

National Park Service
U.S. Department of the Interior

Buck Island Reef National Monument
United States Virgin Islands



Buck Island Reef National Monument

Draft General Management Plan/ Environmental Impact Statement



Draft
General Management Plan /
Environmental Impact Statement
March 2012

Buck Island Reef National Monument

St. Croix, U.S. Virgin Islands



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**DRAFT
GENERAL MANAGEMENT PLAN / ENVIRONMENTAL IMPACT STATEMENT
BUCK ISLAND REEF NATIONAL MONUMENT
ST. CROIX, U.S. VIRGIN ISLANDS**

General management plans are long-term documents that establish and articulate a management philosophy and framework for decision making and problem solving in the parks. Buck Island Reef National Monument's last comprehensive management planning effort was completed in 1983. Since that time, many changes have taken place including the 2001 boundary expansion of the park from 880 acres to 19,015 acres, establishing the monument as a "no-take" marine reserve, federal listing of elkhorn and staghorn corals as federal threatened species, re-introduction of the federally endangered St. Croix ground lizard, and impacts to marine and coastal ecosystems associated with climate change, disease, and storms. The park faces new resource and other management challenges as a result of these and other changes. This General Management Plan provides management direction for the park for the next 15 to 20 years.

This document examines four alternatives for managing Buck Island Reef National Monument. The impacts of implementing each of the alternatives are also analyzed. One of the four alternatives is Alternative A, the "no-action alternative," that reflects current park conditions and management actions continued into the future. This alternative provides a baseline against which to compare the other alternatives. The remaining alternatives differ mainly in the type and level of access to the park and in particular, to Buck Island in terms of anchoring and/or mooring within the monument, number of vessels accommodated by each alternative, and number of staff proposed.

This General Management Plan / Environmental Impact Statement has been distributed to other agencies and interested organizations and individuals for their review and comment. The public comment period for this document will last for 60 days after the Environmental Protection Agency's notice of availability has been published in the Federal Register. Readers are encouraged to comment.

How to Comment: Comments may be submitted either over the Internet or in writing. Commenters are encouraged to use the Internet if at all possible. Please submit only one set of comments. To be sure that you are included on our mailing list, please provide your name and address on any correspondence. Internet comments may be submitted on the NPS planning, environment and public comment website at: <http://parkplanning.nps.gov/BUIS>. Before including your address, phone number, e-mail address, or other personal identifying information in your comment, you should be aware that your entire comment – including your personal identifying information – may be made publicly available at any time. While you can ask us in your comment to withhold your personal identifying information from public review, we cannot guarantee that we will be able to do so.

Written comments may be sent to: Superintendent Joel A. Tutein, Buck Island Reef National Monument, 2100 Church Street, #100, Christiansted, VI 00820-4611.

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SUMMARY

BRIEF DESCRIPTION OF THE PARK

Buck Island Reef National Monument (hereafter also referred to as the monument or park) was established in 1961 by Presidential Proclamation (No. 3443) for the purpose of “protecting Buck Island and its adjoining shoals, rocks, and undersea coral reef formations” and to preserve “one of the finest marine gardens in the Caribbean Sea” for the benefit and enjoyment of the people and to protect it from “despoliation and commercial exploitation.” The park consists of 19,015 land and water acres north of the island of St. Croix in the U.S. Virgin Islands. The park supports many terrestrial and marine threatened and/or endangered species (migratory humpback and pilot whales, dolphins, least terns, four species of sea turtles, St. Croix ground lizard, and elkhorn and staghorn corals). The park also contains important cultural resources, including remains from prehistoric occupation and use (ceramic and shell middens), wrecks of two eighteenth century slave ships—the Mary and General Abercrombie —and archeological sites from Danish rule in the eighteenth and nineteenth centuries.

PURPOSE OF THE GENERAL MANAGEMENT PLAN / ENVIRONMENTAL IMPACT STATEMENT

General management plans are required for all units of the national park system and are intended to establish future management direction. This General Management Plan provides comprehensive guidance for perpetuating natural systems, preserving cultural resources, and providing opportunities for quality visitor experiences at Buck Island Reef National Monument. This general management plan establishes the management framework for the park, addresses changing issues and conditions, incorporates new resource information, and provides management direction for new park waters.

Although a general management plan provides the analysis and justification for future funding, the plan in no way guarantees that money will be forthcoming. Requirements for additional data for legal compliance and competing national park priorities can delay implementation of actions. Full implementation of a plan could lie many years in the future.

MANAGEMENT ZONES

Management zones and prescriptions indicate how different areas of the park would be managed. The following five management zones were created for the park: Resource Protection Zone, Anchoring Zone, Island Discovery Zone, Recreation Zone, and Marine Hazard Zone. The focus of the Resource Protection Zone is on resource preservation, protection, and scientific research. The Anchoring Zone allows boaters to anchor in deep sand in designated areas with a permit. The Island Discovery Zone represents areas that allow a range of recreational and self-discovery activities in a relatively undisturbed natural environment on Buck Island. The Recreation Zone focuses on beach, near-shore, and off-shore areas surrounding Buck Island that offer a variety of recreational opportunities, including swimming, snorkeling, SCUBA diving, vessel mooring, beach walking, picnicking, and use of picnic tables, shelter, and barbeque grills. The Marine Hazard Zone focuses on sensitive marine areas where vessel navigation is hazardous due to shallow reef complexes.

ALTERNATIVES

The National Park Service (NPS) developed all alternatives with substantial public, interagency, and NPS staff participation. Four alternatives have been developed for managing visitor use and resources at Buck Island Reef National Monument. Each alternative provides a different management approach. The alternatives were based on the park’s purpose and significance, legal mandates, public views, and information on visitor use and park resources. The alternatives are: Alternative A – the No Action

Alternative, Alternative B (the preferred alternative), Alternative C, and Alternative D. The Marine Hazard Zone and Resource Protection Zone would be the same under Alternatives B, C, and D.

Alternative A – No-Action

Alternative A consists of a continuation of current management practices at the current levels of enforcement, resource management, and education and outreach/ interpretive activities. No new zones would be created under Alternative A.

Alternative A would involve continued use of the existing 22-acre anchoring area located off West Beach in areas of deep sand by permit only. The underwater trail and mooring area (with ten moorings) and the two SCUBA moorings north of the underwater trail would continue to be used and managed as they are now. Up to eight additional moorings would be installed for administrative use only. In addition, all current land-based facilities, marine facilities, and the existing hiking trail on Buck Island, would continue to be provided and maintained at current levels.

Beach use would be continued with access via the existing anchoring area. Shoreline bow and stern anchoring practices would be expected to continue, except during certain nesting periods when areas of the beach are closed off for sensitive species, such as terns and sea turtles. Permits would be issued for anchoring areas to protect sensitive resources such as seagrasses. As seagrass beds recover, the availability of anchoring locations is expected to decrease. Non-native invasive species, including the lionfish would continue to be monitored and removed in accordance with current management documents and policies.

Park staff conducts extensive research and monitoring, resource protection, and management activities, which would be expected to continue at existing levels. However, there is an ever-increasing demand for more research and monitoring associated with protection of threatened coral species, the effects of coral bleaching and diseases, monitoring of the endangered St. Croix ground lizard, threatened and endangered sea turtle nesting and foraging populations, enforcement of the park as a “no-take” marine reserve, delineating resources within the expanded park boundaries, and numerous other park management concerns. With these increased demands, some existing programs would be expected to be adversely affected, and the number of new programs would not be expected to increase.

The park would continue its partnerships and research activities to the extent that staffing levels would allow. Efforts to work with the territorial government, other agencies, and universities to research, map, and monitor resource conditions would be expected to continue, and the levels of such activity would be expected to be maintained at current levels due to staff constraints.

Education and outreach activities would continue to be conducted primarily from NPS facilities located at Christiansted National Historic Site, as well as by park rangers and by park concessioners. Park concessioners would continue to operate by concession contracts to provide visitor access to Buck Island Reef National Monument. No new programs would be implemented and there would be no increase in visitor services.

The amount of ranger presence, activity, and enforcement would be expected to remain near existing levels. Ranger patrols at Buck Island and throughout the park are limited due to staffing constraints, and this condition would be expected to continue.

Alternative B – the Preferred Alternative

Alternative B would likely result in a greater degree of resource protection while maintaining visitor use and park experiences. Alternative B provides for moorings and limited opportunities for anchoring for vessels at designated locations. Alternative B would provide increased resource protection by phasing out the existing 22-acre anchoring area along the West Beach of Buck Island over a 10-year period as moorings are installed. Installation of moorings and phasing out of the

majority of anchoring in the park will reduce the adverse effects of anchoring resulting in less stress to ecological communities and healthier marine resources that may better cope with stresses related to climate change. The projected changes, such as sea level rise, frequency and duration of storms, coastal erosion, and acidification, all contribute to conditions that may change the seagrass community over time, and therefore where anchoring would be most appropriate. Alternative B provides the ability to adapt to such changes and protect seagrasses, while providing continued access.

Opportunities for anchoring would be limited to up to five designated locations in deep sand, under emergency conditions, or for NPS administrative purposes, consistent with the regulations. Up to 45 new moorings would be provided off West Beach in place of the anchoring area. In addition, up to 10 new moorings would be provided southwest of the pier.

Alternative B allows for the continued use of existing recreational moorings (up to 10) located at the underwater trail as well as two SCUBA moorings. Up to 8 resource management moorings would be established for NPS administrative use. The total estimated number of vessels that could access Buck Island via moorings and limited anchoring would be approximately 72.

Beach access channels would be located north and south of the mooring area off West Beach to protect swimmers and snorkelers and prevent boater and swimmer conflicts. The northern beach access channel would consist of approximately 50 feet of beach frontage. The southern beach access channel would consist of approximately 100 feet of beach frontage. This would allow for safe passenger drop off and pick up. Beach use and many existing types of recreation would continue under Alternative B; however, shoreline bow and stern anchoring would not be appropriate. As with Alternative A, all current land-based facilities would continue to be provided and maintained. New facilities would consist of limited new trails, signage, and moorings. Limited new trail development would be appropriate to improve visitor experience, reroute to avoid dangerous vegetation or improve resource conditions.

Alternative B includes four of the five management zones: Recreation Zone, Marine Hazard Zone, Resource Protection Zone, and Island Discovery Zone. The sizes of the Recreation Zone, Marine Hazard Zone, and the Island Discovery Zone are similar across each of the action alternatives (Alternatives B, C, and D), and vary only due to changes to the Anchoring Zone (see Chapter 2). The Recreation Zone is larger in Alternative B than in any of the other action alternatives since it encompasses the area off West Beach.

Alternative B would provide increased opportunities for partnering with agencies and other organizations compared to Alternative A due to an anticipated increase of 6 full time resource management staff, or equivalents. In addition, increased levels of research and monitoring would be conducted to provide the data necessary to adapt the best management practices to avoid adverse effects to rare, threatened, or endangered species. Volunteer programs would continue and would have the potential to expand due to proposed increases to interpretive, enforcement, and resource management staff.

Education and outreach activities would continue to be conducted from Christiansted National Historic Site by rangers and concessioners. However, under Alternative B, there would also be increased opportunities for education and outreach activities to occur at Buck Island as well as increased opportunities for guided hikes. The level of ranger presence would increase within the park as proposed positions are filled.

Alternative C

Alternative C provides for bow and stern anchoring and new moorings off West Beach and southwest of the pier, allowing for both anchoring and mooring of vessels. Alternative C was created as the result of input from boaters and weekend recreational visitors. This input was provided after the preliminary alternatives were presented to the public in August 2005. Alternative C includes all five management

zones: Resource Protection Zone, Anchoring Zone, Island Discovery Zone, Recreation Zone, and Marine Hazard Zone.

The Anchoring Zone in Alternative C would provide an approximate 2-acre bow and stern Anchoring Zone at West Beach. Due to the dynamic nature of beach conditions at Buck Island, the extent of the Anchoring Zone may shift over time. Projected changes associated with climate change, including sea level rise, frequency and duration of storms, coastal erosion, and acidification all contribute to conditions over time. Alternative C provides the ability to adapt to such changes and protect seagrasses, while providing continued access.

An additional maximum of five deep sand anchoring locations would also be designated west of Buck Island for larger vessels (91 feet to 150 feet). Anchoring would be allowed by permit only in deep sand, including along the shoreline where anchors would be required to be buried in the sand to avoid tripping and falling hazards.

Up to 45 additional moorings would be provided in a designated area beyond the Anchoring Zone at West Beach to address overflow of users wanting access to West Beach. Beach access channels would be marked to provide safe access to the beach for users mooring outside the Anchoring Zone and to protect swimmers. The beach access channels would be located north and south of the Anchoring Zone, with the northern beach access channel providing approximately 50 feet of beach frontage, and the southern access channel providing approximately 100 feet of beach frontage.

The underwater trail mooring area would also be maintained similar to Alternative A, with up to ten moorings for the underwater trail, and two SCUBA moorings. Additional moorings (up to ten) would also be located southwest of the existing pier. Moorings (up to 8) would also be installed for NPS administrative use.

Similar to Alternative B, there would be increased opportunities for partnering with agencies and other organizations due to increased levels of resource management staff. In addition, increased levels of monitoring would be conducted to provide the data necessary to adapt the best management practices to avoid adverse effects to rare, threatened or endangered species. Volunteer programs would continue and would have the potential to expand due to proposed increases to interpretive, enforcement, and resource management staff - an anticipated increase of 8 full time staff, or equivalents.

Education and outreach activities would continue to be conducted from Christiansted National Historic Site by rangers and concessioners. In addition, under Alternative C, there would also be increased opportunities for education and outreach activities to occur at Buck Island as well as increased opportunities for guided hikes. The level of ranger presence would increase within the park as proposed positions are filled.

Alternative D

Alternative D provides for recreational opportunities similar to existing conditions under Alternative A, with the exception that shoreline bow and stern anchoring would be eliminated. Similar to Alternative C, Alternative D includes all five management zones: Resource Protection Zone, Anchoring Zone, Island Discovery Zone, Recreation Zone, and Marine Hazard Zone.

Alternative D would provide vessel access via an Anchoring Zone off the shore of West Beach. Alternative D provides the largest Anchoring Zone of all the action alternatives, with approximately 16 acres in this zone. However, the size of the anchoring zone would be based upon resource conditions and would be subject to change to protect resources. The extent of the Anchoring Zone may change over time to reflect changes in the conditions in this area. Seagrass recovery and projected climate changes such as sea level rise, frequency and duration of storms, coastal erosion, and acidification all contribute to conditions that may change the seagrass and sand community over time, and therefore

where anchoring would be most appropriate. Anchoring would be appropriate only in deep sand, by permit, and on a first come, first serve basis.

There would also be up to five deep water anchoring locations designated (same as Alternatives B and C). In addition, up to 45 new moorings would be provided in a designated area beyond the Anchoring Zone at West Beach.

The underwater trail mooring area would be maintained similar to Alternatives A, B, and C, with up to ten underwater trail area moorings and two SCUBA moorings. Additional moorings (up to ten) would also be located southwest of the existing pier. Up to eight moorings would also be installed for NPS administrative use.

Beach access channels would be marked to provide safe access to the beach for those mooring and anchoring similar to Alternatives B and C. Also similar to Alternatives B and C, there would be increased opportunities for partnering with local agencies and other organizations due to increased levels of resource management staff. In addition, increased levels of research and monitoring would be conducted to provide the data necessary to adapt the best management practices to avoid adverse effects to rare, threatened or endangered species. Volunteer programs would continue and would have the potential to expand due to proposed increases to interpretive, enforcement, and resource management staff.

Alternative D provides for a greater increase in park staff due to the projected need for more ranger support and visitor services. This alternative would require the higher degree of management due to the larger size of the Anchoring Zone and increased number of vessels. Additional staff would be needed for enforcing park regulations, conducting monitoring of resources, and increased public education and interpretation activities for greater numbers of potential visitors. Due to the estimated level of up to 112 vessels proposed under Alternative D, an anticipated increase of 9 full time staff, or equivalents would be required.

Education, outreach and interpretive activities would continue to be conducted from Christiansted National Historic Site by rangers and concessioners. In addition, under Alternative D, there would also be increased opportunities for education and outreach activities at Buck Island as well as increased opportunities for guided hikes.

ENVIRONMENTAL CONSEQUENCES

The process of determining environmental consequences included identifying the regulations and policies applicable to each impact topic, and then defining the methods to conduct the analysis. Impact thresholds for each impact topic are defined in terms of negligible, minor, moderate and major; and whether they would be short-term or long-term and adverse or beneficial effects. Cumulative effects were also assessed. The impact analysis compared future conditions under potential new types of management practices (action alternatives) to future conditions that would occur if current management practices were to continue unchanged (Alternative A, No Action). An overview of climate change is provided in Appendix D. Threats associated with climate change (for example sea level rise, water temperature increases, increased storm activity, acidification) are described under Chapter 3, Affected Environment and Chapter 4, Environmental Consequences, including cumulative impacts, by impact topic.

When compared to Alternative A, action alternatives B, C and D provide enhanced protective measures by establishing management zones, instituting vessel size limitations by management zone, and increasing research, monitoring, enforcement, education, and partnering efforts that would provide beneficial effects.

The following is a summary of effects. All future development projects are subject to compliance with the National Environmental Policy Act, the National Historic Preservation Act and other appropriate

laws and regulations. Future project environmental reviews will be site specific and address natural and cultural resources, visitor experiences, and park operations.

Impacts of Alternative A:

Impacts to soil/ sand, water resources, vegetation and wildlife under the no action alternative, Alternative A, would generally be long-and short-term, negligible to minor and adverse due to the continuation of current management practices, policies, and park programs. Impacts to marine and coastal resources in terms of the shallow water coral reef community, sand bottom community, and seagrass and algal plain community would be long-term, moderate and adverse. Deeper habitats including the deep reefs and wall reefs, deep water abyssal bottom community and deep water oceanic/pelagic community would be negligible to minor and adverse. Impacts to fish and aquatic life would primarily be long-term, minor, and beneficial largely as a result of park management efforts as a “no take” marine reserve. Effects to essential fish habitat would range from long- and short-term, minor, and adverse due to vessel access and recreational use; and long- and short-term, moderate, and adverse due to illegal anchoring and fishing within the park. Impacts under Alternative A to threatened and endangered species would result in a “may affect, likely to adversely affect” determination under the Endangered Species Act for elkhorn and staghorn coral and “may affect/not likely to adversely affect” designation for sea turtles and the St. Croix ground lizard. Impacts to territory listed birds would be long- and short-term, negligible to minor, and adverse; and minor and beneficial for territory listed plant species.

Impacts to archeological resources within the park would primarily be long-term, moderate, and adverse due to human activities, natural processes, and lack of data. However, park management, interpretation, and visitor education efforts would have long-term, minor beneficial effects to archeological resources in the park.

Effects to the park’s soundscape, scenic resources, park operations and public health and safety would generally be long- and short-term, negligible to moderate and adverse. Under Alternative A, effects to visitor use and experience would generally be long-term, minor to major, beneficial and adverse due to individual preference for anchoring and the type of experience valued (more social versus anchorless and more protected), recreational opportunity, and access to orientation information and interpretation in the park.

Impacts of Alternative B:

Compared to Alternative A, eliminating the majority of anchoring, establishing management zones, establishing vessel size limits within zones, and increasing research, monitoring, enforcement, education, and partnering efforts have overall beneficial effects for the majority of impact topics. There would be long-and short-term moderate to major beneficial effects to the shallow water coral reef community, sand bottom community and seagrass and algal plain community as well as to fish and other marine animals. For deep reefs, wall reefs, abyssal bottom, oceanic/pelagic communities there would be long-term, negligible to minor and beneficial effects. Implementing Alternative B would have overall long-term, moderate beneficial effects to essential fish habitat. Overall impacts to soil/sand, water resources, vegetation and wildlife would be negligible to minor and both adverse and beneficial. Impacts to threatened and endangered species would result in a “may affect, not likely to adversely affect” determination under the Endangered Species Act. Territory listed species of concern would have long-term negligible to minor, beneficial and adverse effects.

Impacts to archeological resources would be long-term, minor, and adverse due to human activities, natural processes, and lack of data. Long-term moderate benefits would accrue from NPS management, interpretive, preservation, and protection efforts.

Impacts to soundscape would be long- and short-term, negligible to minor, and beneficial. Scenic resources would have long-term, minor, adverse effects. Under Alternative B, effects to visitor use and

access would be long- and short-term, moderate to major, adverse and beneficial due to individual preference for anchoring and degree of resource protection, recreational opportunity, and access to orientation information and interpretation in the park. Effects to park operations and facilities would be long- and short-term, major and beneficial; and impacts to public health and safety would primarily be long- and short-term, minor, and beneficial.

Impacts of Alternative C:

Characteristics of Alternative C are generally similar to Alternative A providing for bow and stern anchoring yet with beneficial effects from enhanced protective measures including establishing management zones, instituting vessel size limitations by zone, and increasing research, monitoring, enforcement, education, and partnering efforts. Impacts to wildlife would be long-term, negligible and beneficial. Impacts to soil/sand, water resources and vegetation would be long-and short-term, negligible to moderate, and adverse. Impacts to marine and coastal resources would generally be long-term and beneficial (ranging from negligible to major), with the exception of the sand bottom community which would have long-term, minor adverse effects associated with bow and stern anchoring. The effects to fish and aquatic life, and essential fish habitat would be long-term, minor to moderate and beneficial. Impacts to threatened and endangered species managed under Alternative C would result in a “may affect, not likely to adversely affect” determination under the Endangered Species Act. Territory listed species of concern would have long-term, minor, beneficial and adverse effects.

Archeological resources would have long-term, minor, and adverse effects from human activities, and moderate benefits under Alternative C, resulting from management efforts, management zones, mitigation measures for development, proactive management, and enhanced opportunities for visitor education.

Impacts to soundscapes and scenic resources would be long- and short-term, minor, and adverse. Under Alternative C, effects to visitor use and access would be generally long- and short-term, minor to major adverse and beneficial due to individual preference for anchoring and degree of resource protection, recreational opportunity, and access to orientation information and interpretation in the park. Park operations and facilities and public health and safety would primarily be long- and short-term, moderate and negligible (respectively), and beneficial.

Impacts of Alternative D:

Under Alternative D, the effects to soil and sand, water resources, and vegetation, would generally be long- and short-term, minor to moderate and adverse. Effects to wildlife would be long-term, negligible, and adverse. Effects to marine and coastal resources in terms of the shallow water coral reef community and sand bottom community would be long-term, minor and adverse. Due to anchoring, the effects to the seagrass and algal plain community would be long-term, moderate, and adverse. Impacts to the deep water community types (reefs, abyssal bottom, oceanic/pelagic) would be long-term, negligible to minor, and beneficial. Impacts to fish/aquatic life and essential fish habitat would be long-term, minor to moderate, and beneficial. Threatened and endangered species managed under Alternative D would result in a “may affect, not likely to adversely affect” determination under the Endangered Species Act. Territory listed species of concern would have long- term, minor, beneficial and adverse effects.

Archeological resources would have long-term, minor, and adverse effects from human activities, and moderate benefits under Alternative D, resulting from management efforts, management zones, mitigation measures for development, proactive management, and enhanced opportunities for visitor education.

Impacts to soundscapes would be long- and short-term, minor to moderate, and adverse. Scenic resources would be the same as those described under Alternative B, long-term, minor, and adverse.

Under Alternative D, effects to visitor use and access would be generally long- and short-term, minor to major, adverse and beneficial due to individual preference for anchoring and degree of resource protection, recreational opportunity, and access to orientation information and interpretation in the park. Public health and safety park operations and facilities and would primarily be long- and short-term, negligible and minor (respectively), and adverse.

THE NEXT STEPS

After distribution of this Draft General Management Plan / Environmental Impact Statement, there will be a 60-day public review and comment period. After the comment period ends, the NPS planning team will evaluate all input received regarding the draft plan and incorporate any resulting changes into a Final General Management Plan / Environmental Impact Statement. Following distribution of the final plan and a 30-day no-action period, a record of decision will be signed by the NPS regional director documenting the NPS selection of an alternative for implementation. Although this General Management Plan / Environmental Impact Statement provides the analysis and justification for future proposals at Buck Island Reef National Monument, this plan does not guarantee future NPS funding. Many actions would be necessary to achieve the desired conditions for natural resources, cultural resources, recreational opportunities, and facilities as envisioned in this plan. The NPS will seek funding to achieve these desired conditions. Park managers will continue to pursue other options, including expanding the service of volunteers, drawing upon existing or new partnerships, and seeking alternative funding sources, including the philanthropic community. This General Management Plan / Environmental Impact Statement provides the framework from which these choices and decisions will be made.

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Chapter 1

PURPOSE AND NEED FOR A GENERAL MANAGEMENT PLAN



Photo by: NPS Resource Management Staff

Buck Island

Buck Island Reef National Monument
Draft General Management Plan/
Environmental Impact Statement

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CHAPTER 1 PURPOSE AND NEED FOR A GENERAL MANAGEMENT PLAN

A GUIDE TO THIS DOCUMENT

Organization of this document is in accordance with the Council on Environmental Quality's implementing regulations for the National Environmental Policy Act and the National Park Service's Director's Order on "Environmental Analysis" (DO-12). Each of the five chapters is briefly described below.

Chapter 1: Introduction sets the framework for this document. This chapter provides a description of the park, why the plan is being prepared, and what needs it must address. It gives guidance for the alternatives that are considered, which are based on the legislated mission of Buck Island Reef National Monument, its purpose, the significance of its resources, special mandates and administrative commitments, servicewide mandates and policies, and other planning efforts in the area. The chapter also details the planning opportunities and issues raised during public meetings and planning team efforts. This chapter concludes with a statement of the scope of the environmental impact analysis — specifically, what impact topics were or were not analyzed in detail.

Chapter 2: Alternatives, including the preferred alternative, begins by describing the management prescriptions and zones developed for the future management of Buck Island Reef National Monument. An overview of how the alternatives were developed and a description of each alternative are provided. Alternative A is the continuation of current management and trends in the park (or the No Action Alternative). Alternatives B, C, and D are the action alternatives. These alternatives respond to presidential proclamation expanding the park and designation as a "no take" Marine Reserve. The environmentally preferred alternative is also described.

Mitigation measures proposed to minimize or eliminate the impacts of some proposed actions are described just before the discussion of future studies and/or implementation plans that will be needed. Evaluation of the environmentally preferred alternative is followed by a summary table of the alternative actions and the environmental consequences of implementing those alternative actions.

Chapter 3: Affected Environment describes those areas and resources that would be affected by implementing actions in the various alternatives. The topics addressed include natural resources, cultural resources, visitor use and experience, and park operations.

Chapter 4: Environmental Consequences analyzes the impacts of implementing the alternatives. Each impact topic described in Chapter 3 is analyzed. Methods used for assessing the impacts in terms of the intensity, type, and duration of each impact topic are outlined.

Chapter 5: Consultation and Coordination describes the history of public involvement and agency coordination conducted during the planning effort. Agencies and organizations that received copies of the document are also listed.

The Appendices present supporting information for the document, along with references, a glossary of terms, legislation, and pertinent supporting documentation.

INTRODUCTION

This *Draft General Management Plan / Environmental Impact Statement* presents and analyzes four alternative directions for future management and use of Buck Island Reef National Monument. Alternative B is the National Park Service's (hereafter referred to as NPS) preferred alternative. The potential environmental impacts of all alternatives have been identified and assessed.

General management plans are intended to be long-term documents that establish and articulate a management philosophy and framework for decision making and problem solving in national parks. General management plans are intended to provide guidance over a 20-year period.

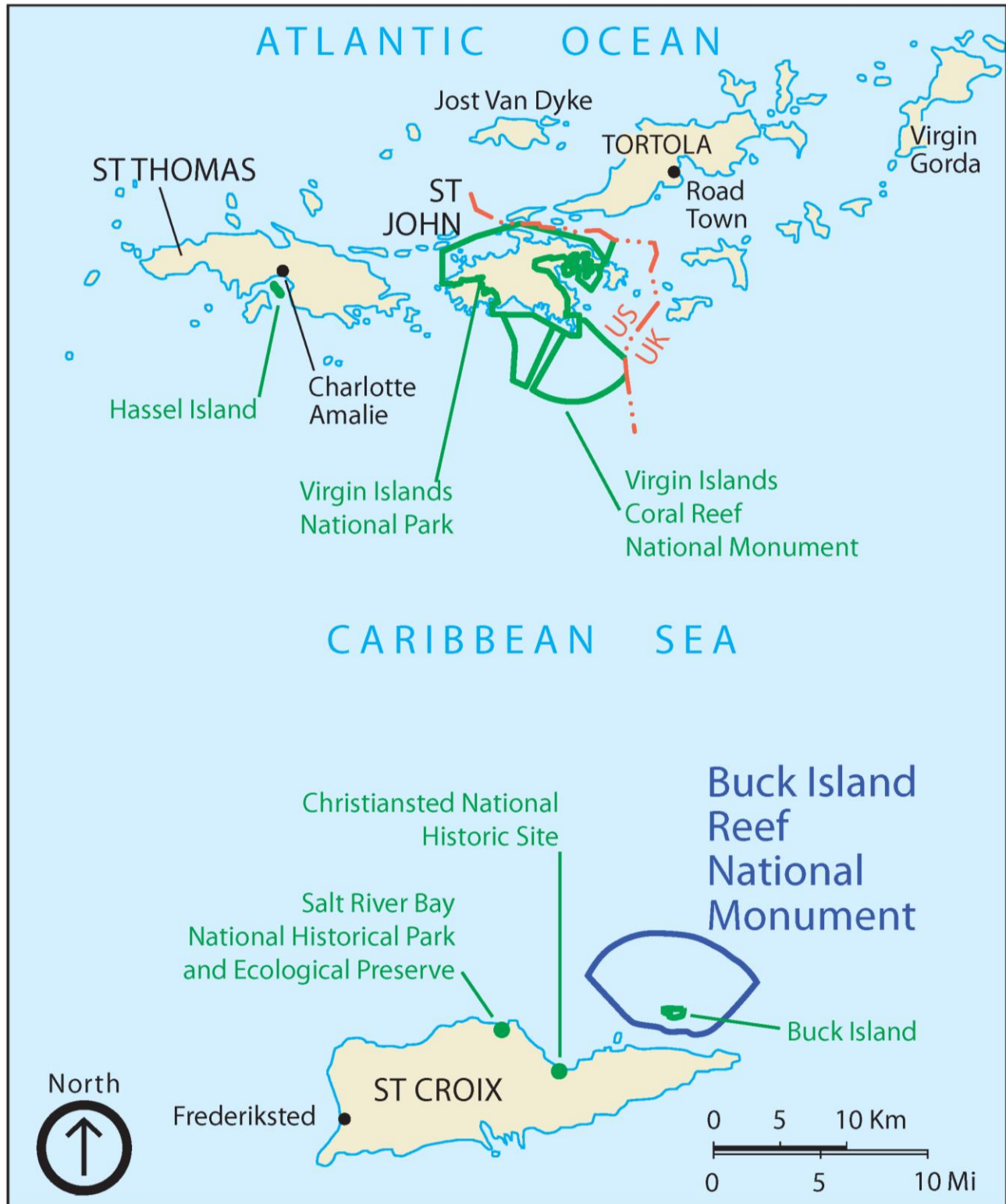
The detailed actions directed by general management plans or in subsequent implementation plans are intended to be accomplished over time. Implementation of the approved plan will depend on future funding and servicewide priorities. Approval of this *General Management Plan* does not guarantee that funding and staffing needed to implement the plan will be forthcoming. It is likely that all capital improvements will not be totally implemented during the life of this plan. Larger capital improvements may be phased over several years, and full implementation of this plan could be many years into the future.

The term *park* is used to refer to all units of the National Park System, including national monuments. The terms *park* or *monument* are used throughout this document to refer to Buck Island Reef National Monument.

Brief Description of Buck Island Reef National Monument

Buck Island Reef National Monument consists of approximately 19,015 land and water acres north of the island of St. Croix in the U.S. Virgin Islands (Figure 1). The monument originally consisted of approximately 176 acres of land and 704 acres of water. It was established in 1961 by Presidential Proclamation (No. 3443) for the purpose of “protecting Buck Island and its adjoining shoals, rocks, and undersea coral reef formations” and to preserve “one of the finest marine gardens in the Caribbean Sea” for the benefit and enjoyment of the people and to protect it from “despoliation and commercial exploitation.” In 1975, 30 acres of submerged lands east of the underwater trail area were added by Presidential Proclamation (No. 4346). Under the U.S. Coral Reef Initiative, the monument was expanded in 2001 by Presidential Proclamation (No. 7392) to include submerged lands totaling 19,015 acres, to bring into the monument “additional objects of scientific and historic interest, and provide necessary further protection for the resources of the existing monument and prohibit all extractive uses.” The expanded park and boundary are shown on Figure 2. The park is now one of only a few fully protected “no-take” marine reserves in the national park system.

An interim rule (36 Code of Federal Regulations Part 7) was published in the Federal Register on April 4, 2003 (effective May 5, 2003) prohibiting extractive uses (fishing, taking whelk, conch, lobster, etc.) and anchoring except in designated areas of deep sand by permit or in the event of emergencies (all other anchoring subject to permit), or for administrative purposes. The interim rule remains in effect until final regulations are adopted upon completion of this General Management Plan. The interim rule codifies the prohibition of extractive uses as outlined in Proclamation No. 7392 of 2001, and therefore, supersedes the limited authorization for extractive uses included in the proclamation of December 28, 1961 (No. 3443). Pertinent park legislation is provided in Appendix A.



Regional Location Map

Buck Island Reef National Monument
U.S. Department of the Interior - National Park Service

Figure 1





Figure 2

Map of Buck Island Reef National Monument
Buck Island Reef National Monument
U.S. Department of the Interior - National Park Service

The park's outstanding resources provide ample opportunities for education and scientific research. The 176-acre Buck Island and 18,035-acre surrounding coral reef and marine environment support a large variety of native terrestrial and marine species. Many threatened and endangered species use and live in the waters within the monument, including migratory humpback and pilot whales, dolphins, brown pelicans, least terns, and four species of sea turtles.

Buck Island will be one of two federally protected areas that will support the federally endangered St. Croix ground lizard re-introduced to the park in 2007. The park, established for its elkhorn coral barrier reef that surrounds two-thirds of the island, now includes extensive habitat (over 4,000 acres) for two listed species of coral: elkhorn and staghorn, unique coral formations, and an extensive array of reef fishes and marine invertebrates. The park also contains important cultural resources, including remains from prehistoric occupation and use (ceramic and shell middens), wrecks of two eighteenth century slave ships—the Mary and General Abercrombie—and archeological sites from Danish rule in the eighteenth and nineteenth centuries.

PURPOSE OF THE GENERAL MANAGEMENT PLAN

The approved *General Management Plan* will be the basic document for managing Buck Island Reef National Monument for the next 20 years. The purposes of this *General Management Plan* are as follows:

- Confirm the purpose, significance, and special mandates of Buck Island Reef National Monument.
- Clearly define future resource conditions and visitor uses and experiences to be achieved for Buck Island Reef National Monument.
- Provide a framework for managers to use when making decisions about how to best protect Buck Island Reef National Monument's resources; how to provide quality visitor uses and experiences; how to manage visitor use; and what kinds of facilities, if any, to develop in/near Buck Island Reef National Monument.
- Ensure that this foundation for decision making has been developed in consultation with interested stakeholders and adopted by NPS leadership after an adequate analysis of the benefits, impacts, and economic costs of alternative courses of action.

The legislation that established the NPS as an agency provides fundamental direction for the administration of Buck Island Reef National Monument (and other units and programs of the national park system). This *General Management Plan* builds on existing laws and the legislation that established Buck Island Reef National Monument to provide a vision for the park's future. The "Servicewide Mandates and Policies" section of this *General Management Plan* calls the reader's attention to topics that are important to understanding the management direction for the park. Table 1 summarizes the topics and conditions that management is striving to achieve. Appendix B provides more detail on the laws or policies directing management actions. The alternatives in this *General Management Plan* address the desired conditions that are not mandated by law or policy and must be determined through a planning process.

Table 1. Desired Conditions and Applicable Laws and Policies Summarized by Impact Topic

TOPIC	DESIRED CONDITIONS	APPLICABLE LAWS AND POLICIES
Relations with Private and Public Organization, Owners of Adjacent Land, and Governmental Agencies	The Buck Island Reef National Monument is managed as part of a greater ecological, social, economic, and cultural system. Good relations are maintained with the surrounding communities, agencies, and private and public groups that affect, and are affected by the park. The park is managed proactively to resolve external issues and concerns and ensure that park values are not compromised. Because Buck Island Reef National Monument is an integral part of larger regional environment, the NPS works cooperatively with others to anticipate, avoid, and resolve potential conflicts, and protect Buck Island Reef National Monument resources. Regional cooperation involves territorial, federal, and local agencies, and all other concerned parties.	NPS Management Policies NPS Organic Act Director's Order 17: NPS Tourism Director's Order 75A: Civic Engagement and Public Involvement
Natural Resources		
General Natural Resources / Restoration	Native species populations that have been severely reduced in or extirpated from Buck Island Reef National Monument are restored where feasible and sustainable. Populations of native plant and animal species function in as natural condition as possible except where special considerations are warranted.	NPS Management Policies NPS Organic Act Executive Order 13112 40 CFR par 24 Director's Order 77: Natural Resource Management Reference Manual
Natural Lightscape / Night Sky	Excellent opportunities to see the night sky are available. Artificial light sources, both within and outside Buck Island Reef National Monument, do not unacceptably adversely affect opportunities to see the night sky.	NPS Management Policies NPS Organic Act Director's Order 13A: Environmental Management Systems
Soundscape	Park natural soundscape resources encompass all natural sounds, including the physical capacity for transmitting those natural sounds and the interrelationships among park natural sounds of different frequencies and volumes. The NPS will preserve, to the greatest extent possible, the natural soundscape of the park.	NPS Management Policies NPS Organic Act 36 CFR 2.12: Audio Disturbances Director's Order 47: Sound Preservation and Noise Management
Native Vegetation and Wildlife	The NPS will maintain as parts of the natural ecosystem, all native plants and wildlife in the park.	NPS Management Policies NPS Organic Act Migratory Bird Treaty Act Executive Order 13112 40 CFR part 24 National Invasive Species Act of 1996 Director's Order 77: Natural Resource Management Reference Manual

Table 1. Desired Conditions and Applicable Laws and Policies Summarized by Impact Topic (Continued)

TOPIC	DESIRED CONDITIONS	APPLICABLE LAWS AND POLICIES
Marine Resources	Natural resources will be managed to preserve fundamental physical and biological processes, as well as individual species, features, and plant and animal communities. A “no take” marine reserve will be managed to enhance the conservation of our Nation’s natural and cultural marine heritage and the ecologically and economically sustainable use of the marine environment for future generations.	NPS Management Policies NPS Organic Act Clean Water Act Rivers and Harbors Appropriation Act of 1899 Coastal Zone Management Act of 1972 Magnuson-Stevenson Fisheries Management and Conservation Act Marine Mammal Protection Act of 1972 Clean Vessel Act of 1992 National Invasive Species Act of 1996 Marine Protection, Research and Sanctuaries Act Migratory Marine Game-Fish Act Fish and Wildlife Coordination Act Coral Reef Conservation Act of 2000 Federal Aid in Sport Fish Restoration Act Executive Orders: 13089, 13158, 13352 Director’s Order 77: Natural Resource Management Reference Manual Virgin Islands Code (various titles/chapters, primarily Title 12)
Soils / Sand	The NPS actively seeks to understand and preserve the soil and sand resources of Buck Island Reef National Monument and to prevent, to the extent possible, the unnatural erosion, physical removal, or contamination of the soil, or its contamination of other resources. Natural soil and sand resources and processes function in as natural a condition as possible, except where special considerations are allowable under policy.	NPS Management Policies NPS Organic Act Coastal Zone Management Act Virgin Islands Code, Title 12 Section 910
Threatened and Endangered Species	Federal and territory-listed threatened and endangered species and their habitats are protected and sustained. Native threatened and endangered species populations that have been severely reduced in or extirpated from the Buck Island Reef National Monument are restored where feasible and sustainable.	NPS Management Policies NPS Organic Act Endangered Species Act Virgin Islands Code, Title 12, Chapter 2
Water Resources	Surface water and groundwater are protected, and water quality meets or exceeds all applicable water quality standards. NPS and NPS-permitted programs and facilities are maintained and operated to avoid pollution of surface water and groundwater.	Clean Water Act of 1972 NPS Organic Act Executive Order 11514 NPS Management Policies Clean Vessel Act of 1992 Executive Order 12088 Director’s Order 83: Public Health

Table 1. Desired Conditions and Applicable Laws and Policies Summarized by Impact Topic (Continued)

TOPIC	DESIRED CONDITIONS	APPLICABLE LAWS AND POLICIES
Wetlands	The natural and beneficial values of wetlands are preserved and enhanced. The NPS implements a “no net loss of wetlands” policy and strives to achieve a longer-term goal of net gain of wetlands across the National Park System through the restoration of previously degraded wetlands. The NPS avoids to the extent possible the long- and short-term adverse impacts associated with the destruction or modification of wetlands and avoids direct or indirect support of new construction in wetlands wherever there is a practicable alternative. The NPS compensates for remaining unavoidable adverse impacts on wetlands by restoring wetlands that have been previously degraded.	NPS Management Policies NPS Organic Act Clean Water Act Rivers and Harbors Appropriation Act of 1899 Executive Order 11990 Director’s Order 77-1: Wetland Protection
Cultural Resources		
Archeological Resources	Archeological sites are identified and inventoried and their National Register of Historic Places significance is determined and documented. Archeological sites are protected in an undisturbed condition unless it is determined through formal processes that disturbance or natural deterioration is unavoidable. When disturbance or deterioration is unavoidable, the site is professionally documented and mitigating measures for register-eligible sites are developed in consultation with the Virgin Islands State Historic Preservation Office and the Advisory Council on Historic Preservation (as appropriate). Mitigation may include a variety of measures ranging from avoidance to data recovery, and is generally included in a memorandum of agreement. Artifacts, materials, and records resulting from data recovery are curated and conserved as provided for in 36 Code of Federal Regulations 79. Some archeological sites that can be adequately protected may be interpreted to visitors. These requirements are specified in Director’s Order 28, which directs the NPS to protect and manage cultural resources in its custody through effective research, planning, and stewardship and in accordance with the policies and principles contained in the NPS Management Policies.	NPS Management Policies NPS Organic Act National Historic Preservation Act National Environmental Policy Act National Parks Act of August 25, 1916 The Antiquities Act of 1906 Archeological and Historic Preservation Act; Standards and Guidelines for Federal Agency Historic Preservation Programs pursuant to the National Historic Preservation Act (63 FR 20495-20508) Archaeological Resources Protection Act Executive Order 11590 Executive Order 13007 36 CFR 800 36 CFR 79 Director’s Order #4: Diving Management Director’s Order #12: Conservation Planning, Environmental Impact Analysis, and Decision-making and its accompanying Handbook Director’s Order #28: Cultural Resource Management Guidelines Abandoned Shipwreck Act Guidelines Nationwide Programmatic Agreement to Implement Section 106 under the NHPA of 1966 (2008) Secretary of the Interior’s Standards and Guidelines for Archeology and Historic Preservation (1983) NPS Cultural Resource Management

Table 1. Desired Conditions and Applicable Laws and Policies Summarized by Impact Topic (Continued)

TOPIC	DESIRED CONDITIONS	APPLICABLE LAWS AND POLICIES
		Handbook U.S. Virgin Islands Antiquities and Cultural Properties Act (Act No. 6234, Bill No. 22-0112 to amend Title 29 of the Virgin Islands Code)
Historic Structures	Historic structures are inventoried and their significance and integrity are evaluated under National Register of Historic Places criteria. The qualities that contribute to the listing or eligibility for listing of historic structures on the national register are protected in accordance with the <i>Secretary of the Interior's Standards and Guidelines for the Treatment of Historic Properties</i> (36 Code of Federal Regulations 68), (unless it is determined through a formal process that disturbance or natural deterioration is unavoidable).	NPS Management Policies NPS Organic Act National Historic Preservation Act National Environmental Policy Act National Parks Act of August 25, 1916 The Antiquities Act of 1906 Archeological and Historic Preservation Act; Standards and Guidelines for Federal Agency Historic Preservation Programs pursuant to the National Historic Preservation Act (63 FR 20495-20508) Executive Order 11590 Executive Order 13007 36 CFR 800 Director's Order #4: Diving Management Director's Order #28: Cultural Resource Management Guidelines Nationwide Programmatic Agreement to Implement Section 106 under the NHPA of 1966 (2008) Secretary of the Interior's Standards and Guidelines for Archeology and Historic Preservation (1983) Abandoned Shipwreck Act Guidelines NPS Cultural Resource Management Handbook U.S. Virgin Islands Antiquities and Cultural Properties Act (Act No. 6234, Bill No. 22-0112 to amend Title 29 of the Virgin Islands Code)
Ethnographic Resources	All ethnographic resources determined eligible for listing or listed on the National Register of Historic Places are protected. If disturbance of such resources is unavoidable, formal consultation with the Advisory Council for Historic Preservation and, as appropriate, with the state historic preservation officer is conducted. This consultation is in accordance with the National Historic Preservation Act and the Advisory Council for Historic Preservation implementing regulations and programmatic agreement.	NPS Management Policies NPS Organic Act National Historic Preservation Act Archaeological Resources Protection Act National Environmental Policy Act Director's Order 28B: Ethnography Program
Museum Collections	All museum collections such as artifacts, specimens, field notes, and manuscripts are documented,	NPS Management Policies NPS Organic Act

Table 1. Desired Conditions and Applicable Laws and Policies Summarized by Impact Topic (Continued)

TOPIC	DESIRED CONDITIONS	APPLICABLE LAWS AND POLICIES
	inventoried, catalogued, preserved, and protected, and provision is made for their access to and use for exhibits, research, and interpretation. The qualities that contribute to the significance of collections are protected in accordance with established standards.	Museum Act of 1955 as amended, 16 USC 18f, 18f-2—18f-3 36 CFR 79 Director's Order 24: NPS Museum Collections Management NPS Museum Handbook
Cultural Landscapes	Cultural landscape inventories are conducted to identify landscapes potentially eligible for listing in the National Register, and to assist in future management decision for landscapes and associated resources, both cultural and natural. The preservation, rehabilitation, restoration, or reconstruction of cultural landscapes is undertaken in accordance with the Secretary of the Interior's Standards for the Treatment of Historic Properties with Guidelines for the Treatment of Cultural Landscapes and 2006 Management Policies.	NPS Management Policies NPS Organic Act National Historic Preservation Act (Sections 106 and 110) National Park's Act of August 15, 1916 Executive Order 11593 36 CFR 800 Director's Order 28: Cultural Resource Management Guideline Secretary of the Interior's Standards for the Treatment of Historic Properties with Guidelines for Treatment of Cultural Landscapes (1992) Programmatic MOA among the NPS, Advisory Council on Historic Preservation, and the National Council of State Historic Preservation Officers (1995)
Visitor Use and Experience		
Visitor Use and Experience	Buck Island Reef National Monument resources are conserved "unimpaired" for the enjoyment of future generations. Visitors have opportunities for forms of enjoyment that are uniquely suited and appropriate to the superlative natural and cultural resources found in the Buck Island Reef National Monument. No activities occur that would cause derogation of the values and purposes for which the park has been established. The types and levels of visitor use are consistent with the desired resource and visitor experience conditions prescribed. Buck Island Reef National Monument visitors will have opportunities to understand and appreciate the significance of the monument and its resources and to develop a personal stewardship ethic. To the extent feasible, programs, services, and facilities in the monument are accessible to and usable by all people, including those with disabilities.	NPS Management Policies NPS Organic Act National Park System General Authorities Act Americans with Disabilities Act 36 CFR Parts 1,3, and 7: Boating and Water Use Activities Director's Order 12: Conservation Planning, Environmental Impact Analysis, and Decision Making
Commercial Services	Same as Visitor Use and Experience and Park Use Requirements above. All commercial services must be authorized, must be necessary and/or appropriate, and must be	NPS Management Policies NPS Concessions Management Improvement Act of 1998 NPS Organic Act

Table 1. Desired Conditions and Applicable Laws and Policies Summarized by Impact Topic (Continued)

TOPIC	DESIRED CONDITIONS	APPLICABLE LAWS AND POLICIES
	economically feasible. Appropriate planning must be done to support commercial services authorization. Commercial services are provided in a manner consistent with the mission of the park.	National Park System General Authorities Act
Public Health and Safety	To the extent feasible, programs, services, and facilities in the monument are accessible and provided in a safe manner. All decisions regarding Buck Island Reef National Monument operations, facilities management, and development— from the initial concept through design and construction — reflect sound public health and safety principles.	NPS Management Policies NPS Organic Act Council on Environmental Quality regulations as part of the National Environmental Policy Act Director’s Orders 50B, 50C, 58, and 83

This *General Management Plan* does not describe how particular programs or projects should be prioritized or implemented; those decisions will be addressed in more detailed future planning efforts. All future plans will tier from the approved *General Management Plan*.

Need for the Plan

This new *General Management Plan* for Buck Island Reef National Monument is needed because the last comprehensive planning effort for the monument was completed in 1983. Much has changed since then, including patterns of visitor use, prohibition of all extractive uses within the park’s boundaries, listing of species within the park in accordance with the Endangered Species Act, expansion of the monument’s boundaries from 880 acres to 19,015 land and water acres, coral bleaching and other threats associated with climate change. The Proclamation (3443) stipulated that a management plan also be completed. These changes have major implications on how visitors use the monument and the facilities needed to support those uses, how resources are managed, and how the NPS manages its operations.

A general management plan is also needed to meet the requirements of the National Parks and Recreation Act of 1978 and NPS policy, which mandate the development of a general management plan for every park in the national park system.

FOUNDATION FOR PLANNING AND MANAGEMENT

Park Mission

The mission of Buck Island Reef National Monument is to protect, preserve, manage, and interpret the monument’s seascapes, scenic views, and unique natural and cultural resources unimpaired for the education, enjoyment, and inspiration of present and future generations.

Purpose

Purpose statements for Buck Island Reef National Monument reaffirm the reasons for which the park was set aside as a unit of the national park system. Purpose statements are grounded in an analysis of the park’s legislation and legislative history, providing a strong foundation for directing future park management and use.

The purpose of Buck Island Reef National Monument is to:

- Preserve and protect the island and tropical marine ecosystem, including coral reefs, seagrass beds, octocoral hardbottom, sand communities, algal plains, shelf edge, and oceanic habitats;
- Protect threatened and endangered species and enhance their habitats and survivability;
- Enhance the health and diversity of fisheries resources through their protection;

- Protect and manage terrestrial and submerged cultural resources; and
- Preserve this area of outstanding scientific, aesthetic, and educational importance for the benefit and enjoyment of the people now and for the future.

Significance

Significance statements capture the essence of Buck Island Reef National Monument's importance to the nation's natural and cultural heritage. Significance statements describe the monument's distinctiveness and help to place Buck Island Reef National Monument within its regional, national, and international contexts. Significance statements answer various questions, such as "Why are Buck Island Reef National Monument's resources distinctive?" "What do they contribute to our natural and cultural heritage?" Defining the significance of the monument's resources helps managers to make decisions that preserve the resources and the values necessary to accomplish Buck Island Reef National Monument's purpose.

The significance statements for Buck Island Reef National Monument are as follows:

- Buck Island and its surrounding coral barrier reef formations constitute one of the finest marine gardens in the Caribbean and support countless species of reef fishes, invertebrates, plants, sea birds, and marine mammals and reptiles.
- The monument's tropical marine ecosystems are a continuum of coral reefs (patch, spur and groove, deep and wall), unusual "haystacks" of elkhorn coral, seagrass beds, octocoral hardbottom, sand, algal plains, shelf edge, and open ocean, and provide habitats that are essential for sustaining fragile communities of plants and animals.
- Several threatened and endangered species forage, breed, nest, rest, or calve in the waters within the monument, including humpback whales, pilot whales, dolphins, brown pelicans, least terns, and the hawksbill, leatherback, loggerhead, and green sea turtles. Buck Island is the only completely protected habitat that will support the globally endangered St. Croix ground lizard.
- The monument contains the wrecks of two eighteenth century slave ships, the Mary and General Abercrombie, other yet unidentified shipwrecks, and terrestrial archeological sites associated with Danish sovereignty in the eighteenth and nineteenth centuries.
- The monument offers outstanding opportunities for education and scientific research due to the diversity, complexity, and relationship of the natural resources and provides a dynamic laboratory for study and learning.

SPECIAL MANDATES AND ADMINISTRATIVE COMMITMENTS

Special mandates and administrative commitments refer to park-specific requirements. These formal agreements are often established concurrently with the creation of a unit of the national park system. Special mandates for the park reflect the park's status as a "no take" marine reserve, prohibiting extractive uses and prohibiting anchoring except in designated areas in deep sand.

The interim rule (36 Code of Federal Regulations Part 7) that was published in the Federal Register (effective May 2003) prohibits extractive uses (fishing, taking whelk, conch, lobster, etc.) and anchoring except in areas of deep sand, in the event of emergencies (all other anchoring subject to permit), or for administrative purposes. The interim rule remains in effect until final regulations are adopted upon completion of this General Management Plan.

Written comments on the interim rule were solicited from all interested parties. Comments that were received on the interim rule provided part of the basis of scoping for the General Management Plan. Such comments were also considered during the development of the plan. Comments were also solicited and received as part of the broader General Management Plan scoping process. The

publishing of the interim rule and adoption of final regulations is conducted in accordance with the Administrative Procedures Act. The Secretary of the Interior determined under 5 U.S.C 553 (b) (B) and 318 DM 5.3 that it was not in the public interest to delay the effective date of the interim rule to accommodate notice and comment procedures for the following reasons:

- The Proclamation (No. 7392 of 2001) clearly outlines the limits of the Secretary of the Interior's discretion in disallowing extractive uses at the monument. The interim rule codifies the prohibitions of extractive uses outlined in the Proclamation and public comment will be useful only as to the few narrow exceptions allowed under the Proclamation.
- Delaying implementation of the Proclamation (No. 7392 of 2001) may lead to confusion about what law applies in the park unit and could result in harm to the objects protected by the Proclamation.
- Immediate action was necessary to effectuate the purpose for which the Proclamation (No. 7392 of 2001) was issued (protecting the objects within the monument).

Comments on the interim rule received to date included the desire to maintain fishing in the park and disagreement with the interim rule; the economic hardship of no extractive use; and the desire to minimize the extent of the prohibition of extractive use within all park boundaries. The interim rule codifies the prohibition of extractive uses as outlined in Proclamation No. 7392 of 2001, and therefore supersedes the limited authorization for extractive uses included in the proclamation of December 28, 1961 (No. 3443).

Comments regarding anchoring in the park were raised during the planning process and were considered during scoping and the development of alternatives as described in Chapter 2. Planning issues and concerns addressed and those not considered further are described in the subsection entitled, Planning Issues and Concerns within this chapter.

Service-wide Laws and Policies

This section identifies what must be done at Buck Island Reef National Monument to comply with federal laws and policies of the NPS. Many of the monument's management directives are specified in laws and policies guiding the NPS and are therefore not subject to alternative approaches. For example, there are laws and policies about managing environmental quality (such as the Clean Air Act, the Endangered Species Act, and Executive Order 11990, Protection of Wetlands); laws governing the preservation of cultural resources (such as the National Historic Preservation Act and the Antiquities and Cultural Properties Act of the Virgin Islands); and laws about providing public services (such as the Americans with Disabilities Act) — to name only a few. In other words, a general management plan is not needed to decide, for instance, that it is appropriate to protect endangered species, control exotic species, protect archeological sites, conserve artifacts, or provide for handicap access. Laws and policies already prescribe such actions. Although attaining some of these conditions set forth in these laws and policies may have been temporarily deferred in the park because of funding or staffing limitations, the NPS will continue to strive to implement these requirements with or without a new general management plan.

Some of these laws and executive orders are applicable solely or primarily to units of the national park system. These include the 1916 Organic Act that created the National Park Service, the General Authorities Act of 1970, the act of March 27, 1978, relating to the management of the National Park System, and the National Parks Omnibus Management Act (1998). Other laws and executive orders have much broader application, such as the Endangered Species Act, the National Historic Preservation Act, Executive Order 11990 addressing the protection of wetlands; Coral Reef Protection, Executive Order 13089 (1998) that establishes policies and actions needed to address growing threats to the nation's coral reefs; Executive Order 13158 that establishes a national system of marine protected areas, and Executive Order 13352 that addresses cooperative conservation.

By enacting the NPS Organic Act of 1916 (Organic Act), Congress directed the U.S. Department of Interior and the NPS to manage units “to conserve the scenery and the natural and historic objects and wildlife therein and to provide for the enjoyment of the same in such a manner and by such a means as will leave them unimpaired for the enjoyment of future generations” (16 United States Code, Section 1). Congress reiterated this mandate in the Redwood National Park Expansion Act of 1978 by stating that NPS must conduct its actions in a manner that will ensure no “derogation of the values and purposes for which these various areas have been established, except as may have been or shall be directly and specifically provided by Congress” (16 United States Code, Section 1a-1).

The National Park System General Authorities Act (16 USC §1a-1, et seq.) affirms that while all national park system units remain “distinct in character,” they are “united through their interrelated purposes and resources into one national park system as cumulative expressions of a single national heritage.” The act makes it clear that the NPS Organic Act and other protective mandates apply equally to all units of the system. Further, NPS management of park units should not “derogate...the purposes and values for which these various areas have been established.”

The NPS also established policies for all units under its stewardship. These are identified and explained in a guidance manual entitled *NPS Management Policies 2006* (NPS 2006a). The management alternatives considered in this document incorporate and comply with the provisions of these mandates and policies, and director’s orders (DO).

Public Law 95-625, the National Park and Recreation Act, requires preparation and timely revision of a general management plan for each unit of the national park system. Section 604 of the National Park and Recreation Act outlines several requirements for general management plans, including measures for the protection of the area’s resources and “indications of potential modifications to the external boundaries of the unit and the reasons therefore.” NPS Management Policies 2006 adopted in 2006 reaffirm this legislative directive.

To understand the implications of a management alternative, it is important to combine the servicewide mandates and policies with the management actions described in an alternative. Table 1 summarizes some of the most pertinent servicewide mandates and policy topics related to planning and managing Buck Island Reef National Monument and the desired conditions the park is striving to achieve. Appendix B expands on this information by citing the law or policy directing these actions. The alternatives in this *General Management Plan* address the desired conditions not mandated by law and policy and which must be determined through a planning process.

BOUNDARY ADJUSTMENTS

As part of general management planning, the NPS is required to identify and evaluate boundary adjustments that may be necessary or desirable to carry out the purposes of the park. Boundary adjustments may be recommended to:

- Protect significant resources and values, or to enhance opportunities for public enjoyment related to park purposes,
- Address operational and management issues, such as the need for access or the need for boundaries to correspond to logical boundary delineations such as topographic or other natural features or roads, or
- Otherwise protect park resources that are critical to fulfilling park purposes.

All recommendations for boundary changes must meet NPS criteria for consideration. There are no boundary adjustments under consideration for Buck Island Reef National Monument.

PLANNING ISSUES AND CONCERNS

Introduction

During the summer of 2004, the general public, NPS staff, representatives from territorial, federal and other agencies, and representatives from various organizations identified various issues and concerns during scoping (early information gathering) meetings conducted for this *General Management Plan*. An issue is defined as an opportunity, conflict, or problem regarding the use or management of public lands. Comments were solicited at public meetings, through planning newsletters, fact sheets, and on the park's website (see Chapter 5 Consultation and Coordination).

Comments received during the scoping process demonstrated there is much the public likes about the management, use, and access of Buck Island Reef National Monument. In general, the issues and concerns that emerged involved determining the appropriate visitor use, types, and levels of access via anchoring and /or mooring, types of visitor services and activities, and resource protection. The *General Management Plan* alternatives provide strategies for addressing the issues within the context of the park's purpose, significance, and special mandates.

Issues and Concerns to be Addressed

The range of planning issues and concerns that were discussed with the park staff, stakeholders, and the general public during the planning process include:

- Moorings: number, location, and use.
- Anchoring: location, number, and size of vessels that may anchor. Practice of shoreline bow and stern anchoring and resource protection. Safety concerns getting to the beach from offshore moorings.
- Identification of boundaries.
- Visitor Use and Experience: recreational opportunities.
- Education and Outreach: type, location, and amount. Improved signage.
- Protect Resources: balance resource protection and use.
- Enforcement: need to increase park ranger presence on Buck Island, park waters, and provide consistency; posting of rules.

Decision points identify the key decisions that remain to be made after consideration of all laws, policies, and mandates. As with any decision-making process, there are key decisions that, once made, will determine the direction of subsequent decisions. Based on public comments and issues and NPS concerns, several decision points were identified. This *General Management Plan* focuses on alternative ways of addressing these decision points. Related issue categories are addressed by each decision point statement:

- Access: Given the existing legal, physical, and natural and cultural resource constraints specific to Buck Island Reef National Monument, to what extent can access be provided?
- Visitor Use: While protecting natural and cultural resources should visitor experiences, activities (commercial and non-commercial) and associated facilities be kept at present levels, reduced, or expanded?
- Management and Protection: What level of NPS presence is required to protect natural and cultural resources while providing and maintaining a quality visitor experience?
- Education / Partnerships: What levels of education / outreach and partnering programs should the NPS develop?

Issues and Concerns Not Addressed in the General Management Plan

Not all issues or concerns raised by the public are included in this *General Management Plan / Environmental Impact Statement*. Some issues raised by the public were not considered because they:

- Are already prescribed by law, regulation, or policy.
- Would be in violation of laws, regulations, or policies.
- Were at a level that was too detailed for a general management plan and are more appropriately addressed in subsequent planning documents.

This section briefly describes these issues, and the basis for excluding them from this *General Management Plan*.

- *Fishing / extractive use.* Many public comments addressed the desire to continue to be allowed to fish within park boundaries, to address the economic impact to local fishermen, to compensate local fisherman, and other related concerns. In accordance with Presidential Proclamation 7392 and the interim rule, all extractive uses are prohibited, and therefore the effects of prohibiting fishing / extractive use within the boundary are not further addressed. In addition, agency concerns were expressed to the park indicating the desire for NPS to address the effects on essential fish habitat from prohibiting fishing within the boundary of the monument, as well as the cumulative effects to the fishery resources in the St. Croix area. The purpose of this *General Management Plan / Environmental Impact Statement* is to assess the impact of future management actions at the park. It is not the expressed purpose of this plan to address the effects of implementation of the interim rule. The stipulations of the presidential proclamation and the interim rule are the foundation of the planning effort. These issues will not be assessed in this *General Management Plan / Environmental Impact Statement*.
- *The need for the Buck Island Reef National Monument.* The park's purpose statement is based on Buck Island Reef National Monument's legislation and legislative history and NPS policies and is described at the beginning of this chapter along with park significance statements. These statements are part of the foundation of this planning effort. The purpose of the *General Management Plan / Environmental Impact Statement* is to address proposed management actions.
- *Desire to anchor anywhere within the monument.* Presidential Proclamation No. 7392 specifically prohibits all boat anchoring, "provided that the Secretary may permit exceptions for emergency or authorized administrative purposes, and may issue permits for anchoring in deep sand bottom areas, to the extent that it is consistent with the protection of the objects" (i.e. resources identified in Proclamation 7392). This *General Management Plan* is prepared in accordance with Proclamation 7392 and interim rule.
- *Provision of free access for local visitors.* Buck Island Reef National Monument does not charge an entrance fee. Boat access to the park is provided via concession, private vessel, or special permit. Concession fees include transportation costs to transport visitors to the park for commercial services such as snorkeling, SCUBA, hiking, and other recreational use. Some administrative fees are required.
- *Provide details regarding placement, type, and number of moorings.* Specific details regarding the exact location, number, type of use, and placement of moorings will be provided in a separate Vessel Management Plan. The NPS is preparing a Vessel Management Plan in which the details of mooring installation, location, and purpose, as well as management issues regarding vessels, will be provided. The public will have an opportunity to comment during the preparation of the Vessel Management Plan and environmental assessment.

- *Establish a memorandum of agreement of some type to develop a cooperative working relationship between the NPS and the Virgin Islands Government to develop a territorial park system.* The NPS recognizes the value of cooperative agreements and cooperates with the Virgin Islands Government and many other organizations on many projects, some of which are identified in the section entitled, “Relationship of other Planning Efforts to this General Management Plan.” NPS individual partnering agreements would be addressed outside this general management planning process, and are not considered individual planning issues.
- *Help train and develop a management team within the Virgin Island Government, at the East End Marine Park.* The staff from Buck Island Reef National Monument were involved in the planning stages of East End Marine Park as described in the section, “Relationship of other Planning Efforts to this General Management Plan.” This cooperative effort would continue into the future as staff resources allow; however, specifics regarding training and development of a management team are outside the scope of this *General Management Plan*.
- *Relocation of fish attraction devices.* Several individuals who commented requested the relocation of fish attraction devices since they are located within park boundaries and fishing is now prohibited. The park worked with other agency officials regarding the relocation of these devices and subsequent to receiving these comments, all fish attraction devices have been removed.
- *Lighting of park’s boundary buoys.* Comments were received regarding the need to light the park’s boundary buoys. The U.S. Coast Guard is coordinating with the territorial Division of Fish and Wildlife to address this concern, as these buoys are for informational purposes and are not required to be lighted.

Impact Topics

Discussions during the early planning phases of preparation of this *General Management Plan / Environmental Impact Statement* identified the range of potential natural and cultural resources and elements of the human environment that might be of concern or might be affected by implementation of this *General Management Plan*. This review led to the selection of impact topics to be analyzed. The impact topics that were retained and dismissed, along with rationales, are presented in the following paragraphs. Relevant laws, regulations, and policies for each impact topic retained are described in Appendix B: Service-wide Mandates and Policies Pertaining to Buck Island Reef National Monument, and are summarized in Table 1 of this *General Management Plan*. The impact topics are described in accordance with Council on Environmental Quality guidelines for implementing the National Environmental Policy Act and NPS management policies.

Global climate change is expected to affect the park in several ways, and not all the effects are well understood. The range of effects include sea level rise, changes in sea water temperature, acidification, frequency and intensity of storms. The inter-relationship of all of these factors is also thought to be important, and is also poorly understood at the present time. An overview of climate change and related effects is provided in Appendix D. Some of the ways that climate change is expected to affect the park are summarized by impact topic.

Impact Topics Retained for Analysis

Impact topics retained for analysis are listed below:

Natural Resources

- Soils / Sand
- Water Resources
- Vegetation

- Wildlife
- Marine and Coastal Resources
 - o Coral Reefs and Other Marine Communities
 - o Shallow Water Coral Reef Communities
 - o Seagrass Communities and Algal Plains
 - o Sand Bottom Communities
 - o Deep Reefs and Wall Reefs
 - o Deep Water Abyssal Bottom Community
 - o Deep Water Oceanic/Pelagic Community
- Fish/Aquatic Life
 - o Fish
 - o Essential Fish Habitat
 - o Other Marine Animals
- Species of Concern
- Cultural Resources
- Soundscapes
- Scenic Resources
- Visitor Use and Experience
- Park Operations and Facilities
- Public Health and Safety
- Sustainability and Long-Term Management

Impact Topics Considered but Dismissed from Further Evaluation

Some impact topics commonly considered during the planning process were not relevant to the development of this *General Management Plan* because: (a) implementing the alternatives would have no effect or a negligible effect on the topic or resource, or (b) the resource does not exist in the Buck Island Reef National Monument. The impact topics considered and dismissed from further evaluation are listed below with a brief rationale for each topic.

Air Quality. Under each proposed management alternative for Buck Island Reef National Monument, visitor use and administrative operations would generate similar levels of air pollutant emissions from vessels and potential incidental use of motorized equipment. The NPS would follow established policy requiring the use of energy-efficient and environmentally friendly products and processes whenever possible. Although public visitation and vessel use are expected to increase during the next 20 years, levels of vehicle and vessel exhaust are not expected to dramatically increase or significantly contribute to regional air pollutant loads. This is due, in part, to the use of more efficient motorized vessels and mechanical tools. NPS will use sustainable practices wherever feasible. None of the identified air pollutant sources would generate enough quantities to require a permit. The impacts of these emissions are deemed to be short-term, and negligible on the local environment and regional air quality for all alternatives. Local air quality conditions would be expected to continue to be affected by African dust and sources from St. Croix. The management actions the park would take in terms of this *General Management Plan* would not affect these conditions. For these reasons, air quality is excluded from further analysis.

Geologic Resources. The geology of the monument would not be affected by any of the proposed management alternatives, and has not been included as an impact topic. There would be no geologic

hazards caused by any of the alternatives. None of the actions analyzed in this *General Management Plan* would affect geologic natural processes. There are no caves and/or karst environments present. The topic of soil has been retained as a separate impact topic due to concerns related to potential soil erosion associated with trail construction and use.

Coastal Processes. Coastal processes would not be affected by any of the proposed management alternatives, and has not been included as an impact topic. There would be alteration of the coastal environment related to storms, hurricanes, other natural events, and climate change. Although NPS management policies do allow for modifications to coastal dynamics in the event that coastal erosion and storm events have detrimental effects on park resources, this is not a practice that has been used at Buck Island Reef National Monument. Resource impacts may occur as a result of placement of anchors or moorings, and are discussed under the marine and coastal resources impact topic, as well as impacts related to sand communities and seagrasses; however, coastal processes would not be affected by management actions.

As climate changes occur over the coming decades, globally averaged sea level may rise between 0.19 and 0.58 meters (7.5 inches and 1.9 feet) by the year 2100 (Meehl et al. 2007). The park will allow natural processes to continue to occur. Management actions will not affect coastal processes. The effects of climate change are addressed by impact topic. In addition, an overview describing climate change is provided in Appendix D.

Prime and Unique Farmlands. The Council on Environmental Quality's 1980 memorandum on prime and unique farmlands states that prime farmlands have the best combination of physical and chemical characteristics for producing food, feed, forage, fiber, and oilseed crops. Unique agricultural land is land other than prime farmland used for production of specific high-value food and fiber crops. Both categories require that the land be available for farming uses. Lands within Buck Island Reef National Monument are not available for farming uses, nor do they meet these definitions. This impact topic was dismissed from further consideration.

Paleontological Resources are not known to occur within the park, and therefore this impact topic was not considered further.

Water Quantity or Flow was dismissed as an impact topic as none of the management alternatives would affect water quantity or flow. In addition, water rights and concerns are not an issue as water is not provided within the monument, nor would any management alternative affect water rights issues.

Wetlands in the national park system units are protected and managed in accordance with Executive order 11990, Wetland Protection, and NPS Director's Order 77-1 and NPS Management Policies 2006 (NPS 2006a). This guidance requires the NPS to protect and enhance natural wetland values and requires the examination of impacts on wetlands. It is NPS policy to avoid affecting wetlands and to minimize impacts when they are unavoidable. Under all alternatives in this plan, activities and facilities would be sited to avoid any impacts to the salt pond at Buck Island Reef National Monument. No developments or other management actions in the alternatives would be proposed in areas known to contain wetlands. Therefore, this topic will not be analyzed further.

Floodplains would continue to be affected by natural conditions such as storm surges and flooding; however, park management actions would not affect floodplain values, nor are any Federal Emergency Management Agency floodplains identified within the monument.

Exotic Species are assessed through a separate NPS management plan, the *Exotic Plant Management Plan/Environmental Impact Statement*. Management actions would not affect the treatment of these species; the *General Management Plan* is consistent with the *Exotic Plant Management Plan*. Treatment of exotic species would also be addressed under the Resource Stewardship Strategy. Therefore, this topic was not further assessed.

Lightscares, which are the natural resources and values that exist in the absence of human-caused light, are affected by those that moor overnight within the park boundary. Lights from vessels mooring overnight within the park boundary are not unusual, and are considered part of the landscape and are expected. The local St. Croix boating community would not find these sights to be adverse. These effects are considered short-term and negligible and would not be considered to adversely interfere with the ambient light, or night sky. The presence of large or super cruise ships on the horizon will be addressed in the Vessel Management Plan.

Wilderness is not designated with Buck Island Reef National Monument, and is therefore not included as an impact topic.

Wild and Scenic Rivers are not designated within Buck Island Reef National Monument, and is therefore not included as an impact topic.

Other Unique Landforms, Ecologically Critical Areas, National Natural Landmarks were dismissed from further consideration. Aside from designated Essential Fish Habitat which is addressed in the Fish / Aquatic Life section of Chapter 3 and Chapter 4, the alternatives being considered would not affect any designated ecologically critical areas, wild and scenic rivers, or other unique natural resources, as referenced in the Wild and Scenic Rivers Act, *Management Policies 2006*, 40 *Code of Federal Regulations* 1508.27, or the 62 criteria for national natural landmarks.

Historic Structures or Buildings. In terms of cultural resources, there are no extant historic structures or buildings on Buck Island. The island's structural ruins are included as part of the discussion of archeological resources. Therefore, the impact topic of historic structures and buildings will be dismissed from further analysis.

Cultural Landscapes have not been inventoried or evaluated within Buck Island Reef National Monument, and no such landscapes have been identified within the park. A cultural landscape by definition occupies a geographic area that incorporates natural and cultural elements associated with a historic activity, event, or person, and cultural landscapes typically include patterns of settlement or land use, systems of circulation and transportation, buildings and structures, open space, etc. As noted above, no historic structures are located on Buck Island. Buck Island was used as a strategic signaling station for defense and transportation purposes. The island was also used by prehistoric peoples from St. Croix for fishing, gathering turtles and eggs, birds, and other resources.

Early in its history, the island was stripped of its *lignum vitae* and other valuable timber, and by 1948 goat grazing had reduced the island to a more tropical dry forest / desert scrub-like appearance. Several old tamarind trees (thought to be over 250 years old) can possibly be "attributed to the period Johan Deidrich owned the island (1754) or perhaps earlier, such as during the French occupation of St. Croix when Buck Island was known as *Isle Verte*" (NPS 2004b). After grazing was discontinued in the 1950s, some natural vegetation began to recover but non-native plants and animals proliferated. The types and proportions of plants present today reflect continuing management efforts by the NPS to control invasive, exotic plants and restore historic vegetation such as *lignum vitae*.

A cultural landscape study/inventory is recommended to document the use of Buck Island over time, and is included in the "Relationship of Other Planning Efforts to this General Management Plan" section of this chapter. The activities proposed under any of the management alternatives would not significantly alter the landscape of Buck Island. Current activities, including terrestrial trail and recreational beach use, would be expected to continue into the future. No activities are planned that would adversely affect the cultural landscape as understood to date. For these reasons "Cultural Landscapes" has been dismissed as an impact topic in this *General Management Plan*.

Ethnographic Resources. Ethnography is concerned with peoples whose life ways are traditionally associated with resources under NPS stewardship. Some contemporary groups and communities are permitted by law, regulation, or policy to pursue customary religious, subsistence, or other cultural

uses of park resources with which they are traditionally associated (NPS 1997). This association should have endured for at least two generations. As described above under the topic of Cultural Landscapes, traditional associations of Caribbean peoples to Buck Island are, at best, tenuous. For example, most of the archeological sites on the island are associated with Euroamerican ownership; one site dates to prehistoric times. Buck Island was unoccupied for most of the last 300 years, and was used primarily for fishing, wood cutting, and raising livestock. Wood cutting and livestock raising ended more than 40 years ago, and by law, fishing is no longer allowed within the park boundaries. The NPS continues to work with interested groups to help ensure any ethnographic resource concerns are identified. The topic of ethnographic resources will not be further evaluated.

Indian Trust Resources / Sacred Sites have not been identified within the boundary of the park. The Federal Indian Trust responsibility is a legally enforceable fiduciary obligation on the part of the United States to protect tribal lands, assets, resources, and treaty rights. There are no living populations of American Indians in the Virgin Islands, nor are there federally recognized Native American nations in the Virgin Islands. This impact topic was eliminated from further consideration.

Museum collections would be addressed in a similar fashion under any of the alternatives. All alternatives would identify the need to continue and improve protection of the museum collection in an environment that protects them from degradation, maintains their regional context and research value, and provides access for scholars, a long-term, minor benefit to collections. Any activity that would require Section 106 compliance would likely result in some collections. Collections are currently housed at Christiansted National Historic Site, St. Croix, or the Southeast Archeological Center, Tallahassee, Florida. Natural history specimens are also stored at other NPS repositories. Museum collections would continue to be managed in a similar manner under all alternatives, and since few actions disturbing existing conditions are proposed, impacts are assumed to be negligible to minor across alternatives. Therefore, museum collections is dismissed as an impact topic.

The **Socioeconomic Environment / Land Use**, in terms of induced changes in land use outside the park boundary, would not be affected by any of the management alternatives, nor would there be effects to adjacent landowners or nonfederal property owners. There are no inholdings, or nonfederal property owners within the park boundary. The management alternatives would not affect land use plans, policies, or controls on St. Croix or the marine environment. The management alternatives would not conflict with the East End Marine Park or territorial plans. Therefore, land use, adjacent landowners, nonfederal property owners, and conflicts with other plans are impact topics that are eliminated from further consideration.

The management alternatives would not affect the **population density and growth** of St. Croix or the Virgin Islands; therefore, this impact topic was eliminated from further consideration. Nor would there be effects to community services or public services and utilities since there are no services to Buck Island and the park. There would be no more than 9 new employees proposed under any of the alternatives and, therefore, effects to **local employment** would be negligible. This impact topic was not further assessed.

Concession services are addressed under several different impact topics, including visitor use and park operations.

Environmental justice as defined by Executive Order 12898, requires all federal agencies to incorporate environmental justice into their missions by identifying and addressing disproportionately high and adverse human health or environmental effects of their programs and policies on minorities and low-income populations and communities.

For the purpose of fulfilling Executive Order 12898, in the context of the National Environmental Policy Act, the alternatives addressed in this plan were assessed during the planning process. It was determined that none of these alternatives would result in disproportionately high direct or indirect

adverse effects on any minority or low-income populations or community. The following information contributed to this conclusion:

- The developments and actions in the alternatives would not result in any identifiable human health effects. Therefore, there would be no direct or indirect effects on human health within any minority or low-income populations or community.
- The impacts on the natural and physical environment that would occur due to any of the alternatives would not disproportionately adversely affect any minority or low-income populations or community, or be specific to such populations or communities.

Impacts on the socioeconomic environment due to the implementation of actions proposed in the alternatives would be negligible and such impacts would not be expected to substantially alter the physical and social structure of nearby communities in St. Croix or the Virgin Islands. Therefore, this topic will not be analyzed further.

Transportation. There is no vehicular transportation or sidewalks on Buck Island. Therefore, transportation issues addressed are in the context of access. Currently all access to the monument is provided by either private vessel or vessels operated by authorized concessions. During 2005, the highest monthly visitation at the monument was 6,000 visitors during the month of March. Therefore, the average visitation during the peak month would be approximately 200 visitors per day. If additional vessels are required to accommodate additional passengers in the future, it is assumed that the concessions would increase their fleets to meet these demands, providing that National Environmental Policy Act compliance has been undertaken to address user capacity. Concession operations related to visitor access are addressed under visitor use and access subsections of Chapters 3 and 4. Impacts would be considered long-term, negligible to minor and adverse and, therefore, this topic was dismissed from further analysis.

Energy Efficiency and Conservation Potential. Implementation of any of the action alternatives would result in similar amounts of fuels and energy being used. Under any alternative, the NPS would continue to implement its policies of reducing costs, eliminating waste, and conserving resources by using energy-efficient and cost-effective technology (NPS 2000a; 2006). The NPS would continue to look for energy-saving opportunities in all aspects of park operations. Because the NPS would promote energy efficiency in an equal manner under any alternative, this impact topic was dismissed from further consideration.

Natural or Depletable Resource Conservation Potential. There would be no discernable differences in natural or depletable resource conservation among the alternatives considered. Limited construction activities would involve installation of moorings, kiosks or trails, and allowance for anchoring. However, these effects are addressed in Chapter 4: Environmental Consequences. This impact topic was dismissed from further consideration.

Quality of the Built Environment. Limited construction (kiosks, trail work) would occur under any of the alternatives and would be built in harmony with the natural surroundings. These actions would cause negligible effects to the built environment, as the park currently has very limited development. Therefore, the quality of the built environment was dismissed from further analysis.

Public Services and Utilities. The management alternatives do not alter the services or location of the existing signal station on Buck Island. There are no other public services or utilities within the monument. This impact topic was dismissed from further consideration.

RELATIONSHIP OF OTHER PLANNING EFFORTS TO THIS GENERAL MANAGEMENT PLAN

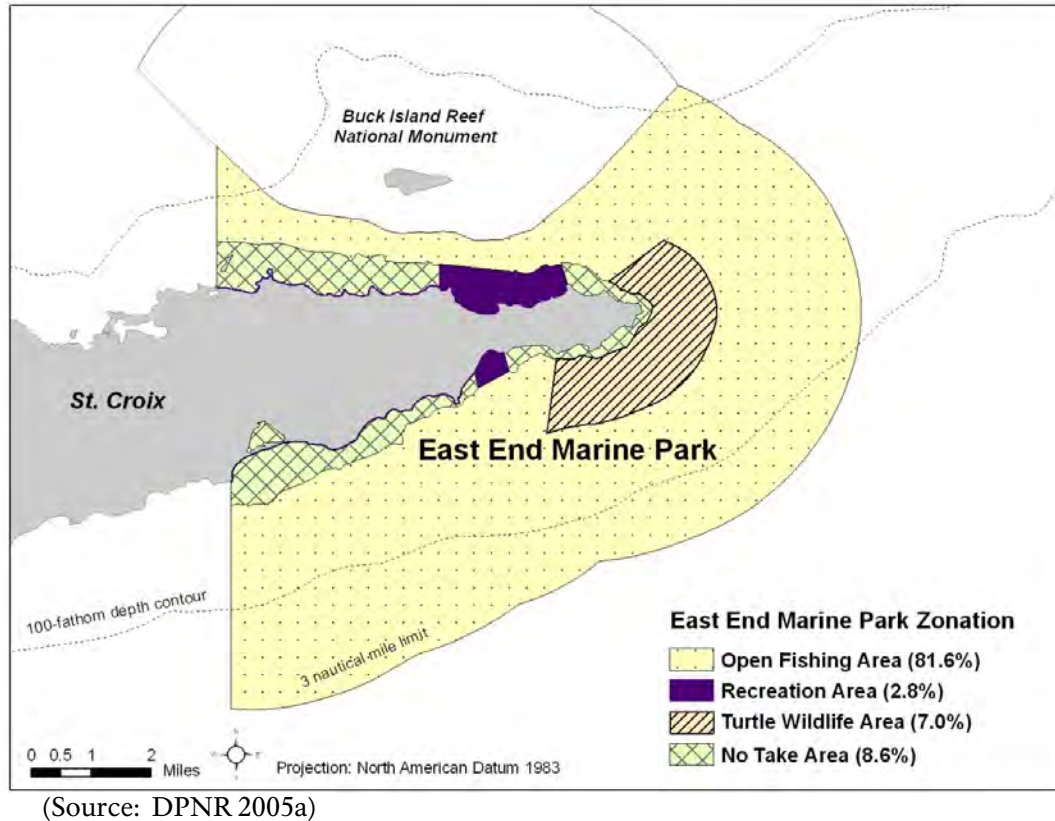
Many projects and plans that the NPS and other organizations have in place, are in progress, or planned for the near future, may affect the management direction and resulting actions proposed in this *General Management Plan*. As part of the analysis and consideration of potential impacts, the planning team identified the following relevant planning efforts. The list is not comprehensive, but provides an overview to show the connection between this General Management Plan and other planning and research entities.

- **Museum Collections Management Plan:** The NPS prepared a Museum Collections in 2004 for Buck Island Reef National Monument, Christiansted National Historic Site, and Salt River Bay National Historic Park and Ecological Preserve that addresses collections for the park in a comprehensive manner. The Regional and Servicewide Museum Collections Storage Plans (2007) and the park Museum Collection Plan (2004) guide management efforts for collections in the park. Actions proposed in this General Management Plan are consistent with these museum collections and storage plans.
- Buck Island Reef National Monument is responsive to the initiatives of the United States Coral Reef Task Force, an interagency body that works to develop and implement comprehensive, multi-disciplinary, and coordinated approaches to preserve and protect U.S. coral reef ecosystems, and encourage sound coral reef conservation practices globally. The Task Force is authorized under Executive Order 13089 (63 Federal Register 32701). The Task Force functions as a clearinghouse and coordinating mechanism for federal, State, and territorial agencies involved in coral reef ecosystem protection and management efforts. It also advises members concerning the impact of their actions and programs upon coral reefs, and encourages cooperation and partnerships to conserve coral reef ecosystems worldwide. Buck Island Reef National Monument's efforts related to the Task Force include coral reef mapping, monitoring, research, conservation, mitigation, restoration, training and education and outreach opportunities, and cooperation with other partners.
- The NPS cooperated with partners to implement the Ocean Park Stewardship 2006 to 2008 Action Plan. The strategy seeks to establish a seamless system of ocean parks, sanctuaries, refuges and reserves; discover, map and protect ocean parks; engage visitors in ocean park stewardship; and increase NPS technical capacity for ocean exploration and stewardship. The NPS is collaborating with the U.S. Geological Survey and the National Oceanic and Atmospheric Administration, universities, and others. The NPS will be working with these other partners under existing funding levels to implement this Action Plan. Action items pertaining to the park that have been prioritized for implementation include the following:
 - o Execute a memorandum of understanding among the NPS, National Oceanic and Atmospheric Administration Sanctuaries, the National Estuarine Research Reserves System, and the U.S. Fish and Wildlife Service Refuge System.
 - o Implement a cooperative law enforcement agreement with National Oceanic and Atmospheric Administration National Marine Sanctuaries Program.
 - o Enter and maintain current park data in the national marine managed area inventory in cooperation with the joint Department of the Interior and National Oceanic and Atmospheric Administration Marine Protected Area Center.
 - o Complete benthic habitat maps for ocean parks in cooperation with partners.
 - o Assess conditions of 52 coastal park watersheds and water resources.
 - o Enhance compliance with new marine reserves by providing education and outreach programs at Buck Island Reef National Monument and other marine reserves.

- o Initiate cooperative studies to evaluate performance of marine reserves.
- o Ensure vital signs monitoring includes marine and estuarine resources.
- o Work with partners to get digital boundaries of ocean parks on charts and maps.
- o Engage visitors in ocean park stewardship by developing interpretive and educational materials on ocean parks for educators and other organizations.
- o Create a communication strategy to better inform the public about ocean parks.
- o Combine efforts with other agencies to reinvigorate the NPS Dive Program.
- o Develop a “Restore and Protect Ocean Park Resources Initiative.”
- o Describe and analyze ocean park jurisdictions, boundaries, authorities, and remedies.
- The park continues to conduct long-term monitoring as part of the NPS’s Inventory & Monitoring Program for Coral Reef Habitat and associated marine ecosystem. The monument, in conjunction with South Florida/Caribbean Inventory and Monitoring Program Network, conducted computer analysis of Aquamap coral reef monitoring data. Additional details regarding monitoring programs are provided in Chapter 3.
- The park coordinates with multiple universities for research, inventory, and monitoring programs, with an average of five to fifteen visiting researchers per year. For example, in 2003 park staff assisted with several projects, logistics, and support of research activities, including a University of Maine coral recruitment study, University of Central Florida Mus Population Study, and Acadia University/Government of the Virgin Islands Department of Planning and Natural Resources Division of Fish and Wildlife Reintroduction of St. Croix Ground Lizard Assessment.
- The park conducts bi-annual reef fish census in the park’s three major marine habitats (reef, sand, and seagrass) with their partner National Oceanic and Atmospheric Agency’s Biogeography Program. Over a two-week period, 120 sites are surveyed by divers using a visual/belt transect method to count reef fishes and collecting data on the habitat. These data are critical in establishing a baseline inventory and species status to monitor the effectiveness of the expanded park’s new regulations prohibiting all extractive uses, including fishing activities.
- The park continues post-eradication monitoring for the exotic tree rat and mouse populations. Bi-annual monitoring is conducted to ensure there has been no accidental reintroduction of rats. Continued cooperative volunteer efforts are encouraged in this *General Management Plan*.
- The park coordinates with other agencies to control non-native invasive species on land and in water, including the control of lion fish.
- The park continues to work with the St. Croix Marine Animal Stranding Network in cooperation with U.S. Fish and Wildlife Service, the Nature Conservancy, and Territorial Division of Fish & Wildlife.
- Buck Island Reef National Monument Sea Turtle Research Program is a research and monitoring program that conducts year round documentation of sea turtle nesting on monument beaches and beach forest habitat. During peak nesting season, July – October, park science staff and volunteer research assistants conduct a saturation tagging program for four species of sea turtles (leatherback, hawksbill, green, and most recently, loggerhead). This program includes such efforts as tracking long-term nesting female turtle reproductive history, nesting success, conducting threatened nest relocation, monitoring interactions with critical nesting habitat, post-storm erosion events, effect of temperature on hatchling sex ratio and hatch / emergence success, and a variety of research experiments, including radio and satellite

tracking of nesting females post-reproductive migrations, foraging habitats, growth rates, and genetics.

- The NPS and the Joint Institute for Caribbean Marine Studies are developing plans for a proposed Marine Research and Education Center at Salt River Bay National Historical Park and Ecological Preserve, St. Croix, Virgin Islands. The Center would promote the preservation and research of the sensitive and unique resources contained within Salt River Bay National Historical Park, which include coral reefs, over 400 species of reef fish, mangrove forests, and numerous prehistoric and colonial-era archeological sites and ruins. The Center would include multiple educational and research facilities, including classrooms, teaching labs, conference rooms, a library, an education center, dormitories, staff housing, a wet laboratory, and a marine operations facilities. Buck Island Reef National Monument is a prime research and education site for the NPS Salt River Marine Research and Education Center's consortium of universities.
- The Youth Conservation Corps Program introduces students and leaders to research, stewardship, education, and work activities within the park. Efforts of volunteers in the park are consistent with continued partnering and outreach efforts described in the General Management Plan.
- The park continues monitoring brown pelican and least tern seasonal nesting in cooperation with the Virgin Island Government Division of Fish and Wildlife and the U.S. Fish and Wildlife Service to conduct regular monitoring of least tern nesting on Buck Island and provide public outreach and education for visitors.
- Under Virgin Islands Code Annotated Title 12, Section 903-906, the Virgin Islands Coastal Zone Management Commission is responsible for the Coastal Zone Program and required to submit plans for review. The Division of Coastal Zone Management was reportedly revisiting the concept of a Territorial Park System and developed a "Management Framework for the Marine Protected Areas of the United States Virgin Islands." The St. Croix East End Marine Park (hereafter referred to as the East End Marine Park), a marine protected area, was established in 2003 and is managed by the Virgin Islands Department of Planning and Natural Resources under this program. The boundary of East End Marine Park, located at the East End of St. Croix in the U.S. Virgin Islands, extends out to the 3-nautical mile territorial boundary; Buck Island Reef National Monument abuts the boundary of the East End Marine Park (Figure 3). The NPS was involved in many planning workshops during establishment of the East End Marine Park, and continues its cooperation for the protection of resources in the marine park. The management actions proposed in the *General Management Plan* do not conflict with the goals and objectives of the East End Marine Park Management Plan.
- The U.S. Virgin Islands Department of Planning and Natural Resources established a Non-Point Source Program that administers grants and sets policies to mitigate non-point source pollution. The Program is supported by the Non-Point Source Pollution steering committee, a diverse group of individuals from the public and private sectors. The Program funds such initiatives as the Environmental Protection Handbook (Wright 2002), which serves as a guide for best management practices that should be used for all new construction. In addition, the Division of Environmental Protection added an Environmental Education and Outreach Program that has been involved in numerous outreach projects, including: used oil drives, elementary and high school presentations, environmental public service announcements, and the Non-Point Source Conference.

Figure 3. Map Depicting East End Marine Park and Buck Island Reef National Monument

THE NEXT STEPS

Following distribution of the *Draft General Management Plan / Environmental Impact Statement*, there will be a 60-day public review and comment period after which the NPS planning team will evaluate comments from other federal agencies, organizations, businesses, and individuals regarding the draft plan and incorporate appropriate changes into a *Final General Management Plan / Environmental Impact Statement*. The final plan will include letters from governmental agencies, any substantive comments on the draft document, and NPS responses to those comments. Following distribution of the *Final General Management Plan / Environmental Impact Statement* and a 30-day no-action period, a record of decision approving a final plan will be signed by the southeast NPS regional director. The record of decision will document the NPS selection of an alternative for implementation. With the signing of the record of decision, the plan can then be implemented.

IMPLEMENTATION OF THE PLAN

Implementation of the plan will largely depend on future funding. Approval of the plan does not guarantee that the funding and staffing needed to implement the plan will be forthcoming. Full implementation of the plan could extend many years into the future.

Implementation of the plan also could be affected by other factors. Once the plan has been approved, additional feasibility studies and more detailed planning and environmental documentation would be completed, as appropriate, before any proposed actions could be carried out. In addition, other agency consultation and coordination would occur. For example:

- Appropriate permits would be obtained before implementing actions (such as installation of moorings) that would affect resources or navigation;

- Appropriate federal and territorial agencies would be consulted concerning actions that could affect threatened and endangered species; and
- The territorial historic preservation office would be consulted concerning actions that could affect cultural resources.

These more detailed actions would tier from the *General Management Plan* and would describe specific actions managers intend to take to achieve desired conditions and long-term goals. Some of the future NPS planning efforts are described in the section that follows.

Future National Park Service Planning Efforts

Cultural Landscape Study/Inventory: This inventory is recommended to document the use of Buck Island over time. There are historic ruins on Buck Island that are the remains of a signal station and the signal keeper's residence. The signal station was a part of the 18th – 19th century transportation and defense system used for signaling to the fort in Christiansted of approaching ships and warning those ships of coral reefs. The report would also chronicle the use of Buck Island by prehistoric peoples that came from St. Croix over to Buck Island most likely to fish, gather turtles and eggs, and gather other food.

Vessel Management Plan: A Vessel Management Plan will be developed to provide details regarding the use of vessels within park waters and will be compatible with the *General Management Plan*. The Vessel Management Plan will include details on the use of moorings, navigational aids, any vessel limitations, and general guiding management strategies for vessels and their use in park waters. An environmental assessment would be prepared in conjunction with the Vessel Management Plan and there would be opportunity for public input.

Commercial Services Plan: Commercial visitor services planning will identify the appropriate role of commercial operations in the park. This level of planning will assist the park to achieve the desired visitor experiences identified in the *General Management Plan*, and integrate the results into other plans and planning processes. The concession management plan or commercial services plan will support the park's purpose and significance, resource values, and visitor experience objectives and be consistent with the park's legislation. The commercial services plan and other implementation plans will also identify whether proposed concession facilities and services are necessary and appropriate, and will consider alternatives.

Management / Recovery Plans for Threatened and Endangered Species: Recovery plans for threatened and/or endangered species, for example, elkhorn coral and staghorn coral, would be developed in coordination with other federal and territory agencies. The plans would comply with the Endangered Species Act. Actions identified in this *General Management Plan* are consistent with the Recovery Plan for the St. Croix Ground Lizard developed in 1983, and the Hawksbill Recovery Plan of 1993.

Resource Stewardship Strategy: Protection, research, and management of the park's natural resources and processes are essential for achieving the park's purpose and mission. A park-wide Resource Stewardship Strategy would address these issues and other scientific and legal requirements to promote understanding and management of park resources. This planning document would provide details on the strategies and actions necessary to address the park's most important resource management problems and research needs. Integral to this strategy would be the need to research the status of sensitive species in the park, including corals and the effects of coral bleaching. The Resource Stewardship Strategy would integrate the best available science and prescribe activities including inventories, research, monitoring, restoration, mitigation, protection, education and management of resource uses.

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Chapter 2

ALTERNATIVES



Photograph Courtesy of: Zandy Hillis-Starr

Snorkelers at the Underwater Trail, Buck Island Reef National Monument

Buck Island Reef National Monument
Draft General Management Plan/
Environmental Impact Statement

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CHAPTER 2 ALTERNATIVES

Many aspects of the desired future conditions of Buck Island Reef National Monument are defined in the park's legislation, purpose, and significance statements, and service-wide mandates and policies (as described in Chapter 1). Within these parameters, the NPS solicited input from the public, park staff, federal, territory, and local government officials, and other organizations regarding the future long-term management and use of Buck Island Reef National Monument. Among other things, the planning team gathered information about existing visitor use tendencies, resource conditions, and facilities within the park, to help guide the decisions and recommendations presented in this plan.

The planning team developed five management zones and four management alternatives--three action alternatives and a no action alternative--to reflect the range of ideas and issues identified by park and NPS staff, interested parties, and the public. This chapter presents the management zones, management alternatives, user capacity, comparative cost analysis, mitigation measures common to all alternatives, the environmentally preferred alternative and a summary of environmental impacts of implementing the alternatives.

MANAGEMENT ZONES

Management zones prescribe how different areas of the monument would be managed and give an indication of the management priorities for various areas. The five management zones describe a range of desired future conditions for resources, visitor experiences, and types and levels of facility development. The management zones identify the widest range of potential future resource conditions, visitor experiences, and facilities for Buck Island Reef National Monument that fall within the scope of the park's legislation, purpose, significance, and special mandates and policies. In every management zone, the monument intends to preserve and protect natural and cultural resources to the greatest extent possible given available funds.

Management zones were applied in different configurations within the park's boundary, to create the three action alternatives. Appropriate types of visitor use and activities, and types and levels of development were identified for each management zone. These are summarized by zone in Table 2. The management zone prescriptions emphasize desired future resource conditions, visitor experiences, kinds, and levels of development, and similar management approaches for each zone. The five management zones are *Resource Protection Zone*, *Anchoring Zone*, *Island Discovery Zone*, *Recreation Zone*, and *Marine Hazard Zone*. These zones are described in detail in the sections that follow.

RESOURCE PROTECTION ZONE

The Resource Protection Zone represents an area that focuses on resource preservation, protection, and scientific research. This zone would allow protection of reefs ranging from shallow (north lagoon) to deep reefs, seagrass beds, shelf edge communities, and oceanic habitats. Extractive uses would be prohibited in this zone pursuant to the 2001 proclamation that prohibits extractive uses throughout the park. Vessel operators would be permitted to navigate within this zone. Moorings would be provided in designated areas near Buck Island, and up to five new designated anchor locations would be designated in deep sand for vessels from 91-150 feet. The Resource Protection Zone includes the majority of the park's marine environment.

Table 2. Management Zones and Prescriptions

Category	Resource Protection Zone	Anchoring Zone	Island Discovery Zone	Recreation Zone	Marine Hazard Zone
Visitor Use					
Boating	✓	✓		42 feet (or less) in the lagoon; up to 150 feet outside the lagoon.	NONE
Private vessels up to 150 feet in length	✓	AT DESIGNATED LOCATIONS		AT DESIGNATED LOCATIONS	
Moorings	AT DESIGNATED LOCATIONS			AT DESIGNATED LOCATIONS	
Overnight Use of Moorings by permit	✓			✓	
Day Hiking on Trail			✓	✓	
Guided Interpretive Tours	✓		✓	✓	
Picnicking (fires in NPS grills only)				✓	
Nature Observation	✓	✓	✓	✓	
Sunbathing	✓	✓	✓	✓	
Swimming	✓	✓		✓	✓
SCUBA Diving (Concession and Private)				AT SCUBA MOORINGS	
Snorkeling (Concession and Private)	✓	✓		✓	
Pets	ON BOARD VESSELS ONLY				
No Wake Zone		✓		✓	

Table 2. Management Prescriptions and Zones (Continued)

Category	Resource Protection Zone	Anchoring Zone	Island Discovery Zone	Recreation Zone	Marine Hazard Zone
Habitat Restoration	✓	✓	✓	✓	✓
Scientific Research	✓	✓	✓	✓	✓
Special use permits for large groups and special events	✓	✓	✓	✓	
National Park Service administrative use	✓	✓	✓	✓	✓
Kinds and Levels of Development					
Trails (including underwater trail)			✓	✓	
Picnic areas				✓	
Beach Access Channel	✓	✓		✓	
Anchoring by permit	AT DESIGNATED LOCATIONS	✓			
Restrooms				✓	
Kiosks			✓	✓	

- Activities prohibited or not considered appropriate include: open beach fires, collecting, camping, jet skis, water skiing, kite surfing, boogie boarding or parasailing, or motorized vehicles on Buck Island.
- Swimming is prohibited in the beach access channel for safety reasons.
- No waste receptacles are provided at Buck Island. Visitors are requested to "pack in - pack out" all refuse.
- Vessels over 151 feet in park waters by permit only.

Visitor Experience

The Resource Protection Zone would provide ample opportunities for visitors to experience solitude, tranquility, and closeness to nature. The level of encounters with other visitors and park staff would range from low in most areas of the zone to moderate in areas surrounding Buck Island. Visitors would have opportunities for a highly diverse experience in this zone. The level of challenge for some visitors could be high due to the skills necessary to safely operate a vessel.

Resource Conditions

Resource protection, habitat restoration, scientific research, and monitoring are the key elements of the Resource Protection Zone. This zone would provide improved habitat diversity through the protection of sensitive environments needed to support species, including listed elkhorn coral, staghorn coral, sea turtles, brown pelicans, migratory least terns, and numerous species of fish. A moderate level of resource and visitor management would be required to protect resources, and there would be low tolerance for resource degradation.

Appropriate Kinds of Activities or Facilities

Appropriate kinds of visitor activities in the Resource Protection Zone would include nature observation, guided interpretive tours, and boating (for vessels up to 150 feet long; vessels 151 feet and over would be required to have a permit to operate within the park boundary). Establishment of beach access channels and installation and use of moorings would be appropriate in this zone. Limited anchoring by permit (for up to 5 vessels, 91 feet to 150 feet) would be appropriate in designated, deep sand. Pets would be allowed on vessels only. Overnight use of moorings would be appropriate at designated moorings, by permit. Research, monitoring, and resource restoration activities would be appropriate in this zone.

ANCHORING ZONE

The Anchoring Zone represents areas where boaters may anchor in designated deep sand areas with a permit. Anchoring would only be appropriate to the extent that it is consistent with the 2001 proclamation and implemented regulations. The sand and seagrass area to the south of West Beach has historically been used for small vessel anchoring (dinghies to 65 feet). This is a dynamic area with constantly shifting sands from wave action and storm events. As seagrass beds recover and grow, the areas where anchoring is appropriate could change. Consequently, management strategies might need to change to adapt to changing resource conditions. In addition, use of the Anchoring Zone could change to protect nesting species such as sea turtles, least terns, or migratory shorebirds, during nesting season. Notification of beach closures and general information regarding safe visitor use and resource protection would be addressed by several means, including boater education via the anchoring permit system, distribution of information from NPS facilities in Christiansted, public service announcements, public radio and television announcements, and routine postings. Should adverse effects from anchoring activities occur, permit requirements for anchoring could be changed to accommodate the protection of sensitive resources.

Visitor Experience

The Anchoring Zone would allow a relatively high level of visitor use. At certain times during the day or in different seasons, opportunities for solitude would be available to visitors; however, generally the likelihood of encountering other visitors would be moderate to high. The degree of isolation and feeling of closeness to nature would be relatively moderate, and would be limited by the presence of other people and vessels. The level of challenge for some visitors could be high, as the skill level expected to safely anchor a vessel would require training and experience. Visitors would have opportunities for a highly diverse experience in this zone, with a high level of facilitation by park staff.

Resource Conditions

The Anchoring Zone would require a high level of management and enforcement to protect resources and visitors because of the inherent potential impacts associated with anchoring. The sights and sounds of people would be clearly evident. Seagrass beds would be regularly monitored to avoid adverse impacts.

Appropriate Kinds of Activities or Facilities

A wide variety of activities would be allowed in the Anchoring Zone. Appropriate activities would include boating and anchoring by permit, swimming, snorkeling, sunbathing, and wildlife observation. Facilities in this zone would be kept to a minimum to support appropriate activities, and would include such things as regulatory markers and buoys, and beach access channels.

ISLAND DISCOVERY ZONE

The Island Discovery Zone represents areas that provide opportunities to hike on a trail, use picnic area with barbeque grills, experience the sights and sounds of nature, learn about the island's natural and cultural features, and enjoy surrounding views. This zone allows for educational opportunities through guided tours, exploration of the island via a hiking trail, and obtaining information at kiosks (i.e., a fixed sign structure with posted information provided). The concept of this zone is to allow a range of recreational and self-discovery activities in a relatively undisturbed natural environment.

Visitor Experience

The number of visitors in this zone would vary depending on location within the management zone, allowing a moderate degree of isolation. The opportunity for feeling close to nature and experiencing solitude would be expected to be high. Due to hazardous vegetation, the degree of trail difficulty, and warm temperatures, the level of challenge for visitors would generally be high and would require moderate to high degrees of outdoor recreation skills and self-sufficiency. Visitors would have opportunities to enjoy views of the island, seascape, and St. Croix and northern Virgin Islands in the distance from the observation point. The level of contact with NPS staff or other visitors would be low.

Resource Conditions

This zone would require a moderate to high level of management to protect resources due to the presence of cultural resources, sensitive species, hazardous vegetation, and the steep slopes found on Buck Island. Some natural areas could be modified for new or improved trails and for other uses, but the overall setting would maintain existing natural conditions. There would be low tolerance for natural resource degradation, and resources would be managed to maintain natural conditions. Any trails or other facilities would be designed to harmonize with the natural environment.

Appropriate Kinds of Activities or Facilities

Appropriate visitor experiences in this zone would include nature observation, trail hiking, guided interpretive tours, vista viewing/overlook, and photography. Park facilities currently located on Buck Island would be maintained. Development of interpretive/informational kiosks and trails would be appropriate in this zone.

RECREATION ZONE

The Recreation Zone represents beach, near-shore, and off-shore areas surrounding Buck Island that offer a variety of recreational opportunities, including swimming, snorkeling, SCUBA diving at the two SCUBA moorings, vessel mooring, beach walking, picnicking, and use of picnic tables, shelter, and NPS provided barbeque grills. This zone would consist of beach and marine landscapes on the northwestern, southern, and eastern portions of Buck Island. The Recreation Zone include the north

west shoreline, West Beach to the Pier, and beyond along south shore to Turtle Bay, south lagoon inside the barrier reef, the underwater trail off the islands' eastern tip and mooring area, and two SCUBA moorings. Across all action alternatives, the Recreation Zone borders, but does not include, the barrier reef. Excluding the reef from the Recreation Zone is necessary to protect the threatened species--elkhorn and staghorn coral--from potential harm during recreational activities.

To protect sensitive species such as corals, seagrasses, nesting sea turtles, and migratory shorebirds (least terns), management actions may be necessary to adapt to changing beach conditions, variations in species nesting seasons, visitor use patterns, or other conditions. This would be addressed by several means, including boater education via the anchoring permit system, distribution of information from NPS facilities in Christiansted, public service announcements, public radio and television announcements, and routine postings. Should adverse effects from recreational activities occur, management actions would need to be taken to protect sensitive resources.

Visitor Experience

The Recreation Zone would have a relatively high amount of visitor use. At certain times during the day or in different seasons, opportunities for solitude would be available to visitors; however, the probability of encountering other visitors would be moderate to high. The degree of isolation and feeling of closeness to nature would be relatively low, and would be mostly limited by the presence of other people. The level of challenge for visitors in this zone would be moderate to high, and would depend on the level and type of recreational activity. The diversity of experiences would be greater in this zone compared to other zones, with a moderate to high amount degree of ranger led walks, talks, and ranger presence.

Resource Conditions

The Recreation Zone would require a moderate to high level of management to protect resources because of the higher number of users. Some natural areas could be modified for new or improved trails and for other uses, but the overall setting would maintain existing natural conditions. There would be a low tolerance for resource degradation, and resources would be managed to maintain natural conditions and preserve cultural sites. Trails and other facilities would be designed to harmonize with the natural and cultural environment.

Appropriate Kinds of Activities or Facilities

A wide variety of activities would be allowed in the Recreation Zone, but with specific restrictions in place to protect resources and maintain safe conditions. For example, boating would be appropriate, but within the lagoon only shallow draft vessels up to 42 feet would be allowed. Vessel size is restricted by water depth, vessel draft, and maneuverability to avoid reef damage. Buck Island barrier and surrounding reef limits large vessel access and maneuverability; vessels with drafts greater than 4 feet should not attempt to navigate Buck Island near shore areas. Outside the lagoon, the maximum vessel size allowed would be up to 150 feet. Activities in the Recreation Zone would include swimming, SCUBA, snorkeling, sunbathing, picnicking, use of tables, shelter, grills, and wildlife observation. Facilities and development in this zone would be kept to a minimum to support appropriate activities and would include such things as toilets, information kiosks, picnic areas (tables, NPS grills, shelter), and hiking trails. Moorings would be appropriate at designated locations, including the underwater trail off the island's east end, West Beach, and southwest of the pier.

MARINE HAZARD ZONE

The Marine Hazard Zone represents marine areas where resources are sensitive, and vessel navigation is hazardous due to shallow reef complexes. For safety reasons and as a means to protect coral, non-NPS vessels would not be appropriate in this zone. NPS vessels would be appropriate for research and resource monitoring, administrative use, or for enforcement reasons. This zone mainly encompasses

the marine environment northwest to southeast of Buck Island, extending to the southeast park boundary, including the coral patch reefs (see alternatives figures). The Marine Hazard Zone would provide a similar level of resource protection as in the Resource Protection Zone.

