*This document was produced by the United States Geological Survey, Patuxent Wildlife Research Center, at the request of Cape Hatteras National Seashore. The information and recommendations presented are the professional opinions of the scientists that analyzed and interpreted the scientific data associated with protected species at the Seashore. This information will be considered by the National Park Service (NPS), along with federal laws and mandates, NPS policies, other scientific information, and public input, in developing management plans and conservation strategies implemented at the Seashore.*

SYNTHESIS OF MANAGEMENT, MONITORING, AND PROTECTION PROTOCOLS FOR THREATENED AND ENDANGERED SPECIES AND SPECIES OF SPECIAL CONCERN AT CAPE HATTERAS NATIONAL SEASHORE, NORTH CAROLINA

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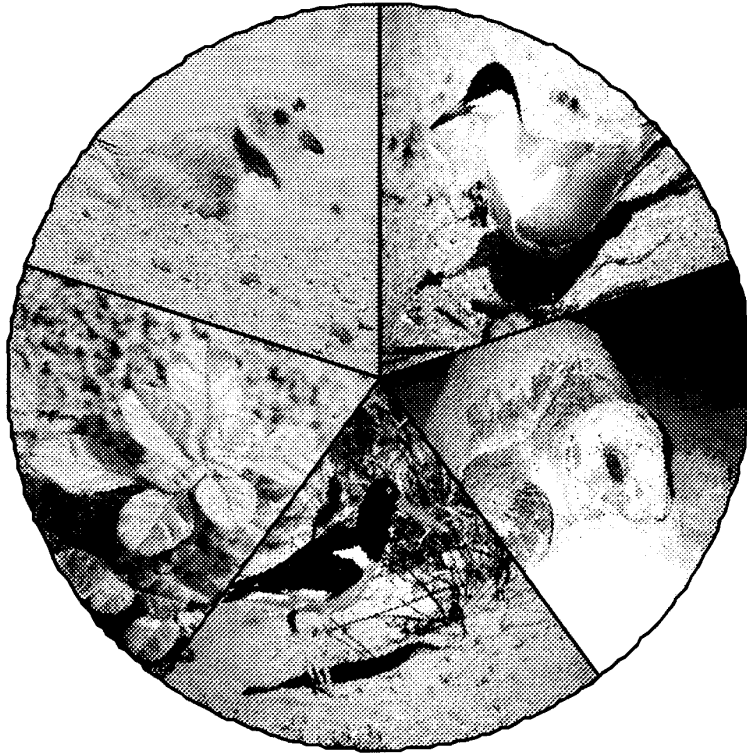
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Introduction

From 1985 to 2004, the breeding population of the federally threatened piping plover (*Charadrius melodus*, USFWS 1996a) and seabeach amaranth (*Amaranthus pumilis*, USFWS 1996b) declined at Cape Hatteras National Seashore (CAHA) in North Carolina. 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 North Carolina Wildlife Resources Commission (NCWRC). At the same time, the number of recreational visitors to CAHA greatly increased. In general, recreational activity has been implicated as a cause for (i) low reproductive success and declining populations of all of these species, and for (ii) disturbance or mortality of migrating and wintering piping plovers, colonial water birds and oystercatchers, and (iii) disturbance or mortality of nests, hatchlings and adults, 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).

Over the past decade, management of these natural resources has been inconsistent at CAHA, partially due to the lack of effective and consistent monitoring of the location, reproductive activity, mortality factors, and winter habitat use of these species. As a result, the National Park Service Southeast Region and CAHA requested assistance from the U.S. Geological Survey's Patuxent Wildlife Research Center (USGS PWRC) to develop a scientifically-based series of protocols for the Protection and

Monitoring of piping plovers, sea turtles, seabeach amaranth, American oystercatchers, and colonial waterbirds for CAHA. This overview provides a partial summary of these individual documents, as well as discussion of some overall issues that affect the management procedures recommended for all the species.

