

Boston Harbor Islands National Park Area:
Coastal Waterbird Management Recommendations

FINAL REPORT

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Coastal Waterbird Program, Mass Audubon

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Introduction

The Boston Harbor Islands National Park Area provides habitat for significant numbers of breeding, wintering and migrating coastal waterbirds. For example, more than 50% of all the Black-crowned Night-Herons and Snowy Egrets nesting in the state occur on a few islands in Boston Harbor. Similarly, important populations of other long-legged wading birds and nesting seabirds use habitats within the Park. Finally, the harbor supports regionally important nesting populations of Common Eider and American Oystercatcher. With the establishment of the Boston Harbor Islands National Park Area, the opportunity exists to facilitate coordinated, landscape-scale management of the natural resources of the harbor. With decades of experience managing and protecting coastal waterbirds throughout the state, Mass Audubon's Coastal Waterbird Program is pleased to participate in management planning as the Park develops its Resource Stewardship Strategy.

Executive Summary

The objective of all management recommendations provided in this report is to ensure optimum protection for coastal waterbirds using Park habitats and thereby provide for their long-term persistence in the Park. We recognize that additional information is necessary to develop comprehensive, effective and practicable management policy for natural resources in the Park. As conservation scientists, we understand our role to be to provide guidance on management practices that will result in optimum protection for vulnerable and threatened bird populations.

The occurrence of coastal waterbirds in the Boston Harbor Islands National Park Area (BHINPA) is relatively well-known. Wildlife agencies and NGO partners have committed to obtaining estimates of breeding coastal waterbirds since the mid-1970s. Comprehensive, harbor-wide surveys (i.e. all islands surveyed for all coastal bird species during a given year) used to develop recommendations in this document were conducted by state and federal agencies in 1977¹, 1996, 2006² and 2009³. In addition, harbor-wide data on individual species were collected in 2011⁴ and 2012 (Trocki, unpublished data). These datasets are supplemented by surveys conducted on a subset of island nesting sites during 2007, 2008 and 2010 (all reports : <https://irma.nps.gov/App/Reference/Profile/2186044>). In general, comprehensive, harbor-wide survey data were used to understand trends, especially in the context of

¹ Erwin, R. M. and C. E. Korschgen. 1979. Coastal waterbird colonies: Maine to Virginia 1977. An atlas showing colony locations and species composition. USFWS Biological Services Program, FWS/OBS-79/08.

² Melvin, S. 2010. Survey of Coastal Nesting Colonies of Cormorants, Gulls, Night-Herons, Egrets, and Ibises in Massachusetts, 2006-08. Final Report--Natural Heritage and Endangered Species Program Massachusetts Division of Fisheries and Wildlife

³ Trock, C. L. 2010. Boston Harbor Islands National Recreation Area coastal breeding bird monitoring: 2009 field season summary. Natural Resource Technical Report NPS/NETN/NRTR—2010/336. National Park Service, Fort Collins, Colorado.

⁴ Trock, C. L. 2012. Coastal breeding bird monitoring in Boston Harbor Islands National Recreation Area: Northeast Temperate Network 2011 summary report. Natural Resource Technical Report NPS/NETN/NRTR—2012/595. National Park Service, Fort Collins, Colorado.

state-wide estimates which were obtained in 1977, 1996, and 2006-2007. These population estimates show that six of eleven coastal waterbird species in the harbor are undergoing very significant declines that in most cases reflect statewide declining trends. Three species with small populations in the harbor appear to be relatively stable, and two species are increasing.

Assessments of the conservation status of coastal waterbird species using habitats within the park have been developed by a number of entities. These include: 1) US Department of Interior-USFWS 2008 Birds of Conservation Concern

(<http://www.fws.gov/migratorybirds/CurrentBirdIssues/Management/BCC.html>). In addition, the USFWS administers the US Endangered Species Act (<http://www.fws.gov/endangered/>). Although no coastal bird species listed under ESA have been documented nesting in BHINPA during comprehensive surveys, the Piping Plover (*Charadrius melodus*; listed as “Threatened” under ESA) has nested in the vicinity of the Park (South Boston 2011) and may utilize park habitats in the future. 2) Massachusetts Division of Fisheries and Wildlife-State Wildlife Action Plan (http://www.mass.gov/dfwele/dfw/habitat/cwcs/cwcs_home.htm). In addition, MADFW administers the Massachusetts Endangered Species Act (http://www.mass.gov/dfwele/dfw/nhesp/species_info/mesa_list/mesa_list.htm); Piping Plover is listed as “Threatened,” and Least Tern (*Sternula antillarum*) and Common Tern (*Sterna hirundo*) are listed as “Special Concern” under this statute. 3) Mass Audubon’s State of the Birds Report (<http://www.massaudubon.org/StateoftheBirds/index.php>) which reviews the status of breeding and wintering bird species in the state. Because of the inappropriateness of scale and lack of relevance, global assessments (such as IUCN Red List) of species that occur in the park are not included in this report.

Few studies have been conducted to identify limiting factors in the harbor. In addition, the impacts to nesting birds of regional-scale changes in harbor management over the past four decades (e.g. conversion of Spectacle Island to a spoil deposition and waste management site, and subsequent capping) have not been assessed. Overall, available science-based information on causes of population declines in the harbor is not sufficient to develop highly targeted management recommendations. Nevertheless, on the basis of site visits conducted in 2012 with BHINPA staff and familiarity with island nesting sites, we believe the impact of ground predators may be low on most islands. Vegetation management to promote nesting habitat for terns and oystercatchers is recommended for two islands. Specific needs for developing better information on limiting factors are outlined below. In addition, supplemental information regarding census methodology is contained in Appendix B.

Of greater importance and applicable to most Park islands is the need to provide nesting habitat relatively free of human disturbance. The Park receives more than 20,000 visitors each year (counts from NPS ferry islands). Because nesting coastal birds are highly vulnerable to human disturbance due to coloniality and/or ground-nesting, we consider disturbance management to be the most important strategy for restoring and protecting bird populations. Disturbance management is foundational to other strategies (e.g. human disturbance is known to exacerbate the effects of predators).

The importance of a disturbance management approach derives both from the mission of the Boston Harbor Islands National Park Area—“to preserve and protect a drumlin island system within Boston Harbor, along with its associated natural, cultural and historic resources” and the specific needs of island-nesting birds whose breeding ecology (including defense strategies) has evolved to succeed in isolated habitats void of ground predators and human disturbance. Along no other stretch of the US Atlantic coastline south of Maine does such a unique assemblage of islands suitable for coastal bird nesting occur.

We recommend that islands that are accessible to the boating public due to the availability of landing areas, and that are both supporting species in significant decline and a high diversity of avifauna, be protected as bird sanctuaries with human access to the islands strongly restricted through signage and patrolling (i.e. no public access Apr-Aug). In addition, islands supporting species listed under the Massachusetts Endangered Species Act should be managed to eliminate or reduce disturbance. Finally, islands that are relatively inaccessible to the public (e.g. outer harbor islands), and providing habitat to declining species should be managed to restrict human disturbance primarily through signage.

Prioritized protection categories are as follows: 1) Keystone islands supporting high diversity of species in decline (Calf Island, Middle Brewster Island, Outer Brewster Island, Sarah Island, Sheep Island) should be closed to visitors Apr-Aug; closures should be enforced through signage and patrolling; 2) Islands that support nesting tern species protected under the Massachusetts Endangered Species Act (Snake Island, Rainsford Island, Lovells Island) should be managed to prevent harm, harassment, etc of any egg, chick, or adult of a listed species. Landowners are responsible under the law to ensure that state guidelines are adhered to (e.g. symbolic fencing and signage of important nesting areas by April 1; see Appendix A); 3) Outer harbor islands supporting significant numbers of cormorants and gulls (all species of which are very significantly declining) should be closed to the public Apr-Aug; closures should be enforced through signage principally. Most of these islands, which include Green Island, Little Calf Island, Shag Rocks, do not have convenient landing areas and may require fewer Park resources to implement management; 4) Finally, we recommend that other islands in the harbor that are accessible through public transportation and that are providing habitat to small numbers of coastal birds be managed to reduce human disturbance (e.g. educational signage, “closed area” signage, fencing) from park visitors to these islands.

Table 1. Prioritized recommendations for coastal waterbird management in the Boston Harbor Islands National Park Area (management details provided in island accounts Appendix C).

