Appendix A

Guidelines for Managing Recreational Use of Beaches to Protect Piping Plovers, Terns, and Their Habitats in Massachusetts

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I. Introduction

The Massachusetts Division of Fisheries and Wildlife (the Division) has developed the following guidelines to assist beach managers and property owners with protecting piping plovers, least terns, common terns, roseate terns, arctic terns, and their habitats. Implementing these guidelines will help beach managers and property owners avoid potential violations of the Massachusetts Endangered Species Act (MGL c. 131A) and its implementing regulations (321 CMR 10.00) involving recreational use of beaches used by piping plovers and terns for breeding and nesting habitat.

The Division intends to apply these guidelines in its review of Notices of Intent, pursuant to the Massachusetts Wetlands Protection Act regulations (310 CMR 10.37), for vehicular use of beaches where piping plovers and terns occur.

The Department of Environmental Protection has developed a set of recommended conditions for barrier beach management to be used by municipal conservation commissions in drafting Orders of Conditions. In addition, the Massachusetts Barrier Beach Task Force, coordinated by the Office of Coastal Zone Management, has developed a comprehensive set of guidelines covering the full range of barrier beach management issues. The following guidelines should be read and applied in conjunction with these other documents.

Users of these piping plover and tern guidelines are advised that they do not supersede any law, regulation, or official policy of this or any other agency. Rather, these guidelines are intended to complement other regulatory review processes regarding recreational activities on beaches by providing a standard set of scientifically based management recommendations.

This document contains five sections: 1) an introduction, 2) summaries of life histories of these species and threats to their continued existence in the state, 3) a summary of pertinent laws and regulations, 4) guidelines for managing and protecting plovers, terns, and their habitats, and 5) literature cited.

In these guidelines, the Division has sought to provide the necessary protection to piping plovers and terns without unnecessarily restricting appropriate access along all of the state's beaches. The Division has a long history of promoting the rights of citizens to enjoy a variety of outdoor pursuits, provided that they do not jeopardize the state's wildlife resources. The Division has worked to facilitate fishing and hunting access statewide and has supported the common law right of access to the shorelines of the coast and "Great Ponds" for the purposes of fishing and fowling. Although these guidelines make it clear that it will be necessary at times to restrict vehicular access temporarily on beaches where and when piping plovers and terns are present, the Division will only support such restrictions when it is necessary to protect the habitat, nests, and unfledged chicks of plovers and terns. The Division will continue to seek and consider management measures that offer maximum flexibility in balancing recreational use with protection of rare species and their habitats. Even when vehicular access is restricted, the Division will normally support continued access to beaches for fishermen and other recreational users by foot and by boat.

II. Species Status, Life History, and Threats

Piping Plover

Piping plovers are small, sand-colored shorebirds that nest on sandy, coastal beaches from South Carolina to Newfoundland. The U.S. Atlantic coast population is listed as "Threatened" by the U.S. Fish and Wildlife Service under provisions of the U.S. Endangered Species Act of 1973 (U.S. Fish and Wildlife Service 1988), and was estimated at 790 pairs in 1992 (U.S. Fish and Wildlife Service 1992). In Massachusetts, the piping plover is also listed as "Threatened" by the Massachusetts Division of Fisheries and Wildlife under provisions of the Massachusetts Endangered Species Act. In 1992, 213 pairs of piping plovers nested on Massachusetts beaches (Melvin 1992).

Piping plovers nest on coastal beaches above the high-tide line, sand flats at the end of sand spits, gently sloping foredunes, and in blow-outs or washover areas between or behind coastal dunes. They may also nest where sandy dredged material has been deposited. Nests are simple scrapes in the sand or mixtures of sand, gravel, and shells. Nests are placed on open sand or in

patches of sparse to moderately dense beach grass and other dune vegetation. Piping plovers depend on natural processes of beach erosion and accretion through wind and wave action to maintain suitable nesting habitat.

Piping plovers return to nesting beaches in Massachusetts from mid-March to early May. Males establish and defend territories and court females. Nesting may occur from mid-April through late July. Clutch size is usually four eggs, and eggs are usually incubated for 27-28 days before hatching. Piping plovers fledge only a single brood per season, but may renest several times if previous nests are lost. Chicks are precocial and able to move about within hours after hatching. They may move hundreds of yards from the nest site during their first week of life. Chicks remain together with one or both parents until they fledge (are able to fly) at 25 to 35 days of age. Depending on date of hatching, unfledged chicks may be present from late May until mid-August, although most fledge by the end of July. Adults and chicks feed on amphipods, marine worms, flies, and other invertebrates. The most important feeding habitats for both adults and chicks are intertidal areas and wrack (seaweed, vegetation, shells, and other organic debris deposited on the beach by tides and storms) (Gibbs 1986, Goldin et al. 1990, Hoopes et al. 1992).

Sandy beaches that provide nesting habitat for piping plovers are also attractive recreational habitats for people and their pets. Human recreational activities can be a source of both disturbance and direct mortality to piping plovers (Blodget 1990, Melvin et al. 1991). People on beaches may inadvertently crush eggs, cause nests to be abandoned, and disturb or displace unfledged chicks. Unleashed dogs may chase adults, kill chicks, and eat eggs. Kites and fireworks are highly disturbing to piping plovers (Hoopes et al. 1992; Howard et al. 1993).

Unrestricted use of motorized vehicles on beaches is a serious threat to piping plovers and their habitats. Vehicles can crush both eggs and chicks (Burger 1986, Patterson 1988, Strauss 1990, Melvin et al. 1991). In Massachusetts, biologists documented 7 incidents in which 9 chicks were killed by vehicles between 1989 and 1992 (Melvin et al. 1993). Many biologists that monitor and manage piping plovers believe that many more chicks are killed by vehicles than are found and reported. On sections of Massachusetts beaches used by vehicles during nesting and brood-rearing periods, breeding plovers are generally either absent or less abundant than expected given available nesting and feeding habitat. In contrast, plover abundance and productivity has increased on beaches where vehicle restrictions during chick-rearing periods have been combined with protection of nests from predators.

Typical behaviors of piping plover chicks increase their vulnerability to vehicles (Melvin et al. 1993). Chicks frequently move between the upper berm or foredune and feeding habitats in the

wrack line and intertidal zone. These movements place chicks in the paths of vehicles driving along the berm or through the intertidal zone. Chicks stand in, walk, and run along tire ruts, and sometimes have difficulty crossing deep ruts or climbing out of them. Chicks sometimes stand motionless or crouch as vehicles pass by, or do not move quickly enough to get out of the way. Wire fencing placed around nests to deter predators is ineffective in protecting chicks from vehicles because chicks typically leave the nest within a day after hatching and move extensively along the beach to feed.

Vehicles also degrade piping plover habitat by crushing wrack into the sand and making it unavailable as cover or a foraging substrate, by creating ruts that may trap or impede movements of chicks, and by causing disturbance that may prevent plovers from using habitat that is otherwise suitable (Goldin et al. 1990, Strauss 1990, Melvin et al. 1993).

Least Tern

Least terns are small, white and black seabirds that nest along Atlantic coast beaches from southern Maine to Florida. The least tern is listed as a "Species of Special Concern" by the Division of Fisheries and Wildlife under provisions of the Massachusetts Endangered Species Act. An estimated 2,642 pairs nested at 51 sites in Massachusetts in 1992 (Blodget 1992).

Least terns nest in habitats that are similar to those of the piping plover, and the two species often nest near each other. Least terns arrive in Massachusetts in early May, engage in elaborate courtship rituals, mate, and quickly establish nesting colonies. Actual nesting occurs from about the third week of May to mid-July. Nesting colonies range in size from several pairs to over 500 pairs. Nests are shallow "scrapes" in the sand, usually in sandy areas devoid of vegetation, but sometimes in areas of sparse beach grass, beach pea, and other dune vegetation. Least terns, like piping plovers, have nested along the Atlantic coast for thousands of years and depend on natural processes of beach and dune erosion and accretion to maintain their habitats.

Clutches consist of 1-3 eggs and incubation averages 21 to 23 days. Least terns are single-brooded, but will renest multiple times if previous nests are lost. Chicks are precocial and may move considerable distances along the beach before fledging, which occurs after 20-22 days. Adults deliver fish caught in the surrounding waters to chicks. Soon after chicks are able to fly, least terns gather in pre-migratory flocks and depart southward; most are gone before the end of August.

Least terns are vulnerable to disturbance from humans, pets, and vehicles during periods of courtship and egg-laying in May and

June. Similar to piping plovers, incubating least tern adults, eggs, and chicks are extremely cryptic. Prolonged or repeated disturbance at colonies can lead to egg and chick loss from exposure, predation, or abandonment. Least tern chicks are also vulnerable to mortality caused by off-road vehicles, and may stand or crouch in or walk and run along vehicle ruts.

Common, Roseate, and Arctic Terns

These three similar species of white and black seabirds nest together in mixed-species colonies. All are slightly larger than the least tern. The common tern is indeed the most "common" of the group. In 1992, 8,600 pairs were estimated at 35 sites in Massachusetts, although only 9 of those colonies exceeded 100 pairs (Blodget 1992). The arctic tern, at the southern edge of its natural range in Massachusetts, has been declining since the 1950's and reached an all-time low of only 8 pairs in 1992. Both of these species are listed by the Massachusetts Division of Fisheries and Wildlife as "Species of Special Concern" under provisions of the Massachusetts Endangered Species Act.

The Northeastern population of the roseate tern is listed as "Endangered" by both the U.S. Fish and Wildlife Service under the U.S. Endangered Species Act of 1973 (U.S. Fish and Wildlife Service 1989), and the Massachusetts Division of Fisheries and Wildlife under provisions of the Massachusetts Endangered Species Act. Of an estimated 1,412 pairs in Massachusetts in 1992, 1,375 pairs (97%) nested on Bird Island in Buzzards Bay (Blodget 1992). The rest were scattered among large colonies of common terns.

