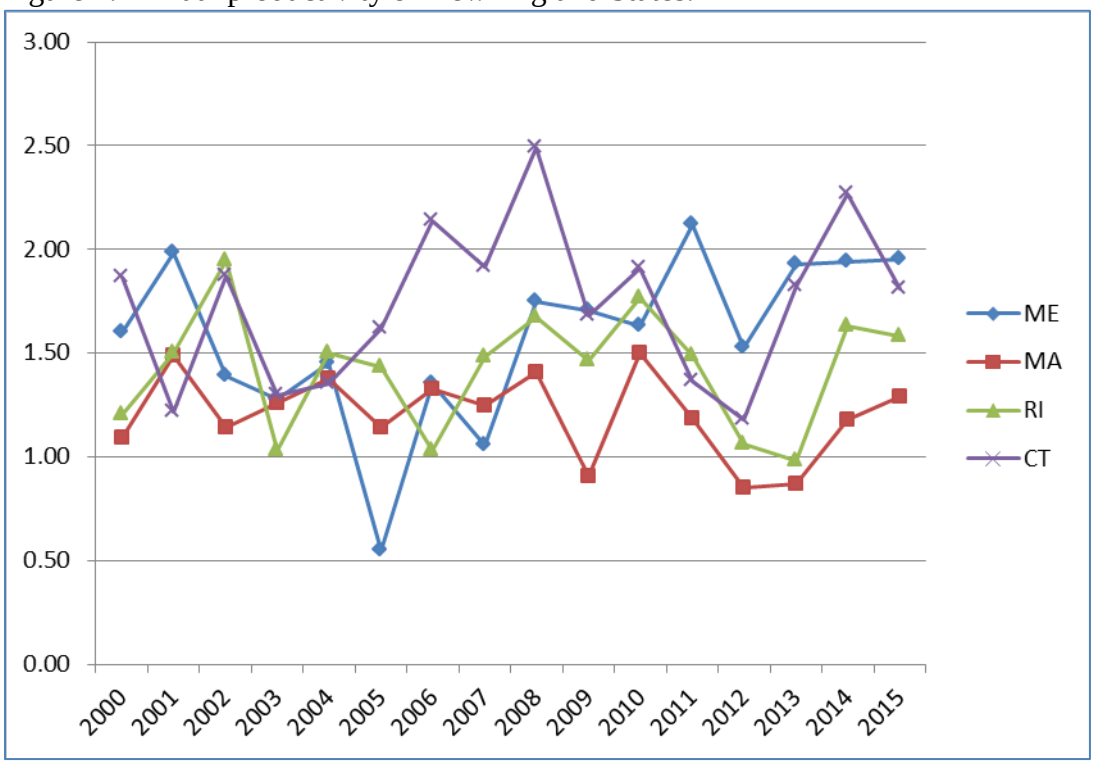
[13] 2015 abundance data are preliminary for the Atlantic Coast population.

Figure 3. Massachusetts breeding piping plover population compared to New England Geographic Recovery Unit goal (dashed line).



From 1987 to 2015, the average productivity of the Massachusetts population was approximately 1.36 fledglings per breeding pair, above the 1.2 fledglings per pair, estimated to be necessary to maintain a stable population in New England (Melvin & Gibbs 1996; Hecht & Melvin 2009a). Although there is no clear trend in productivity during this time period, average productivity in 6 of the past 7 years was below the long-term average (2009 – 2015 average = 1.11), suggesting there could be an emerging downward trend. Since 2008, plover productivity in Massachusetts has been lower than other New England states (Connecticut, Rhode Island, Maine), where increases in abundance correlated with an increase in productivity (Figure 4).

Figure 4. Annual productivity of New England States.[14]



In 2013, 133 sites in Massachusetts were confirmed to have breeding piping plovers, for an adjusted total count of 666 pairs (ten less pairs than in 2012) and an average annual productivity of 0.87 chick/pair fledged. In 2014, 663 breeding pairs of piping plovers were confirmed at 150[15] sites. The 2014 abundance data indicates little change in the population despite low productivity the two years prior (~0.86 chick/pair). Productivity in 2014 increased to 1.18 chicks/pair (Mostello and Longsdorf 2016). The population increased to 687 breeding pairs in 2015, with a productivity of 1.29 chicks/pair (Natural Heritage and Endangered Species Program [NHESP] 2016).

Abundance of Massachusetts breeding pairs continues to increase after years with good productivity (e.g., 2008 and 2010) and grow modestly after years with productivity close to 1.2 chicks per pair (e.g., 2011 and 2014), but it has been less sensitive to poor productivity (e.g., 2009, 2012, 2013). A combination of factors may account for the relatively stable or slightly increasing Massachusetts population (+/- 30 pairs in 2011-2015) despite productivity rates less than the 1.2 chicks fledged per breeding pair estimated to be necessary to maintain a stationary population. These include, but are not limited to (1) possible recruitment in 2012 (perhaps even

[14] New Hampshire not included due to low abundance (less than 10 breeding pairs) and highly variable productivity.

[15] The increase is not necessarily due to 17 additional sites. Some sites were split into multiple sites and only a few new sites were documented (J. Regosin, MADFW, in electronic email dated March 25, 2015).

in 2013) of first-time breeders from the large 2010 cohort of fledged chicks,[16] (2) less frequent use of exclosures in recent years than during the period when the relationship between productivity and population trend was assessed (i.e., fewer exclosures may result in lower adult mortality as well as lower productivity),[17] and (3) higher rates of immigration into Massachusetts from other New England states, where productivity was higher than in Massachusetts during this period. Although dispersal of first-time breeders diminishes with distance from the natal site, it is not unreasonable to expect that, after years when the other states experienced higher productivity, recruits to Massachusetts originating from Maine, New Hampshire, Rhode Island, and Connecticut might have slightly exceeded the number of dispersers from Massachusetts to the other states.

Notwithstanding the factors (described above) that may confound recent relationships between the productivity and the population trend in New England, productivity remains an important, albeit partial, predictor of trend in future abundance of piping plovers. Furthermore, because small populations may be vulnerable to extinction due to variability in productivity and survival rates, productivity needed to assure a secure population (that can withstand, for example, catastrophic and stochastic events) may be higher than the rate sufficient for a stationary population. As abundance increases, however, the productivity rates required for demographic stability and security are likely to converge. Although the Service continues to monitor plover productivity rates and assess their implications for recovery, abundance of breeding pairs has become a more informative indicator of decreased extinction risk in New England than the annual productivity rate.

The majority of breeding piping plovers occur on Cape Cod, which accounts for 50 to 60 percent of all plover pairs. The North Shore (beaches north of Boston) has the second highest percentage of breeding pairs (12 to 17 percent). Statewide, annually, between 15-17 sites with ten or more breeding pairs account for over 50 percent of the Massachusetts breeding population or 12 percent of all sites (Mostello and Longsdorf 2016; NHESP 2016).

The largest piping plover breeding sites (20 pairs or more) are federally or municipally owned and managed, with the exception of Crane Beach, owned and managed by The Trustees of Reservations, Ipswich (28 to 30 pairs) (MADFW 2016). These federally or municipally owned beaches include South Beach, Chatham (53 to 62 pairs), South Monomoy Island, Monomoy

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[16] In studies with large numbers of marked interior breeding piping plovers, Saunders et al. (2014) found that 56 percent of female Great Lakes piping plovers mated in their first season post-hatch during 1993-2012, while 68 percent of female yearlings mated in Saskatchewan in 2001-2006 (Gratto-Trevor et al. 2010). Both studies found that probability of breeding in the first year was lower for males than females, but Great Lakes males that had not bred earlier were more likely than females to recruit into the breeding population year two and year three. Virtually all surviving Great Lakes piping plovers began breeding by year three (Saunders et al. 2014).

[17] In Massachusetts, between 1992 and 2003, 14 percent of exclosed nests were abandoned, versus 7 percent of unexclosed nests (S.M. Melvin, MADFW, pers. comm. 2013). Preliminary analysis of 2015 Massachusetts data found abandonment rates for exclosed nests that were four times greater than those for unexclosed nests (J. Regosin, MADFW, electronic email dated June 13, 2016). Because evidence from Great Lakes piping plovers indicates that most nest abandonments in that population are caused by mortalities of incubating adults (Roche et al. 2010), it is likely that exclosures induce elevated rates of adult mortality. A study is currently in progress to determine when and under what circumstances the benefits of increased hatching outweigh the demographic cost of increased adult mortality (Darrah and Cohen 2016).