Management Recommendations	Highest Priority	High Priority	Priority
Disturbance	- Seasonal closure of “keystone” islands through signage and patrolling - Protection of tern	Protection of oystercatcher nesting sites on islands without public transportation access	Protection of oystercatchers on islands accessible by public transportation through fencing,

	nesting sites according to state guidelines	through closures, fencing, signage • Protection of seabird nesting sites on outer harbor islands	signage
Vegetation	• Enhancement of nesting habitat on Snake and Lovells Islands		
Applied Research	• Targeted studies to identify factors limiting wading bird and tern reproductive success	• Monitoring to quantify oystercatcher fledging success • Targeted studies to identify factors limiting gull and cormorant reproductive success	• Identify key stopover sites within the Park for migrating shorebirds
Education	• Educational signage on islands accessed by public transportation that host nesting birds (e.g. Bumpkin, Rainsford)	• Educational panels, materials and presentations on island ferries, and on islands accessed by public transportation	• Advanced training for staff and volunteers on survey/monitoring techniques and investigator disturbance management

Common Eider

Occurrence and Status

Common Eider (COEI; *Somateria mollissima*) has been documented nesting on four islands in the Boston Harbor Islands National Park Area since the 2000s. The MAS State of the Birds Report identifies Common Eider as a species whose population is increasing state-wide (green-listed; strong increase in breeding range, likely increase in wintering range).

Habitat and Disturbance Management

Common Eider, a ground-nesting species, is sensitive to human disturbance both resulting from recreationists intruding in nesting areas and investigators/wildlife managers conducting surveys. Access to nesting areas on harbor islands should be strictly prohibited during the nesting season through signage and enforcement.

Double-crested Cormorant, Terns and Gulls

Occurrence and Status

Seabird species nesting in the Boston Harbor Islands National Park Area include Double-crested Cormorant (DCCO; *Phalacrocorax auritus*), Least Tern (LETE; *Sternula antillarum*), Common Tern (COTE; *Sterna hirundo*), Herring Gull (HERG; *Larus argentatus*) and Great Black-backed Gull (GBBG; *Larus marinus*). In general, Boston Harbor has not supported numbers of nesting Common Tern that are significant relative to state populations. Least Tern numbers have represented approximately 5% of the state population in some years. Terns persist in BHINPA in relatively small but stable numbers. LETS has been documented nesting on three islands in BHINPA since the mid-2000s; peak counts totaled 154 nests in 2007. COTE has been documented nesting on one island in BHINPA since the 1970s; peak counts totaled 40 nests in 1977. In addition, COTE has nested on three piers in the harbor that are not under BHINPA management. Gulls represent small relative populations in the harbor, but have declined very significantly in the BHINPA and statewide. Double-crested Cormorant in BHINPA has been a significant component of the state's population, and has declined significantly both within the harbor and statewide.

Table 2. Conservation status of Double-crested Cormorant, terns and gulls in the Boston Harbor Islands National Park Area .

	Federal Status	Statewide Status	BHINPA maximum percent of state population (peak abundance)	Percent change in BHINPA (peak to 2009)	Percent change statewide (peak to 2000s)
Double-crested Cormorant		MAS orange-listed	33% (1970s)	-40% (1990s)	-24% (1990s)
Least Tern	USFWS Birds Conservation Concern	MESA Special Concern; MAS red-listed			
Common Tern		MESA Special Concern; MAS red-listed			
Herring Gull		MAS orange-listed	16% (2000s)	-86% (1970s)	-62% (1970s)
Great Black-backed Gull		MAS orange-listed	33% (1970s)	-40% (1990s)	-24% (1990s)

Habitat and Disturbance Management

Double-crested Cormorant, Herring Gull and Great Black-backed Gull

The majority of cormorants nesting in BHINPA build ground nests on exposed rocky islands and around the perimeter of vegetated islands. Most cormorants nesting on Sarah Island and Sheep Island build nests in trees. When tree nesting sites are limited, cormorants have been documented to nest on artificial structures. Ground-nesting seabirds are highly sensitive to the presence of humans in the colony whether as recreational pedestrians or wildlife managers/investigators. Recreational access to nesting colonies should be strictly prohibited through signage and enforcement from April through August.

Least and Common Tern

Terns begin to arrive and establish nesting areas in May through mid-July. When terns are observed scraping and/or exhibiting courtship activity, these areas should be posted, giving the birds a 50 yard (according to MA NHESP guidelines) protection zone on all sides. A corridor along the high tide line, outside of symbolic fencing can be left to allow pedestrian and vehicle access (nesting season only, not during chick-rearing). Dogs and kite flying should be restricted from within 200 yards of potential nesting areas. When nest scrapes and/or eggs are found, the colony should be roped off or encircled with welded wire fence (not snow fence because it will alter nesting habitat). The protected zone should include all nests and give the nests on the perimeter of the colony a 50 yard buffer zone if possible. Pedestrian and vehicle corridor may be left along the high tide line.

If terns are present on the beach before Memorial Day weekend, it is critical that protective measures are taken before the Friday evening of that busy weekend. During chick-rearing season (generally mid-June through end July) the protection zone may need be shifted or increased beyond 50 meters to whatever is necessary to protect the young terns that move on and off the open beach and use the intertidal wrack line as cover. All vehicular traffic (ORV tracks were observed in 2012 on Peddocks and Thompson Islands) should be restricted from within 100 yards of the colony site if any chicks are present. Efforts should be made to communicate with landowners regarding presence of unfledged chicks so that they are aware of their presence and that vehicle use is problematic in these areas. When it has been determined that all chicks have fledged, signs, rope, and fence can be removed and all restrictions lifted; however if possible, we recommend to leave some areas up to protect post-breeding terns that may be using the areas for roosting and/or staging

Long-legged Wading Birds

Occurrence and Status

Long-legged wading bird species nesting in the Boston Harbor Islands National Park Area include Black-crowned Night-Heron (BCNH; *Nycticorax nycticorax*), Snowy Egret (SNEG; *Egretta thula*), Great Egret (GREG; *Ardea alba*), and Glossy Ibis (GLIB; *Plegadis falcinellus*). With the exception of Great Egret, abundance of long-legged wading birds has declined significantly in BHINPA over the past decades. BCNH and SNEG are identified in the Massachusetts State Wildlife Action Plan as Species of Greatest Conservation Need. Historically, long-legged wading birds have nested on eight islands in BHINPA; in 2009 these species nested on five islands.

Table 3. Conservation status of long-legged wading birds in the Boston Harbor Islands National Park Area .

	Federal Status	Statewide Status	BHINPA maximum percent of state population	Percent change in BHINPA (peak abundance to 2009)	Percent change statewide (peak abundance to 2000s)
Black-crowned Night-Heron		SWAP Greatest Conservation Need; MAS red-listed	56% (2000s)	-25% (2000s)	-60% (1970s)
Snowy Egret	USFWS Birds Conservation Concern	SWAP Greatest Conservation Need; MAS red-listed	57% (1990s)	-86% (1990s)	-36% (1990s)
Great Egret		MAS orange-listed	33% (2000s)	+4% (2009)	+4,700% (2000s)
Glossy Ibis		MAS green-listed; likely increase	15% (2000s)	-59% (2000s)	+206% (1990s)

Habitat and Disturbance Management

Wading birds have been shown to be very sensitive to disturbance especially before and during the egg-laying period. Most studies have shown that foot-traffic elicits a greater response in wading birds than mechanical disturbance and will result in a decrease of young fledged. This may be due to eggs being dislodged as the adult flushes from the nest, increased predation as a result of decreased attentiveness, and resulting nest and colony abandonment. An extensive literature exists characterizing the impacts of human disturbance to wading birds. Among other sources of disturbance, photographers can be very disruptive because of their desire to approach the birds closely. Recreational boat traffic has been shown to impact nesting bird colonies.

Because of the high importance of Boston Harbor wading bird populations to regional abundance, and due to very significant declining trends both in the harbor and statewide over the past decades, the BHINPA should make protection of nesting wading birds a top priority. Pedestrian access to nesting islands should be prohibited from 15 Mar through 1 Sep. No vegetation modifications are recommended at this time. There is reason to suspect that ground predators may have caused the colony on Middle Brewster to abandon. Previous surveys (Parsons, unpublished data) documented wading birds nesting in low (<1m) *Rubus* sp. patches. Surveys of ground predators are recommended and predator management may be warranted in order to restore the habitat on this island.

American Oystercatcher and other Shorebirds

Occurrence and Status

The American Oystercatcher is listed as a Bird of Conservation Concern by the USFWS. In addition, the US Shorebird Conservation Plan identifies the American Oystercatcher as a species of High Concern due to small, locally-designated population size and threats to breeding and non-breeding populations. The MAS State of the Birds Report identifies American Oystercatcher as a species whose breeding population is increasing state-wide (green-listed; strong increase). Oystercatchers in the BHINPA represent approximately 10% of the state population.

Habitat and Disturbance Management

American Oystercatcher is perhaps the most wary of our beach nesting bird species, often quietly leaving their nest long before an intruder has seen them, and not returning to incubate until the intruder has moved a good distance away. Many beach-goers (i.e., the intruders) are not even aware that they are near a nest and disturbing the birds, unless they get too close. When they do, the adult oystercatchers again become quite noisy and conspicuous. The birds then do a “butterfly” flight overhead and give a loud, distress call, or they may do distracting ground displays such as pretending they are injured, crouching and running, or mock feeding or sleeping. Because of their wariness of human intruders, the oystercatchers may not incubate or brood eggs and young, or be on the alert for predators, leaving the eggs and young extremely vulnerable.

