BIOLOGICAL ASSESSMENT
OF THE INTERIM PROTECTED SPECIES MANAGEMENT STRATEGY
CAPE HATTERAS NATIONAL SEASHORE
NATIONAL PARK SERVICE
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INTRODUCTION

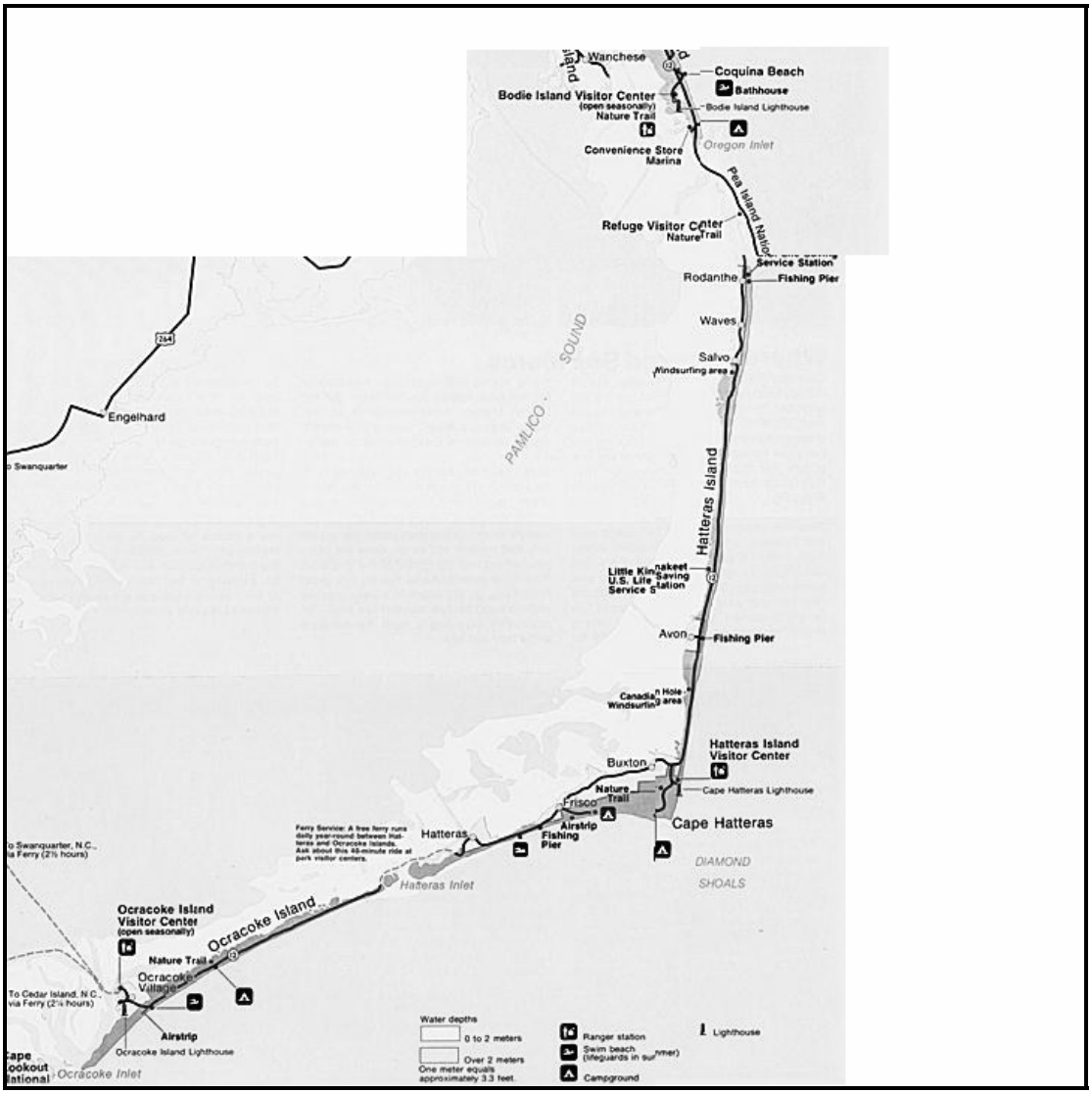
Officially authorized in 1937 along the Outer Banks of North Carolina, Cape Hatteras National Seashore (CAHA) is the nation's first national seashore. CAHA is a unit of the National Park Service (NPS) and is part of a dynamic barrier island system. It consists of 30,000 acres distributed along 70 miles of shoreline (Figure 1). The Outer Banks of North Carolina formed as a result of changes in sea level, wave and wind action, and ocean currents. These factors continue to influence the islands today through the processes of erosion and accretion of the shoreline, overwash across the islands, and the formation, migration, and closure of the inlets. These natural processes are influenced by human actions such as building sand berms to protect roads and homes, dredging inlets, and closing new naturally created inlets.

The CAHA serves as a popular recreation destination, with nearly 2.3 million visitors recorded in 2004. From 1986-2004, the number of recreational visitors to CAHA increased 44%, from 1.54 million/yr to 2.21 million/yr (NPS 2005). Federal ownership of CAHA extends from ocean to sound across three barrier islands—Ocracoke, Hatteras, and Bodie. The U.S. Coast Guard property and eight village enclaves are outside of CAHA boundaries. On the ocean side of the villages, federal ownership was established as a 500-foot strip measured landward from the mean low water at the time of acquisition. A larger area seaward of Buxton and Frisco includes portions of Buxton Woods. The 5,880-acre Pea Island National Wildlife Refuge, located at the northern end of Hatteras Island, is part of CAHA, but administered for refuge purposes by the U.S. Fish & Wildlife Service (USFWS).

Congress established CAHA in 1937 as a national seashore for the enjoyment and benefit of the people, and to preserve the area. As it's enabling legislation states, CAHA:

> ". . . shall be, and is hereby established, dedicated, and set apart as a national seashore for the benefit and enjoyment of the people." The legislation provides in part: "Except for certain portions of the area, deemed to be especially adaptable for recreational uses, particularly swimming, boating, sailing, fishing and other recreational activities of similar nature, which shall be developed for such uses as needed, the said area shall be permanently reserved as a primitive wilderness and no development of the project or plan for the convenience of visitors shall be undertaken which would be incompatible with the preservation of the unique flora and fauna or the physiographic conditions now prevailing in this area…." (50 Stat. 669, August 17, 1937)

Fig 1. Cape Hatteras National Seashore Map



While the number of human visitors to CAHA has grown, the breeding population of the federally threatened piping plover (*Charadrius melodus*, USFWS 1996a) and the occurrence of seabeach amaranth (*Amaranthus pumilus*, (USFWS 1996) have declined within CAHA. Furthermore, statewide declines were documented for common terns (*Sternus hirundo*), least terns (*Sternus antillarum*), gull-billed terns (*Sterna nilotica*), black skimmers (*Rynchops niger*), and American oystercatchers (*Haematopus palliatus*) all of which are Species of Special Concern for the NCWRC. Recreational pressure has been implicated in low reproductive success and declining population trends for all of these species, as well as for disturbance and/or mortality of migrating and wintering piping plovers, colonial waterbirds, and oystercatchers and adults, nests, and hatchlings of the three species of sea turtles that nest at CAHA [the federally threatened loggerhead (*Caretta caretta*) and the federally endangered green turtle (*Chelonia mydas*) and leatherback turtle (*Dermochelys coriacea*)] (NMFS and USFWS 1991a, NMFS and USFWS 1991b, NMFS and USFWS 1992).

Increased use by the public for recreational purposes necessitates the development of a long term management strategy to meet the requirements for protection of federally listed species under Sections 7(a) (1) and (2) of the Endangered Species Act (ESA). According to the 2001 National Park Service (NPS) Management Policy: "The NPS will survey for, protect, and strive to recover all species native to national park system units that are listed under the Endangered Species Act. The Service will fully meet its obligations under the National Park Service Organic Act and the Endangered Species Act to both pro-actively conserve listed species and prevent detrimental effects on these species."

The ESA directs federal agencies to carry out programs for the conservation of endangered and threatened species and to ensure that any action authorized, funded, or carried out by an agency is not likely to jeopardize the continued existence of endangered or threatened species or result in the destruction or adverse modification of critical habitat.

The purpose of the Interim Protected Species Management Strategy is to evaluate and implement strategies to protect sensitive species and provide for recreational use as directed in the CAHA enabling legislation, NPS management policies, and other laws and mandates until the long-term Off-Road Vehicle (ORV) Management Plan is developed. The effectiveness of management, however, should be assessed in an ongoing manner to the extent possible in order to assist managers in choosing from among the most effective and feasible management options recommended in the strategy.

The NPS has prepared this Biological Assessment pursuant to Section 7 of the ESA in order to evaluate the potential effects of the preferred alternative on the federally threatened or endangered species that occur within the project area. This document provides the most current data available on the status of the piping plover (*Charadrius melodus),* seabeach amaranth (*Amaranthus pumilus)*, and three species of sea turtles (loggerhead *Caretta caretta,* leatherback *Dermochelys coriacea,* green turtles *Chelonia mydas)* and assesses potential impacts to these protected species under the Interim Protected Species Management Strategy preferred alternative (Appendix A).

Background information on the biology of the species was derived in large part from U. S. Geological Survey (USGS) Management, Monitoring and Protection Protocols for the Piping Plover, Seabeach Amaranth and Sea Turtles on Cape Hatteras National Seashore, North Carolina (2005).

PROJECT DESCRIPTION

The action which serves as the basis for this biological assessment is described as the Interim Protected Species Management Strategy (Action). This Action will guide management practices for recreational use and protection of species at CAHA for the next three to four years until an ORV Management Plan and regulations are completed (currently scheduled for completion in 2008). The Action was developed considering public input, practical knowledge, federal laws, science, and NPS policy. The scope of the Action is focused on consideration of ORV and pedestrian access and the relationship of these activities to protected species. Analysis of the Action was conducted via National Environmental Policy Act (NEPA) and NPS Directors Order 12 (Conservation Planning, Environmental Impact Analysis, and Decision-Making) processes. Given the limited timeframe and scope of this Action, the NPS will initiate another consultation process with USFWS as part of the longer term planning effort.

ORV use on CAHA beaches predates establishment of CAHA and is considered an appropriate visitor use. ORVs are currently used to provide vehicular access onto CAHA beaches for recreational purposes, including surf fishing; surfboarding; sunbathing; swimming; bird watching; scenic driving; etc. ORV use at CAHA is a year-round visitor activity with the most intense months of use being April through November. Ranger counts of ORVs on the beach have reached as high as 2,200/day on summer holiday weekends with concentrated use at the three spits (Bodie, Hatteras and Ocracoke Islands), and Cape Point. During winter months all CAHA beaches are open to ORV use. During summer months, certain beaches are closed to ORV use, including beaches in front of the Hatteras Island villages, in accordance with the CAHA ORV Site Bulletin (Appendix C). Beaches narrower than 100' are closed to ORV use during any time of the year due to safety concerns. For the past couple of years, ORV corridors have been used in certain areas of CAHA to provide for recreation use and access while ensuring areas are also provided for protection of natural resources.

The long term ORV management planning effort is based on the recognition by the NPS that ORVs must be regulated in a manner that is not only consistent with applicable law, but also appropriately addresses resource protection (including protected, threatened and endangered species), potential conflicts among the various CAHA users, and visitor safety. Executive Order (E.O.) 11644 of 1972, amended by E.O. 11989 of 1977, requires certain federal agencies permitting ORV use on agency lands to publish regulations designating specific trails and areas for this use. Title 36, section 4.10 of the Code of Federal Regulations implements the E.O.s by providing that routes and areas designated for ORV use shall be promulgated as special regulations. Section 4.10 also provides that the designation of routes and areas shall comply with E.O. 11644 and with section 1.5 of Title 36 of the Code of Federal Regulations.

The NPS has contracted with the U.S. Institute for Environmental Conflict Resolution to assess the feasibility of using negotiated rulemaking to reach consensus among interested parties in development of the required special regulation for CAHA. This facilitated approach has been used in other national park sites to reach consensus on regulations. If negotiated rulemaking is feasible, the NPS would carry out and complete the rulemaking process concurrently with the development of an ORV Management Plan for CAHA and accompanying NEPA analysis. The

NPS has assigned a high priority to completing the long-term plan/environmental impact statement and regulations.

The project area that will be affected by the proposed strategy includes approximately 55 miles of open sandy beach, much of which is bordered on the west by a man-made dune line. From north to south, this includes approximately six miles on the southern end of Bodie Island, the southern 35 miles of Hatteras Island and all 14 miles of Ocracoke Island. The northern 14 miles of Hatteras Island is managed by Pea Island Wildlife Refuge. The most diverse sites in terms of wildlife use are the spits at the southern ends of the three islands and the Cape Hatteras Point, located in the mid-section of Hatteras Island. These landforms are extremely dynamic, often resulting in dramatic changes to their shorelines over a short period of time. Bodie, Hatteras and Ocracoke Island spits are comprised mainly of moist unvegetated flats with adjacent sand/shell banks and/or small developing dunes. As inlet shorelines accrete, the backshores have become dominated by *Spartina alternaflora, Spartina patens*, *Iva imbricata* and *Cakile edentula.* The low lying flats are subject to frequent flooding. This occurs daily on the backside of the flats that border Pamlico Sound. Tidal and ephemeral pools are often found at the spits. Bodie Island and Ocracoke Island spits are comprised of approximately 350 acres each. Hatteras Island spit is less extensive at an estimated 150 acres. The Cape Hatteras Point, a sandy cuspate feature projecting into the ocean has both an east and south facing shoreline. Cape Hatteras Point is approximately 250 acres based on 2003 CAHA acreages. It has moist interior flats that often communicate with the ocean on the more protected southern side. The site as a whole offers more high ground than the spits. Extensive shell banks surrounding the flats may be devoid of vegetation or on the upper beach, interspersed with *Iva imbricata* and *Cakile edentula.* Developing dune fields on the backshore are dominated by *Spartina patens, Uniola imbricata* and *Ammophila breviligulata.* Various rushes and sedges now inhabit the moist interior flats that only flood irregularly due to shoreline accretion.

SPECIES DESCRIPTION

The following federally listed species have been identified as occurring within the Action area:

Common Name	Scientific Name	Status	Occurrences
Piping Plover	*Charadrius melodus*	Threatened	Known
Seabeach amaranth	*Amaranthus pumilus*	Threatened	Known
Loggerhead sea turtle	*Caretta caretta*	Threatened	Known
Leatherback sea turtle	*Dermochelys coriacea*	Endangered	Known
Green sea turtle	*Chelonia mydas*	Threatened	Known

The NPS began monitoring breeding plovers at CAHA in 1989. NPS staff, volunteers and/or contract researchers have documented plover presence on nesting grounds each year since. Annual reports were completed. Non-breeding surveys were scant with CAHA participating in International Winter Piping Plover Surveys conducted once every five years beginning in 1991. Non-breeding surveys were conducted more frequently after 2000 when NCWRC began compiling a data base. Efforts were made to survey spits at least three times a month during fall migration and once a month during winter season.

CAHA staff has conducted annual surveys of seabeach amaranth since 1985 with the exception of 1991 through 1995. Though annual reports were not done each year, information has been entered into a CAHA data base.

Monitoring for nesting species of sea turtle was infrequent in the 1970s. Efforts increased beginning in 1983 and became more comprehensive by 1990 with all CAHA beaches being patrolled daily from June 1 through August 31. Leatherback nests were first reported in 1998 (Lyons 1998). The first known green turtle nest at CAHA was documented in 1988 (NCWRC).

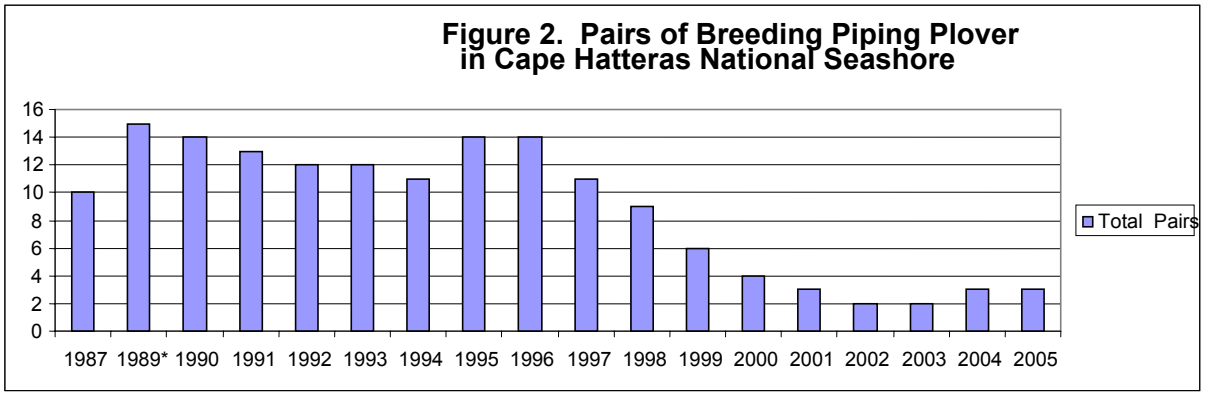
Piping Plover

The piping plover is a small (17-18 cm long, 43 – 63 g) sand-colored shorebird endemic to North America (Haig 1992). Breeding piping plovers occur in three distinct sub-populations: the Atlantic Coast (from the Maritime Provinces of Canada to the Outer Banks of North Carolina), the Great Lakes (along Lake Superior and Lake Michigan), and the Great Plains (from southern prairie Canada to Iowa). Wintering populations occur on the Atlantic Coast from North Carolina to Florida, and the Gulf Coast from Florida to Mexico and the Caribbean.

On the Atlantic Coast, breeding territory establishment and courtship generally begin in late March, the first nests are initiated in late April, and the brood- rearing period extends from late May to mid-August. Departure from the breeding grounds extends from mid-July to early September. Residency on the wintering grounds occurs from mid-July through early May, with the duration depending on the location. North Carolina lies at the northern edge of the piping plover's wintering range and at the southern edge of its breeding grounds.

The Atlantic Coast population of the piping plover (*Charadrius melodus*) was federally listed in 1986 as threatened (Federal Register 1985). At that time approximately 790 pairs remained and the species was in decline (USFWS 1996). Habitat loss caused by human development and recreation, and low reproductive rates caused by human disturbance and predation were considered to be the primary causes of the decline (Haig 1992). Disturbance and predation were intensively managed after listing, and the population rebounded to 1676 pairs by 2003 (USFWS 2004), but was still short of the recovery goal of 2000 pairs (USFWS 1996). The population south of New Jersey was estimated at 203 pairs in 2003, well short of the regional goal for the southern Atlantic Coast (DE, MD, VA, NC, SC) of 400 pairs, and North Carolina itself experienced a >50% decline in breeding pairs from 1989 to 2003 (USFWS 2004).

No published accounts exist of breeding piping plovers in North Carolina from 1902 to 1960, when a pair was found on Ocracoke Island (Golder 1985). Four nests and one brood were discovered within the boundaries of CAHA in 1984 incidental to monitoring for other species, and 5 chicks were known to have fledged that year (Golder 1985). Nine pairs were counted in 1986, again incidentally (Golder 1986), and 10 pairs were discovered in 1987 during specific surveys for the plover (Cooper 1990) (Figure 2).



The plover population reached a high of 15 pairs in 1989 and varied between 11 and 14 pairs through 1997, after which it began to decline. The population reached a low of 2 breeding pairs in 2002 and 2003 with only 3 breeding pairs reported in 2004 (Figure 2) (Lyons 2001, Lyons 2002, Lyons 2003, Lyons 2004, M. Lyons, NPS. unpublished data 2004), and 2 in 2005 (unpublished CAHA data). Three plover pairs defended territories in 2005 with only two of these pairs actually nesting. Plovers breeding at CAHA have had to coexist with increasingly higher numbers of human visitors to CAHA. From 1986-2004, the number of recreational visitors to CAHA increased 44%, from 1.54 million/yr to 2.21 million/yr (NPS 2005). Specifically, there was a 29% increase in visitation in the plover nonbreeding months (Sept.-Feb.) from 0.57 million/yr to 0.73 million/yr, and a 52% increase in the plover breeding months (Mar. – Aug.) from 0.97 million/yr to 1.48 million/yr.

Table 1. Number of Piping Plover breeding pairs by site in Cape Hatteras National Seashore (1985-2004)

Year	Total	Sites within Cape Hatteras National Seashore					
	Pairs	Oregon Inlet (Bodie Island Spit)	Cape Point	South Beach	Hatteras Inlet (Spit)	North Ocracoke	South Ocracoke
1986*	9						
1987	10	0	4	0	4	1	1
1989*	15						
1990	14	0	8	0	4	2	0
1991	13	0	5	0	3	5	0
1992	12	0	4	0	4	4	0
1993	12	0	5	1	3	3	0
1994	11	0	5	1	3	2	0
1995	14	0	6	1	4	2	1
1996	14	1	5	1	5	1	1
1997	11	1	4	1	3	0	2
1998	9	0	4	1	3	0	1
1999	6	0	3	1	1	0	1
2000	4	0	2	0	2	0	0
2001	3	1	1	0	1	0	0
2002	2	1	0	0	1	0	0
2003	2	0	0	0	1	0	1
2004	3	1	0	0	1	0	1

* no specific site locations for 1986 and 1989

On the Atlantic Coast, piping plovers nest in sand, gravel, or cobble substrates in backshore, dune, interdune blowout, overwash fan, and barrier flat zones of open or sparsely-vegetated beaches (Haig 1992). Nests sites may have little or no slope (Cairns 1982, Burger 1987), although nesting does occur on lower-elevation dunes (Cairns 1982). On wide beaches, plovers nest in the open to maintain a wide field of view, but on narrower beaches eggs can be laid in clumps of vegetation (Cairns 1982). On Assateague Island, Maryland, mean vegetative cover within 1 m of nest sites ranged up to 19.3% for depredated nests, and up to 14.8% for other nests (not significantly different, $P > 0.05$, Patterson et al. 1991). In New Jersey, substrate with 5-20% shell cover was preferred over sites with no shell cover (Burger 1987). Where beaches are wide enough, plovers nest far from the tide line to reduce risk of nest overwash, but this places nests closer to vegetated dunes where risk of predation is high (Burger 1987). In Virginia, piping plovers typically nest on the backside of overwash fans that have a minimum of 25% shell cover and offer unimpeded access to backside low-wave energy moist substrate habitat (MOSH) (R. Boettcher, VA Dept. Game and Inland Fisheries, personal communication).

Plovers prey mainly on terrestrial arthropods and benthic worms (Haig 1992). Adults forage both day and night (Staine and Burger 1994), but young chicks are brooded during the night (Wolcott and Wolcott 1999), although they are still vulnerable to nocturnal mortality due to weather, predation, or human activity. During territory establishment, foraging adults exhibit a preference for MOSH for foraging, especially intertidal mudflats and sandflats (Keane et al. in

press). Benthic invertebrates in MOSH provide prey at a time of year when terrestrial arthropods are scarce (Houghton et al. unpublished), and in Massachusetts were found to be more abundant than in the high-wave energy ocean intertidal zone (Hoopes 1993). Foraging broods exhibit a preference for beach-cast tidal wrack and MOSH, including mudflats, sandflats, and ephemeral pools (Goldin 1993, Hoopes 1993, Kuklinski et al. 1996, Elias et al. 2000). Such habitat has a higher abundance of terrestrial arthropods than drier zones (Hoopes 1993, Loegering and Fraser 1995, Kuklinski et al. 1996, Elias et al. 2000).