These three species of larger terns prefer to nest on offshore islands and remote tips of barrier beaches. Unfortunately, gulls have usurped most optimal nesting sites since the 1950's, forcing terns to nest at a limited number of secondary inshore sites where they are more exposed to human disturbance and a host of land-based predators.

The life histories of these three species of terns are generally similar. Exemplifying the three, common terns select dune areas with moderate to dense stands of beach grass and other dune vegetation. Birds arrive from the south in early May and select colony sites before the end of May. Ritualized courtship and pair formation occur on the beach and sandflats adjacent to the colony site. Nesting colonies range from a few to over 4,000 pairs. Nests are usually scrapes in the sand lined with beach grass and seaweed. Clutches of 2-3 eggs are laid and both parents share incubation duties for about 23 days. Young are precocial but are fed and brooded by adults. Diets of these terns are almost exclusively fish. As the young approach fledging at about 28 days, they congregate in rearing or "nursery" areas on broad expanses of beach and sand flats, where they loaf and are fed by adults. At

some sites, thousands of young terns may be present in these nursery areas from late July through mid-August. After mid-August, most terns have fledged and all three species gather at staging areas prior to departing for winter quarters by the end of August.

Prolonged or repeated disturbance at nesting colonies or nursery areas of common, arctic, or roseate terns can lead to egg and chick loss from exposure, predation, or abandonment. Eggs and young chicks tend to be less subject to mortality from vehicles because they occur more often in dune areas, but older chicks are sometimes run over when they move onto the outer beach prior to fledging. Older chicks have also been found dead, tangled in kite string.

III. Massachusetts Law

This section is provided to give a brief overview of provisions of the Massachusetts Wetlands Protection Act and Endangered Species Act that are pertinent to the management of piping plovers, terns, and their habitats. The reader is strongly advised to read the official texts of the current laws and regulations cited below.

Massachusetts Wetlands Protection Act (MGL c. 131 s. 40)

The Natural Heritage and Endangered Species Program of the Massachusetts Division of Fisheries and Wildlife (the Program) acts as the scientific authority to determine what is actual habitat and to provide an opinion about whether proposed activities subject to the Wetlands Protection Act will have adverse effects on rare wetlands wildlife habitat. Opinions issued by the Program are presumed to be correct, although this presumption is rebuttable and may be overcome upon a clear showing to the contrary.

Massachusetts Endangered Species Act (MGL c. 131A)

The Massachusetts Endangered Species Act (MESA) and regulations (321 CMR 10.00) are administered by the Massachusetts Division of Fisheries and Wildlife. The Act prohibits the "taking" of any species of animal or plant listed as "Endangered", "Threatened", or "Species of Special Concern" in Massachusetts. For animals, "taking" is defined as: "to harass, harm, pursue, hunt, shoot, hound, 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". Regulations implementing the Act state further that: "All state agencies shall utilize their authorities in furtherance of the purposes of MESA and these regulations; review, evaluate and

determine the impact on Endangered, Threatened and Special Concern species or their habitats of all works, projects, or activities conducted by them; and use all practicable means and measures to avoid or minimize damage to such species or their habitats." This includes "any work, project, or activity either directly undertaken by a state agency, or if undertaken by a person, which seeks the provision of financial assistance by an agency or requires the issuance of permits by an agency".

IV. Management Guidelines

VEHICLE MANAGEMENT

Protection of Nests and Nesting Habitat

On beaches where vehicles will be driven, all areas of suitable piping plover nesting habitat, as determined by the Division, should be identified and delineated with posts and warning signs or symbolic fencing on or before April 1 each year. Suitable nesting habitat for all species of terns should be identified and so delineated on or before May 15 each year.

All vehicular access into or through delineated nesting habitat should be prohibited. However, prior to hatching, vehicles may pass by such areas along designated vehicle corridors established along the outside edge of plover and tern nesting habitat. Vehicles may also park outside delineated nesting habitat, if beach width and configuration and tidal conditions allow. Vehicle corridors or parking areas should be moved, constricted, or temporarily closed if territorial, courting, or nesting plovers or terns 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.

Protection of Chicks and Chick Habitat

Sections of beaches where unfledged piping plover or tern chicks are present should be temporarily closed to all vehicles not deemed essential. (See the provisions for essential vehicles below.)

When unfledged plover chicks are present, vehicles should be prohibited from all dune, beach, and intertidal habitat within 100 yards of either side of a line drawn through the nest site and perpendicular to the long axis of the beach. The resulting 200 yard-wide area of protected habitat for plover chicks should extend from the ocean-side low water line to the bay-side low water line

or to the farthest extent of dune habitat if no bay-side intertidal habitat exists. However, vehicles may be allowed to pass through portions of the protected area that are considered inaccessible to plover chicks because of steep topography, dense vegetation, or other naturally-occurring obstacles. If unfledged plover chicks move outside the original 200 yard-wide area of protected habitat, then the boundaries of the protected area should be adjusted to provide at least a 100 yard buffer between chicks and vehicles.

When unfledged least tern chicks are present, vehicles should be prohibited from all dune, beach, and intertidal habitat within 100 yards of either side of lines drawn through the outermost nests in the colony and perpendicular to the long axis of the beach. The resulting area of protected habitat for least tern chicks should extend from the ocean-side low water line to the bay-side low water line, or to the farthest extent of dune habitat if no bay-side intertidal zone exists. If unfledged chicks move outside the original protected area, then the boundaries of the protected area should be adjusted to provide at least a 100 yard-wide buffer between unfledged chicks and vehicles. However, vehicles may pass through any portions of the protected area considered inaccessible to least tern chicks because of distance, steep topography, dense vegetation, or other naturally-occurring obstacles. Because least tern chicks disperse from nests shorter distances and at older ages than piping plover chicks, under some circumstances it may be possible to allow passage of vehicles through portions of protected least tern chick habitat if, in the opinion of the Division, this can occur without substantially increasing threats to least tern chicks or their habitats.

Timing of Vehicle Restrictions in Chick Habitat

Restrictions on use of vehicles in areas where unfledged plover or tern chicks are present should begin on or before the date that hatching begins and continue until chicks have fledged. For purposes of vehicle management, plover chicks are considered fledged at 35 days of age or when observed in flight, whichever occurs first. Tern chicks are considered fledged when they are capable of flight.

When piping plover nests are found before the last egg is laid, restrictions on vehicles should begin on the 26th day after the last egg is laid. This assumes an average incubation period of 27 days, and provides a 1 day margin of error.

When plover nests are found after the last egg has been laid, making it impossible to predict hatch date, restrictions on vehicles should begin on a date determined by 1 of 3 scenarios:

1) If a plover nest found with a complete clutch is monitored twice per day, at dawn and dusk (before 0600 hrs and after

1900 hrs), vehicle use may continue until hatching begins. Nests should be monitored at dawn and dusk to minimize the time that hatching may go undetected if it occurs after dark. Whenever possible, nests should be monitored from a distance with spotting scope or binoculars to minimize disturbance to incubating plovers.

2) If a plover nest is found with a complete clutch before May 22 (the earliest recorded hatch date for piping plovers in Massachusetts), and is not monitored twice per day, at dawn and dusk, then restrictions on vehicles should begin May 22.

3) If a plover nest is found with a complete clutch on or after May 22, and is not monitored twice per day, at dawn and dusk, then restrictions on vehicles should begin immediately.

If hatching occurs earlier than expected, or chicks are discovered from an unreported nest, restrictions on vehicles should begin immediately.

If, in the opinion of the Division, ruts are present that are deep enough to restrict movements of plover chicks, or vehicle impacts on wrack are so severe that wrack must be allowed to accumulate naturally prior to hatching, then restrictions on vehicles should begin at least 5 days prior to the anticipated hatching date of plover nests. If a plover nest is found with a complete clutch, precluding estimation of hatching date, and availability of wrack has been substantially reduced by vehicle passage, or deep ruts have been created that could reasonably be expected to impede chick movements, then restrictions on vehicles should begin immediately.

Restrictions on use of vehicles in least tern chick habitat should begin as soon as hatching begins (as early as June 12). Restrictions may begin later if, in the opinion of the Division, tern chicks are not endangered by vehicles because of distance or intervening steep terrain, dense vegetation, or other naturally-occurring barriers.

Areas of dune, beach, or intertidal habitat used as nursery areas by unfledged or recently fledged tern chicks, as identified by the Division, should be delineated with posts, warning signs or symbolic fencing not later than June 21. All access by vehicles into posted tern nursery areas should be prohibited while unfledged or recently-fledged tern chicks are present in these areas, until it is determined that use of nursery areas by young terns has ended (i.e. young terns are no longer being fed by adult terns).

Essential Vehicles

Essential vehicles, as defined by municipal conservation commissions pursuant to the Guidelines for Barrier Beach Management in Massachusetts developed by the Massachusetts Barrier Beach Task Force, should only travel on sections of beaches where unfledged plover or tern chicks are present if such travel is absolutely necessary and no other reasonable travel routes are available. Essential vehicles should travel through chick habitat areas only during daylight hours, except in emergencies, and should be guided by a qualified monitor who has first determined the location of all unfledged plover and tern chicks. All steps should be taken to minimize number of trips by essential vehicles through chick habitat areas. Use of open, 3 or 4-wheel motorized all-terrain vehicles (ATVs) or non-motorized all-terrain bicycles is recommended whenever possible for monitoring and law enforcement because of the improved visibility afforded operators. Homeowners should consider other means of access, eg. by foot, water, or shuttle services, during periods when chicks are present. A log should be maintained by the beach manager of the date, time, vehicle number and operator, and purpose of each trip through areas where unfledged chicks are present. Personnel monitoring plovers and terns should maintain and regularly update a log of the numbers and locations of unfledged plover and tern chicks on each beach. Drivers of essential vehicles should review the log each day to determine the most recent number and location of unfledged chicks.

Travel by essential vehicles should avoid the wrack line and should be infrequent enough to avoid creating deep ruts that could impede chick movements. If essential vehicles are substantially reducing availability of wrack or are creating ruts that could impede chick movements, use of essential vehicles should be further reduced and, if necessary, restricted to only emergency vehicles.