American oystercatcher scrapes and nests should be fenced to prevent pedestrian disturbance; a minimum of 137m is recommended (see resources at <http://amoywg.org/>) but should be increased if needed. Signage and/or buoys should be in place on oystercatcher nesting beaches or before Apr 1, and should remain in place until all young have fledged. Generally, if no birds are present and nesting at a site all season, signage could be removed after 7 July. Vehicles should be prevented from driving in areas where there are unfledged oystercatcher chicks. Fledged is defined as able to fly 300'+. Dogs should be prohibited from islands providing nesting and/or foraging habitat for oystercatchers regardless of occupancy.

Protection of Migrating Shorebirds

Migratory shorebirds including Black-bellied Plover (*Pluvialis squatarola*) stop over to feed and rest during their southward migration on barrier beaches, tidal flats, and salt marsh habitats. Significant numbers of Black-bellied Plover (60-70) have been documented on site visits to Thompson Island (S. Corona, pers. com.). Hundreds of Sanderling (*Calidris alba*), Semipalmated Sandpiper (*C. pusilla*), Dunlin (*C. alpina*), Semipalmated Plover (*Charadrius semipalmatus*), and Greater Yellowlegs (*Tringa melanoleuca*) have been documented during migration in Suffolk County (www.eBird.org). High tide resting areas should be posted and, if necessary, roped off and/or fenced to protect them from all disturbances. It is most important that dogs be restricted from areas used by resting and foraging shorebirds.

Appendix A--GUIDELINES FOR MANAGING RECREATIONAL USE OF BEACHES TO PROTECT PIPING PLOVERS, TERNS, AND THEIR HABITATS IN MASSACHUSETTS

Massachusetts Division of Fisheries and Wildlife
Natural Heritage and Endangered Species Program
Field Headquarters, Rt. 135
Westborough, MA 01581

21 April 1993

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.

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Appendix B—Waterbird Census Methodology

Common Eider

Ground-based nest counts provide the most accurate information from which to estimate abundance. Surveys should be conducted to coincide with early incubation. Boat-based surveys of females and chicks may provide information sufficient to discern broad trends (accuracy may be $\pm$ an order of magnitude).

Double-crested Cormorant, Terns and Gulls

Double-crested Cormorant, Herring Gull and Great Black-backed Gull

Surveys of nesting seabirds should be timed and conducted in a manner to minimize adverse effects from disturbance. Ground-based nest counts should occur before hatching (preferably during mid-incubation if the colony is synchronous). Aerial counts of nesting birds on exposed islands can be conducted from aircraft and provide real-time surveys as well as opportunity for photographic counts.

Least Tern

The state census “A” period for Least Tern is June 5-20. The breeding pair estimate reported during this window should be the maximum determined from all site visits during the window. Any changes in numbers after June 20 should be recorded and reported as a “B” period census. Least Terns are very sensitive to disturbance, especially after chicks have hatched. In particular, Least Tern chicks are very mobile after about 3-4 days post-hatch, and disruption to the colony can cause them to scatter, become more vulnerable to predation, exposure, and even mortality caused by neighboring adults. Use the following guidelines for working in tern colonies:

1. DO NOT go into or near the colony if:
 - a. It is over approximately 80 degrees F or if incubating terns are panting (always avoid going into or near the colony during mid-day heat).
 - b. Water collects on glasses or clothing (too foggy, misty, rainy); this may also apply to entering blinds because blinds are positioned close enough to the colony to disrupt incubating/brooding adults.
 - c. Do not disrupt the colony for more than 15 minutes.
2. If the colony is disturbed as you approach, back off and allow the birds to settle down.
3. During each visit, if possible, conduct incubating adult counts from a distance without disturbing terns (see below). It is not necessary to conduct ground nest counts. Depending on the size and configuration of the colony, a complete nest count may be conducted during the census period, but only with a sufficient number of people to avoid more than 15 minutes of time off the nest for adults, and only if there are very few chicks hatched that are 4 days old or less. If chicks are present during the census window, an adult count or incubating adult count should be conducted instead of a nest count.
4. Adult counts can be a good alternative to nest counts:
 - a. When conducting adult counts, observations should be made from outside the colony.

- b. Count the number of birds incubating or sitting to get an *estimation* of the number of nests.
- c. Count the number of birds observed in the air over the colony, acting in a defensive way. Add to the number of sitting birds for an *estimated* adult count. For the state census forms, the adult count should then be multiplied by 0.8 to get an estimated pair count.
- d. Do not include birds that do not appear to be associated with nests/chicks at the colony (i.e. loafing or foraging birds that are not within the upland breeding area).
- e. If possible, conduct counts with two or more people. Individually count the number of birds observed sitting and in the air, then compare counts. Repeat counts if necessary to rectify discrepancies.

Once chicks are present, counting becomes even more difficult. The chicks are hard to see, often hiding in beach grass until their parent returns with fish. Some suggestions when attempting chick counts:

1. Chick counts should be conducted from outside the colony (or from a blind if available). Blinds should be constructed of sturdy material (e.g. wood) that does not flap in any light breeze. If used, blinds should be erected on the outer edges of the colony, and no courting, incubating or brooding adults or their chicks should be disturbed after entry into the blind. If this occurs, observers should exit the blind. Blinds should not be removed until the end of the season unless absolutely necessary.
2. Be patient, the old sit-wait-watch approach works well when counting chicks. Chicks will often become visible when adults feed them, and at dawn or dusk. Counts should not be conducted during mid-day, particularly when it is hot (over 80 degrees), as chicks will be resting/hiding in vegetation.
3. As with adult counts, use landmarks, particularly if you have a large, spread-out colony.
4. If possible, conduct chick counts with two people.

Fledgling counts can easily be overestimated. Young terns may move from site to site as they prepare for migration. Some suggestions when attempting fledgling counts:

1. The best time to conduct fledgling counts is at or just before dusk. Fledglings will often congregate by the water's edge during this time.
2. Conduct your first count of fledglings approximately 23 days after the first known hatch. Continue to count fledglings on each visit after this date. Use the highest number of fledglings roughly 23-25 days from peak hatch to make your best estimate of fledging success from this colony.
3. Often adults will continue to defend fledged or nearly fledged young. Use this to assist you in determining if fledglings are part of the colony.
4. Record your chick and fledgling counts, and bring those with you in the field. If the maximum number of fledglings you had on site was much higher than the number of estimated nests, it's likely that many of the fledglings are from another site. Keep in mind that chicks are often not visible, and in a large colony, it is likely you will not see Least Tern chicks that are 4-18 days old during that period.
5. Remember to keep track of the ages of chicks observed on site. Use this to gauge whether or not fledglings observed are actually from nests on site.

Common Tern

The state census "A" period for Common Tern is June 5-20; the date of the census should be timed to be approximately the date of first hatch, or approximately 23 days from the date the first egg is located. Common

terns are very sensitive to disturbance, especially after chicks have hatched. Extended periods of disturbance can make tern chicks more vulnerable to predation, exposure, and even mortality caused by neighboring adults. Use the following guidelines for working in tern colonies:

1. DO NOT go into or near the colony if:
 - a. It is over approximately 80 degrees F or if incubating terns are panting (always avoid going into or near the colony during mid-day heat).
 - b. Water collects on glasses or clothing (too foggy, misty, rainy); this may also apply to entering blinds because blinds are positioned close enough to the colony to disrupt incubating/brooding adults.
 - c. Do not disrupt the colony for more than 15 minutes.
2. Always approach the colony and enter/exit (if necessary) in the same ways. Establish known entry/exit areas. This allows the terns to become used to your presence, your activities, and your path over time (within and between years).
3. If the colony is disturbed as you approach, back off and allow the birds to settle down.
4. During each visit, if possible, conduct incubating adult counts from a distance without disturbing terns (see below). It is not necessary to conduct ground nest counts on each visit. Depending on the size and configuration of the colony, a complete nest count may be conducted during the census period, but only with a sufficient number of people to avoid more than 15 minutes of time off the nest for adults.
5. Adult counts can be a good alternative to nest counts:
 - a. Adult counts can be conducted from outside the colony (see below), or, if inside the colony, by taking a “high count” of all birds overhead.
 - b. Count the number of birds incubating, standing or sitting within the colony boundary (i.e. birds that appear to be incubating, but also include birds that are just sitting or resting) to get an *estimation* of the number of adults on the ground. Do not include birds that do not appear to be associated with nests/chicks at the colony (i.e. loafing or foraging birds that are not within the upland breeding area).
 - c. Count the number of birds observed in the air over the colony, acting in a defensive way. Add to the number of sitting birds for an *estimated* adult count. For the state census forms, the adult count should then be multiplied by 0.8 to get an estimated pair count.
 - d. If possible, conduct counts with two or more people. Individually count the number of birds observed sitting and in the air, then compare counts. Repeat counts if necessary to rectify discrepancies.

