St. Croix East End Marine Park Management Plan

Prepared by the Virgin Islands Program of The Nature Conservancy for:
Virgin Islands Department of Planning and Natural Resources
Division of Coastal Zone Management

Commissioned by:
University of the Virgin Islands
July 18, 2002

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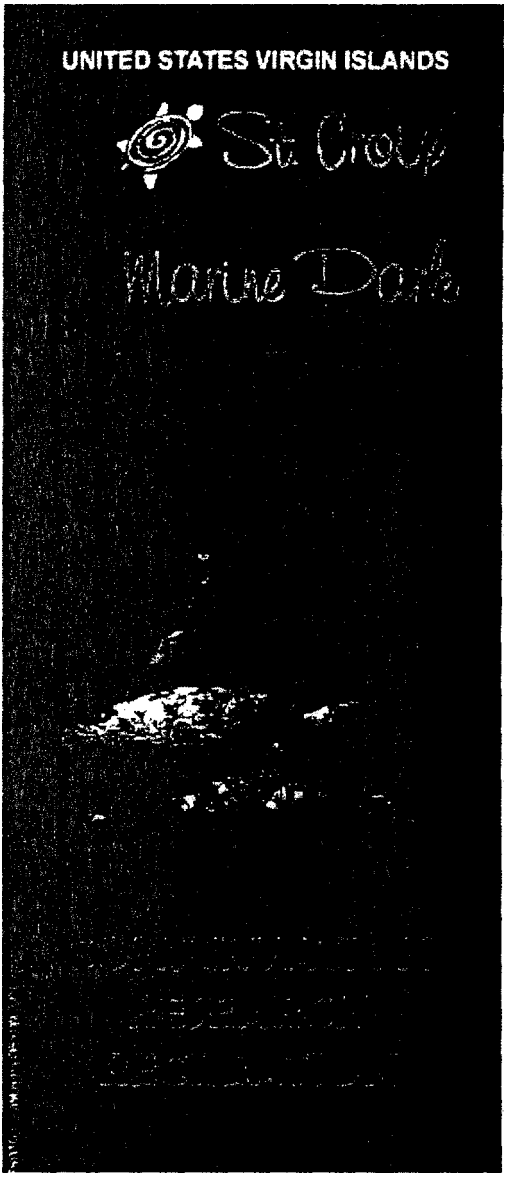

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List of Acronyms

APC	Area of Particular Concern
APR	Area for Preservation and Restoration
CDC	Conservation Data Center
CFMC	Caribbean Fisheries Management Council
CoE	Corps of Engineers
CZM	Coastal Zone Management
DA	Department of Agriculture
DEE	Division of Environmental Enforcement
DEP	Division of Environmental Protection
DFW	Division of Fish and Wildlife
DOL	Department of Law
DPNR	Department of Planning and Natural Resources
EEMP	East End Marine Park
EEMPO	East End Marine Park Office
FAC	Fisheries Advisory Council
FAD	Fish Aggregating Device
FKNMS	Florida Keys National Marine Sanctuary
FLO	Fisheries Liaison Office
GIS	Geographical Information System
GPS	Geographical Positioning System
IRF	Island Resources Foundation
IUCN	International Union for Conservation of Nature and Natural Resources
MPA	Marine Protected Area
NMFS	National Marine Fisheries Service
NOAA	National Oceanic and Atmospheric Administration
NPS	National Park Service
SEA	St. Croix Environmental Association
SNA	Significant Natural Area
TNC	The Nature Conservancy
TOC	The Ocean Conservancy
TPS	Territorial Park System
USCG	US Coast Guard
USFS	US Forestry Service
USFWS	US Fish and Wildlife Service
UVI	University of Virgin Islands
VIMAS	Virgin Islands Marine Advisory Service
VIPD	VI Police Department

1. BACKGROUND

1.1 Reasons for Preparation of the Management Plan

A Management Plan outlines the purposes and manner in which an area is to be used. It sets the management objectives, policies, and strategies to achieve the stated objectives. It also addresses the administrative structure, resource use, zoning, boundaries, financial support, staff needs, and monitoring plans. A successful Management Plan provides Park managers with a blueprint of how the Park will function, but will also be flexible and allow for modifications to be made when deemed appropriate. During the planning process of the Marine Park, specific issues were identified that have shaped the design of the Park. These issues range from current resource use, to activities that threaten the Park, to types of research that should take place in the Park. The synthesis of these issues, their complexities, and solutions, take the form of a Management Plan. The Management Plan is a working document that should be updated periodically, and should be used to actively and appropriately manage the Park, ultimately leading to the sustainable use of coastal and marine resources. The management objectives outlined in this Plan represent short term, measurable steps toward attaining this goal.

1.2 Wider MPA Management Context for the U.S.V.I.

This Management Plan is presented as an output of the VI Marine Park Project. The project is an initiative of the Government of the U.S.V.I., implemented as part of the National Action Plan to Conserve Coral Reefs.

The US National Action Plan to Conserve Coral Reefs was developed to guide the sustainable use of coral reef ecosystems within the jurisdiction of the USA, including its Territories and Commonwealths. Sustainable use simply means that coral reef ecosystems should be used and managed in such a manner as to ensure the security of the economic, cultural, social, and environmental values and benefits of such ecosystems in perpetuity.

The overall goal of the VI Marine Park Project is to establish the objectives, policies, and procedures for management of marine resources within the territorial waters of the U.S.V.I., through the development of marine protected areas. The VI Marine Park Project involves four main components:

- A Resource Description Report, prepared by Island Resource Foundation (IRF)
- A Socio-economic Assessment, prepared by Hinds, Unlimited
- A Management Framework for a System of Marine Protected Areas, prepared by Lloyd Gardner of Environmental Support Services, LLC and
- A Management Plan for the East End Marine Park, St. Croix, prepared by The Nature Conservancy (TNC).

1.3 Legislative and Other Authority for Plan Preparation

Under V.I. Code Annot. tit. 12, Section 903-906, the Virgin Islands Coastal Zone Management Commission is charged with administering the Coastal Zone Program, and is required to "prepare and submit to the legislature of the Virgin Islands for adoption any additional plans, and undertake any studies it deems necessary and appropriate to better accomplish the purposes, goals, and policies of this chapter" (see Sections 903(a)(1), 903(a)(5), 903(b), 903(b)(2), 903(b)(4), 903(b)(5), 903(b)(7), 903(b)(8), 903(b)(11), 904(a), 904(e), 904(d), and 906(c)).

In 1960, the Department of Interior completed a study for the Governor of the Virgin Islands that recommended that the East End of St. Croix be designated as a Nature Preserve. A series of similar designations have been made in the forty years since for the land and waters of the East End of St. Croix, including:

- Designation as an Area of Particular Concern (APC) – Planning Office 1979
- Designation as an Area for Preservation and Restoration (APR) – Teytaud 1980
- Nomination as a Significant Natural Area (SNA) – DCCA/Teytaud 1980
- Candidate for park within V.I. Territorial Park System plan – VITPS/Alexander 1981
- Nomination as a candidate for National Marine Sanctuary status- 1982
- Recommended as a multi-purpose park within proposed Territorial Park System – VITPSPP/Island Resources Foundation 1991

Recently, the Division of Coastal Zone Management revisited the concept of a Territorial Park System and is currently in the process of developing a "Management Framework for the Marine Protected Areas of the United States Virgin Islands." As a part of this effort, the Department of Planning and Natural Resources tasked the University of the Virgin Islands to develop a Management Plan for marine parks within the U.S.V.I.. The University of the Virgin Islands as required (or directed) by DPNR contracted The Nature Conservancy to prepare a Management Plan for the East End of St. Croix. Additionally, parallel efforts by other contractors are underway to assess the socioeconomic issues as well as the status of the marine resources throughout all of the U.S.V.I..

1.4 Process Used for Plan Preparation

The U.S.V.I. chapter of The Nature Conservancy (TNC) was tasked with the creation of a Management Plan for the proposed marine park at the East End of St. Croix. TNC used a conservation framework known as Site Conservation Planning (SCP) that has been successfully implemented at numerous TNC sites. This process relied heavily on community expertise, with a series of community workshops held in September and October of 2001 on St. Croix. The workshops were attended by representatives of the Division of Coastal Zone Management, Division of Fish and Wildlife, Division of Environmental Protection, Conservation Data Center, National Park Service, The Ocean

Conservancy, Island Resources Foundation, St. Croix Fisheries Advisory Council, the commercial fishing industry, dive operators, and UVI faculty and scientists. During these workshops management strategies and Action Plans were developed. A brief description of the process that guided the workshop activities can be found in Appendix A.

2. MANAGEMENT OBJECTIVES

2.1 Overall Goals for Management

The Marine Park being developed will be a protected area managed mainly for the sustainable use of natural ecosystems. However, within the Park, other objectives will guide operations including: managing the area for ecosystem protection and tourism, and managing the area for conservation of specific natural features. Ultimately, this Management Plan should serve as a guide for Park operations and future activities to Park managers and planners. The following goals were taken from IUCN's description of a Managed Resource Protected Area (MRPA), and will be used as guidelines for management of the Park:

- Protect and maintain the biological diversity and other natural values of the area in the long term
- Promote sound management practices for sustainable production purposes
- Protect the natural resource base from being alienated for other land use purposes that would be detrimental to the area's biological diversity
- Contribute to regional and national development

2.2 Specific Management Objectives for Planning Period

The VI Government recognizes the value of the marine resources that surround the island of St. Croix, and the challenges of minimizing degradation of the marine ecosystems. In order to effectively ensure long-term protection and maintenance of these valuable resources, as well as the sustainability of the products and services provided by such resources, a Management Plan is required. Formal management of this Park aims to meet the following objectives:

- Create a clearly defined park on the East End of St. Croix
- Create an infrastructure and support system that effectively manages the area
- Establish a Park that is accepted and used by both locals and tourists
- Promote understanding and increase local knowledge of the value of local marine resources and the ultimate benefits of protecting them
- Provide an example for future parks in the U.S.V.I.

The emphasis on sustainability of marine resources is essential to the people of the U.S.V.I., for both cultural and economic reasons. In addition to these management objectives, all activities that have been given a medium to high priority, as outlined in the strategy portion of this document, should be completed by the end of the first 5-year period.

3. SITE DESCRIPTION

3.1 Geographic, Biogeographic, and Political Location

The St. Croix East End Marine Park (EEMP) is located at the East End of St. Croix in the U.S.V.I. (Figure 1). Centrally located in the West Indies, the U.S.V.I. include three large islands- St. Croix, St. John, and St. Thomas – as well as about 50 small islets and cays. Located at the eastern end of the Caribbean archipelago in the Greater Antilles, the U.S.V.I. are home to about 100,000 residents, and host between 1 million and 2 million visitors annually. St. Croix is the largest and most southern of the U.S.V.I's, with a land area of approximately 84 miles^2 (218 km^2), and a population of more than 50,000.

Figure 1. St. Croix East End Marine Park Boundary

St. Croix was formed during the Upper Cretaceous period from volcaniclastic sediments deposited on the seafloor. Because St. Croix is a relatively low-lying island, (highest point is 1165 ft (355 meters)); and has lost large tracts of old-growth forested land, it receives relatively low amounts of rainfall with an average of 40 inches (102 cm) per year in the west, and 30 inches (76 cm) per year in the east (Mac et al. 1998). The wet season is from June to November. The average mid-island temperature is 26°C, varying only 3°C to 5°C seasonally (Mac et al. 1998). St. Croix has a higher number of endemic animal and plant species than other islands in the area because it has been isolated from Puerto Rico for a longer time, and may never have been connected to other islands of the

Puerto Rican Bank (Mac et al. 1998). With a length of 23 miles (37 km), the coral reef system that surrounds much of the island of St. Croix is one of the largest and most developed in the Caribbean.

The EEMP surrounds the entire East End of the island. On the north shore the boundary begins at the western border of Chenay Bay (17° 45' 39" N, 64° 40' 5"W) and extends out to the 3-nautical mile territorial boundary (Figure 1). The Park extends around the eastern tip of St. Croix, with the southern boundary extending to the western border of Great Pond Bay (17° 42' 51" N, 64° 39' 52"W). The Park is within the jurisdiction of the VI government, as it falls inside of the 3-nautical mile territorial boundary. The Buck Island National Monument is nested within the Park and remains under the jurisdiction of the Federal government. The land that borders the Park is entirely within the Coastal Zone (First Tier); therefore, any development activity is subject to approval by the Virgin Islands Coastal Zone Commission.

3.2 General Description of Coastal Ecosystems Associated with the East End of St. Croix

Although this Management Plan addresses the marine resources surrounding the East End of St. Croix, the land that borders the Park has a significant impact on those resources, and has been considered throughout the planning process. The terrestrial environment of the East End is dominated by xeric scrub, with western and northern facing slopes dominated by dry forest remnants and stream gallery forests (Island Resources Foundation 1993a). Three complete watersheds and the majority of two other major watersheds drain into the Park.

From Chenay Bay to just west of Boiler Bay on the north shore, the coastline is generally sandy. Similar coastline is found on the south shore from East End Bay to Great Pond Bay. On the easternmost part of the north shore, the coastline is rocky and rugged due to the dominant high-energy regime caused by the prevailing northeasterly wind and wave direction (Island Resources Foundation 1993a). The easternmost beaches on the south shore (East End, Isaac, and Jack) are important nesting grounds for two species of endangered sea turtles: the green and hawksbill (Good, 1999; Mackay and Rebholz 1998, 1997).

The marine communities in the waters that surround the East End encompass a broad spectrum of biodiversity (see Appendix H for SCMP-1). There is a relatively shallow shelf (depth range = 0-230 feet (70 m)) that extends out about 2 miles (3.2 **km)** offshore (Conservation Data Center, Bathymetric Map). The barrier reef system that protects the shoreline on the East End actually extends west on the north shore to Coakley Bay, and on the south shore to Halfpenny Bay.

3.3 General Description of the Ecosystems Found Within the Boundaries of the Park

3.3.1 Coral reefs

Coral reefs are unique in that they are formed entirely by biological activity. The stony structures that support the diverse assemblage of fishes and invertebrates are essentially massive deposits of calcium carbonate produced by coral animals, with additional calcium carbonate coming from calcareous algae, such as Halimeda spp. and other calcium carbonate producing organisms (Knowlton and Jackson 2001). The waters surrounding St. Croix are ideal for coral reef formation because of their warm temperatures, relatively low nutrient levels, and high water clarity (Pinet 1996). Two of the three major reef categories (atolls, barrier, and fringing) are represented in St. Croix, with an extensive barrier reef surrounding much of the island, and a complex mosaic of fringing reefs along most of the shoreline (Island Resources Foundation 1993b). Both of these reefs types can be found in the Park (see Appendix H for SCMP-1). In fact, nearly all of the coastline inside of the Park includes either linear reef structure or patch reefs, with a great deal of reef structure concentrated off the northeastern shore. The barrier reef is clearly viewed from shore, with a line of waves constantly crashing over the reef crest. The characteristic structures of these reefs have changed over time, due to both anthropogenic effects and their susceptibility to hurricane damage (Knowlton and Jackson 2001). The zonation of reef types extends from the shoreline, beginning with well-protected patch reefs and coral heads (see Appendix H for SCMP-1). The barrier reef runs along the coastline less than 0.5 miles off shore, with a mosaic of patch reefs scattered beyond the fore reef. These patch reefs are concentrated mostly on the northeast shore of St. Croix (Island Resources Foundation 1993b). The linear reef is present around the tip of the East End and continues around to Isaac Bay where the barrier-like reef structures become less frequent in the western direction. A submerged shallow platform known as Lang Bank, extends east from Point Udall, beyond the Park boundaries approximately 11 miles. Lang Bank is characterized by hardbottom gorgonian communities intermingled with patch reefs, sandy bottoms, and seagrass beds (Island Resources Foundation 1993b). Very little habitat description is currently available for Lang Bank, but efforts are underway to focus research activities at Lang Bank, ultimately providing much needed information about those habitats.

3.3.2 Seagrass Beds

St. Croix has an extensive network of seagrass beds off much of the northeast and central coastline as well as off the southern coast. These seagrass beds are primarily subtidal, with some extending into the intertidal zone (Island Resources Foundation 1993b). They are distributed throughout much of the Park, forming linkages to other marine communities through movement of animals and export of large quantities of slowly decaying organic matter. The seagrass beds provide habitat for diverse populations of macroalgae, epiphytic diatoms, invertebrates, and juvenile fish (Island Resources

Foundation 1993b). Seagrass habitats serve a variety of functions, including trophic support, refuge from predation, recruitment, provision of nursery areas, and waterfowl habitat (Island Resources Foundation 1993b). Seagrass beds within the Park are characterized by the habitat-forming turtle grass *(Thalassia testudinum),* manatee grass *(Syringodium filiforme),* shoalgrass *(Halodule spp.),* and calcareous green algae *(Halimeda spp.* and *Penicillus spp.)* (Island Resources Foundation 1993b).

3.3.3 Mangroves/Salt Ponds

St. Croix once had extensive mangrove communities along its shores. After the destruction of more than 700 acres of wetland in Krause Lagoon, and the filling in of other mangrove communities, there are only three prominent mangrove tracts remaining (Island Resources Foundation 1993b). Great Pond is the only significant salt pond within the EEMP; but both Altoona Lagoon and Salt River should receive similar consideration in future planning efforts. Great Pond is approximately 118 acres (48 hectares) in size, with a depth averaging 12-20 inches (30-50 cm) and is separated from the sea to the south by a 0.6 mile (1 km) long baymouth bar, 82 to 330 feet (25 to 100 m) in width (Tobias 1998). An eroding headland to the east deposits sediments ranging from sand to cobble-sized clasts on the bar (Bruce et al. 1989). Hurricane Hugo caused a shift in the vegetation on the higher elevations of the bar, from manchineel trees and upland scrub to thorn scrub, tan-tan, and sea grape (Knowles 1996). The exchange of seawater between Great Pond and Great Pond Bay is limited to a narrow channel (approx. 13 ft (4 m) wide and 5 ft (1.5 m) deep) at the southeastern corner of the pond (Tobias 1998). The salt pond is bordered on the north, east, and west by mud flats (Tobias 1998).

3.3.4 Colonized pavement

Distributed throughout the remaining available habitat, wherever there is a sediment-free substrate, are communities dominated by sponges and gorgonians (Hubbard 1989). These communities typically have a less complex substrate with gentle slopes, a moderate energy regime, and are found at greater depths (Hubbard 1989). Although the structural heterogeneity that supports reef biodiversity is absent, these areas do provide food, refuge, and much sought after space to numerous invertebrates and fishes (Pinet 1996). These communities provide linkages to surrounding marine communities, and often provide corridors within which large schools of fish travel (Pinet 1996). According to benthic habitat maps, these communities dominate the seafloor surrounding St. Croix. However, future ground-truthing efforts will likely reveal more information about the characteristics of these poorly studied habitats.

3.3.5 Sandy Beach

The sandy coastline that dominates the East End varies, depending on wind and wave action. The most important beaches within the Park, in terms of habitat are East End, Jack, and Isaac Bay. These beaches serve as nesting habitat for green and hawksbill sea turtles year-round, with a peak nesting season between July and October (Good 1999; Mackay and Rebholz 1998, 1997). Although other beach profiles within the Park are

amenable to sea turtle nesting, these beaches have remained the least disturbed by anthropogenic effects, and continue to support a growing population of nesting turtles. The lack of lighting and heavy development has helped to preserve this critical habitat.

3.4 Site Boundaries and Use Zones

The Park boundaries encompass an area of approximately 60. square miles (155 square kilometers). The shoreline that borders the Park is approximately 17 miles (27 kilometers) long (see Appendix H for SCMP-1 map). In order to identify effective boundaries for resource use zones, both workshop discussion and user-group input were considered. Workshop participants agreed that marine reserves (i.e., no-take areas) were necessary in certain areas, and also identified areas that should be open to general use. It is important to note that great efforts have been made to avoid displacing resource users and further input is necessary. The Park will have use-zones including: Open Fishing Area, Recreational Area, No-Take Area, and Turtle Wildlife Preserve Area (see Chapter 7 for zoning strategies).

3.4.1 Proposed Zone Descriptions

No-Take Areas, Turtle Wildlife Preserve Areas, and Recreational Areas are established to ensure the protection of Park resources. Each of these zone types is designed to reduce damage to resources and threats to environmental quality, while allowing uses that are compatible with resource protection. The zones will protect habitats and species by limiting consumptive and/or conflicting user activities, and allowing resources to evolve in a natural state, with minimum human influence. Descriptions of each zoning category are below:

No-Take Areas are designed to encompass large, contiguous diverse habitats. They are intended to provide natural spawning, nursery, and permanent residence areas for the replenishment and genetic protection of marine life, and to protect and preserve all habitats and species; particularly those not protected by fisheries management regulations. These zones are intended to protect areas that represent the full range of diversity of resources and habitats found throughout the Park. Restricted activities will be defined in future public input meetings.

Turtle Wildlife Preserve Areas are established to minimize disturbance to sensitive wildlife populations and their habitats, to ensure protection and preservation of wildlife resources in the Park. In particular, this designation will be applied to the primary turtle nesting beaches and near shore resting areas. Regulations governing access are designed to protect the endangered turtles and their habitat, while providing opportunities for public use.

Recreational Areas are designed to provide areas for snorkeling, diving, and boating while prohibiting any activities that would compromise the recreational values for which the area may be designated. Restricted activities will be defined in future public input meetings. Specified recreational opportunities may be protected, enhanced or restricted,

while preserving basic resource values of the area. No other uses are specifically restricted with the exception general shipping (see Open Fishing Areas).

Open Fishing Areas are areas in which there are no restrictions on fishing, boating, and diving activities. These areas are governed by all the rules and regulations pertaining to commercial and recreational fishing in the Virgin Islands Code. These areas are designated to monitor and evaluate the effects of resource zoning in the Park. Trawling and general shipping are prohibited, as well as those activities inconsistent with the Park's long-term conservation (e.g., mining and oil drilling).

3.4.2 Proposed Zoning Justification

Several factors determined where different resource use zones should be placed within the Park. Workshop participants considered current resource use, presence of sensitive marine habitat, connectivity between different habitat types, and presence of threatened species as the primary factors when designating these areas. A more detailed explanation of each zone type is below.

No-Take Areas: These areas are intended to protect the near shore environments including: coastal mangrove stands, seagrass beds, lagoonal patch reefs, and barrier reef. Protecting these areas will serve to preserve important habitat types that are fundamental to the functionality of tropical marine ecosystems. These areas are used as nursery areas for juvenile fish as well as provide structure in which diverse assemblages of species reside and forage. In addition to biological values, areas such as seagrass beds and mangrove stands serve as environmental filters of sediments and pollutants as well as buffers to wave energy. Fishermen participating in the community workshops identified the proposed No-Take Areas as light fishing areas and agreed that these areas would be appropriate for a No-Take Area (Pers. comm. Thomas Daly, Gerson Martinez, Robert McAuliffe, and Jose Sanchez).

Turtle Wildlife Preserve Area: This area is intended to protect nesting female sea turtles that use East End Bay, Isaac Bay, and Jack Bay to lay their eggs. During their nesting cycle, the female turtles are known to use the waters adjacent to their nesting site and have been found up to 1.5 miles from shore. This area will prohibit any activities that disturb or potentially harm nesting turtles that are using these waters. Examples of such activities include net fishing and jet skiing. Further analysis of potentially harmful activities is necessary.

Recreational Areas: These areas are currently more heavily used for recreational purposes. In addition to current resource use, these areas have been identified as appropriate for catch and release fishing and bait fishing. Further public input will be solicited to determine appropriate uses of these areas. The designation of these areas as Recreational Areas also serves to concentrate recreational activities into areas where access has already been established, which may negate the need to construct additional access routes.

Open Fishing Areas: These areas comprise the majority of the EEMP. They have been identified to clarify the function of the Park, and emphasize that only a small portion of the Park limits fishing activities. In addition to commercial and recreational fishing, recreational activities (i.e., boating, diving, snorkeling) will also be permitted.

It is important to note that specific zoning may be revised when Park managers review Park monitoring data.

4. CRITICAL THREATS AND STAKEHOLDERS

4.1 Critical Threats

A "threat" is actually a combination of a stress and a source of stress. Critical threats are those highly ranked threats that have an active source of stress. Highly ranked threats that have an historical source are best thought of as persistent stresses, since the source component is no longer active (The Nature Conservancy 2000). During the community workshops, a group of 16 threats across all systems were identified and were combined into three threat categories. Although a particular threat may be of great concern to one system, if it does not affect several focal systems(see Appendix B) it will likely not come out as a critical threat (The Nature Conservancy 2000). When considering the list of threats developed during the planning process, it is important to recognize the potential negative effects each threat may have in the future. Threats change over time, and it is important to anticipate the potential negative impacts of certain activities, and consider them when making management decisions and amendments to the Management Plan (The Nature Conservancy 2000).

The three main threats that have negative impacts across several systems are:

- Incompatible Upland Development
- Recreation Impacts
- Incompatible Fishing Practices

These threats are actually compilations of related threats and activities that have similar impacts, and would likely be abated using similar strategies. For example, *recreation impacts* is a combination of diving and boating activities; and *incompatible upland development* encompasses gut management, road development, commercial property development, and housing development issues. A brief description of each main threat follows. However, it should be noted that the problems associated with these threats are complex and not easily understood, and are often focal issues for local and federal legislative activities. Chapters 5 and 7 provide strategies and activities intended to minimize the effects of these threats, and ensure continued health of the marine communities within the Park.

4.1.1 Incompatible Upland Development

The main upland development activities that have negative impacts on marine communities are land movement, resulting in increased erosion, and the loss of wetland habitat through land reclamation. The removal of vegetation or the movement of soil without appropriate stabilization (e.g., sediment traps, barrier walls, pavement) has the potential to have extreme deleterious effects on nearshore marine communities. Both seagrass and coral reef communities rely on high light levels (low turbidity), low nutrient levels, and low sediment loads to persist long term (Pinet 1996). When soils are

destabilized by loss of vegetation, rates of erosion increase, thus leading to increases in water turbidity, nutrient levels, and sediment loads.

Effects of high sediment loads can also have immediate negative effects on coral reef colony survival due to suffocation by sediments. Nutrient increases (e.g., raw sewage discharge) can cause long term shifts from seagrass and coral reef communities to habitats dominated by ephemeral algae (Bell 1992, Lapointe 1997, Lapointe et al. 1994). In high nutrient conditions, filamentous algae will out-compete the structurally and ecologically important seagrass and coral reef communities (Lapointe et al. 1994). With increases in erosion, an increase in known toxins such as heavy metals, pesticides, and agricultural run-off is inevitable. The loss of salt ponds and mangrove communities on the East End to land development; that has directly or indirectly caused infilling, has resulted in a loss of habitat for a diverse assemblage of fish, invertebrates, and birds; many of which use these areas as nursery grounds before moving offshore to reefs and deeper waters.

