COUPON BIGHT

AQUATIC PRESERVE MANAGEMENT PLAN

1990

DEPARTMENT OF NATURAL RESOURCES

DRAFT MANAGEMENT PLAN

FOR

COUPON BIGHT AQUATIC PRESERVE

SEPTEMBER 1990

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Executive Director

Florida Department of Natural Resources

Division of State Lands

Bureau of Submerged Lands and Preserves

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Copies of the legal description of the Coupon Bight Aquatic Preserve, as well as copies of Chapter 253 and 258, F.S., and Chapter 18-21, F.A.C., may be obtained from:

Bureau of Submerged Lands and Preserves
Department of Natural Resources
3917 Commonwealth Blvd.
Mail Station 140
Tallahassee, Florida 32399

CHAPTER I

INTRODUCTION

Coupon Bight Aquatic Preserve is located in the lower half of the Florida Keys in Monroe County. The aquatic preserve includes approximately 6000 acres of submerged lands in Coupon Bight and the Atlantic Ocean in a narrow band parallel to the Newfound Harbor Keys south of Big Pine Key (Figure 1). There are currently 42 aquatic preserves throughout the state (Figure 2). Coupon Bight is one of three that are located in the Key's. (Lignumivitae Key Aquatic Preserve lies in the upper Keys and the Card Sound portion of Biscayne Bay Aquatic Preserve is located between north Key Largo and the Florida mainland.) Coupon Bight is unique within the state system because it encompasses living coral reef formations.

This management plan will also address several upland habitats contained within the Coupon Bight Buffer Project. To date, 99 acres of transitional wetlands and tropical hardwood hammock uplands have been purchased by the Conservation and Recreational Lands (CARL) Trust Fund. Purchase of these lands was deemed necessary because of their environmental sensitivity, proximity to the aquatic preserve and to protect several species of endangered and threatened plants and animals.

The role of the Aquatic Preserve Program is to manage and protect the natural resources within the boundaries of a preserve through staff programs and coordination with other state and federal resource management programs. An integrated management plan encompassing all the legislatively delegated resource management and protection laws is essential in preserving the resource values of the preserve. Local government will also be encouraged to incorporate this plan's policy directives into the local government comprehensive plan.

The rich mosaic of resource types within Coupon Bight Aquatic Preserve and the Buffer area contribute to the biological diversity and productivity of marine systems and enhance man's enjoyment of the area. The aquatic preserve was designated by the Florida Legislature in 1969 to conserve and protect these values. This plan is intended to be used as the primary tool for management of the preserve to attain these goals. It is designed to be site-specific in addressing resource management issues relative to lands within the preserve.

The process of developing this management plan involved compiling an inventory of resource information, coordinating with other plans that have been developed for the area and state, and identifying resource and management issues related

to present and future uses of the preserve and adjacent uplands. Various management areas will be identified or delineated. Supporting goals, objectives and policies were developed to be consistent with statutory authority and the overall intent of the Aquatic Preserve Program for helping ensure that the resources of Coupon Bight Aquatic Preserve will remain for future generations to enjoy. As additional resource information becomes available or as laws are implemented or revised, changes may have to be made to the plan to reflect those events.

The Governor and Cabinet, sitting as the Board of Trustees of the Internal Improvement Trust Fund has been legislatively delegated statutory authority (Section 253.03, F.S.) to exercise proprietary control over state-owned lands and may assign management responsibilities for those lands to appropriate governmental agencies. Development and implementation of this management plan will be through the administrative support and the field staff of the Department of Natural Resources (DNR), Division of State Lands, Bureau of Submerged Lands and Preserves.

More specifically, this plan is divided into chapters according to their management application:

Chapter II cites the statutory authorities upon which this resource management program and plan are built.

Chapter III provides a description of the aquatic preserve and details the physical, biological and cultural components of the preserve. It also contains an overview of regional and local land use and associated impacts.

Chapter IV delineates the management areas within the preserve. These areas are defined by taking into account the quantity and the quality of the biological resources in conjunction with the use of the adjacent lands.

Chapter V presents specific needs and issues that are unique to the preserve that are not addressed through statute or code.

Chapter VI outlines the program's goals, objectives, and the tasks required to fulfill those needs within the preserve for resource management, resource protection, research, and environmental education.

Chapter VII identifies local, regional, state, and federal agencies, their authorities and programs, and how they relate and assist in protection and management of the preserve. It also identifies non-governmental organizations, interest groups, and individuals that have interests in or may assist in management objectives.

Chapter VIII projects future staffing and fiscal needs necessary for providing effective management and protection of the preserve, as well as supporting research and environmental education.

Chapter IX outlines a monitoring program for recording and reporting resource changes and establishes a tracking system for detailing the progress and accomplishments in resource management.

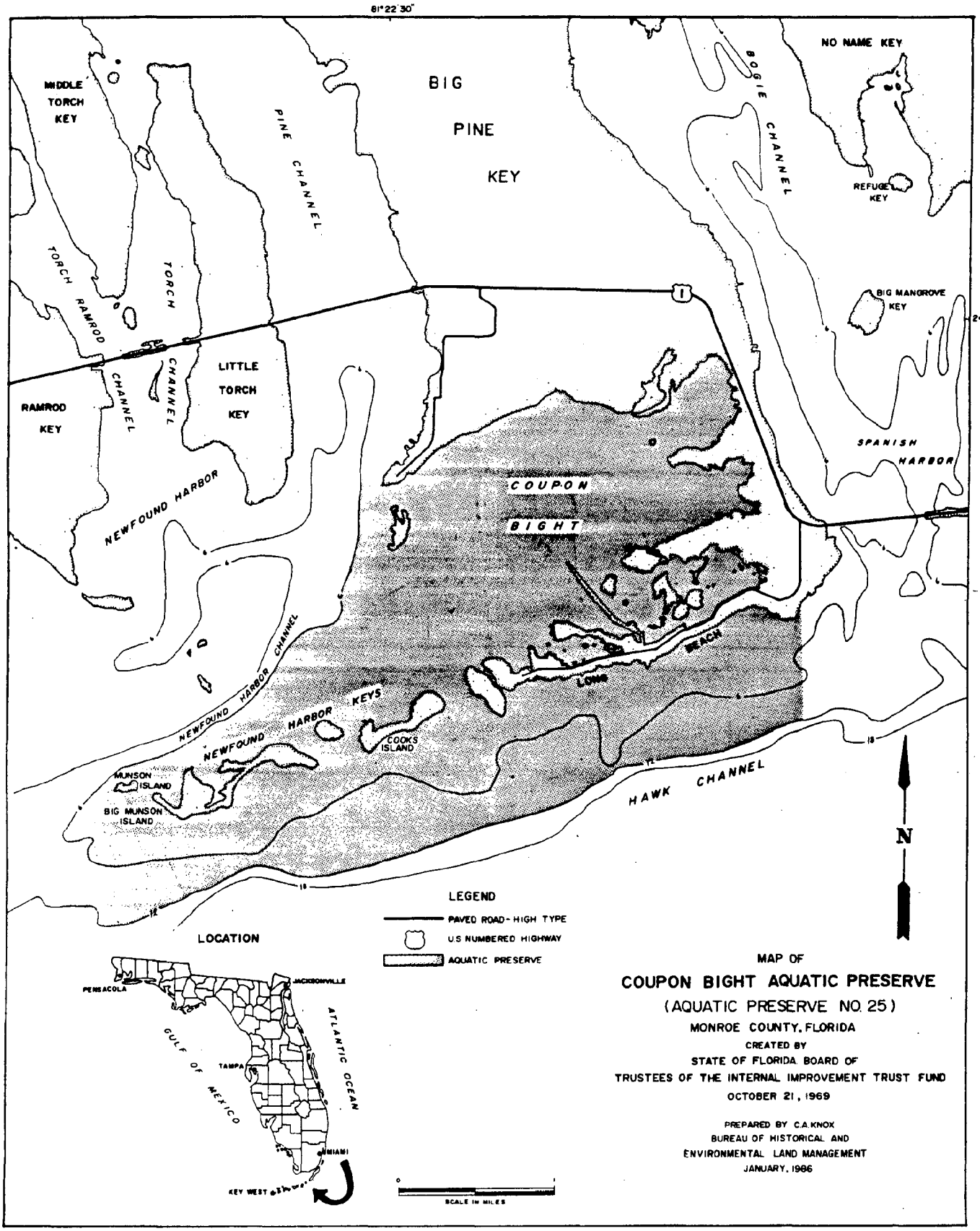
81°22'30"
MIDDLE TORCH KEY
BIG PINE KEY
PINE CHANNEL
BOGIE CHANNEL
NO NAME KEY
REFUGE KEY
TORCH RAMROD CHANNEL
TORCH CHANNEL
BIG MANGROVE KEY
24°40'
LITTLE TORCH KEY
RAMROD KEY
SPANISH HARBOR
NEWFOUND HARBOR
COUPON BIGHT
NEWFOUND HARBOR CHANNEL
LONG BEACH
NEWFOUND HARBOR KEYS
COOKS ISLAND
MUNSON ISLAND
BIG MUNSON ISLAND
HAWK CHANNEL
N
LEGEND
PAVED ROAD - HIGH TYPE
U.S. NUMBERED HIGHWAY
AQUATIC PRESERVE
LOCATION
PENSACOLA
JACKSONVILLE
GULF OF MEXICO
ATLANTIC OCEAN
TAMPA
MIAMI
KEY WEST
SCALE IN MILES
MAP OF
COUPON BIGHT AQUATIC PRESERVE
(AQUATIC PRESERVE NO. 25)
MONROE COUNTY, FLORIDA
CREATED BY
STATE OF FLORIDA BOARD OF
TRUSTEES OF THE INTERNAL IMPROVEMENT TRUST FUND
OCTOBER 21, 1969
PREPARED BY C.A. KNOX
BUREAU OF HISTORICAL AND
ENVIRONMENTAL LAND MANAGEMENT
JANUARY, 1986

FIGURE 1


AQUATIC PRESERVES
AQUATIC PRESERVES ARE ESTABLISHED BY THE FLORIDA LEGISLATURE AND INCLUDE ONLY STATE OWNED SOVEREIGNTY SUBMERGED LANDS. THE GOVERNOR AND CABINET SITTING AS TRUSTEES OF THE INTERNAL IMPROVEMENT TRUST FUND ARE MANAGERS OF THESE AREAS.
FOR MORE INFORMATION REGARDING AQUATIC PRESERVES CONTACT:
DEPARTMENT OF NATURAL RESOURCES
DIVISION OF STATE LANDS
BUREAU OF AQUATIC PRESERVES
3900 COMMONWEALTH BLVD
TALLAHASSEE, FLORIDA 32303
CREATED BY CAROL A. KNOX
1986
FT PICKENS STATE PARK
YELLOW RIVER MARSH
WOODS BAYOU STATE PARK
ST ANDREWS STATE PARK
ST JOSEPH BAY
APALACHICOLA BAY
ALLIGATOR HARBOR
LAKE JACKSON
BIG BEND SEAGRASSES
GULF OF MEXICO
ST MARTINS MARSH
PINELLAS COUNTY
ROCA CEIA BAY
COCKROACH BAY
TERRA CEIA
LEMON BAY
GASPARILLA SOUND CAPE HAZE
CHARLOTTE HARBOR
MATLACHA PASS
PINE ISLAND SOUND
ESTERO BAY
ROOKERY BAY
CAPE ROMANO 10,000 ISLANDS
COUPON BIGHT
LIGHTHOUSE KEY
BISCAYNE BAY
LOXAHATCHEE RIVER
NORTH FORK ST LUCIE RIVER
JENSEN BEACH TO JUPITER INLET
INDIAN RIVER VERO BEACH TO FT PIERCE
INDIAN RIVER-MALABAR TO VERO BEACH
SEBASTIAN RIVER
MOSQUITO LAGOON
WEKIVA RIVER
TOMOKA MARSH
PELICAN CREEK
ORLANDO RIVER
RAINBOW SPRINGS
LAKE WEIR
GUANA RIVER
NASSAU RIVER-ST JOHNS RIVER MARSHES
ST CLINCH
ATLANTIC OCEAN

FIGURE 2

CHAPTER II

MANAGEMENT AUTHORITY

A. STATUTORY AUTHORITY

The primary statutory authorities available to the staff for the management of aquatic preserves are found in Chapters 253 and 258, Florida Statute (F.S.). In particular, Sections 258.35-258.24 enacted in 1975 by the Florida Legislature represent the Florida Aquatic Preserves Act. These statutes set forth a standardized management criteria for all designated aquatic preserves and represent the primary laws governing the use of sovereignty submerged lands. These authorities also clearly establish the proprietary management role of the Governor and Cabinet in their capacity as the Board of Trustees of the Internal Improvement Trust Fund. All management responsibilities assigned to the Trustees may be fulfilled directly by the Governor and Cabinet or indirectly via staff through delegations of authority, management agreements, or other legal mechanisms. All references to the "Board" or the "Trustees" in this plan potentially include staff in addition to the Governor and Cabinet themselves.

Aquatic Preserve staff may be designated to review requests for use of state-owned lands and provide comments to the Board of Trustees, via the Division of State Lands and Department of Natural Resources administrative staff, relevant to the environmental impacts of a proposed use. The staff review is conducted within the confines of Section 258.42, F.S., and in conjunction with other governmental bodies, comments and recommendations are presented to the Board as an agenda item for their deliberations.

B. ADMINISTRATIVE RULES GOVERNING AQUATIC PRESERVES

Chapters 18-20 and 18-21, Florida Administrative Code (F.A.C.), are two administrative rules directly applicable to the DNR's/Trustees' actions regarding uses of lands in aquatic preserves and other state-owned submerged lands.

1. CHAPTER 18-20, F.A.C.

Chapter 18-20, F.A.C., addresses the aquatic preserves and derives its authority from Sections 258.35, 258.36, 258.37 and 258.38, F.S., and is found in Appendix A. The intent of this rule is contained in Section 18-20.001, F.A.C., which states:

> "(1) All sovereignty lands within a preserve shall be managed primarily for the maintenance of essentially natural conditions, the propagation of fish and

wildlife, and public recreation, including hunting and fishing where deemed appropriate by the Board and the managing agency.

(2) The aquatic preserves which are described in Section 258.392, F.S., and in 18-20.002, F.A.C., were established for the purpose for being preserved in an essentially natural or existing condition so that their aesthetic, biological and scientific values may endure for the enjoyment of future generations.

(3) The preserves shall be administered and managed in accordance with the following goals:

(a) To preserve, protect, and enhance these exceptional areas of sovereignty submerged lands by reasonable regulation of human activity within the preserves through the development and implementation of a comprehensive management program;

(b) To protect and enhance the waters of the preserves so that the public may continue to enjoy the traditional recreational uses of those waters such as swimming, boating, and fishing;

(c) To coordinate with federal, state, and local agencies to aid in carrying out the intent of the Legislature in creating the preserves;

(d) To use applicable federal, state, and local management programs, which are compatible with the intent and provisions of the act and these rules, to assist in managing the preserves;

(e) To encourage the protection, enhancement or restoration of the biological, aesthetic, or scientific values of the preserves, including but not limited to the modification of existing man-made conditions toward their natural condition, and discourage activities which would degrade the aesthetic, biological, or scientific values, or the quality, or utility of a preserve, when reviewing applications, or when developing and implementing management plans for the preserve;

(f) To preserve, promote, and utilize indigenous life forms and habitats, including but not limited to: sponges, soft coral, hard corals, submerged grasses, mud flats, estuarine, aquatic and marine reptiles, game and non-game fish species, estuarine, aquatic and marine invertebrates,

estuarine, aquatic and marine mammals, birds, shellfish and mollusks;

(g) To acquire additional title interests in lands wherever such acquisitions would serve to protect and enhance the biological aesthetic, or scientific values of the preserves;

(h) To maintain those beneficial hydrologic and geologic functions, the benefits of which accrue to the public at large."

2. CHAPTER 18-21, F.A.C.

Chapter 18-21, F.A.C., controls activities conducted on state-owned submerged lands and is predicated upon the provisions of Sections 253.12 and 253.03, F.S. The stated intent of this administrative rules is:

"(1) To aid in fulfilling the trust and fiduciary responsibilities of the Board of Trustees of the Internal Improvement Trust Fund for the administration, management and disposition of sovereignty lands;

(2) To insure maximum benefit and use of sovereignty lands for all the citizens of Florida;

(3) To manage, protect, and enhance sovereignty lands so that the public may continue to enjoy traditional uses including but not limited to, navigation,fishing, and swimming;

(4) To manage and provide maximum protection for all sovereignty lands, especially those important to public drinking water supply, shellfish harvesting, public recreation, fish and wildlife propagation and management;

(5) To insure that all public and private activities on sovereignty lands which generate revenues or exclude traditional public uses provide just compensation for such privileges; and

(6) To aid in the implementation of the State Lands Management Plan."