Once chicks are present, counting becomes even more difficult. The chicks are hard to see, often hiding in beach grass until their parent returns with fish. Some suggestions when attempting chick counts:

1. Chick counts should be conducted from outside the colony (or from a blind if available).
2. Be patient, the old sit-wait-watch approach works well when counting chicks. Chicks may be visible when adults feed them, and at dawn or dusk. Counts should not be conducted during mid-day, particularly when it is hot (over 80 degrees), as chicks will be resting/hiding in vegetation.
3. As with adult counts, use landmarks, particularly if you have a large, spread-out colony.
4. If possible, conduct chick counts with two people.
5. Fledglings will often congregate by the water’s edge.
6. Conduct your first count of fledglings approximately 21-23 days after the first known hatch. Continue to count fledglings on each visit after this date. Use the highest number of

fledglings roughly 23-25 days from peak hatch to make your best estimate of fledging success from this colony.

7. Often adults will continue to defend fledged or nearly fledged young. Use this to assist you in determining if fledglings are part of the colony.
8. Record your chick and fledgling counts, and bring those with you in the field. If the maximum number of fledglings you had on site was much lower than the number of estimated nests, it's likely that many of the fledglings are from another site. Keep in mind that chicks are often not visible.

Long-legged Wading Birds

The following protocol is recommended for estimating abundance of long-legged wading birds in tall vegetation (e.g. nests in trees).

Protocol:

- During surveys that coincide with late incubation/early hatchling phase to minimize disturbance to nestlings at later stages of development, locate nests through ground-based visual searches.
- Inspect nest contents visually. In trees with nests too high to observe from the ground or with a ladder, examine nest contents using a mirror attached to an extendable pole.
- In mixed species colonies containing Snowy Egret (Little Blue Heron and Cattle Egret are also possible nesters in the park), it is necessary to inspect nest contents during abundance surveys in order to identify nest occupant.
- During ground-based surveys, adults are typically not present at nests due to investigator disturbance. Nest construction and other clues are not sufficient to distinguish between the nests of these small day herons, although egg size, egg color and nestling color can be used to identify nest occupant.
- Nests of Glossy Ibis, and to a lesser extent, Black-crowned Night-Heron, are more easily distinguished based on nest construction and quantity of guano.

The following protocol is effective for use in a small colony and when birds are nesting in low vegetation (such as is the case historically on Middle Brewster Island). Estimating detection probability generally requires greater time in the colony than conventional survey techniques. Managers must weigh the benefits of a rigorous ability to quantify trends against real-time disturbance to nesting birds. Investigator disturbance in small colonies of low nesting birds is more easily assessed and managed than in large colonies of complex habitat. The objectives are to 1) obtain a complete ground count of active nests by searching all appropriate habitat and 2) determine detection probability.

Protocol:

- Teams of two will search low vegetation
- One member is searcher; other member is recorder/searcher
- Searcher points out nests to recorder and calls out species identification and nest contents
- Recorder follows behind searcher and records nests as called out; in addition, recorder searches for nests missed by searcher and records them as well in data book; *missed nests must be identified as such in data book*
- At regular intervals (e.g. between patches of habitat) team members switch roles

Species Identification:

- BCNH nest construction and contents:
 - Build substantial nests (approx 35 cm diam) of twigs;
 - Smaller fresh twigs used to line nest;
 - Nest may be close to ground
 - With significant amount of guano;
 - Eggs are pale aqua blue approx 50 mm long;
 - Downy young are gray/brown (0-6 da);
 - Larger young have brown speckled pin feathers (7+ da)
- SNEG nest construction and contents:
 - Build smaller nests (approx 25 cm diam) of small twigs
 - Use fine twigs or grass to line nest
 - Nest may be elevated in low vegetation relative to BCNH
 - Guano not as prominent
 - Eggs pale aqua approx 42 mm long
 - Young white
- Great Egret nest construction and contents:
 - Large, flat nests of twigs and sticks approximately 50 cm diameter
 - Nests may be higher in canopy than smaller Ardeids
 - Eggs pale aqua approximately 56 mm in length
 - Young white
- Glossy Ibis nest construction and contents:
 - Medium-sized nests constructed of larger twigs arranged somewhat rectilinearly (reminiscent of Lincoln Logs); average 35 cm in diameter
 - Nests may be in canopy at level of smaller Ardeids, but also occur on ground
 - Eggs a more intense blue approximately 52 mm long
 - Young dusky grey; curved bill prominent

Human Disturbance:

- Investigators should be aware of impact on adults and young; time in the colony should be recorded.
- As much as possible, check habitat patches from perimeter (trade off between a close inspection of all vegetation clumps and minimizing human disturbance—mid-large size nestlings most at risk)
- Look into habitat patches from perimeter to check stage of nesting before entering if possible; going in and out to use the perimeter may be a viable strategy for medium-sized clumps rather than sweeping through the middle which may be more disturbing
- Move methodically through areas; team members stay generally together; do not retrace steps, disturb an area more than once, or stay for an extended period of time in any one area
- If nestlings move out of nest, retrieve and place in nest as you are leaving area

American Oystercatcher and other Shorebirds

Monitoring for American Oystercatchers can begin approximately March 15, but should be initiated no later than April 1 in order to appropriately document breeding and territorial pairs early in the season. Although it is preferable to estimate these numbers on foot, boat surveys can be used to assess initial numbers of breeding pairs. After ~ April 8 (the earliest known oystercatcher nest in MA) surveys for nests and scrapes should be conducted on foot where signage and posting is appropriate/warranted. Surveys should ideally take place 2x/week, beginning April 1, and continue until the end of the fledging season (which can be into August/early September). After a nest is found and eggs counted, future monitoring should only include observations of incubating/defensive birds from a distance, and eggs observed through a spotting scope or binoculars where possible. The nest area should only be approached if it is suspected that a nest has been lost, to determine cause of loss. Hatching should be estimated to be about 27 days from the date the 2nd egg is laid, and can also be determined based on the behavior of adults. If an adult is suspected to have chicks, it is important to observe the area from a distance, to allow for natural behaviors (i.e. feeding) to take place, and allow for observation/counts of chicks.

Color banding adults and fledglings may help in identification of breeding pairs and productivity estimates, as well as provide important information regarding the recovery of oystercatchers in Boston Harbor and other areas based on the productions of chicks in these areas.

Bumpkin Island



Number of breeding pairs

		1977	1994	2006	2009	2012
Bumpkin Island	AMOY					1

Current (2011) Public Use

This island is served by public inter-island ferries during July and August and is accessible by private boaters.

	Total Visitors	MONTHLY TOTALS			
		Progs	Prog #s	Campsites	Total Campers
JANUARY TOTALS	0	0	0	0	0
FEBRUARY TOTALS:	0	0	0	0	0
MARCH TOTALS:	0	0	0	0	0
APRIL TOTALS:	0	0	0	0	0
MAY TOTALS:	50	0	0	1	25
JUNE TOTALS:	405	15	119	33	204
JULY TOTALS:	1,428	37	282	175	1,109
AUG. TOTALS	640	24	124	106	757
SEPT. TOTALS	299	7	38	22	223
OCT. TOTALS	4	0	0	2	8
NOV. TOTALS	0	0	0	0	0

DEC. TOTALS	0	0	0	0	0
YEAR TOTAL	2,826	83	563	339	2,326

Management Recommendations

- Dogs should be prohibited on the island from April 1-Sep 1.
- Historical nesting habitat for AMOY should be posted as of April 1.
- The area where AMOY are known to breed at this site is in very close proximity to at least one campsite. We recommend this campsite be closed during active nesting times for AMOY, particularly during May and June (the time where the least amount of campers visit the island), and potentially into July or August if necessary. Early closures of the campsite would increase the chances that the campsites can be reopened in July/August.
- Placement of protective fencing and signage is critical. If possible, we recommend that recreational activities of the visitors be directed away from the breeding area during the nesting season, and away from the easternmost intertidal areas (where *Spartina* marsh is present, as well as foraging habitat for AMOY).
- In the future, recommend creating a wider buffer between the nesting area and the campsites if feasible.
- Signage explaining that breeding oystercatchers are present on the island from April to August, basic ecology, and how to help protect the birds would provide educational opportunities for visitors and may decrease disturbance.

Button Island



Number of breeding pairs

		1977	1994	2006	2009	2011
Button Island	AMOY					1
Button Island	GBBG		1	8		2
Button Island	HERG		1	8		8

Current Public Use

Private boats are permitted to land on Button Island.

Management Recommendations

- Dogs should be prohibited on the island from April 1-Sep 1.
- Historical nesting habitat for AMOY should be posted as of April 1. During chick rearing season, placement of protective fencing and signage is important because of the number s of gulls nesting in the area, when disturbance of chicks can easily lead to predation by gulls.

- We recommend that recreational activities of the visitors be directed away from the intertidal areas where AMOY are likely to be found foraging and feeding chicks.
- Educational signage explaining that breeding oystercatchers are present on the island from April to August, basic ecology, and how to help protect the birds would provide educational opportunities for visitors and may decrease disturbance.