4.1.2 Recreation Impacts

Recreational activities may include, but are not limited to, boating, snorkeling, diving, and swimming. Depending on both knowledge and skill, or the lack thereof, recreational boaters and divers can have significant negative impacts on marine communities. In the past ten years, there have been several studies examining the effects of diving and snorkeling activities on coral reef systems. Divers are known to damage corals and other marine organisms through direct physical contact with their hands, body, equipment, and fins (Talge 1990, 1992; Rouphael and Inglis 1995, 1997). The cumulative effects of such damage can cause substantial localized damage to reef communities (Garrabou et al. 1998; Hawkins et al. 1999; Plathong et al. 2000). Beyond the physical damage that inexperienced divers may cause, the direct take of marine organisms (i.e., lobsters, conch, shells, corals) adds to the negative impacts humans can have as underwater spectators. Although the East End reefs are not heavily used by the diving/snorkeling community currently, the potential for future use is high and such impacts are important to consider in this Management Plan. Small boat impacts on benthic habitats include septic and oil discharge, anchor damage, prop scars, groundings, and wildlife disturbance. A lack of knowledge and experience increases the likelihood for damage to the marine communities of concern by recreational boaters.

4.1.3 Incompatible Fishing Practices

Issues involving the effects of fishing are likely the most complex, as the types of fishing and fishers determine the impact on marine communities. Methods employed by fishers in St. Croix include trap-fishing, net-fishing, line-fishing, spear-fishing, and diving for lobster and conch. Fishers include full-time commercial fishers, part-time commercial fishers, recreational fishers, seasonal fishers, weekend fishers, and illegal fishers (i.e., illegal residents and illegal commercial fishers). To add to the confusion, there is currently a moratorium on new commercial fishing licenses until new regulations defining commercial fishermen, as well as equipment and permitting issues, are

developed. The obvious effects of fishing are the direct removal of fish from the sea. Depending on the type of fish, this can have different impacts on the marine community. Removal of top predators can seriously disturb trophic dynamics, potentially causing an imbalance in predator, prey, herbivore, and detritivore communities. Removal of herbivorous fish can dramatically alter the balance between algal and coral communities. During the workshop process, legal full-time commercial fishers were NOT identified as the main source of this critical threat. In fact, it was noted, that many of these fishers actively work to conserve the fish resources on St. Croix, in order to sustain the fishery for future use. It was agreed that illegal fishing tends to cause the most damage. However, certain less selective gear types tend to exacerbate these problems.

4.2 Stakeholder Diagrams

In examining the critical threats, it is also important to consider the major stakeholders that contribute in both positive and negative ways. A stakeholder analysis is an integral part of site planning, designed to insure that strategies are formulated with adequate knowledge of the stakeholder situation issues surrounding the site. During the workshop process, conceptual diagrams were created to explain the complex interactions that exist between activities and stakeholders. These diagrams provide a broad range of information regarding the relevant stakeholders and their effects on focal systems, thus helping site planners to determine which stakeholders need to be most involved in strategy implementation to achieve goals. A stakeholder-situation diagram is a mapping exercise in which the relationships between the critical threat, the stakeholders, and the forces that drive their behavior, are spatially represented and linked. These diagrams provide a visualization of the direct and indirect relationships between stakeholders and the critical threats, and the structure of influences motivating stakeholders (see Appendix C for an explanation of the diagram format). The diagrams were developed in work groups for the three main threats: *Incompatible Upland Development, Incompatible Fishing Practices,* and *Recreation Impacts* (see Appendix C for diagrams).

5. STRATEGIES

5.1 Priority Strategies

The way we respond, or fail to respond, to the critical threats and persistent stresses, will very likely be the single most important factor affecting the long-term viability of the Park. The ultimate objective of a management strategy is to reduce the stresses that are degrading and creating impairment (or have the potential to do so), and thus lowering the viability of important communities, systems, and species (The Nature Conservancy 2000). Both restoration and threat abatement serve to improve the viability of such entities. Strategies that build capacity, engage stakeholders, and/or promote policy actions are also important in improving the viability of the marine communities of the East End Marine Park.

In developing the course of action for this Park, several different types of strategies will be used (see Chapter 7 for Action Plans associated with these strategies). Strategies that focus on **management** of the area, more specifically the management entity, structure, and responsibility, are addressed in the design of the Park. These strategies fall within the category of Best Management Practices, and have been used in the implementation of similar Marine Parks within the United States. **Zoning** strategies have been developed that are designed to abate threats across the board, by managing commercial, recreational, and scientific activities in a very direct manner. Designating specific areas for certain activities addresses user conflicts, as well as serving to protect marine resources from overuse. **Restoration** strategies will be employed that protect and manage wetlands, to ensure continued viability as filters and nursery habitats. These strategies will take the form of special initiatives that emphasize the importance of wetlands to both terrestrial and marine communities. **Monitoring** and **research** strategies will help to support all other activities by providing much needed information about the dynamics and status of these fragile marine systems. Such strategies will serve as measures of success for the Marine Park (see Chapter 8). Finally, **threat-specific** strategies that focus on critical threats identified through the workshop process will contribute to a broad range of activities, all designed to result in a successful marine park. The threat-specific strategies addressed in this chapter are better described as management guidelines, and are meant to provide rationale for Action Plans discussed in Chapter 7.

To begin, workshop participants focused on the critical threats identified previously, and developed a list of potential strategies. The main issues highlighted during this process were lack of enforcement due to lack of resources; lack of education about marine resources and destructive activities; lack of appropriate regulations; and a strained commercial fishing industry lacking necessary resources. Given these themes, the strategies were then combined under the following strategy categories:

- Develop, adopt, and enforce development regulations
- Develop and implement a long-term education program
- Review/revise fishing regulatory program

- Promote fishing shift from reefs to pelagic/highly migratory species and fishing guide activities

The strategies developed can and should be expanded as time and resources allow. Those highlighted in this Management Plan are intended to be the foundation of a diverse portfolio of strategies and actions, leading to the successful implementation of the Park.

Strategy 1: Strictly enforce development regulations

When appropriate regulations are created and enforced, the regulatory system becomes an effective tool that provides structure and stability to management efforts. Both commercial and residential development, as well as road building, road improvement, and gut maintenance, should be carefully reviewed when those activities affect the associated fragile marine ecosystems. Permits granted for land movement and similar activities should receive greater scrutiny within the area bordering the Park. Minimizing the impacts of land development will decrease the devastating effects of erosion (i.e., increased sediment and nutrient loads) on seagrass and coral reef communities. Additionally, careful review and appropriate enforcement of land development activities that affect nearby wetlands (i.e., mangrove communities and salt ponds), should prevent further loss of essential habitat for juvenile fish and wading birds.

Strategy 2: Develop and implement a long-term education program

Many of the threats identified during the planning process can be addressed through education and outreach programs. The success of this Park relies heavily on community participation and understanding of the ultimate goal, as well as how an individual's actions directly impact the marine communities that surround St. Croix. Working with community groups, dive shop operators, boaters, schools, fishers, tour operators, hoteliers, and government agencies will help in gaining community support, as well as distribute essential information throughout the community at all levels. With increased information and education, decreases in garbage dumping, boating damage, diver damage (i.e., fin damage), turtle poaching, and illegal fishing activities are expected. Such educational programs can be developed and implemented by multiple government agencies, as well as non-government organizations.

Strategy 3: Review/revise fishing regulatory program

Both historic and current fishing practices have a significant impact on the health of the coral reefs and associated flora and fauna. Finding a balance between protecting and preserving fishery resources for future use, as well as preserving fishing as a livelihood, is critical to the success of the Park. Recent efforts by local fishers and government officials to review and revise current fishing regulations for all territorial waters surrounding St. Croix, have raised concerns among the fishing community. In making changes, it is important to emphasize the ultimate goal, benefits, and likely outcome; in order to generate support and avoid misunderstandings, and misplaced opposition. The changes under consideration are positive, and help ensure that fish populations will thrive

in the very near future, as well as be available to future generations. New regulations, coupled with effective enforcement, will decrease the likelihood of fish population collapses and commercial and ecological extinction. This will, in turn, help to maintain the balance of carnivorous and herbivorous fishes that control reef community structure and composition.

Strategy 4: Promote fishing shift from reefs to pelagic/highly migratory species and fishing guide activities

Promoting a fishing shift from fragile reef systems to pelagic species, such as dolphin fish (i.e., *Coryphaenidae spp.),* that are known to reproduce and reach market size relatively rapidly, will help to accomplish at least two goals. The obvious result would be the reduction in fishing pressure on susceptible reef species. Reduction in fishing pressure has at least two significant effects: (1) reduction in overall numbers of fish removed; (2) reduction in reef damage from fishing gear (i.e., discarded traps, lines, and nets). Herbivorous fish such as parrotfish and doctor fish (i.e., scarids and acanthurids) make up large portions of the total catch in fish traps. Therefore, a reduction in the use of fish traps will have a positive effect on herbivorous fish populations. Maintaining a healthy herbivorous fish population is a key element in the effort to control algal growth that otherwise threatens to overtake the coral reefs. Because some fishing methods used are generally highly selective, commercial fishers are able to catch entire breeding schools of parrotfish in one set (W. Tobias, pers. comm.), an increase in reef fish biodiversity and abundance would likely occur with a reduction in fishing pressure. Additionally, developing and promoting new fishing activities such as a recreational guide fishery has - the potential to open new markets for the fishing industry. A recreational guide fishery could be developed in the coastal waters of St. Croix, focused on such species as permit, snook, tarpon, and bonefish, thereby providing new jobs for commercial fishermen displaced by Marine Park zoning.

6. MARINE PARK OFFICE

6.1 Site Leadership and Support

Currently, the Department of Planning and Natural Resources carries the responsibility for the EEMP, with the Division of Coastal Zone Management playing the primary role. Because the scope of activities within CZM is broad, as is their jurisdiction, it is recommended that a separate unit be created for the management of this Park. For the purposes of this Management Plan, this office has been named the East End Marine Park Office (EEMPO). This office (or division) would be focused entirely on issues related to the EEMP, and *could* eventually function similarly to Magens Bay Authority in St. Thomas. In the beginning, the EEMPO will function through CZM. However, it is important that the EEMPO function independently, thus ensuring focus entirely on Park activities. CZM already plans to develop a new office that addresses marine areas of the coastal zone, with the purpose being to implement the U.S. All Island Coral Reef Initiative Strategy and U.S. Coral Reef Task Force Plan. This EEMPO should be under the new office proposed by CZM, which eventually will expand to include all managed areas, or serve as headquarters for the network of managed areas throughout the U.S.V.I.. The staff required to operate the EEMPO include: Park manager/director, field biologist(s), field assistant(s), enforcement officers, licensing coordinator, education and outreach personnel, and maintenance personnel. EEMPO staff would be responsible for EEMP operations, enforcement of regulations, review of development activities as they pertain to the Park, monitoring of public use, monitoring of biological communities, education and outreach programs, and development of new Action Plans. Specific EEMPO activities and responsibilities are described in Chapters 7 and 8.

6.2 Marine Park Advisory Committee

In addition to an independent EEMPO, the Marine Park Advisory Committee should continue to be an active participant, by providing periodic consultation, evaluating effectiveness, reviewing progress, approving work plans, and contributing to budget plans. The composition of this committee is likely to change over time, but should always include representatives from involved government agencies, local scientists; and stakeholder groups such as fishermen, tour operators, boaters, hoteliers, and non-profit organizations. It is critical that this committee represent the entire spectrum of stakeholders in order for the Park to be successful. Stakeholder representatives serve to keep the local population informed on current activities, as well as provide a different perspective when developing Management Plans. Additionally, community involvement will increase support and understanding of EEMPO activities.

6.3 Site Constituency

Including stakeholders from the beginning is critical to the success of the Park. The objectives of public participation include:

- Inclusion of concerns and priorities of stakeholders in the management process
- Increase the cooperation of stakeholders in implementation of the plan
- Increase the sense of ownership of the plan and final result
- Increase the understanding of and commitment to the plan
- Provide access to local knowledge, resources, and assistance
- Increase the public and political support for the plan and associated activities

Getting stakeholders involved can be approached in several ways, including: one-on-one meetings, small discussion groups or workshops, and public meetings (see 7.3 for details). Continuous exchanges of information and ideas will help to increase the likelihood that stakeholders will support plan efforts, and even more desirable, become active participants in the process. Educating the public about how the plan was developed, how it will affect them, when they will see results, and how it will ultimately benefit them, should be a continuous activity in the first several years of plan implementation. Providing such information engages the stakeholder groups, and will increase overall local public support. This support will ultimately result in acceptance of and adherence to the rules of the Park. Additionally, general environmental awareness among all members of the community is necessary for success, and can be accomplished through education and outreach efforts detailed previously. Different types of engaging activities as well as educational materials are outlined in the Action Plans in Chapter 7.

7. ACTION PLANS

When considering Action Plans for a park, it is important to consider activities that will produce high benefits with the greatest chance of success, and affordable costs. Successful implementation depends on many variables, but the most critical involve identifying the right person or institution to take responsibility to implement the strategy; and awareness that the more complex the strategy or action, the more likely it is that unanticipated events will affect the outcome. The actions outlined in this Management Plan are a combination of Best Management Practices and those developed during community workshops. They are intended to serve as the foundation for future related actions that will contribute to the success of the Park.

The following Action Plans outline the process for implementing the Management Plan strategies. The Action Plans are composed of several management strategies with common management objectives, and present the initial outline of the steps required for implementation. They provide an organized structure and process for implementing management strategies, including a description of the activities required, institutions involved, and requirements necessary for implementation. Detailed information regarding restricted activities and required tasks must be developed for each strategy prior to implementation. Further public input will be solicited to define the details of park use and regulations.

Action Plans provide only preliminary implementation and funding guidelines, and their parameters may change in the future. They present only the planned actions considered necessary to address the threats confronting the East End Marine Park. Another limitation relates to the timing, cost, funding, and personnel requirements for each plan. Given the uncertainties in the planning stage, this information represents an estimate, as more detailed information cannot be provided at this time. These estimates must be refinedcloser to the time of strategy implementation.

7.1 Navigational/Boundary Marking

The strategies in this Action Plan are designed to establish effective navigational and boundary marking system for boaters and other resource users within the Park. This is a *Best Management Practice* that will establish a standardized system of signage to be used throughout the Park. The Navigational/Boundary Marking Program is comprised of two strategies. First, the Navigational Marking strategy will identify areas that require navigational markings; as well as install the markers and develop a maintenance program. Second, the Boundary Marking strategy will identify Park boundaries, install markers and develop a maintenance program, using a geographic information system (GIS). The locations of the navigational and boundary markers will be incorporated into GIS database to be maintained by the Marine Park Office. Marking the reefs will minimize the damage done to shallow-water resources throughout the Park. In addition, implementation of the plan will facilitate enforcement action against damaging effects to the Park, resulting from inappropriate boating or fishing activities and thereby address *Recreation Impacts,* as a threat to the health of the management targets

7.1.1 Navigational Marking Strategy

Activity 1: Inventory and GeoReference Areas Requiring Navigational Markings. Identify areas requiring navigational markings within the Park. A major component of this activity will include the development of a GIS database of marker locations. This activity will be implemented by the Marine Park Office, or subcontracted, and completed in Year 1. This activity has a medium priority.

Activity 2: Implement Navigational Marking Program. Based on the results of Activity 1, place markers within the Park. The type of anchor device used will be determined by the substrate where the marker is placed. This activity will be implemented by the Marine Park Office, or subcontracted, and completed in Year 1. This activity has a medium priority.

Activity 3: Develop Navigational Marker Maintenance Program. A marker maintenance program will be developed and implemented to ensure the upkeep of the navigational markers. This activity will be implemented by the Marine Park Office, or subcontracted, and completed in Year 1, and then be ongoing. This activity has a medium priority.

7.1.2 Boundary Marking Strategy

Activity 1: Inventory and GeoReference Areas Requiring Boundary Markings. Using GIS, identify Park boundaries. A major component of this activity will include the development of a GIS database of marker locations. This activity will be implemented by the Marine Park Office, or subcontracted, and completed in Year 1. This activity has a high priority.

Activity 2: Implement Boundary Marking Program. Place markers along the boundary of the Park at a spacing of 800 yards, or as determined by the Marine Park Office. The type of anchor device used will be determined by the substrate where the marker is placed. Signs will be placed on the beach at 100-yard intervals, or as determined by the Marine Park Office, indicating that the offshore waters and beaches to the high water mark (or vegetation line) are within the boundaries of the East End Marine Park. Signs will also be placed along the roads. Signs will indicate any restrictions, per resource use zones. This activity will be implemented by the Marine Park Office, or subcontracted, and completed in Year 1. This activity has a high priority.

Activity 3: Develop Boundary Marker Maintenance Program. A marker maintenance program will be developed and implemented to ensure the upkeep of the boundary markers. This activity will be implemented by the Marine Park Office, or subcontracted, and completed in Year 1, and then be ongoing. This activity has a high priority.

7.1.3 Implementation

Schedule. Table 2 lists the estimated time required to implement each strategy and activity in the Navigational/Boundary Marking Program. Most activities in the strategy are expected to be completed in Year 1. However, the maintenance of markers will be a continuous process.

Costs. The costs associated with implementing the Navigational/Boundary Marking Program are expected to be approximately $350,000 over five years. The bulk of these costs are associated with the placement and maintenance of the markers throughout the Park on both land and sea. The estimated cost of each activity is provided in Table 2. Currently, no funds have been identified for the implementation of these strategies and activities. See Appendix G for detailed annual budgets.

Personnel. It is estimated that the implementation of the Navigational/Boundary Marking Program will require approximately 50 percent of two full-time Park Maintenance staff positions (each position with an annual salary of $25,000, or $25,000 applied to this strategy). These staff positions will also be utilized in the implementation and maintenance of the Zoning Marking Program and Mooring Buoy Program. For budgeting purposes, a 38 percent benefit rate has been added to each annual salary. The benefits package covers employee health, vacation, sick, and retirement benefits. Furthermore, a three percent annual increase in salary has been budgeted.

Equipment. The Navigational/Boundary Marking Program will require the use of a boat for both implementation and maintenance. It is estimated that the Program will require approximately 50 percent of the use of this boat after installation for maintenance ($50,000 total cost for boat, or $25,000 applied to this strategy). This boat will also be utilized in the implementation and maintenance of the Zoning Marking Program and Mooring Buoy Program. It is estimated that the program will require 60 boundary and navigational buoys (for a total cost of $24,000 with installation, or $400 per buoy) and up to 360 signs (for a total maximum cost of $36,000 with installation, or $100 per sign).

Evaluating Program Effectiveness and Efficiency. The effectiveness of the Navigational/Boundary Marking Program will be evaluated based on how many proposed markers are installed and maintained each year. Also, the success of the program will be based on surveys indicating that Park users are aware of the Park boundaries (e.g. survey takers able to identify park boundaries on a map), and based on the number of boat groundings within the Park (e.g. the lower the number of boat groundings the higher the effectiveness of the Navigational Marker Program).

Table 1. Agencies/Organizations Identified for Implementing Navigational/Boundary Marking Program

Strategy/Activity	EEMPO	Army CoE	CZM, DPNR	USCG	NPS
Navigational/Boundary Marking					
Navigational Marking					
Inventory and GeoReference Areas	X		x	x	
Implement Navigational Marker Program	X	x	x	x	
Develop Navigational Marker Maintenance Program	X	x	x	x	
Boundary Marking					
Inventory and GeoReference Areas	X		x	x	x
Implement Boundary Marker Program	X	x	x	x	x
Develop Boundary Marker Maintenance Program	X	x	x	x	x

Table 2. Requirements for Implementation of Navigational/Boundary Marking Program

Strategy/Activity	Overall MPA Priority Level	Year to Complete	Funding Available to Complete	Total 5-year Cost ($1,000)	# of Personnel
Navigational/Boundary Marking					
Navigational Marking				138	0.5
Inventory and GeoReference Areas	High	1	No	10	
Implement Navigational Marker Program	High	1	No	42	
Develop Navigational Marker Maintenance Program	High	1-5	No	86	
Boundary Marking				210	0.5
Inventory and GeoReference Areas	High	1	No	10	
Implement Boundary Marker Program	High	1	No	78	
Develop Boundary Marker Maintenance Program	High	1-5	No	122	

7.2 Enforcement

The primary law enforcement objective in the Park is to achieve resource protection by gaining compliance with the Park regulations, and other Federal and Territorial statutes that apply within the East End Marine Park. An enforcement program is one of the tools available to managers of marine protected areas, and is a Best Management Practice. This program can compliment other management programs, such as research and education, and lead to increased levels of success. Successful enforcement will require resource managers to commit to enforcement programs that are properly supervised and funded. Combined with proper recruitment, training, equipment, policy, and guidelines, these criteria form the basis of a professional law enforcement operation.

The enforcement philosophy should be that preventive enforcement is best achieved by maintaining sufficient patrol presence within the Park to deter violations and by

preventing, through education, inadvertent violations of the law. Successful enforcement relies on frequent water patrols, and routine vessel boardings and inspections. Water patrols will ensure that Park users are familiar with Park regulations, deter willful or inadvertent violations of the law, and provide quick response to violations and/or emergencies. Park officers should have the capability to investigate, document, and assess Park fines.

The success of Park enforcement will depend on how well the enforcement entities on St. Croix are coordinated. Because of limited resources at the Federal, Territorial and Park level, enforcement assets must be targeted and used in an efficient and directed effort to achieve compliance with existing and proposed regulations. The coordination of enforcement assets will be an integral component of the management of the Park. Interagency agreements among other enforcement entities on St. Croix should be developed, including the National Park Service, US Fish and Wildlife Service, US Coast Guard, Virgin Islands Department of Planning and Natural Resources (Enforcement Division) and the Virgin Islands Police Department.

This Action Plan contains only two strategies: the enforcement program and interagency agreements. Implementation of this Action Plan addresses *Incompatible Fishing Practices* as a threat to the health of the management targets.

7.2.1 Enforcement Program

Activity 1: Hire and Train Park Enforcement/Interpretive Officers. Given the need to have a regular presence in the Park, including regular water patrols, it will be necessary to hire at least four Enforcement/Interpretive Officers, one of whom should be made a supervisor of the Enforcement Team. This will permit at least two Enforcement/Interpretive Officers to be on duty seven days a week. Given their intimate knowledge of the Park, the Marine Park Office should seek to hire qualified local fishermen as Enforcement/Interpretive Officers. The Enforcement/Interpretive Officers should receive training as Marine Park Enforcement Officers as well as Marine Park Interpreters. Officers will be the primary contact and information source for Park users and should be well versed in the goals and activities of the EEMP. This activity will be implemented by the Marine Park Office, and completed in Year 1. This activity has a high priority.

7.2.2 Interagency Agreements

Activity 1: Develop Interagency Agreements. An effective Park enforcement program requires the establishment of interagency agreements with the various enforcement entities in St. Croix. These agreements will set forth Federal, Territorial and Park enforcement authority among all officers for enforcement within the Marine Park. Interagency agreements should be established between the Marine Park Office and the National Park Service, US Fish and Wildlife Service, US Coast Guard, Virgin Islands Department of Planning and Natural Resources (Enforcement Division) and the Virgin Islands Police Department. This activity will be implemented by the Marine Park Office

in conjunction with the other agencies and completed in Year 1. This activity has a medium priority.

Activity 2: **Develop Standard Operating Procedures.** This will increase the efficiency and effectiveness of the enforcement efforts. It will establish coordination and cooperation among agencies, and increase interagency communication by: scheduling staff and equipment efficiently among agencies, developing a process for handling violations, and standardizing radio communications. This activity will be implemented by the Marine Park Office, in conjunction with the other agencies, and completed in Year 2. This activity has a low priority.

Activity 3: **Develop Standard Training Program.** A training program should be established to enable various enforcement agencies to educate each other about their respective statutes and codes. This activity will be implemented by the Marine Park Office in conjunction with the other agencies, completed in Year 2, and then be ongoing. This activity has a low priority.

7.2.3 Implementation

Schedule. Table 4 lists the estimated time required to implement each strategy and activity in the Enforcement Program. Most activities in the strategy are expected to be completed by Year 2. However, the Enforcement Program in the Park will be continuous.

Costs. The costs associated with implementing the Enforcement Program are expected to be approximately $1.2 million over five years. The bulk of these costs are associated with the hiring and retention of Enforcement/Interpretive Officers for the Park. The estimated cost of each activity is provided in Table 4. Currently, approximately half the funds for the first two years have been identified for the implementation of these strategies and activities. See Appendix G for detailed annual budgets.

Personnel. The implementation of the Enforcement Program will require four full-time Enforcement/Interpretive Officer staff positions ($30,000 annual salary per officer and $40,000 annual salary for the supervisor). This includes one Enforcement/Interpretive Officer in a supervisory role. For budgeting purposes, a 38 percent benefit rate has been added to each annual salary. The benefits package covers employee health, vacation, sick, and retirement benefits. Furthermore, a three percent annual increase in salary has been budgeted.

Equipment. The Enforcement Program will require a high performance vessel with trailer ($75,000) and vehicle ($25,000). Each Officer will have to be equipped with enforcement gear ($6,000 total). Each Officer must be formally trained ($40,000 total). Potentially, these Officers may be trained at the Florida Marine Patrol Law Enforcement Academy and then participate in annual training programs.

Evaluating Program Effectiveness and Efficiency. A system will have to be designed to evaluate the effectiveness of the Enforcement Program. Evaluations will be done on a monthly and annual basis. Evaluations should be based on the reduction of citations issued for violations of Marine Park rules and regulations, which would indicate increased knowledge of both the Marine Park and its rules and regulations.