MANAGEMENT OF OTHER RECREATIONAL USES

The activities discussed in this section are not subject to the jurisdiction of the Wetlands Protection Act because they are not considered to be alterations of wetland resource areas. The following guidelines should only be applied in reference to the Massachusetts Endangered Species Act.

On beaches where pedestrians, joggers, sun-bathers, picnickers, fishermen, boaters, horseback riders, or other recreational users will be present in numbers that could harm or disturb incubating plovers or terns, their eggs, or chicks, refuge areas of at least 50 yard-radius around nests and above the high tide line should be delineated with warning signs and symbolic fencing. Only persons engaged in rare species monitoring,

management, or research activities should enter refuge areas. Refuge areas should remain fenced as long as viable eggs or unfledged chicks are present.

Refuge areas around nests should be expanded if a 50 yard-radius is deemed inadequate to protect incubating adults or unfledged chicks from harm or disturbance. This may include situations where plovers or terns are especially intolerant of human presence, or where a 50 yard-radius refuge provides insufficient escape cover or alternative foraging opportunities for plover chicks. If nests are discovered outside fenced areas, fencing should be extended to create a sufficient buffer to prevent harm or disturbance to incubating adults, eggs, or unfledged chicks. On some beaches where plovers and terns have traditionally nested or where suitable habitat occurs, it may be necessary to symbolically fence portions of habitat during March or April, prior to plover nesting, or during May, prior to tern nesting, if, in the opinion of the Division, failure to do so could discourage plovers or terns from nesting as a result of disturbance from human use.

Rearing or nursery areas used by unfledged or recently fledged tern chicks, as identified by the Division, should be delineated with posts, warning signs, or symbolic fencing not later than June 21. Only persons engaged in rare species monitoring, management, or research should enter posted or fenced tern nursery areas while unfledged tern chicks or tern chicks being fed by adult terns are present, although individuals may pass by outside these areas. Such nursery areas may be re-opened when all tern chicks have fledged and are not being fed by adult terns.

Pets should be leashed and under control of their owners at all times from April 1 to August 31 on beaches where piping plovers or terns are present or have traditionally nested. Pets should be prohibited on these beaches from April 1 through August 31 if, based on observations and experience, pet owners fail to keep pets leashed and under control.

Kite flying should be prohibited within 200 yards of nesting or territorial adult or unfledged juvenile piping plovers or terns, from April 1 to August 31.

Fireworks should be prohibited on beaches where plovers or terns nest from April 1 to August 31.

V. Literature Cited

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Appendix B

Guidelines for Managing Recreational Activities in Piping Plover Breeding Habitat on the U.S. Atlantic Coast to Avoid Take Under Section 9 of the Endangered Species Act

Northeast Region, U.S. Fish and Wildlife Service
April 15, 1994

The following information is provided as guidance to beach managers and property owners seeking to avoid potential violations of Section 9 of the Endangered Species Act (16 U.S.C. 1538) and its implementing regulations (50 CFR Part 17) that could occur as the result of recreational activities on beaches used by breeding piping plovers along the Atlantic Coast. These guidelines were developed by the Northeast Region, U.S. Fish and Wildlife Service (Service), with assistance from the U.S. Atlantic Coast Piping Plover Recovery Team. The guidelines are advisory, and failure to implement them does not, of itself, constitute a violation of the law. Rather, they represent the Service's best professional advice to beach managers and landowners regarding the management options that will prevent direct mortality, harm, or harassment of piping plovers and their eggs due to recreational activities.

Some land managers have endangered species protection obligations under Section 7 of the Endangered Species Act (see section I below) or under Executive Orders 11644 and 11989[1] that go beyond adherence to these guidelines. Nothing in this document should be construed as lack of endorsement of additional piping plover protection measures implemented by these land managers or those who are voluntarily undertaking stronger plover protection measures.

This document contains four sections: (I) a brief synopsis of the legal requirements that afford protection to nesting piping plovers; (II) a brief summary of the life history of piping plovers and potential threats due to recreational activities during the breeding cycle; (III) guidelines for protecting piping plovers from recreational activities on Atlantic Coast beaches; and (IV) literature cited.

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[1] Executive Order 11644, Use of Off-Road Vehicles on the Public Lands and Executive Order 11989, Off-Road Vehicles on Public Lands pertain to lands under custody of the Secretaries of Agriculture, Defense, and Interior (except for Indian lands) and certain lands under the custody of the Tennessee Valley Authority.

I. Legal Considerations

Section 9 of the Endangered Species Act (ESA) prohibits any person subject to the jurisdiction of the United States from harassing, harming, pursuing, hunting, shooting, wounding, killing, trapping, capturing, or collecting listed wildlife species. It is also unlawful to attempt such acts, solicit another to commit such acts, or cause such acts to be committed. A "person" is defined in Section 3 to mean "an individual, corporation, partnership, trust, association, or any other private entity; or any officer, employee, agent, department, or instrumentality of the Federal Government, of any State, municipality, or political subdivision of a State, or of any foreign government; any State, municipality, or political subdivision of a State; or any other entity subject to the jurisdiction of the United States." Regulations implementing the ESA (50 CFR 17.3) further define "harm" to include significant habitat modification or degradation that results in the killing or injury of wildlife by significantly impairing essential behavioral patterns including breeding, feeding, or sheltering. "Harass" means 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. Penalties for violations of Section 9 are provided in Section 11 of the ESA; for threatened species, these penalties include fines of up to $25,000, imprisonment for not more than six months, or both.

Section 10 of the ESA and related regulations provide for permits that may be granted to authorize acts prohibited under Section 9, for scientific purposes or to enhance the propagation or survival of a listed species. States that have Cooperative Agreements under Section 6 of the ESA, may provide written authorization for take that occurs in the course of implementing conservation programs. For example, State agencies have authorized certain biologists to construct predator exclosures for piping plovers. It is also legal for employees or designated agents of certain Federal or State agencies to take listed species without a permit, if the action is necessary to aid sick, injured, or orphaned animals or to salvage or dispose of a dead specimen.

Section 10 also allows permits to be issued for take that is "incidental to, and not the purpose of, carrying out an otherwise lawful activity" if the Service determines that certain conditions have been met. An applicant for an incidental take permit must prepare a conservation plan that specifies the impacts of the take, steps the applicant will take to minimize and mitigate the impacts, funding that will be available to implement these steps, alternative actions to the take that the applicant considered, and the reasons why such alternatives are not being utilized.

Section 7 of the ESA may be pertinent to beach managers and landowners in situations that have a Federal nexus. Section 7 requires Federal agencies to consult with the Service (or National Marine Fisheries Service for marine species) prior to authorizing, funding, or carrying out activities that may affect listed species. Section 7 also requires that these agencies use their authorities to further the conservation of listed species. Section 7 obligations have caused Federal land management agencies to implement piping plover protection measures that go beyond those required to avoid take, for example by conducting research on threats to piping plovers. Other examples of Federal activities that may affect piping plovers along the Atlantic Coast, thereby triggering Section 7 consultation, include permits for beach nourishment or disposal of dredged material (U.S. Army Corps of Engineers) and funding of beach restoration projects (Federal Emergency Management Authority).

Piping plovers, as well as other migratory birds such as least terns, common terns, American oystercatchers, laughing gulls, herring gulls, and great black-blacked gulls, their nests, and eggs are also protected under the Migratory Bird Treaty Act of 1918 (16 U.S.C. 703-712). Prohibited acts include pursuing, hunting, shooting, wounding, killing, trapping, capturing, collecting, or attempting such conduct. Violators may be fined up to $5000 and/or imprisoned for up to six months.

Almost all States within the breeding range of the Atlantic Coast piping plover population list the species as State threatened or endangered (Northeast Nongame Technical Committee 1993). Various laws and regulations may protect State-listed species from take, but the Service has not ascertained the adequacy of the guidelines presented in this document to meet the requirements of any State law.

II. Life History and Threats from Human Disturbance

Piping plovers are small, sand-colored shorebirds that nest on sandy, coastal beaches from South Carolina to Newfoundland. Since 1986, the Atlantic Coast population has been protected as a threatened species under provisions of the U.S. Endangered Species Act of 1973 (U.S. Fish and Wildlife Service 1985). The U.S. portion of the population was estimated at 875 pairs in 1993 (U.S. Fish and Wildlife Service 1993). Many characteristics of piping plovers contribute to their susceptibility to take due to human beach activities.

Life History

Piping plovers begin returning to their Atlantic Coast nesting beaches in mid-March (Coutu et al. 1990, Cross 1990, Goldin 1990,

MacIvor 1990, Hake 1993). Males establish and defend territories and court females (Cairns 1982). Eggs may be present on the beach from mid-April through late July. Clutch size is generally four eggs, and the incubation period[2] usually lasts for 27-28 days. Piping plovers fledge only a single brood per season, but may renest several times if previous nests are lost. Chicks are precocial[3] (Wilcox 1959, Cairns 1982). They may move hundreds of yards from the nest site during their first week of life (see Table 1, Summary of Chick Mobility Data). Chicks remain together with one or both parents until they fledge (are able to fly) at 25 to 35 days of age. Depending on date of hatching, flightless chicks may be present from mid-May until late August, although most fledge by the end of July (Patterson 1988, Goldin 1990, MacIvor 1990, Howard et al. 1993).

Piping plover nests are situated above the high tide line on coastal beaches, sand flats at the ends of sandspits and barrier islands, gently sloping foredunes, blowout areas behind primary dunes, and washover areas cut into or between dunes. They may also nest on areas where suitable dredge material has been deposited. Nest sites are shallow scraped depressions in substrates ranging from fine grained sand to mixtures of sand and pebbles, shells or cobble (Bent 1929, Burger 1987a, Cairns 1982, Patterson 1988, Flemming et al. 1990, MacIvor 1990, Strauss 1990). Nests are usually found in areas with little or no vegetation although, on occasion, piping plovers will nest under stands of American beachgrass (Ammophila breviligulata) or other vegetation (Patterson 1988, Flemming et al. 1990, MacIvor 1990). Plover nests may be very difficult to detect, especially during the 6-7 day egg-laying phase when the birds generally do not incubate (Goldin 1994).