Calf Island



Number of breeding pairs:

		1977	1994	2006	2009	2012
Calf Island	AMOY				2	3
Calf Island	BCNH		1	28	38	
Calf Island	COEI					
Calf Island	DCCO	0			59	62
Calf Island	GBBG	40	152	63	17	12
Calf Island	GLIB		2	0	0	
Calf Island	HERG	100	352	197	93	54

In addition to the above counts, seventy-two Common Eider nests were documented in 2007; 111 nests in 2008. Calf Island is notable in hosting three pairs of American Oystercatcher—one of the most populous of approximately 15 islands supporting oystercatchers. Calf Island has also supported significant numbers of Great Black-backed Gull (18% of BHINPA population in 1990s; 16% in 2000s) and Herring Gull (13% of BHINPA population in 1990s; 27% in 2009) historically. Great Black-backed Gull has declined in Boston Harbor by 88% since the 1990s and statewide by 40%. Herring Gull has declined in Boston Harbor by 86% since the 1970s and statewide by 62%. Both species are orange-listed (continued conservation action needed) in MAS State of the Birds Report.

Current Public Use:

Private boats are permitted to land on the island.

Management Recommendations:

- Recommend the island be closed to visitors Apr 1 – Sep 1. Calf Island is important to nesting long-legged wading birds in the harbor. Most landing locations on the island have or could support nesting oystercatchers. Calf Island is one a few islands that support nesting Common Eider. In addition, Calf Island has supported significant numbers of Great Black-backed Gulls.
- Signage should be erected that is readable from off shore at least 100 yards, with very large lettering, that clearly states “Area Closed” in known landing areas. This can also be done using floating buoys.
- Park staff should enforce no landing rule.
- Overall the island looks very suitable for AMOY, 2 pairs potentially in middle section (on either side of marsh), also 1 pair at southern end. In addition, there are some suitable high rocks for nesting. Mussels and periwinkles are present providing foraging opportunities for AMOY.

Gallops Island



Number of breeding pairs

		1977	1994	2006	2009	2011
Gallops Island	AMOY					1
Gallops Island	BCNH		38	0		
Gallops Island	GBBG	0	8	29		15
Gallops Island	HERG	85	118	82		14

Current Public Use

Gallops Island has been closed to the public due to a public health hazard resulting from asbestos in the abandoned military structures. Camping has been permitted on the island in the past and the island was serviced by the inter-island ferry.

Management Recommendations

- If recreational boat landings occur despite the island being closed, signs should be erected at oystercatcher nesting location

Grape Island



Number of breeding pairs

		1977	1994	2006	2009	2012
Grape Island	AMOY					1

Current (2011) Public Use

This island is served by public inter-island ferries during July and August and is accessible by private boaters.

	Total Visitors	MONTHLY TOTALS			
		Progs	Prog #s	Campsites	Total Campers
JANUARY TOTALS	0	0	0	0	0
FEBRUARY TOTALS:	0	0	0	0	0
MARCH TOTALS:	0	0	0	0	0

APRIL TOTALS:	0	0	0	0	0
MAY TOTALS:	26	0	0	1	25
JUNE TOTALS:	480	20	74	35	109
JULY TOTALS:	1,036	46	194	89	358
AUG. TOTALS	600	20	88	43	135
SEPT. TOTALS	279	4	18	13	133
OCT. TOTALS	10	0	0	2	10
NOV. TOTALS	0	0	0	0	0
DEC. TOTALS	0	0	0	0	0
YEAR TOTAL	2,430	90	374	183	770

Management Recommendations

- Dogs should be prohibited on the island from April 1-Sep 1.
- Historical nesting habitat for AMOY should be posted as of April 1. This is particularly important because of the number of visitors that use the area during May and June.
- If possible, we recommend that recreational activities of the visitors be directed away from the breeding area during the nesting season, and away from the easternmost intertidal areas (where *Spartina* marsh is present, as well as foraging habitat for AMOY). In the future, recommend creating a wider buffer between the nesting area and the campsites if feasible.
- Signage explaining that breeding oystercatchers are present on the island from April to August, basic ecology, and how to help protect the birds would provide educational opportunities for visitors and may decrease disturbance.
- Nesting areas should be fenced and restricted access enforced

Great Brewster Island



Number of breeding pairs

		1977	1994	2006	2009	2011
Great Brewster	AMOY				2	2
Great Brewster	COEI					
Great Brewster	GBBG	17	12	16		9
Great Brewster	HERG	130	398	157		108

In addition to the above counts, eight Common Eider nests were documented in 2007; four nests in 2008. Great Brewster Island has supported significant numbers of Herring Gull (15% of BHINPA population in 1990s; 24% in 2012). Herring Gull has declined in Boston Harbor by 86% since the 1970s and statewide by 62%. The species is orange-listed (continued conservation action needed) in MAS State of the Birds Report.

Current Public Use

Private boats are permitted to land on Great Brewster Island.

Management Recommendations

- Dogs should be prohibited on the island from April 1-Sep 1.
- Historic nesting habitat for AMOY should be posted as of April 1.
- The area where AMOY are known to breed at this site is in close proximity to boat landing areas; we recommend signage directing boaters to appropriate landing sites away from nesting areas be erected, with signage that is visible from 100 yards away or more; this can also be done through buoys.
- Signage that directs recreationists to areas away from oystercatcher and gull breeding locations could be placed in known nesting areas that overlap with popular recreational areas/areas of historic recreational use.
- Signage explaining that breeding oystercatchers and gulls are present on the island from April to August, basic ecology, and how to help protect the birds would provide educational opportunities for visitors and may decrease disturbance.

Green Island



Number of breeding pairs

		1977	1994	2006	2009	2012
Green Island	AMOY					0
Green Island	DCCO	0	393	90	92	180
Green Island	GBBG	40	111	20	19	21
Green Island	HERG	140	206	30	32	7

One American Oystercatcher pair was observed on Green Island in 2010. In addition, the island is notable in numbers of nesting Double-crested Cormorant (21% of BHINPA population in 1990s; 15% in 2012) and Great Black-backed Gull (17% of BHINPA population in 2012). Double-crested Cormorant has declined in Boston Harbor by 40% since the 1970s and statewide by 24%. Great Black-backed Gull has declined in Boston Harbor by 88% since the 1990s and statewide by 40%. Both species are orange-listed (continued conservation action needed) in MAS State of the Birds Report.

Current Public Use

Private boats are permitted to land on Green Island.

Management Recommendations

- We recommend that private landings on Green Island be prohibited from 1 Apr – 1 Sep. Although there may be few landings on the island, it is an important nesting location for cormorants and gulls.
- Signs should be erected that are readable from the water from at least 100 yards to inform the public that the island is closed to landing.

Hangman Island



Number of breeding pairs

		1977	1994	2006	2009	2011
Hangman	AMOY					1
Hangman	DCCO					1
Hangman	GBBG		61	42		29
Hangman	HERG		4	7		0

One American Oystercatcher pair was observed on Hangman Island in 2012. In addition, Hangman Island is notable in numbers of nesting Great Black-backed Gull (23% of BHINPA population in 2011). Great Black-backed Gull has declined in Boston Harbor by 88% since the 1990s and statewide by 40%. The species is orange-listed (continued conservation action needed) in MAS State of the Birds Report.

Current Public Use

Private boats are permitted to land on Hangman Island.

Management Recommendations

- Signs should be erected on the island to restrict access during the nesting season from 1 Apr – 1 Sep.

- Signs should be erected that are readable from the water from at least 100 yards to inform the public that the island is closed to landing.

Langlee Island



Number of breeding pairs

		1977	1994	2006	2009	2012
Langlee Island	AMOY				1	0
Langlee Island	GBBG		2	0		
Langlee Island	HERG		2	0		

Current Public Use

Private boats are permitted to land on Langlee Island.

Management Recommendations

- Dogs should be prohibited on the island from April 1-Sep 1.
- Historic nesting habitat for AMOY should be posted as of April 1. Signs should be erected restricting boat landings away from oystercatcher nesting areas using signs that are visible from at least 100 yards or more.

- Signage that directs recreationists to areas away from oystercatcher and gull breeding locations could be placed in known nesting areas that overlap with popular recreational areas/areas of historic recreational use.
- Signage explaining that breeding oystercatchers and gulls are present on the island from April to August, basic ecology, and how to help protect the birds would provide educational opportunities for visitors and may decrease disturbance.

Little Brewster Island



Number of breeding pairs

		1977	1994	2006	2009	2012
Little Brewster	AMOY				1	0

Current (2011) Public Use

Scheduled public tours operate Memorial Day through Columbus Day on weekends. A light keeper lives on the island approximately ½ time, including all summer.