Visitor Experience

Boater access would be prohibited in the Marine Hazard Zone, thereby limiting the type and variety of visitor experiences. Visitors would be able to swim within this zone, but other recreational activities would not be appropriate.

Resource Conditions

The Marine Hazard Zone allows for resource protection, habitat restoration, scientific research and monitoring. Moderate to high levels of resource management activities would be necessary to protect resources. There would be low tolerance for resource degradation in this zone.

Appropriate Kinds of Activities or Facilities

The types of appropriate visitor experiences in this zone would be limited due to the prohibition of vessel use. Research and monitoring, habitat monitoring and resource restoration activities would be appropriate. No visitor facilities or development would be appropriate in this zone.

FORMULATION OF THE ALTERNATIVES

This *Draft General Management Plan/Environmental Impact Statement* presents four alternatives for the future management of Buck Island Reef National Monument, including the NPS preferred alternative. Alternative A, the “no action” alternative, represents a continuation of existing management direction. Alternative A is included as a baseline for comparing the consequences of implementing each of the other alternatives. The NPS is required under the National Environmental Policy Act to include the no action alternative for comparison purposes. The other “action” alternatives are Alternative B, which is the Preferred Alternative, Alternative C, and Alternative D. The three action alternatives present different ways to manage resources and visitor use and improve facilities at the park within the context of Buck Island Reef National Monument’s legislation, purpose, significance, and special mandates and policies.

Management alternatives represent the full range of what could be reasonably accomplished with regard to natural resource conditions, cultural resource conditions, visitor use and experience, and facilities and development at Buck Island Reef National Monument over the next 15 to 20 years. To the degree possible, the alternatives incorporate and reflect the concerns, comments, and issues identified during the NPS internal, stakeholder, and public scoping process. Visual representations of each alternative were developed by overlaying the management zones in different configurations on a map of Buck Island Reef National Monument. The acreage for each management zone is summarized by alternative in Table 3.

Table 3. Acreages of Management Zones by Alternative

Zone	Alternative B (acres)	Alternative C (acres)	Alternative D (acres)
Resource Protection Zone	15,609	15,609	15,597
Anchoring Zone	None	2	16
Island Discovery Zone	166	166	166
Recreation Zone	112	110	108
Marine Hazard Zone	3,128	3,128	3,128

Note: zones do not apply to Alternative A. Existing anchoring area is approximately 22 acres.

A description of each management alternative is provided below. Each alternative provides for appropriate levels of resource protection in accordance with NPS mandates, laws, and policies. As noted in the “Special Mandates and Administrative Commitments” section of Chapter 1, the NPS would continue to follow existing agreements and service-wide mandates, laws, and policies regardless of the alternatives considered in this plan. The following is a summary of the steps used to develop the alternatives:

- The NPS received written public comments over a 45-day comment period and at three separate public meetings held at the Danish West India Guinea Company Warehouse (former U.S. Post Office) in Christiansted in June 2004. All public meetings were announced via newspaper, radio, television, and through public service announcements, postings in public places, and flier distribution. The public submitted over 350 written comments.
- The comments were reviewed by the NPS planning team and then further sorted into the following categories, in accordance with NPS planning guidelines: (1) actions that cannot be done because they are inconsistent with existing NPS laws or policies; (2) actions that must be done because they are mandated by existing laws, regulations, policies, or mandates; (3) interests or concerns that are appropriate to consider in a general management plan; and (4) actions that are more appropriately addressed by other types of plans, such as an implementation plan.
- The planning team developed four preliminary alternatives within the framework of the park’s legislation, purpose, significance, and special mandates and policies.
- These preliminary alternatives were presented during public meetings conducted at the Danish West India Guinea Company Warehouse during August 2005. All public meetings were announced via newspaper, radio, television, and through public service announcements, postings in public places, and flier distribution.
- Based on comments received and input from park staff and the public during these meetings, the preliminary alternatives were changed to address additional concerns brought forward. These concerns mainly included desires for different types of experiences at West Beach, including:
 - The ability to unload people on the beach.
 - The ability to enjoy safe swimming and walking on the beach.
 - The ability to bow and stern anchor at the West Beach shoreline.
 - Safe access.

In addition, other changes were made to the zones to address resource protection and safety needs. These changes included shifting the Recreation Zone to protect elkhorn and staghorn coral species (added to the list of threatened species under the Endangered Species Act in 2006, subsequent to the public meetings), and changes to the Marine Hazard Zone to avoid impacts to threatened coral species, avert vessel groundings on shallow reef areas, and reduce hazardous navigating conditions for boaters.

The alternatives focus more conceptually on desired future resource conditions and visitor experiences, including the appropriate kinds and levels of management, use, and development. The alternatives do not go into detail on how such conditions and uses or experiences should be achieved over the next 15 to 20 years. Thus, the alternatives do not include specific details on resource or visitor use management. For example, the exact location, number, and use of moorings in the park are not detailed in this general management plan. Such information would be provided in a park vessel management plan and environmental assessment (i.e., implementation plan) upon completion of site specific surveys.

More detailed implementation plans or studies will need to be completed and implemented before most of the conditions proposed in the alternatives can be achieved. Furthermore, implementation of any alternative is largely dependent on future funding and compliance with existing laws and policies. Although the plan establishes a vision for future management of Buck Island Reef National Monument, full implementation may extend many years into the future. Many of the management actions proposed in this plan would be dependent on increased funding and staffing, which is not guaranteed. An environmental assessment would be prepared for each action or project and would specify site-specific impacts and mitigation measures needed for implementation.

Overview of the Alternatives

Each of the alternatives provides preservation and protection for natural and cultural resources, a diverse visitor experience, and limited facilities within the park. Based on public comments and NPS staff recommendations, there was a strong desire expressed for many park activities and visitor opportunities to remain the same. Therefore, many of the existing features and amenities of the park are maintained across all action alternatives. The following elements are common to alternatives B, C, and D:

- The regulations frame every alternative. The proclamation prohibits extractive use and allows for anchoring in deep sand areas.
- The location and acreage of the Marine Hazard Zone and Island Discovery Zone are the same.
- Existing facilities including toilets, picnic, pier, and trails (hiking and underwater) would continue to be provided and maintained (see Figure 4 for the locations of these facilities). There may be use restrictions to protect sensitive species; for example, during nesting season, St. Croix Ground Lizard habitat, and for protection of coral. The effects of use would be monitored, and appropriate management actions may be implemented to protect resources.
- Moorings are to be used on a first come, first serve basis. Time limits for concessioners or concession operations are in accordance with their contracts and park policies.
- Educational materials, outreach efforts, and interpretive activities would continue to be provided by the NPS from Park Headquarters located at Christiansted National Historic Site, Visitor Contact Station in Fort Christiansvaern, and the Scale House Eastern National Bookstore, by park staff, and by concessioners.
- Increases in staffing levels would allow opportunities for educational / interpretive programs that are focused on Buck Island Reef National Monument; this is an increase over present conditions.
- Concessioners would continue to operate under concessions contracts.
- Concessioners would receive information regarding park rules, regulations, and resources.
- The NPS would continue to partner and coordinate with stakeholders, partners, and research institutions to conduct research and monitoring and other programs within the park.
- Use or possession of fishing equipment is prohibited in the monument.
- All moorings and beach access channels would be located to avoid sensitive resources such as seagrass beds, bird and sea turtle nesting, and cultural resource sites. Surveys would be conducted prior to locating any additional moorings. Details of mooring locations would be developed during the implementation

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Alternative A

Buck Island Reef National Monument
U.S. Department of the Interior - National Park Service

Figure 4



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phase after this *General Management Plan* is completed. Locations of proposed moorings would be provided in detail in an environmental assessment/vessel management plan.

- Anchoring permits would be required for anchoring in the Anchoring Zone (Alternatives C and D) and for the designated (up to five) deep sand anchoring locations proposed under all of the action alternatives for large vessels (91-150 feet). Permit holders would be required to attend an information session to learn about park rules, regulations, and permit conditions. Information sessions would be held on a routine basis.
- The pier at Buck Island would be available for short-term use only, including loading and unloading of visitors and gear on a first come, first serve basis. This use applies to private vessels and concessioners. Park administrative use of the pier is also to be expected.

A description of each alternative is provided in the section that follows. A comparison of the alternatives is provided in Table 4. The proposed maximum number of vessels accommodated under each alternative is provided in Table 5. The estimated costs associated with each alternative are presented in the “Comparative Cost” section.

Selecting the Preferred Alternative

Development of a preferred alternative involves evaluating the alternatives with the use of a rational analysis process called “choosing by advantages.” Choosing by advantages is a decision-making system based on determining the advantages of different alternatives for a variety of factors or goals.

Through this process, the planning team identifies and compares the relative benefits or advantages of each alternative according to the following factors:

- Provide safe visits and working conditions.
- Protect natural and cultural resources.
- Improve visitor enjoyment through better service and educational and recreational opportunities.
- Improve efficiency, reliability, and sustainability of park operations.

The advantages are scored in relation to their satisfaction of each factor and summed to help identify the preferred alternative. This process is a systematic way to perform a complicated task, provides a way to engage participants, and assists in the consensus building process. It also leads to documented and consistent decision making. The NPS’s preferred alternative for this *Draft General Management Plan/Environmental Impact Statement* is Alternative B.

ALTERNATIVE A

Alternative A is the no action alternative. National Environmental Policy Act guidelines require an assessment of the impacts of the no action alternative, which is defined as a continuation of current park management practices into the future. Under Alternative A, current management practices, policies, and park programs – such as maintenance, law enforcement, and operational practices – would continue to be implemented with no major changes. Current resource management programming would also remain unchanged from the present level. The no action alternative is used as a way to evaluate the effects of the other three action alternatives and is also useful in understanding why changes for future management of the park are necessary. The map of Alternative A (Figure 4) represents the park as it currently exists. The map shows the location of the park boundary as expanded in 2001 increasing park acreage to 19,015-acres with northern boundary extending out to the territorial 3-mile limit, single hiking trail, observation point, pier, existing anchoring area off West Beach, underwater trail and moorings and SCUBA diving at two moorings.

Table 4. Comparison of Alternatives

Feature	Alternative A	Alternative B	Alternative C	Alternative D
Zones	Not applicable	Resource Protection Zone Island Discovery Zone Recreation Zone Marine Hazard Zone Anchoring Zone/Phased out over 10 years	Resource Protection Zone Island Discovery Zone Recreation Zone Marine Hazard Zone Anchoring Zone	Resource Protection Zone Island Discovery Zone Recreation Zone Marine Hazard Zone Anchoring Zone
Anchoring in deep sand by permit in designated areas	Existing anchor area at West Beach maintained	Existing anchor area at West Beach to be phased out over 10 years as moorings installed with the exception of up to 5 new anchor locations in deep sand designated for vessels 91-150 feet	Anchoring Zone is provided for bow and stern anchoring. Existing anchor area at West Beach to be phased out over 10 years as moorings installed. Up to 5 new anchor locations in deep sand designated for vessels 91-150 feet	The majority of the existing anchoring area at West Beach is maintained as Anchoring Zone
	Shoreline bow and stern anchoring at West Beach maintained.	No shoreline bow and stern anchoring at West Beach	Shoreline bow and stern anchoring at West Beach provided for shallow draft vessels up to 42 feet.	No shoreline bow and stern anchoring at West Beach
	Up to 5 new designated anchor locations for vessels from 91 to 150 feet	Up to 5 new designated anchor locations for vessels 91-150 feet; Vessels greater than 151 feet by special use permit only.	Up to 5 new designated anchor locations for vessels 91-150 feet; Vessels greater than 151 feet by special use permit only.	Up to 5 new designated anchor locations for vessels 91-150 feet; Vessels greater than 151 feet by special use permit only.
Moorings (first come first serve)	Underwater trail – Maximum of 10 (vessels up to 42 feet) (2hr limit)	Underwater trail – up to 10 (vessels up to 42 feet) (2hr limit)	Underwater trail – up to 10 (vessels up to 42 feet) (2hr limit)	Underwater trail – up to 10 (vessels up to 42 feet) (2hr limit)
	SCUBA – 2 (vessels up to 42 feet)	SCUBA – 2 (vessels up to 42 feet)	SCUBA – 2 (vessels up to 42 feet)	SCUBA – 2 (vessels up to 42 feet)
	None off West Beach	Maximum of 45 off West Beach (majority of moorings for vessels up to 60 feet; limited moorings in deeper water for vessels 61 to 90 feet)	Maximum of 45 off West Beach (majority of moorings for vessels up to 60 feet; limited moorings in deeper water for vessels 61 to 90 feet)	Maximum of 45 off West Beach (majority of moorings for vessels up to 60 feet; limited moorings in deeper water for vessels 61 to 90 feet)

Table 4. Comparison of Alternatives (Continued)

Feature	Alternative A	Alternative B	Alternative C	Alternative D
	None southwest of pier	Maximum of 10 southwest of pier (moorings for vessels up to 60 feet)	Maximum of 10 southwest of pier (moorings for vessels up to 60 feet)	Maximum of 10 southwest of pier (moorings for vessels up to 60 feet)
Vessel Size	Limits applicable: vessels up to 42 feet within lagoon	Limits applicable: shallow draft vessels up to 42 feet within lagoon; up to 150 feet within the Resource Protection Zone. Vessels over 151 feet within park boundary by permit only	Limits applicable: shallow draft vessels up to 42 feet within lagoon; up to 150 feet within the Resource Protection Zone. Vessels over 151 feet within park boundary by permit only	Limits applicable: shallow draft vessels up to 42 feet within lagoon; up to 150 feet within the Resource Protection Zone. Vessels over 151 feet within park boundary by permit only
Education, Outreach and Partnering	Continue limited activities conducted from Christiansted and by staff and concessioners. Level of partnering expected to remain at current levels, no increase planned.	Improved with increased law enforcement ranger presence, resource management and interpretive staff activities.	Improved with increased law enforcement ranger presence, resource management and interpretive staff activities.	Improved with increased law enforcement ranger presence, resource management and interpretive staff activities.
Staffing Levels	Remain at 2008 levels (14 FTEs)	Increase by 6.5 FTEs	Increase by 8 FTEs	Increase by 9 FTEs
Resource Management	Remain at 2008 levels	Improved due to increased staff for resource management	Improved due to increased staff for resource management	Increase staff to address additional visitation and potential resource impacts; increased staff levels required to enforce and monitor

FTE: full time equivalent

NOTE: As of March 2009 Anchoring Permit Vessel list shows that out of 203 vessels 22% are over 42 feet. 10 vessels were over 60 feet (0.05 percent).

Table 5. Maximum Number of Vessels Proposed Under Each Alternative

Feature	Alternative A	Alternative B	Alternative C	Alternative D
Maximum Number of Vessels Accommodated by Anchoring Area / Zone	70 vessels Anchoring area approximately 22 acres	Not applicable Existing Anchoring area at West Beach to be phased out over 10 years as moorings installed with the exception of up to 5 new designated anchoring locations in deep sand for vessels 91-150 feet	20 vessels Anchoring Zone for shoreline bow and stern anchoring, approximately 2 acres	40 vessels Anchoring Zone approximately 16 acres
Anchoring for Vessels 91 to 150 feet	5 designated locations in deep sand	5 designated locations in deep sand	5 designated locations in deep sand	5 designated locations in deep sand
Number of Existing Moorings	10 - Underwater trail 2 - SCUBA	10 - Underwater trail 2 - SCUBA	10 - Underwater trail 2 - SCUBA	10 - Underwater trail 2 - SCUBA
Number of Proposed New Moorings	8 – Administrative Use	45 – Maximum number proposed for area off of West Beach 10 – Maximum number proposed for area southwest of pier 8 – Administrative Use	45 – Maximum number proposed for area off of West Beach 10 – Maximum number proposed for area southwest of pier 8 – Administrative Use	45 – Maximum number proposed for area off of West Beach 10 – Maximum number proposed for area southwest of pier 8 – Administrative Use
Maximum Number of Vessels Accommodated by Alternative (Anchoring and Mooring)	87 Vessels (8 Administrative moorings are not included)	72 Vessels (8 Administrative moorings are not included)	92 Vessels (8 Administrative moorings are not included)	112 Vessels (8 Administrative moorings are not included)

Note: Total number of vessels subject to change due to resource conditions (shifting sands, resource concerns, and sensitive species). Where numbers are presented, it is assumed that it is up to and including that number, i.e. a maximum.

Alternative A would involve continued use of the existing 22-acre anchoring area located off West Beach. However, additional restrictions would be required in order to comply with the 2001 proclamation, which only allows anchoring in areas of deep sand. Permits would be issued for the anchoring areas to protect sensitive resources such as seagrasses. Over time, as the seagrass beds grow, the availability of anchoring locations would be expected to be reduced. The underwater trail and mooring area (with up to ten moorings) would continue to be used and managed as they are now. Two SCUBA moorings would continue to be provided just north of the underwater trail area, and up to eight additional moorings would be installed for administrative use only. In addition, all current land-based facilities (picnic area, NPS provided grills, toilets, the pier) and marine facilities (boundary and regulatory buoys), and the existing hiking trail on Buck Island would continue to be provided and maintained at current levels. Beach use would be continued, and beach access would be allowed from the existing anchoring area.

Shoreline bow and stern anchoring practices would be expected to continue, except during certain nesting periods when areas of the beach are closed off to protect sensitive species, such as terns and sea turtles. Non-native invasive species would continue to be monitored and removed in accordance with current management documents and policies (for example, to address tree rats and non-native vegetation, and threats from non-native invasive lion fish).

Park staff conducts extensive research and monitoring, resource protection, and management activities, which would be expected to continue at existing levels. However, there is an ever-increasing demand for more research and monitoring associated with protection of threatened coral species, the effects of coral bleaching and diseases, monitoring of the globally endangered St. Croix ground lizard, threatened and endangered sea turtle nesting and foraging populations, the status of the park as a “no take” marine reserve, delineating resources within the expanded park boundaries, and numerous other projects. With these increased demands, some existing programs would be expected to be adversely affected, and the number of new programs would not be expected to increase.

The park would continue its partnerships and research activities to the extent that staffing levels would allow. For example, the park would continue to work with local scientists from the Virgin Islands Department of Planning and Natural Resources, Division of Fish & Wildlife, Coastal Zone Management, St. Croix East End Marine Park, and with partner federal agencies including Virgin Islands National Park, the South Florida/Caribbean Inventory and Monitoring Program, the U.S. Fish & Wildlife Service, and the National Oceanographic and Atmospheric Administration Biogeography Division, to inventory, assess, and monitor the status of the park’s marine ecosystem. Park staff and volunteers also monitor threatened and endangered sea turtles nesting and foraging throughout the park. The turtle research and monitoring program would be expected to continue as well as partnerships that support this effort. Efforts to work with the territorial government, other agencies, and universities to research, map, and monitor resource conditions would be expected to continue, but the levels of such activity would be expected to be maintained at current levels due to staff constraints.

Education and outreach activities would continue to be conducted primarily from NPS facilities located at Christiansted National Historic Site, as well as by park rangers and by park concessioners. Park concessioners would continue to operate by concession contracts to provide visitor access to Buck Island Reef National Monument. No new programs would be implemented, nor would there be any increase in visitor services.

The amount of ranger presence, activity, and enforcement would be expected to remain near existing levels. Ranger patrols at Buck Island and throughout the park are limited due to staffing constraints, and this condition would be expected to continue.

No new zones would be created under Alternative A. The park would continue its current management practices at the current levels of enforcement, resource management, and education and outreach / interpretive activities.

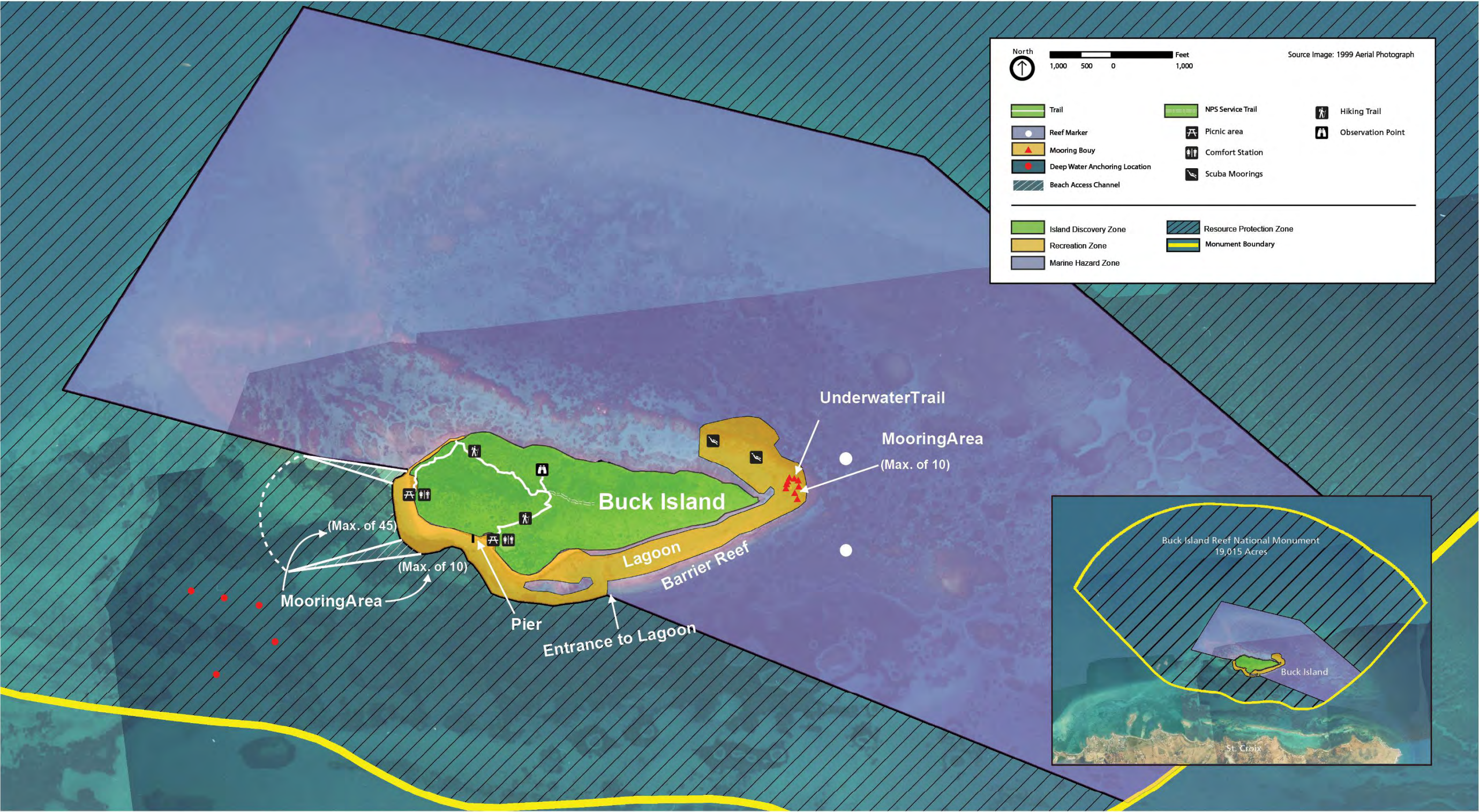
ALTERNATIVE B

Alternative B would likely result in the highest degree of resource protection while maintaining visitor use of the park. Alternative B provides for moorings and limited opportunities for anchoring in deep sand for vessels at designated locations. This alternative responds to comments that noted a desire to protect resources by removing the anchoring area and allow for moorings. Alternative B would provide increased resource protection by phasing out the existing 22-acre anchoring area along the west end of Buck Island over a 10-year period of time as moorings are installed. Opportunities for anchoring would be limited to up to five designated locations in deep sand for vessels 91 to 150 feet. Consistent with the Proclamation, anchoring could occur under emergency conditions and for NPS administrative purposes. Installation of moorings and phasing out of the majority of anchoring in the park would reduce adverse effects resulting in less stress to ecological communities and healthier marine resources that may better cope with stresses related to climate change. These projected changes, such as sea level rise, frequency and duration of storms, coastal erosion, and acidification all contribute to conditions that may change the seagrass community over time, and therefore where anchoring would be most appropriate. Alternative B provides the ability to adapt to such changes and protect seagrasses, while providing continued access.

Up to 45 new moorings would be provided off West Beach in place of the anchoring area. In addition, up to 10 new moorings would be provided southwest of the pier for vessels up to 60 feet, in response to public comments that stated the need for this type of sheltered mooring during northern swells. Vessels up to 60 feet would use the majority of the moorings. A limited number of moorings would be provided for vessels 61 feet to 90 feet. Moorings would be used on a first come, first serve basis.

All moorings would be located to avoid sensitive resources such as seagrass beds and coral. Detailed layout of the mooring field would be conducted following site specific surveys and an environmental assessment would be prepared prior to locating any additional moorings. Figure 5 depicts the management zones, mooring areas, proposed anchoring locations, and visitor facilities proposed under Alternative B.

Alternative B allows for the continued use of existing recreational moorings located at the underwater trail as well as SCUBA moorings. The underwater trail would provide up to ten moorings, and two SCUBA moorings would be maintained. Up to eight moorings would be established for NPS administrative use. The total estimated number of vessels that could access Buck Island via moorings/and limited anchoring would be approximately 72 (see Table 5).



Alternative B

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Figure 5



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Beach access channels would be located north and south of the mooring area off West Beach to protect swimmers and snorkelers, and prevent boater and swimmer conflicts. These channels would be used to transfer people from their mooring/anchoring area to the beach without having to swim to shore. Swimming in the beach access channels would be prohibited for safety reasons. The northern beach access channel would consist of approximately 50 feet of beach frontage; the southern beach access channel would consist of approximately 100 feet of beach frontage. This allows for safe passenger drop off and pick up.

Beach use and many existing types of recreation would continue under Alternative B; however, shoreline bow and stern anchoring would not be appropriate. As with Alternative A, all current land-based facilities (hiking trail, picnic areas, NPS grills, toilets, and the pier) would continue to be provided and maintained. Only limited new trail development would be appropriate to improve visitor experience, reroute to avoid dangerous vegetation or improve resource conditions. Trails would be properly designed and maintained to avoid erosion and adverse impacts to vegetation and wildlife.

Alternative B includes four of the five management zones: Recreation Zone, Marine Hazard Zone, Resource Protection Zone, and Island Discovery Zone (Figure 5). The sizes of the Recreation Zone, Marine Hazard Zone, and the Island Discovery Zone are similar across each of the action alternatives (Alternatives B, C, and D), and vary only due to changes to the Anchoring Zone (see Table 3). The Recreation Zone is larger in Alternative B than in any of the other action alternatives since it encompasses the area off West Beach that was an anchoring area under Alternative A.

Alternative B would provide increased opportunities for partnering with local agencies and other organizations compared to Alternative A due to increased levels of resource management staff. In addition, increased levels of research and monitoring would be conducted to provide the data necessary to determine the best management practices to avoid adverse effects to rare, threatened, or endangered species. Research and monitoring of elkhorn and staghorn coral in the park would increase, as would other research needed to determine if additional measures should be taken to help protect these threatened species, as well as other resources in the park. This would involve continued partnerships with existing and potentially new organizations. Volunteer programs would continue and would have the potential to expand due to proposed increases to interpretive, enforcement, and resource management staff - an anticipated increase of 6 full time staff, or equivalents. Successful implementation of Alternative B would be dependent on the hiring of additional staff members.

Education and outreach activities would continue to be conducted from Christiansted National Historic Site by rangers and concessioners. However, under Alternative B, there would also be increased opportunities for education and outreach activities to occur at Buck Island as well as increased opportunities for guided hikes. The level of ranger presence would increase within the park as proposed positions are filled.

ALTERNATIVE C

Alternative C provides for bow and stern anchoring and new moorings off West Beach and southwest of the pier, thus allowing for both anchoring and mooring of vessels. Alternative C was created as the result of input from boaters and weekend visitors. This input was provided after the preliminary alternatives were presented to the public in August, 2005. Alternative C includes all five management zones: Resource Protection Zone, Anchoring Zone, Island Discovery Zone, Recreation Zone, and Marine Hazard Zone, as shown in Figure 6.

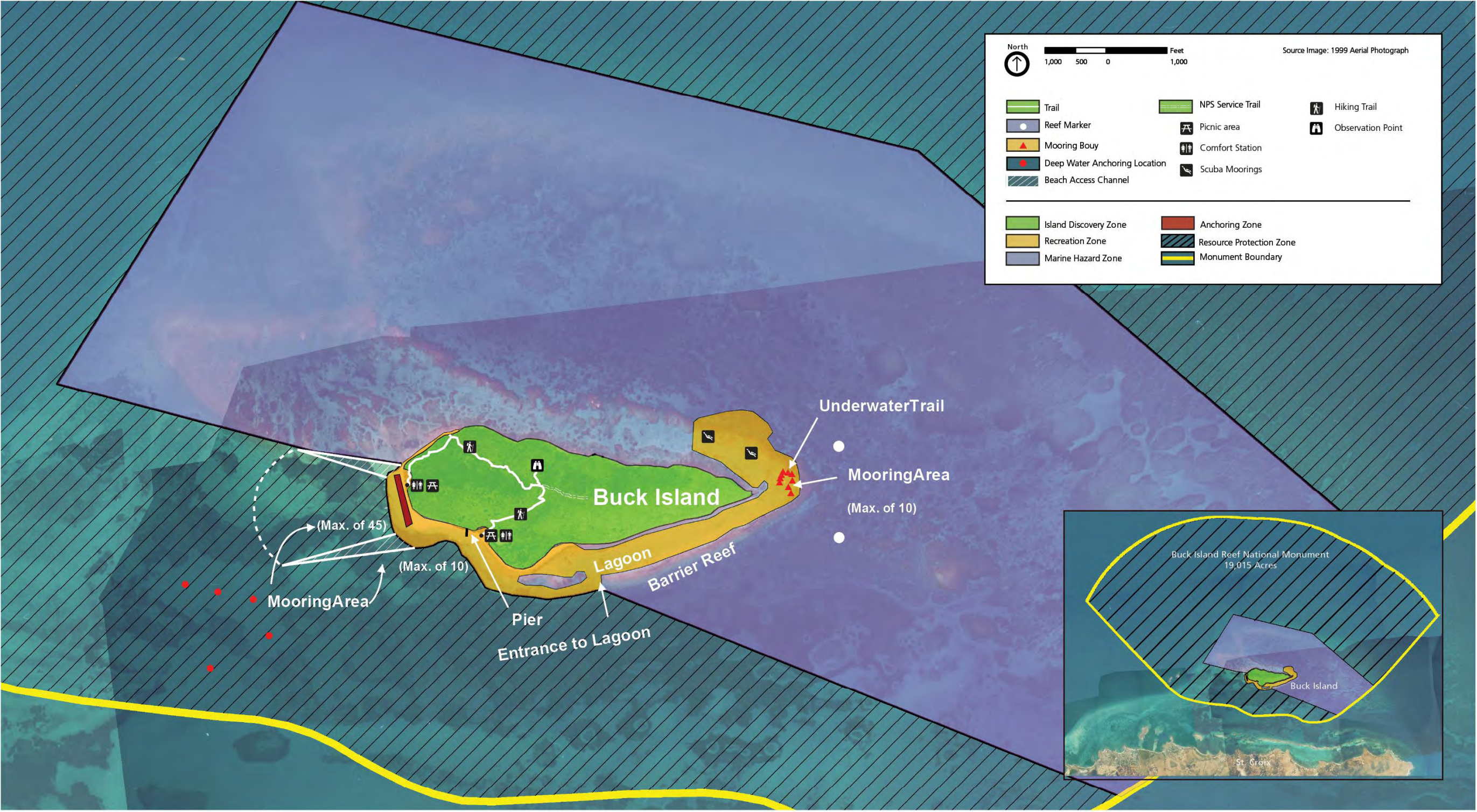
The Anchoring Zone in Alternative C would provide an approximate 2-acre bow and stern Anchoring Zone at West Beach. Due to the dynamic nature of beach conditions at Buck Island, the extent of the Anchoring Zone may shift over time. Projected changes associated with climate change, including sea level rise, frequency and duration of storms, coastal erosion, and acidification all contribute to conditions over time. Alternative C provides the ability to adapt to such changes and protect seagrasses, while providing continued access.

Anchoring in deep sand for shallow draft vessels up to 42 feet would be appropriate within this zone by permit on a first come, first serve basis. Along the shoreline all bow and stern anchors would be required to be buried in the sand to avoid visitor tripping and falling hazards. Vessels 91 to 150 feet would be able to anchor in deep sand at up to 5 designated locations. Consistent with the Proclamation, anchoring could occur under emergency conditions and for NPS administrative purposes.

Up to 45 additional moorings would be provided in a designated area beyond the Anchoring Zone at West Beach. Vessels up to 60 feet would use the majority of the moorings. A limited number of moorings would be provided for vessels 61 feet to 90 feet. Moorings would be used on a first come, first serve basis. Beach access channels would be marked to provide safe access to the beach for users mooring outside the Anchoring Zone and to protect swimmers. The beach access channels would be located north and south of the Anchoring Zone, with the northern beach access channel providing approximately 50 feet of beach frontage, and the southern access channel providing approximately 100 feet of beach frontage.

Beach use and many existing types of recreation would continue under Alternative C. As with Alternative A, all current land-based facilities (hiking trail, picnic areas, NPS grills, toilets, and the pier) would continue to be provided and maintained. Limited new trail development would be appropriate and would be properly designed and maintained to avoid erosion and adverse impacts to vegetation and wildlife.

The underwater trail mooring area would also be maintained similar to Alternative A, with up to ten moorings for the underwater trail, and two SCUBA moorings. Additional moorings (up to ten) would also be located southwest of the existing pier in response to public comments that stated the need for this type of sheltered mooring during northern swells. These moorings would be appropriate for vessels up to 60 feet. Moorings (up to 8) would also be installed for NPS administrative use. All moorings would be located in deep sand to avoid sensitive resources, such as seagrass beds and coral. Detailed layout of the mooring field would be conducted following site specific surveys and an environmental assessment would be prepared prior to locating any additional moorings. Figure 6 depicts the management zones, mooring areas, proposed anchoring locations, and visitor facilities proposed under Alternative C.



Alternative C

Buck Island Reef National Monument
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Figure 6



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Similar to Alternative B, there would be increased opportunities for partnering with local agencies and other organizations due to increased levels of resource management staff. In addition, increased levels of research and monitoring would be conducted to provide the data necessary to determine the best management practices to avoid adverse effects to rare, threatened or endangered species. Monitoring of the protected species, elkhorn and staghorn coral, would increase, as would other research needed to determine if additional measures should be taken to help protect these threatened species as well as other resources in the park. This would involve continued partnerships with existing and potentially new organizations. Volunteer programs would continue and would have the potential to expand due to proposed increases to interpretive, enforcement, and resource management staff - an anticipated increase of eight full time staff, or equivalents. Successful implementation of Alternative C would be dependent on the hiring of additional staff members.

Education and outreach activities would continue to be conducted from Christiansted National Historic Site by rangers and concessioners. In addition, under Alternative C, there would also be increased opportunities for education and outreach activities to occur at Buck Island as well as increased opportunities for guided hikes. The level of ranger presence would increase within the park as proposed positions are filled.

ALTERNATIVE D

Alternative D provides for recreational opportunities similar to existing conditions under Alternative A, with the exception that shoreline bow and stern anchoring would not be appropriate. Similar to Alternative C, Alternative D includes all five management zones: Resource Protection Zone, Anchoring Zone, Island Discovery Zone, Recreation Zone, and Marine Hazard Zone, as shown in Figure 7.

Alternative D would provide vessel access via an Anchoring Zone off the shore of West Beach. Alternative D provides the largest Anchoring Zone of all the action alternatives, with approximately 16 acres in this zone. However, the size of the anchoring zone would be based upon resource conditions and would be subject to change to protect resources. The extent of the Anchoring Zone may change over time to reflect changes in the conditions in this area. Seagrass recovery and projected climate changes such as sea level rise, frequency and duration of storms, coastal erosion, and acidification all contribute to conditions that may change the seagrass and sand community over time, and therefore where anchoring would be most appropriate. Anchoring would be appropriate only in deep sand, by permit, and on a first come, first serve basis.

There would also be up to five anchoring locations designated in deep sand for vessels 91 to 150 feet, similar to Alternatives B and C. Consistent with the Proclamation, anchoring could occur under emergency conditions and for NPS administrative purposes.

In addition, up to 45 new moorings would be provided in a designated area beyond the Anchoring Zone at West Beach. Vessels up to 60 feet would use the majority of the moorings. A limited number of moorings would be provided for vessels 61 feet to 90 feet. Moorings would be used on a first come, first serve basis. Detailed layout of the mooring field, Anchoring Zone, and size of vessels appropriate for the anchoring zone would be determined following site specific surveys and an environmental assessment prepared in conjunction with a vessel management plan. Figure 7 depicts the management zones, mooring areas, proposed deep sand anchoring locations, and visitor facilities proposed under Alternative D.

The underwater trail mooring area would be maintained similar to Alternatives B and C, with up to ten underwater trail area moorings and two SCUBA moorings. Additional moorings (up to ten) would also be located southwest of the existing pier in response to public comments that stated the need for this type of sheltered mooring during northern swells. Up to eight moorings would also be installed

for NPS administrative use. All moorings would be located to avoid sensitive resources such as seagrass beds and coral. Site specific surveys would be conducted prior to locating any additional moorings.

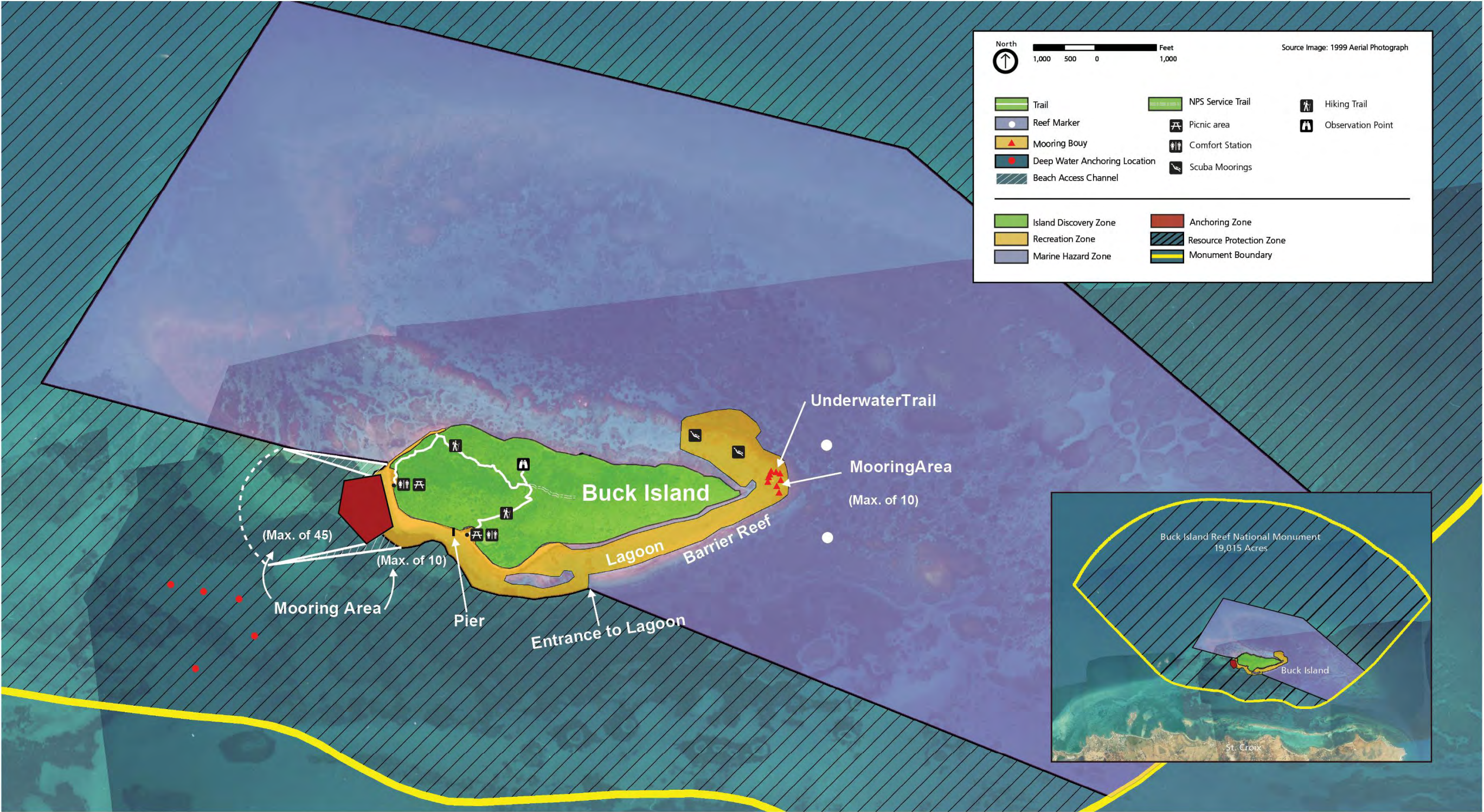
Beach access channels would be marked to provide safe access to the beach for users mooring and anchoring similar to Alternatives B and C. Swimming would not be appropriate in the beach access channels to avoid boater/swimmer conflicts and provide for safe visitor experiences.

Beach use and many existing types of recreation under Alternative A would continue under Alternative D, with the exception of bow and stern anchoring. As with Alternative A, all current land-based facilities (hiking trail, picnic areas, NPS grills, toilets, and the pier) would continue to be provided and maintained. Limited new trail development would be appropriate and would be properly designed and maintained to avoid erosion and adverse impacts to vegetation and wildlife.

Similar to Alternatives B and C, there would be increased opportunities for partnering with local agencies and other organizations due to increased levels of resource management staff. In addition, increased levels of research and monitoring would be conducted to provide the data necessary to determine the best management practices to avoid adverse effects to rare, threatened or endangered species. Monitoring of the protected species, elkhorn coral and staghorn, in the park would increase, as would other research needed to determine if additional measures should be taken to help protect these threatened species, as well as other resources in the park. This would involve continued partnerships with existing and potentially new organizations. Volunteer programs would continue and would have the potential to expand due to proposed increases to interpretive, enforcement, and resource management staff.

Alternative D provides for the greatest increase in park staff due to the projected need for more ranger support and visitor services. This alternative would require an increased degree of management due to the larger size of the Anchoring Zone combined with a mooring area compared to Alternative A. Additional staff would be needed for enforcing park regulations, conducting research and monitoring of resources, and increased public education and interpretation activities for potentially greater numbers of visitors. Successful implementation of Alternative D would be dependent on the hiring of additional staff members. Due to the estimated level of up to 112 vessels proposed under Alternative D, an anticipated increase of nine full time staff, or equivalents would be required.

Education and outreach activities would continue to be conducted from Christiansted National Historic Site by rangers and concessioners. In addition, under Alternative D, there would also be increased opportunities for education and outreach activities at Buck Island as well as increased opportunities for guided hikes. The level of ranger presence would increase within the park as proposed positions are filled.



Alternative D

Buck Island Reef National Monument
U.S. Department of the Interior - National Park Service

Figure 7



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USER CAPACITY

General management plans for national park system units are required by law to identify and address implementation commitments for user capacity, also known as carrying capacity. The NPS defines user capacity as the types and levels of visitor use that can be accommodated while sustaining the quality of park resources and visitor experiences consistent with the purposes of the park. Managing user capacity in national parks is inherently complex and depends not only on the number of visitors, but also on where the visitors go, what they do, and the “footprints” they leave behind. In managing for user capacity, park staff implement a variety of management tools and strategies rather than relying solely on regulating the number of people in a park area. The ever-changing nature of visitor use requires a deliberate and adaptive approach to managing user capacity in the national park system.

The foundations for making user capacity decisions in this general management plan are the purpose, significance, special mandates, and management zones associated with the park. The purpose, significance, and special mandates define why the park was established, identify the most important resources and values, and visitor opportunities within the park. Management zones in each action alternative describe the desired resource conditions and visitor experiences, including appropriate types of activities and general use levels, for different locations throughout the park. The zones, as applied in the alternatives, are consistent with, and help the park achieve its specific purpose, significance, and special mandates. As part of the NPS’s commitment to implement measures to address user capacity, the park staff would abide by the directives described above for guiding the types and levels of visitor use that would be accommodated while sustaining the quality of park resources and visitor experiences consistent with the purpose of the park.

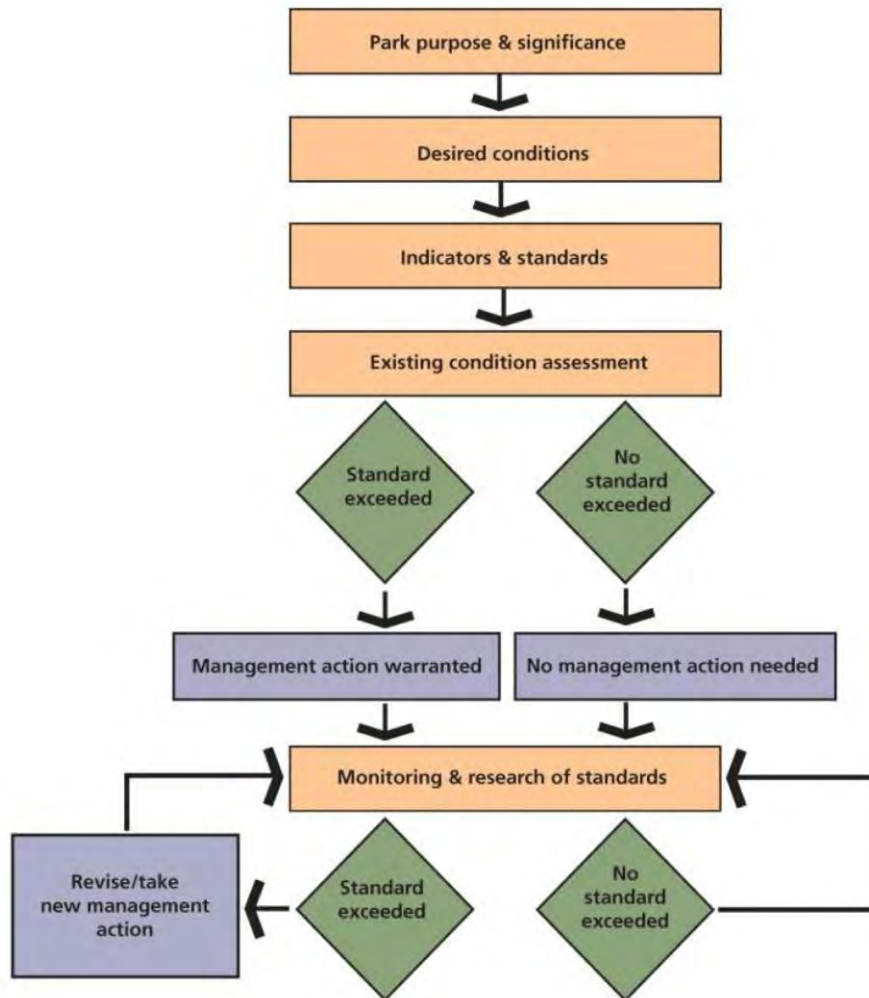
In addition to these important directives, this plan includes indicators and standards for Buck Island Reef National Monument. Indicators and standards are measureable variables that would be monitored to track changes in resource conditions and visitor experiences. The indicators and standards help the NPS make sure that desired conditions are being attained, thereby supporting the fulfillment of the park’s legislative and policy mandates. The general management plan also identifies the types of management actions that would be taken to achieve desired conditions and related legislative and policy mandates.

Table 6 at the end of this discussion includes the indicators, standards, and potential future management strategies, allocated by management zones that would be implemented as a result of this planning effort. The management strategies in Table 6 are generally listed in sequential order, i.e., strategies near the top of the list would generally be implemented first; strategies near the bottom are less preferred and may be implemented only if needed. The planning team considered many potential issues and related indicators that would identify impacts of concern for the park. Indicators and standards described in this section were considered the most significant, given the importance and vulnerability of the resource and/or visitor experience affected by use. The planning team also reviewed other parks with similar issues to help identify meaningful indicators. Standards that represent the minimum acceptable condition for each indicator were then assigned, taking into consideration the qualitative descriptions of the desired conditions, data on existing conditions, relevant research studies, staff management experience, and public preferences identified during the early planning phases of the general management plan.

User capacity decision making is a form of adaptive management (Figure 8) in that it is an iterative process in which management decisions are continuously informed and improved. Indicators are monitored, and adjustments are made as appropriate. As monitoring of conditions continues, managers may decide to modify or add indicators if better ways are found to measure important changes in resource and visitor experience conditions. Information on the NPS monitoring efforts,

related visitor use management actions, and any changes to the indicators and standards would be shared with the public.

Figure 8. User Capacity Framework



RESOURCE AND VISITOR EXPERIENCE INDICATORS AND STANDARDS

The priority indicators for Buck Island Reef National Monument are associated with the following issues (not in priority order):

- resource damage associated with vessel groundings
- resource damage associated with coral damage from visitor use
- resource damage associated with anchoring
- visitor experience and satisfaction at the underwater trail
- resource damage and visitor experiences associated with trail use
- visitor experiences at beaches and picnic areas

The condition of these resources is already being monitored and managed in various ways, but the indicators described in this section would help the park staff track specific influences to these resources as a result of visitor use.

Shallow coral reefs in the park are navigation hazards. Coral reefs are highly sensitive to a number of changing conditions, and the park continues to monitor coral reef status in the park to increase their knowledge and adapt the best management practices to protect these fragile resources while still providing opportunities for visitor enjoyment. The management strategies considered in this plan to further manage coral reefs in the park include establishing the Marine Hazard Zone that prohibits vessel use as well as the establishment of vessel size limitations. These management actions help prevent vessel groundings that could cause irreparable damage to coral reefs, especially threatened elkhorn and staghorn corals. The standard to be maintained is zero tolerance for vessel groundings to protect coral reefs.

Coral damage associated with visitor use includes such impacts as accidental touching, bumping or breakage, flipper scrapes from snorkelers getting too close to coral, and other types of related visitor use impacts, particularly at the underwater trail. Since the underwater trail is such a popular destination, protection of the resources requires special consideration to address impacts related to visitor use. The standard identified is that new coral damage does not exceed a 5% increase over baseline conditions. The baseline will be established using video / photographic footage at the underwater trail. This video/photographic coverage of the underwater trail will be developed in 2011 as the baseline for future comparisons. The NPS encourages the use of adaptive strategies to help reduce impacts from visitor use, including education, training, working with concessioners to adjust visitation patterns / levels, increasing the presence of park staff, altering mooring use or setting limitations at the underwater trail.

Impacts on seagrass from visitor activities include scarring from anchors. These impacts are primarily related to visitor use off West Beach. Increased boating activity and anchoring at times by boaters with no or only limited experience make the area off West Beach susceptible to further seagrass scarring. Anchoring adversely affects seagrasses by destroying their underground system of stems (rhizomes), which in turn causes sediments to destabilize and erode. Some seagrasses, such as turtle grass, have a relatively slow rate of growth, and recovery of damaged stems can take several years. Other species such as manatee grass have a relatively rapid rate of growth. For example, rapid regrowth of this species in the Buck Island channel was observed between 1971 and 1999 (Kendall et al. 2004a). However, over time, continued use of anchors in seagrass beds destroys existing beds and also prevents damaged beds from reestablishing themselves. The loss of seagrass from anchoring is a significant concern because seagrass beds in the park are highly productive and provide areas of habitat for recreationally and commercially important fish and invertebrates. Although active restoration of damaged seagrass communities is technically possible, it is expensive and time-consuming.

The area off of West Beach is highly dynamic, and the shifting sands in this area make it impossible to permanently designate an anchoring area without affecting seagrass growth and recovery. Minimizing the extent and severity of impact on the seagrass beds has been the focus of ongoing management concern. The Proclamation dictates that anchoring is prohibited; however the NPS may permit exceptions for emergency or authorized administrative purposes, and may issue permits for anchoring in deep sand bottom areas to the extent that it is consistent with the protective purposes of the monument. The indicator included in Table 6 for seagrass scarring would encourage the use of adaptive management strategies to help reduce impacts.

The goal/standard of these efforts would be to achieve at least a 5% per year reduction in the total area scarred at West Beach over 2010 baseline conditions. The management strategies being considered in this plan to further manage this impact include designating anchoring locations in deep sand by permit only, reducing or eliminating the anchoring area, and establishing moorings to replace anchoring. Further strategies include increased education, interaction with park staff, training, and use of regulatory buoys and other aids to navigation.

Resource damage at the picnic areas, the beaches, and trail at Buck Island may be caused by a variety of visitor uses and practices such as moving picnic tables, cutting back vegetation, or clearing areas. Disturbances from such practices include trampling or removal of vegetation, removal of ground cover that could impact threatened and endangered species such as the St. Croix ground lizard, and disturbance of nesting areas (sea turtles and least tern). The indicator reported on Table 6 for resource damage is the number of incident reports. It is anticipated that as anchoring practices shift over time and moorings are installed, and as NPS staff increase their presence in the park, the number of incident reports may also change in the initial 3 to 5 years. Therefore, a baseline would be established in 2016, and the percent decrease in number of incident reports would equal 1 percent per year thereafter. Management strategies would include increased education and awareness of low impact practices and compliance with park policies and regulations, increased interaction with park staff, consider use during off-peak days, restrict or limit activities in designated areas, use a reservation system for selected facilities, or area closures.

The underwater trail at Buck Island Reef National Monument is the number one tourist destination for visitors to St. Croix. Visitors to the underwater trail experience premiere snorkeling and have the opportunity to be immersed directly into coral grottos. Maintaining high levels of visitor satisfaction with these experiences is an important management goal. Because the underwater trail is so popular, crowding and conflicts may become a problem particularly as the economy recovers, and the number of potential cruise ship passengers increase. The indicator related to these concerns helps track trends (through random surveys and annual visitor satisfaction surveys) in visitor satisfaction levels specific to visitors' experiences at the underwater trail. The standard would help ensure that most visitors (85 percent) have a high satisfaction level. If the satisfaction levels are not meeting the established standard, park staff would further investigate the source of the crowding or conflict and implement appropriate management strategies such as increased education, encourage concession use during off-peak times, and consider developing alternative mooring use patterns.

The priority visitor experience concerns for the beaches, trail and picnic areas are: crowding and conflicts, facility use, and maintenance. Similar to the resource indicators, visitors' opportunities and related experiences in the park are already being monitored and managed in various ways. The indicators described below would help the park staff track these specific issues more systematically to ensure that desired conditions are being achieved.

Disturbance to soils, vegetation and wildlife (including threatened and endangered species) along trails is a concern due to the fragile condition of these resources on Buck Island. The indicator and standard in Table 6 would be based on maintaining the existing trail to a width of 2 feet to prevent resource damage. Trail maintenance and protection of resources would help ensure that quality visitor experiences along the trail are also maintained. Education, increased enforcement, signs, or use of barriers are some of the management tools that would be used to address this issue.

Currently, use levels along the trail are relatively low, and encounters between hiking groups are infrequent. To maintain these conditions over the long term, an indicator of the number of encounters per day between groups on hiking trails would be monitored. A standard of no more than two groups (with approximately 6 people per group) encountered per day helps to disperse use and allow visitor opportunities for solitude within the interior trail portion of Buck Island.

Maintaining high satisfaction levels may be monitored by tracking the number of registered complaints. Registered complaints would be monitored, with a standard of no increase in registered complaints compared to 2010 baseline conditions. Potential management strategies include increased education, encouraging use at less busy times, increased interaction with park staff and law enforcement, and possible implementation of a reservation system.

In order to maintain visitor satisfaction with facilities, the park would monitor the number of work orders issued. Park facilities include the picnic area, trails, comfort station, pier and future moorings. Potential management strategies include education regarding low impact practices and compliance with park rules and regulations, increasing interaction with park staff and law enforcement, and encouraging use to off-peak days. These measures would help park staff maintain desired conditions at high use locations, such as the beach, trail and picnic area.

For both on-the water and hiking activities, park staff would continue to educate visitors and concessioners on times of peak use in hopes of redistributing use to off-peak times. If needed, the park may use other management strategies, including re-evaluation of mooring use. Education about peak use times, real time information about current use, and enforcement would help park staff maintain desired conditions at high use locations, such as the underwater trail and beaches.

Table 6. User Capacity Indicators, Standards, and Management Strategies for Action Alternatives

Management Zone	User Capacity Indicator	User Capacity Standard	Potential Management Strategies
Recreation Zone; Resource Protection Zone; Marine Hazard Zone	Occurrence of vessel groundings reported by NPS, US Coast Guard, visitor or other reports	Zero tolerance for vessel groundings	• Educate to increase awareness of park regulations and sensitive resources • Establish mooring guide • Increase interaction with park staff • Train volunteers to provide information • Provide training for appropriate vessel use in the park • Increased park regulatory buoys and/or other aids to navigation, and signage (including electronic chart updates) • Conduct damage assessment

Table 6. User Capacity Indicators, Standards, and Management Strategies for Action Alternatives (Continued)

Management Zone	User Capacity Indicator	User Capacity Standard	Potential Management Strategies
Recreation Zone; Resource Protection Zone	New coral damage (breakage, flipper scrapes, or other related visitor use impacts)	New coral damage does not exceed 5% increase over baseline conditions from video baseline in 2011	- Educate concessioners, visitors and businesses to increase awareness of park regulations and sensitive resources - Increase outreach regarding park policies and regulations on a routine and recurring basis (at a minimum on annual basis) - Provide training for appropriate vessel use (including anchoring) in the park - Provide training - snorkeling do's and don'ts - Track visitation levels and resource damage occurrences - Conduct routine training for concessioners - Increase interaction with park staff and law enforcement - Increase park regulatory buoys and other aids to navigation, or signage - Encourage alternative mooring use patterns - Establish limitations on underwater trail use levels - Encourage reporting of damage by visitors, concessioners and park staff; track and analyze information gathered - Conduct damage assessment
Recreation Zone; Resource Protection Zone; Marine Hazard Zone	Percent reduction in total area of anchor scars at West Beach	Percent decrease in total area damaged by anchor scars equals 5 percent per year over baseline conditions in 2010 at West Beach	- Educate to increase awareness of sensitive resources and park regulations - Establish moorings and mooring guide - Increase interaction with park staff - Train volunteers to provide information - Provide training for appropriate vessel use (including anchoring) in the park - Increase park regulatory buoys and/or other aids to navigation, or signage
Recreation Zone; Island Discovery Zone	Number of incident reports of resource damage	Initial (3 to 5 year) increase in reports due to increased staff presence. Establish baseline in year 2016. Percent decrease in number of incident reports equals 1% per year over baseline conditions	- Educate to increase awareness of low impact practices and compliance with park rules and regulations - Develop educational videos/multi-media presentations for cruise ship passengers, hotels, travel venues, etc. - Increase interaction with park staff and law enforcement - Restrict visitor activity at designated areas - Redistribute use to off-peak days - Institute reservation system for moorings/beach use - Close areas (seasonal, temporary, permanent)

Table 6. User Capacity Indicators, Standards, and Management Strategies for Action Alternatives (Continued)

Management Zone	User Capacity Indicator	User Capacity Standard	Potential Management Strategies
Recreation Zone	Percent satisfaction with park underwater trail experiences (using random survey instrument and annual visitor survey results)	Achieve and maintain at least 85 percent satisfaction level	• Educate concessioners, visitors and businesses to increase awareness of sensitive resources; • Increase outreach regarding park regulations on a routine and recurring basis (at a minimum on annual basis) • Encourage use during times that are less busy; consider alternative mooring use patterns • Increase interaction with park staff and/or law enforcement
Island Discovery Zone; Recreation Zone	Mean trail width of 2 feet	Mean trail width does not exceed 2 feet	• Educate to increase awareness of park regulations and sensitive resources • Improve interpretive signs of designated trail, use areas, and park regulations • Use barriers and other restrictive measures • Establish access limitations (closure; reduction of number of users; trail permits); • Establish reservation system for large group use of trails.
Island Discovery Zone; Recreation Zone	Number of people encountered per day (over 6 hours) along designated trail	No more than two groups (approximately 6 people per group) per day along designated trail	• Educate to increase awareness of park regulations and sensitive resources • Improve interpretive signs of designated trail, use areas, and park regulations • Implement use of barriers and other restrictive measures • Establish access limitations (closure; reduction of number of users; establish trail permits); • Establish reservation system for large group use of trails.
Recreation Zone; Island Discovery Zone	Number of registered complaints	No increase in registered complaints over 2010 baseline condition	• Educate to increase awareness of resource sensitivity, low impact practices and compliance with park rules and regulations • Educate to encourage use at less busy times • Increase interaction with park staff and law enforcement • Redistribute use to off-peak days • Reservation system for moorings/beach use

Table 6. User Capacity Indicators, Standards, and Management Strategies for Action Alternatives (Continued)

Management Zone	User Capacity Indicator	User Capacity Standard	Potential Management Strategies
Recreation Zone; Island Discovery Zone	Number of work orders	Negative impact to facilities (picnic area, trails, comfort station) from visitor use (for example, damage to picnic area, movement of picnic tables into sensitive areas, sign damage) as reflected by an increase of 5% of emergency work orders for facilities over 2010 baseline condition	• Educate to increase awareness of low impact practices and compliance with park rules and regulations • Increase interaction with park staff and law enforcement • Redistribute use to off- peak days

LONG-TERM MONITORING

Park staff would continue monitoring use levels and patterns throughout the park. In addition, park staff would monitor these user capacity indicators. The intensity of monitoring the indicators (e.g., frequency of monitoring cycles, amount of geographic area monitored, staff availability) might vary considerably depending on how close existing conditions are to the standards. If the existing conditions are far from exceeding the standard, the rigor of monitoring might be less than if the existing conditions are close to or trending towards the standard.

Initial monitoring of the indicators would determine if the indicators are accurately measuring the conditions of concern and if the standards truly represent the minimally acceptable condition of the indicator. Park staff might decide to modify the indicators or standards and revise the monitoring program if better ways are found to measure changes caused by visitor use. Most of these types of changes should be made within the first several years of initiating monitoring. After this initial testing period, adjustments would be less likely to occur. Finally, if use levels and patterns change appreciably, park staff might need to identify new indicators to ensure that desired conditions are achieved and maintained. This iterative learning and refining process, a form of adaptive management, is a strength of the NPS user capacity management program.

COMPARATIVE COST ANALYSIS

The actual cost of implementing the approved general management plan will ultimately depend on future funding and service-wide priorities over the life of the plan, as well as the ability to partner with other agencies or groups. Approval of a general management plan does not guarantee that funding and staffing needed to implement the plan will be forthcoming. Funding for capital construction improvements is not currently shown in NPS construction programs. It is not likely that all capital improvements will be totally implemented during the life of the plan. Larger capital improvements may be phased over several years.

Cost estimates were developed through an evaluation of capital and annual operating costs for each of the alternatives. The estimates in this section regarding the general costs of implementing the alternatives were developed based on fiscal year 2008 dollars using NPS and industry standards to the extent available. These estimates are not intended for budgeting purposes.

Range of Annual Costs

The range of annual costs includes personnel, maintenance, and operations costs. The park's operations costs for fiscal year 2008 were \$1,728,600. The existing staffing level is approximately 14 full time permanent employees (Table 7).

The costs for staffing for each of the alternatives have been adjusted to address the need for additional fulltime employees, or equivalents, to provide essential protection, maintenance, and visitor services for the proposed new facilities at the park.

The annual costs for Alternative A would be approximately \$1,728,600, while the annual costs for Alternative B, Alternative C, and Alternative D would be approximately \$2,272,700, \$2,356,700, and \$2,379,200, respectively. The actual cost of staffing each alternative would vary according to the government service rating, experience level, and education and professional certifications as well as the deployment of staff needed to provide minimum levels of satisfactory park services.

One-Time Costs

The range of initial one-time costs including construction, facility modifications, general improvements and natural and cultural resource studies and plans identified for each alternative are outlined on Table 7.

One-time costs for Alternative A include maintenance of vehicles and vessels necessary for law enforcement activities and resource management actions; removal of fishing gear that has been abandoned at Buck Island Reef, presenting risk to park resources; installation of boundary and regulatory buoys for the expanded boundary to delineate the park boundary to allow for enforcement of park regulations and for visitor awareness; installation of 8 new administrative moorings to support resource management and monitoring needs as well as serve law enforcement needs; and a study of submerged culture resources. These projects are estimated at \$1.1 million and are common to all alternatives.

One-time costs for Alternative B, Alternative C, and Alternative D are all estimated to be \$1.3 million. When compared to Alternative A, these Alternatives include installation of additional public moorings at the park, terrestrial trail stabilization, and signage to include descriptions of the management zones. In addition, a 22 foot vessel would be purchased to provide access for maintenance staff to Buck Island. This vessel would be equipped to accomplish routine maintenance activities at Buck Island. In addition to these project costs, Alternative C would also include costs to install new signage delineating and educating visitors about bow and stern anchoring and appropriate uses in the Anchoring Zone.

All cost estimates are for recommended improvements and for education and visitor services; they do not reflect cost sharing anticipated from other federal, state, territory, or municipal agencies or from the private sector.

Table 7. Comparison of Costs Estimated for Each Alternative

	Alternative A	Alternative B	Alternative C	Alternative D
Annual Operating Costs (ONPS)	\$1,728,600	\$2,272,700	\$2,356,700	\$2,379,200
Staffing (FTE)	14	20	22	23
Total One-Time Costs	\$1,142,900	\$1,258,400	\$1,268,400	\$1,258,400
Facility Costs	\$994,900	\$1,110,500	\$1,120,500	\$1,110,500
Non-Facility Costs	\$121,000	\$121,000	\$121,000	\$121,000
Other Costs	\$27,000	\$27,000	\$27,000	\$27,000
Projects	• Maintain vehicles and vessels • Remove fishing gear at Buck Island Reef • Install boundary and regulatory buoys for expanded boundary • Install 8 new moorings for administrative use • Conduct submerged cultural resource investigation	• All projects listed under Alternative A • Purchase a 22 foot boat for maintenance staff, equipped to conduct routine activities at Buck Island. • Purchase and install a maximum of 63 new moorings • Install information signs describing management zones • Stabilize terrestrial trail	• All projects listed under Alternatives A and B • Increase signage for bow and stern anchoring / Anchoring Zone	• All projects listed under Alternatives A and B
Additional Assumptions: 1. The base year for all cost estimates is 2008. 2. The cost estimates have been developed using NPS and industry standards to the extent available, and are not intended for budgeting purposes. 3. Annual operating costs are inclusive of personnel, equipment, vehicles, materials and supplies, utilities, and other services. Cost and staffing estimates assume that the alternative is fully implemented as described in the narrative. One-time non-facility costs include actions for the preservation of cultural or natural resources not related to facilities, the development of visitor use tools, and other park management activities that would require substantial funding above park annual operating costs.				

MITIGATION MEASURES COMMON TO ALL ACTION ALTERNATIVES

Congress charged the NPS with managing the lands under its stewardship “in such manner and by such means as will leave them unimpaired for the enjoyment of future generations” (NPS Organic Act, 16 USC 1). As a result, the NPS routinely evaluates and implements mitigation measures whenever conditions occur that could adversely affect the sustainability of resources in the national park system.

To ensure that implementation of the action alternatives protects natural and cultural resources unimpaired while providing a high quality visitor experience, a consistent set of mitigation measures would be applied to actions proposed in this plan. The NPS would prepare and process appropriate environmental compliance reviews (i.e., those required by the National Environmental Policy Act, National Historic Preservation Act, and other relevant legislation) for these future actions. As part of the reviews, the NPS would avoid, minimize, or mitigate adverse impacts where practicable. The park could consider implementing a compliance-monitoring program that would apply these mitigation measures and also include reporting protocols.

The following mitigation measures and best management practices would be applied to avoid or minimize potential impacts from implementation of the management alternatives. Mitigation measures summarized in Table 8 would apply to all action alternatives.

Table 8. Mitigation Measures and Best Management Practices

Natural Resources	
• Best management practices would be implemented to control the amount of disturbance during mooring installation, trail construction, maintenance, or other activities. These practices would include erosion control measures, controlling the presence and distribution of exotic species, and avoidance of seagrass beds and other sensitive marine plants and animals. • Any ground disturbing activities would require compliance with park guidelines and requirements for control of exotic species. • Marine engines would be operated and maintained in accordance with recommended manufacturer operation and maintenance procedures. • Use of public education materials, revegetation of disturbed areas with native plants, and placement of barriers would be used to control potential adverse impacts from trail erosion, use of facilities, or recreational activities. • Efforts to document and protect rare, threatened, and endangered species would include completing environmental compliance prior to any activity, preparation of species-specific management plans, and agency coordination, research, and monitoring for these species. Management plans would include methods for implementation, performance standards, monitoring criteria, and adaptive management techniques. • Resource stewardship strategies would be developed for natural and cultural resources. • Additional interpretive, educational and outreach activities would promote understanding among park visitors. Maintaining partnerships, volunteer programs, and increasing partnerships, where feasible, would also help with the promotion of shared park values, quality visitor experiences and protection of resources.	
Cultural Resources	
• Ground-disturbing actions or actions that could disturb submerged cultural resources would be designed to avoid known archeological sites and historic features. • Before any ground disturbing activity such as trail building, installation of moorings, buoys, etc. occurs, the proposed project area(s) would be surveyed for cultural resources, and identified resources would be evaluated under National Register of Historic Places criteria. Protective measures, including site avoidance, would be developed and implemented in accordance with 36 Code of Federal Regulations, part 800.	

Table 8. Mitigation Measures and Best Management Practices (Continued)

Cultural Resources (Continued)
• Until such time as the appropriate cultural landscape inventories/evaluations have been conducted, trail work on Buck Island would be preceded by identification and documentation of “marker” plant species (either exotic or native species) for prehistoric and historic archeological sites. Plants that potentially could have ethnographic or cultural landscape value also would be documented and, wherever possible, left undisturbed. • Under authority of the Archaeological Resources Protection Act and the National Historic Preservation Act, publicly disseminated information about location, nature, and ownership of shipwrecks discovered within the park boundaries would be of a general nature to avoid possible vandalism, pilfering, or other damage. • If previously undiscovered archeological resources are unearthed, or in the unlikely event that human remains are discovered, work would be stopped in the area of the discovery, resources would be protected, and the park would follow procedures in accordance with 36 Code of Federal Regulations part 800. • Known archeological sites would not be disturbed by trail or sign installation activities and equipment staging areas would be located away from known resources. Construction crews would be briefed on avoidance of known archeological resources. • Contractors and construction crews would be informed of the federal policies and penalties regarding the illegal collection of artifacts or disturbance of plants and animals in the park.

ENVIRONMENTALLY PREFERRED ALTERNATIVE

According to the Council on Environmental Quality, regulations implementing the National Environmental Policy Act, and NPS guidelines (Director’s Order No. 12), an environmentally preferred alternative must be identified in environmental documents. The environmentally preferred alternative would cause the least damage to the biological and physical environment, and would best protect, preserve, and enhance historical, cultural, and natural resources. Section 101(b) of the National Environmental Policy Act identifies six criteria to help determine the environmentally preferred alternative. Alternative B has been determined to be the environmentally preferred alternative due to its ability to best meet the Section 101(b) criteria as described below:

Fulfill the responsibilities of each generation as trustee of the environment for succeeding generations.

Alternative B would best protect the environment by limiting anchoring within park boundaries and providing moorings as an alternative means of accessing Buck Island for recreational use. Alternative B has a larger Resource Protection Zone due to the absence of an Anchoring Zone, providing greater protection for seagrasses and other marine plants and animals. Mooring causes fewer adverse environmental effects than anchoring. Installation of moorings and phasing out of the majority of anchoring in the park would reduce adverse effects resulting in less stress to ecological communities and healthier marine resources that may better cope with stresses related to climate change. These projected changes, such as sea level rise, frequency and duration of storms, coastal erosion, and acidification all contribute to conditions that may change the seagrass community over time, and therefore where anchoring would be most appropriate. Alternative B provides the ability to better adapt to such changes and protect seagrass and sand communities, while providing continued access. Due to these factors, all other alternatives would fulfill this criterion to a lesser degree.

Assure for all Americans safe, healthful, productive, and aesthetically and culturally pleasing surroundings.

Alternative C would best meet this criterion because it provides vessel access to the beach and allows for close access to personal vessels for visitors who prefer not to swim, or are unable to swim easily to the shore. However, the practice of shoreline bow and stern anchoring under Alternative C also creates trip and fall safety hazards for beach goers due to vessel anchor lines. The beach access channels provided under the other action alternatives provides other means of accessing the beach from moored vessels. Therefore, the other alternatives would fulfill this criterion, but to a lesser degree. The alternative with the greatest challenge to meet this criterion is Alternative A since no new personnel would be proposed to help enforce regulations and protect resources in the park.

Attain the widest range of beneficial uses of the environment without degradation, risk to health or safety, or other undesirable and unintended consequences.

Alternative B would attain the widest range of beneficial uses of the environment, without degradation, risk to health or safety, or other undesirable and unintended consequences. Of all the alternatives, Alternative B would do the most to minimize inadvertent or unintentional damage to park resources. Under Alternatives C and D, there is greater potential for unintentional or inadvertent damage with the greater use of anchors. In addition, fewer vessels would have access to Buck Island under Alternative B compared to Alternatives A, C or D. Therefore, the level of recreational use would be less, resulting in lower potential for inadvertent or unintentional damage to resources associated with hiking trail use on Buck Island, disturbance of marine animal life or vegetation, or disturbance to corals and other sensitive species.

On balance, both Alternatives B and C would attain the widest range of beneficial uses of the environment without risk of safety. Whereas Alternative B would require visitors mooring off West Beach to use the beach access channel to reach the shore, Alternative C would allow bow and stern anchoring along the shoreline. For visitors who prefer to shoreline bow and stern anchor, Alternative C would provide for safer access to Buck Island. However, anchor lines along the shoreline would create a safety trip hazard for visitors and increase number of vessels in close proximity to the beach causing potential disturbances to seasonal nesting birds and turtles. The presence of up to 20 shallow draft vessels up to 42 feet anchored bow and stern at the beach causes noise and activity levels that impact seasonal nesting birds. However, the bow and stern anchoring is at its highest level on weekends and long holiday weekends. During the week visitation levels are lower, and disturbances are less frequent. The proposed increase in ranger presence within the park under Alternatives B, C and D would increase the level of enforcement and ability to promote the values of the park. This would help reduce the potential for inadvertent or unintentional damage to resources, as compared to Alternative A. Overall, Alternative B would best meet the objective of this criterion.

Preserve important historic, cultural, and natural aspects of our national heritage, and maintain, wherever possible, an environment which supports diversity, and variety of individual choices.

Each of the alternatives preserves important historical, cultural and natural aspects of the nation's heritage and maintains, wherever possible, an environment which supports diversity and variety of choice. In terms of access to areas that may allow greater choice in the fulfillment of this experience, Alternative C offers the greatest variety to access Buck Island by providing opportunities for shoreline bow and stern anchoring and mooring.

Achieve a balance between population and resource use which will permit high standards of living and a wide sharing of life's amenities.

Each of the action alternatives provide equal opportunity for commercial services to operate in the park in the future. Opportunities for sharing park resources and facilities are also similar under Alternatives B, C and D. Therefore there are no major discernable differences across alternatives with regard to this criterion.

Enhance the quality of renewable resources and approach the maximum attainable recycling of depletable resources.

Alternative B would best meet this criterion, as it would improve renewable resource conditions for wildlife and vegetation. All the other alternatives would maintain existing conditions or result in reductions in the quality of renewable resources through alteration or loss of habitat or inadvertent damage to resources. None of the alternatives proposes long-term changes in the use of depletable resources; therefore, no discernable difference exists between the alternatives for this component of the criterion.

Some specific actions under Alternative B may achieve similar, or in some cases greater, levels of protection for cultural and natural resources than under Alternatives C or D. Based on potential resource and visitor impacts and on proposed mitigation for impacts to natural and cultural resources, Alternative B best meets the six criteria. Whereas Alternative C integrates resource protection with greater variety for visitor access to Buck Island for recreational use, Alternative B provides an advantage for the protection of cultural and natural resources while attaining the widest range of beneficial uses of the environment without degradation or other undesirable and unintended consequences.

ALTERNATIVES AND ACTIONS CONSIDERED BUT DISMISSED FROM DETAILED EVALUATION

Some aspects of the preliminary alternatives presented to the public in 2005 were changed or dismissed from further evaluation as a result of public input and the May 2006 listing of elkhorn and staghorn coral as threatened species under the Endangered Species Act. The changes made to the alternatives include the following:

- The size of the Recreation Zone was increased at the east end of Buck Island to accommodate a SCUBA diving area while also clearly defining the area for monitoring listed coral species.
- The size of the Marine Hazard Zone was increased to address marine hazards and protection of major portions of reef habitat. Boating in this zone was eliminated due to boater safety concerns associated with marine hazards and dangers to shallow reef resources, especially threatened coral species.
- The Anchoring Zone was changed to reflect the desire of visitors to maintain shoreline bow and stern anchoring at Buck Island. The size of the zone was adjusted in Alternative C to reflect current use patterns. In Alternative D, the shape of the zone was changed to reflect avoidance of seagrass beds while allowing for the addition of moorings beyond the zone. The number of potential moorings was increased for each of the action alternatives.

SUMMARY OF ENVIRONMENTAL CONSEQUENCES

A summary of environmental consequences is provided in Table 9. The summary shows each alternative's potential effects by impact topic. Detailed descriptions of the context, intensity, and duration of impacts--called thresholds--are provided in Chapter 4 Environmental Consequences.

Table 9. Summary of Impacts of the Alternatives

Impact Category	Alternative A	Alternative B: Preferred Alternative	Alternative C	Alternative D
Natural Resources				
Soil/ Sand	Long- and short-term, minor, adverse Cumulative: Long- and short-term, minor, and adverse	Long- and short-term, negligible, adverse Cumulative: Long- and short-term, minor, and adverse	Long- and short-term, minor to moderate, and adverse Cumulative: Long- and short-term, minor to moderate, and adverse	Long- and short-term, minor to moderate, and adverse Cumulative: Long- and short-term, minor to moderate, and adverse
Water Resources	Long- and short-term, minor, adverse Cumulative: Long- and short-term, minor, and adverse	Long- and short-term, minor, beneficial Cumulative: Long- and short-term, minor, and beneficial	Long- and short-term, negligible, adverse Cumulative: Long- and short-term, negligible, and beneficial	Long- and short-term, minor, adverse Cumulative: Long- and short-term, negligible, and adverse
Vegetation	Short-term, minor, and adverse Cumulative: Long-term major beneficial	Long-term, negligible to minor adverse Cumulative: Long- and short-term, major, and beneficial	Long-term, minor, and adverse effect Cumulative: Long- and short-term, moderate, beneficial	Long-term, moderate, adverse Cumulative: Long- and short-term, moderate, and beneficial
Wildlife	Short- and long-term, negligible to minor, and adverse Cumulative: Long-term, moderate, and beneficial	Long-term, minor benefit Cumulative: Long-term, moderate to major, and beneficial	Long-term, negligible beneficial Cumulative: Long-term, moderate to major, and beneficial	Long-term, negligible adverse effects Cumulative: Long-term, moderate to major, and beneficial
Marine and Coastal Resources				
Shallow Water Coral Reef Community	Long-term, moderate, and adverse Cumulative: Long-term, major and adverse	Long- and short-term, moderate to major, and beneficial Cumulative: Long-term, major and adverse	Long- and short-term, negligible, and beneficial Cumulative: Same as Alternative B	Long-term, minor, adverse Cumulative: Same as Alternative B
Sand Bottom Community	Long-term, moderate, and adverse Cumulative: Long-term, major and adverse	Long-term, moderate to major beneficial Cumulative: Long-term, major and adverse	Long-term, minor, adverse Cumulative: Same as Alternative B	Long-term, minor, and adverse Cumulative: Same as Alternative B
Seagrass and Algal Plain Community	Long-term, moderate, and adverse Cumulative: Long-term, major and adverse	Long-term, moderate to major beneficial Cumulative: Long-term, major and adverse	Long-term, moderate to major, beneficial Cumulative: Same as Alternative B	Long-term, moderate, adverse Cumulative: Same as Alternative B

Table 9. Summary of Impacts of the Alternatives (Continued)

Impact Category	Alternative A	Alternative B: Preferred Alternative	Alternative C	Alternative D
Deep Reefs and Wall Reefs	Long- and short-term minor, and adverse Cumulative: Long-term, major and adverse	Long-term, minor and beneficial Cumulative: Long-term, major and adverse	Long-term, minor, beneficial Cumulative: Same as Alternative B	Long-term, minor, beneficial Cumulative: Same as Alternative B
Deep Water Abyssal Bottom Community	Long- and short-term, negligible, and adverse Cumulative: Long-term, major and adverse	Long-term, negligible, beneficial Cumulative: Long-term, major and adverse	Long-term, negligible, beneficial Cumulative: Same as Alternative B	Long-term, negligible, beneficial Cumulative: Same as Alternative B
Deep Water Oceanic/ Pelagic Community	Long- and short-term, minor, and adverse Cumulative: Long-term, major and adverse	Long-term, minor, beneficial Cumulative: Long-term, major and adverse	Long-term, minor, beneficial Cumulative: Same as Alternative B	Long-term, minor, beneficial Cumulative: Same as Alternative B
Fish/Aquatic Life				
Fish	Long-term, minor, beneficial Cumulative: Long-term, major and adverse	Long-term, moderate to major, beneficial Cumulative: Long-term, major and adverse	Long-term, minor to moderate, beneficial Cumulative: Long-term, major and adverse	Long-term, minor to moderate beneficial Cumulative: Long-term, major and adverse
Other Marine Animals	Long-term, minor, beneficial Cumulative: Long-term, major and adverse	Long-term, moderate to major, beneficial Cumulative: Long-term, major and adverse	Long-term, minor to moderate, beneficial Cumulative: Long-term, major and adverse	Long-term, minor to moderate, beneficial Cumulative: Long-term, major and adverse
Species of Concern				
Elkhorn and Staghorn Coral	May affect, likely to adversely affect Cumulative: may affect/ likely to adversely affect	May affect, not likely to adversely affect Cumulative: same as Alternative A	May affect, not likely to adversely affect Cumulative: same as Alternative A	May affect, not likely to adversely affect Cumulative: same as Alternative A
Sea Turtles (Green Turtle, Hawksbill Turtle, Leatherback Turtle, and Loggerhead Turtle)	May affect / not be likely to adversely affect Cumulative: may affect/ not likely to adversely affect	May affect, not likely to adversely affect Cumulative: same as Alternative A	May affect, not likely to adversely affect Cumulative: same as Alternative A	May affect, not likely to adversely affect Cumulative: same as Alternative A
St. Croix Ground Lizard	May affect / not likely to adversely affect Cumulative: may	May affect, not likely to adversely affect Cumulative: same as	May affect, not likely to adversely affect Cumulative: same as	May affect, not likely to adversely affect Cumulative: same as

Table 9. Summary of Impacts of the Alternatives (Continued)

Impact Category	Alternative A	Alternative B: Preferred Alternative	Alternative C	Alternative D
	affect/ not likely to adversely affect.	Alternative A	Alternative A	Alternative A
Brown Pelican	Short-term, negligible adverse effects Cumulative: long-term, major, and adverse.	Long-term, minor, beneficial effect Cumulative: same as Alternative A	Long-term, minor, beneficial effect Cumulative: same as Alternative A	Long-term, minor, beneficial effect Cumulative: same as Alternative A
Least Tern	Long-term, minor, adverse effects Cumulative: long-term, major, and adverse	Long-term, negligible, adverse effects Cumulative: same as Alternative A	Long-term, minor, adverse effect Cumulative: same as Alternative A	Long-term, minor adverse effect Cumulative: same as Alternative A
Territory Listed Plant Species	Long-term, minor, and beneficial Cumulative: long-term, moderate, and adverse	Long-term, minor, beneficial Cumulative: same as Alternative A	Long-term, minor, beneficial effect Cumulative: same as Alternative A	Long-term, minor, beneficial effect Cumulative: same as Alternative A
Cultural Resources				
Archeological Resources	Long-term, moderate, and adverse effects due to human activities, natural processes, and lack of data Park management, interpretation, and visitor education efforts would have long-term, minor benefits Cumulative: Long-term, minor to moderate, and adverse	Long-term, minor adverse effects due to human activities, natural processes, and lack of data Long-term moderate benefits would accrue from NPS management, interpretive, preservation, and protection efforts Cumulative: Long-term, minor, and adverse	Long-term, minor, and adverse effects from human activities Moderate benefits resulting from management efforts, management zones, mitigation measures for development, proactive management and enhanced opportunities for visitor education Cumulative: long-term, minor, and adverse	Impacts from human activities are the same as Alternative B Effects from NPS Management, interpretive, preservation, and protection efforts would be the same as Alternative B Cumulative: Same as Alternative B
Soundscape				
Soundscape	Long- and short-term, negligible to moderate and adverse Cumulative: Long- and short-term, negligible to minor, and adverse	Long- and short-term, negligible to minor and beneficial Cumulative: Long- and short-term, minor, and beneficial	Long- and short-term, minor, and adverse Cumulative: Long- and short-term, negligible, and adverse	Long- and short-term, minor to moderate, and adverse Cumulative: Long- and short-term, negligible, and adverse

Table 9. Summary of Impacts of the Alternatives (Continued)

Impact Category	Alternative A	Alternative B: Preferred Alternative	Alternative C	Alternative D
Scenic Resources				
Scenic Resources	Long- and short-term negligible, and adverse Cumulative effects on viewshed and seascape would be long- and short-term, minor, and adverse. Cumulative effects on underwater scenic resources would be long-term, major and adverse	Long-term, minor, and adverse Cumulative: Same as Alternative A	Same as Alternative B Cumulative: Same as Alternative A	Same as Alternative B Cumulative: Same as Alternative A
Visitor Use and Experience				
Visitor Use and Access	Long- term, major, beneficial effects for visitors who value accessing Buck Island via both anchoring at West Beach and existing moorings near the underwater trail Long-term, moderate, adverse effects for visitors who prefer a substantially anchorless park and/or a change to the current visitation trends Cumulative: Long-term, minor, and beneficial	Long-term, major, adverse effect for visitors who value accessing the park via both anchoring and mooring Long- and short-term, moderate, beneficial effects for visitors who prefer a substantially anchorless park and/or a change to the current visitation trends Cumulative: Long-term, major, adverse effects for visitors who value accessing the park via both anchoring and mooring Long- and short-term, moderate, beneficial effects for visitors who prefer a substantially anchorless park and/or a change to the current visitation trends	Long-term, minor to moderate, and beneficial effects for visitors who value accessing the park via moorings and anchoring Long- and short-term, moderate, and adverse effects to visitors who prefer a substantially anchorless park and a change in visitation use trends Cumulative: Long-term, minor to moderate, and beneficial effects for visitors who value accessing the park via moorings and anchoring Long- and short-term, moderate, and adverse effects to visitors who prefer a substantially anchorless park and a change in visitation use trends	Long-term, minor, and adverse for visitors who value accessing the park via both anchoring and mooring and appreciate a more social experience Long- and short-term, major, and adverse for visitors who prefer a substantially anchorless park, fewer vessels and therefore fewer visitors Cumulative: Long-term, minor, and adverse

Table 9. Summary of Impacts of the Alternatives (Continued)

Impact Category	Alternative A	Alternative B: Preferred Alternative	Alternative C	Alternative D
Recreational Opportunity	Long-term, minor, and beneficial Cumulative: Long-term, minor, and beneficial	Long- and short-term, major, beneficial effects on visitors who prefer a substantially anchorless park and limitations on recreational opportunities to provide greater resource protection Long- and short-term, major, adverse effects on visitors who prefer to anchor and enjoy similar recreational opportunities and access provided under current conditions Cumulative: long- and short-term, major, beneficial effects on visitors who prefer a substantially anchorless park and limitations on recreational opportunities to provide greater resource protection long- and short-term, major, adverse effects on visitors who prefer to anchor and enjoy recreational opportunities provided under current conditions	Long- and short-term, moderate, and beneficial Cumulative: Long- and short-term, moderate, and beneficial	Long- and short-term, minor, and beneficial Cumulative: Long- and short-term, minor, and beneficial
Access to Orientation Information and Interpretation	Long- term, minor to moderate, and adverse Cumulative: Long-term, minor, and adverse	Long- and short-term, major, and beneficial Cumulative: Long- and short-term, major, and beneficial	Long- and short-term, major, and beneficial effects Cumulative: Long- and short-term, major, and beneficial	Long- and short-term, moderate, and beneficial Cumulative: Long- and short-term, moderate, and beneficial

Table 9. Summary of Impacts of the Alternatives (Continued)

Impact Category	Alternative A	Alternative B: Preferred Alternative	Alternative C	Alternative D
Park Operations and Facilities				
Park Operations	Long- and short-term, moderate, and adverse Cumulative: Long- and short-term, moderate and adverse	Long- and short-term, major, and beneficial Cumulative: Long- and short-term, major, and beneficial	Long- and short-term, moderate, and beneficial Cumulative: Long-term, moderate, and beneficial	Long- and short-term, minor, and adverse Cumulative: Long- and short-term, negligible, and adverse
Public Health and Safety				
Public Health and Safety	Long- and short-term, minor, and adverse Cumulative: Long- and short-term, minor, and adverse	Long- and short-term, minor, and beneficial Cumulative: Long- and short-term, minor and beneficial	Long- and short-term, negligible, and beneficial Cumulative: Long- and short-term, negligible and beneficial	Long- and short-term, negligible, and adverse Cumulative: Long- and short-term, negligible and beneficial
Sustainability and Long-Term Management				
Unavoidable Adverse Impacts	No major adverse effects	No major adverse effects for natural and cultural resources. Unavoidable adverse effects for visitors who prefer opportunities for bow and stern anchoring.	No major adverse effects	No major adverse effects
Irreversible and Irretrievable Commitments of Resources	With the exception of fuels and raw materials, none	Some consumption of energy and materials	Some consumption of energy and materials	Some consumption of energy and materials
Relationship of Short-term Uses and Long-term Productivity	Visitor access and use would continue; NPS continues to manage for natural and cultural resource preservation.	Limited new facilities proposed would have short-term use; mitigation and best management practices would ensure long-term productivity of park resources.	Limited new facilities proposed would have short-term use; mitigation and best management practices would ensure long-term productivity of park resources.	Limited new facilities proposed would have short-term use; mitigation and best management practices would ensure long-term productivity of park resources.

Chapter 3

AFFECTED ENVIRONMENT



Photograph Courtesy of: Philippe Mayor

Elkhorn Coral

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CHAPTER 3 AFFECTED ENVIRONMENT

NATURAL RESOURCES

This section describes the characteristics of the existing environment that could be affected by the management alternatives. The description of the affected environment focuses on only those environmental aspects potentially subject to the effects resulting from the proposed management alternatives. This is done in compliance with the guidelines contained in the National Environmental Policy Act and Section 1502.15 of the regulations for implementing that act developed by the Council on Environmental Quality (1978). As discussed in Chapter 1, Purpose and Need for a General Management Plan, the NPS has identified impact topics that may be affected by the proposed actions or the no action alternative. This section establishes the basis for Chapter 4, Environmental Consequences, which addresses the effects the alternatives may have on the impact topics. Each impact topic addressed is as listed in Chapter 1.

Units for data presented in this plan are provided as published by individual references.

SOIL / SAND

Buck Island, situated off the north-eastern side of St. Croix, is 6,000 feet long, oriented in an east-west direction. The island is 2,000 feet wide at its widest point and rises in a single east-west ridge to an elevation of 340 feet. It covers a land area of about 176 acres, with 90 percent of its landmass consisting of slopes steeper than 30 percent. On the island's eastern two-thirds the shore is gravelly or rocky, falling steeply into the sea.

The coastal areas of the U.S. Virgin Islands vary widely. The St. Croix/Buck Island complex developed from volcanic ash deposited on the sea floor, which through plate tectonics has been pushed up, folded, and tilted, creating a very rugged coastline that exhibits a variety of substrate types. Rocky coralline materials dominate most beaches; Buck Island's sands consist of rounded remains of calcite composed of the skeletons of organisms that live between the beach and the reef. The action of waves, storms, grazing of parrotfish, snails, and sea urchins reduces the coral reef to sand size pieces. This coral sand mixes with shells, sponge spicules, sea urchin spines, calcified algae, and "foraminifera." Forams cause the pink color in the beaches. The dark red skeletal animals in particular, *Homotrema rubrum*, grow on the underside of coral reefs and when the red forams die, the skeletons drop to the ocean floor. Wave action erodes the forams and mixes them with fragments of coral, shells, and algae, and coral sand is created. Beach sand depth above the bedrock varies, depending on the wave action and current.

Running east to west along the southern side of Buck Island is a narrow sandy beach; toward the southwestern end, the beach expands into a large seasonal sand spit. Along the island's south shore (from Turtle Bay to the Diedrich's Point picnic area) the coastline consists of coral cobble and narrow coralline sand in front of the beach forest. At West Beach, sand fringes an eroded shoreline and manchineel-dominated beach forest for about 1,000 feet. West Beach is backed by sand dunes and beach grasses to the east and wraps around the western end of the island from the southwest side to the North Shore, covering a moderately level area of about 10 acres.

West Beach is the primary beach used by visitors to the island, and is a dynamic, high energy environment due to wave action, currents, wind, and storm events. This wide open beach changes in shape and size with seasonal sand transport (NPS 2000b). West Beach sands build in the winter, typically peaking in March, with sand loss occurring during summer months as a result of oceanographic conditions. In addition, sand bottoms near the beach can be removed by storms, leaving bare limestone pavement and bedrock. The greatest loss of permanent beach occurred during hurricane Hugo in 1989, in addition to destroying a conch midden (600-1200 A.D.) that was located

on the southwestern corner of West Beach. Increased frequency and intensity of hurricane and tropical storm activity continues to erode this section of West Beach, directly affecting the space available for picnic and other recreational use. Storms also cause soil erosion in other areas of Buck Island. Trail stabilization measures have been used to address soil erosion caused by Hurricane Omar in 2008.

Upland soils of the U.S. Virgin Islands consist of shallow, gravelly loams and clayey loams (USDA 2002). Buck Island upland soils are dominated by shallow, well-drained, stony soils that cover the slopes and summits. The soils are generally 10 inches deep or less, with weathered bedrock found at depths from 10 to 30 inches (USDA 2002). The general soil map of St. Croix produced by the U.S. Department of Agriculture Natural Resources Conservation Service indicates that the majority of Buck Island is characterized by the Southgate-Victory-Cramer general soil map unit, while a very small parcel of the northeastern tip of Buck Island is characterized by the Annaberg-Cramer-Southgate soil map unit. Both units are described as well-drained, steep to very steep soils on summits and side slopes of volcanic hills and mountains. The Southgate-Victory-Cramer unit is described as shallow and moderately deep while the Annaberg-Cramer-Southgate is described as shallow. Both units are associated with rugged hills that are dissected by very narrow valleys that have dendritic drainage patterns (USDA 1998).

A small, rain-fed salt pond is located on the south side of Buck Island slightly east of Diedrich's Point picnic area. Saline marshes in this region are characterized by very deep, very poorly drained soils that have formed by alluvial and marine sediments and the remains of hydrophytic plants. These soils are high in organic matter and would commonly be called muck (USDA 2002).

WATER RESOURCES

Freshwater resources are limited in the U.S. Virgin Islands. There are no large freshwater lakes, ponds, or perennial streams on any of the islands. Gullies, or "guts" as they are locally called, flow intermittently in response to rain and storm events. The absence of large freshwater resources and perennial streams means that guts form the basis for watershed management in the territory (DPNR 2006a).

Watersheds have a high percentage of steep slopes and rocky, well-drained soils. This results in runoff rushing from the mountains to valley bottoms and the sea. Short-duration, localized flooding is a concern on the islands, especially in the event of a tropical storm or hurricane. Drought is also a concern on the islands, affecting some part of the islands each year. Because of the shallow, rocky soils and lack of freshwater supplies, these dry periods can adversely affect plant communities (USDA 2002).

Saltwater ponds may develop at the mouth of guts where corals grow across the mouth near the shoreline. As materials are deposited on these shallow shoreline coral reefs, they build up a ridge that traps run-off water. In high tides or storms, there may be water exchange between the pond and the sea. These ponds support mangrove stands and also serve as important habitats for wildlife. The salt pond located on the south side of Buck Island is no longer connected to the sea; it typically remains dry, but can remain wet for weeks at a time during rainy periods.

Groundwater resources are also limited in the territory and are subject to saltwater intrusion and pollution by wastewater and petroleum products. Most of the potable water supply for the islands comes from stored rainwater and/or desalination plants, which provide water for the urban and residential communities throughout St. Croix. There is no potable water supply on Buck Island.

Water Quality Standards

Waters of the U.S. Virgin Islands are classified into three groups based on designated uses: Class A, B, and C. Class A waters are defined as being for the preservation of natural phenomena requiring special

conditions with existing natural conditions that shall not be changed. Class A water standards are the most stringent of the three classes because of its pristine or near-pristine state. The waters surrounding Buck Island are designated as Class A. Class B and C waters are for the propagation of desirable species of marine life and for primary contact recreation. Class C waters have less stringent water quality standards than Class B (DPNR 2006a). Appendix C includes a summary of the water quality standards for each of these classes.

U.S. Virgin Islands water quality standards do not address drinking water use attainment. Since most of the drinking water supply comes from reverse osmosis and flash desalinization plants or from traditional rainwater cisterns, most drinking water issues directed at surface or groundwater resources are not applicable in the territory. There are no water quality standards available for organic compounds, inorganic compounds, unregulated chemicals, and radiological contaminants that apply to the ocean surrounding the territory as a drinking water source because ocean water does not fit the definition of surface water under the Safe Drinking Water Act (DPNR 2006a).

The territory is enhancing and strengthening its Water Pollution Control Act and revising its water quality standards. Draft revised standards, regulations, and related requirements were published for comment in December 2008. Final water quality standards were pending at the time of publication of this plan (DPNR 2008).

The Virgin Islands Beach Monitoring Program was established pursuant to requirements of the Beach Environmental Assessment and Coastal Health Act of 2000. Major goals of the Virgin Islands Beach Monitoring Program are to increase and improve water quality monitoring at local beaches, expand notification to the public of beach warnings or closings, and identify and eliminate threats to local beach water quality. While twenty beaches in St. Croix have been selected for routine monitoring for fecal coliform, the beach at Buck Island is no longer included (DPNR 2006c).

Sources of Pollution

Marine waters that encircle the U.S. Virgin Islands and Buck Island Reef National Monument are generally of good quality and support a variety of sensitive habitats, from mangroves to seagrasses to coral reefs. However, periodic reductions in local water quality result from ongoing erosion from rapid development and continued use of unpaved roads and releases of sediment during heavy rainfall events (USGS 2004; UVI 2004). Discharge of untreated or partially treated sewage can occur as chronic, low-level contamination from individual septic systems, recreational boaters, or municipal systems that are improperly maintained or inundated during tropical storm events. In addition, water quality in high boat traffic areas such as harbors and marinas can be degraded by petroleum products and industrial waste (UVI 2004).

Non-point Source Pollution. Non-point source pollution, especially from urban development, impairs more water bodies than any other source of pollution in the U.S. Virgin Islands. The physical processes by which urban development adversely affect water quality are storm water runoff, erosion, and sedimentation. Because of the scarcity of flat land, development in the territory has taken place in areas that far exceed the typical environmental constraint of 15 percent slope. Slopes in excess of 45 percent have been developed in the territory, further increasing the potential for erosion (DPNR 2006a). According to data summarized in the 2002 Virgin Islands Environmental Protection Handbook developed by the University of the Virgin Islands Cooperative Extension Service (Wright 2002), sediment is the most prevalent pollutant, by volume, polluting surface waters in the U.S. Virgin Islands. Uncontrolled construction site sediment loads have been reported to average 35 to 45 tons/acre/year in the continental United States (Novotny and Chesters 1981). However, a 1986 study of erosion rates on St. Thomas and St. Croix estimated erosion from a disturbed dirt road site to be 591 tons/acre/year (Wernicke, et al. 1986). Studies of erosion rates in the Fish Bay watershed on St. John have soil loss from dirt roads of between 100 to 600 tons per year (MacDonald, et al. 1997; Sampson 1997). Sediment has many harmful impacts on aquatic ecosystems, including increased

turbidity, reduced light penetration (which inhibits coral and seagrass growth), smothering coral reefs, reduced prey capture for sight-feeding fish, clogging of gills and filters in fish and shellfish, reduced spawning and juvenile fish survival, and decline of commercial and recreational fishing success (Schueler 1987, Rogers 1990) (see also “Marine and Coastal Resources” subsection of Chapter 3).

The pumping of bilge water (water that does not drain off the side of the deck but drains down into the boat and accumulates) from vessels in the park is a concern, since this water may contain oil, grease, fuel, or other materials. Water quality can also be seriously affected by oil spills resulting from accidental vessel groundings on reefs, and vessel discharge from tankers that may lighten their load east of the park prior to entry to the major oil refinery, Hess Oil Venezuela South America (HOVENSA), and/or the Wilfred "Bomba" Allick Port and Transshipment Center (locally known as "The Containerport") on the south shore of St. Croix, and/or into the Christiansted harbor, Port Authority terminal, southwest of the park.

Other forms of potential water pollution include paint from the bottoms of boats, insect repellent, and/or sunscreens worn by park visitors. Studies involving personal care products, including sunscreens, show that sunscreens promote viral infection in corals, potentially playing a role in coral bleaching in areas prone to high levels of recreational use (Danovaro, et al. 2008). Sunscreen products are also reported to bioaccumulate in aquatic animals (Giokas, et al. 2007 in Danovaro, et al. 2008).

The Department of Planning and Natural Resources established a Non-Point Source Program that administers grants and sets policies to mitigate non-point source pollution. The Program is supported by the Non-Point Source Pollution steering committee, a diverse group of individuals from the public and private sectors. The Program funds such initiatives as the *Environmental Protection Handbook* (Wright 2002) which serves as a guide for best management practices that should be used for all new construction. In addition, the Division of Environmental Protection added an Environmental Education and Outreach program that has been involved in numerous outreach projects, including: used oil drives, elementary and high school presentations, environmental public service announcements, and Non-Point Source Conferences.

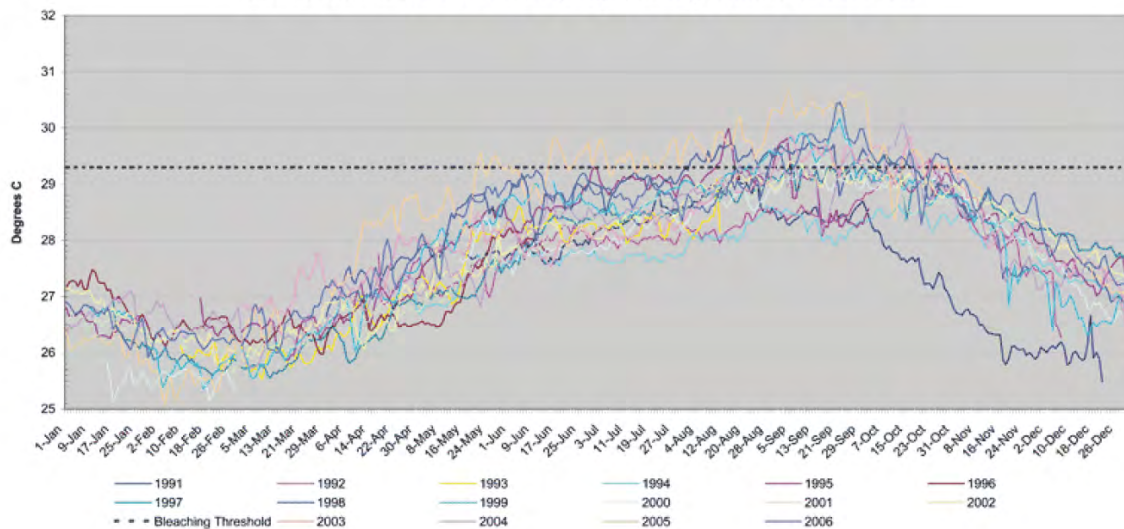
Point Source Pollution. U.S. Virgin Islands Code defines a point source as “any discernable, confined and discrete conveyance, including, but not limited to any pipe, ditch, channel, tunnel, conduit, well, discrete fissure, container, rolling stock, concentrated animal feeding operation, or vessel or other floating craft from which pollutants are or may be discharged” (VI Code T.12 §182(j)) (DPNR 2006c). Other regulated point source discharges in St. Croix include point source discharges from inadequate industrial commercial pretreatment operations (Manning Bay/Estate Anguilla Beach–public dump); municipal point source discharges (Hovensa, west treatment plant); and industrial point sources (rum plant outfall and Carlton Beach) (DPNR 2008). The locations of these point source outfalls are on the southwest end of St. Croix, and do not directly affect water quality within the park.

Water Quality Assessment within Park Boundaries

The most recent comprehensive inventory of water quality within the park boundary was published by the NPS Water Resources Division and Servicewide Inventory and Monitoring Program in 1999 (NPS 1999a). This document consists of a summary of surface-water-quality data retrievals from several databases from stations located within Buck Island Reef National Monument, Christiansted National Historical Site, and Salt River Bay National Historical Park and Ecological Preserve. The majority of data was obtained from the U.S. Environmental Protection Agency’s Storage and Retrieval (STORET) database. A total of 129 monitoring stations were queried, of which six were located within the boundary of Buck Island Reef National Monument with a record spanning from 1968 to 1996. Reported parameters included, but are not limited to, temperature, transparency (secchi depth), dissolved oxygen, pH, salinity, fecal coliform, phosphorus, and total Kjeldahl nitrogen. The six stations located within the park are shown in Appendix C.

Additionally, the park has collected water temperature data from two to four long term monitoring stations within the park since 1988. The “Marine and Coastal Resources” Section of this Chapter, Coral Bleaching subsection provides information on the relationship between temperature and coral bleaching events. Temperature data recorded from 1991 through 2006 near the underwater trail are plotted as shown on Figure 9 (Lundgren 2008).

**Figure 9. Buck Island Reef National Monument Temp Logger,
10m Depth Forereef Underwater Trail**



VEGETATION

The flora of Buck Island Reef National Monument includes both terrestrial and marine communities. The terrestrial plant communities are those found on the island from the water line landward, including mangroves, but dominated by coastal and tropical dry forest plants. Marine plant communities include substantial seagrass beds that occur in shallow waters that extend from the south side of Buck Island Channel to depths of 50 to 75 feet. Seagrass communities are discussed in the “Marine and Coastal Resources” subsection. Descriptions of terrestrial plant communities discussed in the following paragraphs are based on information contained in *The Flora of St. John* (Acevedo-Rodriguez 1996) and the park’s vascular plant inventory report (Ray 2003).

The composition of terrestrial plant communities within the park has been affected by numerous historical changes, resulting primarily from colonial-era land use activities. During the early days of the Danish colonial period (the eighteenth century), the original dense tropical forests described in earliest accounts were cleared for lumber, creating rough grazing for goats and sheep that remained on the island through the first quarter of the twentieth century. The tropical hardwood trees, particularly lignum vitae, were logged for timber for construction and export, and for conversion into charcoal, the main fuel source for the early settlers. The introduction of non-native animal species such as goats, Indian mongoose, tree rats, and the common house mouse, interrupted the ecological balance on the island and contributed to the decline and extirpation of native wildlife species like many ground-nesting birds and lizards. Non-native pest species also affected seed dispersal and success by consuming all mast production season after season. The introduction of non-native invasive plants resulted in the decline of certain native plant species due to the competition for light, nutrients, moisture, and space. Natural occurrences, such as extreme prolonged drought, periodic flooding, fires, and hurricanes, also affected composition of the plant community on Buck Island.

Terrestrial vegetation can be described as consisting of six distinct vegetation classifications: seasonal deciduous forest, beach forest, mangrove forest, thorn/cactus scrub, thicket scrub, and coastal thicket (Gibney 1996).

The **seasonal deciduous forest** community is found in guts and ravines, on the landward edge of beach forests, and on portions of the north-facing slopes of hills. Trees that dominate the canopy in this community include gumbo-limbo (*Bursera simaruba*), chinkwood (*Bourreria succulenta*), fish-poison tree (*Piscidia carthagenensis*), water mampoo (*Pisonia subcordata*), white manjack (*Cordia dentata*), and wild lime (*Adelia ricinella*). Areas that provide more moisture include black cedar (*Tabebuia heterophylla*), black mampoo (*Guapira discolor*), and ebony (*Krugiodendron ferreum*) in the tree layer. Gibney (1996) describes *Bursera* and *Guapira* trees that are over 100 years old in this vegetation community. Shrubs present in the understory include guayabilla (*Samyda dodecandra*), boxwood (*Schaefferia frutescens*), and broom bush (*Croton betulinus*) (Gibney 1996).