Plover foods consist of invertebrates such as marine worms, fly larvae, beetles, crustaceans or mollusks (Bent 1929, Cairns 1977, Nicholls 1989). Feeding areas include intertidal portions of ocean beaches, washover areas, mudflats, sandflats, wrack lines[4], and shorelines of coastal ponds, lagoons or salt marshes (Gibbs 1986, Coutu et al. 1990, Hoopes et al. 1992, Loegering 1992, Goldin 1993). Studies have shown that the relative importance of various feeding habitat types may vary by site (Gibbs 1986, Coutu et al. 1990, McConnaughey et al. 1990, Loegering 1992, Goldin 1993, Hoopes 1993) and by stage in the breeding cycle (Cross 1990). Adults and

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[2] "Incubation" refers to adult birds sitting on eggs, to maintain them at a favorable temperature for embryo development.

[3] "Precocial" birds are mobile and capable of foraging for themselves within several hours of hatching.

[4] Wrack is organic material including seaweed, seashells, driftwood and other materials deposited on beaches by tidal action.

chicks on a given site may use different feeding habitats in varying proportion (Goldin et al. 1990). Feeding activities of chicks may be particularly important to their survival. Cairns (1977) found that piping plover chicks typically tripled their weight during the first two weeks post-hatching; chicks that failed to achieve at least 60% of this weight gain by day 12 were unlikely to survive. During courtship, nesting, and brood rearing, feeding territories are generally contiguous to nesting territories (Cairns 1977), although instances where brood-rearing areas are widely separated from nesting territories are not uncommon (see Table 1). Feeding activities of both adults and chicks may occur during all hours of the day and night (Burger 1993) and at all stages in the tidal cycle (Goldin 1993, Hoopes 1993).

Threats from Nonmotorized Beach Activities

Sandy beaches that provide nesting habitat for piping plovers are also attractive recreational habitats for people and their pets. Nonmotorized recreational activities can be a source of both direct mortality and harassment of piping plovers. Pedestrians on beaches may crush eggs (Burger 1987b, Hill 1988, Shaffer and Laporte 1992, Cape Cod National Seashore 1993, Collazo et al. 1994). Unleashed dogs may chase plovers (McConnaughey et al. 1990), destroy nests (Hoopes et al. 1992), and kill chicks (Cairns and McLaren 1980).

Pedestrians may flush incubating plovers from nests (see Table 2, Summary of Data on Distances at Which Plovers React to Disturbance), exposing eggs to avian predators or causing excessive cooling or heating of eggs. Repeated exposure of shorebird eggs on hot days may cause overheating, killing the embryos (Bergstrom 1991). Excessive cooling may kill embryos or retard their development, delaying hatching dates (Welty 1982). Pedestrians can also displace unfledged chicks (Strauss 1990, Burger 1991, Hoopes et al. 1992, Loegering 1992, Goldin 1993). Fireworks are highly disturbing to piping plovers (Howard et al. 1993). Plovers are particularly intolerant of kites, compared with pedestrians, dogs, and vehicles; biologists believe this may be because plovers perceive kites as potential avian predators (Hoopes et al. 1992).

Threats from Motor Vehicles

Unrestricted use of motorized vehicles on beaches is a serious threat to piping plovers and their habitats. Vehicles can crush eggs (Wilcox 1959; Tull 1984; Burger 1987b; Patterson et al. 1991; United States of America v. Breezy Point Cooperative, Inc., U.S. District Court, Eastern District of New York, Civil Action No. CV-90-2542, 1991; Shaffer and Laporte 1992), adults, and chicks. In Massachusetts and New York, biologists documented 14 incidents in which 18 chicks and 2 adults were killed by vehicles between 1989 and 1993 (Melvin et al. 1994). Goldin (1993) compiled records of

34 chick mortalities (30 on the Atlantic Coast and 4 on the Northern Great Plains) due to vehicles. Many biologists that monitor and manage piping plovers believe that many more chicks are killed by vehicles than are found and reported (Melvin et al. 1994). Beaches used by vehicles during nesting and brood-rearing periods generally have fewer breeding plovers than available nesting and feeding habitat can support. In contrast, plover abundance and productivity has increased on beaches where vehicle restrictions during chick-rearing periods have been combined with protection of nests from predators (Goldin 1993; S. Melvin, pers. comm., 1993).

Typical behaviors of piping plover chicks increase their vulnerability to vehicles. Chicks frequently move between the upper berm or foredune and feeding habitats in the wrack line and intertidal zone. These movements place chicks in the paths of vehicles driving along the berm or through the intertidal zone. Chicks stand in, walk, and run along tire ruts, and sometimes have difficulty crossing deep ruts or climbing out of them (Eddings et al. 1990, Strauss 1990, Howard et al. 1993). Chicks sometimes stand motionless or crouch as vehicles pass by, or do not move quickly enough to get out of the way (Tull 1984, Hoopes et al. 1992, Goldin 1993). Wire fencing placed around nests to deter predators (Rimmer and Deblinger 1990, Melvin et al. 1992) is ineffective in protecting chicks from vehicles because chicks typically leave the nest within a day after hatching and move extensively along the beach to feed (see Table 1).

Vehicles may also significantly degrade piping plover habitat or disrupt normal behavior patterns. They may harm or harass plovers by crushing wrack into the sand and making it unavailable as cover or a foraging substrate, by creating ruts that may trap or impede movements of chicks, and by preventing plovers from using habitat that is otherwise suitable (MacIvor 1990, Strauss 1990, Hoopes et al. 1992, Goldin 1993).

III. Guidelines for Protecting Piping Plovers from Recreational Disturbance

The Service recommends the following protection measures to prevent direct mortality or harassment of piping plovers, their eggs, and chicks.

Management of Nonmotorized Recreational Uses

On beaches where pedestrians, joggers, sun-bathers, picnickers, fishermen, boaters, horseback riders, or other recreational users are present in numbers that could harm or disturb incubating plovers, their eggs, or chicks, areas of at least 50 meter-radius

around nests above the high tide line should be delineated with warning signs and symbolic fencing[5]. Only persons engaged in rare species monitoring, management, or research activities should enter posted areas. These areas should remain fenced as long as viable eggs or unfledged chicks are present. Fencing is intended to prevent accidental crushing of nests and repeated flushing of incubating adults, and to provide an area where chicks can rest and seek shelter when large numbers of people are on the beach.

Available data indicate that a 50 meter buffer distance around nests will be adequate to prevent harassment of the majority of incubating piping plovers. However, fencing around nests should be expanded in cases where the standard 50 meter-radius is inadequate to protect incubating adults or unfledged chicks from harm or disturbance. Data from various sites distributed across the plover's Atlantic Coast range indicates that larger buffers may be needed in some locations (see Table 2). This may include situations where plovers are especially intolerant of human presence, or where a 50 meter-radius area provides insufficient escape cover or alternative foraging opportunities for plover chicks.[6]

In cases where the nest is located less than 50 meters above the high tide line, fencing should be situated at the high tide line, and a qualified biologist should monitor responses of the birds to passersby, documenting his/her observations in clearly recorded field notes. Providing that birds are not exhibiting signs of disturbance, this smaller buffer may be maintained in such cases.

On portions of beaches that receive heavy human use, areas where territorial plovers are observed should be symbolically fenced to prevent disruption of territorial displays and courtship. Since nests can be difficult to locate, especially during egg-laying, this will also prevent accidental crushing of undetected nests. If nests are discovered outside fenced areas, fencing should be

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[5] "Symbolic fencing" refers to one or two strands of light-weight string, tied between posts to delineate areas where pedestrians and vehicles should not enter.

[6] For example, on the basis of data from an intensive three year study that showed that plovers on Assateague Island in Maryland flush from nests at greater distances than those elsewhere (Loegering 1992), the Assateague Island National Seashore established 200 meter buffers zones around most nest sites and primary foraging areas (Assateague Island National Seashore 1993). Following a precipitous drop in numbers of nesting plover pairs in Delaware in the late 1980's, that State adopted a Piping Plover Management Plan that provided 100 yard buffers around nests on State park lands and included intertidal areas (Delaware Department of Natural Resources and Environmental Control 1990).

extended to create a sufficient buffer to prevent disturbance to incubating adults, eggs, or unfledged chicks.

Pets should be leashed and under control of their owners at all times from April 1 to August 31 on beaches where piping plovers are present or have traditionally nested. Pets should be prohibited on these beaches from April 1 through August 31 if, based on observations and experience, pet owners fail to keep pets leashed and under control.

Kite flying should be prohibited within 200 meters of nesting or territorial adult or unfledged juvenile piping plovers between April 1 and August 31.

Fireworks should be prohibited on beaches where plovers nest from April 1 until all chicks are fledged.

Motor Vehicle Management

The Service recommends the following minimum protection measures to prevent direct mortality or harassment of piping plovers, their eggs, and chicks on beaches where vehicles are permitted. Since restrictions to protect unfledged chicks often impede vehicle access along a barrier spit, a number of management options affecting the timing and size of vehicle closures are presented here. Some of these options are contingent on implementation of intensive plover monitoring and management plans by qualified biologists. It is recommended that landowners seek concurrence with such monitoring plans from either the Service or the State wildlife agency.

Protection of Nests

All suitable piping plover nesting habitat should be identified by a qualified biologist and delineated with posts and warning signs or symbolic fencing on or before April 1 each year. All vehicular access into or through posted nesting habitat should be prohibited. However, prior to hatching, vehicles may pass by such areas along designated vehicle corridors established along the outside edge of plover nesting habitat. Vehicles may also park outside delineated nesting habitat, if beach width and configuration and tidal conditions allow. Vehicle corridors or 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.