Chapter 18-21.0041 provides more specific statements regarding multi-slip docking facilities in the Florida Keys Marina and Dock Siting Policies and Criteria. This section of the F.A.C. requires consistency and conformity with the "Principles for Guiding Development in the Florida Keys Area of Critical State

Concern" designation (Chapters 27F-8, -9, -10, -11, -12, -13, and -15, F.A.C.). In summary, this rule is intended to protect endangered, threatened and species of special concern, the Florida Reef Tract, other corals, wetland and submerged vegetation, and benthic communities. Additionally, this rule requires that facilities be located in areas with adequate tidal flushing and adequate water depths to avoid dredging and other bottom disturbance. More specific criteria require a minimum depth of -4 feet and that depth be adequate in the mooring, turning and access channel areas, with greater depth requirements for those facilities intended for mooring of boats with drafts greater than 3 feet. Specific structure design criteria are also contained with Chapter 18-21.

C. RELATIONSHIP TO OTHER PLANS AND PROGRAMS

As mandated in 18-20.001, 3 (a), F.A.C., this plan, as well as plans for other aquatic preserves have and are being developed as funding is made available. Presently, 14 management plans have been approved by the Trustees, which cover 21 of the State's 42 aquatic preserves. Former plans were designed to be generic in nature, with policies and management guidance generally applicable to all aquatic preserves. However, this plan and all future plans will be more site-specific and contain policy guidance and directives applicable to an individual preserve. The former management plans were incorporated into rule in 1988. This and future plans will be similarly incorporated. As such, these plans carry the same authority as do Chapters 18-20 and 18-21, F.A.C.

The Conceptual State Lands Management Plan, adopted on March 17, 1981, and amended by the Trustees on July 7, 1981 and March 15, 1983, contain specific policies concerning spoil islands, submerged land leases, "Outstanding Native Florida Landscapes", unique natural features, seagrass beds, archaeological and historical resources, and endangered species. These policies provide management direction for the Aquatic Preserve Program.

The State Comprehensive Plan, established by Chapter 187, F.S., provides board policy guidance for the development of management plans for the statewide system of aquatic preserves, Therefore, the goals, objectives and policies set forth in this aquatic preserve management plan are designed to be consistent with the goals and policies of the State Comprehensive Plan pertaining to the water resources, coastal and marine resources and natural systems.

The Local Government Comprehensive Planning Act of 1975 (Section 163.3163, F.A.C.) (as amended by Chapter 85-55, Laws of Florida, to the Local Government Comprehensive Planning and Land Development Regulation Act) requires that all counties in

Florida have a Local Government Comprehensive Plan (LGCP) by 1990. Monroe County government is required to provide planning for various elements including: housing, physical facilities, land use, conservation, and coastal zone protection. This plan has been developed to be consistent with present conservation and coastal management elements of the local government plan and will endeavor to provide criteria and standards that will be used in local plan revision. Monroe County's LGCP will be submitted in September of 1990. When the LGCP plan is adopted, applicable policy statements will be incorporated into this management plan.

D. OTHER MANAGEMENT AUTHORITIES

Other Department of Natural Resources management authorities applicable to aquatic preserves include management and protection of fisheries and marine mammals as well as beach and shore preservation programs outlined in Chapters 370 and 161, F.S., respectively. Land acquisition programs conducted under the Environmentally Endangered Lands (EEL) authorities of Chapter 259, F.S., and the Conservation and Recreation Lands (CARL) program, authorized by Chapter 253, F.S., will enhance management and protection of the natural resources within the aquatic preserves.

Chapter 403, F.S., which is an important adjunct to Chapters 253 and 258, F.S., governs, in part, the State's regulatory programs affecting water quality and biological resources. The Department of Environmental Regulation (DER), through a permitting and certification process, administers this program. Section 253.77, F.S., as amended by the Warren S. Henderson Wetlands Protection Act of 1984, requires that any person requesting use of state-owned land to have approval of the proposed use from the Trustees before commencing the activity. An interagency agreement between DNR and DER provides an avenue for staff comments on the potential environmental impacts of projects in aquatic preserves through the DER permitting process. Additionally, the DER has designated through administrative rule, a series of waterbodies as Outstanding Florida Waters (OFWs). The DER has adopted stringent use criteria for these OFWs. The inclusion of all aquatic preserve waters within this classification greatly enhances the protective provisions of Chapter 258, F.S. As the designated "306" Coastal Zone Management Agency, the DER also provides a source of funding matched by federal monies for data collection and planning in various areas. Funding for this plan was provided, in part, from these sources.

The DER's administrative rules of primary significance to the aquatic preserve management program are based upon the authorities contained in Chapter 403, F.S. Chapter 17-3,

F.A.C., addresses water quality standards and establishes the OFW category. Chapter 17-4, F.A.C., addresses permit requirements.

Other opportunities for environmental review and input into activities potentially affecting aquatic preserves are afforded by the Department of Community Affairs (DCA). The DCA is statutorily responsible for administering the Development of Regional Impact (DRI) and Area of Critical State Concern (ACSC) designation. The DRI program, authorized by Section 380.06, F.S., was established by the Legislature to provide a review and monitoring procedure for those development projects potentially affecting more than one county. The Governor and Cabinet designated the Florida Keys as an Area of Critical State Concern on April 15, 1975. A prime objective of the designation and regulations (or "Principles for Guiding Development" established for the Keys 1984) was to strengthen local land use management capabilities. DCA has been working with the local governments in a cooperative intergovernmental effort to meet this objective. DCA also has the authority to approve or amend the local comprehensive growth management plan and implement land use regulation within the ACSC.

The Department of State's Division of Archives, History, and Records Management (DAHRM) is legislatively assigned to preserve and manage Florida's archaeological and historical resources. DAHRM holds title to the cultural resources located on state-owned lands, including state-owned submerged lands, pursuant to Chapter 267, F.S.

The Department of Health and Rehabilitative Services (HRS), under their public mandate, administers two programs directly affecting the aquatic preserve management program. The regulation of septic tanks is typically administered by the county health department. The arthropod (mosquito) control program is implemented through the local Mosquito Control District (MCD). Administration of these programs may potentially have significant impacts upon the aquatic preserve. Although there is no legislatively created vehicle, establishment of close working relationships between the aquatic preserve staff and HRS is a necessary element of the aquatic preserve management program.

The South Florida Water Management District (SFWMD) administers permitting programs for the local potable water supply, stormwater discharges, and some dredge and fill activities. Stormwater discharges in the area of the aquatic preserve may potentially affect certain management objectives. Close coordination with SFWMD permitting review is indicated when a particular project could pose threats to the quality or quantity of water introduced into the preserve.

Additional agencies and organizations that have interests or regulatory authority within the aquatic preserve or the adjacent uplands are listed in Chapter VII (Management Implementation Network) of this plan.

CHAPTER III

RESOURCE DESCRIPTION

The geology, climate, and hydrology of the Florida Keys have combined to create a unique environment suitable for colonization by tropical plants and animals that are highly specialized and limited to a relatively small geographic area on this continent. Coupon Bight Aquatic Preserve encompasses a variety of habitats or communities that support many of this species.

Detailed information on the resources (e.g., species lists, water quality data, archaeological and historical site information, life histories, supporting maps, cultural resource information, etc.) is listed in the following sections. The resource information presented in this chapter is intended to be generally descriptive of major management functions and resources in the area of the preserve.

A. LOCATION AND BOUNDARIES

Coupon Bight Aquatic Preserve is located in the lower half of the Florida Keys archipelago. Lying south of the main land mass of Big Pine Key, the preserve is bounded on the north and east by the extension of that land area and on the south by the twelve foot depth contour in the Atlantic Ocean. The western boundary runs from the 12 foot Atlantic contour along the 6 foot depth contour of Newfound Harbour Channel in a northeasterly direction to the southwestern tip of Big Pine Key. The privately owned Newfound Harbor Keys lie between the interior waters of the Bight and the Atlantic portions of the preserve. Only state-owned submerged lands are included within the boundary. Total area is approximately 6000 acres.

Additionally, this management plan will address state-owned uplands acquired through the Conservation and Recreational Lands Coupon Bight Buffer project. Approximately 100 acres of mangrove/saltmarsh and tropical hardwood hammock areas have been purchased to date.

B. GEOLOGY

Both the ancient and modern geology of the Florida Keys is reflective of the biological communities and the marine environment that have shaped and continue to influence the configuration of these islands and adjacent marine areas. In geological time, the area is still very young and the present epoch heralds further change as sea levels rise with the retreat of glacial ice fields.

The present geological formations began 100,000 years ago during the Pleistocene Era when sea level was approximately 25 feet above present level. Corals and other marine organisms assimilated calcium carbonate from marine waters and constructed reef formations very similar to the living reefs of today. As the plants and animals died, their skeletal remains became part of the fossilized patch reefs and sea floor that were exposed as sea level receded during the Wisconsin glaciation period. The glacial fields bound up large volumes of the earth's water and sea level dropped to approximately 325 feet below present levels. The exposed limestone was subjected to the erosive forces of wind, rain, and plants and began to take on its present appearance. During the recent Holocene period, sea level rose to its present level and is continuing a slow rise of about two inches every 100 years (Hoffmeister, 1974, Wanless, 1969). More recent calculations by Wanless (1989) estimate that sea level in Florida may be rising at 8-16 inches per 100 years.

The geological formations of the Keys may be further subdivided into two distinct physiographic and geologic regions. The Upper Keys (from Soldier Key to the eastern edge of Big Pine Key) are distinguished by the elongate dome and linear configurations that are the remains of the ancient coral reefs. Elevations may rise 15-18 feet above sea level near the center of the northern most islands. This porous aggregate of fossil skeletal remains is referred to as the "Key Largo limestone" formation. Many of the fossilized remains are recognizable as the progenitors of species that inhabit the reef today (Multer, 1977)(Hoffmeister and Multer, 1964).

In the Lower Keys (Big Pine Key to Key West), the Key Largo limestone is overlain by the Miami limestone formation, or Miami oolite. The Miami limestone was formed in a high energy, shallow water environment with low silt content and high levels of calcium carbonate. Spherical ooid films were cemented together in dense layers around a core material, usually a grain of sand (Multer, 1977).

The geological interface of these two formations is exposed near the Long Beach area at the eastern boundary of the preserve. Some areas have been obliterated by road building and other earth moving activities. Other areas have been exposed by the same activities and the construction of drainage ditches. The submerged portions of the interface within the Coupon Bight are difficult to distinguish, having been buried by layers of silt and detritus. Small ledges and outcroppings encountered while mapping community distribution in 1985 may be an indicator of the submerged portions of the interface. Observations by Howard et al., (1970) described the Key Largo limestone as underlying the southern one-third of the Bight.

Although the exposed portions of the interface are presently outside the boundary of the preserve, every effort should be made to encourage protection of this locally significant point of geological interest.

The Miami limestone is not as porous as the Key Largo formation. Acid etched solution features form depressions that retain freshwater. These freshwater lenses influence the biological communities. They support a variety of plants and animals that are not found in the Upper Keys and are more closely akin to communities on the mainland. This is especially true on Big Pine Key and No Name Key where pinelands and cattail (Typha) marshes are common upland features.

C. PHYSIOGRAPHY

Based upon biogeography and physical characteristics, the modern geologic environments of the preserve may be divided into three regions: lagoon, nearshore and patch reef. Each environment or region is significantly influenced by existing basement geology, as well as tidal circulation patterns and the biological communities that occur in each.

1. Lagoon

Coupon Bight is a shallow semi-enclosed basin approximately 2.2 miles (3.5 kilometers) long and 1.6 miles (2.5 kilometers) wide and with an average 6 foot (1.8 meter) depth near the center. Tidal circulation in the shallow-water bay is restricted by the land mass of Big Pine Key on the north and east, to a lesser extent by the Newfound Harbor Keys on the south, and the bay mouth bank at the western opening of the Bight. The deep sediments associated with the bay mouth bar are the result of hydrological transport and deposition from Newfound Harbor and Big Pine Channels. Turtle grass (Thalassia testudinum) is a major influence in stabilizing the bank and in trapping additional sediments.

The lagoon environment of the Bight is characterized by varying depths of sediments over bedrock. Exposed portions of the basement rock are colonized by sponges, small corals or algae. (This type on environment is referred to as hardbottom, hardgound or live bottom by various authors. For purposes of this management plan it will be referred to as hardbottom.) Areas of deeper sediments are colonized by marine grasses and algae. Areas of thinner sediments are dominated by algae, sponges or sparse colonies of grasses.

Major sediment constituents are fragments of calcareous algae, Foraminifers, rock and mollusk shells. Minor constituents of scleractinian corals, crustacean carapaces and echinoderm

ossicles, and pellets are also present. The abundant coral skeletal fragments in the southern portion of the Bight are transported from the Atlantic nearshore to the south through the tidal passes between the New Found Harbor Keys. The sediment facies are generally reflective of the living biota that occur within the Bight today. There are 55 species of Foraminifera and approximately 94 species of mollusks represented within the Bight (Howard et al., 1970) (Howard and Faulk, 1968).

2. Nearshore

The submerged substrate seaward of the Newfound Harbor Keys slopes gradually from the shoreline to the edge of Hawks Channel. As in the Bight, sediment depth over bedrock is a major factor in determining the distribution of community associations and individual organisms that shape the geophysical environment. The intertidal zone is typically a broad, shallow shelf of the exposed bedrock material with a thin veneer of sediment. The crenelate, solution pocked surface is the product of the soluble nature of limestone and the burrowing and boring organisms that inhabit the intertidal zone. Sponges, worms, crustaceans, mollusks, and echinoderms are major erosive agents in these areas. As it is being eroded, crustose and filamentous algae bind sediments and as they are alternately wetted and dried, form a karst-like layer over the underlying limestone in the intertidal zone (Ginsburg, 1953; Neuman, 1966; Robertson, 1963).

Subtidal areas are typically colonized by hardbottom communities where sediment is thin. Clear, shallow waters nearshore support impressive colonies of clubbed finger coral (Porites) and coraline algae near Cooks and Big Munson Islands. Their skeletal remains form a large proportion of the sediment in the passes between the Newfound Harbor Keys and may be deposited in the Bight during storm events and high tides. In deeper water, sponges, gorgonians, algae and small colonies of stony corals tend to dominate. This hardbottom community is the most common association in the Atlantic portion of the preserve. As in the Bight, the basement rock is dotted with shallow, sediment filled depressions that support sea grass beds of varying dimensions and density.

3. Patch Reef

Patch reefs develop on hardbottom substrate where other environmental factors are favorable. These three dimensional features are elevated, solid frameworks of living organisms (and their skeletal remains) that are actively building the geological record of the future. Major reef building organisms are the stony corals (Scleractinia) and coraline algae.

In the early stages of patch reef development, the fauna is dominated by pioneering species such as finger corals (Porites spp.), rose coral (Manicina areolata) and golfball coral (Favia fragum). These are smaller nonreef building species. The corals assimilate and redistribute calcium carbonate in the form of an exoskeleton. Over time, these corals live, die, erode, and recolonize the hardbottom, transforming it into a very different community. They will consolidate the hardbottom into a substrate dominated by coral and coral skeletal material. The larger coral colonies then have a foundation for colonization. The primary frame builders of this stage of the reef are the starlet corals (Siderastrea sp.), star corals (Montastraea sp.) and the brain corals (Diploria sp.). The more massive corals add vertical relief and numerous micro-habitats that offer sustenance to a vast array of other organisms (Japp, 1984).

Many other organisms are instrumental in the geological formation of the reef. Some are active bioerosive forces that bore or feed upon corals and fragment the exoskeleton. This sediment is thus redistributed on the reef where other physical and geochemical agents consolidate loose sediments and provide additional substrate for reef expansion (Ginsburg and Schroeder, 1973). Exported sediment is redistributed in other marine areas or washed ashore to form beaches and berm. This course carbonate "sand" or rubble is remarkably different from the quartzous silica of other shorelines in Florida. The fine grained silica sands of riverine systems make up only a small proportion of the beach sediments in the Keys.

The growth and distribution of patch reefs is governed by several other physical and biological factors. They are not arranged haphazardly but lie in areas that not only offer suitable substrate, but have access to the photic zone, warm water temperatures, nutrients from the waters of Florida Straits and protection from the excessive sediments, temperature and salinity fluctuations of Florida Bay (Hoffmeister and Multer, 1968). Given optimum local conditions a coral colony may grow as much as 190 inches (482.6 cm) in a thousand years (0.2 inches or .5 cm/year) (Shinn et al., 1977).