The **beach forest** occurs on the coastline around the perimeter of much of the island, but is most prevalent on the west end. The dominant tree in the beach forest canopy is the manchineel tree (*Hippomane manchinella*). Vegetation on Buck Island may be considered dangerous by visitors not familiar with the habitats. For example, the manchineel tree is poisonous; contact with this tree causes painful blisters, and eating the fruit can be deadly. Standing under the tree when it rains is also hazardous, as the water passing through the leaves and fruit can cause burns and blisters if it comes in contact with skin. Several hurricanes have altered the island coastal vegetation. Two major (category 4-5) hurricanes, Hugo (1989) and Marilyn/Luis (1995), severely damaged the manchineel beach forest along North Shore and West Beach and killed mature trees comprising a 30 to 40-foot high canopy. As of 2006, the manchineel beach forest has substantially recovered along with various other trees and shrubs, including water mampoo, white stopper (*Eugenia axillaris*), sea grape (*Coccoloba uvifera*), pink cedar (*Tabebuia heterophylla*) and orange manjack (*Cordia ricksickeri*).

The **thorn/cactus scrub** vegetation community is an open shrubland that provides a transition between the seasonal deciduous dry-forest and the thicket scrub, and is found predominantly on the southwestern slope of the island. The community is characterized by spiny shrubs of simple leaf bushweed (*Flueggea acidoton*), with casha (*Acacia tortuosa*) and greenheart ebony (*Rochefortia acanthophora*) and the tree-like forms of organ pipe cactus (*Pilosocereus royerii*). The thorn/cactus community is located predominantly on the southwestern slope of the island, and transitions into the scrub-thicket (dense shrubland) on the eastern end. Gibney (1996) speculated that the dominance of thorny plants evolved due to the grazing habitats of the imported goats and sheep that once inhabited the island; they avoided grazing on the thorny or toxic species, which flourished without competition from the more palatable species.

The **thicket/scrub** vegetation community is found predominantly on the east side of the island, and to a lesser degree, on the south slopes. This community is also believed to have occurred as a result of decades of grazing by goats and sheep and their preferential grazing on plants without thorns, spines, toxins, and other unpalatable attributes. Predominant species in this community include mainly shrubby species such as *Croton* sp., sage (*Lantana involucrate*), white manjack, bushy heliotrope (*Heliotropium ternatum*), and prickly bush (*Oplonia spinosa*). These shrubs are intertwined with vines such as monarch amazonvine (*Stigmaphyllon emarginatum*) and cluster vines (*Jacquemontia* spp.), creating dense, impenetrable stands. Two cactus species are frequently found as ground cover, including brittle-jointed “sucker” cactus (*Opuntia repens*) and turk’s cap cactus (*Melocactus intortus*).

The **coastal thicket** forms a narrow band of vegetation landward from the upper beach and berm on the south and west shores. The few woody species in this habitat include sea grape (*Coccoloba uvifera*), black torch (*Erithalis fruticosa*), and bitter ash (*Rauvolfia viridis*) as the dominant shrubby species present, with false button weed (*Spermacoce prostrata*), beach berry (*Scaevola plumieri*), sea purslane (*Sesuvium portulacastrum*), and bay bean (*Canavalia rosea*) comprising the understory.

There are no shallow estuarine areas or embayments on Buck Island to support a mangrove forest. However, white (*Laguncularia racemosa*) and black (*Avicennia germinans*) mangroves are present around the salt pond on the southern side of the island, forming a shallow band around its perimeter (Ray 2003). Buttonwood (*Conocarpus erectus*) was observed in 1976 (Woodbury, et al. 1976) but not in 1996 (Gibney 1996).

Infestations of non-native plant species on Buck Island are not as extensive as they are on neighboring islands. Most infestations are mixed with native plant communities and do not form mono-cultures, as is the case in other areas of the Caribbean. Seventeen species of non-native plants were observed in 1976 (Woodbury, et al. 1976), and two additional species were noted by Gibney (1996). The 2002 vascular plant inventory identified a total of 20 non-native plants, or 13 percent of 163 documented species (Ray 2003). Beginning in 2002, the NPS Exotic Plant Management Program identified 10 target non-native invasive species for island-wide eradication and control. The dominant species present at that time included tamarind (*Tamarindus indica*), genip (*Melicoccus bijugatus*), guinea grass (*Urochloa maxima*), ginger Thomas (*Tecoma stans*), wild pineapple, penguin (*Boerhavia erecta*), aloe (*Aloe vera*) and tan-tan (*Leucaena leucocephala*). Many of these species have been or are in the process of being eradicated from the island by the NPS; the park's non-native invasive plant control was at 60-80 percent for target species group by 2009. The invasive non-native vegetation on Buck Island is discussed in detail in the *Exotic Plant Management Plan Environmental Impact Statement for the South Florida and Caribbean National Parks* (NPS 2006b; 2010).

WILDLIFE

Approximately 10,000 years ago, St. Croix and Buck Island comprised a single land mass with similar floral communities (Woodbury, et al. 1976). When the ice caps began to melt and the Caribbean Sea rose, the two land masses were separated and became individual islands, but the flora on the islands did not significantly change. Based on this natural history it is assumed that the fauna communities of both islands would also be just as similar. Therefore, recent surveys of St. Croix faunal species were used to make assumptions regarding wildlife found in the park. On the other hand, no similar assumptions can be made with the fauna of St. Thomas, St. John, and Puerto Rico because these islands are on different oceanic plates and have been separated from St. Croix and Buck Island by a deep, wide channel for millions of years, which may have limited some species from colonizing.

Inventories were undertaken for most faunal species on the larger islands of the U.S. Virgin Islands and for Buck Island; those for Buck Island were completed and are included in the NPS National Inventory and Monitoring Program Vascular Plant and Vertebrate Inventories. Separate field surveys for Buck Island herpetofauna and bats were also completed (NPS 2008a).

Reptiles and Amphibians

Eight species of reptiles are known to occur on Buck Island, three of which are lizards (*Anolis acutus*, *Hemidactylus mabouia*, *Sphaerodactylus beattyi*), and four are sea turtles (leatherback, loggerhead, hawksbill, and green) (Waddell and Rice 2002). The only species previously reported from the island that was not detected was the St. Croix ameiva or ground lizard (*Ameiva polops*), a globally endangered lizard native to St. Croix (see Species of Concern section). Only one introduced species was detected, the tropical house gecko (*Hemidactylus mabouia*). No amphibians occur on the island.

Although the herpetofauna of Buck Island is small, it is important. Three of the island's lizards are endemic to St. Croix and the surrounding cays. The island has now become a significant refuge for the globally endangered St. Croix ground lizard since its successful reintroduction in 2007 (see Species of Concern). The only introduced species detected on Buck Island, the tropical house gecko, is ubiquitous throughout the West Indies (NPS 2008b). It is easily transported on boats and in building materials, the likely source of introduction onto Buck Island. This species has not been shown to interact negatively with the native herpetofauna elsewhere.

Eradication of the Indian mongoose (*Herpestes javanicus*) (1980-1985) and tree rat (*Rattus rattus*) (1999-2001) from Buck Island has been advantageous to the herpetofauna, eliminating a significant source of nest predation on sea turtles and reducing predation on the lizards. The current resource management strategy of maintaining rodent eradication should allow native fauna to thrive.

Birds

Birds species observed in the park include those that frequent the salt pond behind Diedrich's Point, like herons (*Ardea* sp.), egrets (*Egretta* sp.) and ducks, including Bahama white-cheeked pintail ducks (*Anas bahamiensis*). Other birds that frequent the beaches and shoreline coastal areas include sandpipers (*Calidris*, *Tringa*, and *Actitis* spp.); rarely noted are gulls (*Larus* sp.), plovers (*Charadrius* sp.), yellowlegs (*Tringa* sp.), terns (*Sterna* sp.), and stilts (*Himantopus mexicanus*). Birds known to be permanent residents or breeders on the island include bananaquit (*Coereba flaveola*), the Antillean crested hummingbird (*Orthorhyncus cristatus*), the green throated carib (*Eulampis holosericeus*), seasonal warblers (*Dendroica* sp.), the black-throated grass quit (*Tiaris bicolor*), mangrove cuckoo (*Coccyzus minor*), white crowned pigeon (*Patagioenas leucocephala*), common ground dove (*Columbia passerina*), pearly-eyed thrasher (*Maragarops fuscatus*), and belted kingfisher (*Cerle alcyon*). There is a roosting area for the magnificent frigate bird (*Fregata magnificens*), although there is no record of them nesting on the island. Several raptors have been observed on Buck Island, including the red-tailed hawk (*Buteo jamaicensis*), peregrine falcon (*Falco peregrinus*), and more frequently the osprey (*Pandion haliaetus*). There are several other protected species listed by the territory including the brown pelican (*Pelecanus occidentalis*) rookery, the largest for the St. Croix island group located on the island's north side; these species are discussed in greater detail in the *Species of Concern* section (DPNR 2005b). The least tern (*Sterna antillarum*), a protected migratory species, has been documented using the sand spit at West Beach as a seasonal nesting area. Seasonally adults continue to attempt nesting, laying eggs, however there has not been a successful nest fledged from 2005-2010.

The park maintains a complete bird species list. Future investigations regarding the island's species composition, breeding, habitat use, and nesting success, since the rat eradication is planned.

Mammals

At one time, the non-native roof or tree rat and Indian mongoose were the only mammals known to occur on Buck Island. These destructive pests were introduced by man and were severely altering the flora and fauna on the island; they were responsible for the nearly 100 percent destruction of endangered hawksbill sea turtle nests, destroying migratory least tern nesting colonies, and negatively affecting native vegetation and visitor experience. The NPS, in collaboration with the U.S. Fish and Wildlife Service and the Virgin Islands Division of Fish and Wildlife, began a mongoose control program in 1980 that ultimately removed 85 percent of the pests. In the mid-1990s, due to the absence of the mongoose, the tree rat population exploded, becoming another menace to the eggs and hatchlings of the threatened and endangered sea turtles. In 1999, an island-wide effort was undertaken by the NPS and the U.S. Department of Agriculture, Animal and Plant Health Inspection Service, Wildlife Services to rid the island of the invasive tree rat (NPS, 2002a). By December 2001, the project to control the rat population was declared a success, and bi-annual monitoring continues today. Following decline of the tree rat, there was an increase in the presence of the European house mouse (*Mus musculus*) whose population had previously been limited by the tree rats (Witmer, et al. 2007).

The National Park Service Vascular Plant Survey and Vertebrate Inventory and Monitoring Program began to survey Buck Island to confirm the presence of an elusive bat population. Conducted between 2003 and 2007, these bat surveys found few bats in residence, but some were observed foraging in the park during the wet season. The presence of both the velvety free-tailed bat (*Molossus molossus*) and Mexican free-tailed bat (*Tadarida brasiliensis*) were confirmed on Buck Island. Most bats require open bodies of fresh water for drinking and foraging, and there are no freshwater wetlands present in the park (NPS 2008a).

Terrestrial Invertebrates

Invertebrates are the dominant terrestrial life form in the U.S. Virgin Islands (DPNR 2005b). Buck Island, like the rest of the Virgin Islands, has an abundance of invertebrates such as snails, crabs, spiders, scorpions, centipedes, millipedes, beetles, and insects. Beetles are prevalent at Buck Island, prompting a beetle fauna survey from 1993-1997 that resulted in the identification of over 126 species of beetles (coleopteran), including several endemic species and two new species of Chrysomelidae (*Longitaris milleri* and *Longitaris zandae*) and Curculionidae *Decuanellus brevicrus* (Pollock and Ivie 1996).

The NPS conducted a short-term, terrestrial invertebrate fauna survey in 1996 that assessed the invertebrate species present at Buck Island and their susceptibility to a variety of capture methods. The survey recorded several invertebrate groups, including Blattaria (cockroaches), Millipede (millipedes and centipedes), Orthoptera (grasshoppers and crickets), Lepidoptera (moths and butterflies), Diptera (flies), Hemiptera (aphids, cicadids, and true bugs), Acari (mites and ticks), Hymenoptera (ants, wasps, and bees), Neuropteran (ant lions, lacewings), Odonata (dragonflies and damselflies), and Arachnida (spiders and scorpions).

Several species of crabs are present, including the most commonly seen Soldier (hermit) crab (*Coenobita clypeatus*), which have been observed across the island, from the shoreline to the ridgeline. These species are terrestrial (except during their breeding phases), occur in coastal scrub, mangrove forests, and upland forests, and utilize abandoned shells primarily from the West Indian top shell or “whelk” (*Cittarium pica*). Ghost crabs (*Ocypode quadrata*) are frequently observed along the sand shoreline in burrows in the wet sand at or above the high tide line. Ghost and hermit crabs provide valuable food resources for wetland and shorebirds. The great land crab (*Cardisoma guanhumi*) is infrequently encountered in the beach forest. Land crabs (*Gecarcinus ruricola*) are more frequently encountered in the beach forest, and semi-aquatic mangrove crabs (*Aratus pisonii*) are common along shoreline rocks and the pier (NPS 2000b).

MARINE AND COASTAL RESOURCES

The following section provides a description of the existing conditions of marine and coastal resources in the park, a summary of how these conditions developed over time, and an analysis of the numerous factors that affect the ecological health of the park’s resources. When the park was established in 1961, it encompassed 176-acre Buck Island and 704 acres of marine habitat surrounding it. The park proclamation describes the park and its “adjoining shoals, rocks, and undersea coral reef formations” as “one of the finest marine gardens in the Caribbean Sea,” which are of “great scientific interest and educational value to students of the sea and to the public.” The original legislation allowed for multiple uses within the park’s boundaries, even allowing fishing in some areas while protecting others within the “Marine Garden” area including the east end of the lagoon and underwater trail. In 2001, the park was expanded to 19,015 acres, and all forms of resource extraction were prohibited, making it the first fully protected marine area in the national park system.

In a tropical marine ecosystem, coral reef communities live in complex and often fragile, interdependent relationships. The expansion of Buck Island Reef National Monument added essential types of coral reef habitats (patch, spur and groove, deep and wall), seagrass beds, and sand communities, as well as algal plains, shelf edge, deep and dimly lit reefs, and deep oceanic habitats not originally within the park boundary. These additional habitats preserve ecological links that help sustain the park and its resources. Another important effect of the boundary expansion was to place a vast reef shelf area for the recently listed species, of elkhorn coral (*Acropora palmata*), a major reef-building species, within the park; this shelf includes unusual “haystack” formations.

There are numerous agencies and organizations that have conducted and are conducting marine and fisheries related research near St. Croix in addition to the NPS, including:

- National Oceanic and Atmospheric Administration's National Ocean Service/ National Centers for Coastal Ocean Science / Center for Coastal Monitoring and Assessments / Biogeography Branch,
- United States Geological Survey-Biological Resources Division,
- The former West Indies Laboratory of Fairleigh Dickinson University,
- University of Virgin Islands-Virgin Island Marine Advisory Service,
- Coastal Zone Management-St. Croix East End Marine Park,
- Virgin Islands Department of Planning and Natural Resource-Division of Fish and Wildlife, Division of Environmental Protection, Water Quality,
- The Nature Conservancy,
- Ocean Conservancy, and
- Individual researchers from various universities.

The baseline conditions presented in this section are based on available information from these sources unless otherwise noted. A summary of on-going monitoring programs as tabulated in the NPS Vital Signs Monitoring Plan (NPS 2008a). The information presented herein represents a snapshot in time of these resources; therefore, caution should be taken when referencing this document as new research results will inevitably refine, change or update the reported findings.

This section covers the following two impact topics: *Coral Reefs and Other Marine Communities* and *Fish / Aquatic Life*. Because marine and coastal resources are a major issue in this general management plan, more detail is provided on these systems than other impact topics. This is consistent with the requirements of the National Environmental Policy Act of 1969 (as amended). The following outlines the contents of this section:

Coral Reefs and Other Marine Communities

- Shallow coral reef communities
- Seagrass community and algal plains
- Sand bottom community
- Deep reefs and wall reefs
- Deep water abyssal bottom community
- Deep water oceanic/pelagic community
- Factors affecting the health of coral reefs and marine communities

Fish / Aquatic Life

- Fish
- Essential Fish Habitat
- Other Marine Animals
 - o Lobsters
 - o Conch
 - o Long-spined sea urchins

The first part of this discussion is organized primarily according to ecological community, which is defined as all the interacting organisms living together in a specific habitat. A habitat is defined as the place where organisms live, grow, feed and reproduce. In the park, habitats occur along gradients that form relatively distinct ecological zones. For nearly 40 years, researchers have defined communities,

habitats and ecological zones in the park in a variety of ways. The terms used in this summary are therefore taken from the individual authors as they were reported in the literature.

Both common and scientific names are provided for plants and animals in the sections that follow. In some cases, however, two common names were provided in the literature for the same scientific name. Where possible, these differences were reconciled, but in some cases this was not possible, and where needed, both common names were provided. Where differences appeared, common names were obtained from the National Oceanic and Atmospheric Administration on-line database (NOAA 2006b), or from the Integrated Taxonomic Information System (ITIS 2006).

Coral Reefs and Other Marine Communities

This section provides a description of coral reefs and other marine communities in the park, and the factors known to affect their ecological condition. The ecological communities and habitats in the park form a dynamic and complex mosaic that has developed over thousands of years and is the result of a large number of physical, chemical, and biological factors (Hubbard, et al. 2005). Figure 10 illustrates this concept, and how various factors are thought to relate to organisms, biological processes, and communities. The following specific examples are provided to illustrate some of these interrelationships between the different components of the ecosystem of the park:

Fish with planktonic larvae are known to reproduce in deeper offshore waters.

Algal plains and seagrass beds may serve as nursery areas (Rogers and Teytaud 1988).

As juveniles, lobsters rely on habitat that occurs on the east end of St. Croix and then migrate to areas within Buck Island Reef National Monument where they mature and live on reefs and deeper rock bottom areas (Rogers and Teytaud 1988). The presence of adult, reproductive, and juvenile lobsters within both the park and Teague Bay was recently verified (Cox, et al. 2009).

Several species of reef fish, including parrotfish and grunts, migrate nightly from the protection of the reef to more open seagrass beds to feed. In turn, seagrass beds produce dead plant material that is exported to adjacent areas where it can be utilized and consumed by small animals (Kendall 2003).

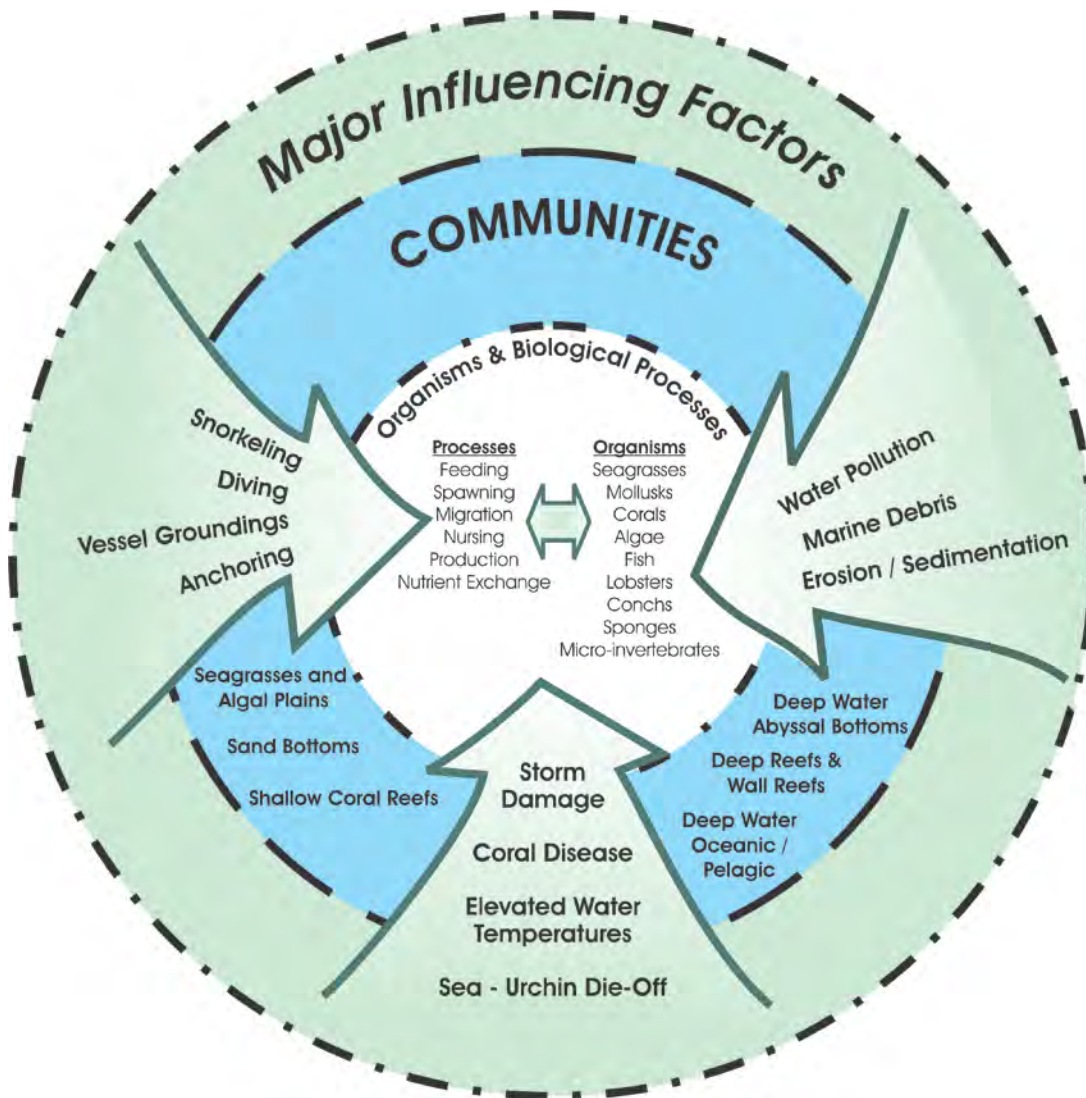
Conch feed primarily on algae in seagrass beds and also ingest seagrass blades (Rogers and Teytaud 1988). Queen conch (*Strombus gigas*) larvae settle in sandy areas and, as they grow, move into shallow seagrass beds and eventually to deeper water coral reefs, algal plains, and seagrass beds (Drayton, et al. 2004). Large predatory fish, such as spotted rays, sharks, and queen triggerfish, all prey on conch, and spiny lobsters feed on juvenile conch (Rogers and Teytaud 1988).

Parrotfish graze directly on coral, which breaks down the calcareous coral skeletons and produces large amounts of sediment that contributes to the structure of the reef and nourishes sandy beaches. Nutrients from fish waste are essential inputs to a relatively nutrient-poor reef system, increasing productivity (Rogers and Teytaud 1988).

Sea urchins (such as the long-spined urchin) feed on marine macro-algae on the reef and have been shown to control algal population structure (Ogden and Lobel 1978). Loss of the long-spined urchin 20 years ago has resulted in increases of algae on some reefs (Rogers and Teytaud 1988).

Changes in one component of the system caused by natural or man-made factors can therefore affect other components. In the park, the major factors include storm damage, coral disease, elevated sea water temperatures, and the effects of physical damage on seagrasses, corals, and other communities from recreational use, vessel groundings, and inappropriate anchoring (Figure 10). These factors are discussed in more detail in this section for each community and major groups of organisms.

Figure 10. Depiction of Key Interrelationships Between Marine Organisms, Processes, and Communities and the Factors That Influence Them



Shallow Water Coral Reef Communities

Coral reefs are valuable coastal resources that support a wide variety of plants and animals, many of which have commercial or recreational importance (Mac et al. 1998; Goenaga and Boulon 1991; Bohnsack 1992, *in* Mac, et al. 1998). Coral reefs and associated marine habitats are among the most productive ecosystems on earth, supporting more biological diversity than any other ecosystem, with the exception of tropical rain forests. They serve as breeding grounds, nurseries, feeding grounds, and refugia for a variety of protected and other species. They dissipate wave energy and protect inshore and lagoon areas. Coral reefs exist in a delicate balance that requires a relatively narrow range of depth, temperature, salinity, currents, wave action, and water clarity, and coral reef communities occur in zones along physical gradients and depths (NPS 1974a).

Shallow water coral reef communities in the park are defined as those which occur to a depth of roughly 40 meters. This depth is the approximate boundary of the shelf edge, a predominant

geological feature on the north side of Buck Island. Another major shallow water coral reef feature of the park is a single, magnificent barrier reef formed by large stands of elkhorn coral, which parallels the shoreline for nearly two-thirds of the length of Buck Island and encloses an extensive shallow lagoon. Well-developed shallow coral reefs also occur outside the lagoon on the southeastern, northern (especially at the North Bar), and northwestern ends of Buck Island.

Bythell, et al. (1989) investigated changes in the shallow coral reefs in the park between 1976 and 1985. This study summarized the major characteristics of the coral community structure in five transects radiating out from shoreline to 15 meters placed at various locations around Buck Island. Major community types described included lagoon pavement, lagoon, lagoon patch reefs, bank barrier reef, mixed coral/gorgonian bank, and bank patch reefs (haystacks). The overall conclusion was that there had been a major reduction in live coral coverage in almost all areas of the Buck Island reef system during this period (Bythell, et al. 1989). The major change was the staghorn coral and especially elkhorn coral, which was previously the dominant species throughout the park. By 1985, staghorn coral had also almost disappeared completely from the northern reef and was significantly depleted on the south reef. Some signs of recovery of elkhorn and staghorn corals had been observed, but total cover was still much lower in 1985 than in 1976. It was uncertain if the root cause of these changes was attributed to man-made or natural causes, including the massive loss of elkhorn coral due to white-banded disease in 1976 (Gladfelter 1982), and long-term monitoring of the reef at Buck Island was recommended (Bythell, et al. 1989). After Hurricane Lenny in 1999, Bythell, et al. 2000 conducted a status of the reef survey and found the reef in flux, with patchy recovery.

The unprecedented number of hurricanes in 1989, 1995, 1999 and the 1998 bleaching event caused serious disturbances to the Buck Island reef system, including reduction of live coral cover by more than 10 percent, an abundance of macroalgae, and impacts to star coral populations (as a result of the bleaching event). However, elkhorn coral recruitment was documented along the heavily devastated south forereef (Note the 2005 bleaching event is addressed in subsequent paragraphs).

The National Park Service, the National Oceanic and Atmospheric Administration Biogeography Branch, the Government of the Virgin Islands and other organizations have cooperated on many subsequent monitoring projects of shallow coral reefs in the park.

The NPS South Florida Inventory and Monitoring Program's Aquamap Monitoring Program is being conducted at two coral reef sites within the park (NPS 2003). The western spur and groove and south forereef sites have been monitored annually since 2000 using the sonar-based relocation system, Aquamap, that was spatially referenced to the terrestrial global positioning system (NPS 2003). This video sampling method evaluates the condition and change of the benthic (bottom) community over time.

In a separate monitoring program the NPS monitored coral colony survivorship and trends at selected locations in the park, most located within the original 1961 boundary. In 1988, approximately 450 coral colonies of three coral species, brain coral (*Diploria strigosa*), mustard hill coral (*Porites astreoides*), and boulder star coral (*Montastraea annularis*), were individually tagged at 13 locations throughout the park. In 2000, a new site was established to monitor re-growth of elkhorn coral along the south forereef, an area completely destroyed by Hurricane Hugo in 1989. Twenty-five young colonies were randomly selected along the depth gradient, tagged, and videotaped. Initially the colonies were monitored annually. Data on colony condition, percent live versus dead tissue, and disease presence was collected.

Outside of the annual monitoring, colonies are also checked during bleaching events to determine the impact bleaching might have on the colonies. From 2001 through today, colony monitoring occurs when staff are available. Park staff conducted colony monitoring during the bleaching events of 2003 and 2005; in 2005, a sub-set of colonies were photographed and/or videoed to establish impact of

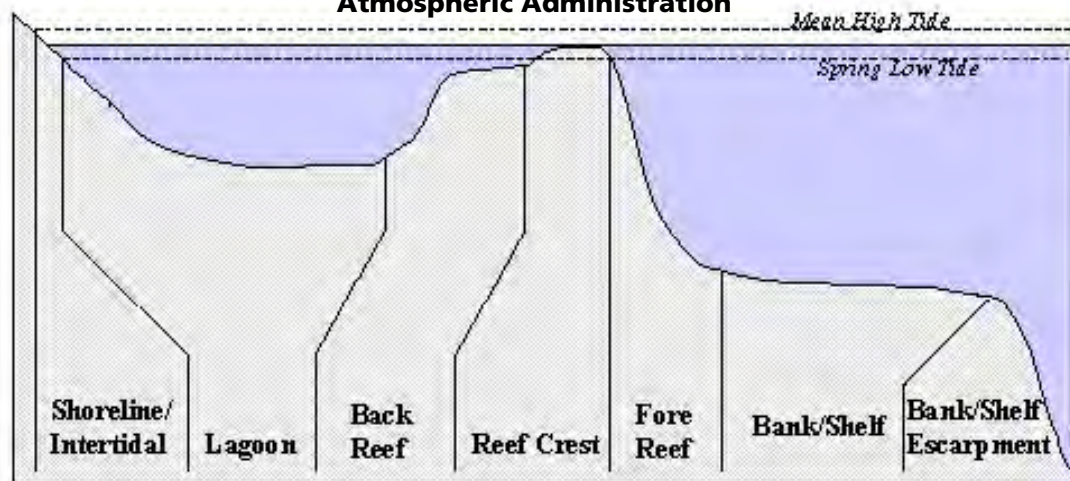
bleaching on tagged colonies. Over 60 percent of colonies observed were affected by the bleaching events. Monitoring of tagged colonies has been sporadic since 2005 due to staffing limitations.

Beginning in 1987, the NPS conducted linear chain transects monitoring of the coral benthic community at three locations in the park: one on the south forereef and two in the north lagoon (NPS 2003). A fourth set of transects was established in the northwestern lagoon after Hurricane Lenny in 1999. Eight 10-meter transects were established at each location, and data were collected by both video and chain. Data collected provides information on species, percent live cover and algae, and changes over time.

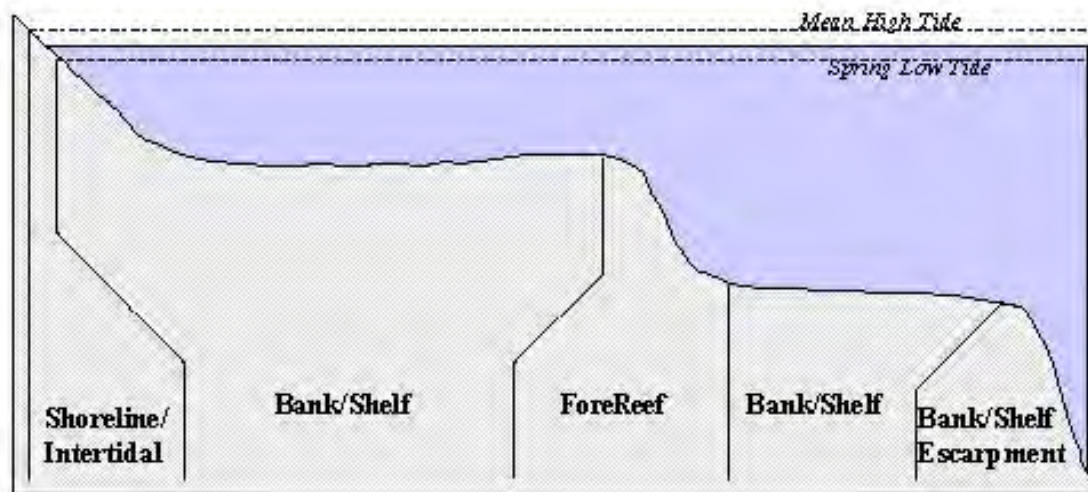
Since 2001, the National Oceanic and Atmospheric Administration has conducted benthic habitat mapping in the park (NOAA 2001a; NOAA 2006b; Kendall, et al. 2001). The program is ongoing and includes mapping of benthic zones and habitats, and quantitative assessments of corals and other benthic animals, such as conch, spiny lobsters, and long spined sea urchins. Results of the benthic surveys conducted from 2001 to 2006 are published in both a searchable database on the Internet (NOAA 2006b) and the NOAA Technical Memorandum NOS NCCOS 71. Methods employed in the surveys are provided in the metadata files for the on-line database (NOAA 2006b). A summary of the majority of the habitats is provided in the following paragraph and figures.

The first part of this mapping project was creation of a set of benthic habitat maps of the park using aerial photographs taken in 1999 (Kendall, et al. 2001). For this mapping effort, a system of habitats that are distributed across ecological zones was developed as shown in Figures 11 and 12 (note – zone descriptions do not match those provided by Bythell, et al. 1989). These ecological zones are an ecological designation, and are not to be confused with the NPS management zones described in Chapter 2. Twenty-one benthic habitat types within eight zones were mapped using a geographic information system (Figure 13). Coral reef and hardbottom covers the majority of the shallow water areas within the portion of the park surveyed, and predominates the northwest and southeast of the island. Sand areas are most common on the west end of Buck Island, to the south and southwest, but occur in other areas as well.

Figure 11. System of Ecological Zones Developed by the National Oceanic and Atmospheric Administration



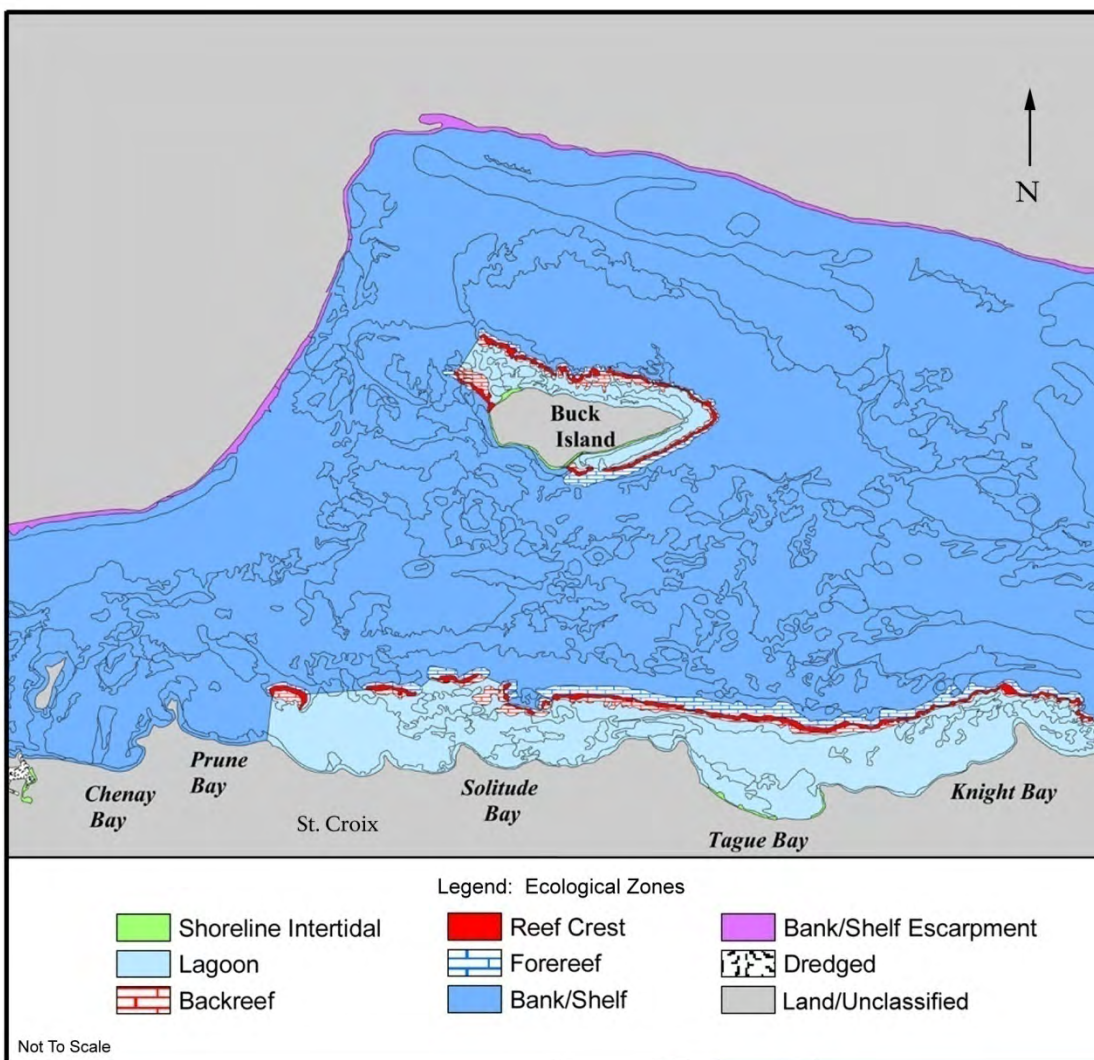
Cross-section of ecological zones where an emergent reef crest is present.



Cross-section of ecological zones where no emergent reef crest is present.

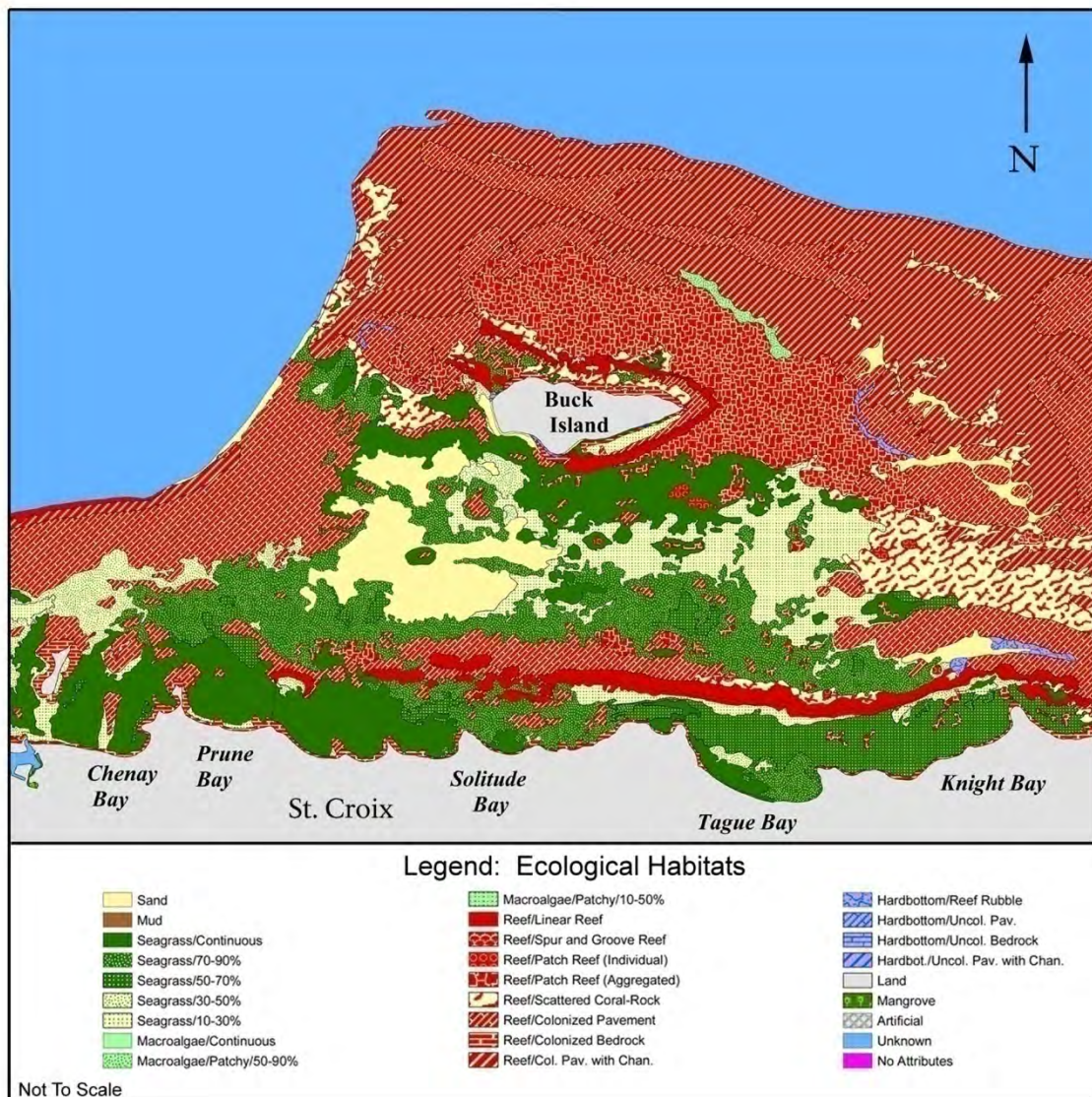
Source: Kendall, et al. 2001

Figure 12. Ecological Zones of Buck Island Reef National Monument and Surrounding Area Mapped by the National Oceanic and Atmospheric Administration



Source: Kendall, et al. 2001

Figure 13 Habitats in Buck Island Reef National Monument Mapped by the National Oceanic and Atmospheric Administration



Source: Kendall, et al. 2001

Table 10 presents a summary of all plants and animals observed during the 2001-2006 surveys by the National Oceanic and Atmospheric Administration (NOAA 2006b). A total of 49 species of corals was observed (including all genera, species, or combined taxa as provided in the National Oceanic and Atmospheric Association database [NOAA 2006b]). Three types of gorgonians, 58 types of marine benthic algae and seagrasses, three types of micro-invertebrates, and three types of sponges were reported. Conch and lobster data were also obtained. These data are summarized in the *Fish / Aquatic Life* section. Table 10 also summarizes the physical (non-living habitat) cover data for all of the 2001-2006 assessments.

Table 10. List of Plants and Animals Observed by the National Oceanic and Atmospheric Administration at all Stations Between 2001 and 2006

Category/Percent Cover ¹	Genus/Species	Common Name
Corals (49 taxonomic units) • Grand mean percent cover from 2001 to 2006 was 1.44% • Grand mean percent cover of diseased coral from 2001 to 2006 was 0.02% • Grand mean percent bleached coral cover was 0.08%	<i>Stephanocoenia mechinii</i>	Blushing star coral
	<i>Acropora cervicornis</i>	Staghorn coral
	<i>Acropora palmata</i>	Elkhorn coral
	<i>Agaricia agaricites</i>	Lettuce coral
	<i>Agaricia grahamae</i>	Graham's sheet coral
	<i>Agaricia lamarcki</i>	Lamarck's sheet coral
	<i>Agaricia spp</i>	Agaricia spp.
	<i>Colpophyllia natans</i>	Boulder brain coral
	<i>Dendrogyra cylindrus</i>	Pillar coral
	<i>Dichocoenia stokesii</i>	Elliptical star coral
	<i>Diploria clivosa</i>	Knobby brain coral
	<i>Diploria labyrinthiformis</i>	Grooved brain coral
	<i>Diploria spp.</i>	Diploria spp.
	<i>Diploria strigosa</i>	Symmetrical brain coral
	<i>Eusmilia fastigiata</i>	Smooth flower coral
	<i>Favia fragum</i>	Golfball coral
	<i>Heliocoris cucullata</i>	Sunray lettuce coral
	<i>Isophyllastrea rigida</i>	Rough star coral
	<i>Isophyllia sinuosa</i>	Sinuuous cactus coral
	<i>Madracis decactis</i>	Ten-Ray star coral
	<i>Madracis mirabilis</i>	Yellow pencil coral
	<i>Madracis pharensis</i>	Star coral
	<i>Madracis spp.</i>	Madracis spp.
	<i>Manicina areolata</i>	Rose coral
	<i>Meandrina meandrites</i>	Maze coral
	<i>Millepora alcicornis</i>	Branching fire coral
	<i>Millepora complanata</i>	Blade fire coral
	<i>Millepora spp.</i>	Fire coral (spp.)
	<i>Millepora squarrosa</i>	Box fire coral

Table 10. List of Plants and Animals Observed by the National Oceanic and Atmospheric Administration at all Stations Between 2001 and 2006 (Continued)

Category/Percent Cover ¹	Genus/Species	Common Name
Corals (49 taxonomic units)	<i>Montastraea annularis</i>	Boulder star coral
	<i>Montastraea cavernosa</i>	Great star coral
	<i>Montastraea</i> spp.	Montastraea spp
	<i>Mussa angulosa</i>	Spiny flower coral
	<i>Mycetophyllia aliciae</i>	Knobby cactus coral
	<i>Mycetophyllia danaana</i>	Lowridge cactus coral
	<i>Mycetophyllia ferox</i>	Rough cactus coral
	<i>Mycetophyllia reesi</i>	Ridgeless cactus coral
	<i>Mycetophyllia</i> spp.	Mycetophyllia spp
	<i>Porites astreoides</i>	Mustard hill coral
	<i>Porites porites</i>	Finger coral
	<i>Porites</i> spp.	Porites spp.
	<i>Scleractinia</i> spp.	Unknown coral
	<i>Scolymia cubensis</i>	Artichoke coral
	<i>Scolymia</i> spp.	Scolymia spp
	<i>Siderastrea radians</i>	Lesser starlet coral
	<i>Siderastrea siderea</i>	Massive starlet coral
	<i>Siderastrea</i> spp.	Starlett coral
	<i>Solenastrea bournoni</i>	Smooth star coral
	<i>Solenastrea</i> spp.	Solenastrea spp
Gorgonians (3 taxonomic units) • Grand mean percent cover from 2001 to 2006 was 1.78 percent	<i>Erythropodium caribaeorum</i>	Encrusting gorgonian
	<i>Gorgonacea fan</i>	Sea fans
	<i>Gorgonacea prw</i>	Sea plumes, Sea rods and Sea whips
Marine Plants, Algae (58 taxonomic units) • Grand mean percent cover from 2001 to 2006 was 9.63 percent	<i>Acanthophora</i> spp.	Acanthophora spp.
	<i>Acetabularia</i> spp.	Mermaid's wine glass (sp.)
	<i>Algae fil</i> spp.	Filamentous algae (sp.)
	<i>Algae</i> spp.	Algae
	<i>Amphiroa</i> spp.	Amphiroa spp.
	<i>Asparagopsis</i> spp.	Asparagopsis spp.
	<i>Avrainvillea</i> spp.	Avrainvillea spp.
	<i>Bryothamnion</i> spp.	Bryothamnion spp.
	<i>Caulerpa</i> spp.	Caulerpa spp.
	<i>Centroceras</i> spp.	Centroceras spp.
	<i>Ceramium</i> spp.	Ceramium spp.
	<i>Champia salicornioides</i>	Champia salicornioides
	<i>Chlorophyta fil.</i> spp.	Filamentous algae, green
	<i>Chondria</i> spp.	Chondria spp.
	<i>Cladophora</i> spp.	Cladophora spp.

Table 10. List of Plants and Animals Observed by the National Oceanic and Atmospheric Administration at all Stations Between 2001 and 2006 (Continued)

Category/Percent Cover ¹	Genus/Species	Common Name
Marine Plants, Algae (58 taxonomic units)	<i>Cladosiphon</i> spp.	Cladosiphon spp.
	<i>Codium</i> spp.	Codium spp.
	<i>Cyanophyta</i> spp.	Blue-green algae
	<i>Dasya</i> spp.	Dasya spp.
	<i>Dictyopteris</i> spp.	Dictyopteris spp.
	<i>Dictyota</i> spp.	Y branched algae
	<i>Digenea</i> spp.	Digenea spp.
	<i>Galaxaura</i> spp.	Tubular thicket algae
	<i>Gelidium pusillum</i>	Gelatin algae
	<i>Gracilaria</i> spp.	Gracilaria spp.
	<i>Griffithsia</i> spp.	Griffithsia spp.
	<i>Halimeda</i> spp.	Halimeda
	<i>Halodule wrightii</i>	Halodule wrightii
	<i>Halophila decipiens</i>	Halophila decipiens
	<i>Halymenia floresia</i>	Halymenia floresia
	<i>Hypnea</i> spp.	Hypnea spp.
	<i>Jania</i> spp.	Jania spp.
	<i>Laurencia</i> spp.	Laurencia spp.
	<i>Liagora</i> spp.	Liagora spp.
	<i>Lobophora</i> spp.	Encrusting fan-leaf algae
	<i>Magnoliophyta</i> spp.	Seagrass
	<i>Neomeris</i> spp.	Neomeris spp.
	<i>Padina</i> spp.	Padina spp.
	<i>Penicillus</i> spp.	Penicillus spp.
	<i>Phaeophyta fil.</i> spp.	Filamentous algae, brown
	<i>Porolithon pachydermum</i>	Reef cement
	<i>Rhodophyta cru.</i> spp.	Crustose coralline algae
	<i>Rhodophyta fil.</i> spp.	Filamentous algae, red
	<i>Rhodophyta mac.</i> spp.	Macro algae, red
	<i>Sargassum</i> spp.	Sargassum algae
	<i>Schizothrix</i> spp.	Schizothrix spp.
	<i>Scinaia</i> spp.	Scinaia spp.
	<i>Spyridia</i> spp.	Spyridia spp.
	<i>Stypopodium</i> spp.	Stypopodium spp.
	<i>Syringodium filiforme</i>	Manatee grass
	<i>Thalassia testudinum</i>	Turtle grass
	<i>Trichogloea</i> spp.	Trichogloea spp.
	<i>Turbinaria</i> spp.	Turbinaria spp.
	<i>Turf Algae</i>	Turf algae
	<i>Udotea</i> spp.	Mermaid's fans (unknown)
	<i>Valonia</i> spp.	Valonia spp.
	<i>Ventricaria</i> spp.	Ventricaria spp.
	<i>Wrangelia</i> spp.	Wrangelia spp.

Table 10. List of Plants and Animals Observed by the National Oceanic and Atmospheric Administration at all Stations Between 2001 and 2006 (Continued)

Category/Percent Cover ¹	Genus/Species	Common Name
Micro-invertebrates (3 taxonomic units) Grand mean percent cover from 2001 to 2006 was 1.29 percent	<i>Actiniaria</i> spp.	Anemones
	<i>Ascidacea</i> spp.	Tunicates
	<i>Zoanthidea</i> spp.	Zoanthids (unknown)
Sponges (three taxonomic units) Grand mean percent cover from 2001 to 2006 was 1.33 percent	<i>Porifera</i> <i>btv.</i> spp.	Barrel/Tube sponge [Upright/Erect sponge]
	<i>Porifera</i> <i>enc.</i> spp.	Encrusting sponge
	<i>Porifera</i> spp.	Sponge

Source: (NOAA 2006b)

¹ Grand mean percent cover calculated from NOAA database (2006b) and is based on best available data.

Results summarized in Table 10 and Figure 12 show how the bottom habitats in the park form a complex and highly diverse physical and biological mosaic of hard and soft bottom areas, characterized by living and non-living components.

Seagrass Community and Algal Plains

Seagrasses include species such as turtle grass (*Thalassia testudinum*), manatee grass (*Syringodium filiforme*), and shoal grass (*Halodule wrightii*). Seagrasses inhabit shallow water areas generally less than 10 to 15 meters deep and are found in soft-bottom habitats on the south and southwest side of the island, the relatively protected waters between St. Croix and Buck Island. Seagrasses are true flowering plants that reproduce both sexually, via underwater pollination, and asexually, by horizontal spread of buried stems called rhizomes. The buried stems are extensive and serve to stabilize sediments and minimize erosion of shorelines. These functions help shield adjacent coral reefs from the potential effects of sedimentation (Ward, et al. 1984 and Kenworthy, et al. 1988 in Kendall, et al. 2004a).

Seagrasses are important members of the marine community because of their high levels of primary productivity (Kenworthy and Schwarzschild 1998 in Kendall, et al. 2004a). Seagrasses produce large amounts of green photosynthetic plant material that is eaten by sea turtles. Decaying plant material enters a detritus food chain that supports invertebrates and fish. Much of this dead plant material is also exported to adjacent systems where it helps support numerous associated marine animals (Hubbard, et al. 1981).

Seagrasses provide important habitat for numerous fish and invertebrates and are important as feeding, nursery, and spawning areas for various fish and shellfish (Kenworthy et al., 1988; Nagelkerken, et al. 2000 in Kendall et al. 2004a). For example, snappers and grunts move from adjacent reefs into seagrass beds at night to feed (Rogers and Teytaud 1988). Spiny lobster (*Panulirus argus*) are strongly reliant on seagrass habitats, and are important for the brooding of eggs and for fish with demersal eggs (demersal eggs are heavier than water and are laid in prepared spawning sites on the sea bed). Many fish reside only temporarily in seagrass beds, to forage, spawn, or escape predation. Economically-important species which use these habitats for nursery and/or spawning grounds include: grunts (haemulids), snook (*Centropomus* spp.), tarpon (*Megalops atlanticus*) and several species of snapper and grouper (CFMC 2004).

Seagrass beds are also primary habitat for queen conch, which feeds on algae that grow on the blades of seagrasses (Rogers and Teytaud 1988). Fish and sea urchins grazing on seagrasses create bare halos around patch reefs (Rogers and Teytaud 1988).

The Kendall, et al. 2004a study shows that seagrass has become much more abundant in the Buck Island Channel over the last several decades. Using aerial photographs, this study shows that seagrass coverage in this area increased from 1.33 square kilometers to 4.34 square kilometers between 1971 and 1999. The study also concluded that seed dispersal, germination, and seed growth were the primary mechanisms for the observed increase. Seagrasses were also observed to be concentrated around reef areas, but beyond the usual sand halo typical of reef - seagrass interfaces. The study suggested that higher frequency of hurricanes enhanced the distribution of seagrass fragments.

Individual seagrasses and associated species form biological and physical areas known as seagrass meadows (CFMC 2004). Meadows vary in size from small, isolated patches of plants less than a meter in diameter, to a continuous distribution of grass such as the area identified within the Buck Island Channel, or off Buck Island's West Beach. Despite the life stage or type of species, different growth and mortality rates can cause seagrasses, patches, and/or meadows to shift in location and time, the rate of which can vary from hours to decades depending on site conditions. According to the Caribbean Fisheries Management Council (2004), seagrass habitats must be recognized as including not only continuously vegetated perennial beds, but also patchy environments that include unvegetated areas between patches. Patchy habitats provide many ecological functions similar to continuous meadows.

Patchy seagrass beds occur in the vicinity of the anchoring area off West Beach. In higher energy areas, qualitative observations by park staff indicate that seagrass densities adjacent to the beach can change relatively quickly as a result of storms, especially in the area off West Beach. Anchoring can destroy the seagrass rhizomes and lead to bare areas that are more subject to effects of winds, currents and wave action.

Green, red, and brown benthic marine algae occur in seagrass beds as well as in other areas such as reefs and open hard bottom habitats. Many benthic algae occur in what has been defined as algal plains, which occur mainly in the shallow water landward of the backreef zones. These areas are inhabited by calcareous green algae such as *Halimeda* sp., *Udotea* sp, *Penicillus* sp., and *Rhipocephalus* sp. that are important sources of calcium carbonate. A variety of species of non-calcareous red and brown benthic marine algae also occur in the algal plains, and additionally on hardbottom reefs. The ecology of the algal plain is not well known, but Earle (1972) observed 154 species of plants and 35 species of herbivorous fish from the algal plain located on the south shore of St. John (Rogers and Teytaud 1988). Earle concluded that fish had a greater influence on plant distribution than invertebrates in that area (Earle 1972, in Rogers and Teytaud 1988). Threatened hawksbill and green sea turtles utilize some benthic algae species as food. This habitat is also inhabited by invertebrates including mollusks and crustaceans, which are eaten by fish (CFMC 2004).

Sand Bottom Community

A sand bottom community generally occurs between a coral reef and shallow shore area. In the park, a sand community occurs in the lagoon between the elkhorn coral barrier reef and the shoreline, while the most extensive sand bottom community occurs off the southwest end of the island nearshore. Here, deep sand deposits form an arc around West Beach that moves seasonally, building in the winter months and wasting in the late summer/fall. Late winter storms can alter this sand beach and associated sand spit dramatically, either by removing the beach and leaving a 2 meter high berm or by building 10-20 meters of beach overnight (Hillis-Starr, pers. communication, 2009). A more extensive sand/seagrass community exists between Buck Island and St. Croix in the Buck Island Channel where there are also large areas of sand without seagrass at depths between 30 to 50 feet.

Although the density and diversity of benthic plants and animals of the sand community are lower than neighboring reef and seagrass communities, numerous species inhabit this community type (The Ocean Conservancy 2006). Nova University conducted a study of fish in sandy habitats from 24 stations in the park during April and October 2005 (Nova University unpublished). A total of 39 fish species were recorded (Table 11). The most abundant fish were rosy razorfish (*Xyrichtys martinicensis*, *Xyrichtys* sp.), pipehorse (*Xyrichtys* sp.), peacock flounder (*Bothus lunatus*), bluelip parrotfish (*Cryptotomus roseus*), pugnose pipefish (*Syngnathus dunckeri*), and redbtail parrotfish (*Sparisoma chrysotum*).

Table 11. Results of Fish Sampling from 24 Stations Located in Sandy Habitats in the Park (April and October 2005).

Habitat	Common Name	Scientific Name	Abundance (Number)
Date: 5 April 2005 Latitude: 17° 46.964 Longitude: 064° 38.255			
Sand	Rosy razorfish	<i>Xyrichtys martinicensis</i>	>50
Sand	Barbfish	<i>Scorpaena brasiliensis</i>	1
Sand	Pipehorse	<i>Acentronura dendritica</i>	1
Sand		<i>Xyrichtys</i> sp.	>50
Sand	Stripe eel	<i>Aprognathodon platyventris</i>	3
Sand	Brown garden eel	<i>Heteroconger longissimus</i>	6
Sand	Surf eel	<i>Ichthyapus ophioneus</i>	1
Sand	Peacock flounder	<i>Bothus lunatus</i>	29
Sand		<i>Ophidion</i> sp.	5
Sand		<i>Monacanthidae</i> sp.	1
Sand		<i>Chaenopsis</i> sp.	2
Sand	Bluestriped lizardfish	<i>Synodus saurus</i>	1
Date: 5 April 2005 Latitude: 17° 46.959 Longitude: 064° 38.231			
Sand	Rosy razorfish	<i>Xyrichtys martinicensis</i>	>50
Sand		<i>Xyrichtys</i> sp.	>50
Sand	Stripe eel	<i>Aprognathodon platyventris</i>	1
Sand	Brown garden eel	<i>Heteroconger longissimus</i>	3
Sand	Peacock flounder	<i>Bothus lunatus</i>	19
Sand	Margintail conger	<i>Paraconger caudilimbatus</i>	1
Sand	Surf eel	<i>Ichthyapus ophioneus</i>	1
Sand	Yellowface pikeblenny	<i>Chaenopsis limbaughi</i>	1
Sand		<i>Ophidion</i> sp.	2
Sand	Mushroom scorpionfish	<i>Scorpaena inermis</i>	1
Sand		<i>Callionymidae</i> sp.	1
Date: 9 October 2005 Latitude: 17° 46.953 Longitude: 064° 37.749			
Seagrass / Sand	Seagrass eel	<i>Chilorhinus suensonii</i>	1
Seagrass / Sand	Stripe eel	<i>Aprognathodon platyventris</i>	7
Seagrass / Sand	Slippery dick	<i>Halichoeres bivittatus</i>	2
Seagrass / Sand	Academy eel	<i>Apterichthys ansp</i>	5
Seagrass / Sand	Lantern bass	<i>Serranus baldwini</i>	1
Seagrass / Sand	Goldspot goby	<i>Gnatholepis thompsoni</i>	1

Table 11. Results of Fish Sampling from 24 Stations Located in Sandy Habitats in the Park (April and October 2005) (Continued).

Habitat	Common Name	Scientific Name	Abundance (Number)
Seagrass / Sand	Green razorfish	<i>Xyrichtys splendens</i>	4
Seagrass / Sand	Lancer dragonet	<i>Paradiplogrammus bairdi</i>	1
Seagrass / Sand	Bluethroat pikeblenny	<i>Chaenopsis ocellata</i>	1
Seagrass / Sand	Eyed flounder	<i>Bothus ocellatus</i>	1
Seagrass / Sand	Shortfin pipefish	<i>Syngnathus elucens</i>	2
Seagrass / Sand	Fringed filefish	<i>Monacanthus ciliatus</i>	4
Seagrass / Sand	Pugnose pipefish	<i>Syngnathus dunckeri</i>	6
Seagrass / Sand		<i>Neomerinthe beanorum</i>	2
Seagrass / Sand	Bluelip parrotfish	<i>Cryptotomus roseus</i>	15
Seagrass / Sand	Redtail parrotfish	<i>Sparisoma chrysopterum</i>	9
Seagrass / Sand	Redband parrotfish	<i>Sparisoma aurofrenatum</i>	1
Seagrass / Sand	Seagrass eel	<i>Chilorhinus suensonii</i>	3
Seagrass / Sand	Stripe eel	<i>Aprognathodon platyventris</i>	5
Seagrass / Sand	Slippery dick	<i>Halichoeres bivittatus</i>	1
Seagrass / Sand	Rosy razorfish	<i>Xyrichtys martinicensis</i>	11
Seagrass / Sand	Academy eel	<i>Apterichtus ansp</i>	1
Seagrass / Sand	Goldspot goby	<i>Gnatholepis thompsoni</i>	1
Seagrass / Sand	Finless eel	<i>Apterichtus kendalli</i>	3
Seagrass / Sand	Key Worm Eel	<i>Ahlia egmontis</i>	2
Seagrass / Sand		<i>Gillellus jacksoni</i>	6
Seagrass / Sand	Bluethroat pikeblenny	<i>Chaenopsis ocellata</i>	2
Seagrass / Sand	Shortfin pipefish	<i>Syngnathus elucens</i>	1
Seagrass / Sand	Pugnose pipefish	<i>Syngnathus dunckeri</i>	14
Seagrass / Sand	Bluelip parrotfish	<i>Cryptotomus roseus</i>	5
Seagrass / Sand	Bucktooth parrotfish	<i>Sparisoma radians</i>	3
Seagrass / Sand	Redtail parrotfish	<i>Sparisoma chrysopterum</i>	14
Seagrass / Sand		<i>Scorpaenidae</i> sp.	1
Seagrass / Sand	Reef squirrelfish	<i>Sargocentron coruscum</i>	1
Seagrass / Sand	Longjaw squirrelfish	<i>Neoniphon marianus</i>	1

Source: Nova University, unpublished.

Deep Reefs and Wall Reefs

Deep reefs and wall reefs occur below depths of 40 meters and are located to the north and west of Buck Island. Two National Oceanic and Atmospheric Administration (2006b) surveys of deepwater benthic habitats were completed from 2003 to 2006 within the park. These surveys focused on deepwater habitats north of Buck Island, and extended to depths of approximately 100 to 300 meters.

The Biogeography Branch at NOAA's National Centers for Coastal Ocean Science has been developing (2004 onward) detailed bathymetric models of the U.S. Caribbean seafloor, including the park, as well as continued benthic habitat characterizations and ecological inventories that go beyond the depth limits (30 meters) of optical remote sensing. The Biogeography Branch has created a series of habitat maps from the shoreline to 1000 meters water depth. This information will help provide a better understanding of the marine resources within the surveyed areas by filling in data gaps and

providing valuable information regarding marine species and habitat use for the following communities: deep reefs and wall reefs, the deep water abyssal bottom, and deep water ocean/pelagic.

A wide diversity of habitat types were characterized during this mapping project, such as rock precipices, ledges, limestone caves, boulders, rock outcroppings, flat mud, deep channels wider than one kilometer in mud, and shallow channels thinner than one meter in mud. The biota below 200 meters, never visually characterized before, included *Lophelia* coral, black coral sea whips, feather stars, sea pens, sea anemones, starfish, brittlestars, urchins, sponges, isopods, sea cucumbers, lobsters, shrimps, crabs, conch, orange roughy (*Hoplostethus atlanticus*), roundnose grenadier (*Coryphaenoides rupestris*), tripod fish (*Bathypterois grallator*) and several types of snappers.

Deep Water Abyssal Bottom Community

The abyssal benthic community includes the bottom habitats at depths greater than 275 to 375 meters north and west of Buck Island. This deepwater area is inhabited by fish, benthic invertebrates, and other marine animals. This area is relatively steep and extends to a depth of over 1,500 meters. This area has been mapped and inventoried by NOAA's seafloor mapping program described above.

Deep Water Oceanic/Pelagic Community

The oceanic/pelagic community is an open, deep water area located on the north side of Buck Island that extends from the shelf edge out to the northern boundary of the park. This area includes the entire water column from the surface to a depth of over 1,500 meters. Few studies have been conducted of the open water pelagic area. This community is inhabited by fish adapted to water in the open ocean, and is characterized by relatively low levels of nutrients and primary productivity, and patchy distribution of plants and animals (CFMC 2004). Pelagic fish such as dolphin and juvenile flying fish congregate in and among floating *Sargassum* weed or drifting mats of turtle grass (*Thalassia*). Eggs and larval stages of migratory fish and invertebrates are also known to drift in pelagic areas. Pelagic areas are also inhabited by billfish, tuna, jacks, mackerel, and by sharks and rays (CFMC 2004). On rare occasions a whaleshark (*Rhincodon typus*) has been found basking on the surface by sport fishers. Additionally, several species of whales have been documented in the northern portion of the park, including humpbacks (*Megaptera novaeangliae*) during seasonal (January - February) reproductive migrations to the south, killer whales or Orca (*Orcinus orca*) following humpbacks migration, and pilot whales (*Globicephala*).

Factors Affecting the Health of Coral Reefs and Marine Communities

A number of factors affect the health of coral reef and other marine communities in the park. An overview of some of the man-made and natural stresses on coral reefs is summarized in the text that follows.

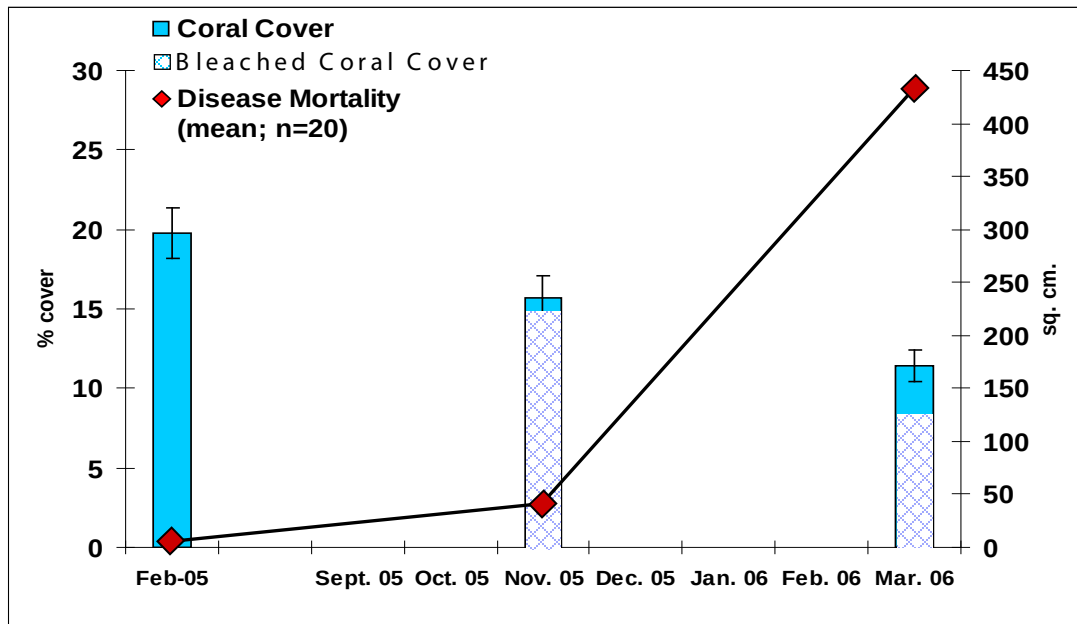
Coral Bleaching: Elevated water temperatures are shown to adversely affect coral reefs in the park (NPS 2006c; NOAA 2006d; Lundgren and Starr 2008; Clark et al. 2005; Miller et al. 2009) and throughout the Caribbean (Lundgren 2008). Scientific evidence to date indicates that greenhouse gas emissions produced by man are responsible for the most recently observed increases in the temperature of the earth's atmosphere and oceans (Hansen, et al. 2006, Stern, et al. 2006). When water temperatures are elevated above the bleaching threshold of 29.5° Celsius (83.3 ° Fahrenheit) for a sufficient duration, the brown colored symbiotic algae in the coral are expelled, leaving a white coral exoskeleton and polyps (Waddell, et al. 2005). This can ultimately lead to death of the coral polyps themselves or make the coral susceptible to numerous types of disease.

In 1998-1999, a severe Caribbean-wide bleaching event was reported (Waddell, et al. 2005). According to the NPS (2006c), the 1998 bleaching event coincided with the highest recorded surface sea temperatures in the U.S. Virgin Islands up to that time. Bleaching was probably less severe in 1999 because water temperatures were slightly lower (28.8°C) during that year. The 1999 bleaching event

did not result in extensive coral colony mortality because most colonies recovered within six months of being bleached (Nemeth and Sladek-Nowlis 2001; Nemeth et al., 2003c; in Waddell et al. 2005).

A mild bleaching event was observed by NPS staff and scientists from October through November 2003. Then, in the late summer of 2005, the largest bleaching event in the Virgin Islands' recorded history was observed (Lundgren and Starr 2008; Miller et al. 2009). NPS documented the impact of the bleaching event at several sites, including NPS Aquamap coral monitoring sites and three elkhorn coral tag sites. NPS Aquamap sites were monitored, including roughly 40,000 square meters of the south forereef site, and the western spur and groove site (NPS 2006c). Results for the south forereef of Buck Island are summarized in Figure 14.

Figure 14. Changes in Coral Cover in the South Forereef of Buck Island Reef National Monument Between February 2005 and March 2006



Source: NPS 2006c

From February 2005 to March 2006, 95.6 percent of coral present at these sites experienced bleaching (Clark et al. 2005; NPS 2006c). During this same period, a 42 percent reduction in live cover occurred, but this reduction was caused by coral mortality. The exact causal relationships between bleaching, disease (and other factors), and coral mortality are not known.

The National Oceanic and Atmospheric Administration (NOAA 2006d) published a separate report on coral bleaching in the park, based on data collected during October 16-30 and December 12-14, 2005. The study was conducted as part of the biannual NOAA/NPS fish and habitat survey for Buck Island. The survey identified the broad range of coral species affected by the bleaching event (NOAA 2006d). Recent coral death (i.e., overgrowth by Cyanobacteria or bluegreen algae) was observed in only a few species. Finger coral (*Porites porites*) and fire corals (*Millepora* spp.) had the highest occurrence of dead coral and may have been the species most affected by the bleaching event. Continued monitoring of Buck Island Reef National Monument and East End Marine Park corals was recommended to determine recovery and the overall impact of such extreme natural events on coral reef ecosystems (NOAA 2006d).

Diseases play a significant role in the losses of hard coral communities, and are identified as one of the most important factors in the deterioration of many Caribbean coral reefs (NOAA 2008). The number

of described coral diseases has increased exponentially over the past three decades (Sutherland et al. 2004), and Buck Island Reef National Monument is no exception. NOAA (2005) reported that, “Between 1976 and 1989, white band disease, bleaching, and hurricanes reduced the cover of elkhorn coral by as much as 85 percent within the Virgin Islands National Park and Buck Island Reef National Monument” (Gladfelter, et al. 1977; Rogers, et al. 1982; Edmunds and Witman 1991; Bythell, et al. 1992; Rogers and Beets 2001). Furthermore, a white-plague disease outbreak, which followed the 2005 Caribbean coral bleaching event resulted in observed loss of up to 79 percent live tissue or percent coral cover on the massive coral-dominated south forereef area at the park (Miller, et al. 2009; Turgeon, et al. 2002).

White-Band Disease – Branching acroporid species, major reef-building corals, have been significantly impacted by white-band disease. At Buck Island Reef National Monument, elkhorn coral cover fell from 85 percent in 1976 to 5 percent in 1988, due to mortality from the combination of disease and tropical storms (Rogers, et al. 1982, Gladfelter 1991, *in* Turgeon, et al. 2002). White band typically starts at the base of the colony and moves towards the branch tips causing complete colony mortality. Shallow reef areas, once covered with elkhorn coral, are now graveyards with branches and fragments interspersed among algal-covered skeletons still upright in normal growth position. Although prevalence of white band has declined since the 1980s, this disease is still occasionally seen at the park and throughout the U.S. Virgin Islands.

White-Pox Disease – Elkhorn coral is the only species affected by white pox disease, which was first described in the 1990s. This disease is the primary cause of tissue loss on elkhorn colonies monitored monthly in Virgin Islands National Park (Miller, et al. 2005) and contributes to coral loss. Unlike white band disease, white pox does not typically kill entire colonies. Corals with white pox have the potential to heal disease-induced lesions as long as disease progression stops before complete colony mortality occurs.

Black-band Disease – This disease primarily infects major reef-building corals such as boulder star coral (*Montastraea annularis*) and brain coral (Edmunds 1991; Richardson, et al. 1997, *in* Turgeon, et al. 2002). In 1988, Edmunds (1991) found very low incidence of black-band disease (0.2%) on corals in seven sites in the U.S. and British Virgin Islands. Nemeth reported 1.2 percent on St. John and on St. Thomas or St. Croix (Nemeth, et al. *in press in* Turgeon, et al. 2002). At the park, black-band disease is seen on *Diploria* spp. colonies but typically on fewer than 10 colonies a year (Hillis-Starr pers. comm., *in* Turgeon et al. 2002).

White-Plague Disease – Several months after the 2005 Caribbean coral-bleaching event, an outbreak of white-plague disease resulted in significant coral loss in St. John and Buck Island Reef National Monument (Miller, et al. 2009). Coral cover at the south forereef long term monitoring site in the park declined 79.3 percent within 1.5 years of the bleaching event. Average coral cover declined by more than 60 percent throughout St. John and Buck Island Reef National Monument, making this event the most widespread loss of coral cover ever documented within the Virgin Islands.

Other Diseases – Small U.S. Virgin Islands patch reefs of finger coral have died from an unknown disease and some of these reefs have been dead for over 12 years (Beets, et al. 1986; Rogers 1999; J. Miller pers. comm.; B. Kojis pers. comm., *all in* Turgeon, et al. 2002). Finger coral is not known to be susceptible to either white-band or black-band disease, but has been observed with white plague.

Sea fan disease, caused by the fungus *Aspergillus sydowii*, occurs in sea fans on St. John reefs (G. Smith pers. comm. *in* Turgeon, et al. 2002) as well as those in Buck Island Reef National Monument. The prevalence of this disease and its impact on the sea fan population of the U.S. Virgin Islands is presently unknown.

Invasive Lionfish: Lionfish (*Pterois volitans/miles*) are the first invasive marine fish to establish populations along the United State’s Atlantic coast from Florida to Rhode Island (Lundgren and Starr

2009). Since 2000, Lionfish have expanded through the Caribbean including the Bahamas, Cayman Islands, Cuba, the Dominican Republic, Haiti, Jamaica, the Turks and Caicos, and have recently (2010) been identified at Buck Island Reef National Monument and Virgin Islands National Park (Hillis-Starr pers. comm., 2010; Lundgren and Starr 2009). Lionfish pose a significant threat to coral reef ecosystems due to few predators and negative effects on native species through competition and predation. Recent research in the Bahamas concluded that Lionfish caused an 80 percent reduction in coral reef fish recruitment (Lundgren and Starr 2009). Control of invasive Lionfish is currently taking place at Virgin Islands National Park, Virgin Islands Coral Reef National Monument and Buck Island Reef National Monument (Hillis-Starr per. comm., 2010).

Tropical Storms and Hurricanes: Tropical storms and hurricanes have major effects on coral reef communities in the Caribbean. Storms have the capacity to degrade reefs in several ways. They increase terrestrial runoff, sedimentation, and pollution affecting coral reefs, and cause extensive physical damage to the substratum (Waddell, et al. 2005).

Pollution: Sources of point- and non-point source pollution are addressed in the Water Resources subsection earlier in this chapter. The effects of nonpoint runoff from development can cause adverse effects on the structure and function of coral ecosystems through smothering of corals, reduction in coral photosynthesis, and interference with larval settling and growth (DPNR 2005b).

The principal concerns in the U.S. Virgin Islands are siltation, sedimentation, and smothering, following removal of upland vegetation, and nutrient enrichment, particularly in areas adjacent to inshore reefs (Goenaga and Boulon 1992 *in* DPNR 2005b). Turbidity associated with increased sediment load shades corals that require light for their algal symbionts (zooxanthellae), thus reducing productivity and growth. The energy expended by corals in clearing away sediment is also a factor influencing growth (Rogers 1990 *in* DPNR 2005b). Sediment loading may also influence the incidence of coral diseases (Peters 1984 *in* DPNR 2005b) and coral bleaching rates and it also reduces substrate availability for the settlement of coral and other larvae (Nemeth and Sladek-Nowlis 2001). Turbidity has clearly been shown to influence fish abundance and diversity (Amesbury 1981; Hubbard, et al. 1987; and Loya 1976a; *all in* DPNR 2005b).

Chronic sedimentation may reduce the abundance and diversity of corals and other reef organisms, increase coral stress and susceptibility to diseases, increase bleaching, and reduce the ability of corals and other reef organisms to recover and regenerate after natural disturbances such as hurricanes (Acevedo and Morelock 1988; Rogers 1990; Rice and Hunter 1992; and Nemeth and Sladek-Nowlis 2001 *all in* DPNR 2005b).

Land-use practices, such as upland clearing of vegetation, farming, urban development, fires, and animal grazing, increase the runoff of nutrients (fertilizers) and other contaminants (e.g., pesticides and metals). Nutrients enhance the growth of algae that compete with corals for space on the reef and influence coral larval recruitment (Birkeland 1977 *in* DPNR 2005b). Exposure of corals and associated biota to pesticides and other contaminants may result in toxic or sub lethal impacts depending on the concentrations and duration of exposure.

The impact of wastewater discharges on coral was reviewed by Pastorok and Bilyard (1985) and Marszalek (1987). Impacts include effects due to turbidity, sedimentation, enhancement of algal growth, increased risk of coral disease, and toxic effects. Marszalek (1987, *in* DPNR 2005b) concluded that the toxic effects of municipal wastewater were overshadowed by the indirect effects of nutrient loading. Eutrophication (nutrient enrichment) by sewage disposal or land drainage can stimulate algal blooms, which will outcompete or displace slower-growing organisms, such as corals. This can result in the proliferation of organisms that compete with, or damage corals (e.g., burrowing bivalves and boring algae and sponges).

Information on water quality in the park and vicinity is summarized in the *Water Resources* subsection of this chapter.

Vessels and Groundings: Vessels passing in or near the park have the potential to harm coral reefs by groundings, anchoring, oil or other discharges, spills, or pumping of bilge water (which may contain oil, grease, fuel, or other materials). Smaller vessels in the park can harm reefs and sea grass beds by inappropriate use of anchors, or by propeller or hull damage to shallow reefs. Over the last 20 years there have been several vessel groundings related to poor navigation, loss of engine power, and illegal smuggling. As of 2009, no oil spills have occurred in the park.

In addition, the presence of vessels in park waters has a potential to affect reef health through release or sloughing of toxic material contained in bottom paint. In 2007, the Danish Galathea Expedition conducted a study on organic pollutants and toxic metals in the marine environment. Tributyltin (TBT) and its metabolites dibutyltin (DBT) and monobutyltin (MBT) were detected at all the examined sites, including the park; however, only low levels of TBT were found in *Thais rustica* (neogastropod) samples in the park (Strand, *et al.* 2009).

Marine Debris: Marine debris includes remnants of fishing nets, floating manmade debris, plastics of all kinds, abandoned/lost fishing buoys, and abandoned fish traps. Fishing line and nets, rope, and other trash can wrap around animals and cause drowning, infection, or amputation, or can settle on hard bottom areas and kill coral colonies (Waddell, *et al.* 2005). The park has a fish trap removal program in place, and has made efforts to remove abandoned traps. Other debris found along the shoreline or on the reef is removed on a periodic and opportunistic basis.

FISH/AQUATIC LIFE

Buck Island Reef National Monument is a “no take” marine reserve. Like all marine reserves, the park provides beneficial effects on the marine resources in the reserve as well as a spill-over effect, potentially increasing fish abundance and fishery yield in nearby waters outside the park boundaries (Rogers and Beets 2001; NPS 2007a). There is convincing evidence that fully protected marine reserves, where no extraction is permitted, allow for the preservation of nature for recreation, research, inspiration; for rebuilding depleted fishing stocks; and for helping to restore productivity, sustainability, and resilience to the coastal ocean. In 76 studies of reserves around the world, densities of fishery species increased in 69 percent of reserves, the average body size of fish increased in 88 percent of reserves, and biomass was reported to increase in 92 percent of the reserves (NPS 2007a). Worm, *et al.* (2006) analyzed 44 fully protected marine reserves and reported that reserves and closures reversed the decline of marine biodiversity on local and regional scales.

Characteristics of fish assemblages in the park, the regulatory definition of “essential fish habitat” and how it applies to the park, and a discussion of spiny lobsters, conch, and the long-spined sea urchin are provided in this section.

Fish

Fish are associated with all marine habitat types in the park. Many fish depend exclusively on coral reefs for shelter, food, and spawning (Mac, *et al.* 1998). Certain other species, such as the bucktoothed parrotfish and fringed filefish, complete their entire life cycle in seagrass beds, and other species such as the French grunts (*Haemulon flavolineatum*) use the seagrasses as a nursery area. Snappers and grunts leave the reef at night and feed in seagrass beds (Mac, *et al.* 1998), while others, like the scrawled file fish (*Aluterus scriptus*), use hardbottom areas such as the mixed coral/gorgonian bank. The spotted snake eel (*Ophichthus ophis*) lives in the sand bottom community, and the chalk bass (*Serranus tortugarum*) depends primarily on algal plain habitats. Fish are therefore an integral part of the entire marine ecosystem in the park.

Numerous studies of the ecology of fish in the park have been completed. These include studies of community structure and dynamics (Gladfelter, et al. 1979; Gladfelter and Gladfelter 1980; and Simpson 1979b in Kendall 2004b), coral predation by parrotfish (Simpson, 1979a, in Kendall 2004b), population composition and abundance (Gladfelter et al. 1977; Tobias 1988), and qualitative observations of abundance and diversity (Bayer and Robins 1965).

The NPS and the National Oceanic and Atmospheric Administration Center for Coastal Monitoring and Assessment conducted a survey of reef fish in February 2001 in Virgin Islands National Park and Buck Island Reef National Monument (Kendall, et al. 2004b; Monaco, et al. 2003). The objective of this study was to provide a baseline assessment of fish communities within the parks that could be used for park planning. In February 2001, fish were monitored using visual counts along roughly 120 belt transects placed randomly in bottom habitats within and proximate to park boundaries that measured 25 by 4 meters. A detailed description of methods is provided in Kendall, et al. (2004b). Key results and conclusions of this study include:

A total of 7,417 individual fish, including 35 families and 103 species, were observed. The most abundant fish observed at any single location included the bluehead wrasse (*Thalassoma bifasciatum*), slippery dick (*Haliocoeres bivittatus*), and blue tang (*Acanthurus coeruleus*). These fish had the highest abundance at hardbottom sites.

The most frequently observed fish included slippery dick, bluehead wrasse, striped parrotfish, blue tang and ocean surgeonfish, bicolor damselfish (*Stegastes partitus*), and French grunt. Rare species included the tiger grouper (*Mycteropera tigris*), schoolmaster snapper (*Lutjanus apodus*), peacock flounder (*Bothus lunatus*) and Bermuda chub (*Kyphosus sectatrix*).

A comparison of fish density, habitat type, and total number of fish in Buck Island Reef National Monument between 1975 and 2001 was provided in Kendall, et al. (2004b) (Table 12). Results show that expansion of the park increased the total number of fish that were protected from 2.6 million to over 24 million.

Table 12. Comparisons of Fish Densities and Estimates of Total Fish Protected by Buck Island Reef National Monument in 1975 and 2001

Habitat Type	Habitat Area (m ²)	Fish Density by Habitat (No. of Fish/m ²)	Total Number of Fish by Habitat	Total Estimated Fish Population – all Habitat Types
1975 Park Boundary				
Sand	293,000	0.20	58,600	
Seagrass	474,000	0.17	80,580	
Hard Bottom	1,963,000	1.26	2,473,380	
2001 Park Boundary			Total	2,612,560
Sand	2,696,000	0.20	539,200	
Seagrass	2,892,000	0.17	491,640	
Hard Bottom	18,297,000	1.26	23,054,220	
			Total	24,085,060

Source: Kendall et al. 2004b

The National Oceanic and Atmospheric Administration Center for Coastal Monitoring and Assessment conducted annual surveys of reef fish in Buck Island Reef National Monument's waters between 2001 and 2009 (NOAA 2001b; 2006b; 2006c). A review of the fish data (NOAA 2006b) shows that a total of 95,883 individual fish were counted in the six sampling events between 2001 and 2006. These data are summarized in Table 13. This included 55 families of fish, with over 43 percent from the wrasse family. Angelfish, surgeonfish and tangs, and parrotfish accounted for 14.7, 13.0 and 11.8 percent of the total, respectively. The remaining 51 families accounted for the rest of the fish observed. Menza et al. (2006) analyzed the results of this sampling program for the data from 2001 through 2005. Results were subdivided into hard and soft bottom habitat types as shown in Figure 15.

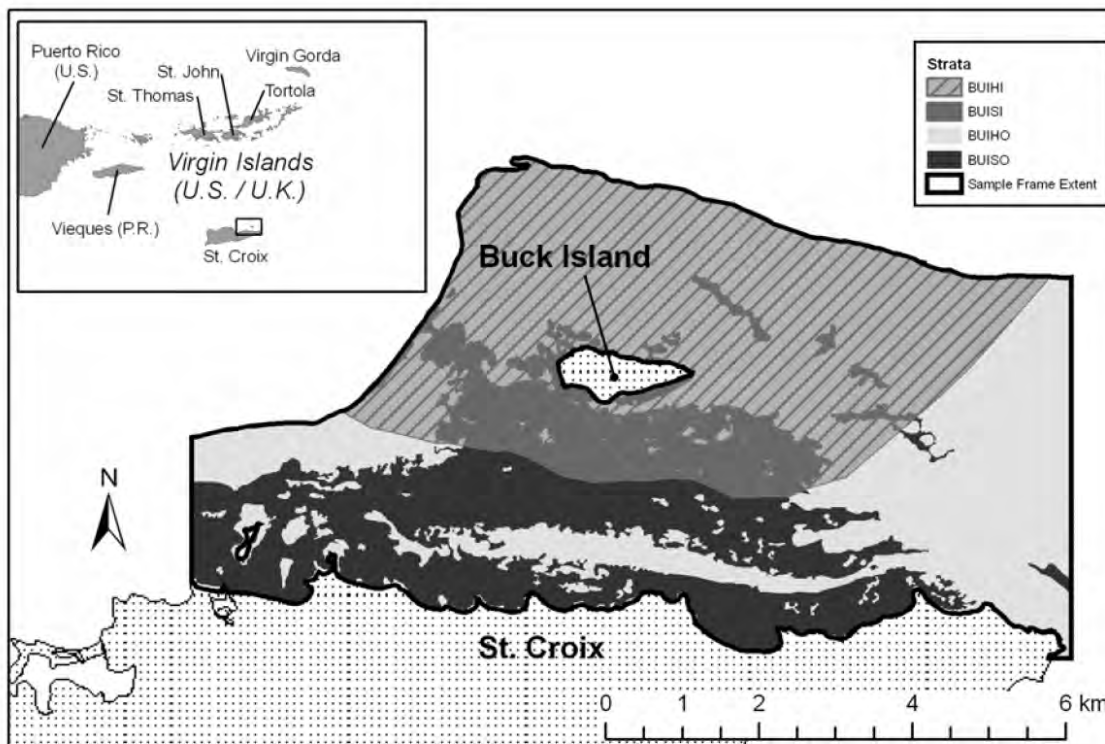
Table 13. Number of Fish of Each Family Observed at all Stations Between 2001 and 2006 During National Oceanic and Atmospheric Administration Surveys of Buck Island Reef National Monument

Common Family Name	Scientific Family Name	Number Observed	% of Total
Wrasses	Labridae	41,369	43.145%
Angelfishes	Pomacanthidae	14,066	14.670%
Surgeonfish and Tangs	Acanthuridae	12,507	13.044%
Parrotfishes	Scaridae	11,284	11.769%
Grunts	Haemulidae	4,291	4.475%
Jacks and Pompanos	Carangidae	2,235	2.331%
Gobies	Gobiidae	1,686	1.758%
Groupers and Sea Basses	Serranidae	1,645	1.716%
Conger and Garden Eels	Congridae	1,580	1.648%
Goat Fishes	Mullidae	775	0.808%
Squirrelfishes and Soldierfishes	Holocentridae	575	0.600%
Snappers	Lutjanidae	534	0.557%
Herrings, Shads, Sardines, Menhadens	Clupeidae	470	0.490%
Bonnetmouths	Inermiidae	385	0.402%
Barracudas	Sphyraenidae	343	0.358%
Butterflyfishes	Chaetodontidae	295	0.308%
Scaled Blennies	Labrisomidae	256	0.267%
Blennies, Combtooth Blennies, and Scaleless Blennies	Blenniidae	227	0.237%
Triggerfishes	Balistidae	185	0.193%
Pike-, Tube- and Flagblennies	Chaenopsidae	174	0.181%
Puffers	Tetraodontidae	153	0.160%
Mojarras	Gerreidae	133	0.139%
Tilefishes	Malacanthidae	116	0.121%
Basslets	Grammatidae	101	0.105%
Jawfishes	Opistognathidae	77	0.080%
Trumpetfishes	Aulostomidae	61	0.064%
Needlefishes	Belonidae	50	0.052%
Filefishes	Monacanthidae	40	0.042%
Boxfishes, Coffersfishes, Cowfishes, and Trunkfishes	Ostraciidae	39	0.041%
Lefteye Flounders	Bothidae	32	0.033%
Cardinalfishes	Apogonidae	31	0.032%
Stingrays	Dasyatidae	28	0.029%
Lizardfishes	Synodontidae	20	0.021%
Dragonets	Callionymidae	17	0.018%
Wormfishes	Microdesmidae	17	0.018%
Pilotfishes, Rudderfishes, and Sea Chubs	Kyphosidae	13	0.014%
Hawkfishes	Cirrhitidae	11	0.011%
Burrfishes and Porcupinefishes	Diodontidae	9	0.009%

Table 13. Number of Fish of Each Family Observed at all Stations Between 2001 and 2006 During National Oceanic and Atmospheric Administration Surveys of Buck Island Reef National Monument (Continued)

Common Family Name	Scientific Family Name	Number Observed	% of Total
Nurse sharks	Ginglymostomatidae	8	0.008%
Remoras	Echeneididae	7	0.007%
Mackerels, Tunas, Bonitos	Scombridae	7	0.007%
Pipefishes and seahorses	Syngnathidae	7	0.007%
Drums or croakers	Sciaenidae	5	0.005%
Moray eels	Muraenidae	4	0.004%
Flying Gurnards	Dactylopteridae	3	0.003%
Large-tooth Flounders	Paralichthyidae	3	0.003%
Firefishes, Goblinfishes, Rockfishes, and Scorpionfishes and Scorpaeonidae	Scorpaenidae	4	0.004%
Anchovies	Engraulididae	1	0.001%
Eagle and Manta Rays	Myliobatidae	1	0.001%
Batfishes	Ogcocephalidae	1	0.001%
Snake Eels	Ophichthidae	1	0.001%
Bigeyes and Catalufas	Priacanthidae	1	0.001%
Total Observed		95,883	100.0%

Adapted from: NOAA 2006b

Figure 15. Areas Sampled for Fish Inside and Outside the Park (2001 to 2005) (Menza 2006).

The following is a summary of results of the study by Menza et al. (2006):

- The highest species richness (number of species) and assemblage densities of fish (total number of all fish per square meter) were typically found in linear reef, aggregated patch reef, and individual patch reef habitats, and the lowest species richness was found in sand, seagrass, and scattered coral/rock in sand habitats. The average number of species for all stations for the period 2001-2005 was 15.96 (standard error = 0.73 fish/100 m²).
- Aggregated patch reefs, individual patch reefs, and colonized bedrock habitats also possessed high densities, but this pattern was not consistent for other groups of fish. The average density of all fish for all stations for the period 2001-2005 was 158.17 fish/100 m² (standard error = 23.88 fish/100 m²).
- Species richness, mean density of the community (all species) and mean density of groupers were highest in mid-shelf reef sites, but snappers and piscivores (predatory fish) were conspicuously absent. Grouper, snapper, and piscivore density decreased steadily from 2002-2005.
- Significant differences in community biomass were observed with 2003 densities inside the park being greater than outside the park.

During this multi-year observation study, it was noted that fish that eat mobile invertebrates were the most commonly observed (49.6 percent of the total number of fish observed), and herbivorous (feeding mainly on plants) fish accounted for 37.1 percent of the total. Together, these two groups of fish accounted for 86.7 percent of all fish observed. The remaining fish included those that depend primarily on zooplankton, other fish, decaying plant material (detritivores), or combinations of the eating habits.

As part of the NPS National Vertebrate and Vascular Plant Inventory Program, Buck Island Reef National Monument conducted a cryptic fish inventory allowing the use of rotenone collection method. These additional fish surveys conducted with rotenone techniques show that a significant proportion of the park's reef fish assemblage has been underrepresented or missed when sampled using visual censuses only. Rotenone is a natural chemical produced by plants used as a tool for sampling reef and other shore species. Only 36 percent of the 228 species sampled with rotenone were visually detected, 70 percent of the 115 species visually detected were also collected with rotenone, and 31 percent of the 262 total species were common to both techniques (B. Smith-Vaniz 2006).

Fish and benthic habitats of the park were compared to the surrounding area (2003 to 2006) by Pittman and others (2008) using a wide range of comparative analyses of biotic components representing community, trophic, family and individual species level data incorporating measures of abundance, biomass and diversity. A summary of the findings is provided below (Pittman, et al. 2008).

Study results indicate that many of the coral reefs with the highest fish species richness were within 200 meters of seagrass beds. Other studies have also indicated links between fish distribution on coral reefs and proximity to seagrass beds, suggesting that many species may benefit from a mosaic of habitat types.

Increases in fish density in the park occurred in 2005 and 2006 that were significantly higher than 2003. It is not clear if this is the result of the park boundary being expanded, with enforcement of the no-take provision. Densities outside the park boundary were significantly lower in 2005 and 2006 compared to 2003.

Over the course of six years of monitoring (2001 to 2006) using 1,275 samples, only three Nassau grouper, three yellowfin grouper, and one tiger grouper were observed in the study region (both inside and outside the park), indicating that the grouper have been overfished.

Coney and red hind were more abundant around Buck Island between 2001 and 2006 compared to 1979.

Threespot damselfish (*S. planifrons*), a potential indicator of healthy reefs with high live coral cover, was more abundant around Buck Island in 1979 than in the 2001 to 2006 sampling period.

A total of 201 fish species/species groups were identified from 56 families. Nine of the 10 most frequently found species belonged to the wrasse, surgeonfish and parrotfish families.

The majority of the most abundant fish across the study region (inside and outside the park) were found in highest densities over hardbottom habitat types, and most also used multiple habitat types including seagrasses and sand.

Essential Fish Habitat

Essential fish habitat is defined under the reauthorization of the Magnuson-Stevens Fishery Conservation and Management Act as “those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity” (50 CFR 600.100). Section 302 of the Act established eight regional fishery management councils, including the Caribbean Fisheries Management Council, to develop Fishery Management Plans to regulate fisheries in an effort to prevent overfishing in each of the regions (CFMC 2004). The Magnuson-Stevens Act required fishery management councils to describe and identify essential fish habitat, identify adverse impacts from both fishing and non-fishing activities on essential fish habitat, and identify actions required to conserve and enhance essential fish habitat. An analysis of resources that would be considered ecologically critical areas, including essential fish habitat and habitat areas of particular concern as defined by the National Oceanic and Atmospheric Administration and mapped by the Council, is also required by the National Environmental Policy Act.

Essential fish habitat for reef fish, spiny lobster, queen conch, corals, and coral reefs in the park has been described by the Caribbean Fisheries Management Council (CFMC 2004). Because the life stages of these species (including pelagic stages) collectively occur in all habitats of the U.S. Caribbean, essential fish habitat under the Council’s Generic Amendment included all waters and substrates (e.g., mud, sand, shell, rock, and associated biological communities), coral habitats (coral reefs, coral hard bottoms, and octocoral reefs), subtidal vegetation (seagrass and algae), adjacent intertidal vegetation (wetlands and mangroves), and pelagic waters. Therefore, essential fish habitat includes virtually all marine waters, substrates (mud, shell, rock, coral reefs), and associated biological communities in the areas between the coastline and 200 nautical miles into the sea (referred to as the exclusive economic zone by the Magnuson-Stevens Fishery Conservation and Management Act) including Buck Island Reef National Monument.

The Caribbean Fisheries Management Council identified coral reefs, hard and soft bottoms, sand/shell bottoms, benthic algae, and seagrass as essential fish habitat in the park (CFMC 2004). Since barrier reefs, deep reefs, patch reefs, extensive hard-bottom communities of gorgonid corals and sponges, unique elkhorn coral formations, and extensive seagrass beds occur in the park, Buck Island Reef National Monument is designated as habitat of particular concern for Caribbean coral species. The designation of habitat areas of particular concern is intended to identify those areas of essential fish habitat considered to be of the highest importance in the life cycles of managed species and most in need of protection. Buck Island meets habitat area of particular concern considerations for ecological importance and sensitivity to human-induced degradation (CFMC 2004).

Essential fish habitat provides forage and nesting areas for reef fish, spiny lobster, queen conch, and corals including now listed elkhorn and staghorn corals. Appendix C provides a comprehensive list of these species. Within the U.S. Virgin Islands, for each category of fishery, all waters, from mean high water to the outer boundary of the exclusive economic zone, are protected for eggs and/or larvae. For other life stages, the following essential fish habitats are defined (CFMC 2004):

Reef Fish — All substrates from mean high water to 100 fathoms depth.

Spiny Lobster — Seagrass, benthic algae, mangrove, coral, and live/hard bottom substrates from mean high water to 100 fathoms depth.

Queen Conch — Seagrass, benthic algae, coral, live/hard bottom and sand/shell substrates from mean high water to 100 fathoms depth.

Coral Fishery — Coral and hard bottom substrates from mean low water to 100 fathoms depth.

Other Marine Animals

Lobsters. Two species of lobsters occur in the park; the spiny lobster (*Panulirus argus*) and spotted lobster (*Panulirus guttatus*). The Environmental Impact Statement for Essential Fish Habitat in the Caribbean (CFMC 2004) concluded that the spiny lobster has a strong reliance on seagrass habitats. The following general information on lobsters is excerpted from Herrnkind (no date, *in* CFMC 2004; CFMC 1998):

The lobster has six life history stages, and uses three distinct habitats: open ocean; the shallow, vegetated coastal zone; and coral reefs. The larvae spend several months as plankton, and may travel large distances. Postlarvae migrate to nearshore areas and settle to the bottom. Postlarvae molt to juveniles that live in algal beds or among mangrove roots, and subsequently move to crevices in shallow areas. Sub-adults and adults live on reefs.

Most spiny lobster mate in spring and early summer along outer reefs near the shelf edge. Egg hatching occurs in deeper waters with strong water movements. The larval stage of spiny lobster is spent in the open ocean.

Post larvae collect in shallow water areas, where they molt to an algal-phase that is dependent of shallow water habitats such as coral reefs, mangroves and seagrasses.

The most important Caribbean habitats for juvenile lobster appear to be *Thalassia* beds and mangroves (CFMC 1998). Additional juvenile lobster habitat includes algal mats (plains) and rock crevices.

Sub-adult lobster forage at night on benthic invertebrates and hide during the day around the bases of sea whips and large sponges, rock ledges, seagrass rhizome mats, or coral heads. In response to seasonal storms (especially during hurricane season), subadults mass-migrate in single-file queues from shallow banks to 10-20 m deep rock and coral shelters and disperse into sheltered waters.

Adult lobster forage at night on seagrass beds, algal plains, and reefs.

In 1988, as part of the Virgin Islands Resource Management Cooperative, the first census work was conducted on spiny lobster in the park (Tobias, et al. 1988). Lobster populations were counted each month for six months at three study sites in the park. The average density of spiny lobster for the six-month study was 1.2 lobsters per 624 square meters, 1.5 lobsters per 165 square meters, and 1.3 lobsters per 1,500 square meters, respectively. It was noted that the abundance of lobster in the park is largely controlled by habitat availability, food supply, and seasonal migrations.

The Florida Fish and Wildlife Conservation Commission's Florida Marine Research Institute, in cooperation with the NPS, conducted a baseline study of the spiny lobster inside and adjacent to the park between April of 2004 and April of 2007 (Cox, et al. 2009). Five habitats comprising high quality lobster shelters were selected inside the park for monitoring (Deep Reef, Linear Reef, Back Reef, Patch Reefs and, Western Ledges). These areas were compared to areas outside the park. Two of the areas, colonized pavement and haystacks inside the park were eliminated from future sampling efforts because there was insufficient structure to support lobster.

Lobster size inside and outside of the park differed by habitat and distance from shore. Lobsters sampled close to the shore of St. Croix were primarily juveniles and increased in size at sites that were farther from the shore. The mean size of a lobster (measured as carapace length) on nearshore patch reefs, the habitat closest to St. Croix, was 51 mm. Back reef and base of linear reef outside of the park were also dominated by juvenile lobsters; mean sizes 54 mm and 61 mm, respectively. Lobsters on mid-channel patch reefs both inside and outside of the park varied widely in size. Adult lobsters are found in the remaining habitats, all within the park boundary. Lobsters on deep reef habitats and western ledges within the park were the largest (on average 106 mm). These habitats are the furthest from the shore of St. Croix. There were significantly more legal size lobsters on deep reef habitat inside the park than outside the park; and more legal lobster on mid-channel patches inside the park than those just outside the park (Cox, et al. 2009).

In general, the lobsters found outside the park at the deep reef and patch reef sites were smaller than those found inside the park. Cox, et al. (2009) reported that these differences were most likely due to the fact that the areas outside the park are fished. The higher abundance of larger lobsters inside the park compared to outside the park indicates that lobsters experience refuge from the fishery, and that fishers select out the largest animals. Overall, Cox, et al. (2009) concluded that the park has a positive effect on spiny lobster abundance and size.

Conch. Due to overfishing in many regions of the Caribbean and Florida, queen conch (*Strombus Gigas*) was listed in Annex II of the Cartagena Convention's Protocol Concerning Specially Protected Areas and Wildlife as a species that may be used on a rational and sustainable basis and that requires protective measures (Pittman, et al. 2008). The United States proposed and later adopted the queen conch for listing in Appendix II of the Convention on International Trade in Endangered Species of Wild Fauna and Flora (referred to hereafter as the Convention) in 1992, making the queen conch the first large-scale fisheries product to be regulated by the Convention. The queen conch fishery is regulated under the auspices of the Caribbean Fishery Management Council (Pittman, et al. 2008).

Valle-Esquivel (2002) provides general information on the biology of the queen conch (*Strombus gigas*) in the Caribbean that is summarized in the paragraphs that follow. Conch generally occurs on shallow shelf areas in tropical or subtropical waters from a few inches in depth to a maximum of 250 feet in depth. Being benthic grazers, conch habitat and depth is limited to areas where clear water and sandy substrate support algae and seagrass production. Preferred habitats for conch are therefore shallower than 60 feet to 80 feet and include seagrass and sandy algal beds, gravel, coral rubble, smooth hard coral and beach rock bottoms (CFMC 1996 in Valle-Esquivel 2002).

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After a planktonic stage of life that lasts two or three weeks, conch settle in areas of soft sand and remain buried during the first year. Young juveniles emerge when their shells measure from 50 to 100 millimeters. They then transition to an epibenthic (on top of the benthic surface) existence in nearby seagrass beds (Appeldoorn and Ballantine 1983 in Valle-Esquivel 2002). Large conchs move more slowly than small conchs. They exhibit two types of migration: the first is an ontogenetic (developmental) migration, characterized by juveniles leaving the nursery areas to move gradually into deeper waters as they age. The second migration is seasonal and related to spawning. Adults move into shallower waters for reproduction during the summer months, and move back to deeper waters during the winter (Stoner, et al. 1988; Stoner and Waite 1990; CFMC/CFRAMP 1999 all in Valle-Esquivel 2002).

Surveys of conch conducted in the U.S. Virgin Islands in 1981, 1985, and 1990 showed declines in conch densities in St. Thomas and St. John (from 37 to 11 conch per hectare). Estimates for St. Croix were among the lowest (7.6 conch per hectare) in the Virgin Islands (Wood and Olsen 1983; Friedlander, et al. 1994; Friedlander 1997 *all in* Valle-Esquivel 2002). Tobias, et al. (1988) prepared a report on fish and shellfish populations within the park, including conch. Surveys were conducted along two, 332 meter long by 4 meter wide parallel elevated transects in a large seagrass bed within the park's boundary. Conch was associated with a dense bed of manatee and turtle grass. The mean density of conch along the two transects was one conch per 7 meters. This study indicated that the seagrass bed was being used as a nursery area (Tobias et al 1988).

Additional studies were conducted in St. Croix, both inside and outside the park from 2004 onward by NOAA and the NPS. Comparison of estimates of sighting frequency show that conch juveniles and adults were more common in northeastern St. Croix than for St. John or southwestern Puerto Rico (Pittman et al 2008), highlighting the importance of the large expanse of protected seagrasses between Buck Island and the St. Croix coastline as key resources supporting regional conch populations.

Long-spined Sea Urchins. A large-scale die-off of the long-spined sea urchin (*Diadema antillarum*) occurred in the Caribbean during 1983-1984, reducing its numbers by more than 97percent (Ogden, et al. 1973 *in* Miller, et al. 2005) and was not followed by rapid recovery. Because the sea urchin feeds on bottom dwelling algae on reefs, they affect the species composition and structure of the coral reefs in the park in a variety of different ways. Sea urchins clear the substrate of fast-growing algae, allowing coral larvae to settle and grow. Algal biomass within coral reefs increased following the urchin die-offs, thereby potentially reducing substrate for coral settlement (DPNR 2005b).

Intensive ecological studies of *Diadema* on St. Croix reefs in the 1970s showed that *Diadema* grazing caused the mysterious halos of bare sand found around Caribbean patch reefs (Ogden, et al. 1973 *in* Miller et al 2005). *Diadema* shapes the entire reef community (Miller, et al. 2005). Miller, et al. (2005) documented the possible beginnings of recovery of *Diadema* populations in St. Croix, comparing spatial patterns of recovery with that of the mass mortality. *Diadema* densities on St. Croix were reported to be far below pre-mortality numbers, but substantially higher than the near-zero densities that immediately followed the mass die-off. Rapid population growth (greater than 100 percent increase on back-reefs, and greater than 350 percent on patch reefs) is a sharp contrast to the very slow growth over the 17 years following the die-off. Size distribution reported in 2003 was reported to reflect successful recruitment, suggesting population recovery, returning *Diadema* to its critical role for the reef community (Miller, et al. 2005). Subsequent studies also report that although the long-spined urchin densities around Buck Island have not recovered since the mass mortality in 1983, some minor recovery may be occurring in the lagoonal and back reef areas along the sheltered coastline of northeastern St. Croix (Pittman, et al. 2008). Highest densities reported from surveys conducted inside and outside the Buck Island Reef National Monument between October 2005 and November 2006 were observed in the nearshore environments within the East End Marine Park on colonized bedrock, colonized pavement and macroalgal beds in close proximity to extensive seagrass beds (Pittman, et al. 2008).

SPECIES OF CONCERN

The NPS is required under the Endangered Species Act to ensure that federally listed species and their habitats are protected on all lands within the agency's jurisdiction. In addition, park policy and management actions include maintenance of territory program-listed species as part of the park's natural heritage.

The territorial lists of endangered and threatened animals and plants are maintained by the Division of Fish and Wildlife under the Virgin Islands Department of Planning and Natural Resources. The listings are supported by the U.S. Virgin Islands Indigenous and Endangered Species Act of 1990 (Act Number 5665, Section 104g) under Administrative Code title 12, Chapter 2. This Act gives the

Commissioner of the Department of Planning and Natural Resources the authority to promulgate territorial lists of endangered plants and animals. The list has not been updated since 1991, and there is a movement to revise the list through an Amendment to the Act. While the existing laws provide reasonable protection, enforcement is lax and ineffective (DPNR 2005b).

Table 14 provides a list of the species identified in the park and their status with respect to their federal or territorial designation for protection. The following paragraphs provide a summary of information presently available regarding the species of concern.

Table 14. Species of Concern on Buck Island Reef National Monument

Common Name	Scientific Name	Federal Status	Territory Status
Leatherback sea turtle	<i>Dermochelys coriacea</i>	Endangered	Endangered
Hawksbill sea turtle	<i>Eretmochelys imbricata</i>	Endangered	Endangered
St. Croix ground lizard	<i>Ameiva polops</i>	Endangered	Endangered
Green sea turtle	<i>Chelonia mydas</i>	Threatened	Threatened
Loggerhead sea turtle	<i>Caretta caretta</i>	Threatened	
Elkhorn coral	<i>Acropora palmata</i>	Threatened	
Staghorn coral	<i>Acropora cervicornis</i>	Threatened	
Lignum vitae	<i>Guaiaacum officinale</i>		Endangered
Stinging bush	<i>Malpighia infestissima</i>		Endangered
Butterfly orchid	<i>Psychillia macconnelliae</i>		Endangered
Woolly nipple cactus	<i>Mammillaria nivosa</i>		Endangered
Spanish lady	<i>Opuntia triacantha</i>		Endangered
Brown pelican	<i>Pelecanus occidentalis</i>		Endangered
Least tern	<i>Sterna antillarum antillarum</i>		Threatened

Plants

Stinging bush (*Malpighia infestissima* Rich. Ex Nied; *Malpighia pallens* syn.) is endemic to St. Croix and Buck Island (Woodbury et al 1976). It has T-shaped hairs on the underside of the leaf surface which penetrate the skin on contact and cause an irritation or dermatitis. These stinging hairs may have led to its decline on St. Croix and extirpation on St. John. The stinging bush is found in coastal scrub and dry, deciduous forests. Threats and distribution are not well known and it was delisted by the U.S. Fish and Wildlife Service in 1995 for those reasons.