If data from several years of plover monitoring suggests that significantly more habitat is available than the local plover

population can occupy, some suitable habitat may be left unposted if the following conditions are met:

1. The Service OR a State wildlife agency that is party to an agreement under Section 6 of the ESA provides written concurrence with a plan that:

A. Estimates the number of pairs likely to nest on the site based on the past monitoring and regional population trends.

AND

B. Delineates the habitat that will be posted or fenced prior to April 1 to assure a high probability that territorial plovers will select protected areas in which to court and nest. Sites where nesting or courting plovers were observed during the last three seasons as well as other habitat deemed most likely to be pioneered by plovers should be included in the posted and/or fenced area.

AND

C. Provides for monitoring of piping plovers on the beach by a qualified biologist(s). Generally, the frequency of monitoring should be not less than twice per week prior to May 1 and not less than three times per week thereafter. Monitoring should occur daily whenever moderate to large numbers of vehicles are on the beach. Monitors should document locations of territorial or courting plovers, nest locations, and observations of any reactions of incubating birds to pedestrian or vehicular disturbance.

AND

2. All unposted sites are posted immediately upon detection of territorial plovers.

Protection of Chicks

Sections of beaches where unfledged piping plover chicks are present should be temporarily closed to all vehicles not deemed essential. (See the provisions for essential vehicles below.) Areas where vehicles are prohibited should include all dune, beach, and intertidal habitat within the chicks' foraging range, to be determined by either of the following methods:

1. The vehicle free area should extend 1000 meters on each side of a line drawn through the nest site and perpendicular

to the long axis of the beach. The resulting 2000 meter-wide area of protected habitat for plover chicks should extend from the ocean-side low water line to the bay-side low water line or to the farthest extent of dune habitat if no bay-side intertidal habitat exists. However, vehicles may be allowed to pass through portions of the protected area that are considered inaccessible to plover chicks because of steep topography, dense vegetation, or other naturally-occurring obstacles.

OR

2. The Service OR a State wildlife agency that is party to an agreement under Section 6 of the ESA provides written concurrence with a plan that:

A. Provides for monitoring of all broods during the chick-rearing phase of the breeding season and specifies the frequency of monitoring.

AND

B. Specifies the minimum size of vehicle-free areas to be established in the vicinity of unfledged broods based on the mobility of broods observed on the site in past years and on the frequency of monitoring. Unless substantial data from past years show that broods on a site stay very close to their nest locations, vehicle-free areas should extend at least 200 meters on each side of the nest site during the first week following hatching. The size and location of the protected area should be adjusted in response to the observed mobility of the brood, but in no case should it be reduced to less than 100 meters on each side of the brood. In some cases, highly mobile broods may require protected areas up to 1000 meters, even where they are intensively monitored. Protected areas should extend from the ocean-side low water line to the bay-side low water line or to the farthest extent of dune habitat if no bay-side intertidal habitat exists. However, vehicles may be allowed to pass through portions of the protected area that are considered inaccessible to plover chicks because of steep topography, dense vegetation, or other naturally-occurring obstacles. In a few cases, where several years of data documents that piping plovers on a particular site feed in only certain habitat types, the Service or the State wildlife management agency may provide written concurrence that vehicles pose no danger to plovers in other specified habitats on that site.

Timing of Vehicle Restrictions in Chick Habitat

Restrictions on use of vehicles in areas where unfledged plover chicks are present should begin on or before the date that hatching begins and continue until chicks have fledged. For purposes of vehicle management, plover chicks are considered fledged at 35 days of age or when observed in sustained flight for at least 15 meters, whichever occurs first.

When piping plover nests are found before the last egg is laid, restrictions on vehicles should begin on the 26th day after the last egg is laid. This assumes an average incubation period of 27 days, and provides a 1 day margin of error.

When plover nests are found after the last egg has been laid, making it impossible to predict hatch date, restrictions on vehicles should begin on a date determined by one of the following scenarios:

1) With intensive monitoring: If the nest is monitored at least twice per day, at dawn and dusk (before 0600 hrs and after 1900 hrs) by a qualified biologist, vehicle use may continue until hatching begins. Nests should be monitored at dawn and dusk to minimize the time that hatching may go undetected if it occurs after dark. Whenever possible, nests should be monitored from a distance with spotting scope or binoculars to minimize disturbance to incubating plovers.

OR

2) Without intensive monitoring: Restrictions should begin on May 15 (the earliest probable hatch date). If the nest is discovered after May 15, then restrictions should start immediately.

If hatching occurs earlier than expected, or chicks are discovered from an unreported nest, restrictions on vehicles should begin immediately.

If ruts are present that are deep enough to restrict movements of plover chicks, then restrictions on vehicles should begin at least 5 days prior to the anticipated hatching date of plover nests. If a plover nest is found with a complete clutch, precluding estimation of hatching date, and deep ruts have been created that could reasonably be expected to impede chick movements, then restrictions on vehicles should begin immediately.

Essential Vehicles

Because it is impossible to completely eliminate the possibility that a vehicle will accidently crush an unfledged plover chicks,

use of vehicles in the vicinity of broods should be avoided whenever possible. However, the Service recognizes that life-threatening situations on the beach may require emergency vehicle response. Furthermore, some "essential vehicles" may be required to provide for safety of pedestrian recreationists, law enforcement, maintenance of public property, or access to private dwellings not otherwise accessible. On large beaches, maintaining the frequency of plover monitoring required to minimize the size and duration of vehicle closures may necessitate the use of vehicles by plover monitors.

Essential vehicles should only travel on sections of beaches where unfledged plover chicks are present if such travel is absolutely necessary and no other reasonable travel routes are available. All steps should be taken to minimize number of trips by essential vehicles through chick habitat areas. Homeowners should consider other means of access, eg. by foot, water, or shuttle services, during periods when chicks are present.

The following procedures should be followed to minimize the probability that chicks will be crushed by essential (non-emergency) vehicles:

1. Essential vehicles should travel through chick habitat areas only during daylight hours, and should be guided by a qualified monitor who has first determined the location of all unfledged plover chicks.

2. Speed of vehicles should not exceed five miles per hour.

3. Use of open 4-wheel motorized all-terrain vehicles (ATVs) or non-motorized all-terrain bicycles is recommended whenever possible for monitoring and law enforcement because of the improved visibility afforded operators.

4. A log should be maintained by the beach manager of the date, time, vehicle number and operator, and purpose of each trip through areas where unfledged chicks are present. Personnel monitoring plovers should maintain and regularly update a log of the numbers and locations of unfledged plover chicks on each beach. Drivers of essential vehicles should review the log each day to determine the most recent number and location of unfledged chicks.

Essential vehicles should avoid driving on the wrack line, and travel should be infrequent enough to avoid creating deep ruts that could impede chick movements. If essential vehicles are creating ruts that could impede chick movements, use of essential vehicles should be further reduced and, if necessary, restricted to emergency vehicles only.

SITE-SPECIFIC MANAGEMENT GUIDANCE

The guidelines provided in this document are based on an extensive review of the scientific literature and are intended to cover the vast majority of situations likely to be encountered on piping plover nesting sites along the U.S. Atlantic Coast. However, the Service recognizes that site-specific conditions may lead to anomalous situations in which departures from this guidance may be safely implemented. The Service recommends that landowners who believe such situations exist on their lands contact either the Service or the State wildlife agency and, if appropriate, arrange for an on-site review. Written documentation of agreements regarding departures from this guidance is recommended.

In some unusual circumstances, Service or State biologists may recognize situations where this guidance provides insufficient protection for piping plovers or their nests. In such a case, the Service or the State wildlife agency may provide written notice to the landowner describing additional measures recommended to prevent take of piping plovers on that site.

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Table 1. Summary of Chick Mobility Data

Source	Location	Data
Patterson 1988 (p.40)	Maryland and Virginia	18 of 38 broods moved to feeding areas more than 100 meters from their nests; 5 broods moved more than 600 meters (distance measured parallel to wrackline).
Cross 1989 (p.23)	Virginia	At three sites, observers relocated broods at mean distances from their nests of 153 m +/-97m (44 observations, 14 broods), 32 m +/-7 m (8 observations, 3 broods), and 492 m +/-281 m (12 observations, 4 broods).
Coutu et al. 1990 (p.12)	North Carolina	Observations of 11 broods averaged 212 m from their nests; 3 broods moved 400-725 m from nest sites.
Strauss 1990 (p.33)	Massachusetts	10 chicks moved more than 200 m during first 5 days post-hatch while 19 chicks moved less than 200 meters during same interval.
Loegering 1992 (p.72)	Maryland	Distances broods moved from nests during first 5 days post-hatch averaged 195 m in Bay habitat (n=10), 141 m in Interior habitat (n=36), and 131 m in Ocean habitat (n=41). By 21 days, average movement in each habitat had, respectively, increased to 850 m (n=1), 464 m (n=10), and 187 m (n=69). One brood moved more than 1000 m from its nest.
Melvin et al. 1994	Massachusetts and New York	In 14 incidents in which 18 chicks were killed by vehicles, chicks were run over $\leq$ 10 m to $\leq$ 900 m from their nests. In 7 of these instances, mortality occurred $\geq$ 200 m from the nest.

Table 2. Summary of Data on Distances at which Piping Plovers React to Disturbance

Source	Location	Data
Flushing of Incubating Birds by Pedestrians		
Flemming et al. 1988 (p.326)	Nova Scotia	Adults usually flushed from the nests at distances <40 m; however, great variation existed and reaction distances as great as 210 m were observed.
Cross 1990 (p.47)	Virginia	Mean flushing distances in each of two years were 47 m (n=181, range = 5 m to 300 m) and 25 m (n=214, range = 2 m to 100 m).
Loegering 1992 (p.61)	Maryland	Flushing distances averaged 78 m (n=43); range was 20 m to 174 m. Recommended use of 225 m disturbance buffers on his site.
Cross and Terwilliger 1993	Virginia	Mean flushing distance for all years on all sites (Virginia plover sites, 1986-91) was 63 m (n=201, SD=31, range = 7 m to 200 m). Differences among years were not significant, but differences among sites were.
Hoopes 1993 (p.72)	Massachusetts	Mean flushing distance for incubating plovers was 24 m (n=31).
Disturbance to Non-incubating Birds		
Hoopes 1993 (p.89)	Massachusetts	Mean response distance (all ages, all behaviors) was 23 m for pedestrian disturbances (range = 10 m to 60 m), 40 m for vehicles (range = 30 m to 70 m), 46 m for dogs/pets (range = 20 m to 100 m), and 85 m for kites (range = 60 m to 120 m).