Table 3. Agencies/Organizations Identified for Implementing Enforcement Program

Strategy/Activity	EEMPO	USGS	USFWS	NPS	DEE, DPNR	VI PD
Enforcement						
Enforcement Program						
Hire and Train MPA Enforcement/Interpretive Officers	X					
Interagency Agreements						
Develop Interagency Agreements	X	x	x	x	x	x
Develop Standard Operating Procedures	X	x	x	x	x	x
Develop Standard Training Program	X	x	x	x	x	x

Table 4. Requirements for Implementation of Enforcement Program

Strategy/Activity	Overall MPA Priority Level	Year to Complete	Funding Available to Complete	Total 5-Year Costs ($1,000)	# of Personnel
Enforcement					
Enforcement Program				1,202	4
Hire and Train MPA Enforcement/Interpretive Officers	High	1	Some	1,202	
Interagency Agreements				20	
Develop Interagency Agreements	Medium	1	No	5	
Develop Standard Operating Procedures	Low	2	No	5	
Develop Standard Training Program	Low	2	No	10	

7.3 Education & Outreach

The diverse habitats, resources and unique setting of the East End Marine Park offer opportunities for the interpretation of marine tropical environments. Education and outreach strategies fall into two categories: community involvement/community program strategies, and product development strategies. The first group includes education and outreach strategies designed as interactive programs for user groups. Strategies that result in the development of specific products, providing a mechanism for public education and outreach, are included in the second group.

Education and outreach have been used as tools in resource protection throughout the world. The goals of this Action Plan are: (1) to facilitate environmental education opportunities for all segments of society, (2) to promote a holistic view of the Park ecosystem as an interrelated and interdependent system of habitats, (3) to encourage and promote a sense of user stewardship regarding the marine environment, and (4) to promote the awareness of and support for the East End Marine Park. This will be done through community partners in education, outreach, awareness, enforcement, and management. Implementation of this Action Plan directly addresses *Recreation Impacts* and *Incompatible Fishing Practices* as threats to the health of the management targets.

7.3.1 Community Involvement/Community Program

Activity 1: School Programs. The strategy will promote and support environmental education in Territorial schools. Park staff will develop grade-appropriate environmental education materials, provide natural resources field trips, and provide educators with information regarding Park resources. While engaging in this activity, Park staff should take advantage of the network of educators and institutions already in place. This activity will be implemented by the Marine Park Office and completed in Year 2, and then be ongoing. This activity has a high priority.

Activity 2: Special Events. Organize, support, and/or participate in special events that allow for the exchange of Park information. Examples include a large-scale social event to announce the Park's "Grand Opening," or designing and implementing a "Park Awareness Week" designed to raise awareness of the Park, and generate a sense of ownership for the resources of the Park. This activity will be implemented by the Marine Park Office, or subcontracted, and completed in Year 1, and then be ongoing. This activity has a high priority.

Activity 3: Public Forum. Establish a program to ensure public involvement throughout St. Croix in Park activities, by holding public meetings and promoting Park awareness to extracurricular groups. Park staff will make presentations, promoting dialogue between Park staff and the public. This activity will enhance communication between Park staff and the public, provide periodic public input, and provide an opportunity to educate the public about current management issues. This activity will be implemented by the Marine Park Office, or subcontracted, and completed in Year 1, and then be ongoing. This activity has a high priority.

7.3.2 Product Development

Activity 1: Printed Materials. Develop printed materials to inform the public about the impact of their activities, both land and water-related, on the Park's resources and environmental quality. Materials may include brochures, posters, newsletters, and contributions to periodicals. Distribute materials in bulk to high interception locations, such as marinas, dive shops, hotels, airports, tourism offices, and schools. This activity

will be implemented by the Marine Park Office, or subcontracted, and completed in Year 1, and then be ongoing. This activity has a high priority.

Activity 2: **Audio-Visual Materials.** Develop audio-visual materials to educate the public about the impact of their activities, both land and water-related, on the Park's resources and environmental quality. Distribute materials to schools and other public forums. This activity will be implemented by the Marine Park Office, or subcontracted, and completed in Year 1. This activity has a high priority.

Activity 3: **Public Service Announcements.** Establish a program to promote the Park goals and activities through public service announcements in St. Croix that present an overview of the Park, its resources, and their ecological significance, for routine distribution to radio, television and newspapers. This activity will be implemented by the Marine Park Office, or subcontracted, and completed in Year 1, and then be ongoing. This activity has a high priority.

7.3.3 Implementation

Schedule. Table 6 lists the estimated time required to implement each strategy and activity in the Education and Outreach Program. A number of the activities in the strategy are expected to be completed in Year 1. However, Program implementation will be continuous.

Costs. The costs associated with implementing the Education and Outreach Program are expected to be approximately $620,000 over five years. The bulk of these costs are associated with the hiring and retention of Education and Outreach Coordinator for the Park and printing of Park Informational Materials. The estimated cost of each activity is provided in Table 6. No funds have been identified to implement this Program. See Appendix G for detailed annual budgets.

Personnel. The implementation of the Education and Outreach Program will require one full time Education and Outreach Coordinator staff position ($30,000 annual salary).

Equipment. The Education and Outreach Program will require basic office equipment (computer, furniture, etc) and supplies ($7,000).

Evaluating Program Effectiveness and Efficiency. The Education and Outreach Program will be evaluated based on the development of printed materials, audio-visual materials, and public service announcements. The Program will also be evaluated by assessing:

- The demand for information, products and programs;
- The level of media exposure;
- The level of awareness of target audiences (e.g., fishermen, children);
- Public attitudes towards the Park;
- Whether the level of compliance with zoning and regulatory provisions increases or decreases.

Table 5. Agencies/Organizations Identified for Implementing Education/Outreach Program

Strategy/Activity	EEMPO	DFW, DPNR	VIMAS, UVI	TNC	SEA	TOC
Education and Outreach						
Community Involvement/Community Program						
School Programs	X	x	x	x	x	x
Special Events	X	x	x	x	x	x
Public Forum	X	x	x	x	x	x
Product Development						
Printed Materials	X					
Audio-Visual Materials	X					
PSAs	X					

Table 6. Requirements for Implementation of Education and Outreach Program

Strategy/Activity	Overall MPA Priority Level	Year to Complete	Funding Available to Complete	Total 5-Year Costs ($1,000)	# of Personnel
Education and Outreach					
Community Involvement/Community Program				289	1
School Programs	High	2-5	No	239	
Special Events	High	1-5	No	25	
Public Forum	High	1-5	No	25	
Product Development				350	
Printed Materials	High	1-5	No	275	
Audio-Visual Materials	High	1	No	50	
PSAs	High	1-5	No	25	

7.4 Use Regulation

The primary purpose of regulating activities affecting Park resources or characteristics is to protect, preserve, and manage the area's conservation, ecological, recreational, research, educational, historical, and aesthetic resources and characteristics. Another purpose is to minimize conflicts among users of these resources.

The goals of this Action Plan are: (1) to establish a comprehensive and coordinated regulatory program for the East End Marine Park to ensure the protection and use of the Park resources in a manner that complements existing regulatory authorities; (2) to facilitate all public and private uses of the Park that are consistent with the primary objective of resource protection; and (3) to utilize systems of temporal and geographic zoning that will ensure effective, site-specific resource protection, and user management.

The format of this Action Plan is unlike the others in this document. The Action Plan outlines how management strategies should be incorporated into regulations that do not yet exist. In other words, this section outlines proposed regulations specific to the Park that represent Best Management Practices. Furthermore, implementation of this Action Plan directly addresses *Recreation Impacts, Incompatible Upland Development* and *Incompatible Fishing Practices* as threats to the health of the management targets.

7.4.1 Submerged Land Use

Activity 1: Dredging Prohibition. Upon review of existing code, this strategy will prohibit any new dredge and fill activities within the Park. This activity will be implemented by DPNR, and completed after Year 1. This activity has a low priority.

7.4.2 Recreation

Activity 1: Coral Touching. This strategy will protect coral communities from damage by prohibiting coral touching in the Park. This activity will be implemented by DPNR and completed after Year 1. This activity has a medium priority.

7.4.3 Boating

Activity 1: Boat Groundings. Upon review of existing code, a standard response plan will be developed to address boat groundings throughout the Park. This activity will be implemented by DPNR, and completed after Year 1. This activity has a medium priority.

Activity 2: **Pollution Discharges.** Upon review of existing code, this strategy will help avoid further water quality degradation in the Park caused by boaters and live-aboards, by requiring them to use holding tanks and prohibiting the discharge of substances, other than finfish waste and exhaust, into nearshore waters. This activity will be implemented by DPNR, and completed after Year 1. This activity has a low priority.

Activity 3: Special-use Permits. This strategy allows the issuance of Special-use permits to conduct concession-type or commercial activities, including dive shops, guided fishing, and guided tours, within the Park under certain conditions. Activities conducted under Special-use Permits will be monitored, and permit conditions enforced. Individuals and institutions conducting scientific research within the Park will also be required to obtain Special-use permits. As a condition to conduct research in the Marine Park, copies of all research products produced must be provided to the Marine Park Office. Fees collected from the Special-use Permits will be used for operation of the Marine Park. Initially, these fees will be run through DPNR's financial management system. If an independent Park Authority is created, these fees would be run through the Park Authority's central management structure. This activity will be implemented by EEMPO in conjunction with DPNR, and completed after Year 1. This activity has a medium priority.

Activity 4: Salvaging/Towing. This strategy will reduce damage to natural resources resulting from improper vessel salvage methods by developing standard vessel salvage procedures, including: obtaining a permit, notifying authorities, where appropriate, having an authorized observer at the site or receiving permission to proceed, providing operator training, and promoting the use of environmentally sound salvaging and towing practices and techniques. This strategy will also address the removal of existing derelict vessels within the Park. This activity will be implemented by DPNR and completed after Year 1. This activity has a low priority.

Activity 5: Vessel Operations/Personal Watercraft Management. This strategy addresses impacts to Park resources, and conflicts among users of the Park, resulting from vessel operations-- including personal watercraft. This strategy requires the review and revision, if necessary, of existing code to impose a number of restrictions, including: a prohibition on the operation of vessels in a manner which injures coral, seagrasses and hardbottom habitats throughout the Park; on operating vessels carelessly or recklessly; on all vessels from operating at speeds greater than idle speed only; and requirements of no wake in areas designated as "idle speed", no wake within 100 yards of residential shorelines and stationary vessels, or within 100 feet of the red and white "divers down" flag; no wake within 100 yards of navigational aids indicating shallow or emergent reefs; as well as prohibitions on all vessels from operating in such a manner as to injure, harass, or cause disturbance to wading, roosting, or nesting birds or marine mammals. This activity will be implemented by DPNR and completed after Year 1. This activity has a medium priority.

7.4.4 Fishing

Activity 1: Review of Fishing Regulations. This strategy should provide for the review of current VI fishing regulations, and the development of new fisheries regulations in the Park. Regulations should be developed requiring the use of low-impact gear and methods in the Park. Regulations restricting certain types of fishing may be developed. This activity will be implemented by DPNR, Department of Law, National Park Service, and the Fisheries Advisory Council, and completed after Year 1. This activity has a high priority.

Activity 2: Licensing Program. This strategy should provide for the review of the current licensing program, and the design and implementation of a new licensing program, with separate licenses for recreational and commercial fisherman. In addition, it will be necessary to determine the appropriate number of licenses for both recreational and commercial fisherman that may be issued for use. This activity will be implemented by DPNR and the Fisheries Advisory Council, and completed after Year 1. This activity has a high priority.

7.4.5 Implementation

Schedule. Table 8 lists the estimated time required to implement each strategy and activity in the Regulatory Program. All of these activities in the strategy are expected to

be completed by Year 2. However implementation and enforcement of the regulations developed by the Program will be continuous.

Costs. The costs associated with implementing the Regulatory Program are expected to be approximately $325,000 over five years. The bulk of these costs are associated with the hiring of contractors to perform a review of existing Virgin Islands code, the development of new code for the Park, and the hiring of a Licensing Coordinator. The estimated -cost of each activity is provided in Table 8. While no funds have been identified to implement this Program, the implementation of the proposed licensing programs should generate sufficient funds to more than cover the cost of implementing the licensing program, and provide funds to implement other unfunded strategies. See Appendix G for detailed annual budgets.

Personnel. The implementation of the Regulatory Program will require one full-time Licensing Coordinator staff position ($30,000 annual salary). The Licensing Coordinator will be responsible for coordinating both the Special-use and fishing license permits for the Park. For budgeting purposes, a 38 percent benefit rate has been added to each annual salary. The benefits package covers employee health, vacation, sick, and retirement benefits. Furthermore, a three percent annual increase in salary has been budgeted.

Equipment. The Licensing Coordinator will require basic office equipment (computer, furniture, etc.) and supplies ($9,000).

Evaluating Program Effectiveness and Efficiency. The Regulatory Program will be evaluated based on reduced impact to the biological systems within the Marine Park, as measured in the Research and Monitoring Program. Also, the Regulatory Program will be evaluated based on the revenue generated for the operation of the Marine Park, via the Special-use Permitting.

Table 7. Agencies/Organizations Identified for Implementing Regulatory Program

Strategy/Activity	DPNR (CZM, DFW, DEP)	VI Gov't	EEMPO	FAC	DOL	TOC	NPS
Regulatory							
Submerged Land Use							
Dredging Prohibition	X	x	x			x	x
Dredging Regulation	X	x	x			x	x
Recreation							
Coral Touching	X	x	x			x	x
Boating							
Boat Groundings	X	x	x			x	x
Pollution Discharges	X	x	x			x	x
Special-Use Permits	x	x	X			x	x
Salvaging/Towing	X	x	x			x	x
Vessel Operations/PWC Management	X	x	x			x	x
Fishing							
Review of Fishing Regulations	X	x	x	x	x	x	x
Licensing Program	x	x	X	x		x	x

Table 8. Requirements for Implementation of Regulatory Program

Strategy/Activity	Overall MPA Priority Level	Year to Complete	Funding Available to Complete	Total 5-Year Costs ($1,000)	# of Personnel
Regulatory					
Submerged Land Use				**10**	
Dredging Prohibition	Low	2+	No	5	
Dredging Regulation	Low	2+	No	5	
Recreation				**5**	
Coral Touching	Med	2+	No	5	
Boating				**156**	**0.5**
Boat Groundings	Med	2+	No	5	
Pollution Discharges	Low	2+	No	5	
Special-Use Permits	High	2+	No	136	0.5
Salvaging/Towing	Low	2+	No	5	
Vessel Operations/PWC Management	Med	2+	No	5	
Fishing				**151**	**0.5**
Review of Fishing Regulations	High	2+	No	15	
Licensing Program	High	2+	No	136	0.5

7.5 Fisheries Liaison Office

Opening a Fisheries Liaison Office would help to support and promote a shift of commercial fishing from reefs to pelagic/highly migratory species. Catch and release fishing would help to minimize the damage to coral reefs and other marine resources, resulting from incompatible fishing practices within the Park. The Fisheries Liaison Office would focus on such activities as supporting the acquisition and deployment of Fish Aggregation Devices (FADs) outside of the Park, providing training to commercial fisherman as fly fishing guides for catch and release, and identifying opportunities for commercial fishermen.

This plan will further the Park's goal of protecting and managing the Park's natural resources, by shifting fishing from sensitive marine habitats, specifically, coral reef formations and the organisms that rely on them. Furthermore, this plan will provide real economic benefits and options to the fishermen, who rely on the waters inside and outside of the Park, for their economic livelihood. Implementation of this Action Plan addresses *Incompatible Fishing Practices* as a threat to the health of the management targets.

7.5.1 Promote Fishing Pressure Shift

Activity 1: Fisheries Liaison Office. Open a Fisheries Liaison Office, staffed with a Fisheries Liaison Officer. Placement of the Fisheries Liaison Office will need to be determined, but it is suggested that it and its staff be housed in the Department of Planning and Natural Resources. The Fisheries Liaison Officer will be responsible for coordinating its activities with appropriate Federal and Territorial agencies, and the Fisheries Advisory Council. Such activities may include supporting the FAD program, liaising with fishing cooperatives, training opportunities for commercial fishermen such as long-line training, and pursuing opportunities for Virgin Island waters to be opened to hand line fishing of sharks and swordfish. This activity will be implemented by DPNR and completed in Year 1 and then be ongoing. This activity has a high priority.

Activity 2: FADs. Fish Aggregation Devices have been placed in the waters off of St. Croix, outside of the East End Marine Park, successfully shifting fishing pressure away from reefs within the Park. Installing more FADs would continue to aid in the shift of fishing pressure away from reefs within the Park, to pelagic/highly migratory species that are attracted to the FADs. A FAD maintenance program will be developed and implemented to ensure the upkeep of the FADs. This activity will be implemented by the Division of Fish and Wildlife, supported by the newly created Fisheries Liaison Office, and completed in Year 1 and then be ongoing. This activity has a high priority.

Activity 3: **Fly Fishing Guide Training.** Promoting fly fishing of catch and release fish, such as bonefish, tarpon, permit and snook, has been demonstrated as an effective means

of shifting fishing pressure from reefs. Even more important, visiting fly fishermen are willing to pay top dollar for knowledgeable guides. Providing fly fishing guide training to commercial fishermen, who are already knowledgeable of the waters in the Park, and actively promoting fly fishing of catch and release species, will provide alternative income to commercial fishermen, and has even been demonstrated to replace full-time commercial fishing in many instances. This activity will be implemented by the newly created Fisheries Liaison Office, or subcontracted, and completed in Year 1. This activity has a high priority.

7.5.2 Implementation

Schedule. Table 10 lists the estimated time required to implement each strategy and activity in the Fisheries Liaison Office Program. Most of these activities in the strategy are expected to be completed by Year 1. However, the operation of the Fisheries Liaison Office and introduction of FADs will be continuous.

Costs. The costs associated with implementing the Fisheries Liaison Office Program are expected to be approximately $380,000 over five years. The bulk of these costs are associated with the hiring and retention of a Fisheries Liaison Officer staff position. The estimated cost of each activity is provided in Table 10. See Appendix G for detailed annual budgets.

Personnel. The implementation of the Regulatory Program will require one full-time Fisheries Liaison Officer staff position ($40,000 annual salary). This position will be not be placed in the East End Marine Park Office, but instead it is recommended that this position be placed in DPNR. For budgeting purposes, a 38 percent benefit rate has been added to each annual salary. The benefits package covers employee health, vacation, sick, and retirement benefits. Furthermore, a three percent annual increase in salary has been budgeted.

Equipment. The Fisheries Liaison Officer will require basic office equipment (computer, furniture, etc.) and supplies ($5,000). Other equipment needs include five Fish Aggregation Devices (total cost of $25,000 over five years, including installation, or $5,000 per Fish Aggregation Device).

Evaluating Program Effectiveness and Efficiency. The Fisheries Liaison Office Program will be evaluated based on the staffing of the position, the number of FADs placed in the waters around St. Croix, and the number of fishermen trained as fly fishing guides as well as the number of fishermen active as fly fishing guides.

Table 9. Agencies/Organizations Identified for Implementing Fisheries Liaison Office Program

Strategy/Activity	DPNR	FLO	FAC	EEMPO	TOC	CFMC	USFWS	TNC
Fisheries Liaison Office								
Promote Fishing Pressure Shift								
Fisheries Liaison Office	X	x	x		x	x	x	
FADs	X	x	x		x	x	x	
Fly Fishing Guide Training Program	x	X	x	x				x

Table 10. Requirements for Implementation of Fisheries Liaison Office Program

Strategy/Activity	Overall MPA Priority Level	Year to Complete	Funding Available to Complete	Total 5-Year Costs ($1,000)	# of Personnel
Fisheries Liaison Office					
Promote Fishing Pressure Shift					1
Fisheries Liaison Office	High	1-5	No	331	1
FADs	High	1-5	No	25	
Fly Fishing Guide Training Program	High	1	No	25	

7.6 Mooring Buoys

Environmentally safe (i.e., single-point, no chain) mooring buoys have been shown to be an effective management tool, when used to minimize the damage to coral reefs, and other sensitive marine resources, resulting from careless and/or inappropriate anchoring practices. This plan will establish a methodology for identifying areas appropriate for locating mooring buoys, and managing boating activities near coral reefs to minimize negative impacts.

In addition to minimizing anchor damage, the Mooring Buoy Program will also serve to identify areas for certain activities. Specially marked (color-coded) buoys may be used to identify General Mooring Areas, Research Areas, Recreational Diving Areas, and Fishing Areas. These areas may also be identified through the boundary marking system, with the ultimate goal being clearly defined and marked resource use zones. If implemented, the use of Research, Diving, and Fishing buoys may require a permit issued by the Marine Park Office.

The mooring buoy Action Plan will further the Park's goal of protecting and managing the Park's natural resources; by minimizing the impact to sensitive marine habitats, specifically coral reef formations, caused by the inappropriate use of anchors, and

providing reasonable access to Park resources, consistent with the primary goal of resource protection, and managing or restricting human activities where such activities are found to have a detrimental impact on Park resources. Implementation of this Action Plan addresses *Recreation Impacts* as a threat to the health of the management targets.

7.6.1 Mooring Buoy Program

Activity 1: Inventory and GeoReference Areas Requiring Mooring Buoys. Work in conjunction with marinas, yacht clubs, dive shop operators, fishermen and other resource users of the Park, to identify areas that require mooring buoys within the Park. A major component of this activity will include the development of a GIS database of buoy locations. This activity will be implemented by the Marine Park Office, or subcontracted, and completed in Year 1. This activity has a medium priority.

Activity 2: **Implement Mooring Buoy Program.** Based on the results of Activity 1, place mooring buoys within the Park. This activity will be implemented by the Marine Park Office, or subcontracted, and completed in Year 1. This activity has a medium priority.

Activity 3: **Develop Mooring Buoy Maintenance Program.** A buoy maintenance program will be developed and implemented to ensure the upkeep of the navigational markers. This activity will be implemented by the Marine Park Office, or subcontracted, and completed in Year 1 and then be ongoing. This activity has a medium priority.

7.6.2 Implementation

Schedule. Table 12 lists the estimated time required to implement each strategy and activity in the Mooring Buoy Program. Most activities in the strategy are expected to be completed in Year 1. However, the maintenance of the buoys will be a continuous process.

Costs. The, costs associated with implementing the Mooring Buoy Program are expected to be approximately $195,000 over five years. The bulk of these costs are associated with the placement and maintenance of the buoys throughout the Park. The estimated cost of each activity is provided in Table 12. Currently, no funds have been identified for the implementation of these strategies and activities. See Appendix G for detailed annual budgets.

Personnel. It is estimated that the implementation of the Mooring Buoy Program will require approximately 25 percent of two full-time Park Maintenance staff positions (each position with an annual salary of $25,000, or $12,500 as applied to this strategy). These staff positions will also be utilized in the implementation and maintenance of the Zoning Marking Program and Navigational/Boundary Marking Program. For budgeting purposes, a 38 percent benefit rate has been added to each annual salary. The benefits package covers employee health, vacation, sick, and retirement benefits. Furthermore, a three percent annual increase in salary has been budgeted.

Equipment. The Mooring Buoy Program will require the use of a boat for both implementation and maintenance. It is estimated that the Program will require approximately 25 percent of the use of this boat ($50,000 total cost for boat, or $12,500 as applied to this strategy). This boat will also be utilized in the implementation and maintenance of the Zoning Marking Program and Navigational/Boundary Marking Program. It is estimated that the program will require 100 mooring buoys (for a total cost of $40,000 with installation, or $400 per buoy).

Evaluating Program Effectiveness and Efficiency. The effectiveness of the Mooring Buoy Program will be evaluated based on how many mooring buoys are installed and maintained each year. Also, the success of the program will be based on usage of the mooring buoys and lack of anchor damage in the Park (as determined by the number of citations issued for use of anchors restricted areas in the Park).

Table 11. Agencies/Organizations Identified for Implementing Mooring Buoy Program

Strategy/Activity	EEMPO	DEE, DPNR	DFW, DPNR	Marinas
Mooring Buoys				
Mooring Buoy Program				
Inventory and GeoReference Areas Requiring Mooring Buoys	X	x	x	x
Implement Mooring Buoy Program	X	x	x	x
Develop Mooring Buoy Maintenance Program	X	x	x	x

Table 12. Requirements for Implementation of Mooring Buoy Program

Strategy/Activity	Overall MPA Priority Level	Year to Complete	Funding Available to Complete	Total 5-Year Costs ($1,000)	# of Personnel
Mooring Buoys					
Mooring Buoy Program				194	0.5
Inventory and GeoReference Areas	Med	1	No	10	
Implement Mooring Buoy Program	Med	1	No	70	
Develop Mooring Buoy Maintenance Program	Med	1-5	No	114	

7.7 Water Quality

Water quality has a critical role in maintaining Park resources. This plan addresses point and non-point sources of pollution, in the hope of maintaining the chemical, physical, and

biological integrity of the Park; including the maintenance of a balanced, indigenous population of fish, corals, other invertebrates, and recreational activities in and on the water.

This Action Plan's goals are the protection and improvement of Park water quality and enhancement of living resources. The plan proposes many activities to achieve these goals, such as reducing anthropogenic loading (wastewater and stormwater) to Park waters, and water quality issues related to marinas and live-aboards, and hazardous materials. It also addresses means of reducing development pressures on critical coastal wetlands and watersheds that feed into the East End Marine Park, by developing a "Comprehensive Coastal Wetland and Watershed Protection Plan for the East End of St. Croix." This will be done through a coordinated effort of Federal, Territorial and local non-governmental organizations. Implementation of this Action Plan addresses *Incompatible Upland Development,* and *Recreation Impacts* as threats to the health of the management targets.

7.7.1 Domestic Wastewater

Activity 1: Water Quality Standards. Upon reviewing current standards, this activity will identify and evaluate indicators (biochemical and ecological measures to provide early warning of widespread ecological problems) in each type of ecosystem. Examples are C:N:P ratios (Carbon:Nitrogen:Phosphorus), alkaline phosphatase activity, and shifts in community structure by habitat. These measures could be incorporated into the current water quality monitoring program, and could provide the basis for resource-oriented water quality standards (biocriteria) for the Park. This activity will be implemented by the Division of Environmental Protection and completed after Year 1. This activity has a high priority.

Activity 2: Resource Monitoring of Surface Discharges. Upon reviewing current standards, this activity would help to evaluate environmental impacts of point source discharges, by requiring all non-point permitted surface dischargers to develop resource-monitoring programs within watersheds that drain into the Park. This activity may be implemented by requiring resource monitoring when individual non-point source permits come up for renewal, or new permits are issued. This activity will be implemented by the Division of Environmental Protection and completed after Year 1. This activity has a low priority.

7.7.2 Stormwater

Activity 1: Stormwater Permitting. Based on a review of existing stormwater permitting, require that no development in watersheds that drain into the East End Marine Park be exempted from the stormwater permitting process. This strategy would require that the Virgin Islands ordinances cover all developments, with no exemptions from the stormwater permitting process within the Park watersheds. This activity will be implemented by DPNR and completed in Year 1. This activity has a high priority.

Activity 2: **Stormwater Management (Guts, Roads, Etc.).** Upon reviewing current standards, enact and implement stormwater management ordinances and comprehensive stormwater management master plans. This strategy would help to reduce stormwater pollutant loading (sediment, toxics, and nutrients). Currently, there is little regulation of stormwater runoff in the watersheds of the East End Marine Park. This activity will be implemented by DPNR and completed in Year 1. This activity has a high priority.