Butterfly orchid (*Psychillia macconnelliae*) (also locally referred to as the Sandy Point orchid) was originally misidentified by Woodbury, et al. 1976 as *Epidendrum brittonianum*, by Gibney (1996) as *E. bifidum*, a species that only occurs in Haiti, and by Ray (2003) as *P. macconnelliae*. The butterfly orchid is an epiphyte on small trees and shrubs in a variety of habitats, usually near salt water. The flowers are showy and in various shades of red to lavender. Little is known about this orchid, including what pollinates it, or what its habitat requirements are, but as with most orchids, it is likely that it is threatened by habitat loss and illegal collecting.

Woolly nipple cactus (*Mammillaria nivosa*) is a small, colonial cactus with wooly white hairs at the base of each axil. The spines are yellow to brown, the flowers are yellow, and the fruits are red and succulent. The cactus is found on Puerto Rico, the Bahamas, and other West Indian Islands, but distribution is limited to a few colonies at each location. Threats to this species include loss of habitat, predation on fruits and seeds by introduced rodents, degradation of habitat due to exotic vegetation, and illegal collection. All *Mammillaria* species are popular with collectors and plant tradesmen.

Spanish lady (*Opuntia triacantha*) is a rare, medium-sized cactus of the dry, deciduous forest slopes and back beach areas in sandy, calcareous soils. It is found in small populations throughout the U.S.

Virgin Islands, Puerto Rico, and in the Florida Keys. It blooms year-round with yellow flowers, followed by succulent red fruits. Threats include loss of habitat, predation on fruits and seeds by introduced rodents, and predation by *Cactoblastis cactorum*, a non-native moth which preys on this and other *Opuntia* species.

Lignum vitae (*Guaiacum officinale*) is a large, slow-growing tree native to the Caribbean and was once found on nearly all the various islands. European settlers harvested the trees for use in the construction of boats, charcoal production, and for medicinal purposes. The wood had the unique quality of being self-lubricating and was valuable for use in bearings and bushing blocks for steamship propeller shafts (Woodbury, et al. 1976). The lignum vitae was extirpated from the park and has been nearly driven into extinction in other areas. Over the past 30 years the NPS successfully reintroduced lignum vitae to Buck Island.

Corals

On May 9, 2006 (Federal Register, Vol. 71, No. 89)(50 CFR Part 223), elkhorn coral and staghorn coral (*Acropora cervicornis*) were officially designated as threatened species by the National Oceanic and Atmospheric Administration/National Marine Fisheries Service. This listing was made on the basis of the following facts (Acropora Biological Review Team 2005):

Drastic and historic reductions (97%) in abundance of these species throughout their ranges, including the Florida Keys, Dry Tortugas, U.S. Virgin islands, and Jamaica.

Potential to restrict broad geographic ranges due to local extirpations.

Limited sexual recruitment in some areas and unknown in most areas, and unsuccessful settlement of larvae.

Decreases in fertilization success as densities of adults decline, and rapid mortality of new recruits at most locations.

Factors Affecting Health of Elkhorn and Staghorn Corals

The factors causing reductions in the abundance of these two species of coral throughout the Caribbean include hurricanes, disease, sedimentation, anthropomorphic abrasion and breakage, competition, predation, contaminants, loss of genetic diversity, African dust, elevated carbon dioxide levels, and sponge boring (Acropora Biological Review Team 2005). More recently, elevated water temperatures have shown to cause high mortalities (NPS 2006c). An overview of these factors is summarized in the description of coral communities in the “Marine and Coastal Resources” section of this chapter.

A more detailed summary of factors affecting the abundance of elkhorn and staghorn corals is provided by the Acropora Biological Review Team (2005), NPS (2003) and Rogers, et al. (2006). The Acropora Biological Review Team (2005) concluded that the combined effects of all known factors has led to the overall decline in elkhorn and staghorn corals in the Caribbean, with the resulting threat of extinction. It was estimated that elkhorn and staghorn corals would become extinct in approximately 30 years.

Biological Features of Elkhorn and Staghorn Corals

Elkhorn and staghorn coral are branching corals. They reproduce sexually by broadcast spawning and asexually by fragmentation (Acropora Biological Review Team 2005). They require clear, well-mixed water and rely almost exclusively on photosynthesis for sunlight. As a result, they depend on bright sunlight and are very sensitive to elevated turbidities caused by suspended matter in the water column. Due to their dependency on photosynthesis, they are also one of the most rapidly growing corals in the Caribbean, as opposed to corals that feed more on zooplankton. The optimal growth temperature

range for elkhorn and staghorn corals is 25 to 29 degrees Celsius and they require near oceanic salinities between 34 to 37 parts per thousand (Acropora Biological Review Team 2005).

Historical Changes in Abundance of Elkhorn and Staghorn Corals in the Park

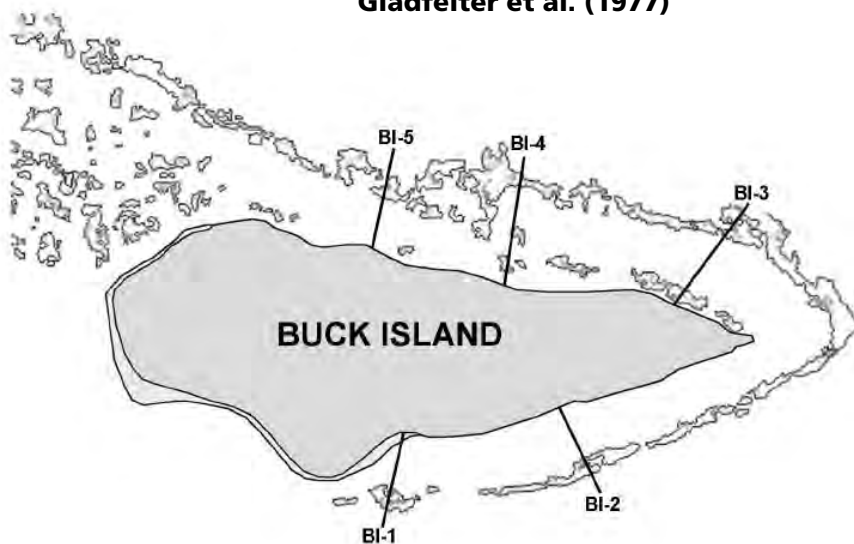
The spectacular elkhorn coral barrier reef was the primary reason for the establishment of the park. The park expansion included the elkhorn coral-dominated northern reef shelf, for a total of over 5,000 acres of critical habitat (Lundgren 2008). Because of this, additional details are provided in this *General Management Plan* on the historical trends of abundance and distribution of both elkhorn and staghorn corals in the park, and the factors thought to account for these changes. A detailed summary of the historical changes in the various other species of coral studied in the park is provided in the section of this plan entitled "Shallow Coral Reef Communities."

The following is a discussion of historical trends in the abundance of elkhorn and staghorn corals arranged according to the time period in which the studies were conducted.

Early 1970s: The first signs of white band disease were noted by NPS staff (NPS reports, unpublished). Gladfelter, et al. (1977) determined prevalence levels at about 3 percent, where prevalence is defined as the number of cases of a disease in a population at a specific time.

1976-1988: Gladfelter, et al. (1977) established five transects in 1976 as shown in Figure 16. In 1976, elkhorn coral comprised over 50 percent of the south bank barrier reefs and the northern forereef (the area of the reef on the seaward side of the reef crest – see "Marine and Coastal Resources" section for further definition). Elkhorn coral "was the most abundant coral on the forereef slope down to ... a depth of 10 to 15 meters in the north and east sections of the reef. In the south, this species was dominant to depths of 3 to 4 meters" (Rogers, et al. 2002).

Figure 16. Five Sampling Transects Established in the Park in 1976 by Gladfelter et al. (1977)



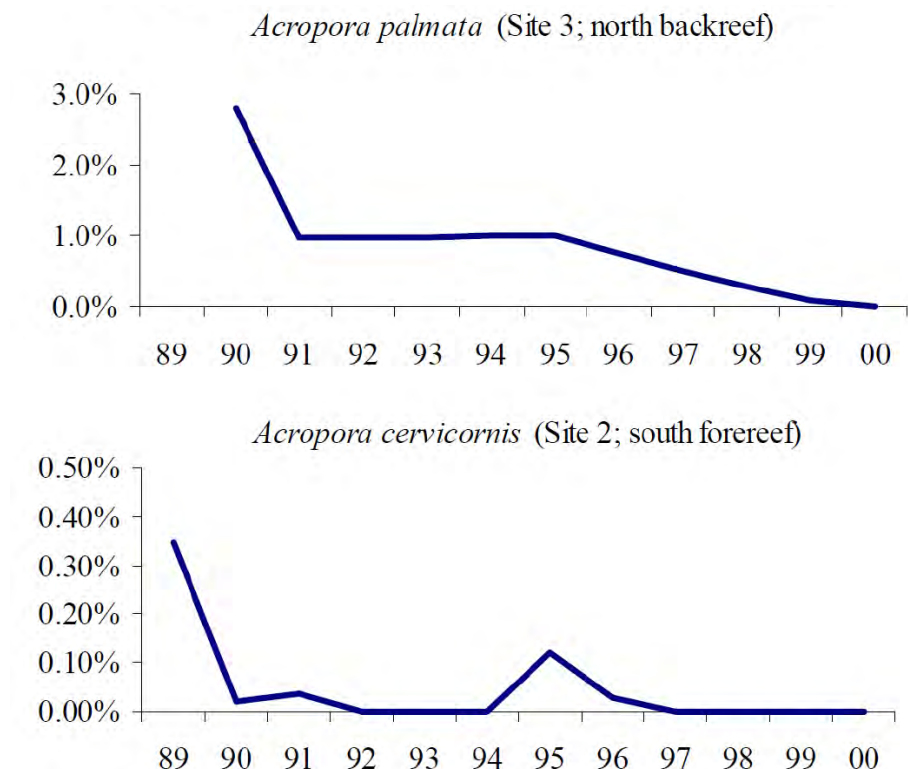
Additional declines in the elkhorn coral in the park were observed by 1988. Elkhorn coral cover on the forereef area in the vicinity of transects BI-3 and BI-4 (Figure 16) was 3 percent. However, along transect BI-5 (Figure 16) elkhorn coral comprised 72 percent of the total cover on the upper forereef, suggesting that this area was less affected by the mass mortality that devastated most of the reef. In 1988, elkhorn coral virtually disappeared on the north side of Buck Island (Bythell, et al. 1989 in Rogers, et al. 2002).

In 1988, additional permanent monitoring sites were established at Buck Island (Bythell, et al. 1992, 1993a in Rogers, et al. 2002). These studies concluded that elkhorn and staghorn corals were no longer a dominant part of the coral community and that further reductions in the previous 10 years occurred during a period of unusually intense hurricane activity (Bythell, et al. 2000a in Rogers, et al. 2002).

1989-2000: In 1989, Hurricane Hugo caused extensive destruction of the reefs in the park (Rogers, et al. 2002). The five reef transects established in 1976 by Bythell, et al. (1989) were re-surveyed. The shallow forereef on the south side of Buck Island was reported to have been reduced to pavement, and the coral rubble generated was moved up onto the reef crest, forming a raised berm 30 meters landward of the crest (Hubbard, et al. 1991). No elkhorn coral was recorded on the south reef in locations where it had previously been dominant. On the eastern shallow forereef, elkhorn coral cover fell from 5 percent to 0.8 percent in an area that had once supported 85 percent cover (Gladfelter et al. 1991). The north reef at Buck Island was less severely damaged by Hurricane Hugo, but elkhorn coral populations were still reduced from approximately 1.8 percent to 1.0 percent cover on the forereef of transect BI-3 (Gladfelter, et al. 1991). These surveys clearly showed the effects of the storm, even though most elkhorn coral mortality had already occurred.

In 1979, Hurricane David caused extensive physical damage to shallow elkhorn coral stands. Off the southeastern forereef, 66 percent of the elkhorn coral branches were still alive 11 months after the storm, with many beginning to heal and initiating new branches. However, elkhorn coral recovery was hindered by white band and live elkhorn coral coverage was reduced by over 90 percent, leaving vast areas of dead standing colonies (Anderson, et al. 1986; Bythell, et al. 1989; Rogers, et al. 2002). By 1984 elkhorn coral was dramatically reduced in the area of transects BI-3 and BI-2 (Figures 16 and 17). In the forereef area of transect BI-3, elkhorn coral was still dominant (greater than 10 percent cover). Patches of healthy elkhorn coral containing 80 percent live cover occurred in this area, but many stands on the forereef were almost completely dead (Anderson, et al. 1986).

Figure 17. Reductions in Cover of Elkhorn and Staghorn Coral at Transects BI-2 and BI-3 in Buck Island Reef National Monument



Source: Rogers et al. 2002

Beginning in 1993, elkhorn coral colonies were observed in the southeast forereef in the area scraped clean by Hurricane Hugo, although they were only a minor component (0.4%) of the coral community recruiting to the area (Bythell, et al. 1993a, 2000b). In 1995, after Hurricane Marilyn, some colonies were up to 1 to 2 meters across but exhibited physical damage from the storm.

2000-2008: Several different studies of elkhorn coral were initiated between 2000 and 2006. These are summarized in the order in which they began. In 2000, 25 individual colonies of elkhorn coral were tagged and monitored annually by the NPS. To document and monitor this re-growth, a pilot study was conducted in 2002 by Dr. Caroline Rogers of the U. S. Geological Survey Biological Resources Division (NPS 2003).

An additional study to document the re-growth of elkhorn coral was initiated in 2002 by the NPS (NPS 2003) to map the spatial distribution and colony size of elkhorn coral colonies along the south forereef. In 2003, a total of 2,150 colonies larger than 0.5 m were recorded within an area of approximately 10 acres. The areas surveyed during the 2002 pilot study experienced a 40 percent increase in medium size colonies (0.5 – 1 m), from 2002 to 2003 (NPS 2003).

In 2002, Gladfelter surveyed selected reef zones around St. Croix that had been formerly dominated by elkhorn coral in order to measure percent cover and recruitment, and to compare current cover to that from the 1970s - 1990s (Rogers, et al. 2002). Included in this survey was a study area initiated in 1988, located on the eastern forereef of Buck Island (Gladfelter 1991). Size frequency distributions (made by measuring the maximum diameter of each colony) and colony density were also determined at some sites. Percent cover at the eastern forereef was reduced from 62 percent in 1976 to 0.5-1.0 percent in 2002, described in Rogers, et al. (2002) as a "catastrophic" reduction. However, by 2002, all the surveyed sites showed some live elkhorn coral, and some had evidence of at least two successful recruitment events in the past 10-15 years. The majority of the recovery, however, appeared to be from fragmentation, not sexual reproduction (Rogers, et al. 2002).

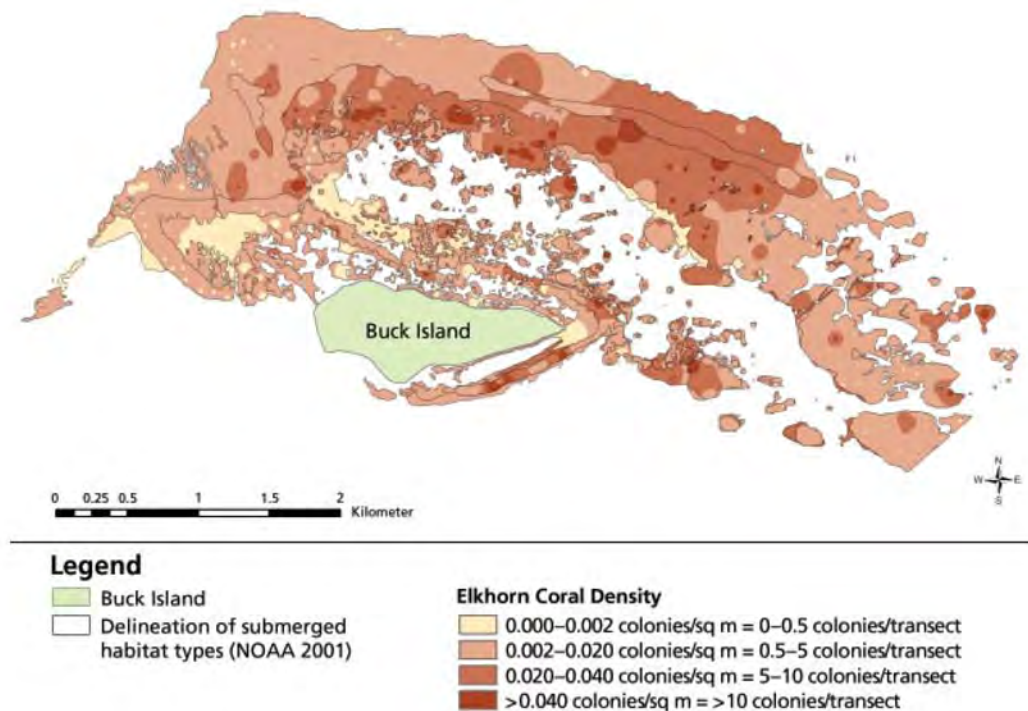
In 2004, park staff began mapping elkhorn coral distribution throughout the park. A pilot study was conducted in January 2004 and expanded to the rest of the park shelf area habitat by that summer. This program indicated that between 2002 and 2005, populations of elkhorn coral had made a comeback, in contrast to decreases in other parts of the Caribbean (Mayor 2006). However, monitoring of all coral species in the fall of 2005 revealed that the largest bleaching event in 20 years had occurred, having a significant impact on elkhorn coral recovery. At Buck Island, elkhorn coral experienced extensive bleaching in 2005. Water temperatures were higher than at any time since 1991 and exceeded the bleaching threshold by over 2 degrees Celsius, causing extensive coral bleaching. Forty-four elkhorn coral colonies were surveyed at three sites before, during, and after the thermal stress event. Elkhorn coral colonies in the backreef exhibited a different response to the thermal stress event than those located elsewhere in the park (forereef and north shelf) and bleached earlier and suffered greater live tissue loss (Lundgren 2008).

These results are discussed in more detail in the subsection entitled "Factors Affecting the Health of Coral Reefs and Marine Communities." In the south forereef, over 99 percent of the elkhorn corals experienced bleaching, and 46 percent of the total coral populations had been killed, including elkhorn and staghorn corals (Lundgren 2008; NPS 2006c).

NPS data on densities of coral colonies from the most recent NPS surveys in 2006 are illustrated in Figure 18. Densities of elkhorn coral ranged from 0.002 to 0.020 colonies per square meter over the majority of the shallow water reefs in the park. Areas of intermediate densities (0.020 to 0.040 colonies per square meter) were observed over large areas of the reef shelf north of Buck Island and on the south forereef. The highest densities of elkhorn coral (greater than 0.040 colonies/m²) were observed in shallow reefs scattered along the north side of Buck Island and the south forereef. The reefs will continue to be monitored to determine the effects of these bleaching and disease events on the abundance and diversity of elkhorn and staghorn coral, and other species. In 2010 NPS established 30

long-term elkhorn monitoring sites to track the species status in the park including recruitment, growth, and disease (Hillis-Starr, personal communication 2009). Data related to other coral species is included in the “Marine and Coastal Resources” section. Results of studies conducted to date for coral and other species are reported on the NPS, South Florida Caribbean Network website (<http://science.nature.nps.gov/im/units/sfcn/Index.cfm>), National Oceanic and Atmospheric Administration’s website (<http://www.noaa.gov/index.html>) and the National Marine Fisheries Service website (<http://www.nmfs.noaa.gov/>).

Figure 18. Distribution and Density of Elkhorn Coral Colonies at Buck Island Reef National Monument in 2004



The St. Croix Ground Lizard

In 1977, the St. Croix ground lizard (*Ameiva polops*) was listed by the U.S. Fish and Wildlife Service as endangered. The St. Croix ground lizard’s range was restricted to Green Cay, Protestant Cay near St. Croix, and the dredge spoil island off St. Croix’s south shore, Ruth Cay. This lizard requires dry, rocky coastal areas with sandy soils and shrub-scrub or forested vegetation communities. The woody vegetation should be relatively open or intermediate in density to create dappled areas of sun and shade. The lizard requires bare, sandy, exposed ground with adjacent shaded areas with dense leaf litter. Burrows of crab species are also important in the preferred habitat (DPNR 2005b).

In the 1984 U.S. Fish and Wildlife Recovery Plan for the St. Croix Ground Lizard, Buck Island was identified as a relocation site pending successful removal of the non-native predators which would substantially increase the available habitat for the species and provide it a better chance of surviving catastrophic events like hurricanes. These non-native predators included mongooses and rats, which the NPS successfully eradicated in 2001 (Witmer, et al. 2007). This step made Buck Island a suitable site for re-introduction of the St. Croix ground lizard. In 2007, the NPS, in collaboration with the U.S. Fish and Wildlife Service, the Virgin Islands Division of Fish and Wildlife, and Texas A&M University

initiated actions toward the translocation and introduction of the species. In 2008, the lizard was successfully translocated to Buck Island; 57 adults were released into enclosures and monitored from April to May 2008. By June, adults were exhibiting behaviors indicating a successful adaptation to their new environment, such as foraging, basking, courtship/copulation, and successful reproduction (a hatchling was observed on July 2008).

Sea Turtles

Four species of marine turtles nest seasonally on Buck Island. All four marine turtles are protected by the Endangered Species Act and international treaty. Buck Island is a significant breeding site for the Atlantic Hawksbill (*Eretmochelys imbricata*) whose nesting population has been the target of park management and conservation efforts resulting in a substantial increase in seasonal numbers of nesting females (40 to 80 per season) and success of hatched nests. Green sea turtles (*Chelonia mydas*) have benefited from these actions as well with seasonal nesting numbers between 12 to 20 females per season. Leatherback (*Dermochelys coriacea*) and loggerhead sea turtles (*Carretta carretta*) both nest on Buck Island but in smaller numbers (one to five per season). Both juvenile and adult hawksbill and green sea turtles are found in the coral reef and sea grass habitats surrounding the island year round. Hawksbills have demonstrated long-term residency in the developmental habitat around Buck Island (Riegl and Dodge 2008).

Sea turtles have been exploited for centuries by the indigenous people of the Caribbean for their meat and eggs. When Europeans settled in the Caribbean, the slaughter of sea turtles for food source increased, but sea turtles were also taken for oil, and hawksbill sea turtles were taken for their shells, which were used for curios and jewelry. In 1972, U.S. Virgin Islands laws made it illegal to harvest sea turtles on their nesting beaches and allowed harvest in the water only between the months of October and April. In 1973, leatherback and hawksbill sea turtles were protected under the Endangered Species Act. In 1978, the green sea turtle and loggerhead sea turtle were listed as threatened species; consequently, it is now illegal to harvest the sea turtles or eggs in U.S. waters. There is still a significant illegal trade in the hawksbill sea turtle shells, and some countries continue to allow the harvest of sea turtles (Mac, et al. 1998).

Current threats to sea turtles include nest poaching and illegal harvest of sea turtles as well as indirect impacts of humans. The introduction of animals such as hogs, mongooses, dogs, and goats destroy nests and eggs and harass nesting sea turtles. Development of coastal areas, recreational and commercial boating activity, incidental take from the fishery industries, ingestion of or entanglement in marine debris, and inadequate local protection and enforcement of laws are all modern day threats to sea turtles in the Caribbean (Mac, et al. 1998). Other human impacts on sea turtles include damage to coral reefs and seagrass beds by visitor use and boat-related damage, raw sewage discharges in Puerto Rico and the U.S. Virgin Islands, oil spills, and other forms of pollution in the marine environment (NOAA n.d.). Natural threats include beach erosion, hurricanes, and predation on hatchlings by natural predators such as birds, crabs, and large fish.

Between 40 and 80 hawksbill sea turtles seasonally nest on Buck Island, and the park is identified as an index beach for the hawksbill sea turtle recovery in the eastern Caribbean. Hence, the Buck Island Sea Turtle Research Program was started in 1988 and functions primarily to study the biology of the endangered hawksbill sea turtle, though information is also gathered on the leatherback, green, and loggerhead sea turtles. The program uses volunteers and trained scientists to monitor the sea turtles nesting activities all year, with intensified monitoring during July through October, which is the peak nesting season. Monitoring consists of patrolling the beaches at night and recording the nesting activity of the all sea turtle species encountered. Adult sea turtles are tagged after they nest, and each nesting sea turtle is evaluated for nesting behavior, fecundity, site selection and fidelity, remigration intervals, and, physical data such as size, weight, growth, and nesting and hatch success.

The hawksbill sea turtle utilizes different habitats at different stages of its life cycle. Post-hatchlings occupy the deep waters of the tropic ocean zones, and are often found riding in floating masses of sea plants that accumulate at convergent points. When they reach 20 to 25 centimeters in carapace length, they return to the coastal waters and frequent rocky areas, coral reefs, and lagoons. Adult hawksbill sea turtles rely on sponges as the main component in their diet, which explains their return to coastal areas and reefs that support sponge growth. Hawksbill sea turtles will nest on both low-and high energy beaches and, due to their small size and agility, they are able to maneuver over reefs to nest on beaches that would be inaccessible to other sea turtles (NOAA n.d.). The nesting habitat, which consists of 1,500 meters of Buck Island shoreline, is divided into four areas; North Shore, West Beach, South Shore, and Turtle Bay.

The leatherback sea turtle is federally-listed as an endangered species and is in a critical position world-wide, mainly due to loss of nesting and foraging habitat. The leatherback sea turtle is known to nest in relatively large numbers on Sandy Point National Wildlife Refuge, up to 200 nesting females per season, a beach on the southwest corner of St. Croix, and in much smaller numbers (one to five females per year) on Buck Island Reef National Monument. Leatherback sea turtles are unable to maneuver the coral reefs that surround the majority of Buck Island, while the beaches at Sandy Point are located near the shelf edge and are thus readily accessible. The leatherback sea turtles are likely limited to nesting on the southwest corner of Buck Island as a result.

The green sea turtle is federally-listed as a threatened species and is the subject of a federal recovery plan (DPNR 2005b). In the U.S. Virgin Islands, the green sea turtle is more susceptible to poaching than the other sea turtles because of their valuable meat, shell, and leather, and this species also appears to be more likely to become injured by boats and propellers (DPNR 2005b). Buck Island is not a significant green sea turtle nesting area, but the surrounding seagrass beds provide an excellent foraging area for adult and juvenile sea turtles. Between 12-20 green sea turtles currently nest on Buck Island per season. Green sea turtle nesting begins in May or June, peaks in August, and all eggs are hatched by October. The nesting activity is concentrated on either West Beach or Turtle Bay.

The loggerhead sea turtle is a federally-listed threatened species inhabiting continental shelves, bays, estuaries, and lagoons in temperate, subtropical, and tropical waters. Loggerhead sea turtles have a varied diet but feed mainly on mollusks, crustaceans, and horseshoe crabs (Dodd 1992). In the Atlantic, the range of the Loggerhead sea turtle extends from Newfoundland to as far south as Argentina. During the summer, nesting occurs in the lower latitudes. Mating takes place in late March to early June, and eggs are laid throughout the summer. The primary Atlantic nesting sites are along the east coast of Florida, with additional sites in Georgia, the Carolinas, and the Gulf Coast of Florida. The loggerhead sea turtle was listed as threatened throughout its range in 1978, with the most significant threats to the loggerhead sea turtle populations being coastal development, commercial fisheries, and pollution. Loggerhead sea turtles are the most abundant species in U.S. coastal waters, and are often captured incidentally by shrimp trawling (NMFS 2005d). Rare in the U.S. Virgin Islands, two loggerhead females have been nesting on Buck Island since the 2003 nesting season (Hillis-Starr 2006).

Birds

Two territory-listed avian species are known to nest in the park (NPS 2003b). The brown pelican and least tern have been identified by NPS staff as a high priority for conservation and management. There are currently at least three avian monitoring projects being conducted at the park:

- Brown pelican reproductive survey that includes counts of adults, nests, and fledglings
- Least tern adults, nests, and egg counts (seasonal)
- Christmas Bird Count that covers Buck Island

The **Caribbean brown pelican** (*Pelecanus occidentalis occidentalis*) was a federally-listed threatened species until November 2009 when it was de-listed by the U.S. Fish and Wildlife Service due to recovery. However, the brown pelican will remain protected under the provisions of the Migratory Bird Treaty Act, and it is anticipated that it will remain as a territory-listed species since the territory list has not been updated since 1991. The Caribbean brown pelican nests at four locations in the Virgin Islands. The two larger nesting sites are on St. Thomas and St. John, while the smaller sites are on Buck Island and Green Cay. Buck Island is the location of an important rookery for this species, with over 40 birds nesting there annually between September and February (NPS 2004). The breeding success of the Caribbean subspecies of the brown pelican is primarily limited by the availability of food. The timing and success of the breeding cycle and the pronounced seasonal fluctuations of pelican numbers in the region appear to be closely tied to the alternating and unpredictable periods of fish abundance. Other factors influencing the size of the population include poaching of eggs, hatchlings and adults; human disturbance of nesting colonies; non-native predators (rats, historically); mortalities resulting from the birds being caught on fish hooks and monofilament lines; and loss or degradation of mangrove forests (USFWS 1995).

Least tern (*Sterna antillarum antillarum*) is the smallest American tern and can be found on the east and west coast as well as in the interior of North America, throughout the Caribbean, and central and South America. Although the terns are widespread and even common in some localities, populations are declining due to the loss of nesting habitat. Terns nest on open sandy or gravelly beaches and river banks, and are therefore often subject to human disturbance. When terns leave their nests, the eggs may be subjected to extreme heat and potential predation. The least terns nesting in the Caribbean are declining due to the loss of habitat and the decline in fish populations due mainly to over fishing (Cornell Lab of Ornithology 2003). The tern is listed as a special concern species by the U.S. Virgin Islands Department of Planning and Natural Resources, Division of Fish and Wildlife (2005). Only the interior (50 miles from coast) population of the least tern is federally listed as endangered (*Sterna antillarum athalassos*) and does not occur at Buck Island Reef National Monument.

A colony of 20 to 80 least terns were known to nest on West Beach until 2006. The reason for the terns' absence from the park is unknown. The U.S. Fish and Wildlife Service found low breeding productivity over a four-year period of monitoring due to predation by dogs, cats, mongoose, and avian predators. On St. Croix, the majority of nests were laid on dried salt ponds, making them susceptible to inundation by flooding during heavy summer rain events (C. Lombard 2007). When terns nest at Buck Island, park staff mark the nesting area with signs and fencing. Although dogs are not allowed on Buck Island, there have been reports of dogs on the beach. Dogs are extremely dangerous to a nesting colony of terns as one dog can destroy a whole colony in a matter of minutes.

CULTURAL RESOURCES

Introduction

Cultural resource data were collected from Christiansted National Historic Site, Virgin Islands National Park, the Virgin Islands State Historic Preservation Office (VISHPO), pertinent literature, other available historic sources, and park visits. Data collection in the Virgin Islands occurred in August and September 2004. Additional records were researched through 2005. The park as a whole has not been subject to a systematic cultural resources survey, although numerous areas within Buck Island and the park have undergone investigation and archeological survey (Hardy 2006). As part of future surveys, shipwreck sites known to exist on the reef require mapping, testing, and evaluation.

The chronological scheme for the division of the prehistoric period (i.e., the time before Columbus) for the Lesser Antilles, including the U.S. Virgin Islands, is divided into five major stages: Casimiroid (or Lithic), 4000-2000 BC; Ortoiroid (or Archaic), ca. 2000-500 BC; Saladoid (Early Ceramic), ca. 500 BC-AD 500; Ostionoid (Late Ceramic), ca. AD 500-1492; and Taíno (European Contact), AD 1492-1550

(Rouse 1992; Hayward et al. 1997; Righter 1995; Vescelius 1952). Many of these stages are not represented on Buck Island. The following presents a brief overview of the prehistoric period for the region in general, followed by specific data regarding Buck Island.

Prehistory

Caribbean. Scholars (Rouse 1992; VISHPO 2002) have delineated two major prehistoric divisions within the Caribbean for the period prior to the development of ceramics. These divisions are the Casimiroid and Ortoiroid periods. The Casimiroid or Lithic period (approximately 4000-2000 BC) has been securely documented only in the Western Greater Antilles (Cuba, Haiti, Dominican Republic), but might extend into Puerto Rico and Jamaica. Central America appears to be a likely point of origin of the people associated with this period, although the northern coastal area of South America is also a possible candidate. No sites have been identified for this period within the Virgin Islands.

The Ortoiroid or Archaic period (2000-500 BC), as represented in the Virgin Islands, originated most likely from peoples migrating into the Antilles from Trinidad and the easternmost coast of Venezuela. Diagnostic material of the period includes hammerstones, edge grinders, shell picks, and chipped or partially ground stone celts. Simple shell and stone beads and pendants have also been recovered. Subsistence appears to have been based primarily on hunting, fishing, and gathering (e.g., shellfish, reef fish, birds, turtles, rodents). The diet appears to have consisted principally of shellfish obtained from shallow marine environments (beaches, river mouths, mangrove swamps), supplemented by other locally available foodstuffs. Sites consist mostly of shell middens and are located on or near the coasts. These sites were most likely occupied by small groups of people for short or recurrent periods (Righter 1995; Rouse 1992). Archaic period settlements have been identified at Krum Bay (St. Thomas) and Lameshur Bay (St. John).

The Saladoid period (ca. 500 BC-AD 500) marks the beginning of the Ceramic age in the Virgin Islands, the first appearance of settled village life, and a reliance on cultivated foodstuffs. Pre-ceramic groups may have begun experimenting with agricultural techniques (harvesting of certain crops, encouragement of others) in the preceding period. The peoples of this new cultural tradition, who perhaps rather rapidly displaced the Archaic populations, were again from mainland South America (Righter 1995; Rouse 1992). Subperiods within the Saladoid reflect changes in pottery style and decoration. Other material-cultural items typical of the early ceramic period include pottery griddles, coral hammerstones, chert tools, spindle whorls, mortars, manos, small zemis, stone axes, and various types of lapidary objects (beads, amulets). Lapidary objects are made largely from exotic and rare gemstones (e.g., amethyst, quartz crystal, greenstones, carnelian, lapis lazuli), indicating the existence of a Pan-Caribbean trade network involving the islands and mainland South America. The frequency of lapidary objects, and presumably the volume of trade in these particular items, declines from the early to the late Saladoid period.

Settlement patterns changed from the preceding Lithic and Archaic ages. The early ceramic period sites were located on coastal plains, near river mouths and the shoreline, and at the edge of the forests, presumably to take advantage of the available resources (shellfish, fish, birds, wood products, fruits). Nevertheless, the sites remain about the same size, and this territorial expansion continues into the Ostionoid period.

The Ostionoid period (AD 500-1492) in the Caribbean can be characterized by a continuation and intensification of previous trends toward increased sociopolitical organization and economic diversity, as well as the introduction of new trends, such as an increase in the regionalization of ceramic styles. During the Ostionoid period, three ceramic styles are represented in the Virgin Islands: Mogens Bay/Salt River I and II, and III (Faber Morse 1995; Rouse 1992). In addition, petaloid celts are common, and ritual zemis (three-pointed objects) are manufactured out of local stone, shell, and clay.

Settlement-pattern data indicate an increase in the number of sites from the previous Saladoid period, with an emphasis on inland versus coastal site locations. Proximity to rivers still appears to have been a consistent factor in site location. Sites located on hilltops, ridges, or terraces suggest their location for protection from the natural elements or from other populations. Ostionoid peoples primarily relied on manioc, shellfish, fish, and birds for their subsistence. Resource exploitation became more specialized, with increased reliance on maritime and agricultural resources. Settlements on St. Croix during the early Ostionoid period appear to range from relatively small, possibly specialized procurement sites to the large village sites of Salt River and Aklis.

Differentiation and the ranking of sites are evident during the Ostionoid period. Site types include large and small coastal and inland villages, individual homesteads, specialized resource exploitation sites (forests, mangroves), specialized small or local ritual areas represented by cave or riverine rock art sites, and specialized regional ceremonial sites characterized by the presence of ball courts and plazas. An associated increase in sociopolitical organization is indicated as well. Increasing population and site density, the common occurrence of zemis and ball courts, the presence of regional ceremonial sites, and site differentiation all suggest a stratified social system (perhaps simply divided into upper and commoner classes) and a stratified political system, on the order of chiefdoms (Rouse 1992).

The indigenous peoples that Christopher Columbus encountered in Puerto Rico and Hispaniola have been termed the Taínos by present-day scholars (Rouse 1992). They were organized into hierarchical chiefdoms with a type of class system, and lived in permanent villages, the larger ones with populations ranging from 1,000 to 2,000 inhabitants. The Taínos played a ball game usually around a central plaza or ball court, rectangular in shape, referred to as a batey. The ball courts were used locally and games occurred between villages.

The Taíno religion focused on the worship of deities referred to as zemis (cemís). Two supreme zemis were recognized, one who reigned over the sea and cassava (manioc), and the other, his mother, who reigned over fresh water and human fertility. Lesser zemis representing spirits of ancestors and other spirits that lived in various places throughout the landscape have also been identified. Zemis were made of stone, wood, bone, shell, and pottery (Rouse 1992).

Buck Island. Scant information is available for Buck Island regarding the activities of peoples from prehistoric time to the early 1700s, but the island was probably used as a temporary camp to collect marine resources. The prehistoric Buck Island site (BUIS-2; 12VAm1-68) has produced Late Saladoid through Ostionoid period pottery, with decorative elements ranging from red painting on vessel rims to Chicoid and Elenoid-style incisions. Radiometric dates taken from charcoal and shell excavated from hearths at West Beach provided evidence for human occupation Cal AD 410-600 and Cal AD 510-700 (2 sigma) (Hardy 2006).

History

The Virgin Islands. Christopher Columbus encountered St. Croix and claimed it for Spain during his second voyage to the New World in 1493. When Columbus' fleet anchored off St. Croix on November 13, the Spaniards found it highly cultivated and "well populated" (Lewisohn 1970; VISHPO 2002). After a brief skirmish with the Amerindians at Salt River Bay, which was the first recorded instance of Amerindian-European conflict, the Spaniards sailed north to a cluster of small islands that were named *Once Mil Virgines*, then west to Puerto Rico; the Amerindians encountered at Salt River were likely Carib language speakers, who had recently taken over the island from the Taíno. Spain made no subsequent attempt to colonize St. Croix. Although subject to periodic Spanish raids, the Amerindians, who reportedly occupied 20 villages between 1509 and 1542, retained possession of St. Croix until the end of the sixteenth century, when they departed of their own accord, were driven away or annihilated (Figueredo 1978a; Hardy 2006).

At various times during the seventeenth century, the English, French, and Dutch attempted to settle St. Croix, but were driven off by either the Spanish or one of the other colonizers. In 1650, a brief contest for power erupted between the English, Spanish, Dutch, and French, from which the French emerged victorious. Philippe de Lonvilliers de Poincy, official of the Knights of Malta on St. Christopher, sent 160 men to St. Croix, eventually succeeding in getting the Spanish to abandon their holdings and return to Puerto Rico. Thereafter, the French managed to dominate St. Croix until abandoning it in 1696 (Boyer 1983; Caron and Highfield 1980; Figueredo 1978b; Lewisohn 1970; Tyson 1997; VISHPO 2002).

By 1653, Louis XIV, through de Poincy, deeded St. Croix to the Knights of Malta. Within ten years, the French Crown decided that expansion of their Caribbean holdings was necessary. In 1665, a new commercial company, the French West India Company, was created to govern the islands of St. Croix, St. Bartholomew, and the French halves of St. Christopher and St. Martin. Company rule of St. Croix was plagued with problems, and, in 1674, the Company's control over the island was dissolved by Louis XIV. The French Crown then directly ruled the islands. At its peak in the 1680s, the French colony numbered about 1,300 people (half were African slaves) who lived scattered throughout St. Croix. These colonists produced small quantities of sugar, cotton, tobacco, coffee, indigo, cocoa, and ginger, and engaged in illegal trade with the neighboring Danish colony of St. Thomas. However, because of the costs of handling illegal trade, war, privateering, and piracy, the Crown decided it was no longer feasible to maintain the colony. In 1696, the residents, including 147 white settlers and 623 African slaves, were removed to the more promising colony of St. Dominique. The French maintained weak title to St. Croix from 1696 to 1733, but made no effort to reoccupy it. During this period, St. Croix was visited periodically by parties of mariners and woodcutters. In the late 1720s into the 1730s, an unauthorized settlement of British planters (and their slaves) occupied the island (Boyer 1983; Caron 1982; Caron and Highfield 1980; Lewisohn 1970).

France sold St. Croix to Denmark in 1733. When the Danes arrived in 1735, they discovered 150 English settlers with 456 slaves already there. The Danes encouraged large-scale plantation agriculture (e.g., cotton and sugar), and the resulting plantation system dictated rural population and settlement patterns until the mid-twentieth century (Boyer 1983; VISHPO 2002). Before 1800, slaves accounted for over 90 percent of the total population, which rose to 28,803 in 1796. Danish colonial authorities encouraged other nationalities to bring their capital, slaves, expertise, and technology to the infant sugar colony. As a result, by the second half of the eighteenth century, Britons comprised some 40 percent of the plantation owners and most of the plantation supervisors. Controlled by foreign entrepreneurs, the plantation system on St. Croix spread rapidly at first. However, a process of consolidation after 1754 reduced the number of working plantations to 197 plantations by 1792. Of that number, 161 produced sugar, 27 cultivated cotton, and nine raised livestock and market provisions (Rigsarkivet 1792).

At the beginning of the nineteenth century, St. Croix, despite its relatively small size, had become the fourth largest sugar-producing colony in the Caribbean. In 1812, its peak year, St. Croix's 175 sugar plantations with 26,000 slaves produced 46,000,000 pounds of sugar and some 12,000,000 gallons of rum for export (Westergaard 1917). Slave emancipation in 1848 weakened the planter's control over rural workers. A stringent contract labor law was only partially successful in binding the field workers to the plantation (Green 1972). The restrictive laws were removed after a major labor insurrection in 1878. As the rural population declined and labor problems intensified, production costs rose, and Crucian sugar planters were increasingly uncompetitive with European beet sugar and other low-cost producers. As a result, the amount of land in cane production declined and the number of non-sugar plantations increased by the early 1910s. In 1917 the Danish Government sold St. Croix and Buck Island to the U.S. Government.

Despite these economic trends, Crucian sugar plantations retained their dominance over the economy and landscape until the middle of the twentieth century. Nearly two-thirds of all land on St. Croix was

occupied by the sugar plantations in 1915 (Rigsarkivet 1742-1917). By 1930, their percentage of all land-holdings had dropped only slightly to 55 percent (Hardy 2006). Nevertheless, sugar production began falling after 1920, ceasing altogether in 1963. After 1960, the advent of a tourist and industrial economy began pushing residential, industrial and commercial development throughout St. Croix.

Buck Island. During the seventeenth and eighteenth centuries, what is now Buck Island received numerous names from various European mapmakers. Names given to the island included Isle Verte, Cabrit, Cabrite, Cabrito, Burre, Goat, Vert, Holm, Gedeeoen Frederiksgave, Pockholz, Pocken Eyland, Bocken Island, and Diedrichs Plantage (Hardy 2006). The town clerk for Christiansted, Johann Diedrich, controlled Buck Island from 1754 to 1773 and reportedly erected a structure at the highest point on the island to observe the shipping lanes. It is unlikely that Diedrich actually lived on the island, but between six and 12 slaves did live there during this time. The slaves no doubt erected cisterns to collect rainwater and lived off the land; remains of cisterns have been identified on the island. Nicolay Salamon assumed control of Buck Island from Diedrich in 1773. From 1774 to 1780, Joseph Coakley managed the island for Salamon. From 1780 to 1797, John Heyliger Abrahamson was listed as island caretaker/taxpayer (he would serve in this position again in 1818 and from 1823 to 1826). John Benners served in this position from 1797 to 1802, when he was replaced by John de Graff Godette. It is not recorded if these men lived on the island, but between 1787 and 1789 only a single slave was recorded as living on the island (Hardy 2006). In 1789 a Royal Signal Station was erected by the Danes at the 329-foot elevation.

The Danish Government took control of Buck Island in 1822 under the policy of *landskassen* (land treasury), in which the government appropriated rural lands for its protection (Hardy 2006). The crown or its colonial designate would lease the island for “appropriate uses,” such as grazing of goats and sheep, fishing, or subsistence agriculture. A small number of individuals lived on the island throughout the remainder of the nineteenth century into the early twentieth century.

Not unexpected, shipwrecks occurred in the waters surrounding the island, including BUIS-3 (12VAm1-202) Buck Island Reef Wreck (or Coal Wreck). A U.S. Coast Guard signal beacon was constructed in the 1950s at the 329-foot elevation, near the ruins of the former signal station.

Under the Virgin Islands Organic Act of June 22, 1936, the Government of the Virgin Islands obtained direct control of Buck Island. However, submerged lands technically remained under control of the U.S. Government. In 1948, the Government of the Virgin Islands established Buck Island and its surrounding reefs as a territorial park (Hardy 2006). As previously mentioned, Buck Island Reef National Monument was established in 1961 by presidential proclamation as a unit of the national park system. In 1975, 30 acres of submerged lands were added to the park. The 2001 proclamation expanded the park’s size by 18,135 acres, establishing the 19,015-acre national park that exists today.

Previous Studies

This section describes the existing environment of the park and the surrounding region. A more detailed discussion of the cultural history of Buck Island can be found in *Archeological Overview and Assessment of Buck Island Reef National Monument, St. Croix, U.S. Virgin Islands* (Hardy 2006). Further information on St. Croix and the Caribbean can be found in the *Archaeological Investigations at the Aklis Site Sandy Point National Wildlife Refuge St. Croix, U.S. Virgin Islands* (Hayward, et al. 1997), *The Tainos: Rise and Decline of the People who Greeted Columbus* (Rouse 1992), and *Statewide Comprehensive Historic Preservation Plan: Prehistoric Context* (Righter 1992).

A number of previous investigations and surveys provide data regarding Buck Island’s cultural and archeological resources. The majority of the reports seem to investigate the same three sites (the Buck Island site, the Signal Station site, and Buck Island Reef Wreck) in a cursory manner. Four of the studies are “trip reports” submitted by the Southeast Archeological Center (SEAC) of the NPS, and one of these investigations (Hardy 2004) is comprehensive. Although shipwrecks are known to have

occurred in the waters surrounding the island and several have been identified, no systematic survey of shipwrecks has been conducted for the area surrounding Buck Island. The following section summarizes these studies (from earliest to latest).

In 1975, G.S. Vescelius and L.S. Robinson conducted archeological investigations at Buck Island for the Office of the Territorial Archeologist. Vescelius and Robinson identified the Buck Island site (BUIS-2; 12VAm1-68), which comprised a small surface scatter of Chicoid-style pottery and four conch/coral piles representing a prehistoric conch midden site. Their findings are cited in Prokopetz (1976c), but no formal report has been located.

A team of archeologists from the Southeast Archeological Center, directed by George Fischer, visited Buck Island in 1976 and conducted a reconnaissance survey. These investigations were documented in a trip report that dealt with the terrestrial and submerged cultural resources of the island (A. Wayne Prokopetz 1976a, 1976b, 1976c). The survey “examined three known cultural resources sites: 1) a historic homestead (BUIS-1, 12VA1-252), 2) an aboriginal site (BUIS-2, 12VA1-68), and 3) a historic period shipwreck (BUIS-3)” (Hardy 2004). These sites are itemized in the section that follows.

An inventory and assessment of the integrity of site 12VAm1-68 was conducted by Barbara Johnston and crew in 1982. At the time site 12VAm1-68 had been described as the West Beach site by Prokopetz (1976a), but was later included as part of the Buck Island site (Hardy 2006). No artifacts were collected, but pottery sherds from the Elenois/Chicoid period, were noted, along with bone, shell, and stone tools.

An anonymous 1984 source notes that a mammal bone was found around site BUIS-1; however, no report was prepared for this find. An investigation by Riddle, dated 1984, was cited in the literature, but no record of the work could be located.

In 1985, Elizabeth Righter conducted a cultural resources reconnaissance survey at Buck Island. This project included the systematic subsurface testing of the Buck Island site (BUIS-2). Intended to delineate the site boundaries, the testing recovered Ostionoid pottery, faunal food remains, a lithic tool, and a possible prehistoric shell midden.

Righter’s survey also identified a stone masonry foundation near the western end of the island. Labeled the Foundation Site (BUIS-4), the find included historic ceramics and seemed to indicate a 1½ to 2-story structure that may have been a slave residence. In addition, a historic midden (BUIS-6) was discovered near BUIS-4 and BUIS-2. Afro-Cruzan vessel fragments ceramics (historic) found at BUIS – 6 were similar to those recovered at the Foundation site. Dates for the ceramics ranged from the end of eighteenth century through the nineteenth century. Righter’s report recommended a full Phase I investigation for the entire island.

A 1985 trip report by Larry Murphy identified two shipwrecks, and described NPS assessment of the research potential of submerged cultural resources on the north side of Buck Island.

In the aftermath of Hurricane Lenny, Brenda Lazendorf and Richard Curry visited Buck Island to assess damage to the island’s cultural resources. Their investigations, including a shipwreck previously identified by Prokopetz (later number 12VAm1-286), were described in a 2000 trip report.

In 2002, Meredith D. Hardy visited Buck Island to conduct archival research and to assess collections housed by Christiansted National Historic Site. Her trip report documented re-location of previously identified cultural resources, including the Signal Station site (BUIS-1; 12VAm1-252), the Buck Island prehistoric site (BUIS-2; 12VAm1-68), and the Buck Island Reef Wreck (BUIS-3). The remains of an above-ground cistern with nineteenth-century ceramics and glass were identified, and the site was designated as the West Beach Historic or Goby site (BUIS-5; 12VAm1-288). Surface collection between BUIS-1 and BUIS-5 identified ceramics and glass.

During the summer of 2003, Hardy and others from the Southeast Archeological Center conducted an archeological pedestrian survey and limited subsurface testing at Buck Island Reef National Monument. Sites visited and recorded via global positioning system included the Signal Station site (BUIS-1; 12VAm1-252) and the Foundation site (BUIS-4; 12VAm1-287). A second set of ruins was discovered nearby; this site (BUIS -6) had historic ceramics, glass, and pipe fragments. Late eighteenth- and nineteenth-century ceramics were collected at the West Beach Historic or Goby site (BUIS-5; 12VAm1-288). The Buck Island prehistoric site (BUIS-2; 12Vam1-68) was tested, a buried A-horizon was identified, and a hearth was excavated (Hardy 2004).

The archeological overview and assessment of cultural resources on Buck Island completed by Hardy in 2006 presents a summary of all archeological work on the island and assesses the status of museum collections.

Description of Known Archeological Resources

Since at least 1754, the African slaves of European colonists at St. Croix were sent to Buck Island to harvest *lignum vitae* trees; gather shellfish, lobsters, and crabs; and tend sheep and goats that were taken to the island to forage. A few Europeans lived on the higher ridges of the island (BUIS-1; 12VAm1-201).

BUIS-1 includes a privy foundation, an above-ground cellar foundation, stone wall remnants, and eighteenth through nineteenth century ceramic sherds, glass, and pipe fragments (Prokopetz 1976a; Hardy 2002). A National Register of Historic Places nomination form was prepared for the site, but was not submitted. A surface collection of ceramics and glass was made in the area between BUIS-1 and BUIS-5, and the site was recommended as potentially eligible for listing to the National Register of Historic Places (Hardy 2002; 2003).

The Buck Island Site (BUIS-2; 12VAm1-68) comprises a surface scatter of Late Saladoid through Ostionoid-style prehistoric pottery, and four conch/coral piles (Vescelius and Robinson 1975; Prokopetz 1976b; Johnston 1982; Righter 1985; Hardy 2002, 2003, 2004). Righter attempted to delineate boundaries of this site in 1985 through the systematic excavation of three units and 72 shovel tests. The site is recommended as potentially eligible for listing to the National Register of Historic Places.

The Buck Island Reef Wreck (BUIS-3; 12VAm1-202) was identified northwest of Buck Island in 1976. The ship's wood hull measured approximately 205 feet by 70 feet and was surrounded by copious amounts of coal (Prokopetz 1976b; Murphy 1985; Lazendorf 2000; Hardy 2002).

The Foundation Site (BUIS-4) consists of a stone masonry foundation whose dimensions are approximately 30-feet by 15-feet, without an eastern wall. A variety of historic ceramic sherds (dating from the end of the eighteenth century through the nineteenth century) were recovered (Righter 1985; Hardy 2003). A second foundation (a chimney), along with ceramics and glass fragments also was identified, and was recommended as potentially eligible for listing to the National Register of Historic Places.

The Goby Site (BUIS-5; 12-VAm1-203) comprises a cistern or well ruins and includes late eighteenth through nineteenth century ceramic sherds (Righter 1985; Hardy 2002, 2003, 2004). The site is recommended as potentially eligible for listing to the National Register of Historic Places.

Afro-Cruzan ceramic vessel sherds and ceramic sherds similar to those found at BUIS-4 were collected at the Historic Midden site (BUIS-6) (Righter 1985). This site is recommended as potentially eligible for listing to the National Register of Historic Places.

Ships occasionally wrecked on the coral reefs surrounding the island (see Table 15). Towle, et al. (1976) and Tyson (1983) identify shipwrecks in the vicinity of the Virgin Islands between 1523 and 1917. Two of these vessels were British slave ships, but most were smaller cargo ships or at least wrecked while carrying cargo. No systematic survey of maritime cultural resources has been conducted to date.

Table 15. Shipwrecks/Underwater Archeological Sites

Ship Type	Name /Location	Year (if known)	Source
Cargo ship	<i>Brothers</i> / St. Croix	1769	Towle et al. 1976
Cargo ship	<i>Lord Mount Cathell</i> / St. Croix	1773	Towle et al. 1976
Ship	Unknown Dutch ship / Buck Island	1781	Tyson 1983
Schooner/ cargo ship	<i>Nancy</i> / Buck Island	1793	Tyson 1983
Slave ship	<i>Mary</i> / Buck Island	1797	Towle et al. 1976
Slave ship from Africa (slave ship)	<i>General Abercrombie</i> / Buck Island	1803	Towel et al. 1976
Cargo ship	<i>Angelica</i> / Buck Island	1823	Towle et al. 1976
Cargo ship	Unknown	Between 1871-1917	Tyson 1983
Cargo ship	Unknown	Between 1871-1917	Tyson 1983
BUIS-3 / 12VAm1-202	Buck Island Reef Wreck Archeological site (historic/maritime)	Mid- 19 th to 20 th century	Prokopetz 1976b

Two shipwrecks have been identified north of Buck Island. The first is a circa 1850 shipwreck (Shipwreck 1), consisting of two anchors (Murphy 1985; Prokopetz 1976b; Lazendorf 2000). The second is a circa 1800 sailing ship wreck whose hull measures about 50 to 60-feet by 18- to 20-feet (Murphy 1985).

National Register of Historic Places. Although to date none of the previously identified archeological resources located on Buck Island are listed or have been determined eligible for listing on the National Register of Historic Places, five resources have been recommended as potentially eligible for listing (Table 16). These are the Signal Station site (12VAm1-252, BUIS-1); Buck Island Prehistoric Site (12Vam1-68, BUIS-2), Foundation site (12VAm1-287, BUIS-4); West Beach Historic or Goby site (12VAm1-288, BUIS -5); and the Bigeye/West End Historic Midden (12VAm1- 289, BUIS-6).

Thus the potential exists to encounter as yet unidentified resources associated with the prehistoric period, the colonial period, lives of slaves, the later historic period, and shipping. These sites could contribute useful information about the lifeways and subsistence activities of prehistoric peoples and African slaves, as well as shipping practices, fishing and subsistence activities, and related economic issues from colonial times to the present.

Table 16. Known Archeological Resources

Resource	Resource Type	Site Name/ Location	Date (if known)	Potentially National Register-Eligible
BUIS-1 / 12VAm1-201; 12VAm1-252	Archeological (historic)	Buck Island	Late 18 th -19 th century	x
BUIS-2 / 12VAm1-68	Archeological (prehistoric)	Buck Island	Ca AD 410-700	x
BUIS-4 / 12VAm1- 287	Archeological (historic)	Foundation and associated chimney	Late 18 th -19 th century	x
BUIS-5 / 12VAm1- 203	Archeological (historic)	Goby Historic Site	Late 18 th -19 th century	x
BUIS-6 / 12VAm1- 289	Archeological (historic)	Bigeye Historic Midden	Late 18 th -19 th century	x
	Archeological (historic/maritime)	Sail hull		

Threats to Archeological Resources. Current threats to archeological resources within the park boundaries include beach erosion, storm impact, non-native plants, bioturbation from plants and animals, vandalism and inappropriate visitor uses. As a result of climate change, areas of the park have experienced, or may in the future experience, higher sea levels, stronger wave effects, increased water temperatures and pH levels, acidification, and changed precipitation patterns. All of these factors could contribute to the loss of cultural resources.

SOUNDSCAPES

A soundscape refers to the total acoustic environment of an area. Both natural and human sounds may be desirable and appropriate in a soundscape, depending on the purposes and values of the park. Soundscapes often vary in their character from day to night and from season to season and can be affected by changes in the number of visitors who introduce human-caused sound into the environment.

The soundscape of the park includes existing and potential sources of natural sound and potential sources of interference (noise) to natural sounds in the park. The natural soundscape at the park is created by natural processes, including but not limited to, sound created by biological and physical components such as wind, wave action, birds, reptiles such as the woodslave or gekko, and insects. Natural ambient sound is the natural soundscape condition that exists in the park in the absence of noise made by humans. Noise is defined as undesirable human-caused sound. Sound can be perceived as noise because of loudness, frequencies, duration, occurrence at unwanted times or from an unwanted source, or because it interrupts or interferes with a desired activity. A sound that is considered neutral or desirable by one person (such as a radio or boat engine) may be considered unpleasant noise by another person because of a perception of inappropriateness or disturbance. Noise can adversely affect park resources or values, including the natural soundscape, wildlife, and visitor experience.

Buck Island Reef National Monument is a serene and quiet environment with a natural soundscape consisting predominantly of wind and wave sounds, and occasional birds. In high visitor use areas of the park, such as West Beach, motorized boating activity (speed boat engine noise) and human sounds can be heard during the day. These sounds include generators for lights, air conditioning, refrigeration, televisions, and sound speakers for loud music. Progressing inland from the shore, natural sounds dominate, and there is opportunity for ambient sounds to be appreciated without interruption. During periods of peak visitation, such as weekends, human-caused sound is of greater

intensity than during weekdays when the natural soundscape prevails. This also varies by season. Sound levels have not been recorded at the park to date.

Some human-caused sound can be considered acceptable in that it is attendant to purposes and uses for which the park was created. NPS Director's Order 47 requires park units to determine the level of human-caused sound necessary for park purposes, and to achieve that level by reducing noise and restoring the natural soundscape to the greatest extent possible.

SCENIC RESOURCES

Scenic resources are a defining feature of Buck Island Reef National Monument as stated in the park's mission statement which is "...to protect, preserve, manage, and interpret the park's seascapes, scenic views, and unique natural and cultural resources unimpaired for the education, enjoyment and inspiration of present and future generations." Park visitors enjoy the views of sparkling blue water, white beaches, dry tropical forest vegetation, and sparse-to-no development (such as picnic tables, comfort stations). This unique combination of scenic resources is an asset to the national park system.

As visitors travel to the park from St. Croix, the view of Buck Island and the surrounding waters is virtually uninterrupted. There is relatively little infrastructure at Buck Island (no roads, utilities, etc.) with minimal facilities consisting of a pier, picnic shelter, observation platform, comfort station, and moorings at the underwater trail. Vessels anchored at West Beach are also visible upon the approach to Buck Island and may be viewed as an intrusion on the scenic landscape by some visitors, while others might perceive this as a common element of the picturesque, marine landscape. This same dual perception would also be applicable to moorings located near the underwater trail. The natural viewshed looking back toward St. Croix from Buck Island has been altered by private development and consists more of the built environment, including residential housing, roads, lights and commercial development.

VISITOR USE AND EXPERIENCE

Many different types of use and experiences occur at the park. This section provides a summary of the types and levels of visitor use and the types of access to park, recreational opportunities that occur, and the availability of information for visitors. Information contained within the following sections regarding general park use, recreation, and park policies has been obtained from park brochures, the Buck Island Reef National Monument website (<http://www.nps.gov/buis>), interviews with park staff conducted between 2004 and 2006, and review of visitor use surveys up to 2008.

Visitors Use and Access

Buck Island Reef National Monument fills an important role for the St. Croix community and visitor. It is the number one tourist destination for the island of St. Croix, with an annual visitation between 40,000 to 50,000 visitors each year, from 1995 to 2008. As a public use area, the park is exposed to a large and growing number of visitors for the underwater experience, sailing and boating, as well as hiking, picnicking, sunbathing, swimming, and snorkeling.

There are two ways to get to the park, either by private vessel or with park concession operators who charge a fee. Vessels for hire are not permitted within the park without authorization. An anchoring permit is required for all vessels, and anchoring is only allowed in a designated area near West Beach in deep sand. Anchoring permits are obtained from the Park Headquarters at Christiansted National Historic Site, Christiansted, St. Croix. Vessels cannot exceed 150 feet in length and vessels must be 42 feet in length or less to enter the lagoon.

Concession vessel sizes and passenger limits vary from one concessioner to another depending on the type of vessel and contract. Twelve authorized concessioners offer half and full day trips to the park, which include the trip to Buck Island, snorkeling at the underwater trail, and sometimes West Beach at Buck Island. The half day trip includes 45 minutes at the underwater trail and some include a trip to

West Beach; when the trip includes a beach visit, less time is spent at each location. A full day trip includes a trip to West Beach at Buck Island, 1 to 1.5 hours at the underwater trail, and another stop outside the park. Two vessels received storm damage in 2008 and have not been operating in the park since 2008.

Concessioners depart from the Christiansted Harbor or Green Cay Marina. Information regarding concessioner operations is also provided at Christiansted National Historic Site or the park website. A concrete pier, located on the south side of Buck Island mid-way between the two picnic areas, provides universal access.

Table 17 summarizes visitation counts from 1995 to 2008. The number of recreational visitors is calculated based on concessioner passenger logs and estimates of visitors arriving by private boat. Visitors arriving by private boat are estimated on a monthly basis, and range from 1,800 to 2,400 visitors per month (NPS 2002c). Park staff report that the majority of visitation, particularly from the local population, occurs on Sunday. In addition, visitation is typically greatest between the months of February and April with other increases in visitation for cold weather travelers. Under current management, there are no limits set on park visitation, and user capacity is limited by the number of visitors who can be transported via concessioner and by the number of anchoring permits issued.

Recreational Opportunities

Recreational activities at the park are both aquatic and land-based. Visitor activities include boating, swimming, sunbathing, snorkeling, SCUBA diving, guided interpretive tours, daily guided boat trips, picnicking, hiking, and nature observation. Recreational opportunities are typically available year-around; however, portions of the park, particularly beach areas, may be closed at the park's discretion for resource protections, as during sea turtle and least tern nesting seasons. Beach closures may also occur for safety reasons.

Visitors may anchor by permit only in a designated area near West Beach, and shoreline bow and stern anchoring also occurs in this area. Moorings are also provided on the east side of Buck Island: up to ten at the underwater trail and two for SCUBA diving. Swimming, snorkeling, and boating are currently appropriate activities within all waters of the park; however, visitors must be aware of and avoid contact with sensitive resources (elkhorn coral) in order to maintain safe experiences in the park (see "Public Health and Safety" subsection) and to preserve and protect marine resources. Vessels in park waters cannot exceed 150 feet in length, and cannot exceed 42 feet in length in the lagoon.

**Table 17. Annual Visitation Estimates for
1995 to 2008**

Year	Annual Number of Visitors
1995	57,716
1996	45,618
1997	53,583
1998	46,455
1999	Data not available
2000	Data not available
2001	Data not available
2002	50,213
2003	46,274
2004	44,806
2005	47,883
2006	47,456
2007	46,303
2008	46,025

Source: NPS 2009

An underwater snorkeling trail is located off the east end of Buck Island. Visitors receive instruction from concessioner guides who lead visitors on the trail. Underwater signs are present along the underwater trail on the bottom, to aid and guide snorkelers and help interpret the various marine resources. SCUBA diving within the park is permitted at two designated SCUBA moorings on the northeast side of Buck Island. Dives are shallow (30 to 40 feet) and provide an opportunity to view elkhorn coral grottos and haystack formations. In addition, authorized concession operations provide marine life viewing and boating recreation for park visitors. Boat tours by catamaran, sailboats, and motor vessels are available. Fishing, fishing gear, and collecting activities are prohibited in the entire park.

The bulk of visitor activity on Buck Island occurs on West Beach and in the two picnic areas adjacent to the beach. Picnicking and barbeque grilling are favorite past-times for visitors. Frequently visitors plan family gatherings at the park and spend the entire day at the beach cooking lunch and dinner. All grilling must be conducted in grills provided by the park, and open fires are not permitted. In addition, motorized vehicles and pets are not permitted on the island. Special use permits can be obtained from park headquarters at Christiansted National Historic Site for weddings, sailing regattas, swim races, and other similar activities.

Hiking is also available at Buck Island on a marked overland hiking trail that extends from West Beach to the summit of Buck Island and then down to Diedrich's Point picnic area. From West Beach the trail goes through low-lying beach forest over gentle hillsides with turpentine and pigeon-berry trees to the island crest. A side trail to the north leads out to an observation point that affords views of the north shelf coral reef and drop-off into deeper waters farther out. The trail continues down the south side in small switchbacks through frangipani trees, organ pipe cactus, and bromeliads and ends at the Diedrich's Point picnic area. A shorter hike is also available by beginning at West Beach and exiting the main trail on a side trail that terminates on the beach. Visitors can then return to West Beach via the shoreline.

Camping and overnight stays are not permitted on Buck Island; however, overnight anchorage in the designated anchoring area is permitted. Lighting must be kept at a minimum during overnight stays since bright lights disorient sea turtles and disturb other wildlife and visitors.

Access to Orientation Information

Information regarding park resources and policies is disseminated to the public through a variety of sources. The primary visitor contact station is located at park headquarters in Christiansted National Historic Site on St. Croix. A visitor contact station is located in Fort Christiansvaern, where information is disseminated through park staff and through interpretive displays, and at the Eastern National Bookstore located in the Scale House. Anchoring permit applications and information regarding authorized park concessioners can also be obtained at park headquarters. At Buck Island, interpretation is provided by kiosks, one located at the West Beach picnic area and another at the Diedrich's Point picnic area shelter, located at the head of the hiking trail. Additional information is provided by underwater signs located throughout the underwater trail. In addition, park concessioners receive information from park staff and serve as liaisons for providing information to visitors regarding resource protection, park regulations and policies, and safety.

PARK OPERATIONS AND FACILITIES

Staffing

Park staff provide the full scope of functions and activities to accomplish management objectives and perform duties that include resource protection and management, visitor services, interpretation and education, law enforcement, emergency services, public health and safety, and maintenance. In 2008, there were 14 NPS staff shared between the three NPS units — Buck Island Reef National Monument, Christiansted National Historical Site, and Salt River Bay National Historical Park and Ecological Preserve. Some of the Resource Management staff are fully dedicated to Buck Island Reef National Monument, though the majority of the staff have duties at all three park units. For the purposes of this *General Management Plan*, it was estimated that if all positions serving the three NPS units were filled, it would translate to approximately 14 full time employees serving Buck Island Reef National Monument.

Park staff spend time partnering with a variety of federal, territorial, and other local agencies and organizations to aid the park in achieving its mission. The park actively coordinates with many other agencies, organizations and research/educational institutes including: the U.S. Geological Survey, Biological Resources Division; the National Oceanic and Atmospheric Association; and the many non-government organizations and universities. In addition, the park coordinates volunteers for its Youth Conservation Corps and the Buck Island Sea Turtle Research Program.

Park Infrastructure and Facilities

Park facilities are shown on Figure 4 in Chapter 2. The park has up to ten moorings installed near the underwater trail located at the east end of the island's coral barrier reef and two moorings in the north lagoon designated for SCUBA. Regulatory and boundary buoys are also located in the park. The underwater trail contains underwater interpretive signage and requires routine maintenance. A concrete pier is located midway between Diedrich's Point and West Beach.

At West Beach and Diedrich's Point there are picnic tables, charcoal grills, and comfort station / vault toilets. In addition, a small wooden shelter (16' x 24') is located at Diedrich's Point picnic area. This shelter provides for covered picnicking and has visitor educational displays and locked storage for park program use. The shelter is occasionally requested for use through special use permits for events such as family gatherings (NPS 2000b). There are no trash receptacles on Buck Island, and visitors must pack out all trash and wastes upon departing the island. In addition, there are no utilities or a potable water supply on Buck Island.

A marked terrestrial trail bisects the south side of Buck Island and leads up to an observation platform located on the north shore of the island. A U.S. Coast Guard navigational tower is also located on the island, but is closed to the public, and the trail leading to this tower is for administrative use only.

Commercial Services

Commercial services are a vital component of park operations since many of the park visitors access the park via authorized park concessioner boats. In 2010 there were 12 authorized concessioners providing charter services to Buck Island. In addition, Eastern National Parks & Monuments provides a bookstore/gift shop concession to the park under a national partnership agreement. It is located in the Scale House associated with the Christiansted National Historical Site. The need for a Commercial Services Plan for the park has been identified.

PUBLIC HEALTH AND SAFETY

The park is responsible for maintaining safe conditions that protect the health and safety of employees and the public. This not only applies to providing safe facilities and grounds within the park, but also includes NPS program and project operations. There are no recorded, comprehensive safety statistics available for the park. However, areas of concern related to health and safety identified during public and internal scoping for this *General Management Plan* include boating and beach safety, marine and reef hazards, terrestrial hazards, and law enforcement.

Boating and Beach Safety

Several issues regarding safe operation of vessels and beach access/safety were raised during public and internal scoping meetings. Disregard of the no-wake zone and operation of vessels at an unsafe speed near West Beach were identified as potential safety issues. These problems were noted to intensify during periods of high visitation, particularly on Sundays. The potential for vessel groundings is also a safety concern, since the shallow reef poses a navigational hazard.

Beach access was also noted as a potential safety concern. Currently, shoreline bow and stern anchoring is permitted on West Beach in the designated anchoring area, allowing a vessel to anchor directly on the beach. Many visitors have expressed a desire to maintain this policy, citing a concern for safety if vessels that do not have dinghies were forced to discharge passengers in open waters. This issue is compounded because there is no lifeguard on duty. Conversely, other visitors and park staff have noted that shoreline bow and stern anchoring poses a trip and fall hazard by allowing anchors and lines to extend onto the beach in the path of visitors. Additionally stern anchoring requires boats to motor stern to the beach, often with the propeller lifted up due to shallowness of the water, which exposes visitors to a spinning propeller in the shallow swimming area.

Boaters may use the pier for passenger and supply unloading, not for docking. The pier is used on a first come first serve basis, and is intended for short-term use only.

Marine and Terrestrial Biological Hazards

Shoreline shallows and near-shore reefs have many potential biological hazards such as Southern Atlantic stingrays, spiny sea urchins, fire coral, fire worms, barbed snails, and sharp corals. Cuts from marine organisms can quickly result in infection, and should be cleaned and medicated as soon as possible. To minimize contact with these organisms, it is recommended that visitors practice snorkeling in shallow water at the beach before going to the underwater trail and reef. During certain weather conditions, especially calm winds from the south, sea wasp and man-o-war jelly fish can be washed into the reef area and ashore. The NPS closes the beaches and anchoring area at Buck Island during certain storms, when stinging jellyfish are present, or during other hazardous conditions. Predator species such as barracuda and sharks are naturally occurring in park waters, and it is likely that these species will eventually become more numerous since the “no-take” policy will improve fishery resources.

Several forms of hazardous vegetation are present at Buck Island, making it important to stay on the beach or on designated trails while visiting the park. For example, contact with the leaves, bark, and fruit of the poisonous Manchineel tree causes a chemical burning and can cause blindness if contact is

made with the eyes. Visitors should also avoid Christmas bush, which looks like holly, and stinging nettle, a small vine with heart shaped leaves with fine silver hairs. Various other trees, cacti, and plants bearing thorns or barbed hairs should be avoided. Centipedes, scorpions, biting spiders, and ants are also present in the park. In addition, island topography can also pose a hazard since slopes are steep (30-60 % grades) and soils are often unstable. The hot climate and lack of potable water on the island also results in the potential for dehydration.

Law Enforcement

The mission of park law enforcement includes ensuring resource protection as well as visitor safety. Park rangers are tasked with enforcement of the “no-take” policy, beach closings for sensitive species’ nesting seasons, no wake zones, the “pack-it-in/pack-it-out” policy, anchoring and mooring area, and all other park rules and regulations. Park rangers also respond to swimmers, snorkelers, and boaters in distress and other safety-related incidents. In addition, illegal drug trafficking and illegal immigration is also a potential concern at Buck Island due to its offshore location.

The law enforcement division is shared between Buck Island Reef National Monument, Christiansted National Historical Site, and Salt River Bay National Historical Park and Ecological Preserve. Due to staffing limitations and funding constraints, law enforcement presence is not provided on a full time basis. The need for full staffing to meet the 16 hour /7 day per week schedule was an issue of concern expressed frequently during the scoping process.

Chapter 4

ENVIRONMENTAL CONSEQUENCES



Photograph Courtesy of: Zandy Hillis-Starr



Visitor Use at Buck Island

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CHAPTER 4 ENVIRONMENTAL CONSEQUENCES

INTRODUCTION

The National Environmental Policy Act mandates that environmental impact statements disclose the environmental impacts of proposed federal actions. In this case the proposed federal action is implementation of the general management plan for Buck Island Reef National Monument. This chapter analyzes the impacts that could result from implementing the management alternatives, as described in Chapter 2, on natural resources, cultural resources, visitor opportunities, and park operations. This general management plan establishes management objectives and implementation actions needed to manage Buck Island Reef National Monument for the next 20 years. Therefore, the analysis period of this environmental impact statement is 20 years.

The alternatives provide broad management direction for the park. Because of the general, conceptual nature of the alternatives, their potential consequences can only be analyzed in general terms. Therefore, this environmental impact statement should be considered a programmatic analysis. Prior to undertaking specific actions as a result of this general management plan, appropriate detailed environmental and cultural compliance documentation would be prepared consistent with provisions of the National Environmental Policy Act, the National Historic Preservation Act, and other legal and policy requirements. The public will have opportunity to review and comment during the implementation phase as well.

Included in Chapter 4 is a summary of the laws and policies relevant to addressing environmental consequences, definitions of impact thresholds (for example, negligible, minor, moderate, and major), methods used to analyze impacts, and the analysis methods used for determining cumulative effects. A summary of the environmental consequences of each alternative is provided in Table 9 in Chapter 2. The impact topics presented in this chapter and the organization of the topics correspond to the discussion contained in Chapter 3, Affected Environment.

SUMMARY OF LAWS AND POLICIES

Four overarching environmental protection laws and policies guide the actions of the NPS in the management of the parks and their resources: the NPS Organic Act of 1916, the National Environmental Policy Act and its implementing regulations, the National Historic Preservation Act and its implementing regulations, and the Omnibus Management Act. For a complete discussion of these and other guiding regulations, refer to Chapter 1 as well as Appendix B. These guiding regulations are described in brief below.

The *Organic Act of 1916* (16 United States Code [USC] 1) commits the NPS to making informed decisions that perpetuate the conservation and protection of park resources unimpaired for the benefit and enjoyment of future generations.

The *National Environmental Policy Act of 1969* is implemented through Council on Environmental Quality regulations (40 Code of Federal Regulations [CFR] 1500-1508). NPS procedures for compliance with these regulations are detailed in Director's Order 12: *Conservation Planning, Environmental Impact Analysis, and Decision-making Handbook* (NPS 2001).

The *1966 National Historic Preservation Act* is implemented through the Advisory Council on Historic Preservation's regulations (36 CFR 800). These regulations require that, as a federal agency, the NPS must assume responsibility for cultural resources within the parks, and must take into account the effects of NPS undertakings on these historic properties (e.g., cultural resources eligible for or listed on the National Register of Historic Places). NPS procedures for compliance with these regulations are outlined in Director's Orders 28 and 28A, *Cultural Resource Management and NPS Management Policies 2006*.

The *Omnibus Management Act* (16 USC 5901, *et seq.*) underscores the National Environmental Policy Act in that both are fundamental to park management decisions. Both acts provide direction for connecting resource management decisions to the analysis of impacts and communicating the impacts of these decisions to the public, using appropriate technical and scientific information. Both acts also recognize that such data may not be readily available, and they provide options for resource impact analysis should this be the case. 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, NPS will follow the provisions of the CEQ regulation (40 CFR 1502.22)". If the incomplete information relevant to reasonably foreseeable significant adverse effects is essential to a reasoned choice among alternatives and the overall costs of obtaining it are not exorbitant, the agency is directed to include the information in the environmental impact statement. If the relevant information cannot be obtained because the overall costs of obtaining it are exorbitant or the means to obtain it are not known, the agency is directed to include the following within the environmental impact statement:

- A statement that such information is incomplete or unavailable;
- A statement of the relevance of the incomplete or unavailable information to evaluating reasonably foreseeable significant adverse impacts on the human environment;
- A summary of existing credible scientific evidence relevant to evaluating the reasonably foreseeable significant adverse impacts on the human environment; and
- The agency's evaluation of such impacts based on theoretical approaches or research methods generally accepted in the scientific community.

The term "reasonably foreseeable" includes impacts that have catastrophic consequences, even if their probability of occurrence is low, provided that analysis of the impacts is supported by credible scientific evidence, is not based on pure conjecture, and is within the rule of reason. Collectively, these guiding regulations provide a framework and process for evaluating the impacts of the alternatives proposed in this general management plan / environmental impact statement.

IMPACT ASSESSMENT METHODS

This impact analysis and conclusions are based largely on the review of existing scientific literature and studies; information provided by experts in the NPS, other agencies, universities, and the public; and professional judgment. The method of analyzing impacts is further explained below. It is important to remember that impacts have been assessed assuming mitigating measures would be implemented to minimize or avoid impacts.

A brief description of relevant components of existing conditions is presented for each impact topic in Chapter 3. This information is the basis for determining the effects of implementing each alternative. The impact analysis involved the following steps:

- Define the issues of concern, based on scoping input as described in Chapter 1.
- Identify the geographic area that could be affected. This varies by impact topic, and may include a specific location, within park boundaries, or the region. The region typically is defined as the area surrounding the park, St. Croix and waters surrounding St. Croix. In certain instances the region is defined as the U.S. Virgin Islands, and is so noted.
- Define the resources within the area that could be affected.
- Identify the effects caused by the management alternative, compare these to the No Action Alternative, Alternative A, and determine the relative change in resource conditions. For the No Action Alternative, the analysis assumes continuation of the current management direction, that is, the NPS continues to manage Buck Island and the waters surrounding the island within the park to the extent possible given current conditions and constraints.

- Director's Order 12, Conservation Planning, Environmental Impact Analysis, and Decision Making, presents an approach to identifying the duration (occurs over the short or long term), type (adverse or beneficial), and intensity or magnitude (e.g., the degree, level, or strength of an impact as negligible, minor, moderate, or major) and that approach has been used in this document. Impact topic-specific thresholds for each level of intensity are provided in each impact topic methods section. Threshold values were developed based on federal and state standards and consultation with NPS and other agency resource experts. Because definitions of intensity vary by impact topic, intensity definitions are provided separately for each impact topic analyzed. Where duration is not noted in the impact analysis, it is considered long term.
- Define whether the effect would be beneficial or adverse.
- Determine cumulative effects by evaluating the effect in conjunction with the past, on-going, or reasonably foreseeable future actions for Buck Island Reef National Monument and the region. Additional detail regarding the method for determining cumulative effects is provided in sections that follow.
- Determine whether impairment would occur to resources and values considered necessary and appropriate to fulfill the purposes of Buck Island Reef National Monument. Details regarding the method for analyzing impairment and a discussion of impairment will be provided in the record of decision.

Impacts of the alternatives are analyzed in this order: Alternative A – No Action Alternative, Alternative B, Alternative C, and Alternative D. Each impact topic includes a description of the impacts of the alternative, a discussion of cumulative effects, and a conclusion. At the end of the chapter is a brief discussion for each alternative of sustainability and long-term management to include: unavoidable adverse impacts, irreversible and irretrievable commitments of resources, and effects on short-term uses and long-term productivity. The major assumptions used in the analysis of effects are described in the paragraphs that follow.

For each of the impact topics, access to Buck Island and the underwater trail is directly related to the number of vessels that can be accommodated by a particular alternative through the number of moorings and/or anchoring capacity. Anchoring in the park is dependent upon the availability of deep sand (per the proclamation) and avoidance of sensitive resources. Placement of moorings is also dictated by resource conditions and avoidance of sensitive resources including seagrasses and corals. Impacts are assessed based on these conditions.

The number of vessels that can be accommodated through moorings was estimated based on the area of deep sand, safe swing radius of a vessel, and avoidance of sensitive resources such as seagrasses and corals. The number of vessels that could potentially be accommodated in the existing anchoring area (Alternative A) or an Anchoring Zone (Alternatives C and D) was based upon historical use and avoidance of sensitive resources. Although acreages are specified for these areas under each alternative, it is unlikely that the entire proposed acreages could be utilized at a single point in time due to shifting sands, the presence and recovery of seagrass, or other resource-related protective measures. Acreages and number of vessels proposed under each alternative are presented in Chapter 2. It is assumed that as the number of vessels increase, the number of visitors also increases relative to the number of vessels.

Estimates of maximum number of vessels under each alternative are approximations and are provided for relative comparison of impacts. These estimates will be refined during the implementation phase based on further planning efforts such as the vessel management plan and related environmental compliance documents, site specific data, resource analysis, and user capacity analysis.

CUMULATIVE IMPACT ANALYSIS

The Council on Environmental Quality (1978) regulations for implementing the National Environmental Policy Act require assessment of cumulative impacts in the decision-making process for federal actions (40 CFR 1508.7). Cumulative impacts are defined as “incremental impacts of the action when added to other past, on-going, and reasonably foreseeable future actions, regardless of what agency (federal or nonfederal) or person “undertakes such other action.” Cumulative impacts can result from individually minor, but collectively significant, actions taking place over a period of time. The time horizon for the cumulative impacts analysis depends on the impact topic under consideration, but for most topics was plus or minus twenty years, unless otherwise noted.

Cumulative impacts were determined by combining the impacts of each management alternative with known past, on-going, and reasonably foreseeable future actions. Other management actions that have the potential to have a cumulative effect in conjunction with measures that would be implemented in this general management plan were identified in Chapter 1 under the “Relationship of Other Planning Efforts to This General Management Plan” section. Cumulative impacts are considered for all management alternatives, including the no action alternative – Alternative A.

In addition to specific agency actions and programs, other activities would continue within the park or in the region that would cumulatively impact resources. These would include a variety of past, on-going, and future actions and events that would have effects on resources within park boundaries. These would include the effects of anchoring, mooring, releases of fuels and other pollutants from vessels and those associated with hulls; visitor use of sunscreens and insect repellents; recreational activity and inadvertent bumping, breaking, and touching of corals; accidental groundings; facility use and maintenance of the pier, toilets, and picnic areas; trail use; introduction and control of non-native species, terrestrial and marine; and enforcement of the no-take provision of the Proclamation. Prior overfishing of the park and region has also contributed to the deteriorated fishery in the park. Continued management of the park as a “no take” marine reserve into the future also contributes beneficial effect to the cumulative picture.

Other changes over time are attributable to hurricanes and other storms, African dust, temperature increases, diseases, and other effects related to climate change. Global climate change is expected to affect the park in several ways, and not all the effects are well understood. The inter-relationship of all of these factors is also thought to be important, and is also poorly understood at the present time. The South Florida/Caribbean Network coral reef monitoring program (NPS 2007) and other researchers will address these issues in the future, based on scientific studies.

An overview of climate change and related effects is provided in Appendix D. Some of the ways that climate change is expected to affect the park are summarized below and by impact topic.

Scientists are certain that human activities are changing the composition of the atmosphere, and that increasing the concentration of greenhouse gases will change the planet's climate (USEPA 2008; IPCC 2007). However, they are not sure by how much it will change, at what rate it will change, or what the specific effects will be. Observed effects have included sea level rise, changes in storm events, temperature increases, ocean acidification and others. Sea level rise is expected to result in inland movement of mangroves, alteration and loss of coastal habitats, and alterations in estuarine salinity patterns, consequently affecting important habitat for endangered species (such as sea turtles, terns, rare plants, fish, corals, etc). Changes in frequency of extreme weather events, such as major hurricanes, droughts, extreme ocean temperature events are expected to accelerate the impacts of sea level rise, strongly impact coral reefs, and further stress inland communities. Changes in temperature and rainfall are expected to impact hydrology, fire patterns, species migratory patterns, species ranges, reproductive timing and success, other recurring biological phenomena, and exotic species.

Over the past 200 years the oceans have absorbed nearly half the carbon dioxide produced by human activities. One effect has been to produce carbonic acid, thus increasing acidity and lowering the pH of surface seawater by 0.1 pH unit. Projections based on different emission scenarios give additional reductions in average global surface ocean pH of between 0.14 and 0.35 units by the year 2100 (IPCC 2007). This seawater acidity is probably higher than has been experienced for hundreds of millennia, and there is convincing evidence that such acidification will impair the process of calcification by which animals, such as corals and mollusks, make their shells from calcium carbonate. Acidification would likely also have affects on the beaches at Buck Island.

A cumulative impact discussion is provided for each impact topic by alternative in the sections that follow.

SOIL / SAND

Regulations and Policies

The regulations and policies that guide NPS actions with respect to soil are presented in the “Servicewide Mandates and Policies” Section of Chapter 1 and in Appendix B.

Methods

Soil and sand issues identified during public meetings and planning workshops included: (1) the highly erodible and fragile nature of the soil at Buck Island; and (2) the potential effects of visitor use on terrestrial trails and beaches. To address these issues, an assessment of the effects of projected park management actions on soil and sand was made using qualitative estimates of the expected levels of visitor use in the terrestrial portion of the park and expected levels of land-disturbing activities inside the park (installation and/or maintenance of picnic tables, grills, restroom, for instance), the practice of bow and stern anchoring, and the effects were compared to Alternative A. In addition, information on soil and sand was evaluated based on the professional judgment of NPS staff. Primary sources of information used in this analysis included U.S. Department of Agriculture soil surveys, NPS policy documents, and unpublished observations and insights from knowledgeable park staff. Buck Island is the area analyzed for possible effects on soil and sand.

The major assumption used in the analysis of effects on soil and sand was: (1) increased visitor use and access to Buck Island could potentially translate to greater terrestrial trail usage and a greater potential for erosion and trail compaction; (2) construction activities (e.g., installation of additional picnic tables or trail expansion) would be minimal under all alternatives given the fragile soil conditions and sensitive habitat present on Buck Island; and (3) under all alternatives, best management practices for construction would be implemented on any construction project proposed by the park and that potentially adverse effects of construction on soil would be minimized by implementation of site-specific mitigation measures identified in environmental assessments tiered to this general management plan/environmental impact statement.

Foot traffic on trails from visitors and park staff can compact soil or crush vegetation to the point where plants may no longer be able to grow. Due to shallow, friable soil conditions, once plant cover is removed the soil is more susceptible to erosion. Construction-related efforts frequently result in soil disturbance while the activity is conducted. Clearing vegetation and maintenance activities around facilities such as restrooms, trails, and picnic areas would be a soil disturbance. Other types of activities considered in the analysis include restoration, development of trails, picnic areas, improvement of trail access and signage areas, and bow and stern anchoring where applicable.

The discussions presented later in this chapter about impacts to soil and refer to the terms compaction, erosion, and disturbance as described above. Lengthy descriptions are not provided to avoid repetition. The effects of potential increases in visitation have been factored into the analysis.

Effects of individual projects on soil would be effectively assessed and mitigation measures employed. The geographic area analyzed is Buck Island.

Impact Threshold Definitions

The thresholds to determine the intensity of impacts on water resources are defined as follows:

Negligible: Soil and sand would not be affected, or the effects on soil and sand would be below or at levels of detection. There would be no discernable effect on the rate of soil or sand erosion and/or the ability of the soil or sand to support native species.

Minor: The effects on soil and sand would be detectable, but effects on soil productivity would be localized. There would be detectable effects on the rate of soil and sand erosion and/or the ability of the soil or sand to support native species.

Moderate: The effect on soil productivity would be readily apparent and would result in a change to the soil character over a relatively wide area. The rate of soil or sand erosion and/or the ability of the soil or sand to support native species would be appreciably changed.

Major: The effects on soil productivity would be readily apparent and would substantially change the character of the soil over a large area in the monument. The actions would have substantial, highly noticeable influence on the rate of soil or sand erosion and/or the ability of the soil or sand to support native species.

Duration: Long-term: Takes more than one year to recover.
Short-term: Recovers within one year.

Impacts of Alternative A

The soil of Buck Island is shallow, highly friable, and sensitive to disturbance. The combination of shallow, friable soil, dry conditions, and steep topography results in the potential for high erosion rates and decreased ability of the soil to support native vegetation. Under current management practices, the existing trail is used for hiking, with an estimated eight to ten hikers traversing the terrestrial trail per day. Due to the rigorous environment, there is a low potential for visitors to walk off-trail, creating unauthorized trails. However, park staff indicate that localized adverse effects to soil are observed even with a limited amount of trail usage, and trail stabilization measures are being taken.

Limited installation or replacement of existing facilities would occur under Alternative A and would not likely affect soil erosion rates. In addition, current methods of non-native, invasive vegetation removal have not adversely affected erosion rates on Buck Island (NPS 2004a; Hillis-Starr 2004). Removal of guinea grass and other non-native, invasive vegetation would also provide localized benefits by reducing the threats posed to soil by high intensity wildfires. Use of existing facilities would cause soil and sand disturbances and possible erosion in areas of concentrated visitor use, such as the picnic area and grills. Continued bow and stern anchoring would disturb sand along the shoreline, causing erosion to occur. The overall effect of Alternative A on soil and sand would be long- and short-term, minor, and adverse.

Cumulative Effects

Under all alternatives, including Alternative A, the cumulative effects on soil would largely be controlled by park management actions, since effects on soil are primarily related to the number of visitors that access Buck Island. The cumulative adverse effects of operation and maintenance activities on soil under Alternative A would be negligible, since this alternative would involve small amounts of land disturbance, use of stabilization measures along the park trail, and little to no new facility construction now and into the future. Past, on-going, and future management of non-native, invasive species including vegetation, goats, rats, and mice would constitute long-term and beneficial effects.

Continuation of bow and stern anchoring would continue to cause sand disturbance and possible erosion along West Beach where this type of anchoring occurs. The amount of erosion has not been quantified and would be difficult to determine due to the effects of other coastal processes such as storm surges and tidal activity. Climate change is anticipated to cause sea level rise and acidification that could adversely affect sand, erosion rates, and availability of habitat.

Regional implementation of outreach and educational programs such as the Virgin Islands Department of Planning and Natural Resources' Non-Point Source Program, Environmental Protection Handbook (Wright 2002), and Environmental Education and Outreach program have the potential to benefit park resources, including soil, by promoting awareness of the importance of resource preservation, benefits of non-native plant control and native restoration program, and methods for minimizing erosion. However, due to staffing and funding limitations, coordination and planning efforts between the NPS and other government agencies and organizations would remain at current levels, which could hinder the potential of such beneficial effects.

When the beneficial and adverse effects of other past, on-going, and future plans, projects, and activities affecting soil and sand are combined with actions under Alternative A, the resulting cumulative effects would be long- and short-term, minor, and adverse.

Conclusions

Long- and short-term, minor, adverse effects on soil would occur under Alternative A due to the sensitive nature of the soil and sand on Buck Island and effects related to trail usage and bow and stern anchoring. When other past, on-going, and future actions are taken into consideration, the cumulative effects on soil would also be long- and short-term, minor, and adverse.

Impacts of Alternative B, the Preferred Alternative

The Island Discovery Zone would be created under Alternative B, which includes trails as an appropriate use; however, construction of new trails would be limited under Alternative B, and constrained by sensitive conditions such as island topography, dry, shallow erodible soil, and hazardous vegetation. An environmental assessment would be required for any proposed trail and site specific mitigation measures would be identified and implemented. Under Alternative B, a similar amount of trail usage would be anticipated as compared to Alternative A, although phasing out anchoring at West Beach under Alternative B could potentially reduce the number of visitors resulting in slightly less trail usage.

Phasing out of bow and stern anchoring along West Beach would also reduce disturbance and erosion of sand with related beneficial effects. In addition, an increase in the number of park staff are proposed under Alternative B compared to Alternative A, which could limit visitors going off-trail due to greater law enforcement presence and resource-related education. Trail stabilization measures would also be implemented to address soil compaction and erosion as necessary. Therefore, related adverse effects would be less than Alternative A. The effects of management actions under Alternative B would be long- and short-term, negligible, and adverse.

Cumulative Effects

As described under Alternative A, cumulative effects for soil and sand are derived primarily from park management actions. Therefore, cumulative effects for Alternative B would also be long- and short-term, minor, and adverse. Although additional staff would be proposed under Alternative B, allowing for additional partnerships, enforcement, and opportunities for providing information to visitors regarding soil and sand conditions, and these efforts would have positive results, a similar level of cumulative effects is likely. Cumulative effects on soil and sand would not be measurably different from those described in Alternative A: long- and short-term, minor, and adverse.

Conclusions

Long- and short-term, negligible, adverse effects on soil and sand would occur under Alternative B due to implementation of management actions to address effects related to trail usage and elimination of bow and stern anchoring. When other past, on-going and future actions are taken into consideration, the cumulative effects on soil and sand would also be long- and short-term, minor, and adverse.

Impacts of Alternative C

Similar types of effects as those described under Alternative A are applicable to Alternative C. Shoreline bow and stern anchoring would be appropriate under Alternative C, with similar effects to Alternative A, such as sand disturbance and erosion along the shoreline. Since the limited bow and stern Anchoring Zone would be considerably smaller, and it is likely that Alternative C would accommodate fewer visitors with direct beach access via a reduced Anchoring Zone compared to Alternative A (Table 5). However, the additional mooring capacity provided by Alternative C would equate to a similar number of overall park visitors and numbers of visitors to Buck Island Alternative A.

The Island Discovery Zone would be created under Alternative C, and includes trails as an appropriate use; construction of new trails is limited by sensitive conditions such as island topography, dry, shallow erodible soil, and hazardous vegetation. New trail construction would cause erosion and compaction of soils in the vicinity of a new trail. An environmental assessment would be required for any proposed trail, and stabilizing boards would need to be utilized as a mitigation measure to protect the soil and minimize effects of erosion and soil compaction along existing and any proposed trails. Minimal facility construction or installation would be appropriate under Alternative C (installation of additional or replacement of existing picnic tables or grills for instance). The greater number of staff proposed under Alternative C compared to Alternative A would somewhat limit the potential for visitors to stray off-trail, creating unauthorized trails due to greater law enforcement presence and resource-related education. Since adverse effects would increase associated with new trail construction and use when compared to Alternative A, the level of intensity would be relative to the amount of trail use and construction. Therefore, the effects of implementation of Alternative C would be long- and short-term, minor to moderate, and adverse.

Cumulative Effects

As described under Alternative A, cumulative effects for soil and sand are derived primarily from park management actions. Hence, cumulative effects for Alternative C would also be long- and short-term, minor to moderate and adverse. Additional staff would be proposed under Alternative C, allowing for additional partnerships with local and other government agencies, universities, and organizations; however, it is likely that partnering efforts resulting in changes to soil and sand conditions would not be measurably increased above the levels described in Alternative A. When the beneficial and adverse effects of other past, on-going, and future plans, projects, and activities affecting soil and sand are combined with actions under Alternative C, the resulting cumulative effects would be long- and short-term, minor to moderate, and adverse.

Conclusions

Alternative C could result in greater trail construction and usage compared to Alternative A. Stabilizing boards would need to be used as a mitigation measure to protect soils and minimize effects of soil compaction and erosion. The overall effects of implementation of Alternative C would be long- and short-term, minor to moderate, and adverse. When other past, on-going and future actions are taken into consideration, the cumulative effects for Alternative C would also be long- and short-term, minor to moderate, and adverse.

Impacts of Alternative D

The elimination of bow and stern anchoring under Alternative D would eliminate associated effects of sand disturbance and erosion. It is projected that Alternative D would likely accommodate a greater number of vessels and visitors within the park when compared to Alternative A and other alternatives. This would increase the likelihood of trail use and increase the potential for soil compaction, erosion, and disturbance.

The Island Discovery Zone would be created under Alternative D, and includes trails as an appropriate use; construction of new trails is possible, and would be limited by sensitive conditions such as island topography, dry, shallow erodible soil, and hazardous vegetation. New trail construction would cause erosion and compaction of soils in the vicinity of a new trail. An environmental assessment would be required for any proposed trail, and stabilizing boards would need to be utilized as a mitigation measure to protect the soil and minimize effects of erosion and soil compaction along existing and any proposed trails. Minimal facility construction or installation would be appropriate under Alternative D (installation of additional or replacement of existing picnic tables or grills for instance). The greater number of staff proposed under Alternative D compared to Alternative A would somewhat limit the potential for visitors to stray off-trail, creating unauthorized trails due to greater law enforcement presence and resource-related education. However, due to the shallow, highly erodible nature of soils in the park, the increase in park staff would not be able to offset the adverse effects of new trails combined with increased visitation in the park. Since adverse effects would increase associated with new trail construction and use when compared to Alternative A, the level of intensity would be relative to the amount of trail use and construction. Therefore, the effects of implementation of Alternative D would be long- and short-term, minor to moderate, and adverse.

Cumulative Effects

As described under Alternative A, cumulative effects for soil are derived primarily from park management actions. Therefore, cumulative effects for Alternative D would also be long- and short-term, minor to moderate, and adverse.

Conclusions

Alternative D could result in increased trail construction and usage when compared with Alternative A. Stabilizing boards would be used as a mitigation measure to protect the soil and minimize effects of soil compaction and erosion. The overall effects would be long- and short-term, minor to moderate, and adverse. When other past, on-going, and future actions are taken into consideration, the cumulative effects for Alternative D would also be long- and short-term, minor to moderate, and adverse.

WATER RESOURCES

Regulations and Policies

The regulations and policies that guide NPS actions with respect to water resources are presented in the “Servicewide Mandates and Policies” Section of Chapter 1 and in Appendix B.

Methods

Water resource issues identified during public meetings and planning workshops included: (1) water quality issues related to vessels and visitor use; this includes spilled or leaking vessel fuel and oil, bacterial contamination from swimmers or sewage illegally discharged from vessel holding tanks, unauthorized bilge water pump-out, disposal of trash at sea by vessel owners, leaching or sloughing of vessel bottom paint, and sunscreen, insect repellent, or other products used by visitors. These types of pollutants are hereafter referred to pollutant discharges or releases throughout this document; (2)

effects related to potential vessel groundings and any associated spills within park waters; and (3) regional water quality issues that could potentially affect the park. To address these issues, an assessment of the effects of projected park management actions on water resources was made using qualitative estimates of the expected location, number, and size of vessels in park waters and the anticipated increase in staffing levels and partnering. Because water pollutants can lead to degradation of water quality over time, the effects were then compared to Alternative A. Increased water temperature resulting from changes consistent with climate change reported world-wide are addressed under the “Marine and Coastal Resources” section and, therefore, are not repeated in this impact analysis.

The primary sources of information used in this analysis included published water quality data, scientific journal articles, NPS policy documents, and unpublished observations and insights from knowledgeable park staff. Since there is no potable water supply on Buck Island and since there would be no effect on the salt pond on Buck Island under any alternative, surface water and groundwater resources were not included in this analysis. The area of possible effect for the impacts analysis corresponds to the marine waters of the park, nearshore areas and regional waters (the east coast of St. Croix) since marine currents could transport pollutants from these areas into the park.

The major assumptions used in the analysis were that: (1) potential effects on water resources from vessels would increase proportionally to the number of vessels that can be accommodated (via either anchoring or mooring under each alternative); (2) additional staff proposed under the action alternatives would benefit water resources through increased enforcement, research and monitoring, education, and interpretation; and (3) adverse regional effects (cumulative effects) could potentially be offset by partnering with territorial and other government agencies, universities, and organizations.

Under all alternatives, best management practices would be implemented on any proposed park project and potential adverse effects on water resources would be minimized by implementation of site-specific environmental assessments tied to this general management plan/environmental impact statement. Effects of individual projects on water resources would be effectively assessed, and mitigation measures employed. The discussions presented later in this chapter about impacts to water resources refer to the pollutants and uses as described above. Lengthy descriptions are not provided to avoid repetition. The impacts of potential visitation increases have been factored into the analysis.

Impact Threshold Definitions

The thresholds to determine the intensity of impacts on water resources are defined as follows:

Negligible: Chemical, physical, or biological changes to water quality would not be detectable and would be below or within historical or desired water quality conditions.

Minor: Chemical, physical, or biological changes would be measurable but would be below water quality standards and would be within historical or desired water quality conditions.

Moderate: Chemical, physical, or biological changes to water quality would be measurable and readily apparent, but within all water quality standards. Water quality would be altered compared to historical baseline or desired water quality conditions. Mitigation would be necessary to offset adverse effects, and would likely be successful.

Major: Chemical, physical, or biological changes to water quality would be readily measurable, and some water quality standards would be periodically approached, equaled, or exceeded. Water quality would be frequently altered from the historical baseline or desired water quality conditions. Extensive mitigation measures would be necessary and their success would not be assured.

Duration: Long-term: Takes more than one year to recover.
Short-term: Recovers within one year.

Impacts of Alternative A

Under Alternative A, water quality in the park would be affected by pollutant discharges or releases as defined under the methods section. Water quality could also potentially be affected by erosion resulting from trail usage, although these impacts on overall water quality are negligible. In addition, there would also be the threat of oil tanker or other vessel groundings on reefs within the park, which could result in the release of oil or other harmful substances into park waters. However, a release associated with a grounding would constitute an isolated event and would not be typical of average conditions. The overall effect of Alternative A on water resources would be long- and short-term, minor, and adverse.

Cumulative Effects

Under all alternatives, including Alternative A, the cumulative effects on water resources would largely be controlled by park management actions. Regional impacts, such as runoff and sedimentation from development in Teague Bay, less than 1-mile south of Buck Island on the east coast of St. Croix, vessel discharge from tankers that may lighten their load north or east of the park and/or the container port on the south shore of St. Croix, sewage spills in Christiansted, and disposal of trash at sea outside the park boundary, could also contribute cumulative adverse effects.

On-going and future coral and other resource research and monitoring programs conducted by the NPS and its partners within park waters may have an indirect, beneficial, cumulative effect on water resources through collection and interpretation of water quality data. Regional implementation of outreach and educational programs such as the Virgin Islands Department of Planning and Natural Resources' Non-Point Source Program, the Environmental Protection Handbook (Wright 2002), and Environmental Education and Outreach program have the potential to benefit park resources, including water resources, by promoting awareness of the importance of resource preservation and methods for minimizing adverse impacts to water quality. However, due to staffing and funding constraints, Alternative A would likely not increase coordination and planning between the NPS and government agencies and other organizations, which could hinder the potential benefit of such actions.

When the beneficial and adverse effects of other past, on-going, and future plans, projects, and activities affecting water resources are combined with actions under Alternative A, the resulting cumulative effects would be long- and short-term, minor, and adverse.

Conclusions

Long- and short-term, minor, adverse effects on water resources would occur under Alternative A, primarily due to the potential for pollutant discharges or releases primarily from illegal waste disposal from vessels, which cannot be consistently monitored and prevented due to staffing limitations. The lack of restrictions on vessel size and access to potentially hazardous navigational areas within the park also increase the likelihood of a grounding and/or spills within park waters. Cumulative effects on water resources would also be long- and short-term, minor, and adverse due to the added potential for adverse impacts related to regional sources of pollution and the limited amount of regional partnering that is possible with existing staffing levels.

Impacts of Alternative B, the Preferred Alternative

Under Alternative B, water quality in the park would be affected by many of the same influences as those described under Alternative A, and the number of vessels that can be accommodated under each alternative would be slightly less (approximately 72 versus 87, respectively). However, increased staff proposed for this alternative would help limit unauthorized pollutant discharges or releases as described under Alternative A through increased education and enforcement. Creation of a Marine Hazard Zone under all action alternatives (elimination of vessels in this zone) would significantly

decrease the potential for vessel grounding on reefs within the park, reducing the potential for an oil spill in shallow waters within the park boundary. Vessels 151 feet and over would be required to have a permit to operate in park waters. This would also reduce the potential for spills/discharges into park waters and allow the NPS to monitor large vessel use in the park. The overall effects of Alternative B on water resources would be long- and short-term, minor, and beneficial.

Cumulative Effects

Under all alternatives, including Alternative B, the cumulative effects on water resources would largely be controlled by park management actions, but regional impacts described under Alternative A could also contribute adversely to cumulative effects. Likewise, the same beneficial cumulative effects described under Alternative A (on-going and future research and monitoring programs) would also be applicable to Alternative B. However, the increased staffing proposed under Alternative B would allow for more partnering and coordination between the NPS, government agencies, and other organizations on research, monitoring, and outreach programs, which would have long-term, beneficial effects on water resources. When these effects are combined with the adverse and beneficial effects of actions resulting from implementation of Alternative B, the resulting cumulative effects would be long- and short-term, minor, and beneficial.

Conclusions

Long- and short-term, minor, beneficial effects on water resources would occur under Alternative B due to increased staff presence in the park, creation of management zones and vessel size limitations in the park. Cumulative effects on water resources would be long- and short-term, minor, and beneficial due to the added potential for NPS interaction and partnering with other agencies in an effort to increase the knowledge base and stewardship of water resources, as well as implementation of other plans.

Impacts of Alternative C

Effects would be similar to Alternative B since Alternative C also proposes additional staffing, management zones and vessel size restrictions. However, Alternative C would accommodate approximately five more vessels compared to Alternative A. Shoreline bow and stern anchoring would also be permissible under Alternative C, which would allow for more vessels to be concentrated near West Beach and simultaneously allow for a greater potential of localized water quality impacts in this area related to discharge from outboard engines, oil and gasoline, swimmers and use of sunscreen and other products. In addition, shoreline bow and stern anchoring also allows for more direct access to the island, which could potentially translate to greater terrestrial trail usage, increased erosion, and limited increased sedimentation in park waters. The overall result would likely be long- and short-term, negligible, adverse effects on water resources since effects would be localized, mitigation measures would be successful and because it is unlikely that changes to water quality would be detectable in the majority of park waters.

Cumulative Effects

The beneficial and adverse effects of other past, on-going, and future plans, projects and activities affecting water resources are the same as those described for Alternative B. When these beneficial and adverse effects are combined with management actions proposed under Alternative C (which allows for anchoring and an increase in the number of vessels), the resulting cumulative effect would be long- and short-term, negligible, and beneficial.

Conclusions

Long- and short-term, negligible, adverse effects on water resources would occur under Alternative C due to the combined effects of increased staff presence, creation of the Marine Hazard Zone, shoreline bow and stern anchoring, and the increased number of vessels that may anchor or moor in

the park. Cumulative effects on water resources would be long- and short-term, negligible, and beneficial due to the added potential for NPS interaction and partnering with other agencies in an effort to increase the knowledge base and stewardship of water resources.

Impacts of Alternative D

Similar effects as those described under Alternative C are applicable to Alternative D. However, it is projected that Alternative D would likely accommodate a greater number of vessels and visitors within the park compared to Alternative A, with an associated increase in adverse effects to water quality associated with increased number of swimmers and vessels in the park. Increased vessel usage increases the potential for accidental spills, pollutant discharges and releases and adverse effects to water quality, particularly in areas where vessels are concentrated (off West Beach). A greater number of additional staff are also proposed under Alternative D when compared to Alternative A and other alternatives. Increased staff and elimination of shoreline bow and stern anchoring would help offset adverse effects to water resources resulting from increased visitation. Overall, the effects of Alternative D on water resources would be long and short-term, minor and adverse.

Cumulative Effects

The beneficial and adverse effects of other past, on-going, and future plans, projects, and activities affecting water resources are the same as those described for Alternative B. However, when these effects are combined with management actions under Alternative D (which allows for an increase in the number of vessels), the resulting cumulative effect would be long- and short-term, negligible, and adverse.

Conclusions

Long- and short-term, minor, adverse effects on water resources would occur under Alternative D due to the combined effects of increased staff presence, creation of the Marine Hazard Zone, and shoreline bow and stern anchoring. However increased number of vessels in the park will increase the likelihood of pollutant discharges or releases, and vessel accidents resulting in oil spills and fuel discharges into park waters. Cumulative effects on water resources would be long- and short-term, negligible, and adverse due to the added potential for NPS implementation of other plans, and interaction and partnering with other agencies in an effort to increase the knowledge base and stewardship of water resources.