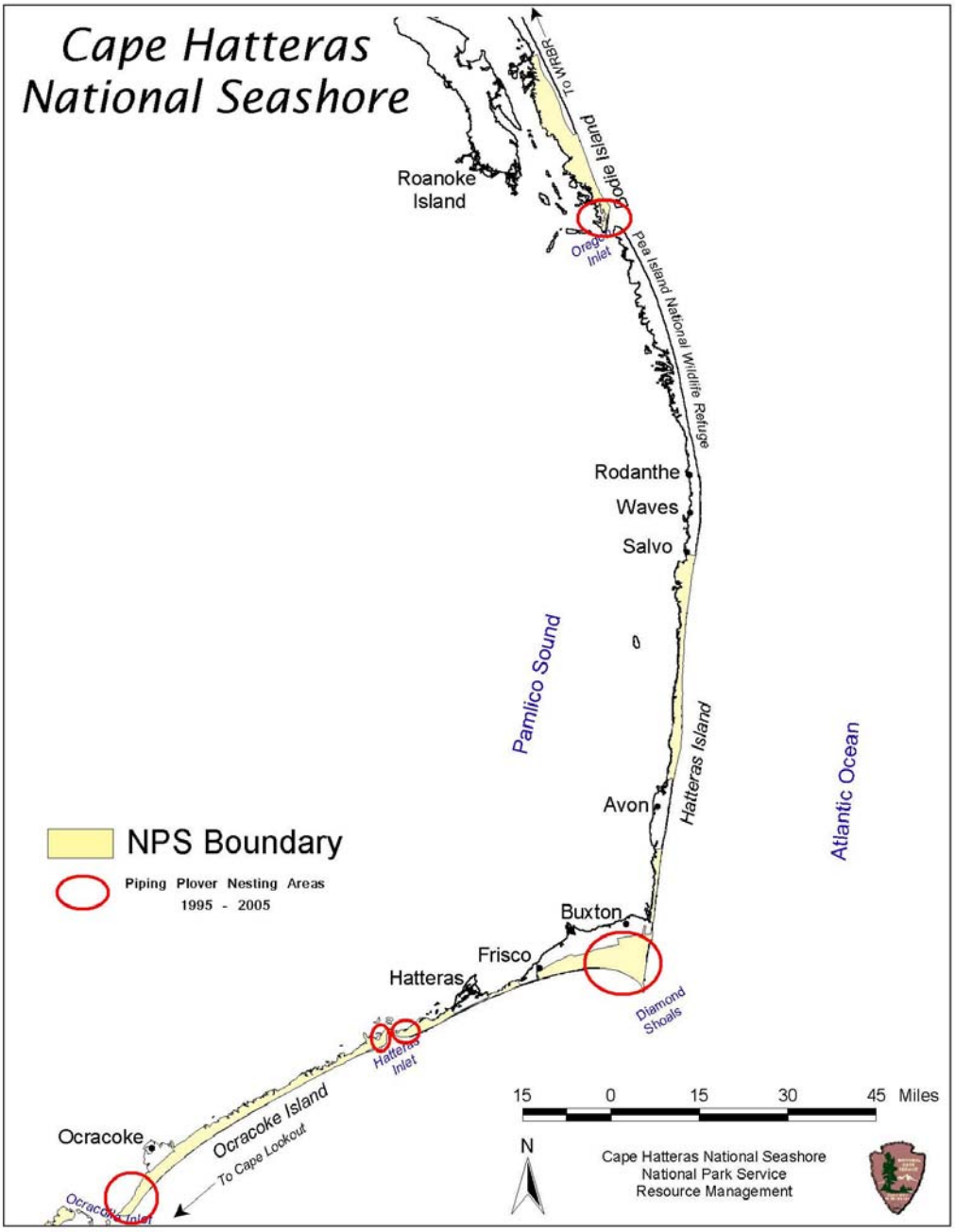
In 1989, plovers at CAHA were observed to lay 50% of their nest attempts on the ocean beach, 37% on the dune toe, and 5% (1 nest) in an overwash (Coutu et al. 1990). Broods foraged primarily on damp sand flats (Coutu 1990), where their percent time spent foraging, foraging rate (pecks/min), and prey abundance was much higher than in other habitats (Kuklinski 1996). Brood percent use of oceanside fresh wrack, sparse vegetation, wet sand flat, and overwash was greater than expected based on the percent availability of those habitats (Kuklinski 1996).

Chicks with access to MOSH survived better than chicks without such access in Virginia (Loegering and Fraser 1995), Rhode Island (Goldin and Regosin 1998), and in some years in New York (Elias et al. 2000). Burger (1994) found that having a diversity of foraging habitat zones available to broods reduced the impact of human disturbance, because it provided opportunities for chicks to escape disturbance and still forage.

Wintering plovers on the Atlantic Coast select wide beaches in the vicinity of inlets that are associated with a high percent area of MOSH (Nicholls and Baldassarre 1990, Wilkinson and Spinks 1994). In coastal Alabama, MOSH was the primary foraging habitat, while sandy beaches served as roosting habitat (Johnson and Baldassarre 1988). Wintering plovers in Texas exhibited a preference for algal flats and sandflats (Drake et al. 2001). Because tide and weather variation often cause plovers to move among habitat patches, a complex of patches may be important to local wintering populations (Nicholls and Baldassarre 1990). At CAHA, piping plovers select breeding territories which contain suitable nesting and foraging habitat. Sand flats, coves, intertidal zones and ephemeral pools, such as those found at the spits and Cape Point are used by foraging plovers and their chicks. (Coutu 1990, Callozo 1994, Lyons 1995 – 2004).

Based on an analysis of plover nesting areas between 1989 and 2005, six primary nesting sites have been identified at CAHA. These are Bodie Island Spit at the south end of Bodie Island, Cape Hatteras Point (Cape Point), South Beach, Hatteras Spit on Hatteras Island, and the north and south tips of Ocracoke Island (NPS unpublished data 2004) (Figure 3). Locally-breeding plovers arrive at CAHA in mid-March, begin courting and pairing in April, and begin to initiate nests the third week of April (Coutu 1990).

Figure 3. Locations of Piping Plover Nests at CAHA 1995 - 2005



Reproductive Success by Area at CAHA for Piping Plover

Oregon Inlet/Bodie Island Spit had one pair of breeding plovers in 1996, 1997, 2001, 2002, and 2004. Mean nest survival (nests that hatched at least one egg/nests laid) was 40%, mean chick survival (chicks fledged/eggs hatched) was 0%, and mean reproductive rate (chicks fledged/pair) was 0.00.

Cape Point had 4-6 breeding pairs of plovers/yr from 1992-1996, after which the number of pairs declined to 1 pair/yr by 2001. No pairs were found at this site from 2002-2004. It should be noted however, that since symbolic fencing was not erected here at the beginning of the 2004 breeding season and monitoring levels were low, it remains unknown if any plovers attempted to establish territories. Mean nest survival was 64% and mean chick survival was 37%. Reproductive rate ranged from 0.00 in 2001 to 1.70 fledglings/pair in 1999, and averaged 0.85.

South Beach had 1 pair of plovers/yr from 1993-1999 and none were found between 1999 and 2004. Mean nest survival was 93% and mean chick survival was 36%. Reproductive rate ranged from 0.00 (in several years) to 2.0 fledglings/pair (in 1998 and 1999), and averaged 0.67.

Hatteras Inlet/Spit had 3-5 pairs nested/yr from 1992-1998, and 1-2 pairs nested from 1999-2004, including one pair in 2004. Mean nest survival was 40% and mean chick survival was 22%. Reproductive rate ranged from 0.00 (in several years including 2002-2004) to 2.00 fledglings/pair in 2001, and averaged 0.47.

North Ocracoke had 1-4 breeding pairs/yr from 1992-1996. Mean nest survival was 36% and mean chick survival was 43%. Reproductive rate ranged from 0.00 to 0.50 fledglings/pair and averaged 0.30.

South Ocracoke had 1-2 breeding pairs from 1995-1999, and 1 breeding pair in 2003-2004. Mean nest survival was 67% and mean chick survival was 25%. Reproductive rate ranged from 0.00 (in several years) to 4.00 fledglings/pair in 1998, and averaged 0.70.

Mean nest survival at these CAHA sites was moderate to high when compared with nest survival at other breeding grounds, while chick survival was low (Mayer and Ryan 1991, Patterson et al. 1991, Loegering and Fraser 1995, Goldin and Regosin 1998) (Table 2). At South Beach, however, where nest survival was 100% in all years but one. Chick survival was highly variable at all sites. With all sites pooled, reproductive rate was correlated with chick survival ($r = 0.87$, $P < 0.001$, $n = 13$ yr), but not nest survival ($r = 0.16$, $P = 0.603$, $n = 13$ yr).

Table 2. Piping Plover Hatching Success on Cape Hatteras National Seashore (1992-2004)										
YEAR	NESTS	EGGS	NESTS LOST / ABANDONED		NESTS HATCHED		EGGS HATCHED		NESTS W/ FLEDGED CHICKS	
	#	#	#	%	#	%	#	%(a)	#	%
2004	2	6	1	50%	1	50%	4	66%	0	0%
2003	2	5(b)	0	0%	2	100%	4(b)	100%	1	50%
2002	3	8	2	67%	1	33%	1	13%	0	0%
2001	3	10	2	67%	1	33%	3	30%	1	33%
2000	6	23	3	50%	3	50%	10	44%	2	33%
1999	6	23	3	50%	3	50%	11	48%	3	50%
1998	8	31	2	25%	6	75%	20	65%	5	63%
1997	16	47(b)	6	38%	10	63%	32	68%	2	13%
1996	16	56(b)	6	38%	10	63%	30	53%	2	13%
1995	19	63	6	32%	13	68%	30	48%	6	32%
1994	18	65(c)	8	44%	10	56%	32(d)	49%	6	33%
1993	21	69	12	57%	9	43%	27	39%	5	24%
1992	14	49(e)	6	43%	8	57%	17	35%	6	43%
(a) - of all known eggs										
(b) - assumes 1 egg from a brood whose nest was not found (see 2003 report)										
(c) - assumes 2 eggs from a brood whose nest was not found (see 1992 report)										
(d) - includes those presumed hatched (see 1994 report)										
(e) - assumes 3 eggs from a brood whose nest was not found (see 1992 report)										

In 2005, there was evidence of territory prospecting by at least one pair at Bodie Island Spit, at least one pair at South Ocracoke, one pair at Hatteras Spit, and two pairs at Cape Point. Ultimately, nests were found for one pair at Hatteras Spit and one pair at Cape Point. Each pair fledged 3 chicks.

Predation, human disturbance, and inclement weather have been implicated as causes of low reproductive success at CAHA (Cooper 1990, Coutu et al. 1990, Kuklinski et al. 1996, Lyons 2002, Lyons 2003, Lyons 2004). Poor nutrition of broods without access to MOSH was also suspected as a source of mortality in one study (Kuklinski 1996).

In 1996, nest predation varied among sites and was most severe at Hatteras Spit. Nest abandonment increased from 2000-2002 compared to previous years, but neither of the two nests laid were lost in 2003. Abandonment was sometimes associated with predator trails circling nest exclosures (Lyons 2002, Lyons 2003, Lyons 2004). A nest was lost to flooding in 2002. In 2001-2003, sources of chick loss were unknown. Chick mortality, however, sometimes followed a rain event. After the disappearance of some chicks, predator trails were found where the brood was last seen, including red fox, domestic dog, and cat (Lyons 2002, Lyons 2003).

The three CAHA pairs produced two known nests in 2004. One nest (50%) successfully hatched. This was located at Hatteras Inlet spit and was the pair's initial nesting attempt. Average clutch size

was 3.0 eggs with 4 eggs laid at Hatteras Inlet spit and 2 eggs laid Bodie Island spit. Four eggs (33%) hatched. No chicks survived to fledgling age. Fledgling rate was 0.00 chicks per breeding pair. Since 1989 productivity rates have ranged from 0.0 to 1.3. The average rate over the past thirteen years is 0.58 (Table 3). All years have been below the level set in the federal recovery plan of 1.5 fledglings per breeding pair. (USFWS 1996) The reduced breeding population we are now seeing is likely a reflection of low productivity over the years. A rate of 1.2 fledglings per breeding pair annually would be needed to sustain a population and a higher rate needed to increase a population. (USFWS 1996)

Table 3. Fledging Success of Piping Plovers Cape Hatteras National Seashore (1992-2004)

YEAR	# PAIRS	# BROODS	# CHICKS	AVE. BROOD SIZE chicks/brood	CHICKS FLEDGED #	CHICKS FLEDGED %	BROODS FLEDGED #	WITH CHICKS %	FLEDGE RATE chicks/pair
2004	3	1	4	4	0	0%	0	0%	0.00
2003	2	2	5(c)	2.5	1	20%	1	50%	0.50
2002	2	1	1	1	0	0	0	0	0.00
2001	3	1	3	3.0	2	67%	1	100%	0.67
2000	4	3	10	3.3	3	30%	2	67%	0.75
1999	6	3	11	3.7	7	64%	3	100%	1.20
1998	9	6	20	3.3	12	60%	5	83%	1.33
1997	11	10	32	3.3	3	9%	2	20%	0.27
1996	14	10	30	3.0	3	10%	2	20%	0.21
1995	14	13	30	2.3	7	23%	6	46%	0.50
1994	11	10(a)	32(b)	3.2	9	30%	6	60%	0.82
1993	12	9	27	3.0	8	30%	5	56%	0.67
1992	12	8	17	2.1	8	47%	6	75%	0.67

(a) - includes 2 broods whose nest was presumed hatched (see 1994 report).

(b) — includes 8 chicks from 2 nests that was presumed hatched (see 1994 report).

(c) — includes1 known chick from nest not found (see 2003 report)

In 1990, research indicated that enforcement levels at the time were not adequate to keep pedestrians, pets, and ORVs out of symbolically fenced plover breeding areas (Coutu et al. 1990). In 1996, potential human disturbance sources appeared to remain outside of protected areas, and predation rather than disturbance was considered the major direct threat to reproductive success (Kuklinski 1996), although fieldwork did not begin until May 30 and missed the first part of the nesting season. Documented violations of protected areas by pedestrians began to increase sharply after 2000, but this may have been due in part to more careful recording of incidents (Lyons 2002, Lyons 2003, Lyons 2004). Approximately 50-60 incidents of ORVs entering protected areas were recorded each year from 2000-2002, and in 2003 the symbolic fence was vandalized by an ORV and several instances of ORVs within the protected area were observed (Lyons 2002, Lyons 2003, Lyons 2004).

Three breeding pairs of Piping Plover were found at CAHA during the 2004-breeding season (Table 4). Nesting occurred at the southern end of the Bodie Island spit bordering Oregon Inlet and at the Hatteras Inlet spit, on the southwestern terminus of Hatteras Island. This is one additional pair than found in 2002 and 2003, which represented the lowest number of breeding pairs recorded

since monitoring began in 1989. The three 2004 CAHA pairs produced two known nests this season and one nest (50%) successfully hatched. This was located at Hatteras Inlet spit and was the pair's initial nesting attempt. Average clutch size was 3.0 eggs with 4 eggs laid at Hatteras Inlet spit and 2 eggs laid Bodie Island spit. Four eggs (33%) hatched. No chicks survived to fledgling age. Fledgling rate was 0.00 chicks per breeding pair in 2004.

Chicks were lost in 2004 at the ages of two, five, eight and twenty days, respectively. The death of the eight day old chick may have been related to a leg injury. When last seen it would not put weight on the leg with a swollen tarsus. The loss of the eldest chick may have occurred during daylight hours; cause unknown. In previous breeding seasons between 1989 and 2003, chick losses ranged between 36% and 100% (Wrenn 1990, Collazo 1992-1994, Lyons 1995-2003). As in past years, the majority of chicks were lost within ten days of hatching.

Table 4. Piping Plover Nesting Season Cape Hatteras National Seashore 2004

LOCATION	#BREEDING PAIRS	#NESTS	#NESTS HATCHED	#NESTS LOST	#CHICKS FLEDGED	#CHICKS LOST
BODIE IS. SPIT	1	1	0	1	0	0
CAPE POINT	0	0	0	0	0	0
SOUTH BEACH	0	0	0	0	0	0
HATTERAS IS. SPIT	1	1	1	0	0	4
OCRACOKE NORTH	0	0	0	0	0	0
OCRACOKE SOUTH*	1	0	0	0	0	0
TOTAL	3	2	1	1	0	4

* pair occupied territory all season

Non-breeding and Wintering Plovers at CAHA

In addition to its declining breeding population, CAHA is used by migrating plovers and by wintering plovers from the threatened Atlantic Coast and Great Plains populations and the endangered Great Lakes population. The dynamics of the non-breeding populations at CAHA are less well documented than for the breeding populations. However, gathering information and protecting non-breeding plovers and their habitat is a priority in the recovery plans for all three North American breeding populations (USFWS 1988, USFWS 1996, USFWS 2003).

North Carolina is currently the only state on the Atlantic Coast that has piping plovers during all phases of the annual cycle. Band sightings indicate that plovers from all three North American breeding populations use CAHA during migration and/or the winter, and plovers from the endangered Great Lakes population have been documented in fall and spring migration and the wintering period. CAHA currently does not have any designated critical habitat. The U.S. District Court for the District of Columbia vacated the USFWS designation as critical habitat for wintering piping plovers of areas NC-1, NC-2, NC-4 and NC-5 and remanded to the USFWS for further action. The court determined that to designate critical habitat the USFWS must 1) complete an assessment meeting the requirements of the NEPA, 2) adequately evaluate the

economic impacts of the designation, 3) only designate as occupied critical habitat those areas containing physical or biological features that "may require special management consideration or protection", and 4) only designate as occupied critical habitat those areas where the pertinent physical or biological features are "found" (Cape Hatteras Access Preservation Alliance vs. U.S. Dept. of the Interior, 344 F. Supp. 2d 108 (D.D.C. 2004)).

From 2000-2005, the greatest number of non-breeding plovers at CAHA occurred during fall migration, which begins in July and peaks between July and September and may last until November (Table 5). The fall counts were highest at South Ocracoke, followed by Oregon Inlet (Bodie Island Spit, Pea Island National Wildlife Refuge, and formerly Green Island which is now largely unusable due to vegetation growth), then Hatteras Spit and Cape Point.

The first banded winter residents have appeared in August, although wintering birds may arrive in July (USGS 2005). The non-breeding population from Dec.-Jan. likely consists entirely of winter residents. The size of the resident wintering population is not precisely known, but it may be on the order of 20-35 birds (Table 5). Maximum numbers seen were about 50% of the recent norm in the winter of 2004-2005, but whether that was due to a difference in survey effort is unknown. The highest counts of wintering birds were at Oregon and Ocracoke Inlets. Rarely surveyed shoals, such as Clam Shoal (which is not part of CAHA) in Pamlico Sound, had up to 6-7 plovers when they were checked. Based on a sample of banded birds, winter residents can be present until April.

Spring migrants may appear in February or early March, and their numbers peak in late March or April (Table 5). Sites at Oregon Inlet have had the highest abundance of spring migrants, followed by South Ocracoke, with lesser numbers at Hatteras Spit and Cape Point. Ecological factors governing the distribution and size of the non-breeding population at CAHA are unknown.

Rates and sources of mortality and disturbance and responses of plovers to disturbance in the non-breeding period have not been assessed at CAHA. Plover foraging and roosting habitat, however, is used by pedestrians and ORVs year round. The potential therefore exists for direct mortality of plovers due to ORVs (Melvin et al. 1994) and domestic pets, and disturbance to roosting and foraging birds which may reduce foraging efficiency or alter habitat use thereby increasing the risk of nutritional or thermal stress (Zonick 2000).

Table 5. Median and maximum non-breeding birds seen/daily survey during fall, winter, and spring, selected sites at Cape Hatteras National Seashore, 2000-2005. Not all sites were surveyed

each day (typically only one or two were surveyed), so these numbers provide only a rough idea of the total size of the non-breeding population.

	Month	Oregon Inlet	Cape Point/ S. Beach	Hatteras Inlet	Ocracoke Inlet	All Sites
Median	Jul	0.49	0.18	0.45	2.21	5.67
	Aug	0.68	0.31	0.13	3.76	6.43
	Sept	0.66	0.07	0.38	4.22	5.67
	Oct	0.36	0.00	0.86	1.81	3.33
	Nov	0.82	0.00	0.07	1.00	4.21
	Dec	0.77	0.00	0.00	2.07	2.88
	Jan	0.25	0.00	0.00	1.00	1.18
	Feb	3.33	0.00	0.00	1.00	4.33
	Mar	1.25	0.00	0.00	0.75	2.75
	Apr	1.89	0.00	0.62	1.31	3.60
Maximum	Jul	32	5	21	56	56
	Aug	34	6	14	72	72
	Sept	16	5	4	37	37
	Oct	12	1	28	31	31
	Nov	15	0	8	12	15
	Dec	17	0	7	15	17
	Jan	18	0	1	11	18
	Feb	14	0	0	18	18
	Mar	12	3	4	8	12
	Apr	25	3	7	11	25

Current Management at CAHA for Piping Plovers

At the three CAHA spits (Bodie Island, Hatteras Island and Ocracoke Island) starting in 2004, ORV traffic was restricted year-round to a 150'-wide corridor parallel to the shoreline, bounded at one side by the average high water line. A similar corridor was established at Cape Point in 2005. ORVs may drive along or park within the corridor. Where there is a primary dune line, this corridor effectively extends to the dune toe in most places. Thus, little to no ocean intertidal zone, ocean wrack, or ocean backshore habitat is free of ORV use between breeding periods. With some exception at the inlets, the dunes, sound side shoreline, and interior features (such as sandflats, overwash fans, and ephemeral pools) are free from ORV use, but not pedestrian use, year round. In addition, some areas of ocean intertidal zones are free from ORV use due to narrowness of the beach or other safety concerns. Pedestrians, but not pets, are permitted outside the ORV corridor at the spits, except where there are specific "resource closures."

Historically-used breeding habitat has been closed to ORVs and pedestrians by the first week of April in most locales in most years (Lyons 2004), using symbolic fencing with interpretive signs. Such resource closures are off limits to all recreation, including pedestrians and pets. However,

this policy is not consistently applied prior to the discovery of nests, and string is not always used to bar the gaps between the signposts until after eggs are laid. In 2003 violations of protected areas by pedestrians and ORVs were frequent, especially at Hatteras Spit, prompting an increased presence of monitors and law enforcement. Breeding sites are sometimes closed to ORVs, to varying degrees, when a nest is expected to hatch (USDOI 2004).

Predator exclosures are erected around most nests. The effectiveness of exclosures in protecting nests, however, was lower in 2001 (33% of exclosed nests hatched), due to nest abandonment associated with predator disturbance (Lyons 2002, Lyons 2003), than in the years of 1999, 2000, and 2002 (50% of exclosed nests hatched). Previous years' surveys found that 75-90% of exclosed nests hatched. From 2002-2005 the NPS undertook trapping to remove mammalian predators from Bodie Island and Hatteras Island. In 2002, 12 foxes were removed from Hatteras Island by U.S. Dept. of Agriculture (USDA) Wildlife Services personnel and another 16 from Bodie Island. USDA officials believed there was still one fox left near South Beach, and a number of foxes on Bodie Island. In 2003, 15 foxes were removed from Bodie Island and one from Hatteras, as well as three opossums and one raccoon at Hatteras. CAHA staff removed one feral cat from near Hatteras Inlet. Although a number of foxes were still believed to be on Bodie Island, no fox tracks were seen in plover habitat after trapping began in 2002. Predator removal may enhance the success of exclosures.

CAHA has a leash law but it is difficult to enforce. CAHA has no regulations regarding the flying of kites near endangered species areas (Lyons 2003). With over 55 miles (88 km) of beach to patrol, a limited staff size, and 24 hour public access, biological monitoring and law enforcement are challenging at CAHA.

There are no specific procedures for protection of non-breeding plover habitat at CAHA. Migrants may currently benefit from nesting area closures (see below), which in some years were left up for an extended period to protect migrants. Furthermore, the current ORV corridor may provide some refuge from disturbance to non-breeding birds.

In 2005, a 0.1-mile "pass through only" section of the ORV corridor at Bodie Island spit was allowed in order to reduce disturbance to plovers foraging at ephemeral pools close to the original corridor boundary. The corridor was patrolled by CAHA rangers during daylight hours only, and ORV use was allowed after dark without rangers present. Pedestrians were not allowed in the pass through zone. At Cape Point, a resource closure was created around a complex of ephemeral pools to protect an oystercatcher brood (the closure extended to approximately 50 feet from the edge of the pools). This closure was later used by a plover brood that hatched to the west. At hatching, an additional 0.05 miles between Cape Point closure and the nest site to the west, was temporarily closed to ORVs to allow the brood safe passage to Cape Point where it was believed the brood would forage. This was reopened when the brood established itself at Cape Point. Public access to the eastern side of Cape Point was restricted after the plover brood moved to the eastern side of the ephemeral pool area. At Hatteras Spit, ORV traffic was only permitted in the ORV corridor once per hour in convoys escorted by bird monitors, to reduce the risk of mortality to an oystercatcher brood and to reduce disturbance to an incubating plover nest. ORVs were permitted to park at the tip of the spit, west of the escort corridor. The spit was closed to recreation at night. Once the plover eggs hatched, Hatteras Spit

was closed to ORV traffic until the chicks fledged. At South Ocracoke, the ORV corridor was narrowed in one place to protect a section of ocean intertidal zone where a pair of adult plovers was observed foraging on several occasions. ORVs were permitted to drive past the protected area in the backshore, but were restricted from the shore of the Sound.