National Wildlife Refuge (41 to 50 pairs), Parker River National Wildlife Refuge (30 to 32 pairs), Sandy Neck, Barnstable (27 to 30 pairs), North Beach Island, Chatham (22 to 24 pairs), and account for 30 percent of the statewide population of breeding piping plovers. Recreational activities during the plover season vary among these beaches, including little to no recreational use on Monomoy National Wildlife Refuge and Parker River National Wildlife Refuge, to moderate use on South Beach and North Beach Island, Chatham (primarily due to remote pedestrian access), to heavily used and managed pedestrian activity at Crane Beach, and pedestrian and OSV activity on Sandy Neck. See Table 2-6 in the HCP for a summary of land ownership and land use of Massachusetts beaches that support at least five pairs of piping plovers.

The majority of Massachusetts beaches are restricted to pedestrian access or a mix of pedestrian and boat access. Recreational OSV use is allowed and managed according to State and Federal guidelines on 14 beaches during the plover season (Table 2)[18] encompassing 23 percent of the statewide plover population.

Table 2. Massachusetts beaches allowing OSV access.

Beach	Town	# Pairs (2015)
Plymouth/Long Point Beach	Plymouth	17
Duxbury Beach	Duxbury	26
Sandy Neck	Barnstable	37
Chapin Beach	Dennis	4
Crowes Pasture (Coles Pond)/ Quivett Neck	Dennis	1
(North) Nauset Beach	Orleans and Chatham	25
Nauset Spit (partial OSV access)	Orleans	6
Race Point – South Beach	Provincetown	10
Race Point North/Hatches Harbor	Provincetown	6
High Head Beach	Truro	2
Coskata-Coatue Wildlife Refuge	Wauwinet	4
Smith's Point/Madaket Beach	Nantucket	6
Norton Point	Edgartown	4
Wasque (multiple beaches)	Edgartown	13
South Beach/Katama Beach	Edgartown	0

The MADFW oversees the statewide piping plover monitoring and management program that is implemented by a wide variety of cooperators, including wildlife biologists, seasonal shorebird monitors, beach managers, researchers, and volunteers affiliated with over 30 Federal and State agencies, local municipalities, local and regional land trusts, private conservation organizations,

[18] Parker River National Wildlife Refuge currently allows OSV use during the time of year that plovers are not present.

and universities. Over 95 percent of Massachusetts piping plover beaches is managed according to State and Federal guidelines (MADFW 2016). The MADFW collects data reported by the cooperators, including data on number of breeding pairs (Index Count and Total Count); frequency of site visits; design(s) and installation dates of predator exclosures;[19] dates of nest discovery, completion, and hatching or failure; number of eggs on the date the nest was discovered; total numbers of eggs laid, eggs hatched, and chicks fledged; reasons for egg and chick loss, if determined; and comments regarding census results, limiting factors, and management needs; and provides an annual report on the plover abundance and productivity.

EFFECTS OF THE ACTION

With the exception of the proposed covered activities, piping plovers on most recreational beaches throughout Massachusetts will continue to be managed according to State and Federal guidelines. The MADFW would receive the ITP and in turn issue 3-year COIs to individual applicants for one or more covered activity that would result in an annual authorized level of take anticipated from implementation of the covered activity/activities. The ITP term will be for 26 years. Incidental take as a result of implementing the HCP may only occur during the first 25 years; the 26th year of the ITP will only allow mitigation to be implemented in the event that an additional year of mitigation is required to fully offset take accrued from the covered activities.

Take would result when breeding pairs and their territories, nests and/or broods are exposed to the covered activity. The HCP measures take in the form of reduced productivity for those pairs exposed to the covered activities, with the exception of the covered activity for parking lots and roads where 0.05 adult per breeding pair may be killed. Disruption of territory establishment, abandonment of territories, and mortality of eggs and chicks are anticipated to reduce annual productivity, on average, by 50 percent.

The MADFW developed a sliding scale of take that limits the maximum amount of annual take based on a percentage of breeding pairs and tied to the State's breeding population (3.3.2 of the HCP) in order to ensure that the HCP does not impede the State's contribution to recovery. The MADFW would allow no more than 7 percent of breeding pairs for a statewide population of 655 pairs or more (based on the average of the 3 preceding years' populations) to be exposed to take and would require that no take exposure occur (0 percent pairs exposed) should the population decline to 500[20] breeding pairs or less in a given year. Between 655 and 500 pairs, the rate of allocated take is reduced concurrently with the population (see Table 1).

Effects by covered activity

Use of Roads and Parking Lots in the Vicinity of Unfledged Piping Plover Chicks
In general, roads and most parking lots do not provide suitable feeding, nesting or sheltering habitat for piping plover adults and chicks. However, piping plovers have been documented to

[19] The MADFW authorizes the use of exclosures to ensure qualified monitors appropriately implement their use.

[20] Five hundred pairs is 80 percent of the New England Recovery Unit's abundance objective, corresponding to the highest proportion of the recovery unit population recorded between 1987 and 2015.

nest in parking lots adjacent to sandy beaches or dunes where sand has covered portions of the gravel and/or asphalt parking lot substrate. Parking lots and roads may bisect nesting, foraging and sheltering habitat, causing adults and unfledged chicks to transit these areas as they move between these habitats. Although plovers may not spend a significant amount of time in parking lots or roads, chicks and adults may be at risk of mortality from vehicles, may be prevented from accessing preferred habitats, or broods may be separated from tending adults.

Under this covered activity, take in the form of mortality would occur if unfledged chicks are crushed by vehicles as they attempt to cross roads to reach foraging or sheltering habitat. Increased disturbance by passing vehicles may cause adult plovers to flush (fly away) from the unfledged chicks, thereby increasing the risk of predation for unguarded chicks. Adult plovers may also be killed by vehicles in roads and parking lots if they are brooding young chicks, or herding chicks between foraging or sheltering habitats, although the risk is much less since adults can fly.

Take may also occur in the form of harm or harassment of adults and their young if their normal movement patterns are disrupted by barriers or by monitors herding broods out of a parking lot or across a road. Chicks unable to move freely between prime foraging habitats (for instance if there is a tide differential between outer beach and back bay feeding habitats) or to sheltering habitat may expend energy waiting for the disturbance (e.g., vehicle traffic and associated noise and movement) to cease, or expend energy as they are being forced to move away from their initial destination. Repeated incidences of chick harassment in this manner could increase the energetic demand of chicks that is then compounded by the lack of subsequent foraging opportunities to replace lost energy. Additional energetic demands placed on unfledged chicks could cause a failure to thrive, delay fledging or possibly cause the death of the chick. Delayed fledging may decrease the likelihood of surviving migration. Preventing chicks from reaching sheltering habitat could increase the risk of predation if sheltering habitat is not attained. Avian and mammalian predators may also exploit barriers to capture chicks with limited escape routes. However, the role of barriers in reducing the risk of direct mortality due to vehicle collisions outweighs the risks from preventing access to cover or foraging resources.

Minimization measures required under the HCP to reduce the likelihood of take include: barriers to prevent chicks from accessing road and parking areas; signage; staff training, and managing traffic during periods when birds are crossing. The measures generally designed to prevent chicks from entering parking lots or roads and managing traffic when chicks near the road or parking lot through intensive monitoring would be the most successful in minimizing adverse effects.

Recreation and Beach Operations Associated with Reduced Symbolic Fencing Around Nests and Reduced Proactive Symbolic Fencing of Piping Plover Habitat

Under this covered activity, recreation and beach operations would be allowed to occur in areas less than 50 yards from a piping plover nest that otherwise would be symbolically fenced and restricted from use if management was implemented in accordance with the State and Federal guidelines. Beach sections near major access points with high recreational use would remain open throughout the breeding season. Recreation and beach operations would be allowed to occur in suitable piping plover nesting, feeding, and sheltering habitat that otherwise would be

protected by the placement of proactive symbolic fencing according to the State and Federal guidelines.

Recreation and beach operations close to piping plover nests that have reduced symbolic fenced buffers have the potential to cause harassment of nesting adults and to result in egg mortality through increased risk of nest abandonment or lower hatch rates due to inconsistent incubation. Increased flushing of incubating adults from nests could expose eggs to predators (e.g., crows, gulls, cats) and could cause excessive cooling or heating of eggs. Eggs repeatedly exposed on hot days may overheat, killing the embryos (Bergstrom 1991). Excessive cooling may kill embryos or delay their development, thus delaying hatching dates.

The HCP outlines minimization measures to reduce adverse effects to breeding piping plovers from this covered activity. Fencing would be reduced only to the extent necessary to achieve specific recreational objectives (e.g., opening a specific beach access trail) and would not be reduced to less than 10 yards around a nest except under very limited circumstances, such as in lieu of moving a nest, and must be approved by the MADFW. A buffer larger than the target buffer would be established during egg-laying and would be slowly reduced to the target buffer 24 hours after clutch completion to reduce the likelihood of nest abandonment.