VEGETATION

Regulations and Policies

The regulations and policies that guide NPS actions with respect to vegetation are presented in the “Servicewide Mandates and Policies” Section of Chapter 1 and in Appendix B.

Methods

Vegetation issues identified during public meetings and planning workshops were more general and included resource protection and habitat preservation. To address these issues, an assessment of the effects of projected park management actions on vegetation was made using qualitative estimates of the expected levels of visitor use in the terrestrial portion of the park and expected levels of land-disturbing activities inside the park (maintenance of picnic tables or grills, and trail work for instance), and the effects were compared to Alternative A. The primary sources of information used in this analysis include NPS plant species inventories, NPS policy documents, NPS research, and unpublished observations and insights from knowledgeable park staff. The area analyzed for possible effects on vegetation encompasses Buck Island.

The major assumptions used in the analysis of effects on vegetation were that: (1) increased visitor use and access to Buck Island could potentially translate to greater impacts to terrestrial vegetation

communities through increased picnic area and trail usage; (2) construction activities (e.g., installation of additional picnic tables or trail expansion) would be minimal under all alternatives given the fragile soil conditions and sensitive habitat present on Buck Island; and (3) under all alternatives, best management practices for construction would be implemented on any construction project proposed by the park, and potentially adverse effects of construction on vegetation would be minimized by implementation of site-specific mitigation measures identified in environmental assessments tied to this general management plan/environmental impact statement. Effects of individual projects on vegetation would be effectively assessed, and mitigation measures employed.

Visitor use can impact vegetation through different means, including trampling of vegetation when hiking off designated trails, or moving picnic tables. Introduction or spread of invasive species can also result from visitors unwittingly bringing seeds to Buck Island on their clothing, shoes or other materials. Constructing new trails would cause the loss of vegetation and possibly introduce non-native species. The impacts of potential visitation increases have been included in the analysis. The geographic area assessed is Buck Island.

Impact Threshold Definitions

The thresholds to determine the intensity of impacts on vegetation are defined as follows:

Negligible: Individual native plants may occasionally be affected, but measurable or perceptible changes in plant community size, integrity, or continuity would not occur.

Minor: Effects on native plants would be measurable or perceptible. The natural function and character of the plant community would not be affected and, if left alone, would recover.

Moderate: A change would occur in the natural function and character of the plant community in terms of basic properties (e.g., growth, abundance, reproduction, distribution, structure, or diversity) but not to the extent that the basic properties of the plant community change.

Major: Effects on native plant communities would be readily apparent and would substantially and permanently change the natural function and character of the plant types.

Duration: Long-term: Takes more than one year to recover.
Short-term: Recovers within one year.

Impacts of Alternative A

Under current management practices, existing trails are used for hiking, with an estimated eight to ten hikers traversing the terrestrial trail per day. No new trails would be developed. Due to the rigorous environment, there is a low potential for visitors to walk off-trail, creating unauthorized trails. However, any off-trail use by hikers could affect scrub and dry deciduous forest habitats. Damage to vegetation could result in the trampling or uprooting of native vegetation on the island, and introduction and spread of non-native seed brought to Buck Island accidentally via hiker clothes, shoes or other materials. Beach and coastal thicket vegetation that occurs near the shoreline would likely continue to be affected as a result of off-trail usage by beachgoers, particularly in the high use area at West Beach. Visitors moving picnic tables farther into vegetated areas would likely continue to adversely affect vegetation in this area by trampling and other disturbances. Should visitation increase in the future, additional enforcement would be required to minimize the effects of unauthorized trail use and visitor expansion of the picnic area. Overall, this alternative would have short-term, minor, adverse effects on native plant species.

Cumulative Effects

Management plans to treat and remove non-native plants and animals on the island would have long-term, moderate to major, beneficial effects on native vegetation. The non-native vegetation management plan, which controls exotic vegetation, would result in recovery of native plant

communities, particularly in areas of scrub and dry deciduous forest where infestation is greatest. Implementation of the non-native vegetation plan would restore nearly 33 percent of the island's native vegetation. Removal of non-native animals, mongoose, rats, and mice would also indirectly contribute to the recovery of native vegetation. By suppressing native bird and lizard populations, non-native mammals have adversely affected the dispersal of native plants.

The short-term localized minor adverse effects of visitor impacts on terrestrial vegetation that would occur under Alternative A would not reduce the overall major, long-term, beneficial effects of non-native plant and animal management measures that would restore native plant communities in large areas of the island. When the beneficial and adverse effects of other past, on-going and future plans, projects, and activities affecting vegetation are combined with actions under Alternative A, the resulting cumulative effects would be considered major, long-term, and beneficial.

Conclusions

The effects to vegetation communities through continuing current management practices would be localized, short-term, minor, and adverse as a result of limited off-trail use or trampling that occurs along high use beach areas. Cumulative effects of Alternative A and other projects and plans would have overall long-term major beneficial effects.

Impacts of Alternative B, the Preferred Alternative

Similar effects as those described under Alternative A are applicable to Alternative B. The Island Discovery Zone would be created under Alternative B, which includes trails as an appropriate use; however, construction of new trails is limited by sensitive conditions such as island topography and shallow, dry, erodible soil. Potential development of limited new trails would result in a loss of habitat and loss of native plants in the localized area where the trail would be constructed. This would have long-term, minor to moderate, adverse effects as trail development would be expected to be the largest type of facility development that would occur on the island; however, this activity would not result in a loss of populations or changes to community types. Potential limited increased trail development would also result in the introduction of visitors into new areas, which would increase the area that could be affected by off-trail use by visitors and potential introduction of non-native species brought to Buck Island accidentally via hiker clothes, shoes or other materials. Increased trails and use increases the potential for adverse effects to native plant restoration as well. Due to the dry forest and scrub habitat conditions of the island, this activity would be localized and would have minor, short-term, adverse effects.

An environmental assessment would be required for any proposed trail, and mitigation measures would also be employed to reduce the spread of non-native plants into newly disturbed areas and to reduce or minimize erosion into adjacent native habitat. Under Alternative B, a similar amount of trail usage would be anticipated as compared to Alternative A, although phasing out anchoring at West Beach under Alternative B could potentially reduce the number of visitors, resulting in slightly less hiking on Buck Island. In addition, an increase in the number of park staff is proposed under Alternative B compared to Alternative A, which could limit the use of unauthorized trails and vegetation trampling in the picnic area due to greater law enforcement presence and resource-related education. Management actions would be taken as needed to reduce visitor impacts on native vegetation. The overall effect on native vegetation as a result of implementation of Alternative B would be long-term, negligible to minor, and adverse.

Cumulative Effects

Cumulative effects of other past, on-going, and future projects, plans, and activities would be the same as described for Alternative A. When the beneficial and adverse effects of other on-going and future plans, projects and activities affecting vegetation are combined with actions under Alternative B, the resulting cumulative effects would be long-and short-term, major, and beneficial.

Conclusions

Limited development of trails and potential for spread of non-native plants would have long-term, minor to moderate, adverse effects. However, these adverse effects would be offset by greater law enforcement presence, resource-related education, and a fewer trail hikers when compared to Alternative A, resulting in an overall long-term, negligible to minor, adverse effect on native vegetation. Cumulative effects of other projects and plans in combination with impacts of Alternative B would result in overall long-and short-term, major, benefits on native vegetation.

Impacts of Alternative C

The Island Discovery Zone would be created under Alternative C, which includes trails as an appropriate use; construction of new trails is limited by sensitive conditions such as island topography and shallow, dry, erodible soil. Development of new trails would result in a loss of habitat and loss of native plants in the localized area where the trail would be constructed. This would have long-term, minor to moderate, adverse effects as trail development would be expected to be the largest type of facility development that would occur on the island; however, this activity would not result in a loss of populations or changes to community types. Potential increased trail development would also result in the introduction of visitors into new areas, which would increase the area that could be affected by unauthorized or off-trail use by visitors and potential introduction of non-native species brought to Buck Island accidentally via hiker clothes, shoes or other materials. Increased trails and use increases the potential for adverse effects to native plant restoration as well.

An environmental assessment would be required for any proposed trail, and mitigation measures would also be employed to reduce the spread of non-native plants into newly disturbed areas and to reduce or minimize erosion into adjacent native habitat. Under Alternative C, an increased amount of trail usage would be anticipated as compared to Alternative A, associated with the increased number of visitors, resulting in slightly more hiking on Buck Island. In addition, an increase in the number of park staff is proposed under Alternative C compared to Alternative A, which could limit the use of unauthorized trails and vegetation trampling in the picnic area due to greater law enforcement presence and resource-related education. Management actions would be taken as needed to reduce visitor impacts on native vegetation. The overall effect on native vegetation as a result of implementation of Alternative C would be long-term, minor, and adverse.

Cumulative Effects

Cumulative effects of other past, on-going, and future projects and plans would be the same as described for Alternative A. When the beneficial and adverse effects of other on-going and future plans, projects and activities affecting vegetation are combined with actions under Alternative C, the resulting cumulative effects would be long-and short-term, moderate, and beneficial.

Conclusions

Development of trails and potential for spread of non-native plants, combined with an increased level of visitation, when compared to Alternative A, would have a long-term, minor, adverse effect on vegetation. When the beneficial and adverse effects of other on-going and future plans, projects and activities affecting vegetation are combined with actions under Alternative C, the resulting cumulative effects would be long-and short-term, moderate, and beneficial.

Impacts of Alternative D

The effects of potential development of new trails that would result in a loss of habitat and loss of native plants in localized areas where trails would be constructed would be similar to those described in Alternative D. The capacity for greater numbers of visitors to the island is greater under Alternative D, with approximately 25 more vessels than under Alternative A. The effects on vegetation from a greater number of visitors would be offset somewhat by the addition of enforcement and educational

outreach compared to Alternative A; however, increased trampling of vegetation at West Beach is likely. The overall effect on vegetation would be long-term, moderate, and adverse.

Cumulative Effects

Cumulative effects of other past, on-going, and future projects, plans, and activities would be the same as described for Alternative A (long-term, major, beneficial). When the beneficial and adverse effects of other on-going and future plans, projects and activities affecting vegetation are combined with actions under Alternative D, the resulting cumulative effects would be long-and short-term, moderate, and beneficial.

Conclusions

Development of trails and potential for spread of non-native plants combined with a greater capacity for visitor use and increase in enforcement and educational outreach, when compared to Alternative A, would have a long-term, moderate, adverse effect on vegetation. When the beneficial and adverse effects of other on-going and future plans, projects and activities affecting vegetation are combined with actions under Alternative D, the resulting cumulative effects would be long-and short-term, moderate, and beneficial.

WILDLIFE

Regulations and Policies

The regulations and policies that guide NPS actions with respect to wildlife are presented in the "Service-wide Mandates and Policies" Section of Chapter 1 and in Appendix B.

Methods

Wildlife issues raised during public meetings and planning workshops were general in terms of protection of park resources and habitat preservation. To address these issues, an assessment of the effects of projected park management actions on terrestrial wildlife was made using qualitative estimates of the expected levels of visitor use in the terrestrial portion of the park and expected levels of land-disturbing activities inside the park (installation and/or maintenance of picnic tables or grills, and trail use for instance), and the effects were compared to Alternative A. In addition, information on wildlife was evaluated based on the professional judgment of NPS staff. The primary sources of information used in this analysis include NPS faunal species inventories, research, NPS policy documents, and unpublished observations and insights from knowledgeable park staff. The area analyzed for possible effects on wildlife incorporates Buck Island and the surrounding waters.

The major assumption used in the analysis of effects on wildlife were that: (1) increased visitor use and access to Buck Island could potentially translate to greater impacts to terrestrial wildlife through increased picnic area and trail usage; (2) construction activities (e.g., installation of additional picnic tables or trail expansion) would be minimal under all alternatives given the fragile soil conditions and sensitive habitat present on Buck Island; and (3) under all alternatives, best management practices for construction would be implemented on any construction project proposed by the park and potentially adverse effects of construction on wildlife would be minimized by implementation of site-specific mitigation specified in environmental assessments tied to this general management plan/environmental impact statement. Effects of individual projects on wildlife would be effectively assessed, and mitigation measures employed.

Impact Threshold Definitions

The thresholds to determine the intensity of impacts on wildlife are defined as follows:

Negligible: Native wildlife species, their habitats, and the natural processes sustaining them would not be affected or the effects would be at or below the level of detection. Effects would not be of any

measurable or perceptible consequence to wildlife populations. Habitats would retain adequate ecological integrity to support a full complement of native fish and wildlife species.

Minor: An action would result in detectable effects to species and/or their habitats, but changes would not be expected to result in substantial population fluctuations, their habitats, or the natural processes (e.g., competition, dispersal). Occasional responses to disturbance by some individuals could be expected but without interference to feeding, reproduction, or other factors affecting population levels.

Moderate: An action would result in detectable effects on native wildlife, their habitats, or the natural processes sustaining them. Key processes such as dispersal, competition, and/or predation may experience disruptions that would alter population size and/or distribution, but would return to natural conditions after initial disturbance. Sufficient habitat would remain functional to maintain viable native fish and wildlife populations.

Major: An action would result in detectable effects on native wildlife, their habitats, or the natural processes sustaining them. Key processes such as dispersal, competition, and/or predation would be altered permanently. Adverse responses to disturbance by some individuals would be expected, with negative impacts on feeding, reproduction, or other factors, resulting in a long-term decrease in population numbers and genetic variability. Habitats may not remain functional for maintaining viable fish and wildlife populations.

Duration: Short-term: The effect would occur only during or shortly after a specified action or treatment. Within a year or less, conditions would be similar to those that predominated previously.

Long-term: Species would continue to be affected beyond one year's time, and/or conditions would not be similar to those that predominated previously.

Impacts of Alternative A

Birds use Buck Island for foraging and nesting as described in Chapter 3, Affected Environment. Continuation of recreational use of the island and the marine environment would cause many shorebirds, upland birds, waterbirds, and waterfowl to avoid areas with visitor activity due to human presence and associated noises, sights, vessels, recreational devices, or scents. Because of the rugged terrain on the interior of the island, the number of visitors to the interior is limited, and the impact of flushing and stress would not be as pronounced as it would be near the beach.

Disturbance by beach goers, people picnicking near the salt pond, and hikers can reduce the amount of time birds spend foraging and can result in flushing birds from nesting areas. Studies show that the number and proximity of people and their activities reduce the amount of time that species of sandpipers spent foraging (Ingle et al. 2003). The disturbances could result in physiological effects related to the altered behavior. Flushing that would lead to reduced foraging success of birds may result in reduced reproductive success. Visitors walking along the shoreline impact foraging plovers, sandpipers, and oystercatchers, as birds are flushed each time visitors pass; this typically occurs along the south shore coral cobble area. The presence of moorings on the eastern end of the monument at the underwater trail and SCUBA moorings may result in reduced foraging time by birds that feed on fish due to avoidance of the area or as a result of a change in the distribution of prey species. Brown pelican, osprey, and magnificent frigate bird foraging, nesting, and roosting occurs along the north shore above the lagoon, adjacent to but separated from the underwater trail area. Anchoring at the southwestern end of the island would have no overall long-term effect on fish species abundance and distribution that waterbirds feed upon. Overall, effects of disturbance from visitor use activities in the marine environment and on the island would have short- and long-term, minor, adverse effects to shorebird, waterbird, and waterfowl foraging, as the effects would be measurable but would not affect population levels in the monument.

Impacts on reptiles on the island, such as the St. Croix anole and the dwarf gecko, would occur from visitor access to forested and xeric habitats, respectively, on the island's hiking trail and any intrusion into forested habitats off-trail or from the beach. The presence of visitors would cause disturbance and result in temporary displacement of lizards but would not be expected to affect breeding and foraging behaviors. Because of the ruggedness of the area, the number of visitors to the interior of the island is limited, and the impact of disturbance on reptiles would be short-term, negligible, and adverse as individuals would be affected without resulting in population level changes.

Ghost crabs and hermit crabs spend a portion of their time on land. Adverse effects to these species would occur as a result of continued use of park beaches for recreation. Research on ghost crabs shows that higher densities of crabs occur in areas with fewer people (Cooper et al. 2005). The ghost crab is considered to be an indicator species of human interaction – the more holes, the less the impact by humans, unless food is introduced. Recent research shows that burrows of ghost crabs are more abundant in areas with less recreational activity, but the exact reasons why are unknown at this time (Barrows 2001). However, other research shows that pedestrians do not have harmful effects on ghost crabs and that densities were higher in areas with people, possibly due to the presence of food scraps (Leatherman (1981) as cited in Ingle et al. 2003). Bow and stern anchoring may disturb ghost crab burrows by accidentally disturbing them, thereby displacing some crabs. Continuing use of the beaches on the island would result in long-term, negligible, adverse effects along the beach, because few individual crabs may be displaced or trampled, but overall abundances of crabs would not be affected.

Other terrestrial invertebrates, which include insects and other species without a backbone, may be displaced or disturbed by human activity on the island; however, there is suitable habitat adjacent to visitor use areas that would provide habitat and forage and there would be no impacts at the population level. Therefore, Alternative A would have long-term, negligible, adverse effects on terrestrial invertebrates.

The overall effect on wildlife under Alternative A would be short- and long-term, negligible to minor, and adverse.

Cumulative Effects

Other on-going management actions to remove non-native vegetation, maintenance of trails, and limited island infrastructure would result in short-term, negligible to minor, adverse effects to wildlife from noise and presence of humans that may cause individuals to be displaced or avoid areas for short periods.

Restoration programs on the island would have long-term, moderate to major benefits to wildlife. Large areas of Buck Island, approximately 75 acres or 33 percent of the island (NPS 2006b; 2010) would be treated under the non-native plant removal project. This level of native habitat restoration would have moderate benefits to wildlife species that use the forested and shrub land habitats.

Eradication of non-native mongoose and tree rats on the island has also had a moderate to major beneficial effect on wildlife species on the island. Prior to eradication, these non-native species adversely affected ground-nesting shorebirds, native trees, and shrubs. As a result, native wildlife species are recovering. The non-native house mice population is also increasing as a result of the mongoose and rat eradication. As such, NPS plans to implement an eradication and/or control program to reduce or eliminate the effects of house mice on native wildlife species. Eradication of these non-native species on the island improved conditions thereby making it possible to re-introduce the endangered St. Croix ground lizard to Buck Island. Removal of non-native species and restoration of native species provides long-term, moderate beneficial effects.

Long-term effects from climate change including sea level rise, acidification, temperature increases, coral reef effects, and increased storm activity would have adverse effects on wildlife foraging, nesting,

and reproduction that cannot be quantified due to lack of available data and a thorough understanding of the interrelationships of all the effects.

Overall restoration programs and successful management of the monument's resources has led to long-term, moderate benefits. The short- and long-term negligible to minor adverse effects of Alternative A would not reduce these benefits. The overall cumulative effects on wildlife as a result of implementation of Alternative A in combination with other past, on-going, and future plans, projects, and activities would be long-term, moderate, and beneficial.

Conclusions

The impacts on wildlife would be short- and long-term, negligible to minor, and adverse as a result of terrestrial disturbances and visitor use of the island. Wildlife species would be disturbed due to visitor use of the island which may cause flushing from nests and foraging areas. Shorebirds, waterfowl, and waterbirds may be additionally affected as a result of potential collisions and changes in prey distribution as a result of boating activities, including mooring and anchoring. Cumulative effects of Alternative A in combination with other projects, plans, and actions would be long-term, moderate, and beneficial.

Impacts of Alternative B, the Preferred Alternative

Continued use of the monument for recreational purposes would have the same effects as described for Alternative A for wildlife. Potential development on the island, such as limited new trails, would result in a loss of habitat and displacement of individuals. Trail development could result in introduction of visitors into new previously undisturbed environments, which would result in the disturbance of wildlife in localized areas. Increased visitor use of the island's interior could also result in the spread of non-native plants into newly developed areas, thereby degrading habitat. Limited use of the island for hiking reduces the potential for this occurrence. Trail development and the potential for increased use of the island would have long-term negligible to minor adverse effects on birds, reptiles, and terrestrial invertebrates, assuming that trail development would be limited and that suitable adjacent habitat for foraging and nesting would be available.

Benefits to bird species from phasing out the existing anchoring area under this alternative would be offset by the use of vessels at new mooring sites. Development of additional mooring sites along the western portion of the island and for resource management purposes would cause short-term changes in distribution of fish species, but would not affect the overall availability of prey species for piscivorous birds (those that feed on fish). Waterbirds would avoid the area during mooring installation and while vessels are present, resulting in short-term, minor, adverse effects.

Under this alternative, a Marine Hazard Zone would be created that would prohibit recreational vessel use in this zone and limit the type and variety of visitor activity north and southeast of the island outside the underwater trail area. This zone would eliminate vessel-related effects to wildlife in this zone and reduce disturbance of waterbirds and waterfowl by visitors. In addition, protection of this area would increase fish abundance and distributions due to a lack of boating and recreational disturbance. Management of marine resources in this zone and the Resource Protection Zone would increase food availability for piscivorous bird species, which could lead to increased reproduction and success of populations. Development of these zones, along with increased ranger presence associated with increased staffing levels, would have long-term moderate benefits.

Enhanced research and monitoring of resources in the Resource Protection and Marine Hazard Zones within the monument would allow staff to detect impacts of monument use on wildlife, their habitats, and prey species or food sources more readily. Increased educational activities would enhance visitor knowledge and associated opportunities for stewardship and protection of wildlife. Management actions would be taken as needed to reduce visitor impacts on wildlife and wildlife habitats. Overall, Alternative B would have long-term, minor beneficial impacts to wildlife.

Cumulative Effects

The long-term moderate cumulative benefits of resource protection actions, restoration projects, and non-native species management programs would be the same as discussed in Alternative A. Short-and long-term negligible to minor adverse effects of Alternative B from potential installation of trails and moorings would not reduce these benefits. In addition, Alternative B, through management of marine resources in designated management zones and enhanced research and monitoring and outreach programs, would have overall moderate benefits to wildlife species that rely on marine resources for forage. The overall cumulative effects on wildlife and wildlife habitat as a result of implementation of Alternative B in combination with other past, on-going, and future plans and projects would be long-term, moderate to major, and beneficial.

Conclusions

Overall, Alternative B would have a long-term, minor benefit to wildlife, primarily due to creation of the Marine Hazard Zone, which would eliminate vessel-related effects to wildlife in this zone and reduce disturbance of waterbirds and waterfowl by visitors and increase fish abundance. Cumulative effects of management actions under Alternative B in combination with other past, on-going, and future projects, plans, and actions, would be long-term, moderate to major, and beneficial.

Impacts of Alternative C

The effects of visitor use of the monument and potential development of new trails in the Island Discovery Zone on the island would have the similar types of adverse effects on birds, reptiles, and terrestrial invertebrates as described for Alternative B. Designation of a Marine Hazard Zone and a Resource Protection Zone and enhanced research and monitoring of resources in these zones under Alternative C would also have similar types of beneficial effects as described under Alternative B. The increased number of vessels and therefore visitors to Buck Island proposed under Alternative C may increase the level of wildlife disturbance, particularly in high use areas such as West Beach during peak periods of visitation. Results would be similar to Alternative A, however, since the increase is slight (five additional vessels) and would be offset by creation of zones, and other measures mentioned above.

Under Alternative C, a two-acre Anchoring Zone and additional mooring sites off the western portion of the island would result in short-term displacement of fish that waterbirds forage upon. The placement of five additional anchoring locations in deep sand would result in negligible effects on fish as a result of loss of habitat, with negligible effects on wildlife. Therefore, there would be minor short-term adverse effects on prey species for foraging waterbirds during installation of moorings and during vessel use and activity in the Anchoring Zone. Overall, Alternative C would have long-term, negligible beneficial effects on wildlife.

Cumulative Effects

The long-term moderate cumulative benefits of resource protection actions, restoration projects, and non-native species management programs would be the same as discussed in Alternative A. Short-and long-term negligible to minor adverse effects of Alternative C from installation of trails and installation of moorings would not reduce these benefits. In addition, Alternative C, through management of marine resources in designated management zones and enhanced research and monitoring and outreach efforts, would have overall moderate benefits to wildlife species that rely on marine resources for forage. The overall cumulative effects on wildlife and wildlife habitat as a result of implementation of Alternative C in combination with other past, on-going, and future plans, projects, and activities, would be long-term, moderate to major, and beneficial.

Conclusions

Alternative C would have similar impacts on wildlife as Alternative B, but slightly less beneficial due to the creation of the Anchoring Zone and increased number of vessels and visitors resulting in an overall long-term, negligible beneficial effect. Cumulative effects of Alternative C in combination with other past, on-going, and future projects, plans, and actions would be long-term, moderate to major, and beneficial.

Impacts of Alternative D

The same types of effects described for Alternative C are applicable to Alternative D. The increased capacity created by the increased acreage for anchoring and installation of moorings would result in an increased potential disturbance associated with human presence, particularly at highly visited areas such as West Beach. The designation of a Marine Hazard Zone and a Resource Protection Zone and enhanced research and monitoring of resources in these zones under Alternative D would also have the same beneficial effects as described under Alternative C. Although there would be an increase in park staff, the increase in the number of vessels and likelihood of disturbance associated with more visitors would be greater than Alternative A. Because there would be an increase in adverse effects associated with human presence, the overall result would be long-term, negligible adverse effects to wildlife.

Cumulative Effects

The same cumulative effects described for Alternative C are applicable to Alternative D. Overall cumulative effects on wildlife and wildlife habitat as a result of implementation of Alternative D, although there would be an increase in the number of vessels and therefore visitors, when taken in combination with other past, on-going, and future plans, projects, and actions, would be long-term, moderate to major, and beneficial.

Conclusions

Alternative D would have similar impacts on wildlife as Alternative C, but slightly less beneficial due to the creation of a larger Anchoring Zone under Alternative D resulting in overall long-term, negligible adverse effects. Cumulative effects of Alternative D in combination with other past, on-going, and future projects, plans, and actions would be long-term, moderate to major, and beneficial when compared to Alternative A.

MARINE AND COASTAL RESOURCES

Regulations and Policies

The regulations and policies that guide the NPS actions with respect to marine and coastal resources are presented in Appendix B.

Methods

The impact assessment is organized according to the resource subcategories identified in Chapter 3, including communities of shallow coral reef (including patch reefs and haystack formations), seagrass and algal plains, sand bottom, deep reef and wall reef, deep water abyssal bottom, and deep water oceanic/pelagic. Impacts to corals are addressed under “shallow coral reef communities,” and impacts to elkhorn and staghorn coral, specifically, are addressed in the “Species of Concern” section of this chapter. The impact assessment is based on issues regarding marine and coastal resources identified during public meetings and planning workshops, and includes:

- Potential effects of anchoring and accidental vessel groundings on marine and coastal resources. These types of effects would include, for example, disturbance of seagrass rhizomes

by vessel anchors, crushing of benthic invertebrates such as *Calianassa* by vessel anchors, or breakage of corals caused by accidental groundings on reefs.

- Potential effects of installation of moorings on marine and coastal resources. These types of effects would include physical disturbance of sand bottom or seagrass habitat and organisms during placement of sand anchors or other devices used to anchor moorings.
- Potential effects of recreation on marine and coastal resources. These would include, for example, effects of touching, bumping, or breakage of corals by snorkelers (particularly at the underwater trail) and/or SCUBA divers at the SCUBA moorings, effects of snorkeling, SCUBA diving, and vessel movement on behavior of marine animals. Effects of pollutant discharges or releases from vessels and visitors in the anchoring and mooring areas are addressed under the “Water Resources” section. Effects on marine organism are addressed in this section. (Note: pollutant discharges or releases include spilled or leaking vessel fuel and oil, bacterial contamination from swimmers or sewage illegally discharged from vessel holding tanks, unauthorized bilge water pump-out, disposal of trash at sea by vessel owners, leaching or sloughing of vessel bottom paint, and sunscreen, insect repellent, or other products used by visitors. These types of pollutants are hereafter referred to pollutant discharges or releases).

Climate change is expected to impact coral reef communities by increasing the frequency of extreme water temperature events (that result in coral bleaching, as summarized in Chapter 3), ocean acidification, sea level rise, and major storms. The 2005 temperate increases, coral bleaching and disease outbreaks resulted in 41 to 79 per cent live stony coral cover at monitored reefs in the Virgin Island parks. Changing climate conditions in which coral reefs have lived in the Caribbean for millennia are rapidly changing. Global climate change models predict that for the year 2070, the air temperature in the Caribbean will rise between 2 ° and 4 °Celsius, with the greatest changes occurring in the northern Caribbean and around continental borders (IAC et al. 2009). Because current levels of sea surface temperature are already close to the upper temperature threshold for the survival of corals, it is projected that for the year 2020, coral bleaching will become an annual event in the Caribbean (IAC et al. 2009). Other impacts include damages caused by hurricanes and storms, which are becoming more frequent, rising sea levels, reduction of potential calcification (increased acidity of water), and diseases.

These and other changes due to climate change are addressed under cumulative effects. However, the detailed nature and interrelationships of these cumulative effects are not understood at the present time. The various potential interrelationships of these factors will be assessed during future research and monitoring programs conducted by the NPS, National Oceanic and Atmospheric Administration, other agencies, the University of the Virgin Islands, and other organizations, colleges and universities. A summary of the cumulative effects of climate change is presented in the introduction of Chapter 4 as well as Appendix D.

Effects associated with anchoring, mooring, and recreation were addressed for each alternative by making qualitative estimates of: (1) differences in the numbers of vessels that would anchor or moor in different areas of the park; (2) relative size and location of anchoring and mooring areas; (3) relative effects of anchoring versus mooring on the bottom; and (3) relative numbers of visitors who would be expected to boat, swim, snorkel, or SCUBA dive under each alternative in different areas of the park, as determined by zones and prescriptions. This information was summarized for each action alternative (Alternatives B, C, and D) and the potential effects on marine and coastal resources were then assessed and compared with Alternative A. Cumulative effects are discussed at the end of this section and address all community subtopics (shallow water coral reef; sand bottom; seagrasses and algal plain; deep reefs and wall reefs; deep water abyssal bottom, and deep water oceanic/pelagic).

The major assumptions used in this analysis were that: (1) potential direct effects on marine and coastal resources would increase according to the number of vessels and visitors that use a given area

of the park; (2) effects on marine resources resulting from park use would be concentrated primarily in the relatively select areas used for moorings or anchoring; (3) installation and use of moorings would have a beneficial effect on marine resources as compared with anchoring because moorings are attached to the bottom by a small device such as a sand screw, which has a very small footprint. Anchors result in repeated disturbance of the bottom every time they are used, affect a larger area of the bottom than moorings, and can drag if not placed properly; (4) despite implementation of NPS management programs of research and monitoring, enforcement, and education and outreach programs, some activities in the park would continue to result in adverse effects on marine and coastal resources. These would include illegal taking of fish and shellfish, accidental or emergency vessel groundings and anchoring, pollutant discharges and releases, and accidental breaking of corals related to swimming, walking in shallow water, snorkeling, and SCUBA diving; and (5) expansion of park management programs would serve to offset the various potentially adverse effects of anchoring, mooring and recreational activities in the park. For example, additional staff proposed under the action alternatives would have a beneficial effect on marine and coastal resources through increased research and monitoring, enforcement, education and outreach, and partnering efforts.

The analysis is based on available published and unpublished scientific papers, agency research reports, planning documents, agency databases and mapping efforts, and consultation with NPS specialists. The area analyzed for possible effects on marine and coastal resources include the marine waters and bottom habitats within the park. The area of possible effect used in the cumulative analysis corresponds to the marine waters and benthic habitats of the park, surrounding waters, and nearshore areas (for example, the eastern end of St. Croix), and for issues such as climate change and temperature effects, the area of affect encompasses the park, while acknowledging that increases in water temperature and other related climate changes are happening on a world-wide scale.

Under all action alternatives, best management practices would be implemented on any proposed park project, and potential adverse effects on marine and coastal resources would be addressed under site-specific mitigation measures identified in environmental assessments tiered to this general management plan/environmental impact assessment. Effects of individual projects on marine and coastal resources would therefore be effectively assessed and mitigation measures employed.

Impact Threshold Definitions

Impact threshold definitions for marine and coastal resources (communities such as shallow coral reef, seagrass and algal plains, sand bottom, deep reef and wall reef, deep water abyssal bottom, and deep water oceanic/pelagic) are as follows:

Negligible: Coral reefs and other marine communities would not be affected or the effects would be at or below the level of detection, and the changes would be so slight that they would not be of any measurable or perceptible consequence to diversity, abundance, or health. Coral reefs and other marine communities would retain adequate ecological integrity to support a full complement of dependent or associated plants and animals.

Minor: Effects on coral reefs and other marine communities would be detectable, although the effects would be localized. Disturbance to individuals may occur, but perceptible changes to the overall abundance and diversity of coral reefs and other marine communities would not be expected. Habitats would retain adequate ecological integrity to support a full complement of dependent or associated plants and animals.

Moderate: Effects on coral reefs and other marine communities would be readily detectable resulting in a small but perceptible reduction in abundance and a decline in species diversity. Actions would result in creation of conditions that would inhibit feeding and decrease substrate availability. Coral reefs and other marine communities would return to natural conditions after initial disturbance and

sufficient habitat would remain functional to support plant and animal populations that are dependent on them.

Major: Effects on coral reefs and other marine communities would be readily detectable resulting in a large and substantial reduction in abundance and a decline in species diversity and abundance. The effects would alter the function of the habitat needed to support coral reefs and other marine communities.

Duration: Short-term: Recovers within one year.
Long-term: Takes more than one year to recover.

Impacts of Alternative A

Shallow Water Coral Reef Community

Alternative A features the continued regulation of anchoring in deep sand within the existing designated anchoring area at West Beach. Since no reefs occur in this part of the park, anchoring would have no adverse effects on the shallow water coral community. Up to eight new moorings for administrative use would be installed under Alternative A, and would be installed in areas that do not impact the shallow water coral community.

Occasional accidental groundings of vessels on shallow coral reefs would continue to occur under Alternative A. The probability of groundings on reefs would be the greatest on shallow reefs in areas north, northwest, and southeast of the island. In these areas, reefs often reach the water's surface posing a navigational safety hazard, as well as a threat of significant ecological damage to these valuable reef habitats should a vessel contact the reef. Marine wildlife such as sea turtles, sting rays, and dolphins can also be inadvertently struck by vessel propellers or hulls. These types of activities would have adverse effects on the shallow water coral community, but are expected to be relatively infrequent. Accidental spills of oil and gasoline from vessels, pollutant discharges and releases (as previously defined) in mooring and anchoring areas would also continue, with resulting adverse effects on water quality and exposure of marine organisms to contaminants.

Under Alternative A, continued snorkeling and SCUBA diving on the coral reefs at the underwater trail and SCUBA moorings, respectively, would continue to have adverse effects resulting from inadvertent touching, bumping, and accidental breaking of coral. Visitors would continue to swim and snorkel in the vicinity of West Beach and would have access to shallow patch reefs located in the vicinity as well as the shallow lagoon. This would result in continued touching, bumping and accidental breaking of corals in patch reefs in these areas.

Effects of anchoring and recreation would occur in a limited area of the park. Existing levels of research and monitoring, enforcement, education, outreach, and partnering efforts would continue. Staff limitations and funding constraints would likely continue into the future, resulting in constraints on the level of staff activity and presence near the shallow reef community. If monitoring results indicated that anchoring and recreation were having adverse effects on the health of the shallow coral reef community, management practices would adapt to reduce, avoid or minimize these effects where possible with existing staff resources and funding. These changes would be made in accordance with the Proclamation and all applicable laws, NPS regulations and management policies.

In summary, under Alternative A, continued authorized and unauthorized vessel anchoring, continued use of moorings, incidental vessel groundings, pollutant discharges and releases, and direct physical contact between snorkelers and SCUBA divers with corals, would result in long-term, moderate adverse effects on the shallow coral reef community in certain areas of the park. Research and monitoring, enforcement, education, outreach, and partnering efforts would likely continue to be constrained by staffing limitations and funding.

Sand Bottom Community

Under Alternative A, anchoring off West Beach would continue to be limited by the NPS to deep sand areas. These areas are dominated by benthic invertebrates and fish associated with the sand bottom community type. Fish, free swimming, can escape the effects of anchors placed in these areas, however there are several species of fishes that make shallow burrows in the sand that will be damaged by anchors. Benthic invertebrates such as *Calianassa* worms that live in deep sand areas can be crushed by anchors placed in the sand, or by anchors that drag across the sand bottom. Shoreline bow and stern anchoring in areas dominated by the sand bottom community would continue at West Beach under Alternative A. Similar effects from anchor drags and bow and stern anchoring on benthic invertebrates would occur in these areas. Installation of a maximum of eight new administrative-use moorings would have minor adverse effects on sand bottom communities through physical disturbance limited in extent by the area affected by the placement of the mooring equipment, and the short term period during installation.

Pollutant discharges and releases would continue to occur in the anchoring and mooring areas, with resulting adverse effects on water quality and marine resources (see also, “Water Resources” section). At West Beach, this would have an adverse effect on the sand bottom community by directly exposing organisms to contaminants in the water column. These types of effects would be expected to be in areas with higher vessel use, with negligible to minor adverse effects.

Snorkeling and SCUBA diving activities would have no effect on sand bottom communities since these types of recreational activities do not result in disturbance of this type of habitat. People walking and swimming in shallow water in the vicinity of West Beach would disturb the sand bottom community in this area. Impact to the high energy, shallow shoreline sand community would be minimal as the dynamics of the area limit permanent plant and animal community establishment. The wash zone in this area consists mainly of invertebrates, ghost crabs and small crustaceans. Shoreline activities (walking, swimming) have minimal disturbance as sandy areas are constantly being changed by tidal cycles and wave action. These types of activities would therefore have an overall minor, adverse effect on the sand bottom communities in the park.

Effects of anchoring and recreation would occur in a limited area of the park. Effects would be minimized by continuation of the existing research and monitoring, enforcement, education, outreach, and partnering efforts. If research and monitoring results indicate that anchoring and recreation were having adverse effects on the health of the sand bottom community, management practices would adapt to reduce, avoid, or minimize these effects. These changes would be made in accordance with the Proclamation and all applicable NPS regulations and management policies.

In summary, under Alternative A, continued authorized and unauthorized vessel anchoring, visitor use such as walking and swimming, and pollutant discharges and releases (as previously defined) within the designated anchoring area, would result in long-term, moderate, adverse effects on the sand bottom community. Research and monitoring, enforcement, education, outreach, and partnering efforts would likely continue to be constrained by staffing limitations and funding.

Seagrass and Algal Plain Community

Anchoring adversely affects seagrasses by destroying their underground system of stems (rhizomes), which in turn causes sediments to destabilize and erode. Some seagrasses, such as turtle grass, have a relatively slow rate of growth, and recovery of damaged stems can take several years. Other species such as manatee grass have a relatively rapid rate of growth. For example, rapid regrowth of this species in the Buck Island channel was observed between 1971 and 1999 (Kendall et al. 2004a). However, over time, continued use of anchors in seagrass beds destroys existing beds and also prevents damaged beds from reestablishing themselves.

Under Alternative A, seagrasses would continue to be protected from effects of anchoring by requiring anchoring in deep sand within the designated area. The ability of park staff to monitor seagrass in the vicinity of the anchoring area, and periodically update permit holders as to where anchoring is appropriate to avoid seagrass impacts would continue to be limited by availability of park staff. The abundance and distribution of seagrasses within the designated area would continue to be affected by natural factors, including waves and currents and movements of sand during periodic storms. Unauthorized and emergency anchoring, both inside and outside the designated anchoring area, would also have a minor adverse effect on seagrasses. Because of staffing limitations, enforcement of anchoring within the designated area is not conducted on a consistent basis. Therefore, adverse effects on seagrasses would likely continue to occur both inside and outside of the designated anchoring area. These types of effects would occur in a limited area of the park, and would affect a small percentage of the total area of seagrasses that are present. NPS would avoid seagrasses when locating a maximum of eight new administrative-use moorings, thereby avoiding impacts where possible. If determined to be necessary for management purposes, minor adverse effects on seagrasses or algal plain communities through physical disturbance would be limited to the period of installation and the footprint of the mooring equipment.

Accidental spills, pollutant discharges or releases (as previously defined) would continue to occur in the designated anchoring area, which would directly expose seagrasses to contaminants in the water column in these areas. These types of effects would occur in a limited area of the park. Research and monitoring, enforcement, education, outreach, and partnering efforts would likely continue to be constrained by staffing limitations and funding. Seagrass cover is very sparse in the mooring area at the underwater trail, so these types of effects would not be expected to occur in this area of the park.

Swimming and snorkeling within the designated anchoring area and the mooring area at the east end of the island would continue at present levels under Alternative A. These types of recreational activities would result in some direct physical disturbance of seagrasses in the designated anchoring area. Because these types of effects would occur in a limited area of the park, they would affect a small percentage of the total area of seagrasses that are present. It is unlikely that snorkeling would have any effect on seagrasses within the mooring area on the east end of the island since seagrass cover is sparse, and these types of activities typically do not adversely affect seagrasses. SCUBA diving does not typically occur in areas where seagrasses are present and is not expected to cause adverse effects.

The algal plain community does not occur in the areas in which anchoring would be allowed. Effects on this community type would be limited to occasional unauthorized, accidental or emergency anchoring in shallow water areas of the back reef.

Existing NPS monitoring, education, outreach, and partnering efforts regarding seagrasses would be maintained under Alternative A. Since these efforts would not be expanded under Alternative A, the potential for adverse effects of anchoring on seagrass beds would likely continue at existing rates, and would not be expected to be reduced compared to existing conditions.

In summary, under Alternative A, continued authorized and unauthorized vessel anchoring, spills, vessel related pollutant discharges and releases within the designated anchoring area, and visitor use activities would result in long-term, moderate, adverse effects on the seagrass community in a limited area of the park.

Deep Reef and Wall Reef Community

Continuation of large vessel access along the northern boundary of the park presents a continued threat from potential oil spills, groundings of large vessels, and illegal dumping of bilge water. These events could potentially affect the deep water and wall reef community, since pollutants could be transferred to these areas through the food chain or by physical circulation patterns. Illegal fishing would likely also continue to occur in deep reef areas. Limitations of available staff and enforcement

under Alternative A would result in continued limitations of enforcement of the regulations and NPS policies. Overall, Alternative A would result in long- and short-term, minor, adverse effects to the deep reef and wall reef community.

Deep Water Abyssal Bottom Community

Deep abyssal depths of 1000 feet occur within ½ to 1 mile of Buck Island making the park one of the only parks with this type of bottom community present. Research of this area of the park is underway, as NPS and the National Oceanographic and Atmospheric Administration have conducted video and multibeam sonar surveys of this area of the park. It is unlikely that human activity in the park would greatly affect this community, however data is not available to quantify existing types of use, number of vessels, or class of vessels in this area of the park. Based on existing information, there would be long- and short-term, negligible adverse, effects on the deep water abyssal bottom community under Alternative A.

Deep Water Oceanic/Pelagic Community

Vessel access along the northern boundary of the park within the deep water oceanic pelagic community would continue to occur under Alternative A. Smaller vessels coming from St Croix or other islands would also continue to have access to this part of the park. Under Alternative A, this community would therefore be subject to a continued threat from illegal fishing of pelagic species, pollutant discharges or releases, or other pollutants from large vessel groundings in shallow water areas with transport of pollutants to deep water communities, and illegal dumping of wastes such as bilge water in deep water areas. Continuation of existing management practices under Alternative A would result in continued limitations of enforcement of the regulations and NPS policies due to limitations in available staff and enforcement efforts in the deep water oceanic/pelagic community due to the distance of travel necessary to enforce park policies. Overall, Alternative A would result in long- and short-term, minor adverse effects on the deep water oceanic/pelagic community.

Cumulative Effects

A variety of past, on-going, and future plans, projects, and actions would have effects on coral reefs and other marine communities within park boundaries. These would include the following:

- Past, on-going, and future permitted and unauthorized anchoring of vessels in areas of deep sand off West Beach in shallow water areas have an adverse affect on sand bottom and seagrass communities in this area. Vessels in the anchoring area would also continue to experience pollutant discharges and releases with associated adverse effects on the seagrass and sand bottom communities. Unauthorized anchoring outside of the designated area would continue to affect corals, seagrasses and sand bottom communities;
- Use of the existing underwater trail moorings and SCUBA moorings would result in continued effects on corals through bumping, breaking and touching of corals in this area, as well as adverse effects on fish and sea turtle behavior. Moored vessels would also continue to result in pollutant discharges and releases with associated adverse effects on the shallow coral community;
- Operation of vessels in the area along the north, northwest and southeast sides of Buck Island where reefs are at or very near the surface would continue to result in occasional accidental vessel groundings on shallow reefs, with adverse effects on corals;
- Maintenance and operation (and initial installation) of the dock, toilets, and picnic facilities at West Beach and Diedrich's Point, and use of the upland trails and observation tower cause limited amounts of erosion to occur on Buck Island. However, based on monitoring by park staff, these actions have had negligible effects on marine and coastal resources. Under Alternative A, no new facilities would be constructed on Buck Island in the future and

therefore there would be no related effects to coral reefs and other marine communities in the park;

- Under the non-native plant removal project, approximately 75 acres or 33 percent of the upland portion of the Buck Island (NPS 2006b; 2010) would be managed to control non-native invasive plants using mechanical removal and chemical herbicides. Control of non-native plant species on Buck Island has had no adverse effects on marine and coastal resources (NPS 2006b), and this would continue to be the case into the future. Removal of other invasive species would also continue to occur as staff and funding allows.
- Natural resources monitoring, research, and documentation would continue to occur as described in Chapters 1 and 3, as well as coordination with agencies, park partners, researchers, and others as staff and funding allows;
- Past fishing practices have had an adverse effect on the mosaic of marine and coastal resources. Implementation of regulations to protect the marine resource has resulted in the beginning or indications of improvement of marine and coastal resources (NOAA 2008). Illegal poaching presently occurs and is likely to be reduced due to enforcement of the Proclamation; and
- Partnering and education and outreach programs would continue to occur on a limited basis dependent on staffing and funding constraints.

Past, on-going, and future actions in the region surrounding the park (St. Croix and surrounding waters) would continue to occur under Alternative A. These include:

- Point- and non-point source pollution from development on St. Croix (siltation, sedimentation, nutrient enrichment, pesticides, and metals);
- Pollutant discharges and releases as defined in the methods section;
- Marine debris originating outside the park and carried into the park;
- Hurricanes and other storms that cause major changes in the structure and function of marine and coastal resources;
- Various forms of diseases such as white and black band disease, as described in Chapter 3;
- African dust (including its relation to disease effects); and
- Temperature increases, sea level rise, acidification, frequency and severity of storms and other changes related to climate change affect coral and other marine organisms in the park. These changes represent challenging major, adverse, cumulative effects that have been created by factors outside the park and occur on a world-wide scale. These and other effects related to climate change are described in the “Cumulative Impact Assessment” section and Appendix D.

Cumulative effects on coral reefs and other marine communities are therefore related to a wide variety of both natural and man-made factors that are interrelated in various complex ways, many of which are still being investigated and debated. The potential interrelationship between all these factors is not completely understood at the present time. The primary goal of research and monitoring by the NPS and other federal agencies and organizations is to develop improved understanding of these relationships, and to use this information to adapt management actions in the park in the most effective manner.

Cumulative effects would be offset to the extent possible via implementation of various NPS enforcement, research and monitoring, and education and outreach efforts. For example, regional implementation of education and outreach programs such as those outlined in Chapter 1 have the potential to benefit coral reefs and other marine communities in the park by promoting awareness of the importance of resource preservation and best management practices. NPS would continue to conduct research and resource research and monitoring under Alternative A. However, due to staffing and funding limitations, there would be no expected increase in the levels of these efforts under

Alternative A. Other plans as identified in Chapter 1 would also be prepared, including a vessel management plan that would specify terms and conditions for vessel use in the park. These plans would be created based on management approaches that maximize protection of resources in the park. Despite all the actions taken by NPS, however, they are likely to be overshadowed by the combined effects of the above factors that are outside NPS control, such as the damaging effects related to climate changes.

In summary, the NPS would therefore continue to conduct research and monitor coral reefs and other marine communities under Alternative A. Current trends of temperature increases, sea level rise, acidification, increased severity of storms and other changes related to climate change affect coral and other marine organisms in the park and would have projected long-term, major, adverse effects that would overshadow management actions taken by the park. Based on scientific studies conducted to date, it is unknown whether recovery of coral populations would be able to outpace the cumulative effects of future damage from hurricanes, bleaching events, temperature increases, sea level rise, acidification, and disease outbreaks. When the beneficial and adverse effects of other past, on-going, and future plans, projects, and activities affecting coral reefs and other marine communities are combined with actions under Alternative A, the resulting cumulative effects would be long-term, major, and adverse.

Conclusions

Under Alternative A, shallow water coral and seagrass and sand bottom communities would continue to be affected by visitor use activities such as boating, swimming, walking in shallow water areas, snorkeling, and SCUBA diving in designated anchoring and mooring areas as well as other areas within the park where recreation occurs. These effects would be associated primarily with touching and bumping of corals and inadvertent coral damage, physical disturbance of sand and seagrass communities by anchors, occasional accidental groundings on reefs, and pollutant discharges and releases from vessels. Contaminants and marine debris originating outside the park also have an adverse effect on coral reefs and other marine communities inside the park. Overall, implementation of management actions under Alternative A would result in long-term, moderate, and adverse effects on shallow water coral and seagrass and sand bottom communities.

Alternative A would have long-term, minor, adverse effects on the deep reef and wall reef community and deep water oceanic/pelagic community and a long-term, negligible, adverse effect on the deep water abyssal bottom community since these communities are so remote.

The NPS would continue to conduct research and monitor coral reefs and other marine communities under Alternative A. Current trends of climate change would have projected long-term, major, adverse effects that would overshadow management actions taken by the park. Based on scientific studies conducted to date, it is unknown whether the recovery of coral populations will be able to outpace the cumulative effects of future damage from hurricanes, bleaching events, and disease outbreaks. When the beneficial and adverse effects of other past, on-going, and future plans, projects, and activities affecting marine and coastal communities are combined with actions under Alternative A, the resulting cumulative effects would be long-term, major, and adverse.

Impacts of Alternative B, the Preferred Alternative

Shallow Water Coral Reef Community

Eventual phase-out of anchoring under Alternative B (with the exception of five designated anchoring locations in deep sand for vessels 91 to 150 feet by permit only) would have no effect on the shallow water coral reef community since anchoring in reefs has never been allowed in the park. Accidental vessel groundings could still occur under Alternative B. Establishment of the Marine Hazard Zone would eliminate use of vessels (except for administrative and research and monitoring purposes) in shallow reefs to the northwest, north and southeast of Buck Island, thereby reducing the potential for

adverse effects of emergency anchoring and/or groundings on the shallow water coral reef community in these areas. This would have a beneficial effect on the shallow water coral reef community. Adverse effects would be minimized through an increase in enforcement staff and patrol activities at the park, establishment of the Marine Hazard Zone, and through an increase in education, outreach, and partnering programs. The effects of an accidental grounding would be long-term, major, and adverse at the point where a grounding occurred; however, the likelihood of such an event would be minimized by the Marine Hazard Zone restrictions on vessel use and increased enforcement and education as to the hazards inherent in this zone.

A maximum of 10 new moorings would be installed southwest of the existing pier under Alternative B. These moorings would be placed in areas of deep sand and low density seagrass cover. Mooring installation would have no effects on the shallow water coral community in this area, since coral reefs are not present. A maximum of 45 new moorings would be installed off West Beach to offset the phased elimination of anchoring under Alternative B. Mooring installation would have no effects on the shallow water coral community in this area, since coral reefs are not present. No new moorings for recreational use would be installed at the east end of the park in the vicinity of the underwater trail under Alternative B. Mooring installation would have no effects on the shallow coral community in this area as a result. Administrative moorings would be installed in areas avoiding shallow water coral reef communities, and would have no adverse effect on these communities.

Under Alternative B, visitors would disembark at West Beach from the 45 moorings via marked beach access channels and/or at the pier. This would allow continued use of the West Beach and pier areas by visitors, similar to Alternative A. Swimming and snorkeling in the vicinity of the sand bottom, seagrass and the nearby shallow water coral communities would continue in the West Beach area. These types of activities are estimated to have minor adverse effects on the shallow water coral reef community in the vicinity of the West Beach similar to those associated with Alternative A, since access to these same areas would be provided from moored vessels under Alternative B.

Visitors using the 10 new moorings southwest of the pier would have increased access to adjacent shallow reefs in the vicinity of the mooring area as compared with Alternative A. This would result in minor adverse effects on reefs in these areas due to the potential for incidental touching and breaking of corals. Continued snorkeling at the underwater trail and SCUBA diving at the SCUBA moorings off the east end of the island would have similar effects as Alternative A on reefs in this area.

Inclusion of a major portion of the southern bank barrier reef in the Marine Hazard Zone would result in more limited uses of this area for recreation. This would result in a beneficial effect on the bank barrier reef by reducing the potential for touching and breaking of coral and by reducing the potential for groundings and damage from propellers. This would have beneficial effects on the shallow water coral reef community in these areas of the park.

Vessel use would continue to result in effects on water quality in the park as described in the "Water Resources" section. Under Alternative B, water quality in the park would be affected by many of the same influences as those described under Alternative A, and the number of vessels that would be accommodated under alternatives A and B would also have similar effects (87 vessels and 72 vessels, respectively). Increased staff proposed for Alternative B would help curb unauthorized pollutant discharges and releases from vessels through increased education and enforcement efforts. These pollutants would have adverse effects on shallow water coral reef communities by exposing marine organisms to contaminants during movement of vessels into and out and staying in the mooring and anchoring areas. Creation of a Marine Hazard Zone under all action alternatives (elimination of vessels in this zone) would significantly decrease the potential for vessel grounding on reefs within the park, reducing the potential for an oil spill within the park boundary. A restriction of vessel size to less than 150 feet in all park waters would also reduce the potential for spills / pollutant discharges and releases in park waters from freighters, tankers, cruise ships, or other large vessels. The effects of

Alternative B on shallow water coral reef communities would be long- and short-term, moderate to major, and beneficial.

Sand Bottom Community

Eventual phase-out of anchoring in the park (with the exception of 5 designated anchoring locations for vessels 91 to 150 feet by permit only, in deep sand) would have a beneficial effect on the sand bottom community off West Beach compared to Alternative A where bow and stern anchoring and anchoring in other deep sand is allowed. The phased elimination of anchoring off West Beach would eventually eliminate anchor drags and other adverse effects associated with off-shore and bow and stern anchoring. Replacing the anchoring area with 45 new moorings at West Beach would cause a short-term, negligible, adverse effect of the sand bottom community during installation. Installation of a maximum of 10 new moorings southwest of the pier would have minor adverse effects on sand bottom communities in this area through physical disturbance limited to the period of installation. Continuation of present mooring practices at the east end of the island would have no adverse effects on the sand bottom community since no new moorings would be installed.

Vessel use would result in minor adverse effects on water quality as described in the "Water Resources" section. Pollutant discharges and releases from vessels could have adverse effects on the sand bottom community in the anchoring and mooring areas similar to Alternative A. However, under Alternative B, these effects would be minimized more effectively as compared with Alternative A, by expansion of the existing park research and monitoring, enforcement, education, outreach, and partnering programs.

In summary, the sand bottom community would benefit from the transition from anchoring to the use of moorings. Installation and use of 45 new moorings at West Beach and 10 new moorings southwest of the pier, continued use of the existing moorings at the underwater trail, and expansion of existing park research and monitoring, enforcement, education, outreach, and partnering programs would have a long-term, moderate to major beneficial effect on the sand bottom community.

Seagrass and Algal Plain Communities

Eventual phase-out of anchoring in the park (with the exception of 5 designated anchorage locations for vessels 91 to 150 feet by permit only) would have a beneficial effect on seagrasses by allowing seagrasses to grow, recover, and expand existing coverage, including the existing anchoring area. Anchors result in repeated disturbance of the substrate and if not placed in deep sand, have the potential for having major adverse effects on seagrasses. Installation of new moorings southwest of the pier would have minor adverse effects on seagrasses in this area through physical disturbance limited to the period of installation.

The abundance and distribution of seagrasses would continue to be affected by periodic storms, waves and currents, and movement of sand, especially during storms. Some emergency anchoring may occur within seagrass beds. Effects on seagrasses and algal plains in these areas would be of lower intensity than Alternative A because management zones, research and monitoring, enforcement, education, outreach, and partnering programs would be expanded under Alternative B.

Pollutant discharges and releases from vessels and recreational use would result in minor adverse effects on water quality in the park as described in the "Water Resources" section. The effects of these pollutants on the seagrass community would be similar to Alternative A. However, under Alternative B, these effects would be minimized more effectively as compared with Alternative A, by expansion of the existing park research and monitoring, enforcement, education, outreach, and partnering programs.

No algal plain community exists in the areas in which anchoring would be allowed or where new moorings would be installed. Alternative B would have no adverse effect on the algal plain community

as a result, and would benefit from increased staffing levels for research and monitoring, enforcement, education, outreach, and partnering programs.

In summary, eventual phase-out of the majority of anchoring throughout the park under Alternative B would have long-term, moderate to major beneficial effects on seagrass and algal plain communities. Expansion of park research and monitoring, enforcement, education, outreach, and partnering programs would be expanded under Alternative B, which would minimize potentially adverse effects associated with vessel use, pollutant discharge and inappropriate anchoring.

Deep Reef and Wall Reef Community

Continuation of ship access along the northern boundary of the park presents a continued threat from potential oil spills during groundings of large vessels and illegal dumping of bilge water, and other pollutant discharges and releases. However, the vessel size limitations (vessels over 151 feet by permit) in the Resource Protection Zone under the action alternatives would allow the NPS to monitor the amount of large vessel traffic, and therefore the potential for these adverse effects to occur in the park, as well as the potential scale of impacts. Spill and grounding events could potentially affect the deep water and wall reef community from other locations, however, since pollutants could be transferred to these areas through the food chain or by physical circulation patterns.

Illegal fishing may continue to occur in deep reef areas. However, enhanced research and monitoring of resources and enforcement activities in the Resource Protection Zone under Alternative B would provide increased awareness as well as enhanced protective measures within park boundaries as compared to Alternative A. Overall, the effects of proposed management actions under Alternative B would be long-term, minor and beneficial.

Deep Water Abyssal Bottom Community

The impacts to the deep water abyssal bottom community would be similar to Alternative A because it is unlikely that human activity would greatly affect this resource. Under Alternative B, however, this community would be included in the Resource Protection Zone, and would be managed to protect all resources, including increased enforcement efforts. Management actions proposed under Alternative B would result in long-term, negligible, beneficial effects.

Deep Water Oceanic/Pelagic Community

Under Alternative B, this community would be included in the Resource Protection Zone, and would be managed to protect these resources. The effects of illegal fishing of pelagic species, pollutant discharges or releases from vessels, releases of oil or other pollutants from large ship groundings in shallow water areas would be similar to Alternative A. However, enhanced research and monitoring of resources and enforcement activities in the Resource Protection Zone within the park would provide knowledge as well as enhanced protective measures within park boundaries. Overall, Alternative B would have long-term, minor, beneficial effects to the deep water oceanic / pelagic community.

Cumulative Impacts

The NPS would conduct research and monitor marine and coastal communities under Alternative B, providing additional protective measures. Implementation of proposed plans, and increased staffing levels would provide increased research and monitoring, enforcement and outreach efforts. However, similar to Alternative A, the current trends of climate change would have projected long-term, major, adverse effects that would overshadow management actions taken by the park. Based on scientific studies conducted to date, it is unknown whether the recovery of coral populations and other communities will be able to outpace the cumulative effects of future damage related to climate changes such as hurricanes, bleaching events, and disease outbreaks. When the beneficial and adverse effects of other past, on-going, and future plans, projects and activities affecting marine and coastal

communities are combined with actions under Alternative B, the resulting cumulative effects would be long-term, major, and adverse.

Conclusions

Under Alternative B, eventual phase-out of the majority of anchoring in the park would result in a major beneficial effect on marine and coastal communities. Installation of moorings would allow continued visitor access to the island and beach areas, while protecting seagrasses and sand bottom communities from recreational activities. Some adverse effects associated with visitor use on shallow water coral, seagrass and sand bottom communities would occur. The overall effect of Alternative B on the shallow water coral community, sand bottom community, and seagrass community and algal plain would be long-and short-term, moderate to major, and beneficial.

The effects of Alternative B on the deep reefs and wall reefs community would be long-term, minor, and beneficial and the deep water abyssal bottom community would be long-term, negligible and beneficial. The effects of Alternative B on deep water oceanic/pelagic community would be long-term, minor, and beneficial.

Although the effects of management actions proposed under Alternative B differ from Alternative A, the major adverse effects of climate change overshadow the management actions proposed by the park. When the beneficial and adverse effects of other past, on-going, and future plans, projects and activities affecting marine and coastal communities are combined with actions under Alternative B, the resulting cumulative effects would be long-term, major, and adverse.

Impacts of Alternative C

Shallow Water Coral Community

The effects related to anchoring on the shallow water coral community would be similar to Alternative A since anchoring would not be allowed in areas inhabited by shallow coral reefs under Alternative C. Bow and stern anchoring at West Beach would not directly affect coral reefs, which are located at some distance to the north of this area. Some emergency anchoring on shallow reefs elsewhere in the park may occur, however.

Establishment of the Marine Hazard Zone would eliminate use of vessels in shallow reefs to the northwest, north and southeast of Buck Island, thereby reducing the potential for adverse effects of emergency anchoring and/or groundings on the shallow water coral reef community in these areas. Inclusion of a major portion of the southern bank barrier reef in the Marine Hazard Zone would result in more limited uses of this area for recreation. This would result in a beneficial effect on the bank barrier reef by reducing the potential for touching and breaking of coral and by reducing the potential for groundings and damage from propellers. This would have beneficial effects on the shallow water coral reef community in these areas of the park. Adverse effects would be minimized through an increase in enforcement staff and patrol activities at the park, establishment of the Marine Hazard Zone, and through an increase in education, outreach, and partnering programs compared to Alternative A. The effects of an accidental grounding would be long-term, major and adverse at the point where a grounding occurred; however, the likelihood of such an event would be minimized by the Marine Hazard Zone restrictions on vessel use and increased enforcement and education as to the hazards inherent in this zone.

Under Alternative C, visitors would disembark at West Beach from the 45 moorings via marked beach access channels and/or at the pier, or designated Anchoring Zone. This would allow continued use of the West Beach areas by visitors, similar to Alternative A. Swimming and snorkeling in the vicinity of the sand bottom, seagrass and the nearby shallow water coral communities would continue in the West Beach area. These types of activities are estimated to have adverse effects on the shallow water coral reef community to the north of West Beach similar to those associated with Alternative A, since

access to these same areas would be provided by a similar number of vessels and therefore visitors to nearby shallow water coral communities (92 vessels under Alternative C, compared to 87 vessels under Alternative A).

Visitors using the 10 new moorings southwest of the pier would have improved access to adjacent shallow reefs in the vicinity of the mooring area as compared with Alternative A. This is not expected to increase snorkeling activity on the shallow reefs east of the pier.

Vessel use would continue to result in effects on water quality in the park as described in the "Water Resources" section. Under Alternative C, water quality in the park would be affected by many of the same influences as those described under Alternative A, and the number of vessels that would be accommodated under alternatives A and C would also have similar effects (87 vessels and 92 vessels, respectively). Increased staff proposed for Alternative C would help curb unauthorized vessel pollutant discharges and releases through increased education and enforcement efforts. These pollutants would have adverse effects on shallow water coral reef communities by exposing marine organisms to contaminants during movement of vessels into and out, and staying in mooring and anchoring areas.

In summary, the overall effects of management actions under Alternative C on the shallow water coral reef community would be long- and short-term, negligible, and beneficial, due to the establishment of the Marine Hazard Zone and other management zones and additional resource protective measures enforced by an increased workforce.

Sand Bottom Communities

Under Alternative C, use of moorings and limitation of anchoring to a two-acre Anchoring Zone located immediately adjacent to West Beach, primarily for bow and stern anchoring, would minimize the effects of disturbance on the sand bottom community as compared with Alternative A, which features an approximately 22-acre anchoring area. Effects of moorings on the sand bottom community would be beneficial compared to anchoring that would be phased out in the anchoring area provided under Alternative A. Anchors result in repeated disturbance of the substrate and if not placed in deep sand, have the potential for having major adverse effects on sand bottom communities. Installation of new moorings southwest of the pier would have minor adverse effects on sand bottom communities in this area through physical disturbance limited to the period of installation. Sand bottom communities would continue to be affected by periodic storms, waves and currents, and movement of sand, especially during storms.

Pollutant discharges and releases from recreational vessel use would result in minor adverse effects on water quality in the park as described in the "Water Resources" section. The effects of these pollutants on the sand bottom community would be similar to Alternative A based on the number of vessels. However, under Alternative C, these effects would be of lower intensity because management zones, research and monitoring, enforcement, education, outreach, and partnering programs would be expanded under Alternative C.

In summary, the expansion of park research and monitoring, enforcement, education, outreach, and partnering programs under Alternative C would minimize potentially adverse effects associated with vessel use, pollutant discharge and inappropriate anchoring. Overall, Alternative C is estimated to have long-term, minor, adverse effects on the sand bottom community.

Seagrass and Algal Plain Communities

Shoreline bow and stern anchoring would be appropriate within the Anchoring Zone at West Beach. Since no seagrasses or algal plains occur in the Anchoring Zone, bow and stern anchoring would have no adverse effects on these communities under Alternative C. Installation of new moorings off West Beach and southwest of the pier would have minor adverse effects on seagrasses in this area through

physical disturbance limited to the period of installation. The phasing out of anchoring off West Beach would have beneficial effects on the seagrasses in this area, by allowing them to grow, recover and expand existing coverage.

The abundance and distribution of seagrasses would continue to be affected by periodic storms, waves and currents, and movement of sand, especially during storms. Some emergency or unauthorized anchoring may occur within seagrass beds. Effects on seagrasses and algal plains in these areas would be of lower intensity than Alternative A because management zones, research and monitoring, enforcement, education, outreach, and partnering programs would be expanded under Alternative C.

Effects of changes in water quality on seagrass and algal plain communities resulting from recreational activities would be similar to Alternative A, except Alternative C would accommodate more vessels, with a slightly higher potential for adverse effects of vessel discharges and releases. Expanded research and monitoring, enforcement, education and outreach programs would result in minimization of these effects, however. Overall, Alternative C is estimated to have long-term, moderate to major, beneficial effects on seagrass communities.

No algal plain community exists in the areas in which anchoring would be allowed or where new moorings would be installed. Alternative C would have no adverse effect on the algal plain community as a result, and would benefit from increased staffing levels for research and monitoring, enforcement, education, outreach, and partnering programs.

In summary, eventual phase-out of the majority of anchoring in the park under Alternative C and expanding park research and monitoring, enforcement, education, outreach and partnering efforts with increased staffing levels would result in long-term, moderate to major beneficial effects on seagrass and algal plain communities.

Deep Reef and Wall Reef Community

The effects of Alternative C on the deep reef and wall reef community would be the same as Alternative B. Management actions proposed under Alternative C would result in long-term, minor, beneficial effects.

Deep Water Abyssal Bottom Community

The effects of Alternative C on the deep water abyssal bottom community would be the same as Alternative B. Overall, management actions proposed under Alternative C would result in long-term, negligible, beneficial effects to the deep water oceanic / pelagic community.

Deep Water Oceanic/Pelagic Community

The effects of Alternative C on the deep water oceanic/pelagic community would be the same as Alternative B. Overall, management actions proposed under Alternative C would result in long-term, minor, beneficial effects to the deep water oceanic / pelagic community.

Cumulative Effects

The cumulative effects of Alternative C on marine and coastal resources would be the same as those described for Alternative B. When the beneficial and adverse effects of other past, on-going, and future plans, projects and activities affecting marine and coastal communities are combined with actions under Alternative C, the resulting cumulative effects would be long-term, major, and adverse.

Conclusions

Under Alternative C, use of moorings and limitation of anchoring to a two-acre Anchoring Zone located at West Beach and large vessel anchoring in deep sand would minimize the effects on marine and coastal resources as compared with Alternative A. NPS management zones and expanded park

research and monitoring, enforcement, education, outreach and partnering efforts with increased staffing levels would result in long-term, beneficial effects to marine and coastal resources. When compared to Alternative A, the overall effect of management actions under Alternative C to shallow water coral reef communities would be long- and short-term, negligible and beneficial; for sand bottom communities the effects would be long-term, minor and adverse; for seagrass communities and algal plains, the effects would be moderate to major, and beneficial; for deep reefs and wall reefs, and deep water oceanic/pelagic communities there would be long-term, minor beneficial effects; and for deep water abyssal bottom communities the effects would be long-term, negligible and beneficial.

The cumulative effects of Alternative C on marine and coastal resources would be the same as Alternative B, long-term, major, and adverse.

Impacts of Alternative D

Shallow Water Coral Community

Effects of anchoring under Alternative D on the shallow water coral community would be similar to Alternative A, since no anchoring in areas occupied by coral reefs would be authorized in any management zone. Moorings would not be installed in areas inhabited by shallow water coral reefs and, therefore, would have no adverse effects on the shallow water coral community. Effects of water quality of shallow coral reefs resulting from vessel use would increase relative to the increased number of vessels (25) and visitors, from approximately 87 vessels under Alternative A compared to 112 under Alternative D.

The potential adverse effects of recreation on the shallow water coral community would be of greater intensity than Alternative A relative to a greater number of visitors accommodated under Alternative D by a 16-acre Anchoring Zone, 45 moorings at West Beach as well as 10 new moorings southwest of the pier. Alternative D would therefore result in a greater potential for increased touching, bumping and accidental breaking of coral from visitor use as compared with Alternative A. These activities would have minor adverse effects on the shallow water coral community, as increased staffing would provide additional research and monitoring, enforcement and education efforts that would help offset adverse effects.

The effects of changes in water quality under Alternative D on the shallow water coral community would be greater in intensity compared to Alternative A due to the increased number of vessels mooring and anchoring in the park. Enforcement, research and monitoring, education and outreach programs would be expanded under Alternative D, which would help to offset adverse effects of recreational activities on shallow water coral reefs, yet some adverse effects are likely to occur. Overall, Alternative D is therefore estimated to result in long-term, minor, adverse effects on the shallow water coral community compared to Alternative A.

Sand Bottom Community

Under Alternative D, effects of anchoring in a 16-acre Anchoring Zone on the sand bottom communities would be roughly similar to Alternative A, which features a 22-acre anchoring area. Elimination of bow and stern anchoring at the West Beach would have a beneficial effect on the sand bottom community in this area. Installation of 45 moorings off West Beach, and 10 other moorings southwest of the pier would have a moderate adverse effect on the sand bottom community during installation, but mooring use would provide a beneficial effect by minimizing future disturbances of the substrate compared to anchor related disturbances. Expanded recreational opportunities provided by a 16-acre anchoring zone and additional moorings would increase the potential for adverse effects of recreational activities and disturbance of the sand bottom community. Enforcement, research and monitoring, education and outreach programs would be expanded under Alternative D, which would help to offset adverse effects of recreational activities on sand bottom communities. Effects of water quality on the sand bottom community resulting from vessel use would

be of greater intensity compared to Alternative A due to the increased number of vessels that may anchor and/or moor. Overall, because of the nature of the offsetting impacts of moorings and additional research and monitoring, enforcement and outreach management actions taken under Alternative D, the effects to the sand bottom community are estimated to be long-term, minor, and adverse.

Seagrass and Algal Plain Communities

Under Alternative D, effects of anchoring in a 16-acre area on the seagrass community would be similar to Alternative A, which features a 22-acre anchoring area. Elimination of bow and stern anchoring at West Beach would have no effect on the seagrass community since seagrasses are not present in this area. Installation of moorings would have a moderate adverse effect on the seagrass community during the installation period, but mooring use would provide an offsetting beneficial effect by minimizing future disturbances of the substrate. Expanded recreational opportunities provided by a 16-acre anchoring zone (and additional moorings) would increase the potential for adverse effects of physical disturbance of the seagrass community. Enforcement, research and monitoring, education and outreach programs would be expanded under Alternative D, and would help to somewhat offset adverse effects of recreational activities on the seagrass community.

The abundance and distribution of seagrasses would continue to be affected by periodic storms, waves and currents, and movement of sand, especially during storms. Some emergency or unauthorized anchoring may occur within seagrass beds. Effects on seagrasses and algal plains in these areas would be of lower intensity than Alternative A because management zones, research and monitoring, enforcement, education, outreach, and partnering programs would be expanded under Alternative D.

Effects of changes in water quality on seagrass and algal plain communities resulting from recreational activities would be of greater intensity compared to Alternative A, because Alternative D would accommodate more vessels, with a slightly higher potential for adverse effects of vessel pollutant discharges and releases and use of products by visitors. Expanded research and monitoring, enforcement, education and outreach programs would help reduce the intensity of effect. Overall, management actions proposed under Alternative D would result in long-term, moderate, adverse effects on seagrass and algal plain communities.

Deep Reef and Wall Reef Community

The effects of Alternative D on the deep reef and wall reef community would be similar to Alternative B. Although there would be an increase in the number of vessels mooring and anchoring in the park, the visitation to the deep reef and wall reef community is not expected to have the same relative increase. Management actions proposed under Alternative D would result in long-term, minor, beneficial effects.

Deep Water Abyssal Bottom Community

The effects of Alternative D on the deep water abyssal bottom community would be similar to Alternative B. Although there would be an increase in the number of vessels mooring and anchoring in the park, the visitation to the deep water abyssal bottom community is not expected to have the same relative increase. Overall, management actions proposed under Alternative D would result in long-term, negligible, beneficial effects to the deep water abyssal bottom community.

Deep Water Oceanic/Pelagic Community

The effects of Alternative D on the deep water oceanic/pelagic community would be similar to Alternative B. Although there would be an increase in the number of vessels mooring and anchoring in the park, the visitation to the deep water oceanic/pelagic community is not expected to have the same

relative increase. Overall, management actions proposed under Alternative D would result in long-term, minor, beneficial effects to the deep water oceanic / pelagic community.

Cumulative Effects

The cumulative effects of Alternative D on marine and coastal resources would be the same as those described for Alternative B. When the beneficial and adverse effects of other past, on-going, and future plans, projects and activities affecting marine and coastal communities are combined with actions under Alternative D, the resulting cumulative effects would be long-term, major, and adverse.

Conclusions

The effects of management actions proposed under Alternative D on the shallow water coral reef community and sand bottom community would be long-term, minor and adverse. This is primarily due to the increase in numbers of vessels and therefore visitors in the park. Some of the adverse effects would be offset by increased levels of staffing providing increased research and monitoring, enforcement, education, outreach and partnering efforts as compared to Alternative A. Establishing management zones and these same beneficial effects of increased staffing would influence the overall effects to deep reefs and wall reefs, and deep water oceanic/pelagic communities, resulting in long-term, minor beneficial effects. Effects to the deep water abyssal bottom community would be long-term, negligible, and beneficial. Since anchoring would continue to occur and the number of vessels and associated visitors would increase under Alternative D, the effects to the seagrass community and algal plain would be long-term, moderate, and adverse.

Cumulative effects of Alternative D on coral reefs and other marine communities would be the same as Alternative B, long-term, major, and adverse.

FISH/AQUATIC LIFE

This section assesses the potential effects of the alternatives on finfish and other forms of aquatic life. Other forms of aquatic life are defined as spiny lobsters (*Panulirus argus*), queen conch (*Strombus gigas*) and long-spined sea urchins (*Diadema antillarum*) as summarized in the Chapter 3. Spiny lobsters are included in the impact assessment because they are an important sport and commercial fisheries species in the area surrounding the park. As a marine reserve in which no extractive uses of any type are allowed, the park serves to help replenish this resource. The queen conch has been included for the same reason. Long-spined sea urchins are included as a resource in the general management plan because historically sea urchins are a major factor in controlling algae growth on coral reefs without which algae will inhibit coral recruitment, can smother corals, and disrupt reef recovery. Long spined urchin populations are still low at the present time due to Caribbean-wide urchin die-off in the 1980's. They are included because of their ecological importance to reef recovery. A discussion of effects of the alternatives on Essential Fish Habitat is included in a separate subsection.

Regulations and Policies

The regulations and policies that guide the NPS actions with respect to fish and aquatic life are presented in Appendix B.

Methods

The same methods presented in the "Marine and Coastal Resources" subsection are applicable to fish / aquatic life. All extractive uses of fish and aquatic life are prohibited throughout the park, and this requirement would be continued under all alternatives, with long-term beneficial effects as fish and other aquatic life populations continue to recover, as described in Chapter 3. Continued recovery of fish/ aquatic populations in the park is part of the existing condition under all management actions. As described in Chapter 1, this analysis does not address the impacts of establishing the marine reserve.

This evaluation addresses the change that would occur related to management actions proposed under each action alternative (B, C and D) compared to the No Action Alternative (A), or continuation of current management practices. The geographic area assessed includes the waters within the park boundary; the region is defined as waters surrounding St. Croix unless otherwise noted. Past, on-going and future projects and actions addressed under cumulative effects are the same as those presented under the “Marine and Coastal Resources” section.

Impact Threshold Definitions

The thresholds to determine the intensity of impacts on fish/aquatic life are defined as follows:

Negligible: The waters and substrates that define the habitat for fish and aquatic life would not be affected or the effects would be at or below the level of detection, and the changes would be so slight that they would not be of any measurable or perceptible consequence to the fish and aquatic life.

Minor: Effects to waters and substrates that define the habitat for fish and aquatic life would be detectable. Individuals of fish and aquatic life populations that depend on the habitat may be affected, but it would not be expected to result in substantial population fluctuations.

Moderate: Effects to waters and substrate that define the habitat for fish and aquatic life would be readily detectable, resulting in disruptions or disturbance of small portions of habitat that would alter population size or distribution of fish and aquatic life that depend upon it. The system, however, would return to natural conditions after initial disturbance, and sufficient habitat would remain functional to maintain viable fish and aquatic life populations.

Major: Effects to waters and substrates that define the habitat for fish and aquatic life would be detectable. The effects would result in the loss of the habitat for fish and aquatic life over a large area, thereby altering the function of the habitat and its ability to maintain viable fish and aquatic life populations.

Duration: Short-term: recovers within one year.
Long-term: takes more than one year to recover.

Impacts of Alternative A

Fish

Continuation of the current management practices under Alternative A provides for the continued protection of fish and aquatic life under the Proclamation which prohibits extractive use in the park. Continuation of NPS management actions to enforce the “no take” requirement provides protection to fish populations in the park resulting in long-term beneficial effects. Due to constraints on staffing and funding availability to enforce the no take rule, some illegal poaching/fishing would occur, and would be expected to have minor adverse effects on fish.

Continuation of the existing limited anchoring program under Alternative A would have minor, beneficial effects on fish populations in the park because anchoring would be limited to deep sand habitat and sparse seagrass in a 22 acre area off West Beach (fish populations are characterized by low abundance and diversity in deep sand areas). Likewise, the installation of a maximum of 8 new administrative moorings in deep sand would have short-term, negligible adverse effects on fish. Use of these moorings for research and monitoring purposes would assist park resource specialists in their efforts, resulting in increased knowledge and beneficial effects regarding the management of fish. Continued management efforts limiting anchoring to a 22 acre area of deep sand and seagrass area would result in long-term, minor and beneficial effects to fish. Some adverse effects would occur related to anchor drag and disturbance of sand bottom communities in the anchoring area.

Under Alternative A, fish behavior could be disturbed in the anchoring area and in the vicinity of the moorings at the underwater trail by vessel activity, swimmers, snorkelers, and by SCUBA divers at the

two SCUBA moorings. No quantitative studies of potential adverse effects on fish behavior have been conducted in the park. However, qualitative changes in fish behavior have been documented by the NPS at West Beach that may be associated with inappropriate fish feeding (prohibited in the park). These types of activities would be expected to have negligible adverse effects on fish by altering natural predator/prey conditions.

Continuation of existing vessel use and practices in the park would result in occasional groundings resulting in reef damage from propeller and keel strikes. These types of accidents would result in minor adverse effects on fish habitat and behavior depending on the severity of the occurrence. Changes in water quality as a result of discharges from vessel operations primarily within the anchoring and mooring areas would result in relative minor adverse effects on fish populations.

Habitats for fish would continue to be protected through the use of the anchoring, mooring and law enforcement programs. NPS would continue to monitor and survey fish in and outside the park in cooperation with other agencies and organizations. The park would provide limited education and outreach programs with available staffing and funding. Research and monitoring and educational efforts would help identify and minimize effects of human actions on valuable reef and seagrass habitats that are important to fish for spawning, breeding, and feeding. Under Alternative A, these programs would not be expanded. Enforcing the prohibition of extractive use would continue to be a challenge due to availability of staff, and some amount of illegal fishing would continue to occur. Overall, continuation of existing management practices under Alternative A would have long-term, minor, beneficial effects on fish.

Other Marine Animals (Lobster, Conch, Long-Spined Sea Urchin)

Under Alternative A, anchoring would continue to be allowed in the designated area at West Beach. Spiny lobster live primarily on the reefs or other rocky areas, but during their life cycle, juveniles migrate from mangrove nursery areas off St. Croix through sand bottom areas and seagrass beds across Buck Island Channel to shallow reefs in the park. Some lobsters could therefore be expected to periodically occur within sand bottom areas and seagrass beds within the designated anchoring area. The presence of vessels, swimmers, and snorkelers as well as anchoring activity within designated areas could disturb the migration of some lobsters. However, the overall adverse effects of Alternative A on lobster habitat and migration patterns would be expected to be negligible, since the designated anchoring area is a small portion of the total spiny lobster habitat available. The illegal poaching of lobsters would likely continue to occur based on current constraints to enforcing the no take provision without an expanded enforcement staff. This could result in significant illegal harvesting that could affect future populations of spiny lobster in and outside the park since the species is dependent on a mosaic of habitats over its life cycle.

Based on previous survey results, the anchoring area is not a primary habitat for conch. Seagrasses are a primary habitat for conch, and they are known to occur in adjacent turtle or manatee seagrass areas north and south of the anchoring area, and other locations near the anchoring area. It is unknown if this is due to the visitor presence, illegal harvesting practices, the status of the seagrass coverage in the area, or natural preferences. Anchoring could affect conch habitat by destroying seagrass rhizomes and causing erosion of the substrate. Also, the designated anchoring area represents a small portion of the total conch habitat in the park. Continued anchoring in the designated area would therefore have negligible adverse effects on conch. Illegal poaching of conch would likely continue to occur based on current constraints to enforcing the no take provision without an expanded enforcement staff. This could result in significant illegal harvesting that could affect future populations of conch.

Long-spined sea urchins are present in the park, but are at low population levels compared to historic conditions as a result of abrupt decline in the 1980s brought about by disease and other unidentified factors. This species lives primarily on reefs and feeds mainly on attached algae in these areas. This species may occur only occasionally in the anchoring area, and leaves the reefs at night to feed on

seagrasses. However, it is not likely to occur in any abundance within the designated anchoring areas, therefore continued anchoring and visitor use in the existing designated areas would have negligible adverse effects on the long-spined sea urchin.

Installation of new administrative moorings would not adversely affect conch, lobster or long-spined sea urchins. These moorings would provide a means for consistent monitoring and meet park research needs that would benefit fish and aquatic life.

Recreational use of the park in areas inhabited by lobster, conch and long-spined sea urchins would continue in the present manner under Alternative A. Potential effects of recreational use would include direct disturbance of animals as a result of contact with swimmers, vessels, snorkelers and SCUBA divers, and effects of pollutant discharges and releases from vessels within the mooring and anchoring areas or in the vicinity of accidental groundings. Direct contact with swimmers and other water recreational activities could have adverse behavioral effects on lobsters and conchs. However, these effects would be limited to the anchoring area and the mooring area at the underwater trail. Because these are relatively small areas in relation to the total habitat for these species available in the park, direct effects of contact with visitors is expected to have negligible adverse effects on lobster, conch and long-spined urchins.

Changes in water quality in the park would continue as a result of pollutant discharges and releases from vessel operations inside and outside the park. These changes in water quality are estimated to result in negligible adverse effects on lobster, conch and long-spined sea urchin because of the limited extent of the areas that are used for anchoring and mooring, and that these areas are not the prime or preferred habitat for these species.

The effects identified above would be offset by continuation of the existing research and monitoring, enforcement, education, outreach, and partnering programs. Under Alternative A, these programs would not be expanded, however. Enforcing the prohibition of extractive use would therefore continue to be a challenge due to availability of staff, and some amount of illegal taking of lobster and conch would continue. Overall, continuation of existing management practices under Alternative A would have long-term, minor, beneficial effects on lobster, conch and long-spined sea urchins.

Cumulative Effects

Overfishing of fish and shellfish in the St. Croix region and in the area now occupied by the park has occurred in the past, and is therefore included for consideration in this cumulative impact assessment. Since all extractive uses are now prohibited in the park, overfishing within park boundaries by commercial, sport and recreational fishermen does not occur and will not occur in the future. Fisheries in the area surrounding the park will continue to be depleted unless the present trends change. However, establishment of the park as a “no-take” marine reserve will have a beneficial long-term effect on fisheries in the area surrounding the park by helping to replenish these resources. This will amount to a beneficial cumulative effect, assuming the park ecosystems function sufficiently to serve in this role. Although the park cannot reverse the existing trends alone, by functioning as a “no take” marine reserve, it provides a unique opportunity to improve the health of marine and coastal ecosystem in the area. Research and monitoring programs implemented by the NPS and others will reveal the nature of these types of effects on fish and other aquatic life in the park and its effectiveness in replenishment of fish populations in the surrounding area. NPS would continue to conduct research regarding fish and aquatic life under Alternative A with the funds and staff available.

The current trends of temperature increases, acidification, sea level rise and frequency and intensity of storms and other associated climate changes, diseases, and other factors (discussed previously in the methods section for cumulative effects section and Appendix D) would have projected long-term, major, adverse effects that would overshadow management actions taken by the park. When the beneficial and adverse effects of other past, on-going, and future plans, projects and activities affecting

fish and aquatic life are combined with continued management actions under Alternative A, the resulting cumulative effects would be long-term, major, and adverse.

Conclusions

Continuation of the existing anchoring program would have a negligible adverse effect on fish and aquatic life in the park because anchoring would be limited to deep sand in a relatively small area off West Beach. Since no new moorings would be installed under Alternative A, mooring installation would have no adverse effects on fish and aquatic life. Recreational activities in the mooring and anchoring areas, including disturbance of fish and aquatic life behavior, and changes in water quality as a result of discharges and releases from vessel operations within the anchoring and mooring areas would result in minor adverse effects on fish and aquatic life. Overall, Alternative A would have long-term, minor, adverse effects on fish and aquatic life. These effects would be offset by enforcement, research and monitoring, education and outreach programs that would be continued, but not expanded, under Alternative A.

The NPS would continue to conduct research and fish and aquatic life under Alternative A. Current trends of climate change, and other factors discussed previously would have projected long-term, major, adverse effects that would overshadow management actions taken by the park. When the beneficial and adverse effects of other past, on-going, and future plans, projects and activities affecting fish and aquatic life are combined with actions under Alternative A, the resulting cumulative effects on fish and aquatic life would be long-term, major, and adverse.

Impacts of Alternative B, the Preferred Alternative

Fish

Eventual phase-out of anchoring in the park under Alternative B (with the exception of 5 anchoring sites to be located in deep sand) would have moderate beneficial effects on fish habitat in the designated anchoring area by preventing damage to the sand bottom community and avoiding effects of physical disturbance of seagrasses by anchors. Some accidental groundings would be possible to occur outside the designated deep sand anchoring locations under Alternative B, with minor adverse effects on fish. Elimination of bow and stern anchoring would have negligible beneficial effects on fish habitat at West Beach since this area is characterized by a naturally low fish density and diversity.

Addition of a maximum of 10 moorings to be located southeast of the pier, 45 moorings off West Beach and 8 administrative moorings could affect fish habitat by temporary disturbance of the bottom during mooring installation. However, density and diversity of fish populations are much lower in the sand bottom areas of the park as compared with seagrass beds or coral reefs, and the total area affected by mooring tackle would be small. Therefore, installation of new moorings would have short-term, negligible adverse effects on fish habitat and populations in these areas of the park.

Under Alternative B, fish behavior could be disturbed in the vicinity of the moorings at the underwater trail by vessel activity, swimmers, snorkelers, and by SCUBA divers at the two SCUBA moorings. No quantitative studies of potential adverse effects on fish behavior have been conducted in the park. However, qualitative changes in fish behavior have been documented by the NPS at West Beach that may be associated with inappropriate fish feeding (prohibited in the park). These types of activities would be expected to have negligible adverse effects on fish by altering natural predator/prey conditions.

Elimination of vessels in the Marine Hazard Zone would help minimize the likelihood of groundings and propeller damage on shallow reefs in these areas, thereby avoiding adverse effects to fish and aquatic species, especially in the reefs in the lagoon, areas to the north, northwest and southeast of the island. This change would have a moderate beneficial effect on fish habitat and populations. Inclusion of a large portion of the bank barrier reef in the Resource Protection Zone would help minimize

effects of snorkelers and vessels on coral reef habitat that are used by fish. This change would result in moderate beneficial effects on fish populations.

Changes in water quality in the park as a result of discharges from vessel operations inside and outside the park are estimated to result in minor, adverse effects on fish populations.

In summary, elimination of anchoring in the park under Alternative B would have moderate beneficial effects on fish habitat in the designated anchoring area by preventing damage to the sand bottom and seagrass communities. Some accidental vessel groundings would be possible outside the designated anchoring areas under Alternative B, with minor adverse effects on fish. Elimination of bow and stern anchoring would have negligible beneficial effects on fish habitat at the West Beach since this area is characterized by a naturally low fish density and diversity. Installation of moorings near the pier and at West Beach would have short-term, negligible adverse effects on fish habitat and populations in these areas of the park since little habitat would be disturbed during mooring installation. Elimination of vessels in the Marine Hazard Zone would have a moderate beneficial effect on fish habitat and populations by greatly reducing the likelihood of accidental groundings and vessel use in this zone. Inclusion of a large portion of the bank barrier reef in the Resource Protection Zone would have moderate beneficial effects on fish populations by minimizing effects of vessels.

All of the adverse effects described above would be offset to a greater level than under Alternative A by expansion of the existing research and monitoring, enforcement, education, outreach, and partnering programs provided by an increase in staffing levels and efforts. Enhanced research and monitoring of resources and enforcement activities in the newly created zones within the park would provide knowledge as well as enhanced protective measures within park boundaries, resulting in major, beneficial effects to fish and aquatic life. The increased efforts would provide opportunities for increased knowledge to adapt management actions in the “no take” marine reserve for species protection. Expanding partnering efforts would provide opportunities for increasing stewardship of park resources, particularly given the interrelationships of habitats and species during their life cycles spent both inside and outside the park.

Overall, management actions proposed under Alternative B would have long-term, moderate to major, beneficial effects on fish habitat and populations in the park as compared to Alternative A.

Other Marine Animals (Lobster, Conch, Long-Spined Sea Urchin)

Eventual phase-out of anchoring in the park under Alternative B (with the exception of 5 anchoring sites to be located in deep sand) would have moderate beneficial effects on other marine animals and habitat in the designated anchoring area by preventing damage to the sand bottom community and avoiding effects of physical disturbance of seagrasses by anchors. Elimination of bow and stern anchoring would not adversely affect conch, lobster, or long-spined sea urchins since this area is characterized by a sand bottom that does not provide preferred habitat for lobster, conch, or long-spined sea urchins. Although difficult to assess given the existing condition of the long-spined sea urchins, phasing out anchoring would be expected to have beneficial effects by protecting habitat by eliminating anchor drags and creating less disturbance of bottom conditions. Creating the Marine Hazard Zone would also reduce the likelihood of potential groundings that would protect these reef dwelling animals. Some accidental groundings would be possible to occur outside the designated anchoring sites under Alternative B, with minor adverse effects on habitat for other marine life.

Addition of a maximum of 10 moorings to the southeast of the pier and 45 moorings at West Beach as well as administrative moorings could temporarily affect lobster and conch habitat by disturbing the bottom during mooring installation. However, density and diversity of lobster and conch populations are much lower in the sand bottom areas of the park as compared seagrass beds or coral reefs located elsewhere in the park. NPS would avoid these sensitive areas when locating mooring sites. Therefore, installation of new moorings would have negligible adverse effects on lobster and conch habitat and

populations in these areas of the park. Addition of these moorings would have no adverse effects on long-spined urchin populations, since they are primarily reef dwelling animals, and are uncommon in the mooring areas.

Under Alternative B, elimination of vessels in the Marine Hazard Zone would reduce the likelihood of groundings and propeller damage on shallow reefs in these areas, especially in the reefs in the lagoon on the north shore of the island, and on the reefs southeast of the island. This change would also help reduce illegal take or poaching of lobster and conch in these same areas. This would have a moderate to major beneficial effect on lobster, conch and long-spined sea urchin and habitat in these areas.

Inclusion of a large portion of the bank barrier reef in the Resource Protection Zone would help reduce the effects of snorkelers on lobster, conch and long-spined sea urchins. This would have a minor, beneficial effect on these animals.

Changes in water quality in the park as a result of discharges from vessel operations inside and outside the park are estimated to result in negligible, adverse effects on lobster, conch and long-spined sea urchin habitat and populations.

Recreational use of the park in areas inhabited by lobster, conch and long-spined sea urchins would continue in the present manner under Alternative B. Potential effects of recreational use would include direct disturbance of animals as a result of contact with swimmers, vessels, snorkelers and SCUBA divers, and effects of pollutant discharges and releases from vessels within the mooring and the 5 anchoring sites or in the vicinity of accidental groundings. Direct contact with swimmers and other water recreational activities could have adverse behavioral effects on lobsters and conchs. However, these effects would be limited to the anchoring area and the SCUBA moorings and underwater trail moorings. Because these are relatively small areas in relation to the total habitat for these species available in the park, direct effects of contact with visitors is expected to have negligible adverse effects on lobster, conch and long-spined urchins.

Changes in water quality in the park would continue as a result of pollutant discharges from vessel operations inside and outside the park. These changes in water quality are estimated to result in negligible adverse effects on lobster, conch and long-spined sea urchin because of the limited extent of the areas that are used for anchoring and mooring, and the fact that these animals not common in these areas.

All of the adverse effects described above would be offset by expansion of the existing research and monitoring, enforcement, education, outreach, and partnering programs provided by an increase in staffing levels and efforts under Alternative B compared to Alternative A. Enhanced research and monitoring of resources and enforcement activities in the newly created zones within the park would provide knowledge as well as enhanced protective measures within park boundaries, resulting in major, beneficial effects to marine life. Increased efforts would provide opportunities for increased knowledge to adapt management actions in the “no take” marine reserve for species protection. Expanding partnering efforts with other agencies, organizations and researchers would provide opportunities for increasing stewardship of park resources, particularly given the interrelationships of habitats and species during their life cycles spent both inside and outside the park. Overall, Alternative B would have long-term, moderate to major, beneficial effects on lobsters, conch, long-spined sea urchins, through the phasing out the majority of anchoring, and installation of moorings, establishment of management zones, and increased staffing and research and monitoring, enforcement, education and partnering efforts.

Cumulative Impacts

The NPS would expand the level of research and monitoring of fish and aquatic life under Alternative B due to the increase in park staff and level of effort. Implementation of other plans and activities would provide beneficial effects to park marine resources. Current trends of temperature increases

and other climate changes, hurricanes, disease, and other factors discussed previously in the marine and coastal resources section would have projected long-term, major, adverse effects on coral reefs and associated species in the park. The overall cumulative effect associated with climate change, and in particular water temperature increases on the marine ecosystem is not well understood due to the complexities of the system. The effects of temperature increases and other results of climate changes would overshadow management actions taken by the park under Alternative B. When the beneficial and adverse effects of other past, on-going, and future plans, projects and activities affecting aquatic life are combined with actions under Alternative B, the resulting cumulative effects on fish and aquatic life would be long-term, major, and adverse.

Conclusions

Overall, Alternative B would have long-term, moderate to major, beneficial effects on fish and aquatic life (such as lobsters, conch, long-spined sea urchins) through the phasing out the majority of anchoring, and installation of moorings, establishment of management zones, and increased staffing, research and monitoring and research, enforcement, education and partnering efforts.

The NPS would continue to conduct research and monitor fish and aquatic life under Alternative B. Current trends of climate change, hurricanes, disease, and other factors would have projected long-term, major, adverse effects that would overshadow management actions taken by the park under Alternative B. When the beneficial and adverse effects of other past, on-going, and future plans, projects and activities affecting aquatic life are combined with actions under Alternative B, the resulting cumulative effects on fish and aquatic life would be long-term, major, and adverse.

Impacts of Alternative C

Fish

Phasing out of the existing 22-acre designated anchoring area under Alternative C (with the exception of 5 anchoring sites to be located in deep sand) and replacement with moorings would have a beneficial effect on fish in this area by elimination of continued physical disturbance of sand bottom and sparse seagrass habitat. Use of the two-acre Anchoring Zone at West Beach would have negligible adverse effects on fish habitat and populations, since this area is characterized by deep sand, and naturally low diversity and densities of fish. Some accidental groundings would be possible to occur outside the designated anchoring areas under Alternative C, with minor adverse effects on fish.

Under Alternative C, fish behavior could be disturbed in the Anchoring Zone and in the vicinity of the moorings as well as at the underwater trail by vessel activity, swimmers, snorkelers and SCUBA divers at the SCUBA moorings. No quantitative studies of potential adverse effects on fish behavior have been conducted in the park. However, qualitative changes in fish behavior have been documented by the NPS at West Beach that may be associated with inappropriate fish feeding (prohibited in the park). These types of activities would be expected to have negligible adverse effects on fish by altering natural predator/prey conditions.

Installation of a maximum of 10 moorings to be located southeast of the pier, 45 moorings off West Beach and 8 administrative moorings could affect fish habitat by temporary disturbance of the bottom during mooring installation. However, density and diversity of fish populations are much lower in the sand bottom areas of the park as compared with seagrass beds or coral reefs, and the total area affected by mooring tackle would be small. Therefore, installation of new moorings would have short-term, negligible adverse effects on fish habitat and populations in these areas of the park. Use of moorings versus anchors would provide long-term, beneficial effects to fish and aquatic life.

Elimination of vessels in the Marine Hazard Zone would help minimize the likelihood of groundings and propeller damage on shallow reefs in these areas, thereby avoiding adverse effects to fish and aquatic species, especially in the reefs in the lagoon, areas to the north, northwest and southeast of the

island. This change would have a moderate beneficial effect on fish habitat and populations. Inclusion of a large portion of the bank barrier reef in the Resource Protection Zone would help minimize effects of snorkelers and vessels on coral reef habitat that are used by fish. This change would result in moderate beneficial effects on fish populations.

Visitor use of moorings and the Anchoring Zone would have a negligible beneficial effect on fish populations in the mooring areas as anchoring is phased out compared to Alternative A because the number of vessels and therefore visitors is similar (92 vessels in Alternative C compared to 87 under Alternative A). The increase of five vessels would have negligible adverse effects on water quality and fish resulting from vessel discharges.

Beneficial effects of the new Marine Hazard Zone and the Resource Protection Zone on fish would be similar to Alternative B, and provide increased protection of reef habitat for fish, decrease the likelihood of vessel groundings, and protect sensitive fish habitats, resulting in long-term, moderate to major beneficial effects.

All of the adverse effects described above would be offset to a greater level than under Alternative A by expansion of the existing research and monitoring, enforcement, education, outreach, and partnering programs provided by an increase in staffing levels and efforts. Enhanced research and monitoring of resources and enforcement activities in the newly created zones within the park would provide knowledge as well as enhanced protective measures within park boundaries, resulting in major, beneficial effects to fish and aquatic life. Increased efforts would provide opportunities for increased knowledge to adapt management actions in the “no take” marine reserve for species protection. Expanding partnering efforts would provide opportunities for increasing stewardship of park resources, particularly given the interrelationships of habitats and species during their life cycles spent both inside and outside the park.

Overall, management actions proposed under Alternative C would have long-term, minor to moderate, beneficial effects on fish habitat and populations in the park as compared to Alternative A.

Other Marine Animals (Lobster, Conch, Long-Spined Sea Urchin)

Phasing out anchoring in the park under Alternative C to all but 2 acres of a bow and stern Anchoring Zone, (with the exception of 5 anchoring sites to be located in deep sand) would have moderate beneficial effects on other marine animals and habitats by preventing damage to the sand bottom community and avoiding effects of physical disturbance of seagrasses by anchors. The 2-acre bow and stern Anchoring Zone would not adversely affect conch, lobster, or long-spined sea urchins since this area is characterized by a sand bottom that does not provide preferred habitat for lobster, conch, or long-spined sea urchins. Although difficult to assess given the existing condition of the long-spined sea urchins, phasing out anchoring would be expected to have beneficial effects by protecting habitat by eliminating anchor drags and creating less disturbance of bottom conditions.

Addition of a maximum of 10 moorings to the southeast of the pier and 45 moorings at West Beach as well as 8 administrative moorings could temporarily affect lobster and conch habitat by disturbing the bottom during mooring installation. However, density and diversity of lobster and conch populations are much lower in the sand bottom areas of the park as compared seagrass beds or coral reefs located elsewhere in the park. NPS would avoid these sensitive areas when locating mooring sites. Therefore, installation of new moorings would have negligible adverse effects on lobster and conch habitat and populations in these areas of the park. Addition of these moorings would have no adverse effects on long-spined urchin populations, since they are primarily reef dwelling animals.

Under Alternative C, elimination of vessels in the Marine Hazard Zone would reduce the likelihood of groundings and propeller damage on shallow reefs in these areas, especially in the reefs in the lagoon on the north shore of the island, and on the reefs southeast of the island. Creating the Marine Hazard Zone would protect these reef dwelling animals. Some accidental groundings would be possible to

occur outside the designated anchoring sites and Anchoring Zone under Alternative C, with minor adverse effects on habitat for other marine life. The Marine Hazard Zone would also help reduce illegal takings of lobster and conch in this zone. This would have a moderate to major beneficial effect on lobster and conch habitat.

Inclusion of a large portion of the bank barrier reef in the Resource Protection Zone would help reduce the effects of snorkelers on lobster, conch and long-spined sea urchins. This would have a minor, beneficial effect on these animals.

Changes in water quality in the park as a result of discharges from vessel operations inside and outside the park are estimated to result in negligible, adverse effects on lobster, conch and long-spined sea urchin habitat and populations, since the number of vessels would be similar to Alternative A.

Recreational use of the park in areas inhabited by lobster, conch and long-spined sea urchins would continue in the present manner under Alternative C. Potential effects of recreational use would include direct disturbance of animals as a result of contact with swimmers, vessels, snorkelers and SCUBA divers, and effects of pollutant discharges from vessels within the mooring and anchoring sites or in the vicinity of accidental groundings. Direct contact with swimmers and other water recreational activities could have adverse behavioral effects on lobsters and conchs. However, these effects would be limited to the anchoring area and the mooring area at the underwater trail. Because these are relatively small areas in relation to the total habitat for these species available in the park, direct effects of contact with visitors is expected to have negligible adverse effects on lobster, conch and long-spined urchins.

All of the adverse effects described above would be offset by expansion of the existing research and monitoring, enforcement, education, outreach, and partnering programs provided by an increase in staffing levels and efforts under Alternative C compared to Alternative A. Enhanced research and monitoring of resources and enforcement activities in the newly created zones within the park would provide knowledge as well as enhanced protective measures within park boundaries, resulting in major, beneficial effects to marine life. The increased efforts would provide opportunities for increased knowledge to adapt management actions in the “no take” marine reserve for species protection. Expanding partnering efforts with other agencies, organizations and researchers would provide opportunities for increasing stewardship of park resources, particularly given the interrelationships of habitats and species during their life cycles spent both inside and outside the park. Overall, Alternative C would have long-term, minor to moderate, beneficial effects on lobsters, conch, long-spined sea urchins, through the reduction in anchoring, and installation of moorings, establishment of management zones, and increased staffing and research and monitoring, enforcement, education and partnering efforts.

Cumulative Effects

The NPS would continue to conduct research and monitor fish and aquatic life under Alternative C. Current trends of climate change, hurricanes, disease, and other factors discussed in the “Marine and Coastal Resources” section would have projected long-term, major, adverse effects that would overshadow management actions taken by the park. When the beneficial and adverse effects of other past, on-going, and future plans, projects and activities affecting fish and aquatic life are combined with actions under Alternative C, the resulting cumulative effects on fish and aquatic life would be long-term, major, and adverse.

Conclusions

Overall, Alternative C would have long-term, minor to moderate, beneficial effects on fish, lobsters, conch, long-spined sea urchins, through the reduction in anchoring, and installation of moorings, establishment of management zones, and increased staffing and research and monitoring, enforcement, education and partnering efforts.

The NPS would continue to conduct research and monitor fish and aquatic life under Alternative C. Current trends of climate change would have projected long-term, major, adverse effects that would overshadow management actions taken by the park. When the beneficial and adverse effects of other past, on-going, and future plans, projects and activities affecting fish and aquatic life are combined with actions under Alternative C, the resulting cumulative effects on fish and aquatic life would be long-term, major, and adverse.

Impacts of Alternative D

Fish

Creating a 16 acre Anchoring Zone in addition to installation of moorings would provide opportunities for approximately 112 vessels to access Buck Island. Continuation of anchoring off West Beach would be similar to Alternative A with the exception of no bow and stern anchoring. This would disturb less bottom habitat, however, impacts to fish would be considered similar to Alternative A. This is because the former bow and stern anchoring area under Alternative A is characterized by deep sand, and naturally low diversity and densities of fish. Continued limitation of anchoring off West Beach would result in long-term, minor beneficial effects to fish under Alternative D.

Under Alternative C, fish behavior could be disturbed in the Anchoring Zone and in the vicinity of the moorings as well as at the underwater trail by vessel activity, swimmers, snorkelers and SCUBA divers at the SCUBA moorings. No quantitative studies of potential adverse effects on fish behavior have been conducted in the park. However, qualitative changes in fish behavior have been documented by the NPS at West Beach that may be associated with inappropriate fish feeding (prohibited in the park). These types of activities would be expected to have negligible adverse effects on fish by altering natural predator/prey conditions.

Installation of a maximum of 10 moorings to be located southeast of the pier, 45 moorings off West Beach and 8 administrative moorings could affect fish habitat by temporary disturbance of the bottom during mooring installation. However, density and diversity of fish populations are much lower in the sand bottom areas of the park as compared with seagrass beds or coral reefs, and the total area affected by mooring tackle would be small. Therefore, installation of new moorings would have short-term, negligible adverse effects on fish habitat and populations in these areas of the park. Use of moorings versus anchors would provide long-term, beneficial effects to fish and aquatic life. Installation and use of 8 administrative moorings for research and monitoring purposes would assist park resource specialists in their efforts, resulting in increased knowledge and beneficial effects regarding the management of fish.

Elimination of vessels in the Marine Hazard Zone would help minimize the likelihood of groundings and propeller damage on shallow reefs in these areas, thereby avoiding adverse effects to fish and aquatic species, especially in the reefs in the lagoon, areas to the north, northwest and southeast of the island. This change would have a moderate beneficial effect on fish habitat and populations. Inclusion of a large portion of the bank barrier reef in the Resource Protection Zone would help minimize effects of snorkelers and vessels on coral reef habitat that are used by fish. This change would result in moderate beneficial effects on fish populations.

Visitor use of moorings and the Anchoring Zone would have a negligible adverse effect on fish in the area of this zone compared to Alternative A because the number of vessels and therefore visitors is greater (112 vessels in Alternative D compared to 87 under Alternative A). The increase of 25 vessels would have minor adverse effects on water quality resulting from vessel discharges, and the potential to also have adverse effects on fish and aquatic life.

Beneficial effects of the new Marine Hazard Zone and the Resource Protection Zone on fish would be of greater intensity compared to Alternative A without the zones, by providing increased protection of

reef habitat for fish, decreasing the likelihood of vessel groundings, and protecting sensitive fish habitats, resulting in long-term, moderate to major beneficial effects.

All of the adverse effects described above would be offset to a greater level than under Alternative A by expansion of the existing research and monitoring, enforcement, education, outreach, and partnering programs provided by an increase in staffing levels and efforts. Enhanced research and monitoring of resources and enforcement activities in the newly created zones within the park would provide knowledge as well as enhanced protective measures within park boundaries, resulting in major, beneficial effects to fish and aquatic life. Increased efforts would provide opportunities for increased knowledge to adapt management actions in the “no take” marine reserve for species protection. Expanding partnering efforts would provide opportunities for increasing stewardship of park resources, particularly given the interrelationships of habitats and species during their life cycles spent both inside and outside the park.

Overall, management actions proposed under Alternative D would have long-term, minor to moderate beneficial effects on fish habitat and populations in the park as compared to Alternative A.

Aquatic Life (Lobster, Conch, Long-Spined Sea Urchin)

Effects of management actions proposed under Alternative D to aquatic life are similar to Alternative C. Although the number of vessels and relative number of visitors would increase, the overall intensity of effects would be similar due to increased staff levels and management efforts. Therefore, Alternative D would have long-term, minor to moderate, beneficial effects on fish, lobsters, conch, and long-spined sea urchins, through the reduction of anchoring, and installation of moorings, establishment of management zones, and increased staffing, research and monitoring and research, enforcement, education and partnering efforts.