Goldin 1993b (p.74)	New York	Average flushing distance for adult and juvenile plovers was 18.7 m for pedestrian disturbances (n=585), 19.5 m for joggers (n=183), and 20.4 m for vehicles (n=111). Pedestrians caused chicks to flush at an average distance of 20.7 m (n=175), joggers at 32.3 m (n=37), and vehicles at 19.3 m (n=7). Tolerance of individual birds varied; one chick moved 260 m in direct response to 20 disturbances in 1 hour.

Appendix C

Guidelines for the Use of Predator Exclosures to Protect Piping Plover Nests

Prepared by the Atlantic Coast Piping Plover Recovery Team
Revised, February 1996

Introduction

First trials of wire fences to prevent predation of piping plover (*Charadrius melodus*) nests on the Atlantic Coast occurred in 1987, when seven exclosures were used on four sites. Over 70 nests on 14 sites were exclosed in 1988; state plover coordinators reported use of exclosures to protect nests of 141 pairs of plovers along the U.S. Atlantic Coast in 1989 (U.S. Fish and Wildlife Service 1989). By 1993, exclosures were deployed in every State and at least three Canadian Provinces in the plovers' Atlantic Coast breeding range.

Rimmer and Deblinger (1990) found that 24 of 26 nests (92%) protected by exclosures hatched at least one egg, while only six of 24 (25%) unexclosed nests hatched at a Massachusetts site over four years. Melvin et al. (1992) reported 90% (26/29) hatching of exclosed nests versus 17% (4/24) at six sites on Outer Cape Cod, Massachusetts. Information on 211 exclosures used in eight states and three Canadian provinces in 1990 was evaluated to assess the effectiveness of various designs and construction techniques (Deblinger et al. 1992, Vaske et al. 1994).

While exclosures are contributing to improved productivity and population increases in some portions of the plover's Atlantic Coast range, problems have been noted in some localities. Loegering (1992) reported loss of six nests in exclosures without tops in Maryland in 1988, but nest loss stopped after string tops were added. Van Schoik (TNC, *in litt.* 1993) documented loss of 12 nests over just a few days on Jones Beach Island, New York to common crows (*Corvus brachyrhynchos*) that entered exclosures covered with parallel rows of string; no further losses occurred when net tops were installed. Cross (1991) found that exclosed nests hatched significantly more often than unexclosed nests over three years on three sites in Virginia, but hatch rates were not significantly improved at all sites or in all years; furthermore, two instances of foxes depredating adult plovers occurred in the vicinity of exclosures. Foxes or coyotes systematically depredated 5-10 exclosures at each of three widely separated sites in 1995 (USFWS files). Several instances of adult plover entanglement in string or net tops, with and without attendant mortality, have been reported (USFWS files). Predator exclosures have been associated with abandonment of snowy plover (*Charadrius alexandrinus*) nests on

California beaches, where fox track patterns suggest that the birds were subjected to intense harassment by foxes (M. Parker, U.S. Fish and Wildlife Service, pers. comm., 1994). Other potential risks associated with exclosures include vandalism or disturbance of the birds by curiosity seekers. Therefore, exclosures must be carefully constructed, monitored, and evaluated by qualified persons.

Exclosures are a valuable tool for countering human-abetted predation threats to piping plover eggs (see USFWS 1995, page 40), but they are not appropriate for use in all situations, nor do they provide any protection for mobile plover chicks. Therefore, it is strongly recommended that exclosure use occur in the context of an integrated predator management program that employs a full range of appropriate techniques, including methods to prevent predator access to human supplied food sources and, when warranted, predator removal (see USFWS 1995, tasks 1.41 and 1.43).

Pre-use Evaluation

Since the use of exclosures is not without risks, the predation threat must be assessed and the potential benefits and risks evaluated. Rates of nest depredation observed during the previous season, abundance of predator tracks on the beach, and other indicators of predator numbers and activity should be considered. Even on beaches that are generally suitable for exclosures, some individual nest sites may be physically inappropriate, such as where the beach face is too steep.

Exclosures draw attention to the exact location of nests, which may attract potential vandals as well as people who are simply curious about these rare birds. Measures to minimize this threat include use of symbolic fences and signs to keep people far away from the exclosures, public information brochures, interpretive displays, wardens, and law enforcement.

Authorization

Any person constructing predator exclosures must have a letter of authorization from the State wildlife agency designating him/her an agent of the State for the purpose of constructing and monitoring the exclosures. Authorization letters should list any approved deviations from recommendations on exclosure design, construction, or monitoring provided in these Guidelines. Persons authorized to deploy exclosures should be very familiar with the biology and behavior of piping plovers. These authorizations are necessary to meet legal requirements under Sections 9 and 10 of the Endangered Species Act; they also facilitate timely communication of any revisions to these guidelines with those deploying exclosures.

Exclosure Design

Exclosures should be constructed of 2 inch X 2 inch or 2 inch X 4 inch welded wire fence and supported by at least four sturdy metal or wooden stakes. Fences should be buried at least 8 inches in the sand (12 inches is better) and should be a *minimum of 36 inches* above the sand. Tops of posts supporting the fence must be below the top wire to prevent use of the posts as perches by crows and other avian predators (other signs and posts in the area should be similarly designed to discourage perching). Triangular, rectangular, and circular exclosure designs have all been used effectively. *Minimum* distance from the nest to the fence should be *five feet* (ten foot diameter for a circular exclosure). Exclosures that are taller and/or wider than the minimum dimensions reduce risks that an incubating plover will hit the fence if it is startled and make it harder for a potential predator to discern what is inside, and their use is strongly encouraged.

If avian predators such as crows, grackles, ravens, or gulls are present in the area, either a net or twine top must be installed, as exclosures may cue these avian predators to the nest location. On some sites, common or fish crows (*Corvus brachyrynchos* and *C. ossifragus*) have systematically penetrated twine tops, but net tops appear more likely to invite other bird species to perch on them, creating a risk that the incubating plovers may abandon the nest. Material used for net tops (generally fruit-tree or blueberry netting) should have a mesh size of *3/4 inches* or less; mesh should lie flat and form square holes without stretching (do not use nets that are intended to be stretched). Nets should be cut to fit the top of the exclosure with minimum overhang, pulled taut, and securely attached to wire fence with hog clips or similar devices. Alternatively, seining twine may be strung in parallel rows about 6 to 8 inches apart across the top of the exclosure. Use of monofilament, which was used in the past to top exclosures, is no longer recommended and only parallel rows of twine should be strung (no perpendicular patterns); both monofilament and perpendicular string patterns have been associated with entanglement of adult plovers. Rigid tops, including fencing, should *never* be used on top of exclosures, as they attract perching birds.

Construction

Exclosure construction is most safely and efficiently accomplished with a crew of two to four persons. Construction should be practiced around a "dummy nest" until the operation can be done smoothly. Construction time should not exceed 20 minutes and can generally be accomplished in less than 10 minutes without sacrificing quality of construction (i.e., secure installation of posts and careful attachment of wire fencing and tops). Unless the incubating bird stays on the nest, a basket or similar device should be inverted on the nest to mark its location. Once

construction is completed, rake or otherwise smooth out the sand immediately around the fence so that the surface of the sand is flush with the bottom wire, assuring easy access for birds walking through the fence.

Exclosures should be constructed after a full clutch of eggs has been confirmed. Exceptions allowing for exclosure of incomplete clutches may be approved by State agencies for beaches where egg predation is very likely to occur before clutch completion and plover monitoring is done by experienced biologists.

Exclosures should be constructed early or late in the day, to avoid exposing the eggs to the hot sun and to prevent attracting curious bystanders. Construction during rainy, very windy, or otherwise inclement weather must also be avoided.

Monitoring

As soon as construction is completed, all persons should move well away from the nest, preferably to a location out of sight of the birds. The nest should be monitored until an adult returns to the nest, resumes incubation, and then exchanges with its mate. If neither adult returns to the nest within 60 minutes or the birds' behavior appears abnormal, the exclosure should be removed.

Exclosed nests should be monitored at least every other day from a safe distance. At sites where this frequency of monitoring is not feasible, risks and benefits of exclosure use should be carefully evaluated and use of exclosures should only proceed with explicit authorization from a representative of the State wildlife agency.

Monitors should be alert for evidence that crows, gulls, or other birds are perching on exclosure fences or tops. Loss of several nests to the same predator species during a short time period or tracks that suggest a predator is systematically visiting exclosures should be immediately reported to the State wildlife agency and the U.S. Fish and Wildlife Service. Both perching and evidence of "smart predators" that may be cued to exclosures should be evaluated immediately to determine whether exclosures should be modified or removed (see next section). Monitors should also assure that sand, wrack, or other debris around the base of the exclosure does not obstruct the ability of the plovers to walk under the bottom horizontal wire around a significant portion of the exclosure (plovers almost always walk into the exclosures).

Whenever exclosure failure (nest depredation or abandonment) is detected, a thorough investigation of the site should be made. Tracks, fur, means of entry, or egg-shell remains may aid the identification of predators. Means of predator entry into the exclosure may suggest needed modifications in exclosure design. In cases of suspected nest abandonment, an extremely thorough search

of the area should be made for any signs of adult mortality, including predator track patterns; signs of a struggle; or plover feathers, bones, or other remains. The area should also be monitored for several days for sightings of one or both adults.