The reduction of proactive symbolic fencing would allow recreation and beach operations in suitable piping plover nesting habitat and could result in direct adverse effects to piping plovers. Recreational activity within unfenced suitable nesting habitat may disrupt territorial and breeding behavior, including courtship, may force piping plovers to seek alternative nesting habitat either close by or at another beach, may trample nest scrapes or undetected eggs, especially of incomplete clutches that are not being incubated, and will generally discourage plovers from successfully nesting within unfenced areas.

This covered activity could reduce piping plover nesting and fledging success in the event that affected adults relocate to poorer quality habitat, face increased intraspecific competition during nest establishment or as they seek suitable foraging habitat. Additional off-site adverse effects may also impact pairs at the site to which the displaced pair disperses, potentially affecting their productivity as competition for resources increases. Piping plovers arriving later in the breeding season might be forced to fly much farther from their preferred site to find suitable, unoccupied nesting habitat.

As previously stated, adult piping plovers generally return to the same nesting beach, or a nearby beach (see Status of the Species for discussion on dispersal). If less suitable habitat is available for establishing territories and nests, plovers may be forced to seek out different breeding habitat, possibly increasing energetic demands, especially on late arriving birds as they seek new nesting options farther from their traditional breeding areas. Plovers forced from their traditional nesting locations may encounter later territory establishment and nesting than previous years when sufficient habitat was available. If the piping plover population in a region approaches the available habitat's carrying capacity, some adults that are displaced may not breed at all and potential new recruits may not find territories. Therefore, it is possible that this covered activity could affect the abundance and distribution of nesting pairs at sites where it is implemented. However, based on the limited amount of suitable habitat and numbers of pairs that may be

affected by this activity, it is unlikely that the one or two pairs per site that might be affected by this covered activity would meaningfully alter the statewide distribution of plovers, although population growth may slow or decline slightly. Moreover, breeding pairs forced to relocate as a result of less available habitat may relocate closer to another occupied territory, causing an increase in agonistic behavior between pairs, delayed nesting of either pair, or competition for resources, especially once chicks have hatched and adults are defending their broods. However, we anticipate that the mitigation will cover the small percent of incidental take for those resident plovers affected by the covered activity pair.

The reduction of proactive symbolic fencing could also result in increased harassment of unfledged chicks by affecting their ability to find shelter and to forage if protected areas of the beach are decreased. The reduced protective beach areas may cause chicks to move greater distances between protected foraging and sheltering habitat as they avoid humans, or are forced to move away from disturbances caused by recreational beach-goers or beach operations. Adverse effects and reduced chick survival may affect either the displaced brood or broods in the territory into which they move. However, the number of breeding pairs, broods, nests or territories exposed by this covered activity is anticipated to be limited locally and statewide, since 1) this covered activity's conditions require that the great majority of a site (80 percent or more) remains symbolically fenced, 2) sites with fewer than 14 pairs may only affect one breeding territory and 3) this covered activity is only applicable in high-use recreational areas. This holds true even when the MADFW allows up to 20 percent of a site or 4 acres at up to five sites statewide.

The HCP outlines minimization measures to limit the impact of reduced proactive fencing on breeding adult plovers and broods and the local population. The plan participant would immediately install symbolic fencing around any nest found outside of the reduced proactive fencing to limit disturbance and prevent destruction of eggs and would implement the measures consistent with the covered activity of reducing fencing buffers around nests (described above).

Beach raking is regulated under the MESA and MWPA and is currently allowed with specific conditions that avoid direct and indirect take of plovers and their habitat. Under reduced proactive fencing, beach raking could, as an indirect effect of this covered activity, extend into piping plover habitat that would have been protected by the Guidelines in the absence of the HCP. Conservation measures would ensure that direct take of chicks or eggs would not occur, although nest scrapes may be removed. Therefore, adverse effects in areas of reduced symbolic fencing could result in the destruction of nest scrapes and disturbance or harassment of courting and scraping adults. Removal of wrack in areas of reduced fencing may reduce the available foraging habitat by up to 20 percent (or 4 acres, whichever is less), causing plovers to forage at a greater distance from the nest, forcing young chicks to move greater distances to find suitable foraging habitat or delaying their growth if they are unable to encounter sufficient food. Should beach raking occur within the area of reduced symbolic fencing, the adverse effects from beach raking would be captured within the overall projected average loss of productivity for each piping plover pair exposed to the reduced symbolic fencing-covered activity.

Recreation and Beach Operations at Piping Plover Nest Sites with Nest Moving
Moving piping plover nests in order to allow increased recreational use or beach operations could result in the direct mortality of eggs if adults abandon nests and will cause harassment of adults. Incubating adults will be forced off of the nest during the nest moving procedures[21] and will expend energy if they repeatedly attempt to lure beach staff away from their eggs with broken wing displays or increased calling behavior (distress behavior displayed by adults in the presence of predators or perceived predators). Repeated periods of nest moving may cause nest abandonment or delayed return of the incubating adults, exposing eggs to predation and hot or cold weather. Minimization measures will be in place to reduce the likelihood of nest abandonment and will prohibit nest moving during inclement weather. If a nest is inadvertently moved to a location that is too close to the territory of an adjacent pair, antagonistic interactions could result in reduced nest or brood attendance by either pair; adults have been known to attack and (in rare instances) even kill chicks from other broods that encroach on their territories.

OSV Use in Vicinity of Unfledged Chicks
OSV use is likely to result in adverse effects leading to take of unfledged piping plover chicks that may be in the vicinity of the escorted vehicles. Adverse effects may include direct mortality due to crushing of unfledged chicks, disturbance, and very transient presence of tire ruts during and between the escort periods that could temporarily trap chicks.

Adult mortality is not anticipated. Under State and Federal beach management guidelines, the likelihood of take by vehicles in designated travel corridors in the vicinity of adult piping plovers foraging or roosting outside of symbolically fenced nesting habitat (when unfledged chicks are not present) is considered discountable. Although rare mortalities of adult piping plovers actively brooding unfledged chicks have been documented (Melvin et al. 1994; Houghton 2005), this risk is discountable for this HCP because vehicle traffic may only occur during daylight hours and in most cases, with a pedestrian escort. The MADFW may approve a qualified shorebird monitor driving in an open-top OSV at a speed of 5 mph as an escort for a caravan of vehicles in lieu of a single pedestrian caravan escort. In contrast to risks posed by unescorted vehicles in parking lots and along roads, given the slow speed of travel and the ability to survey a wider area via an open-top OSV, mortality of adults is not anticipated under this escorting protocol.

Direct chick mortality is anticipated to occur in the event an unfledged piping plover chick or chicks enter the escorted vehicle travel corridor during OSV travel and are run over by a vehicle. This could occur if a chick is not detected by the chick monitors or the escort preceding each vehicle or the vehicle caravan. Due to their cryptic coloration, small size, and behaviors, piping plover chicks are difficult to see. Their movements are very unpredictable, and they are capable of moving very fast. Two-day-old chicks are capable of moving 100 feet in less than 15 seconds (Wilcox 1959).

Minimization measures to reduce mortality include: continuous monitoring of chicks by qualified monitors during the vehicle travel period, vehicle traffic must be stopped if chicks

[21] Initially up to twice daily, although the MADFW may allow up to three movements per day once procedures for repeated nest-moving have been tested and proven

approach or enter the travel corridor, a compliance monitor will be in place to ensure vehicle travel and escorting is following protocols to reduce adverse effects, and ruts will be smoothed at least once daily to prevent habitat degradation. These minimization measures will reduce, but not eliminate the risk of vehicle collisions with chicks. In the event that a mechanized rake is used to smooth ruts in lieu of hand raking, the marginal risk of chick mortality is extremely small, but not completely discountable.

Impacts to breeding and foraging habitat will be of short duration, and spatially limited to a designated travel corridor, and similar in type to impacts that occur on OSV beaches before and after brood rearing under the State and Federal guidelines. No reduction in habitat for courtship or nest establishment is anticipated because the habitat will be managed according to State and Federal guidelines until chicks are present, unless more than one covered activity is implemented on the beach. The OSV travel corridor is generally located above intertidal foraging habitats and as a rule should not affect the wrack line, so OSV travel and raking of ruts should not affect the prey base in moist substrate habitats or wrack line favored by piping plover adults and chicks. In areas where travel corridors are close to moist intertidal habitat or include very high tide wrack lines (causing wrack to be ground into the substrate), limited impacts to foraging habitat may be incurred and may cause adults and broods to seek alternative areas for foraging for the duration of the OSV escort program.

