

# ENVIRONMENTAL CONSEQUENCES

## SUMMARY OF LAWS AND POLICIES

Three overarching environmental protection laws and policies guide the NPS — the National Environmental Policy Act (NEPA) of 1969, and its implementing regulations; the National Parks Omnibus Management Act of 1998 (NPOMA); and the NPS Organic Act.

1. The National Environmental Policy Act is implemented through regulations of the Council on Environmental Quality (CEQ) (40 CFR 1500–1508). The NPS has in turn adopted procedures to comply with the act and the CEQ regulations, as found in *Director's Order #12: Conservation Planning, Environmental Impact Analysis, and Decision-making* (2001), and its accompanying handbook.
2. The National Parks Omnibus Management Act of 1998 (NPOMA) (16 USC 5901 et seq.) underscores the National Environmental Policy Act in that both are fundamental to NPS park management decisions. Both acts provide direction for articulating and connecting the ultimate resource management decision to the analysis of impacts, using appropriate technical and scientific information. Both also recognize that such data may not be readily available, and they provide options for resource impact analysis should this be the case.

The Omnibus Act directs the NPS to obtain scientific and technical information for analysis. The NPS handbook for *Director's Order #12* states that if “such information cannot be obtained due to excessive cost or technical impossibility, the proposed alternative for decision will be modified to eliminate the action causing the unknown or uncertain impact or other alternatives will be selected” (sec. 4.4).

Section 4.5 of *Director's Order #12* adds to this guidance by stating “when it is not possible to modify alternatives to eliminate an activity with unknown or uncertain potential impacts, and such information is essential to making a well-reasoned decision, the NPS will follow the provisions of the regulations of CEQ (40 CFR 1502.22).” In summary, the Park Service must state in an environmental assessment or impact statement (1) whether such information is incomplete or unavailable; (2) the relevance of the incomplete or unavailable information to evaluating reasonably foreseeable significant adverse impacts on the human environment; (3) a summary of existing credible scientific adverse impacts that is relevant to evaluating the reasonably foreseeable significant adverse impacts; and (4) an evaluation of such impacts based on theoretical approaches or research methods generally accepted in the scientific community.

3. The 1916 NPS Organic Act (16 USC 1) commits the Park Service to making informed decisions that perpetuate the conservation and protection of park resources unimpaired for the benefit and enjoyment of future generations.

## GENERAL METHODOLOGY FOR ASSESSING IMPACTS

The general approach for establishing impact thresholds and measuring the effects of the alternatives on each resource category includes the following elements:

General analysis methods as described in guiding regulations

Basic assumptions used to formulate the specific methods used in this analysis

Thresholds used to define the level of impact resulting from each alternative

Methods used to evaluate the cumulative effects of each alternative in combination with unrelated factors or actions affecting park resources

Methods and thresholds used to determine if impairment of specific resources would occur under any alternative

### GENERAL ANALYSIS METHODS

The analysis of impacts follows CEQ guidelines and Director's Order 12 procedures (NPS 2001) and is based on the underlying goal of species protection. This analysis applies the results of scientific research and monitoring along with the best available scientific literature applicable to the region and setting, the species being evaluated, and the actions being considered in the alternatives.

The interdisciplinary planning team created a process for impact assessment, based upon the directives of the *DO #12 Handbook* (sec. 4.5(g)). National park system units are directed to assess the extent of impacts on park resources as defined by the context, duration, and intensity of the effect. While measurement by quantitative means is useful, it is even more crucial for the public and decision-makers to understand the implications of those impacts in the short and long term, cumulatively, and within context, based on an understanding and interpretation by resource professionals and specialists. With interpretation, one can ascertain whether certain impact intensity to a park resource is "minor" compared to "major" and what criteria were used to base that conclusion.

To determine impacts, methodologies were identified to measure the change in park resources that would occur with the implementation of the alternatives. Thresholds were established for each impact topic to help understand the severity and magnitude of changes in resource conditions, both adverse and beneficial, of the various management alternatives.

Potential impacts are described in terms of type (Are the effects beneficial or adverse?), context (Are the effects site-specific, local, or even regional?), duration (Are the effects short-term, lasting less than one year, or long-term, lasting more than one year?), and intensity (Are the effects negligible, minor, moderate, or major?). Because definitions of intensity (negligible, minor, moderate, or major) vary by impact topic, intensity definitions are provided separately for each impact topic analyzed in this document.

Each alternative is compared to a baseline to determine the context, duration, and intensity of resource impacts. For purposes of impact analysis, the baseline is the protected species management that occurred at the seashore prior to 2005 (See "Chapter 2, Alternatives" for a complete description of alternative A). The team assumed, for the purposes of analysis, that actions taken in 2004 would continue over the life of the interim protected species management strategy, until the long-term ORV management plan/EIS can be developed and implemented. This is sometimes referred to the "No-Action or Existing Management Continued" alternative. The action alternatives are then compared against alternative A to determine the relative change or effect to park resources, visitor experience and other impact topics. In the absence of quantitative data, best professional judgment was used to determine impacts. In general, the thresholds were developed from existing literature, federal and state standards, and consultation with subject matter experts and appropriate agencies.

For the purposes of analysis, the following assumptions are used for all impact topics:

- Direct impacts:* Direct impacts are those that are caused by, or connected to management of protected species and recreational use. For example, the seabeach amaranth may be directly impacted from trampling.
- Indirect impacts:* Indirect impacts are those that are further removed from the action or activity either geographically or through time. For example, there may be indirect, beneficial effects to the seabeach amaranth from seed dispersal caused by human and natural occurrences.
- Duration:* The duration of an impact varies according to the resource area evaluated. Therefore, the following is an example and the duration is defined under each impact topic.
- Short-term impacts:* Those impacts occurring over the course of one year or less. Some short-term impacts could occur over several days, or a nesting season spanning several months. Other short-term impacts (socioeconomic, for example) may be more measurable over the course of a year.
- Long-term impacts:* Those impacts occurring over several years.
- Study area:* Each resource impact is assessed in direct relationship to those resources affected both inside and outside the park, to the extent that the impacts can be substantially traced, linked, or connected to the proposed action. Each impact topic, therefore, has a study area relative to the resource being assessed, and it is further defined in the impact methodology.

## CUMULATIVE IMPACTS

The CEQ regulations to implement the National Environmental Policy Act require the assessment of cumulative impacts in the decision-making process for federal projects. Cumulative impacts are defined as “the impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (federal or non-federal) or person undertakes such other actions” (40 CFR 1508.7). Cumulative impacts are considered for all alternatives, including the no-action alternative.

Cumulative impacts were determined by combining the impacts of the alternative being considered with other past, present, and reasonably foreseeable future actions. Therefore, it was necessary to identify other ongoing or reasonably foreseeable future projects and plans at Cape Hatteras and, if applicable, the surrounding region. Table 25 summarizes these actions that could affect the various resources at the seashore. These actions are described in more detail in the “Related Policies, Laws, Plans, and Actions” section of this document (see the “Purpose of and Need for Action” chapter).

The analysis of cumulative effects was accomplished using four steps:

- Step 1—Resources Affected. Fully identify resources affected by any of the alternatives.
- Step 2—Boundaries. Identify an appropriate spatial and temporal boundary for each resource.
- Step 3—Cumulative Action Scenario. Determine which actions to include with each resource.
- Step 4—Cumulative Impact Analysis. Summarize x + y statements, proposed action plus cumulative action, defining context, intensity, duration and timing; defining thresholds, methodology, etc.

**TABLE 25: CUMULATIVE IMPACT SCENARIO**

Impact Topic	Study Area	Past Actions	Current Actions	Future Actions (life of strategy/EA)
Federally Listed Threatened & Endangered Species	Specific to species as identified in Recovery Plans	Oregon Inlet Dredging Commercial Fishing Storms and Other Weather Events County Land Use Development Plan for Dare and Hyde Counties Hurricane Recovery Resource Management Plan Continued Maintenance of NC-12 and Berms Berm Maintenance for Private Property in Front of Villages (NPS Authorized)	Oregon Inlet Dredging Commercial Fishing County Land Use Development Plan for Dare and Hyde Counties Hurricane Recovery Continued Maintenance of NC-12 and Berms Berm Maintenance for Private Property in Front of Villages (NPS Authorized) Cape Lookout National Seashore Interim Protected Species Management Plan/EA	Oregon Inlet Dredging Commercial Fishing County Land Use Development Plan for Dare and Hyde Counties Continued Maintenance of NC-12 and Berms Berm Maintenance for Private Property in Front of Villages (NPS Authorized) Cape Lookout National Seashore Interim Protected Species Management Plan/EA Development of Cape Hatteras National Seashore long-term ORV Management Plan/EIS Development of Cape Lookout National Seashore long-term ORV Management Plan/EIS
Locally Sensitive Species	Focus on North Carolina populations	Oregon Inlet Dredging Commercial Fishing	Oregon Inlet Dredging Commercial Fishing	Oregon Inlet Dredging Commercial Fishing

**TABLE 25: CUMULATIVE IMPACT SCENARIO**

Impact Topic	Study Area	Past Actions	Current Actions	Future Actions (life of strategy/EA)
	populations	Storms and Other Weather Events County Land Use Development Plan for Dare and Hyde Counties Hurricane Recovery Resource Management Plan Continued Maintenance of NC-12 and Berms Berm Maintenance for Private Property in Front of Villages (NPS Authorized)	County Land Use Development Plan for Dare and Hyde Counties Hurricane Recovery Continued Maintenance of NC-12 and Berms Berm Maintenance for Private Property in Front of Villages (NPS Authorized) Cape Lookout National Seashore Interim Protected Species Management Plan/EA	County Land Use Development Plan for Dare and Hyde Counties Continued Maintenance of NC-12 and Berms Berm Maintenance for Private Property in Front of Villages (NPS Authorized) Cape Lookout National Seashore Interim Protected Species Management Plan/EA Development of Cape Lookout National Seashore long-term ORV Management Plan/EIS Development of Cape Hatteras National Seashore long-term ORV Management Plan/EIS
Other Wildlife	Park Boundary	Same as above.	Same as above.	Same as above.
Visitor Use and Experience	Park Boundary	Commercial Fishing Storms and Other Weather Events Continued Maintenance of NC-12 and Berms Hurricane Recovery GMP Resource Management Plan	Commercial Fishing Continued Maintenance of NC-12 and Berms Hurricane Recovery GMP	Development of Cape Hatteras National Seashore long-term ORV Management Plan/EIS Commercial Fishing Continued Maintenance of NC-12 and Berms Comprehensive Interpretive Plan Commercial Services Plan Bonner Bridge Replacement Opening of Dune Road Around Cape Point
Socioeconomics Including Local Commercial Fishing Activities	Regional—counties	Commercial Fishing Storms and Other Weather Events	Cape Lookout National Seashore Interim Protected Species Management Plan/EA Commercial Fishing	Development of Cape Lookout National Seashore Long-term ORV Management Plan/EIS Development of Cape Hatteras National Seashore long-term ORV Management Plan/EIS Commercial Fishing Opening of Dune Road Around Cape Point
Cape Hatteras National Seashore Management and Operations	Park Boundary	GMP Commercial Fishing Storms and Other Weather Events Oregon Inlet Dredging Hurricane Recovery Fire Management GMP Resource Management Plan	GMP Commercial Fishing Oregon Inlet Dredging Hurricane Recovery Fire Management GMP Ongoing Law Enforcement Ongoing Research Studies Ongoing Maintenance Ongoing Surveying	Development of Cape Hatteras National Seashore long-term ORV Management Plan/EIS Commercial Fishing Oregon Inlet Dredging Fire Management Commercial Services Plan Comprehensive Interpretive Plan Opening of Dune Road

**TABLE 25: CUMULATIVE IMPACT SCENARIO**

Impact Topic	Study Area	Past Actions	Current Actions	Future Actions (life of strategy/EA)
				Around Cape Point Ongoing Law Enforcement Ongoing Research Studies Ongoing Maintenance Ongoing Surveying

The past, present, and future actions outlined in Table 25 are described in the Related, Laws, Policies, Plans, and Actions section in the “Purpose of and Need for Action.” Recreational use, past, present, and future, is considered as an integral part of the action alternatives and is, therefore, not addressed within the cumulative impact scenario.

## IMPAIRMENT ANALYSIS

The NPS *Management Policies 2001* require an analysis of potential effects to determine whether actions would have the potential to impair park resources. The fundamental purpose of the national park system, as established by the Organic Act and reaffirmed by the Redwood National Park Act, as amended, begins with a mandate to conserve park resources and values. NPS managers must always seek ways to avoid, or to minimize to the greatest degree practicable, adversely impacting park resources and values. However, the laws do give the NPS the management discretion to allow impacts to park resources and values when necessary and appropriate to fulfill the purposes of a park, as long as the impact does not constitute impairment of the affected resources and values. Although Congress has given the NPS the management discretion to allow certain impacts within a park system unit, that discretion is limited by the statutory requirement that the agency must leave park resources and values unimpaired, unless a particular law directly and specifically provides otherwise. The prohibited impairment is an impact that, in the professional judgment of the responsible NPS manager, would harm the integrity of park resources or values.

An impact to any park resource or value may constitute an impairment, but an impact would be more likely to constitute an impairment to the extent that it has a major or severe adverse effect upon a resource or value whose conservation is:

- necessary to fulfill specific purposes identified in the establishing legislation or proclamation of the park;
- key to the natural or cultural integrity of the park; or
- identified as a goal in the park's general management plan or other relevant NPS planning documents.

Impairment may result from NPS activities in managing the park, visitor activities, or activities undertaken by concessioners, contractors, and others operating in the park.

The following process was used to determine whether the alternatives had the potential to impair park resources and values:

1. The park's enabling legislation, the General Management Plan, the Strategic Plan, and other relevant background were reviewed with regard to the unit's purpose and significance, resource values, and resource management goals or desired future conditions.
2. Management objectives specific to resource protection goals at the park were identified.
3. Thresholds were established for each resource of concern to determine the context, intensity and duration of impacts, as defined above.
4. An analysis was conducted to determine if the magnitude of impact reached the level of "impairment," as defined by NPS Management Policies.

The impact analysis includes any findings of impairment to park resources and values for each of the alternatives.

## FEDERALLY LISTED SPECIAL STATUS WILDLIFE AND PLANT SPECIES

### GUIDING REGULATIONS AND POLICIES

The Endangered Species Act (16 USC 1531 et seq.) mandates that all federal agencies consider the potential effects of their actions on species listed as threatened or endangered. If the NPS determines that an action may adversely affect a federally listed species, consultation with the U.S. Fish and Wildlife Service is required to ensure that the action would not jeopardize the species' continued existence or result in the destruction or adverse modification of critical habitat. NPS *Management Policies 2001* state that potential effects of agency actions would also be considered on state or locally listed species.

### GENERAL METHODOLOGY AND ASSUMPTIONS

The following information was used to assess impacts on listed species:

1. which species are found in areas likely to be affected by management actions described in the alternatives
2. habitat loss or alteration caused by the alternatives
3. displacement and disturbance potential of the actions and the species' potential to be affected by the activities

Specific methodologies that were implemented and assumptions that were made that pertained to the piping plover, sea turtles, or seabeach amaranth are described under the relevant species impact analyses below.

### STUDY AREA

The study area for federally listed species is defined as the seashore and regionally, as defined in the recovery plans for each species.

### IMPACT THRESHOLDS

The Endangered Species Act defines the terminology used to assess impacts to the piping plover, sea turtles, and seabeach amaranth as follows:

- |   |   |
|---|---|
| <i>No effect:</i>                                   | When a proposed action would not affect a listed species or designated critical habitat.  |
| <i>May affect / not likely to adversely affect:</i> | When effects on listed species are expected to be discountable, insignificant, or completely beneficial. Beneficial effects are contemporaneous positive effects without any adverse effects to the species. Insignificant effects relate to the size of the impact and should never reach the scale where take occurs. Discountable effects are those extremely unlikely to occur. Based on best judgment, a person would not (1) be able to meaningfully measure, detect, or evaluate insignificant effects; or (2) expect discountable effects to occur. |
| <i>May affect / likely to adversely affect:</i>     | When any adverse effect to listed species may occur as a direct or indirect result of the proposed action or its interrelated or interdependent actions, and the effect is not: discountable, insignificant, or beneficial. If the overall effect of the proposed action is beneficial to the listed species,   |

but is also likely to cause some adverse effects, the proposed action “is likely to adversely affect” the listed species. If incidental take is anticipated to occur as a result of the proposed action, then it “is likely to adversely affect” the species. Incidental take is the take of a listed species that results from, but is not the purpose of, carrying out an otherwise lawful activity.

*Is likely to jeopardize proposed species / adversely modify proposed critical habitat:*

The appropriate conclusion when the NPS or the U.S. Fish and Wildlife Service identifies an adverse effect that could jeopardize the continued existence of a proposed species or adversely modify critical habitat of a species within or outside park boundaries.

*Impairment:*

The action would contribute substantially to the deterioration of federally listed or special status species in the Cape Hatteras National Seashore to the extent they would no longer function as a part of the natural system. In addition, some of these adverse major impacts on the park’s resources and values would

- contribute to deterioration of federally listed or special status wildlife resources and values to the extent that the purpose of the Cape Hatteras National Seashore would not be fulfilled as established in its enabling legislation
- affect resources key to the natural or cultural integrity or opportunities for enjoyment in the Cape Hatteras National Seashore
- affect the resource whose conservation is identified as a goal in the General Management Plan (NPS 1984) or other planning documents for the Cape Hatteras National Seashore.

## **PIPING PLOVER**

### **SPECIES-SPECIFIC METHODOLOGY AND ASSUMPTIONS**

Potential impacts on the federally threatened piping plover populations and habitat were evaluated based on available data on the species’ past and present occurrence at Cape Hatteras National Seashore, as well as the species’ association with humans, pets, predators, and ORVs. Information on habitat and other existing data were acquired from staff at Cape Hatteras National Seashore, the U.S. Fish and Wildlife Service, and from available literature.

The analysis focuses on effects to the piping plover from a variety of human recreational activities, as well as impacts incurred as a result of surveying and management activities.

### **IMPACTS OF ALTERNATIVE A: NO ACTION ALTERNATIVE - CONTINUATION OF 2004 PROTECTED SPECIES MANAGEMENT**

#### **Analysis**

*Species Surveying and Management.* Alternative A includes a range of surveying activities across pre-nesting, nesting, migration, and over-wintering life-stages. Except for the once-a-week direct check of piping plover nests for eggs and/or chicks during the nesting stage, all other observations would continue

to be made from distances at or greater than the recommended 150 foot buffer established in the Revised Recovery Plan for the Atlantic Coast population of piping plovers (USFWS 1996a). All essential vehicles must travel at not more than 5 mph through chick habitat areas only during daylight hours and with the aid of an observer. Essential vehicles are to avoid the wrack line and travel should be infrequent to avoid creating deep ruts. Surveying brings people and/or essential vehicles into direct, short-term contact with piping plovers and piping plover habitat, and these activities themselves are a known, short-term risk (Burger 1994). However, many precautions would be taken by park staff to minimize impacts during surveying, and the surveying would provide benefits to the species if the information gained is used to better protect piping plovers. Therefore, species surveying may affect / is not likely to adversely affect piping plovers and their habitat.

Alternative A would include erecting symbolic fencing around piping plover nesting and foraging habitat. A 3,000-foot buffer would be established around a piping plover brood from oceanside low water to the soundside to protect foraging chicks. Management would be performed from distances at or greater than the recommended 150-foot buffer established in the Revised Recovery Plan for the Atlantic Coast population of piping plovers (USFWS 1996a). Nevertheless, management activities are a known short-term risk factor (Burger 1994). Conversely, symbolic fencing is a deterrent to the entry of people, pets, and ORVs into piping plover habitat, and the buffers would provide protection at critical life stages. All closures would be removed when areas have been abandoned for a 2-week period to allow for renesting opportunity.

Alternative A includes use of essential vehicles for surveying and enforcement, as well as predator control activities that include erecting predator exclosures directly over piping plover nests when they contain three or four eggs and a once-a-week check of the exclosures and the surrounding area for predator tracks. Predator control activities must be done at the nest and therefore inside the recommended 150 foot buffer established in the Revised Recovery Plan for the Atlantic Coast population of piping plovers (USFWS 1996a), resulting in a short-term disturbance.

Under alternative A, in addition to predator exclosures and surveying, USDA trappers would continue to remove red and gray fox that are preying on nests and chicks. Between 2002-2005, 49 predators (44 foxes, 3 opossums, 1 raccoon, and 1 feral cat) were trapped and removed from Bodie and Hatteras Islands (Lyons 2003; 2004; pers. comm., S. Smith, LBG, December 2005). While predator control provides some protection to nesting piping plovers, this management would bring people, essential vehicles, and equipment into direct contact with piping plovers and their habitat (Burger 1994) and could cause short-term disturbance. The predators exclosures are an identified short-term risk factor (Mabee and Estelle 2000; Murphy et al. 2003a) from exclosure causing bird entrapment and/or from occasionally attracting predators (Lyons 2003). Conversely, predator exclosures can be an effective deterrent to some predators.

Essential vehicles used for surveying and law enforcement are permitted to travel through chick habitat areas, but only during daylight hours and while guided by an observer. Essential vehicles are not to exceed 5 mph and should avoid the wrack line.

Other management activities may adversely affect the piping plover, but the activities would be generally short-term and of relatively low impact. Also, predator management would serve to protect the piping plover. Therefore, species management may affect / is not likely to adversely affect piping plovers and their habitat.

**Recreation.** Alternative A provides for opportunities for a variety of recreation uses that have the potential to expose piping plovers to direct impact from ORV, pedestrian and pet access, and kite flying, and ball and Frisbee tossing. Alternative A specifies that all recreation activity take place at distances at or greater than the recommended 150 foot buffer established in the Revised Recovery Plan for the Atlantic Coast population of piping plovers (USFWS 1996a). Direct impacts from recreation can occur, however, due to the presence of people and the potential for damage to nests, chicks, or habitat.

Recreation use and the waste-stream (food, trash, fish bait, etc.) associated with recreation activities within the seashore can attract a greater number of predators. These predators are a well-known factor in nest failure for piping plover and all ground nesting birds within Cape Hatteras National Seashore (Lyons 2003, 2004, and personal communication).

Recreational closures and park regulations under alternative A provide a major deterrent to the entry of people, pets, and ORVs into essential piping plover habitats. However, the recreating public's compliance with buffers and corridors is not 100%, and therefore recreation invariably brings people, ORVs, pets and other recreational equipment into direct contact with piping plovers and piping plover habitat (Coutu et al. 1990, Kuklinski 1996, Lyons 2002, Lyons 2003, Lyons 2004). Furthermore, piping plovers can be highly mobile at all life stages and can range outside of a bird closure before surveying and management can respond. Recreation use also leads indirectly to a greater number of predators (attracted to recreation refuse). For these reasons, recreation may affect / is likely to adversely affect piping plovers and their habitat.

### **Cumulative Impacts**

The past, present, and future actions discussed under the cumulative impact scenario would be expected to have a range of impact on piping plover (see table 25). The dredging of Oregon Inlet may affect /is likely to adversely affect piping plover when piping plover are holding territories in the area, and maintenance dredging could result in long-term habitat building that may affect / is not likely to adversely affect piping plover nesting. Impacts would depend on the timing and duration of the maintenance dredging of the Oregon Inlet channel as well as upon the type and placement of the dredge spoils. For example, if the dredged material is placed at sea then dredging impacts could be negligible or slightly adverse if dredging noise disturbs nesting piping plovers. However, if the dredge spoils are used to build habitat on spoil islands, for example, that could be beneficial. Similarly, highway berm maintenance could both disturb or create or stabilize nesting habitat. The degree to which this activity is positive or negative is a function of the timing and location of the activity itself relative to piping plover nesting and the degree to which the activity results in the creation or maintenance of any high-quality piping plover habitat.

Storms and other weather events during the piping plover breeding season (March - August) can result (depending upon storm intensity) in disturbance of nesting birds or even wash away of nests. These impacts would be direct, short term and may affect / are likely to adversely affect piping plovers. In addition to the timing of summer storms, storm severity is also an important variable. Powerful storms can have high tidal surges and overwash large areas of piping plover habitat including up to the toe of the dune and beyond, resulting in the loss of scrapes, nests, eggs, chicks and even breeding adults. Conversely, winter, late fall, and early spring storms are capable of having long-term benefits to piping plovers by depositing new materials and creating overwash areas and hence new nesting habitat for piping plovers or long-term direct negative impacts by eroding and removing otherwise suitable habitat. The impacts of storms on piping plovers depend on the timing and severity of storm events and whether they result in piping plover habitat creation or destruction.

Hurricanes can also affect the piping plover because of their impact on staff resources. Hurricane recovery efforts that pull staff from resource management (and presumably surveying) activities during piping plover breeding season would have a short-term adverse effect. Because the hurricane season essentially overlaps with the piping plover breeding season, the loss of staff services may affect / is likely to adversely affect piping plovers at Cape Hatteras National Seashore.

Several local and NPS past, current, and future planning efforts can also affect the piping plover. For example new development might result from the County Land Use Development Plan for Dare and Hyde County, but the details are lacking and its potential for impact piping plovers is indeterminate at this time. The outcome of the current action to develop a Cape Lookout Interim Protected Species Management Plan/EA would have direct, short-term impact on piping plover which can move back and forth during

nesting, migration, and overwintering. However, whether the impact of the Cape Lookout interim plan would be beneficial or adverse to this species would depend upon the management decisions that are made and ultimately implemented. The upcoming NPS Resource Stewardship Plan would address ORVs and, especially because of the documented risks that ORVs pose to piping plovers, this plan would have long-term, direct impacts on piping plovers at Cape Hatteras National Seashore. Other future planning efforts include the development of the Cape Hatteras National Seashore ORV Management Plan/EIS, which would have direct, long-term impact on piping plover. However, whether the impact of the ORV plan would be beneficial or adverse to piping plovers would depend upon the management decisions that are made and ultimately implemented. The outcome of the Cape Lookout National Seashore long-term ORV Management Plan/EIS would have direct, long-term impact on piping plovers which can move back and forth during nesting, migration, and overwintering. However, whether the impact of the ORV Management Plan would be beneficial or adverse to piping plovers would depend upon the management decisions that are made and ultimately implemented.

The overall cumulative impact of these past, current and future actions, combined with the effects of actions under alternative A, may affect / are likely to adversely affect the piping plover.

### **Conclusion**

Alternative A may affect / is likely to adversely affect piping plovers, mainly due to the effects of recreational uses. Past, present, and future actions inside the seashore and within the region, when combined with the impacts of recreation use and the surveying and management of the species expected under this alternative, would continue to result in impacts that may affect / are likely to adversely affect the piping plover. Impairment to the piping plover would not occur under alternative A because none of the activities described could be said definitively to lead to a long-term jeopardy of the resource.

### **IMPACTS OF ALTERNATIVE B: UNDISTURBED AREA FOCUS**

#### **Analysis**

**Species Surveying and Management.** Alternative B includes all the actions of alternative A, but with earlier and more intensive surveying (see the “Alternatives” chapter for more details). Under alternative B more data pertaining to the chick status is specified, which could result in staff lingering longer inside the nest closure. As is the case with alternative A, surveying brings people and/or essential vehicles into direct, short-term contact with piping plovers and piping plover habitat, and these activities themselves are a known risk (Burger 1994). Compared to alternative A, however, surveying actions under alternative B would begin earlier in the breeding season, would be conducted more frequently, and might put staff in closer proximity to nesting piping plovers for longer periods of time. While the surveying actions under alternative B may be more intense and might cause more disturbance than those under alternative A, these actions would still be expected to be short-term with relatively minor impacts. Precautions would be taken based on best professional judgment of the staff to minimize impacts during surveying, and the surveying itself would provide beneficial effects based on the use of the data gathered. Therefore surveying under alternative B may affect / is not likely to adversely affect piping plovers.

Alternative B includes all the actions of alternative A, but with several substantial differences regarding closures, including earlier closures and larger closures. As is the case with alternative A, the species management actions taken under alternative B may affect / are not likely to adversely affect piping plovers. Because the closures are larger, established earlier than alternative A, and are maintained year round, they protect more piping plovers and more piping plover habitat from risks associated with recreation use than does alternative A.

Alternative B includes the same essential vehicle use and predator control activities as described under alternative A. Bird predation would be further controlled by enforcing proper trash disposal and anti-

feeding regulations throughout Cape Hatteras National Seashore (Boarman 2003). These management actions may affect / are not likely to adversely affect piping plovers and their habitat.

**Recreation.** As with alternative A, alternative B provides for opportunities for a variety of recreation uses that have the potential to expose piping plovers to direct impact from the various recreational activities. Provisions to restrict recreation use under alternative B would provide a major deterrent to the entry of ORVs, people, pets, and predators into essential piping plover habitats (Coutu et al. 1990, Kuklinski 1996, Lyons 2002, Lyons 2003, Lyons 2004). However, alternative B primarily provides enhanced protection to piping plovers from the risks associated with ORV traffic and could result in higher impacts from pedestrians. This is because pedestrian traffic would be allowed under alternative B anywhere outside of the closures, which leaves opportunity for pedestrians to impact piping plovers (especially if they do not respect posted closures). At this time, it is not known whether piping plovers react more negatively to ORVs or pedestrians, or to pedestrians with leashed pets. Also, given that ORVs are not permitted to enter these highly desirable locations for recreation use, this may be expected to result in an increase in pedestrian traffic given the fact that walking in would be the only way to access these sites. Furthermore, more ORV traffic might be expected in the areas adjacent to these important nesting grounds as cars stage and park to drop off pedestrians. Nevertheless, because pedestrians are not allowed to bring pets into these areas, direct impact under alternative B would be reduced compared to alternative A and not likely to adversely impact piping plovers. Therefore, overall, the recreation use actions taken under alternative B may affect / are not likely to adversely affect piping plovers, primarily because closures would be larger, established earlier, and maintained year round relative to alternative A.

Substantially more outreach is proposed under alternative B than under alternative A, including annual reporting, educational signage, and informational brochures. This additional outreach would be beneficial and may affect / is not likely to adversely affect piping plovers.

### **Cumulative Impacts**

Cumulative impacts to piping plover under alternative B would be the same as those described for alternative A. Although alternative B does provide some additional protection due to its restrictions on use and earlier/larger closures, the adverse effects on piping plover from other actions occurring in the region would still exist. Therefore, the effects of these other actions, added to the effects of actions under alternative B, may affect / are likely to adversely affect piping plover on a regional basis.

### **Conclusion**

Under alternative B, there is more potential for disturbance from surveying than under alternative A; however, this is offset by the larger and longer duration ORV closures. Past, present, and future actions inside the seashore and within the region, when combined with the impacts of recreation use and the surveying and management of the species expected under this alternative, would continue to result in impacts that may affect / are likely to adversely affect the piping plover. Impairment to the piping plover would not occur under alternative B because none of the activities described could be said definitively to lead to a long-term jeopardy of the resource.

## **IMPACTS OF ALTERNATIVE C: TAILORED MANAGEMENT FOCUS**

### **Analysis**

**Species Surveying and Management.** Alternative C includes the actions of alternative B with some variation in surveying. There would be slightly less surveying and less disturbance, since less data would be collected. As is the case with alternatives A and B, surveying under alternative C brings people and/or essential vehicles into direct, short-term contact with piping plovers and piping plover habitat and these activities themselves are a known risk factor (Burger 1994). Compared to alternative B; however, surveying actions under alternative C are started two weeks later and are less data intensive than alternative B in all life stages except for unfledged chicks, when alternative C has continuous visual

surveying during daylight hours. This level of chick surveying has the potential (depending on distance of observers, use of essential vehicles, etc.) to be a substantial source of disturbance and even mortality. Hence, these surveying actions could cause short-term impacts that may affect / are likely to adversely affect piping plovers.

As is the case with alternatives A and B, the species management actions taken under alternative C may affect / are not likely to adversely affect piping plovers. Although the closures in alternative C are smaller and of shorter duration than alternative B, they would result in more ORV and recreation access under alternative C than under B, but still less than alternative A. Also, alternative C might, depending upon what surveying shows, require more moving of symbolic fencing, which could be a source of management disturbance not seen in either alternative A or B. Therefore, less piping plover and habitat would be protected from risks associated with recreation, surveying, and management under alternative C than under B.

As in alternatives A and B, alternative C includes essential vehicle use and predator control activities. Predator management under C is identical to that defined under alternative A. As with alternatives A and B, other management activities under alternative C may affect / are not likely to adversely affect piping plovers and their habitat because, while the placement and checking of predator exclosures, traps, and some essential vehicle traffic takes place inside the distance recommended in the Revised Recovery Plan (USFWS 1996a), these management activities are short-term and of relatively low impact.

**Recreation.** As with alternative A and B, alternative C provides for opportunities for a variety of recreation uses that have the potential to expose piping plovers to direct impacts. Whereas many of the popular recreational areas are closed year round under alternative B, alternative C attempts to maintain a minimum ORV corridor where and when possible, but also allows for closures when alternate routes are not possible.

Alternative C goes further in controlling recreation in general (and ORVs in particular) than does alternative A, but does not go as far as alternative B (which has several year round closures). In contrast to A, alternative C has floating closures around foraging chicks whereby they are guaranteed that their protective buffers would follow them as they change locations. Alternative C defines a tighter feedback loop between surveying and management such that closures during piping plover nesting can be expanded if necessary based on bird behavior. Under alternative C it is still likely that recreation activity would impact nesting piping plovers because people, pets, and especially predators may still potentially enter piping plover habitat during critical times (Coutu et al. 1990, Kuklinski 1996, Lyons 2002, Lyons 2003, Lyons 2004). Therefore, the recreation use under alternative C may affect / are likely to adversely affect piping plovers.

Similar to alternative B, substantially more outreach is proposed under alternative C than under A. This would be beneficial and may affect / is not likely to adversely affect piping plovers.

### **Cumulative Impacts**

Cumulative impacts to piping plover under alternative C would be the same as those described for alternative A. Alternative C would provide some additional protection for piping plover through its provision to close areas if no ORV route is feasible and its provision for buffers, but the adverse effects of other actions in the region would still exist. Therefore, the effects of these other actions, added to the effects of actions under alternative C, may affect / are likely to adversely affect piping plover on a cumulative basis.

### **Conclusion**

Under alternative C, there would still be potential for disturbance from surveying and management; but more protection for the piping plover due to the larger ORV closures provided relative to alternative A. Overall, alternative C may affect / is likely to adversely affect piping plovers, mainly due to recreational

impacts. Past, present, and future activities inside the seashore and within the region, when combined with the impacts of recreation use, surveying and management of the species expected under this alternative, would continue to result in impacts that may affect / are likely to adversely affect the piping plover. Impairment to piping plover would not occur under alternative C.

**IMPACTS OF ALTERNATIVE D: ACCESS / RESEARCH COMPONENT FOCUS (PREFERRED ALTERNATIVE)**

**Analysis**

**Species Surveying and Management.** Under alternative D surveying would be done following guidelines in the U.S. Fish and Wildlife Service Piping Plover Recovery Plan (USFWS 1996a). Before nest establishment, the park would conduct surveying of areas via ORV or on foot outside of resource closure areas using field scopes. Neither observers nor survey vehicles would pass through prospective territory. Vehicles would be parked at least 600 feet from the suspected center of territorial activity. The area would be approached on foot, maintaining adequate distance to not disturb birds.

Under alternative D, piping plovers would likely benefit from surveying 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 checked for breeding plovers. It would also improve surveying prior to actual nesting given that in 2004, surveying 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 could be erected if piping plovers display territorial, courtship, or scrapes in these areas. By continuing observations of piping plover in these areas until at least June 15, the seashore would have the flexibility to extend surveying until later in the season if warranted, which would positively affect plovers that may not establish nests until later in the season.

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

Alternative D would provide for surveying and resource closures to protect areas for migrating and wintering plovers. The surveying plan would benefit plovers by providing park managers with information on the types of habitats used by non-breeding piping plovers, seasons, and times of day utilized, and the locations of those habitats. This would increase knowledge on how and when piping plovers use the park.

Alternative D 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. This would benefit chicks given the continuous daytime staff observations until the brood fledges. Staff observing piping plover chicks may disturb the birds, keeping them from foraging or resting as they would under undisturbed conditions; however, this would be minimized by conducting observation activities from a distance so as not to disturb the brood. These monitoring actions could cause short-term impacts that may affect / are not likely to adversely affect piping plovers.

Alternative D would improve protection at recent breeding sites by closing them by April 1. Habitat not used within the last three years or new suitable habitat would not be posted by April 1 under alternative D. This could cause adverse impacts since any piping plovers attempting to use these unprotected areas in the early spring (prior to April 1) may abandon their attempts due to human disturbance (e.g., vehicles, pedestrians, kites) prior to being detected by bi-weekly surveys.