2011 Visitors to Little Brewster Island						
Month	NPS Tours	NPS Program Visitors	Charter Visitors	Private Powerboaters	Kayaks, Sailboats, etc.	Total Visitors
May	0	0	0	12	0	12
June	8	233	24	16	7	280
July	24	873	68	52	71	1064
August	12	436	0	39	51	526
September	15	545	0	67	22	634
October	0	0	23	0	0	23
2011 Totals	59	2087	115	186	151	2539

Management Recommendations

- Dogs should be prohibited on the island from April 1-Sep 1.
- Historic nesting habitat for AMOY should be posted as of April 1.
- Signage that directs recreationists to areas away from oystercatcher and gull breeding locations could be placed in known nesting areas that overlap with popular recreational areas/areas of historic recreational use.
- Signage explaining that breeding oystercatchers and gulls are present on the island from April to August, basic ecology, and how to help protect the birds would provide educational opportunities for visitors and may decrease disturbance.

Little Calf Island



Number of breeding pairs

		1977	1994	2006	2009	2012
Little Calf Island	AMOY					0
Little Calf Island	DCCO	301	189	147	248	132
Little Calf Island	GBBG	0	8	0	10	6
Little Calf Island	HERG	50	0	0	9	3

One American Oystercatcher pair was observed on Little Calf Island in 2010. In addition, Little Calf Island is notable in numbers of nesting Double-crested Cormorant (51% of BHINPA population in 1970s; 23% in 2009). Double-crested Cormorant has declined in Boston Harbor by 40% since the 1970s and statewide by 24%. The species is orange-listed (continued conservation action needed) in MAS State Birds Report.

Current Public Use

Private boats are permitted to land on Little Calf Island.

Management Recommendations

- We recommend that private landings on Little Calf Island be prohibited from 1 Apr – 1 Sep. Although there may be few landings on the island, it is an important nesting location for cormorants.
- Signs should be erected that are readable from the water to inform public from at least 100 yd.

Lovells Island



Number of breeding pairs

		1977	1994	2006	2009	2011
Lovells Island	AMOY				1	1
Lovells Island	LETE					75

In addition to the above counts, Least Tern was documented in 2007 (154 pairs). No other island supported Least Tern nesting in 2011. The species is protected under the Massachusetts Endangered Species Act as a Species of Special Concern.

Current (2011) Public Use

This island is served by public inter-island ferries during July and August and is accessible by private boaters.

	Total Visitors	MONTHLY TOTALS			
		Progs	Prog #s	Campsites	Total Campers
JANUARY TOTALS	0	0	0	0	0
FEBRUARY TOTALS:	0	0	0	0	0
MARCH TOTALS:	0	0	0	0	0
APRIL TOTALS:	0	0	0	0	0
MAY TOTALS:	9	0	0	2	16
JUNE TOTALS:	686	11	97	52	290
JULY TOTALS:	2,320	40	208	237	1,074
AUG. TOTALS	1,416	24	181	158	595
SEPT. TOTALS	950	5	14	33	121
OCT. TOTALS	485	0	0	3	55
NOV. TOTALS	0	0	0	0	0
DEC. TOTALS	0	0	0	0	0
YEAR TOTAL	5,866	80	500	485	2,151

Management Recommendations

- We recommend that management of Lovells Island provide explicit protection for terns; management should follow the Natural Heritage and Endangered Species Program Guidelines for Managing Recreational Use of Beaches to Protect Piping Plovers, Terns and their Habitats in Massachusetts (see Appendix A).
- Protection of Least Tern from human disturbance should be a high priority. The species has nested on the island in recent years and is listed under the Massachusetts Endangered Species Act.
- Dogs should be prohibited on the island from April 1-Sep 1.
- Historic nesting habitat for AMOY should be posted as of April 1, for Least Terns by May 1.
- Vegetation management to enhance nesting habitat for terns should be explored; also assessment of possible impact and control of ground predators.
- The areas where AMOY and Least Terns are known to breed at this site are in close proximity to boat landing areas; we recommend signage directing boaters to appropriate landing sites away from nesting areas be erected, with signage that is visible from 100 yards away or more; this can also be done through buoys.
- Signage that directs recreationists to areas away from oystercatcher and tern breeding locations could be placed in known nesting areas that overlap with popular recreational areas/areas of historic recreational use.
- Signage explaining that breeding oystercatchers and terns are present on the island from April to August, basic ecology, and how to help protect the birds would provide educational opportunities for visitors and may decrease disturbance.
- The island receives thousands of visitors each year which provides an opportunity for educational signage and programs.

Middle Brewster Island



Number of breeding pairs

		1977	1994	2006	2009	2012
Middle Brewster Is	AMOY				1	1
Middle Brewster Is	BCNH	20	207	23	2	
Middle Brewster Is	COEI					
Middle Brewster Is	DCCO	0	878	772	453	566
Middle Brewster Is	GBBG	48	114	96	9	2
Middle Brewster Is	GLIB		3	0	0	
Middle Brewster Is	GREG		8	0	0	
Middle Brewster Is	HERG	535	700	364	97	54
Middle Brewster Is	SNEG		207	23	0	

In addition to the above counts, thirty-five Common Eider nests were documented in 2007; 28 nests in 2008. Middle Brewster Island is notable as one of the most significant sites in the harbor supporting long-legged wading birds. Twenty-five percent of the harbor's Black-crowned Night-Herons and 58% of Snowy Egrets nested on the island in the 1990s. Black-crowned Night-Heron has declined in the harbor by 25% since the 2000s; statewide abundance has declined by 60%. Snowy Egret has declined in the harbor by 86% since the 1990s; statewide abundance has declined by 36%. Black-crowned Night-Heron and Snowy Egret have been identified as Species of Greatest Conservation Need in the MA State Wildlife Action Plan and are red-listed (conservation action need is urgent) in MAS State of the Birds Report. In

addition, Middle Brewster Island is one of the most important nesting sites for Double-crested Cormorant, Herring Gull and Great Black-backed Gull. Harbor-wide percentages of cormorants nesting on the island are as follows: 47% in 1990s; 58% in 2000s; 41% in 2009; 47% in 2012. Double-crested Cormorant has declined in Boston Harbor by 40% since the 1970s and statewide by 24%. Harbor-wide percentages of Herring Gull nesting on the island are as follows: 22% in 1970s; 27% in 1990s; 24% in 2000s; 28% in 2009. Herring Gull has declined in Boston Harbor by 86% since the 1970s and statewide by 62%. In addition, Middle Brewster Island is notable in numbers of nesting Great Black-backed Gull (18% of BHINPA population in 1970s; 24% in 2000s). Great Black-backed Gull has declined in Boston Harbor by 88% since the 1990s and statewide by 40%. All three seabird species are orange-listed (continued conservation action needed) in MAS State of the Birds Report.

Current Public Use

Private boats are permitted to land on Middle Brewster Island.

Management Recommendations

- We recommend the island be closed to visitors Apr 1 – Sep 1. Middle Brewster Island is of critical importance to nesting long-legged wading birds, cormorants and gulls, and supports at least one pair of oystercatchers each year. In addition, COEI nest in significant numbers on the island. It is one of a few islands in the harbor supporting a very high diversity of coastal waterbirds.
- Signage should be erected that is readable from off shore.
- Park staff should enforce no landing rule.
- A ground predator survey and habitat assessment would assist in identifying limiting factors for nesting coastal birds.
- The area where AMOY are known to breed at this site is in the only landing area on the island. We recommend signage clearly stating “No Landing”, visible from 100 yards away or more, be erected. This can also be done through buoys.

Outer Brewster Island



Number of breeding pairs

		1977	1994	2006	2009	2012
Outer Brewster Is	AMOY				1	1
Outer Brewster Is	BCNH		25	38	36	
Outer Brewster Is	COEI					
Outer Brewster Is	DCCO	0	90	60	77	69
Outer Brewster Is	GBBG	60	333	55	26	10
Outer Brewster Is	GLIB		2	18	6	
Outer Brewster Is	GREG				1	
Outer Brewster Is	HERG	750	329	215	111	79
Outer Brewster Is	SNEG		5	14	12	

Eighty-one Common Eider nests were documented on Outer Brewster Island in 2007; 57 nests in 2008. Outer Brewster Island is notable in numbers of nesting Great Black-backed Gull (23% of BHINPA population in 1970s; 40% in 1990s; 14% in 2000s; 29% in 2009) and Herring Gull (30% of BHINPA in 1970s; 13% in 1990s; 14% in 2000s; 32% in 2009). Great Black-backed Gull has declined in Boston Harbor by 88% since the 1990s and statewide by 40%. Herring Gull has declined in Boston Harbor by 86% since the 1970s and statewide by 62%. Both species are orange-listed (continued conservation

action needed) in MAS State of the Birds Report. In addition, Outer Brewster Island is notable in numbers of Glossy Ibis supporting 82% of the BHINPA population in 2006.

Current Public Use

Private boats are permitted to land on Outer Brewster Island.