Current management at CAHA results in the presence of ORVs in oceanside and inlet habitat during the non-breeding and territory establishment periods, and pedestrians in oceanside, inlet, and soundside habitat. Based on 2005 management, recreation is restricted from plover habitat when broods of plovers or other species are present, although recreation is kept to a 50 m distance from incubating nests by resource closures.

Additional management needs for Hatteras Inlet were enumerated in the Atlantic Coast revised recovery plan as predator exclosures, additional predator control, vegetation control, monitoring of brood foraging and ORV impacts, additional enforcement of protective rules, intensified wardening, education and outreach, control of feral animals, pet restrictions, and clarification of signs (USFWS 1996).

Seabeach Amaranth

The seabeach amaranth (*Amaranthus pumilus*) is an annual plant, with no vegetative reproduction, in the Family Amaranthaceae native to the beaches of the Atlantic Coast. Historically the plant occurred in 31 counties of nine states from Massachusetts to South Carolina (USFWS 1996). Currently, seabeach amaranth is known from NY, NJ, DE, MD, VA, NC and SC. The species was federally listed as threatened on April 7, 1993 (USFWS 1993). Seabeach amaranth has a global rank of G2 by The Nature Conservancy.

According to recent survey data collected by USFWS in 2005, the number of plants within the state of North Carolina decreased from 7093 to 5959 between 2001 and 2002. Most of these, however, were found along beaches south of CAHA. These numbers represent only a fraction of the reports of approximately 40,000 individuals reported in the late 1980s and in 1995. For example, between the period from1985 to1988 the number of individual plants ranged from over 500 to over 15,000 per year within CAHA, and in the period from 1990 to 1995 individuals ranged from 3332 to a single plant (Table 6). In 2004 only one plant was found at CAHA, however it was the first recorded for Bodie Island spit. In 2005, two plants were located, one at Bodie Island spit and one at the northeast end of Ocracoke Island.

Table 6. Numbers of naturally occurring plants of *A. pumilus* at Cape Hatteras National Seashore since 1985. Empty cells represent no data. Censuses were completed by a variety of personnel and agencies, typically in July and August. (From Jolls et al. 2004 and Lyons 2004, 2005)

Site	2005	2004	2003	2002	2001	2000	1998	1997	1996	1995	1990	1988	1987	1986	1985
Cape Point			16	45	37	1	9	59	2		2830	800	5200	200	
Hatteras Inlet			2	75	16	1	47	16	62	0	252	1718	274	300	450
N. Ocracoke	1		36	13			0	6	14	1	250	13,310	1409	100	100
Bodie Is. Spit	1	1													
Totals	2	1	54	133	53	2	56	81	78	1	3332	15,828	6883	600	550

The plants must recruit annually from seed banks either *in situ* or from other source populations dispersed by water, wind, or from on or offshore sediments distributed by anthropogenic factors (Jolls et al. 2004). Seeds must be scarified (the seed coat broken by nicking or abrasion, Hancock and Hosier 2003) or cold stratified (chilling for weeks) before germination of any magnitude can occur (Baskin and Baskin 1998, Blazich et al. 2005, Jolls et al. 2001).

Germination takes place over a relatively long period of time, generally beginning in April and continuing at least through July (USFWS 1996). Upon germinating, this plant initially forms a small unbranched shoot but soon begins to branch profusely into a clump, often reaching 30 cm in diameter and consisting of 5 to 20 branches. Occasionally a clump may get as large as a meter or more across, with a hundred or more branches. The stems are fleshy and pink-red or reddish, with small rounded leaves that are 1.3 to 2.5 cm in diameter. The leaves are clustered toward the tip of the stem, are normally a somewhat shiny, spinach-green color, and have a small notch at the rounded tip. Flowers and fruits are relatively inconspicuous and are borne in clusters along the stems. Flowering begins as soon as plants have reached sufficient size, sometimes as early as June in the Carolinas but more typically commencing in July and continuing until their death in late fall or early winter. The plants are reported to be monoecious (having male and female flowers on the same plant) (USFWS 1996). Seed production begins in July or August, reaches a peak in most years in September, and continues until the plant dies. The species is a prolific seed producer of waxy seeds which are relatively large (2-2.5 mm) and are believed to be viable for long periods (New Jersey DEP 2003). Seed dispersal may occur by wind, water and possibly birds, and whole plants and seeds are temporarily buoyant.

USFWS and NPS conducted surveys from 1985 – 1988 and NC Natural Heritage Program conducted a statewide survey in 1990 (Weakley 1991). Once a Resource Management Division was established at CAHA, annual surveys were done at the Bodie Island spit, Cape Point – South Beach, Hatteras Island spit, North Ocracoke and the spit at South Ocracoke between 1996 and 2005 (Lyons 1996, 1997, 1998, 1999, 2000, 2001). Most surveys were done in late July or August. Within specific sites, plant surveys were postponed until nesting bird activity ceased.

The plant grows only on Atlantic Coast beaches, mainly on coastal overwash flats at the accreting ends of the islands and lower foredunes and on ocean beaches above mean high tide (occasionally on sound-side beaches) (NatureServe 2005). It often grows in the same areas selected for nesting by shorebirds such as plovers, terns, and skimmers. It is intolerant of competition with other plants and does not occur on well-vegetated sites. According to Weakley and Bucher (1991), this species appears to need extensive, dynamic, natural areas of barrier island beaches and inlets. Within this dynamic landscape, *A. pumilus* functions as a fugitive species, occupying suitable habitat as it becomes available (NatureServe 2005). Seeds may survive many years buried in the sand; they germinate when brought near the surface by overwash events or more severe storms.

Some notable studies have recently assessed habitat requirements and experimented with *A. pumilus* recovery methods (Sellars 2001, Sellars and Jolls 2001, Jolls et al. 2004). A model developed by Sellars based on topographical factors, including highly accurate elevation measures obtained from LIDAR data, was used to predict *A. pumilus* occurrence and habitat with evaluations based on the occurrence of 164 plants in Carteret and Brunwick Counties, NC. This work found that elevation was the most limiting topographic variable controlling the occurrence of *A. pumilus.* Subsequent work used natural plant occurrences on Cape Lookout with a stepwise discriminate function analysis with grayscale (passive) LIDAR data to assess the role of vegetation cover. This work found that passive LIDAR (an index of bare sand) and elevation has been able to predict 72% of the plant occurrences and excluding 98% of the landscape as unsuitable habitat (Sellars et al. 2003).

Johnson, Jolls and Holbert (in review) report on a growth chamber experiment that evaluated the competitive effects of perennial plant neighbors (*Cakile edentula*, *Iva imbricata* and *Uniola paniculata*). *A. pumilus* plants experienced reduced survival and growth with these other plants and reduced growth when grown with other *A. pumilus* plants. Association with other *A. pumilus* plants is less detrimental than with the other species in term of survival, plant diameter, total competitive response and relative growth rate, although the limiting resources and mechanisms remain unknown. According to the authors: "Reduced performance of *Amaranthus* planted with neighbors in this experiment suggests that this species is a relatively poor competitor and may suffer lower reproductive fitness from competitive interactions with associates on the beach." The specific mechanisms of competition were not investigated but are cited as a future research need, particularly the abiotic resource partitioning (Hutchinson, 1961) and the relative effects of biotic and abiotic factors among the associate species in the dune community.

The predominant threat to *A. pumilus* is loss of suitable habitat, primarily due to beach stabilization efforts and storm-related erosion (USFWS 1993). This species occupies a narrow and precarious elevation niche, bounded by its relative intolerance of flooding in lower beach

settings and competition with other plants in upper beach and dune settings. Its placement within upper beach and overwash area habitats is severely limiting because these areas are often absent on barrier islands that are experiencing beach erosion. If sea levels continue to rise, then beach erosion and habitat loss will accelerate, especially where beach stabilization efforts limit the ability of barrier islands to respond naturally to such changes (USFWS 1993).

Previous surveys have found very few *A. pumilus* plants on east- and north-east facing coastlines, which experience the greatest erosion rates. South-facing beaches, such as those immediately south of Cape Hatteras, have lower erosion rates and likely provide better habitat for *A. pumilus*. Construction and maintenance of a continuous barrier dune by the North Carolina Department of Transportation to protect Route 12 is likely also a significant factor.

Intensive recreational use, both vehicular and pedestrian, also threatens the plant's survival. Its stems are easily broken or crushed by foot traffic and tires, thus, even minor traffic can be detrimental during the growing season (USFWS 1993). Although some may argue that recreational uses in the dormant season may even be helpful by decreasing and/or limiting the cover of perennial vegetation, there are no data to support this premise and heavy traffic can erode substrates and pulverize or bury seeds below depths from which seeds can germinate. Particularly in the Carolinas, webworms (caterpillars) can defoliate the plants to the point of killing them or at least preventing reproductive functions.

Current Management at CAHA for Seabeach Amaranth

No active management for amaranth occurred in 2005. Monitoring surveys for 2005 found only one plant, which was located in the Bodie Island flats. Resource closures for birds were established when nesting occurred or was expected at Hatteras Island, Bodie Island, Green Island, Cape Point and South Ocracoke; thus, where *A. pumilus* might have occurred, the plant benefited from the bird protection measures. Likely areas where *A. pumilus* may have germinated include the inlet-pond area at Bodie Island Spit, Cape Point, and South Ocracoke. In the past when *A. pumilus* is found outside of areas closed for bird protection, or in the fall, CAHA staff have fenced off an area of approximately 10 m in diameter around the plant, with appropriate signs asking visitors to stay clear of the location. These protection measures are continued until the plants have died, occasionally as late as December. From 1989 until 2003, the large piping plover bird closures erected by April 1 at Cape Point and South Beach (area west of Cape Point) provided protection to the seeds from disturbances. Any other bird closure established each year after that date gave protection to potential seabeach amaranth habitat as well.

Between 2000 to 2003 one to 37 occurrences of amaranth plants were recorded at Cape Point and South Beach, while one to 75 were located at Hatteras Inlet (Figures 4 and 5). No plants were located at either site during surveys conducted in 2004 and 2005. On Ocracoke Island seven and 11 plants were located in the years 2002 and 2003 respectively (Figure 6). No plants were discovered in 2004 surveys while one plant was located in 2005. Historically no plant occurrences have been documented for Bodie Island; however, one plant was found at Bodie Island Spit (Hatteras Inlet) in both 2004 and 2005 (Jolls et al 2004).

Figure 4. Natural Seabeach Amaranth occurrences at Hatteras (Cape) Point (CAHA) for the years 2000 through 2003 overlain on the LIDAR Passive Reflectance image from 1999. (Jolls et al 2004).

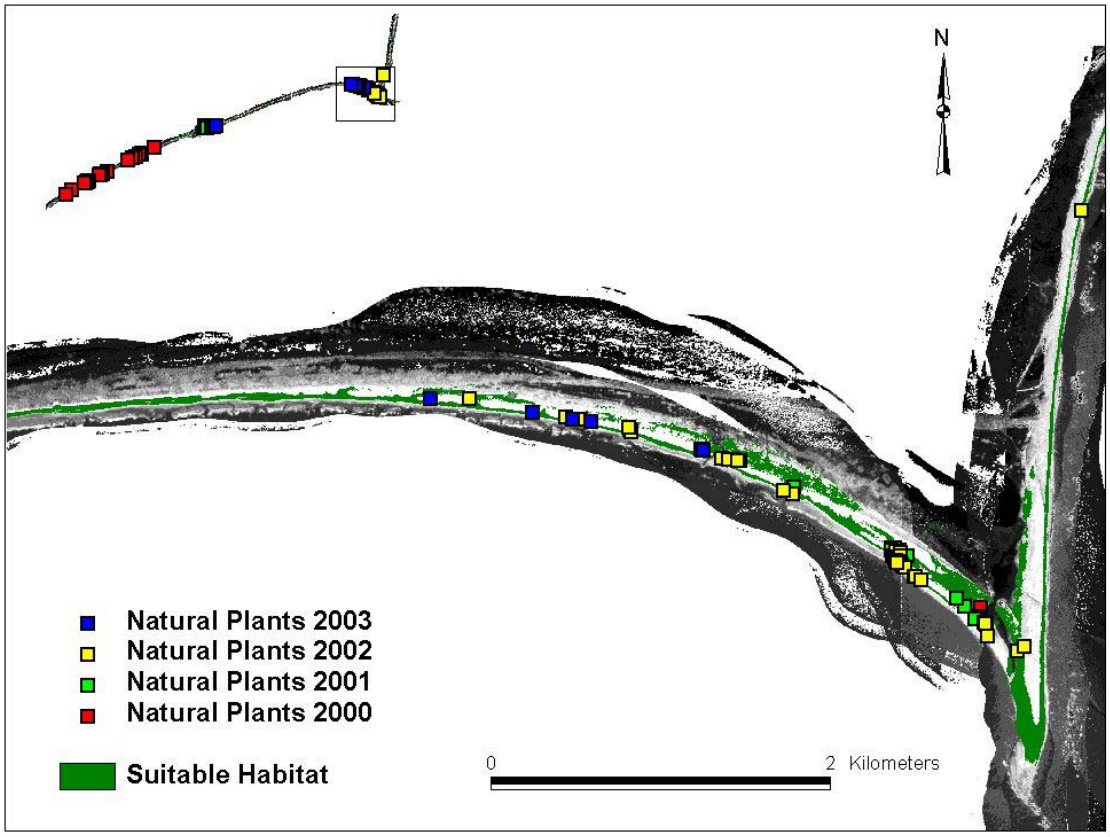


Figure 5. **Natural Seabeach Amaranth plant occurrences at Hatteras Inlet for the years 2000 through 2003 overlain on the LIDAR Passive Reflectance image from 1999. (Jolls et al 2004).**

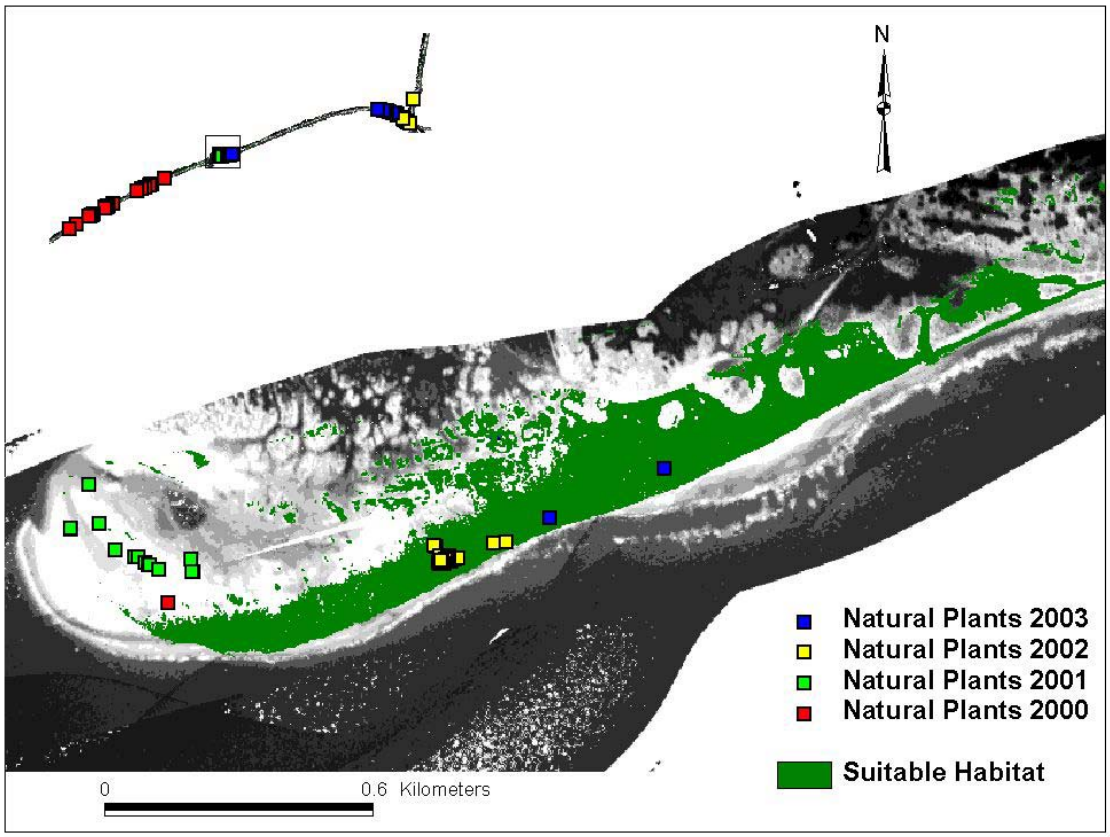
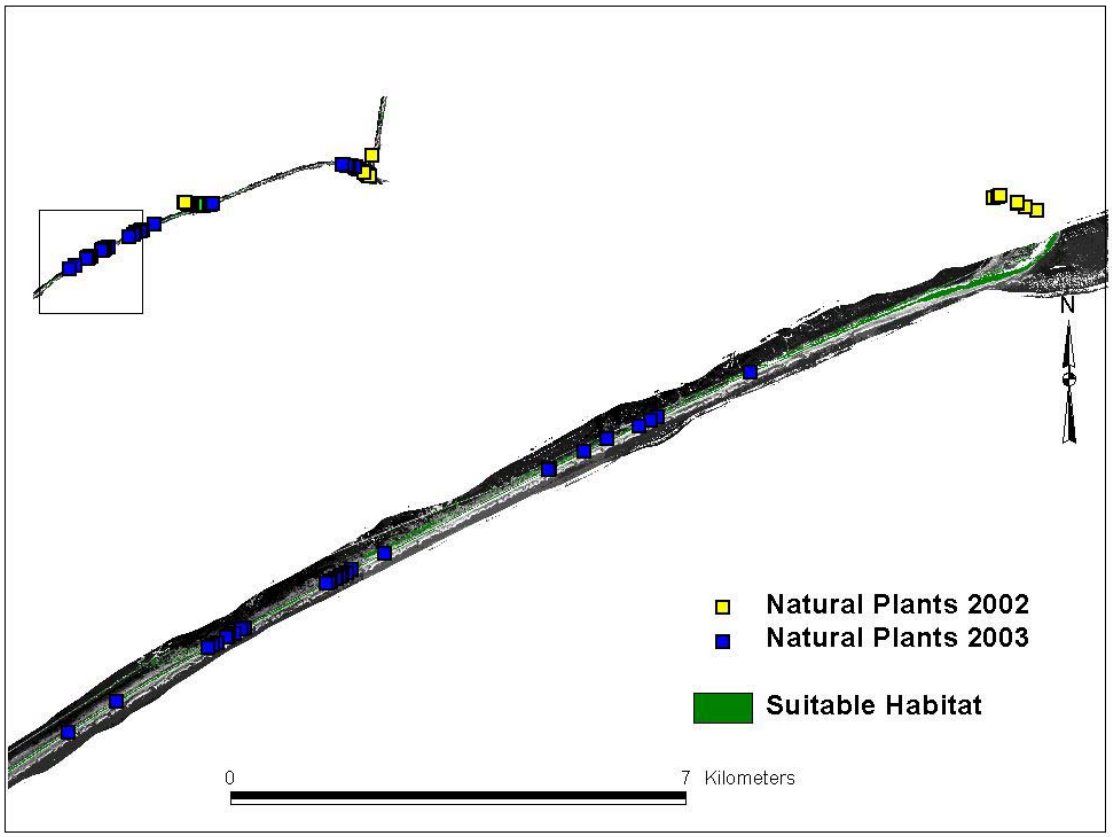


Figure 6. Natural Seabeach Amaranth plant occurrences on Ocracoke Island (CAHA) from 2002 and 2003 overlain on the LIDAR Passive Reflectance image from 1999. (Jolls et al 2004).



Sea Turtles

Three species of sea turtles are known to nest at CAHA, loggerhead turtles (*Caretta caretta*), green turtles (*Chelonia mydas*), and leatherback turtles (*Dermochelys coriacea*). All of the listed sea turtles known to occur at CAHA have similar ranges and habitat requirements; therefore, the information provided in this section will be applicable to all three species.

The loggerhead turtle (*Caretta caretta*) is by far the most numerous sea turtle to nest at CAHA. Green turtles (*Chelonia mydas*) and leatherbacks (*Dermochelys coriacea*) are known to nest at CAHA, but at fewer numbers than the loggerhead (Altman and Lyons 2003). CAHA is the northernmost nesting site for leatherbacks on the Atlantic Coast (Rabon et al. 2003).

Loggerhead turtles were listed as federally threatened in the U.S. in 1978 (NMFS and USFWS 1991a), while green turtles and leatherbacks listed as endangered in 1978 (NMFS and USFWS 1991b) and 1970 (NMFS and USFWS 1992), respectively. The U.S. Atlantic loggerhead population has increased since listing, from approximately 14,150 animals in 1983 (NMFS and USFWS 1991a) to between 32,000 – 56,000 by the year 2000 (Ehrhart et al. 2003). Within the northern subpopulation (north Florida to North Carolina), studies in South Carolina and Georgia have documented a decline in number of nests (Ehrhart et al. 2003). Based on genetic evidence,

male loggerheads disperse freely among sites within the U.S. Atlantic population, while females are faithful to their natal sites (Bowen et al. 2005). Because sex ratio is determined by temperature during incubation (Miller et al. 2003), the northern part of the U.S. Atlantic population, which includes North Carolina, apparently provides a disproportionate number of males to the larger population Mrosovsky et al. 1984, Hansen et al. 1998, Hawkes et al. in review).

One recovery goal for the loggerhead turtle in North Carolina is to attain the pre-listing nesting rate of 800 nests/season (NMFS and USFWS 1991a). The number of nests in North Carolina fluctuated broadly around 800 nests/season from 1990-2003 (Godfrey and Cluse 2003). Since standardized monitoring began in North Carolina in the mid-1990's, the number of loggerhead sea turtle nests/season at CAHA was lowest in 1995 and 1996 and highest in 2002. Only 46 loggerhead nests were laid in 2004, a year that showed low numbers for the entire southeast Atlantic Coast (M. Godfrey, NCWRC, pers. comm.) (Figure 7). One leatherback and two green turtle nests were found in 2003 (Figure 8). One leatherback and three green turtle nests were located at CAHA in 2004 and 10 green turtle nests and 19 false crawls were found in 2005, with no evidence of leatherback activity (Lyons 2005).

Figure 7. Number of loggerhead sea turtle nests at Cape Hatteras National Seashore, NC, 1995-2004.