The amounts of calcium carbonate ($CaCO3$) associated with coral reefs is a good indicator of this community's importance as a geological agent. As much as 163 metric tons of $CaCO3$ can be fixed by a moderate sized reef shelf in a single year (Stearn et al., 1977). Primary fixing agents are the stony corals and the crustose coraline algae. In warmer climates growth may be triple this annual rate (Adey, 1977). Thus, the patch reef is a significant engineer of both past and future geology in tropical waters.

D. HYDROLOGY

The present geological landforms and the hydrological regime interact to influence the distribution of biological communities and ongoing process of deposition and erosion that sculpture the appearance of the area. The islands of the Lower Keys are oriented on a perpendicular axis to the Upper Keys islands. The numerous north/south channels that separate the Lower keys allows the sediment laden waters of the Gulf of Mexico and Florida Bay to mix with the Atlantic Ocean. The longshore currents and eddies that circulate from the north-bound Gulf stream flow roughly parallel to the island shorelines in a southwesterly direction. Silt and sediments from the channels are transported by these currents. As current velocity diminishes, sediments fall to the bottom forming bars or filling in depressions in the bedrock.

The distribution of patch reefs within the preserve is affected by the proximity of the two channels east and west of the preserve boundaries and by the barrier created by the Newfound Harbor Keys. Turbid waters from Pine Channel are diverted to the southwest by Little Munson and Big Munson Islands and the bay mouth bar on the west side of Coupon Bight. Circulation of the waters from Coupon Bight is obstructed by bars that shoal the passes between the islands. The larger patch reefs lie in the "shadow" or sheltered area, seaward of Big Munson Island, in those areas where the island's land mass acts as a barrier to the turbid, cooler waters of Florida Bay and Coupon Bight.

Sediment laden waters from Spanish Harbor (Bogie) Channel are propelled along the shoreline of the Long Beach area at the eastern side of the preserve. Fewer patch reefs are located in that portion of the preserve as a result of the excessive sediments and fluctuating salinities and temperatures. For this same reason, the best developed beach strand also occurs in this area. Fine sediments are sorted and transported, then deposited on the shoreline in the Long Beach area.

Hydrological regime within Coupon Bight also plays a role in the distribution of biological communities in the lagoon. Water flow and circulation is governed almost entirely by the proximity to Big Pine Channel. Hydrological patterns affect the distribution of sediments and deposits reach maximum depth in the area of the bay-mouth bar at the edge of Big Pine Channel. The bar acts as a barrier to circulation and a catchment for additional deposits of sediments from the channel. The bay-mouth bar and the shoals between the Newfound Harbor Keys restrict tidal import and export of vital nutrients and creates conditions of highly variable salinities and temperatures within the Bight. The more diverse biological communities occur in the northeastern corner of the lagoon where larger volumes of water from the channel are

circulated. As the circulation pattern diminishes toward the eastern portions of the Bight, the biological communities are correspondingly less diverse with distance from the channel (Howard et al., 1970).

Wind plays a secondary role in the hydrological patterns in the lagoon. The shallow waters are easily agitated and fine sediments are easily suspended by wind-driven currents. Suspended sediments inhibit photosynthetic activity by reducing light penetration and thus may determine the variety and density of marine flora. Water near the center of the lagoon is frequently turbid and marine grass beds in deeper portions of the Bight are usually sparse even though sediment depths are adequate to support them (pers. obser.). Waters along most of the leeward shorelines of the New Found Harbor Keys are protected from wind/currents and tend to be relatively clear. Grass beds in these areas are generally lush and expansive.

Historically, Coupon Bight may have been open to additional circulation from Big Pine and Spanish Harbor Channels. The restricted baylet at the northeast corner of the Bight appears to have been open to circulation currents from Spanish Harbor Channel and was most probably obstructed during the construction of U.S. Highway 1 or during the railroad era. An existing mangrove creek was connected to Spanish Harbor channel at the southeast corner of the Bight. This creek has been interrupted by the construction of the Long Beach and U.S. Highway 1 roadways and a marina/campground at the channel's edge. A similar creek, or slough, exists near the center of the north shoreline and angles toward the northwest. It has been interrupted by a series of residential finger canals and roadways before it connects to Pine Channel.

Little researched information is available regarding the more recent events that have perpetuated or altered the hydrology of the Bight. The effects that these events have had upon the distribution and diversity of marine organisms is therefore purely speculative. The gradual rise (or retreat) in sea level is yet another factor that will determine the future configuration of emergent lands and hydrological regime in the area. Additional observation and research may reveal the patterns of biological succession that can be anticipated.

Tide cycles are semi-diel, having two highs and two lows within each lunar period. Tidal flood enters the Bight via the channel north of the bay mouth bar and to a lesser extent through the passes between the Newfound Harbor Keys. Velocity gradually diminishes traveling eastward and is barely perceptible in the constricted baylets. Tidal ebb typically moves in the reverse direction (Howard et al., 1970). Tidal range is approximately 2 feet with higher and lower tides experienced during full and new moon phases. Low elevations

of adjacent wetlands contributes to frequent flooding during these events.

E. WATER QUALITY

The Florida Department of Environmental Regulation (DER) has designated waters of the preserve as Outstanding Florida Waters (OFW) (17-3.041, F.A.C.). As such, these waters are to be afforded the highest protection possible. To qualify for this designation, water quality must be maintained within the established standards. All activities that may potentially alter these standards are evaluated accordingly.

Water quality data is limited in the area of the preserve. DER maintains a monitoring station west of Newfound Harbor Channel, outside the preserve boundary. Data from this station is generally reflective of ambient conditions since 1982. A summary of conditions for both ambient and impacted stations was published in "Report to the Environmental Regulation Commission on the Proposed Designation of the Florida Keys as an Outstanding Florida Water" (DER, 1984). A short term study by Newfound Harbor Marine Institute (Unpublished, 1987) provides limited data. Present proposals for research include an extension of the previous study.

Other research centered on the effects of septic tank effluent on ground and surface waters in the Big Pine Key area. This study has determined that septic effluent increases contamination in ground waters during the dry (winter) season and that horizontal subsurface transport introduces these effluents to contiguous (marine) surface waters during the wet (summer) period. Nutrient loading of surface waters is also indicated with the use of aerobic treatment units with shallow injection wells. The non-saline wastewater effluent is buoyant and rises within the rock strata to mix with surface waters. Continued increases in land use density and use of on-site sewage disposal systems (OSDS) are predicted to increase nutrient contamination of marine waters. (La Pointe, 1989).

Highly publicized reports on the recent decline of marine grass beds in the eastern portion of the Bight attribute the loss to water pollution from upland development (Estrin, 1988). However, Howard et al., (1970) described this area as having 'generally sparse' marine grasses and algae as early as 1967. Howard further points out that 'the primary factor in biotic distribution (in the Bight) is the type of substrate present.' Extreme temperatures and highly variable salinities would also tend to inhibit grasses in this area.

F. CLIMATE

The nearly tropical climate is characterized by mild, dry winters and warm, humid summers. Prevailing trade winds from the east and southeast are occasionally interrupted by winter cold fronts that move over the area from the north or northwest in the winter and infrequent tropical storms and depressions in the summer months (Warzeski, 1976). The average rainfall at Key West is 39.8 inches per year with large peaks occurring in June and September (NOAA, 1965, 1979). Rainfall increases from Key West to the Upper Keys by about five inches per year. Summer thunderstorms and the occasional tropical storm provide the bulk of the rainfall, with minor amounts associated with the winter cold fronts.

Annual average air temperature (measured at Key West) is 77.5 degrees Fahrenheit (F). Seasonal mean highs of 84.7 degrees F occur in July and August. Mean lows of 69.0 degrees F occur during December and January (NOAA, 1965, 1979). Ambient temperatures are a direct influence of the Gulf Stream (Jordan, 1973). Neither frost nor freeze have been recorded for the area. As with most maritime climates, average humidity is typically high.

The tropical storms and hurricanes that visit this area deserve more than a casual mention. They tend to have major effects on the biology and natural features of a large area and on the activities of the human populations that visit and inhabit those areas. The long term benefits and deficits to the natural environment are poorly understood. Ball et al., (1967) and Craighead and Gilbert (1962) reported extensive biological and geological rearrangement and destruction of the coastal zone in South Florida and the Keys after the passage of Hurricane Donna in 1960. The greatest destruction or erosion of shorelines occurred where shoreline vegetation or shallow water marine grassbeds had been previously damaged or destroyed. Recovery of these areas was hindered by these alterations, as erosion often continued after the initial onslaught of the storm (Multer, 1977).

It is necessary to understand a hurricane's potential as a destructive agent and to be prepared for its occurrence. It is also necessary to plan development that will minimize destruction of natural communities. Although these natural communities may be severely damaged by hurricanes, the corals, grass beds and mangroves provide a natural buffer that can reduce the severity of impacts on coastal areas. They demonstrate a capacity to recover when functional integrity has not been undermined by manmade alterations to biological and geological features.

G. BIOLOGICAL COMMUNITIES

This section will discuss some of the plant and animal associations within the preserve. Individual species are grouped in representative community types based upon dominance or absence of certain floral and faunal constituents. General descriptions and species lists are intended to be reflective of the community being discussed under each subheading. The listing of a species in one community does not limit its occurrence to only that community. Each community association is presented separately, but in reality they display an infinite variety of mixed and interdependent associations. Major community associations in the preserve are mangrove/saltmarsh, coastal beach or berm, marine grassbeds, hardbottom and patch reefs. Figure 3 illustrates the submerged vegetation resources of the preserve.

Subtle differences in geology, topography, microclimate and other physical parameters may determine the initial dominance of a particular association in an area, or the particular area may be modified by the existing biota and thus evolve or succeed into an entirely different association. The natural components of the environment are never static and usually progress in an orderly sequence of change from one sere to the next. Each succeeding sere is generally more complex and diverse than the previous association. Those communities that have reached a climax or balanced condition are usually most productive in terms of biomass and species diversity.

Catastrophic events, such as hurricanes and man-made alteration of natural features disrupt orderly progression and may set back the sere to an earlier stage that is less productive. Many of the man-made disturbances will be discussed in the text. These changes not only inhibit or reverse succession but may replace entire associations with other less productive environments. The affected environment or community is not the only one to be diminished. All marine systems are interrelated and thus changes to one association will directly or indirectly affect a number of other related and interdependent associations. The importance of marine productivity has been expounded upon since ancient times yet only recently has modern man begun to appreciate the intricate and vital role that these communities play in the larger ecological profile of our region and our planet.

1. Mangrove/Saltmarsh

Mangrove/saltmarsh communities contribute substantially to the health and productivity of marine systems in the preserve. Shoreline stabilization, storm protection, filtration and stabilization of sediments, nutrient cycling and habitat diversity are only a few of the many functions that this

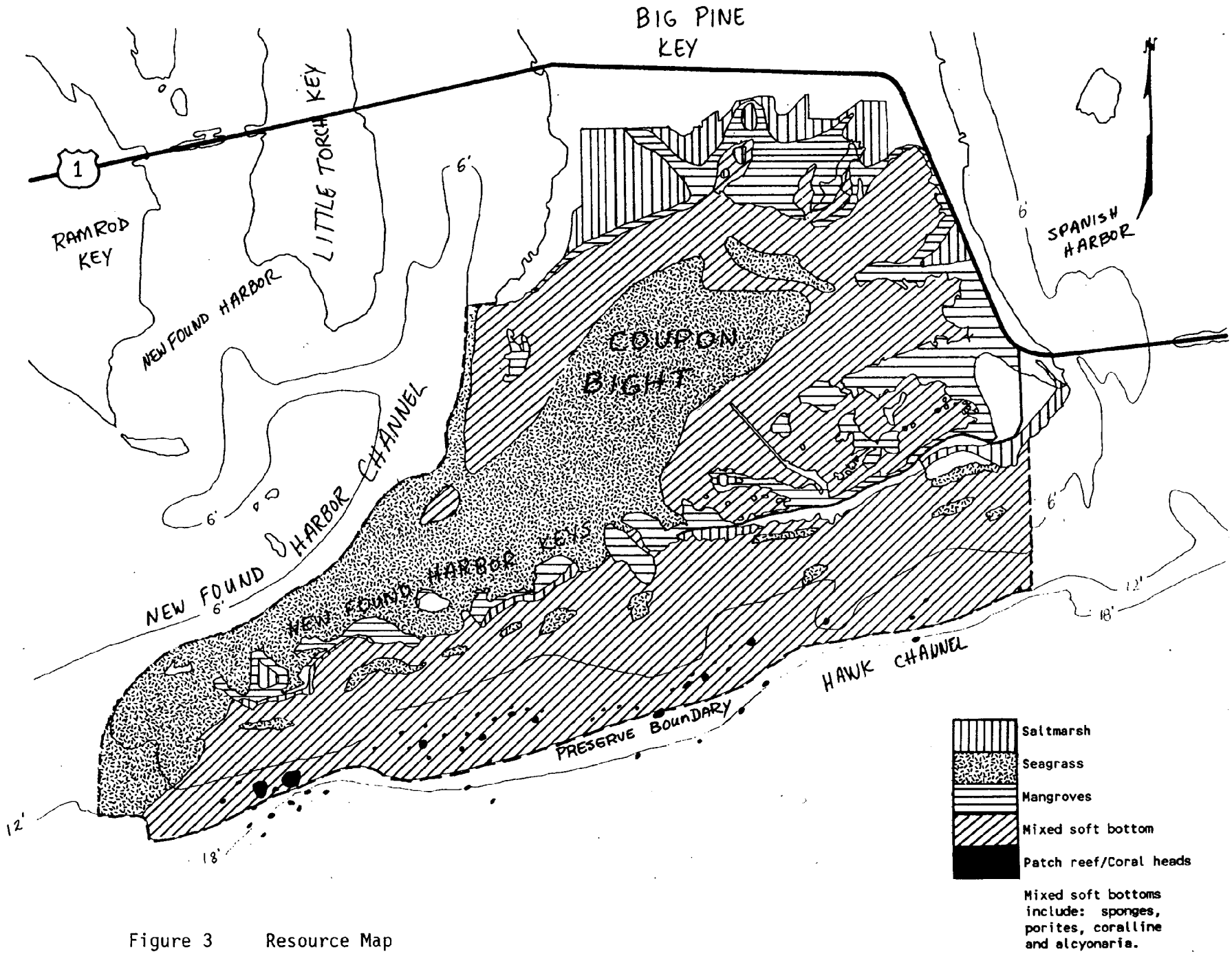

Figure 3 Resource Map

community performs. It is composed of two diverse groups of salt tolerant plants.

The saltmarsh vegetation is represented by a large group of herbaceous and woody plants that lie landward of the fringing mangroves. Members of this plant community are often included in what is referred to as the "buttonwood" or "transition zone". It is distinguished by an open canopy of buttonwood (Conocapus erectus) trees and low growing species that are tolerant of periodic tidal inundation and extreme fluctuations in salinity. Plants in this community may also be intermixed with mangroves and beach/berm communities and form a rich mosaic of vegetative types. A partial list of the mangrove/saltmarsh plants is presented in Table 1. Endangered and threatened species are noted.

Mangroves are a pan-tropical species, occurring on seventy-five percent of the worlds tropical coastline (McGill, 1959). Of the 72 species recognized by Chapman (1976), only three species occur in Florida. Red mangrove (Rhizophora mangle) and white mangrove (Languncularia racemosa) grow along low energy shorelines from the Florida Keys to near Cedar Key on the west coast (Rehm, 1976) and north to Ponce de Leon Inlet on the east coast (Teas, 1977). Black mangrove (Avicennia germinans) extends farther north on the east coast to near 30 degrees north latitude and along the Gulf coast to Louisiana and Texas (McMillan, 1971). These tropical trees are sensitive to fluctuating temperatures and prolonged periods of cold or frost (Davis, 1940). Prolonged temperatures below 66 degrees F may be lethal or cause stunted growth forms (Waisel, 1972). Accordingly, the largest mangrove forests (90% according to estimates by the Coastal Coordinating Council, 1974) are located in the more southern areas of the state, primarily in Lee, Collier, Dade, and Monroe Counties. Monroe County encompasses approximately 234,000 acres (95,000 ha.) of mangroves, the majority lying within the boundaries of Everglades National Park and the small islands in Florida Bay.