Cumulative Effects

The NPS would continue to conduct research and monitor fish and aquatic life under Alternative D. Current trends of climate change, hurricanes, disease, and other factors discussed previously in the “Marine and Coastal Resources” section would have projected long-term, major, adverse effects that would overshadow management actions taken by the park. When the beneficial and adverse effects of other past, on-going, and future plans, projects and activities affecting fish and aquatic life are combined with actions under Alternative D, the resulting cumulative effects on fish and aquatic life would be long-term, major, and adverse.

Conclusions

Effects of management actions proposed under Alternative D to aquatic life are similar to Alternative C. Although the number of vessels and relative number of visitors would increase, the overall intensity of effects would be similar due to increased staff levels and management efforts. Therefore, Alternative D would have long-term, minor to moderate, beneficial effects on fish, lobsters, conch, and long-spined sea urchins, through the reduction of anchoring, and installation of moorings, establishment of management zones, and increased staffing, research and monitoring, enforcement, education and partnering efforts.

The current trends of climate change, hurricanes, disease, and other factors would have projected long-term, major, adverse effects that would overshadow management actions taken by the park under Alternative D. When the beneficial and adverse effects of other past, on-going, and future plans, projects and activities affecting fish and aquatic life are combined with actions under Alternative D, the resulting cumulative effects on fish and aquatic life would be long-term, major, and adverse.

ESSENTIAL FISH HABITAT

Guiding Regulations and Policies

The Magnuson-Stevens Fishery Conservation and Management Act, as amended by the Sustainable Fisheries Act of 1996 (Public Law 104-267) requires all federal agencies to consult with National Marine Fisheries Service on all actions or proposed actions permitted, funded, or undertaken by the agency that may adversely affect Essential Fish Habitat (EFH). Essential fish habitat is defined as “those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity.” “Waters” include aquatic areas and their associated physical, chemical and biological properties. “Substrate” includes sediment underlying the waters. “Necessary” means the habitat required to support a sustainable fishery and the managed species’ contribution to a healthy ecosystem. Spawning, breeding, feeding, or growth to maturity covers all habitat types utilized by a species throughout its life cycle. The National Marine Fisheries Service would provide recommendations on conserving essential fish habitat to federal, territory or state agencies for activities that would adversely affect essential fish habitat. The NPS will consult with the National Marine Fisheries Service before any future implementation action is undertaken that may affect essential fish habitat.

Methods

Buck Island Reef National Monument provides essential fish habitat for reef fish, spiny lobster, queen conch, corals, and coral reefs (CFMC 2004). Because the life stages of these species (including pelagic stages) collectively occur in all habitats of the U.S. Caribbean, essential fish habitat at Buck Island Reef National Monument includes coral reefs, hard and soft bottoms, sand/shell bottoms, benthic algae, seagrass, and pelagic waters that may be affected by management alternatives.

The intent of the 1996 Magnuson-Stevens Fishery Conservation and Management Act is to conserve and enhance essential fish habitat and focus conservation efforts on areas that are important to the life cycles of federally managed fish and shellfish. For this document, complying with the Act includes the protection of coral reefs, seagrasses, and hard-bottom habitats that provide refuge, foraging, and breeding areas for fish and shellfish.

Issues were evaluated using information obtained through best professional judgment of park staff. In addition, relevant scientific literature and data was used to assess impacts. In particular, the *Environmental Impact Statement for the Generic Essential Fish Habitat Amendment to Caribbean Fisheries Management Plan* (2004) was used to evaluate impacts to essential fish habitat.

Issues related to essential fish habitat were identified during public and internal scoping. They include: 1) habitat modification/habitat degradation; 2) motorized vessel activity, anchoring, and mooring installation may alter and/or degrade habitat; 3) visitor use of the underwater environment may damage or disturb essential fish habitats; and 4) management zones that restrict access or use could provide enhanced protection of essential fish habitats.

For a detailed analysis of effects of management alternatives and cumulative effects analysis for seagrasses, corals, and fisheries, see the “Marine and Coastal Resources” and “Fish / Aquatic Life” sections of Chapter 4.

Impact Threshold Definitions

As defined by the Magnuson-Stevens Fishery Conservation and Management Act, adverse effects on essential fish habitat are those that reduce the quality or quantity of this habitat by (1) altering the physical, chemical, or biological condition of the waters or substrates; or (2) resulting in the injury or loss of benthic organisms or prey species and their habitat. Adverse impacts are “more than minimal and not temporary in nature” based on an evaluation of the intensity, extent, and frequency of the impact and the type and function of habitat being impacted (50 CFR 600.815[a] [2]). Minimal impacts “are those that may result in relatively small changes in the affected environment and insignificant

changes in ecological functions.” Temporary impacts “are those that are limited in duration and that allow the particular environment to recover without measurable impact” (67 FR 2354). Determination of substantial adverse effects “should be based on project-specific considerations, such as the ecological importance or sensitivity of an area, the type and extent of essential fish habitat affected, and the type of activity. Substantial adverse effects are “effects that may pose a relatively serious threat to essential fish habitat and typically could not be alleviated through minor modifications to a proposed action” (67 FR 2367). The thresholds to determine the intensity of impacts on essential fish habitat are defined as follows.

Negligible: The waters and substrates that define the essential fish habitat would not be affected or the effects would be at or below the level of detection, and the changes would be so slight that they would not be of any measurable or perceptible consequence to the essential fish habitat. Fisheries or invertebrate species that depend on these habitats would not be affected. There would be no adverse effect as defined by the Magnuson-Stevens Fishery Conservation and Management Act.

Minor: Effects to waters and substrates that define the essential fish habitat would be detectable, although the effects would be localized, and would be small and essential habitat would not be lost. The function of the habitat for fisheries or invertebrate species would not be affected. Although some individuals’ behaviors may be affected, populations of the fish and invertebrate species that use these habitats would not be affected. The adverse effects would be considered minimal as defined by the Magnuson-Stevens Fishery Conservation and Management Act.

Moderate: Effects to waters and substrate of the essential fish habitat would be readily detectable resulting in changes of small portions of habitat and effects would alter some of its function for fisheries or invertebrates that depend on this habitat. This would result in a decline or increase in populations of these fish or invertebrate species in the local area. The adverse effects would be considered minimal as defined by the Magnuson-Stevens Fishery Conservation and Management Act.

Major: Effects to waters and substrates that define essential fish habitats would be widespread. The effects result in the loss or increase of essential fish habitat over a large area and would result in a loss or enhancement of function of the habitat to support fisheries and invertebrate populations resulting in substantial changes in fisheries or invertebrate populations that rely on that habitat. The adverse effects would be considered substantial as defined by the Magnuson-Stevens Fishery Conservation and Management Act.

Duration: Long-term: Species would continue to be affected beyond one year’s time, and/or conditions would not be similar to those that predominated previously.

Short-term: The effect would occur only during or shortly after a specified action or treatment. Within a year, conditions would be similar to those that predominated previously.

Impacts of Alternative A

Anchoring would continue in the deep sand areas inside authorized, designated anchoring areas established by the NPS. These areas are permitted for use and are designated by park staff to avoid areas where seagrass and corals occur. Continuation of permitted anchoring would have short-term negligible adverse effects on essential fish habitat that would occur over the life of the plan. Bow and stern anchoring on West Beach would also continue under this alternative and would disturb sand bottom communities in this area. This area of Buck Island is very dynamic in nature and is affected by wind and wave action. As such, marine fish and invertebrates that inhabit, forage or reproduce in this area are also adapted to these highly changing conditions. Because of this dynamic nature it would be expected that bow and stern anchoring that occurs in this area would have short-term, negligible, adverse effects and the area would recover rapidly after vessels are removed.

The potential for illegal and emergency anchoring or groundings in the monument would continue to occur in areas of shallow reefs and seagrasses and hard bottom habitats. These activities could have long-term minor adverse effects in localized areas as larger patches of seagrass and coral reefs take long periods of time to recover from this type of damage or disturbance. In some cases, recovery is not possible. These infrequent and dispersed unauthorized or emergency activities would not be expected to affect the overall abundance and use of the habitat by designated fish and invertebrate species.

Recreational use of the marine environment for snorkeling and SCUBA diving could disturb both the essential fish habitat and the fisheries that rely on those habitats. Scarring of seagrass beds, damage to hard bottom substrates, and loss or damage to coral reefs as a result of recreational vessel use would be long-term and up to moderate in intensity depending on the size of the area affected and the type of coral damaged. In addition, snorkelers and divers can inadvertently damage corals by touching and/or breaking coral and disturbing other habitats. These effects have not been quantified but are mitigated to some degree by boat operator experience and education of visitors of the sensitivity of these habitats to disturbance. These communities take a long time to recover from loss and damage, and in some cases, recovery is not possible. Because of the infrequency of such occurrences, essential fish habitats would continue to function without loss of abundance of designated fish and invertebrate species that depend on the habitat. The impacts would be long-term, minor, and adverse.

NPS enforcement efforts would be expected to continue at existing levels and therefore would not be able to address all illegal fishing or poaching activities within park boundaries. This would result in long- and short-term, moderate, adverse effects as these illegal activities would result in damage to essential fish habitats from techniques such as fish traps, gill nets, grappling, and others. Because of the destructive nature of these activities and the size of the areas affected, there could be localized declines in designated fish and invertebrate species populations.

Cumulative Effects

Essential fish habitat has been and continues to be affected by human induced environmental degradation that results from both fishing and non-fishing related activities such as coastal development and pollution from agricultural and urban land uses. There is no information currently available to define quantitatively the effect of these actions and effects depend also on the sensitivity of the environment. Due to the distance from development activities on St. Croix, and existing current patterns, adverse impacts on essential fish habitat would continue to be expected to be negligible. In fact, the park is used as a background station for comparison of water quality conditions. The following paragraphs describe the conditions which could substantially change the effects from human induced environmental degradation related to development activities on St. Croix.

A number of non-fishing impacts to essential fish habitat include a variety of physical, water quality, and biological effects. The majority of these impacts are directly related to anthropogenic activities that vary across St. Croix, such as dredge and fill operations, urbanization and land development, and industrial and municipal waste. Nutrient loading from agricultural areas and sewage entering the water can severely degrade essential fish habitats. Excess nutrients fuel phytoplankton blooms in the water column, which can contribute to low oxygen events in the water column and bottom sediments, causing fish kills and mortality of fish and non-mobile invertebrates in various habitats. Reduced light availability in the water column from plankton blooms and excessive epiphytic growth impacts the ability of seagrasses to survive and grow. Excess nutrient loading can result in toxic blooms such as red tide.

Activities associated with urbanization (e.g., building construction, utility installation, road and bridge building, storm water discharge) can significantly affect essential fish habitat through habitat loss or modification. Construction activities and removal of vegetation that expose soils to erosion, alter essential fish habitat by increasing sedimentation which prohibits the settlement of corals and other larvae, and inhibits coral ability to feed. Increasing turbidity in the habitat and diminishing light

penetration cause mortality of seagrass and corals and inhibit the ability of visual predators to feed. Development activities also alter the amount of water entering the habitats thereby changing salinity, raising water temperature, and transporting pollutants causing the loss of essential fish habitat. The level of effect of development activity on St. Croix to the surrounding waters has not been fully quantified.

Fishing related impacts to essential fish habitat result from previous use of bottom-disturbing fishing gear such as traps, grappling and gills nets. Commercial or recreational vessel operators also disturb the bottom as a result of accidental groundings, and anchoring. These activities disturb bottom substrates and uproot seagrass. Habitat such as corals and hard bottom can be physically destroyed and water clarity reduced as a result of these activities. The disturbance of soft bottom habitat can alter productivity of benthic microalgae and reduce structural complexity of the bottom (CFMC 2004).

Establishment of comprehensive management plans by National Oceanic Atmospheric Administration National Marine Fisheries Service, conservation efforts by local, territory, and federal agencies, and increased collaboration between agencies have resulted in major long-term beneficial effects on essential fish habitats in the U.S. Virgin Islands that outweigh many of the adverse effects of those activities discussed above. National Oceanic Atmospheric Administration National Marine Fisheries Service management plan for the protection of essential fish habitats and the economically important species that rely on them have ceased or set conservation limits on harvesting over a wide area of the Caribbean. This plan which implements monitoring, sets regulations on harvestable species and types of equipment used, and is adaptive to allow for stricter enforcements and limitations as needed in the future, and has resulted in increases in the size, abundance, and distribution of economically important fish and invertebrate species. This comprehensive management has led and would continue to provide long-term major benefits to essential fish habitats and the species associated with them. Regional actions by territorial and local actions to restore and protect essential fish habitat such as the mangrove restoration project in Salt River Bay and the establishment of the St. Croix East End Marine Park on St. Croix would provide long-term major benefits as well. Protection of essential fish habitats in the St. Croix East End Marine Park in particular has provided protection of important habitats that are used by species which migrate between this location and Buck Island Reef National Monument. Although harvesting of economically important species is permitted within St. Croix East End Marine Park, the limitations set on types of equipment used and size of the catch and the overall preservation of habitat provide great benefits. Protection of these areas and limitations on harvesting of species in the Buck Island Channel would continue to allow for the connectivity between critical sites of the various life stages of important species into the future (CFMC 2004).

The long-term major benefits provided by regional level management plans that would adapt as needed to enhance protection of essential fish habitats and continuing and future efforts to preserve essential fish habitats in large areas of the Caribbean find that the challenge of the recovery of past and present fishing and non-fishing related effects continue. The combined effects of these other actions, projects, and plans would be long-term, moderate, and beneficial. The combined effects of past, on-going, and future actions along with the long-term adverse effects of Alternative A would result in overall long-term, moderate benefits on essential fish habitats within the region. Cumulative effects related to climate change include temperature increase, acidification, sea level rise and increase in frequency and intensity of storms (as described in the marine and coastal resources section and Appendix D). The trends of climate change and the potential effects on coral reef that are designated as essential fish habitat would have projected long-term, major, adverse effects that would overshadow management actions taken by the park. When the beneficial and adverse effects of other past, on-going, and future plans, projects and activities affecting the abundance and distribution of essential fish habitat are combined with management actions under Alternative A, the resulting cumulative effects would be long-term, major, and adverse.

Conclusion

Continuing current management actions under Alternative A would result in long- and short-term, minor, adverse effects to essential fish habitat from vessel access and recreational use of the monument and long- and short-term, moderate, adverse level of effect due to illegal anchoring and fishing activities that take place in part due to limitations on enforcement abilities. Overall, the diversity and abundance of designated fish and invertebrate species that rely on the essential fish habitats within the monument would not be adversely affected by management actions.

The cumulative effects of comprehensive management planning, preservation of large areas, and restrictions of harvesting, would outweigh the adverse effects of commercial, recreational, and land use actions occurring with the region. The cumulative effect of these actions combined with effects of Alternative A would be long-term, moderate, and beneficial. Current trends of climate change and the effects on coral reefs as essential fish habitat would have projected long-term, major, adverse effects that would overshadow management actions taken by the park. The resulting overall cumulative effects on coral reef habitats would be long-term, major, and adverse.

Impacts of Alternative B, the Preferred Alternative

Under this alternative, anchoring, including bow and stern anchoring, at West Beach would be phased out, with the exception of 5 anchoring sites located in deep sand. This would have long-term, negligible to minor, beneficial effects on the essential fish habitat off West Beach particularly sand bottom community and seagrass community as seagrass may be able to establish in the anchor area.

Installation of moorings off West Beach in place of the anchoring area would result in negligible short-term, adverse effects on essential fish habitat as the placement of moorings would be conducted in a manner that avoids sensitive habitats such as seagrasses. Short-term effects would include generation of noise and temporary increase in turbidity during installation of mooring equipment. Adult and juvenile fish are highly mobile and would be expected to vacate the area to avoid these impacts and return to the area once turbidity and sounds returned to background levels. Given the size of the area where mooring equipment would be installed, effects to non-mobile species inhabiting the sand bottom would be short-term, negligible and adverse. These activities would not be expected to affect the overall abundance and use of the habitat by designated fish and invertebrate species. Installation of moorings compared to anchoring would provide long-term beneficial effects to seagrass and sand bottom communities as moorings, once installed, do not disturb seagrass and sand bottom communities.

Visitor activities such as snorkeling and SCUBA diving would continue to occur with the potential for damage from touching and inadvertent breaking particularly to hard-bottom and coral reef habitats. However, enhanced visitor education as to the sensitivity of the environments and the enhanced research, monitoring and enforcement of regulations would reduce the level of long-term adverse effect to negligible to minor.

Under this alternative, along with other management zones, the Marine Hazard Zone would be created that would prohibit vessel use and limit the type and variety of visitor activity north and southeast of the island. This zone would eliminate vessel related adverse effects of grounding or accidental anchoring to essential fish habitats such as shallow coral reefs and hard-bottom habitats in the area. In addition, the limitation of vessel size within the Resource Protection Zone would also act to reduce potential impacts of groundings on these sensitive habitats. Development of these zones would have long-term, moderate beneficial effects to essential fish habitat.

Illegal activities such as fishing and anchoring activities would be reduced to a large degree and over a large area as a result of the establishment of management zones that would have a low tolerance for resource degradation and enhanced levels of enforcement of regulations. Although there is a low potential for these illegal actions to still occur, overall, this increased level of enforcement and

protection would represent a long-term, moderate benefit to essential fish habitat and would be expected to result in an increase in designated fish and invertebrate species abundance.

Management actions under Alternative B that include restricting vessel activity in the monument and the size of vessels permitted by zone and the elimination of anchoring and installation of moorings would have long-term minor to moderate beneficial effects. Visitor use of the marine environment would have long-term negligible to minor adverse effects on essential fish habitat. Development of management zones that would enhance protection of essential fish habitat and increased and consistent enforcement of regulations would have overall long-term moderate benefits. Overall, management actions under Alternative B would have long-term, moderate beneficial effects to essential fish habitat and the designated species they support.

Cumulative Effects

Cumulative effects of other projects and plans would be the same as described for Alternative A.

Similar to Alternative A, when combining the effects of comprehensive management, restoration and protection projects, commercial, agricultural, and recreational use that occur in the region with the long-term moderate beneficial effects of Alternative B on essential fish habitat, the overall cumulative effects would be long-term, moderate, and beneficial. However, as described in Alternative A, the effects of global climate change on essential fish habitat would far outweigh these other cumulative effects, resulting in long-term, major, adverse effects to essential fish habitat and the designated species they support.

Conclusion

Alternative B would have long-term moderate beneficial effects on essential fish habitat from elimination of anchoring areas and replacement with moorings, establishment of management zones that restrict or eliminate vessel use, and enhanced protection and preservation of the marine environment. Mooring installation would have short-term negligible adverse effects to essential fish habitat during installation. Overall, the diversity and abundance of designated fish and invertebrate species that rely on essential fish habitat within the monument would increase as a result of management actions.

Similar to Alternative A, when combining the effects of comprehensive management, restoration and protection projects, commercial, agricultural, and recreational use that occur in the region with the long-term moderate beneficial effects of Alternative B on essential fish habitat, the overall cumulative effects would be long-term, moderate, and beneficial. As described in Alternative A, the effects of global climate change on essential fish habitat would far outweigh these other cumulative effects, resulting in long-term, major, adverse effects to essential fish habitat and the designated species they support.

Impacts of Alternative C

Under this alternative bow and stern anchoring would occur in a 2-acre Anchoring Zone in areas of deep sand at West Beach. This activity would disturb sand bottom communities in this area of the monument. As the nature of this environment is dynamic and marine fish and invertebrate species that use this environment have adapted to the highly changeable conditions, the affected area would be expected to return to existing conditions shortly following vessel removal. As in Alternative A, permitted anchoring and bow and stern anchoring under this alternative would have short-term negligible adverse effects on essential fish habitat.

Installation of moorings off West Beach in place of the anchoring area would result in negligible short-term, adverse effects on essential fish habitat as the placement of moorings would be conducted in a manner that avoids sensitive habitats such as seagrasses. Short-term effects would include generation of noise and temporary increase in turbidity during installation of mooring equipment. Adult and

juvenile fish are highly mobile and would be expected to vacate the area to avoid these impacts and return to the area once turbidity and sounds returned to background levels. Given the size of the area where mooring equipment would be installed, effects to non-mobile species inhabiting the sand bottom would be short-term, negligible and adverse. These activities would not be expected to affect the overall abundance and use of the habitat by designated fish and invertebrate species. Installation of moorings compared to anchoring would provide long-term beneficial effects to seagrass and sand bottom communities as moorings, once installed, do not disturb seagrass and sand bottom communities.

Visitor activities such as snorkeling and SCUBA diving would continue to occur with the potential for damage from touching and inadvertent breaking particularly to hard-bottom and coral reef habitats. As in Alternative B, enhanced visitor education as to the sensitivity of the environments and the enhanced monitoring and enforcement of regulations would reduce the level of long-term adverse effect to negligible to minor.

The establishment of a Marine Hazard Zone that would prohibit vessel use, establishment of a Resource Protection Zone, and increased research, monitoring, education and partnering programs, and enforcement of regulations would have the same overall effects on essential fish habitat as described in Alternative B. Management actions under Alternative C including restricting vessel activity in the monument and the size of vessels permitted in management zones would have long-term moderate beneficial effects. Visitor use of the marine environment, anchoring by permit, bow and stern anchoring, and mooring installation would have short- and long-term negligible to minor adverse effects on essential fish habitat. Development of management zones that would enhance protection of essential fish habitats and increased enforcement of regulations would have overall long-term moderate benefits. Overall, Alternative C would have long-term moderate benefits to essential fish habitat and the designated species they support.

Cumulative Effects

Cumulative effects of other projects and plans would be the same as described for Alternative A.

Similar to Alternative A, when combining the effects of comprehensive management, restoration and protection projects, commercial, agricultural, and recreational use that occur in the region with the long-term moderate beneficial effects of Alternative C on essential fish habitat, the overall cumulative effects would be long-term, moderate, and beneficial. As described in Alternative A, the effects of global climate change on essential fish habitat would far outweigh these other cumulative effects, resulting in long-term, major, adverse effects to essential fish habitat and the designated species they support.

Conclusion

Alternative C would have long-term, moderate, beneficial effects on essential fish habitat from establishment of management zones that restrict or eliminate vessel use and enhance protection and preservation of the marine environment. A reduced Anchoring Zone limited to bow and stern anchoring by permit, and mooring establishment would have short-term negligible adverse effects to essential fish habitat. Overall, the diversity and abundance of designated fish and invertebrate species that rely on the essential fish habitat within the monument would increase as a result of management actions. Overall, Alternative C would have long-term moderate benefits to essential fish habitat and the designated species they support.

Similar to Alternative A, when combining the effects of comprehensive management, restoration and protection projects, commercial, agricultural, and recreational use that occur in the region with the long-term moderate beneficial effects of Alternative C on essential fish habitat, the overall cumulative effects would be long-term, moderate, and beneficial. However, as described in Alternative A, the effects of global climate change on essential fish habitat would far outweigh these other cumulative

effects, resulting in long-term, major, adverse effects to essential fish habitat and the designated species they support.

Impacts of Alternative D

Under this alternative anchoring by permit would occur in a 16-acre Anchoring Zone in areas of deep sand that would be slightly smaller than the anchoring area under Alternative A. Locations for anchoring would be designated by park staff to avoid areas where seagrass has established. As in Alternative A, permitted anchoring under this alternative would have short-term negligible adverse effects on essential fish habitat. Installation of moorings in lieu of anchoring would provide beneficial effects to seagrass and sand bottom communities.

Elimination of bow and stern anchoring in the West Beach area under this alternative would have long-term negligible beneficial effects on sand bottom communities and fish and invertebrate species that inhabit this dynamic shoreline area.

Visitor activities such as snorkeling and SCUBA diving would continue to occur with the potential for damage from touching and inadvertent breaking particularly to hard-bottom and coral reef habitats. As in Alternative B, enhanced visitor education as to the sensitivity of the environments and the enhanced research, monitoring and enforcement of regulations would reduce the level of long-term adverse effect to negligible to minor.

The establishment of a Marine Hazard Zone that would prohibit vessel use, establishment of a Resource Protection Zone, and increased education of visitors and enforcement of regulations would have the same overall effects on essential fish habitats as described in Alternative B (long-term, moderate, beneficial). Overall, Alternative D would be expected to result in an increase in designated fish and invertebrate species abundances from protection and preservation of essential fish habitat.

Management actions under Alternative D include restricting vessel size and access by management zone would have long-term moderate beneficial effects. Visitor use of the marine environment, anchoring by permit, and establishment of moorings would have short- and long-term negligible to minor adverse effects on essential fish habitat. Development of management zones that would enhance protection of essential fish habitat and increase enforcement of regulations would have overall long-term moderate benefits. Overall, Alternative D would have long-term, moderate beneficial effects to essential fish habitat and the designated species they support.

Cumulative Effects

Cumulative effects of other projects and plans would be the same as described for Alternative A.

Similar to Alternative A, when combining the effects of comprehensive management, restoration and protection projects, commercial, agricultural, and recreational use that occur in the region with the long-term moderate beneficial effects of Alternative D on essential fish habitat, the overall cumulative effects would be long-term, moderate, and beneficial. As described in Alternative A, the effects of global climate change on essential fish habitat would far outweigh these other cumulative effects, resulting in long-term, major, adverse effects to essential fish habitat and the designated species they support.

Conclusion

Alternative D would have long-term moderate beneficial effects on essential fish habitat from establishment of management zones that restrict or eliminate vessel use and enhance protection and preservation of the marine environment. Anchoring by permit and mooring installation would have short-term negligible adverse effects to essential fish habitat. Elimination of bow and stern anchoring at West Beach would have short-term negligible beneficial effects of sand bottom community. Overall,

the diversity and abundance of designated fish and invertebrate species that rely on the essential fish habitat within the monument would increase as a result of management actions.

The cumulative effects of comprehensive management planning, preservation of large areas, restrictions of harvesting, would outweigh the adverse effects of commercial, recreational, and agricultural actions occurring within the region. The cumulative effect of these actions combined with overall moderate benefits of Alternative D would be long-term, moderate, and beneficial. Current trends of climate change and the effects on essential fish habitat would have projected long-term, major, adverse effects that would overshadow management actions taken by the park. The resulting overall cumulative effects on essential fish habitat would be long-term, major, and adverse.

SPECIES OF CONCERN

Regulations and Policies

The regulations and policies that guide NPS actions with respect to species of concern are presented in the “Servicewide Mandates and Policies” Section of Chapter 1 and in Appendix B. In accordance with 50 CFR 402(a), federal agencies are required to review all actions to determine whether an action may affect listed species or critical habitat. If such a determination is made, formal consultation is required, unless the federal agency determines, with the written concurrence of the U.S. Fish and Wildlife Service or the National Marine Fisheries Service, that the proposed action is not likely to adversely affect any listed species or critical habitat. It is NPS policy to survey for, protect, and strive to recover all native species that are listed under the Endangered Species Act.

Methods

Impacts on special status species were evaluated and determined qualitatively based on the existing literature, professional judgment of NPS staff, South Florida Caribbean Network Inventory and Monitoring Program for Vascular Plant and Vertebrates and Vital Signs, U.S. Fish and Wildlife Service, National Marine Fisheries Service, National Oceanic and Atmospheric Administration, Virgin Islands Department of Planning and Natural Resources Division of Fish and Wildlife, and consultants. The primary sources of information used in this analysis include existing literature for each species, park management documents, NPS research and documents, and unpublished observations and insights from knowledgeable park staff and experts. Based on this analysis, anticipated impacts to the federal listed and territory listed species that have the potential to occur within the park are discussed in this chapter. The geographic area analyzed is the area within the park unless otherwise noted.

Federally listed threatened and endangered species addressed include corals (first marine invertebrates listed under the Endangered Species Act), plants (cactus, orchids), and wildlife (marine mammals, birds, and reptiles). Impacts associated with visitor use and facility development (particularly trails) and use are also described under wildlife, marine and coastal resources, and shallow water coral reef community impact topics and would also apply to the species of concern. Therefore, the reader is encouraged to read previous descriptions of activities leading to habitat alteration and disturbances.

Impacts were evaluated by comparing projected changes resulting from the action alternatives to existing conditions and continuation of existing management actions under Alternative A, the No Action Alternative. These evaluations were based on documented occurrences of the species within the park and the distribution of their preferred habitats within the park. Impacts of potential visitation increases related to increased use of vessels in the park have been factored into the analyses.

Cumulative effects are as described in the introduction to this chapter. The cumulative effects of climate change are generally described in the introduction to this chapter and summarized in Appendix D.

The NPS considers how to protect and perpetuate federally and territory listed species during park management planning, and consults with lead federal and territory agencies as appropriate. NPS will, to the greatest extent possible, inventory, monitor, and manage territory-listed species in a manner similar to the treatment of federally listed species.

Impact Threshold Definitions

The thresholds to determine the intensity of impacts on territory listed species of concern are defined in the paragraphs that follow. The U.S. Fish and Wildlife Service Section 7 impact terms are used for federally listed species and are defined following the negligible, minor, moderate, and major terms.

Negligible: No territory-listed species would be affected, or the action would affect an individual of a listed species or its critical habitat, but the change would not be of any measurable or perceptible and would be within the range of natural variability.

Minor: The action would result in detectable impacts to an individual (or individuals) of a territory-listed species or its critical habitat, but they would be within the range of natural variability both spatially and temporally. No interference with feeding, reproduction or other activities affecting population viability would result from impacts. Sufficient functional habitat would remain to support viable populations.

Moderate: An action would result in detectable impacts on individuals or population of a territory listed species, critical habitat, or the natural processes sustaining them. Key ecosystem processes may experience disruptions that may result in population or habitat condition fluctuations that would be outside the range of natural variation (but would return to natural conditions).

Major: Individuals or population of a territory-listed species, critical habitat, or the natural processes sustaining them would be measurably affected. Key ecosystem processes might be permanently altered resulting at the population level and permanently modifying critical habitat.

Duration: Not applicable due to definitions in accordance with U.S. Fish and Wildlife Service terminology.

The Endangered Species Act defines the terms used to assess impacts on listed species as follows. These were applied only to species listed, proposed for listing, or candidate species at the federal level.

No effect/no adverse modification: The alternative and its interrelated and interdependent actions would not directly or indirectly affect listed species or adversely modify designated critical habitat. A “no effect” determination does not include effects that are unlikely to occur.

May affect/not likely to adversely affect or adversely modify critical habitat: Effects on species or designated critical habitat would be discountable (that is, would be extremely unlikely to occur and could not be meaningfully measured, detected, or evaluated) or completely beneficial. Beneficial effects do not take into consideration any balancing of effect, in other words, there cannot be balancing so that the benefits of the action would outweigh the adverse effects.

May affect/likely to adversely affect species or adversely modify critical habitat: An adverse effect on a listed species or designated critical habitat may occur as a direct or indirect result of the action, and the effect is either not discountable or not completely beneficial.

Is likely to jeopardize a listed species/adversely modify designated critical habitat: The action directly or indirectly could jeopardize the continued existence of a species or adversely modify habitat designated as critical to a species.

Impacts of Alternative A

Federally Listed Species

Elkhorn and Staghorn Coral. Elkhorn and staghorn coral are federally listed threatened species that occur in reef systems within the park as described in Chapter 3. Under Alternative A and all action alternatives, the park is used for a variety of appropriate or allowed recreational uses. Vessels traverse the park, anchor and moor at designated areas, and visitors snorkel, swim, SCUBA dive and walk in areas where these species occur.

Under Alternative A (as under all alternatives) anchoring would be in deep sand, therefore, there would be no adverse effects on the shallow water coral reef community, including elkhorn and staghorn coral associated with anchoring in designated areas. Some unauthorized anchoring could occur as a result of accidental groundings or emergency anchoring that could affect elkhorn and staghorn coral.

Vessels moving throughout the park have the potential to damage the shallow water coral community from groundings or propeller damage, especially within the shallow lagoon and areas surrounding Buck Island where patch reefs reach the water's surface. This would result in adverse effects on elkhorn and staghorn corals from direct hits by anchors, propeller scrapes, or anchor drags in the area where it would occur. Hazardous navigating conditions occur in the shallow coral reefs where the reefs reach the surface of the water. Inexperienced vessel operators such as new operators to the area, or those that rent vessels that may not be aware of navigation hazards, may cause major adverse effects to reefs if they were to ground or be required to anchor for emergency reasons.

Continuation of existing management practices under Alternative A would feature continued use of moorings near the underwater trail and the two SCUBA moorings located to the north of Buck Island. Under Alternative A, 8 new administrative moorings would be installed in areas of deep sand, and therefore, would not affect corals. The use of administrative moorings would aid consistency and efficiency in research and park management efforts. The existing underwater trail and SCUBA moorings provide access for visitors to view the underwater qualities of the "marine garden"; these underwater features of the park are significant. With any human interaction with the natural environment, there is an associated impact. Visitors at the underwater trail and SCUBA diving at the SCUBA moorings may cause damage from touching or inadvertently breaking coral. NPS provides training to concessioners and information to visitors regarding the sensitivity of these resources and would continue to do so under Alternative A as a deterrent to damaging corals. NPS would also continue to monitor conditions in the park within the constraints of funding and staff resources.

Under Alternative A, visitors anchored in the West Beach area would continue to swim and snorkel in this area. Some shallow water coral communities, including elkhorn and staghorn coral habitat are located near the anchoring area and are frequented by snorkelers. This continued activity would have adverse effects on elkhorn and staghorn coral through physical disturbance (touching, standing, handling, or breaking corals). Snorkeling and diving on reefs would have adverse effects on elkhorn and staghorn corals resulting from accidental touching and breaking of coral and disturbance of behavior of marine wildlife such as sea turtles and fish.

Studies have indicated correlations between sunscreen products and adverse effects to corals (Danovaro et al. 2008). The potential effects of visitors using these and other products within park waters have not been quantified. Other water quality concerns for corals are related to pollutant discharges and releases from vessel use (as defined in the introduction to this chapter). These are addressed under the "Water Resources" and "Marine and Coastal Resources" sections of this document. Although data are not available to quantify the potential effects from vessel related pollutants associated with normal use and operations are estimated to have negligible adverse effects on elkhorn and staghorn coral.

In summary, under Alternative A, continued authorized and unauthorized vessel anchoring, continued use of moorings, incidental vessel groundings, spills and pollutants from vessels and vessel hulls moving within the park, and direct physical contact between snorkelers and SCUBA divers at the SCUBA moorings with corals in the vicinity of the moorings and anchoring areas would result in adverse effects on elkhorn and staghorn coral in limited areas of the park. This would equate to a “may affect, likely to adversely affect” determination under the Endangered Species Act Section 7 finding.

These effects would be offset by continuation of the existing monitoring and research, enforcement, education, outreach, and partnering programs. NPS and other agencies involved recognize the need for stewardship of these species and their habitat, and continued access to be able to view these species in the park advances visitor understanding of the importance of resource protection. NPS has coordinated with the National Marine Fisheries Service during the listing of these species, and continues to coordinate coral research and monitoring within park boundaries.

Sea turtles (Green sea turtle, Hawksbill sea turtle, Leatherback sea turtle, and Loggerhead sea turtle). Year round, but intensified during peak sea turtle nesting season, monument staff make every effort to prevent adverse impacts on sea turtles, their nests, and hatchlings by visitors, dogs (which are prohibited, but occur), predation, illegal poaching, and vessel activities in the park. NPS sea turtle research and monitoring efforts would continue to occur, as would partnering, education and outreach efforts.

Visitor access to nesting areas on Buck Island would continue to be restricted during nesting season. Nests laid within or adjacent to high visitor use areas such as picnic areas would continue to be safely relocated. Efforts would be taken to permanently fix picnic tables so that visitors would not inadvertently move them on top of sea turtle nests. Sea turtles would likely continue to avoid areas where visitors frequently occur, such as the underwater trail and anchoring area. Due to the extent of other available habitat, visitor presence would have minor, adverse effects.

The adverse impacts on seagrass beds, benthic algae, and marine invertebrate species from vessel activity and anchoring would be negligible to minor due to restrictions on anchoring locations to deep sand. Shoreline anchoring can pose a threat to sea turtle nests, especially hawksbill nests that are shallow, if laid near the high water line. Sea turtle foraging habitats in other areas such as seagrasses and reefs may be altered due to visitor presence (vessel use, vessel noise, snorkeling, walking in shallow areas or SCUBA diving at the SCUBA moorings), as such this would have minor adverse effects.

The potential for collision with vessels and disturbance from motor vessel activity as sea turtles rest on the surface or surface to breathe is also limited to minor adverse effect due to education regarding sea turtles safety to motor boat operators, and restrictions on vessel speeds when approaching Buck Island. Overall, the actions taken by park staff and other partners, agencies and individuals to protect threatened and endangered sea turtles would continue to have long term benefits, as evidenced by increasing numbers of nesting sea turtles in the park and results of research and monitoring programs.

Continuing the existing management direction would result in conditions that are beneficial to preserving habitat and minimizing impacts on sea turtles. Alternative A may affect but would not be likely to adversely affect threatened and endangered sea turtles.

St. Croix Ground Lizard. Habitat for the federally listed endangered St. Croix ground lizard is typically dry, rocky coastal areas with sandy soils and shrub scrub or forested vegetation communities. NPS has coordinated with the U.S. Fish and Wildlife Service during the successful re-introduction and continued research and monitoring of the St. Croix ground lizard on Buck Island. NPS has conducted a successful mongoose and rat eradication program on Buck Island, continues to monitor, and is also conducting a similar program to monitor and potentially control the European house mouse (*Mus*

musculus). Eradication of these pest species made re-introduction of the St. Croix ground lizard to Buck Island possible. NPS would continue these efforts under Alternative A.

Over time as the ground lizard population on Buck Island is expected to increase and disperse, there may be locations near high visitor use areas such as the picnic areas, restroom, or trails where individual lizards could be adversely affected. However, populations of the lizards currently occur on St. Croix on hotel grounds where they are adjacent to areas subject to high levels of human presence and activity. Although individuals may be disturbed or displaced near picnic areas, the restroom, or trails, there is adequate undisturbed habitat in adjacent areas.

Continuing the current management direction would result in conditions that are beneficial to preserving habitat and minimizing impacts to the St. Croix ground lizard. Alternative A “may affect but would not be likely to adversely affect” the endangered St. Croix ground lizard.

Territory Listed Species

Brown Pelican. The brown pelican is territory-listed endangered species. The nesting area of the brown pelican is not easily accessible to park visitors. Some individual birds may alter their foraging habits during peak visitor use periods; however habitat and prey species are available in areas where visitors are not present. Therefore, there would be short-term, negligible adverse effects.

Least Tern. The least tern is a territory-listed threatened species. The least tern has been known to historically nest on Buck Island. Beachgoers on Buck Island and vessels anchoring on West Beach could adversely affect least terns. The occasional unauthorized presence of dogs on Buck Island, would also have adverse effects on least terns, causing stress, flushing, or nest abandonment. Disturbance by recreational visitors can cause terns to flush from foraging areas, increase stress on individuals or cause nest abandonment that would lead to loss of eggs. Recreational vessel use in the vicinity of Buck Island would not be expected to alter small fish abundance and distributions that terns prey upon. When least terns are present during nesting season, park staff restrict access to the nesting area and provides educational information to visitors of the sensitivity of least terns to disturbance during the nesting period. However, terns have failed to nest successfully on Buck Island in recent years for as yet unknown reasons. This has also occurred on St. Croix.

Should least terns return to nest, there is potential for continued disruption since staff resources for research and monitoring, enforcement of regulations and education are limited under current conditions. Because least terns nest in groups, disturbance would have larger effects than to species that nest individually and adverse effects could translate to the population level. Therefore it is estimated that long-term, minor, adverse effects on the least tern could occur under Alternative A due to visitor use and access.

Territory Listed Plant Species

The territory lists the following plants as endangered: lignum vitae, stinging bush, butterfly orchid, woolly nipple cactus, and Spanish lady. Sensitive plant species on Buck Island could potentially be disturbed by visitor use and access by trampling, uprooting, or in the case of the butterfly orchid and the woolly nipple cactus, individuals could be removed by collectors. Because of the rigorous environment on the island, the limited use of the existing hiking trail and the low potential for creation of unauthorized trails or going off-trail, these types of effects on these species would be unlikely. Continuation of existing management direction would result in conditions that are beneficial to preserving habitat and minimizing impacts to territory listed plant species. Under Alternative A, the effects would be long-term, minor, and beneficial.

Cumulative Effects

Elkhorn and Staghorn Coral. Cumulative impacts are described for Alternative A under the “Marine and Coastal Resources” section and readers are encouraged to refer back to this section for additional

details on the types of impacts resulting from past, on-going, and future projects and activities. NPS would continue to conduct research and monitor elkhorn and staghorn coral under Alternative A as well as continue coordination with the National Marine Fisheries Service.

Changing climate conditions in which coral reefs have lived in the Caribbean for millennia are rapidly changing. Global climate change models predict that for the year 2070, the air temperature in the Caribbean will rise between 2 ° and 4 °Celsius, with the greatest changes occurring in the northern Caribbean and around continental borders (IAC et al. 2009). Because current levels of sea surface temperature are already close to the upper temperature threshold for the survival of corals, it is projected that for the year 2020, coral bleaching will become an annual event in the Caribbean (IAC et al. 2009). Other impacts include damages caused by hurricanes and storms, which are becoming more frequent, rising sea levels, reduction of potential calcification (increased acidity of water), and diseases. The degree to which these changes will impact elkhorn, staghorn and other corals has yet to be determined.

Current trends of temperature increases, other effects of climate change, hurricanes, disease, and other factors discussed above and under the marine and coastal resources and essential fish habitat sections would have projected long-term, major, adverse effects that would overshadow beneficial management actions taken by the park under Alternative A. When the beneficial and adverse effects of other past, on-going, and future plans, projects and activities affecting elkhorn and staghorn coral are combined with actions under Alternative A, the resulting cumulative effects on elkhorn and staghorn coral would be “may affect/ likely to adversely affect.”

Sea Turtles (Green sea turtle, Hawksbill sea turtle, Leatherback sea turtle, and Loggerhead sea turtle). Protection of sea turtles from harvesting, poaching, and predation over the past four decades in the U.S. Virgin Islands, has provided major benefits to the populations in the Virgin Islands. In addition, establishment of ocean parks, sanctuaries, refuges, and reserves by federal and territory agencies provide (past, present and future) increased habitat protection for sea turtle nesting and foraging as beaches, seagrass, and coral reefs are preserved. Programs such as those taken on Buck Island Reef National Monument to eradicate and control non-native predators such as mongoose and rats have also provided enhanced protection of nests. Management actions taken by the park continue to contribute to the recovery effort. For example, the average number of Hawksbill sea turtle nests in the park has increased from an average of 12 to an average of 60 per season (Zandy Hillis-Starr, personal communication, 2010).

Although negative trends in recovery are reported for many areas (Nicaragua, Costa Rica, Panama and the Yucatan Peninsula of the Wider Caribbean, the trends for Buck Island Reef National Monument are positive, with recovery after many years of protective actions (IAC et al. 2009). Whereas populations are increasing in the park, similar signs of overall recovery throughout their range despite over a decade of protection are not reported (Mac et al. 1998; IAC et al 2009). Threats include direct take and trade of products, incidental catch and entanglement in discarded fishing gear, coastal development, habitat deterioration, and climate change. Nesting beaches are threatened by development, light pollution, erosion, marine debris, anchoring, and vegetation removal. Nests of sea turtles are impacted by non-native predators, dogs, vehicle traffic, and illegal poaching. These activities have cumulative, widespread, long-term major adverse impacts on sea turtle populations throughout their range. The current trends of climate change as related to effects on habitat and forage for sea turtles (i.e. seagrass, corals, benthic algae, and marine invertebrates) are not completely understood. Increased temperature conditions affect one of the most important sea turtle habitats, coral reefs, by coral bleaching (see also “Marine and Coastal Resources section and elkhorn and staghorn discussion).

Overall programs within the park, other protected areas, and enforcement of regulations to stop harvesting of sea turtles and sea turtle eggs implemented in the U. S. Virgin Islands have resulted in a

rebounding of sea turtle populations with long-term major beneficial effects. When the beneficial and adverse effects of other past, on-going, and future plans, projects and activities affecting sea turtles are combined with management actions under Alternative A, the resulting cumulative effects would be “may affect/not likely to adversely affect” sea turtles.

St. Croix Ground Lizard. The recovery program in the Virgin Islands to re-introduce and conserve the St. Croix ground lizard in combination with efforts to reduce or eradicate non-native predators would have long-term major beneficial impacts. Education and volunteer programs supported by private businesses, the territory of the Virgin Islands, and the NPS would continue to promote preservation of the species. Management actions under Alternative A would continue to contribute to the conservation of the species. Overall the cumulative effects on the St. Croix ground lizard would be, “may affect/not likely to adversely affect.” Territory Listed Species

Brown Pelican. Establishment of ocean parks, sanctuaries, refuges, and reserves by federal and territory agencies would provide increased nesting habitat and protection of marine habitat that would result in increased fisheries for forage. These activities would have major, long-term benefits. Programs on Buck Island and in other nature preserves and sanctuaries to control or eradicate non-native plants would improve nesting habitat in the region. Efforts to protect mangrove forests and associated estuarine nursery areas on St. Croix and in preserves and refuges within the Virgin Islands would have long-term beneficial effects on the brown pelican populations in the Virgin Islands.

Over harvesting of fish species and degradation of important fisheries habitats has major adverse affects on pelican populations, which readily fluctuate as a result of fish abundance. Development within the region affecting mangrove and fringe mangrove habitats would have long-term, adverse impacts on pelicans due to a loss of nesting habitat and increased potential for pollution of adjacent marine habitats (Nature Conservancy 1998). Human disturbance of nests, poaching activities, and mortalities resulting from fishing with hooks and monofilament lines would have minor adverse effects on the species (USFWS 1995). Regionally, populations appear to be stable, but they are not increasing.

The current trends of climate change and the potential effects on fisheries would have projected long-term, major, adverse effects on the brown pelican that would overshadow management actions taken by the park. When the beneficial and adverse effects of other past, on-going, and future plans, projects and activities affecting the brown pelican are combined with management actions under Alternative A, the resulting cumulative effects would be long-term, major, and adverse.

Least Tern. Park staff successfully eradicated and now maintains control of 2 non- native predators, mongoose and tree rats, on Buck Island, which had severely affected the least tern nesting success on the island. These programs and other programs to eradicate or reduce these non-native pests in the region would have long-term moderate benefits.

The establishment of marine protected areas, sanctuaries, and ocean parks by federal and territory agencies, such as the St. Croix East End Marine Park established in 2003, protect and preserve important beach habitat for nesting and enhances small fish prey that least terns feed upon. Increased collaboration with the U.S. Fish and Wildlife Service, U.S. Virgin Islands Coastal Zone Management Program, St. Croix East End Marine Park, and Virgin Island Department of Planning and Natural Resources, Division of Fish and Wildlife to monitor populations and future management actions would further enhance protection of the species based on research and monitoring results as part of collaborative conservation initiatives. These programs to protect and preserve important habitat and forage have long-term major benefits on the least tern population and survival.

Degradation of habitat along beaches due to development and increased recreational use in the area has caused increasing disturbance of nesting birds and avoidance of habitat. Over fishing that continues to occur in the region has resulted in declines of small fish prey. These actions continue to

have long-term major adverse effects on least terns and outweigh the benefits of other programs to preserve and protect least tern habitat. In addition, the current trends of climate change and the potential effects on fisheries would have projected long-term, major, adverse effects that would overshadow management actions taken by the park under Alternative A.

When the beneficial and adverse effects of other past, on-going, and future plans, projects and activities affecting the least tern are combined with management actions under Alternative A, the resulting cumulative effects would be long-term, major, and adverse.

Territory Listed Plant Species

Non-native invasive plant eradication and control program on the island would restore a large portion of the native habitat as exotic plants island-wide are treated. The stinging bush, the wooly nipple cactus, and Spanish lady that inhabit the dry deciduous forest and/or the scrublands on Buck Island would benefit to a moderate level over the long-term due to the high level of habitat restoration. The butterfly orchid would benefit to a lesser degree. Control of non-native plants and restoration efforts undertaken by park staff would continue to have long-term major beneficial impacts on *lignum vitae* on Buck Island and in the region as this species is protected from extinction.

Development within the region, loss of habitat, infestation by non-native plants and insects, and illegal collecting of plant species continue to degrade populations of these sensitive species in the Virgin Islands resulting in long-term major adverse effects. Overall encroachment and degradation of habitat over large areas of the Virgin Islands outweighs to a moderate degree the restoration and preservation programs on Buck Island, resulting in long-term moderate adverse impacts on sensitive plant species. Management actions under Alternative A contribute little to these overall effects. The overall cumulative effects on sensitive plant species as a result of implementation of Alternative A in combination with other past, on-going and future plans and projects would be long-term, moderate, and adverse.

Conclusions

Continuation of management practices under Alternative A may affect threatened and endangered species within the park and the likelihood of adversely affecting each species varies according to impacts associated with vessel and visitor use and protective management actions taken. Impacts to federally listed species and associated intensity of effect are summarized as follows:

- Elkhorn and staghorn coral: may affect/likely to adversely affect
- Sea turtles: may affect/not likely to adversely affect
- St. Croix ground lizard: may affect/not likely to adversely affect

Territory listed species also have a range of effects dependent on the level of impact associated with vessel and visitor use. Least terns could be disturbed and abandon nests due to recreational activities, resulting in long-term, minor, adverse effects. There would be short term, negligible adverse effects to brown pelicans. Continued protection of territory listed plants would result in long-term, minor, beneficial effects.

The current trends of temperature increases, other effects of climate change, hurricanes, disease, and other factors would have projected long-term, major, adverse effects that in some cases would overshadow management actions taken by the park under Alternative A. When the beneficial and adverse effects of other past, on-going, and future plans, projects and activities affecting species of concern are combined with actions under Alternative A, the resulting cumulative effects would vary by species and are summarized below.

- Federal listed elkhorn and staghorn coral: may affect/likely to adversely affect.
- Federal listed sea turtles: may affect/not likely to adversely affect

- Federal listed St. Croix ground lizard: may affect/ not likely to adversely affect
- Territory listed brown pelican: long-term, major and adverse
- Territory listed least tern: long-term, major and adverse
- Territory listed plant species: long-term, moderate, and adverse.

Impacts of Alternative B, the Preferred Alternative

Elkhorn and Staghorn Coral. Eventual phase-out of anchoring under Alternative B (with the exception of 5 designated anchoring locations in deep sand for vessels 91 to 150 feet by permit only) and replacement of anchoring with moorings would reduce the number of vessels (from 87 under Alternative A to 72 under Alternative B), and therefore reduce the number of visitors that would access the park. Phasing out anchoring would not directly affect elkhorn and staghorn coral because anchoring was only authorized in deep sand, however, the reduced number of visitors would proportionally reduce the number of visitors that may be snorkeling, or swimming in areas where elkhorn and staghorn coral occur.

Accidental vessel groundings could still occur under Alternative B, however, establishment of the Marine Hazard Zone would eliminate use of vessels in shallow reefs to the northwest, north and southeast of Buck Island, thereby reducing the potential for adverse effects of emergency anchoring and/or groundings on the shallow water coral reef community where elkhorn and staghorn coral occur. This would have a beneficial effect on elkhorn and staghorn coral. Adverse effects would be minimized through an increase in enforcement staff and patrol activities at the park, establishment of the Marine Hazard Zone, and through an increase in education, outreach, and partnering programs. The effects of an accidental grounding would be long-term, major and adverse at the point where a grounding occurred; however, the likelihood of such an event would be minimized by the Marine Hazard Zone restrictions on vessel use and increased enforcement and education as to the navigation hazards inherent in this zone.

Up to 10 new moorings would be installed southwest of the existing pier under Alternative B. These moorings would be placed in areas of deep sand and low density seagrass cover. A maximum of 45 new moorings would be installed off West Beach to offset the phased elimination of anchoring under Alternative B. Mooring installation would have no effects on the shallow water coral community, since coral reefs are not present in these areas. Administrative moorings would be installed in areas avoiding coral, and would have no adverse effect on elkhorn or staghorn species.

Under Alternative B, visitors would disembark at West Beach from the 45 moorings via marked beach access channels and/or at the pier. This would allow continued use of the West Beach and pier areas by visitors in the Recreation Zone along the shoreline and reef areas in designated areas only, similar to Alternative A. Swimming and snorkeling in the vicinity of the sand bottom, seagrass and the nearby shallow water coral communities would continue in the West Beach area. These types of activities are estimated to have similar types of adverse effects on elkhorn and staghorn coral in the vicinity of the West Beach, but at reduced levels of intensity compared to Alternative A, since there would be fewer visitors. This would result in minor, beneficial effects.

Continued snorkeling at the underwater trail and SCUBA diving at the SCUBA moorings off the east end of the island would have similar effects as Alternative A on elkhorn and staghorn in this area. Increased staff and enforcement under Alternative B, however, would allow additional training of concessioners, education, partnering and enforcement to increase awareness of these sensitive resources and help prevent resource damage.

The elkhorn coral barrier reef is excluded from the Recreation Zone to further protect the threatened species. Inclusion of a major portion of the southern bank barrier reef in the Marine Hazard Zone would result in more limited uses of this area for recreation. This would result in a beneficial effect on

the bank barrier reef by reducing the potential for touching and breaking of coral and by reducing the potential for groundings and damage from propellers. This would have beneficial effects on the elkhorn and staghorn coral.

Vessel use would continue to result in effects on water quality in the park as described in the "Water Resources" section and Alternative A. Under Alternative B, water quality in the park would be affected by many of the same influences as those described under Alternative A, and the number of vessels that would be accommodated under alternatives A and B would also have similar effects (87 vessels and 72 vessels, respectively). Increased staff proposed for Alternative B would help reduce pollutant discharges and releases from vessels through increased education and enforcement efforts. These pollutants would have adverse effects on coral communities by exposing marine organisms to contaminants during movement of vessels into and out, and staying in the mooring and anchoring areas. Creation of a Marine Hazard Zone under all action alternatives (elimination of vessels in this zone) would significantly decrease the potential for vessel grounding on reefs within the park, reducing the potential for an oil spill within the park boundary. A restriction of vessel size in park waters would also reduce the potential for spills/discharges in park waters from freighters, cruise ships, or other large vessels.

The effects of management actions proposed under Alternative B would have less intense effects on elkhorn and staghorn coral than Alternative A, and result in the Section 7 determination of may affect, not likely to adversely affect. NPS would increase efforts regarding monitoring and research, enforcement, education, outreach and partnering under Alternative B compared to Alternative A. NPS would continue to coordinate with the National Marine Fisheries Service regarding the protection of elkhorn and staghorn coral as research and monitoring of these species continues within park boundaries and adaptive measures are developed. As was described for Alternative A, the NPS recognizes the need for stewardship of these species and their habitat, and continued access to be able to view these species in the park advances visitor understanding of the importance of resource protection.

Sea Turtles (Green sea turtle, Hawksbill sea turtle, Leatherback sea turtle and Loggerhead sea turtle). Protection of sea turtle nesting areas and efforts to reduce impacts on sea turtles from recreational use of the park would have the same effects as described for Alternative A. Under Alternative B, anchoring within the monument would be phased out (with the exception of five designated anchoring locations for vessels 91 to 150 feet in deep sand) and moorings would be established for recreation and management use. The overall number of vessels accessing the park would be reduced under Alternative B compared to Alternative A, which could also reduce the potential for collisions with sea turtles and the number of visitors interacting or disturbing sea turtles, their nests, and hatchlings.

The installation of moorings may cause short-term avoidance of the area by sea turtles during the installation timeframe, but would not have overall long-term adverse effects. Phasing out of anchoring and transition to a mooring system could improve foraging habitat, as seagrasses may re-establish and recover in the area off West Beach. Eliminating bow and stern anchoring would also reduce disturbance to sea turtle nests, especially hawksbill nests that are shallow, if laid near the high water line. Impacts associated with the presence of vessels, vessel noise, swimming, snorkeling, and walking in shallow areas, and SCUBA diving at SCUBA moorings would be similar to Alternative A.

The designation of the Resource Protection and Marine Hazard Zones would have beneficial effects on sea turtles. These zones would provide additional protection of habitat for foraging and cover. Elimination of vessels in the Marine Hazard Zone precludes possible vessel damage to coral reefs where sea turtles seek cover, rest, mate, and also reduces the potential for collisions between vessels and sea turtles as they surface to breathe. Increased staffing, research, monitoring, enforcement, education and outreach would also provide long-term beneficial effects. Management actions,

management zones, and vessel size and use limitations proposed under Alternative B would result in conditions that are beneficial to preserving habitat and minimizing impacts to sea turtles. NPS would continue to coordinate with the National Marine Fisheries Service, U.S. Fish and Wildlife Service, and Territorial Department of Natural Resources Division of Fish and Wildlife on future actions. Alternative B would result in a may affect, not likely to adversely affect finding.

St. Croix Ground Lizard. The types of effects of Alternative B on the St. Croix ground lizard would be the same as those described for Alternative A. While a minimal amount of new trail or kiosk construction is possible under Alternative B, construction would be conducted in a manner to avoid critical habitat. Environmental compliance documentation would be conducted prior to any trail work and measures would be taken to avoid the St. Croix ground lizard, and the NPS would coordinate with the U.S. Fish and Wildlife Service regarding future actions. Therefore, the overall effect of Alternative B would be the same as Alternative A. Alternative B may affect but would not be likely to adversely affect the endangered St. Croix ground lizard.

Territory Listed Species

Brown Pelican. The effects of Alternative B on the brown pelican would be similar to Alternative A. Installation of moorings off West Beach and up to 5 anchoring locations in deep sand for larger vessels would not affect the pelican's prey distribution or abundance. The designation of a Marine Hazard Zone that includes the area north of Buck Island would prohibit vessel use in that area, provide additional area for undisturbed foraging and reduce the potential for vessel activities to disturb nesting. Overall Alternative B would have a long-term, minor, beneficial effect on the territory listed, endangered brown pelican.

Least Tern. Under Alternative B, anchoring at West Beach would be phased out as new moorings are installed. The exception would be installation of five designated anchoring locations for vessels 91 to 150 feet in length. These anchoring sites would be located well off shore in deep water, and would not directly affect least terns. Reduction in anchoring along the West Beach shoreline would reduce the potential for stressing individuals, disruption of nesting behaviors, or flushing and abandonment of nests near West Beach. Park staff would continue to restrict access to nesting areas and provide educational information to visitors of the sensitivity of the species to disturbance during the nesting period. Recreational vessel use under this alternative would not be expected to alter small fish abundance and distributions that are prey for the terns.

Limited new trail or kiosk development that may occur under Alternative B would be conducted to avoid sensitive habitats and sensitive nesting periods of terns resulting in no effect on least terns. Under Alternative B, there would be increased staff resources to enhance research and monitoring, education, and enforcement of regulations for protecting least terns. As such, there would be increased protection of least terns and nesting areas. This would eliminate or reduce the potential for disturbance by recreational use compared to Alternative A and would result in long-term, negligible, adverse effects on the territory listed threatened least tern.

Territory Listed Plant Species

The park would continue their efforts to control non-native, invasive plant species with the same beneficial effects as described under Alternative A. Limited development of new trails and kiosks on Buck Island would be conducted in a manner to avoid locations where sensitive plants occur. Limited trail development could increase visitor use of the interior of the island and increase the potential for spread of non-native plant species into sensitive terrestrial habitats. Steep topography, dangerous plant species, and hot temperatures would limit visitor use of the island's interior, however. Increased educational opportunities under this alternative would improve visitor understanding and appreciation of the monument's sensitive species, which would help prevent or reduce unauthorized

off-trail use. As such, there would be long-term, minor, beneficial effects on territory listed plant species.

Cumulative Effects

Effects on special status species from other past, on-going, and future plans and projects would be the same as described for Alternative A. Management actions proposed under Alternative B would likely contribute a relatively small component to these cumulative impacts. The current trends of climate change, hurricanes, disease, and other factors would have projected long-term, major adverse effects on some species of concern that would overshadow management actions taken by the park under Alternative B. When the beneficial and adverse effects of other past, on-going, and future plans, projects and activities affecting species of special concern are combined with actions under Alternative B, the resulting cumulative effects would vary by species and are summarized below.

- Federal listed elkhorn and staghorn coral: may affect/likely to adversely affect.
- Federal listed sea turtles: may affect/not likely to adversely affect
- Federal listed St. Croix ground lizard: may affect/not likely to adversely affect
- Territory listed brown Pelican: long-term, major and adverse
- Territory listed least tern: long-term, major and adverse
- Territory listed plant species: long-term, moderate, and adverse.

Conclusions

Overall the enhancement of research and monitoring of special status species and their habitats and enforcement of regulations in the newly designated management zones within the monument and increased educational information that promotes the protection and preservation of these species would have overall long-term, moderate, beneficial effects. Management actions proposed under Alternative B would result in a “may affect/not likely to adversely affect” Section 7 finding for federal listed species (elkhorn and staghorn coral, sea turtles, and the St. Croix ground lizard). Least terns could be disturbed and abandon nests due to recreational activities; however increased research and monitoring and enforcement of regulations would reduce this potential resulting in a long-term negligible adverse effect. Under Alternative B there would be long-term, minor, beneficial effects on the brown pelican and territory listed plants.

Effects on special status species from other past, on-going, and future plans and projects would be the same as described for Alternative A. Management actions proposed under Alternative B would likely contribute a relatively small component to these cumulative impacts for some species, and would be overshadowed by effects of climate change, hurricanes, disease, and other factors

Impacts of Alternative C

Elkhorn and Staghorn Coral. The types of effects of management actions under Alternative C on elkhorn and staghorn coral are similar to those described under Alternative B due to the beneficial effects associated with the Marine Hazard Zone, Resource Protection Zone and increased park staff, research, monitoring, enforcement, and education and partnering. Alternative C would continue to provide an Anchoring Zone for bow and stern anchoring, and since this area is deep sand, this designated anchoring location would not affect elkhorn and staghorn coral.

The elkhorn coral barrier reef is excluded from the Recreation Zone to further protect the threatened species. Establishment of the Marine Hazard Zone would eliminate use of vessels in shallow reefs to the northwest, north and southeast of Buck Island, thereby reducing the potential for adverse effects of emergency anchoring and/or groundings on the shallow water coral reef community including elkhorn and staghorn coral. Inclusion of a major portion of the southern bank barrier reef in the Marine Hazard Zone would result in more limited uses of this area for recreation. This would result in

a beneficial effect on the bank barrier reef by reducing the potential for touching and breaking of coral and by reducing the potential for groundings and damage from propellers. This would have beneficial effects on elkhorn and staghorn coral in these areas of the park. Adverse effects would be minimized through an increase in enforcement staff and patrol activities at the park, establishment of the Marine Hazard Zone, and through an increase in education, outreach, and partnering programs compared to Alternative A. The effects of an accidental grounding would be long-term, major and adverse at the point where a grounding occurred; however, the likelihood of such an event would be minimized by the Marine Hazard Zone restrictions on vessel use and increased enforcement and education as to the hazards inherent in this zone.

Under Alternative C, visitors would disembark at West Beach from the 45 moorings via marked beach access channels and/or at the pier, or the designated Anchoring Zone. This would allow continued use of the West Beach areas by visitors, similar to Alternative A. Swimming and snorkeling in the vicinity of the sand bottom, seagrass and the nearby shallow water coral communities would continue in the West Beach area. These types of activities are estimated to have adverse effects on elkhorn and staghorn coral located in proximity to the north of West Beach similar to those associated with Alternative A, since access to these same areas would be provided by a similar number of vessels and therefore visitors to nearby shallow water coral communities where elkhorn and staghorn coral are present (92 vessels under Alternative C, compared to 87 vessels under Alternative A).

Continued snorkeling at the underwater trail and SCUBA diving at the SCUBA moorings on the east end of the island would have similar effects as Alternative A on reefs in this area.

Vessel use would continue to result in effects on water quality in the park as described in the "Water Resources" section. Under Alternative C, water quality in the park would be affected by many of the same influences as those described under Alternative A, and the number of vessels that would be accommodated under alternatives A and C would also have similar effects (87 vessels and 92 vessels, respectively). Increased staff proposed for Alternative C would help reduce pollutant discharges and releases from vessels through increased education and enforcement efforts. These pollutants would have adverse effects on shallow water coral reef communities by exposing marine organisms to contaminants during movement of vessels into and out and staying in mooring and anchoring areas.

In summary, the overall effects of management actions under Alternative C may affect but are not likely to adversely affect federally listed threatened elkhorn and staghorn coral. NPS establishment of the Marine Hazard Zone and other management zones and additional resource protective measures enforced by an increased workforce provide for protection of elkhorn and staghorn coral. NPS would continue to coordinate with the National Marine Fisheries Service regarding the protection of these species as coral research and monitoring continues within park boundaries and adaptive measures are developed. NPS recognizes the need for stewardship of these corals and their habitat, and continued access to be able to view these species in the park advances visitor understanding of the importance of resource protection.

Sea Turtles (Green sea turtle, Hawksbill sea turtle, Leatherback sea turtle and Loggerhead sea turtle). The impacts of management actions of Alternative C on threatened and endangered sea turtles would be the same as Alternative B, including establishment of management zones, limitation on vessel size by management zone, increased staffing, enforcement, research and monitoring. The increased number of vessels and therefore visitors that would be possible under Alternative C compared to Alternative A may cause an increase in the potential for boat strikes, and disturbance of nesting, resting and mating sea turtles. However, this would be offset somewhat by the establishment of management zones, enforcement of speed limits, vessel size limitations, and increased staffing, education and outreach. The Anchoring Zone at West Beach would be somewhat reduced compared to Alternative A, which would also decrease potential disturbances. Management actions under Alternative C would also result in conditions that are beneficial to preserving habitat and minimizing

impacts to sea turtles. Alternative C would result in a “may affect, not likely to adversely affect” Section 7 finding.

St. Croix Ground Lizard. The effects of management actions described under Alternative C on the federally endangered St. Croix ground lizard would be the same as those described for Alternative B. Protective measures would be taken during the planning and construction of any facilities such as limited trail work or installation of information kiosks. Alternative C may affect, but would not be likely to adversely affect the endangered St. Croix ground lizard.

Territory Listed Species

Least Tern. The impacts of recreational use and development actions under Alternative C would be similar those described under Alternative A. Under Alternative C, an approximately two-acre area along West Beach would be established for bow and stern anchoring in deep sand habitat. Park staff would continue to restrict access to nesting areas and provide educational information to visitors regarding the sensitivity of the species to disturbance during nesting periods when least terns are present. There would also be increased resources to enhance research and monitoring, education, and enforcement of regulations for protecting least terns. Under Alternative C, if impacts from anchoring are found to be occurring at unacceptable levels, permits would be changed to enhance protection of the least tern. With increased research and monitoring and implementation of adaptive management actions to protect least terns and their nests, the overall effect would be long-term, minor, and adverse.

Brown Pelican. The effects of Alternative C on the brown pelican would be similar to Alternative B. Installation of moorings off West Beach and a limited number (five) of off shore anchoring locations for larger vessels would not affect the pelican’s prey distribution or abundance. Designation of a Marine Hazard Zone that includes the area north of Buck Island would prohibit vessel use in that area, provide additional area for undisturbed foraging, and reduce the potential for vessel activities to disturb nesting. Overall, Alternative C would have a long-term, minor, beneficial effect on the territory listed, endangered brown pelican.

Territory Listed Plant Species

The park would continue their efforts to control non-native, invasive plant species with the same beneficial effects as described under Alternative A. Development of minimal new trails and installation of kiosks on Buck Island would be conducted in a manner to avoid locations where sensitive plants occur. However, new trail development could increase visitor use of the interior of the island and increase the potential for spread of non-native plant species into sensitive terrestrial habitats, and increase the amount of litter. Steep topography, dangerous plant species, and hot temperatures would limit visitor use of the island’s interior, however. Increased educational opportunities under this alternative would improve visitor understanding and appreciation of the monument’s sensitive species, which would help prevent or reduce unauthorized off-trail use. Overall, there would be long-term, minor, beneficial effects on territory listed plant species.

Cumulative Effects

Effects on special status species from other past, on-going, and future plans and projects would be the same as described for Alternative A. Management actions proposed under Alternative C would likely contribute a relatively small component to these cumulative impacts. The current trends of climate change, hurricanes, disease, and other factors would have projected long-term, major adverse effects on some species of concern that would overshadow management actions taken by the park under Alternative C. When the beneficial and adverse effects of other past, on-going, and future plans, projects and activities affecting special status species are combined with actions under Alternative C, the resulting cumulative effects would vary by species and are summarized as follows.

- Federal listed elkhorn and staghorn coral: may affect/likely to adversely affect.
- Federal listed sea turtles: may affect/not likely to adversely affect
- Federal listed St. Croix ground lizard: may affect/not likely to adversely affect
- Territory listed brown pelican: long-term, major and adverse
- Territory listed least tern: long-term, major and adverse
- Territory listed plant species: long-term, moderate, and adverse.

Conclusions

Overall the enhancement of research and monitoring of special status species and their habitats and enforcement of regulations in the newly designated management zones within the monument and increased educational information that promotes the protection and preservation of these species would have overall long-term, moderate, beneficial effects. Management actions proposed under Alternative C would result in a “may affect/not likely to adversely affect” Section 7 finding for federally listed species (elkhorn and staghorn coral, sea turtles, and the St. Croix ground lizard). Least terns could be disturbed and abandon nests due to recreational activities on West Beach and the associated bow and stern anchoring area; however increased monitoring and enforcement of regulations would reduce this potential resulting in a long-term minor adverse effect. Under Alternative C there would be long-term, minor, beneficial effects on the brown pelican and territory listed plants.

Effects on special status species from other past, on-going, and future plans and projects would be the same as described for Alternative A. Management actions proposed under Alternative C would likely contribute a relatively small component to these cumulative impacts for some species of concern.

Impacts of Alternative D

Elkhorn and Staghorn Coral. The types of effects of management actions under Alternative D on elkhorn and staghorn coral are similar to those described under Alternative C as far as the beneficial effects associated with the Marine Hazard Zone, Resource Protection Zone and increased park staff, research, monitoring, enforcement, education and partnering efforts are concerned. Alternative D would provide a 16 acre Anchoring Zone, and since this area is deep sand it would not affect elkhorn and staghorn coral. In addition to the Anchoring Zone, Alternative D would provide an additional 55 moorings off West Beach and west of the pier, combined. The approximate number of total vessels would increase from 87 under Alternative A to approximately 112 vessels under Alternative D. This increased number of vessels and therefore visitors would likely create an increase in adverse impacts to elkhorn and staghorn coral associated with increased recreational activity such as snorkeling, swimming, and SCUBA diving at the SCUBA moorings in the park and the increased likelihood of coral touching, breakage or inadvertent damage.

The elkhorn coral barrier reef is excluded from the Recreation Zone to further protect the threatened species. Establishment of the Marine Hazard Zone would eliminate use of vessels in shallow reefs to the northwest, north and southeast of Buck Island, thereby reducing the potential for adverse effects of emergency anchoring and/or groundings on the shallow water coral reef community including elkhorn and staghorn coral. Inclusion of a major portion of the southern bank barrier reef in the Marine Hazard Zone would result in more limited uses of this area for recreation. This would result in a beneficial effect on the bank barrier reef by reducing the potential for touching and breaking of coral and by reducing the potential for groundings and damage from propellers. This would have beneficial effects on elkhorn and staghorn coral in these areas of the park. Adverse effects would be minimized through an increase in enforcement staff and patrol activities at the park, establishment of the Marine Hazard Zone, and through an increase in education, outreach, and partnering programs compared to Alternative A.

The effects of an accidental grounding would be long-term, major and adverse at the point where a grounding occurred. The likelihood of such an event would be minimized by establishing the Marine Hazard Zone prohibiting vessel use and providing increased enforcement and education as to the hazards inherent in this zone. However, due to the increase in overall capacity for more vessels to access Buck Island via moorings and sites to anchor compared to Alternative A, there may be an increased chance for an accidental grounding to occur.

Under Alternative D, visitors would disembark at West Beach from the 45 moorings via marked beach access channels and/or at the pier, or the designated Anchoring Zone. This would allow continued use of the West Beach areas by visitors, similar to Alternative A. Swimming and snorkeling in the vicinity of the sand bottom, seagrass and the nearby shallow water coral communities would continue in the West Beach area. These types of activities are estimated to have adverse effects on elkhorn and staghorn coral located in proximity to the north of West Beach similar to those associated with Alternative A, since access to these same areas would be provided by an increased number of vessels and therefore visitors to nearby shallow water coral communities where elkhorn and staghorn coral are present (112 vessels under Alternative D, compared to 87 vessels under Alternative A).

Continued snorkeling at the underwater trail and SCUBA diving at the SCUBA moorings on the east end of the island would have similar effects as Alternative A on reefs in this area.

Vessel use would result in effects on water quality in the park as described in the "Water Resources" section. Under Alternative D, water quality in the park would be affected by many of the same influences as those described under Alternative A, and the number of vessels that would be accommodated under Alternative D could have increased adverse effects. Increased staff proposed for Alternative D would help reduce pollutant discharges and releases from vessels through increased education and enforcement efforts. However, the increase in staffing may not be able to address the potential magnitude of the increase in vessels. These pollutants would have adverse effects on shallow water coral reef communities, including elkhorn and staghorn coral by exposing marine organisms to contaminants during movement of vessels into and out and staying in the mooring and Anchoring Zone. In addition, an increase in the number of visitors would increase the use of sunscreens and other products that may adversely affect corals.

In summary, the overall effects of management actions under Alternative D may affect but are not likely to adversely affect federally listed threatened elkhorn and staghorn coral. NPS establishment of the Marine Hazard Zone and other management zones and additional resource protective measures enforced by an increased workforce provide for protection of elkhorn and staghorn coral. NPS would continue to coordinate with the National Marine Fisheries Service regarding the protection of these species as coral research and monitoring continues within park boundaries and adaptive measures would be developed to address any increase in adverse effects to elkhorn and staghorn coral, including the potential adverse effects from an increase in vessel and visitor use, particularly during periods of peak visitation. These measures are included in the user capacity analysis of Chapter 2. NPS recognizes the need for stewardship of these corals and their habitat, and continued access to be able to view these species in the park advances visitor understanding of the importance of resource protection.

Sea Turtles (Green sea turtle, Hawksbill sea turtle, Leatherback sea turtle and Loggerhead sea turtle). Protection of sea turtle nesting areas and efforts to reduce impacts on sea turtles from recreational use of Buck Island would have the similar effects as Alternative A, with the exception of the number of vessels and therefore visitors accessing Buck Island would increase from 87 under Alternative A to 112 under Alternative D. Under Alternative D, a 16 acre Anchoring Zone would be established along with five designated anchoring locations for vessels 91 to 150 feet in deep sand (by permit only). Moorings would also be established for recreation and NPS administrative use. The

overall increase in number of vessels accessing the park could increase the potential for collisions with sea turtles and the number of visitors interacting or disturbing sea turtles.

The installation of moorings may cause short-term avoidance of the area by sea turtles during the installation timeframe, but the presence of moorings would not have overall long-term adverse effects. Impacts associated with the increased presence of vessels, vessel noise, swimming, snorkeling, and walking in shallow areas near West Beach would likely cause sea turtles to avoid areas where people frequent, in particular West Beach and the underwater trail. Visitor use of the underwater trail and nearby SCUBA diving moorings would have effects similar to Alternative A. Sea turtles would avoid these areas during peak visitation periods.

The designation of the Resource Protection and Marine Hazard Zones would have beneficial effects on sea turtles. These zones would provide additional protection of habitat for foraging and cover. Elimination of vessels in the Marine Hazard Zone eliminates possible vessel damage to coral reefs where sea turtles forage, seek cover, rest, mate, and also reduces the potential for collisions between vessels and sea turtles as they surface to breathe. However, the potential for vessels colliding with sea turtles in other zones in the park may increase relative to the increase in number of vessels entering and leaving the mooring areas and Anchoring Zone as well as traversing the park.

Increased access and numbers of vessels and visitors to Buck Island may also result in increased disturbance to nesting sea turtles, their nests, and hatchlings. Park managers would consider adaptive measures should impact to sea turtles become apparent (these measures are addressed in the user capacity analysis in Chapter 2). NPS would continue to monitor sea turtles in the park and take measure should the need be indicated. NPS will continue to coordinate with the National Marine Fisheries Service, U.S. Fish and Wildlife Service, and the Territorial Department of Natural Resources Division of Fish and Wildlife regarding future actions and protective measures taken. Increased staffing, research, monitoring, enforcement, education and outreach would provide long-term beneficial effects. Management actions proposed under Alternative D would result in conditions that are beneficial to preserving habitat and minimizing impacts to sea turtles. Alternative D would result in a may affect, not likely to adversely affect finding.

St. Croix Ground Lizard. The effects of management actions described under Alternative D on the federally endangered St. Croix ground lizard would be the same as those described for Alternative B. Increased number of vessels and therefore visitors would likely increase use of the picnic area and encroachment compared to Alternative A, which could affect the St. Croix ground lizard habitat in this area. Protective measures would be taken during the planning and construction of any facilities such as limited trail work or installation of information kiosks. Increased research and monitoring efforts may be necessary to determine effects and adapt management strategies accordingly. Alternative D may affect, but would not be likely to adversely affect the endangered St. Croix ground lizard.

Territory Listed Species

Least Tern. The effects of recreational use and development actions under Alternative D actions would be the same as those described under Alternative B. Under Alternative D, a 16-acre Anchoring Zone located off West Beach would be established for anchoring in deep sand habitat; however, shoreline bow and stern anchoring would be eliminated compared to Alternative A. Park staff would continue to restrict access to least tern nesting areas when the birds are present and provide educational information to visitors regarding the sensitivity of the species to disturbance during the nesting period. There would also be increased resources to enhance research and monitoring, education, and enforcement of regulations for protecting least terns. If Anchoring Zone impacts were found to occur at unacceptable levels, anchoring permits would be changed to enhance protection of the least tern. Other measures to restrict access may be necessary to protect the least tern and NPS managers would adapt measures to reflect changing conditions. Although the number of vessels and

therefore visitors accessing Buck Island would be greater under this alternative, the enhanced research, monitoring, adaptive management actions, and the prohibition on shoreline anchoring would result in overall long-term, minor, adverse effects.

Brown Pelican. The effects of Alternative D on the brown pelican would be the same as Alternative B. Installation of moorings off West Beach and a limited number of anchoring locations for larger vessels would not affect the pelican's prey distribution or abundance. The designation of a Marine Hazard Zone that includes the area north of Buck Island would prohibit vessel use in that area, provide additional area for undisturbed foraging, and reduce the potential for vessel activities to disturb nesting. Overall, Alternative D would have a long-term, minor, beneficial effect on the territory listed, endangered brown pelican.

Territory Listed Plant Species

The park would continue their efforts to control non-native, invasive plant species with the same beneficial effects as described under Alternative A. Development of minimal new trails and kiosks on Buck Island would be conducted in a manner to avoid locations where sensitive plants occur. However, new trail development could increase visitor use of the interior of the island and increase the potential for spread of non-native plant species into sensitive terrestrial habitats. Steep topography, dangerous plant species, and hot temperatures would limit visitor use of the island's interior, however. Increased educational opportunities under this alternative would improve visitor understanding and appreciation of the monument's sensitive species, which would help prevent or reduce unauthorized off-trail use. As such, there would be long-term, minor, beneficial effects on territory listed plant species.

Cumulative Effects

Effects on special status species from other past, on-going, and future plans and projects would be the same as described for Alternative A. Management actions proposed under Alternative D would likely contribute a relatively small component to these cumulative impacts.

The current trends of climate change, hurricanes, disease, and other factors would have projected long-term, major adverse effects on some species of concern that would overshadow management actions taken by the park under Alternative D. When the beneficial and adverse effects of other past, on-going, and future plans, projects and activities affecting special status species are combined with actions under Alternative D, the resulting cumulative effects would vary by species as summarized below.

- Federal listed elkhorn and staghorn coral: may affect/likely to adversely affect.
- Federal listed sea turtles: may affect/not likely to adversely affect
- Federal listed St. Croix ground lizard: may affect/not likely to adversely affect
- Territory listed brown pelican: long-term, major and adverse
- Territory listed least tern: long-term, major and adverse
- Territory listed plant species: long-term, moderate, and adverse.

Conclusions

Although the number of vessels and therefore visitors accessing Buck Island would be greater under this alternative, the enhancement of research and monitoring of special status species and their habitats and enforcement of regulations in the newly designated management zones within the monument and increased educational information that promotes the protection and preservation of these species would have overall long-term, beneficial effects. Due to the increase in number of vessels and relative number of visitors, NPS may be required to take adaptive measures to protect special status species, particularly during peak visitation periods. Management actions proposed under

Alternative D would result in a “may affect/not likely to adversely affect” Section 7 finding for federally listed species (elkhorn and staghorn coral, sea turtles, and the St. Croix ground lizard). Territory listed least terns, when present, could be disturbed and abandon nests due to recreational activities on West Beach resulting in long-term minor adverse effects. Alternative D would have a long-term, minor, beneficial effect on the territory listed, endangered brown pelican and long-term, minor, beneficial effects on territory listed plant species.

Effects on special status species from other past, on-going, and future plans and projects would be the same as described for Alternative A. Management actions proposed under Alternative D would likely contribute a relatively small component to these cumulative impacts for some species.

CULTURAL RESOURCES

Regulations and Policies

The regulations and policies that guide NPS actions with respect to cultural resources are presented in the “Servicewide Mandates and Policies” section of Chapter 1 and in Appendix B.

Methods

Regulations for implementing the National Environmental Policy Act and the National Historic Preservation Act require the analysis of the effects of proposed actions on important cultural resources. Each of the acts has a different set of definitions for assessing effects on cultural resources. To comply with the requirements of both acts, this general management plan and environmental impact statement uses both definition sets to evaluate effects on the cultural resources of Buck Island Reef National Monument.

In accordance with regulations from the Advisory Council on Historic Preservation (Advisory Council) for implementing Section 106 of the National Historic Preservation Act, the effects on archeological resources were identified and evaluated by:

- Determining the area of potential effects;
- Identifying cultural resources present in the area of potential effects that are either listed in or potentially eligible to be listed in the National Register of Historic Places;
- Applying the criteria of adverse effect to all of the listed or potentially eligible cultural resources that could be affected; and
- Considering ways to avoid, minimize, or mitigate adverse effects.

Section 106 determinations of effect characterize the severity or intensity of impacts on National Register-listed or -eligible cultural resources.

- A determination of no historic properties affected means that either there are no historic properties present or there are historic properties present but the undertaking will have no effect on them (36 CFR 800.4(d)(1)).
- A determination of no adverse effect means there an effect, but the effect would not meet the criteria of an adverse effect; that is, it will not diminish the characteristics of the cultural resource that qualify it for inclusion in the National Register (36 CFR 800.5(b)).
- An adverse effect occurs whenever an impact alters, directly or indirectly, any characteristic of a cultural resource that qualifies it for inclusion in the National Register. For example, this could include diminishing the integrity (or the extent to which a resource retains its historic appearance) of its location, design, setting, materials, workmanship, feeling, or association. Adverse effects also include reasonably foreseeable effects caused by the alternatives that would occur later in time, be farther removed in distance, or be cumulative (36 CFR 800.5(a)(1)). All adverse effects on National Register-eligible cultural resources in Buck Island

Reef National Monument would be long-term and would have a high level of concern because cultural resources are nonrenewable.

The following discussion correlates the differing requirements of the National Historic Preservation Act and National Environmental Policy Act in a way that impacts (effects) on cultural resources are presented in a thorough, thoughtful, and meaningful manner and compliance with both laws is achieved. For these reasons, the impact criteria for cultural resources are presented in a different format from the other impact topics. The Council on Environmental Quality (1978) regulations for implementing the National Environmental Policy Act and Director's Order 12 (NPS 2001) call for a discussion of the appropriateness of mitigation with an analysis of how effective the mitigation would be in reducing the intensity of a potential impact (for example, reducing the intensity of an impact from major to moderate or minor). However, any reduction in intensity of impact from mitigation is an estimate of the effectiveness of mitigation only under the National Environmental Policy Act. The level of effect as defined by Section 106 is not similarly reduced, because cultural resources are nonrenewable, and adverse effects that consume, diminish, or destroy the original historic materials or form would result in a loss in the integrity of the resource that can never be recovered. Therefore, even if actions determined to have an adverse effect under Section 106 may be mitigated, the effect remains adverse.

A Section 106 summary follows the cultural resource impact analysis for the preferred alternative. The Section 106 summary is intended to meet the requirements of Section 106 and is an assessment of the effect of the undertaking (implementation of the alternative) on cultural resources, based on the criteria of effect and adverse effect in the Advisory Council's regulations.

Issues related to cultural resources were identified during public and internal scoping. They include:

- Inappropriate visitor uses, including looting and vandalism, could harm cultural resources, especially submerged shipwrecks.
- Cultural resources could inadvertently be damaged by facility development, such as trails or installation of signs and other maintenance work.

The impact analyses presented are for the purposes of the National Environmental Policy Act. They are intended to assist the NPS with coordinating its compliance with this act and with Section 106 of the National Historic Preservation Act, as amended. However, the NPS does not intend to use this General Management Plan/Environmental Impact Statement to meet Section 106 compliance for individual actions discussed in this document in accordance with 36 CFR 800.8(c). NPS will comply with Section 106 in accordance with 36 CFR 800 as it continues implementation planning and refines its management options with alternatives analyses and specific proposals for individual projects. NPS will consult with the Territory state historic preservation officer and other consulting parties to determine areas of potential effects; to identify cultural resources and evaluate their National Register of Historic Places eligibility; to determine effects on historic properties; and to develop measures to avoid, minimize, or mitigate adverse effects on historic properties.

Impact Threshold Definitions

The thresholds to determine the intensity of impacts on cultural resources are defined as follows:

Negligible: The action would not have the potential to cause effects on archeological resources that would alter any of the characteristics qualifying the resource for inclusion in or eligibility for the National Register. For purposes of §106, the determination would be *no historic properties affected*.

Minor Adverse: The action would affect one or more archeological sites with low data potential and no significant ties to a living community's cultural identity. Site disturbance would be confined to a small area with little, if any, loss of information potential. For purposes of §106, the determination of effect would be *no adverse effect*.

Minor Beneficial: The action would result in preservation of a site in its natural state. For purposes of §106, the determination of effect would be *no adverse effect*.

Moderate Adverse: The action would affect one or more archeological sites with modest data potential and possible ties to a living community's cultural identity. Site disturbance would be noticeable. For purposes of §106, the determination of effect would be *adverse effect*.

Moderate Beneficial: The action would noticeably enhance the protection or preservation of one or more archeological sites. For purposes of §106, the determination of effect would be *no adverse effect*.

Major Adverse: The action would affect one or more archeological sites with medium or higher data potential, and having ties to a living community's cultural identity. The action would result in loss of site or district integrity. Site disturbance or resource degradation would be highly visible. For purposes of §106, the determination of effect would be *adverse effect*.

Major Beneficial: The action would substantially enhance the ability to protect and interpret important archeological resources and would foster conditions under which archeological resources and modern society can exist in productive harmony and fulfill the social, economic, and other requirements of present and future generations. For purposes of §106, the determination of effect would be *no adverse effect*.

Duration: Archeological resources are nonrenewable, so all adverse effects would be long-term.

Impacts of Alternative A

Archeological Resources

Under Alternative A, two primary factors, human actions and natural processes, would contribute to parkwide long-term, moderate, adverse effects on archeological sites from loss of artifacts, damage to structural remains, and diminished site integrity. Effects would be long-term because archeological resources are nonrenewable, and once damaged or lost, cannot be restored. Minor, long-term benefits would result from visitor education and park management actions.

Five terrestrial archeological sites have been documented on Buck Island (see Chapter 3, Table 16). Almost all of the sites are relatively close to the existing trail system and/or to areas typically used by visitors, and thus are vulnerable to unauthorized artifact collecting and inappropriate uses. One of the most threatened of the sites is BUIS-2, which has been disturbed by erosion and is vulnerable to loss of additional artifacts and features. Anchoring or other shoreline or beach-related activities could disturb or erode submerged areas or exposed beach surfaces in the vicinity of archeological sites.

Unauthorized collecting often removes diagnostic artifacts that hold clues to the age, cultural affiliation, and function of the site. Collecting also can skew the assortment of cultural items, leaving behind a puzzling array of items that may reflect a singular function or historical connection. Climbing or standing on ruins could damage exposed foundations or other structural elements and contribute to future damage from erosion and plant growth.

The steep terrain and thick vegetation make access to areas away from trails difficult, so terrestrial site damage from human activities generally would be modest. However, any damage would diminish site integrity and potential for future research, and result in adverse effects on Buck Island's cultural sites.

Ten shipwreck sites are thought to lie within the park, and other shipwrecks are known to be somewhere in the general vicinity (Table 15). Shipwrecks are especially fascinating to visitors, but these complex resources could easily suffer damage if divers attempt to enter and explore the wreck, or try to locate and remove artifacts. Vessels with a deep draft, strong wakes, or unauthorized use of anchors also can disturb submerged resources. The slave ships *Mary* and *General Abercrombie* are especially vital to the park's interpretive story. These and the other shipwrecks are vulnerable to inappropriate uses.

NPS management policies and programs provide an umbrella of protection for cultural sites by establishing proactive procedures for their identification, evaluation, management, and interpretation. Parks develop resource management plans and various special studies to provide the best possible care for non-renewable resources. These policies and procedures would continue to benefit Buck Island's cultural sites.

One of the best deterrents to vandalism and looting is visitor education. On-going park management, interpretation, and visitor education would continue to have some long-term parkwide benefits to archeological sites on Buck Island. However, interpretative and educational materials are only found outside the park at Christiansted, and are not readily available to Buck Island visitors. Concessions operators may not have received training about ways to protect and preserve sites. Park staff have experienced a greatly expanded workload in the recent past, reducing the available time that can be spent on visitor education and resource protection.

While benefits would accrue from park management actions to protect and stabilize sites threatened by natural processes or inappropriate visitor use, management of Buck Island's archeological resources is complicated by the fact that little is known about some of the island's sites, and because no systematic survey of submerged cultural resources has been conducted. Unknown, undocumented sites cannot be protected, and such sites could suffer adverse effects from unwitting visitor or management actions. Resource protection and management activities would be expected to continue at existing levels.

Also, sites lack National Register evaluations. Without an evaluation of National Register significance and integrity of recorded or known sites, it is difficult to develop appropriate, proactive management actions. Consequently, unevaluated sites might not be adequately protected, or, on the other hand, protective measures could be unnecessarily proposed for sites lacking integrity and significance. Lack of information would have an adverse effect on archeological resources.

Natural processes also have damaged sites, and appear to be one of the most destructive of the various threats facing Buck Island's cultural resources. Bioturbation would continue to occur from digging or other activities of rodents and insects that loosen structural features and disrupt soil stratigraphy. Control of rodents in recent years reduces such effects. Mixing of older and newer deposits would make definition of different site occupants, functions, or periods of use difficult, if not impossible. Vegetation growing into foundations or through and over structural ruins would continue to contribute to localized site degradation by expanding cracks and displacing structural elements.

Rough seas, wave action, strong currents and salt water also would continue to damage submerged resources, and wind and water would contribute to terrestrial site damage, particularly those sites near the beach. Rapid erosion is known to have adversely affected Buck Island prehistoric site (BUIS-2) by causing loss of artifacts and site integrity. These natural processes would adversely affect sites in localized areas.

In the future, all of these destructive processes are likely to be influenced by climate change as well. Shipwrecks in shallow waters are damaged by high frequency waves of long duration; on the other hand, increased sea levels could be beneficial to these wrecks by covering them more deeply. Shipwreck resources tend to reach a sort of equilibrium when moisture, pH and temperature levels remain fairly consistent. If a wreck is exposed to the air during frequent storm events, deterioration of its wood and metal components could be accelerated. As with the growth of coral, the various flora and microorganisms present on wrecks could be affected by changes in pH, temperature, amount of sunlight and storm intensity and frequency. The overall effect of such changes is, at present, unclear.

Rising sea levels and frequent storm surges can contribute to the physical damage to or loss of coastal historical and archeological resources from wave action that erodes away beach deposits and exposes sites. In other areas, however, beach deposits could accrue, helping to bury and protect coastal sites.

On the island's steep slopes, previously disturbed soils in archeological and historical sites are especially vulnerable to erosion. Storm events and changing precipitation patterns can contribute to creation of new gullies (guts) or extreme runoff episodes and erosion of existing drainages. Changes in seasonality and temperatures could contribute to unanticipated changes in the types of vegetation and location of vegetation communities on the island, affecting archeological sites and ruins of historic structures both positively and negatively. Because effects from climate change are complex and may be synergistic (both positively and negatively), such effects may not be quantifiable within the lifetime of this general management plan. It is anticipated, however, that with continuing attention to resource preservation such as retrieval of archeological information where sites are threatened, adverse effects of climate change would be negligible to minor over the next decade.

In summary, under Alternative A, human activities, natural processes, and lack of data would result in long-term, moderate adverse effects on the island's archeological resources (site BUIS-2 and the shipwreck sites are especially threatened). It is anticipated that climate change would play a negligible to minor role in adverse effects on cultural resources over the lifetime of this plan, while park management, interpretation, and visitor education efforts would have long-term, minor benefits. Beneficial effects would be minor because of lack of staffing and funding to complete surveys and evaluations.

Cumulative Effects

The area considered for cumulative effects on archeological resources under Alternative A is the entire park. The time period for cumulative effects extends from 1948 (when the Municipal Government of St. Croix designated Buck Island as a park or protected area) to the present, during which time the wind, tides, hurricanes, natural processes, and human activities have added to, modified, or destroyed cultural resources.

Goat grazing and periodic burning had made a virtual desert of the island by the late 1940s. When grazing was discontinued in the 1950s, vegetation gradually returned. Cessation of grazing ended some physical impacts to terrestrial sites from trampling and displacement of structural elements. However, without grazing, vegetation has gained ground within the ruins. Vegetation tends to hide cultural features and artifacts, reducing their vulnerability to unauthorized collecting or disturbance. On the other hand, vegetation growth damages ruins, so there are both positive and negative effects from cessation of grazing.

Existing programs for removal of the island's exotic plants are being implemented with consideration for archeological resources. Removal of exotic plants from archeological ruins would have long-term moderate localized benefits.

Non-native tree rat and mongoose populations also occupied the island. These animals tend to burrow and can undermine and damage archeological ruins and sites. Park management programs recently eradicated both species, greatly benefiting archeological resources.

Acquisition of Buck Island by the NPS helped to ensure the protection and preservation of the property's cultural sites. Also, NPS management activities and interpretive programs have shaped the ways visitors use the island, gradually reducing impacts on sites from collecting and inappropriate uses. These management actions would result in long-term, parkwide moderate benefits to sites. Unfortunately, management of the island's rich and varied natural and cultural resources has sometimes been constrained by limited availability of funding and park staff, and many of these constraints are expected to continue into the foreseeable future. Lack of knowledge about cultural sites also contributes to adverse effects on sites.

Other plans and projects help the park protect its cultural resources. Implementation of the Exotic Plant Management Plan would continue to help reduce the potential for damage to sites from non-native vegetation. Buck Island lacks a comprehensive cultural resources survey, so some unknown

(and consequently unprotected) terrestrial and underwater sites might continue to be subject to damage from human activities and natural forces.

As described above, climate change also could contribute to cumulative effects on cultural sites. The gradual changes in various factors such as sea level, water temperature and acidity and episodic storm events would combine with ongoing physical processes. In some cases, effects could be beneficial, such as covering shipwrecks more deeply or burying beach archeological sites. Or, storm surges and changes in the water temperature and pH level could accelerate the process of deterioration of sites and wrecks. Cultural resources are non-renewable, so over time these various actions and processes described above cumulatively diminish the park's cultural resource base, and reduce the number and variety of cultural sites available for visitor appreciation, ethnographic heritage, and scientific study.

When effects of other plans, projects, and activities affecting cultural resources are combined with these effects of actions under Alternative A, cumulative long-term, minor to moderate, adverse effects would occur, primarily from continuing deterioration of sites and shipwrecks. That is, past site damage and future threats to nonrenewable cultural sites from natural processes, climate change and occasional human actions appear to outweigh the on-going benefits of park management actions.

Conclusions

These effects would accrue from human activities (inappropriate actions such as climbing on ruins, unauthorized artifact collecting, entering and damaging shipwreck structures and artifacts, and damage from vessels, wakes, and unauthorized anchor drops) and natural processes (wind, water, high tides, storm surges, erosion, bioturbation from insects and vermin, and vegetation growing into structural ruins). Over the lifetime of this plan, climate change would likely play a negligible to minor or adverse role in preservation of the park's cultural resources. Adverse effects are offset slightly from current NPS management, interpretation and education, preservation, and protection efforts.

Cumulative effects would be long-term, minor to moderate, and adverse; primarily from continuing human activities and deterioration of sites and shipwrecks as well as from effects of climate change. That is, past site damage and future threats to nonrenewable cultural sites from natural processes and occasional human actions outweigh the on-going benefits of park management actions.

Impacts of Alternative B

Archeological Resources

Overall, the impacts of Alternative B on archeological resources would be similar to those described for Alternative A, except that effects would be long-term, minor, and adverse. When compared with Alternative A, adverse effects on archeological resources would be minor rather than moderate because better protection of resources located underwater and on the shore would be achieved by phasing out the existing anchoring areas with vessel moorings. Cultural sites also would benefit from increased resource protection through use of management zones, by increased research and monitoring, opportunities for education and outreach, and by future implementation of cultural resource research studies.

In all three action alternatives, terrestrial cultural resources would be included in the Island Discovery Zone, and submerged resources would be in either the Resource Protection Zone or the Marine Hazard Zone. The five cultural sites within the Island Discovery Zone would need a moderate to high degree of management to help ensure resource protection, and any future development would be designed to avoid sites other than those suitable for interpretation. Sites in the Resource Protection Zone would benefit from focused resource preservation, protection and scientific research. Sites in this zone would continue to be threatened by inappropriate human actions, but visitor use of this zone would be expected to be less than in the more heavily visited West Beach and south and southeast portions of the island. Although use of the visitor facilities, the beach, and the trails would continue as

in Alternative A, the potential for disturbance of cultural resources in the general vicinity of West Beach would be reduced by the eventual phasing out of anchoring that presently tends to disturb areas near shore and nearby beach. The five designated anchoring locations for vessels 91 to 150 feet in length by permit only would be installed only after survey for resources to avoid impacts.

To avoid physical damage to archeological resources, areas proposed for mooring facilities or beach access channels, such as those proposed for the West Beach area, or limited new trails or sign installation would require archeological investigations prior to implementation of Alternative B. With appropriate investigations, monitoring, and protective measures as described in “Best Management Practices,” development of these facilities would have a negligible effect on archeological resources.

As discussed under Alternative A, human actions such as unauthorized collecting and inappropriate site use at terrestrial sites would have long-term adverse effects, as would effects on shipwreck sites from visitor exploration, souvenir removal, wakes, vessel encounters, and poorly placed anchors. Adverse effects from human activities would be reduced from those described for Alternative A, primarily because of the additional outreach and education and increased opportunities for concessionaire and/or ranger led tours and hikes under Alternative B. These interpretive and educational opportunities would, over the long-term, help visitors to understand and appreciate the importance of the island’s cultural resources, resulting in better protection and increased stewardship, both at Buck Island and outside the park.

Impacts on cultural sites from natural processes (wind, water, storm surges, erosion, bioturbation, and vegetation growth—as described in Alternative A) would continue to have adverse effects. That is, climate change could result in heightened sea levels, wave action, storm surges, loss of coastal terrain and damage to beaches (or accretion), as well as enhance changes in types, locations, and numbers of micro-organisms and plants on wrecks and other cultural sites,

All of these impacts would be partially offset by NPS management of and proactive programs for these Buck Island resources, including development of dynamic resource management schemes and revision of the collections management plan as appropriate. Stewardship that actively involves the public in protection of cultural resources would be important in slowing the adverse effects of natural processes and inappropriate uses. Working closely with resource partners to identify, evaluate and measure potential impacts of climate change would enable the park to better analyze and protect its cultural sites and shipwrecks. The 2004 archeological overview and assessment recommends further archeological investigations of Buck Island’s archeological resources, especially the submerged sites. Future work would help document these resources, and would develop measures for their evaluation and protection to reduce adverse effects on archeological sites.

In summary, under Alternative B, human activities, natural processes, climate change and lack of data would have long-term, minor adverse effects on the island’s archeological resources. With mitigation, installation of moorings, beach access channels, and limited new trails/signs would have negligible effects. Adverse effects on archeological resources would be partially offset by moderately beneficial park management actions, zoning and adaptive management in response to resource research and monitoring, involvement of the public in stewardship activities, and interpretation and visitor education efforts. Most effects would be localized, but benefits of interpretation and visitor education and involvement could extend far beyond the park boundaries as visitors develop a sense of stewardship for cultural resources. The park would work with resource partners to identify effects of climate change as well as potential adaptive management strategies to protect resources.

Cumulative Effects

Under Alternative B, most of the cumulative effects on archeological resources would be the same as described for Alternative A. These cumulative effects are associated with past goat grazing activities,

burnings, cessation of grazing, proliferation of exotic plant and animal species, eradication or planned control of exotic species, visitor uses, and NPS management of those uses and of the affected cultural resources. Other plans that would contribute to cumulative effects include the on-going implementation of the *Exotic Plant Management Plan* (NPS 2006b; 2010). This plan helps to define the species to be treated, appropriate treatment methods, timing, and mitigation measures as well as consideration of exotic plants that exist on archeological sites.

Effects of Alternative B on cultural resources would be as described in the analysis above, long-term, minor adverse effects from human activities (inappropriate uses such as climbing on ruins, unauthorized artifact collecting, entering and damaging shipwreck structures and artifacts; damage from vessels, wakes, anchor drops); lack of knowledge about site locations, integrity and significance; and natural processes (wind, water, high tides, storm surges, erosion, bioturbation from insects and vermin, and vegetation growing into structural ruins). The as yet undefined effects on cultural resources from climate change (e.g. higher ocean levels and changes in pH, water temperature, storm events, vegetation, and microorganisms) would coalesce with these other previous and on-going effects to produce long-term, negligible to minor adverse cumulative effects on cultural sites. Long-term moderate benefits would accrue from NPS management, interpretive, preservation, and protection efforts.

When effects of other plans, projects, and activities affecting cultural resources are combined with these effects of actions under Alternative B, cumulative long-term, minor, adverse effects would occur. Past and on-going adverse effects of human activities, lack of knowledge, climate change and natural processes would continue to outweigh the benefits from zoning and increased opportunities for visitor understanding and stewardship under Alternative B.

Conclusions

Under Alternative B, human actions and natural processes would contribute to long-term, minor adverse effects on archeological resources. These adverse effects would result from inappropriate visitor uses such as climbing on ruins, unauthorized artifact collecting, entering and damaging shipwreck structures and artifacts, and damaging underwater resources by vessels, wakes, and unauthorized anchor drops.

Until studies are done to identify and evaluate underwater sites and other sites that are presently unknown or poorly documented, the lack of knowledge about the park's archeological resources would have minor adverse effects on their management and preservation.

With archeological investigations, site evaluation, and development of mitigating measures prior to development of park facilities such as beach access channels and mooring facilities, development effects on archeological resources would be negligible. Natural processes such as wind, water, high tides, storm surges, erosion, bioturbation from insects and vermin, and vegetation growing into structural ruins would continue to have long-term, minor adverse effects on archeological sites. Climate change causing higher ocean levels, warmer water temperatures and increases in ocean pH, storm surges, new weather patterns, and changes in microorganisms and vegetation communities would have long-term, negligible to minor adverse effects on cultural sites.

When compared to Alternative A, adverse effects would be minor primarily because of increased attention to resource protection. NPS management, cooperative efforts with resource partners, and increased interpretation and education, preservation, and protection efforts would raise visitor resource awareness and stewardship, resulting in moderate benefits and future enhanced resource protection.

Under Alternative B, cumulative long-term, minor, adverse effects would result because past losses from human actions and natural processes would continue to outweigh the moderate benefits of

actions under Alternative B (primarily use of management zones and increased opportunities for visitor understanding and stewardship.).

Impacts of Alternative C

Archeological Resources

Overall, effects of actions in Alternative C on archeological resources would be the same as described for Alternative B, long-term, minor, and adverse. Human actions and natural processes contribute to most adverse effects on archeological resources. Human actions include unauthorized collecting and inappropriate site use such as climbing on ruins or vandalism, attempts to enter shipwreck sites or to remove souvenirs, vessel wakes that are too close to wrecks, vessel/wreck encounters, and poorly placed anchors.

Under all the action alternatives, additional educational and interpretive opportunities would be offered visitors, and these enhanced programs would help to educate and inform them about the importance and sensitivity of cultural sites. Under Alternative C, effects resulting from human actions would have adverse effects on archeological sites, but there would be benefits of enhanced outreach and education for visitors and increased opportunities for concessionaire and/or ranger led tours and hikes under Alternative C. These enhanced opportunities would help develop better resource protection and increased stewardship.

Impacts on cultural sites from natural processes and climate changes (wind, water (including temperature and pH increases), storm surges, erosion, bioturbation, and vegetation growth—as described in Alternative A) would continue to have adverse effects on sites. A lack of knowledge about exact site location, condition, integrity, and significance also contributes to adverse effects (unknown sites cannot be protected, and it is difficult to prioritize funding and protective actions when the importance of a site is undetermined). Future protective management actions under Alternative C, and archeological investigations as recommended by the 2004 archeological overview and assessment would help document submerged resources and provide information on terrestrial sites. These proactive management actions and investigations would help reduce impacts of natural processes on archeological resources.

Management zoning would have the same benefits as described for Alternative B. The Anchoring Zone proposed in Alternative C could pose a threat to area archeological resources. However, when compared with the present anchoring area, the area proposed under Alternative C is relatively small in size (2 acres as compared with the present 22-acre area). Prior to implementation of this zone, and development of the mooring areas, beach access channels, and limited new trails/sign installation, archeological investigations (both underwater and on land) would be conducted to identify resources and evaluate their condition and potential eligibility for the National Register of Historic Places. Before implementation of these actions, compliance investigations would be completed and would further evaluate potential impacts to cultural sites. This documentation would include mitigating measures especially designed for the proposed action.

In summary, under Alternative C, human activities, climate change, natural processes, and lack of data would have an adverse effect on the island's archeological resources, causing occasional loss of artifacts, deterioration of structural remains, and diminished site integrity. However, proactive park management, future studies and investigations, and increased opportunities for visitors to learn about and appreciate the island's cultural sites (developing stewardship) would benefit sites and help to reduce adverse effects. Working with resource partners to identify potential effects and adaptive management strategies would also help reduce effects so the overall long-term adverse effects to archeological resources would be minor and generally localized in nature.

Cumulative Effects

The cumulative effects under Alternative C would be the same as described for Alternative B; that is, the effects of past events such as grazing, burning and the cessation of both; management of the island as a territorial park and later as a national park with forty years of visitor use; removal of non-native animal species; implementation of the Exotic Plant Management Plan; and climate change. Effects of Alternative C on cultural resources would be as described in the analysis above, long-term, minor adverse effects from human activities (inappropriate uses such as climbing on ruins, unauthorized artifact collecting, entering and damaging shipwreck structures and artifacts; damage from vessels, wakes, unauthorized anchor drops); lack of knowledge about site locations, integrity and significance; climate change bringing higher sea levels, warmer water, increased pH, changes in vegetation and microorganisms; and natural processes (wind, water, high tides, storm surges, erosion, bioturbation from insects and vermin, and vegetation growing into structural ruins).

When effects of other plans, projects, and activities affecting cultural resources are combined with these effects of actions under Alternative C, cumulative long-term minor adverse effects would result. Past and on-going negative effects of human activities, lack of knowledge, and natural processes would continue to outweigh the benefits from management enforcement efforts, management zones and increased opportunities for visitor understanding and stewardship under Alternative C.

Conclusions

Under Alternative C, long-term, minor, adverse effects on archeological sites would result from human actions such as shoreline anchoring at West Beach, inappropriate use of sites and unauthorized collecting, climate change and all its associated factors, and natural processes (wind, water, high tides, storm surges, erosion, bioturbation from insects and vermin, and vegetation growing into structural ruins). These adverse effects would be partially offset by the moderate benefits of management efforts, management zones, mitigation measures for development, proactive management and enhanced opportunities for visitors to learn about the park and its sites. The park would work with resource partners to identify and counter resource threats posed by climate change.

When effects of other plans, projects, and activities affecting cultural resources are combined with these effects of actions under Alternative C, cumulative long-term, minor, adverse effects would result. That is, the benefits of actions under Alternative C, primarily use of management zones and increased opportunities for visitor understanding and stewardship, would be outweighed by past and on-going negative effects of human activities, lack of knowledge, and natural processes.

Impacts of Alternative D

Archeological Resources

Overall, actions proposed in Alternative D would result in long-term, minor, adverse effects on archeological resources from the effects of human actions, climate change and natural processes, as described for Alternatives B and C. However, creation of the 16-acre Anchoring Zone could potentially have a moderate adverse localized effect on underwater archeological resources. As described for Alternative C, appropriate archeological investigations and an environmental assessment would be completed before implementation of Alternative D to help ensure that significant resources are not damaged or lost due to project implementation. The park would work with its resource partners to identify, evaluate, and deal with potential adverse effects of climate change.