Removal of Exclosures

Where "smart" foxes or coyotes are systematically entering exclosures or tracks suggest that they are harassing plovers, exclosures should be immediately removed and efforts should be initiated to trap and remove the offending fox(es) or coyote(s).

Where avian species are perching on top of exclosures on more than a very infrequent basis, monitors may attempt prudent modifications, such as substitution of string tops for netting and/or clipping and removing the top row of wire on the fencing. However, if these modifications do not promptly alleviate the problem, subsequent plover nests on that site should not be exclosed during the remainder of the season. Whether or not exclosures that have already been erected should be removed should be determined by weighing the risk of nest abandonment by the incubating plovers due to perching against the risk of nest depredation if the exclosure is removed. It may be prudent to remove a few exclosures and monitor nest survival before removing all exclosures from the site.

Reporting

Please REPORT ANY OBSERVATIONS OF POTENTIAL PROBLEMS TO YOUR STATE WILDLIFE AGENCY IMMEDIATELY. Situations that are especially important to report include any evidence of adult plover mortality or unusual numbers of nest depredations or abandonments. Please also send copies of reports regarding exclosure problems to:

U.S. Fish and Wildlife Service
Weir Hill Road
Sudbury, MA 01776
Attention: Anne Hecht
Telephone: 508-443-4325; Fax: 508-443-2898

Literature Cited

Cross, R.R. 1991. Monitoring, management, and research of the piping plover at Chincoteague National Wildlife Refuge. Unpublished report. Virginia Department of Game and Inland Fisheries. 76 pp.

Deblinger, R.D., J.J. Vaske, and D.W. Rimmer. 1992. An evaluation of different predator exclosures used to protect Atlantic coast piping plover nests. Wildlife Society Bulletin. 20: 274-279.

Loegering, J.P. 1992. Piping plover breeding biology, foraging ecology and behavior on Assateague Island National Seashore, Maryland. M.S. Thesis. Virginia Polytechnic Institute and State University, Blacksburg, Virginia. 247 pp.

Melvin, S.M., L.H. MacIvor, and C.R. Griffin. 1992. Predator exclosures: a technique to reduce predation of piping plover nests. Wildlife Society Bulletin. 20: 143-148.

Rimmer, D.W., and R.D. Deblinger. 1990. Use of predator exclosures to protect piping plover nests. Journal of Field Ornithology. 61: 217-223.

Vaske, J.J., D.W. Rimmer, and R.D. Deblinger. 1994. The impact of different predator exclosures on piping plover nest abandonment. Journal of Field Ornithology. 65(2): 201-209.

U.S. Fish and Wildlife Service. 1989. 1989 status update: U.S. Atlantic coast piping plover. Unpublished report. U.S. Fish and Wildlife Service, Newton Corner, Massachusetts. 34 pp.

U.S. Fish and Wildlife Service. 1995. Piping Plover (*Charadrius melodus*), Atlantic Coast Population, Revised Recovery Plan. Technical/Agency Draft. Hadley, Massachusetts. 238 pp.

Appendix D

Recommended Protocol for Estimating Breeding Population Size of Roseate Terns at Northeastern U.S. Breeding Colonies

Roseate Tern (Northeastern Population) Recovery Team
Technical Advisory Committee
April 1995

Researchers lacking experience with roseate terns should familiarize themselves with fieldwork methods reported in the literature (e.g., Spendelow 1982, Colonial Waterbirds 5:19-31; Nisbet et al. 1990, Colonial Waterbirds 13:85-91) and consult with Chairman Jeff Spendelow or another member of the Technical Advisory Committee (TAC, see list below) before attempting fieldwork on this endangered species. If you are planning to work on a new/small colony containing <100 pairs of terns of all species combined, caution is advised to keep disturbance to a minimum.

If possible, 3 nest-count censuses should be made at all colony sites with 25 or more pairs of breeding roseate terns. (If daily or weekly visits can be made, or productivity will be studied, please contact Jeff Spendelow about procedures for filling out nest history cards.) At sites with <25 breeding pairs, it may be possible to first locate nests (or locate adults, if nests are not easily visible) by viewing the colony from the edge with binoculars or a spotting scope. Because terns in new or small colonies may begin nesting later than those in large or medium-sized colonies, visits to smaller colonies may need to be made 7-10 days later than visits to the larger colonies. A third visit may not be necessary at some sites unless there is evidence from the second visit to indicate that more birds may be laying after mid-July.

1) The first census should be made when the first roseate tern chicks hatch (about 15 June), and, if possible, all nests found should be marked. This nest count will give us an estimate of the number of birds that attempted to nest during the "peak period" of nesting.

2) The second census should be made about 23-25 days later (8-10 July) so that all fertile eggs from the marked "peak period" nests should have hatched. All new nests should be counted and marked, the number of nests from the first census that were abandoned or with eggs that failed to hatch should be counted, and, if so advised, an effort should be made to band all chicks.

3) The third census, if done, should be made about 23-25 days later (1-5 August) using the same procedures described above for the second census.

Data from these censuses should be reported to the Chairman of the TAC for assimilation into the metapopulation study. For more information on recommended procedures or the timing of censuses to be made along your area of the coast each year, please call any of the following TAC members:

Maine	Steve Kress
Massachusetts	Ian C.T. Nisbet
Connecticut	Jeff Spendelow
NY (E'n Long Is.)	Helen Hays
NY (W'n Long Is.)	Joanna Burger

Appendix E

Instructions for Completing the Massachusetts Tern Census Form

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For details on recommended census methodologies, refer to Chapter 8 of the Massachusetts Tern and Plover Handbook: a manual for stewards (Blodget and Melvin 1996).

Colony Names and Numbers: Use identifiers assigned by the U.S. Fish and Wildlife Service (Erwin and Korschgen 1979; Andrews 1990). This information may already be pre-printed on the form. Complete a separate form for each colony visited, even if no nesting birds are found. Remember, it is important to report negative findings to document that a site was visited! If a previously unreported colony location is discovered, attach a photocopy of a labeled USGS topographical map, pinpointing the exact location of the colony.

Species Codes: ROST (Roseate Tern), COTE (Common Tern), ARTE (Arctic Tern), LETE (Least Tern), LAGU (Laughing Gull), and BLSK (Black Skimmer)

Census Window: The primary census period, or "A-Count", for all species is June 5-20. Secondary counts, "B-counts", may be done in certain circumstances after June 20. Refer to Table 1 below, "What to report", for guidance on the timing of counts.

Date: Enter the date of your count. For LETE colonies, which (if possible) should be counted from the perimeter of the colony on numerous dates during the census window, enter only the date on which you counted the maximum number of nests.

Number of Pairs: Remember that for survey purposes, results should be expressed in pairs. Each nest represents a pair. Nests (=scrapes) should contain at least one egg in order to be counted. Also, a nest should be counted if it is apparent that one or more of the eggs have hatched and/or chicks have moved away from the nest. Do not count nests in which no eggs have been laid or nests that are obviously abandoned.

Survey Method (M): Select one of the following codes: **NC** (complete nest count), **EC** (extrapolated estimate of pairs based on a partial nest count), and **AC** (estimate of pairs derived from an adult count multiplied by 0.8). Whenever possible, use the **NC** method; use **EC/AC** only if a complete nest count is not possible.

Quality of Survey (Q): Enter one of the following codes: **LC** (low confidence); **RC** (reasonable confidence); **HC** (high confidence).

Productivity Estimate: Select one of the following: 0 (nil); 1 (poor); 2 (fair to good); 3 (excellent).

Remarks: Use this space to report significant information relating to limiting factors such as predation, tide/storm events, human disturbance, etc. Also, if known, indicate the date of first eggs laid and first hatch.

Table 1. What to report.

Sp.	A-Count All species: June 5-20	B-Count after June 20
ROST	Time as closely as possible to the date of first hatch, approx. 23 days after the first eggs are laid.	Time exactly 25 days after first count.
COTE	Time as closely as possible to the date of first hatch, approx. 23 days after the first eggs are laid (usually 6-8 days before ROST).	No "B-Count" required.
ARTE	Time census to coincide with that of the other species in colony such as COTE or LETE	Another census should be taken to reflect any additional pairs that appear after June 20.
LETE	Visit colony frequently during the count period and report maximum number of nests/incubating birds counted on any one day.	Conduct a "B-Count" if there is a significant change in numbers from the "A-Count".
LAGU	Time count coincident with COTE count.	No "B-Count" required.
BLSK	Time count coincident with COTE count.	Another census should be taken to reflect any additional pairs that appear after June 20.

Massachusetts Tern Census Form

Colony Name: _____

Colony Number: _____

Town: _____

Ownership: _____

Observer/Agency: _____

Street: _____

Town: _____

Zip: _____ Telephone: _____

***PLEASE read the instructions on the reverse of this form before filling out.

Species Code	A-Count				B-Count				P	Remarks: (e.g., evidence of predation, tide or storm washout, human disturbance, etc.) *INDICATE (if known) DATE OF FIRST EGGS LAID AND FIRST EGGS HATCHED.
	Date	No. Pairs	M	Q	Date	No. Pairs	M	Q		
ROST										
COTE										
ARTE										
LETE										
LAGU										
BLSK										
OTHER _____										

Please forward completed form(s) no later than July 31 to Bradford G. Blodget, State Ornithologist, Massachusetts Division of Fisheries and Wildlife, Field Headquarters, Rt. 135, Westborough, MA 01581-3337. Telephone: (508)792-7270 x152 / Fax: (508)792-7275 / Internet address for electronic filing: bblodget@state.ma.us

Appendix F

Instructions for Completing the Massachusetts Piping Plover Census Form

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Instructions are referenced to headings on the 2-page Piping Plover Census Form. Please report data as accurately and completely as possible. Please complete a separate form for each beach that you census or manage.

Census Results - Report total number of breeding pairs and any unpaired adults present during the 9-day standardized count period (Index Count) and the entire breeding season (Total Count). To be tallied in the Total Count, pairs should be present at a site for at least 2 weeks and should exhibit territorial or courtship behavior repeatedly during that period, if not actual nesting. Please complete a form for each beach that you census, even if no plovers were detected. Reporting of "negative" data helps us document trends in both abundance and distribution.