Of the six mangrove forest types described by Lugo and Snedaker (1974), only the fringing forest and the scrub (or dwarf mangrove) forest are well represented in the preserve. The fringing mangroves occur along the intertidal shoreline surrounding the emergent islands and are especially abundant on the leeward sides of these islands that are protected from prevailing easterly winds and waves. The scrub or "dwarf" mangrove forests occur in many of the constricted baylets on the eastern shoreline of Coupon Bight and within the impounded wetlands to the north of the Bight.

TABLE 1

A PARTIAL LIST OF THE MANGROVE/SALTMARSH FLORA

Beach orach	Atriplex arenaria	
Black mangrove	Avicinnia germinans	
Saltbush	Baccharis sp.	
Saltwort	Batis maritima	
Sea oxeye daisy	Borrichia spp.	
Saffron plum	Bumelia celestrina	
Gray nicker	Caesalpinia crista	
Seven-year apple	Casasia clusifolia	
Saltgrass	Distichlis spicata	
Seagrape	Coccoloba uvifera	
Buttonwood	Conocarpus erectus	
Geiger	Cordia sebetena	(E)
Clamshell orchid	Encyclia cochleata	(T)
Butterfly orchid	Encyclia tampensis	(T)
Seaside gentian	Eustoma exaltatum	
Sedge	Fimbristylis castanea	
Wild cotton	Gossypium hirsutum	(E)
Seaside heliotrope	Heloiotropium curassavicum	
Seaside hibiscus	Hibiscus tillaceus	
Manchineel	Hippomane mancinella	
Keys spider lily	Hymenocallis latifolia	(T)
White mangrove	Languncularia racemosa	
Herbaceus sea lavender	Limonium carolinianum	
Christmas berry	Lycium carolinianum	
Sea lavender	Mallotonia gnaphalodes =Tournefortia gnaphalodes	(E)
Wild dilly	Manilkara bahamensis	
Gutta percha mayten	Maytenus phllanthoides	
Poisonwood	Metopium toxiferum	
Key grass	Monanthochloe littoralis	
Prickly pear cactus	Opuntia stricta	(T)
Knot grass	Paspalum distichum	
Purslanes	Portulaca spp.	
Red mangrove	Rhizophora mangle	
Rouge berry	Rivina humilis	
Glasswort	Salicornia spp.	
Sea purslane	Sesuvium portulacastrum	
Virginia dropweed	Sporobolus virginicus	
Sea blight	Suaeda linearis	
Bay cedar	Suriana maritima	(E)
Mahoe	Thespesia populnea	
Air plants	Tillandsia spp.	(*)

(* All except T. usnroides are endangered (E), threatened (T), or commercially exploited (C).)

Local distribution of mangroves is affected by several physical parameters. Wave energy and substrate are probably most significant within the preserve. Fringing mangrove forests reach optimum development on low energy shorelines with fine sediments. Fine sediments deposited in shallow depressions in the caprock provide sufficient depth for propagules to become rooted. Other areas lack sufficient sediment depths or are buffeted by waves or swift currents that would bury seedlings or sweep them away. This type of environment is especially prevalent along the Atlantic shoreline of the Newfound Harbor Keys. Although all three mangrove species are present, the mangrove fringe is usually not wide and may only occupy the extreme seaward edge of the shoreline. Constant wave energy scours the rocky intertidal zone and longshore currents deposit course calcarious sand fragments that form a beach/berm along the more exposed shorelines. This shifting substrate offers few opportunities for mangrove propagules to become established and those that survive are continually threatened with being submerged by additional sand or swept away by storm waves.

Recent loss of several white and black mangroves on the Atlantic side of the Long Beach area may be directly attributed to storm surge associated with minor hurricanes (Kate and Elaina) that passed near the Keys in 1985. Close examination of affected trees revealed that sediments were eroded and large portions of the root systems of these trees were exposed as a result. Leaves withered and died within four to six weeks after the storms and were still attached to the trees months after the event. In some cases only portions of the trees exhibited extreme signs of necrosis. Those individuals that suffered only partial excavation of the root systems showed signs of resprouting or retention of landward portions of the canopy one year after the storms. Survivability of these individuals is precarious, as they may be further stressed by desiccating forces (sun and wind) or toppled by winds.

Tidal regime in coastal areas also plays an important part in mangrove dominance of the shoreline. The advance and retreat of marine waters facilitates import of necessary nutrients into the community and exports organic carbons and other compounds to marine systems. Tides are also instrumental in dispersing the buoyant seeds and propagules.

Ambient marine salinities benefit mangroves in several ways. Competition from less tolerant terrestrial plants is minimized and soil salinities are moderated by daily flushing. Unlike their terrestrial counterparts mangroves have evolved mechanisms to exclude or excrete salt from plant tissues. The red mangrove can exclude salt at the root surface (Scholander, 1968). Black and white mangroves secrete salt through modified glands on the leaf or trunk and by storing salt in

succulent leaves and fruit that fall from the tree. Most halophytic plants are believed to use these mechanisms or a combination of them to dispose of excess salt (Teas, 1979).

Excessive soil or water salinity, however, can stress mangroves. Salinities above 65 parts per thousand (ppt) can kill red mangroves (Cintorn et al., 1978). Salinities at or above 80 ppt may stunt white and black mangroves, especially in combination with high water temperatures (Lugo and Zucca, 1977). Impounded mangroves are frequently subjected to this type of stress. As normal tidal circulation is interrupted, water temperatures may exceed 100 degrees F and evaporation increases salinity to debilitating levels. Highly fluctuating temperatures and salinities combined with low sediment deposition, and low nutrient import create an extremely inhospitable environment. The result is a dwarfed or scrub mangrove forest (after Lugo and Snedaker, 1974). All three species may be represented but are seldom more that 5 feet tall. They are often referred to (locally) as "spider" mangroves. Impoundment may be the result of natural topographic features (e.g., coastal berms) or caused by ditching and other manmade alterations to drainage patterns. Dwarfed mangroves occur over extensive areas of the wetlands adjoining the east and north shorelines of Coupon Bight.

Excessive temperatures and salinities (greater than 100 ppt) are also thought to be responsible for the relatively barren salt ponds or salinas that persist in many areas (Teas, 1979). Although these hypersaline areas may be inhospitable for most vascular plants, they perform other functions and should not necessarily be considered wasteland. They serve as valuable repositories for storm water runoff and sediments. These shallow water environments also support a broad range of algae that serve as a food source and provide cover for an equally diverse faunal community. Large numbers of larval fish species, gastropods, and crustaceans utilize this environment and are in turn valuable food reserves for many of the wading birds when other feeding areas may be flooded during high tides or inaccessible during periods of unfavorable winter weather (Sprunt, pers. com.)

The mangrove/saltmarsh association is a major component of the preserves resources, both in distribution and ecological value. This community is the most common interface between the upland and the marine environment. As such it contributes to the diversity and productivity of the larger ecological units. Major contributions from this community involve the complex and often poorly understood detrital food webs that are an integral part of tropical and temperate marine systems. Nutrients from both marine and terrestrial sources are assimilated and recycled in the vegetative tissues of the mangroves and everpresent root and mud algae. Primary productivity is difficult to partition because all levels of

the community have not been thoroughly researched. It is, however, a widely accepted hypothesis that the organic carbons exported by mangrove systems are a major source of energy for many biologically and economically important species of invertebrates and fishes.

Carbon and other nutrients from terrestrial sources (Carter et al., 1973), rainfall (Lugo et al., 1980), and from marine sources are assimilated and recycled in the form of plant material that is fed upon by a host of arboreal, epiphytic, infaunal, and pelagic life forms. Energy pathways may originate from several different sources within the community. Sea grasses and benthic algae are trapped and broken down into particulate matter that is used by large numbers of consumers (Brook, 1975). Senecsed mangrove leaves are attacked by fungi (Fell et al., 1975) and bacteria (Casagrande and Given, 1975) that colonize the leaf surface. As the leaf surface is fragmented, plant starches and proteins are broken down or converted to other compounds that are more easily consumed and assimilated by other microscopic life forms that break down the plant material to even smaller fragments. As more surface area is actually made available, the biotic community expands, thus increasing the net available energy. As these smaller, protein rich particles are consumed, the resulting energy is passed on to higher order consumers (Odum, 1971; Odum and Heald, 1972; Odum and Heald, 1975; and Odum et al., 1982).

Epiphytic and benthic algae that live on and near the mangrove roots also contribute substantially to the energy transfer to higher trophic levels. Rehm (1974) recorded 74 species of red, brown, green and blue-green algae associated with mangrove areas. This abundant resource is actively grazed by numerous faunal species on site or may die to become part of the detrital food web. The net primary production of prop root epiphytes and mud algae may equal emergent leaf production in some areas (Lugo et al., 1975).

The contributions of plankton to local marine energy budgets are difficult to evaluate. This dynamic group is subject to abrupt changes in density depending upon season, currents and nutrient levels. Although quantitive research has not been done specifically for mangrove estuaries, the importance of planktonic food chains has been well documented for other regions and it may be assumed that there are large numbers of invertebrate grazers that benefit from this community component. The abundance of phytoplankton and zooplankton within the immediate area of mangroves would indicate that this energy source is important to many larval food webs (Odum, 1970). Table 2 contains a partial list of non-vascular plants and phytoplankton of the mangrove/saltmarsh association.

TABLE 2

A PARTIAL LIST OF THE NON-VASCULAR MANGROVE/SALTMARSH FLORA

Genera	Location	Reference
FUNGI		
Nigrospora	Leaf	Fell, et al., 1975, 1980
Phyllostica	"	
Pestalotica	"	
Phytophora	"	"
Drechslera	"	"
Gloeosporium	"	"
Lulworthia	"	"
ALGAE		
Monostroma	High water mark on red and black mangrove	Taylor, 1960
Rhizoclonium		
Bostrychia	Just below high water mark on red prop roots	"
Catenella		"
Caloglossa		"
Acanthorphora	Submerged on red prop roots	Almodovar and Biebl 1962
Caulerpa		
Hypnea	"	
Laurencia	"	"
Spyrida	"	"
Valonia	"	"
Wrangelia	"	"
Centroceras	"	"
Dasya	"	Taylor, 1960
Dictyota	"	
Halimeda	"	"
Murrayella	"	"
Polysiphonia	"	"
Wurdemaniia	"	"
Boodleopsis	Mud near roots	"
Cladophoropsis	"	"
Enteromorpha	"	"
Vaucheria	"	"
PHYTOPLANKTON		
Chaetocerus	Water column	Mattox, 1949
Thalassothrix	"	
Nitzschia	"	Wood, 1965
Skeletonema	"	Walsh, 1965
Rhizosolenis	"	Bacon, 1970

Disploneis	Benthic	Wood, 1965
Mastogloia	sediments	"
Pluerosigma	"	"
Peridinium	Water column	Odum et al., 1982
Gymnodinium	"	"

(From Odum et al., 1982)

Faunal components of the mangrove/saltmarsh community are as diverse as the floral counterpart. This community provides food, cover, spawning, nesting and resting habitat for many species of mammals, birds, reptiles, amphibians, fish and invertebrates. Many species are dependent upon this community during all or part of their life cycle. This interdependency may be critical for several endangered and threatened species that will be discussed in subsequent sections.

Animal life that graze directly upon arboreal leaf material include large numbers of insects including the olethrautid moth (Ecdytolopha sp.) and beetles (principally, Poecilips rhizophorae) (Onuf et al., 1977). Simberloff and Wilson (1969) list 200 species of insects that are assoicated with mangrove communities. The mangrove tree crab (Aratus pisonii) is also a primary consumer of mangrove leaves (Beever et al., 1979). Other invertebrate fauna of the emegent mangrove/saltmarsh include large numbers of gastropods. The snails (Littorina sp., Cerithidea sp. and Melampus sp.), isopods (Ligea spp.), and fiddler crabs (Uca spp.) are especially plentiful (Odum et al., 1982). These invertebrates are in turn a staple to many species of birds.

The striking avifauna is often the most noticeable in the mangrove/saltmarsh association. Many species depend upon the community for feeding, nesting and resting sites. Large wading birds, such as the egrets, ibis, spoonbill, herons and the open-water piscivorous birds, such as the osprey and pelican are especially dependent upon mangrove areas. Others are only occasional or seasonal visitors. Odum et al., (1982) list 181 species that may be expected to use the mangrove community.

Other macrofauna that utilize the mangrove/saltmarsh include a number of terrestrial and aquatic reptiles, amphibians and mammals. Among the marine turtles, only the Atlantic loggerhead (Caretta caretta caretta) is relatively common in the preserve. This species may use mangroves as nursery areas (Odum et al., 1982). The Atlantic hawksbill (Eretmochelvs imbricata) and the Atlantic green turtle (Chelonia mydas) are known to feed upon mangrove roots and leaves (Ernst and Barbour, 1972; Carr and Goin, 1955) and may occasionally frequent mangrove areas in the preserve. The Atlantic ridley

(Lepidochelys kempii) is an occasional visitor to shallow coastal areas of south Florida (Carr and Goin, 1955). Green turtles were once plentiful in the Keys and were an important commercial fishery until populations were nearly extirpated from overharvesting and egg collecting. Recent efforts to reintroduce this species may prove beneficial.

Other reptiles include several species of snakes and anoles, a turtle, a terrapin, and two crocodilians. Of the snakes, only one, the mangrove water snake (Nerodia fasciata compressicauda) is entirely dependent upon mangrove/saltmarsh areas. The others are transitory in habit and may utilize a variety of environments, as do the turtle and terrapin. The American alligator (Alligator mississippiensis) is primarily an inhabitant of freshwater areas but may venture into mangrove areas more frequently than past observations would indicate, especially during periods of drought (Jacobsen, 1983). The American crocodile (Crocodylus actus) is more commonly associated with the mangrove fringed shorelines adjoining deeper waters, such as natural creeks, canals, barrow pits or basins. It is a rare visitor in the preserve.

Amphibians are generally not well represented due to the plausity of freshwater areas that are usually necessary for reproduction. Those listed are suitably adapted to reproducing during the brief rainy period and may utilize brackish water pools for this purpose. The giant toad (Bufo marinus) and the Cuban treefrog (Hyla septentrionalis) are introduced species that have expanded their range considerably in the last several decades (King and Krakauer, 1966; King and Krakauer, 1968; and Krakauer, 1970).

The mammals of the mangrove/saltmarsh include a number of subspecies that are unique to the Lower Keys. Like the reptiles, they utilize a broad range of habitat types. All, except the silver rice rat (Oryzomys argentatus) and the Virginia opossum (Didelphis virginiana), are frequent visitors to the mangrove/saltmarsh areas. The rice rat may utilize saltmarsh areas that adjoin fresh or brackish marshes (Spitzer-Goodyear, pers. com.). The opossum is generally confined to small populations in close proximity to human habitations. Recent signs of range expansion in other areas of the Keys may also be duplicated on Big Pine Key, as urban populations expand. This marsupial and the raccoon are extremely versatile omnivores and are known to forage mangrove/saltmarsh habitats (Layne, 1974).

The Key deer (Odocoileus virginianus clavium) is a frequent visitor to the preserve mangrove/saltmarsh. The deer use a variety of habitats and the mangrove fringe offers excellent cover for foraging and a corridor for movement between the Newfound Harbor Keys and Big Pine Key. Fresh water ponds located in the Cactus Hammock in the Long Beach area are

readily accessible and deer sightings are common throughout the year.

The marine life of the mangrove/saltmarsh is by far the most diverse group of organisms in this association. Detritus and plankton are primary food sources for a large number of invertebrate fauna that attach themselves to prop roots, live in adjacent muds, or swim in the water. Courtney (1975), Tabb et al., (1962), and Odum and Heald (1972) reported extensive lists of invertebrates that are associated with mangroves.

The prop root complex is also important to many species of fish. Ample food and close proximity to cover that offers protection from predators is essential for large numbers of juvenile and adult fish. Many complete their life cycle within the mangrove community. Others are dependent upon mangroves during juvenile stages and migrate to grassbeds and/or coral reefs when mature. Still others are opportunistic vagabonds that utilize a variety of habitats and may be only seasonally or locally abundant. The proximity of other habitat types greatly increases the overlap of species from the other communities.

Many species of invertebrates and fishes that utilize the mangrove/saltmarsh are important to local recreational and commercial fisheries. Important species of local commercial fisheries include; pink shrimp (Penaeus duorarum), stone crab (Menippe mercenaria), spiny lobster (Panulirus argus), jacks (family Caranigadae), jewfish (Epinepelus itajara), grunts (family Pomadasyidae), grouper (Dpinepelus spp.), seabass (family Serranidae), snapper (Lutjanus spp.), mullet (family Mugilidae), red drum (Sciaenops ocellata), ladyfish (Elops saurus), spotted sea trout (Cynoscion nebulsus), and menhaden (Brevoortia patronus).