Alternative D would provide for protection of piping plover nests through the use of buffer distances recommended under the Piping Plover Recovery Plan. Further, additional information would be collected during this life stage based on observations via use of optical equipment outside the symbolic fencing. Staff observing bird location and behavior would have the flexibility to adjust closure buffers, as some individual piping plovers may require larger buffers than others (USFWS 1996a). Adverse impacts could result to piping plovers if adjustments to the buffer are not made in a timely manner. The buffers under alternative D would be expected to have positive effects on the species as park personnel and recreationists would be kept a safe distance (at least 150 feet) from incubating adults and their nests.

Piping plovers would likely benefit from the fact that the resource closure moves with the chicks, which would be especially important for highly mobile broods. Under alternative D, broods with a buffer distance of less than 3,000 feet would be surveyed during the daylight hours but not at night. For mobile broods that cover distances greater than 3,000 feet, brood movements would not be protected. However, given the planned intensive observations of the adults prior to, as well as after hatching, it would be reasonable to expect that the park 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 3,000 feet would be utilized.

Establishing year-round interior closures under alternative D at the spits and Cape Point would have beneficial impacts on piping plovers. The placement of closures may have a negative impact on piping plovers given the 150 foot ORV corridor around ocean and soundside shorelines would limit the availability of undisturbed intertidal and sound shoreline.

Alternative D would benefit piping plover management by expanding on data currently collected. As is the case with alternatives A, B and C, the species management actions taken under alternative D may affect / is not likely to adversely affect piping plovers. However, because the closures in alternative D are smaller and of shorter duration than alternative B and also allow more pedestrian access they will result in more ORV and recreation impact under alternative D than under B but still less than under alternative A.

As in alternatives the other alternatives, alternative D includes essential vehicle use and predator control activities. Predator management under D is identical to that defined under alternative A.

The conservation measures proposed under alternative D would have a beneficial impact, providing the seashore with additional data and information for effective piping plover management. Management activities under alternative D may affect / are not likely to adversely affect piping plovers and their habitat because while the placement and checking of predator exclosures, traps, and some essential vehicle traffic takes place inside the distance recommended in the Revised Recovery Plan (USFWS 1996a), these management activities are short-term and of relatively low impact.

**Recreation.** Alternative D would provide for recreation access around resource closures when possible via alternative routes or park designated bypasses. Protection of piping plover foraging areas that occur outside nesting closures would be provided. ORVs would be routed outside of the closure ensuring maintenance of the proper buffer distance. This would have beneficial impacts protecting foraging adults and the nest/eggs.

A bypass could result in disturbance to plovers if the bypass route is within plover territory. Depending on the location and the movement of the brood there may be risk of disturbance, injury, or death if the ORV bypass route is within the area utilized by the brood. There would also be an adverse impact if disturbance from the ORV route restricted the brood's movements to a potential foraging or resting site. However, alternative D is designed to redirect ORV routes and corridors to areas that would not impact the brood. Further, the bypass route would be closed during night time hours if it was within 3,000 feet of the brood so as not to adversely impact piping plovers.

Alternative D would have negative impacts since it does not guarantee that all adult foraging and nesting habitat would be protected as one contiguous unit. Under alternative D, the bypass would result in

disturbance if it is within plover territory. However, with the presence of trained NPS staff in the area, the park would 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.).

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 would help to provide peer based compliance with closures. 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 a vehicle corridor as described is not possible due to beach width and wrack placement. Tide ranges at Cape Hatteras National Seashore 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 vehicle 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 park visitors would 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 would be mitigated by the prohibition of pets from with ¼ mile of the closures and through education and outreach efforts via the park field personnel and partnerships with local volunteers and organizations.

Though no staff observations would be done after dark, periodic night time patrols of areas by law enforcement rangers and daytime outreach and education by NPS staff would help to deter violations of closures. In addition, partnerships with local organizations would help to provide peer based compliance with closures.

Recreation management taken under alternative D may affect / is likely to adversely affect piping plovers.

### **Cumulative Impacts**

Cumulative impacts to piping plover under alternative D would be very similar to those described for alternative A. Alternative D would provide some additional protection for piping plover through its monitoring of historic breeding habitat, its extended monitoring period, and its provision for buffers, but the adverse effects of other actions in the region would still exist. Therefore, the effects of those other actions, added to the effects under alternative D, may affect / are likely to adversely affect piping plover on a regional basis.

### **Conclusion**

Under alternative D, there would be the potential for disturbance from surveying and management, but more protection would be provided to piping plovers by monitoring historic and newly created breeding habitat, and continuing the monitoring until at least June 15. Overall, alternative D may affect / is likely to adversely affect piping plovers, mainly due to recreational impacts. Past, present, and future activities both inside the seashore and within the region, when combined with the impacts of recreation use, surveying and management of the species expected under this alternative, would continue to result in impacts that may affect / are likely to adversely affect the piping plover. Impairment to piping plover would not occur under alternative D.

## **SEA TURTLES**

### **SPECIES-SPECIFIC METHODOLOGY AND ASSUMPTIONS**

Potential impacts on federally listed sea turtle populations and their habitat within Cape Hatteras National Seashore were evaluated based upon the species' known interaction with humans, domestic pets, recreation and nighttime activities, predators, and off road vehicles, as well past and present occurrence at the seashore. Information on habitat, occurrence within the seashore and potential impacts on sea turtles

from recreation and other activities was acquired from park staff at Cape Hatteras National Seashore, the U.S. Fish and Wildlife Service, the North Carolina Wildlife Resource Commission, and available literature.

Although five threatened or endangered sea turtle species occur in the waters of North Carolina, only three, the loggerhead, green, and leatherback sea turtles, are known to nest at the seashore. The other two species, Kemp's ridley and hawksbill, are only known to occur at the seashore through the occasional stranding, usually due to either prior death or incapacitation due to hypothermia. Therefore the analysis only focuses on the three species that nest at the seashore. For these three species, the analysis focuses on effects to sea turtles from a variety of human recreational activities, as well as impacts incurred as a result of surveying and management activities. Except for the timing of nest laying activities, the nesting habits for loggerhead, green, and leatherback sea turtles at the seashore are similar. Therefore the analysis generally discusses the impacts on the sea turtles as a group. Impacts to a specific species are noted where they differ from the other sea turtle species. Sea turtle nesting habitat overlaps protected bird species and seabeach amaranth habitat seaward of the primary dune line. Therefore management for these species would also be beneficial to nesting sea turtles and is included in the analysis. However, the extent to which the bird and seabeach amaranth closures are beneficial to the turtles would be dependent upon the location, size and duration of the closures. In the analysis it is also assumed that compliance with closures and other regulations such as leash laws, disposal of bait and fish carcasses, etc., would increase from current levels where alternatives increase the natural resource and law enforcement staff.

It should also be noted that Cape Hatteras National Seashore is at or near the northern limit of the breeding range of all three species of sea turtles that nest there. As such it may be difficult to manage the current populations for increased nesting density, especially for the green and leatherback turtles—a goal outlined in the species' recovery plans (USFWS 1991; 1992).

### **Study Area**

The study area for assessment of the various alternatives is the seashore. The study area for the cumulative impacts analysis is the northern reaches of the species' territories, based on the species recovery plans for the turtles.

## **IMPACTS OF ALTERNATIVE A: NO ACTION ALTERNATIVE - CONTINUATION OF 2004 PROTECTED SPECIES MANAGEMENT**

### **Analysis.**

**Species Surveying and Management.** Under alternative A, seashore staff would continue to survey the entire park daily for turtle crawls and nests from June 1 to August 31. Prior to June 1 turtle crawls may be detected by bird observers, as evidence by nests being detected in May during previous years (NPS 1999; Lyons and Altman 2000; Sayles 2002; Gosh and Lyons 2002; Altman and Lyons 2003; Lyons 2005); however, turtle surveying is not the primary focus during this time and would normally occur in areas where bird breeding habitat and turtle habitat overlap. 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, again 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 that 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 surveying. These are likely due to human error or crawls were obliterated by another action such as ocean overwash or vehicle tracks (Lyons 2004). There is also the likelihood that nests can be run over by ATVs being used by the observers to cover the entire park and night patrols (law enforcement) can contribute to the number of false crawls.

Throughout the nesting season, turtle nests may also be missed due to human error or if crawl tracks are obscured by blowing sand or ORV tracks. Undetected turtle nests would not be protected by the seashore and would be subject to multiple potential threats such as being run over by ORVs; depredation by foxes or other predators; and loss due to erosion or frequent flooding. Hatchlings emerging from unprotected nests would be at a greater risk from light pollution, since there would be no light management measures enacted. If an undetected nest were located in an ORV use area, hatchlings would also be subjected to impacts associated with tire tracks, as the tracks would not be raked smooth by seashore staff.

Seashore staff would continue to use ATVs and occasionally ORVs to survey for turtle crawls and nests. Throughout the seashore, essential vehicle use would be required to not exceed 25 mph (15 mph in front of villages). ATVs would be required to not exceed 10 mph in closures, while ORVs would continue to be prohibited from entering closures. Staff using ORVs would be required to park the vehicle and enter the turtle closures on foot. The use of ATVs and ORVs during turtle surveying would allow the seashore staff to cover all 55 miles of shoreline each morning in search of turtle crawls and nests. Without the use of these vehicles, staff would not have the ability to cover the entire seashore, nor would they have the ability to bring the necessary supplies with them to erect closures around nests that they find during surveying. Using ATVs and ORVs during surveying would cause a slight risk of a nest or hatchlings being crushed or disturbance to nesting turtles; however, these risks would be minimized by the fact surveying would occur during the morning while nesting and hatching typically occur at night. On the rare occasion when nesting or hatching activities occur during daylight hours, as happened in 2005 (unpublished data), abiding by the speed and closure limits would allow observers to see and avoid impacting the turtles and their nests.

Surveying nests daily would be beneficial as it would allow closure violations/vandalism, predator activity, and hatching events to be detected. In the case of closure violations/vandalism, daily surveying would allow staff to repair any damage to the closure and rake smooth any tracks left behind by ORVs and/or pedestrians. In the case of predator activity, daily surveying would allow staff to protect those nests with predator exclosures.

While surveying activities under alternative A would provide many benefits, beginning direct surveying of sea turtles on June 1 would continue to result indirectly in an incidental take of sea turtles if a nest is missed and, therefore, not protected. There would also be a slight chance that surveying with ATVs and ORVs could result in an incidental take. Therefore, the surveying activities under alternative A may affect / are likely to adversely affect all species of sea turtles.

Under alternative A the seashore would continue to provide sea turtles the current level of protection from human disturbance. While all of the species management actions would provide some measure of protection to sea turtles, there would still be a high risk of disturbance or injury to adult nesting females, hatchlings, and live stranded sea turtles. Sea turtles nest along all of the seashore beaches, and although the process of nest site selection is not well understood and there is a lack of data describing the characteristics of nesting sites at the seashore, 24 hr/day ORV use may affect the beach profile and substrate characteristics in a way that reduces suitability for nesting and hatching success (Cohen 2005c). Vehicle traffic on beaches contributes to erosion, especially during high tides or on narrow beaches, where driving is concentrated higher up on the beach, which may make some areas unsuitable for nesting (NMFS and USFWS 1991). Vehicle driving also compacts the sand, making it more difficult for females to dig their nest cavities. While the ORV corridor protects some of the beach from ORV use, the area is fairly narrow and it is unknown if the protected areas are more suitable for nesting than the unprotected areas or what percentage of historic nests are located within the protected area as compared to unprotected area. Vehicles also leave ruts in the sand, and although these ruts would be raked smooth 50 days into the incubation period, when nest closures are expanded, closure violations do occur, leaving ruts which can trap hatchlings attempting to reach the ocean (Hosier et al. 1981).

Relocating nests laid in areas prone to erosion or frequent flooding by tides would have both beneficial and negative impacts. Historically, the single greatest impact on hatching success has been weather related events such as hurricanes or other storms which can uncover nests through erosion, frequently flood and inundate nests, or bury nests under feet of sand. Relocating nests prone to these events to areas higher up on the beach increases the likelihood that these nests would not be lost. However, relocation does have some negative impacts. Six hours after deposition, the egg embryo becomes attached to the top of the eggshell. After this the embryo is very sensitive to movement, and can be dislodged if the egg is rotated. This would result in the death of the embryo. If nesting pits are not constructed properly they can lead to loss of hatchlings as well. In addition, relocating nests higher up on the beach could alter the natural sex ratio of the nest by altering the incubation temperature. Temperatures warmer than 84.6°F produce more females, while colder temperatures produce more males. Because North Carolina is near the northern limit of loggerhead nesting, it is believed that North Carolina contributes more males to the population. However, there is currently not enough data to determine if sex ratios are being altered due to relocation efforts. While management under alternative A would provide benefits to the sea turtles, there would still be some incidental takes and therefore management activities may affect / are likely to adversely affect sea turtles.

The seashore would not enact light management measures under alternative A. In addition to the impacts of night driving as described above, lights from seashore structures and fishing piers as well as beachfires could deter nesting females from coming ashore or once ashore cause them to abort nesting attempts. These light sources could also cause hatchlings to become disoriented when trying to find and move to the sea, which would increase the risk of exhaustion, desiccation, or predation.

Continuing to remove fox from the seashore and continuing to use predator exclosures would be beneficial to the sea turtle, as it would reduce the number of nests disturbed or depredated by these predators and would increase the sea turtle hatching success at the seashore. However, there is a slight chance that predator trapping would result in disturbance to females or hatchlings, or result in nest or hatchling loss if trappers are not cognizant of nest locations. Using predator exclosures would entail a slight risk of damaging eggs during placement, and might result in partial or full nest losses if a predator learns to hunt for them. Though predator trapping and the use of predator exclosures would protect nests from predators, there would still be a slight risk for the incidental take of sea turtles due to the actions of the hunters and staff installing exclosures. Therefore, the other management activities under alternative A may affect / are likely to adversely affect determination for all species of sea turtles.

**Recreation.** Erecting a 30 feet by 30 feet buffer around a nest would help protect it from being run over by ORVs or disturbed by pedestrians and their pets. However, occurrences of closure violations and vandalism have become increasingly common, and with no increase in law enforcement or resource staffing levels under alternative A, the closure violations and vandalism would be expected to continue. The small size of the nest closures increases the risk that trespassing by ORVs, pedestrians and/or their pets would lead to the nest being directly affected; either run over or found and dug at. Recreational night driving would be allowed within the seashore, and the presence of ORVs on the beach at night could disturb adult females and cause them to abort nesting attempts. These impacts could also be caused by the presence of essential vehicles on the beach at night. Since 1999, an average of 46% of all turtle activity each year has been false crawls (aborted nesting attempts). While it is not known how many false crawls were a direct result of ORVs, there have been specific incidents documented where it was known that an ORV caused the false crawl (Cape Hatteras National Seashore unpublished data). If too many false crawls occur for one individual, turtles can shed their eggs in the water and, thus, those eggs would be lost. While turtles may attempt to nest again that same night or on subsequent nights, causing a turtle to abort a nesting attempt is considered an incidental take under Section 7 of the Endangered Species Act, and it may cause the turtle to nest in another location that is less optimal. Emerging hatchlings primarily use light cues such as a brighter horizon to find and move towards the sea; however, the headlight from ORVs driving on the beach at night can disorient hatchlings, which can lead to exhaustion and an increased risk

of predation or desiccation. The light filter fencing erected around active nests would decrease this impact somewhat, but would not eliminate it. Night driving could also result in striking and killing nesting or live stranded adult sea turtles.

Under alternative A the public would continue to receive information at the visitor centers about nesting sea turtles and the measures the park is taking to protect the nests and hatchlings. The public would also continue to be notified about temporary closures that would limit ORV traffic as well as when these closures reopen. Such public outreach is beneficial to the species as it educates the public to the specific needs of the species and alerts the public ahead of time to areas where they can not go due to potential impacts to the species. Therefore, public outreach under alternative A may affect / is not likely to adversely affect all species of sea turtles.

### **Cumulative Impacts**

Other past, present, and future planned actions within and around Cape Hatteras National Seashore have the potential to impact the populations of all three species of sea turtles that nest at Cape Hatteras National Seashore. The dredging of Oregon inlet has occurred in the past and would continue to occur on an annual basis in the future. Dredging may affect / is likely to adversely affect sea turtles because it occurs during the turtle nesting season and occasionally uses a hopper dredge which historically are known to be responsible for incidental takes of sea turtles, although as of 2002 no incidental takes had been recorded at Oregon Inlet (USACE 2002). Heavy construction equipment also accesses the inlet via Bodie Island Spit. Though few turtles have historically nested in this area, the heavy equipment could lead to increased erosion or soil compaction, which would make the habitat less suitable for nesting. The presence of the equipment may also cause adult female turtles to abort nesting attempts.

The continued maintenance of NC-12 and berm maintenance have altered the natural morphology and ecology of the dunes and beaches within the seashore and have contributed to the narrowing of the beaches through erosion, and would continue to do so (Marion 2005). This may affect / is likely to adversely affect sea turtles on a long-term basis by making the beach habitat less optimal for nesting. Beach nourishment using dredge spoils from Oregon Inlet is a future action for Cape Hatteras National Seashore and may have both negative and beneficial impacts on nesting sea turtles. Continued NPS authorized berm maintenance for private property in front of villages within the seashore would have similar impacts to the NC-12 berm maintenance and may affect / is likely to adversely affect sea turtles.

Past storms such as hurricanes and other weather events during the turtle nesting and hatching season (April - November) have substantially impacted turtle nesting success within the seashore and throughout the state of North Carolina. Storms, depending upon their intensity can result in partial or complete nest loss due to flooding of nests, exposing nests due to erosion, or burying nests under feet of sand. Sea turtles have developed nesting strategies (e.g. laying lots of eggs and nesting several times during a season) to compensate for catastrophic natural events, so these impacts would be short term may affect / is likely to adversely affect sea turtles. Storms have also altered the beachscape in both positive and negative manners. In some areas storms cause beach erosion, which has made those areas less optimal for nesting, while in other areas the storms have created overwash areas that create new nesting habitat. Weather events such as cold fronts can also cause sudden drops in ocean and soundside water temperatures that can cause hypothermia, which can kill sea turtles. Hurricanes can also affect sea turtles because of their impact on staff resources. Recovery efforts that pull staff from resource management (and presumably surveying) activities during sea turtle nesting and hatchling season may affect / is likely to adversely affect sea turtles by causing nests to be missed due to a lack of surveying.

Several local and NPS past, current, and future planning efforts can also affect the sea turtles. For example new development might result from the County Land Use Development Plan for Dare and Hyde County. Though the details are lacking, additional development within the seashore's boundaries may

affect / is likely to adversely affect sea turtles by increasing the amount of light pollution on the beaches which would continue to cause adult turtles to abort nesting attempts and hatchlings to be disoriented when trying to make their way to the sea. Development might also increase the recreational use of the beaches and the impacts that recreation has on sea turtles. The outcome of the current action to develop a Cape Lookout Interim Protected Species Management Plan/EA could have long-term impacts on the nesting populations of all three species of sea turtles. However, whether the impacts of the interim strategy would be beneficial or adverse would depend upon the management decisions that are made and ultimately implemented. The upcoming NPS Resource Stewardship Plan would address ORVs and, especially because of the documented risks that ORVs pose to sea turtles, this plan would have long-term, direct impacts on sea turtles at Cape Hatteras National Seashore. However, the impacts on the sea turtles are indeterminate at this time and would depend on the policies developed with regards to where within the seashore ORVs would be allowed to go and during what time of day and what time of year. Other future planning efforts include the development of the Cape Hatteras National Seashore long-term ORV Management Plan/EIS, which would have direct, long-term impacts on the nesting sea turtle populations within the seashore as well as within the state of North Carolina. Specifically, it would have an impact on the state's goal of achieving 800 loggerhead nests annually within the state for a period of 25 years per the Loggerhead Recovery Plan (USFWS 1991). However, whether the impact of the ORV plan would be beneficial or adverse to sea turtles would depend upon the management decisions that are made and ultimately implemented. The outcome of the Cape Lookout National Seashore ORV Management Plan/EIS would also have direct, long-term impacts on nesting sea turtle populations within the state, but again, whether these impacts would be beneficial or adverse would depend upon the management decisions that are made and ultimately implemented.

The overall cumulative impact of these past, current and future actions, added to the effects of actions under alternative A, may affect / are likely to adversely affect sea turtles within Cape Hatteras National Seashore.

### **Conclusion**

While surveying and management activities would reduce the impacts to some extent, adult turtles may still be killed or caused to abort nesting attempts, nests may be run over or disturbed in other manners, and hatchlings may be run over or disoriented by light pollution. Therefore, overall the actions taken under alternative A may affect / are likely to adversely affect sea turtles. Past, present, and future activities both inside the seashore and within the state of North Carolina, when combined with the impacts of recreation use, surveying and management of the species expected under this alternative would continue to result in impacts that may affect / are likely to adversely affect the sea turtles. Impairment of sea turtles would not occur under alternative A.

### **IMPACTS OF ALTERNATIVE B: UNDISTURBED AREA FOCUS**

#### **Analysis**

**Species Surveying and Management.** Impacts to sea turtles under alternative B would be similar to alternative A, but with one primary difference based on change to surveying dates. The number of incidental takes of sea turtles resulting from missed nests would be reduced by beginning surveying on May 15 as compared to June 1, since this would cover the entire nesting season for loggerhead turtles which typically begin nesting in mid May in North Carolina (NMFS and USFWS 1991a). However, some leatherback nests may still be missed, as they typically begin nesting prior to May 15 (NMFS and USFWS 1992), and one nest was documented at the seashore as early as April 16 (Lyons and Altman 2000).

While surveying activities under alternative B would be more beneficial than alternative A, there would still be the potential for the incidental take of sea turtles due to missed nests and surveying with ATVs

and ORVs. Therefore, the alternative B surveying activities may affect / are likely to adversely affect all species of sea turtles.

Prohibiting electric lights on all park beaches from May 15 to October 31 or until the last known turtle nest has hatched (whichever is later), prohibiting beachfires from May 15 to November 15, enacting turtle friendly lighting regulations for all seashore structures, and encouraging concessionaires to install turtle friendly lighting would greatly reduce the amount of light pollution within the seashore. This would help prevent false crawls and disorientation of hatchlings.

Similar to alternative A, the seashore would use predator exclosures and would contract USDA personnel to trap predators such as fox. In addition, the seashore would support research efforts studying the sex ratio of sea turtles at the park. This information would be beneficial in making long-term decisions regarding nest relocation policies. However, depending upon the protocols used in conducting the research, there could be a slight risk of disturbing, injuring, killing, or destroying turtles, hatchlings, or eggs. The seashore would also close segments of the beach to all recreation use 24 hr/day to investigate the effect of recreation management on nesting rate, hatching success, sea-finding by hatchlings, proportion of false crawls, presence of potential predators and their tracks or burrows, and nest site characteristics. While this information would prove extremely useful in the decision-making process regarding long-term turtle management policies at the seashore, depending on the research design, there could be a slight risk of disturbing nesting turtles, impacting beach characteristics, injuring or disorienting hatchlings, or destroying eggs. Therefore, due to the possibility of an incidental take, conducting research may affect / is likely to adversely affect all species of sea turtles.

The impacts for these activities would be the same as under alternative A and may affect / are likely to adversely affect all sea turtles.

**Recreation.** Under alternative B the overall impact and number of incidental takes of sea turtles due to ORV and other recreational use would be substantially reduced by restricting ORV use to daylight hours from April 1 to November 15 or until the last known turtle nest has hatched, closing portions of the seashore to ORV use, increasing buffer sizes around nests, increasing law enforcement, and enacting light management measures.

Turtle nesting and hatching occurs mostly during nighttime hours. Only on rare occasions do these events take place during daylight hours; only three documented incidents have occurred at the seashore since 1999. Therefore prohibiting night driving during the turtle nesting and hatching season would provide substantial protection to nesting turtles from being disturbed by ORVs and to hatchlings from being run over or misoriented by ORV headlights, beach fires, and lanterns. Misorientation is when sea turtles travel in any direction other than the general vicinity of the ocean (FWC 2002). Other light sources can misdirect hatchlings away from the ocean.

Closing the spits and Cape Point to all ORV use combined with prohibiting night driving would eliminate all recreational ORV use impacts on sea turtles during the nesting and hatching season in those areas. In addition, closing other segments of beach to all recreation 24 hr/day from April 1 to November 15 for research purposes would eliminate all recreation-related impacts to sea turtles in those areas as well. However, depending upon the protocols used in conducting the research, there could be a slight risk of disturbing nesting turtles, impacting beach characteristics, or injuring or disorienting hatchlings.

Increasing the buffer around a nest from 30 feet to 150 feet would decrease the likelihood of a nest being directly affected if an ORV, pedestrian and/or their pets violated the closure. Conducting random spot checks for violations and increasing the buffer to 300 feet or possibly 600 feet if a violation occurs would further protect the nest from direct impacts by ORVs, pedestrians and/or their pets. Increasing the number of natural resource and law enforcement staffing would increase compliance with closures and reduce the number of potential impacts to the nests. Fifty days into the nest incubation period expanding all nest-to-beach closures to a width of 600 feet while continuing to erect light-filter fencing, and raking the beach

smooth would also reduce the likelihood that the hatchlings would be impacted by ORVs, pedestrians, or light pollution.

In addition to the beneficial impacts of providing information about sea turtles at the visitor's center, the seashore would also inform the public about turtle closures and provide residents of the villages within the boundaries of the seashore about turtle biology and the use of turtle friendly practices, such as not directing lights towards the beach or shielding them, not leaving beach furniture on the beach overnight, etc. The seashore would inform beachside residents and villages about the use of turtle friendly lighting. These measures would have beneficial impacts on the sea turtles by helping to reduce the amount of light pollution on the beach and removing obstacles (i.e., beach furniture) that may deter nesting or trap hatchlings.

Through increased levels of natural resource and law enforcement staffing, the seashore would also enforce proper trash disposal and anti-wildlife feeding regulations throughout the park, including the proper disposal of fishing bait and filleted fish carcasses. This would help prevent attracting predators onto the beach where they may find and depredate turtle nests.

Outreach activities may affect / are not likely to adversely affect sea turtles.

### **Cumulative Impacts**

Cumulative impacts to sea turtles under alternative B would be very similar to those described for alternative A. Although alternative B does provide some additional protection, the adverse effects on sea turtles from other actions occurring in the region would still exist. Therefore, the effects of these other actions, added to the effects of actions under alternative B, may affect / are likely to adversely affect sea turtles on a regional basis.

### **Conclusion**

Though surveying and management activities would greatly reduce these impacts, there would still be a risk that some adult turtles may be killed or caused to abort nesting attempts, unidentified nests may be run over or disturbed in other manners, and hatchlings may be run over or disoriented by light pollution. Therefore the actions taken under alternative B may affect / are likely to adversely affect sea turtles. Past, present, and future activities both inside the seashore and within the state of North Carolina, when combined with the impacts of recreation use, surveying, and management of the species may affect / are likely to adversely affect the sea turtles. Impairment of sea turtles would not occur under alternative B.

## **IMPACTS OF ALTERNATIVE C: TAILORED MANAGEMENT FOCUS**

### **Analysis**

**Species Surveying and Management.** Surveying activities for sea turtles under alternative C would be the same as under alternative B and may affect / is likely to adversely affect sea turtles. Management activities and impacts under alternative C would be similar to alternative A with several exceptions that would enhance the protection of turtles and their habitat.

Turtle nesting habitat would be protected at the spits and Cape Point, where there would be a year-round 150 feet corridor allowing ORV traffic through these areas where conditions and space permit. While management policies under alternative C would provide greater benefits to the sea turtles, there would still be some incidental takes and therefore, management activities may affect / are likely to adversely affect sea turtles.

Predator trapping and the use of predator exclosures would be similar to alternative B; thus, the impacts under alternative C would be the same as under alternative B. Similar to alternative B, the seashore would support research efforts studying the sex ratio of sea turtles at the seashore. However, depending upon the methodology used in conducting the research, there could be a slight risk of disturbing, injuring, killing or destroying turtles, hatchlings or eggs. Although this information would be beneficial in making long-term

decisions regarding nest relocation policies, due to the potential for incidental take, this research effort may affect / is likely to adversely affect all species of sea turtle.

Nesting turtles and hatchlings would be subjected to the impacts of light pollution from beachfires. Due to the possibility of incidental takes associated with beachfires and predator management, other management activities may affect / are likely to adversely affect all species of sea turtle.

**Recreation.** ORVs would be limited to a corridor 150 feet duneward of the mean high tide line or 30 feet (vs. 20 feet under alternative A) seaward of the toe of the dunes or vegetation line whichever is less. This corridor would expand the protected habitat by an additional 10 feet as compared to alternative A; however, sea turtle habitat within the corridor would still be subject to the same ORV impacts as described under alternative A. Fifty days into the incubation period, expanded nest closures would be the same as under alternative A and where possible ORV routes would be provided behind the nests while maintaining a minimum 30 feet buffer. If the expanded closure would block access to a spit or Cape Point and a route behind the nest is not feasible, then access would be provided via an alternate route (other ramps, existing interdunal road, or NC-12). If no alternate route is available, then criteria for a bypass route behind the nest would be evaluated. If no access was feasible after applying the bypass criteria, then a shoreline bypass would be implemented in front of the nest during daylight hours with staff present. If a daytime hatching occurred, the shoreline bypass would be closed. The shoreline bypass would be closed each night and all tire ruts raked smooth. Given the criteria for establishing a bypass behind the nest (e.g., always maintaining a minimum 30 feet buffer behind the nest), such a bypass would not impact the nest. A shoreline bypass would also not impact a nest as it would be protected in case of a daytime hatching event, and the bypass would be closed and tire ruts raked smooth prior to each night.

Recreational night driving would be prohibited from 10 PM to 5 AM from May 15 to August 31. This would protect nesting turtles and hatchlings from ORV impacts at night during these times. However, some turtles, especially leatherback turtles nest prior to May 15 and would still be subject to nighttime impacts from ORVs. On average incubation periods are 63 days, so any nests laid during July and August would probably hatch after August 31 and would be subject to nighttime impacts from ORVs. Any turtles that are nesting or hatchlings that are emerging between sunset and 10 p.m. and between 5 a.m. and sunrise would also be subject to nighttime impacts from ORVs.

The same outreach activities under alternative B would occur under alternative C and would be beneficial to the sea turtles. Therefore outreach activities may affect / are not likely to adversely affect all species of sea turtles.

### **Cumulative Impacts**

Cumulative impacts to sea turtles under alternative C would be very similar to those described for alternative A. Although alternative C does provide some additional protection, the adverse effects on sea turtles from other actions occurring in the region would still exist. Therefore, the effects of these other actions, added to the effects of actions under alternative C, may affect / are likely to adversely affect sea turtles on a regional basis.

### **Conclusion**

Surveying and management activities would reduce these impacts, though not as much as under alternative B but there would still be a risk that some adult turtles may be killed or caused to abort nesting attempts, unidentified nests may be run over or disturbed in other manners, and hatchlings may be run over or disoriented by light pollution. Therefore actions taken under alternative C may affect / are likely to adversely affect all species of sea turtle. Past, present, and future activities both inside the seashore and within the state of North Carolina, when combined with the impacts of recreation use, surveying, and management of the species expected under this alternative may affect / are likely to adversely affect the sea turtles. Impairment of sea turtles would not occur under alternative C.

**IMPACTS OF ALTERNATIVE D: ACCESS / RESEARCH COMPONENT FOCUS (PREFERRED ALTERNATIVE)****Analysis**

**Species Surveying and Management.** Surveying activities for sea turtles under alternative D would be the same as under alternative B, except monitoring would begin until 1. Daily morning surveys would offer benefits to sea turtles similar to alternative B during the nesting season from June 1 to August 31. However, this time period does not cover the entire sea turtle nesting season, and could have negative effects given the potential to miss a nest that may be laid earlier in the season. Due to the potential for an incidental take of sea turtles, species surveying may affect/is likely to adversely affect sea turtles.

Management of sea turtles under alternative D would be similar to alternative C except this alternative would make public use closures more flexible. The alternative improves access past or around protected turtle nests via seashore designated alternate routes or bypasses where possible.

Sea turtles would benefit through management of nests under alternative D by following the North Carolina Wildlife Resource Commission guidelines. Under alternative D, upon finding a turtle nest near the beach spits and points, park staff would immediately assess its potential for vulnerability to erosion or frequent flooding and if its location may have a direct impact on recreation access when the nest and hatchling access is fenced. If observers determine that a nest would be imperiled, the nest would be relocated in accordance with the Handbook for Sea Turtle Volunteers in North Carolina (NCWRC 2002). This would benefit the hatching success of sea turtles.

Predator trapping and the use of predator exclosures would be similar to alternative B and, thus, the impacts under alternative D would be the same. Similar to alternative B, the seashore would support research efforts studying the sex ratio of sea turtles at the park. However, depending upon the methodology used in conducting the research, there could be a slight risk of disturbing, injuring, killing, or destroying turtles, hatchlings, or eggs. However, the information obtained would be beneficial in making long-term decisions regarding nest relocation policies. In addition to sex ratios the seashore would begin studying the levels of night use on the beach and seek funds to study the impacts of night driving on the beaches throughout Cape Hatteras National Seashore. The information collected would be used to develop management techniques for consideration in the long-term ORV management planning process. Although all of the information collected would be beneficial, due to the slight risk of an incidental take while studying sex ratios, sea turtle research results may affect/likely to adversely affect determination for all species of nesting sea turtles at the seashore. Many beachfires are associated with the presence of ORVs (Meekins, White personal communication), and under alternative D beachfires would be allowed year round. In 1998 visitors reported hatchlings crawling into their beach fire (Lyons 1998). In 2001, 773 campfires were documented by turtle observers throughout the seashore, including vehicle and vehicle free areas (Lyons and Goshe 2001). Adult turtles as well as hatchlings would be subject to the impacts of light pollution from beachfires. Under alternative D, concessionaires operating within the park would be encouraged to install turtle friendly lighting, and all park structures would use turtle friendly lighting. This would benefit the sea turtles by reducing the amount of light pollution on the beaches. However, due to the potential for the incidental take of turtles, other management practices may affect/are likely to adversely affect all species of nesting sea turtles at the seashore.

**Recreation.** If it is determined that fencing a nest prior to hatching would cause a disruption of ORV recreation access to the spits and Cape Point, seashore staff would immediately determine if an alternate route is available or if a reasonable bypass route could be established at hatching time. In accordance with NCWRC guidelines, relocation would be considered as a last resort since it carries risk. Embryos may be damaged or development may be compromised (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 for any reason, it would be immediately protected with symbolic fencing and signage, which would provide immediate protection of the nest from recreational use. The use of bypasses or alternate routes around sea turtle nests

is expected to have beneficial effects on the protection of nests and hatchlings by diverting recreation-users away from the sensitive area. However, in some cases, the bypass system could have a negative impact on hatching sea turtles by increasing the potential of hatchlings encountering vehicles if the bypass is located in an area that the hatchlings could be drawn to such as due to an artificial lighting source.

Measures are normally taken to smooth vehicle 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 (FWS 1993, USGS 2005).

Under current management and the proposed alternative, daytime rules would apply for ORV driving on the beaches after dark. 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). Cape Hatteras and Cape Lookout National Seashores are listed in the U.S. Fish and Wildlife Service Loggerhead Recovery Plan as the only federal agencies within the nesting range allowing night time driving on beaches. Though actual vehicle counts are scant, patrol rangers have stated that there is substantial vehicle 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. 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 also be subject to misorientation or disorientation by vehicle lights. Filter cloth, when used, is not always effective in protecting hatchlings from light sources (Lyons 2004). Nighttime vehicle use can indirectly add to the lighting problems for turtles.

Sea turtles would benefit from periodic changes in law enforcement scheduling for the purpose of surveying 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 observers arrive in the morning (Griest, personal communication).

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. These measures would be beneficial and may affect/not likely to adversely affect all species of nesting sea turtles at the seashore.

### **Cumulative Impacts**

Cumulative impacts to sea turtles under alternative D would be very similar to those described for alternative A. The adverse impacts to sea turtles from actions occurring regionally combined with the impacts of alternative D may affect/likely to adversely affect sea turtles on a regional basis.

### **Conclusion**

Though surveying and management activities would reduce these impacts, though not as much as alternative B or C, there would still be a risk that some adult turtles may be killed or caused to abort nesting attempts, unidentified nests may be impacted, and hatchlings may be run over or disoriented by light pollution. Therefore, actions taken under alternative D may affect/are likely to adversely affect all species of sea turtle within the seashore. Past, present, and future activities both inside the seashore and within the state of North Carolina, when combined with the impacts of recreation use, surveying, and

management of the species expected under this alternative may affect/are likely to adversely affect the sea turtles. Impairment of sea turtles would not occur under alternative D.