The USGS developed these protocols, based on the best available scientific information, to guide management, monitoring and research activity at CAHA that would result in the protection and recovery of each species. These protocols do not attempt to balance the need for protection of these species with other activities that occur at CAHA, nor was NPS management policy considered in detail. A draft of the protocols was sent to species experts for scientific review; the final draft of protocols were reviewed by NPS personnel to ensure that description of recent management at CAHA was accurately represented and that the approach was consistent with our work agreement.

Development of Management Protocols

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 wildlife mangers themselves. All of these sources were consulted and formed the basis of the management recommendations found in the protocols. USGS PWRC scientists searched and evaluated the literature and consulted wildife managers to form the first draft of the protocols, which was sent to species experts for scientific review. Corrections based on those comments were incorporated into the draft protocols. The protocols are the best recommendations from

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USGS PWRC to the NPS for management of these species at CAHA, based on the sources noted above.

In recent years, the scientific community has formally recognized and responded to what resource managers have known for a long time, that (i) management actions are not static but must change with changing conditions, often year to year, and (ii) that the published scientific data on which management is based is often incomplete and less specific to the particular location of species under management than is desirable. Hence, a sensible approach is to incorporate into the management program itself efforts to monitor the effects of current management practice, and even, research and local experiments directed toward exploring the effect of different kinds of management practices. There are many benefits of monitoring and such focused research to the improvement of management: the ability to adapt the management program to local habitats and conditions, to adapt management over time to changing conditions, and to identify the best management actions rapidly. The data collected through monitoring form a solid basis for making any such changes, or to justify maintaining current practices. For these reasons, monitoring and focused research are integral to our recommendations.

We provided three management options for protected species, presented in order from the most conservative ("*Option A: Highest degree of protection*") to more liberal ("*Option B: Moderate protection*" and "*Option C: Minimum protection*"). These options are intended to protect habitat used by each species at some time in the last 10 years, where this can be determined. The rationale is that for populations of these species to actually increase in size, more habitat must be available to them than is currently used.

- Under Option A, no recreation is permitted in any habitat used in the previous 10 years by the species in question. This eliminates the threat of direct mortality or disturbance due to recreation, and greatly reduces indirect impacts such as attraction of wild predators to the habitat of proteced species and alteration of the beach profile by off road vehicle (ORV) traffic.

- Under Option B for birds and plants, pedestrian recreation but not ORV traffic is permitted within a corridor in historically-used habitat. For sea turtles, Option B closes all historically-used habitat to night use by ORVs and optionally pedestrians, and closes segments of the habitat completely to all recreation. Option B reduces the risk of direct mortality and disturbance over current management practices, but does not reduce indirect effects of recreation to the same extent as Option A.

- Under Option C for birds and plants, ORV and pedestrian use is permitted in a corridor in historically-used habitat. For sea turtles, night use of the habitat for recreation is only permitted in conjunction with user educational programs, and as in Option B certain segments of beach remain closed. The risk of mortality, disturbance, and indirect effects of recreation are higher than under Option A or B, but still less than under current management practices.

All three options include some degree of exclusion of recreation from a buffer zone around nests and important habitat types, trapping and removal of predators and use of predator exclosures where needed, and restrictions on pets, recreational activities that

might cross into protected zones (such as Frisbee playing or fireworks), and trash disposal and wildlife feeding. Where multiple protected species coexist, the recommendations for the most sensitive species should be employed. A summary of recommended buffer distances for each species is given in Table 1.

In general, because of the dynamic nature of the CAHA beaches and inlets, the management may change by location and time, and new sites (bars, islands) may require additional management, or recommendations may become inapplicable for certain sites, or new sites may form that provide suitable habitat.

Monitoring

Specific monitoring guidelines are provided in the individual protocols, and summarized in the final section of this Overview. We recommend that special attention be paid to the nests and young of both birds and turtles because they are so important to the survival and growth of these species. The primary addition to current CAHA monitoring that we recommend is to record potential threats, and signs of potential threats (e.g., predator trails, ghost crab burrows, and human disturbance) in relation to adults, nests, and young of protected species, as well as the response of adults and young to potential disturbances. We also recommend more frequent, standardized surveys for non-breeding birds. We provide recommendations for documenting possible legal infractions that may be observed during monitoring, and at scenes of past violations.