Activity 3: **Stormwater Retrofitting.** Within the watersheds of the East End Marine Park, identify and develop a plan for retrofitting stormwater hotspots using best management practices, such as grass parking, swales, pollution control structures, and detention/retention structures. Control stormwater runoff in areas handling toxic and hazardous materials. This activity will be implemented by DPW and completed over five years. This activity has a low priority.

7.7.3 Marinas & Live Aboards

Activity 1: Pollution Discharges. Reduce pollution discharges, such as sanitary wastes, debris, and hydrocarbons from vessels operating in the Park, through enforcement and/or a public education campaign. Establish the East End Marine Park, or portions of the Park, as a No-Discharge Zone(s). Criteria for consideration as a No-Discharge Zone include water circulation, concentration of boats in the area, percentage of boats with Type I or II marine sanitation devices, and impacts on fishing and swimming areas. Identify enforcement procedures and responsibilities. This activity will be implemented by the Division of Environmental Protection in conjunction with the Marine Park Office, and completed after Year 1. This activity has a low priority.

Activity 2: **Marina Pumpout.** Identify a facility within the Park to have a pump-out station. This strategy will eliminate marina live-aboard vessels as a source of pollution in the Park. Identify enforcement procedures and responsibilities. This activity will be implemented by the Division of Environmental Protection in conjunction with the Marine Park Office, and completed after Year 1. This activity has a low priority.

Activity 3: **Marina Operations.** Reduce pollution from marina operations within the Park by establishing containment areas for boat maintenance, encouraging marina owners to participate in environmentally-oriented organizations such as the International Marina Institute, and encouraging marina owners to provide a user manual with local environmental information. Within the Park, it would be required that containment areas for boat maintenance, such as hull scraping and repainting, mechanical repairs, fueling, and lubrication, would be paved and curbed. This activity will be implemented by the Division of Environmental Protection and completed after Year 1. This activity has a low priority.

7.7.4 Hazardous Materials

Activity 1: HAZMAT Response. Upon review of existing code, develop oil and hazardous materials response programs for the Park. This strategy will reduce the

chances that a spill of oil or other hazardous materials will have a significant negative impact on Park resources. Improve coordination among Federal and Territorial agencies responding to spills. This activity will be implemented by the Division of Environmental Protection in conjunction with the Marine Park Office and other Federal and Territorial agencies, and completed after Year 1. This activity has a medium priority.

Activity 2: **Spill Reporting.** Establish a reporting system to ensure that all spills in and near the Park are reported to Park managers. Establish a geo-referenced Park spills database. This activity will be implemented by the Division of Environmental Protection in conjunction with the Marine Park Office and other Federal and Territorial agencies, and completed after Year 1. This activity has a low priority.

Activity 3: **HAZMAT Handling.** Conduct an assessment and inventory of hazardous materials handling and use in and near the Park, including facilities, types and quantities of materials, and transport/movement. Add information to GIS database. This activity will be implemented by the Division of Environmental Protection in conjunction with the Marine Park Office and other Federal and Territorial agencies, and completed after Year 1. This activity has a medium priority.

7.7.5 Watershed & Coastal Wetlands Protection

Activity 1: Development of a Comprehensive Coastal Wetland and Watershed Protection Plan. Using a science and community based methodology, this activity will identify those upland watersheds and coastal wetlands that are critical to protecting the integrity of the waters of the Park. This should be undertaken as a coordinated effort between Federal, Territorial and local non-governmental organizations. Critical upland watersheds and coastal wetlands could then be protected via the use of conservation easements and/or fee simple purchase. The Federal government makes available to states and territories funds for upland watershed and coastal wetland protection, via the Land and Water Conservation Fund (L&WCF), the Forest Legacy Act (FLA), and the North America Wetlands Conservation Act (NAWCA). These funds may be used for the purchase of conservation easements and/or fee simple purchase. As these funds often require a local and/or private match, a coordinated effort with local conservation oriented non-governmental organizations to raise matching funds is essential. This activity will be implemented by the Marine Park Office, or subcontracted, and completed over five years. This activity has a high priority.

7.7.6 Implementation

Schedule. Table 14 lists the estimated time required to implement each strategy and activity in the Water Quality Program. All of these activities in the strategy are expected to be completed by Year 2. However implementation and enforcement of the regulations developed by the Program will be continuous.

Costs. The costs associated with implementing the Water Quality Program are expected to be approximately $160,000 over five years. The bulk of these costs are associated

with the hiring of contractors to perform a review of existing Virgin Islands code, and/or develop new code or plans for the Park. The estimated cost of each activity is provided in Table 14. See Appendix G for detailed annual budgets.

Evaluating Program Effectiveness and Efficiency. The Water Quality Program will be evaluated based on the development (and implementation) of new codes and plans, addressing the various water quality issues affecting the Park. The Program will also be evaluated on water quality data collected (e.g., the higher the water quality, the higher the effectiveness of the program).

Table 13. Agencies/Organizations Identified for Implementing Water Quality Program

Strategy/Activity	DEP, DPNR	VI Gov't	EEMPO	EPA	NOAA	USFS	SEA	TOC	TNC
Water Quality									
Domestic Wastewater									
Water Quality Standards	X	x	x	x	x			x	
Resource Monitoring of Surface Discharges	X	x	x	x	x			x	
Stormwater									
Stormwater Permitting	X	x	x	x	x			x	
Stormwater Management (Guts, Roads, Etc.)	X	x	x	x	x			x	
Stormwater Retrofitting	X	x	x	x	x			x	
Marinas & Live Aboards									
Pollution Discharges	X	x	x	x	x			x	
Marina Pumpout	X	x	x	x	x			x	
Marina Operations	X	x	x	x	x			x	
Hazardous Materials									
HAZMAT Response	X	x	x	x	x			x	
Spill Reporting	X	x	x	x	x			x	
HAZMAT Handling	X	x	x	x	x			x	
Watershed & Coastal Wetlands Protection									
Develop Comprehensive Plan		x	X			x	x	x	x

Table 14. Requirements for Implementation of Water Quality Program

Strategy/Activity	Overall MPA Priority Level	Year to Complete	Funding Available to Complete	Total 5-Year Costs ($1,000)	# of Personnel
Water Quality					
Domestic Wastewater				20	
Water Quality Standards	High	2+	No	10	
Resource Monitoring of Surface Discharges	Low	2+	No	10	
Stormwater				60	
Stormwater Permitting	High	1	No	10	
Stormwater Management (Guts, Roads, Etc.)	High	1	No	25	
Stormwater Retrofitting	Low	1-5	No	25	
Marinas & Live Aboards				15	
Pollution Discharges	Low	2+	No	5	
Marina Pumpout	Low	2+	No	5	
Marina Operations	Low	2+	No	5	
Hazardous Materials				35	
HAZMAT Response	Med	2+	No	10	
Spill Reporting	Low	2+	No	5	
HAZMAT Handling	Med	2+	No	20	
Watershed & Coastal Wetlands Protection				30	
Develop Comprehensive Plan	High	1-5	No	30	

7.8 **Zoning**

Marine zoning is a management tool that has been used around the world to protect sensitive marine resources from overuse, and to separate conflicting visitor uses. Marine zoning is being implemented in the East End Marine Park to assist in the protection of biological diversity of marine environments of the East End of St. Croix. In addition, marine zoning will disperse uses of the resources to reduce user conflicts, and lessen the concentrated impact to marine organisms on heavily used reefs. As a management tool, marine zoning allows Park managers to focus the majority of their management efforts on a small portion of the Park, while addressing water quality and habitat degradation in the broader un-zoned portions of the area (see Appendix H for SCMP-1 map).

This plan outlines the process for establishing the zones and represents *Best Management Practices,* as well as addressing *Incompatible Fishing* and *Recreation Impacts* as threats to the health of the conservation targets.

7.8.1 Zoning Marking Strategy

Activity 1: Inventory and GeoReference Areas Requiring Zoning Boundary Markings. Using GIS, identify zoning boundaries within the Park. A major component of this activity will include the development of a GIS database of marker locations. This activity will be implemented by the Marine Park Office, or subcontracted, and completed in Year 1. This activity has a high priority.

Activity 2: **Implement Zoning Boundary Marking Program.** Place markers along the boundary of the marine zoning areas at a spacing of 800 yards, or as determined by the Marine Park Office. The type of anchor device used will be determined by the substrate where the marker is placed. This activity will be implemented by the Marine Park Office, or subcontracted, and completed in Year 1. This activity has a high priority.

Activity 3: Develop Zoning Boundary Marker Maintenance Program. A marker maintenance program will be developed and implemented to ensure the upkeep of the boundary markers. This activity will be implemented by the Marine Park Office, or subcontracted, and completed in Year 1, and then be ongoing. This activity has a high priority.

7.8.2 Implementation

Schedule. Table 16 lists the estimated time required to implement each strategy and activity in the Resource Zone Marking Program. Most activities in the strategy are expected to be completed in Year 1. However the maintenance of the markers will be a continuous process.

Costs. The costs associated with implementing the Resource Zone Marking Program are expected to be approximately $150,000 over five years. The bulk of these costs are associated with the placement and maintenance of the markers throughout the Park. The estimated cost of each activity is provided in Table 16. Currently, no funds have been identified for the implementation of these strategies and activities. See Appendix G for detailed annual budgets.

Personnel. It is estimated that the implementation of the Resource Zone Marking Program will require approximately 25 percent of two full time Park Maintenance staff positions (each position with an annual salary of $25,000, or $12,500 as applied to this strategy). These staff positions will also be utilized in the implementation and maintenance of the Mooring Buoy Program and Navigational/Boundary Marking Program. For budgeting purposes, a 38 percent benefit rate has been added to each annual salary. The benefits package covers employee health, vacation, sick, and retirement benefits. Furthermore, a three percent annual increase in salary has been budgeted.

Equipment. The Resource Zone Marking Program will require the use of a boat for both implementation and maintenance. It is estimated that the Program will require

approximately 25 percent of the use of this boat ($50,000 total cost for boat, or $12,500 as applied to this strategy). This boat will also be utilized in the implementation and maintenance of the Mooring Buoy Program and Navigational/Boundary Marking Program. It is estimated that the program will require 40 marking buoys (for a total cost of $16,000 with installation, or $400 per buoy).

Evaluating Program Effectiveness and Efficiency. The effectiveness of the Resource Zone Marking Program will be evaluated based on how many markers are installed and maintained each year. Also, the success of the program will be based on surveys indicating that Park users are aware of the Park Resource Zone boundaries (e.g., survey takers able to identify park boundaries on a map) and based on the number of citations made in the Park for Resource Zone violations.

Table 15. Agencies/Organizations Identified for Resource Zone Marking Program

Strategy/Activity	EEMPO	NPS
Zoning		
Resource Zone Marking Program		
Inventory and GeoReference Areas	X	x
Implement Zoning Boundary Marking Program	X	x
Develop Zoning Marker Maintenance Program	X	x

Table 16. Requirements for Implementation of Resource Zone Marking Program

Strategy/Activity	Overall MPA Priority Level	Year to Complete	Funding Available to Complete	Total 5-Year Costs ($1,000)	# of Personnel
Zoning					
Resource Zone Marking Program				149	0.5
Inventory and GeoReference Areas	High	1	No	10	
Implement Zoning Boundary Marking Program	High	1	No	46	
Develop Zoning Marker Maintenance Program	High	1-5	No	93	

7.9 **Research** & **Monitoring**

Monitoring is essential to achieve the primary goal of resource protection. The purpose of monitoring is to, first, establish a baseline of resources, processes, and functioning of the ecosystem against which standards for resource protection can be measured; and second, to assess the status and trends of the ecological resources. Monitoring provides a

means to anticipate future problems before they require expensive solutions. Although Research and Monitoring should be considered as an Action Plan, monitoring efforts are currently underway in association with this project. Because specific research and monitoring activities will be employed to directly measure the success of the Marine Park, they are addressed in a separate chapter. Therefore, the next section (Chapter 8) identifies specific types of monitoring that should occur in addition to current efforts, as well as general recommendations.

7.9.1 Biological Monitoring

Activity 1: Develop Biological Monitoring Protocol. This activity will establish a monitoring protocol specific to the Marine Park, to ensure regular data collection intervals and consistent methodologies. This protocol will include marine communities to be monitored, as well as types of data to be collected. This protocol will also serve as the guide for baseline data that must be collected on the date of, or prior to, Park implementation. Because this activity is the foundation of success-measuring activities, this activity should be completed during Year 1. This activity has a high priority.

Activity 2: Identify Biological Monitoring Sites. This activity will establish the permanent monitoring sites that Park biologists will survey for marine community health. Using GIS, these sites will be easy to locate and made available on general Marine Park maps. This activity should be completed during Year 1. This activity has a high priority.

Activity 3: Implement Biological Monitoring Program. This activity will immediately follow the identification of monitoring sites. According to the monitoring protocol that is developed, this activity will produce critical data about marine resources within the Park. Data collection should begin immediately in order to establish baseline data. Analysis of data collected will assist Park managers in determining the direction of management practices. This activity should be completed during Year 1. This activity has a high priority.

Activity 4: Review and Revise Management Practices. This activity will provide an opportunity for Park managers to review analyzed data and determine whether modifications to management practices are necessary. Park managers are responsible for actively responding to changing ecological trends. These responses may range from making changes in management practices and Park zoning, to sharing the successes of the Park with the general public. This activity should be completed after Year 2. This activity has medium priority.

7.9.2 Resource Use/User Monitoring

Activityl: Develop Resource Use/User Monitoring Protocol. This activity will establish a monitoring protocol specific to the Marine Park that will ensure regular data collection intervals and consistent methodologies. The purpose of this activity is to characterize both the public response in both activities and perception to the implementation of the Marine Park. This protocol will include zones to be monitored, as

well as types of data to be collected. This protocol will also serve as the guide for baseline data that must be collected at the start of, or prior to, Park implementation. Because this activity is the foundation of success measuring activities, this activity should be completed during Year 1. This activity has a high priority.

Activity 2: **Implement Resource Use/User Monitoring Program.** According to the monitoring protocol that is developed, this activity will produce critical data about resource uses within the Park. Data collection should begin immediately in order to establish baseline data. Analysis of data collected will assist Park managers in determining the direction of management practices. This activity should be completed during Year 1. This activity has a high priority.

Activity 3: **Review and Revise Management Practices.** This activity will provide an opportunity for Park managers to review analyzed data and determine whether modifications to management practices are necessary. Park managers are responsible for actively responding to changing resource-use trends. These responses may range from making changes in management practices and Park zoning, to sharing the successes of the Park with the general public. This activity should be completed after Year 2. This activity has medium priority.

7.9.3 Fishing Activity Monitoring

Activity 1: Develop Fishing Activity Monitoring Protocol. This activity will establish a monitoring protocol specific to the Marine Park that will ensure regular data collection intervals and consistent methodologies. This protocol will include fishing methods to be monitored as well as types of data to be collected. This protocol will also serve as the guide for baseline data that must be collected at the start of, or prior to, Park implementation. Because this activity is the foundation of success measuring activities, this activity should be completed during Year 1. This activity has a high priority.

Activity 2: **Implement Fishing Activity Monitoring Program.** According to the monitoring protocol that is developed, this activity will produce critical data about fishing activities within the Park. Data collection should begin immediately in order to establish baseline data. Analysis of data collected will assist Park managers in determining the direction of management practices. This activity should be completed during Year 1. This activity has a high priority.

Activity 3: Review and Revise Management Practices. This activity will provide an opportunity for Park managers to review analyzed data and determine whether modifications to management practices are necessary. Park managers are responsible for actively responding to changing fishing trends. These responses may range from making changes in management practices and Park zoning, to sharing the successes of the Park with the general public. This activity should be completed after Year 2. This activity has medium priority.

7.9.4 Marine Park Database

Activity 1: Develop Monitoring Database. This activity will establish a central database system to be used by Park managers and scientists. The database system will be designed to meet the needs of Park managers by keeping information in a central location and increasing the efficiency of data analysis. This activity will be implemented by the Marine Park Office, or subcontracted, and completed in Year 1. This activity has a high priority.

Activity 2: Manage Monitoring Database. This activity will ensure regular data entry and analysis of monitoring data collected by Park managers and scientists. Regular management of this database is required to ensure the integrity and comprehensiveness of information collected about the Marine Park. Managers will coordinate with researchers given permission to work within the Park to ensure inclusion of all data being collected. This activity will be implemented by the Park scientists, or subcontracted, and completed in Year 1. This activity has a high priority.

7.9.5 Implementation

Schedule. Table 18 lists the estimated time required to implement each strategy and activity in the Research and Monitoring Program. Most activities in the strategy are expected to be completed in Year 1. However implementation of the various monitoring program activities will be a continuous process.

Costs. The costs associated with implementing the Research and Monitoring Program are expected to be approximately $700,000 over five years. The bulk of these costs are associated with the hiring of a Field Biologist and Assistant Field Biologist for the Park. The estimated cost of each activity is provided in Table 18. Currently, approximately half the funds have been identified for the implementation of these strategies and activities in the first two years of the Management Plan. See Appendix G for detailed annual budgets.

Personnel. The implementation of the Research and Monitoring Program will require two full-time positions - a Field Biologist ($40,000 annual salary) and an Assistant Field Biologist ($25,000 annual salary). For budgeting purposes, a 38 percent benefit rate has been added to each annual salary. The benefits package covers employee health, vacation, sick, and retirement benefits. Furthermore, a three percent annual increase in salary has been budgeted.

Equipment. The Research and Monitoring Program will require the full-time use of a boat ($60,000) for implementation of the Program activities. The two full-time positions will also require basic office equipment (i.e., computers, office furniture) and monitoring equipment ($25,500).

Evaluating Program Effectiveness and Efficiency. The effectiveness of the Research and Monitoring Program will be evaluated based on the establishment and quality of

baseline data, the collection of biological and resource use data, and the successful development of a Marine Park database.

Table 17. Agencies/Organizations Identified for Research & Monitoring Program

Strategy/Activity	EEMPO	DFW, DPNR	NPS	USFWS	UVI
Research & Monitoring					
Biological Monitoring					
Develop Biological Monitoring Protocol	X	x	x	x	x
Identify Biological Monitoring Sites	X	x	x	x	x
Implement Biological Monitoring Program	X	x	x	x	x
Review & Revise Management Practices	X	x	x	x	x
Resource Use/User Monitoring					
Develop Resource Use Monitoring Protocol	X	x	x	x	x
Implement Resource Use Monitoring Program	X	x	x	x	x
Review & Revise Resource Use Mgmt Practices	X	x	x	x	x
Fishing Activity Monitoring					
Develop Fishing Activity Monitoring Protocol	X	x	x	x	x
Implement Fishing Activity Monitoring Program	X	x	x	x	x
Review & Revise Fishing Activity Mgmt Practices	X	x	x	x	x
Marine Park Database					
Develop Monitoring Database	X	x	x	x	x
Manage Monitoring Database	X	x	x	x	x

Table 18. Requirements for Implementation of Research and Monitoring Program

Strategy/Activity	Overall MPA Priority Level	Year to Complete	Funding Available to Complete	Total 5-Year Costs ($1,000)	# of Personnel
Research & Monitoring					
Biological Monitoring				233	0.67
Develop Biological Monitoring Protocol	High	1	Some	5	
Identify Biological Monitoring Sites	High	1	Some	5	
Implement Biological Monitoring Program	High	1	Some	213	
Review & Revise Management Practices	Med	2+	Some	10	
Resource Use Monitoring Protocol				233	0.67
Develop Resource Use Monitoring Protocol	High	1	Some	10	
Implement Resource Use Monitoring Program	High	1	Some	213	
Review & Revise Resource Use Mgmt Practices	Med	2+	Some	10	
Fishing Activity Monitoring				233	0.67
Develop Fishing Activity Monitoring Protocol	High	1	Some	10	
Implement Fishing Activity Monitoring Program	High	1	Some	213	
Review & Revise Fishing Activity Mgmt Practices	Med	2+	Some	10	
Marine Park Database					
Develop Monitoring Database	High	1	Some		
Manage Monitoring Database	High	1	Some		

7.10 Marine Park Administration

Effective Marine Park administration requires the hiring of a site manager, who will be responsible for interpreting and implementing the Management Plan. The site manager will be responsible for achieving management objectives through the efficient use of funds, staff and equipment. He or she must lead the process of evaluating and re-evaluating conservation needs, identifying and reconciling visitor use conflicts, defining annual management objectives, revising annual budgets, and in selecting and managing suitable staff. Furthermore, the site manager should have a familiarity with and an understanding of the East End Marine Park resources and an ability to communicate effectively with local people and visitors. The site manager will also have the initial responsibility of opening the new East End Marine Park Office, equipping the office, and hiring staff.

7.10.1 Opening of East End Marine Park Office

Activity 1: Open East End Marine Park Office. Open an East End Marine Park Office, staffed with a Marine Park Director and Administrative Assistant (Figure 2). It is

suggested that two different locations be considered for the physical placement of the East End Marine Park Office. Both Cramer's Park and the old West Indies Lab have the potential to serve as office space and/or laboratory space that is fundamental to the functionality of the Park. There is a vacant, unused building of approximately 1,200 square feet located at Cramer's Park, suitable for remodeling as the East End Marine Park Visitor's Center. Cramer's Park is a suitable location for the East End Marine Park Visitor's Center, as it is located on U.S.V.I. government property, it is centrally located, and Cramer's Park receives numerous visitors thereby permitting Marine Park staff to interact with local residents and visitors alike on a regular basis. Interagency agreements between DPNR and Housing, Parks and Recreation would need to be developed prior to any activity by the Marine Park Office at Cramer's Park. It is suggested that interpretive boards be placed at Cramer's Park, identifying the Park boundaries and use zones, the rational for the Park, and identification of key species and systems that the Park is designed to protect and enhance. It is further suggested that a dock be constructed at Cramer's Park to allow for docking of Marine Park boats.

Initially, it is assumed that the financial management for East End Marine Park funds will be provided by DPNR. This includes the financial management of any fees collected under special use permits and fishing licenses. In the future, if an independent Park Authority were created, this function would be centrally managed by the Park Authority and not by the separate Territorial Park offices. It is also assumed that any funds generated via user fees within the East End Marine Park would be applied towards the management costs of the Park. Similarly, liability and property insurance for Marine Park Office staff and equipment would be covered under the Virgin Islands government policy. In the case of an independent Park Authority, this issue would have to be reexamined. This activity will be implemented by DPNR and will be completed in Year 1. This activity has a high priority.

7.10.2 Implementation

Schedule. Table 20 lists the estimated time required to implement each strategy and activity in the Marine Park Administration. Most activities in the strategy are expected to be completed in Year 1. However, administration of the Park will be a continuous process.

Costs. The costs associated with implementing the Marine Park Administration are expected to be approximately $935,000 over five years. The bulk of these costs are associated with the hiring and retention of a Marine Park Director and Administrative Assistant and associated new office costs. The estimated cost of each activity is provided in Table 20. Currently, funds have been identified for the implementation of these strategies and activities. See Appendix G for detailed annual budgets.

Personnel. The implementation of the Marine Park Administration will require two full time staff positions - a Marine Park Director ($60,000 per year annual salary) and Administrative Assistant ($30,000 per year annual salary). For budgeting purposes, a 38 percent benefit rate has been added to each annual salary. The benefits package covers

employee health, vacation, sick, and retirement benefits. Furthermore, a three percent annual increase in salary has been budgeted.

Equipment. The Marine Park Administration will require the use of two vehicles ($50,000) and office equipment and furniture ($25,000) as well as remodeling of the vacant office at Cramer Park ($50,000) and construction of a dock ($50,000).

Evaluating Program Effectiveness and Efficiency. The effectiveness of the Marine Park Administration will be evaluated based on success of implementation of all before mentioned strategies and activities.

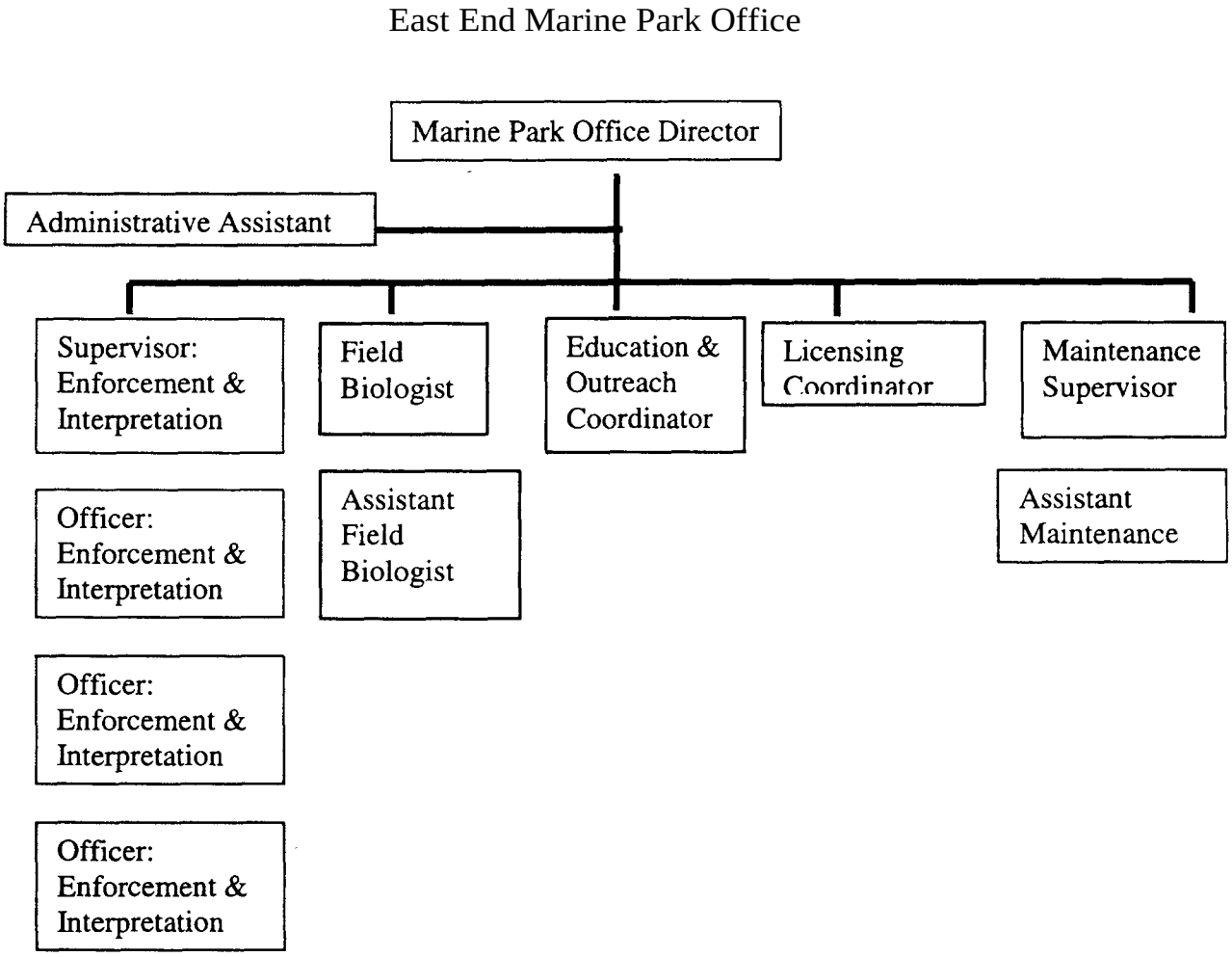
Table 19. Agencies/Organizations Identified for Opening of East End Marine Park Office

Strategy/Activity	CZM, DPNR	EEMPO	DHR
Opening of East End Marine Park Office			
Open East End Marine Park Office			
Open East End Marine Park Office	X	x	x

Table 20. Requirements for Implementation of Opening of East End Marine Park Office

Strategy/Activity	Overall MPA Priority Level	Year to Complete	Funding Available to Complete	Total 5-Year Costs ($1,000)	# of Personnel
Opening of East End Marine Park Office					
Open East End Marine Park Office				934	2
Open East End Marine Park Office	High	1	Some	934	

Figure 2. Organizational Chart



7.11 Action Plan Summary

A simple matrix has been created in order to link the Action Plans developed within this Management Plan, to the threats identified during community workshops. In addition to threats linkages, certain Action Plans are also identified as Best Management Practices. This matrix provides a quick reference to how threats have been addressed within this Management Plan.