## **SEABEACH AMARANTH**

### **SPECIES-SPECIFIC METHODOLOGY AND ASSUMPTIONS**

Potential impacts on seabeach amaranth populations and habitat at Cape Hatteras National Seashore were evaluated based on the species' life history, its past and present occurrence at the seashore, as well as known effects on the species from activities relating to humans, pets, predators, and off road vehicles. Information on habitat and other existing data were acquired from park staff at Cape Hatteras National Seashore, the U.S. Fish and Wildlife Service, and available literature. Methods to analyze impacts on seabeach amaranth use alternative A as the baseline condition against which the action alternatives are compared, for alternative A represents the NPS current management practices as of 2004.

The analysis focuses on impacts to seabeach amaranth from a variety of human recreational activities, as well as impacts incurred as a result of surveying and management activities. Seabeach amaranth often grows in habitat areas used by other protected species within the seashore such as plovers, oystercatchers, colonial waterbirds, and sea turtles. Therefore any closures established to protect the habitat or nests of these species would also benefit seabeach amaranth, though the extent of the benefit would depend upon the actual location, size, and duration of the closures. It is also assumed that increases in natural resource and law enforcement staffing at the seashore would increase public compliance with closures and other park regulations (e.g., leash laws) than currently exists.

### **STUDY AREA**

The study area for assessment of the various alternatives is the seashore. The study area for the cumulative impacts analysis is the entire habitat range for seabeach amaranth, which includes nine states from Massachusetts to South Carolina.

### **IMPACTS OF ALTERNATIVE A: NO ACTION ALTERNATIVE - CONTINUATION OF 2004 PROTECTED SPECIES MANAGEMENT**

#### **Analysis**

**Species Surveying and Management.** During late July or early August, when plants are large enough to be easily detected, an annual survey is conducted of all potential SBA habitats to locate and document plants. Prior to the annual survey, seabeach amaranth is subject only to ancillary surveying by bird and turtle observers while they conduct their primary duties. Unprotected seedlings or plants in areas open to ORV use would likely be crushed and go completely undocumented. Since ATVs and/or ORVs are used in conducting bird and turtle surveying, there would also be a small probability of essential vehicle impacts on plants and seeds due to crushing and burial, respectively.

As a result of plants potentially being destroyed by recreational and surveying ORVs/ATVs, species surveying under alternative A may affect / is likely to adversely affect seabeach amaranth.

Seabeach amaranth is a fugitive annual, or a species adapted to inhabit newly disturbed habitats yearly, whose seeds are viable for long periods of time and can be dispersed long distances by wind and water, allowing it to occupy newly created habitat. Seeds may also just accumulate around the base of a plant when it dies, allowing it to continue to occupy currently available habitat. Therefore, to protect and maintain this species, it is necessary to protect the plants and habitat where they now occur and potential habitat where plants might eventually occur, as well as unknown sites where seeds might be (Jolls et al. 2004).

Since 2000, most areas where the plant has been found were either in established bird closures or other areas closed to vehicular traffic (NPS 2000; Lyons 2001; M. Lyons, NPS, pers. comm., S. Smith, Louis

Berger Group, Inc. October 7, 2005). The primary habitat of seabeach amaranth consists of overwash flats at accreting ends of islands and the sparsely vegetated zone between the high tide line and the toe of the dune. Much of this habitat corresponds with that of piping plover, American oystercatcher, and other protected bird species at the seashore.

Under alternative A, when a seabeach amaranth plant is found outside of an existing closure (i.e., bird or turtle closure) a 10 feet buffer around the plant(s) would be established and marked with signs to prevent trampling of the plant. While this buffer would afford some protection to a plant, such a small buffer in a high ORV use area might be subject to erosion effects from multiple passes of vehicles at speeds of 25 mph.

Webworms (caterpillars of small moths) feed on the leaves of seabeach amaranth, and if prolific enough, can defoliate the plants to the point of either killing them or at least reducing their seed production. Webworms have been numerous in some years and absent in others (M. Lyons, NPS, pers. comm. S. Smith, The Louis Berger Group, Inc. October 7, 2005); however, there is no management policy for how to deal with webworm predation. Beach vitex (*Vitex rotundifolia*) was originally introduced to South Carolina from Korea. Though it has not been documented in the seashore yet, as of 2005 it has migrated from South Carolina as far north as Atlantic Beach, North Carolina (Carolinan Beach Vitex Task Force 2005). Although not classified as an invasive species yet, it is a fast spreading plant that grows in similar habitats and outcompetes seabeach amaranth. Under alternative A, there would be no management plan for this species should it be found in the seashore. Without management policies for webworms and beach vitex, these species, if found in the park, would have negative impacts on seabeach amaranth. There would also be a small probability that USDA trappers hunting fox would trample seabeach amaranth plants during their late May and early July trapping efforts. Due to this potential negative affect and the potential negative affect of not having management actions for webworms or beach vitex, other management activities may affect / are likely to adversely affect seabeach amaranth.

**Recreation.** ORV and pedestrian closures established under alternative A to protect recent piping plover and American oystercatcher habitat and the nesting habitat of other protected species would also protect seabeach amaranth habitat. However, these closures would not necessarily remain in place for the duration of the plant's growing season, and with the number of these birds declining at the seashore, the size and number of the closures would also decline, leaving more seabeach amaranth habitat unprotected and subject to impacts from ORVs and to a lesser extent pedestrians. By November 1 all bird closures are removed allowing ORV access to most seabeach amaranth habitat during its dormant season (December to April). In general, ORV traffic during the seabeach amaranth's dormant season would have some negative impacts including burying seeds or pulverizing them. However, there would also be some benefits. Seabeach amaranth is intolerant of competition from other plants, and winter ORV traffic would help prevent the widespread establishment of perennial grasses and shrubs on the overwash sand flats, which would render the habitat unsuitable for seabeach amaranth (USFWS 1996).

Alternative A would restrict ORV traffic to a corridor 150 feet seaward of the mean high tide line or 20 feet duneward of the toe of the dunes or vegetation line, whichever is less. While this corridor would protect a small strip of potential seabeach amaranth habitat near the toe of the dunes, much of the corridor, especially located near and on the spits and Cape Point, would lie within the primary habitat of seabeach amaranth and would expose any seeds or germinating plants to the impacts of ORVs, namely burying seeds to depths below which they can germinate and crushing any plants that do germinate. In addition to bird closures and habitat near the toe of the dunes that would be protected by the ORV corridor, any section of beach where vehicular traffic would be prohibited, such as swimming beaches and areas on Ocracoke Island, would also protect seabeach amaranth habitat where they co-occur.

Unprotected seedlings or plants in areas open to ORV use would likely be crushed and go completely undocumented. Since ATVs and/or ORVs are used in conducting bird and turtle surveying, there would

also be a small probability of essential vehicle impacts on plants and seeds due to crushing and burial, respectively.

Pedestrians are prohibited from seabeach amaranth closures under alternative A. Pedestrian use of beaches typically does not overlap heavily with the habitat of seabeach amaranth, as joggers prefer wet sand and beach bathers prefer to be closer to the water. Pedestrian traffic during the plants dormant season is much less than during its growing season and would not likely have any impacts on the species. Even during the growing season, pedestrian traffic would generally have little effect on seabeach amaranth populations, as many beaches with daily use by thousands of sunbathers, joggers, and other recreation enthusiasts have substantial and apparently healthy populations of seabeach amaranth (USFWS 1996). However, some undetected seedlings/plants could still be trampled by pedestrians and or their pets, therefore recreation use may affect / are likely to adversely affect seabeach amaranth.

### **Cumulative Impacts**

Other past, present, and future planned actions within and around Cape Hatteras National Seashore have the potential to impact seabeach amaranth. The dredging of Oregon inlet has occurred in the past and would continue to occur on an annual basis. The actual dredging does not directly impact seabeach amaranth; however some heavy construction equipment accesses the inlet via Bodie Island Spit (USACE 2002) and may affect / is likely to adversely affect seabeach amaranth by pulverizing or burying seeds or running over undetected seedlings or plants. Dredging of channels in and around barrier islands occurs throughout the seabeach amaranth's range along the eastern seaboard of the U.S. and would have the same impact depending upon the level of protection afforded the plant. The continued maintenance of NC-12 and berm maintenance have altered the natural morphology and ecology of the dunes and beaches within the seashore and have contributed to the narrowing of the beaches through erosion and removed newly created overwash habitat (Marion 2005). Stabilization of the dune system by planting vegetation is also detrimental to seabeach amaranth. These actions may affect / are likely to adversely affect seabeach amaranth on a long-term basis by reducing suitable habitat for the plant both within the seashore and throughout the plants range where ever berm maintenance occurs. Continued NPS authorized berm maintenance for private property in front of villages within the seashore would have similar impacts as the NC-12 berm maintenance and may affect / is likely to adversely affect seabeach amaranth.

Hurricanes and other weather events have negatively and beneficially impacted seabeach amaranth within the seashore and throughout the plant's range. Seabeach amaranth is extremely susceptible to overwash and strong storms can cause overwash in areas even at the toe of the dunes. If a storm occurs early enough in the growing season it can destroy plants before they set seed. Storms can also bury seeds so deep that they can not germinate. However, storms can also uncover previously buried seed banks, bringing them back to a depth where they can then germinate. Storms also play a major role in dispersing seeds through both wind and water, and can reestablish populations in areas that had become devoid of plants. Storms can destroy habitat through erosion or create new habitat by creating overwash areas. Hurricanes can affect seabeach amaranth because of their impact on staff resources. Hurricane recovery efforts that pull staff from resource management (and presumably surveying) activities may affect / are likely to adversely affect seabeach amaranth by causing plants to be missed and therefore go unprotected.

Several of the local and NPS past, current, and future planning efforts can also affect the seabeach amaranth. For example new development might result from the County Land Use Development Plan for Dare and Hyde County. Though the details are lacking, additional development may affect / is likely to adversely affect seabeach amaranth by increasing the amount of recreation on the beaches. Other potential impacts from development are indeterminate at this time. The outcome of the current action to develop a Cape Lookout Interim Protected Species Management Plan/EA could have long-term impacts on seabeach amaranth populations within Cape Hatteras National Seashore and throughout the rest of the plants habitat range. Populations of seabeach amaranth in the south are probably sources of long distance seed dispersal due to the fact that storms move northward along the U.S. Atlantic seacoast, thus Cape

Lookout National Seashore could be a potential seed source for suitable habitat in Cape Hatteras National Seashore and northward. However, whether the impacts of the interim strategy would be beneficial or adverse depends upon the management decisions that are made and ultimately implemented. The upcoming N Cape Hatteras National Seashore long-term ORV Management Plan/EIS and the Cape Lookout National Seashore long-term ORV Management Plan/EIS would address ORVs and, especially because of the documented risks that ORVs pose to seabeach amaranth, these plans would have long-term, direct impacts on seabeach amaranth at Cape Hatteras National Seashore and indirect impacts throughout the plants range if Cape Hatteras or Cape Lookout act as potential seed sources for long distance dispersal of the plant. However, the impacts on seabeach amaranth are indeterminate at this time and would depend on the policies developed with regards to where within the seashore ORVs would be allowed to go and during what time of year.

The overall cumulative impacts of these past, current and future actions, in combination with the effects of alternative A, may affect / are likely to adversely affect seabeach amaranth within the Cape Hatteras National Seashore and throughout the plants habitat range.

### **Conclusion**

Though surveying and management activities would reduce these impacts slightly, there would still be a risk that plants would be crushed and seeds would be pulverized or buried. Therefore the overall impacts of actions taken under alternative A is may affect/are likely to adversely affect the seabeach amaranth. Past, present, and future activities both inside the seashore and within the plant's historic range, when combined with the impacts of recreation use, surveying and management of the species expected under this alternative would continue to result in impacts that may affect/likely to adversely affect the seabeach amaranth. There would be no impairment of seabeach amaranth under alternative A.

### **IMPACTS OF ALTERNATIVE B: UNDISTURBED AREA FOCUS**

#### **Analysis**

**Species Surveying and Management.** Under alternative B all potential seabeach amaranth habitat, as defined by historic and extant populations within the past 10 years, would be identified by April 15 and those areas existing outside of established bird or turtle closures would be surveyed for plants by qualified observers one to two times per week beginning June 1. Surveying would cease when all plants are dead. An annual survey would be conducted in August with a follow-up survey in September to examine survivorship and seed production. Prior to re-opening any bird or turtle closures to recreational use, the closure would be surveyed for seabeach amaranth. Potential alternative ORV corridors around bird or turtle closures would also be surveyed for seabeach amaranth prior to establishment.

Identifying all potential habitat and surveying it one to two times per week beginning when seedlings are typically first visible in June would be very beneficial by documenting plants that might be destroyed by ORVs, pedestrians, or natural events (i.e. storm overwash) prior to the annual survey in August. Documenting these plants would result in the habitat where they were located being protected as potential habitat (i.e. historic or extant) at the beginning of the nest growing season. This would enhance the chances that the seabeach amaranth population would increase within the seashore. Conducting a follow up survey in September to gather more data about plants, survivorship and seed production would provide beneficial information for the management of this species. Surveying bird or turtle closures prior to reopening them to recreation use and surveying any potential alternative ORV routes around protected species closures would help ensure that any plants located in these areas would be protected.

Under alternative B the seashore would implement management actions for webworms (picking them from individual plants prior to metamorphose) and beach vitex (removing any plants if found). Implementing these measures would be beneficial to the plant. Under alternative B, many of the closures for seabeach amaranth habitat would overlap those for piping plovers and thus would have the same

restrictions for essential vehicles entering the closures. The restrictions, which would include only entering during daylight hours, preferably using only ATVs as compared to ORVs, and traveling at speeds not to exceed 5 mph, would be beneficial to seabeach amaranth as they would greatly reduce the likelihood that plants would be run over by essential vehicles. However, some plants may still be crushed and some burying of seeds by essential vehicles may occur. Plants would also still be subject to trampling by USDA trappers hunting fox during their late May and mid July trapping efforts. As a result, other management activities may affect / are not likely to adversely affect seabeach amaranth.

Under alternative B interpretive signs about the susceptibility of trampling seabeach amaranth would be placed at all ORV entry points and at seashore kiosks. This outreach measure would be beneficial to the species as it would help inform the public about the needs of seabeach amaranth. Therefore, outreach measures may affect / are not likely to adversely affect seabeach amaranth.

**Recreation.** Despite surveying efforts, there would remain a small probability that plants would be missed and subsequently crushed by ORVs or destroyed by natural causes. Seeds in areas open to ORV traffic would still be subject to impacts from ORVs and similar to alternative A, there would remain a small probability that seeds and plants would be impacted by observers using ATVs and/or ORVs while conducting their duties. Therefore, species surveying activities may affect / is likely to adversely affect seabeach amaranth.

Under alternative B, protection of seabeach amaranth habitat and plants would be greatly enhanced by the year-round closures of areas for protection of the piping plover. Also, all potential seabeach amaranth habitats as defined by historic or extant populations within the past 10 years would be closed to ORV traffic from April 15 to November 30. Newly created habitat suitable for seabeach amaranth would also be protected by restricting ORVs to a corridor within 75 feet of the mean high tide line. The 75 feet ORV corridor would likely contain some seabeach amaranth habitat and would likely result in some mortality to plants and burial of seeds by ORVs; however, the impact to plants would be slightly reduced by surveying the area one to two times per week, as any plants found would be documented and have a buffer established around them. Increasing buffer sizes around plants from 10 feet to 30 feet would further protect plants and would likely reduce the likelihood they would be impacted by erosion caused by multiple passes of ORVs in high use areas. At the seashore, seabeach amaranth is often found in association with established closures for protected bird species. However, bird closures are often reopened prior to the end of the seabeach amaranth germination and growing season due to areas being abandoned, nests lost, or chicks fledging. Under alternative B, any plants that have established themselves in bird closures outside of historic seabeach amaranth habitat would be protected by conducting a survey of the closure prior to reopening it to recreation use and establishing new buffers around any plants found.

In general, ORV traffic during the seabeach amaranth's dormant season would have some negative impacts including burying seeds. However, under alternative B, piping plover habitat is closed to ORV use year-round and wintering habitat for other bird species is protected as well. To the extent that these areas overlap seabeach amaranth habitat, they would also protect seabeach amaranth seeds from ORV impacts. However, year-round bird closures may also have some negative impacts. Seabeach amaranth is intolerant of competition from other plants, and in areas where ORV traffic is prohibited year-round, the beach area would experience little disturbance and would continue through its successional stages with the establishment of perennial grasses and shrubs, which would render the habitat unsuitable for seabeach amaranth.

While management actions under alternative B provide a great deal of protection to seabeach amaranth habitat, seeds and plants, the possibility of plant mortality and seed burial caused by ORVs would still exist. Therefore the management actions may affect / are likely to adversely affect seabeach amaranth. Impacts under alternative B would be the same as under alternative A. Recreation use may affect / is likely to adversely affect seabeach amaranth.

A follow-up survey to the annual survey would occur in late September to examine survivorship of individual plants and seed production. This information would provide valuable long-term demographic information and research may affect / is not likely to adversely affect seabeach amaranth.

### **Cumulative Impacts**

The overall cumulative impacts under alternative B would be similar to those described for alternative A. Although the impacts would be less than under alternative A due to the habitat and plant protection measures that would be enacted under alternative B, adverse impacts from other actions would still exist. Therefore, the effects of these other actions, added to the effects of actions under alternative B, may affect / are likely to adversely affect seabeach amaranth on a regional basis.

### **Conclusion**

Though surveying and management activities would protect both the plant and its habitat, greatly reducing the recreational impacts, there would still be a risk that plants would be crushed and seeds would be pulverized or buried. Therefore the overall actions under alternative B may affect / are likely to adversely affect seabeach amaranth. Past, present, and future activities both inside the seashore and within the plant's historic range, when combined with the impacts of recreation use, surveying, and management of the species expected under this alternative, would continue to result in impacts that may affect / are likely to adversely affect the seabeach amaranth. Impairment of seabeach amaranth would not occur under alternative B.

## **IMPACTS OF ALTERNATIVE C: TAILORED MANAGEMENT FOCUS**

### **Analysis**

**Species Surveying and Management.** Impacts would be similar to alternative A as surveying during the growing season prior to the annual survey done in August would only consist of ancillary surveying conducted by bird and turtle observers while conducting their primary activities. However, identifying potential seabeach amaranth habitat by April 15 would allow bird and turtle observers to focus their ancillary surveying efforts in areas that are most likely to contain seabeach amaranth. Surveying bird or turtle closures prior to reopening them to recreation use and surveying any potential alternative ORV routes around protected species closures would help ensure that any plants located in these areas would be protected. Because some mortality to plants and burial of seeds would still be caused by ORV traffic and to a lesser extent observers using ATVs or ORVs, surveying under alternative C may affect / is likely to adversely affect seabeach amaranth.

Similar to alternative A, additional seabeach amaranth habitat would be protected during the plants growing season by management policies for other protected species within the seashore. However, the protection afforded to seabeach amaranth would depend upon the location, size and duration of the other species closures. Specifically, under alternative B the spits and Cape Point would be closed for piping plovers beginning April 1 except for a 150 foot ORV/pedestrian corridor where conditions and space allow. The closure of the spits and Cape Point to ORV traffic and pedestrians would benefit seabeach amaranth as these areas are prime seabeach amaranth habitat. However, there would still be mortality of plants and burial of seeds within the 150 foot corridor. In addition, if there is no bird activity on a given spit by July 15, the spit would be reopened to both pedestrian and ORV traffic. Any plants not detected and protected during the seabeach amaranth survey prior to the reopening would have an increased likelihood of being crushed and seeds would have an increased chance of being buried.

Increasing buffer sizes around plants from 10 feet to 30 feet would further protect plants and would likely reduce the likelihood they would be impacted by erosion caused by multiple passes of ORVs in high use areas.

While management actions under alternative C provide a more protection of seabeach amaranth habitat, seeds and plants than alternative A, the possibility of plant mortality and seed burial caused by ORVs

would still exist. Therefore the management actions may affect / are likely to adversely affect seabeach amaranth.

Impacts under alternative C would be the same as under alternative B as other management may affect / is not likely to adversely affect seabeach amaranth.

**Recreation.** Under alternative C, ORVs would be restricted to a corridor 150 feet duneward of the oceanside mean high tide line from April 15 to November 30 in areas of potential seabeach amaranth habitat as defined by historic and extant populations within the past 10 years. This would protect some seabeach amaranth habitat near the toe of the dunes from ORV impacts; however, much of the 150 feet corridor would likely include potential seabeach amaranth habitat, placing plants and seeds at a high risk of being crushed and buried, respectively, by ORV traffic, especially since there would not be intensive surveying for plants one to two times per week as under alternative B.

Under alternative C, beginning April 15 pedestrians would be restricted to a corridor within 150 feet of the mean high tide line. This corridor would be reevaluated after the annual survey and where no plants exist, it would be reopened. Where plants do exist, the closed areas would be reopened after the plants die. Pedestrian impacts would be slight as pedestrian use of beaches typically does not overlap heavily with the habitat of seabeach amaranth, as joggers prefer wet sand and beach bathers prefer to be closer to the water. However, where the 150 feet corridor overlaps seabeach amaranth habitat, some mortality of plants would occur due to trampling. Pedestrian traffic during the plants dormant season is much less than during its growing season and would not likely have any impacts on the species. Because some plants in the pedestrian corridor would likely be trampled, recreation use may affect / is likely to adversely affect seabeach amaranth.

Under alternative C interpretive signs about the susceptibility of trampling seabeach amaranth would be placed at all ORV entry points and at seashore kiosks. In addition, the public would be provided information about where the ORV/pedestrian corridor restrictions would be implemented. This outreach measure would be beneficial to the species as it would help inform the public about the needs of seabeach amaranth and give prior notification of where ORVs and pedestrians are prohibited, which would help to reduce the potential for conflicts. Therefore, outreach measures may affect / are not likely to adversely affect seabeach amaranth.

### **Cumulative Impacts**

The overall cumulative impacts under alternative C would be similar to those described for alternative A. Although the impacts would be less than under alternative A due to the habitat and plant protection measures that would be enacted under alternative C, adverse impacts from other actions would still exist. Therefore, the effects of these other actions, added to the effects of actions under alternative C, may affect / are likely to adversely affect seabeach amaranth on a regional basis.

### **Conclusion**

While surveying and management activities would reduce these impacts, though not as much as under alternative B, there would still be a risk that plants would be crushed and seeds would be pulverized or buried. The actions taken under alternative C may affect / are likely to adversely affect seabeach amaranth. Past, present, and future activities both inside the seashore and within the plant's historic range, when combined with the impacts of recreation use, surveying, and management of the species expected under this alternative, would continue to result in impacts that may affect/likely to adversely affect the seabeach amaranth. Impairment of seabeach amaranth would not occur under alternative C.

**IMPACTS OF ALTERNATIVE D: ACCESS / RESEARCH COMPONENT FOCUS (PREFERRED ALTERNATIVE)**

**Analysis**

**Species Surveying and Management.** Under alternative D all potential seabeach amaranth habitat, defined as historic and extant populations within the past 10 years, would be identified by April 15. Beneficial effects are anticipated for the seabeach amaranth through the identification of historic and newly created habitat, by providing observers with information to know where there are possible new colonies of the plant. This would also allow the observers to include these areas in surveys in order to provide early protection and surveying for seedlings. Identification of historic and newly created habitat is beneficial in that it allows greater focus for surveying and adaptive management in the event of human or natural disturbances. However, direct negative impacts to the threatened plant may be expected to occur as the proposed alternative does not include targeted surveying beginning June 1 when the seedlings are typically first visible. This could result in the loss of some plants through destruction either by natural or human disturbances as the preferred alternative provides for a survey to begin in August each year to locate and count all plants. Any plants that are not detected, subsequently identified and closed with symbolic fencing, may be destroyed by either human or natural disturbances prior to the August survey and would not be accounted for in the survey. Additionally, the surveys for seabeach amaranth would be conducted as ancillary surveys during routine bird and turtle surveying, creating the greater likelihood that plants germinating outside of an established bird closure or other area where vehicles are prohibited would not be detected. Also, surveying can have negative impacts through the burial of seeds or the occasional crushing of newly germinated plants.

Surveying bird/turtle closure areas for seabeach amaranth prior to opening to ORV traffic would protect any plants that exist within these areas. However, due to the potential for crushing plants or pulverizing or burying seeds species surveying may affect/is likely to adversely affect seabeach amaranth.

Under alternative D, if a seabeach amaranth seedling or plant is found in an area open to ORV and/or pedestrians, the seashore would erect symbolic fencing with signage to create a 30 foot closure around the plant. Alternative A only provides for a 10 foot closure area, when a plant or seedling is found outside an existing closure area.

**Recreation.** ORV use would be restricted to a corridor 150 ft duneward of the oceanside mean high tide line from April 15 to November 30 in areas of potential SBA habitat, as defined by historic and extant populations within the past 10 years, and in areas of newly created habitat suitable for seabeach amaranth. This would protect some seabeach amaranth habitat near the toe of the dunes from ORV impacts; however, much of the 150 ft corridor would likely include potential and current seabeach amaranth habitat, opening it up to both direct and indirect disturbances from ORVs. Stems of the plant are easily broken or crushed by foot traffic and tires, thus, even limited 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 the seashore 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

making the habitat unsuitable for seabeach amaranth because of its inability to outcompete other vegetation.

Under alternative D, similar to alternative B and C, the seashore would implement management protocols for webworms (picking them from individual plants prior to metamorphose) and beach vitex (removing any plants found). Seabeach amaranth would benefit from the removal of webworms before the caterpillars metamorphose on the plants, for 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). Seabeach amaranth would also benefit from the removal of all individuals of beach vitex found in the park as beach vitex is a recent invasive beach plant from South and North Carolina and grows in similar habitats as *A. pumilus* (Carolina Beach Vitex Task Force 2005). This invasive plant outcompetes seabeach amaranth and thus is a threat to coastal dune habitats.

Under alternative D many of the closures for seabeach amaranth habitat would overlap those for piping plovers and thus would have the same restrictions for essential vehicles entering the closures. These measures would be beneficial to seabeach amaranth as they would reduce the likelihood that plants would be run over. However, some plants may still be crushed and some burying of seeds by essential vehicles may occur. Plants would also still be subject to trampling by USDA trappers hunting fox during their late May and mid July trapping efforts. As a result, other management activities may affect / are not likely to adversely affect seabeach amaranth.

**Recreation.** Similar to alternative B, pedestrians are prohibited from seabeach amaranth closures under alternative D. Pedestrians would also be restricted to a corridor within 150 feet of the mean high tide line from April 15 to November 30 in areas of historic or newly created habitat suitable for seabeach amaranth. This corridor would be reevaluated after the annual survey and where no plants exist, it would be reopened. Where plants do exist, the closed areas would be reopened after the plants die. Pedestrian use of beaches typically does not overlap heavily with the habitat of seabeach amaranth, as joggers prefer wet sand and beach bathers prefer to be closer to the water. Pedestrian traffic during the plants dormant season is much less than during its growing season and would not likely have any impacts on the species. Even during the growing season, pedestrian traffic would generally have little effect on seabeach amaranth populations, as many beaches with daily use by thousands of sunbathers, joggers, and other recreation enthusiasts have substantial and apparently healthy populations of seabeach amaranth (USFWS 1996). However, some undetected seedlings/plants in the 150 ft corridor could still be trampled by pedestrians and or their pets; therefore, recreation may affect / are likely to adversely affect seabeach amaranth.

Under alternative D the seashore would place interpretive signs at all ORV entry points and at park kiosks describing the effects and susceptibility of the plants to pedestrian and ORV use. Cape Hatteras National Seashore would provide public notification of where the ORV/pedestrian corridor restrictions would be implemented, and following the annual August survey, notification would be provided of areas that have been reopened due to lack of plants. These actions would be beneficial for helping to protect seabeach amaranth. Therefore, outreach measures may affect/are not likely to adversely affect seabeach amaranth.

### **Cumulative Impacts**

The overall cumulative impacts under alternative D would be similar to those described for alternative A. Although the impacts would be less than under alternative A due to the habitat and plant protection measures that would be enacted under alternative D, adverse impacts from other actions would still exist. Therefore, the effects of these other actions, added to the effects of actions under alternative D, may affect / are likely to adversely affect seabeach amaranth on a regional basis.

## **Conclusion**

While surveying and management activities would reduce these impacts, though not as much as under alternatives B and C, there would still be a risk that plants would be crushed and seeds would be pulverized or buried. The actions taken under alternative D may affect / are likely to adversely affect seabeach amaranth. Past, present, and future activities both inside the seashore and within the plant's historic range, when combined with the impacts of recreation use, surveying, and management of the species expected under this alternative, would continue to result in impacts that may affect/likely to adversely affect the seabeach amaranth. Impairment of seabeach amaranth would not occur under alternative D.

# STATE LISTED AND SPECIAL STATUS SPECIES

## GUIDING POLICIES AND REGULATIONS

The NPS Management Policies 2001 state that potential effects of agency actions would also be considered on state or locally listed species (NPS 2000c). The NPS is required to control access to important habitat for such species and to perpetuate the natural distribution and abundance of these species and the ecosystems upon which they depend. In addition, one of Cape Hatteras' management goals is to provide protection for species that occur within the park and that suffer population reductions or require special management. Therefore, an analysis of the potential impacts to state-listed species and certain park sensitive species is included in this section. ]

## GENERAL METHODOLOGY AND ASSUMPTIONS

The following information was used to assess impacts on state and special status species:

1. which species are found in areas likely to be affected by management actions described in the alternatives
2. habitat loss or alteration caused by the alternatives
3. displacement and disturbance potential of the actions and the species' potential to be affected by the activities

Specific methodologies that were implemented and assumptions that were made that pertained to the American oystercatcher, colonial waterbirds, Wilson's plover, and red knot are described under the relevant species impact analysis below.

## STUDY AREA

The study area for state and special status species is defined as the seashore for the analysis of the impacts of the alternatives and defined as the state of North Carolina for the analysis of cumulative impacts.

## IMPACT THRESHOLDS

The assessment of impacts on wildlife species listed by the state of North Carolina (but not at the federal level under the Endangered Species Act) and special status species that the park has identified as needing special management consideration uses the same thresholds developed for the assessment of impacts on wildlife, rather than those for federally listed species.

<i>Negligible:</i>	There would be no observable or measurable impacts to native species, their habitats, or the natural processes sustaining them. Impacts would be well within natural fluctuations.
<i>Minor adverse:</i>	Impacts on native species, their habitats, or the natural processes sustaining them would be detectable, but would not be outside the natural range of variability. Occasional responses to disturbance by some individuals could be expected, but without interference to feeding, reproduction, resting, or other factors affecting population levels. Small changes to local population numbers, population structure, and other demographic factors might occur. However, some impacts might occur during critical reproduction periods for a protected species, but would not result in injury or mortality. Sufficient habitat in the park would remain functional to maintain the viability of the species in the park.

- Minor beneficial:* Impacts on native species, their habitats, or the natural processes sustaining them would be detectable, but would not be outside the natural range of variability. Improvements to key characteristics of 1 habitat in the park would sustain or slightly improve existing population levels, population structure, or other factors and maintain the viability of the species.
- Moderate adverse:* Impacts on native species, their habitats, or the natural processes sustaining them would be detectable and could be outside the natural range of variability. Frequent responses to disturbance by some individuals could be expected, with some negative impacts to feeding, reproduction, resting or other factors affecting local population levels. Some impacts might occur during critical periods of reproduction or in key habitats in the park and result in harassment, injury, or mortality to one or more individuals. However, sufficient population numbers or habitat in the park would remain functional to maintain the viability of the species in the park.
- Moderate beneficial:* Impacts on native species, their habitats, or the natural processes sustaining them would be detectable and could be outside the natural range of variability. Changes to key characteristics of habit in the park during critical periods of reproduction would minimize or prevent harassment or injury to one or more individuals and improve the viability of the species in the park.
- Major adverse:* Impacts on native species, their habitats, or the natural processes sustaining them would be detectable, would be expected to be outside the natural range of variability, and would be permanent. Frequent responses to disturbance by some individuals would be expected, with negative impacts to feeding, reproduction, or other factors resulting in a decrease in park population levels. Impacts would occur during critical periods of reproduction or in key habitats in the park and result in direct mortality or loss of habitat that might affect the viability of a sensitive species. Local population numbers, population structure, and other demographic factors might experience large declines.
- Major beneficial:* Impacts on native species, their habitats in the park, or the natural processes sustaining them would be detectable, would be expected to be outside the natural range of variability, and would be permanent. Changes during critical periods of reproduction or in key habitats in the park would prevent mortality or loss of habitat and would result in notable increases in park population levels.
- Impairment:* The action would contribute substantially to the deterioration of state listed or special status species in the Cape Hatteras National Seashore to the extent they would no longer function as a part of the natural system. In addition, some of these adverse major impacts on the park's resources and values would
- contribute to deterioration of state listed or special status wildlife resources and values to the extent that the purpose of the Cape Hatteras National Seashore would not be fulfilled as established in its enabling legislation

- affect resources key to the natural or cultural integrity or opportunities for enjoyment in the Cape Hatteras National Seashore
- affect the resource whose conservation is identified as a goal in the General Management Plan (NPS 1984) or other planning documents for the Cape Hatteras National Seashore.

*Duration:* Short-term effects would be 1 to 2 breeding seasons for other protected species. Long-term effects would be anything beyond 2 breeding seasons. Under all alternatives, long-term effects may occur to any species well beyond the 3 year interim protected species strategy, depending on the outcome of the long-term ORV management plan.

## AMERICAN OYSTERCATCHER

### SPECIES-SPECIFIC METHODOLOGY AND ASSUMPTIONS

Potential impacts on oystercatcher populations and habitat were evaluated based on available data on the species' past and present occurrence at Cape Hatteras National Seashore as well as the species' association with humans, pets, predators, and off road vehicles. Information on habitat and other existing data were acquired from staff at Cape Hatteras National Seashore, the U.S. Fish and Wildlife Service, and available literature. American oystercatchers are identified as a species of high concern by the U.S. Shorebird Conservation Plan and are proposed for listing by the state of North Carolina.

The analysis focuses on effects to the American oystercatcher from a variety of human recreational activities, as well as impacts incurred as a result of surveying and management activities.

### IMPACTS OF ALTERNATIVE A: NO ACTION ALTERNATIVE - CONTINUATION OF 2004 PROTECTED SPECIES MANAGEMENT

#### Analysis

**Species Surveying and Management.** Although surveying would lead to benefits related to the use of the data collected to better protect the species, surveying brings people and/or essential vehicles into direct contact with oystercatchers and oystercatcher habitat and is a known risk factor (Meyers 2005, McGowan 2004, Sabine 2005). However, contact during surveying is indeterminate, because alternative A does not specify the distance that staff and essential vehicles maintain during oystercatcher surveying. Staff would use best professional judgment during surveying and attempt to minimize adverse impacts. However, surveying may lead to frequent responses by some individual oystercatchers and has the potential to negatively impact feeding, reproduction, resting or other factors during critical periods of reproduction or in key habitats, resulting in the chance for harassment, injury, or mortality to one or more individuals (Meyers 2005, McGowan 2004, Sabine 2005). Therefore, species surveying would likely have a long-term moderate adverse impact on American oystercatcher at Cape Hatteras National Seashore on an annual basis during the pre-nesting and nesting season.

American oystercatcher management brings people, essential vehicles, and equipment into direct contact with the birds and their habitat and these activities, as with surveying, are known risk factors (Meyers 2005, McGowan 2004, Sabine 2005). However, because fencing is at the discretion of the Superintendent, it is not known how many American oystercatchers are exposed to management disturbance. Conversely, posting American oystercatcher nests with symbolic fencing can provide a major deterrent to the entry of people, pets, and ORVs into their habitats. Because fencing is at the discretion of the Superintendent, it is not known how many oystercatchers would benefit from the protection afforded by fencing. Therefore, impacts to American oystercatcher at Cape Hatteras National Seashore would be long-term, minor, and adverse.

Predator exclosures are not used for American oystercatchers, but trapping of foxes would occur under alternative A. Night driving would be allowed, and it is possible that ORVs and essential vehicles may come in contact at night with foraging chicks and adults. The overall impact of other management at Cape Hatteras National Seashore would be long-term, minor, and adverse.