These species represent a major portion of the annual seafood landings in Monroe County and are an integral part of the local economy. Finfish from the above groups represented $2,472,866 of the landings value for the county in 1985. Shrimp, spiny lobster and crabs represented $32,781,414 or (92%) of the total value of all species taken. Total landings for all species represented approximately 39 million dollars to the local economy (NMFS, 1985). These figures reflect commercial dockside landing prices and do not include income derived from local support facilities (fuel, repair, dockage, tackle, etc.).

Table 3 provides Monroe County commercial landing statistics data for finfish and crustaceans landed at local docks in 1984 and 1985. These figures were extracted from the NMFS annual report and include only finfish that are dependent upon mangrove and seagrass associations during part or all of their life cycle. They do not include landings for sharks.

Although there were approximately 219,149 pounds harvested in 1985 (and many sharks are closely associated with mangrove areas), the data cannot be fairly apportioned as to species. Neither do the figures include deepwater pelagic species or sponges that are landed locally.

Many of the commercial species are also important to local recreational fisherman. Additionally, tarpon (Megalops atlantica), snook (Centropomus undecimalis), barracuda (Sphyraena barracuda) and bonefish (Albula vulpes) are avidly pursued by local enthusiast as well as thousands of annual visitors. Unfortunately, statistics are not currently available for recreational landings and income. Although the pounds landed would not approach the commercial statistics, conservative estimates would indicate that local income from hook and line enthusiasts is probably in excess of 50 million dollars a year. Once again, the total value of support services cannot be separated from local income statistics.

The statistics themselves do not and cannot reflect the many values of this important resource. They cannot, for example, assign a dollar figure to the aesthetic and ecological values associated with mangrove/saltmarsh habitats. Nor can they relate the cost or efficiency of the intricate transfer of energy from one organism to the other. They can, however, provide some rudimentary knowledge of the importance of this habitat to the many species that enrich our culinary pleasure and our local economy. They also reaffirm man's close association with and dependency on the vital marine food web that emanates from mangrove and saltmarsh estuaries.

TABLE 3

NATIONAL MARINE FISHERIES
MONROE COUNTY FISH LANDINGS 1984-1985

	1984		1985	
Category	Pounds	Value($)	Pounds	Value ($)
Finfish	2,808,582	3,145,376	2,326,927	2,472,866
Crabs	1,783,314	3,407,821	1,738,179	3,569,105
Lobster	5,926,266	14,838,419	5,421,524	13,070,966
Shrimp	10,776,329	15,219,687	10,494,228	16,141,343

(Reference: NMFS/SEFC, 1984, 1985)

Table 4 includes a partial list of the major invertebrate groups and the vertebrate fauna of the mangrove/saltmarsh association. For additional information on specific species, the reader is directed to the noted references. Odum et al., (1982) provide comprehensive lists of habitat types and diet preferences for fish and birds from published literature.

TABLE 4

PARTIAL LIST OF THE MANGROVE/SALTMARSH FAUNA

INVERTEBRATES

Zooplankton
This extensive group includes single-celled protozoans and the larvae and eggs of the invertebrates and fish listed below.

Jellyfish (Scyphozoa)	
Unside-down jellyfish	*Cassiopeia xamachana*
Marine worms (Annelida)	
	Armandia agilis
	Cirratulus sp.
	Lumbrineries maculata
Molluscs	
Blackhorn snail	*Batillaria minima*
Ladderhorn snail	*Cerithidea scalariformis*
Periwinkle	*Littorina* spp.
Saltmarsh snail	*Melampus coffeus*
Bleeding tooth	*Nerita* spp.
Predatory snail	*Pisania tincta*
Crustaceans (may comprise 70% of zooplankton)	
Barnacle	*Chthamalus stellatus*
	Lithortrya dorsalis
Copepod	*Acartia* spp.
Searoach	*Ligia* spp.
Wood borer	*Sphaerom terebans*
Pistol shrimp	*Alpheus* spp.
Pink shrimp	*Penaeus duorarum*
Shore shrimp	*Palaemonetes* spp.
Cleaning shrimp	*Periclimenes* spp.
Shrimp	*Synalpheus fritzmuelleri*
Spiny Lobster	*Panulirus argus*
Hermit crab	*Pagurus* spp.
Hermit crab	*Clibanarius* sp.
Blue crab	*Callinectes sapidus*
Crab	*Cyclograpsus* sp.
Shore crab	*Pachygrapsus* spp.

Mangrove tree crab	Aratus pisonni	
Marsh crab	Sesarma sp.	
Fiddler crab	Uca spp.	
Stone crab	Menippe mercenaria	

Holothurians

Sea cucumber	Holothuria floridana	

(References: Odum et al., 1982)
See Simberloff, 1976; Simberloff and Wilson, 1969 for comprehensive list of insects

VERTEBRATES

Fishes

Nurse shark	Ginglymostoma curratum	
Blacktip shark	Carcharhinus limbatus	*
Lemon shark	Negaprion brevirostris	
Bonnethead	Sphyrna tiburo	
Smalltooth sawfish	Pristis pectinata	
Guitarfish	Rhinobatos letiginosus	
Lesser electric ray	Narcine brasiliensis	
Southern stingray	Dasyatis american	
Yellow ray	Urolophus jamaicensis	
Spotted eagle ray	Aetobatus narinari	
Ladyfish	Elops saurus	
Tarpon	Megalops atlantica	*
Bonefish	Albula vulpes	*
Scaled sardine	Harengula pensacolae	
Atlantic thread herring	Opisthonema oglinum	
Bigeye anchovy	Anchoa lamprotaenia	
Bay anchovy	Anchoa mitchilli	
Inshore lizardfish	Synodus foetens	
Sea catfish	Aruis felis	
Gulf toadfish	Opsanus beta	
Skilletfish	Gobiesox strumosus	
Shortnose batfish	Ogcocephalus nasutus	
Key brotula	Ogilbia cayorum	
Halfbeak	Hyporhamphus unifasciatus	
Redfin needle fish	Strongylura notata	
Timucu	Strongylura timucu	
Houndfish	Tylosurus crocodulus	
Sheepshead minnow	Cyprinodon variegatus	
Rainwater killifish	Lucania parva	
Rivulus	Rivulus marmoratus	
Mosquitofish	Gambusia affinis	
Mangrove mosquitofish	Bamvusia rhizophorae	
Sailfin molly	Poecilia latipinna	
Reef silverside	Allanetta harringtonensis	
Rough silverside	Membras marinica	
Tidewater siverside	Menidia beryllina	

Lined seahorse	Hippocampus erectus	
Dwarf seahorse	Hippocampus zosterae	
Pipefish	Syngnathys spp.	
Snook	Centorpomus undecimalis	*
Black seabass	Centropristis striata	*
Sand perch	Diplectrum formosum	
Jewfish	Epinephelus itajara	*
Red grouper	Epinephelus morio	*
Nassua grouper	Epinephelus Striatus	*
Barred hamlet	Hypolectrus puella	
Gag	Mycteroperca microlepis	*
Bronze cardinalfish	Astrapogon alutus	
Conchfish	Astrapogon stellatus	
Bluefish	Pomatomus saltatrix	*
Cobia	Rachycentron canadum	*
Whitefin sharksucker	Echeneis neucratoides	
Blue runner	Caranx crysos	*
Jack crevalle	Caranx hippos	*
Bar jack	Caranx ruber	
Atlantic bumper	Chloroscombrus chrysurus	
Leatherjacket	Oligoplites saurus	
Florida pompano	Trachinotus carolinus	*
Permit	Trachinotus falcatus	*
Lookdown	Selene vomer	
Mutton snapper	Lutjanus apodus	*
Schoolmaster	Lutjanus apodus	*
Gray snapper	Lutjanus griseus	*
Dog snapper	Lutjanus jocu	
Lane snapper	Lutjanus synagris	*
Striped mojarra	Diapterus plumieri	
Mojarras	Eucinostomus spp.	
Grunts	Haemulon spp.	*
Pigfish	Orthopristis chrysoptera	
Sheepshead	Archosargus probatocephlus	*
Sea bream	Archosargus rhomboidalis	
Grass porgy	Calamus arctifrons	
Saucereye porgy	Calamus calamus	*
Pinfish	Lagadon rhomboides	*
Blue croaker	Bairdiella batabana	
Silver perch	Bairdiella chrysura	
Spotted seatrout	Cynoscion nebulosus	*
Southern kingfish	Menticirrhus americanus	*
Gulf kingfish	Menticirrhus littoralis	*
Atlantic croaker	Micropogon undulatus	*
Black drum	Pogonias cromis	
Red drum	Sciaenops ocellata	*
High hat	Equetus acuminatus	
Atlantic spadefish	Chaetodipterus faber	
Sergeant major	Abudefduf saxatillis	
Slippery dick	Halichoeres bivittatus	
Parrotfishes	Sparisoma spp.	
Mullet	Mugil spp.	*
Great barracuda	Sphyraena barracuda	*

Mottled jawfish	Opistognathus maxillosus	
Bluethroat pikeblenny	Chaenopsis ocellata	
Marbled blenny	Paraclinus marmoratus	
Banded blenny	Paraclinus fasciatus	
Blackbelly blenny	Stathmonotus hemphilli	
Florida blenny	Chasmodes saburrae	
Seaweed blenny	Blennuis marmoreus	
Spotted dragonet	Callionymus pauciradiatus	
Gobys	Gobionellus spp.	
	Gobiosoma spp.	
	Lophogogius sp.	
	Microgobius spp.	
Spanish Mackerel	Scomberomorus maculatus	*
King Mackerel	Scomeromorus cavalla	*
Barfish	Scorpaena brasiliensis	
Plumed scorpionfish	Scorpaena grandicornis	
Searobins	Prionotus spp.	
Eyed flounder	Bothus ocellatus	
Spotted whiff	Citharichthys macrops	
Fringed flounder	Etropus crossotus	
Gulf flounder	Paralichthys albigutta	
Southern flounder	Paralichthys lethostigma	
Dusky flounder	Syacium papillosum	
Lined sole	Achirus lineatus	
Scrawled sole	Trinectes inscriptus	
Hogchoker	Trinectes maculatus	
Blackcheek tonguefish	Symphurus plagiusa	
Orange filefish	Aluterus schoepfi	
Fringed filefish	Monacanthus ciliatus	
Planehead filefish	Monacanthus hispidus	
Gray triggerfish	Balistes capriscus	
Queen triggerfish	Balistes vetula	
Scrawled cowfish	Lactophrys quadracornis	
Trunkfish	Lactophrys trigueter	
Puffers	Sphoeroides spp.	
Burrfish	Chilomycterus spp.	

(List modified from Odum et al., 1982)

* = Locally important species of commercial, sport and bait fisheries.

Amphibians and Reptiles

American alligator	Alligator mississippiensis
American crocodile	Crocodylus acutus
Keys mud turtle	Kinosternon baurii baurii
Mangrove terrapin	Malaclemys terrepin rhizophorarum
Atlantic loggerhead	Caretta caretta caretta
Atlantic green turtle	Chelonia mydas mydas
Atlantic hawksbill	Eretmochelys imbricata imbricata

Atlantic ridley	Lepidochelys kempii
American anole	Anolis carolinensis
Cuban anole	Anolis sagrei
Southern black racer	Columber constrictor haasti
Big Pine Key ringneck	Diadophis punctatus acricus
Eastern indigo snake	Drymarchon corais couperi
Rat snake	Elaphe guttata guttata
Mangrove water snake	Nerodia fasciata compressicauda
Florida brown snake	Storeria dekayi
Florida ribbon snake	Thamnophis sauritus sackeni
Giant toad	Bufo marinus
Southern toad	Bufo terrestris
Treefrog	Hyla squirella
Cuban treefrog	Hyla septentrionalis

(References: Carr and Goin, 1955; Duellman and Schwartz, 1958; Ernst and Barbour, 1972; Paulson, 1966)

Birds

Great egret	Casmerodius albus
Snowy egret	Egretta thula
Cattle egret	Bubulcus ibis
Great white heron	Ardea herodia occidentalis
Great blue heron	Ardea herodias
Reddish egret	Dichromanassa rufescens
Louisiana heron	Hydranassa tricolor
Little blue heron	Florida caerulea
Green heron	Butorides striatus
Black-crowned night heron	Nycticorax nycticorax
Yellow-crowned night heron	Nyctanassa violacea
White ibis	Eudocimus albus
Roseate spoonbill	Ajaia ajaja
Semiplamated plover	Charadrius semipalmatus
Black-bellied plover	Pluvialis squatarola
Ruddy turnstone	Arenaria interpres
Spotted sandpiper	Actitis macularia
Solitary sandpiper	Tringa solitaria
Greater yellowlegs	Tringa melanoleucas
Lesser yellowlegs	Tringa flavipes
Dunlin	Calidris alpina
Least sandpiper	Calidris minutilla
Semipalmated sandpiper	Calidris pusilla
Western sandpiper	Calidris mauri
Short-billed dowitcher	Limnodromus griseus
Black-necked stilt	Himantopus mexicanus
Brown pelican	Pelecanus occidentalis
Double-crested cormorant	Phalacrocorax auritus
Mallard	Anas platyrhynchos
Blue-winged teal	Anas crecca carolinensis
Red-breasted merganser	Mergus serrator

Ring-billed gull	Larus delawarensis
Laughing gull	Larus atricilla
Least tern	Sterna albifrons
Royal tern	Thalasseus maxima
Belted kingfisher	Megaceryle alcyon
Magnificent frigatebird	Fregata magnificens
Red-shouldered hawk	Buteo lineatus
Osprey	Pandion haliaetus
American kestrel	Falco sparverius
White-crowned pigeon	Columba leucocephala
Mangrove cuckoo	Coccyzus minor
Red-bellied woodpecker	Melanerpes carolinus
Gray kingbird	Tyrannus domincensis
Great crested flycatcher	Myriarchus crinitus
Eastern phoebe	Sayornis phoebe
Mockingbird	Mimus polyglottos
Catbird	Dumetella carolinensis
Brown thrasher	Toxostoma rufum
White-eyed vireo	Vireo griseus
Black-whiskered vireo	Vireo altiloguus
Red-eyed vireo	Vireo olivaceus
Black-and-white-warbler	Mniotilta varia
Yellow-throated warbler	Dendroica dominica
Yellow warbler	dendroica petechia
Tellow-rumped warbler	Dendrocia coronata
Prairie warbler	Dendroica discolor
Palm warbler	Dendroica palmarum
Yellowthroat	Geothlypus trichas
American redstart	Setophaga ruticilla
Northern parula	Parula americana
Red-winged blackbird	Agelajus phoeniceus
Boat-tailed grackle	Quiscalus major
Cardinal	Cardinalis cardinalis

(References: Robertson and Kushlan, 1974; Sprunt, 1954; Bent, 1932)

Mammals

Virginia opossum	Didelphis virginiana	+
Keys marsh rabbit	Sylyilagus palustris hefneri	
Silver rice rat	Oryzomys argentatus	+
Key cotton rat	Sigmodon hispidus exsputus	
Black rat	Rattus rattus	
Raccoon	Procyon lotor auspicautus	
Key deer	Odocoileus virginianus clavium	

(References: Layne, 1974; Humphrey and Barbour, 1979; Spitzer and Lazell, 1978; Lazell, 1984)

+ = Species not currently recorded in preserve but available habitat and proximity of known populations suggest presence.

2. Marine Grassbeds

Marine grassbeds are a major feature in the aquatic resources of the preserve. Seagrasses stabilize sediments, baffle wave energy, cycle nutrients, and provide substrate for a complex floral and faunal community. Abundant food and cover make this an important resource for invertebrates and a nursery area for many fish species. However, biological productivity is not limited to the area of distribution. Marine energy cycling is enhanced as detrital material and nursery species are dispersed to other areas. Species from geographically and physiologically isolated habitats, such as, the patch reef and the mangrove communities also forage in the seagrass community. Thus, marine grassbeds function as an interface between other communities and enrich the ecological diversity and productivity of all marine systems.

Dominant marine grasses in the preserve are turtle grass (Thalassia testudium) and Cuban shoalweed (Halodule wrightii). Shoalweed is typically a pioneer species that colonizes disturbed sites and areas where water depth (too shallow or too deep) or substrate is less favorable for turtle grass. Turtle grass is a climax species (Phillips, 1960), and as such is usually considered to be the primary producer in this community. Turtle grass meadows are most expansive were sediments are deepest over the bedrock. Manatee grass (Syringodium filiforme) and several species of Halophila may also be present within the turtle grass beds.