Table 21. Threats vs. Action Plans Matrix

	Navigational & Boundary Marker	Enforcement	Education & Outreach	Regulatory	Fisheries Liason Office	Mooring Buoys	Water Quality	Zoning	Research & Monitoring
Incompatible Fishing		X	X	X	X			X	
Incompatible Development			X	X			X		
Recreational Impacts	X	X	X	X		X	X	X	
Best Management Practice	X	X	X	X		X	X	X	X

8. Monitoring and Measuring Success

Site evaluation and monitoring should be a continuous process, with regular reporting intervals and a formal evaluation mechanism. All monitoring plans should include acceptable limits of change. The monitoring program will provide managers with fundamental information with which to make decisions, and will facilitate a flexible approach, as well as a responsive management system. A comprehensive review by the Park office, performed on at least a biannual basis, will help to ensure that implementation is occurring as planned, and highlight needed revisions to management procedures. In addition to internal review, an external team of reviewers can provide important insights with more objectivity, and is highly recommended every 5 years. Also, working in collaboration with university scientists will help fill in gaps in current knowledge of the marine communities surrounding St. Croix. In addition to university scientists, it is important to prioritize collaborations with other agencies in the U.S.V.I. Many of the study parameters listed in this section will require such collaborations and every effort to maximize resources will benefit the Marine Park. Site monitoring activities will be guided by the following objectives:

- Establish a baseline within the respective use-zones within the Park, thus providing a means for measuring success in the future
- Collect Park utilization data to be part of a social and cultural analyses and used to modify and enhance park regulations and activities
- Collect biological data that are representative of the status and health of marine organisms and their respective habitats
- Collect fisheries data that quantify fishing trends (i.e., fishing methods, species caught, amount caught, etc.) within Park boundaries

8.1 Baseline Data

Current coral reef monitoring efforts by DPNR and the University of the Virgin Islands are providing valuable information for planners and managers. As mandated by contract with DPNR, reef monitoring in the area will be as outlined in *Monitoring of Coral Reefs in the U.S. Virgin Islands.* Ultimately, these data shall be incorporated into the final Management Plan, and will help to provide necessary baseline data to evaluate the effects of establishment of the Park. Currently, the monitoring plan calls for regular monitoring of 10 sites around St. Croix. However, only one site at the East End (Jack/Isaac Bay) is listed as a monitoring site, with a mention of possibly adding Great Pond Bay in the near future. In order to quantify the success of the Park, as well as to develop a database specific to the East End, it is critical to monitor additional sites within the Park. These data will also help define acceptable limits of change. It is recommended that monitoring proceed at the Jack/Isaac Bay site and the Great Pond Bay site, with at least two more sites being added in the next monitoring cycle. Such baseline data are also necessary for the other monitoring activities highlighted here (i.e., park use and fishing activities). As discussed in Section 7.9.4, a Park Monitoring Database will be developed to store baseline data as well as all data collected in the future.

8.2 Suggested Monitoring Activities

In addition to monitoring efforts discussed in Section 8.1, a list of monitoring activities was developed during the community workshops in order to expand and improve the information available to scientists and community members. This brainstorming of ideas was meant to identify gaps in current information. The preliminary list (see below) includes monitoring of seagrass and mangrove communities, in addition to the current reef monitoring. These suggestions should be considered when Park managers develop monitoring protocols (see Section 7.9). As new information is revealed, further additions may be necessary.

- Begin regular monitoring of seagrass communities
- Begin regular monitoring of hardbottom communities
- Begin regular monitoring of mangrove communities
- Expand turtle nesting monitoring to include habitat utilization monitoring
- Develop reef fish monitoring program with dive operators and fishermen
- Characterize land use impacts (i.e., sedimentation rates)
- Characterize beach profiles (i.e., shoreline dynamics)
- Characterize current dynamics

8.3 Indicators of Marine Community Health

The following indicators/measures will help to provide a comprehensive description of community health, and enable managers to respond quickly in the event of declining conditions. Some of these indicators will be more difficult to incorporate into a monitoring plan, and some will likely be part of other research efforts. Those that are most feasible should be prioritized in order to maximize monitoring efforts, and are identified here. Parameters listed describe the physical habitat found within the respective community type, as well as the inhabitants in terms of densities, diversity, and size.

* Indicates priority parameters
** Indicates critical parameters (i.e., parameters/indicators that should be monitored at the minimum)

8.3.1 Mangrove Communities

Fish & Invertebrate density, diversity, and biomass**
Herbivorous fish density**
Predatory fish density**
Mangrove species distribution, abundance, and size*
Bird community composition**
Nutrient levels*
Sedimentation**

8.3.2 Seagrass Communities

Fish & Invertebrate density, diversity, and biomass**
Herbivorous fish density**
Nutrient levels*
Sedimentation**
Light attenuation**
Primary Productivity

8.3.4 Coral Reef Communities

Diadema density**
Elkhorn coral recovery
Fish & Invertebrate density, diversity, and biomass**
Herbivorous fish density**
Predatory fish density**
Coral diseases **
Nutrient levels*
Sedimentation*
Light attenuation*
Live coral percent cover**
Macroalgal diversity and percent cover*

Because the list of parameters to be measured is extensive, it is necessary to consider different methods of obtaining this information. The Marine Park Office will be responsible for the collection and analyses of these data, but will likely not have the resources to collect all the necessary data. The Marine Park Office should collaborate with scientists that have research interests within the Park. That is, for each priority issue to be addressed, scientists should work with Park managers to formulate specific questions that are to be resolved through subsequent scientific investigations.

8.4 Methods of Measurement

Monitoring activities will be carried out by Park Field Biologists. In addition to these personnel, monitoring may be subcontracted as the work requires. Previously developed standardized methods of collection for the types of data described here, should be utilized in order to maintain consistency and facilitate regional comparisons. Interagency cooperation will increase the continuity of conservation and management efforts within the U.S.V.I.. *Coral Reef Monitoring Manual for the Caribbean and Western Atlantic*, developed by the U.S.V.I. National Park Service, in conjunction with regional experts from different organizations, provides a thorough description of the methodologies and issues related to long-term coral reef monitoring. This and similar documents should be used by monitoring personnel, upon Department of Planning and Natural Resources approval. Methods for long-term seagrass monitoring are available (see J. Zieman papers for examples). Wherever standard methodologies are not available, an interagency workgroup should develop appropriate methods to be applied regionally.

The timing and frequency of monitoring activities should be consistent with, or complement, other regional monitoring efforts. In order to provide a complete representation of community health and changing trends, monitoring data should be collected twice per year. In the event of catastrophic changes such as a massive die-off, monitoring frequency should be modified to fit the system of concern.

The process of determining monitoring site location should aim to meet the following criteria/goals:

- Site is representative of community type
- If site is degraded, potential for recovery is high
- Site is easy to access and locate
- Control sites available meet same criteria

In order to provide the necessary comparisons and replications, it is critical that the same sites are sampled every year. Furthermore, a range of site conditions should be represented in the site portfolio. The monitoring manual developed by the National Park Service recommends permanent sites for long-term monitoring, because they offer the greatest amount of information, consistency, repeatability, and reliability. Regular training of personnel will ensure consistency in data collection. Personnel should have familiarity with the sites and issues within the Park, and be a permanent part of the Park team.

9. KEY INFORMATION AND DATA GAPS

9.1 Description of Priority Information Gaps

In designing a Management Plan, planners must make decisions based on the information available. Often this forces planners to make broad generalizations where information is lacking, and to forecast the potential effects of future actions. In this situation, we have relied upon the information available, as well as general information about the marine communities that occupy the waters surrounding St. Croix. During the process, key data that are lacking have been identified and, in some cases, plans to obtain them are already in place. In order for this Management Plan and the resulting Park to be effective, more information is required. This document should be viewed as a "living document" that will grow and be modified as new information is revealed. This section will provide guidance for further development of the Management Plan, by identifying areas that require further information, as well as initiatives that need to be developed and expanded. Although some of these data are already available for historical context and comparison, updated information is needed in order for the Management Plan to be current and effective. These information gaps have been organized in the following categories: Scientific Data and Community and Resource Use Information.

* Indicates priority information needs
** Indicates critical information needs (i.e., information that must be obtained to make management decisions)

Scientific Data:

- Water Nutrient Levels
- Expand Water Quality Monitoring Sites
- Sedimentation Rates**
- Air Quality
- Gut Characteristics-Description and Drainage Analysis
- Invertebrate Density and Diversity Surveys for: coral reefs, seagrass communities, and mangrove communities**
- Fish Density and Diversity Surveys for: coral reefs, seagrass communities, and mangrove communities**
- Macroalgae Abundance and Diversity Surveys for: coral reefs, seagrass communities, and mangrove communities**
- Expand Benthic Monitoring Sites (including deeper reefs) **
- Larval Distribution and Recruitment Surveys*
- Fish Aggregation Site Surveys**
- Coral Recruitment and Growth Surveys
- Coral Disease Surveys**
- Benthic Community Maps (verified by field surveys)
- Restoration Feasibility Study*

Community and Resource Use Information:

- General Socioeconomic Analysis**
- Commercial and Recreational Fishing Trends**
- Tourism Trends
- Dive Operation Survey and Analysis**
- Boat Use Survey*
- Historic and Cultural Resource Analysis*

9.2 Addressing the Information Gaps

Because the gaps in information and scientific data are numerous, and the effort required to address each one is significant, those that are most feasible and information rich should be addressed first. In prioritizing information gathering activities, expansion of current data collection activities is likely to be simpler and more cost effective than embarking on new efforts. In several cases, similar activities are underway in St. Thomas and St. John, allowing for collaboration and more readily available resources. Whenever possible, sharing information, methodologies, and resources between islands should occur. It is recommended that a comprehensive, multi-site, long-term, benthic community monitoring program be implemented within the Marine Park. Data collected from these efforts should be stored and maintained in the Marine Park database. This will provide managers with the quantitative information required to protect and preserve the marine resources in the Park. Furthermore, recognizing that the agencies involved suffer from a shortage of staff and funding, efforts to identify alternative funds and staff to accomplish these tasks are necessary. Interagency collaboration will increase the amount and quality of information collected.

10. FINANCIAL RESOURCES

The East End Marine Park requires financial support to pay personnel, build and maintain infrastructure, and manage natural resources. Lack of funds is a major impediment to the creation and management of Marine Parks. Most governments recognize their obligations to ensure sufficient resources are provided to achieve Management Plan objectives, but government budgets are often taxed to meet existing needs, such as schools, hospitals and other essentials. While it is important that the U.S.V.I. government provide some level of long-term support to demonstrate its commitment to the Marine Park, the trend is to allow protected area agencies to generate at least part of their own revenue, especially from tourism. Once the East End Marine Park Office has raised the money, it should be permitted to keep it for Park management. This will reduce the U.S.V.I. government's cost of administering the East End Marine Park.

Outside of direct government funding, possible means of funding protected areas include:

- User Fees: This could include fees from divers, researchers, leases of moorings, and sale of fishing licenses. Bonaire Marine Park in the Netherlands Antilles is almost entirely funded by visitor fees.
- Environmental Trust Fund: This fund could be capitalized via a debt reduction between States that can lead to the creation of trust funds as a condition for debt forgiveness. This fund can also be capitalized via a tourism head tax. These trust funds are usually national, or territorial, in nature. Usually, interest earned on the principal is paid out from the trust to help cover the cost of administering a national, or territorial, park system. For example, the Environmental Fund of Jamaica was created via a debt-swap between the U.S. government and the Government of Jamaica to help fund conservation work in Jamaica. In Belize, a $10 per tourist tax is paid into the Protected Areas Conservation Trust to provide funds for the management of Belize's protected areas.
- Create a Friends Organization: This can capitalize on the goodwill of visitors. This can cover locals and tourists who want to help the Marine Park. The Friends Organization can be incorporated as Non-Profit Organization, thereby making any donations received tax deductible. The Friends of the National Park of St. John is an excellent local example.

10.1 Funding Levels Required

The total five-year funding need for the East End Marine Park is approximately $5.0 million dollars. The annual operating expense is approximately $850,000, with the exception of the first year with a budgeted operating expense of approximately $1.6 million. This includes a capital (equipment) need of approximately $360,000 in the first year to purchase boats, vehicles, remodel the vacant Cramer Park building as the East End Marine Park office, and build a dock as well as numerous contract fees to finalize certain aspects of the Management Plan. See Appendix G for detailed annual budgets.

Table 22. Five-year Funding Need by Action Plan

Action Plan	Year 1	Year 2	Year 3	Year 4	Year 5	Total
Navigational/Boundary Marking	$ 139,500	$ 50,535	$ 51,602	$ 52,700	$ 53,830	***$348,167***
Enforcement	$ 369,400	$ 204,782	$ 210,325	$ 216,035	$ 221,916	***$1,222,458***
Education and Outreach	$ 160,400	$ 117,642	$ 118,921	$ 120,239	$ 121,596	***$638,798***
Regulatory	$ 75,400	$ 93,642	$ 49,922	$ 51,238	$ 52,596	***$322,798***
Fisheries Liaison Office	$ 95,200	$ 68,856	$ 70,562	$ 72,319	$ 74,128	***$381,065***
Mooring Buoys	$ 79,750	$ 27,768	$ 28,301	$ 28,850	$ 29,415	***$194,084***
Water Quality	$ 90,000	$ 70,000				***$160,000***
Zoning	$ 58,250	$ 21,768	$ 22,301	$ 22,850	$ 23,415	***$148,584***
Research and Monitoring	$ 221,200	$ 122,891	$125,663	$ 128,519	$ 131,459	***$729,732***
Administration	$ 319,200	$ 147,926	$ 151,764	$ 155,717	$159,788	***$934,395***
Total	***$ 1,608,300***	***$ 925,810 ,***	***$ 829,361***	***$ 848,467***	***$ 868,143***	***$5,080,081***

10.2 Current Funding

To date, approximately $800,000 has been identified for implementation of the East End Marine Park Management Plan. This leaves a funding gap of approximately $4.2 million over five years for the implementation of this Management Plan.

Approximately $400,000 has been identified for implementation of the first year of the East End Marine Park Management Plan. It is expected that another approximately $400,000 will be available for implementation of the second year of the East End Marine Park Management Plan.

All of these funds are from a grant from the U.S. Department of Commerce. It is possible that further funds may be identified for specific activities within other departments and divisions of the Virgin Islands government, especially for implementation of the Regulatory and Water Quality Action Plans.

Of the $4.2 million funding gap, it has been recommended that a number of the Action Plans be implemented by other agencies. It is not known whether these agencies have the funds available to implement. For example, it has been recommended that the Regulatory Action Plan be implemented by DPNR for a total five-year cost of approximately $323,000. It has been recommended that the Fisheries Liaison Office Action Plan be implemented by the DPNR for a total five-year cost of approximately $381,000. Finally, it has been recommended that the Water Quality Action Plan be implemented by the Division of Environmental Protection, DPNR for a total five-year cost of $160,000. These Action Plans total $860,000 over five-years, thereby reducing the funds needed directly by the Marine Park Office to implement the Management Plan to approximately $3.3 million. If these agencies do not have the funds to implement these Action Plans, it would behoove the Marine Park Office to assist these agencies in seeking funding for these Action Plans, otherwise the overall success and efficiency of the Marine Park will be reduced.

Furthermore, there are some activities that have historically been undertaken by existing DPNR agencies, with discreet funding sources, that could be used to implement the recommended activities in this Management Plan. For example, the Division of Fish and Wildlife has provided funds for the installation of mooring buoys throughout the territory. Future DFW funds for this activity could be directed towards the installation of mooring buoys in the Marine Park, thereby reducing some of the operating expenses for the Marine Park Office.

10.3 Long-term Sustainable Funding

As outlined previously, long-term sustainable funding of the East End Marine Park requires the development of a comprehensive user fee system to provide funding to implement this Management Plan. This Management Plan has identified mooring buoy, diver, research, and fishing license fees as potential long-term sources of sustainable funding for the Marine Park. Again, it is important to state that any funds generated via user fees within the Marine Park, remain available to the Marine Park for implementation of the Management Plan. In the next sections, each user fee source will be analyzed for its potential to generate long-term funding. The final section addresses the creation of a Marine Park Fund, funded by a minimal tourism tax, to provide long-term sustainable funding for the operation of the entire future U.S.V.I. Territorial Park System.

Mooring Buoys. It is estimated that there are approximately 50 privately owned mooring buoys already in the East End Marine Park, all of which are located in the Yacht Club Harbor. These mooring buoys were installed and are currently maintained by private owners. Currently, these private owners pay an annual leasing fee to the Department of Environmental Enforcement, with these fees going towards its operations. It is recommended that for those buoys located in the Park, these funds would now be directed towards the Marine Park Office for its operations.

It is estimated that it would be necessary to add another 100 mooring buoys to the East End Marine Park. A survey should be conducted to determine an actual number of additional mooring buoys required in the Park, based on need. The annual leasing fee for a buoy, as well as related details, would be set after further public input.

Research Fees. It is estimated that approximately 10 marine research projects are conducted within the Marine Park on an annual basis. The cost of a research permit would be set after further public input.

Diver Fees. Currently, no dive shops operate within the Marine Park. This is due to the lack of mooring buoys for divers as well as a lack of having identified suitable areas within the Marine Park for diving. It is assumed that any mooring buoys put in specifically for diving would be placed in areas identified as dive locations by dive shops. It is further assumed that the dive shops would then lease these mooring buoys. These leasing fees would be captured under the mooring buoy fee structure above.

Fishing Licenses. It is not recommended that separate fishing licenses be developed for use in the Marine Park. Once the current fishing license program has been reviewed and a new program has been adopted, it is recommended that some portion of the revenues generated from the fishing license program be directed towards the operations of the East End Marine Park. Until this review at the territorial level has occurred and a new program developed, it is impossible to determine what funds might be generated from the implementation of an annual territorial fishing license program that could then be directed towards the operations of the East End Marine Park.

For example, according to the Sport Fish Restoration Act that currently provides funding to the Division of Fish and Wildlife, any income from recreational fishing licenses must be available either for administration of the fisheries agency administering the Sport Fish grants (DFW) or for the enforcement of fishing regulations. It is recommended that some portion of the revenues generated by recreational fishing licenses should be directed towards the enforcement operations within the East End Marine Park. Again, at this point in time, it is impossible to determine what funds might be generated from this.

Marine Park Fund. A tourist head tax directed towards an environmental trust fund, collected from every visitor to the U.S.V.I., and with approximately 2.8 million visitors per year, could generate millions per year. This would cover the annual operating cost of implementing the East End Marine Park Management Plan as well as implementing future Territorial Parks.

11. FUTURE PLANNING NEEDS

11.1 Education and Outreach Program

Throughout the planning process, the need for a comprehensive and effective educational program was emphasized. This Management Plan outlines several specific types of activities that provide a framework for the development of such a program (see Section 7.3). This Plan lays out the format (i.e., public forums, printed materials, public events, etc.), however it does not address the specific content that should be included in the various formats or a method for evaluating the effectiveness of such a program. In order for these materials to be effective, the development of a formal Education and Outreach Plan is necessary. Such development should begin immediately, and should be complete at the time of Park implementation. This effort is intended to engage various user groups and community members, by providing much needed information about how the Park will affect and ultimately benefit the community of St. Croix. This initiative can be a collaboration of interested institutions and community members, or be performed by an independent contractor. Suggested subjects or themes to be addressed in the Education and Outreach Program include:

- The uniqueness of the marine resources surrounding St. Croix
- Overview of the functionality of the system, with emphasis on the fragility of the system
- Socioeconomic analysis developed through the Park System Project
- Funding available for implementation of this initiative
- The economic and cultural benefits gained by the implementation of this Plan
- Potential sites identified for the Marine Park System
- The potential outcomes of successful Park implementation
- Where are we headed without a formal Park System?

11.2 User Management Plan

Development of a formal User Management Plan is necessary to address potential overuse and exploitation by recreational and commercial users. Recognizing that resources are finite and cannot sustain unlimited use is key to successful Park use management. Before a User Management Plan can be developed, a comprehensive assessment of current user activities should be completed. The following activities occur within Park boundaries currently:

- **Commercial Fishing:** Netting, trapping, hook and line, spear fishing, diving for conch and lobster
- **Recreational Fishing:** Hook and line, spear fishing, diving for conch and lobster
- **Diving:** Both tour operators and private boats
- **Snorkeling:** Both tour operators and private boats
- **Jet Skiing:** Privately owned

- **Wind Surfing:** Both rented and privately owned
- **Kayaking:** Both rented and privately owned
- **Sailing:** Both rented and privately owned
- **Motor Boating:** Both rented and privately owned
- **Anchoring:** All boat types
- **Beach Camping:** Primarily local residents

The details of these activities need to be quantified and synthesized. It is likely that other activities will be identified during this process. Data collected in the monitoring process will be used to make decisions with regard to user-group activities. Once the socio-economic analysis is completed, efforts to define acceptable limits of change, carrying capacity, user volumes, and user satisfaction in terms of aesthetics and recreational value should begin. These components of Park management can be developed, reviewed periodically, and modified as appropriate. In the beginning of Park implementation, the precautionary principle may be used. After the first two years of Park implementation, Park use will be documented and decisions will be informed.

11.3 Standard Operating Procedures

This Management Plan addresses the issues and activities of the Marine Park Office in a broad sense. In order for the Marine Park Office to operate in an efficient and consistent manner, Standard Operating Procedures (SOPs) must be developed. These SOPs will serve as a reference for all activities conducted by Park staff. They should anticipate events related to user/visitor conflicts as well as protocols for data collection, storage, and analyses. SOPs function to provide the details of daily operations and should be developed during, or prior to, the implementation of the Marine Park.

11.4 Emergency/Disaster Planning

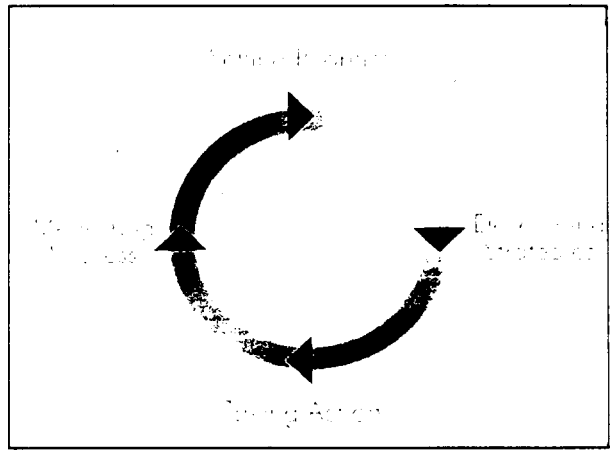
Disaster planning is fundamental to the functionality of the Marine Park. This Plan outlines specific activities that address events such as hazardous material spills. However, other types of emergencies and disasters are not covered within this Plan. A formal Emergency/Disaster Plan is necessary, and should be developed during, or prior to, the implementation phase of the EEMP. Such a plan should be incorporated into the Final Management Plan for the EEMP. Suggested subjects include:

- Chain of command
- Event-specific protocols
- Decision-making guidelines
- Staff responsibilities during and after an event
- Damage assessment protocol
- Equipment logistics (i.e., usage, storage, recovery)
- Interagency coordination (Federal and Territorial)
- Financial requirements

Appendix A: An Introduction to the Five-S Framework' for Site Conservation

The Nature Conservancy's Conservation Process

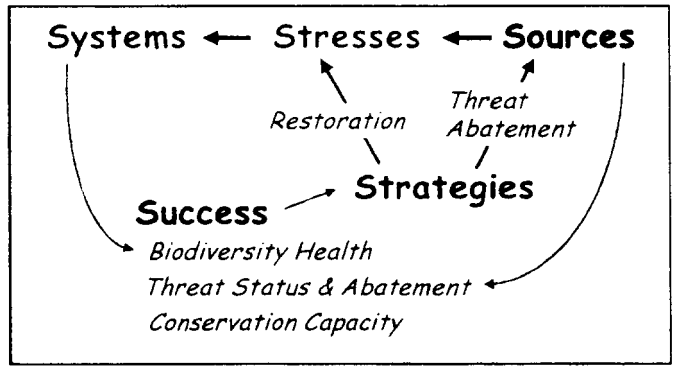
To achieve the goal of long-term sustained conservation at important sites throughout the globe, The Nature Conservancy and its partners employ an integrated conservation process comprised of four fundamental components:



- **Setting priorities through ecoregional planning**
- **Developing strategies to conserve conservation areas through site conservation planning**
- **Taking direct conservation action**
- **Measuring conservation success**

For developing strategies at conservation areas where TNC takes action directly or through partnerships, the 5-S Framework of Site Conservation Planning is used. This methodology provides a well-tested conceptual model to develop effective strategies that achieve tangible conservation results.