**Recreation.** Recreation use brings ORVs, essential vehicles (for safety, enforcement, etc.), pedestrian, and pets into direct contact with oystercatchers and oystercatcher habitat and these activities, all known risk factors to oystercatcher (Meyers 2005, McGowan 2004, Sabine 2005). Because fencing protection is at the discretion of the Superintendent, it is not known how many oystercatchers benefit from protection from the disturbance associated with recreation use. Because of this lack of consistency in applying closure protection to oystercatchers from recreation activities, negative impacts, such as the loss of young or eggs due to ORV use and flushing from the nest, would be detectable and expected to be outside the natural range of variability, and could lead to permanent abandonment of otherwise suitable oystercatcher nesting sites. Furthermore, the recreating public's compliance with buffers and corridors is not 100% and therefore, recreation invariably brings people, ORVs, pets and other recreational equipment into direct contact with oystercatchers and oystercatcher nesting habitat. This is a major concern because oystercatchers need large, undisturbed beach areas for successful nesting and they are particularly sensitive to pedestrians, vehicles and unleashed pets in or near their nesting habitat (Meyers 2005). At Cape Hatteras National Seashore, oystercatchers have no nesting and fledging success in day-use areas that have heavy pedestrian use (Meyers 2005) and in 2001 and 2002, no breeding activity was found on beaches adjacent to villages which are known to have the highest concentrations of pedestrians on the seashore. In addition to this loss of habitat from human disturbance, there are documented cases of ORVs running over oystercatcher chicks (Simon et al 2004, and T. R. Simons, personal communications). Under alternative A, frequent responses to disturbance to oystercatchers would be expected resulting in negative impacts to their reproduction and feeding. Some of these impacts would occur during the most critical periods of reproduction and within key oystercatcher habitat and result in direct mortality or loss of habitat. This has and would continue to lead to population declines and habitat loss Cape Hatteras National Seashore, resulting in a long-term, major adverse effect from recreation use.

### **Cumulative Impacts**

The past, present, and future actions discussed under cumulative impact scenario could be expected to have a range of impact on locally sensitive bird species, including American oystercatcher. The dredging activity in Oregon Inlet could have short-term, moderate adverse impacts to any American oystercatchers holding territories and/or attempting to nest in that area, and maintenance dredging could result in long-term habitat building that could be minor beneficial to the nesting of these species. Impacts would depend on the timing and duration of the maintenance dredging of the Oregon Inlet channel and on the type and placement of the dredge spoils. Similarly, continued maintenance of NC-12 and berm maintenance can have both short-term impacts from the actual maintenance activity itself, especially if it takes place during the breeding season of American oystercatchers and if it encroaches on any of nest buffers or recreation closures for these species. If this were the case, it could be said to result in direct, short-term impacts that could have minor-moderate adverse impact on nesting success. Simultaneously, highway and berm maintenance could help to stabilize or possibly create nesting habitat and in that case this activity would provide long-term impact that would be minor beneficial to locally sensitive species at Cape Hatteras National Seashore. The degree to which this activity is beneficial or adverse is a function of the timing and location of the activity itself relative to bird nesting and to the degree to which the activity results in the creation or maintenance of high-quality American oystercatcher habitat.

Storms and other weather events during the breeding season (March - August) of locally sensitive bird species, including the American oystercatcher, can result (depending upon storm intensity), in disturbance of nesting birds or even in the washing away of nests or eggs. These impacts would be direct, short-term and moderate adverse for the nesting birds impacted. In addition to the timing of summer storms, storm severity is also an important variable. Powerful storms can surge high up and overwash large areas of

breeding habitat including even up to the toe of the dune and beyond and result in loss of scrapes, nests, eggs, chicks and even breeding adults. Conversely, winter, late fall, and early spring storms are capable of being both long-term minor-moderately beneficial to birds by depositing new materials and creating overwash areas and hence new nesting habitat for birds or having long-term minor-moderately adverse impact by eroding and removing otherwise suitable habitat. Hence, the impact scenario of storms and nesting birds depends on the timing and severity of storm events and whether they result in net habitat creation or destruction.

Hurricane recovery that pulls staff from resource management (and presumably surveying) activities during the breeding season for American oystercatchers would have the short-term impact of denying whatever benefit they may have derived from the management but simultaneously protect them from the disturbance that invariably comes along with surveying (in particular) and management. Conversely, Hurricane Recovery that takes place outside of the breeding season would have no effect on locally sensitive bird species. However, because the hurricane season overlaps with the entire breeding season any loss of staff services would be minor adverse to Cape Hatteras National Seashore.

Several of the local and NPS past, current, and future planning efforts can also affect locally sensitive bird species. For example new development might result from the County Land Use Development Plan for Dare and Hyde County, but the details are lacking and its potential for impact locally sensitive bird species is indeterminate at this time. The outcome of the current action to develop a Cape Lookout Interim Protected Species Strategy/EA would have direct, short-term impact on locally sensitive bird species which can move back and forth during nesting, migration and overwintering. However, whether the impact of the interim plan would be beneficial or adverse to these species would depend upon the management decisions that are made and ultimately implemented. The upcoming NPS Resource Stewardship Plan would address ORVs and, especially because of the documented risks that ORVs pose to locally sensitive bird species, this plan would have long-term, direct impacts on locally sensitive bird species at Cape Hatteras National Seashore. The impacts on the locally sensitive bird species are indeterminate at this time and would depend on where within the seashore ORVs would be allowed to go and during what times of the year. Other future planning efforts include the development of the Cape Hatteras National Seashore ORV Management Plan/EIS which would have direct, long-term impact on locally sensitive bird species which nest, migrate, and overwinter in Cape Hatteras National Seashore. However, whether the impact of the ORV plan would be beneficial or adverse to locally sensitive bird species would depend upon the management decisions that are made and ultimately implemented. The outcome of the Cape Lookout National Seashore long-term ORV Management Plan/EIS would have direct, long-term impact on locally sensitive bird species which can move back and forth during nesting, migration and overwintering. However, whether the impact of the long-term ORV Management Plan/EIS would be beneficial or adverse to locally sensitive bird species would depend upon the management decisions that are made and ultimately implemented.

The overall cumulative impact of these past, current and future actions would have long-term, minor, adverse impacts on locally sensitive bird species like the American oystercatcher at Cape Hatteras National Seashore.

### **Conclusion**

Species surveying and management actions under alternative A would result in minor to moderate adverse impacts on the American oystercatcher. Because protection measures for nesting oystercatchers and their habitat are both inconsistently applied and entail some risks when they are applied, recreational use under alternative A is likely to lead to major adverse impacts. Cumulative impacts would be long-term, moderate to major and adverse. Impairment to American oystercatchers at Cape Hatteras National Seashore would not occur.

## IMPACTS OF ALTERNATIVE B: UNDISTURBED AREA FOCUS

### Analysis

**Species Surveying and Management.** Alternative B defines a range of surveying actions across pre-nesting, nesting, migration, and over-wintering life-stages (see the “Alternatives” chapter for details). As is the case with alternative A, surveying can be beneficial to the species, but brings people and/or essential vehicles into direct, short-term contact with oystercatchers and their habitat, and these activities themselves are a known risk factor (Meyers 2005, McGowan 2004, Sabine 2005, Nol and Humphrey 1994, Meyers 2005). Compared to alternative A, however, surveying actions under alternative B would start earlier, would be conducted more frequently, and would be more data intensive. This would put surveying staff in direct proximity to nesting oystercatchers for longer periods of time than the surveying actions defined in alternative A. Furthermore, it is not clear how close the surveying staff would be to oystercatchers during various stages of the surveying defined under alternative B (though much of it, such as the examination of substrates under nests, would require direct observation at the nest). NPS staff would use best professional judgment and take precautions to minimize disturbance during surveying; however, oystercatchers are known to abandon habitat when they are impacted by pedestrians in or near their nesting habitat (Meyers 2005, McGowan 2004, Sabine 2005, Nol and Humphrey 1994, Meyers 2005). Therefore, under the actions in alternative B, species surveying would likely have long-term, moderate adverse impacts on American oystercatcher on an annual basis during the pre-nesting and nesting season.

Management actions under alternative B provide for larger buffers around courting and nesting oystercatchers than does alternative A, a beneficial effect. Yet, as with alternative A, the management actions under B would bring people, essential vehicles, and equipment into direct contact with oystercatchers and their habitat. These activities, as with surveying, are known risk factors (Meyers 2005, McGowan 2004, Sabine 2005). However, posting oystercatcher nests with symbolic fencing can provide a major deterrent to the entry of people, pets, and ORVs into their habitats. Under alternative B, buffer size varies from 600 feet for recent and past oystercatcher nests down to 300 feet for new nests that appear outside of these 600 foot buffers around historical breeding sites. Since first-time breeders are even less tolerant to disturbance than are older, established breeders (Nol and Humphrey 1994), the 300-foot buffer for new nests may not provide sufficient protection. Also, oystercatchers at Cape Hatteras National Seashore can begin courting and nesting as early as mid-February or early March and be particularly sensitive to disturbance at that time (Nol and Humphrey 1994, Meyers 2005). Hence, a March 15 start to management could mean that early nesting oystercatchers would not be fully protected under alternative B. Nevertheless, under the actions in alternative B, species management would likely have long-term, minor adverse impacts on American oystercatcher.

Predator management would be the same as alternative A and would result in long-term, negligible or minor beneficial impacts on American oystercatchers at Cape Hatteras National Seashore.

**Recreation.** Under alternative B, many areas would be closed year-round and 24 hours a day for piping plover protection, which would also protect oystercatchers in those areas. Recreation use under the actions defined in alternative B brings ORVs, essential vehicles (for safety, enforcement, etc.), pedestrian, pets and other recreation activities into direct contact with oystercatchers and their habitat, and these activities are all known risk factors to oystercatcher (Meyers 2005, McGowan 2004, Sabine 2005). Oystercatchers need large, undisturbed beach areas for successful nesting and they are particularly sensitive to pedestrians, vehicles, and unleashed pets in or near their nesting habitat (Meyers 2005). However, because recreation closures under alternative B are larger, oystercatchers would not be disturbed as often as under alternative A, which would be a long-term moderate to major beneficial effect. Oystercatchers that use former nest sites would have a 600-foot buffer, but new nests or nests that appear in an ORV corridor where alternative routing is not available may not have as large a buffer. Also, closures are not active until March 15 and this could be as much as 6 weeks late for some of the early

nesting oystercatchers. Therefore, under alternative B it is likely that some oystercatchers could be disturbed during the most critical periods of reproduction and within key oystercatcher habitat, resulting in direct mortality, abandonment or loss of habitat. This has and would continue to lead to some annual and seasonal declines in oystercatcher population at Cape Hatteras National Seashore. Under B, night driving is prohibited within the seashore from 8:00 pm to 6:00 am March 15 - November 15 (for sea turtle and chick protection). The night driving rules under B would protect more oystercatchers than alternative A. Overall, night driving restrictions would result in long-term negligible or minor, beneficial effects to oystercatchers at Cape Hatteras National Seashore. Overall, there would be long-term, minor adverse impacts from recreation use under alternative B.

Substantially more outreach is proposed under alternative B than under alternative A. This includes providing additional information about proper garbage disposal, pet restrictions, anti-wildlife feeding, and species ecology, including more educational signage. This would result in long-term, minor beneficial effects to birds at Cape Hatteras National Seashore.

### **Cumulative Impacts**

Cumulative impacts from other actions taking place in the study area would be the same as identified under alternative A—long-term, minor, and adverse. Adding in the minor adverse impacts to the oystercatcher from recreational use at the seashore under alternative B, cumulative impacts under alternative B would be long-term, minor, and adverse.

### **Conclusion**

Under alternative B, overall protection to nesting oystercatchers would be much improved over alternative A. However, there is still a likely chance of direct, moderate impacts to early nesting oystercatchers from surveying and impacts to all oystercatchers nesting outside of historical breeding sites or in or near to the ORV corridor. In these cases, buffer size might not be large enough to shield the birds for recreation and surveying disturbances or from the risk of being run over by a vehicle. Predator numbers would likely be an ongoing source of oystercatcher egg and chick loss under alternative B. Overall, alternative B would have mostly long-term, minor adverse impacts on the oystercatcher from recreational use. Cumulative impacts would also be long-term, minor and adverse. Impairment to American oystercatchers would not occur under alternative B.

## **IMPACTS OF ALTERNATIVE C: TAILORED MANAGEMENT FOCUS**

### **Analysis**

**Species Surveying and Management.** As is the case with alternative A and B, surveying would result in benefits to the species, but invariably brings people and/or essential vehicles into direct, short-term contact with oystercatchers and their habitat and these activities themselves are a known, risk factor (Meyers 2005, McGowan 2004, Sabine 2005, Nol and Humphrey 1994, Meyers 2005). Surveying actions under alternative C would be less intensive than alternative B, but more intensive than under alternative A. In all alternatives, it is not clear how close the surveying staff would be to oystercatchers during various surveying activities. Because oystercatchers are known to abandon habitat when they are impacted by pedestrians, vehicles, pets and even resource managers in or near their nesting habitat (Meyers 2005, McGowan 2004, Sabine 2005, Nol and Humphrey 1994, Meyers 2005). Therefore, species surveying under alternative C would likely have long-term, minor to moderate adverse impacts on American oystercatchers on an annual basis during the pre-nesting and nesting season.

Alternative C does not provide full, year round ORV closures of all recent piping plover nesting, roosting, and foraging habitat. If recreation closures were created around oystercatcher nests outside of existing piping plover closures, the ORV corridor would be adjusted to allow vehicle passage and allow surveying to be responsive to individuality in bird behavior. This may adequately protect those oystercatchers that nest inside piping plover closures, but would leave open to question the actual size of the remaining

oystercatcher closures that have to accommodate an ORV corridor. Also, it is not clear what size buffer would result for those oystercatchers that nest inside a piping plover closure but whose nests fall near the perimeter, similar to alternative B, there would be a 600-foot buffer around oystercatcher broods for 35 days after hatching, and this closure would move with chicks as they forage.

The management actions defined under alternative C would provide more protection for courting and nesting oystercatchers than alternative A, but less protection than alternative B. However, as with alternatives A and B, the management actions under C would bring people, essential vehicles, and equipment into direct contact with oystercatchers and their habitat and these activities, as with surveying, are known risk factors (Meyers 2005, McGowan 2004, Sabine 2005). Posting oystercatcher nests with symbolic fencing would provide a major deterrent to the entry of people, pets, and ORVs into their habitats. Under alternative C, buffer size is reduced to 450 feet compared to the 600 feet in alternative B. And while the science surrounding preferred buffers sizes for oystercatcher (and other species) is inherently imprecise, oystercatchers are known to be very prone to flushing from disturbance that is a 0.25 mile (1,320 feet) away (Marcia Lyons personal communication). Also, under alternative C (as with B), oystercatcher closures are not installed until March 15 and therefore run the risk of not protecting those birds that begin courting in mid-February or early March. Oystercatchers at Cape Hatteras National Seashore can begin courting and nesting as early as mid-February or early March and be particularly sensitive to disturbance at that time (Nol and Humphrey 1994, Meyers 2005). Hence, a March 15 start to management could mean that early nesting oystercatchers would not be fully protected under alternative C. Overall, under alternative C, species management would likely have a moderate adverse impact on American oystercatchers.

Predator exclosures are not used for American oystercatchers, but predator management would continue as described under alternative A. The overall impact of other management at Cape Hatteras National Seashore would be long-term, negligible to minor beneficial.

**Recreation.** As with alternatives A and B, alternative C provides for opportunities for a variety of recreation uses that have the potential to expose oystercatchers to direct impacts. Whereas under alternative B some areas would be closed year round, alternative C attempts to maintain a minimum ORV corridor where and when possible, but also would allow for closures when corridors or bypasses are not possible.

Alternative C goes further in managing recreation in general and ORVs in particular in sensitive habitat areas than alternative A, but does not go as far as alternative B (which has several year round closures). In contrast to A, alternative C has floating closures around foraging oystercatcher chicks whereby they are guaranteed that their protective buffers would follow them as they change locations. Night driving would be prohibited from 10:00 PM to 5:00 AM May 15 - Aug 31. Any prohibition of night driving would protect oystercatcher chicks which are known to forage at night in the intertidal zone. Overall, the recreation use actions taken under alternative C would have long-term, moderate adverse impacts on the oystercatcher.

Similar to alternative B, substantially more outreach is proposed under alternative C than under A; this would have long-term minor beneficial effects on American oystercatchers.

### **Cumulative Impacts**

Cumulative impacts from other actions taking place in the study area Cumulative impacts from other actions taking place in the study area would be the same as identified under alternative A—long-term, minor, and adverse. Adding in the long-term, moderate, adverse impacts to the oystercatcher from recreational use at the seashore under alternative C, cumulative impacts under alternative B would be long-term, minor to moderate, and adverse.

## Conclusion

Under alternative C, overall protection to nesting oystercatchers would be much improved over alternative A. However, there is still a likely chance of direct impacts to early nesting oystercatchers and to all oystercatchers nesting outside of historical breeding sites, outside of other bird closures (such as those for piping plovers), or in or near to the ORV corridor. In these cases, buffer size might not be large enough to shield the birds for recreation and surveying disturbances or from the risk of being run over by a vehicle. Predator numbers would likely continue to be an ongoing source of oystercatcher egg and chick loss under alternative C. Therefore, alternative C would result in long-term, moderate, adverse impacts to American oystercatchers. Cumulative impacts would be long-term, minor to moderate, and adverse. Impairment to American oystercatcher would not occur under alternative C.

## IMPACTS OF ALTERNATIVE D: ACCESS / RESEARCH COMPONENT FOCUS (PREFERRED ALTERNATIVE)

### Analysis

**Species Surveying and Management.** Alternative D defines a range of surveying actions across pre-nesting, nesting, migration, and over-wintering life-stages (see the “Alternatives” chapter for details), which would be generally more extensive than the other alternatives considered. As is the case with the other alternatives, surveying can be beneficial to the species when the data collected is used to further protect the species. As stated previously, surveying invariably brings people and/or essential vehicles into direct, short-term contact with oystercatchers and their habitat, and these activities themselves are a known, risk factor (Meyers 2005, McGowan 2004, Sabine 2005, Nol and Humphrey 1994, Meyers 2005). Compared to alternative A, however, surveying actions under alternative D would be more extensive, covering potential new habitat and historic breeding habitat, are conducted more frequently, and are more data intensive. This would put surveying staff in direct proximity to nesting oystercatchers for longer periods of time than the surveying actions defined in alternative A, similar to alternative B. Furthermore, it is not clear how close the surveying staff would be to oystercatchers during various stages of the surveying. NPS staff would use best professional judgment and take precautions to minimize disturbance during surveying; however, oystercatchers are known to abandon habitat when they are impacted by pedestrians, vehicles, pets and even resource managers in or near their nesting habitat (Meyers 2005, McGowan 2004, Sabine 2005, Nol and Humphrey 1994, Meyers 2005). Therefore, under the actions in alternative D, species surveying would likely have long-term, minor to moderate, adverse impact on American oystercatcher on an annual basis during the pre-nesting and nesting season at Cape Hatteras National Seashore.

Management actions under alternative D would provide for buffers and bypasses around courting and nesting oystercatchers, a beneficial effect. Yet, as with alternative A and the other alternatives, the management actions under alternative D would bring people, essential vehicles, and equipment into direct contact with oystercatchers and their habitat. These activities, as with surveying, are known risk factors (Meyers 2005, McGowan 2004, Sabine 2005). In particular, the testing proposed under alternative D to record flushing distances of oystercatchers related to various vehicle types could be very intrusive given the number of flushes per vehicle type that would be required for the testing to yield results. If, for example, it was decided that a minimum of 10 flushes should be observed per vehicle type, this study alone would expose oystercatchers to a lot of flushing disturbance. However, the bypasses that might result along with the posting of oystercatcher nests with symbolic fencing can provide a major deterrent to the entry of people, pets, and ORVs into their habitats. Also under alternative D, adjustments in the 100-foot ORV corridor would be made to avoid nesting birds, maintaining at least a 150 foot buffer at all times. Since first-time breeders are even less tolerant to disturbance than are older, established breeders (Nol and Humphrey 1994), this buffer for new nests may not provide sufficient protection. Also, oystercatchers at Cape Hatteras National Seashore can begin courting and nesting as early as mid-February or early March and be particularly sensitive to disturbance at that time (Nol and Humphrey

1994, Meyers 2005). Hence, a March 15 start to management could mean that early nesting oystercatchers would not be fully protected under alternative D. Under the actions in alternative D, species management would likely have long-term, moderate, adverse impacts on American oystercatcher.

Predator control would be the same as alternative A. The overall impact would be minor and adverse.

**Recreation.** Alternative D would have most of the same controls on recreational uses as alternative B, except for the change in ORV access. As previously described, a 100-foot ORV corridor would be located between the wrack and the dune line to keep ORV users away from oystercatcher nesting areas; there would be no areas closed year-round. Under alternative D, night driving would be permitted, similar to alternative A, and it is possible that ORVs and essential vehicles may come in contact at night with foraging oystercatcher chicks and adults. Funds would be sought to study the impacts of night driving for future consideration in the long-term ORV management plan. Similar to alternative B, any public use areas adjacent to symbolic fencing for oystercatchers would be closed to pets within 0.25 mile of the closure. Finally, kite flying and ball and Frisbee tossing would be prohibited from all sites being used by oystercatchers between April 1 and August 31.

Alternative D goes further in controlling recreation in general (and ORVs in particular) than alternative A, but does not go as far as alternative B (which has several year round closures). Recreation use under the actions defined in alternative D would bring ORVs, essential vehicles (for safety, enforcement, etc.), pedestrian, pets and other recreation activities into close proximity with oystercatchers and their habitat, and these activities are all known risk factors to oystercatcher (Meyers 2005, McGowan 2004, Sabine 2005). Oystercatchers need large, undisturbed beach areas for successful nesting and they are particularly sensitive to pedestrians, vehicles and unleashed pets in or near their nesting habitat (Meyers 2005). Alternative D allows for a 150 foot nest buffer and substantial rerouting around oystercatcher habitat, and it is likely that some oystercatchers could be disturbed during the most critical periods of reproduction and within key oystercatcher habitat, resulting in direct mortality, abandonment or loss of habitat. This has and would continue to lead to some annual and seasonal declines in the oystercatcher population at Cape Hatteras National Seashore. Overall, there would be long-term, moderate adverse impacts from recreation use under alternative D.

Similar to alternatives B and C, substantially more outreach is proposed under alternative D than under alternative A. In addition, where it is not possible to delineate a corridor with posts above the wrack line, signs would be posted asking visitors to avoid the wrack line and education provided regarding the wildlife value and vulnerability of the wrack line to foot and ORV traffic. This would result in minor beneficial effects to oystercatchers.

Research would include assessing the effects of the bypass routes around oystercatcher nesting areas, as described in the “Alternatives” chapter. This research would have minor beneficial impacts on the oystercatcher.

### **Cumulative Impacts**

Cumulative impacts from other actions taking place in the study area would be the same as identified under alternative A—long-term, minor, and adverse. Adding in the moderate adverse impacts to the oystercatcher from recreational use and surveying at the seashore under alternative D, cumulative impacts under alternative D would be long-term, minor to moderate, and adverse.

### **Conclusion**

Under alternative D, overall protection to nesting oystercatchers would be much improved over alternative A. However, there is still a likely chance of direct minor to moderate impacts to early nesting oystercatchers from surveying and management-research associated with implementing bypasses and impacts to all oystercatchers nesting in or near to the ORV corridor. In these cases, buffer size might not be large enough to shield the birds for recreation and surveying disturbances or from the risk of being run

over by a vehicle. Predator numbers would likely continue to be an ongoing source of oystercatcher egg and chick loss under alternative D. Overall, alternative D would have long-term, moderate, adverse impacts from recreational use and surveying. Cumulative impacts would be long-term, minor to moderate, and adverse. Impairment to American oystercatcher would not occur under alternative D.

## **COLONIAL WATERBIRDS**

### **SPECIES-SPECIFIC METHODOLOGY AND ASSUMPTIONS**

Potential impacts on colonial waterbird populations and habitat were evaluated based on available data on the species past and present occurrence at Cape Hatteras National Seashore as well as the species association with humans, pets, predators, and ORVs. Information on habitat and other existing data were acquired from staff at Cape Hatteras National Seashore, the U.S. Fish and Wildlife Service, and available literature. The species addressed in this analysis are state listed threatened and species of special concern and include the common tern, least tern, gull-billed tern, and black skimmer.

The analysis focuses on effects to wildlife from a variety of human recreational activities, as well as impacts incurred as a result of surveying and management activities.

### **IMPACTS OF ALTERNATIVE A: NO ACTION ALTERNATIVE - CONTINUATION OF 2004 PROTECTED SPECIES MANAGEMENT**

#### **Analysis**

**Species Surveying and Management.** Alternative A defines a range of surveying actions across pre-nesting, nesting, migration, and over-wintering life-stages, but does not include observation of reproductive performance / nesting success of colonial waterbirds. Hence, these data are not available to measure the success or impact of management and other actions defined under alternative A. Also, migrant and wintering colonial waterbirds and their habitats are not surveyed at Cape Hatteras National Seashore.

Although surveying would lead to benefits related to the use of the data collected to better protect the species, surveying brings people and/or essential vehicles and equipment into direct contact with colonial waterbirds and their habitat and is a known risk factor. Because colonial waterbirds are all ground-nesters, they are highly vulnerable to direct human activities such as ORVs, pedestrians, photographers, and wildlife managers/scientists (Buckley and Buckley 1976, Erwin 1980, 2005). In particular, modest disturbances early in the spring when colonial waterbirds are first arriving and prospecting for breeding sites can be highly disruptive (Buckley and Buckley 1976). However, disturbance to colonial waterbirds from contact during surveying is indeterminate because alternative A does not specify the distance that staff and essential vehicles maintain during surveying. If surveying distance is too close (for example, less than 600 feet (Rogers and Smith 1995, Erwin 1989, 2005), it could lead to frequent flushing responses, which in turn could have the potential to negatively impact feeding, reproduction, resting or other factors. Therefore, under the actions in alternative A, species surveying would likely have long-term, moderate, adverse impacts on colonial waterbirds on an annual basis during the pre-nesting and nesting season.

Species management would bring people, essential vehicles, and equipment into direct contact with colonial waterbirds and their habitat and these activities, as with surveying, are known risk factors (Buckley and Buckley 1976, Erwin 1980, 2005). Conversely, posting colonial waterbird nests with symbolic fencing would provide a major deterrent to the entry of people, pets, and ORVs into their habitats. However, because closures are at the discretion of the Superintendent, it is not known how many colonial waterbirds would benefit from the protection afforded by fencing. Therefore, under the actions in alternative A, species management would likely have long-term, minor, adverse impacts on colonial waterbirds.

Predator exclosures are not used for colonial waterbirds; however, nests are approached briefly once a week to count eggs and search for any predator tracks. Though no predator trapping is done specifically for colonial waterbirds, these species could be expected to benefit from the reduction in predator numbers from the predator trapping that is done for the endangered and threatened birds and sea turtles. Because the positive effects of other management outweigh the negative, other management defined under alternative A for colonial waterbirds would be expected to have long-term, minor, beneficial effects on colonial waterbirds.

**Recreation.** Recreation use would bring ORVs, essential vehicles (for safety, enforcement, etc.), pedestrian, and pets into direct contact with colonial waterbirds and their habitat, and these activities are all known risk factors (Buckley and Buckley 1976, Erwin 1980, 2005). Because symbolic fencing protection is at the discretion of the Superintendent, it is not known how many colonial waterbirds benefit from the protection conferred by posting. Because of the lack of consistency in applying closure protection to colonial waterbirds from recreation activities, negative impacts (such as direct damage to nests, eggs, or chicks, or flushing from the nest) would be detectable and might be outside the natural range of variability, and could lead to permanent abandonment of otherwise suitable nesting sites. Furthermore, the recreating public's compliance with buffers and corridors is not 100% and therefore, recreation invariably brings people, ORVs, pets and other recreational equipment into direct contact with colonial waterbirds and colonial waterbird nesting habitat. Indeed, incidents of visitors encroaching on posted colonial waterbird closures at Cape Hatteras National Seashore have been documented (Erwin 2005). A total of 105 incidents were recorded of ORVs entering posted bird closures in 2003 alone. This number represents a substantial increase over the 52 and 63 incidents recorded in 2001 and 2002, respectively although this increase may be the result of increased surveillance in 2003 (Erwin 2005).

Impacts from recreation use are a major concern because colonial waterbirds need large, undisturbed beach areas for successful nesting and they are particularly sensitive to pedestrians, vehicles, and unleashed pets in or near their nesting habitat (Erwin 2005). Under alternative A, frequent responses to disturbance from recreation use would be expected, resulting in adverse impacts to colonial waterbird reproduction and feeding. Some of these impacts would occur during critical periods of reproduction and within key colonial waterbird habitat and are known to result in direct mortality, abandonment of nest sites, or loss of habitat. However, because reproductive success is not surveyed for colonial waterbirds under alternative A, it is not known to what extent recreation use may or may not lead to annual or seasonal population declines at Cape Hatteras National Seashore. Therefore, the impact of recreation use under alternative A would be long-term, moderate, and adverse because negative impacts would be expected to affect feeding and reproduction.

### **Cumulative Impacts**

Cumulative impacts from other actions taking place in the study area would be the same as identified for American oystercatcher under alternative A—long-term, minor, and adverse. Adding in the moderate adverse impacts to colonial waterbirds from recreational use at the seashore under alternative A, cumulative impacts under alternative A would be long-term, minor to moderate, and adverse.

### **Conclusion**

Under alternative A, surveying and recreational use would have long-term, moderate, adverse impacts on colonial waterbirds. Species management and other management would have minor impacts. Cumulative impacts would be long-term, minor to moderate, and adverse. Impairment to colonial waterbirds would not be expected to occur under alternative A.

**IMPACTS OF ALTERNATIVE B: UNDISTURBED AREA FOCUS****Analysis**

**Species Surveying and Management.** Alternative B includes a much more intensive surveying of colonial waterbirds than alternative A, as detailed in the Alternatives section. Surveying colonial waterbirds, especially during the nesting season, invariably would have a minor to moderate adverse impact on nesting performance annually due to the nature of the surveying regime described under alternative B. This is primarily because alternative B requires the surveying of reproductive success, which would bring surveying staff into direct contact with nesting colonial waterbirds during very sensitive life history stages.

Species management would be considerably more intensive for colonial waterbirds under alternative B than under alternative A. Species management would bring people, essential vehicles, and equipment into direct contact with colonial waterbirds and their habitat and these activities, as with surveying, are known risk factors (Buckley and Buckley 1976; Erwin 1980, 2005). Conversely, posting colonial waterbirds nests with symbolic fencing does provide a major deterrent to the entry of people, pets, and ORVs into their habitats. Under alternative B, nearly full protection is provided to colonial waterbirds in all their historical nesting areas, in new areas that they may use, and both early and later in their nesting cycle. An ORV corridor would be maintained but, could be closed if conflicts would arise. However, alternative B does provide a pedestrian walking corridor on the oceanside of all closures. This could result in recreation disturbance that could lead to abandonment (Rogers and Smith 1995, Erwin 1989, 2005) of colonial waterbirds especially early in the season in new (especially) or established nesting habitat. Overall, however, management under alternative B would result in long-term, minor, adverse impacts on colonial waterbirds.

Other management, such as predator control, would provide more protection to colonial waterbirds than under alternative A, and overall there would be long-term, minor beneficial effects to colonial waterbirds.

**Recreation.** Impacts from recreation use are a major concern because colonial waterbirds need large, undisturbed beach areas for successful nesting and they are particularly sensitive to pedestrians, vehicles and unleashed pets in or near their nesting habitat and especially during pre-nesting, territory establishment, courtship and nesting phases (Erwin 2005). Under alternative B, frequent responses to disturbance would result primarily from the pedestrian corridors provided under alternative B, which could be expected to result in negative impacts to colonial waterbird reproduction. Some of these impacts could occur during critical, early stages of reproduction and within key colonial waterbird habitat and result in abandonment of nest sites, or loss of otherwise suitable habitat. Night driving would be prohibited from 8:00 PM to 6:00 AM March 15 - November 15. Because colonial waterbirds can be very active at night, the fact that alternative B provides protection from night driving affords these birds more protection than under alternative A. Because alternative B protects colonial waterbirds from all other non-pedestrian recreation at Cape Hatteras National Seashore, the overall impact of recreation would be long-term, minor, and adverse.

Substantially more outreach is proposed under alternative B than under A. This includes providing additional information about proper garbage disposal, pet restrictions, anti-wildlife feeding, and species ecology, including more educational signage. This would have a long-term, minor beneficial impact on colonial waterbirds.

**Cumulative Impacts**

Cumulative impacts from other actions taking place in the study area would be the same as identified for American oystercatcher under alternative A—long-term, minor, and adverse. Adding in the long-term, minor, adverse impacts to colonial waterbirds from recreational use at the seashore under alternative B, cumulative impacts under alternative B would be long-term, minor, and adverse.

## **Conclusion**

Under alternative B, increased surveying to include distribution and reproductive success or fecundity would increase surveying disturbance over alternative A resulting in minor to moderate adverse impacts during the nesting season. However, enhanced protection from all recreation except pedestrian traffic in both historic and new colonial waterbird nesting sites would provide additional protection over and above alternative A, resulting in long-term adverse impacts from management and long-term minor adverse impacts from recreation. Cumulative impacts would be long-term, minor, and adverse. Impairment to colonial waterbirds would not occur under alternative B.

## **IMPACTS OF ALTERNATIVE C: TAILORED MANAGEMENT FOCUS**

### **Analysis**

**Species Surveying and Management.** Alternative C includes more intensive surveying of colonial waterbirds than alternative A, but slightly reduced protection compared to alternative B. Although surveying can be beneficial to the species, alternative C requires surveying of reproductive success and that would bring surveying staff into regular, direct contact with nesting colonial waterbirds during very sensitive life history stages. Surveying colonial waterbirds, especially during the nesting season, would have a minor to moderate adverse impact on nesting performance.

Species management would be more intensive for colonial waterbirds under alternative C than alternative A, but less so than under alternative B. Species management would bring people, essential vehicles, and equipment into direct contact with colonial waterbirds and their habitat and these activities, as with surveying, are known risk factors (Buckley and Buckley 1976, Erwin 1980, 2005). Conversely, posting colonial waterbirds nests with symbolic fencing does provide a major deterrent to the entry of people, pets, and ORVs into their habitats. Alternative C provides more protection to colonial waterbirds during the breeding season than alternative A but less protection than alternative B year round. As with alternative B, alternative C also provides a pedestrian walking corridor around all colonial waterbird closures at all time with no provision for closure. This could result in recreation disturbance that could lead to abandonment (Rogers and Smith 1995, Erwin 1989, 2005) of colonial waterbirds especially early in the season in new (especially) or established nesting habitat. Overall impacts from species management under alternative C would be long-term, minor, and adverse.

Predator control would be the same as identified under alternative A; nests would be approached briefly once a week to count eggs and search for any predator tracks. Though no predator trapping is done specifically for colonial waterbirds, these species could be expected to benefit from the reduction in predator numbers from the fox trapping that is done for the endangered and threatened species. Because the positive effects of other management outweigh the negative, other management defined under alternative C for colonial waterbirds would be expected to have long-term, minor beneficial effects on colonial waterbirds.

**Recreation.** As with alternative A and B, alternative C provides for opportunities for a variety of recreation uses that have the potential to expose colonial waterbirds to direct impacts. Whereas under alternative B some areas would be closed year round, alternative C would provide nesting season buffers around colonies. While these buffers are smaller for least terns under this alternative compared to alternative B, they are probably sufficient in size. Also, if an ORV corridor or alternate route were not feasible, areas that host a colonial waterbird colony would be closed to ORV access. As with alternative B, alternative C allows for management to be responsive to individuality in bird behavior when determining adequate size of closure zones. If a colony is abandoned, the buffers remain in place 2 to 3 weeks after abandonment to determine if birds would re-nest, if no other species is nesting in the area. In addition, night driving would be prohibited under alternative C from 10:00 PM to 5:00 AM May 15 - Aug 31. Any prohibition of night driving would protect any colonial waterbird chicks that might wander at night down to the intertidal zone.

Recreation use can attract mammalian and bird predators to refuse associated with recreation use. However, alternative C has the same predator controls as alternative A, resulting in continued adverse impacts.

Impacts from recreation use are a major concern because colonial waterbirds need large, undisturbed beach areas for successful nesting and they are particularly sensitive to pedestrians, vehicles and unleashed pets in or near their nesting habitat and especially during pre-nesting, territory establishment, courtship and nesting phases (Erwin 2005). Under alternative C, frequent responses to disturbance primarily from the pedestrian corridors provided under alternative C which could be expected to result in negative impacts to colonial waterbird reproduction. Some of these impacts could occur during critical, early stages of reproduction and within key colonial waterbird habitat and result in abandonment of nest sites, or loss of otherwise suitable habitat. However, because alternative C provides some protection for colonial waterbirds from all other non-pedestrian recreation, the overall impact of recreation under alternative C would be to long-term, minor, and adverse.