Management Recommendations

- We recommend the island be closed to visitors Apr 1 – Sep 1. Outer Brewster Island is of critical importance to nesting long-legged wading birds and gulls, and provides oystercatcher breeding habitat. In addition, COEI nest in significant numbers on the island. It is one of a few islands in the harbor supporting a very high diversity of coastal waterbirds.
- Signage should be erected that is readable from off shore, visible from at least 100 yards.
- Park staff should enforce no landing rule.
- The area where AMOY are known to breed at this site is in the only landing area on the island. We recommend signage clearly stating “No Landing”, visible from 100 yards away or more, be erected. This can also be done through buoys.

Peddocks Island



Number of breeding pairs

		1977	1994	2006	2009	2012
Peddocks Island	AMOY					0
Peddocks Island	BCNH	150	2	0		
Peddocks Island	GLIB					
Peddocks Island	SNEG	35				

In addition to the above harbor-wide counts, Glossy Ibis was suspected to be present in 1977. Three pairs of American Oystercatcher were present in 2007; one pair was documented each in 2008 and 2010. Peddocks Island is notable in that the island supported 82% of Black-crowned Night-Heron nesting in Boston Harbor in the 1970s. Black-crowned Night-Heron has declined in the harbor by 25% since the 2000s; statewide abundance has declined by 60%. Black-crowned Night-Heron has been identified as a Species of Greatest Conservation Need in the MA State Wildlife Action Plan and is red-listed (conservation action need is urgent) in MAS State of the Birds Report.

Current (2011) Public Use

Grape "This island is served by public inter-island ferries during July and August and is accessible by private boaters." In addition, numerous maintained cottages occur on the middle and east drumlins, with residents much more active in the warmer months. Some cottagers have dogs.

	Total Visitors	MONTHLY TOTALS			
		Progs	Prog #s	Campsites	Total Campers
JANUARY TOTALS	0	0	0	0	0
FEBRUARY TOTALS:	0	0	0	0	0
MARCH TOTALS:	0	0	0	0	0
APRIL TOTALS:	0	0	0	0	0
MAY TOTALS:	0	0	0	0	0
JUNE TOTALS:	0	0	0	0	0
JULY TOTALS:	966	63	429	61	412
AUG. TOTALS	841	53	372	52	350
SEPT. TOTALS	0	0	0	0	0
OCT. TOTALS	0	0	0	0	0
NOV. TOTALS	0	0	0	0	0
DEC. TOTALS	0	0	0	0	0
YEAR TOTAL	1,806	116	801	113	762

Management Recommendations

- Dogs should be prohibited on the island from April 1-Sep 1.
- Historical nesting habitat for AMOY should be posted as of April 1.
- We recommend signage directing boaters to appropriate landing sites away from nesting areas be erected, with signage that is visible from 100 yards away or more; this can also be done through buoys.
- Signage that directs recreationists to areas away from oystercatcher breeding locations could be placed in known nesting areas that overlap with popular recreational areas/areas of historic recreational use.
- Signage explaining that breeding oystercatchers are present on the island from April to August, basic ecology, and how to help protect the birds would provide educational opportunities for visitors and may decrease disturbance.

Ragged Island



Number of breeding pairs

		1977	1994	2006	2009	2011
Ragged Island	GBBG		2	0		0
Ragged Island	HERG		4	1		1

Current Public Use

Private boats are permitted to land on Ragged Island.

Management Recommendations

- Ragged Island could be identified in signs on Sarah Island as a suitable landing island.

Rainsford Island



Number of breeding pairs

		1977	1994	2006	2009	2011
Rainsford Island	AMOY				1	2
Rainsford Island	HERG				0	1
Rainsford Island	GBBG				0	2
Rainsford Island	LETE				0	0

Thirty-five pairs of Least Terns were documented on Rainsford Island in 2010. Suitable habitat for Piping Plover occurs at the saddle of this island.

Current Public Use

Private boats are permitted to land on Rainsford Island.

Also, Rainsford Island is very actively used by 20-50 people during the summer months who have established a camp and beach recreational area.

Management Recommendations

- We recommend that management of Rainsford Island be developed over time to provide greatly improved protection for oystercatchers, terns and potentially Piping Plover. Rainsford Island has some of the best habitat for these species due to extensive flats and availability of sandy areas
- In addition, suitable nesting habitat for Piping Plover occurs here. We recommend that ground-based surveys for nesting birds be conducted in during spring months to ascertain presence.
- The island appears to be heavily disturbed by people--large (8-10' diameter) firepit in sandy area, middle of island, as well as a lot of human debris (campsite). This is potential breeding habitat for both Least Terns and Piping Plovers.
- Protection of Least Tern from human disturbance should be a high priority. The species has nested on the island in recent years and is listed under the Massachusetts Endangered Species Act. Management should follow the Natural Heritage and Endangered Species Program Guidelines for Managing Recreational Use of Beaches to Protect Piping Plovers, Terns and their Habitats in Massachusetts.
- Dogs should be prohibited on the island from April 1-Sep 1.
- Historic nesting habitat for oystercatchers should be posted as of April 1, for Least Terns by May 1.
- The areas where AMOY and Least Terns are known to breed at this site are in close proximity to boat landing areas; we recommend signage directing boaters to appropriate landing sites away from nesting areas be erected, with signage that is visible from 100 yards away or more; this can also be done through buoys.
- Signage that directs recreationists to areas away from oystercatcher and tern breeding locations could be placed in known nesting areas that overlap with popular recreational areas/areas of historic recreational use.
- Signage explaining that breeding oystercatchers and terns are present on the island from April to August, basic ecology, and how to help protect the birds would provide educational opportunities for visitors and may decrease disturbance.

Sarah Island



Number of breeding pairs

		1977	1994	2006	2009	2011
Sarah Island	AMOY					1
Sarah Island	BCNH		547	343	247	
Sarah Island	DCCO		17	155		85
Sarah Island	GBBG		31	40		11
Sarah Island	GLIB				3	
Sarah Island	GREG		1	76	77	
Sarah Island	HERG		224	215		101
Sarah Island	SNEG		148	49	37	

Sarah Island is the most significant site in the harbor supporting long-legged wading birds. The majority of the harbor's Black-crowned Night-Herons nested on the island in the 1990s (66% of BHINPA population), 2000s (79%), and in 2009 (74%). Significant numbers of Snowy Egret also nest on the island (41% in 1990s; 53% in 2000s; 73% in 2009). Nearly all Great Egrets nesting in the harbor nest on Sarah Island. Nesting long-legged wading birds were first recorded on Sarah Island in 1991. Black-crowned Night-Heron has declined in the harbor by 25% since the 2000s; statewide abundance has declined by 60%. Snowy Egret has declined in the harbor by 86% since the 1990s; statewide abundance has declined by 36%. Black-crowned Night-Heron and Snowy Egret have been identified as Species of Greatest Conservation Need in the MA State Wildlife Action Plan and are red-listed (conservation action need is urgent) in MAS State of the Birds Report. In addition, 14% of Herring Gulls nesting in Boston Harbor

nested on Sarah Island in the 2000s. Herring Gull has declined in Boston Harbor by 86% since the 1970s and statewide by 62%. The species is orange-listed (continued conservation action needed) in MAS State of the Birds Report.

Current Public Use

Private boats are permitted to land on Sarah Island.

Management Recommendations

- Recommend the island be closed to visitors Apr 1 – Sep 1. Sarah Island is of critical importance to nesting long-legged wading birds in the Park and statewide.
- Signage should be erected that is readable from 100 yards off shore.
- Town and park staff should enforce no landing rule.
- Additional analysis of historical vegetation data could assist in assessing habitat suitability for wading birds.

Shag Rocks



Number of breeding pairs

		1977	1994	2006	2009	2012
Shag Rocks	DCCO	288	290	96	173	106
Shag Rocks	GBBG	5	0	0	8	1
Shag Rocks	HERG	25	0	0	2	1

Shag Rocks is notable in numbers of nesting Double-crested Cormorant (49% of BHINPA population in 1970s; 16% in 1990s). Double-crested Cormorant has declined in Boston Harbor by 40% since the 1970s and statewide by 24%. The species is orange-listed (continued conservation action needed) in MAS State of the Birds Report.