The Five-S Framework



The 5-S approach focuses upon the following components:

- **Systems**
- **Stresses**
- **Sources of Stress**
- **Strategies**
- **Success Measures**

Systems are the conservation targets and supporting ecological processes that will be the focus for Site Conservation Planning and measuring conservation success. Targets include *species* (imperiled, endangered, declining, rare or of special concern), *major groupings of species (e.g.* globally significant species aggregations), *ecological communities* (groupings of co-occurring species), and *ecological systems.* Ecological systems are assemblages of communities that occur together on the landscape, are linked by environmental processes, and form a robust, cohesive, and distinguishable unit on the

The term "Five-S " refers to the five elements of the framework used by The Nature Conservancy in Site Conservation Planning; those five elements begin with letter "S" in English *(systems, stresses, sources, strategies,* and *success).*

ground. Systems are chosen to represent all the biodiversity at the site – including terrestrial, freshwater, and marine biodiversity.

Once targets are identified, the **Viability,** or ecological integrity, of each target is assessed at the site according to three criteria: *Size, Condition,* and *Landscape Context. Size* reflects the area or abundance of the conservation target – such as the area covered by an ecological community or ecosystem, or the population size of a species-level target. *Condition* is a measure that integrates composition, structure and biotic interactions of a particular target. *Landscape Context* is an integrated measure of the dominant environmental regimes (e.g., fire, flood) and the connectivity of habitat patches and the access/availability of the target to vital resources needed for long-term survival and reproduction.

Stresses, the second "S", are the types of destruction or degradation affecting conservation targets and reducing their viability. The damage may occur directly to a target, or indirectly to an ecological process important to sustaining the target.

Sources of Stress are the causes or agents of destruction or degradation. These are the human activities, typically uses of land, water or other natural resources, which cause stresses. Each stress has at least one source and stresses often have multiple sources. The Conservancy's approach is to focus upon those proximate sources of stress that can be abated with practical strategies. Some sources of stress are on-going or "active"; others may be historical. With historical sources, the stresses can persist even in the absence of an active source, such as disruptions to a wetland's hydrology, that persist long after the drainage of the wetland has ceased.

The assessment of Systems, Stresses, and Sources of stress leads to a listing of critical threats for a conservation area. Threats are a combination of a source and the stress it causes to a system. Critical threats are those with the greatest impact upon the targets at a conservation area, and their priority is determined through the application of the Site Conservation Planning/Measures of Success methodology.

Based on the identified critical threats, site-planning teams have developed conservation **Strategies.** Strategies are the broad action paths necessary to abate critical threats and enhance the viability of conservation targets. Strategies have two broad objectives:

- **Threat abatement:** eliminate active sources of stress (subsequent reduction in stress and increase in viability)
- **Ecological Management and Restoration:** directly eliminate stress and enhance viability.

Having identified priority strategies, Action Plans were developed to accomplish the strategies. It should be emphasized that TNC provided a format in which workshop participants could play an active role in the development of this Management Plan. Much of the content of this Management Plan is a direct product of the efforts of workshop participants.

Appendix B: Conservation Targets and Stresses: An Overview

Identify main conservation targets

In order to conserve and manage environmental resources, it is important to first identify and understand the important community types and species that characterize the area of concern. This includes an understanding of the natural processes that maintain these entities, providing the basis for all subsequent steps in site planning. During community workshops, a list of species and community types was compiled using the following category types as a guideline.

Ecological communities: Groupings of co-occurring species, as defined at the finest operational level of a community classification hierarchy.

Spatial assemblages of ecological communities or systems: Communities may be aggregated into dynamic assemblages or complexes that (1) occur together on the landscape; (2) are linked by ecological processes, underling environmental features (e.g., soils, geology, topography), or environmental gradients (e.g., elevation, precipitation, temperature); and (3) form a robust, cohesive, and distinguishable unit on the ground.

Species: Types of species targets include:

- Imperiled and endangered native species
- Species of special concern due to vulnerability, declining trends, disjunct distributions, or endemic status within a region
- Focal species, including keystone species, wide-ranging (regional) species, and umbrella species
- Major groupings of species that share common natural processes or have similar conservation requirements
- Globally significant examples of species aggregations

The purpose of identifying these `targets' in site planning is to guide strategic planning at the site. It is important that these focal targets represent and capture the species and communities that are fundamental to ecosystem function at the site. It is important to note that the overall goal should be an ecosystem that is resilient to disturbance. An ecosystem with an intact trophic structure and redundance in ecological function will be able to withstand the effects of hurricanes and other natural events (i.e., disease outbreaks). Whereas, an ecosystem missing important components such as a healthy predator or herbivore population will be much more likely to collapse in response to natural disturbances. Striving for this balance in marine communities should be the theme when considering each component of a particular ecosystem and will ideally provide an "insurance policy" for potential disasters. The systems and species of concern for the EEMP are listed below. General descriptions and rationale for including them as focal targets can be found in the following section.

Management Targets

Sea Turtles
Parrot Fish
Aggregating Fish Predators
Seagrass Communities
Mangroves/Salt Ponds
Coral Reefs

Sea Turtles

Sea turtles are unique on this list of systems and species of concern in that the category only represents two species. While historically, sea turtles were of great economic importance as a food source, their place as a staple in the diet of Caribbean islanders has been lost due to dramatic declines in sea turtle populations. Sea turtle populations around the world have experienced these dramatic losses, and as a group are considered close to extinction. International treaties as well as local, provincial, and national laws provide protection to sea turtles. The Endangered Species Act of 1973 prohibits killing, harming, and harassment of six species of turtles, including the species that inhabit the beaches and waters of St. Croix. Although sea turtles spend only a small portion of their life cycle on beaches, their time there is critical to the survival of future generations of sea turtles. Both the green turtle *(Chelonia mydas)* and the hawksbill turtle *(Eretmochelys imbricata)* use the beaches on the East End of St. Croix for nesting grounds. Researchers monitoring turtle nesting at East End Bay, Isaac Bay, and Jack Bay have recently seen an increase in the number of green turtles coming to nest, while hawksbill numbers continue to decline (see MacKay and Rebholz studies).

Because researchers are generally limited to data collected during nesting, very little is known about the life cycle of sea turtles. Their migration patterns and routes continue to be a mystery, and often scientists must rely on chance encounters to fill in these gaps in knowledge. Identifying where turtles reside when they are not nesting and mating continues to be the goal of many research efforts. It is known however, that turtles tend to mate near their nesting beaches, as well as demonstrate fidelity to the beaches from which they hatched. This is important when considering actions taken that aim to conserve turtle populations. Female turtles will nest several times during nesting season, often returning to the same beach every time. Observations have revealed that nesting turtles remain within one mile of the beach that they are nesting on (Z. Hillis-Starr pers. comm.). Because this is such a critical time in the turtle's life history, great efforts should be made to protect turtles from disturbance and injury, both in and out of the water. Known anthropogenic stresses to nesting turtles include: turtle poaching, egg poaching, nest crushing via vehicles driving over nests, and predation by introduced species (i.e., mongoose and dogs).

Four key factors which can be controlled by effective management are critical to the long-term preservation of nesting turtles on St. Croix:

First, eliminate vehicular traffic on nesting beaches. Limiting access to the East End beaches, will effectively abate this destructive threat. Illegal roads continue to provide easy beach access, and efforts to block these roads has only been marginally successful.

Second, identify the beaches as important nesting habitat for sea turtles using clearly marked signs. Providing this information to the public will help them take an active role in ensuring the future existence of a nesting population on St. Croix, by leashing their dogs and avoiding the area during peak nesting periods.

Third, set aside waters that extend from nesting beaches as marine reserves in order to minimize disturbance during nesting and mating periods. Because these activities occur year-round, it is important that these be permanent reserves, and not seasonal as it has been suggested by some.

Fourth, increase the level of monitoring and enforcement to deter both poaching of turtles and their eggs. As well, reduce or eliminate lighting near nesting beaches. Current monitoring activities seem to be minimizing the amount of poaching, as well as potentially deterring the use of East End beaches for illegal activities such as drug smuggling (Good 1999).

Parrot Fish

Parrot fish in the family Scaridae, along with tangs and doctor fish in the family Acanthuridae, are the two most important herbivorous fish families on Caribbean reefs in terms of density, biomass, and impact on the macrophyte community. We have chosen parrot fish as a target species for conservation because of the important role they play in the ecological community, and because they are under strong fishing pressure in the U.S.V.I., as well as the rest of the Caribbean. Although Acanthurids experience similar intense fishing pressures, and have been suggested to play an equally important role in structuring reef communities; the focus of this conservation target will be parrot fish, because diversity in this group is an order of magnitude greater. Critically, though, all conservation strategies proposed for the preservation of parrot fish will equally protect surgeon fish, as they are designed to protect habitat, and not to limit take of specific species. Since Acanthurids are sympatric with parrot fish, we will assume that efforts taken to protect parrot fish will also protect Acanthurids in a similar manner.

Parrot fish are ecologically and economically important for a variety of reasons. First, they are a primary fish sought by local fisherman for sale at local markets. Second, encounters with these impressive, and often colorful fish are the focus of many eco-tourism dives/snorkels; most sponsored by large hotels, resorts and local merchants, which bring much needed money into the local economy. Third, parrot fish play an integral yet often overlooked, role in maintaining the structure of important, shallow-water communities. For example, it has been suggested by many studies that by suppressing the abundance of fast-growing algae, herbivorous fish indirectly facilitate the persistence of coral reefs. Conservation of these fish will thus benefit the local economy in a variety of ways, and likely facilitate the persistence of important, shallow-water reef

communities. However, like any effective conservation plan, the management design for the long-term preservation of these fishes must be based on an accurate understanding of the animal's life history.

The parrot fish species, which inhabit the shallow waters of St. Croix, range in size from the four-foot rainbow to the six-inch green blotch, and can be found primarily in three habitats: reefs, seagrasses and mangroves. The dominant and most common parrot fish in coral reef communities include: stoplight *(Sparisoma viride),* queen *(Scarus vetula),* midnight blue *(Scarus coelestinus),* red-band *(Sparisoma aurofrenatum),* princess *(Scarus taeniopterus),* and at times blue *(Scarus coeruleus)* and rainbow *(Scarus guacamaia)* parrot fish. However, it should be noted that due to various trends in fishing and environmental disturbances, these fish are not present in great abundance in the waters surrounding St. Croix. Many of these same species can be found during the day, foraging on algae and turtle grass in nearby flats. These species return to the reef at night however, for protection from predators. Again, although this is their habitat, certain species of parrot fish may presently be difficult to locate in St. Croix waters due to reductions in the population. Those species that live almost exclusively in seagrass habitat include: bucktooth *(Sparisoma radians),* striped *(Scarus croicensis),* green blotch *(Sparisoma atomarium),* redtail *(Sparisoma chrysopterum),* redfin *(Sparisoma rubripinne),* and the blue lip *(Cryptotomus roseus).* However, studies conducted by the V.I. Division of Fish and Wildlife have only identified bucktooth parrot fish in significant numbers (W. Tobias, pers. comm.). Mangrove communities, although not primary habitats for adult parrots, are important nursery grounds for many parrots including rainbows, blues, queens, and striped. Successful conservation of parrot fish must then incorporate preservation of not only coral reef and seagrass habitats for adult fish, but also mangrove communities, which act as critical nursery areas for vulnerable juvenile stages. In essence, conservation efforts must take on a landscape level approach.

Parrot fish are unique among all reef fishes in their ability to consume fleshy as well as heavily calcified algae. In addition, a variety of parrot fish (e.g., red-band, stoplight, red-finned queen, striped, and especially the bucktooth) will consume seagrasses which are both epiphitized and unepiphitized. Parrot fish as a group display considerable plasticity in their diets of macrophytes, and are usually large in population size and, at times, in individual biomass. For these reasons it is not surprising that a variety of scientific studies have pointed to their keystone role as important top-down agents, affecting the distribution and abundance of seagrass and macroalgae across flats and coral reef communities.

Three key factors which can be controlled by effective human management are critical to the long-term preservation of parrot fish on St. Croix:

First: Permanent no-take zones which incorporate large tracts (km x km) of barrier reef, patch reef, and fore reef must be established. For future planning, it is critical that the deep fore reef area also be included, as this contains most of the large fish that contribute a disproportionate amount of gametes to spawning aggregations. These no-take zones must also incorporate seagrass habitats used by various species of parrot fish as foraging

and resident areas. Too many no-take zones have failed by just protecting the reef. Intermingled in these areas should be take zones, which allow for commercial and recreational fishing.

Second: There needs to be a strong effort to conserve the critical nursery habitats described above (seagrass and mangrove habitats). Without such efforts, the juvenile life stage of these fish will soon become a bottleneck in their population numbers.

Third: Educational outreach to local fishermen, discussing the benefits of no-take areas to the long-term preservation of their historic fisheries and coral reef communities, must be a constant and never-ending goal. Without their support, little in regards to conservation can be accomplished. *It must be emphasized again and again the importance of co-dependency of species in these near-shore habitats.* The potential for declines at one trophic level to cascade up, down and sideways in the food web, i.e., the propagation of negative effects throughout this community, is high in this intensely interconnected system. Coral reefs buffer the island from the intense wave action of storms and hurricanes, facilitate seagrass and mangrove communities, increase fish production, and increase tourism and thus increase influx of money into the local economy; but they cannot persist without preserving herbivorous fish populations. Conserving fish species, such as parrot fish, is thus critical in conserving the entire near-shore marine system.

Aggregating Fish Predators

In this document, the phrase "aggregating fish predators" does not refer to fish that feed in groups; rather the term refers to large piscivorous fish which are solitary hunters, but must gather in large aggregations to effectively reproduce. Aggregating fish predators refer primarily to two families of reef fish, the snappers – Lutjanidae, and the groupers or sea basses – Serranidae. Some examples of large sea basses that historically inhabited St. Croix include the Nassau grouper *(Epinephelus striatus),* coneys *(Epinephelus fulvus),* red hinds *(Epinephelus guttatus),* rock hinds *(Epinephelus adscensionis),* tiger groupers *(Mycteroperca tigris),* and graysbys *(Epinephelus cruentatus).* Unfortunately, the likelihood of encountering mature adults of any of these species has decreased due to a variety of stresses, both current and historical. Both the Nassau and tiger grouper fisheries are locally extinct (W. Tobias pers. comm.). Examples of abundant and large snappers include mutton snapper *(Lutjanus analis),* school masters *(Lutjanus apodus),* mangrove or gray snappers *(Lutjanus griseus),* lane snappers *(Lutjanus synagris),* cubera *(Lutjanus cyanopterus)* and yellow-tail snappers *(Ocyurus chrysurus).*

Snappers and groupers are ecologically and economically important for a variety of reasons. First, they are the primary fish sought by local fisherman for sale at both local and regional scales. Groupers and snappers, unlike many others fished locally in St. Croix (e.g., parrot fish, squirrel fish, and surgeon fish), are in high demand in off-island markets (e.g., continental U.S.), bring a higher price per pound, and thus suffer from increased fishing pressure. However, due to reduced stocks, neither grouper nor snapper have been exported from the Virgin Islands in over 20 years (W. Tobias pers. comm.).

Second, snappers and groupers are prized game fish for many tourists fishing in the waters off St. Croix. Third, encounters with these impressive fish are often the focus of eco-tourism dives, sponsored by large hotels, resorts and local merchants; which bring much needed money into the local economy. Fourth, snappers and groupers play an integral role in maintaining the structure of important, shallow-water communities. For example, it has been suggested by correlation and lab studies that predators, by suppressing the densities of plant-eating fish, indirectly facilitate the persistence of important macrophyte habitats (e.g., seagrasses and patches of calcium-rich, macroalgae) (Hay 1981, 1984, 1985). Conservation of these fish will thus benefit the local economy in a variety of ways and likely facilitate the persistence of important, shallow-water plant communities. However, like any effective conservation plan, the management design for the long-term preservation of these fishes must be based on accurate understanding of the animal's life history.

During the day, adult groupers and snappers are typically found associated with complex biogenic structure on the barrier reef or on nearby patch reefs. The depth range of groupers is routinely greater than snappers, as they are distributed from the shallow parts of the back reef (10-30m) to the deeper reaches (100-300m) of the fore reef. Adult snappers typically inhabit shallow areas of the barrier and patch reefs but, unlike groupers, are also found in abundance in mangrove creeks and in shallow waters new biogenic (rocks, caves, and blue holes), or artificial (peers, marinas, and docks) structures. This differentiation in habitat use may in part be due to the ability of many species of snappers to endure a much greater variation in salinity (Layman papers, Ray et al. 2000). For example, small adult and juvenile grey, schoolmaster, and cubera snappers can often be found in waters with 5-10 ppt salinity, an almost 70% reduction in the normal salinity of marine waters (Layman and Silliman in press, Layman et al. 2001). At night, both groupers and snappers leave the structural refuge of the reef and other habitats (e.g., mangrove roots, docks, and rocky shores) and fan out over adjacent seagrass beds and sand flats to feed on smaller fish and invertebrates.

Relatively little is known about the life-history of juvenile and young-of-the-year snappers and groupers. Importantly, what is definitive is that these fish do not use the barrier or patch reefs as nursery habitats. Instead, mangroves (e.g., grey, schoolmaster, and cubera snappers), shallow-water sand flats, rocky shores (many groupers), seagrasses and algal beds (e.g., juvenile Nassau groupers are thought to home to red algal *Laurencia* beds), have been shown routinely to be the nursery grounds of aggregating fish predators (Layman et al. 2001, Layman and Silliman in press). Transplant and tethering experiments of juvenile fish onto the reef complex demonstrate that predation rates are far too high and intense for these areas to act as nurseries. Successful conservation of these large aggregating predators must then incorporate preservation of not only barrier and patch reef habitats for adult fish, but also seagrass, mangrove, and other communities which act as critical nursery areas for vulnerable juvenile stages. In essence, conservation efforts must take on a landscape level approach.

Besides a spatial, habitat-based conservation strategy, a successful Management Plan for these fish must also include temporal protection of fish populations during aggregated

spawning events. These events often taken place in the fore reef area where gametes can be dispersed into fast moving currents and, historically, were thought to attract up to 10,000 fish (Ray et al. 2000). Today's estimates suggest that those numbers have dwindled by an order of magnitude for most aggregations, to around 1,000 fish (Ray et al. 2000). In most cases, known aggregation sites have gone extinct due to over fishing. For example, the aggregation of Nassau groupers off the East End of St. Croix, once thought to number in the thousands, is now ecologically extinct. Similar documented accounts and stories abound in Florida and the Bahamas (Ray et al. 2000). These aggregations represent key bottlenecks in the life histories of these fish. Essentially, they provide the seed for future generations and must be thought of as the "suppliers" which sustain near-shore fishery operations. During these aggregations, the usually coy and solitary snappers and groupers are particularly social and undeterred or frightened by typically threatening activities, which usually result in evasive escape behavior. Divers may return again and again to the school to spear unwary fish and drag them wounded to the surface, with no apparent effect on the rest of the school. Without legal protection and enforcement of protection during these critical stages, spearing can reduce fish populations by 90% in a few days, in what would normally take tens of years using conventional methods (Ray et al. 2000, B. Silliman pers. comm.). The critical point here is that making known fish aggregation sites off limits to fishing during aggregation times -- (typically 2-3 days every month for three months a year; but this varies from species to species)-- preserves the supply of fish to the region for generations to come. This is particularly applicable to the management of U.S.V.I. marine fisheries, as recent studies using the chemistry of fish otoliths (i.e., ear bones) to trace the origin of juvenile fish, suggest that up to 50% of bluehead wrasse, *Thalassoma bifasciatum*, recruits on St. Croix are self-recruiting; that is, they originate from spawning events on St. Croix (Swearer et al. 1999).

The area of fish conservation has long been chided by community and ecosystem ecologists for its attempts to conserve species solely by regulating yearly catch and size limits. This method alone has proven time and time again to be painfully ineffective at conserving or revitalizing depleted fish populations. What has been recommended instead is an integrated natural history and community level ecology approach combined with active management of fish extraction for commercial sale. This approach results in: (1) decreased fishing pressure on stressed fish populations and (2) conservation of critical habitat and life-history events, which often represent extremely vulnerable stages in the ontogeny of these ecologically and economically important fish.

Four key factors which can be controlled by effective human management are critical to the long-term preservation of snapper and grouper populations on St. Croix:

First: Permanent no-take zones must be established that provide refuge over a large enough spatial scale to theoretically incorporate, using modeling and fish counts in the literature, at least 1,000 adult fish of the targeted species. Because this goal is often too difficult to accomplish, no-take zones which incorporate large tracts (km x km) of barrier reef, patch reef, and fore reef must be established. For future planning, it is critical that this deep fore reef area be included in the no-take zones as this contains most of the large

fish, which contribute a disproportionate amount of gametes to spawning aggregations. These no-take zones *must also* incorporate seagrass, sand flat and mangrove habitats, which are used by adult snappers and groupers as foraging areas at night. Too many no-take zones have failed by just protecting the reef. Intermingled in these areas should be take zones, which allow for commercial and recreational fishing.

Second: There needs to be a strong effort to conserve the critical nursery habitats described above. Without such efforts, the juvenile life stage of these fish will soon become a bottleneck in their population numbers.

Third: Spawning aggregations must be located and designated as no-take areas with proper enforcement. Again, enforcement here is critical. One slip in the large, no-take zone means a few fish are lost in the day; one slip at this bottleneck, aggregating period could completely eliminate the effective reproduction population of the fish.

Fourth: Educational outreach to local fisherman discussing the benefits of no-take areas and protection of breeding aggregations to the long-term preservation of their historic fisheries must be a constant and never-ending goal. Without their support, little in regards to conservation can be accomplished.

Seagrass Communities

Tropical seagrass communities are among the most productive ecosystems in the world, and are home to a wide variety of fish and invertebrate life. Within the S.C.E.E.M.P, seagrass communities are overwhelmingly dominated by the turtle grass, *Thalassia testudinum*, with manatee grass, *Syringodium filiforme*, and shoal grass, *Halodule wrightii*, being primarily minor constituents, though at times reaching high densities, especially in areas of high disturbance (e.g., on sandy shoals). These grass-dominated habitats are found in relatively clear, shallow water (-.5-10m) in both small (1Ox10m) and expansive (1000x 1000m) beds behind the barrier reef, which buffers them from intense physical disturbance by dissipating the energy of incoming waves. The substrate of these communities is comprised of carbonate sand and fine organic matter, which is product of both autogenic *(in situ* production) and allogenic (trapping of suspended particles) processes. Overall, seagrass communities comprise greater than 65% of the benthic habitat between the shoreline and barrier reef within the EEMP.

Seagrass communities provide a great deal of ecosystem services, which are important both in ecological and economic contexts. For example, seagrass systems are important nursery habitats for a great many fish and invertebrate species, buffer coral reefs from land-based nutrient fluxes by taking-up and fixing large amounts of inorganic nitrogen and phosphorus. Also, through their massive root network, they stabilize sediment, thereby preventing large-scale erosion of shoreline and life-threatening sedimentation of nearby coral reefs. Perhaps, most important of all, seagrasses act as "foundation species", i.e., the persistence of the entire community rests on the persistence of seagrasses. Their loss from areas is associated with rapid declines of commercially and ecologically valuable species and overall community function. Essentially seagrasses,

via their biogenic structure, ameliorate environmental stresses (e.g., biotic – predation; and abiotic – wave disturbance), that would otherwise lead to the local extinction of the great majority of associated flora and fauna. Thus, by focusing conservation efforts on this foundation species, the end result will likely be the preservation of a great number of obligately dependent, symbiotic organisms.

Seagrass systems are home to a great diversity of marine life. Representatives of all major marine invertebrate phyla can be found in this habitat. For example, four of the five classes of the phylum Echinodermata (Ophiuroids – brittle stars, Asteroids – sea stars, Echinoids – urchins and sea biscuits, and Holothuroids – sea cucumbers) depend on seagrasses for both food (directly and indirectly) and shelter. Urchins (e.g., West Indian sea egg and the variegated urchin) are easily the most conspicuous echinoderms in these communities; as they graze, at times in great numbers, on the habitat-forming seagrasses. Brittle stars are some of the most abundant in terms of density and biomass, although they are less visible because they reside in the upper layers of the sediment. Worms in the phyla annelida, platyhelminthes, nematoda, and nemertea, along with shelled molluscs in the class gastropoda and bivalvia, burrowing shrimps (Upogebidae and Stomatopoda) and crabs (Xanthidae) in the supra-phylum crustacea, also inhabit the sediments of seagrasses. They feed on detritus produced by the grasses and associated macro- and microalgae, or on organisms that depend on these items as a primary food source. Epifaunal invertebrates are equally abundant and diverse, and include seagrass anemones, chitons, snails, crabs (Portunids – e.g., the blue crab, *Callinectes sapidus)*, shrimp, small lobsters *(Panularis argus)*, amphipods, isopods, deposit-feeding sea stars (i.e., the cushion star, *Oreastar reticulatus)*, octopus, some corals (e.g., *Porites* spp., *Siderastrea radians)*, and various sponges. Importantly, seagrass habitats are the primary residents of the gastropod *Strombus gigas*, the Queen Conch. These large conchs (up to 30 cm in shell length) feed on seagrasses and associated epiphytes through direct radular contact and utilize seagrass habitats as refuge from predation during early life stages (1-3 years) (Abbot and Morris 1995). Without seagrass beds, S. *gigas* looses its primary food resources, as well as its protection from shell-crushing predators.

Fish also utilize seagrass habitats to a large extent. Small herbivorous fish such as the buck-tooth parrot and pin fish live in seagrass habitats year round, feeding again on seagrasses directly, and their associated epibiont community (algae and small encrusting organisms such as forams). Juveniles of economically and ecologically important reef fish (e.g., Haemulids - grunts, Serranids - groupers, and Lutjanids - snappers), also rely on seagrass communities for food and shelter during the early stages of their lives (see Layman et al. 2000). Adults of these fish are usually not seen in seagrasses during the day, as they hover around the reef for protection. At night though, many of these adult fish migrate from the reef and fan out over the seagrasses to forage on the epifaunal community described above (small fish and invertebrates). Studies have shown that both epifaunal biomass and diversity is greater in seagrasses in comparison to nearby sandflats, which strongly suggests that seagrasses serve as a foundation species for resident organisms and a vital energy source for nearby coral reef fish communities (Peterson 1991).