Similar to alternative B, substantially more outreach is proposed under alternative B than under A, which would have minor beneficial impacts on birds at Cape Hatteras National Seashore.

### **Cumulative Impacts**

Cumulative impacts from other actions taking place in the study area would be the same as identified for American oystercatcher under alternative A—long-term, minor, and adverse. Adding in the mostly minor adverse impacts to colonial waterbirds at the seashore under alternative C, cumulative impacts under alternative B would be long-term, minor, and adverse.

### **Conclusion**

Under alternative C, disturbance from surveying would be more than alternative A but less than alternative B, and would include the measuring of distribution and reproductive success and associated moderate adverse impacts during nesting. However, enhanced protection from all recreation (except pedestrian traffic) in both historic and new colonial waterbird nesting sites would provide additional protection over and above alternative A. Therefore, overall impacts of alternative C on colonial waterbirds would be long-term, minor, and adverse. Cumulative impacts would be long-term, minor, and adverse. Impairment to colonial waterbirds would not occur under alternative C.

## **IMPACTS OF ALTERNATIVE D: ACCESS / RESEARCH COMPONENT FOCUS (PREFERRED ALTERNATIVE)**

### **Analysis**

**Species Surveying and Management.** Alternative D defines a range of surveying actions across pre-nesting, nesting, migration, and over-wintering life-stages (see the “Alternatives” chapter for details), similar to those described for the American oystercatcher. As is the case with other alternatives, surveying can be beneficial to the species when the data collected is used to further protect the species. However, alternative D, like alternatives B and C, requires surveying of reproductive success and that would bring surveying staff into regular, direct contact with nesting colonial waterbirds during very sensitive life history stages. Also alternative D would involve more extensive surveying than alternative A, covering potential new habitat and historic breeding habitat, with more intensive data gathering related to the use of GPS. Therefore, under the actions in alternative D, species surveying would likely have long-term, minor to moderate adverse impacts on colonial waterbirds on an annual basis during the pre-nesting and nesting season.

Species management would bring people, essential vehicles, and equipment into direct contact with colonial waterbirds and their habitat, and these activities and in particular the distance-to-flushing studies proposed for establishing bypasses, as with surveying, are known risk factors (Buckley and Buckley 1976, Erwin 1980, 2005). Conversely, posting colonial waterbirds nests with symbolic fencing does

provide a major deterrent to the entry of people, pets, and ORVs into their habitats. Alternative D would provide more protection to colonial waterbirds during the breeding season than alternative A, but less protection than alternative B year round. As with alternatives B and C, alternative D would also provide for a pedestrian corridor around all colonial waterbird closures at all time, with no provision for closure. This could result in recreation disturbance that could lead to abandonment (Rogers and Smith 1995, Erwin 1989, 2005) of colonial waterbirds especially early in the season in new (especially) or established nesting habitat. However, with the closures and buffers for colonial waterbird nesting areas under alternative D and the flexibility of moving the ORV corridor to avoid nesting areas, impacts from species management under alternative D would be long-term, minor and adverse.

Predator control would be the same as the other alternatives; nests would be approached briefly once a week to count eggs and search for any predator tracks. Though no predator trapping is done specifically for colonial waterbirds, these species could be expected to benefit from the reduction in predator numbers from the fox trapping that is done for the endangered and threatened species. Because the positive effects of other management outweigh the negative, other management defined under alternative D for colonial waterbirds would be expected to have long-term, minor beneficial effects on colonial waterbirds.

**Recreation.** The main indirect impact from recreation use is the attraction of mammalian and bird predators to refuse associated with recreation use. However, alternative D has the same predator controls as alternative A, resulting in continued adverse impacts.

Alternative D goes further in controlling recreation in general than alternative A, but does not go as far as alternative B (which has several year round closures). Impacts from recreation use are a major concern because colonial waterbirds need large, undisturbed beach areas for successful nesting and they are particularly sensitive to pedestrians, vehicles and unleashed pets in or near their nesting habitat and especially during pre-nesting, territory establishment, courtship and nesting phases (Erwin 2005). Under alternative D, frequent responses to disturbance could occur from the pedestrian walkways provided, which could be expected to result in negative impacts to colonial waterbird reproduction. Some of these impacts could occur during critical, early stages of reproduction and within key colonial waterbird habitat and result in abandonment of nest sites, or loss of otherwise suitable habitat. However, because alternative D provides some protection for colonial waterbirds from all other non-pedestrian recreation, the overall impact of recreation under alternative C would be long-term, minor and adverse.

Similar to alternatives B and C, substantially more outreach is proposed under alternative D than under alternative A. In addition, where it is not possible to delineate a corridor with posts above the wrack line, signs would be posted asking visitors to avoid the wrack line and education provided regarding the wildlife value and vulnerability of the wrack line to foot and ORV traffic. This would result in long-term, minor beneficial effects to birds at Cape Hatteras National Seashore.

Research would include assessing the effects of the bypass routes around nesting areas, and the outcome of this research would help determine adequate buffers based on flushing distances. This research would have long-term minor beneficial impacts on colonial waterbirds.

### **Cumulative Impacts**

Cumulative impacts from other actions taking place in the study area would be the same as identified for American oystercatcher under alternative A—long-term, minor and adverse. Adding in the long-term, minor to moderate adverse impacts to colonial waterbirds from recreational use and surveying at the seashore under alternative D, cumulative impacts under alternative D would be long-term, minor to moderate, and adverse.

### **Conclusion**

Under alternative D, overall protection to nesting colonial waterbirds would be much improved over alternative A. However, there is still a likely chance of direct minor to moderate impacts to early nesting

waterbirds from surveying, management-focused research, and minor impacts to all waterbirds nesting in or near to the ORV corridor. In these cases, buffer size might not be large enough to shield the birds from recreation and surveying disturbances or from the risk of being run over by a vehicle. Predator numbers are also likely to be an ongoing source of egg and chick loss under alternative D. Alternative D would have long-term, minor adverse impacts to colonial waterbirds from recreational uses. Cumulative impacts would be long-term, minor to moderate and adverse. Impairment to colonial waterbirds would not occur under alternative D.

### **WILSON'S PLOVER**

#### **SPECIES-SPECIFIC METHODOLOGY AND ASSUMPTIONS**

Potential impacts on Wilson's plover populations and habitat were evaluated based on available data on the species past and present occurrence at Cape Hatteras National Seashore as well as the species association with humans, pets, predators, off road vehicles. Information on habitat and other existing data were acquired from staff at Cape Hatteras National Seashore, the U.S. Fish and Wildlife Service, and available literature. Wilson's plover are identified as a species of high concern by the U.S. Shorebird Conservation Plan.

The analysis focuses on effects to wildlife from a variety of human recreational activities, as well as impacts incurred as a result of surveying and management activities.

#### **IMPACTS OF ALTERNATIVE A: NO ACTION ALTERNATIVE - CONTINUATION OF 2004 PROTECTED SPECIES MANAGEMENT**

##### **Analysis**

**Species Surveying and Management.** Alternative A defines limited surveying activities for Wilson's plovers, tied to surveying for the piping plover. Although surveying would lead to benefits related to the use of the data collected to better protect the species, surveying brings people and/or essential vehicles and equipment into direct contact with Wilson's plovers and their habitat and is a known risk factor (Corbat and Bergstrom 2000). Wilson's plovers, like piping plovers, are highly vulnerable to direct human activities such as ORVs, pedestrians, pets, and managers/scientists (Corbat and Bergstrom 2000). However, disturbance to Wilson's plovers from contact during surveying is indeterminate, because alternative A does not specify the distance that staff and essential vehicles maintain during surveying. Staff would use best professional judgment and attempt to minimize disturbance during surveying. However, surveying impact has the potential to lead to frequent flushing responses which in turn could have the potential to negatively impact feeding, reproduction, resting or other factors. Therefore, species surveying under alternative A would likely have long-term, minor, adverse impacts on Wilson's plovers on an annual basis during the pre-nesting and nesting seasons.

During pre-nesting, territory establishment, and courtship, Wilson's plovers are protected only when they co-occur within piping plover closures. Species management would result in long-term, moderate, adverse impacts to Wilson's plovers because the management applies only to those nests occurring within a closure for another species.

Predator enclosures are not used for Wilson's plover, and no predator trapping is done specifically for Wilson's plover. However, Wilson's plover could benefit from fox trapping done under alternative A. Because the positive effects of other management outweigh the negative, other management defined under alternative A would be expected to result in long-term, minor, beneficial effects on Wilson's plover.

**Recreation.** Because Wilson's plovers nest commonly on beaches with wide berms, which are also favored by beachgoers they are subject to disturbance at their nests and roosts by beachgoers, pets, and off road vehicle traffic on beaches. Wilson's plovers leave their nests when disturbed and are extremely

reluctant to return when intruders are anywhere near, thereby exposing eggs to predation and overheating (Corbat and Bergstrom 2000). Because only those Wilson's plovers that happen to nest within a bird closure would be partially protected from recreation use, the impacts of recreation use to Wilson's plover would be long-term, moderate, and adverse.

### **Cumulative Impacts**

Cumulative impacts from other actions taking place in the study area would be the same as identified for American oystercatcher under alternative A—long-term, minor, and adverse. Adding in the moderate adverse impacts to the Wilson's plover from recreational use and management at the seashore under alternative A, cumulative impacts under alternative A would be long-term, minor to moderate, and adverse.

### **Conclusion**

Under alternative A, impacts to Wilson's plover would occur from other species' surveying, management, and recreation uses, and would be long-term, minor to moderate, and adverse. Other species' management and other management would have long-term, minor adverse effects. Cumulative impacts would be long-term, minor to moderate, and adverse. Impairment to Wilson's plover would not occur under alternative A.

## **IMPACTS OF ALTERNATIVE B: UNDISTURBED AREA FOCUS**

### **Analysis**

**Species Surveying and Management.** Under alternative B, staff would observe recent nest sites while surveying for piping plover beginning March 15. Although surveying can provide benefits to the species, surveying brings people and/or essential vehicles and equipment into direct contact with Wilson's plovers and their habitat and is a known risk factor (Corbat and Bergstrom 2000). Wilson's plovers, like piping plovers, are highly vulnerable to direct human activities such as ORVs, pedestrians, pets, and managers/scientists (Corbat and Bergstrom 2000). Because surveying is more intensive under alternative B than under alternative A, disturbance to Wilson's plovers from contact during surveying would be slightly higher. Specifically, surveying has the potential to lead to frequent flushing responses, which in turn could have the potential to negatively impact feeding, reproduction, resting or other factors. Therefore, species surveying under alternative B would likely have long-term, moderate, adverse impacts on Wilson's plovers on an annual basis during the pre-nesting and nesting season.

Species management would result in long-term, moderate, beneficial impacts to Wilson's plovers, because the closures are larger, established earlier than alternative A, and are maintained year round and thus protect more Wilson's plovers and more Wilson's plover habitat from risks associated with recreation use, surveying, and management.

Predator exclosures would not be used for Wilson's plover, but nests would be approached briefly once a week to count eggs and search for predator tracks around the edge of the colony. Wilson's plovers would benefit substantially from the fox trapping that occurs in piping plover habitat because Wilson's plovers nest in the same habitat. Other management under alternative B provides more protection to Wilson's plover than under alternative A and overall impacts would be long-term, minor, and beneficial to Wilson's plovers.

**Recreation.** Impacts from recreation use are a major concern because Wilson's plover need large, undisturbed beach areas for successful nesting and they are particularly sensitive to pedestrians, vehicles, and unleashed pets in or near their nesting habitat and especially during pre-nesting, territory establishment, courtship and nesting phases (Corbat and Bergstrom 2000). Under alternative B, frequent responses to disturbance primarily from the pedestrian corridors provided under alternative B could be expected to result in negative impacts to nesting Wilson's plovers. Some of these impacts could occur during critical, early stages of reproduction and within key Wilson's plover habitat and result in

abandonment of nest sites, or loss of otherwise suitable habitat. However, because alternative B provides additional protection from all other non-pedestrian recreation, the overall impact of recreation under alternative B would be long-term, minor, and adverse.

Substantially more outreach is proposed under alternative B than under A. This includes providing additional information about proper garbage disposal, pet restrictions, anti-wildlife feeding, and species ecology, including more educational signage. This would result in long-term, minor, beneficial effects on Wilson's plover.

### **Cumulative Impacts**

Cumulative impacts from other actions taking place in the study area would be the same as identified for American oystercatcher under alternative A—long-term, minor, and adverse. Adding in the minor adverse impacts to the Wilson's plover from recreational use at the seashore under alternative B, cumulative impacts under alternative A would be long-term, minor, and adverse.

### **Conclusion**

Under alternative B, there would be more potential for disturbance from surveying than under alternative A, but this is more than offset by the larger and longer duration ORV closures. Furthermore, alternative B includes trapping and control of problem predator species and better control of the recreation use waste stream that contributes to maintaining predator populations at Cape Hatteras National Seashore. Most of the benefits that accrue to Wilson's plovers under alternative B do so because they currently nest inside piping plover closures and not because of comprehensive Wilson's plover-specific management. Overall, recreation use under alternative B would result in long-term, minor, adverse impacts to Wilson's plover. Species management and other management actions would provide long-term, minor to moderate, beneficial effects. Cumulative impacts would be minor and adverse. Impairment to Wilson's plovers would not occur under alternative B.

## **IMPACTS OF ALTERNATIVE C: TAILORED MANAGEMENT FOCUS**

### **Analysis**

**Species Surveying and Management.** Wilson's plovers, like piping plovers, are highly vulnerable to direct human activities such as ORVs, pedestrians, pets, and managers/scientists (Corbat and Bergstrom 2000). Surveying would be less intensive under alternative C than under B, but more intensive than under alternative A. Surveying activities have the potential to lead to frequent flushing responses, which in turn could have the potential to negatively impact feeding, reproduction, resting or other factors. Therefore, species surveying under alternative C would likely have long-term, minor, adverse impacts on Wilson's plovers on an annual basis during the pre-nesting and nesting seasons.

Species management would result in minor beneficial effects on Wilson's plovers because, like alternative B, the closures are larger, established earlier than alternative A and protect more Wilson's plovers and their habitat from risks associated with recreation use, surveying, and management than does alternative A, which only protects Wilson's plovers that occur with piping plovers.

Predator control would be the same as under alternative A. Other management would result in negligible or minor beneficial effects to Wilson's plover at Cape Hatteras National Seashore.

**Recreation.** As with alternative A and B, alternative C provides for opportunities for a variety of recreation uses that have the potential to expose Wilson's plover to direct impacts. But whereas alternative B has some areas closed year round, alternative C provides nesting season buffers around Wilson's plover nests. As with alternative B, alternative C allows for management to be responsive to individuality in bird behavior when determining adequate size of closure zones. Night driving would be prohibited under alternative C from 10:00 pm to 5:00 am, May 15 - Aug 31. Any prohibition of night driving would protect any Wilson's plover adults or chicks that might forage at night in the intertidal

zone. The main indirect impact from recreation use is the attraction of mammalian and bird predators to refuse associated with recreation use.

Impacts from recreation use are a major concern because Wilson's plover need large, undisturbed beach areas for successful nesting and they are particularly sensitive to pedestrians, vehicles, and unleashed pets in or near their nesting habitat and especially during pre-nesting, territory establishment, courtship and nesting phases (Corbat and Bergstrom 2000). Under alternative C, frequent responses to disturbance primarily from the pedestrian corridors provided under alternative C which could be expected to result in negative impacts to nesting Wilson's plovers. Some of these impacts could occur during critical, early stages of reproduction and within key Wilson's plover habitat and result in abandonment of nest sites, or loss of otherwise suitable habitat. However, because alternative C provides more protection than alternative A (but not as much as alternative B), the overall impact of recreation under alternative C would be long-term, minor, and adverse.

Substantially more outreach is proposed under alternative C than under A, which would have long-term, minor, beneficial impacts to birds at Cape Hatteras National Seashore.

### **Cumulative Impacts**

Cumulative impacts from other actions taking place in the study area would be the same as identified for American oystercatcher under alternative A—long-term, minor, and adverse. Adding in the minor adverse impacts to the Wilson's plover from recreational use at the seashore under alternative C, cumulative impacts under alternative C would be long-term, minor, and adverse.

### **Conclusion**

Under alternative C, there is more potential for disturbance from surveying than under alternative A, but less surveying disturbance than under alternative B. Disturbance from surveying and management is more than offset by the protection afforded by ORV closures. However, predators could still cause adverse effects. Most of the benefits that accrue to Wilson's plovers under alternative C are because they currently nest inside piping plover closures and not because of comprehensive Wilson's plover-specific management. Overall, recreation use and surveying under alternative C would result in long-term, minor adverse impacts, and species and other management would provide long-term, minor beneficial effects. Cumulative impacts would be long-term, minor, and adverse. Impairment to Wilson's plovers would not occur under alternative C.

## **IMPACTS OF ALTERNATIVE D: ACCESS / RESEARCH COMPONENT FOCUS (PREFERRED ALTERNATIVE)**

### **Analysis**

**Species Surveying and Management.** Although surveying can provide benefits to the species, surveying brings people and/or essential vehicles and equipment into direct contact with Wilson's plovers and their habitat and is a known risk factor (Corbat and Bergstrom 2000). Wilson's plovers, like piping plovers, are highly vulnerable to direct human activities such as ORVs, pedestrians, pets, and managers/scientists (Corbat and Bergstrom 2000). Surveying would include collection of GPS data and the presence of surveyors has the potential to lead to flushing responses, which in turn could have the potential to negatively impact feeding, reproduction, resting or other factors. Species surveying under alternative D would likely have long-term, minor adverse impacts on the Wilson's plover on an annual basis during the pre-nesting and nesting seasons.

Species management under alternative D would result in long-term, minor beneficial effects on Wilson's plovers because the closures are larger, established earlier than alternative A and thus protect more Wilson's plovers and their habitat from risks associated with recreation use, surveying, and management than alternative A.

Predator control would be the same as the other alternatives; predator exclosures would not be used for Wilson's plover, but nests would be approached briefly once a week to count eggs and search for predator tracks around the edge of the colony. Wilson's plovers would benefit substantially from the fox trapping that occurs in piping plover habitat because Wilson's plovers nest in the same habitat. Because the positive effects of other management outweigh the negative, other management defined under alternative D for Wilson's plover would be expected to have long-term, minor beneficial effects.

**Recreation.** The main indirect impact from recreation use is the attraction of mammalian and bird predators to refuse associated with recreation use. However, alternative D has the same predator controls as alternative A, resulting in continued adverse impacts.

Impacts from recreation use are a major concern because Wilson's plover need large, undisturbed beach areas for successful nesting and they are particularly sensitive to pedestrians, vehicles, and unleashed pets in or near their nesting habitat and especially during pre-nesting, territory establishment, courtship and nesting phases (Corbat and Bergstrom 2000). Under alternative D, frequent responses to disturbance primarily from the ORV and pedestrian corridors provided under alternative D would result in negative impacts to nesting Wilson's plovers. Some of these impacts could occur during critical, early stages of reproduction and within key Wilson's plover habitat and result in abandonment of nest sites, or loss of otherwise suitable habitat. However, because alternative D provides protection based on the closures and ORV corridor location, the overall impact of recreation under alternative D would be long-term, minor and adverse.

Similar to alternatives B, and C, substantially more outreach is proposed under alternative D than under alternative A. In addition, where it is not possible to delineate a corridor with posts above the wrack line, signs would be posted asking visitors to avoid the wrack line and education provided regarding the wildlife value and vulnerability of the wrack line to foot and ORV traffic. This would result in minor beneficial effects to birds at Cape Hatteras National Seashore.

### **Cumulative Impacts**

Cumulative impacts from other actions taking place in the study area would be the same as identified for American oystercatcher under alternative A—long-term, minor and adverse. Adding in the beneficial effects of alternative D and the minor adverse impacts to Wilson's plover from recreational use and surveying at the seashore under alternative D, cumulative impacts under alternative D would remain long-term, minor, and adverse.

### **Conclusion**

Under alternative D, overall protection to Wilson's plover would be much improved over alternative A. However, there is still a likely chance of direct minor impacts to early nesting birds from surveying and impacts to all birds nesting in or near to the ORV corridor. In these cases, buffer size might not be large enough to shield the birds for recreation and surveying disturbances or from the risk of being run over by a vehicle. Predator numbers are also likely to be an ongoing source of egg and chick loss under alternative D. Overall, alternative D would have long-term, minor, adverse impacts on Wilson's plover. Cumulative impacts would be long-term, minor, and adverse. Impairment of Wilson's plover or their habitat would not occur under alternative D.

## **RED KNOT**

### **SPECIES-SPECIFIC METHODOLOGY AND ASSUMPTIONS**

Potential impacts on red knot populations and habitat were evaluated based on available data, on the species' past and present occurrence at Cape Hatteras National Seashore, as well as the species association with humans, pets, predators, and ORVs. Red knot are identified as a species of high concern

by the U.S. Shorebird Conservation Plan. Information on habitat and other existing data were acquired from staff at Cape Hatteras National Seashore, the U.S. Fish and Wildlife Service, and available literature.

The analysis focuses on effects to wildlife from a variety of human recreational activities, as well as impacts incurred as a result of surveying and management activities.

#### **IMPACTS OF ALTERNATIVE A: NO ACTION ALTERNATIVE - CONTINUATION OF 2004 PROTECTED SPECIES MANAGEMENT**

##### **Analysis**

**Species Surveying and Management.** Red knots are not surveyed under alternative A at Cape Hatteras National Seashore. Surveying activities for other species would result in minor adverse impacts to red knot at Cape Hatteras National Seashore

Red knots are not managed under alternative A at Cape Hatteras National Seashore. Management activities for other species would result in long-term, minor adverse impacts to red knots at Cape Hatteras National Seashore.

Red knots are not the target species for other management under alternative A at Cape Hatteras National Seashore. While red knots might benefit from a reduction in predators within any habitats within which they rest or feed, these other management activities would have long-term, negligible impacts on red knots.

**Recreation.** Recreation activities that occur in the months when red knots are in residence on beaches in Cape Hatteras National Seashore have the potential to impact resting and foraging red knots. For example, it is possible that ORV activity and/or other recreation (including pedestrians and pets) that takes place within or near to red knot resting and feeding sites could cause red knots to flush more often than they would without these activities, resulting in red knots sacrificing time spent feeding and resting for time spent fleeing. These impacts would be long-term, minor, and adverse.

##### **Cumulative Impacts**

Cumulative impacts from other actions taking place in the study area to all the special status/state-listed birds examined in this EA were assessed jointly, since the impacts of the other actions were so similar for all the species. This analysis follows the discussion of the impacts on the red knot at the end of this section. Cumulative impacts from these other actions would be long-term, minor, and adverse. Adding in the long-term, negligible to minor adverse impacts to the red knot at the seashore under alternative A, cumulative impacts under alternative A would be long-term, minor, and adverse.

##### **Conclusion**

The red knot is a winter visitor at the seashore, and impacts are therefore very limited. Since red knots rest and feed only during the fall and winter (when recreation use is at its lowest), impacts from recreational use would be long-term, minor, and adverse. Cumulative impacts would also be long-term, minor, and adverse. Impairment to red knot would not occur under alternative A.

#### **IMPACTS OF ALTERNATIVE B: UNDISTURBED AREA FOCUS**

##### **Analysis**

**Species Surveying and Management.** Red knots would be surveyed under alternative B according to protocols for surveying wintering piping plover and other shorebirds, under development by NPS Inventory and Monitoring Program. These surveying activities would have minor adverse impacts to red knots at Cape Hatteras National Seashore.

Red knots would not be managed under alternative B at Cape Hatteras National Seashore. Management activities for other species would have long-term, minor, adverse impacts to red knots, as these actions

take place primarily during the spring, summer, and early fall, whereas the red knot is primarily a winter visitor to Cape Hatteras National Seashore.

Red knots are not the target species for other management but they may benefit from the mammalian predator trapping performed to benefit other birds at Cape Hatteras National Seashore. Nevertheless, these other management activities would likely have long-term, negligible impacts to red knots that are more at risk.

**Recreation.** Similar to alternative A, recreation activities that occur when red knots are in residence on beaches in Cape Hatteras National Seashore would have minor adverse impacts on resting and foraging red knots. However, the chance of impact to red knot is much reduced under alternative B, because there are year-round closures in place during the winter.

There are very few data regarding the winter and fall migration habitats that are used by red knots in Cape Hatteras National Seashores. Red knots have been seen in the winter on the ocean side beaches that have a low angle beach face and presumably larger intertidal area. They have been recorded on South Beach (just above the Frisco Ramp), and on both the east and west side of Ocracoke on the ocean side and on the soundside areas on Ocracoke and Bodie Island (S. Maddock 2005 personal communication). While it is difficult to know how many of these or other red knots in other areas would benefit from the year-round closure of key wintering sites, these closures would provide red knots with far more protection from at least ORV disturbance than currently under alternative A. therefore, impacts to the red knot under alternative B would be long-term, negligible, and adverse.

Substantially more outreach is proposed under alternative B than under A, and this would have long-term, minor beneficial impacts on birds at Cape Hatteras National Seashore.

### **Cumulative Impacts**

Cumulative impacts from other actions taking place in the study area would be the same as identified for American oystercatcher under alternative A—long-term, minor, and adverse. Adding in the long-term, minor adverse impacts to the red knot at the seashore under alternative B, cumulative impacts under alternative B would remain long-term, minor, and adverse.

### **Conclusion**

Surveying, management, and recreation use under alternative B would result in long-term, negligible to minor adverse impacts to the red knot. Cumulative impacts would be long-term, minor, and adverse. Impairment to the red knot would not occur under alternative B.

## **IMPACTS OF ALTERNATIVE C: TAILORED MANAGEMENT FOCUS**

**Species Surveying and Management.** Red knots would be surveyed under alternative C the same as under B, according to protocols for surveying wintering piping plover and other shorebirds, under development by NPS Inventory and Monitoring Program. These surveying activities would have negligible impacts to red knots at Cape Hatteras National Seashore.

Red knots are not managed under alternative B at Cape Hatteras National Seashore. Management activities for other species would have long-term, negligible impacts to red knots, as these actions take place primarily during the spring, summer, and early fall, whereas the red knot is primarily a winter visitor to Cape Hatteras National Seashore.

Red knots are not the target species for other management, but they could benefit from the mammalian predator trapping performed to benefit other birds at Cape Hatteras National Seashore. Nevertheless, these other management activities would likely have negligible impacts to red knots that are more at risk.

**Recreation.** As with alternatives A and B, recreation activities that occur when red knots are in residence on beaches in Cape Hatteras National Seashore would have minor adverse impacts to resting and foraging

red knots. Under alternative C, there would be no year-round closures to key winter habitat. Therefore, impacts would be similar to alternative A, long-term, minor, and adverse.

Substantially more outreach is proposed under alternative C than under A, which would have long-term, minor, beneficial impacts to birds at Cape Hatteras National Seashore.

### **Cumulative Impacts**

Cumulative impacts from other actions taking place in the study area would be the same as identified for American oystercatcher under alternative A—long-term, minor and adverse. Adding in the long-term, negligible to minor adverse impacts to the red knot at the seashore under alternative C, cumulative impacts under alternative C would be long-term, minor, and adverse.

### **Conclusion**

Surveying, management, and recreation use might impact the red knot when in residence at Cape Hatteras National Seashore, resulting in long-term, negligible to minor, adverse impacts. Cumulative impacts would be long-term, minor, and adverse. Impairment to the red knot would not occur under alternative C.

## **IMPACTS OF ALTERNATIVE D: ACCESS / RESEARCH COMPONENT FOCUS (PREFERRED ALTERNATIVE)**

### **Analysis**

**Species Surveying and Management.** Red knots would be surveyed under alternative D the same as under alternatives B and C, according to protocols for surveying wintering piping plover and other shorebirds, under development by NPS Inventory and Monitoring Program. These surveying activities would have negligible impacts to red knots in the winter months at Cape Hatteras National Seashore.

Red knots are not managed under alternative D at Cape Hatteras National Seashore. Management activities for other species would have long-term negligible impacts to red knots at Cape Hatteras National Seashore.

Red knots are not the target species for other management, but they could benefit from the mammalian predator trapping performed to benefit other birds at Cape Hatteras National Seashore. Nevertheless, these other management activities would likely have long-term negligible impacts to red knots.

**Recreation.** As with the other alternatives, recreation activities that occur in the months when red knots are in residence on beaches in Cape Hatteras National Seashore have the potential to impact resting and foraging red knots. Under alternative D, there would be no year-round closures to key habitat. Therefore, impacts would be similar to alternative A, long-term, minor and adverse.

Substantially more outreach is proposed under alternative B than under A, which would have long-term, minor beneficial impacts to birds at Cape Hatteras National Seashore.

### **Cumulative Impacts**

Cumulative impacts from other actions taking place in the study area would be the same as identified for American oystercatcher under alternative A—long-term, minor, and adverse. Adding in the negligible to minor adverse impacts to the red knot at the seashore under alternative D, cumulative impacts under alternative D would be long-term, minor and adverse.

### **Conclusion**

Surveying, management, and recreation use might impact the red knot during the fall and winter when they use the area, resulting in long-term, negligible to minor adverse impacts. Cumulative impacts would be long-term, minor, and adverse. Impairment to red knot would not occur under alternative D.

## OTHER WILDLIFE AND WILDLIFE HABITATS

Wildlife potentially affected by the proposed alternatives include mammalian predators, such as grey and red fox; invertebrate species that inhabit the intertidal sand flats, wrack line, and moist substrate habitat; and other bird species that use the same habitat as the species identified for protection under this proposed strategy.

### GUIDING REGULATIONS AND POLICIES

The seashore's *Resource Management Plan* (NPS 1997) identifies the following natural resource related goals to provide direction for future management of the park.

- Identify visitor uses and impacts in order to establish appropriate management policies which would meet the needs of the park visitor while providing for the preservation and protection of the resources unimpaired for future generations.
- Continue to provide rigorous enforcement, research, environmental surveying and applied resource management in accordance with available funding and direction.

Service-wide NPS regulations and policies, including the NPS Organic Act of 1916, *NPS Management Policies 2001* (NPS 2002), and the NPS Reference Manual 77, Natural Resource Management also direct national parks to provide for the protection of park resources. The Organic Act directs national parks to conserve wildlife unimpaired for future generations and is interpreted to mean that native animal life are to be protected and perpetuated as part of a park unit's natural ecosystem. Parks rely on natural processes to control populations of native species to the greatest extent possible; otherwise, they are protected from harvest, harassment, or harm by human activities. The *NPS Management Policies 2001* state that the NPS would maintain as parts of the natural ecosystems of parks all native plants and animals (sec. 4.4.1). The NPS would achieve this by

- preserving and restoring the natural abundance, diversities, dynamics, distributions, habitats, and behaviors of native plant and animal populations and communities and ecosystems in which they occur
- restoring native plant and animal populations in parks when they have been extirpated by past human-caused actions
- minimizing human impacts on native plants, animal populations, communities, and ecosystems, and the processes that sustain them

Policies in the *NPS Natural Resources Management Guidelines* state, "the National Park Service will seek to perpetuate the native animal life as part of the natural ecosystem of parks" and that "native populations will be protected against . . . destruction . . . or harm through human actions."

### METHODOLOGY AND ASSUMPTIONS

The following describes the methodology used to evaluate the impacts of the proposed alternatives on wildlife at Cape Hatteras National Seashore. This discussion focuses on those species that may potentially be impacted by the actions described in the proposed alternatives and is, therefore, directed towards specific wildlife, including invertebrates and other bird species. The analysis is organized according to those two wildlife types. Although, the proposed alternatives have a direct impact on non-native mammalian predators within the park, these impacts are addressed under the individual protected species management sections and within the other bird species section that follows. USDA trappers presently

remove red and gray fox that are preying on nests and chicks. Cape Hatteras National Seashore will be developing a plan to manage predation losses to nesting birds and sea turtles. The plan would be comprehensive dealing with native, non-native and exotic predators that prey on a variety of federal and state listed species. Seashore staff are working with the USDA Wildlife Services in Raleigh, NC to develop the plan/EA.

Many of the protected bird species found within the seashore feed on invertebrates found in the wrack the intertidal sand flats, and the moist sands of the island spits/Cape Point and the high energy intertidal zone. Because ORV use also occurs in these habitats, the impacts of ORVs on the invertebrate populations within these habitats were evaluated. Data used in the analysis was collected from available literature and park staff. Though a number of studies in the United States and internationally have investigated ORV impacts on invertebrates found on sandy beaches, the studies have focused on a relatively small number of species, and only a few of the studies have occurred on beaches in the southeastern United States that would have similar species to the beaches of Cape Hatteras National Seashore. There have also not been any comprehensive studies within Cape Hatteras National Seashore to determine the species composition and abundance of invertebrates within the bird foraging habitat. As a result, there is not sufficient information available to be able to assess the impact of ORVs on all of the invertebrate species inhabiting the wrack, intertidal sand flats, island spits, and the high energy intertidal zone at Cape Hatteras National Seashore. Therefore, impacts to invertebrates would be discussed in general, and where possible impacts on species specific to Cape Hatteras National Seashore would be discussed.

Potential impacts on other bird species and their associated habitat focused on shorebirds that would likely be using the same habitats as the protected species addressed in this strategy. They were evaluated based on available data, on the species' past and present occurrence at Cape Hatteras National Seashore, as well as the species association with humans, pets, predators, and ORVs. Information on habitat and other existing data were acquired from staff at Cape Hatteras National Seashore, the U.S. Fish and Wildlife Service, and available literature.

### **Study Area**

The study area for assessment of the four alternatives, as well as the cumulative impacts is the seashore.

### **IMPACT THRESHOLDS**

The following thresholds for the impacts on wildlife and wildlife habitat were defined:

- |                          |  |
|--------------------------|--|
| <i>Negligible:</i>       | There would be no observable or measurable impacts to native species, their habitats, or the natural processes sustaining them. Impacts would be well within natural fluctuations.   |
| <i>Minor Adverse:</i>    | Impacts on native species, their habitats, or the natural processes sustaining them would be detectable, but would not be outside the natural range of variability. Occasional responses to disturbance by some individuals could be expected, but without interference to feeding, reproduction, resting, or other factors affecting population levels. Small changes to local population numbers, population structure, and other demographic factors might occur. However, some impacts might occur during critical reproduction periods for a protected species, but would not result in injury or mortality. Sufficient habitat in the seashore would remain functional to maintain the viability of the species in the seashore. |
| <i>Minor Beneficial:</i> | Impacts on native species, their habitats, or the natural processes sustaining them would be detectable, but would not be outside the natural range of variability. Improvements to key characteristics of habitat in the seashore would sustain or slightly improve existing population levels,   |

- population structure, or other factors and maintain the viability of the species.
- Moderate Adverse:* Impacts on native species, their habitats, or the natural processes sustaining them would be detectable and could be outside the natural range of variability. Frequent responses to disturbance by some individuals could be expected, with some negative impacts to feeding, reproduction, resting or other factors affecting local population levels. Some impacts might occur during critical periods of reproduction or in key habitats in the park and result in harassment, injury, or mortality to one or more individuals. However, sufficient population numbers or habitat in the seashore would remain functional to maintain the viability of the species in the seashore.
- Moderate Beneficial:* Impacts on native species, their habitats, or the natural processes sustaining them would be detectable and could be outside the natural range of variability. Changes to key characteristics of habitat in the seashore during critical periods of reproduction would minimize or prevent harassment or injury to one or more individuals and improve the viability of the species in the seashore.
- Major Adverse:* Impacts on native species, their habitats, or the natural processes sustaining them would be detectable, would be expected to be outside the natural range of variability, and would be permanent. Frequent responses to disturbance by some individuals would be expected, with negative impacts to feeding, reproduction, or other factors resulting in a decrease in park population levels. Impacts would occur during critical periods of reproduction or in key habitats in the park and result in direct mortality or loss of habitat that might affect the viability of a species. Local population numbers, population structure, and other demographic factors might experience large declines.
- Major Beneficial:* Impacts on native species, their habitats in the park, or the natural processes sustaining them would be detectable, would be expected to be outside the natural range of variability, and would be permanent. Changes during critical periods of reproduction or in key habitats in the park would prevent mortality or loss of habitat and would result in notable increases in park population levels.
- Duration:* Short-term effects would be 1 to 2 breeding seasons for bird species and 1-2 years for invertebrates. Long-term effects would be anything beyond 2 breeding seasons. Under all alternatives, long-term effects may occur to any species well beyond the life of the interim protected species strategy, depending on the outcome of the long-term ORV management plan.