During the period of escorted vehicle travel, the functional suitability of the habitat may be temporarily affected by creating a barrier to chick movement if chicks are not able to cross the sand trail to reach sheltering or foraging habitat on either side of the corridor. Ruts created by morning vehicle traffic may impede or slow chick travel during the time between vehicle access periods. However, the ruts will be raked at least once daily following the afternoon vehicle access period to provide unimpeded access for the remainder of the day, night, and early morning.

Although direct adverse effects may be incurred in the form of mortality or harassment, based on the short-term and limited impacts to habitat, we would not anticipate the abundance and distribution of nesting pairs would be affected as a result of this covered activity.

Effects of the proposed mitigation

Effects of the proposed mitigation are expected to be wholly beneficial. The HCP identified selective predator management as the sole compensatory mitigation measure that is considered to offset the take accrued by the covered activities. Selective predator management will be implemented by the MADFW for plan participants electing to mitigate off-site, or on-site by individual plan participants, and is anticipated to offset take at a minimum by a one-to-one ratio. The MADFW will implement predator management for plan participants electing to fund off-site mitigation. Sites where predator management will be implemented by the MADFW will be selected based on the following criteria to ensure that the mitigation will offset the anticipated take (Table 4-3 in the HCP):

1. sites must have demonstrated high predation rates that result in productivity of less than one chick per pair;

2. sites should have more than five pairs of plovers; and
3. predators should have been identified as target predators responsible for the low productivity.

The HCP also includes mitigation in addition to the mandatory predator management requirements. These activities, experimental vegetation management to create new piping plover nesting habitat, outreach and education, and increased law enforcement to control off-leash dogs or vandalism, would benefit piping plovers and contribute to plover recovery; however, they are not assessed as offsetting take under the ESA.

Compensatory Selective Predator Management

There is a strong record of increased piping plover productivity associated with targeted predator removal in the species' Atlantic Coast range. Boettcher et al. (2007) state that predator management is "one of the most important and expensive avian conservation measures being implemented on Virginia's barrier islands." Cohen et al. (2009) found that the number of chicks fledged per pair at Westhampton, New York increased with the annual number of cats and foxes trapped and removed from the beach. From 2007 to 2015, 155 pairs of piping plovers breeding at sites in Maine where selective predator removal was implemented (mean = 4.22 sites per year, range = 2 – 7) fledged 36 percent more chicks per pair than 193 pairs at sites without predator removal (mean = 10.3 sites per year, range = 4 – 16). Productivity at sites with predator management was higher than at sites without predator management in 8 of the 9 years (A.D. Vashon, Wildlife Services, pers. comm. 2016). Analysis of data from 11 Massachusetts sites (MADFW unpublished data) with at least one season of selective predator management performed by the U.S. Department of Agriculture Animal and Plant Health Inspective Service (USDA-APHIS) between 2006 and 2014 found that average piping plover productivity in the years with predator management was 84 percent higher than average productivity in the 2 years prior to implementation of predator management. At 4 of the 11 sites where predator management was implemented for 5 or more years, productivity averaged 67 percent higher in years with selective predator management as compared to the 2 years prior to management.

Based on a review of available information from across the Atlantic Coast range (including results from the earliest years of experience at some of the Maine and Massachusetts sites summarized above), USFWS et al. (2012) similarly determined that a selective predator management program associated with the Bouchard Barge 120 Oil Spill (B120) would be expected to increase piping plover productivity by at least 20 percent. Preliminary analyses of pre- and post-predator management implementation at 15 sites selected for restoration from 2011 through 2015 indicate that productivity at sites where predator management was implemented experienced an 18 percent average increased productivity (USFWS in litt. 2016). The effect of predator management varied considerably across all sites. However, productivity increased at five of six sites where pre-predator management productivity was less than one chick per pair (per a criterion for site selection for mitigation in the HCP). The increase in productivity after the implementation of predator management ranged from 16 percent to 86 percent for these sites (Table 3). The productivity for the sixth site decreased by 4 percent (0.63 chick per pair to 0.59 chick per pair) as a result of 2 years with zero productivity, possibly due to factors other than predator pressure. The average productivity for all years combined for these six sites prior to the implementation of predator management was 0.6 chick fledged per pair; the average productivity

with the implementation of predator management was 1.04 chicks fledged per pair, an increase of 0.44 chick fledged per pair, above the 20 percent increase anticipated in the HCP.

Table 3. Summary of productivity pre- and post-predator management for B120 sites with low productivity (USFWS in litt. 2016).

Site	Predator Management	Productivity (chicks fledged/pair)	Effect on Productivity
Dogfish Bar	Pre	0.46	+ 0.63
	Post	1.09	
Cedar Tree Neck	Pre	0.67	+ 0.53
	Post	1.20	
Norton Point	Pre	0.63	- 0.04
	Post	0.59	
Horseneck Beach	Pre	0.43	+ 0.86
	Post	1.29	
South Cape Beach	Pre	0.93	+ 0.16
	Post	1.09	
Dead Neck/Sampson's Island	Pre	0.56	+ 0.44
	Post	1.00	

The effectiveness of predator management at B120-funded sites was also evaluated by comparing the productivity at these sites to other sites in the State where predator management was not implemented during the same time period (2013 through 2015) (USFWS in litt. 2016). Mean productivity at beaches with predator management appears to be higher than at beaches with no predator management in 2 of the 3 years (increase in productivity by 40 percent in 2013 and 51 percent in 2014). In 2015, beaches with and without predator control had almost equal productivity, with non-predator control beaches having a slightly higher productivity of 1.24 chicks fledged per pair versus 1.20 chicks fledged per pair at sites where predator management was implemented. The average productivity for all 3 years combined was higher at beaches with predator management at 1.30, versus 0.99 at beaches without predator management (Table 4). However, this analysis did not evaluate the statistical significance of these differences, which may be low due to low/unequal sample sizes, and also did not account for the effect of other factors that may influence productivity, such as human disturbance and weather events. Nevertheless, these preliminary results indicate that predator management generally increases plover productivity.

Table 4. Statewide comparison of productivity at sites with and without predator management in Massachusetts (USFWS in litt. 2016).

Site Type	Year	No. beaches in analysis (N)	Total Pairs	Total Chicks	Productivity
Plover Beaches in MA - no predator control	2013	106	565	421	0.75
	2014	131	525	529	1.01
	2015	131	523	646	1.24
	TOTAL	368	1613	1596	0.99
Plover Beaches in MA - w/ predator control	2013	9	95	109	1.15
	2014	15	155	236	1.52
	2015	15	183	220	1.20
	TOTAL	39	433	565	1.30

Variables affecting productivity including weather-related nest or chick loss, and changes in use of exclosures have not been taken into account in the preliminary analysis of pre- and post-predator management productivity (USFWS in litt. 2016) and may have had a greater influence on the productivity outcome for some sites than predator management.

Although the overall results of predator removal are strongly positive, we recognize the unevenness in comparisons between years and sites with and without predator management. This variability may indicate that key predators were not removed or may result from confounding factors such as weather, disturbance, or habitat quality that may affect piping plover productivity. For example, after adjusting for changes in annual statewide productivity, the MADFW found that productivity at four sites with 5 or more years of predator management was 57 percent higher than in prior years without predator management (compared with a 67 percent increase without adjustment).

The HCP outlines criteria for sites where predator management will be implemented. Off-site mitigation locations (those sites funded by plan participants in lieu of implementing predator management on the beaches where the covered activity will occur) where predator management will be coordinated by the MADFW must have a productivity of less than 1 chick fledged per pair the prior year, must have identified predators that are feasible to be managed and in general should have relatively high abundance densities (more than five plover pairs) in order to benefit the maximum number of pairs needed to offset the take. The HCP requires that for every pair exposed to take, 2.5 pairs must benefit from selective predator management. For example, if the MADFW allocates take exposure for five pairs of plovers in year X, a site (or sites) totaling 12.5 pairs of plovers must have predator management implemented to offset the take. Implementing predator management at locations with existing low productivity, a high number of pairs and where predation is the primary cause of egg or chick loss increases the likelihood that the predator management will be successful in increasing productivity. Results from the B120 analysis of predator management implemented at sites with low productivity indicate that productivity should increase by at least 20 percent if not more. Thus, the likelihood that the proposed mitigation will offset the loss of chicks due to the covered activities is very high and it

is possible that more fledglings will be produced by mitigation activities than will be lost due to the covered activities.

Optional Vegetation Management to Improve Nesting Habitat
Enhancing or creating nesting habitat through vegetation management has been implemented at a few northeast locations, including Virginia, New Jersey, New York, Rhode Island and Connecticut, with limited success. Vegetation management to enhance nesting habitat has not been implemented in Massachusetts.