Census Remarks - Use this section to clarify or explain any unusual aspects of your census results. Indicate any factors that may have biased your index count, for example wind, rain or dense fog; only one person censusing a large site; census conducted on a low tide when some plovers may have been difficult to detect.

If you suspect any pair(s) failed at this site and departed soon enough (before approximately June 20) to have renested elsewhere, or if you had late-arriving pairs (after the Index Count) that may have attempted to nest elsewhere before moving to this site, please indicate here, along with dates these pairs were first (last) seen. Communicate with monitors at adjacent sites to compare dates of arrival/departure of any such pairs. This information will help us minimize double-counting and will improve the accuracy of the Total Count.

Visits Per Week - To help us gauge intensity of management and monitoring at each site, please indicate the average number of visits per week made to each site during each month from April through July. If visitation frequency changed substantially within a month, or if a site was visited on only one or a few days, so indicate. For example: April 6, 11: 1 visit each
April 16-30: 3/wk
May 1-15: 3/wk
May 16-31 5/wk
June: 5/wk
July: 5/wk

Exclosure Design - Space is provided to describe up to 3 different designs of predator exclosures that you may have used to protect nests at a given site. On page 2 there is space to match each type of exclosure (A,B,C) with specific nests. Examples of information that should be given for each design feature are given below.

Shape: circular, triangular, or other

Diameter/Length of Side: give as appropriate for shape (feet).

Size of Wire Mesh: give height and width (inches) of opening in mesh.

Height Above Ground: height (feet) from ground to top of wire, after burial.

Depth Buried: depth (inches) of bottom of wire below the sand surface.

Cover Material: black twine, black fruit netting, no cover, etc.

Cover Spacing/Mesh Size: for example, 4 in. spacing between lines of twine; twine woven in 4 x 4 in. squares; 3/4 x 3/4 in. mesh netting.

Note that completion of the sections of this form that deal with predator exclosures satisfies reporting requirements for cooperators that received letters of authorization from the Division of Fisheries and Wildlife to use exclosures.

Other Management/Remarks - It is useful to have an annual record of whether symbolic fencing was used to protect nests and provide chick refuge areas, and whether steps were taken to manage off-road vehicles, pedestrians, pets, dune building projects, or other limiting factors. This is also the place to recommend additional management needs for the future and to add remarks about special circumstances or observations that you believe are noteworthy or need clarification. Use a separate sheet if necessary.

Pair No./Nest No. - Number pairs sequentially starting with 1. Match each nest number with the appropriate pair number, if possible. For example: pair no. 1's first nest would be 1a; if they had a second nest, it would be 1b, etc. If you are uncertain whether a given nest was a renest or from a different pair, give your best determination here and then explain under Remarks.

Number of Eggs/Chicks - Report number of eggs laid and hatched, and number of chicks fledged for each pair and nest attempt for which information is available. For purposes of estimating reproductive success, chicks are defined as "fledged" if they are $\geq$ 25 days of age or are observed in flight for $\geq$ 50 feet, whichever occurs first. If data are incomplete for a given nest or brood, don't be

afraid to put a "?" in the appropriate box, or use footnotes to reference explanations of uncertain data in Remarks (for example, "No nest was found, but a brood later appeared and fledged 3 chicks", or "Four eggs were laid and 4 hatched, but uncertain whether 3 or 4 chicks fledged").

Dates - For each nest attempt, give date clutch was completed and date it either hatched or failed (if known). These data allow us to better understand breeding chronology in Massachusetts, sort out pairs that may have moved between sites, and calculate nest exposure-days for purposes of more accurately estimating survival rates of exclosed vs. unexclosed nests.

Exclosure - For each nest, indicate Y (yes) or N (no) whether a predator exclosure was used, the design used (referenced to A, B, or C on page 1), and the date the exclosure was installed.

Causes of egg/chick mortality - Please report any observations or supporting evidence that suggests or confirms causes of egg or chick mortality. While causes of nest loss can frequently be determined by experienced observers at frequently monitored sites, causes of chick mortality are usually difficult to determine with any degree of certainty.

Each year we receive a number of forms on which causes of egg or chick mortality are reported but no supporting data are given. Please indicate if the causes of losses you report were confirmed by convincing evidence, or simply suspected based on incomplete or circumstantial evidence. Provide supporting details that are as specific as possible; attach an additional sheet if necessary. For example: "Nest 1a - egg predation by crows suspected; crow tracks approached within 6 feet of nest, but gravel in immediate area of nest made it impossible to confirm tracks at the nest itself. All eggs gone, no eggshell fragments observed." "Nest 2b - fox predation confirmed; fox tracks approached to within 6 in. of nest scrape, all 4 eggs gone." "Brood from nest 4a - 2 of 4 chicks disappeared at age 2-3 days, after 2 days and a night of heavy rain and winds 15-25 mph northeast, night-time temps. in the 40's (June 1-2)."

Map - Please attach a copy of a map that clearly shows locations of all nests and any pairs that did not nest, referenced by nest or pair number. The Division can provide you with a photocopy of a USGS topographic sheet for your site(s). Hand-drawn sketch maps may be submitted if drawn neatly and as accurately as possible, and if they include points of reference that can be matched to the most recent USGS topographic map of that site.

Please submit completed forms to Scott Melvin or Brad Blodget at: Division of Fisheries and Wildlife, Rt. 135, Westboro, MA 01581. If you need additional forms or have questions, contact your supervisor or the Division (508-792-7270).

MASSACHUSETTS PIPI PLOVER CENSUS FORM

Year:_____

Site Name:_____

Town:_____

Ownership:_____

Observer/Agency:_____

Address:_____

_____

_____ Telephone:_____

Census Results:	Index Count	Total Count
No. of Pairs		
Unpaired Adults		

Census Remarks:

Month	Average# of visits to site per week
April	
May	
June	
July	

Indicate type(s) of exclosure design(s) used:

Exclosure Design	A	B	C
Shape			
Diameter/Length of Side			
Size of Wire Mesh			
Height Above Ground			
Depth Buried			
Cover Material			
Cover Spacing/Mesh Size			

Other Management Undertaken or Needed/Remarks:

Site Name:_____ Year: _____ Observer:_____

Page____of_____

		Number of Eggs/Chicks			Date clutch was:			Exclosure		
Pair No.	Nest No.	Laid	Hatched	Fledged	Found (#eggs?)	Completed	Hatched or Failed	Y/N	Design(A,B,...)	Date Installed

Nest No.	Cause of Egg Mortality/Evidence	Cause of Chick Mortality/Evidence

***Please atta copy of a map of this site that shows locations of all nests and p' 'hat did not nest.

Appendix G

Useful Addresses and Telephone Numbers

FEDERAL AGENCIES

National Park Service (508) 349-3785
Cape Cod National Seashore
99 Marconi Site Rd.
Wellfleet, MA 02667

U.S. Fish and Wildlife Service (617) 443-4661
Great Meadows National Wildlife Refuge
(Anne Hecht)
Weir Hill Rd.
Sudbury, MA 01776

U.S. Fish and Wildlife Service (617) 424-5750
Law Enforcement Division (617) 242 7874
Investigative Section
(Chris Dowd/Pat Bosco)
120 Second Ave.
Charlestown Navy Yard
Charlestown, MA 02129

U.S. Fish and Wildlife Service (508) 945-0594
Monomoy National Wildlife Refuge
Morris Island
Chatham, MA 02633

U.S. Fish and Wildlife Service (603) 225-1411
New England Field Office
(Susi Von Oettingen)
400 Ralph Pill Market Place
22 Bridge St.
Concord, NH 03301-4901

U.S. Fish and Wildlife Service (508) 465-5753
Parker River National Wildlife Refuge
Northern Blvd.(Plum Island)
Newburyport, MA 01950

U.S. Fish and Wildlife Service (413) 253-8200
Regional Office
300 Westgate Center Dr.
Hadley, MA 01035-9589

STATE AGENCIES

Mass. Office of Coastal Zone Management 100 Cambridge St., 20th Flr. Boston, MA 02202	(617) 727-9530
Mass. Dept. of Environmental Management (Jack Lash) 100 Cambridge St., 19th Flr. Boston, MA 02202	(617) 727-3160 x572
Mass. Dept. of Environmental Protection Southeast Regional Office Division of Wetlands & Waterways 20 Riverside Dr. Lakeville, MA 02347	(508) 946-2810
Mass. Division of Fisheries and Wildlife Route 135, Field Headquarters Westboro, MA 01581-3337	(508) 792-7270
Mass. Division of Law Enforcement (Dispatcher) 100 Nashua St., 9th Flr. Boston, MA 02114	(800) 632-8075

TOWN AND COUNTY COOPERATORS

Barnstable Dept. of Recreation Town of Barnstable 141 Bassett Ln. Hyannis, MA 02601	(508) 790-6345
Dukes County Beach Manager Dukes County Courthouse 90 Main St. Edgartown, MA 02539	(508) 693-6692 (508) 627-5535
Duxbury Harbormaster Town of Duxbury Town Hall Duxbury, MA 02330	(617) 934-2866
Nantucket Shellfish and Marine Dept. Town of Nantucket 34 Washington St. Nantucket, MA 02554	(508) 228-7260

Orleans Park Dept.
Town of Orleans
19 School St., P.O. Box 122
Orleans, MA 02653 (508) 240-3775

Plymouth Parks Dept.
Town of Plymouth
11 Lincoln St.
Plymouth, MA 02360 (508) 830-4095

PRIVATE CONSERVATION ORGANIZATIONS

Angry Plover Society
P.O. Box 1350
Nantucket, MA 02554 (508) 228-6782

Lloyd Center for Environmental Studies
430 Potomska Rd.
S. Dartmouth, MA 02748 (508) 990-0505

Massachusetts Audubon Society
Coastal Waterbird Program
2000 Main St.
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