**IMPACTS OF ALTERNATIVE A: NO ACTION ALTERNATIVE - CONTINUATION OF 2004 PROTECTED SPECIES MANAGEMENT**

**Analysis**

**Invertebrates.** Impacts to populations of invertebrates are not known. At Cape Cod National Seashore, attempts to determine whether ORVs impact invertebrate populations were unsuccessful because the high

variability within the sample areas masked any correlation with vehicle impacts (Leatherman and Godfrey 1979)

ORVs operating on the intertidal zone only sink into the firm sand a tenth of an inch or so (Wolcott and Wolcott 1984), and it has been shown in most cases that invertebrates inhabiting the intertidal zone that burrow into the sand when the tide is out are generally unaffected or only minimally affected by ORV traffic, regardless of the intensity of use. In a study in South Africa, Van de Merwe and Van der Merwe (1991) found that the gastropod *Bullia rhodostoma*, the clams *Donax serra* and *Donax sordidus*, and the benthic mysid (*Gastrosaccus psammodytes*) showed a high tolerance for ORV traffic. These species normally occupy the top 0.8 inches of sand, and generally are not found below a depth of 4 inches, and with 50 vehicles passes fewer than 10% of the animals were damaged. At Cape Lookout National Seashore, Wolcott and Wolcott (1984) studied the impact of ORVs on coquina clams, mole crabs, and ghost crabs. They found that coquina clams and mole crabs, both of which reside below the sand surface when the tide is out, are immune to ORV damage. They also found that when ghost crabs are in their sand burrows during the day, they too are immune from ORV impacts, even if they are only 2 inches below the surface.

However, ghost crabs are largely nocturnal and come out of their burrows to feed in the intertidal zone at night. At Cape Lookout National Seashore, Wolcott and Wolcott (1984) found that the crabs have no effective escape response when caught in an oncoming vehicle's headlights and are easily crushed by the ORVs. They recorded an average of 77 crabs killed per 0.6 miles of intertidal zone during the study. During a peak period of crab activity they recorded over 500 crabs killed by a single vehicle pass over a distance of 1.2 miles. Due to the large ghost crab population at Cape Lookout National Seashore, estimated to be 10,000 crabs per 0.6 miles, and the relatively low level of night driving at the time, 0.25 vehicles per 0.6 miles, the authors concluded that if the low levels of night driving remained unchanged, the impact to the ghost crab population would be negligible. However, they also concluded that even modest amounts of beach driving at night (20 – 50 vehicles driving along the intertidal zone) during the crabs' active season (April – November) would substantially reduce the ghost crab population. Several other studies show correlations between ghost crab populations and the amount of vehicle traffic. At Back Bay National Wildlife Refuge in Virginia a ten-fold difference in numbers was found between ORV use areas and nearby control areas where ORVs were prohibited, and at Chincoteague National Wildlife Refuge only one-thirteenth as many ghost crab burrows were found on a beach heavily used by ORVs as on a nearby control areas (Wolcott and Wolcott 1984). While these studies did not investigate causative effects, due to the circumstances surrounding night driving at these locations, Wolcott and Wolcott (1984) stated that "it seems reasonable to conclude that the observed population differences were due to the fraction of ORV use occurring after dark."

Invertebrates inhabiting the softer more protected intertidal sand-flats, however, are not immune from ORV impacts. During studies conducted on populations of sand-flat invertebrates at Cape Cod National Seashore it was found that various animals, particularly amphipods (*Talorchestia*) numbered fewer in sand-flats where driving occurred (Leatherman and Godfrey 1979). The study also found polychaete worm (clam worm) populations and soft-shell clam (*Mya arenaria*) populations were totally decimated after applying 50 vehicle passes per day over 20 days to experimental plots. This is not unexpected, though, as the substrate is softer than the intertidal zone so ORVs would sink slightly further and the species are soft-bodied organisms which makes them particularly susceptible to physical compression.

ORVs can also impact the wrack line. Steinback (in prep) studied ORV impacts to sandy beaches in and around the wrack line at Cape Cod National Seashore, and found the number of animals on beaches where driving was permitted to be 30 – 50% lower than on beaches where driving was prohibited. The wrack line contains a number of amphipods, beetles, mites, worms, flies and spiders, some which are very susceptible to drying out in various stages of their life history and when a vehicle drives over the wrack line, it breaks it up, causing it to dry out.

ORVs could also impact invertebrate populations by altering or disrupting the normal foraging behavior of bird species. As ORVs drive along the beach, they disturb foraging birds and cause them to vacate the areas where they were feeding. Though the birds normally return to foraging in their new location, some areas of heavy ORV use may actually decrease the foraging pressure on invertebrates by continually disrupting bird feeding behavior in those locations. However, more study would be needed in this area to draw any conclusions, as it is currently not known what, if any impact, bird foraging has on invertebrate populations.

Under alternative A there would be no protection of the wrack line, intertidal zone or sand flats from ORV use other than what is closed by protected species closures. While the typical ORV use pattern within the seashore is to drive on the upper beach, above the high tide line (M. Hardgrove, NPS, pers. comm., D. Otto, Louis Berger Group, Inc., November 17, 2005), when vehicles reach their destination they drive into the intertidal zone and park. While driving in the intertidal zone would likely have a negligible impact on invertebrates, it requires the ORV to cross over the wrack line which would disperse it and cause adverse impacts. In addition, tidal ranges at the seashore are normally between one and four feet, thus the wrack line is normally deposited on low to mid sections of the beach, which fall within the normal ORV corridor. It is not possible to determine an impact for the entire seashore of vehicles driving through the wrack, for the width of the beaches and location of species closures are constantly changing from year to year so it is not known what percentage of the overall wrack would be disturbed by ORV traffic. However, in those areas that requires ORVs to frequently drive through the wrack due to insufficient beach width and/or protected species closures the impact to invertebrates within the wrack would be long-term moderate adverse. It is also not known what level of use the intertidal sand flats currently receives or would receive from ORVs under alternative A. Even 50 vehicle passes per day would likely cause long-term moderate adverse impacts on the invertebrate populations within this habitat. Although data is scarce, patrol rangers have stated that substantial vehicle driving occurs on the beaches at night (NPS 2006). Though ghost crab populations within the seashore are not known, given that Wolcott and Wolcott (1984) concluded that even 20-50 vehicles driving at night could significantly impact ghost crab populations, night driving under alternative A would likely have long-term moderate adverse impacts on the ghost crab population.

**Other Bird Species.** Although the management actions described under alternative A do not address bird species outside of those identified in the preceding sections, other bird species would benefit from them. Alternative A includes erecting symbolic fencing around piping plover historic breeding areas, American oystercatcher established territories and nests, and colonial waterbird established territories and nest. These closures would remain in place until all areas have been abandoned for a 2-week period by their respective species. The symbolic fencing is undoubtedly a major deterrent to the entry of people, pets, and ORVs into these habitats. However, other bird species would be able to utilize these protected areas, free of disturbance, thus providing a long-term minor beneficial impact.

Recreation use and the waste-stream (food, trash, fish bait, etc.) associated with recreation activities within Cape Hatteras National Seashore can lead to a greater number of predators. These predators are a well-known factor in nest failure for piping plover and all ground nesting birds within Cape Hatteras National Seashore (Lyons 2003-2004 and personal communication). Grey and red fox removal at the park provides long-term, minor, beneficial impacts to other bird species, reducing the risk of predation for individual birds.

Winter habitat occupancy can be an important determinant of individual performance in migratory birds. Restricted access to food-rich winter habitats may limit survival of females and immature males, an outcome that could be an important driver of population structure and dynamics (Studds and Marra 2005). Alternative A provides for protection of wintering piping plover in the fall months at Bodie, Hatteras, and Ocracoke Spits. These areas, specifically configured for piping plover, provided limited protection to other wintering/migrating species only during the winter months and, thus have a long-term, negligible, beneficial impact.

## **Cumulative Impacts**

Other past, present, and future planned actions within and around Cape Hatteras National Seashore have the potential to impact invertebrates. The dredging of Oregon inlet has occurred in the past and would continue to occur on an annual basis in the future. While the actual dredging would impact benthic invertebrates within the channel, it would not directly impact invertebrates within the sandy beach habitat of the seashore. However, during the dredging operations some heavy construction equipment accesses the inlet via Bodie Island Spit (USACE 2002). Depending on the size and weight of the equipment and the timing and duration of the operations there could be a short-term, moderate to major, adverse impact on some of the invertebrate species residing in the sands of Bodie Island Spit due to crushing and compaction of the sand. However, given the total available spit habitat within the seashore, the overall impact to the seashore would be short-term, minor to moderate adverse. The type and placement location of the dredge spoils, as well as the timing and frequency of placement may also have adverse impacts on invertebrates residing within the sandy beaches of the seashore.

The continued maintenance of NC-12 and berm maintenance have altered the natural morphology and ecology of the dunes and beaches within the seashore and have contributed to the narrowing of the beaches through erosion and removed newly created overwash habitat (Marion 2005). These actions decrease the amount of available intertidal habitat and could have a long-term moderate impact on some of the invertebrate species inhabiting this area. Continued NPS authorized berm maintenance for private property in front of villages within the seashore would have similar impacts as the NC-12 berm maintenance. Both would have short-term, moderate, adverse impacts on other bird species during the maintenance activity itself, especially if it takes place during sensitive life stages (i.e. breeding/nesting).

Commercial fishing has been allowed within the seashore in the past and would continue to be allowed. Commercial fishermen accessing the seashore by vehicle could have adverse impacts to some marine invertebrate species inhabiting the sand flats and intertidal zones by crushing them with their ORVs as they access the seashore for their livelihood. Commercial fishing would have a negligible adverse impact on other bird species unless these species feed on the fish that are harvested. In those cases, the impact of commercial fishing on other bird species would be long-term, minor to moderate adverse.

Several of the local and NPS past, current, and future planning efforts can also affect the marine invertebrates in the sand flats and intertidal zones and other bird species. For example new development might result from the County Land Use Development Plan for Dare and Hyde County and could have adverse impacts on invertebrates and other bird species by increasing the amount of ORV traffic on the beaches. The upcoming NPS Resource Stewardship Plan and the Cape Hatteras National Seashore long-term ORV Management Plan/EIS, would address ORV use at the seashore and, especially because of the documented risks that ORVs pose to some marine invertebrate species inhabiting the sand flats and intertidal zone and other bird species using this habitat, these plans would have long-term, direct impacts on marine invertebrates and other bird species at Cape Hatteras National Seashore. However, the impacts are indeterminate at this time and would depend on the policies developed with regards to where within the seashore ORVs would be allowed to go and during what time of day and year.

The overall cumulative impact of these past, current and future actions, along with the actions under this alternative, would be short- and long-term, minor to moderate adverse depending upon the individual species of marine invertebrate.

Cumulative impacts from other actions taking place in the study area to all other bird species would be the same as those identified for American oystercatcher, colonial waterbirds, and other protected species since other bird species would have similar life stages as any of these birds. Cumulative impacts from these other actions would be long-term, minor, and adverse. Adding in the long-term, minor to moderate adverse impacts to the other bird species identified under alternative A, cumulative impacts under alternative A would be long-term, negligible, and adverse.

## Conclusion

ORV use would have adverse impacts on invertebrate species within the seashore under alternative A. Though driving in the intertidal zone would have negligible impacts, doing so would require driving across wrack lines. In areas where there is continual disruption of the wrack line there would be long-term moderate adverse impacts to the invertebrate population inhabiting this area. To the extent that ORVs drive on softer intertidal sand flats, there would be long-term moderate impacts on soft-bodied animals, for even relatively few vehicles passes can decimate the animals.

Other bird species would be able to use protected areas, free of disturbance, thus providing a long-term, minor, beneficial impact. Predator removal at the park would provide long-term, minor, beneficial impacts to other bird species, reducing the risk of predations for individual birds. These areas, specifically configured for piping plover, provided limited protection to other wintering/migrating species only during the winter months and, thus have a long-term, negligible beneficial impact.

Past, present, and future activities inside the seashore when combined with the impacts of protected species management and recreation use would result in long-term negligible adverse impacts to other bird species and long-term, moderate, adverse impacts to invertebrates in the seashore.

Though many of the ORV impacts to invertebrates would be long-term, major adverse, the impacts would not be at a level that would threaten the existence of the invertebrate populations within the entire seashore, and, therefore, impairment of invertebrates and other bird species would not occur.

## IMPACTS OF ALTERNATIVE B: UNDISTURBED AREA FOCUS

### Analysis

**Invertebrates.** Under alternative B the enhanced protection measures for the protected species would also greatly enhance the protection of the invertebrates within the bird foraging habitat. Closing the spits to ORV use would allow invertebrate populations to recover to natural abundance levels and would provide long-term moderate beneficial impacts to all invertebrate species inhabiting these areas, including any soft-bodied animals and species inhabiting the wrack. Ghost crab mortality generally only occurs from night driving. Therefore prohibiting night driving from April to November, the crab's active season, would provide long-term moderate benefits (depending upon the current level of impact) and would allow the ghost crab population to recover to natural abundances. Outside of the spits, some of the wrack line may still be impacted by ORV use as beach widths and the increased size of protected species closures may force ORVs to drive lower in the intertidal zone than would normally occur. However, the amount of wrack disturbed within the seashore would be less than in alternative A, as efforts to educate the public about the need to avoid the wrack line would take place, bird and turtle observers would avoid the wrack, and the ORV corridor would begin at the mean high tide line, which would encompass the primary wrack line. However, wrack lines placed higher up on the beach from tides higher than the mean high tide would still be subject to adverse impacts. The extent to which disturbance would occur within the entire seashore is indeterminate at this time and would depend on where resource closures occur with regard to beach widths and the amount of wrack placed higher up on the beach than the mean high tide line by storms.

**Other Bird Species.** The symbolic fencing is undoubtedly a major deterrent to the entry of people, pets, and ORVs into these habitats. However, other bird species would be able to utilize these protected areas, free of disturbance, thus providing a long-term, minor, beneficial impact. Predator removal at the park provides long-term, moderate, beneficial impacts to other bird species, reducing the risk of predations for individual birds. These areas, specifically configured for piping plover, provided limited protection to other wintering/migrating species only during the winter months and, thus have a long-term, moderate beneficial impact.

### Cumulative Impacts

Cumulative impacts under alternative B would be the same as alternative A.

## **Conclusion**

ORV use would have direct adverse impacts on invertebrate species within the seashore under alternative B but it would be less than alternative A. Impacts within the intertidal zone would be negligible throughout the seashore. Closing the spits to ORVs would provide long-term moderate benefits by protecting all invertebrate species in these areas and allowing them to recover to natural levels. Ghost crabs would be completely protected by prohibiting night driving with the impacts being long-term moderate beneficial. The overall impact would be long-term minor to moderate adverse. The ORV corridor would also protect the intertidal sand flats from ORV use and would provide long-term minor beneficial effects dependent upon the current level of impacts, which is not known. Impacts to invertebrates under alternative B would generally be beneficial and impairment of the resource would not occur.

Other bird species would be able to use protected areas, free of disturbance, thus providing a long-term, minor, beneficial impact. Predator removal at the park would provide long-term, minor, beneficial impacts to other bird species, reducing the risk of predations for individual birds. These areas, specifically configured for piping plover, provided limited protection to other wintering/migrating species only during the winter months and, thus have a long-term, negligible beneficial impact.

Past, present, and future activities inside the seashore when combined with the impacts of recreation use would result in short to long-term minor impacts to invertebrates in the seashore and long-term negligible adverse impacts to other bird species.

Impairment of invertebrates and other bird species would not occur.

## **IMPACTS OF ALTERNATIVE C: TAILORED MANAGEMENT FOCUS**

### **Analysis**

Under alternative C the protection measures for the protected species would enhance the protection of invertebrates within the bird foraging habitat more than alternative A, but slightly less than alternative B. Impacts to the intertidal zone would continue to be negligible adverse throughout the seashore. Closing the spits to ORV use except for an ORV corridor would protect most of the habitat for invertebrates, allowing them to recover to natural abundances everywhere on the spits except in the ORV corridor, where any soft-bodied animals would be eliminated. Due to the size of the spits and the area protected, though, the overall impact for these areas would be long-term minor to moderate beneficial. Ghost crabs are active at night from April to November and under alternative C night driving would be prohibited from May 15 to August 31. Thus prior to May 15 and after August 31 ghost crabs would be adversely impacted by night driving, and even between May 15 and August 31 crabs would be adversely impacted prior to 10 p.m. and possibly after 5 a.m. Given their susceptibility at night, overall impacts would be long-term minor to moderate adverse. Outside of the spits, some of the wrack line may still be impacted by ORV use as beach widths and the increased size of protected species closures may force ORVs to drive lower in the intertidal zone than would normally occur. However, the amount of wrack disturbed within the seashore would be the same as in alternative B, as efforts to educate the public about the need to avoid the wrack line would take place, bird and turtle observers would avoid the wrack, and the ORV corridor would begin at the mean high tide line, which would encompass the primary wrack line. However, wrack lines placed higher up on the beach from tides higher than the mean high tide would still be subject to adverse impacts. The extent to which disturbance would occur within the entire seashore is indeterminate at this time and would depend upon where resource closures occur with regard to beach widths and the amount of wrack placed higher up on the beach than the mean high tide line by storms.

**Other Bird Species.** Alternative C would provide for species management closures to be erected around those areas where piping plover breeding and/or nesting has occurred in the past 3 years (recent). Predator removal at the park provides long-term, minor, beneficial impacts to other bird species, reducing

the risk of predations for individual birds. These areas, specifically configured for piping plover, provided limited protection to other wintering/migrating species only during the winter months and, thus have a long-term, moderate beneficial impact.

### **Cumulative Impacts**

Cumulative impacts under alternative C would be the same as under alternative A.

### **Conclusion**

ORV use would have direct adverse impacts on invertebrate species within the seashore under alternative C but would be less than alternative A. Impacts within the intertidal zone would be negligible throughout the seashore. Closing the spits to ORVs would be beneficial, but allowing an ORV corridor would decimate any soft-bodied invertebrates within the corridor, resulting in an overall impact of long-term, minor beneficial effect. Ghost crabs would be protected from night driving to some degree, but would still experience adverse impacts outside of night driving prohibitions, resulting in long-term, minor to moderate, adverse impacts the ghost crab population. Similar to alternative B, the wrack would be afforded greater protection than under alternative A. The overall impact to wrack would be long-term, minor to moderate adverse. The ORV corridor would also protect the intertidal sand flats from ORV use and would provide long-term minor beneficial effects dependent upon the current level of impacts, which is not known.

Other bird species would be able to use protected areas, free of disturbance, thus providing a long-term, minor, beneficial impact. Predator removal at the park would provide long-term, minor, beneficial impacts to other bird species, reducing the risk of predations for individual birds. These areas, specifically configured for piping plover, provided limited protection to other wintering/migrating species only during the winter months and, thus have a long-term, moderate beneficial impact.

Past, present, and future activities inside the seashore when combined with the impacts of recreation use would result in short to long-term minor adverse impacts to invertebrates in the seashore and long-term negligible adverse impacts to other bird species.

Impairment of invertebrates and other bird species would not occur.

## **IMPACTS OF ALTERNATIVE D: ACCESS / RESEARCH COMPONENT FOCUS (PREFERRED ALTERNATIVE)**

### **Analysis**

**Invertebrates.** Under alternative D the protection measures for the protected species would enhance the protection of the invertebrates within the bird foraging habitat more than alternative A but less than alternatives B and C. Impacts to the intertidal zone would continue to be negligible adverse throughout the seashore. The spits would not be closed to ORV use so any soft-bodied invertebrates would be subject to adverse ORV impacts. However, these impacts would be limited to areas above the mean high tide wrack line. Night driving would be allowed under alternative D and the impacts to ghost crabs would be the same as alternative A; long-term moderate adverse. Protecting the primary wrack line at the mean high tide line would be beneficial to the invertebrates inhabiting it. However, there may be few areas where this is possible due to beach width, protected species closures, and wrack placement. In addition, any wrack placed by storms higher up on the beach than the mean high tide line would still be subject to ORV impacts. Posting areas along the mean high tide line would also be problematic, since posts would likely be frequently washed out by the surf. In areas not posted, intensive education would be necessary to help minimize the impacts.

**Other Bird Species.** Alternative D would protect habitat used by protected bird species at some time in the last 10 years; however, it would provide for adaptive management in that alternate ORV routes (i.e. another access ramp, an existing interdunal road, and/or NC-12), and potential bypass routes could be

established around species management closure areas to maintain ORV access. Other bird species would be able to utilize these protected areas, free of disturbance, thus providing a long-term, negligible, beneficial impact due to the presence of recreationists on the sound and oceansides of the spits. Removal of non-native grey and red fox from the park prior at the onset of breeding season would provide long-term minor beneficial impacts to other bird species, reducing the risk of predations for individual birds.

Seasonal closures and buffer establishment for piping plover and American oystercatcher migrating/wintering birds would limit ORV access and pedestrian access to some locations, providing protection to other wintering/migrating species throughout migration and winter and, thus having a long-term, minor, beneficial impacts.

### **Cumulative Impacts**

Cumulative impacts under alternative D would be the same as under alternative A.

### **Conclusion**

ORV use would have direct adverse impacts on invertebrate and other bird species within the seashore under alternative D and would be less than alternative A but more than alternative B and C. Impacts within the intertidal zone would be negligible throughout the seashore. The spits would not be closed to ORV use; however, impacts to any invertebrates would be restricted to above the mean high tide wrack line resulting in an overall impact of long-term minor to moderate adverse impacts. Ghost crabs would not be protected from night driving and similar to alternative A the impacts would be long-term moderate adverse. The wrack would be afforded greater protection than under alternative A. The ORV corridor would protect most soft-bodied animals found in the intertidal sand flats from ORV use and would provide long-term minor beneficial effects dependent upon the current level of impacts, which is not known.

Other bird species would be able to use protected areas, free of disturbance, thus providing a long-term, minor, beneficial impact. Predator removal at the park would provide long-term, minor, beneficial impacts to other bird species, reducing the risk of predations for individual birds. These areas, specifically configured for piping plover, provided limited protection to other wintering/migrating species only during the winter months and, thus have a long-term, minor beneficial impact.

Past, present, and future activities inside the seashore when combined with the impacts of recreation use would result in short to long-term minor adverse impacts to invertebrates in the seashore and long-term negligible adverse impacts to other bird species.

Impairment of invertebrates and other bird species would not occur.

# VISITOR USE AND EXPERIENCE

## GUIDING REGULATIONS AND POLICIES

The NPS Management Policies 2001 (NPS 2000c) state that the enjoyment of park resources and values by the people of the United States is part of the fundamental purpose of all parks and that the NPS is committed to providing appropriate, high-quality opportunities for visitors to enjoy the parks.

Cape Hatteras National Seashore's purpose states that, "except for certain portions of the area, deemed to be especially adaptable for recreational uses...the said areas 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." Management goals include making available to the public traditional outdoor recreational opportunities that are not detrimental to the natural or cultural resources of the park.

While recreation is a key component of the NPS Management Policies, they also instruct park units to maintain all native plants and animals as parts of the natural ecosystem. The NPS would achieve this by preserving and restoring the natural abundances, diversities, dynamics, distributions, habitats, and behaviors of native plant and animal populations and the communities and ecosystems in which they occur (NPS 2000c, sec. 4.4.1).

The goals of providing recreational opportunities and protecting the natural systems at Cape Hatteras are evident in the objectives of this EA. With regard to recreation and conservation, the objectives state that these interim species protection strategies should:

- Provide for continued recreational use and access, consistent with the required management of protected species.
- Increase opportunities for public awareness and understanding of NPS resource management and visitor use policies and responsibilities as they pertain to the seashore and protected species management.

In addition, the seashore has identified objectives for communicating with the general public and visitor population that enjoy the recreational opportunities and natural and cultural resources provided by the park. Communication and information-sharing is an integral component of ensuring visitor satisfaction. Thus, the proposed strategies should also accomplish the following:

- Establish an ongoing and meaningful dialogue with the multiple publics who are interested in and affected by protected-species management to ensure development of a strategy that can be successfully implemented.
- Establish procedures for prompt and efficient public notification of protected-species management actions and the reasons for these actions.

## METHODOLOGY AND ASSUMPTIONS

The potential for change in visitor experience was evaluated by identifying projected increases or decreases in visitor uses related to the proposed alternatives, and determining whether these projected changes would affect the visitor use and experience. The primary sources of data used to determine these changes are the 2001 and 2002 visitor surveys and visitor counts, conducted by East Carolina University, Department of Recreation and Leisure Studies (Vogelsong 2003). The data, as presented in the Vogelsong report and shown in the "Affected Environment," provided the average number of off-road vehicles (ORVs) at any one time per access ramp. When added together, the average number of ORVs at each

ramp does not equal the average number of ORVs throughout the park at any one time. This number was most likely determined from an averaging of all counts at each ramp throughout the study area.

In addition, the data in the report was not manipulated or extrapolated to determine total ORV use by month, season, or year at each ramp. Therefore, by using this data, impacts to ORV users could only be quantified in terms of the average number of ORVs that could be affected at one time at each ramp. The percent of ORV use annually that might be impacted annually, as a result of species-related management actions, was grossly approximated, using NPS visitation statistics and the estimated annual ORV use provided by Vogel song (2003). These relative, gross estimates allow a comparison of the potential impacts between alternatives.

The visitor-use analysis focused on the possibility and potential locations of resource-related, partial- and full-beach closures and their potential impact to park recreation uses. Probable future locations for closures, as described in the alternatives, were determined by evaluating historic breeding, roosting, and foraging habitat for the federally and state-listed species and other protected species discussed in previous sections, such as the piping plover, sea turtles, and seabeach amaranth, among others. These potential closure areas are identified in appendix A.

As indicated in “Visitor Use and Experience” in the “Affected Environment,” a large percentage of ORV use and surf fishing occurs in the vicinity of the island spits, where closures have occurred historically for species such as the piping plover. In addition, all major dispersed recreation use, such as swimming, sunbathing, beach walking, and jogging occurs primarily in areas where this ORV activity also occurs (e-mail communication with Norah Martinez, Chief Ranger, Cape Hatteras NS on 11/29/05). Therefore, much of the visitor use analysis focuses on how the species and recreation management strategies proposed in each alternative might affect ORV users at the Bodie, Hatteras, and Ocracoke spits, and Cape Point and South Beach. More developed recreation uses, such as visiting lighthouses, pier fishing, and camping, are not evaluated in this analysis, because these opportunities would either not be affected, or would be affected marginally, by the alternatives.

The breeding habits of each species, particularly the piping plover, American oystercatcher, and the sea turtles, are also important in determining visitor use impacts. The likelihood of partial- or-full beach closures and the restriction of ORV or pedestrian access, is dependent on when the bird species court, establish territory, build nests, and lay eggs, as well as when the young first leave the nest to forage for food or when turtle hatchlings return to the sea.

Based on the life stages of these species, as described in the “Affected Environment,” breeding territory establishment and courtship for the piping plover generally begins in late March, the first nests are initiated in late April, and the brood-rearing period extends from late May to mid-August (Cohen 2005). The time when plover chicks leave the nest and forage for food, and before fledging, generally occurs in July and August and lasts approximately 21 to 35 days (3 to 5 weeks). It is assumed that this is the most likely period for extended and full beach closures to ORV use, depending upon the alternative.

The first turtle nests begin to appear at Cape Hatteras National Seashore in mid-May, and the last nests are typically laid in late August. Eggs incubate approximately 63 to 68 days before hatchlings emerge. At the seashore, hatchlings generally emerge anytime between July and early November. During this period, beach closures could occur between the nest and the ocean shore from approximately 55 days after the nest is laid until the eggs hatch and hatchlings reach the water’s edge unharmed. These closures can impede or prevent ORV and pedestrian travel through sections of seashore beach.

Seabeach amaranth habitat could also result in resource closures. However, unless otherwise mentioned in the analysis, this plant is generally located within other resource closures, such as for the piping plover.

## STUDY AREA

The geographic study area for the visitor use and experience analysis is the entire Cape Hatteras National Seashore, but, primarily, the beaches, spits, and ORV access ramps within the park.

## IMPACT THRESHOLDS

The following thresholds for evaluating impacts on visitor experience were defined:

<i>Negligible:</i>	Visitors would likely be unaware of impacts associated with proposed changes. There would be no noticeable change in visitor use and experience or in any defined indicators of visitor satisfaction or behavior.
<i>Minor:</i>	Changes in visitor use and/or experience would be slight and detectable, but would not appreciably limit or enhance any critical characteristics of the visitor experience. Visitor satisfaction would remain stable.
<i>Moderate:</i>	A few critical characteristics of the existing visitor experience would change, and the number of visitors engaging in a specified activity would be altered. Some visitors participating in that activity or visitor experience might be required to pursue their choices in other available local or regional areas. Visitor satisfaction at the park would begin to either decline or increase.
<i>Major:</i>	A number of critical characteristics of the existing visitor experience would change and/or the number of participants engaging in an activity would be greatly reduced or increased. Large numbers of visitors overall who desire to continue using and enjoying that activity or visitor experience would be required to pursue their choices in other available local or regional areas. Overall visitor satisfaction would markedly decline or increase.
<i>Duration:</i>	Short-term impacts would occur sporadically throughout a year, but would generally last no more than three weeks per year. Long-term impacts would occur more than three weeks per year, and could continue beyond the life of the proposed interim strategy, depending on the outcome of the long-term ORV management plan.

## IMPACTS OF ALTERNATIVE A: NO ACTION ALTERNATIVE - CONTINUATION OF 2004 PROTECTED SPECIES MANAGEMENT

Analysis. Recent breeding activity for piping plover has been limited to Bodie Island Spit, Cape Point and South Beach, Hatteras Island Spit, and Ocracoke Island Spit. American oystercatchers nest here as well, but not exclusively. ORV ramps that provide access to these spits and points for surf fishing and other recreational pursuits include:

- Ramp #4 on Bodie Island
- Ramps #43, 44, and 45 at Cape Point and South Beach
- Ramps #55 and 57 to the Pole Road on Hatteras Island
- Ramp #72 on Ocracoke Island.

These ramps exhibit high levels of ORV use, and their combined use accounts for more than 50% of the average ORV use in the park at one time (Vogelsong 2003).

Although historic piping plover habitat would restrict large areas of each of the spits beginning in April, ORV corridors to the spits and Cape Point would most likely remain open throughout the early parts of the spring and summer. However, as occurred during 2005 on Hatteras Inlet, a full-beach closure could occur to protect piping plover or American oystercatcher chicks once they vacate the nest and begin foraging. This activity could occur anytime throughout the summer months, but most likely in July or August, and could last from 3 to 5 weeks, until the chicks take flight. ORV users would not be able to reach the spits for fishing unless alternate access was available via an existing interdunal road. However, these roads are often times washed out by storms.

Because turtles nest anywhere in the park, partial and full-beach closures could occur anywhere along park beaches throughout the summer and fall months, as hatchlings emerge from the nest. These nest closures generally last from approximately the 55<sup>th</sup> day after the nest is laid until the nests hatch. A full-beach closure almost occurred at Cape Point in 2005, because of a nest location adjacent to a dune. The beach would have been closed, except the dune was raked out behind the nest to continue to allow access.

Partial-beach resource closures on the spits would result in negligible adverse impacts in the long term, because ORVs would have access around these closures using ORV corridors and would not be impeded from reaching favored destinations or fishing locations.

Full-beach resource closures on the spits or along spit access routes would be more adverse, although they would most likely be temporary and limited to a short period. Depending upon the location, such a closure could restrict access for an average of 46 to 86 ORVs at each affected ramp at any one time (Vogelsong 2003). However, at Ramp #4, near the Bodie Island Spit, and at Ramps #43, 44, and 45 to Cape Point, as many as 353 and 234 ORVs have been counted at one time.

Any full-beach resource closures that restrict ORV access would most likely occur during the summer months, when 45% to 50% of the park's annual visitation occurs (Vogelsong 2003; NPS Public Use Statistics Office 2005). Of the estimated 91,900 ORVs in the park annually, approximately 46,000 ORVs visit park beaches during the summer months, assuming that ORV use follows overall park visitation patterns. At least 50%, or 23,000 of those ORVs, would frequent the ramps that provide access to the spits (Vogelsong 2003). Assuming that these 23,000 ORVs are distributed equally among the four ramps and that use is equally distributed between June, July, and August, approximately 5,750 ORVs would occur throughout the summer, and 1,917 ORVs would occur monthly at each ramp. Thus, a one-month closure at one spit could affect approximately 2% of the annual ORV use, or 4,332 visitors, whereas a full-summer closure would impact approximately 6% of ORVs or 12,997 visitors. This assumes that all ORV users at these ramps are driving to the spits, which may not be the case. For example, the park estimates that 40% of the ORV use at Ramps #55 and #57 journeys to Hatteras Inlet (Personal communication with Gary Henson 2005).

The inability to participate in recreational activities, such as fishing, beach driving, or any other ORV-dependent activity at a spit related to a full-beach resource closure, even though the closure may only be temporary, would result in long-term moderate adverse impacts to those visitors who regularly frequent that location. Although unlikely, if full-beach closures occurred at more than one spit location at a time, moderate-to-major adverse impacts to ORV users and fishermen could occur, depending upon the location and time frame, because popular surf fishing areas would be unavailable or provide limited availability for fishermen—one of the primary visitor populations within the park. However, given approximately 2.2 million visitor each year, this temporary loss of opportunity would affect less than 0.5% of park visitors annually.

These visitors would also be displaced from one or more spits to other ORV use or fishing in the park, potentially causing increased crowding. Visitor satisfaction would most likely decline for a small percentage of the park visitor population. The uncertainty of when closures might occur could discourage visitors from visiting the park at all and cause them to seek recreation opportunities elsewhere. Spit-area

closures would be reduced beginning November 1; therefore, these impacts would not apply to fishermen in November and throughout the winter months.

Resource closures for American oystercatchers, colonial waterbirds, and sea turtles may also occur in other areas throughout the park. Besides the spits, American oystercatchers and colonial waterbirds are found along the shore, from Cape Point north to Pea Island and in various areas between Cape Point and Hatteras Inlet and on Ocracoke Island. This breeding habitat occurs in vicinity of ORV-access ramps where ORV use is much lighter. Average ORVs at any one time, range from 2 to 12 ORVs on Hatteras Island from Cape Point to Oregon Inlet. This is much less than the 46 to 86 that occur at more popular ramps near the spits. Generally, ORVs and other dispersed recreation users would negotiate around these smaller closures throughout the park resulting in short-term negligible adverse impacts, because ORV accessibility remains. Although a temporary full-beach resource closure could also result in areas outside the spits, the adverse impacts would be long-term and minor, because the beach would remain open on either side of resource closure and would be accessible from an ORV ramp. Displaced ORV and other recreation activities from the spits, and the potential for these partial- or full-beach resource closures, could result in long-term, minor to moderate, adverse impacts to ORV users and other dispersed recreation users in areas outside the spits.

Fishing tournaments are a special activity that occur during the spring and fall in ocean beach areas throughout the seashore. Approximately eight annual tournaments are permitted by the NPS. As noted in the "Affected Environment," these tournaments are permitted to use all the open seashore beaches except ½ mile on either side of Cape Point, ½ mile from Hatteras and Ocracoke Inlet, and ½ mile on the north side of Oregon Inlet. These restrictions exclude all major nesting areas at the seashore where resource closures related to bird breeding activity have occurred. Some resource closures could occur during the spring and fall outside these restricted areas along other ocean beaches, but as explained above, these would not be overly restrictive to ORV and other recreation uses, including surf fishing. Therefore, alternative A would result in short-term negligible to minor adverse impacts to visitors participating in fishing tournaments.

Pedestrians and other activities, such as swimming, sunbathing, beach walking, jogging, and shell collecting, would be allowed within bird closure areas, with the exception of the buffers immediately surrounding nests. However, pedestrians would not be allowed within turtle or seabeach amaranth closures. Recreational pursuits, such as kite flying, Frisbees, and ball throwing, would not be allowed within piping plover closures. These restrictions would have short-term minor adverse impacts on visitor use, because many other locations exist throughout the park that accommodate these or similar activities.

**Cumulative Impacts.** Other past, present, and planned future activities within Cape Hatteras National Seashore have the potential to affect visitors and the recreational opportunities supported within the park. In recent years, hurricanes, storms, and other events, and the subsequent recovery time required following these events, have adversely impacted visitors. Barrier islands are dynamic and constantly being reshaped by forces of nature, such as weather events. Following these events, roads are often over washed with sand and water, facilities destroyed, and portions of an island may be lost or reshaped. Visitors cannot consistently depend that the recreation opportunity or visitor experience they enjoyed during a recent or past visit may be available in the future. In addition, following an event, staff and other park resources may be dedicated to recovery efforts rather than to facilitating visitor enjoyment in some areas throughout the park. Depending on the degree of damage following a storm, areas of the park may be closed for a substantial period of time. Thus, weather events may result in short-term and long-term minor to major adverse impacts, depending upon the severity of the storm.