Ten habitat restoration projects in Rhode Island, New York, New Jersey, and Virginia were reviewed by Maslo (2009). Monitoring and evaluation of restoration project effects on piping plovers and habitat indicators (e.g., habitat availability-use ratios, predator track indices) were generally absent from project plans or implementation. Six of the 10 sites experienced an increase in number of breeding pairs; at the nine sites with both pre- and post-restoration estimates, the average number of breeding pairs increased from 2.32 pairs to 4.05 pairs.

Connecticut habitat restoration efforts were confined to removing vegetation at known nesting sites and resulted in only short-term benefits to breeding piping plovers, since the vegetation was not continuously managed. Vegetation management was included in a dredge and nourishment project in Clinton, Connecticut as a mitigation measure to offset nesting habitat loss as a result of the dredging. Light construction equipment was used to remove vegetation at locations at the periphery and in the vicinity of existing nesting habitat (U.S. Army Corps of Engineers 2012). Piping plovers were documented to nest in the enhanced habitat within the original nesting habitat and were observed attempting to nest within the adjacent created habitat. However, vegetation subsequently returned to the enhanced areas within 2 to 3 years, making the habitat less suitable for nesting.

The MADFW anticipates that managing vegetation to enhance nesting habitat in appropriate areas would benefit breeding plovers by increasing the availability of suitable nesting habitat and decreasing competition. The Service concurs with the MADFW's assessment that vegetation management could benefit nesting habitat and increase nesting opportunities, since we anticipate that the covered activity that reduces temporary availability of nesting habitat is not anticipated to affect foraging habitat. Vegetation management is proposed as a pilot project for at least two sites within the first 5 years of the permit term, and up to five sites over the 26-year permit term. These pilot projects will be limited in scope to no more than 0.5 acre per project and 2.5 acres total and will mimic natural disturbance processes such as storm overwash. Because of the uncertainty for successful creation of nesting habitat, the MADFW will require pre- and post-implementation monitoring of vegetation and piping plover habitat use (see Table 4-8 of the HCP).

Optional Education, Outreach, and Increased Law Enforcement
As described in USFWS et al. 2012, the purpose of education and outreach is to increase community support for measures to protect and manage piping plovers. The MADFW based this mitigation measure on the Service's "Enhanced Management Program," developed during the settlement of the Bouchard 120 Oil Spill (USFWS et. al. 2012). Education, outreach and law enforcement activities, in addition to selective predator management, were funded under the

Bouchard 120 Oil Spill Settlement to compensate for lost piping plovers. A specific compensation value was attributed to all of these efforts when implemented in combination at select locations (USFWS 2012).

The Service acknowledges that education and outreach is an important aspect of piping plover recovery (USFWS 1996). Outreach and education that results in the modification of recreational users' behavior such that incidences of disturbance are reduced may directly affect the productivity and fitness of piping plovers on those beaches (USFWS 1996). The MADFW outlines potential outreach activities that could be implemented to benefit plovers, including targeted informational programs, informational signs, or printed materials, similar to efforts described in the 1996 piping plover recovery plan (USFWS 1996).

Complex patterns of land ownership and beach use often result in law enforcement gaps, especially in the enforcement of local ordinances. The MADFW's proposal to supplement existing law enforcement efforts will benefit piping plovers, particularly at sites where existing enforcement efforts are not sufficient to address disturbance to plovers from dogs off leash or where vandalism has been documented. Increased law enforcement may include extra patrols and other enforcement operations during the piping plover breeding season in order to reduce the risk of disturbance, harassment, or mortality of piping plovers resulting from off-leash dogs or other illegal recreational activities.

Effects on the Massachusetts population

To meet the biological goal of contributing to the maintenance of a robust and viable population in Massachusetts, the MADFW developed a sliding scale for the annual take allocation (see Table 3-1 in the HCP) that is tied to trends in the State's population. As the statewide piping plover population increases, more take exposure allowances will be authorized to plan participants. If the piping plover population declines for any reason, whether or not it is related to the HCP, the annual take exposure allocation will be reduced. If the statewide plover population drops below 500 pairs, no take will be authorized and no deviations to the existing State and Federal guidelines will be authorized. As the take allocation is increased in response to an increasing population, the amount of mitigation (i.e., selective predator management benefiting plover pairs) will be increased proportionally to offset the take exposure.

The HCP estimates that the primary impact of the covered activities will be as a result of unfledged chick and egg mortality, mostly as a result of vehicles striking chicks and nest failure from reduced proactive fencing or reduced nest buffers. Minimization measures for expanded OSV use are anticipated to reduce the likelihood of chick mortality, particularly the requirement to escort vehicles and the intensive brood monitoring to inform when temporary cessation of vehicle traffic should be implemented (e.g., chicks are observed near or in a travel corridor). Nest abandonment and subsequent egg loss may decrease the probability of successful nesting and may result in reduced productivity as plovers are forced to renest later in the breeding season or if they renest at a location where increased competition impinges on the productivity of other pairs.

The HCP estimated, and we agree, that for every brood, nest or territory exposed to potential take, the affected breeding pair will experience a 50 percent reduction in productivity. This estimate includes mortality and sublethal effects from all covered activities. The maximum percent of broods, nests or territories exposed to potential take in a given year if the statewide population is greater than 655 breeding pairs is 7 percent (45 breeding pairs or more), resulting in a reduction in productivity measured by the 3.4 percent of fledglings that would be lost. Any take authorized by the Service for consultations under section 7 of the ESA for activities similar to the covered activities in the HCP will be deducted from the annual take allocation. For example, currently the CACO has been authorized to expose up to three pairs of piping plovers to take (primarily reduced productivity) as a result of flexible management (reduced proactive fencing or buffers around a nest). Therefore, annual take allocated by the MADFW under the HCP would deduct three pairs for the life of the CACO's incidental take statement (2017). The sliding scale for take allocation also sets a minimum population threshold of 500 pairs at which take may not be allocated, equating to 80 percent of the New England recovery unit goal of 625. This threshold would ensure that take under the HCP will not impinge on Massachusetts' contribution to sustaining the New England portion of Atlantic Coast piping plover recovery.

The breeding population estimate will be the average of the preceding 3-years' population to the year in which take will be allocated. The current estimated allocated take for 2016, based on the breeding pairs documented in 2013, 2014 and 2015 would be 44 broods, nests or territories exposed to take (672 breeding pairs x 7 percent minus the three CACO pairs),[22] resulting in a loss of 24 fledglings (based on the past 3 years' average productivity of 1.11 x 44 breeding pairs x 0.5 reduction in productivity). The actual 2016 exposure to take is anticipated to be far less, as the MADFW anticipates fewer than six requests for COIs, and most if not all requests will be for one to three take exposures (Jonathon Regosin, MADFW, pers. comm. 2016).

The effect of the take on the State's population is not anticipated to impact the statewide distribution of piping plovers because the amount of take exposure per site (all covered activities combined) may not exceed 15 percent of the site's breeding population or up to 30 percent for five sites. Although the HCP retains some flexibility for the MADFW in determining site boundaries, the HCP states that, in general, site boundaries will reflect property lines and sections of recreational beach that have historically been managed as a single unit. Therefore, it may be assumed that a site for which a covered activity is authorized will generally be a unit that may or may not cross political boundaries, but is managed similarly (e.g., one continuous beach shared by two towns managed as one unit under the State and Federal guidelines, or multiple small beaches that are not contiguous and are managed by one landowner). The vast majority of sites in Massachusetts have less than 10 breeding pairs; 15 sites with 10 or more breeding pairs accounted for 50 percent of the Massachusetts breeding population in 2014. Taking this into consideration, sites with seven or less pairs may only impact one breeding pair (according to the HCP), sites with 10 pairs or less may impact one to three breeding pairs (15 to 30 percent, depending on the MADFW's approval). The largest non-Federal sites, with the exception of

[22] Forty-two breeding pairs if Orleans continues to implement their low-effect HCP that allows two breeding pairs to be exposed to take until 2017, and a loss of 23 fledglings.

South Beach Island, Chatham[23] (e.g., Sandy Neck in Barnstable and Crane Beach in Ipswich at 30 pairs; Duxbury Beach, Duxbury at 26 pairs) would be able to expose a maximum of eight to nine pairs at 30 percent allowable exposure for the covered activity. Furthermore, the distribution of breeding pairs is maintained through dispersal of chicks from their natal beaches to other sites (albeit in the general region) when they recruit into the breeding population. Thus, out-year effects of productivity losses (due to covered activities) and gains (due to mitigation activities) are likely to be homogenized across many sites, and probably the entire State. Due to the non-contiguous distribution of large non-federally owned sites, the statewide and site-specific limits for take exposure, and dispersal of recruits from their natal sites, the likelihood that the proposed action will discernably affect the distribution of piping plovers across Massachusetts is negligible.