Four key factors which can be controlled by effective human management are critical to the long-term preservation of seagrass systems:

First, run-off from terrestrial systems must be mitigated by best management practices, as both sediment and nutrient loads associated with increases in erosion result in seagrass decline. Increased sediment loads smother beds and block growth-limiting irradiance from penetrating to the benthos, while increased nutrients shift the balance of power in grass beds from rooted angiosperms to ephemeral algae, which overgrow, shade, and eventually kill-off the underlying seagrasses.

Second, nutrient loads from point sources such as storm-water run-off and municipal sewage must be curtailed as these high nitrogen and phosphorus inputs to the system will lead to rapid overgrowth of seagrasses by fast growing algae.

Third, seagrasses are obligately dependent on other nearby marine communities for persistence. Coral reefs protect grass beds from the scouring effects of oceanic waves and currents, while mangroves filter out harmful sediments and nutrients which contribute to the deterioration of seagrass habitats. Without putting seagrass conservation into a landscape level context, i.e., linking its preservation with the conservation of nearby communities, its long-term preservation will be in jeopardy.

Fourth, many recent studies have shown that seagrass growth and persistence is greatly enhanced by the presence of herbivorous fish, many of which are the focus of intense commercial fishing efforts (i.e., parrot and surgeon fish) (see Valentine and Heck papers). These fish, by preferentially grazing down fast-growing epiphytic algae, indirectly facilitate seagrass growth by consuming their competitive dominant. Even in the face of increased nutrient loading, recent research has shown that consumers may compensate for increased algal growth with increased consumption and secondary growth. This suggests that herbivorous fish in seagrass communities will naturally mitigate, to some extent, the deleterious effects of increased nutrient input from anthropogenic sources. However, they must be there to do so. Therefore, a key component to seagrass conservation is effective fisheries management. Understanding food web linkages and strength of consumer interactions should therefore not be ignored for the long-term management and conservation of seagrass communities.

Mangroves/Salt Ponds

Mangrove communities, like seagrasses, are among the most productive in the world and are home to a wide variety of fish and invertebrate life. Within the EEMP, mangrove communities are overwhelmingly dominated by red *(Rhizophora mangle),* and black *(Avicennia germinans),* mangroves with white mangroves *(Laguncularia racemosa),* buttonwood trees *(Conocarpus erectus),* mangrove ferns *(Arcosticum aureum),* salt marsh spike-grass *(Distichilus spicata),* and salt marsh cordgrass *(Spartina alterniflora),* being relatively minor components. These tree-dominated systems are found in the intertidal zone at gently sloping coastal margins, relatively buffered from extreme wave action. Most of the mangrove species within the EEMP occur in Great Pond, the salt pond

associated with Great Pond Bay. Wave protection is provided at times by the barrier reef, but on St. Croix, this service is primarily furnished by semi-enclosed, coastal embayments. The distribution of tree species is somewhat segregated across the intertidal zone, with red mangroves dominating the lower- and mid-intertidal zones and blacks, the higher reaches (on the north, east, and south). Red mangrove islets are found in the southeastern portion of the pond (Tobias 1998). Both the red and black mangrove zones are flooded daily by the tides. Buttonwoods and white mangroves are found at the - extreme, upper intertidal area, which is normally flooded only once or twice a month. Ferns and grasses are fugitive species and found only in disturbed areas in the upper reaches of the wetland. Competition for light, as is the case for terrestrial systems, is thought to exclude grass species from tree-dominated areas.

Mangrove communities provide critical services to both human and marine life.
First: By trapping land-derived sediments, mangroves buffer seagrass and coral reef habitats from the harmful effects of increased deposition.

Second: By taking-up land-derived nutrients in groundwater and overland-flow, mangroves decrease nitrogen and phosphorus loading in the near-by water column, protecting seagrasses and coral reefs from potential overgrowth by fast-growing, ephemeral algae.

Third: Mangroves buffer human development and natural terrestrial communities from physical disturbance caused by storms and hurricanes. Wetland trees absorb large amounts of storm-induced wave and wind stress, while mangrove sediments act as sponges as the sea level rises, mitigating flood damage.

Fourth: With their massive prop roots, red mangroves act as "foundation species" for a variety of economically and ecologically important fish (e.g., snappers, groupers, parrot fish, and bonefish), and invertebrate species (e.g., oysters, shrimp, spiny lobsters, and blue crabs). Essentially, prop roots provide a structurally complex habitat, which buffers associated fauna from intense consumer pressure. Without mangroves, most of the associated species cannot persist in the remaining shallow-water habitat, as predation intensity is too high. Importantly, most of the fish that utilize mangrove roots for protection are juveniles. Fish which commonly use the entire reach of mangrove creeks as nursery habitats (which encompasses a wide range of salinities, 10-35 ppt.), include: the mutton snapper *(Lutjanus analis),* school masters *(Lutjanus apodus),* mangrove or gray snappers *(Lutjanus griseus),* lane snappers *(Lutjanus synagris),* cubera snappers *(Lutjanus cyanopterus),* the yellow fin majarra or Bahamian shad *(Eucinostomus melanopterus),* and the mottled *(Eucinostomus lefroyi)* and slender majarra *(Eucinostomus jonesi),* which are the primary food for important mangrove-creek/ bite gamefish such as barracudas *(Sphyraena barracuda),* bonefish *(Albula vulpes),* permit *(Trachinotus falcatus),* and tarpon *(Megalops atlanticus).* Fish which use the high-salinity (28-35 ppt.), mouth and lower-reach areas of mangrove creeks as nursery habitats include a number of reef fish such as sergeant majors, and beaugregory, cocoa, and three-spot damsel fish (family: Pomacentridae); doctor fish, surgeon fish, and blue tang (family: Acanthuridae); rainbow, queen, striped, and redband parrot fish (family:

Scaridae); margates, sailors choice, blue-striped, french, small mouth and striped grunts (family: Haemulidae); hogfish, and blue-headed and slippery dick wrasses (family: Labridae); and, at times, sea basses, such as the nassau *(Epinephelus striatus)* and black grouper *(Mycteroperca bonaci)* (see Layman papers).

Fifth: Because mangroves house many juvenile fish and invertebrate species, they are important foraging areas for adult fishes. These fish include sharks, rays, morays and snake eels, needlefish; and the economically important groupers, snappers, grunts, barracudas, jacks, tarpon, bonefish, and permit. Failure to conserve mangrove habitat thus represents not only loss of critical fish nurseries, with the likely result being decreased adult fish densities and diversity in nearby coral reef and seagrass habitats, but also loss of important foraging areas for adult fish, with resulting decreased fish yields in local commercial fisheries. Successful management of these foundation species will likely result in positive effects on nearby coral reef and seagrass communities, increasing overall fish diversity, production, and biomass.

Sixth: Besides acting as critical habitats for a wide variety of fish, mangroves support a great diversity of invertebrate life, encompassing representatives of all major marine invertebrate phyla. These animals live both within, around and attached to the complex network of prop roots in the creek. The fouling community that attaches to mangrove roots is similar in composition and distribution to the assemblage of intertidal organisms on rocky shores. Brown (phylum Phaeophyta), green (phylum Chlorophyta), and red (phylum Rhodophyta) algae, as well as various sponges (phylum Porifera), tunicates (phylum Urochordata), anemones (phylum Cnidaria), and bryozoans (phylum Ecotprotca), form a dense community on the lower portion of red mangrove roots, which are rarely exposed to air (Layman et al. 2000). Dominating the mid- and upper-intertidal root areas, that are exposed daily by the ebbing tide, are mangrove oysters *(Isognomom* spp.), star and ribbed barnacles *(Balanus* and *Chthalamus* spp.), various gastropods (e.g., oyster drills – *Urosalphinx* spp.; the mangrove periwinkle – *Littorina angulifera,* and the Caribbean coffee-bean snail *Melampus coffeus),* and aboreal sesarmid and grapsid crabs (see Layman et al. 2000). Mobile animals, which utilize prop root and creek bed areas for foraging and protection, include the commercially important spiny lobster *(Panularis argus)* and queen conch *(Strombus gigas),* as well as octopus *(Octopus* spp.), infaunal bivalves (e.g., *Codakia spp.* and *Chione spp.* clams), echinoderms (urchins, sea cucumbers, cushion stars, and brittle stars), corals (e.g., starlet - *Siderastrea radians* and finger coral *Porites porites),* sponges, tunicates, and worms in the phyla annelida, platyhelminthes, nematoda, and nemertea. Without the protection of mangrove prop roots, many of these invertebrates would go locally extinct due to predation, or lack of suitable, stable substrate. Many studies have shown that both epifaunal biomass and diversity are greater in mangrove habitats in comparison to nearby sandflats (see Layman and Silliman in press, Ray et al. 2000), which strongly suggests that mangroves serve as a foundation species for resident organisms, and a vital energy source for nearby coral reef fish communities. A proactive role of wetland and salt pond management must occur to increase the wildlife and fisheries habitat of these degraded coastal ecosystems.

The following are five key factors which can be controlled by effective management, and are critical to the long-term preservation of mangrove communities:

First: Since suitable mangrove habitat is relatively rare on St. Croix (–10% of the shoreline is mangrove), habitats currently occupied by mangroves, or that have the potential to be occupied by mangroves, should be conserved.

Second: Not only should a policy of "no net-loss of marine wetlands be instituted", but an active policy of restoring wetlands that have deteriorated due to garbage dumping, terrestrial run-off, and/or human development, should be initiated. For example, the building of the largest oil refinery in the Western Hemisphere (the Hess refinery) on St. Croix, resulted in the loss of the largest mangrove complex on the island, and the largest flamingo rookery in the Caribbean. A positive, proactive attempt should be made to coordinate an active restoration of equal amounts of mangrove wetlands on other parts of the island which involves joint cooperation (financial and person hours) between industry (Hess), conservation (TNC), public (schools and volunteers), and governmental agencies (DPNR, EPA, and U.S. Fish and Wildlife Service). Such an operation would bring positive publicity to everyone and result in broadening community support for marine conservation on St. Croix. Because mangrove restoration can be completed without having to be underwater, efforts to restore mangroves (planting of seedlings, digging of new creeks, and removal of garbage) can involve a great many people of all ages. The opportunity to initiate such efforts should not be overlooked. Additional steps to conserve existing mangrove wetlands need to include: (1) removal of all garbage from wetland areas, (2) prohibition of future dumping, with sign postings and legal enforcement, (3) establishment of a greater network of creeks through use of construction equipment to restore areas filled in by human-induced sedimentation, and (4) active planting activities of mangrove propagules, to accelerate re-colonization of restored and degraded habitats.

Third: Any roads, partial bridges, culverts which block or partially block flow in mangrove creeks, no matter the size, should immediately be replaced by bridges which expand the entire width of the creek. Such efforts in the Bahamas on Andros Island have proven to immediately increase tidal flow and, over a few months to years, increase fish diversity and biomass, as the deep-water habitats in the mangrove wetland expand (C. Layman and B. Silliman pers. comm.).

Fourth: Although mangroves themselves likely benefit from increased sediment and nutrient loading, run-off from terrestrial systems must be mitigated by best management practices (i.e., buffer zones - 10's of meters of terrestrial vegetation between mangroves and residential and/or agricultural development) as both increased sediment and nutrient loads result in die-offs of important flora and fauna that live symbiotically with mangroves. Increased sediment loads block growth-limiting irradiance from penetrating to the benthos (killing seagrasses and other algae), while increased nutrients promote blooms of ephemeral algae. As a result of these blooms, the increased respiration demand at night and during decay, yields critically low dissolved oxygen concentrations, which kills off resident fish and invertebrate populations. Increased nutrient loads also

shift the balance of power in the grass beds of mangrove creeks from rooted angiosperms to ephemeral algae, which overgrow, shade, and eventually kill-off the underlying seagrasses. Importantly, this scenario seems to be occurring at the present moment in the mangrove creeks of Great Pond, as excess nutrients potentially from agricultural run-off are leading to massive blooms of harmful alga on the mangrove benthos.

Fifth: Nutrient loads from point sources, such as_ storm-water run-off and municipal sewage, must be curtailed, as these high nitrogen and phosphorus inputs create the same dire consequences for mangrove flora and fauna. Reductions in both point and non-point nutrient loads reaching mangroves are critical to mangrove survival, yet is rarely addressed because mangrove trees actually benefit from increased nutrient inputs. Indeed, some managers even suggest that nutrient loads are not a threat to mangrove communities because of these reasons. However, conservation of these habitats requires not only policies that facilitate and promote growth of the foundation tree species, but also those which enhance production and persistence of associated fauna. Eutrophication and increased sediment loads does not meet both criteria.

Coral Reefs

Tropical reefs dominated by hermatypic (i.e., reef-building) corals are ecologically and economically among the most important habitats in shallow-water marine systems. They are, however, also some of the most threatened, due to anthropogenic-induced stresses of incompatible fishing practices, sedimentation, and eutrophication. Active conservation strategies are thus needed to ensure long-term persistence of these communities and continuance of important ecosystem services they provide.

Although relative percent cover of corals may change between and among reef habitats and reef types, the dominant reef-building corals on St. Croix reefs and on those in most of the Caribbean include elkhorn *(Acropora palmata)* and staghorn *(Acropora cervicornes)* coral, and various species of brain *(Diploria spp.),* lettuce *(Agaracia spp.),* finger *(Porites spp.),* star *(Montastrea spp.),* and starlet *(Siderastrea spp.)* corals. Recently (within the last twenty years), however, there has been an intense decline in the abundance of these hard corals corresponding with a dramatic increase in the cover of macroalgae, gorgonians (e.g., sea whips, sea rods, and sea plumes) and fire corals *(Millipora spp.).* This shift has been suggested to be caused by, but is not limited to, the separate and interactive effects of: (1) disease – e.g., white-band and black-band, (2) over-fishing of herbivorous fish – primarily parrot and surgeon fish, (3) the die-off of the super-abundant, herbivorous urchin, *Diadema antillerum,* (4) increased nutrient run-off from both point and non-point sources, (5) increased sedimentation due to increased run-off on developed coastlines, (6) anchor and prop scarring, (7) physical mistreatment by recreational and commercial divers - e.g., dynamite and cyanide capture of reef fish sold in pet shops, and (8) decreased mangrove abundance, which buffer corals from the harmful effects of sedimentation and eutrophication.

Coral reefs provide a number of important ecosystem services to both the ecological and human community. First, they buffer seagrass, mangrove and land-based human

development from both routine and intense (hurricane and storm induced surges) wave action by absorbing large amounts of energy as waves propagate over their surface. **Second,** coral reefs are a critical foundation species and, as such, act as hosts to a great variety of marine invertebrate and fish species. Commercially important fish which depend on the reef habitat as refuge from predation include for example: seabasses: Nassau grouper *(Epinephelus striatus),* black grouper *(Mycteroperca bonaci),* coneys *(Epinephelus fulvus),* red hinds *(Epinephelus guttatus),* rock hinds *(Epinephelus adscensionis),* tiger groupers *(Mycteroperca tigris),* and graysbys *(Epinephelus cruentatus);* snappers: mutton snapper *(Lutjanus analis),* school masters *(Lutjanus apodus),* lane snappers *(Lutjanus synagris),* cubera *(Lutjanus cyanopterus)* and yellow-tail snappers *(Ocyurus chrysurus);* and parrot fish: stoplight *(Sparisoma viride),* queen *(Scarus vetula) ,* midnight blue *(Scarus coelestinus),* red-band *(Sparisoma aurofrenatum),* princess *(Scarus taeniopterus),* and at times blue *(Scarus coeruleus)* and rainbow *(Scarus guacamaia)* parrot fish. The commercially important spiny lobster, *Panularis argus,* also finds refuge in the crevices of the reef. Algal and invertebrate species which depend on the coral-built reef number in the thousands and include species of all major marine phyla of animals and plants. Loss of coral reef habitat from areas is associated with rapid declines of commercially and ecologically valuable species and overall community function. Essentially corals, via their biogenic structure, ameliorate environmental stresses (e.g., biotic - predation; and abiotic - wave disturbance) that would otherwise lead to the local extinction of the majority of associated flora and fauna. Thus, by focusing conservation efforts on this foundation species, the end result will likely be the preservation of a great number of obligately dependent, symbiotic organisms.

Because recent studies have shown that both near-shore and far off reefs are subjected to similar stresses (in regards to stress type and magnitude) associated with land-derived eutrophication and sedimentation, we recommend that the same management strategies be applied to both wave-protected and wave-exposed reefs on St. Croix. Five key factors that can be controlled by effective management are critical to the long-term preservation of coral reef systems:

First, run-off from terrestrial systems must be mitigated by best management practices (e.g., establishment of brush/ tree buffer zone -10m wide at terrestrial borders of marine habitats, or sediment traps at construction sites) as both sediment and nutrient loads associated with increases in erosion result in coral reef decline. Heavy sediment loads smother corals (i.e., decrease rates of gas exchange and ability of corals to feed) and block growth-limiting irradiance from reaching their symbiotic algae, while increased nutrients shift the balance of power from hard corals to ephemeral macrophytes, which overgrow, shade, and eventually kill-off the underlying coral colonies.

Second, nutrient loads from point sources such as storm-water run-off and municipal sewage must be curtailed as these high nitrogen and phosphorus inputs to the system will lead to rapid overgrowth of coral reefs by fast growing algae.

Third, coral reefs are obligately dependent on nearby marine communities for persistence. Both mangroves and seagrasses filter out harmful sediments and nutrients

which contribute to the deterioration of reef habitats dominated by corals. Without putting reef conservation into a landscape level context, i.e., linking its preservation with the conservation of nearby communities, its long-term preservation will be in jeopardy.

Fourth, many recent studies have shown that coral growth and persistence are greatly enhanced by the presence of herbivorous fish, many of which are the focus of intense commercial fishing efforts (i.e., parrot and surgeon fish). These fish, by preferentially grazing down fast-growing epiphytic algae, indirectly facilitate reef growth by consuming their competitive dominant. Even in the face of increased nutrient loading, recent research has shown that consumers may compensate for increased algal growth with increased consumption and secondary growth. This suggests that herbivorous fish in coral reef communities will naturally mitigate, to some extent, the deleterious effects of increased nutrient input from anthropogenic sources. However, they must be there to do so. Therefore, a key component to reef conservation is effective fisheries management. Understanding food web linkages and strength of consumer interactions should therefore not be ignored for the long-term management and conservation of coral reef communities.

Fifth, for the same reasons that herbivorous fish facilitate coral abundance, reef growth and persistence is also greatly enhanced by the presence of the herbivorous, long-spined sea urchin, *Diadema antillerum* (Edmunds and Carpenter 2001). Although this species now looks to be recovering from its drastic die-off two decades ago, management practices may be helpful in promoting its return. Although none are known at the present time, this option should be actively pursued in the coming years, as current research is addressing management possibilities and the return of *Diadema* to reefs could drastically alter the current bleak state of algal dominance.

Appendix C: Stakeholder Diagrams

These diagrams were developed during community workshops held during the fall of 2001. They were created to explain complex interactions that exist between activities and stakeholders. The relationships between a critical threat, the stakeholders, and the forces that drive stakeholder behavior are spatially represented and linked. An explanation of the diagram components is below.

The components of a stakeholder-situation diagram:

A. A single **critical threat** is the foundation of a diagram and comes from the SCP prioritized list.

B. One or more **direct activities** create the critical threat.

C. Stakeholders – are social actors who can have a direct or an indirect significant and specific stake in a given territory or a set or natural resources. **Direct stakeholders** engage in direct activities; **indirect stakeholders** engage in indirect activities.

D. Motivations are the reasons for stakeholders to engage in activities.

E. Indirect activities influence the likelihood or magnitude of direct activities, other indirect activities and/or motivations.

F. Controlling forces influence the likelihood or magnitude of direct activities, indirect activities or motivations but, although controlling forces are ultimately the result of stakeholders and their activities, these are usually not known or specified.

Arrows link activities, stakeholders, motivations and controlling forces to each other. These arrows represent directional, dynamic cause-and-effect relationships among stakeholder-situation diagram components. The dynamic cause-and-effect relationships represented by the arrows are **contribution** and **influence.**

1. A **contribution is a relationship** that determines how much a particular stakeholder may be contributing to a particular activity that is contributing to a critical threat. In these stakeholder- situation diagrams a contribution relationship exists:

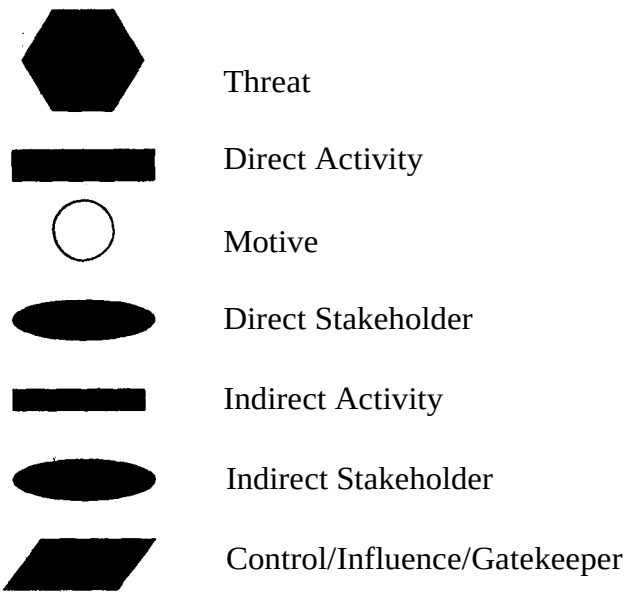
- from a direct activity to the critical threat;
- from a direct stakeholder to a direct activity;
- from an indirect stakeholder to an indirect activity.

2. An **influence is a relationship that** modifies a contribution or modifies another influence. In these stakeholder-situation diagrams an influence relationship exists:

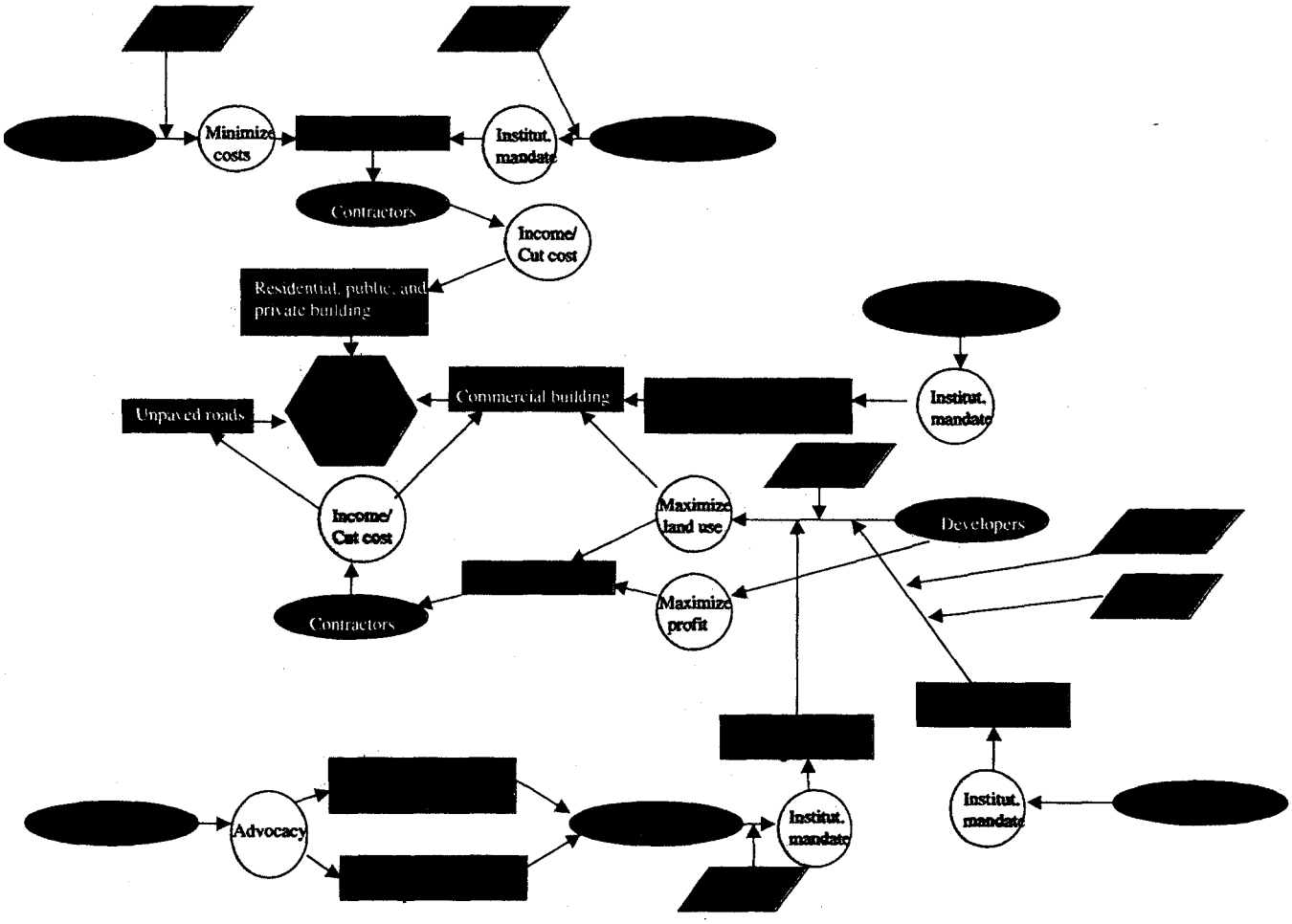
   from a motivation to a direct or an indirect stakeholder;

   from an indirect activity to an *arrow* connecting a direct stakeholder and a direct activity, or an indirect stakeholder and an indirect activity.