Seagrasses are flowering plants that have evolved to a totally marine existence. They have adapted physiological and chemical mechanisms that facilitate photosynthesis, growth, maintenance and reproduction while completely submerged. Unlike their terrestrial counterparts seagrasses lack stomata on the leaf surfaces, thus gases are slowly diffused through the leaf tissue. Oxygen is stored in interstitial cell spaces and passed to root structures and rhizomes when needed (Zieman and Wetzel, 1980). The release of gaseous bubbles from leaf surfaces is often the source of the faint popping sounds heard when grass flats are exposed at low tide. Stored gases also make the leaf blade buoyant, keeping it vertical to the substrate and allow a much larger surface area to be exposed to solar radiation.

Certain plant nutrients are derived from the sediments, while others are taken from the water column. Nitrogen fixation can occur in the rhizomes, on the leaf surface and in some cases may be transferred between the leaf surface and epiphytes on the leaf (Harlin, 1971). Nitrogen and carbons are also derived from the particulate organic matter from dead plant material, and animal excretion. This highly efficient use of relatively limited nutrients and sunlight are the basis for a

level of productivity often compared to the coral reefs and mangroves.

The study of seagrass reproduction has evolved primarily as a means to restore or mitigate those areas that have been adversely impacted by man's activities or natural disturbances. Marine grasses may reproduce both sexually and vegetatively. Vegetative reproduction originates from the root or rhizome of the plant. Vegetative starts (plug or turion) are usually preferred for transplanting as they become established more quickly and survive longer. However, relative cost of this type of restoration may be prohibitive for large areas. Cost ranged from $27,000 to 86,500/ha to revegetate one area in the Upper Keys (Lewis et al., 1981). This technique has also caused much controversy, as many scientists and environmentalists have questioned the possibly negative impacts to donor (source) areas. Donor areas are slow to recolonize and large scale removal may cause a more serious disturbance than it is intended to remedy.

Sexual reproduction in marine grasses is less clearly understood. Orpurt and Boral (1964) observed flowering turtle grass in the Keys during April and fruiting until September. Seed production and seedling survival, however, may vary considerably from year to year. Lewis (1980) while monitoring a revegetation project near Craig Key, reported a "prodigious" seed crop in the intertidal area of Lower Matecumbe Key during 1979. Previous observations by Moffler (from Lewis, 1980) indicated little fruiting occurred in 1975 and Phillips reported large numbers of seedlings in the same area in 1960. Periods of high seed production certainly offer the opportunity to harvest and propagate seedlings for revegetation of disturbed areas but cost may again be prohibitive. Thorhaug and Austin (1976) reported costs of $42,000-$280,000/ha (depending on desired plant cover) for collection, propagation, planting and overhead for restoration efforts. Survival rates for transplanted seedlings are also very low, less than 30% (Zieman, 1982).

Marine grassbed distribution is influenced by physical and chemical factors similar to those described for mangroves. Temperatures and salinities are usually well within the tolerance limits of the species listed. Optimum temperatures (68-86 degrees F) and salinities (24 ppt to 35 ppt) for turtle grass (Phillips, 1960), occur throughout the aquatic preserve waters with the exception of the constricted baylets on the eastern portion of Coupon Bight. These shallow waters are often subjected to extreme fluctuations of salinity during extended periods of drought and during the rainy season. They are also subject to more abrupt temperature changes than normally observed in deeper waters and therefore are usually devoid of grasses.

The three most important parameters determining grassbed distribution in the preserve are light intensity, current velocity, and sediment depth. Like their emergent counterparts, marine plants must have access to sunlight to carry on the photosynthetic process. Unlike terrestrial plants, the water column lies between the source and recipient. Water depth and clarity affect the amount of sunlight that reaches the leaf surface. In this area water depth is less important than water clarity. Shading from docks and turbidity in the water column inhibit photic zone access. High turbidity and water velocity in and near channels inhibit sea grass colonization. Access channel and prop dredging are also sources of excessive turbidity. These impacts are usually localized and not normally of a duration or intensity to cause extensive light reduction but have other, more severe, consequences.

Variations in temperature, salinity, turbidity, and sediment deposition are closely related to current patterns in the preserve. Tidal currents and topographic relief influence the rate of accretion (or erosion) of sediment deposits. Sediment depth and stability are instrumental in the establishment and distribution of marine grassbeds. Areas with low current velocities and adequate sediment depths are more readily colonized. This often accounts for the "patchy" distribution of lush turtle grass in the preserve. Turtle grass requires sediment depths from 3 inches (Scoffin, 1970) to 20 inches (Zieman, 1972) for optimum growth. These conditions are exemplified in the sheltered waters leeward of the Newfound Harbor Keys, on the eastern half of the bay-mouth bank in Coupon Bight, and in the natural depressions in the sea floor. In profile, these colonized depressions often appear as "domes". As the plants entrap additional sediments, the depression fills and appears elevated as more sediments are added. Areas with thin sediments may be more readily colonized by the less selective shoalweed or species from the hardbottom community.

In addition to the previously noted marine grasses, several species of algae are also commonly found in this community. Benthic algae include Halimeda, Penicillus, Caulerpa, Rhipocephalus, and Udotea species. These calcareous algae are instrumental in producing organic carbons and calcium carbonate that are incorporated into the sediments (Zieman, 1982). Benthic algae are also early colonizers of fine sediments and their rhizoid holdfasts may stabilize these sediments so that seagrasses may become established on otherwise unoccupied areas (Williams, 1981). Drift algae, primarily Laurencia, is also a common component of the grassbeds.

Seagrass leaves provide substrate for a wide range of epiphytic algae. Some 66 species have been recorded to

utilize seagrasses for attachment (Ballantine and Humm, 1975). While access to the photic zone is enhanced by this arrangement, the encrusting of the leaf surface may effectively reduce photosynthesis in the host plant (Sand-Jensen, 1977). The overall loss of photosynthetic production may be off-set by the increased habitat for marine fauna and a corresponding increase in animal and plant protein.

The faunal constituents of the marine grassbeds range from the microscopic zooplankton that drift with the currents, epiphytic biota that live upon the grasses and the pelagic invertebrates, fishes and mammals that utilize these areas. Trophic structure presents ample food for a variety of specialized feeders. Herbivores that feed directly upon the algae or seagrasses include a wide variety of invertebrates. Most notable are the crabs, queen conch, and sea urchins. Vertebrate herbivores include the green, loggerhead, and hawksbill turtles, and a wide variety of fishes. Zieman (1982) lists 63 species that utilize seagrass in their diet. Many of these species also consume varying amounts of detritus and epifauna as they forage.

Detrital feeders make up a large percentage of the grassbed fauna and may well represent the primary pathway of energy transfer to higher tropic levels (Zieman, 1982). This group is composed of many small organisms that feed upon the decomposing plant and animal material in the vicinity of the grassbeds. Corals, sponges, tube worms and shrimp filter detritus and plankton from the water column. Others glean material from the sediments and leaf surfaces. Exported detritus becomes available to an even wider range of consumers in more remote areas. Carr and Adams (1973) found detrital feeders to be a major food source for at least one feeding stage in 15 of 21 juvenile marine fishes studied. Commercially important detrital feeders include the pink shrimp (Penaeua duorarum), spiny lobster (Panulirus argus), and mullet (Mugilcurema).

Higher order consumers include the myriads of fishes usually associated with grassbeds, as well as many that are more commonly associated with coral reefs and mangrove areas. Some spend early development stages in the shelter of the sea grasses and move to other habitats when mature. Still others, by alternating periods of diurnal and nocturnal activity, may utilize grassbeds for foraging at night and seek shelter in mangroves or coral reefs during the day. This partitioning of time and resources serves to eliminate competition between similar species and affords a much greater number of niches in the ecological structure of the community. Fishes of recreational and commercial interest include most of those from the annotated list for the mangrove/saltmarsh in Table 4.

Marine grassbeds are heavily utilized by several bird species. The abundant marine fauna of this community are the staple food for most of these birds (Kushlan, 1978). Heron, egrets, and spoonbills exploit fish, crustaceans and other marine organisms in shallow water grassbeds and upon exposed grass flats during low tides. Open water piscivorous birds include the cormorant, osprey, pelican, and gulls.

Mammals that utilize marine grassbeds include the manatee and the bottle-nosed dolphin. The manatee, although not formerly recorded as a resident species in the preserve, may well frequent the area on occasion and is well known for it's predilection for aquatic plant life. It is assumed that the abundant seagrasses would provide a welcome repast for this nomad. Bottle-nosed dolphin are occasional visitors of the aquatic preserve and undoubtedly take quantities of schooling fish as opportunity permits. Consult Table 5 for a list of animal species commonly associated with the marine grassbed community.

Major impacts to the marine grassbed community in Coupon Bight Aquatic Preserve are associated with human activities. Direct removal of grassbeds by prop souring and channel dredging are most noticeable. Although the single prop scar may be comparatively insignificant, the cumulative impact from repeated scaring, which is evident on the bay-mouth bank in Coupon Bight, is of concern. Zieman (1976) estimated recovery for these areas may take from 2-5 years and the natural recovery process may be further inhibited by rechanneling and increased erosion.

Dredging (and the spoiling of material) permanently eliminates grassbeds in most cases. Almost continual turbulence from prop wash and erosion of channels inhibits re-colonization efforts. More stringent regulations on dredging "access channels" have generally been effective in reducing this type of activity. However, intentional "prop dredging" (using boat propeller wash to cut a channel) has been observed and will most probably continue to be a sporadic activity.

The cumulative effect of docking facilities must also be considered. Docks interrupt light penetration and "shade out" vegetation. As with prop scaring, the individual site may be insignificant but is compounded when the total area influenced (by all facilities) is tabulated. The loss in primary productivity must then be multiplied by the "dock life" to comprehend the possible net loss in biological productivity over several years or decades.

The effects of septic effluent and upland run-off in marine communities is often difficult to detect given the highly variable physical and chemical parameters of both the effluent and the community being studied. But recent and future

technological improvements and additional research (and monitoring) may well scientifically validate the general assumption that all nearshore environments are subjected to measurable amounts of pollution from these sources when in close proximity to poorly planned development. Remedial and corrective actions will be time consuming and will require coordination with the appropriate agencies to insure that continued urbanization does not undermine the functional integrity of our marine resources.

The value of marine grassbeds cannot be evaluated by any monetary formula presently available. In the opening paragraphs of this section, the comparatively high cost (and relatively low success) of restoring or mitigating damaged grassbeds were discussed. Further research and experimentation are to be encouraged in hopes of discovering more successful and cost efficient methods of replanting and encouraging expansion of marine grassbeds. However, the preferable alternative to costly and often futile restoration is to protect this dynamic and productive resource from further damage. To achieve that goal, preservation and protection of marine grassbed communities shall be a priority in the designation of management areas and the management procedure and policies in Chapters IV and V of this plan.

TABLE 5

A PARTIAL LIST OF MARINE GRASSBED FAUNA

INVERTEBRATES	
Corals	
Golfball coral	*Favia fragum*
Rose coral	*Manicinia areolata*
Small finger coral	*Porites furcata*
Sponges	
	Aiptasia sp.
	Bartholomea sp.
	Condylactis sp.
	Stoichactis sp.
Annelids	
	Ammatrypane sp.
	Arenicola cristata
	Eurythoe sp
	Hermodice sp.
	Eunice longicerrata

	Lysidice sp.
	Nereis sp.
	Phascolion sp.
	Onuphis magna
	Sipunculoidea *sp.*
	Sthenelais sp.
	Terebellides stroemi
Molluscs	
Gastropods	*Anachis* sp.
	Aplysis sp.
	Astrea sp.
	Bittium varium
	Caecum sp.
	Cardita floridana
	Cerithium sp.
	Crepidula sp.
	Cymatum sp.
	Fasiolaria tulipa
	Mitrella lunata
	Modulus modulus
	Pluroploca gigantea
	Rissoina sp.
	Strombus gigas
	Tegula sp.
	Tridachia sp.
	Vasum sp.
Pelecypods	*Americardia* sp.
	Anadara sp.
	Antigona sp.
	Atrina
	Cardita floridana
	Chione cancellata
	Codakia orbicularis
	Laevicarduim laevigatum
	Lucina pennsylvanica
	Tellina radiata
Amphipods	*Cymadus compta*
	Gammarus mucronatus
	Melita nitida
	Grandidierella sp.
Cephalopods	*Octopus briareus*
Crustaceans	
Shrimp and lobster	*Alpheus normanni*
	Hyppolyte pleuracantha
	Latreutus focorum

	Palaemonetes spp.	
	Penulirus argus	*
	Penaeus duorarum	*
	Periclimenes spp.	
	Thor floridanus	
	Tozeuma sp.	
Crabs		
	Calappa sp.	
	Callinectus sp.	
	Clibanarius sp.	
	Dardanus sp.	
	Glyptoxanthus sp.	
	Libinia sp.	
	Macrocoeloma sp.	
	Microphrys sp.	
	Mithrax sp.	
	Pagurus sp.	
	Petrochirus sp.	
	Pilumnus sp.	
	Pithos sp.	
Mantis shrimp		
	Pseudosquilla sp.	
Echinoderms		
Starfish		
	Echinaster sp.	
	Oreaster reticulata	
Sea urchins		
	Diadema antillarium	
	Echinometria sp.	
	Lytechinus variegatus	
	Tripneustes ventricosus	
Holothurians		
Sea cucumber		
	Actinopyga agassizi	
	Holothura floridana	
Sea hare		
	Aplysia dactylomela	

(From Bock, 1971 and Zieman, 1982)
* = Species of commercial interest

Fishes

Nurse shark	Ginglymostoma curratum	
Lemon shark	Negeprion brevirostris	
Bonnethead	Sphyrna tiburo	
Smalltooth sawfish	Pristis pectinata	
Southern stingrayf	Dasyatis americana	
Ladyfish	Elops saurus	
Tarpon	Megalops atlantica	*
Bonefish	Albula vulpes	*
Scaled sardine	Harengula pensacolae	
Atlantic thread herring	Opisthonema oglinum	
Anchovies	Anchoa spp.	
Inshore lizardfish	Synodus foetens	
Sea catfish	Arius felis	
Gulf toadfish	Opsanus beta	
Skilletfish	Gobiesox strumosus	
Hardhead halfbeak	Chridorus atherinoides	
Needlefishe	Hyporhamphus unfasciatus	
Goldspotted killifish	Flordichthys carpio	
Rainwater killifish	Lucania parva	
Sheepshead minnow	Cyprinodon variegatus	*
Rivulus	Rivulus marmoratus	
Sailfin molly	Poecilia latipinna	
Reef silverside	Allanetta harringonenesis	
Hardhead silverside	Atherinomorus stipes	
Dwarf seahorses	Hippocampus zosterae	
Dusky pipefish	Syngnathus floridae	
Fringed pipefish	Micrognathus crinigerus	
Snook	Centropomus undecimalis	*
Gag	Mycteroperca microlepis	
Jewfish	Epinephalus itajara	*
Cobia	Rachycentron canadum	*
Jacks	Caranx spp.	*
Permit	Trachinotus falcatus	*
Florida pompano	Trachinotus carolinus	*
Leatherjacket	Oligoplites zaurus	
Lookdown	Selene vomer	
Snappers	Lutjanus spp.	*
Silver blenny	Eucinostomus gula	
Grunts	Haemulon spp.	*
Pigfish	orthopristis chrysoptera	
Porgies	Archosargus spp.	
Pinfish	Lagodon rhomboides	*
Red drum	Sciaenops ocellata	*
Silver perch	Bairdiella chrysura	
Spotted seatrout	Cynoscion nibulosu	*
Southern kingfish	Menticirrhus americanus	*
Atlantic spadefish	Chaetodipterus faber	
Sergeant major	Abudefduf saxatilis	
Slippery dick	Halichoeres bivittatus	
Hogfish	Lachnolaimus maximus	
Parrotfishes	Scarus spp.	