Cumulative Effects

Under Alternative D, cumulative effects on archeological resources would be the same as described for Alternatives B and C. That is, when effects of other plans, projects, and activities affecting cultural resources are combined with the effects of actions under Alternative D (short-term adverse effects of

construction, long-term adverse effects on cultural sites from anchoring, looting and inappropriate site use; natural processes; and beneficial effects of NPS management and improved visitor stewardship), the resulting cumulative effects would be long-term, minor, and adverse (e.g. past and on-going damage to resources would continue to outweigh beneficial effects).

Conclusions

The 16-acre Anchoring Zone would slightly increase the potential for inadvertent damage to submerged resources, resulting in occasional localized moderate adverse effects. Minor long-term adverse effects on archeological sites would result from human actions (inappropriate use of sites and unauthorized collecting) and natural processes (wind, water, high tides, storm surges, erosion, bioturbation from insects and vermin, and vegetation growing into structural ruins). Installation of moorings would be preceded by investigations and development of an environmental assessment prior to project initiation; this would help ensure resource protection. Management zones, increased research and monitoring, enforcement, and enhanced opportunities for visitors to learn about the park and its sites would have moderate long-term benefits and would result in improved protection of archeological resources.

The overall effects of climate change on the park's cultural resources are poorly understood at present. However, close coordination among all the resource partners would be necessary to identify, evaluate, and mitigate potential adverse effects of climate change on cultural sites.

When effects of other plans, projects, and activities affecting cultural resources are combined with these effects of actions under Alternative D cumulative long-term minor adverse effects would result. That is, the benefits of actions under Alternative D, primarily establishment of management zones, mitigation measures for development, increased opportunities for visitor understanding, and stewardship, and concerns related to climate change would continue to be outweighed by past and on-going negative effects of human activities, lack of knowledge, and natural processes.

SECTION 106 SUMMARY

This general management plan and environmental impact statement provide detailed descriptions of four alternatives (including a no action alternative), analyze the potential impacts associated with possible implementation of each alternative, and describe the rationale for choosing the preferred alternative. Also contained in the document are mitigation measures that would help avoid adverse effects on cultural resources.

Impacts to resources and values under the Preferred Alternative (Alternative B) were analyzed using the methods described earlier in this document. See the “Methods” subsection in the “Cultural Resources” section of Chapter 4 for further explanation.

There are no standing historic structures, identified cultural landscapes, or ethnographic sites of concern on the island. Thus there would be no historic structures, cultural landscapes, or ethnographic resources affected by this project (*No historical properties affected*). Collections are housed elsewhere and would not be affected by actions proposed in this environmental document. Thus discussion of these impact topics has been dismissed for this document (see the “Impact Topics Considered but Dismissed from Further Evaluation” section of Chapter 1).

Archeological Resources. There are known archeological resources present on Buck Island. These archeological resources document both prehistoric and historic use of the island. For example, Chicoid-style pottery at the prehistoric Buck Island site (BUIS-2) suggests use of the island as early as AD 530 at the beginning of the Ostionoid period. Other sites reflect the use of the island from about 1754 when African slaves of European colonists at St. Croix came to Buck Island to harvest lignum

vitae trees, gather shellfish, lobsters, and crabs, and tend introduced sheep and goats foraging on the island.

Occasionally, Europeans lived or worked on the higher ridges of the island, including those at the Danish Signal Station. Structural ruins from these early occupations include the Signal Station Site (BUIS – 1), which contains wall and foundation remains. The Foundation Site (BUIS-4) also consists of a stone masonry foundation and chimney, and the Goby Site (BUIS-5) is comprised of a cistern or well ruins. Ceramic sherds dating from the end of 1700s through the 1800s are found at both BUIS -4 and BUIS -5.

Several artifact scatters also may be eligible for the National Register of Historic Places; these sites include historic materials such as ceramics and glass (in the vicinity of BUIS - 1), as well as prehistoric pottery and piles of conch shell and coral at the Buck Island Site (BUIS -2). At BUIS-6, the Historic Midden site includes Afro-Cruzan ceramic vessel sherds and sherds similar to those found at BUIS – 4).

While no systematic survey of maritime cultural resources has been conducted to date, at least 10 wrecks on the island's coral reefs between 1523 and 1917 have been identified from historic narratives (Towle, et al. 1976 and Tyson 1983) (Table 14). Most of the wrecks were small cargo ships, and two were British slave ships.

BUIS – 3 (the Buck Island Reef Wreck) is a submerged site identified northwest of the island. Two other shipwrecks (Shipwreck 1 and a circa 1800 sailing ship wreck) have been identified north of Buck Island.

Until formal evaluations of these archeological resources have been made, these resources will be considered eligible for the National Register of Historic Places.

Threats to Resources. Threats to these archeological resources include beach erosion, tides and storm events, invasion by plants, bioturbation from plants and animals, vandalism and inappropriate visitor uses (exploration of submerged remnants, climbing on ruins, etc.). The frequency and intensity of storms and erosion are increasing along with other related climate changes including sea level rise and ocean acidification which could affect archeological resources in the future.

In the past, natural processes have damaged some sites, and appear to be the most destructive of the various threats facing Buck Island's cultural resources. Rapid erosion is known to have adversely affected Buck Island prehistoric site (BUIS-2) by causing loss of artifacts and site integrity. Rough seas, wave action, strong currents and salt water also could continue to damage submerged resources, and wind and water would contribute to localized terrestrial site damage, particularly those sites near the beach.

Bioturbation would continue to occur from digging or other activities of rodents and insects that loosen structural features and disrupt soil stratigraphy. Vegetation growing into foundations or through and over structural ruins also would continue to contribute to localized site degradation by expanding cracks and displacing structural elements. However, on-going exotic plant management would be beneficial by removing some of these plants.

Almost all of the sites are relatively close to the existing trail system and/or to areas typically used by visitors, and thus could be vulnerable to unauthorized artifact collecting and inappropriate uses such as climbing or standing on ruins. However, the steep terrain and thick vegetation make access to areas away from trails difficult, so site damage from human activities generally would be modest.

Eight shipwreck sites are thought to lie within the park, and other shipwrecks are known to be somewhere in the general vicinity (Table 15). Shipwrecks are especially fascinating to visitors, but these complex resources could easily suffer damage if divers attempt to enter and explore the wreck, or try to locate and remove artifacts. Vessels with a deep draft, strong wakes, or unauthorized anchors

also can disturb submerged resources. The slave ships *Mary* and *General Abercrombie* are especially vital to the park's interpretive story. These and the other shipwrecks are vulnerable to inappropriate uses.

Management of Buck Island's archeological resources is complicated by the fact that little is known about some of the island's sites, and because no systematic survey or evaluation of submerged cultural resources has been conducted

Preferred Alternative. Under Alternative B, the preferred alternative, resources located underwater and on the shore would be better protected than at present, because most of the existing anchoring areas would be replaced with vessel moorings. For example, the potential for disturbance of resources in the vicinity of West Beach would be reduced by elimination of bow and stern anchoring that presently tends to disturb areas of the shore and nearby beach.

Cultural sites also would benefit from increased resource protection through establishment of management zones, by increased opportunities for education and outreach, and by future implementation of cultural resource research studies. Continued development and implementation of resource management plans and various special studies would continue to benefit Buck Island's cultural sites.

One of the best deterrents to vandalism and looting is visitor education. Increased staffing and resource management, interpretation, and visitor education services would have long-term benefits to archeological sites on Buck Island. Benefits also would accrue from park management actions to protect and stabilize sites threatened by natural processes or visitor use.

Under Alternative B, the preferred alternative, terrestrial cultural resources would be included in the Island Discovery Zone, and submerged resources would be in either the Resource Protection Zone or the Marine Hazard Zone. The five cultural sites within the Island Discovery Zone would have a moderate to high degree of management to help ensure resource protection, and any future development would be designed to avoid sites other than those suitable for interpretation. Sites in the Resource Protection Zone would benefit from focused resource preservation, protection and scientific research. Sites in the Marine Hazard Zone would benefit from the exclusion of vessels, and resource protection in this zone.

To avoid physical damage to archeological resources, areas proposed for mooring facilities or beach access channels, such as those proposed for the West Beach area, would require archeological investigations and further evaluation prior to implementation of the preferred alternative. With appropriate investigations, monitoring, and protective measures as described in "Best Management Practices," development of these facilities would not have an adverse effect on archeological resources (*No Adverse Effect*).

Human actions such as unauthorized collecting and inappropriate site use at terrestrial sites would likely continue to affect some terrestrial archeological sites, as would effects on shipwreck sites from visitor exploration, souvenir removal, wakes, vessel encounters, and unauthorized anchoring. However, management zones as proposed in Alternative B would help reduce inappropriate activities. In addition, effects on cultural sites would be reduced by additional outreach and education and increased opportunities for concessionaire and/or ranger led tours and hikes proposed under Alternative B. These interpretive and educational opportunities would, over the long-term, help visitors to understand and appreciate the importance of the island's cultural resources, resulting in better protection and increased stewardship, as visitor education would help protect sites.

Future implementation of recommendations for further archeological investigations and evaluation contained in the 2004 archeological overview and assessment would help identify sites and site significance so that measures for their protection could be developed.

Natural processes (wind, water, storm surges, erosion, bioturbation, and rampant vegetation growth) would continue to affect cultural sites, but the majority of these effects would be offset by NPS management of and proactive programs for these Buck Island resources.

Because little is known about effects of climate change on cultural sites in the Caribbean, gaining knowledge about potential effects through close coordination and cooperation with resource partners is important. For example, research is needed to address the effects of temperature rise and acidification on vegetation and microorganisms present on shipwrecks, or to the submerged wood and metal and effects of increased temperature and pH; as well as changes in rainfall patterns and storm events and erosion patterns and the effects on beach sites. Identification and analysis of some of the parameters of climate change would be important in order to develop and implement adaptive management strategies for future resource preservation.

Mitigation measures contained in Table 8 would also help protect sites from unauthorized collecting or inappropriate sites uses; help educate work crews, staff and contractors about cultural resources in general and the need to protect any cultural resources encountered and protect sites prior to and during ground disturbing activities.

As provided for in the implementing regulations for Section 106 (36 CFR 800) of the National Historic Preservation Act, the NPS has complied with the requirements for using the *National Environmental Policy Act* process to achieve Section 106 compliance. The Virgin Islands State Historic Preservation Officer (SHPO), and the Advisory Council on Historic Preservation (ACHP) have been formally notified about the General Management Plan/Environmental Impact Statement, and a variety of public involvement activities have been undertaken, as summarized in Chapter 5. Correspondence related to these notifications is included in the appendices. This General Management Plan/Environmental Impact Statement has been forwarded to the above groups for their review and comment.

After applying the implementing regulations of the Advisory Council on Historic Preservation (36 CFR 800, revised regulations effective January 2001), addressing the criteria of effect and adverse effect, the NPS finds that the implementation of the preferred alternative, Alternative B, would result in a finding of *no adverse effect* to historic properties.

SOUNDSCAPE

Regulations and Policies

The regulations and policies that guide NPS actions with respect to soundscape are presented in the “Servicewide Mandates and Policies” Section of Chapter 1 and in Appendix B.

Methods

Issues related to the park soundscape identified during public meetings and planning workshops included: (1) sound should be minimized that is generated from vessel engines and generators, “rafting parties,” (2 to 3 vessels tied together on one anchor for a party), music from radios and stereos, and other sounds resulting from social activities; and (2) the potential effects of these sounds on the natural soundscape, visitor experience, and wildlife. To address these issues, an assessment of the effects of projected park management actions on the soundscape was made using qualitative estimates of the expected levels of visitor use in the park and the number of vessels that can be accommodated under each alternative. Primary sources of information used in this analysis included unpublished observations and insights from knowledgeable park staff. The area analyzed for possible effects on soundscape includes the entire park; however, effects on soundscape are generally localized to high use areas near West Beach (beach and water) and the underwater trail mooring area. It should also be noted that the affect of sound on wildlife is not included in this impact analysis, but rather is

addressed under the “Wildlife” and “Species of Concern” sections. The area of effect considered for the cumulative impact analysis corresponds to the park boundary because the soundscape is predominately affected by activity within the park.

The major assumptions used in the analysis of effects on soundscape were that: (1) effects on soundscape under all alternatives are variable depending on the season of the year, day of the week, and holidays/non-holidays; (2) increased visitor use and access to Buck Island could potentially translate to an increase in the generation of human-related sounds; and (3) alternatives permitting shoreline bow and stern anchoring could concentrate effects along the West Beach shoreline; and (4) effects on soundscape due to visitor use would outweigh effects related to park operations or programs (installation/replacement and maintenance of facilities, research and monitoring programs, etc.); therefore the analysis focuses primarily on sounds introduced via visitor use and recreational activities.

Impact Threshold Definitions

Impact thresholds to determine the intensity of impacts on soundscape are defined as follows:

Negligible: Human-caused or project specific sounds do not compete with ambient sounds. Where noise is audible, it is for short duration, with significantly lengthy periods of time that are noise free.

Minor: Human-caused or project sounds are detectable above ambient sounds; however, there are frequent periods of time that are noise free. Where noise is audible, impacts occur for short durations (less than an hour) during the day.

Moderate: Human-caused or project sounds compete with ambient sounds. Noise generated is perceptible for extended periods throughout the day. There are however short periods of time that are noise free.

Major: Human-caused sounds dominate the soundscape and replace natural sounds. Natural sounds in the project area are commonly impacted by noise from management or recreational activities for most of the day without periods of time that are noise free.

Duration: Long-term: Persistent
Short-term: Intermittent or subsides in months

Impacts of Alternative A

The natural soundscape of the park consists predominantly of the sounds of birds, (terrestrial and seabirds) and the ocean or sea. Natural soundscape is affected by sounds generated by vessel engines and generators, and from the sounds of visitors (music, “rafting parties,” picnicking, etc.) which are typically concentrated in the vicinity of West Beach. Visitors at the underwater trail moorings may also be heard onboard vessels as well as in the water. Depending on the perspective and the desired activity of a park visitor, these sounds may be perceived as noise. The natural soundscape is more prevalent in the interior or other areas of Buck Island accessible by trail, and in park open water that are farther away from West Beach and the underwater trail moorings.

Under Alternative A, effects on soundscape are greatest during periods of peak visitation, which have traditionally coincided with weekends, particularly Sundays, with lesser visitation occurring throughout the week. Park visitor counts also reflect greater visitation seasonally, with the greatest visitation typically occurring in the months from February through April (with other spikes). Due to staffing limitations and funding constraints, ranger or other staff presence is not always maintained within the park on a regular basis which limits the ability of park staff to minimize noises adversely affecting visitor experience or wildlife. The overall effect on soundscape under Alternative A is variable, and defined as long- and short-term, negligible to moderate, and adverse.

Cumulative Effects

Under all of the alternatives, including Alternative A, the cumulative effects on soundscape would largely be controlled by park management actions and to a lesser extent by outside influences, since effects on soundscape are largely related to the number of visitors to Buck Island. There are few, if any, influences outside of the park that would create sound or noise that would be audible within the park boundaries. Exceptions to this would be vessels traveling directly outside park boundaries or aircraft traveling in airspace within the park. Neither of these factors was identified as an issue during scoping, however. Future planning efforts within the park would include a vessel management plan that would also address noise issues. Recommendations from these planning efforts would be instituted as needed. When the beneficial and adverse effects of other past, on-going, and future plans, projects, and activities affecting soundscape are combined with actions under Alternative A, the resulting cumulative effects would be considered long- and short-term, negligible to minor, and adverse.

Conclusions

Effects on soundscape are variable depending on the day of week, holiday/non-holiday, season of the year, and location within the park. Due to staffing limitations and funding constraints, a ranger or other staff presence is not always maintained within the park on a regular basis which limits the ability of the park staff to minimize noise-related impacts. The overall effect on soundscape under Alternative A is long- and short-term, negligible to moderate, and adverse. The cumulative effects on soundscape would be long- and short-term, negligible to minor, and adverse due to benefits associated with implementation of future planning efforts.

Impacts of Alternative B, the Preferred Alternative

The effects of Alternative B would be similar to Alternative A; however, an increased level of ranger and other staff proposed for this alternative would likely reduce adverse effects on soundscape during periods of high use. Elimination of shoreline bow and stern anchoring would reduce the amount of sound that is associated with vessels concentrated along the shoreline in a small area, including engine sounds and vessel passengers. In addition, sounds generated by vessels would not be present in the Marine Hazard Zone, since vessels are restricted from this zone due to safety- and resource-related concerns. Vessel size limitations by management zone in the park, as compared to Alternative A, which does not limit vessel size in park waters, would also change the type and location of vessel related sounds. Restricting vessel size to 150 feet, with larger vessels anchoring further away from the shoreline would reduce some sounds (primarily vessel engines and generators) in the vicinity of West Beach. The overall effect on soundscape would be long- and short-term, negligible to minor, and beneficial.

Cumulative Effects

The same past, on-going, and future plans, projects, and activities affecting soundscape described under Alternative A are applicable to Alternative B. When combined with management actions proposed under Alternative B, the cumulative effect would be long- and short-term, minor, and beneficial.

Conclusions

An increased level of staffing proposed for this alternative in addition to vessel size and access limitations associated with management zones would likely reduce adverse effects on soundscape during periods of high usage. Therefore, there would be a long- and short-term, negligible to minor, beneficial effect. The cumulative effects on soundscape would be long- and short-term, minor, and beneficial due to benefits associated with implementation of future planning efforts.

Impacts of Alternative C

The effects of Alternative C would be similar to Alternative A since a similar number of vessels would have access to the park via a combination of mooring and shoreline bow and stern anchoring. However, sounds generated by vessels would not be present in the Marine Hazard Zone, since vessels are restricted from this zone due to safety- and resource-related concerns. Vessel size limitations by management zone in the park, as compared to Alternative A, which does not limit vessel size in park waters, would also change the type and location of vessel related sounds. Restricting vessel size to 150 feet, with larger vessels anchoring further away from the shoreline would reduce some sounds (primarily vessel engines and generators) in the vicinity of West Beach. In addition, more staff are proposed under Alternative C when compared to Alternative A; this would likely reduce adverse effects on soundscape during periods of high use. The overall effect of Alternative C on soundscape would be long- and short-term, minor, and adverse.

Cumulative Effects

The same past, on-going, and future plans, projects, and activities affecting soundscape described under Alternative A are applicable to Alternative C. When combined with management actions proposed under Alternative C, the cumulative effect would be long- and short-term, negligible, and adverse.

Conclusions

The effects of Alternative C would be similar to Alternative A since a similar number of vessels would have access to the park via a combination of mooring and shoreline bow and stern anchoring. However, since more staff are proposed under Alternative C when compared to Alternative A, and vessel size and access limitations are proposed under Alternative C, the overall effects would be long- and short-term, minor, and adverse. The cumulative effects on soundscape would be long- and short-term, negligible, and adverse, due to benefits associated with implementation of future planning efforts.

Impacts of Alternative D

Although it is projected that Alternative D would accommodate an increased number of vessels compared to Alternative A (112 compared to 87, respectively), and therefore increase the number of visitors, a greater number of additional staff (9 full time equivalents) and increased presence in the park are also proposed under Alternative D when compared to Alternative A. Increased outreach, enforcement, research and monitoring of conditions would benefit soundscape and help deter some unwanted noise that would likely be associated with an increased number of visitors, particularly on and near West Beach. Elimination of shoreline bow and stern anchoring, proposed limitations to vessel size, implementation of management zones, and access limitations would help decrease some adverse effects to the soundscape for the same reasons described under other action alternatives. However, during peak visitation, these adverse effects would have a greater magnitude of adverse effect. Effects to soundscape would also vary depending on location within the park, with most adverse effects occurring in the vicinity of West Beach where visitation is concentrated. The resulting effects would, therefore, be long- and short-term, minor to moderate, and adverse.

Cumulative Effects

The same past, on-going, and future plans, projects, and activities affecting soundscape described under Alternative A are applicable to Alternative D. When combined with management actions proposed under Alternative D, the cumulative effect would be considered long- and short-term, negligible, and adverse.

Conclusions

Although it is projected that Alternative D would accommodate a greater number of vessels and visitors within the park, additional staff are also proposed under Alternative D which would result in a long- and short-term, minor to moderate, adverse effect on soundscape. The cumulative effects on soundscape would be long- and short-term, negligible, and adverse due to benefits associated with future planning efforts.

SCENIC RESOURCES

Regulations and Policies

The regulations and policies that guide NPS actions with respect to scenic resources are presented in the “Servicewide Mandates and Policies” Section of Chapter 1 and in Appendix B.

Methods

Issues related to scenic resources identified during public meetings and planning workshops included: (1) the potential effects of moorings on the park viewshed; and (2) the potential effects of development in St. Croix on the park viewshed. To address these issues, a qualitative assessment of the effects of projected park management actions on scenic resources was conducted. The primary sources of information used in this analysis included unpublished observations and insights from knowledgeable park staff. The geographic area analyzed for possible effects on scenic resources includes all vantage points visible from the park, including the north eastern portion of St. Croix.

The major assumptions used in the analysis of effects on scenic resources were that: (1) an increase in the number of moorings within park waters could potentially affect scenic resources in the park; (2) visual effects of mooring buoys would be more long-term than effects associated with an anchoring area/zone due to the presence of the mooring buoy; (3) scenic resources would be predominately affected by development on St. Croix, which is outside of the park’s control; and (4) the scenic value of the park’s “marine garden,” including the underwater trail, has been diminished due to several factors (including bleaching events) contributing to the decline of coral populations in the park. The cumulative effects of climate change on the scenic value of the underwater resources including the “marine garden” are summarized in this section.

Impact Threshold Definitions

The thresholds to determine the intensity of impacts on scenic resources are defined as follows:

Negligible: Effects of the action would be barely perceptible and would not affect the scenic quality or the visitor experience.

Minor: Effects of the action would alter features or alter the landscape but would not diminish the scenic quality or the overall visitor experience.

Moderate: Effects of the action would alter features or landscape such that the scenic quality would be slightly degraded and the quality of the visitor experience would be diminished.

Major: Effects of the action would alter features or the landscape in an obvious way. There would be substantial consequences for the quality of the visitor experience.

Duration: Long-term: Changes would be recognized for more than one year;
Short-term: Changes would be recognized for less than one year.

Impact of Alternative A

As visitors travel to the park from St. Croix, the view of Buck Island and the surrounding park waters is relatively unaffected. There is little infrastructure at Buck Island (no roads, utilities, etc.) with minimal facilities consisting of boundary and regulatory buoys, a pier, picnic shelter, toilets, and

moorings at the underwater trail. Vessels anchored at West Beach are also visible upon approach to Buck Island and may be viewed as a minor intrusion on the scenic landscape by some visitors, while others might perceive this as a common, attractive element of a marine seascape. This same dual perception would also be applicable to the moorings located at the underwater trail, the two designated SCUBA moorings, and the proposed new moorings for administrative use. In addition, the practice of shoreline bow and stern anchoring partially obstructs the shoreline and beach view with anchors, lines, and motors. Scenic qualities of underwater resources would not be expected to be change due to management actions taken under alternative A. The overall effect on the scenic resources under Alternative A is long- and short-term, negligible, and adverse.

Cumulative Effects

Under all of the alternatives, including Alternative A, the cumulative effects on scenic resources would be largely controlled by outside influences and to a lesser extent by park management actions. The viewshed facing south toward St. Croix from Buck Island has been altered by private development and consists more of the built environment including houses, small hotels, roads, street lights and commercial development. As St. Croix continues to develop it is likely that these effects would continue to affect the scenic quality. These effects are not a result of park management actions, however, and are outside of the park's control. It should also be noted that only a portion of the vantage points visible from the park would be affected by development on St. Croix and that the majority of the park's scenic resources consists of unobscured seascape.

Beneficial effects on scenic resources could potentially be derived from territory planning efforts that incorporate preservation of scenic vistas and limitations on coastal development. The Division of Coastal Zone Management is reportedly revisiting the concept of a Territorial Park System and is developing a "Management Framework for the Marine Protected Areas of the United States Virgin Islands." St. Croix East End Marine Park, a marine protected area that abuts Buck Island Reef National Monument, was established in 2003 and is managed under this program as described in Chapter 1. NPS was involved in many planning workshops during the establishment of St. Croix East End Marine Park, and continues its cooperation for the protection of resources, in the marine park. It is also anticipated that the park's vessel management plan would incorporate viewsheds as a topic of concern. Past, on-going and future planning efforts provide additional beneficial effects. Overall, the resulting cumulative effects on the viewshed and seascape would be long- and short-term, minor, and adverse.

The spectacular elkhorn coral barrier reef that wraps around the eastern two-thirds of Buck Island, referred to as "one of the finest marine gardens in the Caribbean Sea" in the park's proclamation, was the primary reason for the establishment of the park. The underwater trail provides a means to view these corals as well as other associated marine resources. The scenic value of the "marine garden" and underwater trail has been affected by a variety of factors that have collectively led to reductions in the abundance of coral throughout the Caribbean, including the park. These factors are associated with world-wide trends and conditions, such as elevated water temperatures and other climate changes, hurricanes, disease, and are outside of the park's control and are not related to park management actions. These factors are discussed in detail in the "Marine and Coastal Resources" and "Species of Concern" sections of Chapters 3 and 4. On-going global climate changes have resulted in long- and short-term, major, adverse effects on the scenic value of the "marine garden" and other underwater resources. When the beneficial and adverse effects of other past, on-going, and future plans, projects and activities affecting scenic resources are combined with actions under Alternative A, the resulting cumulative effects to the underwater trail/marine garden would be long and short-term, major and adverse.

Conclusions

Long- and short-term, negligible, adverse effects on the viewshed and seascape would occur under Alternative A due to the presence of moorings in the vicinity of the underwater trail (and the addition of administrative moorings) and the sight of vessels anchored on West Beach. Cumulative effects on the viewshed and seascape would be long- and short-term, minor, and adverse and would be largely due to the effects of development on St. Croix. The decline of coral populations in the park has resulted cumulative long- and short-term, major, adverse effects on the scenic value of the “marine garden” and other marine resources.

Impacts of Alternative B, the Preferred Alternative

Under Alternative B, the existing twelve moorings in the park would be retained and the existing anchoring area at West Beach would be phased out over a ten year period of time and replaced by a mooring field that would contain up to 45 new moorings off West Beach, up to 10 new moorings southwest of the pier, and up to eight new mooring for administrative use only. The exception to this is the addition of five designated anchoring locations in deep sand for vessels 91 to 150 feet in length. These anchoring locations would be established in deep water south of West Beach, and this would be a negligible change to scenic resources. Installation of additional moorings would constitute a more long-term effect on scenic resources than an anchoring area, since a mooring buoy would be a fixture on the seascape, compared to an unobscured seascape when no vessels are anchored under Alternative A. However, it is unlikely that the overall scenic quality and visitor experience would be diminished and the resulting effects would primarily impact the vantage point off West Beach. In addition, some visitors may perceive these sights as common elements of a marine seascape. Establishment of management zones, increased staffing, enforcement, research and monitoring would help prevent resource damage and maintain or improve scenic resources, providing beneficial effects. The overall result of Alternative B on scenic resources would be long-term, minor, and adverse. Effects on the scenic value of the “marine garden” and underwater trail would be the same as described for Alternative A; long- and short-term, major, adverse effects, would be applicable to Alternative B.

Cumulative Effects

Cumulative effects of Alternative B would be the same as those described for Alternative A. Even though the park management actions proposed in Alternative B would result in a minor adverse effect on scenic resources, additional staffing proposed under Alternative B may allow for more partnering between the NPS, government agencies, and other organizations that could potentially increase the level of coordinated efforts to address the scenic viewshed of the park and potential adverse effects of development actions. This may be addressed via zoning restrictions on building heights, low-light options, and design sensitivities. Past, on-going, and future planning efforts and activities described under Alternative A would also be applicable to Alternative B. Cumulative effects on the scenic value of the “marine garden” would also be the same as described for Alternative A, long- and short-term, major and adverse.

Conclusions

Long-term, minor, adverse effects on the viewshed and seascape would occur under Alternative B due to a proposed increase in the number of moorings. Cumulative effects would be long- and short-term, minor, and adverse and would be largely due to the effects of development activities on St. Croix. The cumulative effects of coral bleaching, disease, hurricanes and climate change would result in a cumulative long- and short-term, major, adverse effect on the scenic value of the “marine garden” and other underwater resources due to on-going global climate changes.

Impacts of Alternative C

Under Alternative C, the installation of additional moorings would constitute a more long-term effect on scenic resources than the anchoring area under Alternative A, since a mooring buoy would be a fixture on the seascape, compared to an unobscured seascape when no vessels are anchored under Alternative A. However, it is unlikely that the overall scenic quality and visitor experience would be diminished and the resulting effects would primarily impact the vantage point off West Beach. In addition, some visitors may perceive these sights as common elements of a marine seascape. A two-acre Anchoring Zone would also be incorporated into Alternative C and shoreline bow and stern anchoring would also be appropriate. This would result in partial obstruction of the shoreline and beach views with anchors, lines, and motors, similar to Alternative A. Establishment of management zones, increased staffing, enforcement, research and monitoring would help prevent resource damage and maintain or improve scenic resources, providing beneficial effects. The overall effect of Alternative C on the scenic resources would be long- and short-term, minor, and adverse since the effects of management actions under Alternative C would not diminish the scenic quality or the overall visitor experience.

Cumulative Impacts

Cumulative effects would be the same as those described for Alternative B, long- and short-term, minor, and adverse and would be largely due to the effects of development on St. Croix. The cumulative effects of coral bleaching, disease, hurricanes and climate change would result in a cumulative long- and short-term, major, adverse effect on the scenic value of the “marine garden” and other underwater resources.

Conclusions

Long- and short-term, minor, adverse effects on the viewshed and seascape would occur under Alternative C due to a proposed increase in the number of moorings when compared to Alternative A, which would constitute a more long-term effect. The allowance for shoreline bow and stern anchoring, which partially obscures views of the shoreline and beach, would cause effects the same as Alternative A. Cumulative effects would also be long- and short-term, minor, and adverse and would be largely due to the effects of development on St. Croix. The cumulative effects of coral bleaching, disease, hurricanes and climate change would result in a cumulative long- and short-term, major, adverse effect on the scenic value of the “marine garden” and other underwater resources.

Impacts of Alternative D

Under Alternative D, the installation of additional moorings would constitute a more long-term effect on scenic resources than the anchoring area under Alternative A, since mooring buoys would be a fixture on the seascape, compared to an unobscured seascape when no vessels are anchored under Alternative A. However, it is unlikely that the overall scenic quality and visitor experience would be diminished and the resulting effects would primarily impact the vantage point off West Beach. In addition, some visitors may perceive these sights as common elements of a marine seascape. A 16-acre Anchoring Zone would also be incorporated into Alternative D. Therefore, under Alternative D the number of vessels that could be moored or anchored off West Beach which would affect the seascape from primarily West Beach and surrounding waters. Establishment of management zones, increased staffing, enforcement, research and monitoring would help prevent resource damage and maintain or improve scenic resources, providing beneficial effects. The overall effect of Alternative D on scenic resources would be long- and short-term, minor, and adverse since the effects of management actions under Alternative D would not diminish the scenic quality or the overall visitor experience.

Cumulative Impacts

Cumulative effects would be the same as those described for Alternative B, long- and short-term, minor, and adverse and would be largely due to the effects of development on St. Croix. The cumulative effects of coral bleaching, disease, hurricanes and climate change would result in a cumulative long- and short-term, major, adverse effect on the scenic value of the “marine garden” and other underwater resources due to on-going effects from climate change.

Conclusions

Long- and short-term, minor, adverse effects on the viewshed and seascape would occur under Alternative D due to a proposed increase in the number of vessels in the park associated with opportunities for both moorings and anchoring in the park when compared to Alternative A. Cumulative effects would be long- and short-term, minor, and adverse and would be largely due to the effects of development on St. Croix. The cumulative effects of coral bleaching, disease, hurricanes and climate change would result in a cumulative long- and short-term, major, adverse effect on the scenic value of the “marine garden” and other underwater resources.

VISITOR USE AND EXPERIENCE

Regulations and Policies

The regulations and policies that guide NPS actions with respect to visitor use and experience are presented in the “Servicewide Mandates and Policies” Section of Chapter 1 and in Appendix B.

Methods

Visitor use and experience issues identified during public meetings and planning workshops included: (1) the importance of the park as the primary boating destination in St. Croix; (2) concern that elimination of shoreline bow and stern anchoring would eliminate a valued visitor experience; and (3) a desire for greater opportunities for visitor education and interpretive programs. To address these issues, an assessment of the effects of projected park management actions on visitor use and experience was made using qualitative estimates, and the effects were compared to Alternative A. In addition, information on visitor use and experience was evaluated based on the professional judgment of NPS staff. The geographic area analyzed for possible effects on visitor use and experience includes the entire park.

The major assumptions used in the analysis of effects on visitor use and experience are described in the paragraphs that follow.

Access to Buck Island and the underwater trail is directly related to the number of vessels that can be accommodated by a particular alternative through the number of moorings and/or anchoring capacity. Anchoring in the park is dependent upon the availability of deep sand (per the proclamation) and avoidance of sensitive resources. Placement of moorings is also dictated by resource conditions and avoidance of sensitive resources including seagrasses and corals.

The number of vessels that can be accommodated through moorings was estimated based on the area of deep sand, safe swing radius of a vessel, and avoidance of sensitive resources such as seagrasses and corals. The number of vessels that could potentially be accommodated in the existing anchoring area (Alternative A) or an Anchoring Zone (Alternatives C and D) was based upon historical use and avoidance of sensitive resources. Although acreages are specified for these areas under each alternative, it is unlikely that the entire proposed acreages could be utilized at a single point in time due to shifting sands, the presence and recovery of seagrass, or other resource-related protective measures. Acreages and number of vessels proposed under each alternative are presented in Chapter 2. It is assumed that as the number of vessels increase, the number of visitors also increases relative to the number of vessels.

Estimates of maximum number of vessels under each alternative are approximations and are provided for relative comparison of impacts. These estimates will be refined during the implementation phase based on further planning efforts such as the vessel management plan and related environmental compliance documents, site specific data, resource analysis, and user capacity analysis.

Regional economic growth, levels of tourism in the Virgin Islands, and population levels at St. Croix influences the level of visitation to the park (in other words, visitation numbers may fluctuate given economic conditions), however carrying capacity at the park is determined by resource conditions and other factors as described above.

All alternatives would accommodate universal access through handicapped accessible concession vessels and a handicapped accessible concrete pier.

Under Alternative A, the existing management direction for visitor experience would be extended into the future, and few or no new programs for visitors would be planned and implemented;

Under all alternatives, educational materials, outreach efforts, and interpretive activities would continue to be provided by the NPS from Park Headquarters located at Christiansted National Historic Site, Visitor Contact Station in Fort Christiansvaern, and the Scale House Eastern National Bookstore, by park staff, and by concessioners.

Concessioners will continue to operate in the park at or near existing levels.

Visitor use and experience is assessed in terms of visitor use and access, recreational opportunity, and access to orientation information and interpretation. The effects of shoreline bow and stern anchoring on visitor use and experience are addressed under “Recreational Opportunity” for each of the alternatives.

Impact Threshold Definitions

Impact threshold definitions for visitor use and experience are as follows:

Negligible: Visitors would likely be unaware of any effects associated with implementation of the alternative. There would be no noticeable change in visitor use and experience or in any defined indicator of visitor satisfaction or behavior.

Minor: Changes in visitor use and/or experience would be slight but detectable, but would not appreciably diminish or enhance the desired visitor experience. Visitor satisfaction would remain stable.

Moderate: Few characteristics of the desired visitor experience would change and/or the number of participants engaging in an activity would be altered. Visitors would be aware of the effects associated with implementation of the alternative and would likely express an opinion about the changes. Visitor satisfaction would begin to either decline or increase as a direct result of the effect.

Major: Multiple characteristics of the desired visitor experience would change and/or the number of participants engaging in an activity would be greatly reduced or increased. The visitor would be aware of the effects associated with implementation of the alternative and would likely express a strong opinion about the change. Visitor satisfaction would markedly decline or increase.

Duration: Long-term: Changes would be recognized for more than one year.
Short-term: Changes would be recognized for less than one year.

Impacts of Alternative A

Visitor Use and Access - Under Alternative A, visitor use is traditionally highest on weekends, especially Sundays, and between the months of February and April with other spikes during the year. Visitor use is typically concentrated in the vicinity of West Beach and the underwater trail. These visitor trends

would be unlikely to change. Under Alternative A, visitor use and access would remain essentially unchanged.

Under Alternative A, there is no vessel size or access restriction in place in the park outside of the lagoon. Beach access may be limited during nesting season for sensitive species including least terns and sea turtles. There are no limits set on park visitation, and the user capacity of Buck Island and the underwater trail is established by avoidance of sensitive resources including corals and seagrasses, configuration of the underwater trail, the number of visitors that can be transported via each concessioner, the number of available existing moorings, and by the number of anchoring applications that have been issued to date. There are twelve authorized concessioners, ten moorings located near the underwater trail, and an anchoring area of approximately 22 acres located near West Beach that includes shoreline bow and stern anchoring. It should be noted, however, that the entire anchoring area cannot be utilized at all times due to shifting sands, the presence of seagrass beds, or other resource-related restrictions. As seagrass recovery occurs in this area, the amount of available anchoring space would become increasingly limited. Anchoring is appropriate by permit and only in deep sand. A pier located on the south side of Buck Island is also available for dropping off passengers. Based on the assumptions outlined in Table 5 of Chapter 2, it is estimated that a maximum of approximately 87 vessels could be accommodated under Alternative A through available, existing moorings and authorized anchoring sites.

Continuation of current management actions under Alternative A would result in a range of effects on visitor use and access, from long-term, major, beneficial effects for visitors who value accessing Buck Island via both anchoring at West Beach and existing moorings near the underwater trail, to long-term, moderate, adverse effects for visitors who prefer a substantially anchorless park and/or a change to the current visitation trends. The differences between beneficial and adverse would depend on the expectations and preferences of the visitor.

Recreational Opportunity - Under Alternative A, anchoring is appropriate near West Beach (by permit), and shoreline bow and stern anchoring is also a common practice. Shoreline bow and stern anchoring is a common practice, particularly on weekends and holidays. The park would continue to restrict beach access at certain times of the year to protect nesting species. A size restriction is placed on vessels entering the lagoon (up to 42 feet in length), and this would be the only vessel size limitation within park waters. Swimming and snorkeling are permitted in all waters of the park. A hiking trail, a pier, toilets, picnic tables, and NPS grills, information kiosks and picnic shelter at Diedrich's picnic area would continue to be provided under Alternative A. Some visitors would prefer some additional improvements in existing facilities and the lack of these would result in minor adverse impacts on these visitors. Continuation of current management actions under Alternative A would have a long-term, minor, beneficial effect on recreational opportunity.

Access to Orientation Information and Interpretation - Access to park information, interpretation programs, and educational materials is available outside the monument (at locations noted in the preceding "Methods" section) through authorized park concessioners, two information kiosks (one at West Beach and another at Diedrich's picnic shelter), or incidental contact with NPS personnel. Public and internal scoping identified the desire for increased interpretation training for concessions operators, greater emphasis on educating visitors on resources and resource protection, and educational partnering with schools and other local stakeholders. The current level of staffing limits expansion of the park's educational and interpretive programs, however. Continuation of current levels of education, interpretation, and partnering offered by the park would have long-term, minor to moderate, adverse effects.

Cumulative Effects

Visitor Use and Access - The majority of NPS future studies and implementation plans outlined in Chapter 1 would benefit visitor experience within the park. Future implementation of a vessel

management plan would aid in assessing visitor use, access, and capacity issues and further refine indicators, standards, and monitoring strategies that would be used to protect park resources while providing for quality experiences. Effects related to potential future growth on St. Croix and tourism are described under “Recreational Opportunity”. When the beneficial and adverse effects of other past, on-going, and future plans, projects and activities affecting visitor use and access are combined with actions under Alternative A, the resulting cumulative effects would be long-term, minor, and beneficial for the majority of park visitors.

Recreational Opportunity - Under all the alternatives, there is a potential for increased future growth, development, and tourism in St. Croix yet this is dependent on economic conditions. Increased growth would likely result in an increased demand for recreational activities, especially water-based recreation and tourism, and a subsequent potential increase in visitor use at the park. Assuming this pattern continues, increased visitor use could, in turn, result in fewer recreational opportunities for park visitors since a greater number of visitors would be competing for a relatively fixed number of facilities and recreational opportunities. Development of territorial parks, such as St. Croix East End Marine Park and the proposed Marine Research and Education Center at Salt River Bay National Historical Park and Ecological Preserve, and other as yet unknown commercial attractions could potentially buffer these increased demands.

Increased demand for access to Buck Island would also mean more vessel operators would want to anchor off West Beach. This would adversely affect visitor opportunities and experiences as the potential for crowding at the anchoring area and West Beach would increase. Increased vessel use would create additional enforcement challenges to protect resources. There would therefore be an increased probability of resource damage or other adverse effects from the increased vessel use, including vessel damage from unauthorized anchoring and increased potential for disturbing park resources. This would adversely affect visitor experiences as the overall quality of their experience and opportunities to enjoy recreational activities such as swimming and beach use would be adversely affected. When the beneficial and adverse effects of other past, on-going, and future plans, projects, and activities affecting recreational opportunities are combined with actions under Alternative A, the resulting cumulative effects would be long-term, minor, and beneficial.

Access to Orientation Information and Interpretation - The potential for future increased visitor use would also translate to greater demand for expanded educational and interpretive programs. However, the current level of park staffing and funding limits the capability to expand the park’s educational and interpretive programs. On-going and proposed education and outreach programs within the territory and through other NPS units on St. Croix would have beneficial effects. Such initiatives include the U.S. Virgin Islands Department of Planning and Natural Resources’ Environmental Education and Outreach Program and the proposed Marine Research and Education Center at Salt River Bay National Historical Park and Ecological Preserve. When the beneficial and adverse effects of other past, on-going, and future plans, projects and activities affecting access to park information and interpretation activities are combined with actions under Alternative A, the resulting cumulative effects would be long-term, minor, and adverse.

Conclusions

Continuing existing management direction under Alternative A would result in a range of effects on visitor use and access, from long-term, major, beneficial effects for visitors who value accessing the park via both anchoring at West Beach and existing moorings at the underwater trail to long-term, moderate, adverse effects for visitors who prefer a substantially anchorless park and/or a change to the current visitation trends. Alternative A would have long-term, minor, beneficial effects on recreational opportunities in the park. Continuation of existing management direction and levels of park education and interpretation activities would have long-term, minor to moderate, adverse effects.

Cumulative effects on visitor use and access and recreational opportunities would be long-term, minor, and beneficial for the majority of park visitors. Cumulative effects regarding access to information and interpretive activities would be long-term, minor, and adverse

Impacts of Alternative B, the Preferred Alternative

Visitor Use and Access - Under Alternative B the existing 22-acre anchoring area off West Beach would be phased out over a ten-year period of time as moorings are installed. The exception to this is addition of five designated anchoring locations for vessels 91 to 150 feet in length, by permit only. Up to 45 new moorings off of West Beach and up to 10 new moorings southwest of the pier would be installed, which could potentially reduce the number of vessels able to access Buck Island at a given time. Installation of moorings and phasing out the majority of anchoring in the park will reduce adverse effects resulting in less stress to ecological communities and healthier marine resources and therefore better visitor experiences. In addition, installation of moorings provides for long term access compared to Alternative A, as seagrasses recover in the anchoring area, the amount of available deep sand would likely decrease over time, and vessel operators would compete for available space to anchor. This would cause potential conflicts and visitor frustration. Phasing the mooring installation over a ten year timeframe will allow vessel operators time to adjust to the change and avoid inconveniencing visitors during the installation process. Shoreline bow and stern anchoring is eliminated under Alternative B, which would dissatisfy some visitors, and alter their experiences at Buck Island compared to traditional uses under Alternative A; this would be considered a long-term, major adverse effect to these visitors. Conversely, visitors who would prefer a more natural setting and an anchorless park would be satisfied with Alternative B; this would be considered a long-term, major beneficial effect to these visitors.

In addition, under all the action alternatives, vessel size would be limited to up to 42 feet in the lagoon and 150 feet in all park waters with the exception of the Marine Hazard Zone, where vessel use is not appropriate. Management zones would provide increased protective measures for vessel operators to avoid hazardous conditions, and be able to maneuver safely and effectively while enjoying the park. Access to park waters for vessels 151 feet and over would be authorized by permit only.

Alternative B would provide access to Buck Island for approximately 72 vessels compared to 87 vessels under Alternative A which would likely result in a reduction in visitation. This would constitute a long-term, major, adverse effect for visitors who value accessing the park by vessel to anchor and moor as well as long- and short-term, moderate, beneficial effects for visitors who prefer a substantially anchorless park and/or a change to the current visitation trends. The differences between adverse and beneficial would depend on visitor preferences and expectations related to the change in opportunities and access via anchoring versus mooring. Effects of management zones and access are addressed in terms of recreational opportunity below.

Recreational Opportunity - Under all the action alternatives, including Alternative B, all the current land-based facilities and recreational opportunities (hiking trail, picnic areas, NPS grills, toilets, and the pier) would continue to be provided and maintained in the Island Discovery Zone and Recreation Zone. Limited trail development would be possible, which would provide improved / increased visitor opportunities to explore Buck Island. Visitors would also have opportunities for guided hikes and talks.

Existing moorings at the underwater trail and SCUBA moorings would be maintained under Alternative B. Anchoring within the park would be phased out over a ten year period (with the exception of the five designated anchor locations) eliminating the recreational /social experience associated with shoreline bow and stern anchoring. This would dissatisfy some visitors, and would be a long-term, major adverse effect to these visitors.

Other forms of recreation would be altered by management zones to address visitor safety and protection of threatened elkhorn and staghorn coral, other threatened and endangered species, and sensitive resources. Boating, swimming, snorkeling, SCUBA diving, and several other forms of recreation (see Table 2) would be appropriate in the near shore Recreation Zone that encompasses 112 acres under Alternative B. These recreational opportunities are similar to Alternative A. The majority of the park would be included in the Resource Protection Zone. Beach access channels would be provided in this zone to protect swimmers and snorkelers and to avoid boater and swimmer conflicts near West Beach. The Marine Hazard Zone, where navigation is hazardous due to shallow reef complexes, would be created under all the action alternatives to protect threatened elkhorn and staghorn coral and other shallow reef species and prevent accidental vessel groundings, and protecting vessel operators. Vessel use and all other forms of aquatic recreation, with the exception of swimming, would not be appropriate in this zone. In addition, under all the action alternatives, vessel size would be limited to up to 42 feet in the lagoon and 150 feet in all park waters with the exception of the Marine Hazard Zone, where vessel use is not appropriate. Vessels greater than 151 feet would be authorized in the park under permit. This would allow the NPS the ability to track large vessel use in the park.

Phased elimination of the majority of anchoring, and limitations to vessel size by management zone, and the area available for other forms of aquatic recreation opportunities would affect visitors according to personal preference. The effects of Alternative B range from long- and short-term, major, beneficial effects on visitors who prefer a substantially anchorless park and limitations on recreational opportunities to provide greater resource protection and a natural setting, to long- and short-term, major, adverse effects on visitors who prefer to anchor and enjoy similar recreational opportunities and access as provided under Alternative A.

Access to Orientation Information and Interpretation - Under Alternative B, the methods of providing information and interpretation activities described under Alternative A would continue to be used, and the levels of education, outreach and partnering activities would increase. There would also be increased opportunities for guided interpretive tours within the Island Discovery Zone and Recreation Zone. Increased staff levels would increase NPS presence in the park and provide more opportunities for interacting with visitors. Additional opportunities for education and outreach activities involving school groups, universities and other organizations outside of the park would also be explored such as interpretive activities at Christiansted National Historic Site or utilization of the proposed education center at Salt River Bay National Historical Park and Ecological Preserve. Enhanced educational, outreach, and partnering opportunities would provide visitors an understanding of the park purpose and resources and increase awareness of the sensitivity of park resources. The overall effect on visitor access to information and interpretive activities would be long- and short-term, major, and beneficial.

Cumulative Effects

The same past, on-going, and future plans, projects, and activities affecting visitor use and experience described under Alternative A would be applicable to Alternative B. The cumulative effect of past, on-going, and future plans, projects, and activities when combined with management actions under Alternative B (phasing out the majority of anchoring and replacing the anchoring area with a mooring area, creating management zones and setting vessel size limits in the management zones) result in cumulative effects that might be concurrently viewed as beneficial and adverse, depending on personal preference and expectations.

Visitor Use and Access - The cumulative effect on visitor use and access would range from long-term, major, adverse effects for visitors who value accessing the park via anchoring to long- and short-term, moderate, beneficial effects for visitors who prefer a substantially anchorless park and/or a change to the current visitation trends.

Recreational Opportunity - The cumulative effects on recreation opportunities would range from long- and short-term, major, beneficial effects on visitors who prefer a substantially anchorless park and limitations on recreational opportunities to provide greater resource protection, to long- and short-term, major, adverse effects on visitors who prefer to anchor and enjoy recreational opportunities such as those provided under Alternative A.

Access to Orientation Information and Interpretation - The cumulative effect on visitor access to information and interpretive activities would be long- and short-term, major, and beneficial, substantially due to the contribution of management actions proposed under Alternative B.

Conclusions

Altering the type of visitor access and use via management zones and potentially reducing the number of vessels that would access Buck Island under Alternative B would constitute a long-term, major, adverse effect for visitors who value accessing the park via anchoring, convenience, and a more social experience. Concurrently, for visitors who prefer a substantially anchorless park and/or a change to the current visitation trends and who appreciate a more natural park setting, the effects of Alternative B would be long- and short-term, moderate, and beneficial.

The cumulative effects of Alternative B on recreational opportunity would range according to personal preference as well, from long- and short-term, major, beneficial effects on visitors who prefer a substantially anchorless park and limitations on recreational opportunities to provide greater resource protection, to long- and short-term, major, adverse effects on visitors who prefer to anchor and enjoy similar recreational opportunities and access as provided under Alternative A.

The overall effect of Alternative B on visitor access to information and interpretive activities would be long- and short-term, moderate, and beneficial. The cumulative effect of Alternative B on visitor access to information and interpretive activities would be long- and short-term, major and beneficial.

Impacts of Alternative C

Visitor Use and Access - Under all the action alternatives, including Alternative C, all the current land-based facilities and recreational opportunities (hiking trail, picnic areas, NPS grills, toilets, and the pier) would continue to be provided and maintained in new management zones, Island Discovery Zone and Recreation Zone. Limited expansion of trails would be possible, which would provide increased visitor opportunities to explore Buck Island. Trail conditions could degrade with increased trail use, however with soil stabilization measures and maintenance activities, the visitor experience would not be adversely affected. Visitors would also have opportunities for guided hikes and talks.

Under Alternative C, the existing 22 anchoring area would be eliminated and replaced with a 2-acre Anchoring Zone for shoreline bow and stern anchoring at West Beach. In addition, designated anchoring locations would be provided for vessels 91 to 150 feet. Anchoring would be appropriate by permit only in deep sand. Shoreline bow and stern anchoring would be appropriate under Alternative C, and anchors would be required to be buried in the sand to avoid visitor trip and fall hazards. This would provide similar benefits as Alternative A for visitors who prefer bow and stern anchoring and the ability to access the beach directly from a vessel. In addition, a maximum of 45 new moorings would be installed off West Beach, and 10 new moorings would be installed southwest of the pier. It is anticipated that a similar number of vessels (5 fewer) would be accommodated under Alternative C when compared to Alternative A (92 and 87, respectively), which is a negligible effect.

In addition, under all the action alternatives, vessel size would be limited to up to 42 feet in the lagoon and 150 feet in all park waters with the exception of the Marine Hazard Zone, where vessel use is not appropriate. Management zones would provide increased protective measures for vessel operators to avoid hazardous conditions, and be able to maneuver safely and effectively while enjoying the park. Access to vessels 151 feet and over would be authorized by permit only.

The effects from these management actions might be concurrently viewed as beneficial and adverse, depending on personal preference and expectations. Under Alternative C, for visitors who value accessing the park via anchoring and mooring there would be long-term, minor to moderate, and beneficial effects; the effects to visitors who prefer a substantially anchorless park and a change in visitation use trends would be long- and short-term, moderate, and adverse.

Recreational Opportunity - Under all the alternatives, including Alternative C, all current land-based facilities and recreational opportunities (hiking trail, picnic areas, NPS grills, toilets, and the pier) would continue to be provided and maintained. Moorings (up to 10) would be maintained at the underwater trail, along with 2 SCUBA moorings, the same as Alternative A. As with all alternatives, anchoring in deep sand would be designated at 5 sites for larger vessels by permit. Shoreline bow and stern anchoring is also appropriate, resulting in effects similar to those described under Alternative A. Additional moorings would also provide access for visitors and would replace the anchoring area over a ten year timeframe. Phasing the transition to moorings avoids inconveniencing visitors during installation.

In addition, other forms of recreation would change with the implementation of management zones to address visitor safety and protection of threatened and endangered species and other sensitive resources. Boating, swimming, snorkeling, SCUBA diving, and several other forms of recreation (see Table 2) would be appropriate in the Recreation Zone, which encompasses 112 acres under Alternative C. The majority of the park would be included in the Resource Protection Zone. Beach access channels would be provided in this zone to protect swimmers and snorkelers and to avoid boater and swimmer conflicts. The Marine Hazard Zone, where navigation is hazardous due to shallow reef complexes, would be created under all the action alternatives. Vessel use and all other forms of aquatic recreation, with the exception of swimming, would not be appropriate in this zone. The effects of the management zones would be long-term, moderate and beneficial.

The overall effect on recreational opportunity would be long- and short-term, moderate, and beneficial for the majority of visitors since there are opportunities for anchoring for large vessels, shoreline bow and stern anchoring is appropriate, additional moorings would be provided, underwater trail and SCUBA moorings would remain, and all land based recreational opportunities would be the same as Alternative A. Management zones provide additional benefits for resource protection and visitor safety, which satisfies a large range of visitor preferences.

Access to Orientation Information and Interpretation - The same effects as those described under Alternative B are applicable to Alternative C. With increased staff, the overall effect on access to information and interpretive activities would increase outside the park as well as in the Island Discovery Zone and Recreation Zone, resulting in long- and short-term, major, and beneficial effects.

Cumulative Effects

The same past, on-going, and future plans, projects, and activities affecting visitor use and experience described under Alternative A would be applicable to Alternative C. The cumulative effect of past, on-going, and future plans, projects, and activities when combined with management actions under Alternative C result in cumulative effects that might be concurrently viewed as beneficial and adverse, depending on personal preference and expectations.

Visitor Use and Access - The cumulative effect on visitor use and access under Alternative C, for visitors who value accessing the park via moorings and anchoring there would be long-term, minor to moderate, and beneficial effects; the effects to visitors who prefer a substantially anchorless park and a change in visitation use trends would be long- and short-term, moderate, and adverse.

Recreational Opportunity - The cumulative effects on recreational opportunity would be long- and short-term, moderate, and beneficial for the majority of visitors since there are opportunities which satisfy a large range of visitor preferences.

Access to Orientation Information and Interpretation - The cumulative effect on visitor access to information and interpretive activities would be long- and short-term, major, and beneficial, substantially due to the contribution of management actions proposed under Alternative C.

Conclusions

The effects of Alternative C on visitor use and access would range from long-term, minor to moderate and beneficial for visitors who value a more social experience and accessing the park via both anchoring and mooring to long- and short-term, moderate, and adverse for visitors who prefer a substantially anchorless park, a change in visitation use trends, and a more natural park setting.

The overall effect on recreational opportunity would be long- and short-term, moderate, and beneficial for the majority of visitors since there are opportunities which satisfy a large range of visitor preferences. With increased staff, the overall effect on access to information and interpretive activities would be increased, resulting in long- and short-term, major, and beneficial effects.

The cumulative effect of Alternative C on visitor use and access would be a long- and short-term, minor, benefit for the majority of park visitors compared to Alternative A. The cumulative effect on recreational opportunities would be long- and short-term, moderate, and beneficial for the majority of visitors since a large range of visitor preferences are satisfied, similar to Alternative A. The cumulative effect regarding visitor access to information and interpretive activities would be long- and short-term, major, and beneficial.

Impacts of Alternative D

Visitor Use and Access - Under all the action alternatives, including Alternative D, all the current land-based facilities and recreational opportunities (hiking trail, picnic areas, grills, toilets, and the pier) would continue to be provided and maintained in new management zones, Island Discovery Zone and Recreation Zone. However, the number of these facilities would not increase, with the exception of limited expansion of trails, which would provide increased visitor opportunities to explore Buck Island. Trail conditions could degrade with increased trail use, however with soil stabilization measures and maintenance activities, the visitor experience would not be adversely affected. Visitors would also have opportunities for guided hikes and talks. With the increase in vessels and visitors to Buck Island, the demand for existing picnic tables, NPS grills, toilets, the trail and pier would likely increase. This may adversely affect visitor experiences as visitors may have to compete for available space, or may encounter other visitors on a more frequent basis. Crowding on West Beach would also likely occur especially on peak visitation days, primarily on weekends and holidays when locals traditionally visit Buck Island. These effects would be considered long-and short-term, moderate and adverse.

Under Alternative D, the existing anchoring area would be phased out and replaced with a 16-acre Anchoring Zone off of West Beach. Anchoring would be appropriate by permit only in deep sand. Shoreline bow and stern anchoring would be eliminated under Alternative D and this would dissatisfy some visitors. Up to 45 new moorings would be installed beyond the Anchoring Zone off West Beach, and up to 10 new moorings would be installed southwest of the pier. Compared to Alternative A, Alternative D would provide more opportunities to access Buck Island via moorings and anchoring (87 vessels compared to 112 vessels, respectively).

The effects of management actions proposed under Alternative D would range from long-term, minor, and adverse for visitors who value accessing the park via both anchoring and mooring and appreciate a more social experience, to long- and short-term, major, and adverse for visitors who prefer a substantially anchorless park, fewer vessels and therefore fewer visitors.

Recreational Opportunity - Under all the alternatives, including Alternative D, all current land-based facilities and recreational opportunities (hiking trail, picnic areas, NPS grills, toilets, and the pier)

would continue to be provided and maintained. Moorings (up to 10) would be maintained at the underwater trail, along with 2 SCUBA moorings, the same as Alternative A. Due to the increased number of vessels and visitors to the park, the demand on these moorings would be expected to increase, resulting in some visitors not being able to find an available mooring. This would lead to dissatisfied visitors, or perhaps vessels moving to anchoring sites or moorings off West Beach while they wait available space at the underwater trail. Vessels that idle while waiting for a mooring at the underwater trail also increase the potential for navigation and maneuvering issues for other vessels, as well as the potential for groundings.

As with all alternatives, anchoring would be designated at 5 deep sand sites for larger vessels by permit. Shoreline bow and stern anchoring is eliminated under Alternative D, which would dissatisfy some visitors, and alter their experiences at Buck Island compared to traditional uses under Alternative A. Additional moorings would provide access for visitors and would replace the anchoring area over a ten year timeframe. Phasing the transition to moorings avoids inconveniencing visitors during installation.

Some forms of recreation would change with the implementation of management zones to address visitor safety and protection of threatened and endangered species and other sensitive resources. Boating, swimming, snorkeling, SCUBA diving at the SCUBA moorings, and several other forms of recreation (see Table 2) would be appropriate in the Recreation Zone, which encompasses 112 acres under Alternative C. The majority of the park would be included in the Resource Protection Zone, which would also allow a similar level of recreational opportunities. Beach access channels would be provided in this zone to protect swimmers and snorkelers and to avoid boater and swimmer conflicts. The Marine Hazard Zone, where navigation is hazardous due to shallow reef complexes, would be created under all the action alternatives. Vessel use and all other forms of aquatic recreation, with the exception of swimming, would not be appropriate in this zone. The effects of the management zones would be long-term, moderate and beneficial.

The overall effect on recreational opportunities would be long- and short-term, minor, and beneficial for the majority of visitors since there are opportunities for anchoring for large vessels, moorings would be provided, underwater trail and SCUBA moorings would remain, and all land based recreational opportunities would be the same as Alternative A, with guided walks and limited opportunities for more trails. The elimination of shoreline bow and stern anchoring would dissatisfy some visitors, however. Management zones would provide additional benefits for resource protection and visitor safety, which satisfies a large range of visitor preferences.

Access to Orientation Information and Interpretation - Under Alternative D, the methods of providing information and interpretation activities described under Alternative A would continue to be used, and the levels of education, outreach and partnering activities would increase. There would also be increased opportunities for guided interpretive tours within the Island Discovery Zone and Recreation Zone. Increased staff levels would increase NPS presence in the park and provide more opportunities for interacting with visitors. However, due to the increase in number of visitors at Buck Island, the increase in NPS presence may not be perceptible by some visitors. Additional opportunities for education and outreach activities involving school groups, universities and other organizations outside of the park would also be explored such as interpretive activities at Christiansted National Historic Site or utilization of the proposed education center at Salt River Bay National Historical Park and Ecological Preserve. There would likely be a higher reliance on other NPS units to provide information due to the increased numbers of visitor expected under Alternative D. Enhanced educational, outreach, and partnering opportunities would provide visitors an understanding of the park purpose and resources and increase awareness of the sensitivity of park resources. The overall effect on visitor access to information and interpretive activities would be long- and short-term, moderate, and beneficial.

Cumulative Effects

The same past, on-going and future plans, projects, and activities affecting visitor use and experience described under Alternative A would be applicable to Alternative D. The cumulative effect of these plans, projects, and activities when combined with management actions under Alternative D result in cumulative effects that might be concurrently viewed as beneficial and adverse, depending on personal preference and expectations.

The effects of Alternative D have a major contribution to cumulative effects to visitor use and experience. When the effects are combined, the cumulative effects on visitor use and access would be long-term, minor, and adverse. The elimination of bow and stern anchoring influences the level of intensity of effect, compared to Alternative A. The cumulative effects on recreational opportunity would be long- and short-term, minor, and beneficial for the majority of visitors since there are opportunities that would satisfy a large range of visitor preferences. The cumulative effect on visitor access to information and interpretive activities would be long- and short-term, moderate, and beneficial, substantially due to the contribution of management actions proposed under Alternative D.

Conclusions

The effects of management actions proposed under Alternative D would range from long-term, minor, and adverse for visitors who value accessing the park via both anchoring and mooring and appreciate a more social experience, to long- and short-term, major, and adverse for visitors who prefer a substantially anchorless park, fewer vessels and therefore fewer visitors and appreciate a more natural park setting.

The overall effect on recreational opportunities would be long- and short-term, minor, and beneficial for the majority of visitors since there are opportunities for a wide variety of recreational use. The overall effect on visitor access to information and interpretive activities would be long- and short-term, moderate, and beneficial.

When the beneficial and adverse effects other past, on-going, and future plans, projects, and activities affecting visitor use and experience are combined with actions under Alternative D, the resulting cumulative effects would be heavily influenced by the management actions proposed under Alternative D. The cumulative effects on visitor use and access would be long-term, minor, and adverse. The elimination of bow and stern anchoring influences the level of intensity of effect, compared to Alternative A. The cumulative effects on recreational opportunity would be long- and short-term, minor, and beneficial for the majority of visitors since there are opportunities that would satisfy a large range of visitor preferences. The cumulative effect on visitor access to information and interpretive activities would be long- and short-term, moderate, and beneficial, substantially due to the contribution of management actions proposed under Alternative D.

PARK OPERATIONS

Regulations and Policies

The regulations and policies that guide NPS actions with respect to park operations are presented in the “Servicewide Mandates and Policies” Section of Chapter 1 and in Appendix B.

Methods

This impact topic refers to the ability of NPS staff to protect and preserve Buck Island Reef National Monument and provide opportunities for enjoyable visitor experiences while leaving park resources unimpaired for future generations, and the efficiency and effectiveness with which NPS staff are able to perform tasks. Issues related to park operations identified during public comment periods and planning workshops included: (1) the need for greater law enforcement presence and consistency in the enforcement of rules and regulations; (2) a desire for more education and interpretive programs;

and (3) the importance of interpretive training for concessioners. To address these issues, an assessment of the effects of projected park management actions on park operations was made using qualitative estimates, and the effects were compared to Alternative A. In addition, information on park operations was evaluated based on the professional judgment of NPS staff. The area analyzed for possible effects as well as cumulative effects includes the entire park.

Major assumptions used in the analysis of effects on park operations were that: (1) under Alternative A, the existing management programs would be extended into the future, and that few or no new programs for visitors would be planned and implemented; (2) increased visitor use and access to Buck Island could potentially translate to a greater strain on park staff (see also assumptions for assessing “Visitor Use and Experience” methods section of Chapter 4); (3) increased educational and interpretive programs and increased partnering and/or research initiatives would strain park operations without an increase in staffing; and (4) the type and number of visitor facilities (not including moorings) and corresponding maintenance would be similar under all the alternatives and is not a factor in the impact analysis.

Although increased staffing and funding are proposed under the action alternative, it should be noted that implementation of the approved plan would depend on future funding and servicewide priorities. Approval of a general management plan does not guarantee that funding and staffing needed to implement the plan would be forthcoming. Larger capital improvements may be phased over several years, and full implementation of the general management plan could be many years into the future.

Impact Threshold Definitions

Impact threshold definitions for park operations are as follows:

Negligible: Management actions would be at or below levels of detection and would not have an appreciable effect on park operations.

Minor: Management actions would affect operations in a way that would be difficult to measure. Impacts on the park staff workload would be short term, with little material effect on other on-going park programs. The change would be noticeable to staff but not to the public.

Moderate: Management actions would measurably affect operations. Park staff workloads and priorities would need to be rearranged to implement actions. The change would be readily apparent to park staff and possibly to the public.

Major: Management actions would measurably affect operations. Park staff workloads and priorities would be rearranged to implement actions. The effects would be substantial, widespread, and apparent to park staff and the public.

Duration: Long-term: Changes would be recognized for more than one year.
Short-term: Changes would be recognized for less than one year.

Impacts of Alternative A

Several factors have led to a greatly expanded workload for current park staff including: the 2001 boundary expansion from 880 to 19,015 acres; enforcement of the Proclamation (no extractive use, anchoring in deep sand only, etc); the listing of elkhorn and staghorn coral as threatened species; recent coral bleaching events requiring increased research and monitoring, impact, and recovery documentation efforts; reintroduction of the globally endangered St. Croix ground lizard, impact of the non-native invasive lionfish, climate change, and the associated need for increased enforcement, education, and interpretation. Additionally, without the creation of management zoning, park operations would become increasingly difficult to implement under current conditions resulting in less effective park management.

The levels of NPS ranger presence, activity, and enforcement would be expected to remain near or at existing conditions. NPS patrols at Buck Island and throughout the park are limited due to staffing constraints, and this condition would be expected to continue. Anchoring permits would be required for the designated anchoring area, with permit holders required to attend informational sessions to learn about park rules, regulations, and permit conditions. These sessions would need to be held on a routine basis, which would further increase staff workloads.

The current level of partnerships and cooperation with the territorial government, other agencies, and private organizations would continue; however, there is an ever increasing demand for park staff to partner with outside entities for response to coral bleaching events and coordination regarding protection of threatened and endangered species and other endeavors. Scientific research, coordination, and monitoring would become increasingly difficult with existing staffing levels. Demands for interpretation and activities would likely not be met, resulting in dissatisfaction from local organizations, educators, and visitors.

Concessioners would continue to operate under a similar or same number of concessions contracts, and the level of training for concessioners would remain the same. Some visitors have identified that more information is needed, and more interaction with NPS is needed. This condition would likely continue. Volunteer programs, such as the Youth Conservation Corps Program, would be expected to continue at current levels. Overall, Alternative A would have a long- and short-term, moderate adverse effects on park operations.

Cumulative Effects

Under all alternatives, increased development and tourism in the region would result in an increased demand for recreational activities, especially marine-based recreation and tourism, and a subsequent increase in visitor use. Increased visitor use would, in turn, result in increased pressure on the park to provide more educational and interpretive programs, more recreational opportunities, and increase the need for law enforcement. Since a greater number of visitors would be competing for a relatively fixed number of facilities and recreational opportunities, conflicts could arise, and increased law enforcement would be necessary to deter problems. Current staffing levels are not sufficient to adequately meet these demands. Development of territorial parks, such as St. Croix East End Marine Park and Salt River Bay National Historical Park and Ecological Preserve, could potentially buffer some of these increased demands, however.

Existing vessel use patterns and trends would be expected to continue which would create additional enforcement challenges to protect resources, particularly threatened and endangered species. Additional enforcement and research and monitoring is required to protect the threatened elkhorn and staghorn coral, which would place additional demands on existing park staff. There would therefore be an increased probability of resource damage or other adverse effects from the increased vessel use, including vessel damage from unauthorized anchoring and increased potential for disturbing park resources. This would adversely affect park operations.

The majority of NPS future studies and implementation plans outlined in Chapter 1 would benefit park operations in the long-term. In particular, development and implementation of a commercial services plan and a vessel management plan would greatly benefit routine park operations. A commercial services plan would identify the appropriate role of commercial operations in the park, and would assist the park to achieve the desired visitor experiences identified in this General Management Plan. The commercial services plan would also identify whether proposed concession facilities and services are necessary and appropriate, and would consider alternatives. A vessel management plan would provide a comprehensive tool for all aspects of management of vessels within park waters, including specific locations and appropriate type and use of all moorings and anchoring, and vessel operations. User capacity analyses and routine refinement of the indicators, standards, and

monitoring strategies that can be used to protect park resources while providing for quality experiences would also be beneficial.

While all the above mentioned planning efforts are needed to improve park operations and ensure resource protection and quality visitor experiences, formulation and implementation of these studies and plans would have short- to long-term adverse effects on staff workloads. Current staffing levels would not necessarily be sufficient to develop all the needed plans or to implement and enforce the recommendations of these planning efforts. When the beneficial and adverse effects of other past, on-going, and future plans, projects, and activities affecting park operations are combined with management actions under Alternative A, the resulting cumulative effects would be long- and short-term, moderate and adverse.

Conclusions

Long- and short-term, moderate, adverse effects on park operations would occur under Alternative A largely due to a need for additional staff as a result of a workload that has been greatly expanded. When the beneficial and adverse effects of other on-going, and future plans, projects, and activities affecting park operations are combined with actions under Alternative A, the resulting cumulative effects would be long- and short-term, moderate, and adverse. The cumulative effect level of intensity is slightly less due to management actions proposed under Alternative A due to the benefits of future studies and implementation plans.

Impacts of Alternative B, the Preferred Alternative

The establishment of management zones under Alternative B and all other action alternatives provide effective means to improve park operations. Management zones would provide additional benefits for resource protection and visitor safety, which satisfies a large range of demands on park operations. This would aid park staff in decision-making, resource management, and enforcement.

Public and internal scoping identified a lack of enforcement staff and/or NPS presence (especially during weekends) under Alternative A, the no action alternative. Under Alternative B, approximately 6 additional full time staff, or equivalents, are proposed to help disperse the expanded workload (described under Alternative A). The increase in enforcement would help address this concern. In addition, it is estimated that Alternative B would accommodate slightly fewer vessels than Alternative A which would decrease management needs (72 versus 87 vessels, respectively).

Eventual elimination of the majority of anchoring under Alternative B would greatly reduce staff workloads by lessening the demands of the anchoring permit program and by greatly reducing anchoring-related enforcement and related resource management issues. These benefits to park operations would be slightly offset by the need for monitoring mooring use and routine maintenance of the proposed new moorings. In addition, creation of the Marine Hazard Zone would reduce the potential for vessel strandings/groundings and would limit interaction with sensitive resources which would also benefit resources and management efforts. However, more enforcement and visitor education would be required to convey the purpose of the Marine Hazard Zone as well as other management zones in the short-term to increase visitor awareness. Management zones would have overall long-term, major, beneficial effects.

Educational, interpretive, and volunteer programs and opportunities for partnering with local agencies and other organizations would continue and would have the potential to expand without straining park staff due to proposed increases to interpretive, enforcement, and resource management staff. In addition, increased levels of research and monitoring would be conducted to provide data necessary to determine the best management practices to avoid adverse effects to rare, threatened, or endangered species. Research and monitoring of the elkhorn and staghorn coral in the park and opportunities to partner with other research entities would increase, as would other research needed to determine what additional measures should be taken to help protect these threatened species, as

well as other natural and cultural resources in the park. Research in the park would also be aided by the addition of a maximum of eight resource management moorings. These moorings would provide consistent access for monitoring and other resource protection efforts, thereby increasing efficiency.

Successful implementation of Alternative B would be dependent on the hiring of additional staff, which is dependent on future funding and servicewide priorities. Overall, Alternative B would have a long- and short-term, major, beneficial effects on park operations.

Cumulative Effects

Under all the alternatives, including Alternative B, increased development and tourism in the region would likely result in an increased demand for recreational activities, especially marine-based recreation and tourism, and a subsequent increase in visitor use. Increased visitor use would, in turn, result in increased pressure on the park to provide more educational and interpretive programs as well as more recreational opportunities. Development of territorial parks, such as St. Croix East End Marine Park, could potentially buffer these increased demands, however. Increased staffing proposed under Alternative B would allow for additional cooperative efforts to address issues related to increased visitor use.

The same beneficial effects on park operations related to future NPS studies and implementation plans described under the cumulative effects section for Alternative A would be applicable to Alternative B. However, since additional staff are proposed for Alternative B, the short-term adverse effects described under Alternative A related to formulating and implementing these efforts would be of lesser magnitude. When the beneficial and adverse effects of other past, on-going, and future plans, projects, and activities affecting park operations are combined with actions under Alternative B, the resulting cumulative effects would be long- and short-term, major, and beneficial.

Conclusions

Long- and short-term, major, beneficial effects on park operations would occur under Alternative B due to the implementation of management zones, a proposed increase in staffing, and alleviation of management requirements resulting from the elimination of the majority of anchoring in the park. Cumulative effects on park operations would be long- and short-term, major, and beneficial.

Impacts of Alternative C

The establishment of management zones under Alternative C and all other action alternatives provide effective means to improve park operations. Management zones would provide additional benefits for resource protection and visitor safety, which satisfies a large range of demands on park operations. This would aid park staff in decision-making, resource management, and enforcement. Under Alternative C, approximately 8 additional full time staff, or equivalents, are proposed to help disperse the expanded workload (described under Alternative A). In addition, it is estimated that Alternative C would accommodate approximately 5 more vessels than Alternative A which would have similar management needs (92 versus 87 vessels, respectively).

Eventual elimination of the majority of anchoring under Alternative C would reduce staff workloads by lessening the demands of the anchoring permit program somewhat, and by reducing some anchoring-related enforcement and resource protection issues. These benefits to park operations would be slightly offset by the need for monitoring mooring use and routine maintenance of the proposed new moorings. However, Alternative C would be similar to Alternative A with regard to shoreline bow and stern anchoring at West Beach and park operation concerns regarding enforcement.

In addition, implementation of the Marine Hazard Zone would reduce the potential for vessel strandings/groundings and would limit interaction with sensitive resources which would also benefit resources and management efforts. However, more enforcement and visitor education would be

required to convey the purpose of the Marine Hazard Zone as well as other management zones in the short-term to increase visitor awareness. Management zones would have overall long-term, major, beneficial effects.

Educational, interpretive, and volunteer programs and opportunities for partnering with local agencies and other organizations would continue and would have the potential to expand without straining park staff due to proposed increases to interpretive, enforcement, and resource management staff. In addition, increased levels of research and monitoring would be conducted to provide data necessary to determine the best management practices to avoid adverse effects to rare, threatened, or endangered species. Research and monitoring of the elkhorn and staghorn coral in the park and opportunities to partner with other research entities would increase, as would other research needed to determine what additional measures should be taken to help protect these threatened species, and other resources in the park. Research in the park would also be aided by the addition of up to eight administrative moorings. These moorings would provide consistent access for monitoring and other resource protection efforts, thereby increasing efficiency.

Successful implementation of Alternative C would be dependent on the hiring of additional staff, which is dependent on future funding and servicewide priorities. Overall, Alternative C would have a long- and short-term, moderate, beneficial effects on park operations.

Cumulative Impacts

The same past, on-going and future plans, projects, and activities affecting park operations described under Alternative B are applicable to Alternative C. When combined with management actions proposed under Alternative C, the cumulative effects would be long- and short-term, moderate, and beneficial.

Conclusions

Long- and short-term, moderate, beneficial effects on park operations would occur under Alternative C due to proposed increase in staffing which would allow enforcement, research, partnering, and interpretive programs to continue and expand without straining park operations. Management efforts related to maintaining anchoring permits under Alternative C would be slightly less than Alternative A. When the beneficial and adverse effects of other on-going, and future plans, projects and activities affecting park operations are combined with actions under Alternative C, the resulting cumulative effects would be long- and short-term, moderate, and beneficial.

Impacts of Alternative D

The establishment of management zones under Alternative D and all other action alternatives provide effective means to improve park operations. Management zones would provide additional benefits for resource protection and visitor safety, which satisfies a large range of demands on park operations. This would aid park staff in decision-making, resource management, and enforcement. It is estimated that Alternative D would accommodate approximately 25 more vessels than Alternative A which would have increased management needs (112 versus 87 vessels, respectively).

Maintaining anchoring in the park in the 16 acre Anchoring Zone under Alternative C would require a staff workload similar to Alternative A to maintain the anchoring permit program, and address anchoring-related enforcement and resource protection issues. These park operations requirements would be slightly offset by the elimination of shoreline bow and stern anchoring. However, there would also be concurrent increased requirements for monitoring mooring use and routine maintenance of the proposed new moorings. Under Alternative D, approximately 9 additional full time staff, or equivalents, are proposed to help disperse the expanded workload (described under Alternative A). The increased demand on park operations from the increased number of vessels and

visitors in the park would be somewhat offset by the increase in staff, with short- and long-term, moderate adverse effects.

Implementation of the Marine Hazard Zone would reduce the potential for vessel strandings/groundings and would limit interaction with sensitive resources which would also benefit resources and management efforts. However, more enforcement and visitor education would be required to convey the purpose of the Marine Hazard Zone as well as other management zones in the short-term to increase visitor awareness. Management zones would have overall long-term, major, beneficial effects.

Educational, interpretive, and volunteer programs and opportunities for partnering with local agencies and other organizations would continue and would have the potential to expand without straining park staff due to proposed increases to interpretive, enforcement, and resource management staff. In addition, increased levels of research and monitoring would be conducted to provide data necessary to determine the best management practices to avoid adverse effects to rare, threatened, or endangered species. Research and monitoring of the elkhorn and staghorn coral in the park and opportunities to partner with other research entities would increase, as would other research needed to determine what additional measures should be taken to help protect these threatened species, and other resources in the park. Research in the park would also be aided by the addition of up to eight administrative moorings. These moorings would provide consistent access for monitoring and other resource protection efforts, thereby increasing efficiency.

Successful implementation of Alternative D would be dependent on the hiring of additional staff, which is dependent on future funding and servicewide priorities. Increased staff implementing management actions required to institute the desired conditions and use of management zones would result in long- and short-term, minor, adverse effects on park operations.

Cumulative Effects

The same past, on-going and future plans, projects, and activities affecting park operations described under Alternative A are applicable to Alternative D. When the beneficial and adverse effects of other on-going, and future plans, projects and activities affecting park operation are combined with management actions proposed under Alternative D, the cumulative effects would be long- and short-term, negligible, and adverse.

Conclusions

Increased staff implementing management actions required to institute the desired conditions and use of management zones under Alternative D would result in long- and short-term, minor, adverse effects on park operations. When the beneficial and adverse effects of other on-going, and future plans, projects and activities affecting park operation are combined with management actions proposed under Alternative D, the cumulative effects would be long- and short-term, negligible, and adverse.

PUBLIC HEALTH AND SAFETY

Regulations and Policies

Regulations and policies that guide NPS actions with respect to public health and safety are presented in the “Servicewide Mandates and Policies” Section of Chapter 1 and in Appendix B.

Methods

Issues related to public health and safety identified during public comment periods and planning workshops included: (1) boater safety and navigation hazards; (2) trip and fall hazards associated with shoreline bow and stern anchoring; (3) safe access to West Beach from vessels; (4) the desire for increased NPS ranger presence; and (5) hazards associated with marine life, terrestrial vegetation, and

harsh conditions. The effects of each alternative in relationship to these issues were estimated by qualitatively comparing the management actions under each alternative to effects of Alternative A. The primary sources of information used in this analysis included NPS policy documents, incident reports, and unpublished observations and insights from knowledgeable park staff. The area analyzed for possible effects on public health and safety includes the entire park; however, many of the identified health and safety issues predominate near West Beach, shallow reefs, the lagoon area, and the underwater and terrestrial trails. The cumulative impacts analysis also considers effects within the park boundary.

The assumptions used in this analysis were that: (1) under Alternatives A and C, hazards associated with shoreline bow and stern anchoring would be present (potential to trip on anchors, lines, or vessel propellers on West Beach); (2) the number of incidents of public health and safety concern is relative to the overall number of visitors and the number of vessels that may anchor and/or moor in the park under each alternative; and (3) when compared to Alternative A, adverse effects related to visitor health and safety would be minimized under the action alternatives due to proposed staffing increases.

Although increased staffing and funding are proposed under the action alternatives, it should be noted that implementation of the approved plan would depend on future funding and servicewide priorities. Approval of a general management plan does not guarantee that funding and staffing needed to implement the plan would be forthcoming. Implementation may be phased over several years, and full implementation of the general management plan could be many years into the future.

Impact Threshold Definitions

Impact threshold definitions for public health and safety are as follows:

Negligible: Public health and safety would not be affected; effects on employee and visitor health or safety would not be appreciable or measurable.

Minor: Effects on employee and/or visitor health and safety would be detectable; however, they would not produce an appreciable change in public health or safety.

Moderate: The effects would be readily apparent, and would result in significant, noticeable effects on employee and/or visitor health and safety on a local scale. Changes in rates or severity of injury or illness could be measured.

Major: The effects would be readily apparent, and would result in substantial, noticeable effects on staff and/or visitor health and safety on a regional scale, and could lead to staff or visitor mortality.

Duration: Long-term: Changes would be recognized for more than one year.
Short-term: Changes would be recognized for less than one year.

Impacts of Alternative A

Under Alternative A, existing levels of health and safety-related issues would be expected to continue into the future without change. There is currently no vessel size or access restriction in place in the park outside of the lagoon which increases the potential for vessel groundings and reef damage due to hazardous navigation conditions. Vessel groundings could result in personal injury. In addition, the trip and fall hazard associated with shoreline bow and stern anchoring would continue to exist under Alternative A. Providing vessels direct access to the beach, however, allows safer beach access for non-swimmers which was an expressed concern from visitors. Conversely, there would be no separation of vessels and swimmers near West Beach which could result in conflicts and potential safety hazards for swimmers.

The NPS would continue to close the beaches and anchoring area at Buck Island during storms, when stinging jellyfish are present, or during other hazardous conditions.

Public and internal scoping identified a lack of enforcement staff and/or NPS presence (especially during weekends) under current conditions. This lack of consistent NPS presence would be expected to continue into the future, resulting in an increase in the probable number of safety-related incidents. Staffing limitations also hinder expansion of education and interpretive programs which are instrumental in preventing incidents related to encounters with hazardous vegetation and certain marine life, the importance of adhering to marked trails due to hazards associated with steep and unstable slopes, poisonous/hazardous vegetation, and dehydration. As coastal and marine species continue to recover in the “no take” marine reserve, populations of predator species (such as sharks, barracudas and others) would also be expected to recover. The potential for incidents with sharks and other predators may occur. Without increased NPS presence at Buck Island, it would be difficult to provide onsite information regarding the hazards related to inappropriate fish feeding (fish feeding is prohibited) and inform visitors of the natural predator/prey relationships that exist in the park and how to avoid potential conflicts. The overall effect of Alternative A on public health and safety would be long- and short-term, minor, and adverse.

Cumulative Effects

Under all the alternatives, including Alternative A, cumulative effects on public health and safety would largely be controlled by park management actions and to a lesser extent by outside influences since effects on public health and safety are largely related to the number of visitors to Buck Island and park waters, natural hazards, and the level of NPS staffing presence. Other contributing factors to cumulative effects include working with partners (the territory, U.S. Coast Guard, and other federal agencies) to get digital boundaries of the park on charts and maps, which would aid in consistent enforcement practices, and to educate the public on hazardous navigational challenges, and other health and safety related issues. In addition, development of a vessel management plan would involve the public in identifying and addressing safety-related issues. Concessioners would benefit from a Concessions Management Plan that would clearly outline expectations and requirements for both the NPS and concessioners. Anchoring permit holders would continue to be provided with information regarding park rules and regulations as well as safety considerations.

As the “no take” marine reserve continues to allow for fish and other marine populations to recover, predator species (such as sharks, barracudas and others) would likely also increase in the park. This could present safety concerns to swimmers, snorkelers, and divers. The lack of increased education and outreach efforts or increased staff presence in the park under Alternative A would likely result in an increase in reported overall safety incidents.

When the beneficial and adverse effects of other past, on-going, and future plans, projects, and activities affecting public health and safety are combined with management actions under Alternative A, the resulting cumulative effects would be long- and short-term, minor, and adverse.

Conclusions

Long- and short-term, minor, adverse effects on public health and safety would occur under Alternative A due in part to the lack of consistent NPS staff presence. Adverse effects are also attributed to shoreline bow and stern anchoring and the lack of vessel size and access restrictions (outside of the lagoon). When the beneficial and adverse effects of other past, on-going, and future plans, projects, and activities affecting public health and safety are combined with management actions under Alternative A, the resulting cumulative effects would be long- and short-term, minor, and adverse.

Impacts of Alternative B, the Preferred Alternative

The establishment of management zones under Alternative B and all other action alternatives provide effective means to provide additional public health and safety measures. Management zones would provide additional benefits for resource protection and visitor safety.

Under Alternative B, vessels would not be allowed passage through the Marine Hazard Zone which would eliminate the potential for vessel groundings near shallow reefs within this zone. This would provide additional safety precautions for hazardous navigation conditions and avoid related personal injury. In addition, fall and trip hazards as well as hazards from vessel and propeller movement along and near shore associated with shoreline bow and stern anchoring would be eliminated under Alternative B. However, a potential safety hazard for those that do not swim or have limited swimming skills may be introduced in the form of accessing the beach from an offshore mooring as opposed to accessing the beach from a vessel anchored directly on the beach under Alternative A. This would be offset by use of beach access channels for dinghy use, or dropping passengers off at the pier. Access channels also provide safety for swimmers by eliminating swimming/vessel use conflicts.

The NPS would continue to close the beaches and anchoring area at Buck Island during storms, when stinging jellyfish are present, or during other hazardous conditions. In addition, providing 10 moorings west of the pier under Alternative B would provide a sheltered place for vessels during certain times of the year.

Increased park staff proposed under this alternative would provide consistent staff presence within the park providing visitors with park information, safety information, and enforcement of park mandates and policies resulting in long-term, beneficial effects. The potential for expansion of education and interpretive programs would also aid in informing visitors about hazards associated with poisonous vegetation, harmful marine life, and harsh island conditions. The overall result of Alternative B would be long- and short-term, minor, beneficial effects.

Cumulative Effects

The same past, on-going, and future plans, projects, and activities affecting public health and safety described under Alternative A are applicable to Alternative B. In addition, the additional staff proposed under Alternative B would aid in coordinated enforcement and education efforts between NPS, the territory, and other agencies. When the beneficial and adverse effects of other on-going, and future plans, projects and activities affecting public health and safety are combined with actions under Alternative B, the resulting cumulative effects would long- and short-term, minor and beneficial.

Conclusions

Long- and short-term, minor, beneficial effects on public health and safety would occur under Alternative B due to elimination of shoreline bow and stern anchoring, creation of the management zones, and a proposed increase in NPS staff and presence. When the beneficial and adverse effects of other on-going, and future plans, projects and activities affecting public health and safety are combined with actions under Alternative B, the resulting cumulative effects would be long- and short-term, minor and beneficial.

Impacts of Alternative C

The establishment of management zones under Alternative C and all other action alternatives provide effective means to provide additional public health and safety measures. Management zones would provide additional benefits for resource protection and visitor safety.

The same types of health and safety issues identified under Alternative A would be applicable to Alternative C (bow and stern anchoring is also proposed under Alternative C, and a similar number of visitors would be accommodated in the park as compared to Alternative A). Vessels would not be allowed passage through the Marine Hazard Zone which would eliminate the potential for vessel groundings near shallow reefs within this zone. This would provide additional safety precautions for hazardous navigation conditions and avoid related personal injury. The NPS would continue to close the beaches and anchoring area at Buck Island during storms, when stinging jellyfish are present, or

during other hazardous conditions. In addition, providing up to 10 moorings west of the pier under Alternative C would provide a sheltered place for vessels during certain times of the year.

Increased park staff proposed under this alternative would provide consistent staff presence within the park providing visitors with park information, safety information, and enforcement of park mandates and policies resulting in long-term, beneficial effects. The potential for expansion of education and interpretive programs would also aid in informing visitors about hazards associated with poisonous vegetation, harmful marine life, and harsh island conditions.

Creation of management zones, a proposed increase in NPS staff presence, and the potential for expansion of education and interpretive programs under Alternative C would have beneficial effects on public health and safety for the same reasons described for Alternative B. The overall result would be long- and short-term, negligible, beneficial effects.

Cumulative Effects

The same past, on-going, and future plans, projects, and activities affecting public health and safety described under Alternative A are applicable to Alternative C. In addition, the additional staff proposed under Alternative C would aid in coordinated enforcement and education efforts between NPS, the territory, and other agencies. When the beneficial and adverse effects of other on-going, and future plans, projects and activities affecting public health and safety are combined with actions under Alternative C, the resulting cumulative effects would long- and short-term, negligible and beneficial.

Conclusions

Long- and short-term, negligible, beneficial effects would occur under Alternative C since effects on public health and safety would be similar to Alternative A, but less adverse due to the benefits of management zones, and a proposed increase in NPS staff presence and activity. When the beneficial and adverse effects of other on-going, and future plans, projects and activities affecting public health and safety are combined with actions under Alternative C, the resulting cumulative effects would long- and short-term, negligible and beneficial.

Impacts of Alternative D

The establishment of management zones under Alternative D and all other action alternatives provide effective means to provide additional public health and safety measures. Management zones would provide additional benefits for resource protection and visitor safety. However, due to the increased number of vessels mooring and anchoring in the park, and therefore more visitors (112 versus 87 vessels under Alternative A), there is an increased likelihood of increased incidents in the park. The types of incidents that may increase would include boating accidents or conflicts between vessel operations and swimming and snorkeling in the park. An increase in park staff (an addition of 9 full time equivalents) would help deter some incidents.

Under Alternative D (as is the case for all action alternatives), vessels would not be allowed passage through the Marine Hazard Zone which would eliminate the potential for vessel groundings near shallow reefs within this zone. This would provide additional safety precautions for hazardous navigation conditions and avoid related personal injury. In addition, trip hazards associated with shoreline bow and stern anchoring would be eliminated under Alternative D. However, a potential safety hazard for those that do not swim or have limited swimming skills may be introduced in the form of accessing the beach from an offshore mooring as opposed to accessing the beach from a vessel anchored directly on the beach under Alternative A. This would be offset by use of beach access channels for dinghy use, or dropping passengers off at the pier. Access channels also provide safety for swimmers by eliminating swimming/vessel use conflicts that may increase under Alternative D compared to A due to the increased number of vessels in this area off West Beach.

The NPS would continue to close the beaches and anchoring area at Buck Island during storms, when stinging jellyfish are present, or during other hazardous conditions. In addition, providing 10 moorings west of the pier under Alternative D would provide a sheltered place for vessels during certain times of the year.

Increased park staff proposed under this alternative would provide consistent staff presence within the park providing visitors with park information, safety information, and enforcement of park mandates and policies resulting in long-term, beneficial effects. The potential for expansion of education and interpretive programs would also aid in informing visitors about hazards associated with poisonous vegetation, harmful marine life, and harsh island conditions. The overall result of Alternative D would be long- and short-term, negligible, adverse effects.

Cumulative Effects

The same past, on-going, and future plans, projects, and activities affecting public health and safety described under Alternative A are applicable to Alternative D. In addition, the additional staff proposed under Alternative D would aid in coordinated enforcement and education efforts between NPS, the territory, and other agencies. When the beneficial and adverse effects of other on-going, and future plans, projects and activities affecting public health and safety are combined with actions under Alternative D, the resulting cumulative effects would long- and short-term, negligible and beneficial.

Conclusions

The overall result of Alternative D would be long- and short-term, negligible, adverse effects. An increased number of vessels and visitors would be expected under this alternative which may result in a higher potential for safety-related incidents, however the creation of management zones, and a proposed increase in NPS staff and presence would help deter adverse effects. When the beneficial and adverse effects of other on-going, and future plans, projects and activities affecting public health and safety are combined with actions under Alternative D, the resulting cumulative effects would long- and short-term, negligible and beneficial.

SUSTAINABILITY AND LONG-TERM MANAGEMENT

The National Environmental Policy Act (sec. 101 (b)) and the NPS Organic Act require an assessment of the potential for each alternative to produce long-term effects and the potential of foreclosing future options available to the NPS with regard to managing each park. An alternative is required to allow for sustainable development, which is defined as an action that meets the needs of the present without compromising the ability of future generations to meet their needs (*World Commission on Environment and Development* in NPS 2001). This section addresses the following three components of the sustainability assessment for the alternatives proposed in this general management plan: unavoidable adverse impacts, irreversible and irretrievable commitments of resources, and relationship of short-term uses and long-term productivity.

Unavoidable Adverse Impacts

The National Park Service defines adverse impacts as those that cannot be fully mitigated or avoided. Some negligible to moderate, adverse effects on natural and cultural resources would be essentially unavoidable (e.g., soil erosion, vegetation trampling, and wildlife disturbances); however, the majority of adverse effects may be mitigated or avoided. There are no major, adverse effects to cultural and natural resources identified that are associated with implementation of the management actions proposed under any of the alternatives (A, B, C, or D). Unavoidable adverse impacts to visitor experience would occur for those visitors that would prefer to maintain opportunities for bow and stern anchoring in the park.

Irreversible and Irretrievable Commitments of Resources

The National Environmental Policy Act and the NPS define irreversible effects as those effects that cannot be changed over the long term or are permanent (NPS 2006a). An effect to a resource is irreversible if the resource cannot be reclaimed, restored, or otherwise returned to its condition before the disturbance. Irretrievable commitments of resources are actions that result in the loss of resources but only for a limited period of time.

Alternative A

Under Alternative A, all current land-based facilities (picnic area, NPS grills, toilets, the pier), marine facilities (boundary and regulatory buoys and other moorings for SCUBA and the underwater trail), and the existing hiking trail on Buck Island would continue to be provided and maintained. However, no new facilities or construction are proposed. With the exception of consumption of fuels and raw materials for maintenance activities, no actions in this alternative would result in consumptions of nonrenewable natural resources or use of renewable resources that would preclude other uses for a period of time.

Alternatives B, C, and D

Maintenance of existing facilities, as described under Alternative A, would also occur under each of the action alternatives B, C and D. In addition, 63 additional new moorings and limited trail construction are proposed for Alternatives B, C, and D. Mooring installation and trail construction and maintenance would require limited resources; and a slightly greater consumption of fuels and raw materials would occur when compared to Alternative A. Additional staff are also proposed under these alternatives to provide a greater presence within the park and to conduct additional research, education, and outreach activities. Increased park operations would likely increase the need for additional fuels and materials, which would be irretrievable once committed. No actions under these alternatives would result in consumption of nonrenewable natural resources or use of renewable resources that would preclude other uses for a period of time.

Relationship of Short-term Uses and Long-term Productivity

The NPS must determine if the effects of alternatives involve trade-offs of the long-term productivity and sustainability of park resources for the immediate short-term use of those resources. The NPS also must also consider if the effects of the alternatives are sustainable over the long-term without causing future adverse environmental effects (NEPA Section 102(c)[IV]).

Alternative A

Buck Island Reef National Monument would continue to be used by visitors, and most areas would be protected in a natural state. NP S would continue to manage the park to provide appropriate recreational opportunities consistent with the preservation of cultural and natural resources in accordance with the Proclamation. As demand for visitor use and recreation in the park increases, the long-term protection and enjoyment of resources could be jeopardized under Alternative A since additional park staff, management zones, and programs are needed to ensure long-term resource protection. Several factors have led to a greatly expanded workload for current park staff including: the 2001 boundary expansion from 880 to 19,015 acres; enforcement of the Proclamation (no extractive use, anchoring in deep sand only, etc); the listing of elkhorn and staghorn coral as a threatened species; recent coral bleaching events requiring increased research and monitoring, impact, and recovery documentation efforts; reintroduction of globally endangered St. Croix ground lizard; threat of the non-native invasive lionfish; climate change; and the associated need for increased enforcement, education, and interpretation. Despite current management strategies to provide continued protection of cultural and natural resources, there would likely continue to be instances where resources are disturbed by visitors. These impacts would be avoidable only if visitor use were

not allowed in the park. Mitigation measures would be taken where possible to avoid and reduce these impacts. Partnering, education, and outreach would continue to occur on a limited basis dependent upon staffing and resource constraints, but current levels of these services are not adequate given the expanded workload for current park staff. No new facilities or trails would be provided under Alternative A. Boating, swimming, SCUBA diving at the SCUBA moorings, snorkeling, hiking, and picnicking would continue to provide visitor enjoyment and contribute to the overall visitor experience.

Alternatives B, C, and D

Under Alternatives B, C, and D, management actions would provide appropriate recreational opportunities consistent with the preservation of natural and cultural resources. Factors contributing to the expanded workload described under Alternative A would continue to exist; however, the addition of staff under the action alternatives would allow for the associated need for increased enforcement, education, and interpretation. An increased level of education, outreach and partnering programs as well as increased coordination with local agencies, organizations, and other cooperative initiatives for resource management would contribute to the long-term protection and preservation of resources. Although the potential for limited new facilities is proposed under Alternatives B, C, and D (limited new trails, signage and moorings), these short-term uses would be implemented using best management practices and required mitigative measures to ensure long-term productivity of park resources. Buck Island Reef National Monument would continue to be used by the public and the majority of the park would be protected in a natural state.

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Chapter 5

SUMMARY OF PUBLIC INVOLVEMENT



South Shore of Buck Island

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CHAPTER 5 CONSULTATION AND COORDINATION

PUBLIC INVOLVEMENT

Scoping is an early and open process for determining the scope of a proposed action or project and for identifying issues related to the project. During scoping for this General Management Plan / Environmental Impact Statement, NPS staff provided an overview of the project, including purpose and need and preliminary issues. The public has been involved and was asked to submit comments, concerns, and suggestions relating to the project and preliminary issues. The notice of intent to prepare an environmental impact statement was published in the *Federal Register* on February 28, 2003.

The public had varied avenues by which it participated during development of the plan: participating in public meetings, responding to newsletters, and submitting comments on the park's website by e-mail or letter. Input from the interested public, organizations, and local, state, and federal agencies was gathered throughout the planning process. At the beginning of the process, both internal NPS and external input was obtained as part of the scoping process. Input gathered during scoping was used to develop the alternatives and assess and compare the effects of management alternatives.

Internal scoping consisted of initial identification of issues by NPS staff based on what they had encountered with respect to managing park resources and experiences with visitors who enjoy the park. NPS meetings were held in Christiansted, St. Croix during the week of February 9, 2004 to obtain the park's initial input into the process.

The external scoping process provided early identification of concerns, issues, expectations, and values of existing and potential visitors, neighbors, cooperating associations, partners, scientists, scholars, and other government agencies. Public scoping meetings were advertised early June 2004. A newsletter describing the General Management Plan / Environmental Impact Statement process was prepared and distributed in June 2004 and also announced the public meeting schedule. A scoping letter was mailed to local, state, and federal agency representatives and the public in May 2004. The scoping letter contained information on the purpose and need for the general management plan, information on the planning process, and methods available to the public for communicating with the NPS planning team and participating in the planning effort, including public meeting locations and times.

The public was invited to voice issues and suggest ideas for the future of the park at three public scoping meetings held on June 23, 24, and 25, 2004 at the Park Headquarters (also headquarters for all 3 Virgin Island's park units). Press releases were issued prior to the public meetings, and comment cards and Internet addresses were provided for public use. Meetings were held with stakeholders during February 2004. These stakeholders included representatives from federal, state, and local agencies, local governments, environmental and other interest groups, local businesses, fishermen, the boating community, and concessioners. Information regarding the general management planning process was provided at the visitor center. Park staff also provided information to visitors regarding how to comment.

The public scoping comment period was open for 30 days, and 10 meetings were held with the interested public and stakeholders to obtain public comment on the process. Over 484 comments were received during scoping. The majority of comments pertained to mooring and anchoring, resource protection, enforcement, and presence of NPS staff. Issues identified are summarized in Chapter 1.

A second newsletter was prepared and distributed in July 2005 that described how the management alternatives were developed based on agency and public input, and announced public meetings that were held in August 2005. The alternatives were presented to the interested public during three meetings held in Christiansted, St. Croix on August 2, 3, and 4, 2005. Press releases were issued prior to the public meetings; radio announcements were made and interviews were held with the Superintendent. Fliers and signs announcing the meetings were posted. Comment forms were provided, and the public was notified how to comment via the Internet.

As a result of public meeting input, the alternatives were modified to provide one alternative with bow and stern anchoring as well as to increase the number of vessels the mooring areas and Anchoring Zones could accommodate. Concerns over the need for large vessel anchoring were also addressed by evaluating the historic demand / use by large vessels. Based upon resource conditions, avoidance of seagrasses, and presence of deep sands, five deep anchoring locations were identified for incorporation into all of the action alternatives. Subsequent to the public meetings, elkhorn and staghorn coral were listed as threatened species under the Endangered Species Act. Several measures were proposed to provide additional resource protection; the Marine Hazard Zone was prescribed and the Recreation Zone was adjusted to avoid sensitive corals. The plan was also updated to provide descriptions of climate change and potential effects to resources; the user capacity analysis was also updated to reflect NPS guidance.

Subsequent to the public meetings conducted in 2005 the park has provided updates regarding the status of the plan via radio interviews and public speaking engagements with local stakeholders and representatives.

The Next Steps

Following the distribution of the Draft General Management Plan / Environmental Impact Statement, there will be a 60-day public review and comment period after which the NPS planning team will evaluate comments from other federal agencies, organizations, businesses, and individuals regarding the draft plan. The team will incorporate appropriate changes into a Final General Management Plan / Environmental Impact Statement. The final plan will include letters from governmental agencies, any substantive comments on the draft document, and NPS responses to those comments. Following distribution of the Final General Management Plan / Environmental Impact Statement and a 30-day no-action period, a Record of Decision approving a final plan will be signed by the NPS southeast regional director. The record of decision documents the NPS selection of an alternative for implementation. Implementation of the plan can proceed upon final approval.

The General Management Plan / Environmental Impact Statement, newsletters and other information are posted on the Internet at: <http://parkplanning.nps.gov/BUIS>.

CONSULTATION WITH OTHER AGENCIES/OFFICIALS AND ORGANIZATIONS

In addition to the consultation described above, additional consultation with agencies was conducted prior to completing the Draft General Management Plan / Environmental Impact Statement. Agency coordination letters are included in Appendix E.

In accordance with 36 CFR 800 and the Programmatic Agreement between the Advisory Council on Historic Preservation, the National Conference of State Historic Preservation Officers, and the NPS, a letter was sent to the State Historic Preservation Officer and to the Advisory Council on Historic Preservation to initiate consultation during June 2004. The letters invited them to participate in the planning process and informed them that the NPS plans to use this environmental impact statement to fulfill the requirements of Section 106 of the National Historic Preservation Act as well as comply with provisions of the National Environmental Policy Act. A meeting was also held in 2004 with the Virgin Island Historic Preservation Officer, and comments discussed were incorporated into this document.

The NPS consulted with the Advisory Council on Historic Preservation, and the National Conference of State Historic Preservation Offices under the terms of the Nationwide Programmatic Agreement for Section 106 compliance. Based on this consultation, the NPS determined what actions are programmatic exclusions, and for all other undertakings what actions would be required for review and comment under 36 Code of Federal Regulations 800.

In accordance with Section 7 of the Endangered Species Act (16 U.S.C. 1531 et seq.), the NPS contacted the U.S. Fish and Wildlife Service and the National Marine Fisheries Service by letter to initiate consultation regarding threatened and endangered species. The Virgin Islands Department of Planning and Natural Resources was also contacted by letter. Consultation letters were also sent to the Environmental Protection Agency, the National Oceanographic and Atmospheric Administration, and other agencies. A list of agencies contacted is provided in this chapter.

PUBLIC AND AGENCY INVOLVEMENT

The Draft General Management Plan/ Environmental Impact Statement for Buck Island Reef National Monument represents thoughts of the NPS, Buck Island Reef National Monument staff, and the public. Consultation and coordination among the agencies and the public were vitally important throughout the planning process. The public had four primary avenues by which it participated during the development of the plan: participation in public meetings, responses to newsletters, comments submitted through the Planning, Environment, and Public Comment system (PEPC)(available on the internet at <http://parkplanning.nps.gov/BUIS>), and comments submitted through the mail.

AGENCIES, ORGANIZATIONS, AND INDIVIDUALS RECEIVING A COPY OF THIS DOCUMENT OR NOTIFICATION OF AVAILABILITY

Federal Agencies

- Advisory Council on Historic Preservation
- Department of Homeland Security
- Federal Aviation Authority
- National Oceanographic and Atmospheric Administration/ National Marine Fisheries Service
- United States Attorneys Office
- United States Coast Guard
- United States Department of Agriculture, Natural Resources Conservation Service
- United States Department of the Interior Office of Insular Affairs
- United States Environmental Protection Agency
- United States Federal Bureau of Investigation
- United States Fish and Wildlife Service
- United States Geological Survey
- Virgin Islands National Park and Virgin Islands Coral Reef National Monument

Leadership and Officers of the Virgin Islands

- Congresswoman Donna M. Christensen, Delegate to Congress
- Governor John P. de Jongh, Jr.
- Lt. Governor Gregory R. Francis
- Attorney General, Department of Justice
- President of the 29th Legislature of the Virgin Islands
- Senators of the 29th Legislature of the Virgin Islands
- St. Croix Administrator

Virgin Islands Government Agencies

- Caribbean Fishery Management Council
- Chief Executive Officer, Economic Development Authority
- Commissioner of Education
- Commissioner, Department of Housing, Parks & Recreation
- Commissioner, Department of Planning and Natural Resources

- Commissioner, Department of Public Works
- Commissioner, Department of Tourism
- Department of Agriculture
- Department of Licensing and Consumer Affairs
- Director, State Historic Preservation Office
- High Intensity Drug Trafficking Agency
- Inspector General, Office of the Virgin Islands
- St. Croix Fisheries Advisory Committee
- Virgin Islands Department of Planning and Natural Resources, Coastal Zone Management
- Virgin Islands Department of Planning and Natural Resources, Coastal Zone Management, East End Marine Park
- Virgin Islands Department of Planning and Natural Resources, Division of Environmental Protection
- Virgin Islands Department of Planning and Natural Resources, Division of Fish and Wildlife
- Virgin Islands Energy Office
- Virgin Islands Fire Services
- Virgin Islands National Guard
- Virgin Islands Police Department
- Virgin Islands Port Authority
- Virgin Islands Territory Emergency Management Agency
- Waste Management Authority
- Water and Power Authority
- Estate Judith's Fancy Homeowners Association
- Farchette & Hanley Real Estate, Christiansted
- Florida Caribbean Cruise Association
- Gertudes
- Girl Scouts of America
- Golden Hook Fisherman's Club Inc.
- Green Cay Marina
- Hovensa (Hess Oil Venezuela South America)
- Island Resource Foundation
- Joint Institutes for Caribbean Marine Studies, Michael Bayer
- National Parks and Conservation Association
- N2 The Blue, Frederiksted
- Rotary Club of St. Croix (East, Mid-Island, and West)
- Salt River Homeowners Association
- SCUBA
- Scuba West
- Seaborne Seaplane Adventures
- Seven Seas Limited
- Sierra Club
- St. Croix Board of Realtors
- St. Croix Chamber of Commerce
- St. Croix Commercial Fisherman's Association
- St. Croix Environmental Association
- St. Croix Fisheries Advisory Committee
- St. Croix Foundation
- St. Croix Landmarks Society
- St. Croix Marina Corp.
- St. Croix Rescue Inc.
- St. Croix Tourism and Hotel Association
- St. Croix Yacht Club
- St. George Botanical Gardens
- Sweet Bottom, at Carambola Resort
- The Nature Conservancy
- The Ocean Conservancy
- Trust for Public Land
- U.S. Virgin Islands Hotel & Tourism Association
- VI Bare Boats

Organizations and Businesses

- Anchor Dive Center
- Boys Scouts of America
- Buccaneer Hotel
- Cane Bay Dive Shop
- CHANT
- Crabs Dive Club
- Cruzan Marine Services LLC.
- Dive Experience
- Divi Hotel

- VI Charter Yacht League
- Virgin Island Sea Trans – St.Croix Fast Ferry
- Virgin Islands Audubon Society
- Virgin Islands Sustainable Farm Institute

Media

- St. Croix Avis
- St. Croix This Week
- VI Source
- Virgin Islands Daily News
- da vybe Radio Station 107.9
- WJKC ISLE 95.1 FM Radio
- WSTX AM/FM Radio

- WVIQ Sunny 99.5 FM
- WSVI TV Channel 8
- WTJX TV Channel 12

Concessioners

- Big Beard Adventure Tours
- Caribbean Sea Adventures Inc.
- Dragon Fly
- Jolly Roger Charters
- Llewellyn's Charters
- Teroro II Inc.