The HCP anticipates a 50 percent reduction in productivity of exposed pairs; however, the loss in productivity would be offset by the mitigation. The long-term abundance could be affected if mitigation was not fully successful in offsetting the reduced productivity, and sufficient fledglings did not return to replace adults. Notwithstanding the Service's high confidence in the efficacy of the mitigation plan, the HCP proposed that take may only be allocated for the first 25 years of the ITP, the 26th year is reserved for implementing outstanding mitigation should take not have been fully offset in the last few years of the HCP.

It is possible (but unlikely) that mitigation could fail to produce enough chicks to offset take, but that condition could be masked by immigration from other nearby states. As previously stated, dispersal probabilities of Atlantic Coast piping plovers decline with the distance from the natal or previous nesting site. Movements are generally bi-directional (e.g., an adult dispersed from New York to Rhode Island in 2015, despite higher productivity in the latter state in 2014), but it is possible that net movement could somewhat favor Massachusetts if productivity in surrounding New England states is higher. However, since populations in the other New England states are robust and productive, this would not seriously impinge on security of the New England recovery unit population. Likewise, we do not believe that immigration has the potential to counter a long-term or serious deficit in productivity of Massachusetts piping plovers.

The mitigation required by the MADFW is intended to offset the loss in productivity above the estimated take (e.g., a 50 percent reduction in productivity for those pairs exposed to take for the year covered activities were implemented). The MADFW requires a 2.5 to 1 offset, that is, for every one breeding pair exposed to take, 2.5 breeding pairs must receive the benefits of selective predator management. The MADFW estimates that productivity at sites where selective predator management is implemented will be increased by 20 percent. For example, if the 44 breeding pairs were exposed to take, predator management would need to be implemented for approximately 110 pairs to offset the anticipated loss of 24 fledglings (see calculations above). If the average productivity of 1.11 chicks fledged per pair (average productivity for the 3 years prior) was applied to the 110 pairs, without predator management, 122 chicks should have fledged. With the implementation of selective predator management, an additional 24 chicks

[23] South Beach Island, Chatham may have up to 60 pairs and at 30 percent could hypothetically request take exposure for up to 18 pairs. However, this is unlikely because the Island receives limited recreational use.

should fledge (110 x 1.11 + 110 x 1.11 x 0.2), compensating for the 24 fledglings anticipated to be lost as a result of implementing covered activities under the HCP.

The HCP anticipates that it would be difficult to locate mitigation sites that would total the exact number of breeding pairs required to offset the take. Therefore, it is highly likely that selective predator management will occur at locations that support more than the total required number of breeding pairs, and that the offset might be greater in most years.

Most covered activities under the HCP will cause density-independent effects on reproduction and population growth that can be effectively offset via selective predator removal. Density-independent effects include the use of roads and parking lots in the vicinity of unfledged chicks and from OSV use in the vicinity of unfledged chicks. Effects of reducing symbolic fencing around nests after they are established and moving nests are likewise anticipated primarily to affect nest and chick survival without reducing the number of breeding pairs. Displacement of pairs due to reduced proactive symbolic fencing may also lead to lower productivity if breeding is delayed or the displaced birds are less successful at locations where they have not previously bred. Predator removal can provide an effective offset to such impacts because abundant populations of skunks, foxes, coyotes, gulls, and crows (abetted by human-supplied food and denning and perching structures) are adept at targeting plover nests and chicks on Atlantic Coast beaches regardless of plover nesting density.

In the event that the Massachusetts plover population approaches carrying capacity during the life of the permit, reduced proactive fencing will result in density-dependent effects on abundance that cannot be alleviated by selective predator removal, because new recruits will fail to find breeding territories or will face intense competition for resources such as prey that limits survival of their chicks. Continuing growth of the Massachusetts piping plover population following years of good productivity indicates that it is not yet at carrying capacity. If, as is anticipated, the Massachusetts piping plover population slowly increases during the life of the permit, the population may reach carrying capacity. If successful, vegetation management to improve nesting habitat could partially mitigate a reduction in carrying capacity due to reduced proactive fencing, but this component of the HCP is limited in scope and its benefits are considered relatively uncertain. Although loss of carrying capacity will be difficult, if not impossible to mitigate, we recognize that effects would coincide with a larger and even more robust population than exists at present. Furthermore, the reduced proactive fencing-covered activity will be limited to 50 percent of the allocated take in any year; it will never affect more than 3.5 percent of the habitat in use by the breeding population. It is further restricted to affecting no more than 15 percent of a given site's population and generally should affect less than 10 percent of the site's suitable nesting habitat (some exceptions may occur).

It is also important to note that possible effects on habitat quantity or quality due to reduced symbolic fencing will be limited to functional losses that are immediately reversible because there will be no impairment of underlying physical or biological characteristics. In the event that unanticipated habitat loss due to causes unrelated to the HCP occurs and reduced carrying capacity is sufficient to result in a decline in the abundance of breeding pairs, the amount of take exposure to be authorized under the HCP will also be reduced. Habitat, where any reduced

proactive fencing was implemented in past years, should be functional to the full extent that it would have been, absent earlier implementation of the HCP.

Net effects of the covered activities and the proposed mitigation

The best available information indicates that the selective predator management will, at a minimum, offset the loss of chicks due to the covered activities over the 26-year life of the proposed HCP. Under the proposed action, all covered activities and mitigation measures will be implemented within Massachusetts. Selective predator management may occur on-site, where the covered activities are being implemented or at another beach (off-site). The MADFW will target mitigation sites with a recent history of low productivity and where most cost effective (e.g., has more pairs than a site with similar productivity rates). As a result, there is potential for off-site mitigation to slightly increase evenness of the overall distribution of productivity within Massachusetts.

Effects on the New England recovery unit and the Atlantic Coast population

Because the effects of the HCP on the Massachusetts piping plover population are anticipated to be neutral, effects on the New England and Atlantic Coast population are unlikely. In light of the 26-year life of the proposed action, however, we consider the ramifications if loss of productivity is higher than expected or the mitigation measures fail to fully offset losses.

As previously noted, dispersal probabilities of Atlantic Coast piping plovers decline with the distance from the natal or previous nesting site. Thus, we expect that unmitigated loss of productivity due to the HCP would be reflected in declining abundance of the Massachusetts population, triggering reductions in the allowable take exposure. It is possible that immigration from other New England states into Massachusetts could exceed emigration in some years, but this is most likely to occur when productivity in the other states is very high and when their habitat is relatively densely occupied. Thus, a small net redistribution of recruits into Massachusetts, should it occur, is unlikely to impair the resiliency of the New England recovery unit.

Attainment and maintenance of population abundance targets for the four recovery units provide resiliency, redundancy, and representation that are fundamental to the overall security of the Atlantic Coast piping plover population. The New England population has attained (or been within three pairs of) its abundance goal for 18 years, and it currently exceeds its goal (which is the largest of the 4 recovery units) by 47 percent. Although not anticipated to cause a reduction in the abundance of New England piping plovers, the proposed HCP contains safeguards that reduce take exposure if the Massachusetts population declines *for any reason* during the life of the permit. If the Massachusetts piping plover population drops to 500 pairs (80 percent of the New England recovery goal), take exposure via the covered activities will be suspended. No impairment of physical or biological characteristics of habitat is anticipated that could impinge on future carrying capacity or productivity. These safeguards assure that activities under the HCP will not diminish the contribution of the Massachusetts population to survival and recovery of the New England recovery unit, nor the Atlantic Coast population as a whole.

CUMULATIVE EFFECTS

Cumulative effects include the effects of future State, Tribal, local, or private actions that are reasonably certain to occur in the action area considered in this biological opinion. Future Federal actions that are unrelated to the proposed action are not considered in this section because they require separate consultation pursuant to section 7 of the ESA. We are currently unaware of any other future State, Tribal, local, or private actions that are reasonably certain to occur in Massachusetts. Except for the activities proposed in the HCP, vehicular and pedestrian management on Massachusetts beaches will continue to follow State and Federal guidelines for managing piping plovers on recreational beaches. Moreover, the MESA and the MWPA provide strong protections for piping plovers and their habitats in Massachusetts for projects that may directly or indirectly affect piping plovers and their breeding and foraging habitat, irrespective of a Federal nexus. For example, small revetment reconstruction or new construction in front of individual homes might not trigger a Federal permit, but would trigger a State review under one or both laws. State regulatory review of projects that might adversely affect piping plovers and their habitat would most likely result in the avoidance, minimization and/or mitigation of such effects, reducing the likelihood of cumulative effects to piping plovers or their habitat.