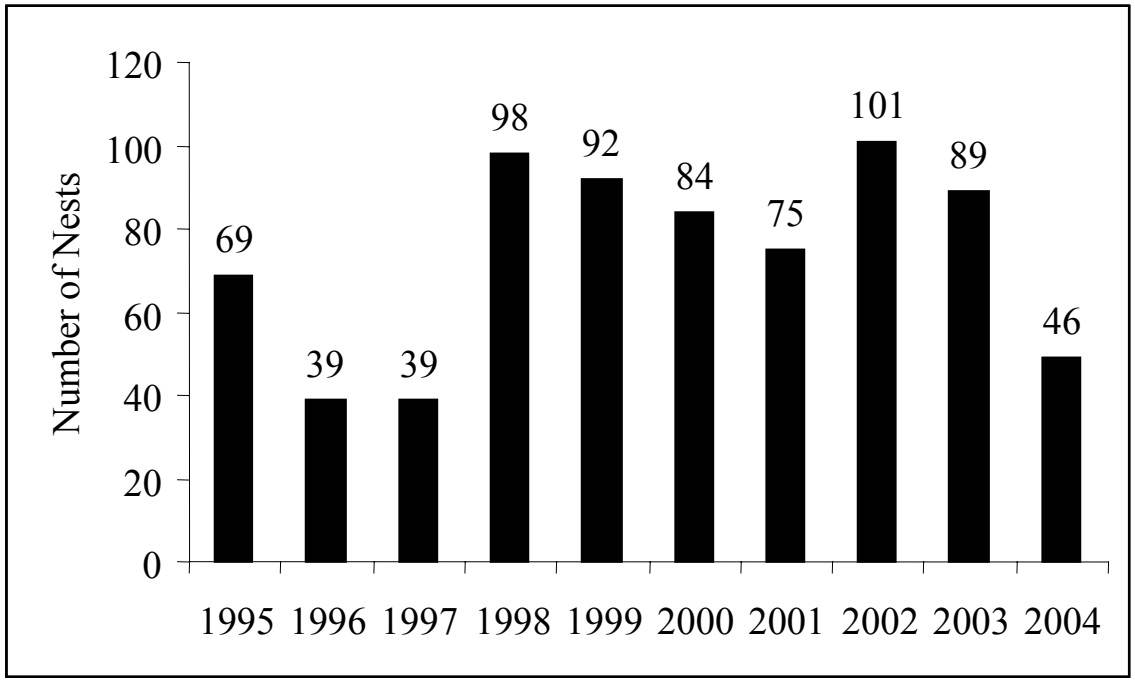
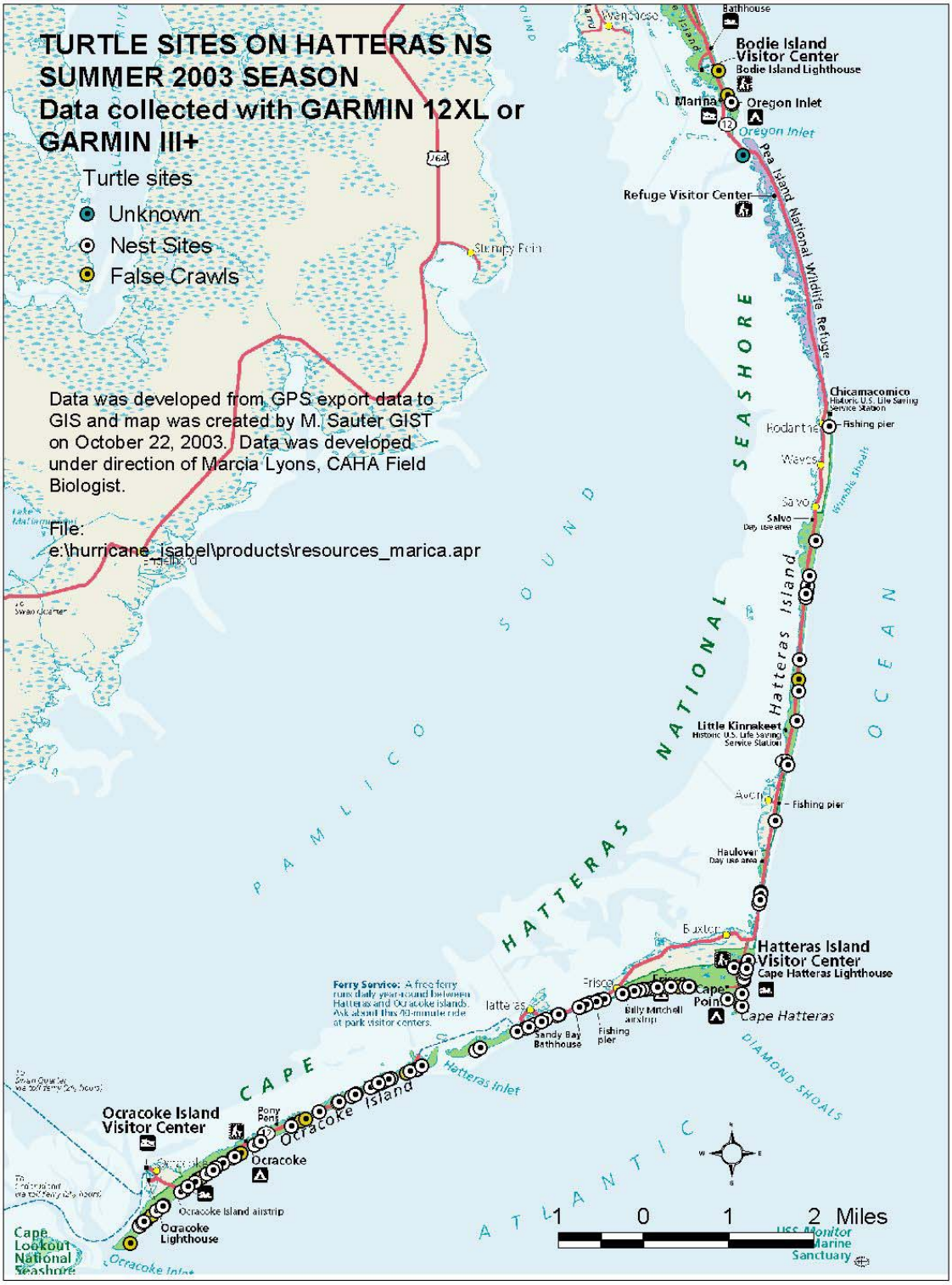


Figure 8. Sea Turtle Nest Sites at CAHA 2003 Season


TURTLE SITES ON HATTERAS NS
SUMMER 2003 SEASON
Data collected with GARMIN 12XL or GARMIN III+
Turtle sites
Unknown
Nest Sites
False Crawls
Data was developed from GPS export data to GIS and map was created by M. Sauter GIST on October 22, 2003. Data was developed under direction of Marcia Lyons, CAHA Field Biologist.
File:
e:\hurricane_isabel\products\resources_marica.apr
Bodie Island Visitor Center
Bodie Island Lighthouse
Marina
Oregon Inlet
Refuge Visitor Center
Pea Island National Wildlife Refuge
Chicamacomico
Fishing pier
Rodanthe
Waves
Salvo
Little Kinnakeet
Avon
Fishing pier
Hatteras Island
Hatteras Island Visitor Center
Cape Hatteras Lighthouse
Cape Point
Cape Hatteras
Ferry Service: A free ferry runs daily year-round between Hatteras and Ocracoke islands. Ask about this 40-minute ride at park visitor centers.
Sandy Bay Bathhouse
Fishing pier
Billy Mitchell airstrip
Hatteras Inlet
Ocracoke Island Visitor Center
Ocracoke
Ocracoke Island airstrip
Ocracoke Lighthouse
Cape Lookout National Seashore
Ocracoke Inlet
PAMLICO SOUND
HATTERAS NATIONAL SEASHORE
ATLANTIC OCEAN
DIAMOND SHOALS
1 0 1 2 Miles
USS Monitor Marine Sanctuary

In 2004, hatching events at various nests either took place in one nightly episode or intermittently over several nights. All nests were examined after hatching to determine productivity rates. Nests were excavated at a minimum of 72 hours after hatching events. In cases where hatching events or dates were unknown, nest cavities would be unearthed 80-90 days after the laying date. A total of 1,870 eggs were known to have hatched (Table 7). Of these, 1,609 hatchlings emerged from the nest cavities (Lyons 2004). Overall, hatching and emerging numbers were low for the second consecutive year due to hurricane impacts. Seasonably early Hurricane Alex passed over CAHA on August 3, 2004. Twenty nests were lost from erosion and water inundation, including the one leatherback and two reported green turtle nests. Several days of storm swells and tides were felt from Hurricane Francis beginning on September 2 and Ivan, beginning on September 18, 2004. These weather events claimed an additional eight nests. The last nest laid during the season was flooded when a low pressure system passed offshore on October 23, 2004. Twenty-nine (58%) of the 50 nests were unsuccessful, all attributed to storm impacts. Twenty-one (42%) nests successfully hatched, with an average hatch success of 72.8%. However the overall season's hatch rate falls to 30.5%, when combined with lost nests. This is only slightly higher than the record low of 27.2% in 2003. Individual nest success ranged from 0% to 99%. No nests were lost to predation in 2004.

Table 7 . Hatch Success at Cape Hatteras National Seashore 2004

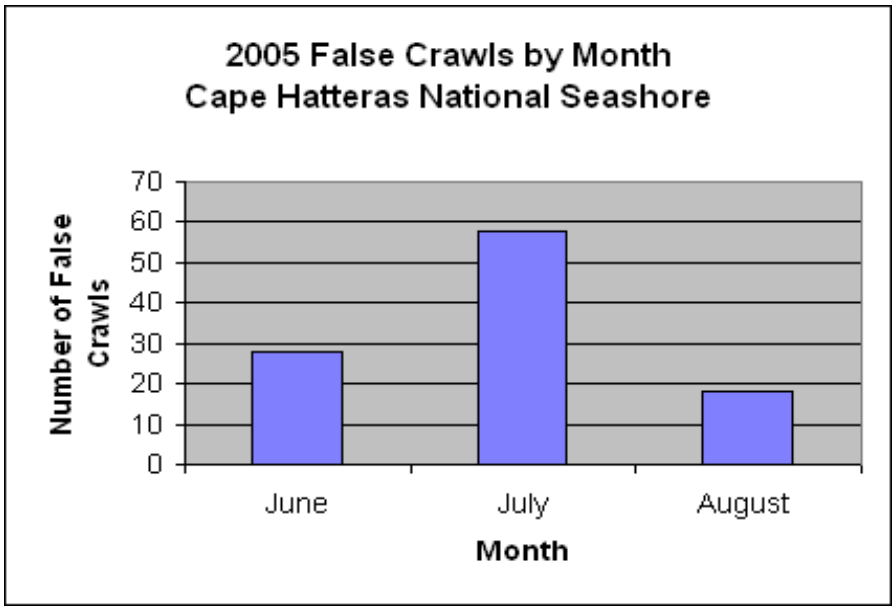
	# of Nests	Hatch Success (%)
Hatched Nests	21	72.8%
	# of Eggs	
Number of Known Eggs Hatched	1870	
Number of Hatchlings Emerged	1609	
Lost Nests	29	0.0%
Hurricane Alex	20	
Other Storm/Tide Events	9	
Combined Season Total	50	30.5%

*note the 51 live loggerheads in nest that hatched but did not emerge (counted as lost nest under other storm/tide events

Of the 128 turtle crawls located during the 2004 breeding season, 78 (61%) of these were false crawls or aborted nesting attempts. This is a significant rise compared to 35% in 2002 and 2003. Forty-five (57%) of the false crawls were found in areas open to ORV use, and 15 (23%) were located in heavy day use areas such as lifeguard beaches and other sites serviced by parking lots. Nine (18%) false crawls each were found on beaches adjacent to village/residential development as well as on beaches which did not fall into the previous mentioned categories and thus had lower concentrations of human activity. As in past years, the highest percentage of false crawls

(77%) occurred on Hatteras Island in 2004. This rate represents a significant increase compared to 46% found on the island in 2003. In 2005 sea turtle activity peaked in the month of July. Of the 57 false crawls reported during the month of July, 36 were found in ORV zones, followed by 17 in day-use areas (Figure 9). The fewest false crawls were reported adjacent to villages and in the more isolated beach areas. No studies have been done to date to ascertain the actual reasons behind false crawls at CAHA.

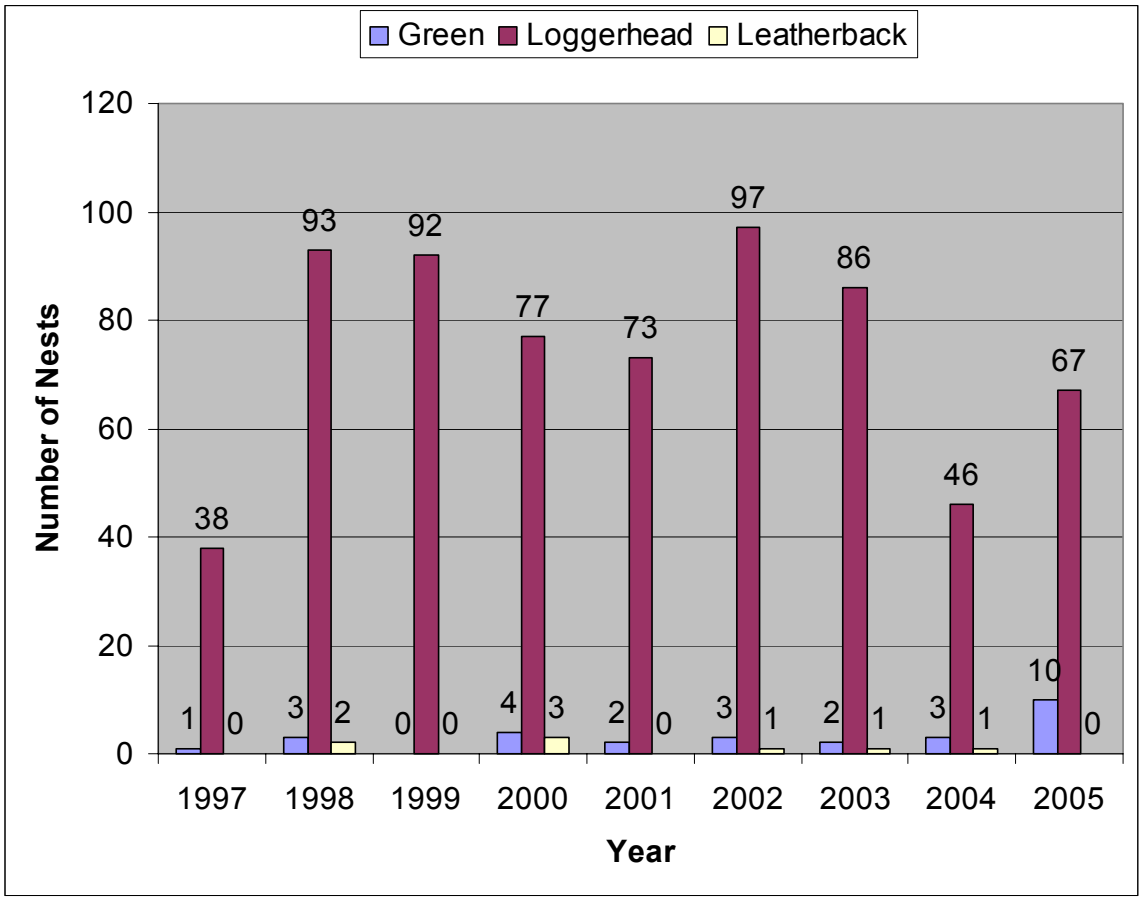
Figure 9. 2005 False Crawls at Cape Hatteras National Seashore



The loggerhead is the smallest of the turtles to use CAHA, with a mean carapace length of 92 cm and a mean mass of 133 kg (NMFS and USFWS 1991a) , compared to 102 cm and 136 kg for green turtles (National Research Council 1990) and 155 cm and 204-696 kg for leatherbacks (NMFS and USFWS 1992). Leatherback and green turtles breed primarily in the tropics and are rarer nesters at higher latitudes, while loggerheads have significant nesting populations outside the tropics (National Research Council 1990). Loggerhead turtles have the highest numbers of nesting activity at CAHA (Figure 10). Loggerhead nests represent approximately 95% of the sea turtle nests at CAHA (Altman and Lyons 2003). For this reason we focus the remainder of the species account on loggerheads, with notes where the biology of the other two species differ in ways relevant to nesting site management.

A small number of green turtles have been found nesting at CAHA. According to a survey conducted by NCWRC between 1980 and 1999, the first documented nest was found in 1988. Leatherback nesting was documented in 1998, 2000, 2002, 2003 and 2004.

Figure 10. Number of sea turtle nests by species at CAHA 1997 – 2005 (Lyons 2005)



Less is known about factors that cue nest site selection than about anthropogenic disturbances that discourage nesting (Miller et al. 2003). Typical nesting areas are "sandy, wide, open beaches backed by low dunes, with a flat, sandy approach from the sea" (Miller et al. 2003). Nesting is nonrandom along the shoreline, but studies of the physical characteristics associated with nests *vs*. random or non-nesting sites on the beach have produced varying results. Some factors that have been found to determine nest selection in certain studies are beach slope (3 of 3 studies), temperature (2 of 3 studies), distance to the ocean (1 of 3 studies), sand type (2 of 2 studies), and moisture (1 of 3 studies), although the results were occasionally contradictory (Miller et al. 2003). Other factors examined but not found to be significant were compaction, erosion, pH, and salinity. Although the process of nest site selection is not well understood, a successful nest must be laid in a low salinity, high humidity, well-ventilated substrate that is not prone to flooding or burying due to tides and storms, and where temperature is optimal for development (Miller *et al*. 2003). Nesting activity for leatherback turtles may begin in late February or March, which is earlier in the season than other species (NMFS and USFWS 1992). In 2000, a leatherback turtle nest was found on Ocracoke Island in April.

Threats to the loggerhead on the nesting grounds, as outlined in their recovery plan (NMFS and USFWS 1991a), are representative of those faced by green and leatherback turtles. Storm events may destroy nests due to flooding or piling of eroded sand on the nest site. Beach erosion due to

wave action may decrease the availability of suitable nesting habitat (Steinetz et al. 1998), which leads to a decline in nesting rate.

Predation by mammals, birds, and ghost crabs may eliminate 100% of productivity on beaches where it is not managed (National Research Council 1990). Fire ants may also kill hatchlings about to emerge from the nest cavity.

Crowding of nesting beaches by pedestrians can disturb nesting females and prevent laying (NMFS and USFWS 1991). Furthermore, the use of flashlights and campfires may interfere with sea-finding behavior by hatchlings. Beach driving by ORVs may harm sea turtles by running over nests, which may increase sand compaction and decrease hatching success or kill pre-emergent hatchlings (NMFS and USFWS 1991). Beach driving poses a risk of injury to females and live stranded turtles, can leave ruts that trap hatchlings attempting to reach the ocean (Hosier et al. 1981), can disturb adult females and cause them to abort nesting attempts, and can interfere with sea-finding behavior if headlights are used at night (NMFS and USFWS 1991). Artificial lighting on human structures may affect turtle behavior in a similar manner (Witherington and Martin 1996). Beach cleaning can directly destroy nests. Poaching is a problem in some countries, and occurs at a low level in the United States.

An increased human presence may lead to an increase in the presence of domestic pets that can depredate nests, and an increase in litter that may attract wild predators (National Research Council 1990). Pedestrian and ORV traffic and beach-cleaning activities can create ruts that trap emerging hatchlings and prevent them from finding the sea (Hosier et al. 1981). Trampling can increase sand compaction that may damage nests or hatchlings (Kudo et al. 2003). When artificial lighting impairs sea-finding behavior of nesting females and emerging hatchlings, the affected animals face increased exposure to the elements and predation.

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

According to CAHA sea turtle monitoring reports, 1999-2004, the majority of nest losses at CAHA were due to weather, particularly hurricanes and other storms (Table 8). In 2003 Hurricane Isabel destroyed so many nests that losses to other sources were difficult to document.

Foxes were first seen at CAHA in 1999, and on Hatteras Island in winter 2001/2002. Foxes disturbed or destroyed 1 to 9 nests/yr from 1999 to 2003, except in 2000 when no predation was reported. Ghost crab predation has been reported sporadically, with crabs seen at 0 to 17 nest sites/yr from 1999 to 2003 and observed predation of 0 to 3 nests/yr. Ghost crab predation has not been well monitored and may have more impacts than are presently known. Pedestrian tracks

have been recorded inside closures, and counts ranged from 8 to 92 trails/yr. Pedestrians disturbed or destroyed 2-6 nests/yr from 1999-2002 by digging them up, and none in 2003.

Table 8. Sea Turtle Monitoring Reports for all three species 1999-2004

Year	Total Nest	Number Lost	Reason
2004	50	29	Storm
		0	Fox
		Unknown	ghost crab
2003	89	52	Storm
		1	Fox
		0	ghost crab
2002	101	1	Storm
		6	Fox
		17	ghost crab
2001	75	11	Storms
		11	Fox
		7	ghost crabs
2000	84	19	Storm
		0	Fox
		3	ghost crab
1999	92	35	Storm
		1	Fox
		7	ghost crab
Total	481	147	Storm
		19	Fox
		34	ghost crabs

Violation of closed areas by ORVs has become increasingly common, with 29 to 109 sets of tracks inside closures and 4 to 146 incidents of fencing vandalism recorded per year. ORVs drove over 4-5 nests/yr from 2000-2002, although the nests survived. Dogs disturbed or destroyed 2 nests in 2000, and 5-60 sets of tracks/yr have been recorded inside closures. Feral cats have not been observed to predate eggs or hatchlings, but 10 to 50 sets of cat tracks per year were counted inside closures from 2000-2002.

Documented beach campfires totaled 174 in 2000 and 773 in 2001. Such fires may misdirect adults and emergent hatchlings. Several cases of hatchlings being misdirected by lights from villages and other human structures were documented in 1999, 2000, and 2002.

Current Management at CAHA for Sea Turtles

CAHA has been monitoring sea turtle nesting since 1988, from June 1 to August 31, although the NCWRC currently encourages turtle monitors (NPS staff, volunteers and Student Conservation Association staff) to begin surveying on May 1 (M. Godfrey, NCWRC, pers. comm) through November 15. Sea turtle hatching may occur that late. A leatherback nest was laid as early as April in 2000 on CAHA, and a green nest as late as Oct 12 the same year (Lyons 2000*)*. CAHA otherwise follows monitoring and management procedures outlined in the *Handbook for Sea Turtle Volunteers in North Carolina* (NCWRC 2002, Altman and Lyons 2003). Dawn patrols locate crawls along the beach and it is determined whether activities represent nests or false crawls. If a nest is present, every effort is made to leave it in place. Nests are only moved in accordance to state guidelines.

Since 2004, ORV traffic has been restricted year-round to a 50 m-wide corridor parallel to the shoreline, bounded at one side by the average high water line. ORVs may drive along or park within the corridor. Where there is a primary dune line, this corridor effectively extends to the dune toe in most places. Thus, little to no ocean backshore nesting habitat is free of pedestrian and ORV use except where specific areas are closed to protect sea turtle or bird nests. Pedestrians, but not pets, are permitted outside the ORV corridor on the spits, except where there are specific "resource closures."

In 2005, monitoring to detect crawls and dig sites was conducted each day at dawn, from June 1 to August 31. When a nest was found, a buffer zone of symbolic fence line was placed around it, approximately 9 m on a side. As the hatching date approached, the buffer zone width was expanded to 23 m in low-recreation areas, 46 m adjacent to villages or areas with high day use, and 107 m in ORV zones. Furthermore, the closures were extended to the surf line to prevent further traffic between the nest and the sea, and to 15 m landward of the nest. ORV tracks between the nest and the sea were mechanically smoothed. Drift fences were placed behind nests to shield emerging hatchlings from headlight beams, and ORV traffic was directed landward of these fence lines. A small number of nests were relocated due to impending threat of overwash or erosion. In past years, relocations also occurred if nests were laid close to artificial light sources such as piers.

In the 2004 season, there were 45 nests found in ORV areas. Of these, five sites required complete closures to through traffic during the expected hatching period. These complete closures excluded all ORV traffic from dune to ocean at a width of 350’ parallel to the shoreline. These temporary closures were implemented when nest were located on the upper beach or in the dunes, and there was not enough room behind the nests for ORV traffic to pass. These areas were well posted and large signs warned visitors at ORV Ramps of "No through traffic to the next Ramp".

In some years prior to 2005, predator exclosure screens were placed over nests to prevent red fox (*Vulpes vulpes*) predation. From 2002-2005 the NPS undertook trapping to remove mammalian predators from Bodie Island and Hatteras Island. In 2002, 12 red foxes were removed from Hatteras Island by U.S. Dept. of Agriculture (USDA) Wildlife Services personnel, and another 16 from Bodie Island. USDA officials believed there was still one fox left near South Beach,

and a number of foxes on Bodie Island. In 2003, 15 foxes were removed from Bodie Island and 1 from Hatteras, as well as three opossums and one raccoon at Hatteras. CAHA staff removed one feral cat from near Hatteras Inlet. Although a number of foxes were still believed to be on Bodie Island, no fox tracks were seen in plover habitat after trapping began in 2002. In 2003, one nest located on Bodie Island was depredated by a red fox (Lyons 2004). Trapping efforts on Bodie Island and Hatteras Islands have greatly reduced this predation threat, and predator removal may enhance the success of exclosures. In 2004, no nests were lost to depredation, the first year since 2001 that red fox had not targeted loggerhead nests.