Other Interested Individuals

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References and Glossary of Terms



Photograph Courtesy of Randy Hillis-Starr

Elkhorn Coral

Buck Island Reef National Monument
Draft General Management Plan/
Environmental Impact Statement

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GLOSSARY OF TERMS

The controlling definitions for terms under the President's Council on Environmental Quality National Environmental Policy Act regulations are contained at 40 Code of Federal Regulations; the numbers in parentheses refer to the appropriate section. These definitions are provided as a supplement to those regulatory definitions.

Aesthetic resources — The intangible perceptions possible in parks, such as natural quiet, solitude, and the experience of nighttime skies.

Categorical exclusion (1508.4) — An action with no measurable environmental impact which is described in one of the categorical exclusion lists in section 3-3 or 3-4 and for which no exceptional circumstances (section 3-5) exist.

Connected actions (1508.25) — Actions that are closely related. They automatically trigger other actions that have environmental impacts; they cannot or will not proceed unless other actions have been taken previously or simultaneously, or they are interdependent parts of a larger action and/or depend on the larger action for their justification.

Conservation planning and impact assessment — Within the National Park Service, this process is synonymous with the National Environmental Policy Act process. This process evaluates alternative courses of action and impacts so that decisions are made in accord with the conservation and preservation mandate of the NPS Organic Act.

Cooperating agency (1508.5) — A federal agency other than the one preparing the National Environmental Policy Act document (lead agency), that has jurisdiction over the proposal by virtue of law or special expertise and that has been deemed a cooperating agency by the lead agency. State or local governments and/or Indian tribes, may be designated cooperating agencies as appropriate (see 1508.5 and 1502.6).

Cultural resources (NPS-28, appendix A) — Aspects of a cultural system that are valued by or significantly representative of a culture or that contain significant information about a culture. A cultural resource may be a tangible entity or a cultural practice. Tangible cultural resources are categorized as districts, sites, buildings, structures, and objects for the National Register of Historic Places and as archeological resources, cultural landscapes, structures, museum objects, and ethnographic resources for NPS management purposes.

Cumulative actions (1508.25) — Actions that, when viewed with other actions in the past, the present, or the reasonably foreseeable future, regardless of who has undertaken or will undertake them, have an additive impact on the resource the proposal would affect.

Cumulative impact (1508.7) — The impacts of cumulative actions.

Direct effect (1508.8) — An impact that occurs as a result of the proposal or alternative in the same place and at the same time as the action.

Environmental assessment (EA) (1508.9) — A brief National Environmental Policy Act document that is prepared to, (a) help determine whether the impact of a proposal or alternatives could be significant; (b) aid the National Park Service in compliance with the National Environmental Policy Act by evaluating a proposal that will have no significant impacts, but that may have measurable adverse impacts; or (c) evaluate a proposal that either is not described on the list of categorically excluded actions, or is on the list but exceptional circumstances (section 3-5) apply.

Environmental impact statement (EIS) (1508.11) — A detailed National Environmental Policy Act document that is prepared when a proposal or alternatives have the potential for significant impact on the human environment.

Environmental screening process — The analysis that precedes a determination of the appropriate level of National Environmental Policy Act documentation. The minimum requirements of the environmental screening process are a site visit, consultation with any agency that has jurisdiction by law or special expertise, and the completion of a screening checklist. The process must be complete for all NPS actions that have the potential for environmental impact and are not described in section 3-3.

Environmentally preferred alternative (1505.2, Q6a) — Of the alternatives analyzed, the one that would best promote the policies in the National Environmental Policy Act section 101. This is usually selected by the interdisciplinary team members. It is presented in the NPS National Environmental Policy Act document (draft and final environmental assessment or environmental impact statement) for public review and comment.

Essential Fish Habitat — Under the Magnuson-Stevens Fishery Conservation and Management Act (50 CFR 600.100) essential fish habitat is defined as “those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity.”

Exceptional circumstances — Circumstances that, if they apply to a project described in the NPS categorical exclusion lists (sections 3-3 and 3-4), mean a categorical exclusion is inappropriate and an environmental assessment or an environmental impact statement must be prepared because the action may have measurable or significant impacts. Exceptional circumstances are described in section 3-5.

Finding of no significant impact (FONSI) (1508.13) — A determination based on an environmental assessment and other factors in the public planning record for a proposal that, if implemented, would have no significant impact on the human environment.

General Management Plan (GMP) — Broad decisions about the kinds of resource conditions and visitor experiences the park should provide over the long term.

Human environment (1508.14) — Defined by the Council on Environmental Quality as the natural and physical environment and the relationship of people with that environment (1508.14). Although the socioeconomic environment receives less emphasis than the physical or natural environment in the Council on Environmental Quality regulations, the National Park Service considers it an integral part of the human environment.

Impact topics — The specific natural, cultural, or socioeconomic resources that would be affected by the proposed action or alternatives (including no action). The magnitude, duration, and timing of the effect to each of these resources are evaluated in the impact section of an environmental assessment or environmental impact statement.

Implementation Plan — Any of a great variety of plans, such as resource management plans, comprehensive interpretive plans, collection management plans, concession management plans, visitor experience and resource protection (VERP) plans, comprehensive interpretive plans, backcountry management plans, wilderness management plans, site development plans, river management plans, and historic structure reports, that specify how a project or activity should be implemented.

Indirect impact (1508.8) — Reasonably foreseeable impacts that occur removed in time or space from the proposed action. These are “downstream” impacts, future impacts, or the impacts of reasonably expected connected actions (e.g., growth of an area after a highway is complete).

Input — Something, like money or manpower, needed to produce a product or conduct an activity. The Government Performance and Results Act makes a distinction between outcomes (results), outputs (efforts/products/activities), and inputs (money, manpower, and other things needed to produce an output).

Interpretation — The translation of scientific and academic information about park resources into forms that are meaningful to the public, helping them understand and appreciate their natural and cultural heritage.

Issues — In the National Environmental Policy Act, issues are environmental, social, and economic problems or effects that may occur if the proposed action or alternatives (including no action) are implemented or continue to be implemented.

Law — The U.S. Congress directs the National Park Service and other federal agencies to carry out certain activities or to achieve certain conditions that it specifies in laws. The National Park Service must comply with these laws and may be sued in court for failure to comply.

Lead agency (1508.16) — The agency either preparing or taking primary responsibility for preparing the National Environmental Policy Act document.

Life Cycle Costing (Analysis) — An accounting method that analyzes the total costs of a product or service, including construction, maintenance, manufacturing, marketing, distribution, useful life, salvage, and disposal.

Management Prescription — A decision about what kinds of resource conditions and visitor experiences should occur in a particular location within a park. Prescriptions are established for each distinctive location (management zone) within a park and specify (1) the desired condition of natural and cultural resources, (2) the desired visitor experience, (3) appropriate kinds and levels of management activities, (4) appropriate kinds and levels of visitor activities, and (5) appropriate kinds and levels of development.

Management Zone — An area within a park that will be managed distinctively from other areas, to achieve different resource conditions and visitor experiences.

Major federal action (1508.18) — Actions that have a large federal presence and that have the potential for significant impacts to the human environment. They include adopting policy, implementing rules or regulations; adopting plans, programs, or projects; ongoing activities; issuing permits; or financing projects completed by another entity.

Marine reserve (NOAA 2010)—On April 22, 2009, NOAA and DOI announced formation of the National System of Marine Protected Areas (MPAs). MPAs are managed and administered by the specific department and agency with authority over the site. Inclusion of the site in the National System of MPAs does not interfere with the independent exercise of that authority, nor does it provide additional regulatory authority. However, inclusion in the National System provides official recognition of the site's contribution to marine cultural and natural resource protection goals.

Marine Reserves are a special category of marine protected areas that restrict or completely prohibit extractive activities (most marine protected areas allow multiple uses.) "No-take" Marine Reserves are effective management tools used to protect, maintain or restore ocean and coastal fish populations and habitats degraded by overfishing. Marine Reserves result in long-lasting and often rapid increases in the abundance, diversity and productivity of marine species, including important keystone species that support healthy ecological functioning of marine ecosystems. Scientific evidence is growing that networks of marine reserves within large geographic areas increase the persistence and resilience of marine ecosystems to climate change. "No-take" marine reserves have been established at Dry Tortugas National Park, Virgin Islands Coral Reef National Monument, Buck Island Reef National Monument, and Channel Islands National Park. Only about one percent of U.S. territorial waters and less than one-tenth of one percent of the world's oceans are protected in Marine Reserves. Executive Order 13158 also directs DOI and NOAA to support a biological assessment of the minimum area where consumptive uses would be prohibited that is necessary to preserve representative habitats in different geographic areas of the marine environment.

Memo to file — A memo to the planning record or statutory compliance file that NPS offices may complete when (a) National Environmental Policy Act has already been completed in site-specific detail for a proposal, usually as part of a document of larger scope, or (b) a time interval has passed since the National Environmental Policy Act document was approved, but information in that document is still accurate.

Mitigated Environmental Assessment (Q40) — An environmental assessment that has been rewritten to incorporate mitigation into a proposal or to change a proposal to reduce impacts to below significance.

Mitigation (1508.20) — A modification of the proposal or alternative that lessens the intensity of its impact on a particular resource.

Natural resources — The ecological features of a park, such as geologic forms and processes, communities of native plants and animals and the processes that sustain them (natural succession, natural fire, natural flood/drought cycles, etc.), air quality and air quality related values such as visibility, water bodies and hydrologic processes, and paleontological remains.

National Environmental Policy Act process — The objective analysis of a proposal to determine the degree of its environmental and interrelated social and economic impacts on the human environment, alternatives and mitigation that reduce that impact, and the full and candid presentation of the analysis to, and involvement of, the interested and affected public.

Notices of availability — Separate notices submitted to the Federal Register that the draft environmental impact statement and the final environmental impact statement are ready for distribution.

Notice of intent (1508.22) — The notice submitted to the Federal Register that an environmental impact statement will be prepared. It describes the proposed action and alternatives, identifies a contact person in the National Park Service, and gives time, place, and descriptive details of the agency's proposed scoping process.

Outcome — A result, usually expressed in terms of resource conditions or visitor experiences. The Government Performance and Results Act makes a distinction between outcomes (results), outputs (efforts/products/activities), and inputs (money, manpower, and other things needed to produce an output).

Output — An effort, product, or activity. The Government Performance and Results Act makes a distinction between outcomes (results), outputs (efforts/products/activities), and inputs (money, manpower, and other things needed to produce an output).

Park — For the purposes of this document, the terms national park or park refer to any unit of the national park system. Although national park system designations formally categorize units as national parks, national preserves, national monuments, national historic sites, national historical parks, national memorials, national recreation areas, national lakeshores, national seashores, national rivers, national battlefields, or national cemeteries, all units of the national park system are managed under a single set of laws and policies with the only distinctions being special mandates included in the specific legislation applying to each particular unit.

Park purpose — The reasons why a park is so important that it has been set aside as a unit of the national park system.

Park significance — The relative international, national, or regional importance of the resources that contributed to the park's addition to the national park system

Plan — The documentation of a decision or decisions and all the factors that were considered during the decision making. The National Park Service produces four kinds of plans: general management

plans, strategic plans, implementation plans, and annual performance plans. Each of these is described separately in the glossary.

Planning — Structured decision making.

Policy — The National Park Service establishes specific criteria and procedures for how it will conduct its activities and carry out its mission. These policies apply to all NPS activities in all units of the National Park System. Park managers must comply with NPS policies, and the National Park Service may be sued in court for failure to comply with its own policies.

Preferred alternative (1502.14 (e)) — The alternative an NPS decision-maker has identified as preferred at the draft environmental impact statement stage or environmental assessment. Identification of the preferred alternative helps the public focus its comments during review of the National Environmental Policy Act document.

Programmatic documents — Broader scope environmental assessments or environmental impact statements that describe the impacts of proposed policy changes, programs, or plans.

Proposal (1508.23) — The stage at which the National Park Service has a goal and is actively preparing to make a decision on one or more alternative means of accomplishing that goal. The goal can be a project, plan, policy, program, and so forth. The National Environmental Policy Act process begins when the effects can be meaningfully evaluated.

Regulation — Federal agencies establish specific criteria and procedures for how they will comply with laws. These regulations must be reviewed and approved through a formal process, then they are compiled in the Code of Federal Regulations (CFR). The National Park Service must comply with all applicable federal regulations, including those promulgated by other agencies having legal jurisdiction over certain aspects of all federal activities, and it may be sued in court for failure to comply.

Record of decision (1505.2) — The document that is prepared to substantiate a decision based on an environmental impact statement. It includes a statement of the decision made, a detailed discussion of decision rationale, and the reasons for not adopting all mitigation measures analyzed, if applicable.

Resource — Something of value (an asset). Park managers often speak in terms of the aesthetic, cultural, and natural resources of parks, meaning the parks' major features. [See also aesthetic resource, cultural resource, and natural resource.] The term is also used less frequently to describe the funding and manpower available to managers.

Scoping (1508.25) — Internal NPS decision-making on issues, alternatives, mitigation measures, the analysis boundary, appropriate level of documentation, lead and cooperating agency roles, available references and guidance, defining purpose and need, and so forth. External scoping is the early involvement of the interested and affected public.

Self Contained Underwater Breathing Apparatus (SCUBA) – A portable apparatus containing compressed air that is used to breathe underwater.

Strategic Plan — A plan describing what a park staff hopes to achieve within the next six years. These plans, required by the Government Performance and Results Act, should include measurable results-oriented goals that the park staff can use to prioritize work and measure progress.

Tiering (1508.28) — The use of broader, programmatic National Environmental Policy Act documents to discuss and analyze cumulative regional impacts and define policy direction, and the incorporation by reference of this material in subsequent, narrower documents to avoid duplication and focus on issues “ripe for decision” in each case.

Vessel — Under 36 Code of Federal Regulations 1.4, vessels are defined as every type or description of craft, other than a seaplane on the water, used or capable of being used as a means of transportation on water, including a buoyant device permitting or capable of free flotation.

Appendices



Photo Courtesy of NPS Resource Management

Buck Island North Reef Overlook

Buck Island Reef National Monument
Draft General Management Plan/
Environmental Impact Statement

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**APPENDIX A
PARK LEGISLATION**

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The Presidents Proclamation No. 3443

ESTABLISHING THE BUCK ISLAND REEF NATIONAL MONUMENT IN THE VIRGIN ISLANDS OF THE UNITED STATES

By the President of the United States of America, John F. Kennedy

Title 3- The President- Proclamation 4346

RESERVING CERTAIN LANDS ADJACENT TO AND ENLARGING THE BOUNDARIES OF THE BUCK ISLAND REEF NATIONAL MONUMENT IN THE VIRGIN ISLANDS OF THE UNITED STATES

By the President of the United States of America, Gerald R. Ford

Presidents Proclamation

BOUNDARY ENLARGEMENT AND MODIFICATIONS OF THE BUCK ISLAND REEF NATIONAL MONUMENT

By the President of the United States of America, William J. Clinton

36 CFR Part 7

INTERIM RULE FOR VIRGIN ISLANDS CORAL REEF NATIONAL MONUMENT AND BUCK ISLAND REEF NATIONAL MONUMENT

National Park Service, 2003

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THE PRESIDENT'S PROCLAMATION NO. 3443
ESTABLISHING THE BUCK ISLAND REEF NATIONAL
MONUMENT IN THE VIRGIN ISLANDS OF THE UNITED STATES
BY THE PRESIDENT OF THE UNITED STATES OF AMERICA

A P R O C L A M A T I O N

WHEREAS, By Section 2 of an Act of Congress approved June 8, 1906, (34 Stat. 225; 16 U.S.C. 431), the President is authorized "in his discretion, to declare by public proclamation historic landmarks, historic and prehistoric structures, and other objects of historic or scientific interest that are situated upon the lands owned or controlled by the Government of the United States to be national monuments, and may reserve as a part thereof parcels of land, the limits of which in all cases shall be confined to the smallest area compatible with the proper care and management of the objects to be protected", and

WHEREAS, Buck Island, situated off the northeast coast of St. Croix Island in the Virgin Islands of the United States, was included in the public, government, or crown lands ceded to the United States by Denmark under the convention entered into August 4, 1916 and proclaimed by the President January 25, 1917 (39 Stat. 1706); and

WHEREAS, all property thus acquired by the United States from Denmark, not reserved by the United States for public purposes prior to June 22, 1937, was placed under the control of the Government of the Virgin Islands by the Act of June 22, 1936, (49 Stat. 1807; 48 U.S.C. 1405-1405b), with the legal title remaining in the United States; and

WHEREAS, Buck Island was not reserved by the United States for public purposes prior to June 22, 1937, but has been owned by the United States continuously since the convention with Denmark in 1916; and

WHEREAS, Buck Island and its adjoining shoals, rocks and undersea coral reef formations possess one of the finest marine gardens in the Caribbean Sea; and

WHEREAS, these lands and their related features are of great scientific interest and educational value to students of the sea and to the public; and

WHEREAS, this unique natural area and the rare marine life which are dependent upon it are subject to constant threat of commercial exploitation and destruction; and

WHEREAS, the Advisory Board on National Parks, Historic Sites, Buildings and Monuments, established pursuant to the Act of August 21, 1935 (49 Stat. 666; 16 U.S.C. 463), impressed by the caliber and scientific importance of the coral reefs of Buck Island, has urged their prompt protection to prevent further despoliation; and

WHEREAS, it is in the public interest to preserve this area of outstanding scientific, aesthetic and educational importance for the benefit and enjoyment of the people;

NOW, THEREFORE, I JOHN F. KENNEDY, PRESIDENT, of the United States of America, under and by virtue of the authority vested in me by Section 2 of the Act of June 8, 1906 (34 Stat. 225; 16 U.S.C. 431), do proclaim that, subject to valid existing rights, there is hereby reserved and set apart, as the Buck Island Reef National Monument, the area embraced within lines drawn between the coordination of latitude and longitude recited as follows:

Beginning at latitude 17°47'58" N., longitude 64°38'16" W.; thence approximately 10,450 feet to latitude 17°47'30" N., longitude 64°36'32" W., thence approximately 1,500 feet to latitude 17°47'15" N., longitude 64°36'32" W., thence approximately 4,500 feet to latitude 17°47'00" N., longitude 64°37'18" W.; thence approximately 8,600 feet to latitude 17°47'35" N. longitude 64°38'37" W.; and thence approximately 3,075 feet to latitude 17°47'58" N., longitude 64°38'16" W., the place of beginning, embracing an area of approximately 850 acres.

Warning is expressly given to all unauthorized persons not to appropriate, injure, destroy, deface, or remove any feature of this monument and not to locate or settle upon any of the lands reserved for the monument by this proclamation.

The Director of the National Park Service, under the direction of the Secretary of the Interior, shall have the supervision, management and control of this monument as provided in the Act of Congress entitled, "An Act to establish a National Park Service, and for other purposes," approved August 25, 1916 (39) Stat. 535; 16 U.S.C. 1-3), and all acts supplementary thereto and amendatory thereof.

IN WITNESS WHEREOF, I have hereunto set my hand and caused the official seal of the United States of America to be affixed.

DONE at the City of Washington this twenty-eighth day
of December in the year
of our Lord nineteen
hundred and sixty-one
and of the
Independence
of the United
States of America
the one hundred and eighty-fifth.

by the President
Secretary of State

Proclamation 4346 - Buck Island Reef National Monument, U.S. Virgin Islands

February 1, 1975

By the President of the United States of America
A Proclamation

RESERVING CERTAIN LANDS ADJACENT TO AND ENLARGING THE BOUNDARIES OF THE BUCK ISLAND REEF NATIONAL MONUMENT IN THE VIRGIN ISLANDS OF THE UNITED STATES

The Buck Island Reef National Monument, situated off the northeast coast of Saint Croix Island in the Virgin Islands of the United States, was established by Proclamation No. 3443 of December 28, 1961 (76 Stat. 1441). It now has been determined that approximately thirty acres of submerged land should be added to the monument site in order to insure the proper care and management of the shoals, rocks, undersea coral reef formations and other objects of scientific and historical interest pertaining to this National Monument.

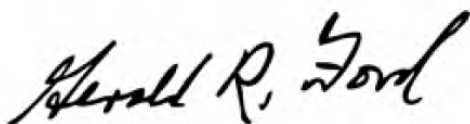
These thirty acres of submerged lands are presently owned in fee by the United States. They will be conveyed to the Government of the Virgin Islands on February 3, 1975, pursuant to Section 1(a) of Public Law 93-435 (88 Stat. 1210), unless the President, under Section 1(b) (vii) of that Act, designates otherwise.

Under Section 2 of the Act of June 8, 1906, 34 Stat. 225 (16 U.S.C. 431), the President is authorized to declare by public Proclamation objects of historic or scientific interest that are situated upon the lands owned or controlled by the Government of the United States to be national monuments, and may reserve as a part thereof parcels of land, the limits of which in all cases shall be confined to the smallest area compatible with the proper care and management of the objects to be protected. The aforementioned thirty acres of submerged lands are contiguous to the site of the Buck Island Reef National Monument, constitute a part of the ecological community of the Buck Island Reef, and will not enlarge the monument boundaries beyond the smallest area compatible with its proper care and management.

Now, Therefore, I, Gerald R. Ford, President of the United States of America, by virtue of the authority vested in me by Section 1(b) (vii) of Public Law 93-435 (88 Stat. 1210), do hereby proclaim that the lands hereinafter described are excepted from the transfer to the Government of the Virgin Islands under Section 1(a) of Public Law 93-435; and, by virtue of the authority vested in me by Section 2 of the Act of June 8, 1906, 34 Stat. 225 (16 U.S.C. 431), do hereby proclaim that, subject to valid existing rights, the lands hereinafter described are hereby added to and made a part of the Buck Island Reef National Monument, and Proclamation No. 3443 of December 28, 1961, establishing the Buck Island Reef National Monument is amended accordingly.

Beginning at latitude 17°47'30" N, longitude 64°36'32" W; thence approximately 1000 feet to latitude 17°47'27" N, longitude 64°36'22" W; thence approximately 900 feet to latitude 17°47'18" N, longitude 64°36'22" W; thence approximately 1000 feet to latitude 17°47'15" N, longitude 64°36'22" W; thence approximately 1500 feet to latitude 17°47'30" N, longitude 64°36'32" W, the place of beginning, embracing an area of approximately 30 acres.

In Witness Whereof, I have hereunto set my hand this first day of February, in the year of our Lord nineteen hundred seventy-five, and of the Independence of the United States of America the one hundred and ninety-ninth.



GERALD R. FORD

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**PROCLAMATION: Boundary Enlargement and Modifications of the Buck Island Reef
National Monument**

THE WHITE HOUSE

Office of the Press Secretary

For Immediate Release

January 17, 2001

BOUNDARY ENLARGEMENT AND MODIFICATIONS OF THE
BUCK ISLAND REEF NATIONAL MONUMENT

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BY THE PRESIDENT OF THE UNITED STATES OF AMERICA

A PROCLAMATION

Buck Island Reef National Monument was established on December 28, 1961 (Presidential Proclamation 3443), just north of St. Croix in the U.S. Virgin Islands, for the purpose of protecting Buck Island and its adjoining shoals, rocks, and undersea coral reef formations. Considered one of the finest marine gardens in the Caribbean Sea, the unique natural area and the rare marine life which are dependent upon it are subject to the constant threat of commercial exploitation and destruction. The monument's vulnerable floral and faunal communities live in a fragile, interdependent relationship and include habitats essential for sustaining the tropical marine ecosystem: coral reefs, sea grass beds, octocoral hardbottom, sand communities, algal plains, shelf edge, and oceanic habitats. The boundary enlargement effected by this proclamation brings into the monument additional objects of scientific and historic interest, and provides necessary further protection for the resources of the existing monument.

The expansion area includes additional coral reefs (patch, pur and groove, and deep and wall), unusual "haystacks" of elkhorn coral, barrier reefs, sea grass beds, and sand communities, as well as algal plains, shelf edge, and other supporting habitats not included within the initial boundary. Oceanic currents carry planktonic larvae of coral reef-associated animals to the shallow nearshore coral reef and sea grass habitats, where they transform into their juvenile stage. As they mature over months or years, they move offshore and take up residence in the deeper coral reefs, octocoral hardbottom, and algal plains. Between the monument's nearshore habitats and its shelf edge spawning sites are habitats that play essential roles during specific developmental stages of many reef-associated species, including spawning migrations of many reef fish species and crustaceans. Several threatened and endangered species forage, breed, nest, rest, or calve in the waters included in the enlarged monument, including humpback whales, pilot whales, four species of dolphins, brown pelicans, least terns, and the hawksbill, leatherback, and green sea turtles. Countless species of reef fishes, invertebrates, plants, and over 12 species of sea birds utilize this area.

The ecologically important shelf edge is the spawning site for many reef species, such as most groupers and snappers, and the spiny lobster. Plummeting to abyssal depths, this habitat of vertical walls, honeycombed with holes and caves, is home to deepwater species and a refuge for other

species.

The expansion area also contains significant cultural and historical objects. In March 1797, the slave ship Mary, captained by James Hunter of Liverpool, sank in this area, and its cargo of 240 slaves was saved and brought to Christiansted. In March 1803, the General Abercrombie, captained by James Booth of Liverpool, also wrecked in this area, and its cargo of 339 slaves was brought to Christiansted. Slave shipwrecks in U.S. waters are rare. The monument contains remnants of these wrecks. Other wrecks may also exist in the monument.

Section 2 of the Act of June 8, 1906 (34 Stat. 225, 16 U.S.C. 431), authorizes the President, in his discretion, to declare by public proclamation historic landmarks, historic and prehistoric structures, and other objects of historic or scientific interest that are situated upon the lands owned or controlled by the Government of the United States to be national monuments, and to reserve as a part thereof parcels of land, the limits of which in all cases shall be confined to the smallest area compatible with the proper care and management of the objects to be protected.

WHEREAS it appears that it would be in the public interest to reserve such lands as an addition to the Buck Island Reef National Monument:

NOW, THEREFORE, I, WILLIAM J. CLINTON, President of the United States of America, by the authority vested in me by section 2 of the Act of June 8, 1906 (34 Stat. 225, 16 U.S.C. 431), do proclaim that there are hereby set apart and reserved as an addition to the Buck Island Reef National Monument, for the purpose of care, management, and protection of the objects of historic and scientific interest situated on lands within the said monument, all lands and interests in lands owned or controlled by the United States within the boundaries of the area described on the map entitled "Buck Island Reef National Monument Boundary Enlargement" attached to and forming a part of this proclamation. The Federal land and interests in land reserved consist of approximately 18,135 marine acres, which is the smallest area compatible with the proper care and management of the objects to be protected.

All Federal lands and interests in lands within the boundaries of this monument are hereby appropriated and withdrawn from all forms of entry, location, selection, sale, or leasing or other disposition under the public land laws, including but not limited to withdrawal from location, entry, and patent under the mining laws, and from disposition under all laws relating to mineral and geothermal leasing, other than by exchange that furthers the protective purposes of the monument.

For the purpose of protecting the objects identified above, the Secretary shall prohibit all boat anchoring, provided that the Secretary may permit exceptions for emergency or authorized administrative purposes, and may issue permits for anchoring in deep sand bottom areas, to the extent that it is consistent with the protection of the objects.

For the purposes of protecting the objects identified above, the Secretary shall prohibit all extractive uses. This prohibition supersedes the limited authorization for extractive uses included in Proclamation 3443 of December 28, 1961.

Lands and interests in lands within the monument not owned or controlled by the United States shall be reserved as a part of the monument

upon acquisition of title or control thereto by the United States.

The Secretary of the Interior shall manage the monument through the National Park Service, pursuant to applicable legal authorities, to implement the purposes of this proclamation. The National Park Service will manage the monument in a manner consistent with international law.

The Secretary of the Interior shall prepare a management plan, including the management of vessels in the monument, within 2 years that will address any further specific actions necessary to protect the objects identified above.

The enlargement of this monument is subject to valid existing rights.

Nothing in this proclamation shall be deemed to revoke any existing withdrawal, reservation, or appropriation; however, the national monument shall be the dominant reservation.

Warning is hereby given to all unauthorized persons not to appropriate, injure, destroy, or remove any feature of this monument and not to locate or settle upon any of the lands thereof.

IN WITNESS WHEREOF, I have hereunto set my hand this seventeenth day of January, in the year of our Lord two thousand one, and of the Independence of the United States of America the two hundred and twenty-fifth.

WILLIAM J. CLINTON

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[Federal Register: April 4, 2003 (Volume 68, Number 65)]
[Rules and Regulations]
[Page 16432-16436]
From the Federal Register Online via GPO Access [wais.access.gpo.gov]
[DOCID:fr04ap03-10]

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DEPARTMENT OF THE INTERIOR
National Park Service

36 CFR Part 7

RIN 1024-AC89

Virgin Islands Coral Reef National Monument and Buck Island Reef
National Monument

AGENCY: National Park Service, Interior.

ACTION: Interim rule with request for comments.

SUMMARY: This interim rule relates to the prohibition on extractive uses contained in Presidential Proclamation No. 7399, which established the Virgin Islands Coral Reef National Monument (VICR), and Presidential Proclamation No. 7392, which expanded the boundaries of the existing Buck Island Reef National Monument (BUIS). This interim rule prohibits extractive uses, with some exceptions, and anchoring within VICR. For the purposes of protecting the objects identified in BUIS, Proclamation No. 7392 supersedes the limited authorization for extractive uses that was included in Proclamation 3443 of December 28, 1961, which created BUIS. Pursuant to Proclamation No. 7392, this interim rule prohibits all extractive uses and boat anchoring within BUIS except in deep sand areas or in emergencies (all other anchoring is subject to permit). This interim rule replaces the BUIS regulations stated in 36 CFR 7.73, which allowed for certain types of fishing and collecting, operation of watercraft, and anchoring. Proclamation Nos. 7399 and 7392 require the National Park Service to prepare management plans, which are to include guidelines for the management of vessels in the monument, within three years for VICR and two years for BUIS.

DATES: This interim rule becomes effective on May 5, 2003. This interim rule will remain in effect until final regulations are adopted. Written comments on this interim rule are solicited from all interested parties, and these comments will be considered in developing the General Management Plans (GMP) and final regulations. Final regulations will be adopted upon completion of the GMPs and review of all comments.

ADDRESSES: Comments should be addressed to: John H. King, Superintendent, Virgin Islands National Park, 1300 Cruz Bay Creek, St. John, Virgin Islands 00830. E-mail: John_H_King@nps.gov. Mr. Joel A. Tutein, Superintendent, Buck Island Reef National Monument, 2100 Church Street, Lot 100, Christiansted, St. Croix, Virgin Islands 00820-4611. E-mail: CHRI_Superintendent@nps.gov.

FOR FURTHER INFORMATION CONTACT: For Virgin Islands Coral Reef: Contact

Superintendent's Office, Virgin Islands National Park, between 8 a.m. and 5 p.m., Monday-Friday by phone at 340/776-6201 or by Fax at 340/693-9301. For Buck Island: Contact Superintendent's Office, Buck Island Reef National Monument, between 8 a.m. and 5 p.m., Monday-Friday, at 340/773-1460.

SUPPLEMENTARY INFORMATION:

Background

On January 17, 2001, President Clinton established Virgin Islands Coral Reef National Monument (VICR) and enlarged and modified Buck Island Reef National Monument (BUIS). Presidential Proclamation Nos. 7399 and 7392, respectively.

In establishing VICR, Proclamation No. 7399 assigns management to the Secretary of the Interior through the National Park Service (NPS) under its existing authorities, but subject to the overriding purpose of protecting the monument's objects of historic or scientific interest. The acreage included is the smallest area compatible with the proper care and management of the objects to be protected. Proclamation No. 7399 contains six major provisions:

(1) It reserves only lands owned or controlled by the United States in the area.

(2) It is subject to valid existing rights in the federal lands or resources within the area, if any, although the exercise of those rights could be regulated in order to protect the purposes of the monument.

(3) The area is withdrawn from mineral and geothermal entry, location, sale, leasing or other disposition.

(4) Boat anchoring is prohibited, except for emergency and authorized administrative uses.

(5) All extractive uses are prohibited, except for bait fishing at Hurricane Hole and for blue runner (hardnose) line fishing in the area south of St. John, both by permit only. The Secretary may issue permits only ``to the extent that such fishing is consistent with the protection of the objects identified in this proclamation.''

(6) A management plan, including vessel management planning, is to be prepared within three years.

Proclamation No. 7392, the ``Buck Island Reef National Monument Boundary Enlargement'', added approximately 18,135 marine acres to the existing Buck Island Reef National Monument. This acreage is the smallest area compatible with the proper care and management of the objects to be protected. The Proclamation added extensive coral reef and fisheries resources not originally within the monument boundaries including deep reefs, sea grass beds, shelf edge communities, and oceanic habitats. The area also contains significant cultural and historic objects including possible shipwrecks from the slave era. The Buck Island Proclamation states that:

For the purposes of protecting the objects identified above, the Secretary shall prohibit all boat anchoring, provided that the Secretary may permit exceptions for emergency or authorized administrative purposes, and may issue permits for anchoring in deep sand bottom areas, to the extent that it is consistent with the protection of the objects.

For the purposes of protecting the objects identified above, the Secretary shall prohibit all extractive uses. This prohibition supersedes the limited authorization for extractive uses included in

Proclamation 3443 of December 28, 1961.

The Proclamations give the Secretary limited discretion in what activities and uses she may allow. She must prohibit all extractive uses, but she may allow very limited fishing in two areas at VICR and may permit certain very limited kinds of boat anchoring at BUIS.

The Proclamations differ from current regulations governing the areas. Note that NPS general regulations prohibit all commercial fishing in any unit of the National Park System except where specifically authorized by federal statutory law. However, NPS regulations at 36 CFR 2.3 allow recreational fishing under state law in all park units unless otherwise prohibited. The Proclamations and this **interim regulation** are generally more restrictive for both VICR and BUIS.

Commercial and recreational fishing were previously authorized by Territorial Government permit within the boundaries of the area that now constitutes VICR, with regulations on the taking of some species (i.e., area and seasonal closures, size limits, gear restrictions, etc.) and prohibitions on the harvest or possession of others. Title 12, chapter 9A VIRR. The harvest of

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certain pelagic species (e.g., swordfish, shark and tuna), was generally regulated by the National Marine Fisheries Service. Mooring and anchoring within the boundaries of VICR were previously authorized by the Territory pursuant to title 25, chapter 16 VIRR.

This **interim** rule prohibits all extractive uses including fishing within VICR, except for bait fishing at Hurricane Hole and blue runner (hardnose) line fishing in the area south of St. John as permitted by the Secretary (and only where consistent with the protection of the objects identified in Proclamation No. 7399). The **interim** rule also prohibits dredging, excavations, or filling operations; protects all wrecks or abandoned waterborne craft and cargo; regulates boats and anchoring to prevent them from causing any damage to any underwater features; and requires boats to follow Coast Guard and Territorial regulations. Although this **regulation** does not specifically prohibit the use of personal watercraft (PWC) within these units, under the PWC regulations located at 36 CFR 3.24, PWC are prohibited from operating within these units and have been prohibited since April 2000. The **interim** rule does permit anchoring in emergency situations to protect life and property.

BUIS originally permitted the continuation of ``the existing fishing (including the landing of boats and the laying of fishpots outside of the marine garden), bathing or recreational privileges by inhabitants of the Virgin Islands''. Proclamation No. 3443. The regulations for BUIS, codified at 36 CFR 7.73, have prohibited dredging, excavations, or filling operations; protected all wrecks or abandoned waterborne craft and cargo; regulated boats and anchoring to prevent them from causing any damage to any underwater features, prevented boats from anchoring or maneuvering near marked swimming trails, and required boats to follow Coast Guard and Territorial regulations. The previous regulations provided that fishing was prohibited except by handheld rod or line or conventional Virgin Islands fish pots or traps, or nets for bait fish; use or possession of spearfishing equipment was banned; special rules and limits applied to Florida spiny lobster, whelk, and conch; and all fishing was prohibited in the ``Marine Garden''.

This **interim** rule leaves in place the existing regulatory provisions regarding dredging, protection of wrecks, and boat **regulation**. It adds a prohibition of all anchoring except as authorized by the Superintendent in deep sand bottom areas, in emergencies, or for limited administrative purposes. It also adds a prohibition on all extractive uses. The **interim** rule eliminates the previous provisions on fishing, and instead prohibits all fishing and bans the use or possession of fishing equipment within BUIS.

Because the Secretary's discretion under the Proclamations is limited, and because the Proclamations supersede existing law over the areas, it is in the public interest to promulgate these **interim** regulations in order to provide notice to interested and affected parties of the designations, prohibitions, and change in management, and to carry out the Proclamations' purpose to protect objects of historic and scientific interest. The **National Park Service** finds that this **interim** rule is both necessary and prudent in order to achieve the goals stated in the Proclamations and make them effective.

Impairment Finding

NPS Management Policies 1.4 requires the Superintendent to consider the impacts of a proposed action before approving it and determine, in writing, that the activity will not lead to an impairment of park resources and values.

Fishing Exceptions

Exceptions to the prohibitions established for VICR include bait fishing at Hurricane Hole by permit and for blue runner (hardnose) line fishing, also by permit, in the area south of St. John. These exceptions are determined to produce no impairment of the objects protected by the proclamation.

The bait fish found in Hurricane Hole are seasonal, migratory species using this area for refuge. This is not a reproductive site for these species and limited harvest, by permit, will not depopulate this resource. This rule establishes limits on harvest to three gallons of bait fish per fisherman per day, and require that nets not be used within ten feet of the seaward edge of the mangrove prop root system (to avoid disturbing the invertebrate communities that live on the prop roots).

The hardnose found south of St. John are a coastal migratory pelagic fish. These fish stay primarily near the surface while feeding and migrating through the **Monument**. Harvest, by permit, of this pelagic resource will not impair objects protected under the designation. The most effective way to fish for hardnose involves anchoring. Since anchoring in this area is not allowed, the NPS will be installing several moorings for use by fishermen.

Anchoring/Moorings

Hurricane Hole has long been used by the marine community as a safe shelter for vessels during hurricanes. Pursuant to maritime law and practice, access to this shelter cannot be denied during an emergency situation. The establishment of a hurricane mooring system in these bays would resolve conflicts between resource protection and hurricane shelter for boats. The installation of a mooring system, after survey for submerged cultural resources, would not impair protected objects.

The Proclamation for BUIS does not have any exceptions to the

prohibition except that boat anchoring may be permitted for emergency or authorized administrative purposes, and the Superintendent ``may issue permits for anchoring in deep sand bottom areas, to the extent that is consistent with the protection of the objects''. This ensures that any such anchoring would not impair protected objects.

This impairment determination will sunset upon adoption of the respective GMPs, which will further evaluate impacts to monument resources and values.

The GMP process will evaluate further the exceptions to the general prohibition on extractive uses. The public will have further opportunity to comment on extractive uses during the GMP process, however, the Secretary's discretion under the Proclamations is limited and only a few exceptions can be modified.

Public Participation: If you wish to comment, you may submit your comments by any one of several methods. You may mail comments to: Superintendent, Virgin Islands National Park; 1300 Cruz Bay Creek, St. John, Virgin Islands 00830, or Superintendent, Buck Island Reef National Monument; 2100 Church Street, Lot 100; Christiansted, VI 00820. You may also comment via the Internet to: John--H--King@nps.gov or CHRI_Superintendent@nps.gov. Please also include

``Attn: RIN 1024-AC89'', your name and return address in your Internet message. Finally, you may hand-deliver comments to the Virgin Islands National Park Visitor Information Center, Cruz Bay, St. John or to the Buck Island Reef National Monument Superintendent's Office at the Danish Customs House, Christiansted, St. Croix. Our practice is to make comments, including names and home addresses of respondents, available for public review during regular business hours. Individual respondents may request that we withhold their home address from the

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rulemaking record, which we will honor to the extent allowable by law. There also may be circumstances in which we would withhold from the rulemaking record a respondent's identity, as allowable by law. If you wish us to withhold your name and/or address, you must state this prominently at the beginning of your comment and state the reason for your request. However, we will not consider anonymous comments. We will make all submissions from organizations or businesses, and from individuals identifying themselves as representatives or officials of organizations or businesses, available for public inspection in their entirety. All comments will be considered as part of the GMP process. There will be further opportunity for public comment during the GMP process. Final regulations will be adopted after the completion of the GMP process.

Drafting Information: The principal authors of this interim rule are John H. King, Superintendent, Virgin Islands National Park and Joel A. Tutein, Superintendent, Buck Island Reef National Monument.

Compliance With Other Laws

Regulatory Planning and Review (Executive Order 12866)

This document is a significant rule and has been reviewed by the Office of Management and Budget under Executive Order 12866.

(a) This rule will not have an effect of \$100 million or more on the economy. It will not adversely affect in a material way the economy, productivity, competition, jobs, the environment, public

health or safety, or State, local, or tribal governments or communities.

(b) This rule does not interfere with actions taken or planned by another agency. The Territorial Submerged Lands Act of 1974 transferred the waters surrounding the Virgin Islands from the Department of the Interior to the Government of the Virgin Islands; however, all submerged lands adjacent to federal lands from mean high water out to three miles remained the property of the Department of the Interior. The Proclamations authorize NPS to manage these lands around VICR and BUIS for the American people.

The Proclamation for BUIS complements plans of the Territorial government to ban all fishing within the **monument** waters according to the St. Croix Coral Reef System Area of Particular Concern Management Plan (1993) (APC Plan) approved by the Government of the Virgin Islands, Department of Planning and Natural Resources. The APC Plan states, on page 40:

Move to establish, as part of the territorial marine park system, an expanded protected area around the **Buck Island Reef National Monument** to provide increased protection to the coral reef and fishery resources of the **Monument**. It is recommended that all forms of fishing be prohibited within the core and expanded area.

The Territory is willing to work with NPS to establish Memoranda of Agreement to specify resource management goals, objectives, standard protocol, and agency responsibilities. The Proclamations have declared the **monument** areas as non-extractive, coinciding with Territorial plans for the same action. The Territory is also in the process of developing a Virgin Islands Marine Park, which will abut both new monuments and hopefully provide further protection for the natural resources in the area.

(c) This rule does not alter the budgetary effects of entitlements, grants, user fees, or monetary loan programs or the rights or obligations of their recipients. The Proclamations establishing VICR and enlarging BUIS do not affect current NPS-authorized concession operations (concession fees) or other commercial operations (e.g., day use excursions) occurring in the monuments. These operations are non-extractive in nature, provide the public the means to experience these unique and delicate marine resources, and allow the public a first-hand opportunity to see the benefits of a fully protected coral reef area.

(d) This rule does not raise novel legal or policy issues. It implements two validly issued Presidential Proclamations, which leave little discretion as to the purposes for the creation of the monuments or uses of the area.

Regulatory Flexibility Act

The Department of the Interior certifies that this **interim** rule will not have a significant economic impact on a substantial number of small entities under the Regulatory Flexibility Act (5 U.S.C. 601, et seq.). The economic effects of this rule are local in nature and negligible in scope.

Small Business Regulatory Enforcement Fairness Act (SBREFA)

This rule is not a major rule under 5 U.S.C. 804(2), the Small Business Regulatory Enforcement Fairness Act. This rule:

- a. Does not have an annual effect on the economy of \$100 million or

more.

b. Will not cause a major increase in costs or prices for consumers, individual industries, Federal, State, or local government agencies, or geographic regions.

c. Does not have a significant adverse effect on competition, employment, investment, productivity, innovation, or the ability of U.S.-based enterprises to compete with foreign-based enterprises.

Unfunded Mandates Reform Act

This rule does not impose an unfunded mandate on State, local, or tribal governments or the private sector of more than \$100 million per year. The rule does not have a significant or unique effect on State, local, or tribal governments or the private sector. The Department has determined that this rule meets the applicable standards provided in section 3(a) and 3(b)(2) of Executive Order 12988.

Takings (Executive Order 12630)

In accordance with Executive Order 12630, the rule does not have significant takings implications. No property acquisition or impacts on private property owners are expected due to the administrative nature of the rule. The Proclamations identify federal submerged lands surrounding Virgin Islands National Park and around the original Buck Island Reef National Monument for management by the National Park Service. These lands were held in reservation in the Submerged Lands Act of 1974 and not transferred to the Territorial government.

Federalism (Executive Order 13132)

In accordance with Executive Order 13132, the rule does not have sufficient federalism implications to warrant the preparation of a Federalism Assessment. The NPS is exercising jurisdiction over submerged federal lands for which control has never been relinquished.

Civil Justice Reform (Executive Order 12988)

In accordance with Executive Order 12988, the Office of the Solicitor has determined that this rule does not unduly burden the judicial system and meets the requirements of sections 3(a) and 3(b)(2) of the Order.

Paperwork Reduction Act

This rule does not require an information collection from 10 or more parties. It does not require submissions under the Paperwork Reduction Act or OMB form 83-I. This rule does not require any outside party to submit any information to the Department of the Interior.

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National Environmental Policy Act

The NPS has determined that this rule will not have a significant effect on the quality of the human environment, health and safety because it is not expected to:

(a) Increase human uses that would compromise the nature and characteristics of any park area or cause physical damage to any park area;

(b) Introduce incompatible uses that compromise the nature and

characteristics of any park area or cause physical damage to it;

(c) Conflict with ownerships adjacent to parks or land uses adjacent to parks; or

(d) Cause a nuisance to owners or occupants of areas adjacent to parks.

Based upon this determination, this rulemaking is categorically excluded from the procedural requirements of the **National Environmental Policy Act (NEPA)** by Departmental Guidelines in 516 DM 6 (49 FR 21438). As such, neither an Environmental Assessment nor an Environmental Impact Statement has been prepared specifically for this rule. The GMPs will be accompanied by proper NEPA documentation.

Government-to-Government Relationship With Tribes

In accordance with Executive Order 13175 ``Consultation and Coordination with Indian Tribal Governments'' (65 FR 67249), the President's memorandum of April 29, 1994, ``Government-to-Government Relations with Native American Tribal Governments'' (59 FR 22951), and 512 DM 2 we have evaluated potential effects on federally recognized Indian tribes and have determined that there are no potential effects.

Administrative Procedures Act

The Secretary of the Interior has determined under 5 U.S.C. 553(b)(B) and 318 DM 5.3 that it is not in the public interest to delay the effective date of this **interim regulation** to accommodate notice and comment procedures. There are 4 reasons for this decision:

(a) The Proclamations clearly outline the limits of the Secretary's discretion in disallowing extractive uses at the Monuments. This **regulation** simply codifies the prohibitions of extractive uses outlined in the Proclamations and public comment will be useful only as to the few narrow exceptions allowed under the Proclamations.

(b) Delaying implementation of the Proclamations may lead to confusion about what law applies in the units and could result in harm to the objects protected by the Proclamations.

(c) Immediate action is necessary in order to effectuate the purpose for which the Proclamations were issued; that is, protecting the objects within the monuments.

(d) Immediate action is necessary in order to implement the exceptions providing for limited, permitted extraction in VICR.

List of Subjects in 36 CFR Part 7

District of Columbia, **National parks**, Reporting and recordkeeping requirements.

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For the reasons stated in the preamble, the **National Park Service** amends 36 CFR part 7 as follows:

PART 7--SPECIAL REGULATIONS, AREAS OF THE **NATIONAL PARK SYSTEM**

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1. The authority citation for part 7 continues to read as follows:

Authority: 16 U.S.C. 1, 3, 9a, 460(q), 462(k); sec. 7.96 also issued under DC Code 8-137 (1981) and DC Code 40-721 (1981).

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2. Add Sec. 7.46 to read as follows:

Sec. 7.46 Virgin Islands Coral Reef National Monument.

(a) Extractive uses. (1) All extractive uses are prohibited within the boundaries of the **Monument**, including, but not limited to, harvest or collection of fish, coastal migratory pelagic fish, baitfish, lobsters, conch, whelk, corals, sponges and all associated **reef** invertebrates, and sand, water, plants, seeds, fruit, marine mammals, marine birds, gas, minerals, and rocks.

(2) All submerged cultural resources are protected under the Archeological Resource Protection Act and the Abandoned Shipwrecks Act.

(b) Exceptions. (1) Exceptions to prohibited extractive uses are limited to bait fishing at Hurricane Hole and blue runner (hardnose) line fishing in the area south of St. John. The Superintendent shall issue permits for such uses.

(2) Bait fishing shall be permitted with cast net at a distance greater than ten feet from the seaward edge of the mangrove prop root system.

(3) A maximum of three gallons of baitfish is allowed per fisherman per day.

(4) Blue runner shall be caught using hand lines and chum (a mixture of ground up baitfish and sand to attract the fish).

(5) Any fish caught other than blue runner shall be released.

(6) Vessels involved in the catch of blue runner may use moorings designated for that purpose.

(c) Marine Operations. No dredging, excavating, or filling operations of any kind are permitted, and no equipment, structures, by-product or excavated materials associated with such operations may be deposited in or on the waters or ashore within the boundaries of the **monument**.

(d) Wrecks. No person shall destroy or molest, remove, deface, displace or tamper with wrecked or abandoned waterborne craft of any type or condition, submerged cultural resources, or any cargo pertaining thereto, unless permitted in writing by an authorized official of the **National Park Service**.

(e) Boats. (1) No watercraft shall operate in such a manner, nor shall anchors or any other mooring device be cast or dragged or placed, so as to strike or otherwise cause damage to any underwater feature.

(2) All watercraft, carrying passengers, for hire, shall comply with applicable regulations and laws of the U.S. Coast Guard and Territory of the Virgin Islands.

(3) Anchoring will only be permitted in emergency situations to protect life and property.

(4) Anchoring shall only be permitted from 48 hours prior to landfall of the hurricane to 48 hours following passage of the hurricane.

(5) No lines or ropes shall be attached to mangroves or other shoreline vegetation.

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3. Amend Sec. 7.73 to add paragraph (a), and revise paragraphs (d) and (e) to read as follows:

Sec. 7.73 Buck Island Reef National Monument.

(a) Extractive uses. All extractive uses are prohibited within the boundaries of the **Monument**, including but not limited to harvest or collection (on the land or in the water) of fish for any use, marine mammals, coastal migratory pelagic fish, baitfish, lobsters, conch, whelk, hermit crabs (soldier crabs), seashells, corals, dead coral, sea fans, sponges and all associated reef invertebrates, plants, fruits and seeds, firewood, driftwood, rocks, sand, gas, oil, and minerals.

* * * * *

(d) Boats. (1) No watercraft shall operate in such a manner, nor shall anchors or any other mooring device be cast or dragged or placed, so as to strike or otherwise cause damage to any underwater features.

(2) Anchoring or maneuvering watercraft within the waters that contain underwater marked swimming trails and interpretive signs is prohibited.

(3) Anchoring is prohibited except by permit issued by the Superintendent for

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deep sand bottom areas or for administrative purposes.

(4) Anchoring will be allowed in emergency situations only to protect life and property.

(5) All watercraft, carrying passengers, for hire, shall comply with applicable regulations and laws of the U.S. Coast Guard and Territory of the Virgin Islands.

(e) Fishing. (1) All forms of fishing are prohibited including, but not limited to, spearfishing, rod and reel, hand-line, nets, gill or trammel, traps or pots, snares, hooks, poison, cast nets, trawl, seine, and long-line.

(2) The use or possession of any type of fishing equipment or any of the items listed in paragraph (a) of this section is prohibited within the boundaries of the **Monument**.

Dated: February 12, 2003.

Craig Manson,

Assistant Secretary for Fish and Wildlife and Parks.

[FR Doc. 03-8190 Filed 4-3-03; 8:45 am]

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**APPENDIX B
SERVICEWIDE MANDATES AND POLICIES PERTAINING TO BUCK ISLAND REEF
NATIONAL MONUMENT**

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APPENDIX B: SERVICEWIDE MANDATES AND POLICIES PERTAINING TO BUCK ISLAND REEF NATIONAL MONUMENT

This section provides an overview of the laws and policies that are applicable to the management of the Buck Island Reef National Monument.

LEGISLATION

The legislation for the park is provided in Appendix A.

SERVICEWIDE LAWS AND POLICIES

This section summarizes the major appropriate legal and administrative mandates that apply to managing all units of the NPS. These are measures that the NPS must strive to meet, regardless of the alternative selected for the long-term management of the park. The body of laws and executive orders that guide park management, with their legal citations, are identified.

The National Park Service Organic Act and the Redwood Act Amendment to the National Park Service General Authorities Act

One of the most important statutory directives for the National Park Service (NPS) is provided by the interrelations of the NPS Organic Act of 1916 and the Redwood Act Amendment to the NPS General Authorities Act of 1970. The Organic Act mandates that the National Park Service “shall promote and regulate the use of Federal areas known as national parks, monuments, and reservations by such means and measures as conform to the fundamental purpose of said parks, monuments, and reservations, which purpose is to conserve the scenery and the natural and historic objects and the wildlife therein and to provide for the enjoyment of the same in such manner and by such means as will leave them unimpaired for the enjoyment of future generations.”

The General Authorities Act amends the Organic Act to broaden the types of areas that are included in the national park system, such as national seashores, recreation areas, and parkways. The Redwood Act further amends the General Authorities Act to reassert system-wide the high standard of protection set forth in the Organic Act. In the Redwood Act, “Congress further reaffirms, declares, and directs that the promotion and regulation of the various areas of the Nation Park System shall be consistent with and founded in the purpose established by the first section of the Act of August 25, 1916, to the common benefit of all the people of the United States. The authorization of activities shall be construed and the protection, management, and administration of these areas shall be conducted in light of the high public value and integrity on the National Park System and shall not be exercised in derogation of the values and purposes for which these various areas have been established, except as may have been or shall be directly and specifically provided by Congress.”

Both the Organic Act and the General Authorities Act, as amended by the Redwood Act, define a single standard for the management of the park service: to safeguard the units of the national park system, conserving resources and values for enjoyment of all people of the United States and prohibiting impairment. Director’s Order 55, Interpreting the National Park Service Organic Act, serves as the NPS interpretation of the meaning of the Organic Act and the General Authorities Act, as amended.

National Historic Preservation Act

The National Historic Preservation Act of 1966 authorized the Secretary of the Interior to “expand and maintain a national register of districts, sites, buildings, structures, and objects significant in American history, architecture, archeology, and culture.” Section 106 of the act requires federal agencies to consider the effects of their undertakings on National Register properties and to allow the Advisory Council on Historic Preservation “a reasonable opportunity to comment” on such

undertakings. The National Register of Historic Places was expanded from the original roster of historic landmarks and areas of the National Park System to a comprehensive inventory of historic properties nationwide. National Park Service actions affecting properties listed on the National Register of Historic Places are subject to review by state historic preservation officers and the Advisory Council.

Section 110 requires among other things that the park to "establish a preservation program to protect and preserve historic properties in consultation with others" and that this program ensure "that historic properties under the jurisdiction or control of [the National park Service], are identified, evaluated, and nominated to the National Register." Further, Section 110 requires "that such properties under the jurisdiction or control of [the park] as are listed in or may be eligible for the National Register are managed and maintained in a way that considers the preservation of their historic, archaeological, architectural, and cultural values in compliance with section 106 of this Act and gives special consideration to the preservation of such values in the case of properties designated as having National significance." Section 112 requires that studies or other actions taken with regards to historic properties be done by personnel or contractors who meet appropriate professional qualifications standards developed by the Secretary of the Interior. It also requires that the park maintain data from historic properties studies in an appropriate database available to prospective researchers.

National Environmental Policy Act

The National Environmental Policy Act of 1969 states as policy that federal agencies must assess the environmental impacts of any proposed action that they fund, support, permit, or implement. It specifically directs federal agencies to document the environmental impact of the proposed action, any adverse environmental effects which cannot be avoided should the proposed action be implemented, and alternatives to the proposed action.

The act also established the Council on Environmental Quality, which is charged with the implementation and oversight of the National Environmental Policy Act. The Council on Environmental Quality subsequently developed the legal requirements (40 Code of Federal Regulations 1500-1508) that all federal agencies must follow in evaluating the environmental effects of proposed actions. These procedures involve three levels of documentation: categorical exclusions; environmental assessments; and environmental impact statements. In the National Park Service, construction activities, natural or cultural resource management projects, and park plans trigger the majority of National Environmental Policy Act documents. The National Environmental Policy Act enables the National Park Service to integrate compliance with other legal mandates and provides a format for public involvement. Director's Order 12 sets forth the policy and procedures by which the service will comply with the National Environmental Policy Act.

Clean Air Act

The Clean Air Act provides a legal framework for the National Park Service to preserve and protect parks' air quality related values. The act establishes national ambient air quality standards for certain criteria pollutants. Major provisions of the act are intended to set a goal for cleaner air by setting national primary and secondary ambient air quality standards. Primary standards define levels of air quality necessary to protect public health, while secondary standards define levels necessary to protect public welfare from any known or anticipated adverse effects of a pollutant.

Under the Clean Air Act, the U.S. Environmental Protection Agency is required to set new source performance standards, based on best-demonstrated technology and to establish national emission standards for hazardous air pollutants. The U.S. Environmental Protection Agency is also required to develop programs for prevention of significant deterioration of air quality in attainment areas. Air

pollution permits in attainment areas mandate installation of pollution controls that represent the best available control technology.

The Clean Air Act also requires states to develop and submit a state implementation plan for achieving national ambient air quality standards within each state. The state implementation plan must establish state air quality control regions and specify emission limits, schedules, and timetables for compliance from both stationary and mobile sources. The Clean Air Act requires federal facilities to comply with state air pollution requirements. The Clean Air Act reinforces the NPS Organic Act role as a protector of natural and cultural resources within the national park system. Under the Clean Air Act, the National Park Service is responsible for protecting air quality within park unit boundaries, and for taking appropriate action to do so, when reviewing emission sources within and outside of the park system.

Clean Water Act

The Federal Water Pollution Control Act of 1972, as amended by the Clean Water Act and the Water Quality Act of 1987, forms the legal framework to support maintenance and restoration of water quality. The Clean Water Act establishes the National Pollutant Discharge Elimination System as the regulatory mechanism to achieve water quality goals by regulating pollutant discharge to navigable streams, lakes, and rivers. Through standards promulgated by individual states, the Clean Water Act requires the NPS to protect its water resources from point and nonpoint sources of pollution. Many NPS construction activities are regulated by the Clean Water Act under stormwater permitting requirements.

Under Section 303 (d) of the Clean Water Act, states are required to develop lists of streams and water bodies that do not meet ambient water quality standards. The resulting inventory of impaired streams, called the 303 (d) list, is updated every two years by states and is the basis for decisions related to restoring water quality. The law requires that the states establish priority rankings for waters on the lists and develop total maximum daily loads for these waters. A total maximum daily load is a calculation of the maximum amount of a pollutant that a waterbody can receive and continue to meet its designated use.

Based on an evaluation of the states' implementation of their Clean Water Act 303 (d) responsibilities, the U.S. Environmental Protection Agency developed changes and improvements to the total maximum daily load regulations. On July 13, 2000, the agency issued a final total maximum daily load rule that will improve current regulations. Congress has required the U.S. Environmental Protection Agency (delegated to the Virgin Islands Department of Environmental Protection) to establish total maximum daily loads for the territory, under the current total maximum daily load regulation.

Endangered Species Act

The Endangered Species Act of 1973, amended in 1982 and 1987, is intended to prevent the further decline of endangered and threatened plant and animal species and to help in the restoration of populations of these species and their habitats. The Endangered Species Act, jointly administered by the Department of Commerce and the Department of the Interior, requires that each federal agency consult with the U.S. Fish and Wildlife Service to determine whether endangered or threatened species are known to exist or have critical habitats on or in the vicinity of the site of a proposed action.

Section 7(c) of the Endangered Species Act authorizes the U.S. Fish and Wildlife Service to review proposed major federal actions to assess the potential impacts to listed species. In accordance with Section 7 (c), the National Park Service, in consultation with the U.S. Fish and Wildlife Service, must identify and promote the conservation of all federally listed species and their critical habitat within park boundaries.

The Fish and Wildlife Coordination Act (16 U.S.C. 661, 666c)

The Fish and Wildlife Coordination Act protects the quality of the aquatic environment needed for fish and wildlife resources. The Act requires consultation with the Fish and Wildlife Service and the fish and wildlife agencies of States where the "waters of any stream or other body of water are proposed or authorized, permitted or licensed to be impounded, diverted . . . or otherwise controlled or modified" by any agency (except TVA) under a Federal permit or license. NOAA Fisheries was brought into the process later, as these responsibilities were carried over, during the reorganization process that created NOAA. Consultation is to be undertaken for the purpose of "preventing loss of and damage to wildlife resources", and to ensure that the environmental value of a body of water or wetland is taken into account in the decision-making process during permit application reviews. Consultation is most often (but not exclusively) initiated when water resource agencies send the FWS or NOAA Fisheries a public notice of a Section 404 permit. FWS or NOAA Fisheries may file comments on the permit stating concerns about the negative impact the activity will have on the environment, and suggest measures to reduce the impact.

Fish & Wildlife Act of 1956 - 16 U.S.C. §§ 742a-742j

The Fish and Wildlife Act establishes a comprehensive national fish, shellfish, and wildlife resources policy with emphasis on the commercial fishing industry. The Act emphasizes that the Act be administered with regard to the inherent right of every citizen and resident to fish for pleasure, enjoyment, and betterment and to maintain and increase public opportunities for recreational use of fish and wildlife resources. Further, the Act established a Bureau of Sport Fisheries and Wildlife and a Bureau of Commercial Fisheries within the US Fish and Wildlife Service.

The Act requires the Secretary of the Interior to:

- Develop measures for "maximum sustainable production of fish";
- Make economic studies of the industry and recommend measures to insure stability of the domestic fisheries;
- Undertake promotional and information activities to stimulate consumption of fishery products; and
- Take steps "required for the development, advancement, management, conservation, and protection of the fisheries resources," and take steps "required for the development, management, advancement, conservation, and protection of fish and wildlife resources" through research, acquisition of land and water or interests therein, development of existing facilities, and other means.

Fish & Wildlife Conservation Act (Nongame Act) - 16 U.S.C. §§ 2901-2911

The Act encourages states to develop conservation plans for nongame fish and wildlife of ecological, educational, aesthetic, cultural, recreational, economic or scientific value. Pursuant to amendments adopted in 1988 and 1989 the Secretary of the Interior is directed to undertake certain activities to research and conserve migratory nongame birds.

Fish Restoration & Management Projects Act - 16 U.S.C. §§ 777 et seq.

Under the Act, the Secretary of the Interior is authorized and directed to cooperate with State fish and game departments in fish restoration and management projects by agreeing upon the fish restoration and management projects to be aided under standards fixed by the Secretary of the Interior. A state may submit programs or projects for fish restoration in two ways:

- The state prepares and submits to the Secretary a comprehensive fish and wildlife resource management plan which insures the perpetuation of these resources for the economic, scientific, and recreational enrichment of the people; or
- The State fish and game department submits to the Secretary full and detailed statements of any fish restoration and management project proposed for that State.

Title III of the Marine Protection, Research and Sanctuaries Act of 1972

The National Marine Sanctuaries Program was created in Title III of the Marine Protection, Research and Sanctuaries Act of 1972. Today, there are 13 national marine sanctuaries protecting some 18,500 square miles of ocean and coasts. Staff from the NOAA Fisheries are involved in the federal management teams that develop the sanctuary management plans to ensure coordination with regard to fisheries management, and protection of vital fishery resources and fishery habitats.

Magnuson-Stevens Fishery Conservation and Management Act (Public Law 94-265)

The purpose of the Magnuson-Stevens Fishery Conservation Management Act is (1) to maintain without change the existing territorial or other ocean jurisdiction of the United States for all purposes other than the conservation and management of fishery resources, as provided for in this Act; (2) to authorize no impediment to, or interference with, recognized legitimate uses of the high seas, except as necessary for the conservation and management of fishery resources, as provided for in this Act; (3) to assure that the national fishery conservation and management program utilizes, and is based upon, the best scientific information available; involves, and is responsive to the needs of, interested and affected States and citizens; considers efficiency; draws upon Federal, State, and academic capabilities in carrying out research, administration, management, and enforcement; considers the effects of fishing on immature fish and encourages development of practical measures that minimize bycatch and avoid unnecessary waste of fish; and is workable and effective; (4) to permit foreign fishing consistent with the provisions of this Act; (5) to support and encourage active United States efforts to obtain internationally acceptable agreements which provide for effective conservation and management of fishery resources, and to secure agreements to regulate fishing by vessels or persons beyond the exclusive economic zones of any nation; (6) to foster and maintain the diversity of fisheries in the United States; and (7) to ensure that the fishery resources adjacent to a Pacific Insular Area, including resident or migratory stocks within the exclusive economic zone adjacent to such areas, be explored, developed, conserved, and managed for the benefit of the people of such area and of the United States.

Migratory Game Fish Study Act of 1959 (16 USC 760(e))

Provides for a continuing study of migratory marine fishes, including the effects of fishing on the species.

Coral Reef Conservation Amendments Act of 2007

The purpose of the Coral Reef Conservation Act are as follows: (1) to preserve, sustain, and restore the condition of coral reef ecosystems; (2) to promote the wise management and sustainable use of coral reef ecosystems to benefit local communities and the Nation; (3) to develop sound scientific information on the condition of coral reef ecosystems and the threats to such ecosystems; (4) to assist in the preservation of coral reefs by supporting conservation programs, including projects that involve affected local communities and nongovernmental organizations; (5) to provide financial resources for those programs and projects; and (6) to establish a formal mechanism for collecting and allocating monetary donations from the private sector to be used for coral reef conservation projects.

Federal Aid in Sport Fish Restoration Act (16 U.S.C. 777-777k, 64 Stat. 430)

The Federal Aid in Sport Fish Restoration Act, also referred to as the Dingell-Johnson Act or Wallop-Breaux Act, provides Federal aid to the States for management and restoration of fish having “material value in connection with sport or recreation in the marine and/or freshwaters of the United States.” Amendments to the Act provide funds to states for aquatic education, wetlands restoration, boat safety and clean vessel sanitation devices (pumpouts), and a non-trailerable boat program.

Clean Vessel Act of 1992; 33 U.S.C. 1322, 106 Stat 5039

The Clean Vessel Act of 1992 provided a 5 year recreational boater sewage disposal program and amends the Federal Aid in Sport Fish Restoration Act to allow the Secretary of Interior to issue grants to coastal and inland States for pumpout stations and waste reception facilities to dispose of recreational boater sewage. Public Law 109-59, the Safe, Accountable, Flexible, Efficient Transportation Equity Act of 2005 reauthorized this Act through 2009.

Abandoned Shipwreck Act of 1987 - 43 U.S.C. § 2101-2106

The ASA declares the US policy that States carry out their responsibilities to develop appropriate and consistent policies to:

- protect natural resources and habitat areas;
- guarantee recreational exploration of shipwreck sites; and
- allow for appropriate public and private sector recovery of shipwrecks consistent with the protection of historical values and environmental integrity of the shipwrecks and the sites.

In managing the resources subject to the provisions of this Act, States are encouraged to create underwater parks or areas to provide additional protection for such resources. Funds available to States from grants from the Historic Preservation Fund shall be available, in accordance with the provisions of title I of the National Historic Preservation Act [16 U.S.C. 470 et seq.], for the study, interpretation, protection, and preservation of historic shipwrecks and properties.

The United States asserts title to any abandoned shipwreck that is:

- embedded in submerged lands of a State;
- embedded in coralline formations protected by a State on submerged lands of a State; or
- on submerged lands of a State and is included in or determined eligible for inclusion in the National Register

Act to Prevent Pollution from Ships of 1980 - 33 USC § 1901-1911

The Act authorizes the EPA and the Secretary of the department in which the U.S. Coast Guard is located, currently the Department of Homeland Security, to administer and implement the requirements of the International Convention for the Prevention of Pollution from ships, the MARPOL Protocol, and this Act.

The Act describes penalties for violation of MARPOL and allows the EPA and USCG to promulgate regulations necessary and proper for the administration of the Act, issue certifications, conduct inspections, and engage in enforcement actions.

Disaster Mitigation Act - Public Law 106-390

The Disaster Mitigation Act, implemented by FEMA, reinforces the importance of pre-disaster infrastructure mitigation planning to reduce disaster losses nationwide. The Act is aimed primarily at the control and streamlining of the administration of federal disaster relief and programs to promote

mitigation activities. The Act also establishes minimum mitigation standards for public and private structures.

Federal Power Act – 16 U.S.C. § 791 et seq.

The Federal Power Act calls for cooperation between the Federal Energy Regulatory Commission (FERC) and other Federal agencies in licensing and relicensing power projects. Under this act FERC is authorized to issue licenses for the construction, operation and maintenance of dams, water conduits, reservoirs, and transmission lines to improve navigation and to develop power from any streams or other bodies of water over which it has jurisdiction.

The 1992 amendments (Public Law 102-486), directed the Secretary of Energy, in consultation with the Secretaries of the Interior and the Army, to study cost-effective opportunities to increase hydropower production from federally-owned or operated facilities. The amendments also authorized a study on the Nation's principal river basins to find opportunities to more efficiently generate hydroelectric power from federal facilities.

Marine Plastic Pollution Research and Control Act - 33 U.S.C. § 1905

Under this Act, ports, terminals and recreational marinas are required to have adequate and convenient “reception facilities” for their regular customers. This is meant to ensure that the ports are able to handle the reception of garbage from incoming vessels

Migratory Bird Treaty Act – 16 U.S.C. § 703 et seq.

This Act provides for the protection of all migratory birds and their parts (including eggs, nests, and feathers). The Act implements the international conventions entered into between the United States and Canada, Japan, Mexico, and Russia, for the protection of selected species of birds that combine to form a common resource.

National Invasive Species Act of 1996 – Public Law 104-332

This Act reauthorized and modified NANPCA as well as extended it to cover the Hudson River region. The Act required record keeping, reporting, sampling and monitoring of vessels for compliance with the voluntary guidelines issued by the US Coast Guard.

National Oceanographic Partnership Act - Public Law 104-201

NOPA Creates the National Oceanographic Partnership Program and its governing body, the National Ocean Research Leadership Council, to promote the national interest in natural security, economic development, quality of life, and strong science education and communication through improved knowledge of the ocean.

Nonindigenous Aquatic Nuisance Prevention and Control Act of 1990 (NANPCA) – 16 U.S.C. § 4701

This Act addressed the problem of ballast water and invasive species. The US Coast Guard was prompted to issue voluntary guidelines for ballast water exchange to combat the entry and spread of invasive species in the Great Lakes.

Oceans Act of 2000 – Public Law 106-256

The Oceans Act establishes a Commission which develops a National Oceans Report which makes recommendations to the President and Congress on ocean and coastal issues. The President then responds to these recommendations in a “National Ocean Policy” that he submits to Congress.

The Commission establishes a multi-disciplinary science advisory panel that assists the Commission in preparing its report, ensuring that the scientific information considered is based on the best available data.

The Commission must provide a copy of their draft report to the Governor of each coastal state whose comments will be included in the Commission's final report. Under this Act the President of the United States must develop his National Ocean Policy in consultation with the states.

Ocean Dumping Act - 16 U.S.C. § 1401 et seq.

The ODA amends and consist of Titles I and II of the Marine Protection, Research, and Sanctuaries Act. This Act provides the basic authority for the Environmental Protection Agency (EPA) and the U.S. Army Corps of Engineers (USACE) to regulate ocean dumping. Title I prohibits any person, without a permit, from:

- Transporting from the U.S. any material for the purpose of dumping it into ocean waters (defined to mean those waters of the open seas lying seaward of the baseline from which the territorial sea is measured). In the case of a vessel or aircraft registered in the U.S. or flying the U.S. flag, or in the case of a U.S. agency, the act prohibits any person, without a permit, from transporting from any location any material for the purpose of dumping it into ocean waters; and
- Dumping any material transported from a location outside the U.S. into the territorial sea, or the contiguous zone extending 12 nautical miles seaward from the baseline of the territorial sea to the extent that it may affect the territorial sea or the territory of the U.S. EPA issues permits regulating the ocean dumping of all material except dredged material, which is permitted by COE.

Oil Pollution Act – 33 U.S.C. §§ 2701-2761

The OPA imposes liability for cleanup and damages on “each responsible party for a vessel or a facility from which oil is discharged, or which poses the substantial threat of a discharge of oil, into or upon the navigable waters or adjoining shorelines or the exclusive economic zone”.

Rivers & Harbors Act of 1899 (RHA) - 33 U.S.C. § 401 et seq.

Under sections 9 & 10 of the RHA, the U.S. Army Corps of Engineers is authorized to regulate the construction of any structure or work within navigable waters.

- USACE jurisdiction under RHA is limited to "navigable waters," or waters subject to the ebb and flow of the tide shoreward to the mean high water mark that may be used to transport interstate or foreign commerce.
- After receiving an application for a section 10 RHA navigation permit, USACE issues a public notice to solicit information from the public, adjacent property owners, and state, local, and federal agencies.
- USACE is required to consult with the U.S. Fish and Wildlife Service and the National Marine Fisheries Service to protect and conserve wildlife resources

Submerged Lands Act – 43 U.S.C. § 1301 et seq.

The SLA gave title to and ownership of the lands beneath navigable waters, with the boundaries of the states, to the respective states, along with the natural resources within such lands. The Act also gave the states the right and power to manage, administer, lease, develop and use the lands and resources granted.

Additionally, the SLA approved and confirmed the seaward boundary of the states as “a line three geographical miles distant from its coast line or, in the case of the Great Lakes, to the international boundary.” The SLA also respected the boundaries of TX and FL to be three marine leagues.

Sustainable Fisheries Act - Public Law 104-297

The SFA includes amendments to the Magnuson-Stevens Fishery Conservation & Management Act. Through the Act, Congress established a requirement that the Secretary of Commerce:

- Prepare advisory guidelines based on the national standards;
 - o The guidelines aid in the development of fisheries management plans, and
 - o Provide guidance to the Secretary in the review and approval of those fisheries management plans
- Expand on and interpret the national standards, providing more detailed requirements for fisheries management under MSFCMA.

Territorial Submerged Lands Act – 48 U.S.C. § 1705

Congress transferred ownership of submerged lands out to three nautical miles to Guam, the Virgin Islands, and American Samoa through the Territorial Submerged Lands Act.

Water Resources Development Act (WRDA) - 33 U.S.C. § 2201 et seq.

The WRDA authorizes and directs the Army Corps of Engineers (Corps) on projects for navigation, flood control, flood damage reduction, environmental restoration, recreation, hurricane and storm damage reduction, ecosystem restoration, shore protection and damage reduction, aquifer storage and recovery, snagging and sediment removal, beneficial use of dredged materials and navigation mitigation throughout the country.

Watershed Protection & Flood Prevention Act - 16 U.S.C. §§ 1001-1009

The act authorizes federal assistance to local organizations for planning and carrying out projects in watershed areas for conservation and use of land and water, and for flood prevention.

The Secretary of Agriculture is required to submit to Congress plans for works of improvement in watershed or sub-watershed areas where the federal contribution exceeds \$5 million or the plan includes a structure with a capacity greater than 2,500 acre feet. These plans must be submitted for comment to the secretary of the interior if they include works of improvement for reclamation or irrigation or affect lands or wildlife under the Department of the Interior's jurisdiction.

Marine Mammal Protection Act (16 U.S.C. 1361 et seq.)

The Marine Mammal Protection Act (MMPA) established a moratorium, with certain exceptions, on the taking of marine mammals in US waters and by US citizens on the high seas, and on the Final EIS Essential Fish Habitat for the US Caribbean FMPs Page 3-115 importing of marine mammals and marine mammal products into the United States. Under the MMPA, the Secretary of Commerce (authority delegated to NOAA Fisheries) is responsible for the conservation and management of cetaceans and pinnipeds (other than walruses). The Secretary of the Interior is responsible for walruses, sea and marine otters, polar bears, manatees and dugongs.

Part of the responsibility that NOAA Fisheries has under the MMPA, involves monitoring populations of marine mammals to make sure that they stay at optimum levels. If a population falls below its optimum level, it is designated as "depleted," and a conservation plan is developed to guide research and management actions to restore the population to healthy levels.

In 1994, Congress amended the MMPA, to govern the taking of marine mammals incidental to commercial fishing operations. This amendment required the preparation of stock assessments for all marine mammal stocks in waters under US jurisdiction, development and implementation of take reduction plans for stocks that may be reduced or are being maintained below their optimum

sustainable population levels due to interactions with commercial fisheries, and studies of pinniped-fishery interactions.

The MMPA requires all commercial fisheries to be placed in one of three categories, based on the relative frequency of incidental serious injuries and mortalities of marine mammals in each fishery. Category I designates fisheries with frequent serious injuries and mortalities incidental to commercial fishing; Category II designates fisheries with occasional serious injuries and mortalities; Category III designates fisheries with a remote likelihood or no known serious injuries or mortalities. For 2001, gear types managed by the Council fall under Category III, as there have been no documented interactions between this fishery and marine mammals; however, the large pelagics longline fishery is listed under Category I (NOAA, 2001c).

Wilderness Act

The Wilderness Act of 1964 established the National Wilderness Preservation System, composed of federal lands designated as wilderness areas. Wilderness areas are to be administered “for the use and enjoyment of the American people in such a manner as will leave them unimpaired for future use and enjoyment as wilderness.” The law states that “the designation of any area of any park, monument, or other unit of the national park system as a wilderness area shall in no manner lower the standards evolved for the use and preservation of such park, monument, or other unit of the national park system.”

Permanent roads are prohibited within any wilderness area, except where specifically provided by law. Except as needed for administrative purposes, temporary roads or use of motorized vehicles or equipment are forbidden within any wilderness area. The following exceptions are permitted: where the use of motorboats is already established, it may be permitted to continue subject to management restrictions; all wheelchairs, including motorized wheelchairs, are allowed in NPS wilderness areas; measures necessary to control fire, insects, and diseases may be taken; and certain mining activities are permitted.

EXECUTIVE ORDERS

Executive Order 12962 – Recreational Fisheries

“in order to conserve, restore, and enhance aquatic systems to provide for increased recreational fishing opportunities nationwide, it is ordered as follows:

Federal agencies shall improve the quantity, function, sustainable productivity, and distribution of U.S. aquatic resources for increased recreational fishing opportunities by:

- (a) developing and encouraging partnerships between governments and the private sector to advance aquatic resource conservation and enhance recreational fishing opportunities;
- (b) identifying recreational fishing opportunities that are limited by water quality and habitat degradation and promoting restoration to support viable, healthy, and, where feasible, self-sustaining recreational fisheries;
- (c) fostering sound aquatic conservation and restoration endeavors to benefit recreational fisheries;
- (d) providing access to and promoting awareness of opportunities for public participation and enjoyment of U.S. recreational fishery resources;
- (e) supporting outreach programs designed to stimulate angler participation in the conservation and restoration of aquatic systems;
- (f) implementing laws under their purview in a manner that will conserve, restore, and enhance aquatic systems that support recreational fisheries;

- (g) establishing cost-share programs, under existing authorities, that match or exceed Federal funds with nonfederal contributions;
- (h) evaluating the effects of Federally funded, permitted, or authorized actions on aquatic systems and recreational fisheries and document those effects relative to the purpose of this order; and
- (i) assisting private landowners to conserve and enhance aquatic resources on their lands.

The EO establishes a National Recreational Fisheries Coordination Council ("Coordination Council") consisting of seven members, one member designated by each of the following Secretaries--Interior, Commerce, Agriculture, Energy, Transportation, and Defense--and one by the Administrator of the Environmental Protection Agency. The Coordination Council shall:

- (a) ensure that the social and economic values of healthy aquatic systems that support recreational fisheries are considered by Federal agencies in the course of their actions;
- (b) reduce duplicative and cost-inefficient programs among Federal agencies involved in conserving or managing recreational fisheries;
- (c) share the latest resource information and management technologies to assist in the conservation and management of recreational fisheries;
- (d) assess the implementation of the Conservation Plan required under section 3 of this order; and
- (e) develop a biennial report of accomplishments of the Conservation Plan.

Calls for a Recreational Fishery Resources Conservation Plan which will set forth a 5-year agenda for Federal agencies identified by the Coordination Council. In so doing, the Conservation Plan will establish, to the extent permitted by law and where practicable;

- (1) measurable objectives to conserve and restore aquatic systems that support viable and healthy recreational fishery resources,
- (2) actions to be taken by the identified Federal agencies,
- (3) a method of ensuring the accountability of such

Federal agencies, and

- (4) a comprehensive mechanism to evaluate achievements. The Conservation Plan will, to the extent practicable, be integrated with existing plans and programs, reduce duplication, and will include recommended actions for cooperation with States, Tribes, conservation groups, and the recreational fisheries community.

The EO mandates that all Federal agencies will aggressively work to identify and minimize conflicts between recreational fisheries and their respective responsibilities under the Endangered Species Act of 1973 by developing a joint agency policy that will;

- (1) ensure consistency in the administration of the ESA between and within the two agencies,
- (2) promote collaboration with other Federal, State, and Tribal fisheries managers, and
- (3) improve and increase efforts to inform nonfederal entities of the requirements of the ESA.

The Secretary of the Interior shall expand the role of the Sport Fishing and Boating Partnership Council to:

- (a) monitor specific Federal activities affecting aquatic systems and the recreational fisheries they support;

- (b) review and evaluate the relation of Federal policies and activities to the status and conditions of recreational fishery resources; and
- (c) prepare an annual report of its activities, findings, and recommendations for submission to the Coordination Council.

Executive Orders on Coral Reefs

Coral Reef Protection Executive Order 13089 (1998) establishes policies and actions needed to address the growing threats to the nation's coral reefs. The U.S. Coral Reef Task Force of 17 federal, state and territorial agencies led by the Departments of Interior and Commerce is coordinating the response to threats from impaired water quality, overfishing, coral bleaching and disease. The NPS is a key player under the U.S. Coral Reef Task Force. In March, 2000, the Task Force adopted the national Action Plan to Conserve Coral Reefs, a comprehensive blueprint with two major themes: 1) better understand coral reef ecosystems, and 2) reduce the adverse impacts from human activities. The Action Plan was endorsed in the 2002 Coral Reef Action Strategy reported to Congress by the Bush Administration.

Executive Order 13158 (2000) establishes policies protect significant natural and cultural resources within the marine environment through the expansion and enhancement of the Nation's system of marine protected areas (MPAs). The purpose of the order is to strengthen the management, protection, and conservation of existing marine protected areas and establish new or expanded MPAs; develop a scientifically based, comprehensive national system of MPAs representing diverse U.S. marine ecosystems, and the Nation's natural and cultural resources; and avoid causing harm to MPAs through federally conducted, approved, or funded activities.

Executive Order 13352 (2004) is intended to ensure that the Departments of the Interior, Agriculture, Commerce, and Defense, and the Environmental Protection Agency implement laws relating to the environment and natural resources in a manner that promotes cooperative conservation, with an emphasis on appropriate inclusion of local participation in Federal decision making, in accordance with their respective agency missions, policies, and regulations. Under this order the term cooperative conservation is defined as the use, enhancement, and enjoyment of natural resources, protection of the environment, or both and involve collaboration among Federal, State, local, and tribal governments, private for- and nonprofit institutions, as well as nongovernmental organizations and individuals.

Executive Orders on Wetlands and Floodplains

Executive Order 11988, Floodplain Management (May 24, 1977), requires federal agencies to evaluate the potential effects of actions in floodplains to avoid adversely impacting floodplains wherever possible. Executive Order 11988 also requires federal agencies to ensure that planning programs and budget requests reflect consideration of flood hazards and floodplain management, including the restoration and preservation of such land areas as natural undeveloped floodplains, and to prescribe procedures to implement the policies and procedures of this executive order.

Executive Order 11990, Protection of Wetlands (May 24, 1977), requires federal agencies to take action to avoid adversely impacting wetlands wherever possible, to minimize wetlands destruction, and to preserve procedures to implement the policies and procedures of this executive order. It is the intent of these executive orders that, wherever possible, federal agencies implement the floodplains/wetlands requirements through existing procedures, such as those internal procedures established to implement National Environmental Policy Act. The National Park Service often integrates compliance with the executive orders with other legal mandates, such as National Environmental Policy Act.

NATIONAL PARK SERVICE DIRECTORS ORDERS AND MANAGEMENT POLICIES

NPS Management Policies 2006

This is an update to the 2001 Management Policies. The policies are derived from the laws that have been enacted to establish and govern the NPS and the National Park System. This document serves as the basic, Servicewide policy manual used by park superintendents and other NPS managers to guide their decision-making. The manual prescribes policies which enable the NPS to preserve park resources and values unimpaired for the enjoyment of future generations, as required by law. The policies have been updated to keep pace with new laws that have been enacted, changes in technology and American demographics, and new understandings of the kinds of actions that are required to best protect the natural and cultural resources of the parks. The policies stress the importance of: using the parks for educational purposes; demonstrating environmental leadership in the parks; managing park facilities and resources in ways that will sustain them for future generations of Americans to enjoy; and working with partners to help accomplish the NPS mission. The new Management Policies is available on the NPS World Wide Web site at <http://www.nps.gov/policy/MP2006.pdf>.

Director's Order #12

Director's Order #12 describes the policy and procedures by which the National Park Service will comply with the National Environmental Policy Act. The Council on Environmental Quality, part of the Executive Office of the President, is the "caretaker" of National Environmental Policy Act. The National Park Service is required to abide by all National Environmental Policy Act regulations (40 Code of Federal Regulations 1500-1508) and any other procedures and requirements imposed by other higher authorities, such as the Department of the Interior.

Director's Order #17: National Park Service Tourism

The purpose of this Tourism Policy is to promote and support sustainable, responsible, informed, and managed visitor use through cooperation and coordination with the tourism industry.

Director's Order #24: Museum Collections Management

This lays the foundation by which the NPS meets its responsibilities toward museum collection. Director's Order #24 provides policy guidance, standards, and requirements for preserving, protecting, documenting, providing access to, and use of, NPS museum collections.

Director's Order #28

Director's Order #28, issued pursuant to 16 United States Code (1 through 4), addresses cultural resource management. The National Park Service will protect and manage cultural resources in its custody through effective research, planning, and stewardship and in accordance with the policies and principles contained in the National Park Service Management Policies 2006.

Director's Order #28A: Archeology

Director's Order #28A provides a management framework for planning, reviewing and undertaking archeological activities and other activities that may affect archeological resources within the National Park System.

Director's Order #47: Soundscape Preservation and Noise Management

The purpose of this Director's Order is to articulate National Park Service operational policies that will require, to the fullest extent practicable, the protection, maintenance, or restoration of the natural soundscape resource in a condition unimpaired by inappropriate or excessive noise sources.

Ban on Personal Watercraft

Personal watercraft use is a relatively new recreational activity that has been observed in approximately 32 of the 87 units of the national park system that allow motorized boating. The NPS is proposing regulations that will prohibit personal watercraft in units of the national park system unless the NPS determines that such use is appropriate for a specific unit based on that unit's enabling legislation, resources and values, other visitor uses, and overall management objectives.

36 CFR Parts 1, 3 and 7 Boating and Water Use Activities

The National Park Service is revising rules that regulate boating and water use activities in areas administered by the NPS. The rule is intended to address changing visitor use patterns, changing technologies, compelling boating and water safety issues, and the evolution of related statutory authorities. The goal is to provide for greater consistency with United States Coast Guard regulations and state laws and regulations and to establish rules which will be more clearly understood by the visiting public, and which can be more effectively communicated and enforced by NPS personnel. Promulgation of the final regulation will eliminate many requirements which are ineffective or out of date and will provide flexibility in managing safety, resource preservation, and public use needs throughout the National Park System.

VIRGIN ISLANDS LAWS

This section summarizes the major legal and administrative mandates that apply to the NPS in the Virgin Islands. These are measures that the NPS must strive to meet, regardless of the alternative selected for the long-term management of the park.

Antiquities and Cultural Properties Act of the Virgin Islands

Virgin Islands Act 6234, the Antiquities and Cultural Properties Act of 1998 (Virgin Islands Code: Title 29 Public Planning and Development, Chapter 17 Antiquities and Cultural Properties) identifies the role and responsibilities of the State Historic Preservation Office, permitting requirements and procedures, rules regarding excavation, procedures upon discovery of human burial sites, enforcement actions, and definitions and actions addressing the management of cultural properties and antiquities. The National Park Service coordinates actions involving cultural resources with the State Historic Preservation Officer in accordance with the National Historic Preservation Act and Virgin Islands Act 6234.

APPENDIX C AFFECTED ENVIRONMENT

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Appendix C is organized into two sections:

C.1 - Water Quality Data

C.2 - Listed Species Using Essential Fish Habitat in the U.S. Virgin Islands

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C.1. Water Quality

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Table C.1. Summary of U.S. Virgin Islands Water Quality Criteria

Criteria	Class B	Class C
Dissolved Oxygen	Not less than 5.5 mg/l from other than natural sources.	Not less than 5.0 mg/l.
pH	<8.3 Tolerable Limit>7.0	<8.5 Tolerable Limit>6.7
Temperature	Less than 32° Celsius	Same as Class B
Bacteria	- Not to exceed 70 fecal coliforms per 100 ml by MF or MPN count. - Not to exceed a geometric mean of 35 enterococci per 100 ml. - Not to exceed a single sample maximum of 104 per 100 ml at any time.	- Not to exceed 200 fecal coliforms per 100 ml by MF or MPN count. - Not to exceed a geometric mean of 35 enterococci per 100 ml. - Not to exceed a single sample maximum of 104 per 100 ml at any time.
Phosphorus	Not to exceed 50 mg/l in any coastal waters	Same as Class B
Chlorine	4-day average concentration of chlorine not to exceed 7.5 ug/l. - The 1-hour average concentration of chlorine not to exceed 13 ug/l.	Same as Class B
Suspended, colloidal or settleable solids	None from wastewater which would cause deposition or be otherwise deleterious.	Same as Class B
Oil and Floating substance	No residue attributable to wastewater. No visible film; no globules of grease	Same as Class B
Radioactivity	- Gross Beta: 1000 picocuries per liter, in the absence of Strontium-90 and alpha emitters - Radium-226: 3 picocuries per liter - Strontium-90: 10 picocuries per liter	Same as Class B
Taste and Odor	None in amounts to interfere with use for primary contact recreation, potable water supply or to render undesirable taste or odor to edible aquatic life.	Same as Class B
Color and Turbidity	- A secchi disc shall be visible at a minimum depth of one meter. For waters where the depth does not exceed one (1) meter, the bottom must be visible. - A maximum nephelometric turbidity unit reading of three (3) shall be permissible.	A Secchi disc shall be visible at a minimum depth of one (1) meter.

¹Requirements for Class A waters consist of no variation on current water quality. At no time should Class B standards be exceeded in Class A waters.

< less than

> greater than

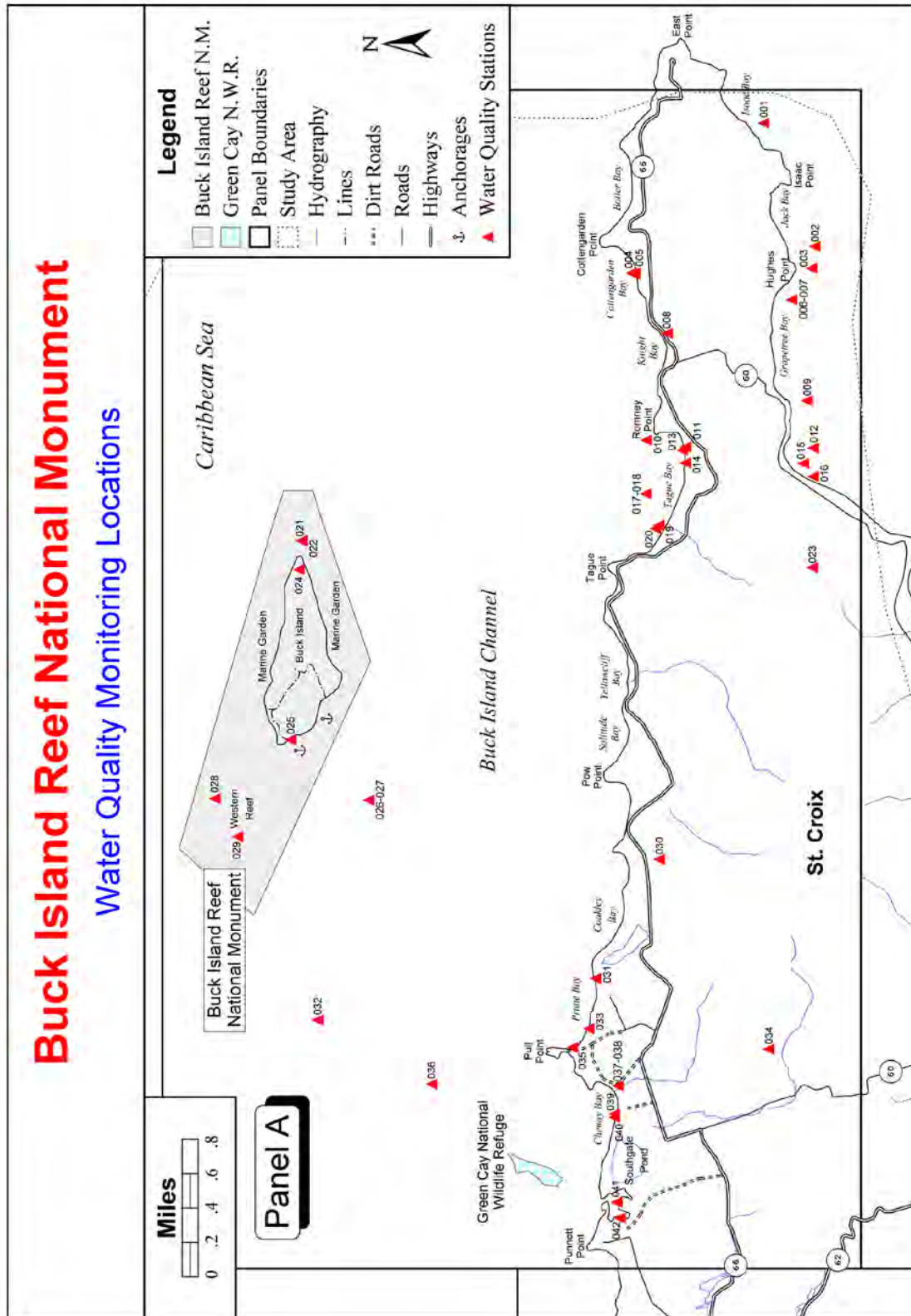
mg/L = milligrams per Liter

ug/L = micrograms per Liter

MPN = most probable number

MF = membrane filter

Source: Modified from DPNR 2006a.



**C.2. LISTED SPECIES
USING ESSENTIAL FISH HABITAT
IN THE U.S. VIRGIN ISLANDS**

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Table C.2.1. Federally Managed Fish Species Using Essential Fish Habitat within the U.S. Virgin Islands

	Common Name	Scientific Name
Reef Fish	Coney	<i>Epinephelus fulvus</i>
	Red hind	<i>Epinephelus guttatus</i>
	Nassau Grouper	<i>Epinephelus striatus</i>
	Mutton snapper	<i>Lutjanus analis</i>
	Schoolmaster	<i>Lutjanus apodus</i>
	Gray snapper	<i>Lutjanus griseus</i>
	Silk snapper	<i>Lutjanus vivanus</i>
	Yellowtail snapper	<i>Ocyurus chrysurus</i>
	White grunt	<i>Haemulon plumier</i>
	Branded butterfly fish	<i>Chaetodon striatus</i>
	Queen triggerfish	<i>Balistes vetula</i>
	Squirrelfish	<i>Holocentrus ascensionis</i>
	Sand tilefish	<i>Malacanthus plumier</i>
	Redtail parrotfish	<i>Sparisoma chrysopterum</i>
	Trunkfish	<i>Lactophrys quadricornis</i>
Spiny lobster	Spiny lobster	<i>Panulirus argus</i>
Queen conch	Queen conch	<i>Strombus gigas</i>
Coral and coral reefs	Coral and coral reefs	All corals

Source: Adapted from CFMC 2004

Table C. 2.2. List of Stony Corals Found within the Vicinity of Buck Island Reef National Monument

Stony Corals		
<i>Acropora cervicornis</i>	<i>Diploria strigosa</i>	<i>Mussa angulosa</i>
<i>Acropora palmata</i>	<i>Eusmilia fastigiata</i>	<i>Mycetophyllia aliciae</i>
<i>Acropora prolifera</i>	<i>Favia fragum</i>	<i>Mycetophyllia ferox</i>
<i>Agaricia agaricites</i> (several different forms)	<i>Helioseris cucullata</i> (= <i>Leptoseris cucullata</i>)	<i>Mycetophyllia lamarckiana</i>
<i>Agaricia fragilis</i>	<i>Isophyllastrea rigida</i>	<i>Oculina diffusa</i>
<i>Agaricia grahamae</i>	<i>Isophyllia sinuosa</i>	<i>Porites astreoides</i>
<i>Agaricia lamarcki</i>	<i>Madracis decactis</i>	<i>Porites branneri</i>
<i>Agaricia tenuifolia</i>	<i>Madracis mirabilis</i>	<i>Porites divaricata</i>
<i>Agaricia undata</i>	<i>Manicina areolata</i>	<i>Porites furcata</i>
<i>Cladocora arbuscula</i>	<i>Meandrina meandrites</i>	<i>Porites porites</i>
<i>Colpophyllia breviserialis</i>	<i>Millepora alcornis</i>	<i>Scolymia lacera</i>
<i>Colpophyllia natans</i>	<i>Millepora complanata</i>	<i>Siderastrea radians</i>
<i>Dendrogyra cylindrus</i>	<i>Millepora squarrosa</i>	<i>Siderastrea siderea</i>
<i>Dichocoenia stellaris</i>	<i>Montastraea annularis</i>	<i>Solenastrea bournoni</i>
<i>Dichocoenia stokesi</i>	<i>Montastraea cavernosa</i>	<i>Stephanocoenia michelinii</i>
<i>Diploria clivosa</i>	<i>Montastraea faveolata</i> (more platelike)	<i>Tubastraea aurea</i>
<i>Diploria labyrinthiformis</i>	<i>Montastraea franksi</i> (bumpier)	

Source: Adapted from CFMC 2004

APPENDIX D CLIMATE CHANGE SUMMARY

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APPENDIX D CLIMATE CHANGE SUMMARY

Climate change refers to any significant change in measures of climate (such as temperature, precipitation, or wind) lasting for an extended period (decades or longer). In general, climate change may result from (USEPA 2008):

- Natural factors, such as changes in the sun's intensity or slow changes in the Earth's orbit around the sun;
- Natural processes within the climate system (e.g. changes in ocean circulation, acidification, or temperature); and
- Human activities that change the atmosphere's composition (e.g. through burning fossil fuels) and the land surface (e.g. deforestation, reforestation, urbanization, desertification, etc.).

The Earth's climate has changed many times during the planet's history, with events ranging from ice ages to long periods of warmth. Historically, natural factors such as volcanic eruptions, changes in the Earth's orbit, and the amount of energy released from the sun have affected the Earth's climate. Human activities associated with the Industrial Revolution have also changed the composition of the atmosphere and therefore are very likely influencing the Earth's climate. For example, over the past 200 years, the burning of fossil fuels and deforestation has caused the concentrations of heat-trapping "greenhouse gases" to increase significantly in the atmosphere (USEPA 2008). As the concentrations of these gases continue to increase in the atmosphere, the Earth's temperature is climbing above past levels (IPCC 2007; United Nations Environment Programme 2007; U.S. Climate Change Science Program 2008). Most of the warming in recent decades is very likely the result of human activities (IPCC 2007). For example, the recent United Nations report (IPCC 2007) stated that "Observational evidence from all continents and most oceans shows that many natural systems are being affected by regional climate changes, particularly temperature increases." The report further states that, "A global assessment of data since 1970 has shown it is likely that anthropogenic warming has had a discernible influence on many physical and biological systems".

Over the past 200 years the oceans have absorbed nearly half the CO₂ produced by human activities. One effect has been to produce carbonic acid, thus increasing acidity and lowering the pH of surface seawater by 0.1 pH unit. Projections based on different emission scenarios give additional reductions in average global surface ocean pH of between 0.14 and 0.35 units by the year 2100 (IPCC 2007). This seawater acidity is probably higher than has been experienced for hundreds of millennia, and there is convincing evidence that such acidification will impair the process of calcification by which animals, such as corals and molluscs, make their shells from calcium carbonate.

Scientists are certain that human activities are changing the composition of the atmosphere, and that increasing the concentration of greenhouse gases will change the planet's climate (USEPA 2008; IPCC 2007). However, they are not sure by how much it will change, at what rate it will change, or what the specific effects will be. Observed effects have included sea level rise, shrinking glaciers, changes in the range and distribution of plants and animals, trees blooming earlier, temperature increases, lengthening of growing seasons, ice on rivers and lakes freezing later and breaking up earlier, and thawing of permafrost.

Studies conducted as part of the NPS Inventorying and Monitoring Program (NPS 2007; Miller et al. 2006) have shown that climate change has had major adverse effects on coral reefs in Buck Island Reef National Monument, Virgin Islands National Park, and Virgin Islands Coral Reef National Monument. For example almost half the reefs in the parks experienced mortality from disease as a result of the 2005 bleaching event (Miller et. al 2006; 2009). These effects have been attributed

primarily to increased water temperatures that have resulted in the bleaching of reef-forming corals, followed by disease. In addition to these effects of climate change, coral reefs have also been affected by hurricanes, sedimentation from development on land, boat groundings and anchoring, fishing, acidification of ocean waters, and effects of tourism and recreation (Rothenberger et al. 2008). The inter-relationship of all of these factors is also thought to be important, and is poorly understood at the present time.

Climate change affects sea level, amounts of precipitation intensity and runoff, height, duration and frequency of ocean waves, and long-term tracks, intensity and frequency of coastal storms (Nicholls 2002). These changes have the potential to adversely affect not only coral reefs, but also mangroves, freshwater wetlands, open and nearshore ocean ecosystems, and terrestrial ecosystems in as yet unknown ways. For example, Barange (2002) concluded that the climate change could affect coastal enrichment and productivity patterns, abundance, diversity and production of planktonic and fish communities, the amount of available marine habitats, species distribution, and predator-prey relationships in marine systems.

Cultural resources also can be affected by climate change. Epic storms and changing sea levels can adversely affect submerged resources. That is, shipwrecks in shallow waters could be damaged by high frequency waves of long duration. Or, increased sea levels could offer some measure of protection.

Shipwreck resources tend to reach a sort of equilibrium if moisture, pH and temperature levels remain fairly consistent. If a wreck is exposed to the air during frequent storm events, deterioration of its wood and metal components could be accelerated. As with the growth of coral, the various flora and microorganisms present on wrecks would be affected by changes in pH, temperature, amount of sunlight and storm intensity and frequency. The overall effect of such changes is, at present, unclear.

Rising sea levels and frequent storm events can contribute to the physical damage to or loss of coastal historical and archeological resources. On the island's steep slopes, previously disturbed soils in archeological and historical sites are more vulnerable to erosion. Storm events and changing precipitation patterns can contribute to creation of new gullies (guts) or extreme runoff and erosion of existing drainages. Climate change could contribute to unanticipated changes in the types of vegetation and location of vegetation communities on the island, affecting both archeological sites and ruins of historic structures. However, the levels and types of change cannot, at present, be determined.

The NPS Inventorying and Monitoring Program (NPS 2007; 2009) will continue to provide a means of monitoring the potential effects of climate change on both marine and terrestrial resources in the park. This information will be used as a means of adapting park management approaches to best deal with observed changes in resources that could result from climate change. (Additional information regarding South Florida/Caribbean Network and climate change research is available on the web at: <http://science.nature.nps.gov/im/units/sfcn/>).

APPENDIX E AGENCY COORDINATION

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Stakeholder Coordination

The following is an example of the scoping letter sent to stakeholders during the 2004 scoping period as described in Chapter 5 of this document.

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United States Department of the Interior

NATIONAL PARK SERVICE
Buck Island Reef National Monument
2100 Church Street #100
Christiansted, St. Croix, VI 00820-4611
(340) 773-1460



IN REPLY REFER TO:

June 4, 2004

Dear Interested Party:

In accordance with the National Environmental Policy Act of 1969 (Public Law 91-190, as amended), the National Park Service is preparing a General Management Plan and Environmental Impact Statement for Buck Island Reef National Monument. The purpose of this letter is to request your comments regarding the General Management Plan/Environmental Impact Statement, identify issues of concern that you might have, and solicit your input on the future management direction for the park.

The Purpose and Need: Buck Island Reef National Monument was established in 1961 to preserve one of the finest marine gardens in the Caribbean Sea. In 2001, the monument was significantly expanded to further preserve and protect the island and tropical marine ecosystem including coral reefs, sea grass beds, octocoral hard bottom, sand communities, algal plains, shelf edge, and oceanic habitats; to protect threatened and endangered species and enhance their habitats and survivability; to enhance the health and diversity of fisheries resources through their protection; to protect and manage terrestrial and submerged cultural resources; and to preserve this area of outstanding scientific, aesthetic, and educational importance for the benefit and enjoyment of the people now and for the future. The expansion of the monument identified the need for the development of a new General Management Plan to guide the future direction of resource preservation and visitor use at the monument. The general management planning process provides a comprehensive approach to establish the basic management philosophy for the park and provide strategies for addressing issues and achieving identified management objectives. The General Management Plan/Environmental Impact Statement will evaluate the environmental impacts of a range of alternatives to address distinct management approaches to preserving significant natural and cultural resources for public enjoyment, competing demands for limited resources, priorities for using available funds and staff, and differing interests and views of what is most important.

National Park Service managers constantly make difficult decisions about ways to preserve significant natural and cultural resources for public enjoyment, about competing demands for limited resources, about priorities for using available funds and staff, and about differing interests and views of what is most important. The General Management Plan process provides methods

and tools for resolving these issues in ways that minimize conflicts and promote mutually beneficial solutions that articulate how public use and enjoyment of the park can be part of a strategy for ensuring that resources are protected unimpaired for future generations.

The Process and Importance of Public Input: The General Management Plan process provides for early identification of concerns, issues, expectations, and values of existing and potential visitors, neighbors, people with traditional cultural ties to lands within the park, cooperating associations, other partners, scientists, scholars, and other government agencies. Input gathered during this process will be used in the Environmental Impact Statement to assess and compare the effects of each alternative on the natural and man-made environment. The Environmental Impact Statement will also recommend selection of a "preferred" management alternative. The National Park Service is requesting the public's input throughout this project.

Public Meetings: Your input is a key element in the General Management Plan/Environmental Impact Statement. You are invited to attend any of the public meetings to be held the week of June 21, 2004 at the following locations:

<i>Area</i>	<i>Date and Time</i>	<i>Location</i>
Christiansted, St. Croix	June 23, 2004 6:30 -8:30 p.m.	National Park Service Danish West India Guinea Company Warehouse Ground Floor (Old U.S. Post Office Building) 2100 Church Street #100 Christiansted, St. Croix
Christiansted, St. Croix	June 24, 2004 6:30-8:30 p.m.	National Park Service Danish West India Guinea Company Warehouse Ground Floor (Old U.S. Post Office Building) 2100 Church Street #100 Christiansted, St. Croix
Christiansted, St. Croix	June 25, 2004 9:30-11:30 a.m.	National Park Service Danish West India Guinea Company Warehouse Ground Floor (Old U.S. Post Office Building) 2100 Church Street #100 Christiansted, St. Croix

Additional public meetings will be scheduled upon release of the Draft General Management Plan/Environmental Impact Statement. Time and place of the additional public meetings will be published in advance of these meetings.

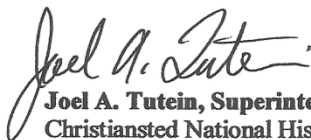
Who to Contact: If you are interested in providing input on the General Management Plan/Environmental Impact Statement, you are invited to attend any of the above meetings, or respond by mail or telephone to:

Mr. Joel A. Tutein, Superintendent
Buck Island Reef National Monument
2100 Church Street #100
Christiansted, St. Croix, VI 00820-4611
(340) 773-1460
CHRI_Superintendent@nps.gov

Our practice is to make comments, including names and home addresses of respondents, available for public review during regular business hours. We will make all submissions from organizations or businesses, and from individuals identifying themselves as representatives or officials of organizations or businesses, available for public inspection in their entirety. Submitting comments will ensure that you are included on the mailing list for further information. If you do not wish to comment at this time, but want to remain on the mailing list, you must notify the planning team at the address listed above. Although your comments are always welcome, comments received by July 26, 2004, are requested.

Supplementary Information: The Draft and Final General Management Plan/Environmental Impact Statement will be made available to known interested parties and appropriate agencies. A regional map of the park is available on the internet at <http://www.nps.gov/buis/pphtml/maps.html> and is also attached for your convenience. Please visit our website for additional information: <http://www.nps.gov/buis/index.htm>. Full public participation by federal, territorial, and other agencies as well as other concerned organizations and private citizens are invited throughout the preparation of this document. The National Park Service would like to thank you for reviewing this letter, and for preparing and submitting your written comments.

Sincerely,



Joel A. Tutein, Superintendent
Christiansted National Historic Site
Buck Island Reef National Monument
Salt River Bay National Historical Park & Ecological Preserve

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