Adverse impacts may also result from other activities within the park, including the dredging of Oregon Inlet, which causes temporary shoreline closures along Bodie Island, and the implementation of the park Resource Management Plan, which, in the interest of protecting park resources, may restrict some visitor opportunities. The development of the Cape Lookout Interim Protected Species Management Plan/EA,

which may impact the availability of seashore areas along the North Carolina coast at Cape Lookout to ORVs and other recreation opportunities in the interest of protecting important park species, could further impact the availability of ORV opportunities along the North Carolina coast, resulting in long-term, moderate, adverse impacts to ORV recreation opportunities until the Cape Lookout long-term ORV Management Plan is implemented. Similarly, the development of the long-term ORV management plans for both Cape Hatteras and Cape Lookout could result in seasonal and annual management changes that may adversely affect ORV and other recreational uses in the long-term. However, long-term benefits may also be provided by improving visitor experience for ORV users through more consistent application and a greater awareness of resource closures and for other seashore users, such as sunbathers, beach combers, and bird watchers seeking a vehicle-free environment.

Other beneficial impacts to visitor experience have occurred, and would continue to occur into the future, from the implementation of the following park plans or actions:

- *Cape Hatteras National Seashore General Management Plan* (1984) that considers visitor needs in managing park resources
- Ongoing maintenance of NC-12, which helps ensure continued and ongoing access to park beaches, visitor facilities, and lighthouses for visitors along the highway that runs the entire length of the park
- *Cape Hatteras National Seashore Comprehensive Interpretive Plan* that would identify the interpretive programs and associated facilities necessary to inform and teach the public about the purpose and significance of the park and the many resources and opportunities that comprise the park
- Bonner Bridge replacement and the opening of the dune road around Cape Point that would continue to ensure visitors and their vehicles access between Bodie and Hatteras Islands along NC-12 and provide alternate access through the dunes at Cape Point, if and when the beach is closed.

Actions, such as ongoing road maintenance and repair to NC-12 and associated bridges, would most likely provide long-term moderate beneficial impacts to visitor use and experience because of the importance of the road in maintaining access. The GMP and interpretive plan would most likely provide long-term moderate, beneficial impacts because these plans and activities would ensure that visitor opportunities continue within the park.

The potentially adverse impacts of storm events and long-term ORV management plans, in combination with the generally moderate adverse impacts of alternative A, would result in long-term, moderate, adverse cumulative impacts to ORV users and other visitors dependent on ORVs for access to particular areas of the seashore. However, the beneficial impacts of seashore plans, including the long-term ORV management plans, and ongoing road maintenance would result in long-term minor to moderate beneficial impacts to all visitors by ensuring continued protection of seashore resources and access for visitors to enjoy these resources.

## Conclusion

Resource closures on the spits would result in long-term negligible to minor adverse impacts if ORVs are able to negotiate around closure areas using ORV corridors and have continued access to favored destinations or fishing locations. Full-beach resource closures on the spits or along spit access routes could affect approximately 2% of annual ORV use per month per spit or approximately 6% per spit for a summer season. Such a closure would result in long-term moderate adverse impacts to visitors who regularly frequent these locations because of the inability to participate in recreational activities, such as

fishing, beach driving, or any other ORV-dependent activity. However, this loss of opportunity would affect less than 0.5% of annual park visitations.

In park areas outside the spits, partial-beach resource closures would result in short-term, negligible, adverse impacts, because ORVs and other dispersed recreation users would negotiate around these smaller closures. Full-beach resource closures in these areas would only be long-term and minor, because the beach would remain open on either side of a resource closure and would be accessible from an ORV ramp. Because pedestrians and most other recreational opportunities could occur in bird closures, but would be restricted in sea turtle and seabeach amaranth closures, short-term minor adverse impacts would occur to these users. Cumulative impacts would be long-term, moderate, and adverse to ORV users, and long-term, moderate, beneficial for other park users.

## **IMPACTS OF ALTERNATIVE B: UNDISTURBED AREA FOCUS**

### **Analysis**

Year-round closures of all the spits, from sound side to ocean side, Cape Point, and South Beach, would adversely impact all the most heavily used ORV ramps and prevent access to the most popular surf fishing areas within the park. As noted in alternative A, ramps that access the spits, Cape Point, and South Beach, include Ramps 4, 43, 44, 45, 55, 57, and 72, and combined, they account for more than 50% of the average ORV use in the park at one time (Vogelsong 2003). Thus, with year-round closures, approximately 50% or 46,000 of the 91,900 ORVs that use the park annually would be potentially affected by these closures.

Assuming that each ORV is occupied by 2.26 visitors, approximately 103,960 visitors would be displaced on a year-round basis from the spits and the primary locations for surf fishing in the park annually. If only 40% of these ORVs actually use the spits or Cape Point and South Beach, as discussed in alternative A, this number would be reduced to approximately 18,400 ORVs (41,584 visitors), or at least 20% of annual ORV use that would be displaced. Vogel's study (2003) reported that over 60% of visitors indicated they would visit less often, or not visit the park at all, if ORVs were not allowed on the beaches they currently frequent. Therefore, some visitors would seek ORV opportunities in other locations outside the park. This loss of recreation opportunity would result in long-term major adverse impacts to ORV users, fishermen, and other ORV-dependent recreational activities. Given the approximately 2.2 million visitors that visited the park in 2004, roughly 2% to 5% of this visitor population would be potentially affected by this loss of opportunity; the recreation opportunities and experiences of the remaining 95% of visitors would most likely remain untouched.

Fishing tournaments held at the seashore would not be adversely impacted by the closure of the spits. As described in alternative A, permits issued by the NPS for these tournaments already exclude major bird nesting areas within ½ mile of each spit or point. Larger and more visible closures in other areas of the park (outside of the spits) could inconvenience some tournament participants by obstructing continuous access along a beach; however, these adverse impacts would be short-term and minor. Fishermen would continue to have access either around a closure or from ORV ramps on either side of a full-beach closure and would only be prevented from accessing small sections of ocean beach within a nesting closure that extends to the surf.

As discussed in alternative A, resource closures for American oystercatchers, colonial waterbirds, sea turtles, and seabeach amaranth in this alternative, could also occur in other park areas outside the spits in vicinity of less popular ORV ramps. In comparison to alternative A, these nesting buffers and potential resource closure areas would be larger to afford more resource protection. As a result, impacts to ORVs and other dispersed recreation users would be slightly more adverse. Although visitors would be able to negotiate around resource closures and nest buffers, these areas would be larger, require additional signage, and generally be more visible to visitors, resulting in short-term, minor, adverse impacts. If a

full-beach resource closure occurred, only long-term, minor, adverse impacts would occur, because the beach would remain open on either side of the closure and be accessible from an ORV ramp.

The recreation use that would be displaced from the spits to less-frequented ORV ramps could substantially change the current visitor experience along nearby beaches. ORV use at ramps #23, 27, 30, 34, and 38 on Hatteras Island and Ramps # 59, 67, and 68 on Ocracoke Island, currently average from 3 to 12.5 ORVs at one time. Ramps #49 and 70 have higher ORV use (38 and 58 ORVs at one time, respectively). The displacement of upwards of 46,000 ORVs from the spits and Cape Point/South Beach to these ramps, could result in increased crowding and decreased visitor satisfaction for ORV users and non-ORV users because of the increased number of ORVs each would encounter. Visitors surveyed in 2001 and 2002 (Vogelsong 2003) did not feel crowded by other park users and found the number of ORVs and people on the beach that they reported seeing to be quite acceptable (without large resource closures). However, Vogelsong also reported that visitors at every data collection site in the park desired to see fewer people than they encountered, particularly at higher-use areas. Generally, visitors to the seashore like uncrowded beaches and prefer low densities of users. Thus, the addition of displaced ORV users to these lesser-used ramps and beaches, and the possibility of resource closures, would most likely result in long-term, moderate, adverse impacts to current recreational users. Some displacement to ORV areas outside the park could also occur.

Other restrictions that would affect the quality of visitor experience would be the elimination of night driving, from March 15 to November 15. This restriction would adversely affect many surf fishermen and other ORV-dependent activities, because they would not be able to access fishing spots at night or in the early morning before daybreak.

Pedestrian corridors would be maintained onto the spits, although ORVs would not be allowed. Therefore, for those individuals willing to walk out onto the spits, other recreational activities such as surf fishing, swimming, sunbathing, beach walking, jogging, and shell collecting, would be allowed within the defined pedestrian corridor. Pedestrian corridors on the spits and throughout the park in other bird closure areas would be narrow and more restrictive than in alternative A. Due to these restrictions, the ability of pedestrians to enjoy the spits without nearby ORVs would result in minor beneficial impacts to non-ORV users.

Pedestrians would not be allowed within turtle or seabeach amaranth closures, and recreational pursuits, such as kite flying, Frisbees, and ball throwing, would not be allowed within piping plover or American oystercatcher closures. Kite-flying would also be restricted near colonial waterbird nesting habitats. These further restrictions on pedestrian uses and other recreation activities within closure areas, and the greater likelihood that other beach users would encounter resource closure or restrictions throughout the park, would cause a decline in visitor experience, resulting in long-term minor-to-moderate adverse impacts because of the potential number of closures. Fishermen who drive at night, and visitors who enjoy beachfires, could also be adversely affected to a minor degree because of restrictions related to bird closures, turtle requirements, and the potential loss of landing sites.

### **Cumulative Impacts**

Impacts related to past, present, and future actions at Cape Hatteras that could affect visitor use and experience would be the same as described in alternative A. A range of long-term, minor to major adverse impacts could occur related to weather events, such as hurricanes, park resource management, and ORV management plans, and the Oregon Inlet dredging. Long-term moderate beneficial impacts would result from ongoing road maintenance and repair to NC-12 and associated bridges, the long-term ORV management plans, and the park GMP and interpretive plan.

These adverse impacts, in combination with the impacts of alternative B, would result in long-term, major, adverse, cumulative impacts to ORV users and other visitors that are dependent on ORVs for beach access. However, the moderate beneficial impacts of park plans and road maintenance, in

combination with the impacts of alternative B, would provide benefits to other non-ORV-dependent park visitors by ensuring continued protection of park resources and visitor enjoyment of these resources (for example, bird watching, shell collecting, etc.). Therefore, cumulative impacts to ORV users accessing the spits would remain long-term, major, and adverse, because of the spit closures, but would be long-term moderate beneficial to other park users, because of the benefits associated with spit closures, as well as the long-term ORV management and other park plans that would improve the overall visitor experience.

### **Conclusion**

Year-round closures of all the spits, Cape Point, and South Beach would eliminate vehicular access from the most heavily used ORV ramps, potentially affecting approximately 50% or 46,000 of the 91,900 ORVs that use the park annually and resulting in long-term, major, adverse impacts to ORV users, fishermen, and other ORV-dependent recreational activities that frequent these areas. However, this loss of opportunity would affect less than 5% of annual park visitation.

In areas outside the spits, partial-beach resource closures would result in short-term minor, adverse impacts, because, although still negotiable by ORVs, closure areas would be larger. Full-beach resource closures would be long-term and minor, because the beach would remain accessible on either side of the closure. However, the displacement of ORVs from the spits, Cape Point, and South Beach to less-frequented areas of the park could substantially change the current visitor experience because of increased crowding. Because visitors to the seashore like uncrowded beaches and prefer low densities of users, resource closures and recreation displacement would most likely result in long-term, moderate, adverse impacts to visitors in areas outside the spits. Some beneficial impacts to visitors would occur, because pedestrian access would be maintained to the spits. However, restrictions on pedestrian uses and other recreation activities within closure areas would result in long-term minor-to-moderate adverse impacts. Cumulative impacts would be long-term, major adverse to ORV users accessing the spits and long-term, moderate beneficial to other park users.

### **IMPACTS OF ALTERNATIVE C: TAILORED MANAGEMENT FOCUS**

#### **Analysis**

Although resource closures would be implemented annually on the spits, Cape Point, and South Beach similar to alternative B, the provision of an ORV and pedestrian corridor into these areas would allow continued access throughout the year. However, similar to alternative A, nesting and fledging piping plovers and American oystercatchers could also cause a corridor to be narrowed or closed to accommodate the needs of foraging chicks.

The availability of alternate routes via interdunal roads or NC-12, would help minimize the likelihood that the spits would be closed because of bird closures. Similarly, provisions to bypass the turtle nests using the identified bypass criteria or, if absolutely necessary, cross through a heavily patrolled turtle closure before hatching, would also help ensure that ORV and pedestrian access would continue to the spits, Cape Point, and South Beach. Although less likely than in alternative A, a closure would affect approximately 46 to 86 ORVs at one time at the more heavily used ORV ramps identified in alternative A. A one-month closure could affect approximately 2% of the annual ORV population, or 4,332 visitors, but that would be less than 0.5% of the annual park visitation, similar to alternative A.

The inability to participate in recreational activities such as fishing, beach driving, or any other ORV-dependent activity at a spit, would result in adverse impacts to the experience of those visitors who frequent that location. However these would be short-term and minor compared to alternative A, because of the reduced likelihood of closures due to alternate routes and bypass options. If access to more than one spit was closed at a time, impacts would be long-term and moderate adverse, because more than one of the most popular surf-fishing destinations would be inaccessible.

Areas outside of the spits, such as between Ramps #59 and 72 on Ocracoke Island, would also be closed to protect bird habitat; however, ORV and pedestrian corridors would be provided. Turtle nests and associated resource closures could occur anywhere throughout the park, as in other alternatives. As described in alternative A, this habitat occurs in the vicinity of ORV access ramps where ORV use is much lighter. Generally, ORVs and other dispersed recreation users would negotiate around these closures throughout the park, resulting in short-term, negligible, adverse impacts, because accessibility remains. Although a temporary full-beach resource closure could result to protect turtle hatchlings or chicks foraging, the adverse impacts would be long-term and minor, because the beach would remain open on either side of the resource closure and would be accessible from an ORV ramp.

Occasional displaced ORV use from the spits and the potential for full-beach resource closures in these other areas could result in adverse impacts to ORV users and other dispersed recreation users in areas outside the spits. However, the likely infrequency of spit closures in this alternative would ensure that any crowding was temporary, resulting in short-term minor adverse impacts to visitor use and experience.

Similar to alternative B, fishing tournaments held throughout the park would not be adversely impacted by the closure of the spits because tournament permits already prevent fishermen from accessing major nesting areas within ½ mile of each spit or point. Options for providing access through or around turtle nests and the provision of an ORV corridor where possible for bird closures would result in negligible adverse impacts because historic beach access for tournament fishermen would continue.

Pedestrians and other activities, such as swimming, sunbathing, beach walking, jogging, and shell collecting, would be allowed within defined pedestrian corridors around bird closures and through seabeach amaranth closures. However, pedestrians would not be allowed within turtle closures. In many cases, the defined ORV and pedestrian corridors would overlap or be the same, raising the possibility of conflict between ORV and non-ORV users and a diminished visitor experience for visitors seeking solitude and freedom from vehicular distractions. Because the width of the ORV corridor would be approximately 150 feet, sufficient room should be available for both operating and park ORVs and pedestrians, resulting in short-term, minor, adverse impacts to pedestrians and other non-ORV dependent visitors.

Recreational pursuits, such as kite flying, Frisbees, and ball throwing, would not be allowed within piping plover or American oystercatcher closures. Kite-flying would also be restricted near colonial waterbird nesting habitats. Similar to alternative B, these restrictions on pedestrian uses and other recreation activities would result in long-term, minor, adverse impacts because of the number and size of planned resource closures. Fishermen who drive at night, and visitors who enjoy beachfires, could also be adversely affected to a minor degree because of restrictions related to bird closures, turtle requirements, and the potential loss of landing sites.

### **Cumulative Impacts**

Impacts related to past, present, and future actions at Cape Hatteras that could affect visitor use and experience would be the same as described in alternative A. Long-term, minor to major adverse impacts could occur related to weather events, such as hurricanes, park resource management and ORV management plans, and the Oregon Inlet dredging. Long-term, moderate, beneficial impacts would result from ongoing road maintenance and repair to NC-12 and bridges, the long-term ORV management plans, and the park GMP and interpretive plan.

The adverse impacts of storm events and long-term ORV plans, in combination with the minor adverse impacts of alternative C, would result in long-term, moderate, adverse, cumulative impacts to ORV users and other visitors that are dependent on ORVs for access to beaches. However, the beneficial impacts of park plans, including the long-term ORV management plans and ongoing road maintenance, would result in moderate beneficial impacts to all visitors, but particularly non-ORV users, by ensuring continued protection of park resources.

### **Conclusion**

Although resource closures would be implemented annually on the spits, Cape Point, and South Beach, the provision of an ORV and pedestrian corridor would allow continued access unless species activity or safety issues required a closure. Before implementing a closure, alternate access routes and bypass criteria would be evaluated, thereby reducing the likelihood of a closure along spit access routes. However, closures could still occur impacting the same ORV population, as described in alternative A (2% of annual ORV users or less than 0.5% of annual park visitors). This temporary loss of recreation opportunity at a spit would result in adverse impacts to ORV users and fishermen. However, it would be short-term and minor because of alternate routes and bypass options.

Similar to alternative A, partial-beach resource closures would result in short-term, negligible, adverse impacts and full-beach resource closures would result in long-term, minor, adverse impacts in park areas outside the spits. Pedestrian impacts would be the same as alternative B. In many cases, the defined ORV and pedestrian corridors would overlap; however, the width of the corridor would be sufficient to avoid user conflicts. Cumulative impacts would be long-term, moderate, and adverse to ORV users and long-term, moderate, beneficial for other park users.

### **IMPACTS OF ALTERNATIVE D: ACCESS / RESEARCH COMPONENT FOCUS (PREFERRED ALTERNATIVE)**

Overall, the impacts to visitor use and experience that would result from the implementation of alternative D are the same as described in alternative C for ORV users, non-ORV users, pedestrians, tournament fishermen, and all other visitors. Although the implementation of bypass criteria for bird closures might further ensure that ORV access would be provided year-round to the spits, Cape Point, and South Beach, the impacts to ORV users and other ORV-dependent recreational users would remain short-term and minor adverse.

### **Cumulative Impacts**

Cumulative impacts would be the same as alternative C.

### **Conclusion**

Resource closures would be based on recent breeding activity on the spits, Cape Point, and South Beach and in other park locations. As described in alternative C, an ORV and pedestrian corridor would be provided adjacent to closure areas unless species activity or safety issues required a closure. Before implementing a closure, alternate access routes and then bypass criteria would be evaluated, thereby reducing the likelihood of a closure along spit access routes. Therefore, impacts to visitor use and experience would be the same as alternative C.

## SOCIOECONOMIC RESOURCES

### GUIDING REGULATIONS AND POLICIES

The National Environmental Policy Act requires that economic and social impacts be analyzed when they are interrelated with natural or physical impacts. Economic impacts would potentially result from actions considered under the alternatives; therefore, they are addressed in this document.

### METHODOLOGY AND ASSUMPTIONS

Socioeconomic impacts analyses estimate the impact of the proposed alternatives on future levels of economic activity for a defined region of influence. The magnitude of the impacts for each proposed alternative is usually quantified using a regional economic model and then compared to a baseline forecast or the no-action alternative. Under the no-action alternative, it is assumed that future economic indicators (e.g., employment rates, income levels) would increase (or decrease) at the same rate as under a scenario in which none of the proposed actions would be implemented. Depending on whether the proposed alternatives would lead to changes in population levels, the socioeconomic impact analysis might also evaluate changes in demand for housing and public services, such as health, education, and law enforcement services.

Socioeconomic impact assessments using modeling tools require specific types of data. For example, an economic assessment of a proposed action involving the construction and operation of a new manufacturing facility would involve evaluating economic impacts for both the construction and operation phases of the facility's life cycle. Data needed to run the economic model would include information on the manufacturing plant's employment and payroll levels, duration of the construction and operational phases, and information on the industrial classification of the production facility (i.e., NAICS code). The economic model would then provide an estimate of the total number of jobs generated by the new plant, including those indirectly generated. Total changes in regional personal income and other economic indicators would also be generated to develop a detailed assessment of the impact of the plant on the regional economy.

The above example is provided to help explain the difficulty of quantifying the potential economic impacts of the proposed alternatives assessed for the current analysis. Whereas the establishment of a new manufacturing facility can be directly linked to specific types and numbers of new jobs, the proposed strategy involves no direct linkage to regional employment or income. The strategy would, for example, involve no new construction or the hiring of workers, either in the public or private sector. It would have no effect on tax policy nor would it involve regulatory changes to how businesses operate. In short, the proposed alternatives are not directly linked to regional economic activity. The strategy, could nonetheless affect future regional economic output, indirectly through induced changes in visitation levels to the Cape Hatteras National Seashore and surrounding areas. Specifically, depending how future prospective visitors would respond to the proposed changes in vehicle accessibility to portions of the seashore, businesses that depend on tourist revenue could be affected, which in turn, could impact the regional economy. Fewer visitors to the region would result in less consumer spending and ultimately reduced business volume. If the reduction in spending were to be sufficiently large, some businesses might reduce their number of employees, leading to an overall lessening of economic activity in the region.

However, unlike the example of a proposed factory, there are no data available to enter into an economic model to estimate employment and income changes. Specifically, there is insufficient information to accurately predict the future behavior of prospective visitors in response to each proposed alternative and the subsequent impact on businesses that would be patronized by these visitors. To quantify the economic changes of the proposed actions one would need to accurately estimate changes in visitation levels for both day visitors and overnight visitors, as well as for local and out-of- region visitors. One would also

need to obtain data on the spending patterns for each of these visitor categories to determine how they allocate their spending among the different types of businesses (e.g., lodging, retail stores, and restaurants) in the region to estimate the “multiplier effect” of the future spending changes. These types of information are usually obtained through a detailed survey of visitor attitudes, which is a costly and time consuming process and which is beyond the scope of the current assessment.

Because of these data limitations, the approach used for the current economic assessment is a qualitative one, although one that is supported by data on annual lodging tax receipts for all of the localities within the region of influence and additional information provided by selected businesses during informational telephone interviews. The following sections describe the categories of impact thresholds used for the economic analysis, a discussion of the information used to determine the impact levels for past closures, and description of the expected impacts for each proposed alternative action.

### **STUDY AREA**

The socioeconomic environment evaluated for this EIS encompasses two counties in coastal North Carolina—Dare and Hyde. These counties form the economic region of influence (ROI) and define the geographic area in which the predominant social and economic impacts from proposed action are likely to take place. Located within these counties are towns and villages that would likely be most affected by the proposed actions, including several villages on Hatteras Island, including Ocracoke, Hatteras, Frisco, Avon, Buxton, Hatteras, Frisco, Salvo, Waves, and Rodanthe. The largest towns within the ROI include Nags Head, Kill Devil Hills and Kitty Hawk. The geographical area of the ROI is defined based on the locations where the proposed restrictions on recreational activities (as part of the interim protected species management strategy) would be implemented and the distribution of the businesses that would most likely be affected by those restrictions. The study acknowledges that the socioeconomic effects from the proposed and alternative actions could extend beyond the ROI, although these impacts would be significantly diminished beyond the directly affected areas.

### **ECONOMIC IMPACTS OF PREVIOUS PROTECTED SPECIES MANAGEMENT**

As noted above, the economic impact of the proposed alternatives would depend on how prospective visitors would respond to future restrictions on vehicle access to portions of the seashore. Although no surveys on visitor attitudes toward beach closures have been conducted for the Cape Hatteras, recent visitor surveys (Vogelsong 2004) indicate that a substantial percentage of the Cape Hatteras visitors travel to the region to participate in recreational fishing and that many of these visitors use ORVs to access fishing areas. As noted in the Vogelsong study, it is estimated that up to 10 percent of Cape Hatteras visitors participate in ORV activities. The impact of the proposed alternatives would then depend on the response of this segment of the visitor population to future vehicle restrictions.

As an alternative to using visitor attitudes towards future vehicle restrictions, one can evaluate how recent restrictions have affected business within the region of influence. Species management has resulted in vehicle restrictions to Cape Hatteras beaches over the past decade, although the nature of those closures has changed somewhat in the past 3 years.

### **LODGING RECEIPTS**

The most reliable information available to gauge the impacts of these restrictions on the region’s economy is lodging occupancy gross sales receipts collected by Dare County for the last six fiscal years. Although the lodging sector is only one of several service sectors likely to be affected by the proposed action, it is critical to the health of the region’s economy, and can serve as a useful surrogate for estimating order of magnitude impacts to the other service sectors. Lodging receipts for the period 1999 to 2005 are presented in table 26.

TABLE 26: GROSS SALES BY DISTRICT BY FISCAL YEAR

	Fiscal Year					
	1999-2000	2000-2001	2001-2002	2002-2003	2003-2004	2004-2005
Avon	\$14,939,306	\$16,416,714	\$19,957,231	\$24,022,677	\$22,514,951	\$23,957,485
Buxton	\$7,935,586	\$8,617,032	\$8,873,742	\$8,821,147	\$7,840,235	\$7,693,996
Frisco	\$4,090,110	\$4,861,892	\$4,882,311	\$4,731,012	\$6,076,748	\$7,089,976
Hatteras	\$7,000,301	\$7,919,974	\$9,344,717	\$10,622,051	\$9,613,019	\$9,961,496
Kill Devil Hills	\$30,307,366	\$33,915,962	\$38,967,503	\$38,655,937	\$40,218,864	\$38,838,344
Kitty Hawk	\$8,552,332	\$9,874,347	\$9,717,543	\$8,780,181	\$9,702,782	\$12,810,635
Manteo	\$4,187,271	\$4,618,858	\$5,046,029	\$5,523,860	\$5,883,858	\$5,511,297
Nags Head	\$47,715,434	\$55,851,275	\$60,755,479	\$63,314,884	\$66,669,464	\$68,071,541
Rodanthe	\$3,247,584	\$4,814,880	\$6,183,916	\$7,565,596	\$6,668,976	\$8,607,027
Salvo	\$4,665,228	\$5,495,523	\$5,914,057	\$6,937,974	\$7,805,532	\$9,378,040
Waves	\$2,904,543	\$3,726,589	\$4,569,642	\$6,329,689	\$6,850,073	\$7,433,662
Southern Shores	\$7,752,850	\$12,654,828	\$13,788,435	\$14,899,780	\$12,621,394	\$13,972,237
Duck	\$28,923,176	\$37,498,068	\$42,014,819	\$44,477,341	\$49,304,706	\$50,173,017
Other	\$618,323	\$250,367	\$588,844	\$350,776	\$1,071,508	\$491,896
	\$172,839,408	\$206,516,309	\$230,604,268	\$245,032,905	\$252,842,109	\$263,990,649

Dare County Department of Finance, 2005

Lodging revenues for Dare County have increased steadily over the 6-year period. Preliminary figures indicate the lodging revenues during the summer of 2005 increased by 10 percent over the same period in 2004. These figures are consistent with the other economic indicators presented in the affected environment section and which indicate a robust regional economy.

The data, however, also indicate that growth in the most recent years has been uneven. Lodging revenues from establishments located in the northern areas of Dare County (north of Hatteras Island) including Nags Head, Kill Devil Hills, and Duck continued to increase and accounted for more than 60 percent of the total in 2004-2005. Although Kill Devil Hills has experienced somewhat stagnant growth in the last 3 fiscal years, lodging revenue in Nags Head, Kitty Hawk, and Duck have continued to rise with 2004-2005 revenues exceeding the previous year's total by about 4.3 percent. In contrast, increases in lodging revenue from establishments located in the southern reaches of Hatteras Island, especially in the villages of Avon, Buxton, and Hatteras have been stagnant. Revenues for fiscal year 2004-2005 remain below 2002-2003 for lodging establishments in these villages. Lodging revenues from establishments located in the villages of Rodanthe, Waves, and Salvo on the northern portion of the island, however, rebounded significantly from the 2003-2004, with lodging revenues significantly exceeding 2002-2003 levels. Lodging data for Ocracoke Island, are not available because Hyde County reports occupancy receipts only at the county level.

The reasons for the differences in revenue growth among these jurisdictions and across years are difficult to ascertain. Overall economic growth, including construction of recreational housing has been substantially stronger in the northern part of the county than in the southern part of the county. The fact that there are more new recreational housing units available for leasing in the area of Nags Head could account for the larger revenue growth rate in that jurisdiction compared to others in the County. Weather events also impact different types of visitors differently. Hurricane Isabel, for example, had a much larger impact on the southern part of the Cape than in the north when it struck North Carolina in September 2003. Numerous businesses, including hotels were not operational for many months.

It should be noted that beach closures could have a greater impact on lodging establishments in the Southern part of the county. This region is considered one of the finest areas for surf fishing and many of visitors who stay overnight at establishments in the area travel to Cape Hatteras National Seashore primarily for recreational fishing. In contrast, individuals staying in the Nags Head area participate in other activities such as swimming and sea shell collecting. Hence, it would appear reasonable to assume that beach closures in the past 3 years might have had some disproportionate impact on establishments in Avon, Buxton, Frisco, and Hatteras. The data indicate no such impact on the county as a whole.

### INFORMATIONAL INTERVIEWS

During the first week of November 2005, a total of 26 businesses in Dare County and on Ocracoke Island were contacted by telephone to obtain general impressions on how past closures affected their businesses. A total of 16 businesses including 11 accommodations establishments provided responses. Of those, none of the establishments from Nags Head or from Ocracoke Island estimated economic losses from past closures. In contrast, 4 accommodation owners from Avon, Buxton, and Frisco asserted economic losses from past closures and would likely close their business or substantially reduce their workforce if beach closures continued onto the future. One asserted that the closures resulted in 38 cancellations, while another owner estimated up a 25 percent loss of business. One other owner indicated no change in past business but would experience some future reduction in business if the NPS implements new closures.

Similar responses were given by retail businesses, in particular purveyors of fishing equipment and supplies. Losses were estimated at up to 50 percent and all four owners projected that they would eventually terminate their operations if the NPS imposes future closures. All of these businesses were located in the three jurisdictions of Avon, Buxton, and Frisco.

### SUMMARY OF DATA FINDINGS

Together the lodging receipt data and the informational telephone interviews, along with the economic data presented in the affected environment section provide a generalized picture on the status of the regional economy over the past decade and the economic impacts of past beach closures. As described in the affected environment section, the regional economy has experienced robust population and economic growth over the past decade. This regional growth has taken place concurrent with NPS restrictions on vehicle access to beaches within the National Seashore.

The lodging receipt data and the informational interviews provide additional insight as to how the beach closures might have affected individual business sectors within the different jurisdictions of Dare County and on Ocracoke Island in Hyde County. The lodging receipt data indicate uneven growth across the region, with revenue growth from accommodation establishments in villages of Avon, Buxton, Hatteras, and Frisco stagnant compared to revenue growth generated in Kitty Hawk, Nags Head, and Duck areas. It must be noted that lodging receipts have rebounded in the past year for establishments in the villages of Rodanthe, Waves, and Salvo. Although differences in growth could be attributed to a wide range of factors, the information interviews with selected businesses support the assertion that past closures might have adverse impacts on establishments in some villages in southern Dare County (Hatteras Island) and have constrained economic growth in these areas. Because, lodging receipt data are not available for Ocracoke Island, which is in Hyde County, the impact of past beach closures is even less clear. Nonetheless, limited information collected from proprietors on Ocracoke Island indicate that economic losses have not been large.

### IMPACT THRESHOLDS

Four potential category impact levels were defined for the purposes of the economic analysis:

<i>Negligible:</i>	No impacts would occur or the impacts to socioeconomic conditions would be below the level of detection.
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<i>Minor:</i>	The impacts to socioeconomic conditions would be small, but detectable and localized. In particular, a business within a town or village within the region could be affected in a perceptible way, but no impacts would be perceptible at the regional level. Local impacts would be limited.
<i>Moderate:</i>	The impacts to socioeconomic conditions would be readily apparent at the localized level. Any impacts would result in changes to socioeconomic conditions on a local scale and could include changes to the operation and/or profitability of local businesses. Impacts at the regional level would be minor.
<i>Major:</i>	The impacts to socioeconomic conditions would be readily apparent. Impacts would cause substantial changes to socioeconomic conditions in the region of influence, including potential large scale changes to the operation and/or profitability of multiple businesses.
<i>Duration:</i>	Short-term impacts would occur sporadically throughout a year, but would generally last between no more than three weeks per year. Long-term impacts would occur more than three weeks per year, and could continue beyond the life of the interim protected species management strategy proposed in this EA, depending on the outcome of the long-term ORV management plan.

#### **IMPACTS OF ALTERNATIVE A: NO ACTION ALTERNATIVE - CONTINUATION OF 2004 PROTECTED SPECIES MANAGEMENT**

##### **Analysis**

Based on the information discussed in the previous section, current management practices appear to have had an adverse impact on service sector businesses in several of the villages in Southern Dare County. Continuation of the current species management practices could continue to depress business volume in these villages. Future impacts could range from reductions in employment at individual establishments to closures of multiple small businesses. Nonetheless, the impacts would likely remain localized and not affect overall regional economic growth. Impacts would be long-term, moderate, and adverse.

##### **Cumulative Impacts**

Other past, present, and planned future activities within Cape Hatteras National Seashore have the potential to affect the economy of the affected study area. In recent years, hurricanes, storms, and other events, and the subsequent recovery time required following these events, have adversely affected visitor attendance resulting in some economic impact in the affected areas. At the regional level, however, these events have had little effect on the overall economic growth during the past decade resulting in long-term, minor adverse impacts. The long-term, minor adverse impacts, when combined with the long-term, moderate adverse impacts under alternative A, would result in long-term, minor adverse cumulative impacts.

##### **Conclusion**

Implementation of alternative A would likely adversely affect some tourist-related businesses located on Hatteras Island in southern Dare County. Future economic losses would be primarily incurred by recreational fishing suppliers and lodging and food establishments in the towns of Avon, Buxton, Hatteras, and Frisco. Regional impacts would be negligible due to the overall economy's reliance on tourist spending not linked to ORV accessibility to Cape Hatteras National Seashore beaches. Impacts would likely remain localized and not affect overall regional economic growth. Impacts would be long-term, moderate, and adverse.

## **IMPACTS OF ALTERNATIVE B: UNDISTURBED AREA FOCUS**

### **Analysis**

This alternative would involve earlier and larger closures and would prohibit night driving during the turtle nesting season. Depending on the response of prospective visitors using ORVs, this alternative could reduce future business volume in the villages of southern Dare County, including Avon, Buxton, Hatteras, and Frisco. Accommodation and fishing supply establishments dependent on recreational anglers as major sources of income could experience economic losses and become less financially viable. Impacts would not likely be felt by establishments in Nags Head, Duck, and Kill Devil Hills, where tourists participate in other recreational activities not dependent on ORV access to beaches. Accordingly, adverse impacts would remain limited to the small communities and would not affect the region as a whole, and socioeconomic impacts would be considered long-term, moderate, and adverse.

### **Cumulative Impacts**

Cumulative impacts would be the same as for alternative A. The long-term, minor adverse impacts, when combined with the long-term, moderate adverse impacts under alternative B, would result in long-term, minor adverse cumulative impacts.

### **Conclusion**

Implementation of alternative B would have long-term, moderate adverse impacts on some tourist related businesses on Hatteras Island in southern Dare County, particularly recreational fishing suppliers and lodging establishments in the villages of Avon, Buxton, Hatteras, and Frisco. Impacts would likely remain localized and not affect overall regional economic growth. Impacts would be long-term, moderate, and adverse.

## **IMPACTS OF ALTERNATIVE C: TAILORED MANAGEMENT FOCUS**

### **Analysis**

This alternative is similar to alternative B but contains greater flexibility on duration and geographical extent of closures. The possibility of fewer and shorter duration closures could increase the number of visitors using the national seashore compared to alternative B. However, if there remains substantial uncertainty as to whether an area of interest to recreational anglers would be open or close during a prospective visit, that individual might still decide to go somewhere else. Accordingly, the overall magnitude of effects would likely be similar to alternative B, long-term, moderate, and adverse.

### **Cumulative Impacts**

Cumulative impacts would be the same as for alternative A. The long-term, minor adverse impacts, when combined with the long-term, moderate adverse impacts under alternative C, would result in long-term, minor adverse cumulative impacts.

### **Conclusion**

Implementation of alternative C would likely have long-term, moderate, adverse impacts on some tourist related businesses on Hatteras Island in southern Dare County, particularly recreational fishing suppliers and lodging establishments in the villages of Avon, Buxton, Hatteras, and Frisco. Regional impacts would likely be negligible due to the overall economy's reliance on tourist spending not linked to ORV accessibility to Cape Hatteras National Seashore beaches. Impacts would likely remain localized and not affect overall regional economic growth. Impacts would be long-term, moderate, and adverse.