The use of predator screens may have attracted foxes to particular nests in 2001 and 2003, and resulted in the loss of a nest in 2003 because a screen was improperly placed (Altman and Lyons 2003). However, the screens have generally only been used when the risk of depredation by foxes was already known to be high, and in 2001 reduced the number of eggs lost even when a fox attempted to dig through a screen (Sayles 2002). Predator screens have been shown to reduce nest depredation in other places (Adamany et al. 1997, Ratnaswamy et al. 1997).

There is a risk of disturbance or injury to adult females and stranded individuals due to night recreation and ORV driving, including deterrence from nesting. CAHA begins monitoring on June 1 which can result in missing nests that were laid earlier, and ending on August 31 which may lead to insufficient protection for hatchlings after that date. Furthermore, nests may be missed by monitors if ORV ruts obscure turtle crawls, and other nests may be missed due the amount of habitat and length of CAHA (55 miles) that monitors must search daily (Altman and Lyons 2003). Each year there are a small number of missed nests. Some were known to have been laid prior to June l, others went undetected as they were laid below the tide line – in some cases it took a nest being exposed by the waves and eggs washing out before there was evidence of a nest site. Some previously unknown nests may have been missed due to crawls being destroyed by tire tracks over crawls. Occasionally, a nest is discovered and reported by visitors who observe the female turtle laying her nest during the night, otherwise, these nests would go unnoticed due to pedestrian and ORV tracks covering the excavation. Unfound nests are at high risk of being crushed by ORVs or pedestrians, as are any other nests that are laid between nest surveys. In spite of the buffer zones used to protect nests there remains a risk that trespassing by people or domestic animals in protected areas will affect the nest itself.

The presence of ORVs on the beach at night could possibly lead to the risk of deterred nesting and misdirection and disorientation of emerging hatchlings, which in turn leads to an increase risk of hatchling loss due to crushing by humans or becoming trapped in ruts, and due to predation and the elements. Campfires and artificial lighting on human structures, especially at the villages, may deter nesting or affect the seafinding hatchlings. The presence of ORVs 24 h/day year round may affect the beach profile and substrate characteristics in a way that reduces suitability for nesting and reduces emergence success.

All species of sea turtles that strand on CAHA shorelines are documented in cooperation with the NCWRC and National Marine Fisheries Service (NMFS). A stranding report is completed for each animal documenting such information as species, condition, sex, carapace measurements, tags, wounds or abnormalities and evidence of entanglement. Photos are also taken. If alive, animals are transported to a permitted facility for care. NMFS biologists are conducting sea

turtle DNA and aging studies. As often as possible, flippers, eyes and muscle tissue was collected from carcasses by CAHA staff and transferred to the NMFS Beaufort laboratory. Collections were done under a permit issued by NCWRC.

In 2004, 97 stranded turtles were documented along the shores of CAHA (Table 9). This represents a 12 % decrease from 2003 total. Annual totals since 1996 have ranged from a low of 47 found in 1996 to a peak of 332 in 2000. Of the 97 found in 2004, 44 were located on the ocean beaches with 53 on the soundside shoreline. This was the first year stranding numbers on the soundside was greater than ocean beach stranding numbers. As in past years, the majority of the strandings were found on Hatteras Island. CAHA-wide, 35 (36%) were identified as loggerhead, 42 (43%) were green, 10 (10%) were Kemp's ridley (*Lepidochelys kempi*), 4 (4%) were leatherback, and 6 (6%) were not identified. Since 1996, loggerheads have represented the most common species of stranded sea turtles at CAHA except in 2004 when green turtle stranding numbers exceeded the other species.

In 2004 ten turtles (10%) were alive when discovered. NC Sea Turtle Network volunteers assisted in transporting many turtles to the Roanoke Island Animal Hospital where health assessments were made. Network for Endangered Sea Turtles (NEST) cared for them at the NC Aquarium in Manteo until they were released. Satellite tracking devices were mounted on a few of these turtles before release. Live strandings occurred mainly in the colder months and on the sound waters. Turtles were cold-stunned in response to falling water temperatures caused by cold fronts. A live leatherback was euthanized by a veterinarian. While conducting a necropsy a Mylar balloon was found blocking its intestines. One live turtle was hooked by a recreational fisherman and the line cut (approximately 100 ft.) before CAHA staff arrived.

Table 9. Sea Turtle Strandings

Cape Hatteras National Seashore 1996-2004

Year	Stranding	Species Composition*					Location	
	Totals	CC	LK	CM	DC	uk	Oceanside	Soundside
1996	47	26	8	10	3			
1997	98	64	17	10	3	4	62	36
1998	85	45	25	12	2	1	53	32
1999	226	149	55	22	0	0	138	88
2000	332	226	31	43	2	2	245	87
2001	69	41	11	11	4	2	46	23
2002	93	52	10	30	0	1	50	43
2003	109	87	8	11	2	1	88	21
2004	97	35	10	42	4	6	44	53

CC = Loggerhead
LK = Kemp's ridley
CM = Green
DC = Leatherback
uk = unknown

Eighty-seven turtles (90%) were dead when found. Cause of death in most cases was unknown. Half of the year's total was found in a 2-month period between November and December. November strandings could not be attributed to hypothermia as the waters remained above lethal temperatures until December. In other cases, three dead turtles had fresh propeller wounds on their carapace. One animal was wrapped in fishing line and another had a long-line hook embedded in its lower esophagus. Noteworthy during this year was the absence of an ocean-side stranding spike in the spring. In a three month period from April through June, a total of nine turtles were reported, a low for this time of year. Spring strandings have been in decline since offshore gill net regulations were changed following a large number of strandings in 2000.

EFFECTS OF PROPOSED ACTION
(see Appendix A)

Piping Plover Effects Assessment

This proposed strategy would provide for increased presence of NPS personnel to anticipate and be responsive to bird behavior, to provide active management of visitor use and access, and to ensure protection of the species. It would incorporate the use of targeted pre-nesting resource closures in areas where piping plovers are documented to occur in recent years, along with flexibility for CAHA to erect additional closures based on the presence and territorial behavior or nesting of birds in areas used by the species within the past ten years. It would further incorporate the use of a decision tree to make closures more flexible based on bird behavior and access issues. The strategy would also provide for recreation access around resource closures when possible via CAHA designated by-passes or use of alternate routes.

Direct and Indirect Effects:
The proposed Action has the potential for both positive and negative impacts to piping plover (breeding and non-breeding birds).

Pre-nesting Activity – The proposed strategy would provide for pre-nesting closures based on the last three years of breeding activity as well as for observation of areas (from April 1 to at least June 15) where piping plovers have nested in the past 10 years and any new habitat created. Monitoring would be done following guidelines in the Recovery Plan, Appendix G. Before nest establishment, CAHA would conduct monitoring of areas via ORV or on foot outside of resource closure areas using field scopes. Neither monitors nor monitoring vehicles would pass through prospective territory. Vehicles would be parked at least 600 feet from suspected center of territorial activity. The area would then be approached by foot maintaining adequate distance to not disturb birds.

Under the proposed strategy, the plovers would likely benefit from monitoring new habitat and historically used sites (sites used in the past 10 years) as well as the areas closed based on nesting of the last three years. This would ensure that all potential areas are being checked for breeding plovers. Recent breeding areas (sites used in the past three years) would be posted with symbolic fencing by April 1. These areas would vary in actual size but are typically greater than 300 feet (Appendix D), and would provide for a mosaic of habitat typically utilized by plovers in establishing territories. Piping plover territorial and courtship habitat encompass areas greater than 300 feet (Cairns 1982). The actual area to be fenced will vary from year to year due to the dynamic nature of CAHA and the available habitat.

Between April 1 – September 30 an ORV corridor would be designated with posts above the wrack line and below the dune line to protect the wrack line from routine driving, maintaining a 100-foot corridor where possible. Where it is not possible to delineate a corridor with posts above the wrack, signs would be posted asking visitors to stay off the wrack line. In areas without well defined wrack line the corridor would be delineated only with posts placed up to 100 feet above the high tide line. Education would be provided for visitors regarding the wildlife

values and susceptibility of the wrack to foot and ORV traffic. In areas of reduced corridor width (i.e. narrower than 100 feet) a reduced speed limit of 5 m.p.h. would be posted.

The proposed Action will improve protection at recent breeding sites by closing them by April 1, as compared to 2004 when no sites where closed by April 1. It will also improve monitoring prior to actual nesting given that in 2004, monitoring was inadequate at Cape Point, South Beach and the north end of Ocracoke (Lyons 2004). By ensuring regular observations of historically used areas, additional resource closures can be erected if piping plovers display territorial, courtship, or scrapes in these areas. By indicating that observations of plover in these areas would continue until at least June 15, CAHA has the flexibility to extend monitoring until later in the season if warranted which would positively affect plovers that may not establish nests until later in the season. Such nests were located at Bodie Island spit on June 29, 2004 (Lyons 2004) and on June 24, 1996 at Ocracoke spit (Lyons 1996). Protecting the wrack line from ORV damage via the 100-foot corridor will likely be beneficial to the species as this is important for foraging plover adults and chicks. This forage habitat has not been previously protected. There is also expected to be a beneficial effect from prohibiting pets from within ¼ mile of resource closures.

Habitat not used within the last three years or new suitable habitat would not be posted by April 1 in the strategy. This could cause adverse affects since any plovers attempting to utilize these unprotected areas in the early spring (prior to April 1) may abandon their attempts due to human disturbance (e.g. ORVs, pedestrians, kites) prior to being detected by bi-weekly surveys. For example, in 2005, a plover nest was found at a site that was not known be used since 1999 (NPS unpublished draft report).

However, by increasing monitoring frequency of the historic areas to three times per week after April 1, there will be a greater likelihood that any plovers establishing territories in these areas will be noted with appropriate follow-up (see section on Courtship and Mating). Actual monitoring could cause a negative effect given that plovers are highly sensitive to disturbance during the early period of territory establishment (USFWS 1996). However, with observers using scopes to watch the birds from a distance and remaining outside closures to the extent possible, this effect will be reduced.

Disturbance could occur day or night since NPS beaches are open to the public 24 hours a day and plovers are known to be active at night (Staine and Burger 1994). However, regular patrols of areas by law enforcement rangers, trained observers, and field biologists should help to deter violations of closures. In addition, partnerships with local organizations will help to provide peer based compliance with closures. Potential predators may also be attracted to the sites due the presence of humans or their trash, which could increase predation (USGS 2005, Hecht 1999). Though establishing an ORV corridor above the wrack line and below the dune line is likely to be beneficial, there may be instances where maintaining an ORV corridor as described is not possible due to beach width and wrack placement. Tide ranges at CAHA are normally between one and four feet (Dolan 1986). Thus wrack is normally deposited on low to mid sections of the beach which fall within the normal ORV corridor. In some cases, posting areas along the high tide line may be problematic since posts could be frequently washed out by the surf. Where areas cannot be posted, education and outreach to CAHA visitors will be used to inform them of

the importance of the wrack line and encouraging them to avoid driving over it. If there is little or limited compliance with pet restrictions in the areas of closures, a negative effect on the plovers could result. This will be mitigated by the prohibition of pets from with ¼ mile of the closures and through education and outreach efforts via the CAHA field personnel and partnerships with local volunteers and organizations.

Following a storm, or if vandalism of fencing occurs, the corridors and symbolic fencing would be inspected for damage and if significant repairs are needed areas may be temporarily closed until fencing and posts can be reestablished.

Courtship and Mating Activity – The proposed strategy would establish additional resource closures where courtship or mating behavior is observed outside of the pre-nesting closures. Given the regular observations of historic breeding areas, this would allow for establishing additional resource closures where needed based on bird behavior. Beneficial effects include ensuring pre-nesting closures are of adequate size to encompass such behavior if it occurs outside of the initial closure by ensuring additional buffer from recreational users is provided. It also allows CAHA to be responsive to individuality in bird behavior in determining adequate size of any additional resource closures. If needed, the ORV corridor would be adjusted or by-pass established around the area to allow ORV passage while maintaining protection.

In the proposed strategy, new habitat would be observed by trained NPS staff twice per week. A potential negative effect is that site abandonment could occur if areas with courting or territorial adults are not symbolically fenced in a timely manner given the potential for disturbance from recreationists. Actual disturbance to plovers could occur due to erecting the posts and strings for the resource closure. Potential predators may also be attracted to the sites due the presence of humans or their trash, potentially resulting in predation. Under the proposed strategy, if identified or established, the by-pass could result in disturbance if the by-pass route is within plover territory. By-passes or identification of alternate routes were not utilized in 2004. However, with the presence of increased NPS staff in the areas, CAHA will be able to keep apprised of bird behavior and also inform the public of alternate routes and ways to reduce their effects on the plovers (e.g. removing trash, reduced speed limit, etc.). Though no staff observations could be done after dark, periodic night time patrols of areas by law enforcement rangers and daytime outreach and education by NPS staff will help to deter violations of closures. In addition, partnerships with local organizations will help to provide peer based compliance with closures.

Following a storm, or if vandalism of fencing occurs the corridors and symbolic fencing would be inspected for damage and if significant repairs are needed areas may be temporarily closed until fencing and posts can be reestablished.

Nesting Activity – The proposed strategy would provide for protection of piping plover nests through use of buffer distances recommended under the Piping Plover Recovery Plan. Further, additional information will be collected during this stage based on observations via use of optical equipment outside the symbolic fencing. As in 2004, field staff observing bird location and behavior would have the flexibility to adjust closure buffers. Some individual plovers may require larger buffers than others (USFWS 1996). The strategy is expected to have positive

effects on the species as CAHA personnel and recreationists are kept a safe distance (at least 150 feet) from incubating adults and their nest. The proposed strategy may benefit plover management by expanding on data currently collected. In addition to nest location, number of eggs, etc., the strategy would provide for the documentation of information on the location of potential predators, pedestrians, ORVs, and pets relative to nests.

It could adversely impact plovers if adjustments to the buffer are not made in a timely manner. Negative effects could also occur if there is non compliance with the closures. However, periodic night time patrols of areas by law enforcement rangers and day time outreach and education by trained NPS staff will help to deter violations of closures. In addition, partnerships with local organizations will help to provide peer based compliance with closures.

In the event a storm or vandalism destroys the symbolic fencing of closed areas, or otherwise restricts staff entry into the closed area, the adjacent ORV access ramps will be closed to the public until monitors can re-establish any damaged symbolic fencing.

Nesting Adult Foraging (in ORV corridor) – The proposed strategy provides for protection of piping plover foraging areas that occur outside nesting closures. ORVs would be routed outside of the closure ensuring maintenance of the proper buffer distance. This should have positive effects given protection of both the foraging adults and the nest/eggs.

The proposed strategy could have negative impacts since it does not guarantee that all adult foraging and nesting habitat will be protected as one contiguous unit as it was in 2004. Under the proposed strategy, the by-pass could result in disturbance if the by-pass route is within plover territory. However, with the presence of trained NPS staff in the areas, CAHA will be able to keep apprised of bird behavior, locations, and also inform the public of alternate routes and ways to reduce their effects on the plovers (e.g. removing trash, reduced speed limit, etc.). No species observations could be done after dark. However, periodic night time patrols of areas by law enforcement rangers and day time outreach and education by trained NPS staff, should help to deter violations of closures. In addition, partnerships with local organizations will help to provide peer based compliance with closures.

In the event a storm or vandalism destroys the symbolic fencing of closed areas, or otherwise restricts staff entry into the closed area, the adjacent ORV access ramps will be closed to the public until monitors can re-establish any damaged symbolic fencing.

Unfledged Chicks – The proposed strategy would provide for continual NPS staff observance of unfledged chicks during the first week with adjustments to observation frequency and resource closures in subsequent weeks based on bird behavior and site conditions. It would also provide for buffer distances as recommended in the recovery plan with the flexibility to adjust the resource closures within a range from 600 ft – 3000 ft the first week and no less than 300 feet thereafter, based on bird behavior. The proposed strategy would likely benefit chicks given the continuous day time staff observations until the brood fledges. The plovers would likely benefit from the fact that the resource closure moves with the chicks, which would be especially important for highly mobile broods. There is also likely to be benefit from the additional night time compliance monitoring which would be provided for via intermittent CAHA personnel

observations and the use of nighttime surveillance equipment. There would also be expected benefits if the ORV by-pass or alternate route avoids altogether the area where the brood is located thereby eliminating the potential for negative impact from recreational activities.

Actual staff observations of plover chicks may have a detrimental impact by keeping them from foraging or resting as they would under undisturbed conditions. However, this would be avoided by conducting observation activities from a distance so as not to disturb the brood. In 2004, a 3000 foot buffer was reserved at all times around unfledged chicks with limited monitoring. In the proposed strategy, broods with a buffer distance of less than 3000 feet would be monitored during the daylight hours but not at night. For mobile broods that cover distances greater than 3000 feet, implementation of the strategy would not protect brood movements similar to what occurred in 2005 when a South Beach brood moved approximately 5000 feet within a closure during the night (NPS unpublished draft report).

Such bird behavior has occurred infrequently at CAHA; similar incidents are recorded to have occurred in 1998 and 1995 (Lyons, McGraine 1995; Lyons 1998). However, given the planned intensive observations of the adults prior to, as well as after egg hatching, it would be reasonable to expect that CAHA would be able to anticipate and/or respond in a timely manner to movement of broods. Further, where it is anticipated that an adult pair is likely to relocate the brood to a preferred foraging area, the appropriate buffer distance up to 3000 feet would be utilized. Under the proposed strategy, an ORV by-pass could be considered during the chick rearing stage which may have a negative impact. Depending on the location and the movement of the brood there may be risk of disturbance, injury or death if the ORV by-pass route is within the area utilized by the brood. There could also be negative impacts if disturbance from the ORV route restricted the brood's movements to a potential foraging or resting site. However, the proposed strategy is designed to re-direct ORV routes and corridors to areas that would not impact the brood. Further, the by-pass route would be closed during night time hours if it was within 3000 feet of the brood so as not to adversely impact plovers.

In the event a storm or vandalism destroys the symbolic fencing of closed areas, or otherwise restricts staff entry into the areas with unfledged chicks, the adjacent ORV access ramps will be closed to the public until monitors can relocate chicks and provide adequate protection with symbolic fencing.

Migrating and Wintering Activities - The proposed strategy provides for monitoring and resource closures to protect areas for migrating and wintering plovers. The proposed monitoring would benefit plovers by providing CAHA managers with information on the types of habitats used by non-breeding plovers, seasons and times of day utilized, and the locations of those habitats. This will increase knowledge on how and when plovers use CAHA. This would be an improvement from 2004, when survey coverage was incomplete especially during the winter and spring months. Establishing year-round interior closures under the proposed strategy at the spits and Cape Point would have positive impacts on plovers as compared to 2004 when no non-breeding closures were in place (non-breeding closures were established each year between 1997 and 2003). The proposed strategy is likely to have a positive effect on plovers given that the interior areas at the spits and at Cape Point provide for moist substrate, mud flats, algal flats, ephemeral ponds, and similar habitat important for plover foraging and roosting. These areas

have been observed to be utilized by non-breeding plovers (NPS unpublished CAHA data collected in 2005).

The proposed plan provides for establishment of a 150-foot ORV corridor October 1- March 30. The placement of the corridor relative to the proposed closures may have a negative impact on plovers given the corridor limits the availability of undisturbed intertidal and soundside shoreline. Though limited in scope, non-breeding data collected by CAHA since 2000 has shown the majority of observed plovers foraging in small groups along the soundside intertidal zones (Lyons 2002, Cameron 2004). Additional unpublished CAHA data collected in 2005 support use of this zone as well as the ocean intertidal zone at Cape Point.

Cumulative Effects:
Any activities that occur within the boundaries of the NPS would require the issuance of a special use permit, a Federal action which would require Section 7 Consultation with the USFWS. Additionally, any special use permit issued by CAHA will comply with and follow the provisions of this Action. Therefore, cumulative effects, which include the effects of future State, local or private actions that are reasonably certain to occur in the Action area, would not be likely due to Federal jurisdiction of all activities within the boundaries of CAHA.

Sea Turtles Effects Assessment

The interim strategy would incorporate the use of a decision tree to make public use closures more flexible. The strategy improves access past or around protected turtle nests via CAHA designated bypasses or alternate routes when possible.

Direct and Indirect Effects:
The proposed Action has the potential for both positive and negative impacts to nesting and hatching sea turtles.

Sea turtles would benefit through management of nests under the preferred alternative by following NCWRC guidelines. Under the proposed strategy, upon finding a turtle nest near the beach spits and points, CAHA staff would immediately record the location using GPS with sub-meter accuracy and assess its potential for vulnerability to erosion or flooding and if its location may have a direct impact on recreation access when the nest and hatchling access is fenced. If monitors determine that a nest would be imperiled by erosion or flooding, the nest would be relocated in accordance with the *Handbook for Sea Turtle Volunteers in North Carolina* issued by the NCWRC. This is expected to benefit the hatching success of sea turtles.

If is determined that fencing the nest to the sea prior to hatching would cause a disruption of ORV recreation access to the spits and Cape Point, CAHA staff would immediately determine if an alternate route is available or if a reasonable bypass route can be established at hatching time. ORV traffic would be routed around the nest on the duneward side, maintaining a no less than 30-foot buffer. If no by-pass trail could be found meeting these criteria, the nest would be relocated if permitted by the NCWRC. In accordance with NCWRC guidelines, relocation would be considered as a last resort since it carries risk. Relocation could result in damage to, or compromise the development of embryos (NCWRC 2002). Nests need to be moved within 12

hours of being laid to avoid embryonic damage (NCWRC 2002). If the nest is not relocated it would be immediately protected with symbolic fencing and signage which would provide protection of the nest from recreational use. Also, use of by-passes or alternate routes around sea turtle nests is expected to have beneficial effects on the protection of nests and hatchlings by diverting recreational beach users away from the sensitive area.

Measures are normally taken to smooth ORV tracks around nests during the hatching window. This practice would continue under the proposed strategy. However, if an undocumented nest (one overseen by patrol) hatches in ORV areas, the emerging young could be trapped in ORV tracks which can be fatal (USFWS 1993, USGS 2005).

The proposed alternative offers a benefit to sea turtles by daily morning monitoring at the initiation of the species' breeding seasons for nests and crawls beginning on June 1 through August 31, similar to present practices. This time period could also have negative effects, however, given the potential to miss a nest that may be laid earlier in the season. Loggerhead nests have been reported at Cape Hatteras in mid to late May with the earliest record of May 12, 2002 (Lyons 1999, 2000, 2001, 2002, 2003, 2004). These early nests were reported incidentally since regular patrols had not yet begun. A leatherback nest was discovered on April 16, 2000 and again in May, 2003. Another leatherback nest, initially discovered upon its hatching in 2002 was estimated to have been laid in May of that year, before the June patrols had begun. Nests, though few in number, have been reported after August 31 with latest being a green sea turtle nest found on Oct 12, 1998. (Lyons 1998). Each year there are records of nests which were nearly overseen because the crawls were obscured by tire tracks (Lyons 2004). There are also records of nests that were not discovered during daily monitoring. These are likely due to human error or crawls were obliterated by another action such as ocean overwash or ORV tracks (Lyons 2004). There is also the likelihood that nests can be run over by ATVs being used by the monitors to completely cover CAHA as well as the potential for night patrols (law enforcement) to contribute to the number of false crawls.

To avoid the potential for negative impacts on hatchling encounters with ORVs, or to be drawn to an artificial light source, the by-pass system would be designed to redirect ORV away from sensitive area to minimize or eliminate risk from impacts to nests or hatchlings.