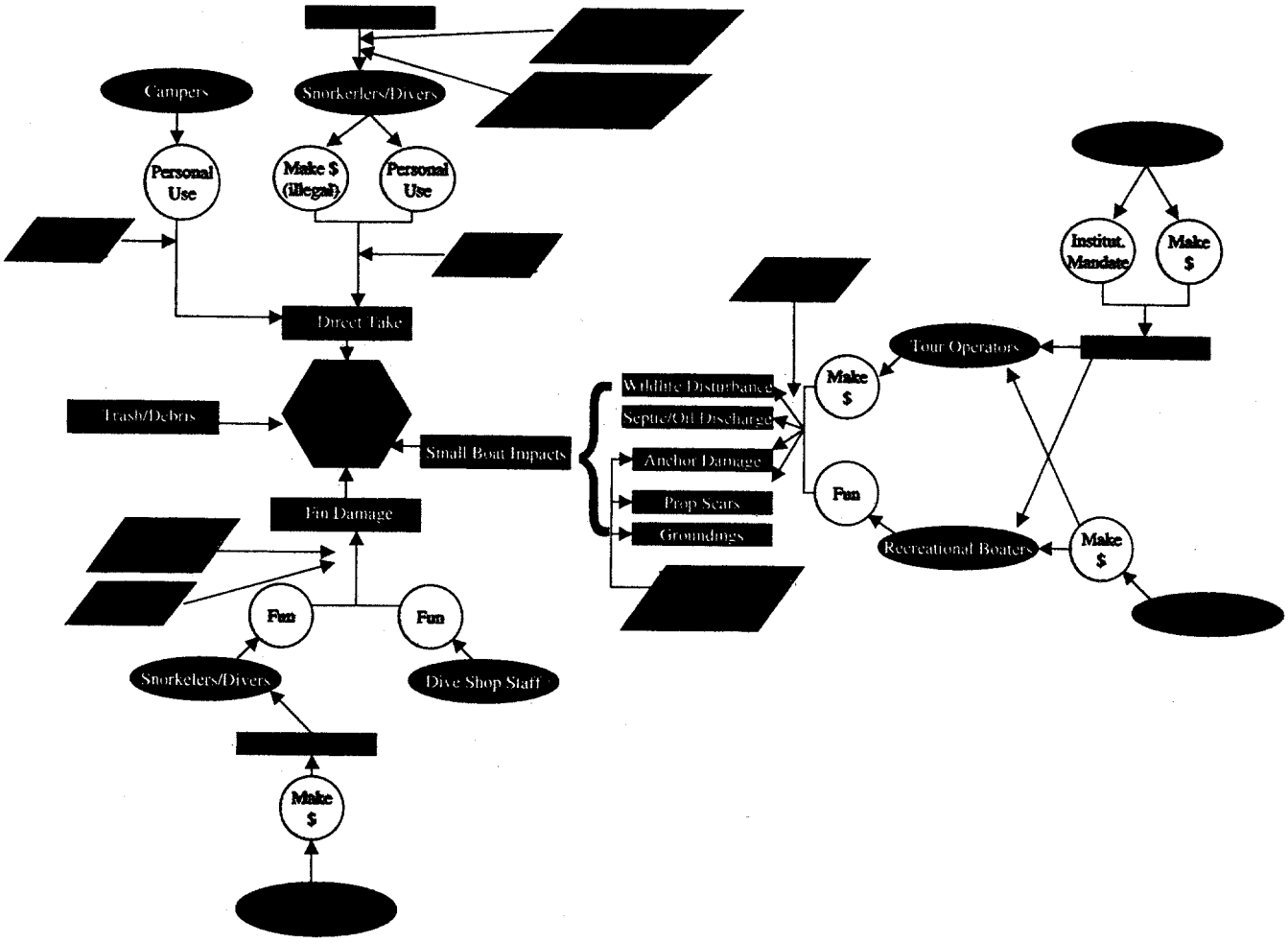
Diagram Key



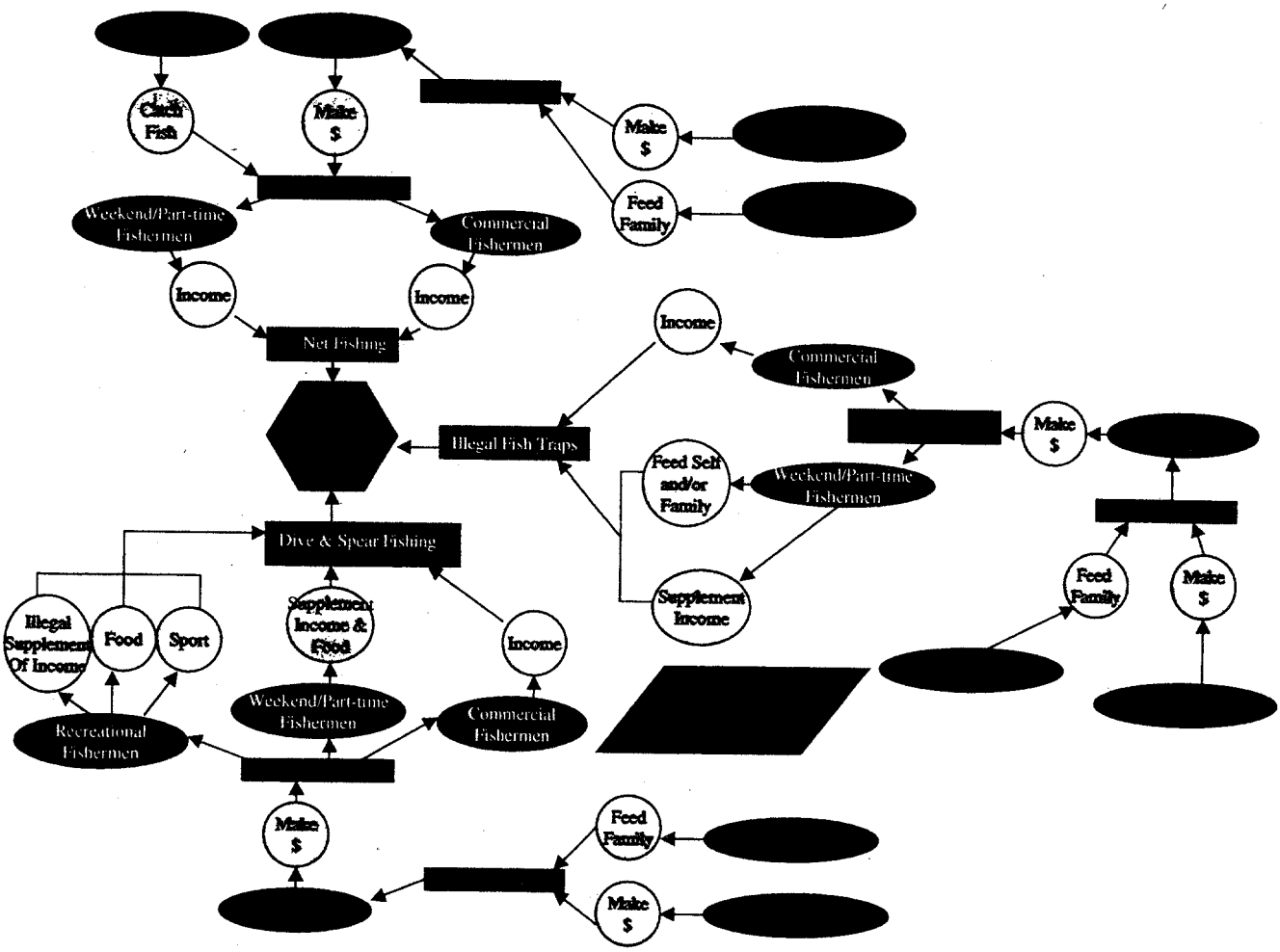
Threat: Incompatible Upland Development



Threat: Recreation Impacts



Threat: Incompatible Fishing Practices



Appendix D: List of Threatened Species Within Park

E = Endangered
T = Threatened

US Endangered Species Act of 1973

Common Name	Scientific Name	Status
Brown Pelican	*Pelecanus occidentalis*	E
Green Turtle	*Chelonia mydas*	E,T
Hawksbill Turtle	*Eretmochelys imbricata*	E
Humpback Whale	*Megaptera novaeangliae*	E
Leatherback Turtle	*Dermochelys coriacea*	E
Peregrine Falcon	*Falco peregrinus*	E
Roseate Tern	*Sterna dougallii*	T

VI Endangered and Indigenous Species Act of 1990 (Act No. 5665)

Common Name	Scientific Name	Status
Antillean Mango	*Anthracothorax dominicus*	E
Bahama Duck	*Anas bahamensis*	E
Black Coral	Order *Antipatharia*	E
Black Crowned Night Heron	*Nycticorax nycticorax*	E
Caribbean Coot	*Fulica caribea*	E
Clapper Rail	*Rallus longirostris*	E
Great Blue Heron	*Ardea herodius*	E
Great Egret	*Casmerodius albus*	E
Jewfish/Goliath Grouper	*Epinephelus itajara*	E
Least Bittern	*Ixobrychus exilis*	E
Least Grebe	*Podiceps dominicus*	E
Least Tern	*Sterna antillarum*	E
Ruddy Duck	*Oxyura jamaicensis*	E
Snowy Egret	*Egretta thula*	E
Snowy Plover	*Charadrius alexandrinus*	E
West Indian Nighthawk	*Chordeiles gundlachii*	E
White-crowned Pigeon	*Columba leucocephala*	E
White-tailed Tropicbird	*Phaethon lepturus*	E
Willet	*Catoptrophorus semipalmatus*	E

Appendix E: List of Contacts

This list includes the names of individuals and their associated institutions that participated in workshops for the East End Marine Park.

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Appendix G: Marine Park Budget

East End, St. Croix Marine Park Management Plan
Navigational / Boundary Marking

OUTPUT 1.1: Navigational Marking Strategy

Description	Year 1	Year 2	Year 3	Year 4	Year 5	Subtotal
Inventory and GeoReference Areas						
Contractual	10,000					10,000
Implement Navigational Marking Program						-
Personnel	17,250					17,250
Equipment	12,500					12,500
Project supplies	12,000					12,000
Contractual						-
Program						-
Personnel		17,768	18,301	18,850	19,415	74,333
Project supplies		3,000	3,000	3,000	3,000	12,000
OUTPUT 1.1 TOTALS	**51,750**	**20,768**	**21,301**	**21,850**	**22,415**	**138,083**

OUTPUT 1.2: Boundary Marking Strategy

Description	Year 1	Year 2	Year 3	Year 4	Year 5	Subtotal
Inventory and GeoReference Areas						
Contractual	10,000					10,000
Implement Boundary Marking Program						-
Personnel	17,250					17,250
Equipment	12,500					12,500
Project supplies	48,000					48,000
Develop Boundary Marker Maintenance Program						-
Personnel		17,768	18,301	18,850	19,415	74,333
Project supplies		12,000	12,000	12,000	12,000	48,000
OUTPUT 1.2 TOTALS	**87,750**	**29,768**	**30,301**	**30,850**	**31,415**	**210,083**

Enforcement

OUTPUT 2.1: Enforcement Program

Description	Year 1	Year 2	Year 3	Year 4	Year 5	Subtotal
Hire & Train MPA Enforcement Officers						
Personnel	179,400	184,782	190,325	196,035	201,916	952,459
Equipment	100,000					100,000
Project supplies	30,000	10,000	10,000	10,000	10,000	70,000
Contractual	40,000	10,000	10,000	10,000	10,000	80,000
OUTPUT 2.1 TOTALS	**349,400**	**204,782**	**210,325**	**216,035**	**221,916**	**1,202,459**

OUTPUT 2.2: Interagency Agreements

Description	Year 1	Year 2	Year 3	Year 4	Year 5	Subtotal
Develop Interagency Agreements						
Contractual	5,000					5,000
Develop Standard Operating Procedures						-
Contractual	5,000					5,000
Develop Standard Training Programs						-
Contractual	10,000					10,000
OUTPUT 2.2 TOTALS	**20,000**	-	-	-	-	**20,000**

Education and Outreach

OUTPUT 3.1: Community Involvement/Community Program

Description	Year 1	Year 2	Year 3	Year 4	Year 5	Subtotal
School Programs						
Personnel	41,400	42,642	43,921	45,239	46,596	219,798
Office and computer costs	5,000	1,000	1,000	1,000	1,000	9,000
Project supplies	2,000	2,000	2,000	2,000	2,000	10,000
Special Events						-
Contractual	5,000	5,000	5,000	5,000	5,000	25,000
Public Forums						-
Contractual	5,000	5,000	5,000	5,000	5,000	25,000
OUTPUT 3.1 TOTALS	**58,400**	**55,642**	**56,921**	**58,239**	**59,596**	**288,798**

OUTPUT 3.2: Product Development

Description	Year 1	Year 2	Year 3	Year 4	Year 5	Subtotal
Printed Materials						
Project supplies	50,000	50,000	50,000	50,000	50,000	250,000
Contractual	5,000	5,000	5,000	5,000	5,000	25,000
Audio-Visual Materials						-
Project supplies	2,000	2,000	2,000	2,000	2,000	10,000
Contractual	20,000					20,000
Public Service Announcements						-
Contractual	5,000	5,000	5,000	5,000	5,000	25,000
OUTPUT 3.2 TOTALS	**82,000**	**62,000**	**62,000**	**62,000**	**62,000**	**330,000**

Regulatory

OUTPUT 4.1: Submerged Land Use

Description	Year 1	Year 2	Year 3	Year 4	Year 5	Subtotal
Dredging Prohibition						
Contractual		5,000				5,000
Dredging Regulation						-
Contractual		5,000				5,000
OUTPUT 4.1 TOTALS	**-**	**10,000**	**-**	**-**	**-**	**10,000**

OUTPUT 4.2: Recreation

Description	Year 1	Year 2	Year 3	Year 4	Year 5	Subtotal
Coral Touching						
Contractual		5,000				5,000
OUTPUT 4.2 TOTALS	**-**	**5,000**	**-**	**-**	**-**	**5,000**

OUTPUT 4.3: Boating

Description	Year 1	Year 2	Year 3	Year 4	Year 5	Subtotal
Boat Groundings						
Contractual		5,000				5,000
Pollution Discharges						-
Contractual		5,000				5,000
Special-Use Permits						-
Personnel	20,700	21,321	21,961	22,619	23,298	109,899
Office and computer costs	2,500	1,000	1,000	1,000	1,000	6,500
Project supplies	2,000	2,000	2,000	2,000	2,000	10,000
Contractual		10,000				10,000
Salvaging/Towing						-
Contractual		5,000				5,000
Vessel Operations/PWC Management						-
Contractual		5,000				5,000
OUTPUT 4.3 TOTALS	**25,200**	**54,321**	**24,961**	**25,619**	**26,298**	**156,399**

OUTPUT 4.4: Fishing

Description	Year 1	Year 2	Year 3	Year 4	Year 5	Subtotal
Review of Fishing Regulations						
Contractual	15,000					15,000
Fishing Licenses						-
Personnel	20,700	21,321	21,961	22,619	23,298	109,899
Office and computer costs	2,500	1,000	1,000	1,000	1,000	6,500
Project supplies	2,000	2,000	2,000	2,000	2,000	10,000
Contractual	10,000					10,000
OUTPUT 4.4 TOTALS	**50,200**	**24,321**	**24,961**	**25,619**	**26,298**	**151,399**

Fisheries Liaison Office

OUTPUT 5.1: Promote Fishing Pressure Shift

Description	Year 1	Year 2	Year 3	Year 4	Year 5	Subtotal
Open Fisheries Liaison Office						
Personnel	55,200	56,856	58,562	60,319	62,128	293,064
Office and computer costs	5,000	2,000	2,000	2,000	2,000	13,000
Travel	5,000	5,000	5,000	5,000	5,000	25,000
FADs						-
Project supplies	1,000	1,000	1,000	1,000	1,000	5,000
Contractual	4,000	4,000	4,000	4,000	4,000	20,000
Fly Fishing Guide Training						-
Contractual	25,000					25,000
OUTPUT 5.1 TOTALS	**95,200**	**68,856**	**70,562**	**72,319**	**74,128**	**381,064**

Mooring Buoys

OUTPUT 6.1: Mooring Buoys

Description	Year 1	Year 2	Year 3	Year 4	Year 5	Subtotal
Inventory and GeoReference Areas						
Contractual	10,000					10,000
Implement Mooring Buoy Program						-
Personnel	17,250					17,250
Equipment	12,500					12,500
Project supplies	40,000					40,000
Develop Mooring Bouy Maintenance Program						-
Personnel		17,768	18,301	18,850	19,415	74,333
Project supplies		10,000	10,000	10,000	10,000	40,000
OUTPUT 6.1 TOTALS	**79,750**	**27,768**	**28,301**	**28,850**	**29,415**	**194,083**

Water Quality

OUTPUT 7.1: Domestic Waste Water

Description	Year 1	Year 2	Year 3	Year 4	Year 5	Subtotal
Water Quality Standards						
Contractual		10,000				10,000
Resource Monitoring of Surface Discharge						-
Contractual		10,000				10,000
OUTPUT 7.1 TOTALS	-	**20,000**	-	-	-	**20,000**

OUTPUT 7.2: Stormwater

Description	Year 1	Year 2	Year 3	Year 4	Year 5	Subtotal
Stormwater Permitting						
Contractual	10,000					10,000
Stormwater Management (Guts, Roads)						-
Contractual	25,000					25,000
Stormwater Retrofitting						-
Contractual	25,000					25,000
OUTPUT 7.2 TOTALS	**60,000**	-	-	-	-	**60,000**

OUTPUT 7.3: Marinas & Live Aboards

Description	Year 1	Year 2	Year 3	Year 4	Year 5	Subtotal
Pollution Discharges						
Contractual		5,000				5,000
Marina Pumpouts						-
Personnel						-
Contractual		5,000				5,000
Marina Operations						-
Contractual		5,000				5,000
OUTPUT 7.3 TOTALS	-	**15,000**	-	-	-	**15,000**

OUTPUT 7.4: Hazardous Materials

Description	Year 1	Year 2	Year 3	Year 4	Year 5	Subtotal
HAZMAT Response						
Contractual		10,000				10,000
Spill Reporting						-
Contractual		5,000				5,000
HAZMAT Handling						-
Contractual		20,000				20,000
OUTPUT 7.4 TOTALS	-	**35,000**	-	-	-	**35,000**

Water Quality (continued)

OUTPUT 7.5: Watershed & Coastal Wetlands Protection

Description	Year 1	Year 2	Year 3	Year 4	Year 5	Subtotal
Develop Comprehensive Protection Plan						
Contractual	30,000					30,000
OUTPUT 7.5 TOTALS	**30,000**	-	-	-	-	**30,000**

Zoning

OUTPUT 8.1: Resource Zoning Marking Program

Description	Year 1	Year 2	Year 3	Year 4	Year 5	Subtotal
Inventory and GeoReference Areas						
Contractual	10,000					10,000
Implement Zoning Marking Program						-
Personnel	17,250					17,250
Equipment	12,500					12,500
Project supplies	16,000					16,000
Develop Maintenance Program						-
Personnel		17,768	18,301	18,850	19,415	74,333
Project supplies		4,000	4,000	4,000	4,000	16,000
Contractual	2,500					2,500
OUTPUT 9.1 TOTALS	**58,250**	**21,768**	**22,301**	**22,850**	**23,415**	**148,583**

Research & Monitoring

OUTPUT 9.1: Biological Monitoring

Description	Year 1	Year 2	Year 3	Year 4	Year 5	Subtotal
Develop Biological Monitoring Protocol						
Contractual	5,000					5,000
Identify Biological Monitoring Sites						-
Contractual	5,000					5,000
Implement Biological Monitoring Protocol						-
Personnel	29,900	30,797	31,721	32,673	33,653	158,743
Office and computer costs	3,500	1,500	1,500	1,500	1,500	9,500
Equipment	20,000					20,000
Project supplies	5,000	5,000	5,000	5,000	5,000	25,000
Review and Revise Management Practices						-
Travel	2,000	2,000	2,000	2,000	2,000	10,000
OUTPUT 9.1 TOTALS	**70,400**	**39,297**	**40,221**	**41,173**	**42,153**	**233,243**

Research & Monitoring (continued)

OUTPUT 9.2: Resource Use Monitoring

Description	Year 1	Year 2	Year 3	Year 4	Year 5	Subtotal
Develop Resource Use Protocol						
Contractual	10,000					10,000
Implement Resource Use Protocol						-
Personnel	29,900	30,797	31,721	32,673	33,653	158,743
Office and computer costs	3,500	1,500	1,500	1,500	1,500	9,500
Equipment	20,000					20,000
Project supplies	5,000	5,000	5,000	5,000	5,000	25,000
Review and Revise Management Practices						-
Travel	2,000	2,000	2,000	2,000	2,000	10,000
OUTPUT 9.2 TOTALS	**70,400**	**39,297**	**40,221**	**41,173**	**42,153**	**233,243**

OUTPUT 9.3: Fishing Activity Monitoring

Description	Year 1	Year 2	Year 3	Year 4	Year 5	Subtotal
Develop Fishing Activitiy Protocol						
Contractual	10,000					10,000
Implement Fishing Activity Protocol						-
Personnel	29,900	30,797	31,721	32,673	33,653	158,743
Office and computer costs	3,500	1,500	1,500	1,500	1,500	9,500
Travel						-
Equipment	20,000					20,000
Project supplies	5,000	5,000	5,000	5,000	5,000	25,000
Review and Revise Management Practices						-
Personnel						-
Travel	2,000	2,000	2,000	2,000	2,000	10,000
OUTPUT 9.3 TOTALS	**70,400**	**39,297**	**40,221**	**41,173**	**42,153**	**233,243**

Research & Monitoring

OUTPUT 9.4: Marine Park Database

Description	Year 1	Year 2	Year 3	Year 4	Year 5	Subtotal
Develop Monitoring Database						
Contractual	10,000					10,000
Manage Monitoring Database						-
Contractual		5,000	5,000	5,000	5,000	20,000
OUTPUT 9.4 TOTALS	**10,000**	**5,000**	**5,000**	**5,000**	**5,000**	**30,000**

Administration

OUTPUT 10.1: Administration

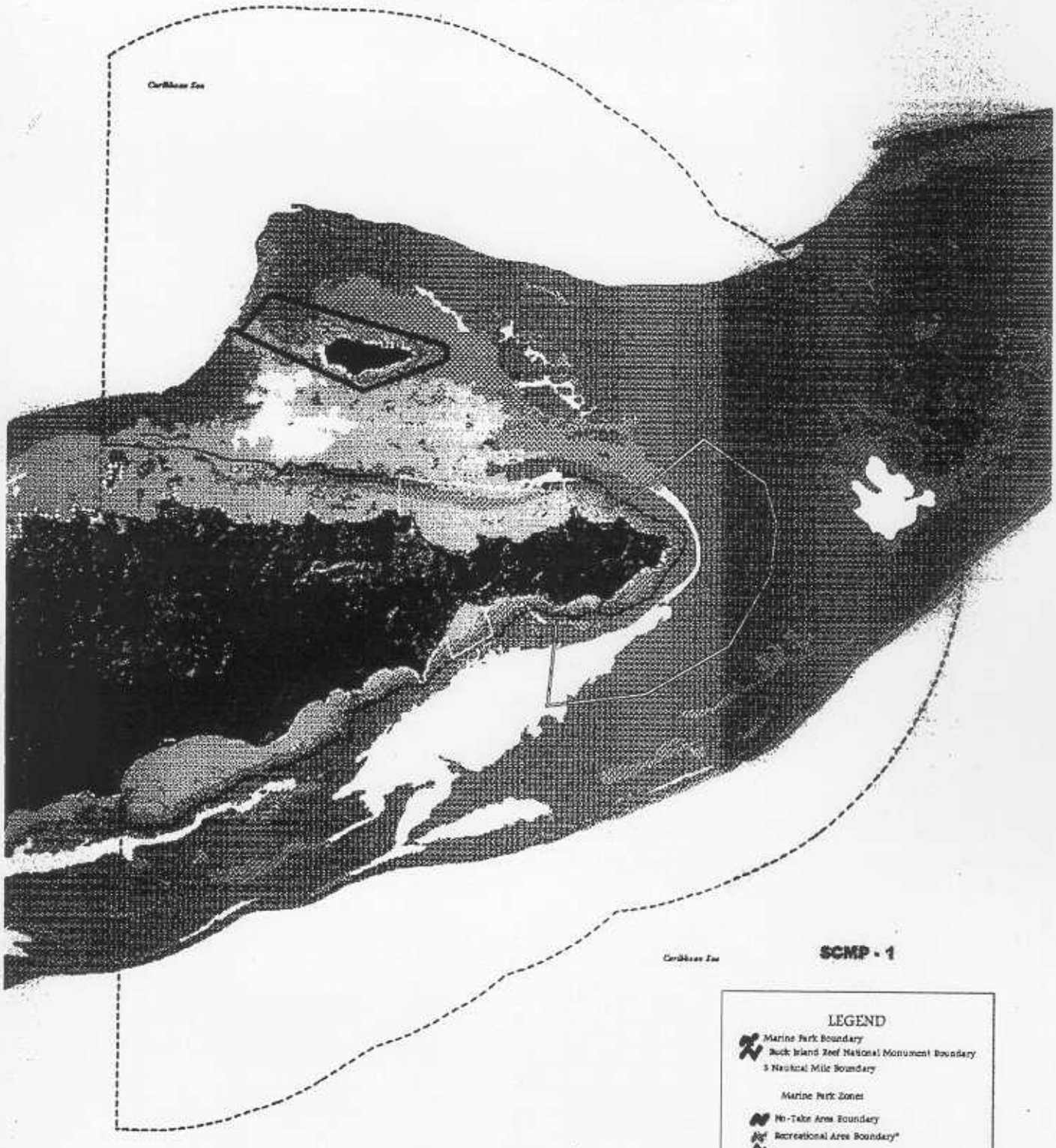
Description	Year 1	Year 2	Year 3	Year 4	Year 5	Subtotal
Open Marine Park Office						
Personnel	124,200	127,926	131,764	135,717	139,788	659,395
Office and computer costs	35,000	10,000	10,000	10,000	10,000	75,000
Travel	10,000	10,000	10,000	10,000	10,000	50,000
Equipment	150,000					150,000
OUTPUT 10.1 TOTALS	**319,200**	**147,926**	**151,764**	**155,717**	**159,788**	**934,395**

Summary by budget category.

Budget Category	Year 1	Year 2	Year 3	Year 4	Year 5	Subtotal
Personnel	600,300	618,309	636,858	655,964	675,643	3,187,074
Office and computer costs	60,500	19,500	19,500	19,500	19,500	138,500
Travel	21,000	21,000	21,000	21,000	21,000	105,000
Equipment	360,000	-	-	-	-	360,000
Project supplies	220,000	113,000	113,000	113,000	113,000	672,000
Contractual	326,500	154,000	39,000	39,000	39,000	597,500
PROJECT CATEGORY TOTALS	**1,588,300**	**925,809**	**829,358**	**848,464**	**868,143**	**5,060,074**

Appendix H: Marine Park Map

EAST END MARINE PARK
St. Croix, U.S. Virgin Islands



SCMP - 1

LEGEND

Marine Park Boundary
Buck Island Reef National Monument Boundary
3 Nautical Mile Boundary

Marine Park Zones

No-Take Area Boundary
Recreational Area Boundary*
Turtle Wildlife Preserve Area Boundary

*

Marine Communities

Macroalgae
Sand
Seachrock
Bedrock Col/uncol
Rubble
Hard pavement Col/uncol
Gorgonian-dominated pavement
Patch reef
Coral reef
Seagrass
Mud
Dredged
Artificial

EAST END MARINE PARK
St. Croix, U.S. Virgin Islands