**IMPACTS OF ALTERNATIVE D: ACCESS / RESEARCH COMPONENT FOCUS (PREFERRED ALTERNATIVE)**

**Analysis**

This alternative would increase surveying to allow for fewer, later, and shorter closures where possible. Beach accessibility would be made possible through the use of bypasses. This alternative is the most flexible and least restrictive of the four alternatives. Given the significantly increased access to most, if not all beach areas under this alternative, adverse impacts to future visitation would likely be greatly diminished compared to all of the other alternatives. Relative to alternative A, there would likely be an improvement to the local economies of Avon, Buxton, Hatteras, and Frisco, and socioeconomic impacts would be considered long-term, negligible, and adverse.

**Cumulative Impacts**

Cumulative impacts would be the same as for alternative A. The long-term, minor adverse impacts, when combined with the long-term, negligible adverse impacts under alternative D, would result in long-term, negligible adverse cumulative impacts.

**Conclusion**

The flexibility of this alternative could lead to more ORV visitors compared to the other alternatives. Therefore, the projected adverse impacts on selected businesses in the towns and villages of Hatteras Island in southern Dare County could be lessened or even eliminated. Hence, this alternative could confer economic benefits to those communities relative to the all three of the other alternatives, including continuation of the current management practices. Impacts would likely remain localized and not affect overall regional economic growth. Impacts would be long-term, negligible, and adverse.

At the regional level, however, the economic benefits would be negligible, because the region's economic growth has not been affected by past closures and would not be affected by continuation of the current species management practices.

## SEASHORE MANAGEMENT AND OPERATIONS

Park management and operations refers to the current staff available to adequately protect and preserve vital park resources and provide for an effective visitor experience. This topic also includes the operating budget necessary to conduct park operations.

### GUIDING REGULATIONS AND POLICIES

Direction for management and operations at Cape Hatteras National Seashore is set forth in the seashore's enabling legislation, *General Management Plan* (1984), *Strategic Plan* (NPS 2000a), and the *Superintendent's Compendium*. Specifically related to the interim protected species management strategy, the *General Management Plan* includes the following specific management objectives for the Interpretation and Resource Management Divisions (NPS 1984):

- Foster awareness, appreciation, and understanding of the natural and cultural resources of the Outer Banks and their interrelationships;
- Encourage visitors to safely pursue only those recreational activities that are compatible with and not detrimental to the natural and cultural resources;
- Provide, through an active education program, for the nonconsumptive use of the seashore as an outdoor classroom by educational organizations;
- Strengthen within visitors and park employees an environmental ethic;
- Promote understanding of and support for NPS goals and policies;
- Preserve the dynamic physiography and characteristic ecological communities of the Outer Banks.

The Strategic Plan identified the following goals in relation to the interim protected species management strategy (NPS 2000a). Although the plan aimed to achieve these goals by the year 2000, they are still applicable to the proposed strategy.

- Identify park populations of threatened and endangered species that have stable populations.
- Ensure park visitor satisfaction with the appropriate park facilities, services, and recreational opportunities.
- Increase the number of volunteer hours.
- Increase the amount of receipts from park entrance, recreation, and other fees.

The *Superintendent's Compendium: Closures, Permit Requirements, and Other Restrictions* sets forth the closure and public use limits that the seashore staff are required to enforce, thus determining levels of park operations.

### METHODOLOGY AND ASSUMPTIONS

Park management and operations, for the purpose of this analysis, refers to the quality and effectiveness of seashore staff to maintain and administer seashore resources and provide for an effective visitor experience. This includes an analysis of the projected need for staff time and materials in relation to protected species management under each of the alternatives, as well as the various funding mechanisms available to implement these alternatives. The analysis also considers trade-offs for staff time or the budgetary needs required to accomplish the proposed alternatives and discusses each alternative in terms of its impacts to the Interpretation, Resource Management, and Law Enforcement Divisions at the

seashore. Seashore staff from each of the divisions were members of the planning team, and were consulted regarding expected staffing and funding needs under each alternative. The impact analysis is based on the current description of park operations presented in the “Affected Environment” chapter of this document.

### STUDY AREA

The study area for park operations and maintenance is the units of the Outer Banks Group: Cape Hatteras National Seashore, Wright Brothers National Memorial, and Fort Raleigh National Historic Site. All units were considered because of shared staff and funding sources.

### IMPACT THRESHOLDS

The following thresholds for evaluating impacts on park operations and management were defined and applied to beneficial and adverse impacts:

<i>Negligible:</i>	Seashore or agency operations would not be impacted or the impact would not have a noticeable or measurable impact on seashore or agency operations.
<i>Minor:</i>	Impacts would be noticeable and would result in a measurable, but small, change in seashore or agency operations. Any required changes in seashore staffing and funding could be accommodated within normal budget cycles and expected annual funding without appreciably affecting other operations within the seashore.
<i>Moderate:</i>	Impacts would be readily apparent and would result in a substantial change in seashore or agency operations that would be noticeable to staff and the public. Required changes in seashore staffing and/or funding could not be accommodated within expected annual funding and would measurably affect other operations within the seashore by shifting staff and funding levels between operational divisions.
<i>Major:</i>	Impacts would be readily apparent and would result in a substantial change in seashore operations that would be noticeable to staff and the public and would be markedly different from existing operations. These changes in seashore staffing and/or funding could not be accommodated by expected annual funding and would require the seashore to readdress its ability to sustain current seashore operations.
<i>Duration:</i>	Short-term effects would be 1 to 2 fiscal years or budget cycles. Long-term effects would continue beyond 3 fiscal years indefinitely into the future, depending on the outcome of the long-term ORV management plan/EIS.

### IMPACTS OF ALTERNATIVE A: NO ACTION ALTERNATIVE - CONTINUATION OF 2004 PROTECTED SPECIES MANAGEMENT

#### Analysis

Under alternative A, resource management activities between the three divisions would continue as conducted before 2005. Staff numbers would remain relatively constant. Table 27 provides total staffing and funding needs under alternative A.

TABLE 27: STAFFING AND FUNDING - ALTERNATIVE A

Action	Assumptions	Annual Costs
Natural Resource Management	3 full-time employees, 4 seasonal employees, and 5 Student Conservation Association interns	Staff: \$155,849 Materials: \$67,500 Total: \$223,349
Interpretation	29 staff spending between 2-15% of their time and 1 staff - (volunteer coordinator) spending 50% of his/her time on protected species related activities.	Staff: \$42,737 Materials: \$10,500 Total: \$53,237
Law Enforcement	16 staff spending between 5- 20% of their time on protected species related activities.	Staff: \$52,948 Materials: \$59,182 Total: \$112,130
<b>TOTAL ANNUAL COST</b>		<b>\$388,367</b>

**Interpretation.** Under alternative A, interpretation staff would continue to implement the existing protected species informational programs. These programs include information at the visitor's center, articles in the seashore paper, public notification of closures, and turtle education programs. No informational programs currently occur in relation to seabeach amaranth. The cost of staff time and materials dedicated to protected species management informational programs is approximately \$53,240 and would remain relatively constant, increasing only in relation to staff salary increases and the cost of inflation for supplies. Existing interpretation staff would be adequate to fulfill normal resource management needs and any impact to park operations and maintenance would not be noticeable, resulting in short- and long-term negligible adverse impacts. When unforeseen circumstances arise (i.e. severe weather events), existing interpretation staff would be redirected from routine activities to address emergency needs. Staff would not be adequate and regular resource management activities could not be maintained with the available staff, resulting in long-term moderate adverse impacts.

**Resource Management.** Under alternative A, natural resource management staff would be responsible for surveying special status bird species throughout the lifecycle (pre-nesting until fledging) as well as surveying for the piping plover during the wintering and migration. Pre-nesting surveys would begin between March 25 and May 1, depending on the species. Based on this surveying, management activities would include closing recent breeding areas to recreational use through the use of symbolic fencing, locating nests, adjusting buffer sizes as necessary, recording nest locations and bird behaviors, and removing closures when applicable. Natural resource management staff would also survey for sea turtle nests beginning June 1 through August 1. Turtle management would include locating false crawls, installing symbolic fencing around nests, relocating nests if they are in danger from erosion or frequent flooding, and excavating nests and data collection after the nest hatch date. Natural resource management staff would survey for seabeach amaranth during bird and turtle surveys, and would not require additional staff for this surveying. Other resource management activities conducted for all species would include surveying for predator tracks and erecting exclosures, where necessary.

To accomplish these activities, a portion or all of the time of three full-time employees, four seasonal employees, and 5 Student Conservation Association interns would be required. The cost of staff time and materials (stakes, signs, etc) to the Resource Management Division under alternative A, would be approximately \$223,500. Existing resource management staff would be adequate to perform normal resource management needs and any impact to park operations and maintenance would not be noticeable, resulting in short- and long-term negligible adverse impacts. In times where additional activities are required (i.e. severe weather events), current staff would not be adequate and regular resource management activities could not be maintained with the available staff, resulting in long-term moderate adverse impacts.

**Law Enforcement.** Under alternative A, law enforcement staff would be responsible for enforcing compliance with management closures, answer phone calls regarding resource management concerns, respond to incidents and violations, and conduct special operations in response to the level of compliance by the public. Specific duties of law enforcement for resource management would include enforcing the 150 foot ORV corridor, restricting pedestrians from nest areas (pedestrians would be allowed in all other areas), and enforcing speed limits, pet restrictions, and other recreational restrictions (i.e. kite flying).

The cost of staff time and materials, approximately \$112,130, would remain relatively constant and would only increase in relation to staff salary increases and the cost of inflation for supplies. Existing law enforcement staff would be adequate to perform normal resource management needs and any impact to park operations and maintenance would not be noticeable, resulting in short- and long-term negligible adverse impacts. When unforeseen circumstances arise (i.e. severe weather events), existing law enforcement staff would be redirected from planned activities to address emergency needs. Staff would not be adequate and regular resource management activities could not be maintained with the available staff, resulting in long-term moderate adverse impacts.

### **Cumulative Impacts**

Storms and other weather events, including hurricanes, have impacted park operations in the past as park staff in all three divisions have been redirected from regular duties to respond to and clean up from storms. These weather events can also alter habitat, resulting in additional responsibilities for the resource management staff that would have to identify and manage the new habitat. After staff respond to these events, normal duties resume. Storms and other weather events have had short-term moderate adverse impacts on park operations and maintenance.

Past and ongoing activities at the seashore that are expected to last throughout the implementation of the interim species management strategy influence the number of people using the seashore including commercial fishing and ongoing research studies. The number of people using the seashore for these activities is likely to increase, requiring each division of seashore staff to devote more resources to protected species management in order to balance visitor needs and resource management. The seashore would also continue ongoing maintenance and fire management. At current levels, the impacts of these activities would be long-term negligible adverse, but if emergency events occur that require park staff to be directed away from protected species management, the impacts could be short-term, moderate to major, adverse during the emergency period.

Future plans at the seashore that could impact park operations and maintenance include the Cape Hatteras National Seashore long-term ORV Management Plan/EIS, the Commercial Services Plan, and the Comprehensive Interpretive Plan. Each of these plans would provide guidance to the three divisions regarding regular duties. As a result of the long-term ORV Management Plan/EIS, all three divisions could be required to provide increased services such as more public outreach programs, changes in resource management approaches, and the need for law enforcement to enforce the provisions of the plan. The additional interpretation requirements under the Comprehensive Interpretive Plan, could also require each division to allocate resources differently or even require additional resources. The proposed opening of Dune Road around Cape Point would also impact park operation and maintenance by opening up another area for law enforcement and resource management to survey for protected species violations, but, due to the small area, would only be expected to have long-term, minor, adverse impacts.

The combination of these past, present, and reasonably foreseeable future actions, when combined with the short- and long-term negligible to moderate impacts of alternative A, are expected to have short-term moderate and long-term minor to moderate adverse cumulative impacts.

### **Conclusion**

Staffing levels and resources in all three divisions dedicated to protected species management activities would remain relatively constant, resulting in negligible, short- and long-term adverse impacts. The

implementation of protected species management programs for all three divisions would cost approximately \$388,870 under alternative A. Any unexpected resource protection needs or weather events may divert staff from other resource management activities and result in long-term, moderate adverse impacts. The cumulative impacts under alternative A would be short-term, moderate and long-term, minor to moderate adverse.

**IMPACTS OF ALTERNATIVE B: UNDISTURBED AREA FOCUS**

**Analysis**

Table 28 provides the total staffing and funding needs under alternative B.

**TABLE 28: STAFFING AND COSTS - ALTERNATIVE B**

Action	Assumptions	Annual Costs
Natural Resource Management	6 full-time staff, no additional funding required. Part-time staff increased from 4 seasonal personnel and 5 Student Conservation Association interns to 13 seasonal positions. All current available funds used for full-time positions, part-time positions would require new funding.	Staff: \$181,057 Materials: \$55,400 Additional annual cost = \$236,457 Total annual costs = \$459,806
Interpretation	Duties of existing staff would be reprogrammed to meet all interpretation needs. Additional materials and supplies required.	Additional annual cost = \$11,000 Total annual costs = \$64,237
Law Enforcement	Existing 16 commissioned staff positions would be filled and no extra funds would be required. 4 additional part-time law enforcement seasons would be hired. No additional materials or supplies required.	Additional annual costs = \$73,711 Total annual costs \$195,901
<b>ANNUAL COST</b>		<b>Additional Costs: \$321,168</b> <b>Total Costs: \$719,944</b>

**Interpretation.** Under alternative B, existing staff would be used to carry out new educational programs and no new staff would be hired. This would result in a no cost increase for staff resources, but would require the existing staff to shift time and responsibilities. In the case where two staff currently run a program, under alternative B one of these staff would be reassigned to resource management interpretation requirements. Interpretation requirements under alternative B would be partially addressed by seasonal resource management employees, discussed below. While there would be no financial cost for interpretation staff under alternative B, there would be the opportunity cost of reassigning the existing staff to cover the new requirements. In addition to more staff time, alternative B would require an additional \$11,000 for materials and supplies, including, bulletin boards, printing, television time, speakers, and other required materials.

Under alternative B, staffing levels in the interpretation division would remain constant and not require additional funding. The additional \$11,000 of funding for supplies may partially be accommodated through normal budget cycles and expected annual funding, but would not be fully covered by this source. The majority of the \$11,000 increase for the interpretation division would be funded through sources, such as the Federal Lands Recreation Enhancement Act fund. In 2005, approximately \$640,000 in such funds were available for other seashore programs. Assuming this level remains constant, these funds would be sufficient to cover the increase in interpretation costs. However, funds used to cover increased

interpretation costs would not be available for other planned uses and some deferred maintenance projects would remain unfunded.

In addition to requiring additional funding for supplies, existing staff would be required to spend more time on resource management activities, resulting in less time being spent on existing programs. The increased costs, possibility of delaying projects due to reallocation of funding, and the diversion of existing staff from current projects to additional resource management projects would require changes in seashore staffing and/or funding that would not be accommodated within expected annual funding and would measurably affect other operations within the park by shifting staff and funding levels, resulting in long- and short-term moderate adverse impacts to management and operation for the interpretation division.

**Resource Management.** To accommodate increased surveying and closures under alternative B, additional full-time staff would be required, but could be accommodated with available funding currently used for part-time seasonal employees and Student Conservation Association interns. Existing natural resource management staff would increase the amount of time spent on protected species management and three seasonal positions would be added, one in each district of the seashore. Full-time staff resources currently directed toward resource management total \$77,824. Under alternative B, the increased time would cost \$210,852. These additional needs would require full-time employees to shift their responsibilities and use part-time staff funding to add additional full-time staff. Some natural resource management activities not pertaining to protected species would not be accomplished due to the rededication of existing staff.

Alternative B would also require an increase in part-time employees from four seasonal positions and 5 Student Conservation interns to 13 seasonal positions. As funding for existing part-time staff would be reprogrammed to fund full-time employees, all 13 seasonal positions would require additional funding at an estimated cost of \$181,057. In addition to increased staff costs, the needed materials and supplies to implement resource management activities would be an additional \$55,400. In total, alternative B would require an additional \$236,457 of funding to implement, for a total cost of \$459,806.

Implementation of alternative B would require additional full-time and part-time staff in the natural resource management division. Funding for full-time staff positions would be accomplished through reprogramming existing funds from part-time to full time staff, leaving part-time staff unfunded. The additional funding for part-time staff and supplies may partially be accommodated through normal budget cycles and expected annual funding, but would not be fully covered by this source. The majority of the \$236,457 increase for the resource management division would be through other sources, such as Federal Lands Recreation Enhancement Act funds. In 2005, approximately \$640,000 of these funds were available for seashore programs. Assuming this level remains constant, these funds would be sufficient to cover the increase in natural resource management costs. However, those funds used to cover increased natural resource management costs would not be available for other planned uses and some deferred maintenance projects would not be funded.

In addition to requiring additional funding for seasonal staff and supplies, existing staff would be required to spend more time on protected species management activities, resulting in less time being spent on existing programs. The increased costs, possibility of delaying projects due to reallocation of funding, and the diversion of existing staff from current projects to additional protected species management activities would require changes in seashore staffing and/or funding that could not be accommodated within expected annual funding and would measurably affect other operations within the park by shifting staff and funding levels, resulting in long- and short-term moderate impacts to management and operation for the resource management division.

**Law Enforcement.** Alternative B would implement year round resource closures at the seashore in areas of high visitor use such as Cape Point and the spits. These resource closures would need to be enforced 24 hours a day to ensure compliance. Areas of turtle habitat that would be closed 24 hours a day from April 1

to November 15 for research purposes would also require extra enforcement. Law enforcement would continue existing activities such as fielding violation calls and responding to incidents. These additional management measures would represent a large change from current operations by requiring 24-hour law enforcement coverage.

Under alternative B, the seashore would use available funding to fill all law enforcement commissions, resulting in an increase from 11 to 16 rangers. Law enforcement staff would spend more time on protected species management activities to meet the resource management requirements under alternative B. The 16 full-time positions would be supplemented by 4 seasonal law enforcement staff, requiring an additional \$73,711 annually. Although there would be an increase in the number of law enforcement personnel, it would not be sufficient to provide complete and continuous 24 hour coverage required under alternative B, resulting in times with less coverage than currently occurs. Staffing night shifts may result in less coverage on day shifts and there could be a delayed response to closure violations due to lack of law enforcement staff. Response to resource management violations may also be delayed as life and death emergencies would take priority with the staff available. When responding to closure violations, law enforcement staff would document the incident to create a record of violations and be able to determine where limited staff should be allocated in order to best meet resource protection needs. Law enforcement needs under alternative B would also be influenced by the increased number of resource personnel. With more resource personnel, protected species sites would be surveyed more frequently resulting in more violations being reported and the increased need for law enforcement staff.

Alternative B would require existing law enforcement staff to spend more time on protected species management activities, including 24 hour coverage. An additional \$73,711 would be required to fill new positions, resulting in an annual total of \$195,014 for law enforcement activities related to species protection. The additional law enforcement and staffing requirements would require changes in seashore staffing that could not be accommodated with expected annual funding, and these changes would be readily apparent resulting in a substantial change in park operations that would be noticeable to staff and the public. These changes in park staffing would require the park to readdress its ability to sustain current park operations, resulting in short- and long-term major impacts under alternative B. To mitigate this impact, the seashore would put priority on implementing a project to recruit, hire, and supervise lifeguards, which is currently proposed for funding from the Federal Lands Recreation Enhancement program. Law enforcement staff currently perform these duties, so the implementation of this program would allow law enforcement staff to allocate their time to resource management programs and increased coverage. With this mitigation, implementation of alternative B would have long- and short-term moderate impacts to the law enforcement division.

### **Cumulative Impacts**

Past, present, and reasonably foreseeable future actions that have the potential for cumulative impacts under alternative B are the same as those described under alternative A. Demands on staff time would be influenced by long-term needs such as the creation and implementation of plans, as well as short-term needs such as response to storm events. Staff would be needed to address these actions.

The combination of these past, present, and reasonably foreseeable future actions, when combined with the short- and long-term moderate impacts of alternative B are expected to have short-term, moderate to major adverse and long-term moderate adverse cumulative impacts to park operations and maintenance, with potential short-term major impacts during emergency events.

### **Conclusion**

Implementation of alternative B would require existing staff in the Interpretation, Resource Management, and Law Enforcement divisions to allocate more staff time toward natural resource management activities. In addition to the opportunity costs from reallocated staff resources, interpretation programs would require an additional \$11,000 and an increase in natural resource management and law

enforcement staff and operations would require an additional \$310,258. The total additional funding required under alternative B would be \$321,168, which would be funded in part by the park’s annual operating budget but mostly through other sources, such as the Federal Lands Recreation Enhancement program. Due to the reprogramming of staff, additional funding required, and potential deferred maintenance, there would be long- and short-term moderate adverse impacts to all divisions, except for law enforcement, which would have short- and long-term major adverse impacts. Cumulative impacts would be short-term moderate to major adverse and long-term moderate adverse.

**IMPACTS OF ALTERNATIVE C: TAILORED MANAGEMENT FOCUS**

**Analysis**

Table 29 provides total staffing and funding needs under alternative C.

**TABLE 29: STAFFING AND FUNDING - ALTERNATIVE C**

Action	Assumptions	Annual Costs
Natural Resource Management	6 full-time staff, no additional funding required. Part-time staff increased from 4 seasonal personnel and 5 Student Conservation Association interns to 13 seasonal positions. All current available funds used for full-time positions, part-time positions would require new funding.	Staff: \$181,057 Materials: \$55,400 Additional annual cost = \$236,457 Total annual costs = \$459,806
Interpretation	Same as alternative B	Additional annual cost = \$11,000 Total annual costs = \$64,237
Law Enforcement	Existing 16 commissioned staff positions would be filled and no extra funds would be required. 2 additional part-time seasonal law enforcement staff would be hired. No additional materials or supplies required.	Additional annual costs = \$36,884 Total annual costs = \$159,041
<b>TOTAL ANNUAL COST</b>		<b>Additional Costs: \$284,341</b> <b>Total Costs: \$683,084</b>

**Interpretation.** Under alternative C, interpretation activities in relation to resource management would be expanded as described for alternative B with existing interpretation staff adjusting current operations to implement new programs related to protected species management. No new staff would be hired under this alternative and the number of staff available for other interpretation activities may decline, as described under alternative B. Interpretation requirements under alternative C would also be partially covered by seasonal resource management employees. While there would be no financial cost for interpretation staff under alternative C, there would be the opportunity cost of reassigning the existing staff to cover the new requirements. In addition to more staff time, alternative C would require an additional \$11,000 for supplies including, bulletin boards, printing, television time, speakers, and other required materials. The additional funding for supplies may partially be accommodated through the park’s annual funding. The majority of the \$11,000 increase for the interpretation division would be funded through other sources such as Federal Lands Recreation Enhancement Act program. In 2005, approximately \$640,000 in these funds were available for other seashore programs. Assuming this level remains constant, these funds would be sufficient to cover the increase in interpretation costs. However, those funds used to cover increased interpretation costs would not be available for other planned uses and some deferred maintenance projects would not be funded.

The reprogramming of existing staff, increased costs, and the possibility of delaying projects planned with other funding sources would require changes in seashore staffing and/or funding that could not be accommodated within expected annual funding and would measurably affect other operations within the park by shifting staff and funding levels, resulting in long- and short-term moderate adverse impacts to management and operation of the interpretation division.

**Resource Management.** Alternative C would incorporate intensive surveying of unfledged chicks with constant visual surveying during daytime hours for the first week with intermittent nighttime surveying. Management for the unfledged chicks would be adjusted based on this surveying and chick behavior. Natural resource management staff would be responsible for identifying potential alternate routes around existing closures and maintaining any established bypass routes, which could include vegetation removal.

To accommodate increased surveying and adjustment of closures under alternative C, additional full-time staff would be required, but could be accommodated with available funding currently used for part-time staff and Student Conservation Association interns. The existing natural resource management staff at the seashore would increase the amount of time spent on protected species management and three seasonal positions would be added, one in each district of the seashore. Full-time staff resources currently directed toward natural resource management total \$77,824. Under alternative C, the increased time would cost \$210,852. These additional needs would require full-time employees to shift their responsibilities and use part-time staff funding to add additional full-time staff. Some resource management activities would not be accomplished due to the rededication of existing staff.

Alternative C would also require an increase in part-time employees from four seasonal employees and 5 Student Conservation interns to 13 seasonal positions. As funding for existing part-time staff would be reprogrammed to fund full-time employees, all seasonal positions would require additional funding at an approximate cost of \$181,057. The needed materials and supplies to implement resource management would be an additional \$55,400. In total, alternative C would require an additional \$236,457 of funding to implement, for a total cost of \$459,806.

Implementation of alternative C would require additional full-time and part-time staff in the resource management division. Funding for full-time staff positions would be accomplished allocating existing funds from part-time to full time staff, leaving part-time staff positions unfunded. The additional funding for part-time staff and supplies may partially be accommodated through normal budget cycles and expected annual funding. The majority of the \$236,457 increase for the resource management division would be funded through sources such as the Federal Lands Recreation Enhancement Act program. In 2005, approximately \$640,000 in these funds were available for seashore programs. Assuming this level remains constant, these funds would be sufficient to cover the increase in interpretation costs. However, those funds used to cover increased interpretation costs would not be available for other planned uses and some deferred maintenance projects would remain unfunded.

In addition to requiring additional funding for seasonal staff and supplies, existing staff would be required to spend more time on protected species management activities, resulting in less time spent on existing programs. The increased costs, possibility of delaying projects due to fund reallocation, and the diversion of existing staff from current projects to protected species management activities would require changes in seashore staffing and/or funding that would not be accommodated within expected annual funding and would measurably affect other operations within the park by shifting staff and funding levels, resulting in long- and short-term moderate impacts to management and operation of the resource management division.

**Law Enforcement.** The resource closures and management actions proposed under alternative C would require 24-hour enforcement during the closure period . Law enforcement would continue existing resource management related activities such as fielding violation calls and responding to violation incidents.

As under alternative B, the seashore would use available funding to fill all law enforcement commissions, resulting in an increase from 11 rangers to 16 rangers. These law enforcement staff would spend more time on natural resource management requirements under alternative C. These 16 full-time staff would be supplemented by 2 part-time law enforcement seasonal staff, costing an additional \$36,884 annually. Although there would be an increase in the number of law enforcement personnel, it would not be sufficient to provide the anticipated increase in law enforcement needs in relation to resource management, resulting in times with less coverage than currently occurs. Staffing night shifts may result in less coverage on day shifts and there could be a delayed response to closure violations due to lack of staff. Response to resource management violations may also be delayed as life and death emergencies would take priority with the staff available. When responding to closure violations, law enforcement staff would document the incident to create a record of violations and be able to determine where limited staff should be allocated in order to best meet resource protection needs. Law enforcement needs under alternative C would also be influenced by the increased number of resource personnel. With more resource personnel and increased surveying, protected species sites would be surveyed more frequently resulting in more reports of violations and the increased need for law enforcement staff.

Alternative C would require existing law enforcement staff to spend more time on protected species management activities, including 24 hour coverage. An additional \$36,884 would be required to fulfill new positions, resulting in a total of \$159,014 annually for law enforcement activities related to species protection. The additional law enforcement requirements and the additional staff needed would require changes in seashore staffing that could not be accommodated within expected annual funding, and these changes would be readily apparent resulting in a substantial change in park operations that would be noticeable to staff and the public and would be markedly different from existing operations. These changes in park staffing, occurring during the breeding and nesting season, would require the park to readdress its ability to sustain current park operations, resulting in temporary short- and long-term major impacts under alternative C. To mitigate this impact, the seashore would put priority on implementing a project to recruit, hire, and supervise lifeguards, which is currently proposed for funding from the Federal Lands Recreation Enhancement Act program. Law enforcement staff currently perform these duties, so the implementation of this program would allow law enforcement staff to allocate their time to resource management programs. With this mitigation, implementation of alternative C would have long- and short-term moderate impacts to the law enforcement division during times of 24 hour enforcement. When 24 hour enforcement is not required, the reallocation of staff would result in changes in park staffing that would measurably affect other operations within the park by shifting staff levels and result in short- and long-term, moderate adverse impacts.

### **Cumulative Impacts**

Past, present, and reasonably foreseeable future actions that have the potential for cumulative impacts under alternative C are the same as those described under alternative A. Demands on staff time would be influenced by long-term needs such as the creation and implementation of plans, as well as short-term needs such as response to storm events. Staff resources would be needed to address these actions.

The combination of these past, present, and reasonably foreseeable future actions, when combined with the short- and long-term moderate impacts of alternative C are expected to have short- and long-term moderate adverse cumulative impacts to park operations and maintenance, with potential short-term major impacts during emergency events.

### **Conclusion**

Implementation of alternative C would require existing staff in the interpretation, resource management, and law enforcement divisions to allocate more staff time for natural resource management activities. In addition to the opportunity costs from relocated staff resources, interpretation programs would require an additional \$11,000 and an increase in natural resource management and law enforcement staff and operations would require an additional \$273,341. The total additional funding required under alternative

C would be \$284,341, which would be funded in part by the annual budget but mostly from other funding source, such as the Federal Lands Recreation Enhancement Act program. Due to the reprogramming of staff, additional funding required, and deferred maintenance because of use of funding for natural resource management programs, there would be long- and short-term moderate adverse impacts to all divisions, except for law enforcement, which would have short- and long-term major adverse impacts. Cumulative impacts would be short-term moderate to major adverse and long-term moderate adverse.

**IMPACTS OF ALTERNATIVE D: ACCESS / RESEARCH COMPONENT FOCUS (PREFERRED ALTERNATIVE)**

**Analysis**

Table 30 provides the total staffing and funding needs under alternative D.

**TABLE 30: STAFFING AND FUNDING - ALTERNATIVE D**

<b>Action</b>	<b>Assumptions</b>	<b>Annual Costs</b>
Natural Resource Management	6 full-time staff, no additional funding required. Part-time staff increased from 4 seasonal personnel and 5 Student Conservation Association interns to 16 seasonal positions. All current available funds used for full-time positions, part-time positions would require new funding.	Staff: \$220,665 Materials: \$56,600 Additional costs = \$277,255 Total annual costs = \$500,604
Interpretation	Duties of existing staff would be reprogrammed to meet all interpretive needs. Additional materials and supplies required.	Additional Cost = \$11,000 Total annual costs = \$64,237
Law Enforcement	Duties of existing 16 staff positions would be reprogrammed to meet all law enforcement needs.	Additional Cost = \$0 Total annual costs: \$112,130
<b>TOTAL ANNUAL COST</b>		<b>Additional Cost = \$288,255</b> <b>Total Cost: \$676,971</b>

**Interpretation.** Under alternative D, interpretation activities in relation to resource management would be expanded as described for alternative B with existing interpretation staff adjusting current operations to implement new programs related to protected species. No new staff would be hired under this alternative and the number of staff available for other interpretation activities may decline, as described under alternative B. Interpretation requirements under alternative D would also be partially covered by seasonal resource management employees. While there would be no financial cost for interpretation staff under alternative D there would be the opportunity cost of reassigning the existing staff to perform additional duties. In addition to more staff time, alternative D would require an additional \$11,000, for a total of \$21,500, in supplies for interpretation programs including, bulletin boards, printing, television time, speakers, and other required materials. The additional funding for supplies may partially be accommodated through the park’s annual budget. The majority of the \$11,000 increase for the interpretation division would be funded through other sources, such as the Federal Lands Recreation Enhancement Act program. In 2005, approximately \$640,000 in these funds were available for seashore programs. Assuming this level remains constant, these funds would be sufficient to cover the increase in

interpretation costs. However, funds used to cover increased interpretation costs would not be available for other planned uses and some deferred maintenance projects would remain unfunded.

The reprogramming of existing staff, increased costs, and the possibility of delaying projects planned due to reallocation of park funding would require changes in seashore staffing and/or funding that could not be accommodated within expected annual funding levels and would measurably affect other operations within the park by shifting staff and funding levels, resulting in long- and short-term moderate adverse impacts to management and operation of the interpretation division.

**Resource Management.** To accommodate increased surveying and adjustment of closures under alternative D, additional full-time staff would be required, but could be accommodated with available funding currently used for part-time staff and Student Conservation Association interns. The existing natural resource management staff would increase the amount of time spent on protected species management and three full-time positions would be added, one in each district of the seashore. Full-time staff resources currently directed toward natural resource management total \$77,824. Under alternative D, the increased time would total \$210,852. These additional needs would require full-time employees to shift their responsibilities and use part-time staff funding to add additional full-time staff. Other natural resource management activities not pertaining to protected species would not be accomplished due to the rededication of existing staff.

Alternative D would also require an increase in part-time employees from four seasonal staff and five Student Conservation interns to 16 seasonal positions to accommodate the additional surveying required. As funding for existing part-time staff would be reprogrammed to fund full-time employees, all 16 seasonal positions would require additional funding at an approximate cost of \$220,655. In addition to increased staff costs, the needed materials and supplies to implement resource management would be an additional \$56,600. Alternative D would require an additional \$277,255 of funding to implement, for a total cost of \$500,604.

Implementation of alternative D would require additional full-time and part-time staff in the resource management division. Funding for full-time staff positions would be accomplished through reprogramming current funds from part-time to full time staff, leaving part-time staff unfunded. The additional funding for part-time staff and supplies may partially be accommodated through the park's annual budget, but would not be fully covered through others funds, such as the Federal Lands Recreation Enhancement Act. The majority of the \$277,255 increase for the resource management division would be funded with these funds. In 2005, approximately \$640,000 in funds were available for seashore programs. Assuming this level remains constant, these funds would be sufficient to cover the increase in natural resource management costs. However, those funds used to cover increased natural resource management costs would not be available for other planned uses and some deferred maintenance projects would remain unfunded.

In addition to requiring additional funding for seasonal staff and supplies, existing staff would be required to spend more time on protected species management activities, resulting in less time being spent on existing programs. The increased costs, possibility of delaying projects planned due to reallocation of park funds, and the diversion of existing staff from current projects to additional protected species management activities would require changes in seashore staffing and/or funding that could not be accommodated within expected annual funding and would measurably affect other operations within the park by shifting staff and funding levels, resulting in long- and short-term moderate impacts to management and operation of the resource management division.

**Law Enforcement.** Alternative D would implement resource closures at the seashore while maintaining an ORV corridor. No restrictions on night driving would occur and, therefore, 24-hour coverage would not be required. These resource closures would require greater enforcement as all recreational users would have access to this area and there would be more variation in the areas available for ORV use, resulting in some users not knowing what areas are open or closed. Under this alternative the opportunity

for resource closure violations would increase. Law enforcement would also continue existing resource management related activities such as fielding violation calls and responding to violation incidents.

The seashore would use currently available funding to fulfill all law enforcement commissions, resulting in an increase from 11 rangers to 16 rangers. The time of these law enforcement staff would be reprogrammed to meet the resource management requirements under alternative D. Although there would be an increase in the number of law enforcement personnel, it would not be sufficient to provide the anticipated increase in law enforcement needs in relation to resource management, resulting in times with less coverage than currently occurring. Response to resource management violations may also be delayed as life and death emergencies would take priority with the staff available. When responding to closure violations, law enforcement staff would document the incident to create a record of violations and be able to determine where limited staff should be allocated in order to best meet resource protection needs. Law enforcement needs under alternative D would also be influenced by the increased number of resource personnel. With more resource personnel and increased surveying, protected species sites would be surveyed more frequently resulting in more reports of violations and the increased need for law enforcement staff.

Alternative D would require existing law enforcement staff to spend more time on protected species management activities. The additional law enforcement requirements would require changes in Seashore staffing that could not be accommodated within expected annual funding, would be readily apparent, and would result in a substantial change in seashore operations that would be noticeable to staff and the public. Under alternative D staff and funding levels would be shifted between operational divisions resulting in short- and long-term moderate impacts to the law enforcement division.

### **Cumulative Impacts**

Past, present, and reasonably foreseeable future actions that have the potential for cumulative impacts under alternative D are the same as those described under alternative A. Demands on staff time would be influenced by long-term needs such as the creation and implementation of plans, as well as short-term needs such as response to storm events. Limited staff resources would be needed to address these actions.

The combination of these past, present, and reasonably foreseeable future actions, when combined with the short- and long-term moderate impacts of alternative D are expected to have short- and long-term moderate adverse cumulative impacts to park operations and maintenance.

### **Conclusion**

Implementation of alternative D would require existing staff in the interpretation, resource management, and law enforcement divisions to allocate more staff time toward natural resource management activities. In addition to the opportunity costs from relocated staff resources, interpretation programs would require an additional \$11,000 and an increase in resource management staff and operations would require an additional \$277,255. The total additional funding required under alternative D would be \$288,255, which would be funded in part by the annual operating budget but mostly from other funds, such as the Federal Lands Recreation Enhancement Act program. Due to the reprogramming of staff, additional funding required, and possible deferred maintenance, there would be long- and short-term moderate impacts to all divisions. Cumulative impacts would be short- and long-term moderate adverse.