Under current management and the proposed alternative, daytime rules would apply to ORVs driving on the beaches after dark. To benefit sea turtles, the NPS would begin to study the levels of night use on the beach and seek funds to study the impacts of night driving on the beaches throughout CAHA. The information collected would be used to develop management techniques for consideration in the long term ORV management planning process. Night driving on the beaches during the sea turtle nesting season could have adverse impacts on turtles by disrupting the nesting process and aborting nesting attempts. The negative impacts on nesting females in the surf zone may be particularly severe (USFWS 1993, USGS 2005). CAHA and Cape Lookout National Seashore are listed in the USFWS Loggerhead Recovery Plan as the only federal agencies within the nesting range allowing night time driving on beaches. Though actual ORV counts are scant, patrol rangers have stated that there is substantial ORV driving on the beaches at night (Henson, Meekins, Balance, personal communication). Since visibility is reduced at night, there is the potential of turtles being hit by ORVs. Under normal, undisturbed

conditions there is generally a one to one ratio between the number of nests and the number of false crawls in a given area (Mathew Godfrey, personal communication). During the peak of turtle nesting in 2005, there were three false crawls to every nest on Hatteras Island (NPS unpublished draft report). Most of these false crawls were found between Cape Point and the South beach which Hatteras Island patrol rangers claim has the district's highest concentration of night time ORV use. This may infer a correlation between false crawls and areas of high ORV use.

Hatchlings could be subject to misorientation or disorientation by ORV lights. Filter cloth, when used, is not always effective in protecting hatchlings from light sources (Lyons 2004). Nighttime ORV use can indirectly add to the lighting problems for turtles. Many beach fires are associated with the presence of ORVs (Meekins, White personal communication). In 1998 visitors reported hatchlings crawling into their beach fire (Lyons 1998). In 2001, 773 campfires were documented by turtle monitors throughout CAHA, including ORV and ORV-free areas (Lyons and Goshe 2001). Under the proposed alternative, turtle friendly lighting for all CAHA structures would be utilized. Further, concessionaires operating within CAHA would be encouraged to install turtle friendly lighting. Additional education measures would include education and outreach to villages regarding turtle biology and turtle friendly practices (e.g. using light timers, shielding and not directing lights onto the beach, not leaving beach furniture on the beach over night, etc.), turtle closure regulations, and turtle friendly lighting. In addition, sea turtles would benefit from periodic changes in law enforcement scheduling for the purpose of monitoring and to enforce compliance with regulations and closures. Night patrol rangers and visitors have been known to place make-shift fencing around nests to protect them until turtle monitors arrive in the morning (Griest, personal communication).

In the event of a hurricane, beaches will not be reopened for recreation until all existing turtle nests are found and areas reposted with symbolic fencing.

Cumulative Effects:
Any activities that occur within the boundaries of the NPS would require the issuance of a special use permit, a Federal action which would require Section 7 Consultation with the USFWS. Additionally, any special use permit issued by CAHA will comply with and follow the provisions of this Action. Therefore, cumulative effects, which include the effects of future State, local or private actions that are reasonably certain to occur in the Action area, would not be likely due to Federal jurisdiction of all activities within the boundaries of CAHA.

<u>Seabeach Amaranth Effects Assessment</u>

Direct and Indirect Effects:
Seabeach Amaranth could be affected both beneficially and adversely by the proposed Action (see Appendix A). The proposed strategy will result in improved monitoring from the current management actions, in that all potential habitat defined as historic and extant populations within the past ten years will be identified annually by April 15. Currently, the presence of seabeach amaranth plants and/or seedlings is only documented during routine bird and turtle monitoring surveys. Additionally, beginning on April 1 trained monitors will note any SBA seedlings or

plants and record the location using GPS with sub-meter accuracy, indicating whether it is in an area open or closed to recreational use.

Beneficial effects are anticipated for the seabeach amaranth through the identification of historic and newly created habitat, and by providing monitors with information to know where there are possible new colonies of the plant. This will also allow the monitors to include these areas in surveys in order to provide early protection and monitoring for seedlings. Identification of historic and newly created habitat is beneficial in that it allows greater focus for monitoring and adaptive management in the event of human or natural disturbances. Additionally, if a seedling or plant is found in an area open to ORV and/or pedestrians, CAHA would erect symbolic fencing with signage to create a 30 foot closure from the plant. Current management actions only provided for a 10 foot closure area, when a plant or seedling is found outside an existing closure area.

Historical locations of seabeach amaranth at CAHA have been found at Cape Point/South Beach, Hatteras Island and Ocracoke Island which are also sites used by piping plovers and other shorebirds. Under the proposed strategy these areas will be posted for closures when bird nesting activities are observed, therefore, also providing protection for seabeach amaranth seedlings which germinate during the time of bird nesting activities. Also, monitoring bird/turtle closure areas for seabeach amaranth prior to opening to ORV traffic will protect any plants that exist within these areas. Additionally, where new suitable habitat is created from April 1 to November 30, ORV and pedestrian recreation will be restricted to a corridor within 150 feet of ocean mean tide.

Seabeach amaranth would also benefit from the removal of all individuals of beach vitex (*Vitex rotundifolia)* found in CAHA, as provided for in the preferred alternative. Beach vitex is a recent invasive beach plant in South and North Carolina and grows in similar habitats as *A. pumilus* (Carolina Beach Vitex Task Force 2005). This invasive plant out-competes seabeach amaranth and thus is a threat to coastal dune habitats. Additionally the preferred alternative provides for the removal of webworms before the caterpillars metamorphose on the plants. Particularly in the Carolinas, webworms (caterpillars) can defoliate the plants to the point of killing them or at least preventing reproductive functions. Predation (herbivory) by webworms is a major source of mortality and lowered fecundity in the Carolinas on seabeach amaranth (USFWS 1996).

Currently, CAHA does not implement any education or outreach actions for seabeach amaranth. Under the preferred alternative CAHA will place interpretive signs at all ORV entry points and at CAHA kiosks describing the effects and susceptibility of the plants to pedestrian and ORV use. CAHA will provide public notification of where the ORV/pedestrian corridor restrictions will be implemented, and following the annual August survey, notification will be provided of areas that have been reopened due to lack of plants.

Potential negative impacts to the threatened plant may occur as the proposed alternative does not include targeted monitoring when the seedlings are typically first visible. The surveys for seabeach amaranth would be conducted as ancillary surveys during routine bird and turtle monitoring creating a likelihood that plants germinating outside of an established bird closure or

other area where ORVs are prohibited would not be detected. The preferred alternative also provides for an annual survey of all potential habitats in August to locate and count all plants (except bird closure areas where surveying activity would disturb nesting birds). Individual plants or plant clusters would be recorded as to GPS location, diameter and whether the location is in an area open or closed to recreational use. Prior to opening bird or turtle closures to recreational use, the closed area would be surveyed for the presence of seabeach amaranth. Any plants that are not detected, subsequently identified and protected with symbolic fencing, may be negatively affected by either human or natural disturbances prior to the August survey. Monitoring itself could also result in negative impacts though the burial of seeds or the occasional crushing of newly germinated plants by the monitors.

Establishing 100-foot wide ORV and pedestrian corridors from April 1 – September 30 under the proposed strategy (avian pre-nesting closures) could have direct and indirect negative effects to seabeach amaranth due to the potential for habitat disturbance. Stems of the plant are easily broken or crushed by foot traffic and tires, thus, even minor traffic can be detrimental during the growing season (USFWS 1993). Another impact from ORVs on seeds is burial of the seeds to a depth beyond which they can germinate. In general, ORV traffic occurring during seabeach amaranth's dormant season (Dec. – Apr.) could potentially have some negative impacts, including the pulverization and burial of seeds outside of closures (USFWS 1996). Due to reduced beach widths in some areas of CAHA the 150 foot corridor could potentially encroach on the toe of the primary dunes, increasing the likelihood for disturbance to seeds and or seedlings. Additionally, as seabeach amaranth must recruit annually and seeds can be dispersed long distances via wind and water, potential habitat where the seeds may germinate would not be protected from ORV traffic outside of the 30 foot area closure around the plant, or areas which overlap with nesting closures for protected bird species.

However, in some cases, off-season ORV traffic may provide benefits for seabeach amaranth through the disturbance to perennial grasses and shrubs outside of any bird closures (USFWS 1996). Through this disturbance the ORVs prevent the overwash/sand flat areas from moving through the successional process which could enhance the ability of seabeach amaranth to compete with other plants.

In order to implement the measures identified in the preferred alternative for seabeach amaranth CAHA will train temporary/seasonal staff to identify the plant seedlings, adult plants and beach vitex.

Cumulative Effects:
Any activities that occur within the boundaries of the NPS would require the issuance of a special use permit, a Federal action which would require Section 7 Consultation with the USFWS. Additionally, any special use permit issued by CAHA will comply with and follow the provisions of this Action. Therefore, cumulative effects, which include the effects of future State, local or private actions that are reasonably certain to occur in the Action area, would not be likely due to Federal jurisdiction of all activities within the boundaries of CAHA.

Staffing Training and Qualifications for all Species

A total of 16 seasonal biological technicians/education/outreach specialists (six-month positions) would be trained by 3 permanent biological technicians.

Piping plover training would be completed by March 15 and cover:

1. Knowledge of piping plover biology, behavior and habitats
2. Ability to identify piping plovers in both basic and alternate plumages
3. Ability to identify shorebirds associated with piping plover
4. Ability to identify potential predators, their tracks and evidence of predation
5. Experience in using field binoculars, spotting scope and GPS unit
6. Ability to collect clear, comprehensive data
7. Ability to communicate with public
8. Ability to perform physical work under adverse environmental conditions such as heat, humidity
9. Ability to hike up to two miles in the sand carrying approximately 20 pounds

Sea turtle training by May 15 and cover:

1. Knowledge of NC Handbook for Sea Turtle Volunteers
2. Ability to identify sea turtle species
3. Ability to differentiate between aborted nesting attempts and nests
4. Ability to collect clear, comprehensive data
5. Ability to use GPS equipment
6. Ability to communicate with public
7. Ability to perform physical work under adverse environmental conditions such as heat, humidity

Amaranth training by June 15 and cover:

1. Ability to identify sea beach amaranth
2. Ability to identify beach vitex
3. Ability to use GPS equipment
4. Ability to communicate to public
5. Ability to hike up to 5 miles in sand carrying approximately 10 pounds
6. Ability to perform physical work under adverse environmental conditions such as heat and humidity

Predator Management Assessment for Protected Species

Under current management USDA staff will trap potential mammalian predators using humane trapping techniques. Red fox are targeted but grey fox, raccoon, opossum, and feral cat have also been trapped. This occurs two times per year for 20 days total. Under the proposed strategy, this beneficial program will continue if funding is available. Funds have been identified for an Environmental Assessment for a Comprehensive Predator Management Plan at the Seashore.

Compliance

In FY 2006 and beyond, there will be an increase of three permanent law enforcement positions over that which existed in FY 2005. It is planned that law enforcement staff activities will be directed to appropriate protected species projects which will have beneficial impacts on the

species. Impacts will likely be adverse in the event that other emergency or enforcement situations must be attended to during this high visitation period. It is the responsibility of the Superintendent and law enforcement managers to direct their resources where most needed depending on circumstances. If, and when this occurs, law enforcement staff may not be able to dedicate as much time to species protection.

CONSERVATION MEASURES

The following conservation measures are actions that when implemented would result in reducing or avoiding adverse effects to and incidental take of listed species. These resource protection strategies would be implemented to provide an effective monitoring and management program under the Action. Additionally, information generated from the research studies and monitoring can be used in the development of the long term ORV Management Plan.

Piping Plover

The following actions will be implemented:

- Monitor abundance and distribution of known wintering plovers through specific winter surveys.
- Identify how young and adult plovers utilize nesting and feeding habitat (breeding, migration, and winter seasons) through monitoring and collecting data on the frequency of feeding and distances traveled from nests to foraging areas.
- Determine survival rates of young in nest, post-fledged, immature, and adult birds.
- Provide monitoring data to the USFWS so that the information may be combined with data from other monitoring efforts to determine the significance of CAHA breeding or wintering population segments to the state, region (middle Atlantic coast), or Atlantic coast wide population changes and trends.
- Document the levels of ORV, pedestrian traffic, and leashed and unleashed pets in piping plover habitat.
- Monitor plover breeding activities at nesting sites to identify factors that may be limiting abundance of nesting plovers and/or productivity.
- Monitor the presence of mammalian and avian predators and evaluate the effectiveness and costs of various trapping methods.

On going studies which will continue at CAHA:

- "Wintering Piping Plover Habitat Use Near Barrier Islands" conducted by Dr. James Fraser, VA Tech. The study will investigate effects to piping plovers from inlet maintenance activities conducted by the U.S. Corps of Engineers, which have the potential to modify nesting, roosting and foraging habitats used by plovers at CAHA.

- "Monitoring and Management of American Oystercatcher on Cape Hatteras National Seashore" conducted by Dr. Ted Simons and Shiloh Shulte, Cooperative

Research Group, North Carolina State University. The study will monitor plover nesting and chick success/survival and document unfledged chick behavior.

- "The Effects of Off-Road Vehicles on the Nesting Activity of the Loggerhead Turtle" conducted by Lindsay Nester, University of Florida. The study will investigate possible differences between nest laying and nesting success of loggerhead sea turtles on sites which have ORV use and ORV-free nesting sites.

Funds will be sought to provide for intensive research studies and surveys will be developed and implemented to address the following issues relative to the piping plover:

- Identify factors limiting the quantity and quality of habitat or its use by piping plovers at specific wintering sites. Collect information which characterizes wintering plover foraging and roosting habitat and determine level of site fidelity by birds.
- Identify factors which limit the size and distribution of breeding and nonbreeding populations.
- Survey to determine the responses of plovers to recreational disturbances (pedestrians, dogs, ORVs, etc.) both day and night and document flushing distances caused by the disturbance.

Seabeach Amaranth

The following actions will be implemented:

- Document population sizes of seabeach amaranth in areas where beach nourishment and or beach stabilization has occurred, compared to sites which have not been impacted.

Funds will be sought to provide for intensive research studies and surveys will be developed and implemented to address the following issues relative to seabeach amaranth:

- Conduct surveys to determine the effects of off-season pedestrian and ORV traffic on *A. pumilus* seeds.
- Identify factors limiting seed and seedling success by conducting survivorship studies on seedlings found or planted on CAHA beaches. Such work could identify the most critical phase of the species life-history and limiting factors. This could be complemented with studies that examine natural seed storage, viability and long distance transport.
- Establish a long-term amaranth population monitoring program to determine and assess effects of both natural and human disturbances to the species at CAHA.

Sea Turtles

The following actions will be implemented:

- Establish surveys and monitoring regimes for recording levels of nighttime driving on the beach. The surveys and monitoring will provide information to determine the

level of visitor use and possible impacts to sea turtles and shorebirds. Monitor and record the number of ORVs on CAHA beach during sea turtle nesting season to determine if night time driving prohibitions may be warranted in the long term ORV Management Plan.

- Support ongoing research efforts to determine the sex ratio of turtles at CAHA and the influences of temperature to sex determinations of hatchlings.
- Compare CAHA sea turtle sex ratios to Pea Island National Wildlife Refuge (ongoing study by USFWS) and/or to nearby dredged islands, including beach temperatures and compaction of sand which influence sex determination. Recent studies by South Carolina Department of Natural Resources show that cool beaches like those in North and South Carolina are more likely to produce male sea turtles while warmer beaches like those in Florida produce more females, since sex is determined by the temperature at which eggs are incubated. Thus, for populations that are threatened or endangered like those species occurring at CAHA, it is of critical importance to know the male and female production in order to be able to model and understand long-term population recovery prospects.
- Assess the number of nesting females and their reproductive success so that the current contribution of CAHA to regional population dynamics can be better understood, since CAHA is at or near the northern limit of the breeding range for all three species of sea turtle that nest there.
- Analyze the backlog of data collected by CAHA on occurrences and locations of false crawls by all species of sea turtles.
- Monitor and document the presence of potential predators and their tracks or burrows (mammalian, avian and ghost crabs) at sea turtle nest sites.

Funds will be sought to provide for intensive research studies and surveys will be developed and implemented to address the following issues relative sea turtles:

- Survey additional observations of plovers or other shorebirds being attracted to lights from night driving.
- Monitor and document the proportion of closure violations that occur by pedestrians and ORVs between sundown and sunrise on CAHA beaches.
- How much ORV and pedestrian traffic occurs in turtle nesting habitat at CAHA, and how does this differ between day and night.
- Determine the effect of recreation on detectability of turtle crawls through monitoring during nesting season by all species of sea turtles.
- Survey and collect data on the impact of ghost crabs on emerging hatchlings at CAHA. Compare and investigate the density of effects in ORV use areas to sites which are ORV–free areas. Determine if there is a change in ghost crab demographics caused by ORV driving.
- Monitor and determine impacts (if any) of filter (silt) fencing on sea turtle hatchlings. Previous monitoring at CAHA has indicated that hatchlings get caught in the fibers or material of fencing. Additionally, determine if the presence or particular placement of the cloth cause potential problems with predators by eliminating escape routes.

Protection of Habitat Created as a Result of Storms and Other Natural Processes

Overwash and breach-created landscape features are a normal part of the barrier-island system, but armoring or renourishing the shoreline and filling or stabilizing inlets to protect human structures is a common practice that prevents such features from forming and alters patterns of vegetative succession (Dolan *et al*. 1973). Piping plovers and other species may exhibit preference for such dynamic features for roosting, nesting, and foraging, and hindering their formation may indirectly effect a local population by decreasing the carrying capacity of the landscape for these animals (Goldin and Regosin 1998, Nicholls and Baldassarre 1990, Elias *et al*. 2000, Cohen 2005). Therefore, CAHA will allow natural processes to occur unimpeded whenever feasible. Newly-created inlets and overwash areas will be assessed to determine whether alteration of the habitat would lead to effects on plovers or their prey in the present or future.

SUMMARY EFFECT DETERMINATION

This assessment has examined the potential impacts of the proposed project on the habitat and listed species of plants and animals that are, or have been, present in the project area. Both direct and indirect impacts have been considered. The designation of critical habitat for wintering plovers at CAHA (Oregon Inlet, Cape Point, Hatteras Inlet, and Ocracoke Island) made in 2001 has been vacated due to a recent court decision and critical habitat has not been designated for any of the three listed sea turtles occurring at CAHA or for seabeach amaranth. Therefore no critical habitat will be affected by the proposed Action.

Based on this analysis, the following effects determinations have been made for each federally listed species found at CAHA.

- It has been determined that the proposed project will result in a may affect, likely to adversely affect the piping plover.
- It has been determined that the proposed project will result in a may affect, likely to adversely affect the three species of sea turtles.
- It has been determined that the proposed project will result in a may affect, likely to adversely affect the seabeach amaranth.

OTHER SPECIES OF CONCERN ON CAHA

Colonial Nesting Birds

It is the policy of the NPS to inventory, monitor and manage state listed species in a manner similar to its treatment of federally listed species, to the greatest extent possible. The Outer Banks region of North Carolina supports a large number of colonial waterbird species that depend upon its extensive sounds and the near-ocean waters for feeding, and relatively undisturbed islands (or portions thereof) for nesting. Many species of waterbirds are in jeopardy in the State (Parnell et al. 1977). Reasons for this are many: predation increases by mammals; competition with, and predation by, large gulls, especially herring gulls, *Larus argentatus;* human development; beach stabilization; and recreational disturbances on the outer beaches

(especially CAHA and villages north, as well as extreme southern North Carolina in the Wilmington region), and perhaps mortality on the wintering grounds (Parnell et al. 1977 and 1995).

The colonially nesting species of most concern for CAHA include: gull-billed terns, *Sterna nilotica,* common terns, *S. hirundo,* least terns, *S. antillarum,* and black skimmers, *Rynchops niger*. Gull-billed terns are considered to be "Threatened" in North Carolina, while the other three are considered "Species of special concern" by the NCWRC (fide D. H. Allen, NCWRC). Numbers of most breeding birds within North Carolina have declined over the past 20-30 years for all of these species. During the period 1977 to 2004, Gull-billed terns declined from approximately 268 to only 99 pairs, common terns from 2760 to only 570 pairs, and black skimmers from 976 to 623 pairs; however, least terns increased from 1925 to 2408 pairs in the same period (NCWRC database, fide D. Allen).

Overall trends in populations of colonial beach nesting water birds have seen a decline in North Carolina and at CAHA. Colonial waterbird nest numbers naturally fluctuate between years however there is a clear decline in beach nesting species in North Carolina over the past 28 years (Table 10). CAHA beaches are important in providing suitable habitat for these species. In 2004, over half of all nesting Black Skimmers and Common Terns in North Carolina were found in the Seashore as well as one third of the state's Gull-billed Terns (Cameron 2004). Within the Seashore, 31 Gull-billed Tern nests were recorded in 2004, representing a 23% decline from the park's long term average (Table 11). A total of 376 Common Tern nests were found in 2004, representing a 27% decline from the park's long term average. Least tern numbers have sharply declined in CAHA, with only 212 nests counted in 2004. This is a 37% decline from the average. Only Black Skimmer nest numbers increased in 2004. The 342 nests counted reflect a 40% rise above the Park's average.

Gull-billed terns are usually found nesting among other tern species on open, sandy-shell beaches, either on large barrier islands or on islands created from dredged material (Parnell et al. 1995). Like piping plovers, they often occur on overwash fans that are shelly and mostly devoid of vegetation. They also occur on elevated shell ridges ("rakes") along the edges of marsh islands from Virginia to South Carolina (Erwin et al. 1998b), which they share with American oystercatchers (*Haematopus palliates*) and common terns.

Gull-billed terns are somewhat unusual among terns in not specializing on fishes. Instead, they are opportunistic, taking insects on the wing, feeding on a variety of invertebrates including fiddler crabs (*Uca pugnax*), decapods, marine worms, clams, as well as small marsh fishes (Erwin et al. 1998*b*). As a result of their opportunism, this species feeds over marshes, creeks, along the ocean and bay beach edges near its colony sites, as well as over agricultural fields sometimes several km from the nesting site.

On migration, little is known of roost habitat use, except that it generally is considered similar to those used during nesting, i.e., open beaches and sand spits along the coast (Parnell et al. 1995). Large staging concentrations have not been mentioned as for other species.

Table 10. Colonial waterbird nests North Carolina (1977 – 2004)

Species	1977	1983	1988	1993	1995	1997	1999	2001	2004	Average
Least tern	1925	1653	1528	2188	1992	882	1271	1742	2408	1732
Common tern	2761	2247	2618	2122	1699	952	888	1131	570	1665
Gull-billed tern	268	233	161	155	249	137	154	258	99	190
Forster's tern	1138	936	933	1660	1117	867	812	1086	828	1042
Black Skimmer	976	797	743	1084	819	570	681	594	623	765
Total	**7068**	**5866**	**5983**	**7209**	**5876**	**3408**	**3806**	**4811**	**4528**	**5394**

Compiled by North Carolina Wildlife Resources Commission

Table 11. Colonial waterbird nests at CAHA (1977 – 2004)

Species	1977*	1983*	1988*	1992*	1993*	1995	1997	1998	1999	2000	2001	2004	Avg
Least tern	121	508	450	454	761	342	278	173	355	184	202	212	337
Common tern	802	763	678	278	422	503	718	715	440	129	573**	376	533
Gull-billed trn	27	7	26	0	12	58	84	21	103	3	108	31	40
Forster's tern	382	63	0	0	0	31	0	0	0	0	0	0	40
Blk Skimmer	286	296	144	30	226	139	454	366	306	149	193	342	244
Sooty tern					1								1
Total	**695**	**366**	**170**	**30**	**239**	**228**	**538**	**387**	**409**	**152**	**1076****	**373**	

*Surveys conducted by J. Parnell, University of North Carolina, Wilmington

**Updated from 2001 report to include nests found on Green Is at Oregon Inlet which is now included in CAHA boundary

Common terns are one of the more widespread terns of the world, thus are considered generalists in many of their life history attributes, including nesting habitats. They nest mostly on open, sandy-shell beaches on ocean coastal islands, as well as at inland island sites in freshwater lakes, or in Europe, in rivers (Nisbet 2002). They are also known to nest in salt marshes along the coast, either on shell or on wrack, especially where human disturbance along the beaches is significant (Erwin 1980). They seem to tolerate sparse vegetation at nesting sites more so than do their colony associates, black skimmers and gull-billed terns (Burger and Gochfeld 1990). Nest substrates vary from sand and shell to wrack or salt marsh vegetation, and even some manmade structures such as old piers or channel markers (Burger and Gochfeld 1990).

Common terns typically prey on small fishes and shrimp, often within several km of their breeding colonies (Nisbet 2002). They feed in flocks in inlets and where tidal convergences

occur along the coast, usually < 1 km from shore, but in inland freshwater areas, may be solitary feeders (Nisbet 2002).