CONCLUSION

The jeopardy analysis in this biological opinion assesses whether the proposed action reasonably would be expected, directly or indirectly, to reduce appreciably the likelihood of both survival and recovery of the Atlantic Coast piping plover by reducing their reproduction, numbers, or distribution in the wild. The action area for this consultation is located in the New England recovery unit. This and three other recovery units were defined in the final recovery plan for this species (USFWS 1996). Recovery units, by definition, comprise areas that are essential to the conservation of the listed species. Therefore, we start by considering the effects of the proposed action on the piping plover population in Massachusetts. We then consider those effects in the context of the current status of piping plovers in the New England recovery unit and the environmental baseline in the action area, taking into account any cumulative effects. Finally, we determine whether implementation of the proposed action is likely to appreciably reduce the likelihood of both the survival and recovery of the species in the wild.

In formulating this biological opinion, we consider the following points discussed earlier in this document:

1. The covered activities will annually expose from 1 to 7 percent of the State's breeding pairs and their territories, nests, and broods to take by harm, harassment, and to a limited extent, direct mortality of adults and chicks when the statewide population is above 500 breeding pairs (based on a sliding scale related to the average statewide population of the 3 preceding years).

2. Only flexible management for parking lots and roads could cause take of adult piping plovers. This covered activity is anticipated to result in 0.05 adult killed per breeding pair exposed; adult mortality is not anticipated for any other covered activity.

3. Impacts to habitat are limited to the temporary functional loss of suitable courtship, nesting and foraging habitat from reduced proactive fencing and the transient presence of tire ruts during the time when the escorted vehicles traverse the beach and prior to rut raking.

4. Minimization measures provided in the HCP will reduce the likelihood of take for all covered activities by intensive monitoring to adaptively manage and reduce the risk of chick mortality (flexible management for parking lots, roads and OSV travel corridors) and nest abandonment (reduced nest buffer and nest moving).

5. Measures to minimize the loss of productivity of pairs exposed to the covered activities are anticipated to ensure that their productivity is not reduced by more than 50 percent.

6. The best available information indicates that mitigation (selective predator management) will at least offset the loss of chicks due to the covered activities, because 2.5 breeding pairs must benefit from predator management for every pair exposed to covered activities.

7. Impacts to the abundance and distribution of nesting pairs of piping plovers in Massachusetts will be minor.

8. No effects of future State, Tribal, local, or private actions that are reasonably certain to occur in the action area have been identified.

9. The proposed action will take place in the New England recovery unit, where the piping plover population has exceeded (or been within three pairs of) its 625-pair abundance goal since 1998, attaining a post-listing high of 918 pairs in 2015, 47 percent above the recovery unit goal.

10. The proposed HCP contains safeguards that assure that activities under the HCP will not diminish the contribution of the Massachusetts population to survival and recovery of the New England recovery unit, nor to the Atlantic Coast population as a whole.

After reviewing the environmental baseline for the action area, the effects of the proposed action, and the cumulative effects, we find that the proposed action is not reasonably expected to reduce appreciably the likelihood of both survival and recovery of piping plovers in the New England recovery unit by reducing their reproduction, numbers, or distribution in the wild. Our analysis indicates that the effects of the covered activities are likely to be minimal, site-specific and likely to be fully offset by mitigation activities. The net effects of the proposed action on the New England recovery unit are expected to be neutral, and the potential for effects (either negative or positive) on the numbers or distribution of piping plovers in the other recovery units is negligible. We conclude that the proposed action is not likely to jeopardize the continued existence of the New England recovery unit or the Atlantic Coast piping plover population as a whole.

INCIDENTAL TAKE STATEMENT

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

In June 2015, the Service finalized new regulations implementing the incidental take provisions of section 7(a)(2) of the ESA. The new regulations also clarify the standard regarding when the Service formulates an Incidental Take Statement [50 CFR 402.14(g)(7)], from "…if such take may occur" to "…if such take is reasonably certain to occur." This is not a new standard, but merely a clarification and codification of the applicable standard that the Service has been using and is consistent with case law. The standard does not require a guarantee that take will result, only that the Service establishes a rational basis for a finding of take. The Service continues to rely on the best available scientific and commercial data, as well as professional judgment, in reaching these determinations and resolving uncertainties or information gaps.

The proposed HCP and its associated documents clearly identify anticipated impacts to piping plovers likely to result from the covered activities and the measures that will be implemented to minimize those impacts. All measures described in the HCP, and any section 10(a)(1)(B) permit issued with respect to the HCP, are hereby incorporated by reference as reasonable and prudent measures and terms and conditions within this Incidental Take Statement pursuant to 50 CFR §402.14(i). Such terms and conditions are non-discretionary and must be undertaken for the exemptions under section 10(a)(1)(B) and section 7(o)(2) of the ESA to apply. If the permittee fails to adhere to these terms and conditions, the section 10(a)(1)(B) permit may be suspended or revoked.

Amount and Extent of Take

We anticipate that some piping plovers could be taken as a result of the proposed action and that the majority of take will result in a 50 percent reduction of productivity for those piping plover pairs exposed to the HCP-covered activities. We expect the incidental take to be in the form of harassment, harm and killing of chicks and adults, although adult mortality is anticipated to be extremely limited. The effects and avoidance and minimization measures to reduce the likelihood of take of the individual covered activities were previously described above and are incorporated by reference.

Harass
Covered activities that could result in harassment of chicks and adults include:

- use of roads and parking lots in the vicinity of unfledged chicks;
- reduced symbolic fencing around nests;
- reduced proactive symbolic fencing of suitable habitat;
- nest moving; and
- OSV use in the vicinity of unfledged chicks.

Take via harassment may occur when covered activities create the likelihood of injury to such an extent as to significantly disrupt normal breeding, feeding and roosting behaviors. Plover chicks and adults may be unable to access food or shelter due to daily, extensive vehicle traffic, including recreational OSVs or traffic in roads and parking lots. A minimization measure to reduce mortality of chicks in roads and parking lots may allow trained monitors to "herd" piping plover chicks away from traffic areas in roads and parking lots, thus impeding chick movement between sheltering and foraging habitat, or forcing chicks to move greater distances to access preferred habitat, reducing resting and foraging time resulting in increased energetic demands. Barriers placed along roads and parking lots (a minimization measure) may force chicks and adults to move greater distances to foraging or sheltering habitat and possibly reducing resting and foraging time, resulting in increased energetic demands. Barriers may also increase chick vulnerability to predation as they move along the barrier.

Reduced proactive symbolic fencing and reduced buffers around nests may lead to reduced nest attendance if incubating adults are repeatedly disturbed by pedestrians or during beach raking activities, leading to overheating or cooling of eggs or abandonment. As a result of disturbance, adults may renest closer or within other plovers' territories causing multiple disruptions if pairs become antagonistic towards each other. Reduced proactive fencing may also disrupt normal behavior, including territory establishment, territory abandonment if plover pairs relocate, and a delay or extension of their breeding period if forced to relocate. Nest moving would prevent adults from incubating the eggs as the nests are being moved and until adults return to the nest, as well as increasing agonistic behavior by adults during nest moving.

Harm
Covered activities that could result in harm to chicks and adults include:

- reduced proactive symbolic fencing;
- use of roads and parking lots in the vicinity of unfledged chicks; and
- OSV use in the vicinity of unfledged chicks.

Harm may occur when significant habitat modification or degradation results in death or injury by significantly impairing behavioral patterns such as breeding, feeding and sheltering. The functional suitability of habitat may be temporarily affected when proactive symbolic fencing is reduced and recreational use of the area precludes plovers from nesting or roosting in undisturbed habitat. Destruction of wrack outside of the symbolic fencing during beach raking operations will remove foraging habitat as an indirect effect of the covered activity of reduced symbolic fencing. Harm caused by these activities would be expressed in the anticipated decrease in productivity from the reduced proactive symbolic fencing-covered activity. Barriers

placed along a road or parking lot may effectively bisect sheltering and foraging habitat, preventing direct chick access to either habitat. Take may occur when habitat is temporarily degraded by vehicle traffic through rut creation and wrack destruction. Although there is a minimization measure that requires raking tire ruts up to twice daily to reduce the level of habitat degradation when plover chicks are present for OSV travel in the vicinity of unfledged plover chicks, the habitat will be affected at least temporarily. Degraded habitat in the rutted travel corridor (prior to smoothing out the ruts) may impede chick movement, especially for very young chicks if they are trapped in ruts and unable to freely access foraging or sheltering habitat.

Kill

Covered activities that could result in the killing of chicks and adults include:

- use of roads and parking lots in the vicinity of unfledged chicks;
- reduced symbolic fencing around nests;
- reduced proactive symbolic fencing of suitable habitat;
- nest moving; and
- OSV use in the vicinity of unfledged chicks.