	Sparisoma spp.	
Mullet	Mugil spp.	*
Barracuda	Sphyraena barracuda	
Blennies	Paraclinus spp.	
	Chaenopsis spp.	
	Blennius sp.	
Dragonet	Callionymus parciradiatus	
Gobies	Bathygobius sp.	
	Gobiosoma spp.	
	Microgobius spp.	
Scorpionfishes	Scorpaena spp.	
Searobin	Prionotus spp.	
Lined sole	Achirus lineatus	
Tonguefish	Symphurus plagiusa	
Filefish	Monocanthus ciliatus	
Cowfish	Lactophrys quadricornis	
Trunkfish	Lactophrys trigonus	
Southern puffer	Sphoeroides nephalus	
Burfish	Chilomycterus schoepfi	

(Adapted from Zieman, 1982)
* = Important sport, commercial and bait species

Reptiles

Green sea turtle	Chelonia mydas
Loggerhead sea turtle	Caretta carretta carretta
American crocodile	Crocodylus acutus

Birds

Roseate spoonbill	Ajaja ajaja
Great blue heron	Ardea herrodias
Great white heron	Ardea occidentalis
Great egret	Casmerodius albus
Little blue heron	Florida caerulea
Reddish egret	Dichromanassa rufescens
Louisiana heron	Hydranassa tricolor
Bald eagle	Halieaeetus leucocephalus
Red-breasted merganser	Mergis serrator
Osprey	Pandion haliaetus
Brown pelican	Pelecanus occidentalis
Double-crested cormorant	Phalacrocorax auritus

Mammals

Bottle-nosed dolphin	Tursiops truncatus
Manatee	Trichechus manatus

(From Kushlan, 1976, 1978)

3. Beach/Berm

The beach and berm community of the preserve exhibits several major differences when compared to other coastal areas of Florida. Classic strand beach and dune formation is a dynamic process of deposition and erosion of fine-grained silica sands that are transported by riverine systems and littoral drift along much of the Florida coastline. Beaches generally tend to have a broad sloping profile with one or several dune lines landward of the beach face. Width of the beach and height and arrangement of dunes are typically reflective of the wave energy and direction exerted upon the shoreline. Substantial changes in topography are usually evident from season to season as winter storms erode the beach and gentler wave action deposits sands during summer. Prevailing winds are also instrumental in transporting and depositing sand that adds to or subtracts from the dune formations (Bascom, 1964).

Substrate and depositional environment are quite different along the shorelines of the preserve. Topography of the sea floor and the island themselves are typically outcroppings of limestone rock. The intertidal zone is often a broad rock ledge that parallels the shoreline. Nearshore patch reefs and the gradually sloping bottom tend to dissipate wave energy and those wave crests reaching shore are reduced to gentle eddies throughout most of the year. This low energy environment is not conducive to expansive beach development, as much of the suspended sediments are dropped well off-shore. Finer sediments and organic materials that are washed near shore are deposited in shallow depressions in the caprock and often support colonies of mangroves or marine grassbeds.

Also noticeably lacking are the fine-grained sands so typical of classic beach and dune strands. Major component material of the beach and berm areas in the preserve are the fragmented remains of corals, cast-off shells, and calcareous algae. The larger, angular fragments are sorted by wave action and deposited on the beach crest or berm during storm events. The relative size and weight of the fragments inhibits extensive dune formation because they are less subject to erosion or deposition by winds. The berm areas are almost solely the result of storm events that have repeatedly deposited these fragments in parallel ridges along the shoreline. These ridges are more accurately referred to as coastal berms. The height and width of many of the berms are testimony to the frequency and severity of some of those storms. Although the geophysical nature of the dune and berm are different, they perform much the same function in the natural environment. They dissipate wave energy during storms and act as a barrier to protect communities that lie landward of the beach.

The most extensive beach development is along the Atlantic shoreline of the Newfound Harbor Keys and Long Beach. The

beach face is relatively narrow along most of the shoreline but reaches optimum development on the Long Beach, Cooks, and Big Munson Island shorelines. Lower energy shorelines are colonized by mangroves. Berm development is much more common and varies in width and height dependent upon the exposure of the shoreline. The southerly shorelines of the Newfound Harbor Keys have well developed berms that are in excess of 50 feet wide and 2 to 4 feet in height over much of their length. The berm gradually becomes lower and terminates in mangroves on the leeward shoreline. The comparatively low profile would be breached during a moderate storm surge. The berm constitutes the only available "uplands" on these islands and has been developed for residential use on Long Beach and Cooks Island.

Lower, narrower berms are located along the northern shoreline of Coupon Bight. Prevailing winds and currents are instrumental in forming these coastal ridges that barely extend above the tide line. They are frequently inundated and are usually colonized by mangroves and saltmarsh vegetation.

Plant communities of the beach and berms are influenced by the proximity to tidal influence. Plants near the beach face and low berms are subjected to intense sun and wind, high salinity tidal wash, and a shifting substrate. Physiological adaptations to prevent moisture loss from salt, sun, and winds are evident in the succulent, shortened leaves of sea purslane (Sesuvium portulacastrum), saltwort (Batis maritima), and glasswort (Salicornia sp.). Other plant species possess thickened or involute leaves, surface hairs, or spines that slow moisture loss and inhibit grazing. Low, vertically spreading growth habits offer optimum leaf surface for photosynthesis and a low profile to damaging winds. Extensive horizontal and vertical root systems of the grasses (Distichlis sp., Spartina sp., and Panicum sp.) intercept available moisture and nutrients in this arid environment to stabilize and enrich the soil for additional plant colonizers. Black and white mangroves are also frequently encountered in this zone.

Portions of the berm above the reach of normal tides support a variety of herbaceous and woody plants including black mangrove and many of the saltmarsh species. Highest portions of the berm are vegetated with coastal plants, as well as many from the tropical hardwood hammock community. Many of the plant species of this community are rare, endangered, threatened or species of special concern because of development pressure on this resource. (See section on Endangered and Threatened Species.) Native plants of the beach and berm community are listed on Table 6.

TABLE 6

A PARTIAL LIST OF THE BEACH/BERM FLORA

Chaff flower	Alternanthera maritima
Beach orach	Artiplex arenaria
Saltmarsh aster	Aster tenuifolius
Black mangrove	Avicennia germinans
Saltbush	Baccharis sp.
Saltwort	Batis maritima
Sea oxeye daisy	Borrichia sp.
Saffron plum	Bumelia celestrina
Gumbo limbo	Bursera simaruba
Gray nicker	Caesalpinia crista
Jamaica caper	Capparis cynophyllopora
Limber caper	Capparis flexuosa
Goatweed	Capraria biflora
Seven-year apple	Casasia clusifolia
Sandspur	Cenchrus incertus
Barbed-wire cactus	Cerus pentagonus
Marine ivy	Cissus trifolata
Spurges	Chamaesyce spp.
Snowberry	Chioccoca alba
Pigeon plum	Coccoloba diversifolia
Sea grape	Coccoloba uvifera
Silver thatch palm	Coccothrinax argentata
Buttonwood	Conocarpus erecta
Geiger	Cordia sebestena
White stopper	Eugenia axillaris
Spanish stopper	Eugenia foetida
Blue mistflower	Eupatorium incarnatum
Garber's spurge	Euphorbia garberi
Seaside gentian	Eustoma exaltatum
Wild cotton	Gossypium hirsutum
Blolly	Guapira discolor
Seaside hibiscus	Hibiscus tiliaceus
Seaside heliotrope	Heliotropium carassavicum
Wild hibiscus	Hibiscus pilosus
Manchineel	Hippomane mancinella
Keys spider lily	Hymenocallis latifolia
Railroad vine	Ipomoea pes-caprae
Joewood	Jacquinia keyensis
Bahama morning glory	Jaquemontia pentantha
Black ironwood	Krugiodendron ferrum
White mangrove	Languncularia racemosa
Wild sage	Lantana involuctata
Beach bamboo	Lasiacis divaricata
Herbaceus sea lavender	Limonium carolinianum
Christmasberry	Lycium carolinianum
Wild dilly	Manilkara bahamensis
Gutta-percha mayten	Maytenus phyllanthoides
Poisonwood	Metopium toxiferum

Key grass	Monanthochloe littoralis
Prickly pear cactus	Opuntia stricta
Corkystemmed passionflower	Passiflora suberosa
Joint grass	Paspalum vaginatum
Beach carpet	Philoxerus vermicularis
Blackbead	Pithecellobium keyense
Cat's claw	Pithecellobium unguis-cati
Purslane	Portulaca oleracea
Indigoberry	Randia aculeata
Darling plum	Reynosia septentrionalis
Rougeberry	Rivinia humilis
Glassworts	Salicornia spp.
Scaevola	Scaevola plumieri (= Mallotonia gnaphalodes)
Sea purslane	Sesuvium portulacastrum
Teaweed	Sida rhombifolia
Bahama nightshade	Solanum bahamense
Pride-of-Big-Pine	Strumfia maritima
Sea blight	Suaeda linearis
Bay cedar	Suriana maritima
Mahoe	Thespesea populnea
Keys thatch palm	Thrinax morrisii
Spanish moss	Tillandsia usenoides
Pearlbery	Vallesia antillana
Hog plum	Ximenia americana
Wild lime	Zanthoxylum fagra

(Source: Author's botanical field notes.)

The plant communities of the beach/berm area play a major role in stabilizing the shoreline and offering a first line defense to waves and winds during storms (Sensabaugh, 1975). They dissipate wave energies and protect upland plant communities and property from the adverse effects of winds and salt spray. Alteration of the berm or the plant communities may subject the shoreline to erosion and will subject less tolerant plant species to the desiccating influence of wind and salt spary. Removal of the plant community may also prepare the soil for invasive exotic plants that offer little value in stabilizing shorelines or as wildlife habitat (Mazzotti et al., 1981).

Exotic plant intrusion is fairly localized with Australian pine (Casuarina equisetifolia) and Brazilian pepper (Schinus terbinthifolius) occurring on distrubed sites. Latherleaf (Colubrina asiatica), an invasive, exotic vine, has also become well established. Disturbance from land clearing or tropical storms may aid the proliferation of these undesirable plants.

Animal life of the beach and berm community represents a wide array of arboreal, terrestrial, and aquatic fauna. Infauna of the sand/shell beach include numerous species of

invertebrates. Marine worms, crabs, snails and clams are periodically inundated by tides that provide detritus and plankton from the sea. These creatures are in turn fed upon by a host of wading and probing birds. Numerous insects and crabs also forage the grass wrack along the shoreline.

The avifauna is a mixture of seasonal and resident species of various habits. The wading and shore birds include many of those associated with the mangrove/saltmarsh communtiy. Passerine species incude the many migrant visitors, as well as the vireos, flycatchers, warblers, cardinal, and grackles that are year round residents. The white-crowned pigeon (a threatened species) is also a frequent visitor to the beach and berm community where it feeds upon the fruit of poisonwood, snowberry, and other native plants. Aerial searching birds would include the red-shouldered hawk, kestrel, night hawk, and others that are opportunistic and make use of any suitable area.

Reptiles include the American and Cuban anoles, and several threatened sub-species of snakes and possibly the Keys mud turtle. The American crocodile is also potentially a visitor of the berm areas within the Bight. These areas would offer loafing beaches for the shy crocodile as they are well away from human habitation. Those berms with vegetative cover and marl soils are also potential nesting sites for the crocodile.

The Atlantic loggerhead turtle is a confirmed visitor to the Atlantic beach and berm areas. This threatened species is known to nest here and efforts to collect data on the number of nests and hatching success in now underway. Hopefully future data and observation may also establish the presence/absence of other endangered sea turtles, including the Atlantic green turtle, which historically may have nested here. The introduced Australian pine has the potential to be a direct threat to turtle nests. Moisture-seeking roots invade nest cavities and enmesh the turtle eggs. Upon hatching, the newborn turtles may not be able to extricate themselves from the root "net" and may perish inside the nest. The relative lack of pristine beaches in the Keys requires that the remaining areas be left in a natural condition and free of exotic plants so that the sea turtles may continue to nest here.

Mammals of the beach and berm community include several species of herbivorous rodents and the marsh rabbit (Silvilagus palustris hefneri) that feed upon leaves, fruit, and seeds and seek out nest sites in the dense foliage (Lazell, 1984). The silver rice rat (Oryzomys argentatus), an endangered spcies, has not been positively confirmed for this area but studies indicate that proximity of suitable habitat to the beach and berm may make this area attractive to the

species for occasional foraging (Spitzer-Goodyear, per. comm.).

The nocturnal ramblings of the raccoon and opossum also include foraging on the beaches and berms. The possibility of a easily obtained meal usually awaits in the seagrass wrack on the shoreline where fruit, crustaceans, molluscs, and other tidbits need only be uncovered. The largest native mammal of the lower Keys is also primarily nocturnal or crepuscular in habit. The tiny Key deer (also an endangered species) forages over a wide range of habitat types. The mangrove areas in the preserve are heavily utilized by the deer and recent observations indicate that the berm areas are also a favored area for bedding and foraging. The berm in the Long Beach area also serves as a dry corridor between the Newfound Harbor Keys and mainland portion of Big Pine Key. Numerous deer trails and signs of foraging are evident over much of the berm throughout the year (pers. obser.).

A partial list of beach and berm fauna is provided in Table 7.

TABLE 7

A PARTIAL LIST OF THE BEACH/BERM FAUNA

INVERTEBRATES

Snails	Batillaria sp.
	Littorina sp.
	Nerita sp.
Marine Worms	Nereis sp.
	Lumbrineris sp.
Land crab	Cardisomaguauhumi
Hermit crab	Coenobita clypeatus
Mole crab	Emerita Talpoida
Ghost crab	Ocypode quadrata
Clam	Anomalocardia sp.
Numerous inscets	

VERTEBRATES

Reptiles and Amphibians

Florida Keys mole skink	Eumeces e. egregius
Five-lined skink	Eumeces inexpectatus
Ashy gecko	Sphaerodactylus cinereus
Reef gecko	Sohaerodactylus n. notatus
American anole	Anolis carolinensis
Cuban anole	Anolos sagrei stejnegeri

Mangrove water snake	Natrix fasciata compressicauda
Rough green snake	Opheodrys aestivus
Eastern indigo snake	Drymarchon corals coupari
Red rat snake	Elaphe guttata guttata
Keys mud turtle	Kinosternon b. bauri
Atlantic loggerhead turtle	Carretta carretta carretta
American crocodile	Crocodylus acutus
Green tree frog	Hyla cinerea
Squirrel tree frog	Hyla squirella
Cuban tree frog	Hyla septentrionalis
Southern toad	Bufo terrestris
Giant toad	Bufo marinus
Narrow-mouthed toad	Gastrophryne carolinensis

Birds

Great blue heron	Ardea herodia
Great white heron	Ardea herodias occidentalis
Little blue heron	Florida caerulea
Great egret	Casmerodius albus
Turkey vulture	Cathartes aura
Red-shouldered hawk	Buteo lineatus
American kestrel	Falco sparverius
Semipalmated plover	Charadrius semipalmatus
piping plover	charadrius melodus
Wilson's plover	Charadrius wilsonia
Black-bellied plover	Pluvialis squatarola
Ruddy turnstone	Arenaria interpes
Willet	Catoptrophorus semipalmatus
Least sandpiper	Calidris minutilla
Dowitchers	Limnodromus sp.
Semipalmated sandpiper	Calidris pusilla
Sanderling	Calidris alba
Herring gull	Larus argentatus
Ring-billed gull	Larus delawarensis
Laughing gull	Larus atricilla
Foster's tern	Sterna fosteri
Least tern	Sterna albifrons
Royal tern	Sterna maxima
Sandwich tern	Sterna sandvicensis
Black skimmer	Rynchops niger
White-crowned pigeon	Columba leucocephala
Ground dove	Columbina passerina
Mangrove cuckoo	Coccyzus minor
Belted kingfisher	Megaceryle alcyon
Gray knigbird	Tyrannus domincensis
Brown thrasher	Toxostoma rufum
Blue-gray gnatcatcher	Pilioptila caerulea
Black-whiskered vireo	Vireo altiloguus
Yellow-rumped warbler	Dendroica coronata
Prairie warbler	Dendroica discolor
Plam warbler	Dendroica palmarum
Common yellowthroat	Geothlypis trichas

House sparrow	Passer domesticus
Red-winged blackbird	Agelaius phoeniceus
Common gackle	Quiscalus quiscula
Cardinal	Cardinalis cardinalis

Mammals

Oppossum	Dildelphis marsupialis
Raccoon	Procyon lotor
Marsh rabbit	Sylvilagus palustris hefneri
Hispid cotton rat	Sigmodon hispidus
Key deer	Odocoileus virginianus clavium

(From: Schomer and Drew, 1982; and field observations.)

4. Coral Patch Reef

There are reef-like buildups as far north as Georgia on the Atlantic coast, but three dimensional, living, coral reefs are restricted to the tropical waters of the Florida Keys in North America.

Narrow tolerances in such factors as substrate, light, temperature and sediment limit distribution within the broader geographic zone, as well as within a local area. Corals develop best where bare limestone sea floor is in close proximity to the Gulf Stream that provides nutrients and stable temperatures. The bare limestone provides a point of attachment for the early colonizers. As the pioneers die, their skeletal remains furnish new ground for additional colonization. This process of building up and tearing down keeps the community in a constant state of change and imparts a distinctive character to the geological profile of the area.