Common terns migrate through North Carolina in late August – October, with little information on habitat use. Most feeding continues to be close to shore, and staging areas are known at large sandy spits and bars at a number of North Atlantic sites with concentrations in thousands at some places (Nisbet 2002). In winter, birds migrate to the Caribbean and South America where they seem to concentrate in large numbers in coastal lagoons in Brazil and Argentina (Nisbet 2002).

Least terns are widespread in North America, and are more specialized in their nesting habitat than are common terns. Their nesting substrate is often the most bare sand-shell areas on coastal islands, or on riverine islands in the interior of the U.S. (Thompson et al. 1997). They are commonly also found nesting on dredged material islands and also on rooftops in a number of coastal areas, where pea gravel is used as part of the roofing material (Thompson et al. 1997). On coastal barrier islands, they often select colony sites either adjacent to inlets or in overwash areas, often interspersed among piping plover (*Charadrius melodus*) nests. Unlike the other Atlantic coastal tern species, least terns are usually found in monospecific colonies, often relatively small (< 100 pairs) in size. Their nests are often widely spaced as well (Thompson et al. 1997). These adaptations are probably a response to ground predation.

In a manner similar to common terns, least terns feed on small surface fishes and shrimp from estuarine marshes, in lagoons, and along the ocean coast, usually within several km of the nesting colony (Thompson et al. 1997). Unlike common terns, they seldom are found feeding in large flocks over shoals of baitfish.

Least terns migrate from the mid Atlantic region, usually in August or September, with distinct migration flocks forming at certain sandy island sites along the route (Thompson et al. 1997). It is unclear whether they form mixed species flocks with other terns in migration. In late July or August, remote sandbars or sandy spits serve as roost sites. The species winters from Florida through the Caribbean, and into Central and South America (Thompson et al. 1997).

Skimmers prefer open, sandy habitats on barrier islands and dredged material islands along the coasts of the U.S. (Gochfeld and Burger 1994). They may often be found in the shell-sand areas at the tips of barrier islands, or even on large shoals in inlets. They are almost always nesting in association with other tern species along the Atlantic Coast (Erwin 1977). With common terns, they are often found nesting in the open patches of the colony, with common tern nests more closely associated with vegetation (Erwin 1977). On occasion, skimmers may also nest on wrack or on shell ridges in lagoonal salt marsh complexes along the Atlantic and Gulf Coasts, and even on rooftops along with least terns (see above) (Gochfeld and Burger 1994).

Black skimmers usually feed very close to their nesting colonies (Erwin 1977), and prefer quiet waters in salt marsh creeks, along lagoon edges, or along barrier islands in protected coves and inlets (Gochfeld and Burger 1994). Like terns, they feed on small fishes of many species, small shrimp, and other small invertebrates that they capture by skimming the surface.

Black skimmers migrate from the mid Atlantic region from September to November, with very large concentrations on sandy spits and sandbars in North Carolina in late fall some years (Gochfeld and Burger 1994), and probably roost with terns at these isolated sites, but few data are available. Birds winter from Florida through the Caribbean and South America (Erwin 1990, Gochfeld and Burger 1994).

During the breeding season, spring storms and high tides often cause flooding of nesting areas for all these ground-nesting seabirds (e.g., common terns, see Burger and Gochfeld 1991, Nisbet 2002). Further, sea-level rise threatens the long-range prospects for barrier island and marsh-nesting species (Reid and Trexler 1992, Erwin et al. in press), and some models predict more frequent and severe storms in the future along the Atlantic Coast (Intergovernmental Panel on Climate Change 2001).

Along many coastal beaches, direct effects by ground predators such as foxes (*Vulpes vulpes),* raccoons (*Procyon lotor*), rats (*Rattus norvegicus*) and feral cats (*Felis domesticus*) have increased in recent years as human populations have grown in coastal regions (Buckley and Buckley 1976, Erwin et al. 2001). The result has been poor reproduction or major redistributions of species (Erwin et al. 2001). In addition, gulls are often predators on terns as well as competitors for nesting space (e.g., see Nisbet 2002 and references therein for common terns); this includes great black-backed gulls (*Larus marinus*), herring gulls, and the smaller laughing gull *(L. atricilla*). In addition, in certain areas, other avian species may prey on terns and skimmers (or their eggs), such as peregrine falcons (*Falco peregrinus*), great horned owls (*Bubo virginianus*), fish crows (*Corvus ossifragus*) and others.

As ground-nesting species, these colonial species are especially vulnerable to direct human activities such as ORVs, aircraft disturbances, pedestrians – beachcombers, photographers, scientists, and even poachers (Buckley and Buckley 1976, Erwin 1980). Vandalism is rare in the United States, however, the unintentional mortality induced by ORVs may be more common than realized as crushed young often go undetected (P.A. Buckley, pers. comm.., R. Cook, pers. comm., B. Blodget, pers. comm.). Indirect effects include such factors as sonic booms from nearby military operations, the presence of pets (both domestic and feral), leaving garbage as attractants (bringing in crows and gulls), and the spread of commensal predatory mammals such as raccoons and rats (see above). Even modest disturbances early in the spring, when birds are first arriving and prospecting for breeding sites, can be highly disruptive to colonial species (see Buckley and Buckley 1976 for a detailed list of disturbances encountered in Atlantic coastal regions).

Unlike foraging habitats of shorebirds, the habitats of feeding terns and black skimmers are not contiguous with their breeding areas. Least terns, common terns, and black skimmers usually feed from 1-10 km from their nesting colonies in shallow waters (Erwin 1978, Burger and Gochfeld 1990), while gull-billed terns feed on invertebrates primarily in marshes and over upland habitats (Parnell et al. 1995). Few data are available on trends in either forage fish populations in coastal waters, or on invertebrates to indicate whether there are current threats to foraging habitats. The effects of major hurricanes (e.g., Floyd in 1999) caused major declines in water conditions and marine life throughout Pamlico Sound in North Carolina for an extended period, as numerous animal waste facility dikes failed (Mallin 2000).

Management for colonial waterbirds at CAHA has focused in the past on reducing the threats to nesting colonies. The general approach to protect all the beach-nesting birds and sea turtles has been to create a 150 ft corridor for ORV and pedestrian traffic from the high tide line landward. ORVs may drive or park within the corridor. Pedestrians, but not pets, may cross the corridor boundary lines, except where there are specific resource closure designations. Areas with nesting birds receive resource closures using signs. When young hatch, sections of the entire beach from the water line to the dunes are closed to prevent direct mortality of chicks. In addition to management of ORVs and beach recreationists, mammalian predator control is also an ongoing management tool. Control of foxes, feral cats, raccoons, opossums, and skunks has been applied at Bodie, Hatteras, and Ocracoke islands.

In 2005, increased management measures were attempted in a number of areas of CAHA. At Bodie Island, there was a narrowing of the corridor near the inlet, and much of the interior of the spit was closed including the cove area. Ponds near the inlet are important bird resource areas and were thus off limits. At Green Island, with cooperation from the NCWRC, closure signs were posted early in the season around the perimeter to protect the island for colonial waterbirds and American Oystercatchers. At Hatteras Island, an area of about 3 acres was closed around ephemeral ponds at Cape Point where terns and black skimmers nested. Along South Beach on Hatteras, the upper beach was closed for about 1.5 km to protect nesting American Oystercatchers, which could also indirectly benefit least terns. At Hatteras Spit, an experimental escort program with bird monitors was attempted, resulting in employing additional law enforcement personnel. This was enacted largely to protect piping plovers and oystercatchers nesting on the Spit. From 7:00 a.m. to 7:00 p.m., ORVs were allowed in the ORV corridor once per hour in convoys escorted by monitors. The area was closed during the night. At North Ocracoke, there was little sign of bird activity; therefore no additional closure was needed. At South Ocracoke, the ORV corridor was narrowed in one area to protect an intertidal zone where piping plovers had been observed feeding. ORVs were permitted to drive past the protected area in the backshore, but were restricted from the shore of Pamlico Sound.

Little management is currently done during the critical stages of colony site prospecting and establishment, a sensitive period for colonial species as well as all bird species. Restrictions apply only when a colony is established. CAHA has a leash law for dogs but it is difficult to enforce. There are no regulations regarding kite flying. With more than 100 km of beach to patrol, 24-hour access for recreation, no ORV permit system, and limited enforcement and resource management personnel, effective monitoring of important biological resources is strongly compromised. However, the management actions that will be implemented to protect plovers, sea turtles and/or seabeach amaranth will also improve and protect colonial waterbirds.

American Oystercatcher

The *U.S. Shorebird Conservation Plan* designates the American Oystercatcher as a "Species of High Concern" due to low relative abundance, threats to its breeding and non-breeding grounds, and its rather restricted non-breeding distribution (USFWS 2001). The Outer Banks region of North Carolina supports approximately 90 breeding pairs of American Oystercatchers (Simon et al. 2004), along 160 km of beach, of an estimated 327 pairs surveyed in the state (Cameron and

Allen 2004). Oystercatcher breeding success in North Carolina has been extremely low — one egg in 32 hatches statewide (Davis et al. 2001). At the Seashore since the 1990s, oystercatchers have sustained declines in breeding pairs e.g., on Hatteras Island nesting pairs declined from 24 to 15 from 1999 to 2004 (Simon et al. 2004).

Reproductive success for CAHA has been very low (<0.1 fledged per breeding pair) and sporadic depending on years and locations; however, some signs of successful reproduction have been noted at Cape Lookout National Seashore (just south of CAHA) on North Core and Middle Core Banks in 2004 (Simon et al. 2004). For CAHA, overall trends indicate that American Oystercatcher nesting attempts could decline to a scattered few per island per year (<5) in less than a decade.

Threats to nesting oystercatchers on CAHA are numerous and inter-related, but more than 51% of nest losses are from undetermined causes, which does not allow managers to correct the problem (Simons et al. 2004). Major causes of known nest failures (<49% of nesting attempts) are mammalian predation (60%), overwash (25%), avian predation (5%), abandonment (5%, possibly another cause), humans (3%), ORVs (<2%), and ghost crabs (<2%) (Simon et al. 2004). Sabine (2005) found strong associations with significantly reduced oystercatcher reproductive success/high predation and high levels of human disturbances on Cumberland Island National Seashore. Others have found reduced foraging for European oystercatchers in areas disturbed by humans (Verhulst et al. 2001). In other countries similar relationships have been found (to quote Sabine, 2005): "Human activities reduced reproductive success and influenced geographical distribution of African Black Oystercatchers (*H. moquini*) in South Africa). Human disturbance and use of coastal areas have been implicated as primary causes of the extinction of the Canarian Black Oystercatcher (*H. meadewaldoi*)."

Oystercatchers build nests near or on the beach by scraping many shallow depressions in the sand (4−6 cm deep and 20 cm in dia.) in close proximity, but choose only one scrape to build a nest. Oystercatchers also build nests on sand and shell flats, marsh islands, and dredge spoil islands (Nol and Humphrey 1994, McGowan et al. 2005). The nest may contain shell fragments, dead plants, small stones, and other debris (Baicich and Harrison 1997). In North Carolina, nests are rarely more than 21−32 m from water (Lauro and Burger 1989 in Nol and Humphrey 1994) and are often on a mound, which serves as a lookout for the birds (Baicich and Harrison 1997). Colonial waterbirds (e.g., Common Tern, *Sterna hirundo*; Least Tern, *S. antillarum*; and Black Skimmer, *Rynchops niger*) often nest in American Oystercatcher territories after oystercatchers begin nesting. Primarily monogamous, American Oystercatchers may mate for life although few long term records exist (Palmer 1967 in Nol and Humphrey 1994).

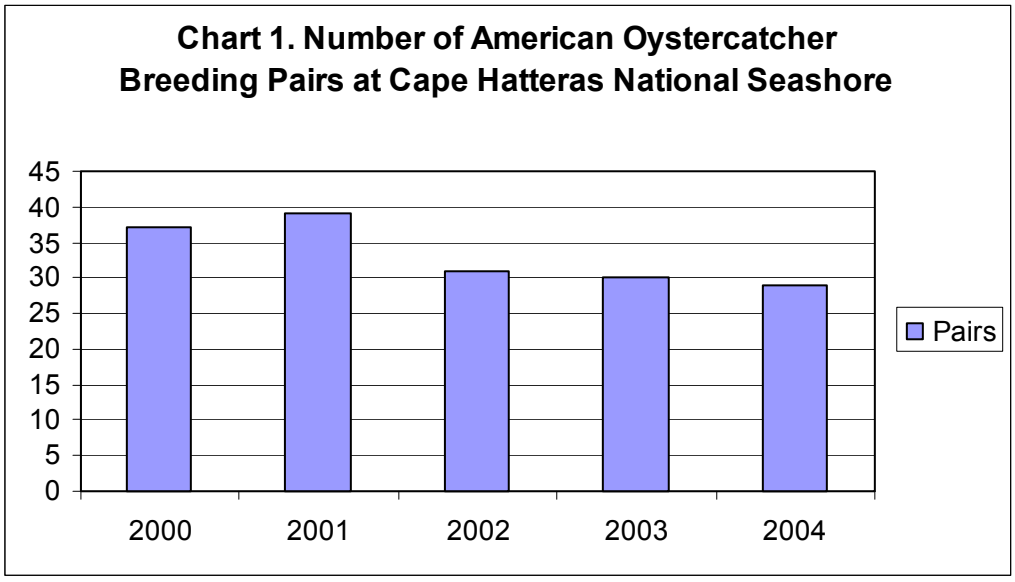
Oystercatchers inhabit marine environments because of their special adaptation – a knife-like bill (laterally compressed) − for feeding on bivalve mollusks from saltwater. During breeding from March to August, pairs can be located along the Atlantic coast from Boston south to Indian River County, Florida. In late February and early March, pair formation and nesting begins in dunes near the beach wrack, but also occurs on dredge spoils and oyster bars in salt marshes in more human-disturbed beach areas. Beach nesting habitats are flat, nearly open sand areas with sparse to no vegetation. In North Carolina, oystercatchers rarely nest on marsh islands and commonly prefer nesting on high sandy sites (Lauro and Berger 1989 in Nol and Humphrey 1994). Marsh

islands may become more common nesting habitat because of disturbances on beaches, but more research is needed (McGowan et al. 2005).

Breeding pairs roost on the edge of intertidal feeding areas. Oystercatchers are more common in areas with few predators, especially areas without domestic dogs and cats (Nol and Humphrey 1994). In North Carolina, winter and migratory roosting habitats should be similar to breeding and roosting habitats, i.e., predator-free islands (e.g., dredge spoil islands) and other isolated habitats near foraging habitat. There is inadequate information in North Carolina on preferred roosting habitat during winter and especially during migration. Limited observations indicate that winter birds roost in open ground without vegetation in areas near foraging habitat (Tomkins 1954). This information is critical because peak wintering oystercatcher populations occur in Virginia, North Carolina, and South Carolina (Nol and Humphrey 1994).

In 2004 29 pairs of oystercatchers were documented at CAHA (Figure 11). This was one pair less than found in 2003 and represents a 29% decline in breeding pairs since monitoring began in 1999. Of the 39 nests located in 2004, 23 nests (59%) were known to have hatched and 15 nests (38%) were known to be unsuccessful. The success of one nest (3%) located on Green Island, a shoal in Oregon Inlet, was unknown (Sayles and Lyons 2004). According to the 2004 survey conducted by CAHA, of the 47 chicks produced, 19 (40%) are known to have reached fledgling age (Figure 12). The fate of one of the Green Island chicks remains unknown. Overall productivity was 0.66 fledglings per breeding pair, the highest on record (Sayles and Lyons 2004).

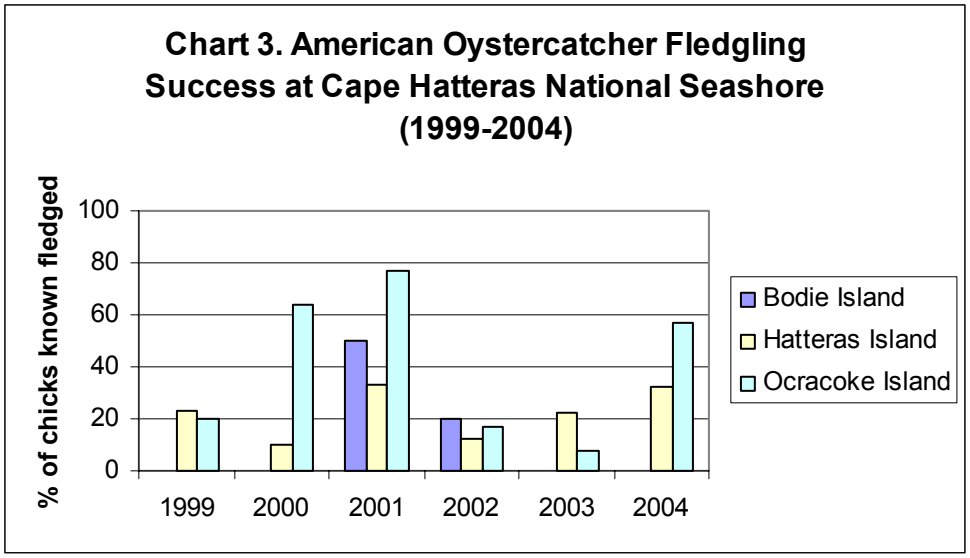
Figure 11. Breeding pairs of American Oystercatcher at Cape Hattteras National Seashore between 2000 and 2004.



Current and future threats to the American Oystercatcher are increasing predators, especially associated with human use, development of coastal areas, and human disturbance within

important breeding, wintering, and migratory habitat (Bent 1929, Tomkins 1954, Nol and Humphrey 1994). Predators include red fox (*Vulpes vulpes*), mink (*Mustela vision*), skunk (*Mephitis mephitis*), dogs, cats, rats (*Rattus rattus, R. norvegicus*), American Crow (*Corvus brachyrynnchos*), and gulls (Nol and Humphrey 1994). More recently, video nest recordings have documented raccoon (*Procyon lotor*), bobcat (*Lynx rufus*), and ghost crab (*Ocypode quadratus*) predation of oystercatcher eggs and nestlings (Sabine et al. 2005). Oystercatchers may lay another clutch if predators depredate their nests early in the season (Nol and Humphrey 1994). Storms and high tides also reduce nesting success; sea level rise of 0.3–0.6 m in the next 50 to 100 years will reduce nesting success of shorebirds because of human development on suitable habitat created further inland (Titus 1990, Pilkey 2004).

Figure 12. American Oystercatcher Fledgling Success at Cape Hatteras National Seashore between 1999 and 2004.



Management at CAHA has focused on reducing threats to nesting oystercatchers. Beginning in 2004, the approach to protect all beach-nesting birds and sea turtles has been to create a 150 ft transportation corridor for ORVs and pedestrian traffic from the high tide line landward. ORVs may drive or park within the corridor. Pedestrians, but not pets, may cross the corridor boundary (inland), except where designated as specific natural resource closures. CAHA staff post and close traditional areas of nesting oystercatchers using signs and symbolic fencing, beginning in April, although March is the time for oystercatcher territorial establishment in North Carolina. CAHA staff post additional sites with solitary-nesting birds when territories are established (dates unknown). When young hatch, sections of the entire beach from the water line to the dunes are closed to prevent direct mortality of chicks. In addition to management of ORVs and beach recreationists, mammalian predator control is also an ongoing management tool. Control of foxes, feral cats, raccoons, opossums, and skunks has been applied at Bodie, Hatteras, and Ocracoke islands.

In 2005, additional management measures were attempted in a number of areas of CAHA. At Green Island, with cooperation from the NCWRC, closure signs were posted early in the season

around the perimeter to protect the island for colonial waterbirds and American Oystercatchers. Oystercatchers nested on Green Island in 2005. At Hatteras Island, an area of about 3 acres (2 ha) was closed around ephemeral ponds at Cape Point where terns, Black Skimmers, and one oystercatcher pair nested. Along South Beach on Hatteras, the upper beach was closed for about 1.5 km to protect nesting American Oystercatchers (3 nested). At Hatteras Spit, an experimental escort program with bird monitors was attempted, resulting in employing additional law enforcement personnel. This was enacted largely to protect Piping Plovers and oystercatchers nesting on the Spit. From 7:00 p.m. to 7:00 p.m., ORVs were allowed in the ORV corridor once per hour in convoys escorted by monitors. The area was closed during the night. At North Ocracoke, there was little sign of bird activity, therefore no additional closure was needed. At South Ocracoke, the 150-ft ORV corridor was narrowed in one area to protect an intertidal zone where Piping Plovers had been observed feeding. Three oystercatchers nested at South Ocracoke in 2005 within an existing closure area. ORVs were permitted to drive past the protected area in the backshore, but were restricted from the shore of Pamlico Sound.

People management and public education is needed during the critical stages of territorial establishment, nesting, and rearing of chicks for oystercatchers, which is a sensitive period for the birds.

Wilson's Plover

The *U.S. Shorebird Conservation Plan* designates the Wilson's plover as a "Species of High Concern" due to low relative abundance, threats to its breeding and non-breeding grounds, and breeding distribution. The Wilson's plover (*Charadrius wilsonia*) is a medium-sized (16.5-20 cm, 55-70 g) plover of coastal habitats. It breeds along the Atlantic coast from Virginia south to the Florida Keys and along the Gulf Coast. On the Pacific coast it breeds from Baja California down south into Central America. Wilson's plover nest on sparsely vegetated saline areas, including beaches above high tide line, overwash fans, sand flats, dune areas, edges of lagoons, and dredge spoil islands. Nests are scrapes in the sand with typically 3 egg clutches. Egg laying begins in mid April and continues through June. The birds may re-nest if the first nest fails and exhibit territorial behavior during the nesting season. They are unique in that they engage in group defense of their nesting areas. The chicks are precocial, feeding and moving themselves hours after hatching. Adults and chicks feed on crustaceans and insects in the coastal environment (Corbat and Bergstrom 2000)

The state of North Carolina coastal environment supported approximately 232 pairs of Wilson's plover in 2004 (Cameron 2004). At CAHA little is known about the status of the Wilson's plover and little attention has been giving to the bird. Scattered sightings have been reported over the years. In 1995 a single bird was reported at Cape Point (Lyons, 2005 pers.comm). More recently in 2003 two pairs and two nests were recorded at Ocracoke Island spit (Lyons, 2003). In 2004 two pairs were again reported at Ocracoke Island spit (Cameron 2004). In 2005 one pair displaying courtship behavior was sighted at Hatteras Inlet spit (Suiter and Rabon, 2005 pers. comm.). On Ocracoke Island in 2005 a single adult was spotted on the north end of the island and one pair was recorded at the south spit (Altman, 2005 pers. comm.).

Loss of beach habitat and disturbance to nesting areas are the primary threats to the species (Corbat and Bergstrom 2000). In 2004 in North Carolina most Wilson's Plovers (87%) were found nesting on barrier islands in early successional habitat on beaches. Undeveloped beaches including CAHA and CALO supported 63% of the Wilson's plovers in the state (Cameron 2004). Wilson's plover are subject to disturbance at nest sites by beachgoers, pets, and ORV traffic on beaches. Wilson's plovers leave their nests and/or chicks when disturbed and are cautious to return when intruders are near. This exposes eggs and chicks to predation (Corbat and Bergstrom 2000). Predators at CAHA include red foxs, feral cats, raccoons, and ghost crabs.

Red Knot

The red knot is a large, bulky sandpiper (23-25cm, 135g) and one of the most colorful. Its red head, neck and breast in breeding plumage make it easily distinguishable. Winter plumage is plain grey above and dull white underparts. This shorebird makes one of the longest yearly migrations of any bird traveling 15,000 km from its Artic breeding grounds to Tierra del Fuego in southern South America (Harrington, 2001). The *United States Shorebird Conservation Plan* (USFWS 2001) has listed the red knot as a "Species of High Concern", due to populations declining in recent years (Brown, Hickey, Harrington, and Gill, 2001). More recently (July, 28 2005) wildlife conservation groups have filed an emergency petitioned asking the Secretary of the Department of the Interior to list the red knot as endangered.