Data Management

Recommendations for raw data collection, data management and entry, metadata format, data storage and analysis, and reporting are the same for all protected species. Guidelines can be found in the individual protocols.

Education and Outreach

While the protections recommended in these protocols are necessary, the ultimate fate of protected species at CAHA depends on knowledge and skill of the staff at CAHA and the values and attitudes of the public that uses CAHA. In each protocol, we provide suggestions for basic skills and knowledge that should be provided to all staff working in the habitat of protected species, and methods to educate the public and involve all stakeholders at CAHA in the management process.

Management-Directed Monitoring and Research

Federal and state agencies now widely recognize the importance of adopting an adaptive resource management (ARM) approach whenever possible. That is, management, monitoring, and research are all integral to effective resource management. Past are the days when "monitoring programs" were set up simply in an attempt to capture changes in environmental parameters or wildlife populations. Determining causation usually requires some type of management experiment. As noted above, monitoring and research focused on local management options are integral to effective management of species. This section is a general description of that approach and an

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outline of relevant monitoring and focused research questions to improve management at CAHA over time.

Management of rare flora and fauna over large landscapes can be improved by incorporating three components:

1. monitoring various characteristics of the species in question to determine the magnitude, duration, and latency of effects associated with management actions

2. management experiments designed to evaluate management alternatives,

3. research aimed at critical gaps in knowledge,

The results of monitoring provide a solid basis for a manager to either continue the current management practice or technique, or modify it until the desired effects are achieved. Focused, applied research or management experiments may be required because species behaviors, habitat use, and community relationships often differ from region to region.

Since all of the species in question are state or federally-listed or "of special concern", the goal of management is to increase populations of these species at CAHA, and, more generally, to contribute to the recovery of the listed species. Protocols for adaptive management are provided for each species or group of species in individual documents. The questions to be addressed for all of the protected species can be generalized as follows:

1) What is the distribution and abundance of the organism at CAHA?

2) What are the vital rates of the population at CAHA, and how do these compare to populations elsewhere?

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3) What is the contribution of the population at CAHA to state and regional populations?

4) What are the threats to survival and reproduction at CAHA? For all species at CAHA, an important (and obvious) management question is, "What is the effect of human recreation (ORV and pedestrian traffic) on distribution, abundance, and reproduction?"

This question can and should be addressed through closure or partial restriction of habitat to recreation and measurement of demographic, behavioral, and habitat variables enumerated in the protocols for each species, specific to CAHA.

Additionally, we recommended investigating at CAHA the necessary buffer distance to prevent disturbance to protected species, the effects of predator exclosure on nest success of piping plovers and colonial nesting water birds, and the effects of artificial lighting management on sea-finding behavior by sea turtle hatchlings.

We identified several additional questions that would benefit from local research order to fine tune the management recommendations for each species.   These include:

1) Determining the current level of pedestrian and ORV traffic in the habitat of protected species, and how this differs between day and night and among different management treatments,

2) Estimating the carrying capacity of CAHA for the species in question, with and without the presence of recreation,

3) Estimating the survival rates and site tenacity of adult and fledgling birds,

4) Monitoring the rate of predation by birds, mammals, and ghost crabs on nests and young,

5) Monitoring the presence of mammalian and avian predators and evaluating the effectiveness and costs of various trapping methods.

6) Monitoring the success of relocated sea turtle nests, and

7) Determining the effect of recreation on detectability of turtle crawls.

Acknowledgement

Table 1. Recommended buffer distances for habitat closures to protect nests and seabeach amaranth plants from injury and disturbance at Cape Hatteras National Seashore, NC.

Species	Buffer Distance (m)[a]
Piping Plover	50
Least Tern	100
Other Colonial Waterbirds	200
American Oystercatcher	150
Sea Turtles	50
Seabeach Amaranth	10

[a]The buffer distance for the most sensitive species in an area should be used. If disturbance occurs with a given buffer distance, the buffer zone should be expanded according to the recommendations in the individual protocols.