Chicks may be killed by OSVs and vehicles on roads or parking lots if they are traversing travel corridors and monitors are unable to stop vehicle traffic in time to prevent the mortality. Adults could be killed if brooding their young in roads or parking lots, or herding chicks between foraging and sheltering habitats. However, the likelihood of adult mortality by vehicles in roads and parking lots is very low and on average, only 0.05 adult per exposure (one pair) is anticipated to be killed.

Eggs may be cracked during nest moving, abandoned by the adults or may become unviable if the adults do not return to incubate in time to prevent overheating or cooling. Eggs may also be inadvertently crushed if a nest outside of the reduced symbolic fencing is undetected.

Detecting mortality or injury of piping plovers (especially chicks), particularly on beaches where vehicles are being operated, is extremely difficult. Cryptic coloration is the species' primary defense mechanism, evolved to cope with natural predators; nests, adults, and chicks all blend with their typical beach surroundings. Tiny, dead chicks may be blown away, covered by wind-blown sand, ground into the sand by other passing vehicles, washed away by high tides, or consumed by scavengers. Thus, direct take of chicks is likely to be undetected. Although few dead adults are anticipated as a result of the HCP, they are more likely to be encountered because they are larger, and intensive monitoring of the broods and adults is required for use of roads and parking lots.

Very few adult piping plovers are marked; therefore it is often difficult to track plovers and attribute take, in particular harm and harass, of exposed pairs. For example, if pairs move as a result of recreational activities in areas of reduced proactive fencing or reduced fencing buffers around nests, it may be difficult to relocate them, especially if they move to another beach. Plovers naturally renest when a clutch is lost and it is possible through intensive monitoring to identify renesting pairs if they relocate nearby. It is far more difficult to track territorial pairs that relocate if they abandon a territory due to disturbance and move to another site. Tracking take due to harassment (increased antagonistic behavior, encounters with other territorial plover

pairs) and assigning effects such as delayed breeding or reduced productivity is extremely difficult without marked individuals and intensive monitoring of their behavior.

Moving nests could result in delayed, partial or no hatching of eggs. However, it may be difficult to determine if the nest movement caused the take or if other factors such as extended poor weather or predators were responsible for the failure to hatch.

In summary, these take mechanisms may result in sublethal to lethal effects to piping plover adults and chicks. The anticipated impact to piping plovers is primarily expected to occur as a 50 percent reduction in productivity per breeding pair exposed to a covered activity, with minimal mortality of adults (0.05 adult killed per exposure as a result of collisions with vehicles in roads and parking lots). Most take is likely to be undetected; however, the mechanism to reduce take allocations concurrently with a reduction in the population (Table 3-1 in the HCP) will assure that effects of undetected take will not go unchecked if they cause or contribute to a population decline.

We are unable to reasonably anticipate the actual number of piping plover broods, nests, territories or adults that would be exposed to take by the HCP annually or over the life of the permit, because the level of annual allocated take exposures is dependent upon the statewide population size, and this may vary from year to year. However, we can determine the maximum number of broods, nests, territories, or adults (if the use of roads and parking lots in the vicinity of unfledged chicks covered activity is implemented) that may be exposed to covered activities in 2016, because we have population data for the previous 3 years. In 2016, the MADFW could allow up to 44 broods, nests, territories, or adults to be exposed to take (allocated take = 682 breeding pairs x 0.07 = 47 - 3 breeding pairs already allocated to CACO for their flexible management = 44). Although the impact or expression of take exposure is a 50 percent reduction in productivity, for the purposes of calculating and tracking take, we will use breeding pairs as a surrogate and consider that the nest, brood, or territory of each breeding pair exposed to take has been taken by one of the methods described above. Accordingly, the HCP's covered activities may cause take of up to 44 breeding pairs of piping plovers in 2016.

Although we cannot predict specific numbers of piping plovers that could be exposed to take after 2016, using the parameters under which the HCP would be implemented and assumptions of population growth, we can provide examples of possible future take exposure scenarios. If the annual rate of increase in the statewide population is 2.4 (based on the past 5 years of population data), we could predict that 49 breeding pairs (703 x 0.07) could be exposed to take in 2017; 50 pairs could be exposed to take in 2018, 51 breeding pairs could be exposed in 2019; and 52 breeding pairs could be exposed in 2020. These numbers are dependent on the assumption that the annual rate of increase for the population is a static 2.4 percent. Given the variability in the annual rate of increase for the Massachusetts plover population, it would be difficult to develop accurate estimates for incidental take over the 26-year span of the permit. For example, during the period 1989-1995, the average annualized growth rate was 21.5 percent, while during the period 1995-2015, the growth rate was 2.1 percent (USFWS 2016). Moreover, because COIs are not issued until after the annual allocated take number has been determined, the take of adults (0.05 adult per breeding pair exposed as a result of the parking lot and improved road covered activity) cannot be predicted. However, based on the current population, and estimating a

continued average annual increase of 2.1 percent, which would result in a population of 1,000 breeding pairs by the end of the permit term, we estimate that the range of annual allocated take would be 44 breeding pairs for 2016 to 70 breeding pairs at the end of the permit term. If the population declines, the estimated take could be less than 44 pairs and could be as low as 0 if the population declined to 500 or fewer breeding pairs.

To determine yearly future allowable take and provide a maximum take exposure number for the MADFW, we will revise the Incidental Take Statement annually beginning in 2017. Each year, we will incorporate updated piping plover population data and calculate the number of broods, nests, territories, or adults (using the number of breeding pairs as a surrogate) that may be exposed to take from the covered activities. Then we will issue a revised, supplemental Incidental Take Statement no later than April 1 or within 20 business days of receiving the previous year's statewide abundance data from the MADFW. This will ensure that the MADFW is able to complete issuance of COIs prior to the plover breeding season. For each subsequent year, we will issue a letter with a new revised Incidental Take Statement and the number of breeding pairs that may be exposed to take and would be authorized pursuant to the Incidental Take Permit for the HCP. This yearly authorization letter will amend the Incidental Take Permit annually as well.

Effect of the Take

The effects of the take described above would have a minor impact on the Massachusetts piping plover population for these reasons:

1. The take would be geographically distributed across the statewide population, because the HCP's limitations on the percent of a site's population that can be exposed to take (in general only 15 percent of the population for sites with more than six pairs) limit how many take exposures a plan participant may request.
2. Many of the small plover breeding sites (10 pairs or less) may not be subject to intense recreational use, are privately owned, and likely would not need or apply for a COI and incidental take coverage.
3. Heavily used recreational sites would be limited to 15 to 30 percent of the broods, nests, or territories being exposed to take (up to five sites with more than six pairs may expose 30 percent of their plovers to take from covered activities). For large sites at current population levels (see Table 3-1 in USFWS 2016), allocated take would range from two to a maximum of 12 pairs exposed to take.
4. Even if the maximum take per site is allocated, we expect that some covered activities will not be implemented in any given year. There will be some cases in which the take allocated to a particular site may not be used at all. For example, if take of two broods is requested for pinch points for OSV access in year X and the plovers do not nest in the area, the covered activity is not implemented and take has not occurred. This further reduces the potential impact of the HCP on the statewide population.
5. The HCP would implement selective predator management, which would offset the impacts of the take caused by covered activities.
6. The updated take authorized by the Incidental Take Permit will never exceed 7 percent of the average statewide population (based on the prior 3 years' population). This would be be further reduced as the MADFW subtracts from the annual take authorization limit the

number of breeding pairs authorized to be taken under Incidental Take Statements pursuant to other consultations under section 7 of the ESA for activities in Massachusetts similar to those described in the HCP.

The protective measures that ensure that the piping plover population will not be significantly affected by the HCP, including mitigation to offset take, the conservative approach to reducing allocated take in response to a decrease in the population irrespective of the cause of the decline, the cessation of take allocation should the population reach 500 pairs or less in any given year, and the maintenance of the statewide population at a minimum of 80 percent of the New England recovery unit, lead us to conclude that the impact of the take caused by the HCP would not jeopardize the continued existence of the piping plover.

CONSERVATION RECOMMENDATIONS

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

Several ongoing Service activities are being implemented to assist in the recovery of the piping plovers on beaches throughout Massachusetts. These include modelling to assess the risks and benefits of predator exclosures and modelling sea-level rise predictions on future availability of Atlantic Coast piping plover habitat. The Service should also continue to collaborate with the MADFW in providing targeted messaging to the public about the importance of piping plover conservation, should continue to seek opportunities to develop partnerships with State, municipal and non-governmental agencies to manage piping plover beaches and should identify research needs to further the recovery of the species.

REINITIATION NOTICE

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

If you have any questions about this biological opinion, please contact Ms. Susi von Oettingen of my staff at 603-227-6418, or by e-mail at Susi_vonOettingen@fws.gov.

Sincerely yours,

Thomas R. Chapman
Supervisor
New England Field Office

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