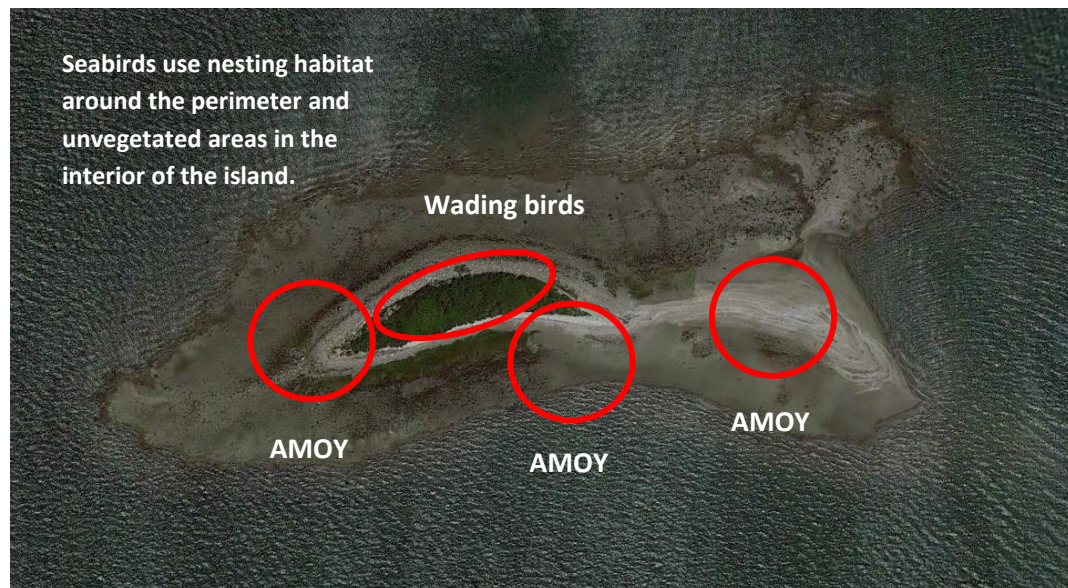
Current Public Use

Private boats are permitted to land on Shag Rocks.

Management Recommendations

- We recommend that private landings on Shag Rocks be prohibited from 1 Apr – 1 Sep. Although there may be few landings on the island, it is an important nesting location for cormorants.
- Signs should be erected that are readable from the water to inform the public

Sheep Island



Number of breeding pairs

		1977	1994	2006	2009	2011
Sheep Island	AMOY				2	3
Sheep Island	BCNH		14	4	9	
Sheep Island	DCCO		0	15		15
Sheep Island	GBBG		6	23		4
Sheep Island	GLIB		0	4	0	
Sheep Island	GREG				1	
Sheep Island	HERG		273	243		123
Sheep Island	SNEG		0	6	2	

In addition to the above counts, Sheep Island has also supported significant numbers of Herring Gull (16% of BHINPA population in 2000s; 28% in 2011. Herring Gull has declined in Boston Harbor by 86% since the 1970s and statewide by 62%. The species is orange-listed (continued conservation action needed) in MAS State of the Birds Report.

Current Public Use

Private boats are permitted to land on Sheep Island.

Management Recommendations

- Recommend the island be closed to visitors Apr 1 – Sep 1. The site is very significant for nesting long-legged wading birds and oystercatchers.
- Signage should be erected that is readable from off shore, visible at 100 yards

Slate Island



Number of breeding pairs

		1977	1994	2006	2009	2012
Slate Island	AMOY					0

One pair of American Oystercatcher was documented in 2007.

Current Public Use

Private boats are permitted to land on Slate Island.

Management Recommendations

- Historical nesting habitat for AMOY should be posted as of April 1.
- The areas where AMOY have been known to breed at this site are in close proximity to boat landing areas; we recommend signage directing boaters to appropriate landing sites away from

nesting areas be erected, with signage that is visible from 100 yards away or more; this can also be done through buoys.

- Signage that directs recreationists to areas away from oystercatcher breeding locations could be placed in known nesting areas that overlap with popular recreational areas/areas of historic recreational use.
- Signage explaining that breeding oystercatchers and gulls are present on the island from April to August, basic ecology, and how to help protect the birds would provide educational opportunities for visitors and may decrease disturbance.

Snake Island



Number of breeding pairs

		1977	1994	2006	2009	2012
Snake Island	AMOY				5	5
Snake Island	COTE	40			0	

Snake Island is notable in hosting five pairs of American Oystercatcher—the most populous of approximately 15 islands supporting oystercatchers and one of the densest breeding sites of oystercatchers in the Commonwealth of Massachusetts. Snake Island is one of a few sites within Boston Harbor that has supported Common Tern, a species listed under the Massachusetts Endangered Species Act as a Species of Special Concern. In addition to the recorded nesting in 1977, five pairs of Common Tern were documented in 2007 and possibly one pair in 2011 (MANHESP report).

Current Public Use

Private boats are permitted to land on Snake Island. Clam diggers utilize the mud flats regularly.

Management Recommendations

- We recommend that management of Snake Island provide explicit protection for oystercatchers and terns including closing public access from 1 Apr – 1 Sep. The island is proximate to residential communities which present challenges for eliminating human disturbance. Educational signs at the nearby marina might be effective.

- Protection of Common Tern from human disturbance should be a high priority. The species has nested on the island and is listed under the Massachusetts Endangered Species Act. Management should follow the Natural Heritage and Endangered Species Program Guidelines for Managing Recreational Use of Beaches to Protect Piping Plovers, Terns and their Habitats in Massachusetts.
- Vegetation management on the island to improve nesting habitat for terns and oystercatchers should include removal of known invasives/exotics on an annual basis on the western and southern portions of the high cobble areas (suitable for nesting COTE and AMOY), prior to the nesting season (April 1). Control of native species should also be considered in the context of vegetation management and diversity within the BHINPA.
- Signage explaining that breeding oystercatchers and terns (perhaps at the nearby marina?) are present on the island from April to August, basic ecology, and how to help protect the birds would provide educational opportunities for visitors and may decrease disturbance.

Spectacle Island



Number of breeding pairs

		1977	1994	2006	2009	2012
Spectacle Island	AMOY					0
Spectacle Island	BCNH	13				
Spectacle Island	DCCO					
Spectacle Island	GBBG	50				
Spectacle Island	GLIB					
Spectacle Island	HERG	650				
Spectacle Island	SNEG	24				

In addition to the above counts, one pair of American Oystercatchers was documented in 2007 and 2008. Significant numbers of wading birds were documented in 1975 including 164 Black-crowned Night-Heron nests, 66 Snowy Egret nests and five Glossy Ibis nests. During harbor-wide surveys, Spectacle Island was found to support significant numbers of Great Black-backed Gull (19% of BHINPA population in 1970s) and Herring Gull (26% of BHINPA population in 1970s). Great Black-backed Gull has declined in Boston Harbor by 88% since the 1990s and statewide by 40%. Herring Gull has declined in Boston Harbor by 86% since the 1970s and statewide by 62%. Both species are orange-listed (continued conservation action needed) in MAS State of the Birds Report. The wading birds and gulls were present

on the island prior to dredge spoil deposition and reclamation. Spotted Sandpiper is known to nest on Spectacle Island but comprehensive surveys of this species have not been undertaken on this or other islands in the park. SPSA is a green-listed species (likely increase) under the MAS State of the Birds Report.

Current (2011) Public Use Spectacle and Georges Islands serve as hub islands for public ferry service. Spectacle ferry service usually runs from Memorial Day to Columbus Day on weekends, and every day in July and August.”

	Ferry visitors	Charter visitors	Private boat visitors	Total visitors	Ranger Programs	Program participants
JAN. TOTALS	0	81	0	81	0	0
FEB. TOTALS	0	0	0	0	0	0
MARCH TOTALS	0	91	0	91	0	0
APRIL TOTALS:	0	138	0	138	0	0
MAY TOTALS:	2,241	158	160	2,559	37	244
JUNE TOTALS:	6,474	512	483	7,469	103	1,241
JULY TOTALS:	18,014	3,273	2,051	23,338	218	2,267
AUG. TOTALS	12,504	2,030	1,072	15,606	153	1,514
SEPT. TOTALS	5,522	297	499	6,318	42	399
OCT. TOTALS	1,396	110	0	1,506	16	93
NOV. TOTALS	0	0	0	0	0	0
DEC. TOTALS	0	0	0	0	0	0
YEAR TOTAL	46,151	6,690	4,266	57,107	569	5,758

Management Recommendations

- Improved vegetation and disturbance management for nesting Spotted Sandpipers should be explored.
- Explore possibility of conducting a targeted study to understand abundance, status, and habitat use by Spotted Sandpiper at this and other islands in the park.

Thompson Island



Number of breeding pairs

		1977	1994	2006	2009	2012
Thompson Island	AMOY					0

One pair of American Oystercatcher was documented in 2008 and 2010. Suitable habitat for Piping Plover occurs at the landing area of this island and is in close proximity to a territory established at L Street Bathhouse beach in South Boston in 2011.

Current Public Use

Thompson Island receives regular ferry service for the operation of a school and other facilities.

Management Recommendations

- There is a good deal of suitable nesting habitat for oystercatchers on this island; fencing of these areas by April 1 could allow for pairs to establish at these sites. Without fencing erected in these areas, it is highly unlikely coastal nesting birds could establish here.
- In addition, suitable nesting habitat for Piping Plover occurs here. We recommend that ground-based surveys for nesting birds be conducted in during spring months to ascertain presence.

- Anti-perching material should be placed on the large signs and poles on the island to prevent perching by avian predators such as owls or peregrine falcons. This practice is standard in threatened coastal bird nesting sites across Massachusetts and the Atlantic Coast, particularly with man-made structures.