The Outer Banks of North Carolina serves as a critical link in the migratory path of several shorebird species. The red knot (*Calidris canutus*) is present all year at CAHA but peak numbers are recorded during the spring migration in May and June. In a 1992 and 1993 shorebird study most red knots were seen around Ocracoke Inlet, North Core Banks (65% of total) and Ocracoke Island (28% of total) (Collazo, Parnell, and Walters, 1995). Data collected by CAHA staff and volunteers for the Manomet Center for Conservation Sciences International Shorebird Surveys from 2001 to 2004 supports the above mentioned study. Surveys were conducted for spring migration from April 1 to June 10 and for autumn migration from July 11 to October 31. Surveys were accomplished at ten day intervals when possible on ocean beaches. At the Bodie Island survey site (from ramp 1 to Oregon Inlet) red knot numbers ranged from 0 to 114 birds. The 114 red knots were recorded on May 25, 2003. At the Hatteras Island survey site (from ramp 44 to ramp 49) red knot numbers ranged from 0 to 475 birds. The 475 birds were recorded on April 25, 2003. At the Ocracoke Island survey site (from ramp 59 to 5 miles south) red knot numbers ranged from 0 to 543 birds. The 534 birds were recorded on May 17, 2002.

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APPENDIX A

INTERIM PROTECTED SPECIES MANAGEMENT STRATEGY

DESCRIPTION OF ACTION

The Action addresses the following species:

- federally threatened piping plover (*Charadrius melodus*)
- federally listed sea turtles:

  threatened loggerhead (*Caretta caretta*)

  threatened green turtle (*Chelonia mydas*)

  endangered leatherback turtle (*Dermochelys coriacea*)

  endangered hawksbill turtle *(Eretmochelys imbricata)*

  endangered Kemp's ridley turtle *(Lepidochelys kempii)*
- federally threatened seabeach amaranth (*Amaranthus pumilus*)
- state listed threatened species and species of special concern:

  common tern (*Sterna hirundo*)

  least tern (*Sterna antillarum*)

  gull-billed tern (*Sterna nilotica*)

  black skimmer (*Rynchops niger*)
- species of high concern

  American oystercatcher (*Haematopus palliatus*)

  Wilson's plover (*Charadrius wilsonia*)

  Red knot (*Calidris canutus rufa*)

The management of endangered and threatened species is mandated by law and should be based on the best available information, including published research, reports and the practical experience of scientists and CAHA resource managers. All of these sources, along with public input, were consulted and formed the basis of the management action. Management guidance or scientific references were gleaned from the following documents:

1. Piping Plover (*Charadrius melodus*) Atlantic Coast Population Revised Recovery Plan U.S. Fish and Wildlife Service. 1996.
2. Technical/Agency Review Draft, Revised Recover Plan for Piping Plovers, Charadrius melodus, breeding on the Great Lakes and Northern Great Plains. U.S. Fish and Wildlife Service. 1994.
3. Recovery Plan for the Great Lakes Piping Plover *(Charadrius melodus)*. U.S. Fish and Wildlife Service. 2003.
4. Recovery Plan for Seabeach Amaranth *(Amaranthus pumilus*). U.S. Fish and Wildlife Service. 1996.
5. *North American Colonial Waterbird Conservation Management Plan*
6. North Carolina Wildlife Resources Commission (NCWRC) in *Handbook for Sea Turtle Volunteers in North Carolina* (2002). An annual permit is issued by NCWRC under the authority of the U.S. Fish and Wildlife Service and USFWS Recovery Plans referenced.
7. Recovery Plan for U.S. Population of Loggerhead Turtle *(Caretta caretta*). U.S. Fish and Wildlife Service. 1991.
8. Recovery Plan for U.S. Population of Atlantic Green Turtle *(Chelonia mydas)*. U.S. Fish and Wildlife Service. 1991.

9. Recovery Plan for the Leatherback Turtles in the US. Caribbean, Atlantic, and Gulf of Mexico (*Dermochelys coriacea*). U.S. Fish and Wildlife Service. 1992.
10. Recovery Plan for the Hawksbill turtles in the U.S. Caribbean, Atlantic Ocean, and Gulf of Mexico *(Eretmochelys imbricata)*. U.S. Fish and Wildlife Service. 1993.
11. Recovery Plan for the Kemp's Ridley Sea Turtle (*Lepidochelys kempii*). U.S. Fish and Wildlife Service. 1992.
12. Synthesis of Management, Monitoring, and Protection Protocols for the Threatened and Endangered Species and Species of Special Concern at Cape Hatteras National Seashore, North Carolina. U.S. Geological Survey, Patuxent Wildlife Research Center. 2005.
13. Management and Protection Protocols for the Threatened Piping Plover (*Charadrius melodus*) on Cape Hatteras National Seashore, North Carolina. U.S. Geological Survey, Patuxent Wildlife Research Center. 2005.
14. Management, Monitoring, and Protection Protocols for Colonially Nesting Waterbirds at Cape Hatteras National Seashore, North Carolina. U.S. Geological Survey, Patuxent Wildlife Research Center. 2005.
15. Management, Monitoring, and Protection Protocols for American Oystercatchers at Cape Hatteras National Seashore, North Carolina. U.S. Geological Survey, Patuxent Wildlife Research Center. 2005.
16. Management and Protection Protocols for Nesting Sea Turtles on Cape Hatteras National Seashore, North Carolina. U.S. Geological Survey, Patuxent Wildlife Research Center. 2005.
17. Management, Monitoring, and Protection Protocols for Seabeach Amaranth at Cape Hatteras National Seashore, North Carolina. U.S. Geological Survey, Patuxent Wildlife Research Center. 2005.

Overarching Framework for the Action

1. In general, because of the dynamic nature of the CAHA beaches and inlets, the actual management may change by location and time, and new sites (bars, islands) may require additional management, or management actions may become inapplicable for certain sites due to changes in ground conditions.
2. Areas with symbolic fencing (string between posts) are closed to recreational access (both ORV and pedestrian).
3. ORV access is provided for in this Action to the extent practicable. Between April 1 and September 30, a 100-ft wide ORV corridor would be established in recent breeding areas, e.g. at a spit or Cape Point. The corridor would be delineated by a row of posts above the wrack line and a row of posts below the dune line. This would provide protection of the wrack line from routine driving. Where it is not possible to delineate a corridor with posts above the wrack line, signs would be posted asking visitors to stay off of the wrack line. In areas without a well defined wrack line, the corridor would be delineated only with posts placed 100 feet above the high tide line. In addition, education materials and opportunities would be provided for visitors regarding wildlife values and susceptibility of the wrack to foot and ORV traffic. In areas of reduced corridor width (i.e. narrower than 100 feet), a reduced speed limit of 5 mph would be posted. If adjustments are needed to the corridor to keep access open, ORVs would be allowed to cross the wrack line at 60-90 degree angles. The 100 foot wide ORV corridor would be reopened after all chicks fledge. The 150 foot ORV corridor would be re-established October 1.

4. Essential vehicles would enter restricted areas only as necessary and in accordance with guidelines in the "Essential Vehicles" section of the Revised Recovery Plan for the piping plover (USFWS). Vehicles would not exceed 5 miles per hour.
5. Frequencies provided for species observations are minimums. If a need arises for more frequent observations than the minimum stated, and staff is available, CAHA may conduct observations more frequently on a case-by-case basis.
6. Staff used for field observations, education and outreach will be trained by qualified NPS staff and will meet the following minimum qualifications:
    a. Completion of a course of instruction conducted by qualified staff biologist. Training would be conducted at the beginning of the season (March/April) and again in late May-early June. Training would include:
        i. Job description/Expectations
        ii. Personal safety
        iii. Professional behavior
        iv. NPS and CAHA rules, regulations, policies
        v. Geographic locations orientation
        vi. Awareness of the community and their role in it
        vii. CAHA personnel and job descriptions
        viii. ATV/beach driving
        ix. Protected species monitoring and management
            1. Identification
            2. Behavior
            3. Needs
            4. Closures
        x. Completion of observation forms etc.
        xi. Overview of existing CAHA activities and studies occurring within CAHA
        xii. Equipment care and upkeep
        xiii. Outreach and public education
    b. Returning staff may not need the full training.
    c. Temporary/seasonal staff would be hired by March 1 and trained by March 15 to begin avian management, education, and/or outreach activities.
    d. Temporary/seasonal staff would be hired and trained by May 15 to conduct turtle management, education and/or outreach activities, following guidelines in the NCWRC Handbook (may include same personnel hired for avian management).
7. Temporary/seasonal staff would be hired using the following guidelines:
    a. A list of needed positions would be identified for resource management volunteers, Student Conservation Assistants (SCA), seasonal employees, and interns including skilled and unskilled labor to provide manual labor (erecting closures and signs) and bird identification and behavior observations.

b. Job descriptions would be created with specific needs and standards for all skilled and unskilled positions including approximately how many hours would be needed.

c. A standard for hiring SCAs, seasonal employees, interns, and volunteers would be developed, including expectations and requirements for in-house training to occur at established times.

d. Recruiting would begin in October of the preceding prior year.

e. A list would be maintained of trained local volunteers and those interested in becoming trained to fill volunteer positions.

f. Set times for training and set start dates for temporary/seasonal staff would be established.

g. All the training information would be available for transmittal to all new staff during training. This would provide consistent information to everyone and managers would be assured that SCA, seasonal employees, interns and volunteers received consistent information.

8. Public compliance with resource closures and species management as described in this Action addressed via combination of education and outreach efforts and by law enforcement.

9. Bypass criteria

Criteria/consideration used to evaluate the feasibility of establishing a short-term bypass route will include the following:

a. Bypass area would be routed around dunes and vegetation if possible. If necessary, ground leveling, consistent with the state coastal management program, may be considered if dune fields do not exceed 36" in height. Leveling would be done by hand (no machinery would be used).

b. Bypass would take advantage of natural terrain (e.g. blowouts) to minimize ground altering disturbance to the natural areas and impacts to wetlands.

c. Bypass would meet minimum requirements to allow one ORV to safely pass or a maximum of two lanes if "line of sight" vision were compromised.

d. Natural area disturbance to accommodate avoidance of turtle or avian nesting would not exceed approximately 6000 ft^2.

e. Minimal vegetation impact would be allowed.

i. Federal or state listed plants or plants falling under the category of special concern (e.g., sea beach amaranth, dune blue curls) would not be compromised.

ii. Vegetation in altered areas would be expected to recover within the following growing season. If vegetation does not recover within one growing season, or by other natural process (such as overwash creating habitat), CAHA would initiate restoration of vegetation.

iii. Any vegetation removal would be performed with hand tools (no machinery would be used).

Areas would be restored if predicted recovery period exceeds one season. Bypass routes would not infringe or fragment upon an adjacent resource/safety closure. Bypass routes would not disturb or impact any cultural resource (i.e. shipwrecks).

Species Monitoring and Management

Monitoring

Breeding areas used by the birds at some time during the past ten breeding seasons would be observed three times a week and any new potential habitat two times a week. Potential new habitat means habitat recently created, usually by storms, e.g. overwash passes, blowouts, etc. Breeding piping plover monitoring would begin April 1, as would monitoring for other species with the exception of American oystercatcher which would be monitored beginning March 15. A range of observation activities would occur for bird species across pre-nesting, nesting, migration, and over-wintering life-stages and include such things as: observing and noting adult behavior, identifying scrapes, nests, eggs, broods, and chicks, providing outreach and education material to visitors, and ensuring safe passage of visitors past resource areas or toward alternate routes. Training and personnel used are described above in Overarching Framework.

Pre-nesting and Mating

Recent breeding habitat for the piping plover (based on last three years of breeding/nesting data) would be closed to the public with symbolic fencing (posts and signs) by April 1st each year. Observation activity will follow essential vehicle guidelines in the piping plover recovery plan so as to minimize disturbance. Symbolic fencing for American oystercatcher and colonial waterbird breeding areas would also be based on the last three years of breeding/nesting data with fencing erected March 15 for American oystercatchers and April 1st for colonial waterbirds. The presence of territorial or courting birds outside of existing closures could further extend these initial closures (ensuring a 150 foot buffer for the observed birds). All closures would be removed if no territorial/mating/nesting activity has been seen by July 15th or when areas have been abandoned for a two-week period, whichever comes later. Wilson's plover are managed when they are present in existing piping plover habitat.

Nesting and Foraging

When nests are found, CAHA staff would collect data on bird behavior, location of nests, and presence of predators. CAHA staff would ensure adequate buffers are provided within existing closures or create buffers for the nests that are found outside of existing closures. Buffer sizes vary according to bird species. A 150 foot buffer, from which all recreational uses would be restricted, would be established around any piping plover nests, with additional buffer provided if warranted based on observed bird behavior. American oystercatcher and colonial waterbird buffers would range from 300 – 450 feet based on observing to determine how the adults are reacting to passing ORVs or pedestrians. If the buffer and the ORV corridor overlap, staff will attempt to identify an alternate ORV route. If an alternate route is not available, than a bypass would be considered through the area, if it can be used without disturbing the nesting oystercatcher or colonial waterbird (for example, a narrowed ORV corridor to allow for driving past the area with no stopping or pedestrian access). The bypass would be sited at a distance that avoids ORV flushing of oystercatchers from the nest. In that oystercatcher breeding pairs tend to

return to the same area each year to nest, collection of information on flushing distance data for a pair may be helpful in establishing the appropriate size closures. Information and data on this approach would be collected and compiled for future management consideration.

For adult plovers foraging outside of an existing resource closure, the closure will be expanded to include the foraging site which may include soundside or inlet shoreline. If the expansion of the buffer restricts ORV access, an alternate ORV route or by-pass would be sought. If no viable alternate route or by-pass can be established, ORV use will be restricted in the area.

Staff would erect predator exclosures directly over piping plover nests when they contain 3-4 eggs. Nesting areas would be monitored for predator tracks and USDA trappers would target red and gray fox for removal.

Unfledged Chicks

-Piping Plovers: During the first week following hatching of plover chicks, CAHA would provide for continual observation of the chicks during daylight hours. Based on observation of adult and chick behavior and the terrain conditions at the site, a 600 – 3000 foot buffer will be established on either side of the brood. Based on observed behavior (i.e. mobility of the brood) and the capability to continually monitor, the buffer zone could be reduced after the first week to no less than 300 feet, but may require expansion up to 3000 feet. The resource closure would be relocated as needed to ensure continued protection of the brood. If the resource closure impedes or overlaps with the ORV corridor, CAHA would adjust the ORV corridor whenever possible to allow ORV passage or attempt to identify an alternate route. If an alternate route is not available, a bypass route would be considered (see by pass criteria). Close bypass route at night if buffer zone for the plover brood is less than 3000 feet. The beach will be closed to recreation access down to the waterline, if necessary, to allow chicks access to foraging areas.

-American oytstercatchers and colonial waterbirds: A 300 foot buffer zone would be established for broods or colonies with unfledged chicks. The buffer could be modified as needed, based on observed behavior. If the resource closure impedes or overlaps with the ORV corridor, CAHA will attempt to identify an alternate route. If an alternate route is not available, a bypass route would be considered (see by pass criteria). The brood would be observed daily for oystercatchers and at 1-2 day intervals for colonial waterbirds. Observational data collected would include brood status, behavior, movements, and effects of human presence, predator tracks, or other environmental interactions.

Migrating/Wintering Plover. CAHA will monitor for fall and spring migrating or wintering plovers on a regular cycle, five days a week, for 11 months (July – May) following protocols on Migratory, Wintering, and Beached Shorebird Monitoring at Southeast Coast Network Parks (November, 2005). This will allow for plover observations in both high use areas as well as low use areas. The sampling intensity could be changed based on an evaluation of the sampling protocol after the first year.

Sea Turtles

CAHA follows sea turtle management guidelines defined by the NCWRC in *Handbook for Sea Turtle Volunteers in North Carolina* (2002). An annual permit is issued by NCWRC under the authority of the USFWS. Beaches would be patrolled at dawn daily between June 1 and September 1 in search of turtle crawls (tracks left by the turtle when they come ashore to nest). Volunteers in the Park, Student Conservation Association volunteers and CAHA seasonal and permanent staff would patrol approximately 55 miles each day on Bodie, Hatteras and Ocracoke Islands.

When a turtle nest is located, staff would immediately assess (1) its vulnerability to frequent erosion or frequent flooding, and/or (2) whether the nest location could have a direct impact on recreation access to beach spits and points when the nest and hatchling access to the sea is fenced. If it is determined that a nest will be imperiled by potential erosion or flooding, the nest will be relocated following the guidelines found in the NCWRC Handbook. If it is determined that fencing the nest to the sea just prior to hatching will cause restricted access to the spits or Cape Point, CAHA staff will immediately determine if an alternate ORV route is available or if a reasonable by-pass route can be established at hatching time. If possible, ORV traffic will be routed around the nest on the duneward side, maintaining a buffer of 50 feet where possible, but no less than 30 feet. If it is determined that no alternate by-pass route can be established, the nest would be relocated if permitted by the NCWRC. If it is determined the nest would not be relocated it would be immediately protected with a symbolic fence measuring 30 sq. feet and signage.

Any single nest left in place, or relocated, would be protected by an approximately 30 feet by 30 feet posted closure during the incubation period. At 55 days into incubation, these small closures would be expanded to the surf line. The width of the closure would be based on the type and level of use of the beach: 75 feet in an ORV-free area with little or no pedestrian traffic; 150 feet adjacent to villages or other high levels of day use; 350 feet in ORV areas. Opposite the surf line on the upper end of the closure, the closed area would be expanded to a minimum of 50 feet duneward from the nest. If present, all ORV tracks would be smoothed over manually with rakes or with a steel mat attached to an ATV, so as not to impede hatchlings attempting to reach the surf (NMFS, USFWS 1991). Boats would not be allowed into these closures if they extended to the surf. In some cases, silt fence would be used behind nests nearing hatching dates. Fencing is used to block light pollution from the villages and from beach ORVs operating after dark. Fencing is often buried and/or removed by high tides and strong winds and often damaged in the process. Therefore, the use of silt fencing would require daily maintenance of the site. Large signs would be posted to notify drivers that the established closures included the surf line at all tides. Interpretive signs warn how ORV traffic can harm eggs and hatchlings. Traffic detours behind the nest area would be clearly marked with signs and reflective arrows. Closure materials would be removed no earlier than 72 hours after hatching occurs, and after the excavation of the nest is complete. CAHA would enact turtle friendly lighting for all CAHA structures visible from the beach and encourage concessionaires to install turtle friendly lighting.

Seabeach Amaranth

During routine bird and turtle monitoring, staff would monitor areas where seabeach amaranth has been found over the past 10 years. Staff would document the presence of any seabeach amaranth plants or seedlings occurring within existing closures erected for avian species management. No proactive management would occur; if a plant or seedling is seen outside of existing closures, the area would be closed and a 10 foot buffer established around the plant or seedling.

Recreation

Between March 15th or April 1st, depending upon species, and September 30th each year, a 100-ft wide ORV corridor would be designated above the mean high tide line in all species breeding areas used within past 3 years. Breeding areas outside the ORV corridor used within the past three years would be closed to pedestrian access using symbolic fencing at the same time. The ORV corridor would be delineated with posts above the wrack line and below the dune line, maintaining a 100 foot corridor where possible. Where it is not possible to delineate an ORV corridor with posts above the wrack line, signs would be posted asking visitors to stay off. In areas without a well defined wrack line, the corridor would be delineated only with posts placed up to 100 feet above the high tide line. Education would be provided for visitors regarding the wildlife values and susceptibility of the wrack to foot and ORV traffic. In areas of reduced corridor width (i.e. narrower than 100 feet) a reduced speed limit of 5 m.p.h. would be posted. Additionally, periodic patrols to observe and enforce compliance with closures would occur.

Pedestrian access would be maintained outside of the symbolically fenced areas. If no bird activity is seen by July 15, or if the area is abandoned for two weeks, whichever is later, the closure area would be reopened to recreation use.

Because closure zones would adjust to individuality in bird behavior, an ORV corridor may not be feasible for safety reasons or due to insufficient area. In these cases, CAHA would attempt to identify an alternate ORV route. If no alternate route is available, a bypass would be considered using the bypass criteria outlined on page 77. An ORV closure would be implemented in the event an alternate route or bypass is unavailable.

Recent breeding habitats within the spits and Cape Point would be closed to ORVs pedestrians beginning in mid-March (oystercatchers) or April 1 (piping plovers and colonial waterbirds). An ORV and pedestrian corridor would provide access around these closures, unless foraging chicks or safety issues required that the access route be closed. If a closure was required, the decision-making process for ensuring continued ORV access would include consideration of alternative ORV route or a bypass. If a turtle nest hatching could lead to the blocking of access to the spits, Cape Point, or South Beach, access would be provided via alternate route, bypass, or relocation of the nest in accordance with NCWRC permits.

Pets must be crated, caged, restrained on a leash, or otherwise physically confined at all times in all areas of CAHA (36 CFR Sec 2.15 Pets). Pets would be prohibited within ¼ mile of symbolic fencing around any avian closure.

Essential Vehicle Use

Essential vehicles would enter restricted areas only as necessary and in accordance with the guidelines in the Essential Vehicles section of the Revised Recovery Plan (app. G). In the spring (Apr 15 - late May) and fall migration (Aug – Sept 30) periods, all vehicles and personnel (NPS, researchers) would avoid when possible the tips of spits and inlet areas where colonial species often stage, or court (spring migration). Observers or monitors may conduct activities by ORV during non-breeding season and before nest-hatching. In turtle and plover habitat staff would avoid the wrack line and travel at speeds NTE 5 mph. In turtle habitat staff would drive only in the ocean inter-tidal zone. If this is not possible, monitoring by ORV should not be conducted at that time. When a courting pair or a set of courtship scrapes is located, the monitoring vehicle would not pass through the prospective territory until the nest is discovered. The vehicle would be parked at least 600 ft from the suspected center of territorial activity (farther away if the area of scraping is more extensive) and monitoring of that area would be conducted on foot. Once a nest is discovered, ORV-based monitoring may resume until the nest is lost and the pair begins attempting to renest, or the nest hatches. When chicks are present, ORVs used to access an area would be parked at least 300 ft from the last known brood location, and the rest of the monitoring conducted on foot until the brood is at least 35 days old.

Outreach and Compliance

CAHA would continue to provide information about endangered species at the visitor's center. Articles would be provided in CAHA's summer and winter newspaper and on the website. In addition, the public would be notified of closures that would temporarily limit ORV traffic via a press release to local and regional newspapers and direct contact with local tackle shops and ORV organizations when closures are established or reopened.

CAHA would enforce and provide outreach regarding proper trash disposal and regulations prohibiting the feeding of wildlife to reduce the attraction of predators to the area. Annual reports regarding the previous bird breeding season would be published on the CAHA website and an initial posting plan for the upcoming season would be drafted outlining nesting areas anticipated for posting in the spring. A variety of educational and outreach materials would be developed regarding the impacts of trash-disposal, wildlife-feeding, fireworks, lighting, and pets on sensitive CAHA species. Local volunteer and community organizations would be enlisted to distribute these materials. In addition, interpretive signage would be developed for certain species.

Staffing/Cost

Costs of implementing this alternative would include the same costs described under the no-action alternative (continuation of 2004 management), plus costs of hiring additional temporary staff, and materials for interpretation, education and outreach (Table 1).

In addition to the financial cost increases, there would also be opportunity costs as staff in the Interpretation and Law Enforcement divisions were reprogrammed to cover responsibilities under the interim strategy.

Table 1. Cost Estimate—Preferred Alternative

Action	Assumptions	Costs
Natural Resource Management /Visitor Education/Outreach	3 full-time bio techs, 1 RM specialist, 1 GIS specialist, and 1 Chief, no additional funding required. Additional funding required for 16 seasonal employees used primarily to improve visitor experience and visitor services.	based funded positions plus: Staff: $220,655; Materials: $56,600 Total additional: $277,255 Total (base + additional) annual costs = $500,604
Interpretation	Existing staff would be reprogrammed to meet all interpretive needs. Additional materials and supplies required.	No additional costs
Law Enforcement	Staff would increase from 11 to 16 rangers, which are already funded positions. Existing staff would be reprogrammed to meet all law enforcement needs.	No additional costs.

APPENDIX B

MIGRATORY, WINTERING, AND BEACHED SHOREBIRD MONITORING AT SOUTHEAST COAST NETWORK PARKS

APPENDIX C

CAPE HATTERAS NATIONAL SEASHORE ORV SITE BULLETIN

APPENDIX D

MAPS IDENTIFYING ESTIMATED AREAS TO BE FENCED BY APRIL 1