The Florida Reef Tract parallels the Florida Keys island chain and reaches optimum development in the deeper waters, seaward of Hawk's Channel and landward of the Straits of Florida. The Florida Keys archipeligo lies between the large lagoonal system of Florida Bay and the oceanic waters of the Atlantic and Gulf Stream. The configuration of the island chain significantly influences the configuration of the reefs (Ginsburg and Shinn, 1964). The reef tract is actually a narrow band of disjunct reefs with many horizontal gaps in the linear configuration. The gaps or breaks in the reef correspond with the creeks, cuts or passes between the islands of the Keys that act much like river deltas. These tidal passes facilitate mixing of the waters of Florida Bay with oceanic currents.

Florida Bay is a shallow receiving basin for run-off from the mainland. Water temperatures and salinities are extremely variable and suspended sediments are fine and easily transported. Outgoing tides carry these waters out to the reef tract. Where tidal channels cross the Keys and the line of the reef, there is a gap in the reef because reef building corals cannot tolerate the excessive sediments and fluctuating temperatures and salinites.

Japp (1984) divides the reefs into four types, based upon physical habitats and community structure patterns. The seaward most community is the bank reef. This community receives the most beneficial nutrients, displays the most diverse associations, and exhibits the most highly developed super-structure. Many of the massive, reef building corals in this community do not occur in the other community types. They thrive in the deep, clear waters and can withstand the wave surge that constantly washes the seaward edge of the formation. The seaward spur and groove configuration and the abundance of elkhorn corals (Acropora palmata) are distinctive (Shinn, 1963; Shinn et al., 1981). Looe Key Reef is a good example of the bank reef formation and exhibits well developed spur and groove formations.

The transitional reef is, as the name implies, between development from patch reef to bank reef. This community has fauna from both the bank reef and the patch reef or may also resemble well developed hardground in some areas. The transitional reef often exhibits a tendency to spur and groove formation and may in time or under more favorable conditions (higher sea level) develop into the more diverse bank reef. This type of formation also occurs on artificial substrate, such as sunken ships or other debris used to construct artificial reefs (Japp, 1984).

Patch reefs are smaller, isolated versions of the bank reef. These domed or horseshoe-shaped mounds usually lie landward of the main reef and seaward of Hawk's Channel in the area commonly referred to as the "reef flan" (Marszelak, 1982). This community assumes many variations in size, dominant species, and degree of diversity. Patch reef development in nearshore waters (landward of Hawk's Channel) is known to occur in only a few locations in the Keys.

The patch reefs in the preserve are in depths from 6 to 12 feet (2 to 4 meters) scattered along a more or less parallel axis to the Newfound Harbor Keys. The two largest are located within .6 mile (1 km.) of Big Munson Island shoreline near the western boundary of the preserve. A large cluster of smaller patches is located due south of Cooks and Hopkins Islands. Other, even smaller, more isolated patches may consist of only one or two large coral heads (colonies) surrounded by gorgonians and sponges. Most are typically ringed by sand and

rubble halos that are created by the foraging activities of fish and sea urchins. These unique patch reefs lie in the "shadow" of the Newfound Harbor Keys and are thus protected from the sediments and variable temperatures and salinities of Big Pine Channel and Coupon Bight.

Species diversity and density generally increase in proportion to the size of the patch reef. Larger patches provide more niches for invertebrates and fishes. Large heads of star coral (Montastrea annularis, M. cavernosa) starlet corals (Siderastrea spp.) and to a lesser extent, the brain coral (Diploria labyrinthiformis) provide crevices and vertical relief that may rise to within a few inches of the surface. Encrusting corals, algae, soft corals and sponges colonize interstitial spaces.

The presence of a large coral head inside Coupon Bight is a unique occurrence. This colony is approximately 2 feet high and 3-4 feet wide. The deep cleft near the center divides it almost in half. Several fish species and a few small gorgonians and sponges (and in one observation, a small loggerhead sea turtle) make up the entire community. If the existence of the nearshore patch reef community on the Atlantic can be described as marginal (Japp, 1984), this small community may well be described as extraordinary. The lagoon environment is subjected to extreme variations in temperature, salinity and turbidity that presumably would inhibit large, hard coral formation, yet this colony survives and has expanded under the most adverse conditions. The origin of this colony is a subject of much speculation.

The fourth type of coral community is the live bottom or hardground (referred to in this plan as hardbottom). This association is dominated by scattered colonies of corals, gorgonians, sponges, and algae that colonize exposed portions of the limestone bedrock or reef ruubble. Hardbottom communities are extremely diverse in distribution and numbers of organisms within a given area. They may contain reef-building species but other environmental conditions (substrate, water depth, sediment loads, currents, etc.) do not favor more extensive patch reef development at the present time. As environmental or biological conditions change, portions of the hardbottom could evolve to patch reefs or be displaced by marine grassbeds. Grassbeds are frequently dispersed throughout this community on substrates with deeper sediments. (Although generally included in the coral reef communities, the hardground community is a major component of the preserve's resources and is discussed in a separate section of this chapter.)

The major structural and biological foundations of the patch reef community are the colonial corals that separate calcium carbonate from sea water and construct a stony skeleton.

Corals are members of the phylum Cnidaria which includes such organisms as jellyfish, sea anemones, and hydrozoans. Two classes of Cnidaria are principal colonial forms associated with or responsible for producing reefs, the Hydrozoa and the Anthozoa. The Hydrozoa are represented by the fire corals or stinging corals. The Anthozoa contain two subclasses, the Octocorallia, the soft corals (e.g. whipcorals, sea feathers and sea fans) and the Zoantharia. Within the Zoantharia subclass is the order Scleractinia, containing the true stony corals (brain coral, star coral, etc.) (Barnes, 1974). The characteristics common to each subclass are the capability to secrete a calcareous skeleton and functional autotrophy (self-production).

The Scleractinia are the reef builders. Although many colonies are only several inches in diameter, larger forms may reach dimensions of up to 8 feet, often referred to as coral 'heads'. The living coral tissue inhabits only the external surface of the head. The individual polyp secretes a cup or calice that provides shape and protection for the individual. As the colony grows, the calices of members of the same species join and the colony assumes a distinctive configuration and coloring. Thus the particular species is often easily identifiable by the visual appearance of the colony as a whole. Some appear relatively smooth and spherical, such as the starlet coral (Siderastrea siderea), and others may be grooved, such as the brain coral (Diploria labyrinthiformis), or still others may form finger-like projections, such as the finger corals (Porites spp.).

Over many generations, stony corals have laid down massive limestone skeletons and sediments that add relief to the sea floor and may rise to within a few feet or even inches of the water's surface. Major reef building species of the patch reef community within the preserve are star coral (Montastraea annularis), cavernous star coral (M. cavernosa), starlet coral and the brain corals. Table 8 provides a partial list of faunal species of the patch reefs.

Coral tissues are host to dinoflagellate zooxanthellae (microscopic algae) that live symbiotically within each coral polyp. Zooxanthellae, like other plants are capable of producing their own food. Using solar energy, they build protein, carbohydrates and other complex compounds from carbon dioxide, nitrates, and phosphates obtained from the surrounding sea water and the host. The algae provide self-sustaining nourishment and contribute to the oxygen requirements of the coral host. The corals capture plankton and other mobile fauna with their tentacles and their metabolic waste products provide some of the basic structural compounds for the algae in return. If environmental influences (heat, cold, disease, pollution, etc.) are adverse, the coral polyps may expel the zooanthellae and the coral

colony will die. This symbiotic relationship is only one of many that occur in the patch reef community.

Other fauna include the "soft" corals or gorgonians. The sea whips (Pseudopterogorgia acerosa), sea fingers (Briareum asbestinum), and sea fans (Gorgonia flabellum) are only a few that colonize reef rubble and are a major element of the hardbottom area that often adjoins the patch reef community. Each of these individual colonies supports a characteristic flora and fauna of their own. Grazing often eliminates these (and other) species closest to the reef and creates the "halo" of bare rubble and course sediment that encircles a patch reef. The sediment and reef rubble is eventually cemented by physical and biological agents and becomes suitable substrate for reef expansion (Ogden et al., 1973).

Infaunal organisms that inhabit the patch reef include boring and burrowing sponges (Cliona sp.), gephyrid worms, urchins (Centrechinus and Echinometra spp.), and numerous bivalves, barnacles and crabs. The corals provide some of these organisms with substrate for attachment and access to nutrients. Several species of invertebrates and fishes feed directly upon coral polyps and are a major component of the biologically erosive forces that tear down the the reef as it is being built. Still others, such as the encrusting corals, play important roles in consolidating reef rubble and sediments for colonization by other organisms.

The macrofauna of the reef are more colorful and diverse than in any other marine environment. The coral formations provide protection and shelter for small shrimp, crabs, fish, and several species of lobster, including (Panulirus argus), the spiny lobster of commercial interest. The larger predators of the reef include the often spectacularly colored schools of fishes that prey upon invertebrates and smaller individuals of their own kind. The most frequently observed larger predators on the reef include the barracuda (Sphyraena barracuda) and moray eel (Gymnothorax spp.). The nurse shark (Ginglymostoma cirratum), primarily a scavenger, is a common shark of the shallow water patch reefs and is seldom a threat to man, unless stepped upon or harassed.

Many of the larger predators are important species for local fisheries. The groupers (Epinephelus spp. and Mycteroperca spp.), snappers (Lutjanus spp. and Ocyurus chrysurus), grunts (Haemulon spp.) and jacks (Caranx spp.) account for a large percentage of the commercial finfish landings in the county. Spiny lobster is also a prime target and the harvest averages 4-5 million pounds a year (NMFS, 1981, 1985, 1986). Ballyhoo (Hemiramphus brasiliensis), a small omnivorous species, is also an economically important bait fish that inhabits coral reef areas.

Trophic levels and dependency upon other communities may be highly specialized. Zooplankton is an important energy source for larval stages of most of the reef species and a primary food source for several adult species. The adult anchovies, herrings, silversides, cardinalfish, chromis, and others are schooling species that feed upon zooplankton. Other fish species of the coral reefs depend upon marine grassbeds for feeding during juvenile life stages. The grassbeds also provide cover for the fry and fingerlings. As they become larger and can no longer hide in the grass, they seek refuge and feed from the relative safety of the reef. Conversely, many adults of a species utilize the reef for temporary refuge and feed almost exclusively in the grassbeds. The nocturnal foraging of the grunts and snappers is a good example of this type of energy partitioning. These fish rest on the reef during the day and feed in the grassbeds at night. These species and others facilitate the dispersal of energy from one community to another in the form of standing biomass and imported nutrients in feces that are dropped over the patch reef (Zieman, 1982).

The productivity of coral reefs has been compared to that of tropical rain forests and considered by some to be the most productive ecosystem on earth (Sournia, 1977). Although qualitative research for south Florida reefs has not been extensive enough to be conclusive, some interesting comparisons seem to reinforce this supposition. The annual overall productivity of a small reef in the Pacific was estimated to be 846 grams dry weight per square meter (g dry wt/m2) with a net gain of 2 g Carbon/m2 per day (Odum and Odum, 1955). In comparison, red mangrove leaf biomass averages between 700 and 800 g/m2 (Odum and Heald, 1975) and leaf biomass of turtle grass on Florida's east coast may average 125-800 g dry wt/m2 (Zieman 1975; from Japp, 1984)

The primary productivity of each of these different environments is further enhanced when in close proximity to each other. The transfer of nutrients between organisms is often quicker and with less opportunity for loss of energy in the transfer from one level to another. The snapper may rest during the day and forage the grassbeds in relative safety during the night. The grouper and moray need not expend large amounts of energy to pursue and capture prey. They lie in wait in safety and concealment for the unwary meal. Many of the reef species need not ambulate at all. They need only to extend their tentacles to capture sustenence. Thus, the net effect of coral reef ecology is to provide a highly diverse and efficient energy resource within a relatively compact area.

Plants of the patch reef are almost exclusively represented by the coraline algae. Small mounds of coral rubble or bare skeleton provide attachment for Hamimeda, Rhizocephalus,

Udotia and Caulerpa species. A large group of filamentous and boring algae are also present but less conspicuous than the fleshier, upright forms (Humm and Wicks, 1980). Densely consolidated substrate, grazing, and competition with sedentary faunal organisms generally limits the abundance of floral species.

These small patch reefs are subject to stress from several sources. Extreme or extended drops in atmosheric temperatures during winter cold fronts quickly cools shallow waters and as surf temperature falls, some die-off of corals and other species is usually evident. Inversely, warming of nearshore waters is evident during late summer and early fall. Coupled with low tides and calm waters, upper portions of coral heads may be severly stressed. Sediments from adjacent areas may also blanket the reefs during heavy storm activity. Heavy sediment loads can literally smother the coral community.

Environmental changes that favor proliferation of one species of organism may well signify the doom of others. Phytoplankton blooms (red tides) may cause heavy fish mortality. Black band disease and coral 'bleaching' are now prevalent phenomena in the Keys' reef and investigative studies have only begun to determine the causes and possible remedies for these maladies. The patch reefs in Coupon Bight Aquatic Preserve are existing in marginal conditions and excessive pressures from human activities may be the deciding factor in their survival.

Cultural and Historic Significance of Coral Reefs

Modern technology has placed this once mysterious world within the reach of a population that can experience first hand it's profound beauty and biological richness. However, these same conveniences have placed additional stress on an extremely sensitive ecosystem that exists at the northern most limits of it's range. The activities of man are potentially the most destructive to the reefs. Many have been destroyed and others are precariously balanced between survival and extinction. Overuse, overharvesting, carelessness and ignorance of the physical and biological requirements of the system are the major causes of decline of the reefs in many areas. Both direct and external impacts are of imminent concern to those who manage for and benefit from this bountiful resource. Hopefully, through education and protective measures this rare and sensitive resource may be preserved for the enjoyment and enrichment of many generations to come.

The coral reef communities of the Florida Keys are truly a unique resource for several reasons. They have played a very important part in the biological, geological, historic and cultural makeup of this small geographic area and they

represent the Keys' most valuable economic and natural resources. Culturally, this intricate assemblage of invertebrates and fishes represents many things to many people. It has been a dreaded navigational hazard to mariners, and object of artistic and scientific interest and a bountiful provider of sustenance to many cultures, both ancient and modern.

The early native Indians and Bahamian fisherman exploited the abundant fish and turtles and salvaged the cargos of unfortunate sailing ships that were dashed upon the treacherous reefs. The somewhat sketchy but colorful exploits of the pirates who plundered the treasure laden ships of the Spanish fleets were also to become an indelible page in the Keys' history. Later, the descendants of these enterprising sailors and the immigrants from the Bahamas and Cuba were to become permanent colonizers of this chain of islands. The ever present threat to navigation, the tropical growing climate and the rich bounty of the sea were the mainstay of a culture devoted to ship salvage (or "wreckers"), citrus and pineapple plantations, and the sponge, turtle and fishing industries. (Carter, 1976) (Eyster, 1987)

The 1900's brought many changes to both the culture and their utilization of the areas natural resources. A chain of lighthouses on the reef edge guided vessels on a safer course. Blight and more productive ports in Cuba soon usurped the agricultural markets and delining numbers of turtles and sponging grounds eliminated those industries as sources of subsistence. Motorized vessels and improved fishing methods were to become the basis for an ever expanding fishery. Flagler's railroad and a developing tourist industry on the mainland soon lured hundreds and then thousands to the tranquil splendor of the Keys. The railroad was eventually replaced with a roadway and bridges after the Labor Day Hurricane of 1935. The Overseas Highway would accommodate ever increasing numbers of sightseerers and fisherman. Coupled with the tropical climate and year round abundance, both the commercial and sport fisheries flourished (Martin, 1949; Dean, 1982).

In the last half of this century, improved snorkel and scuba equipment has added an even more exciting dimension to the local tourist industry. A short, comfortable boat ride will deposit visitors in the clear, warm waters to observe the natural wonders of the reef first hand. The awe inspiring formations and animated fish are even accessible to many others who are less adventuresome and may prefer the experience of observing from the comfort of one of the many glass-bottomed boats that make several daily trips to the reef tract. Commercial dive operations, tour boats, and other tourist accommodiations cater to several million visitors a year. The dive industry contributes substantially to the local

economy and employs a substantial number of the local and seasonal residents. Whether it be snorkeling, photography, diving, fishing or academic study, the visitor is almost always assured of a most unique and rewarding experience.

Income from the sport (recreational) fishery is a major contributor the local economy. Income from recreational fishing includes guide services, charter boats, bait, fuel, food, ice and taxidermy services that are procured from local businesses. This income is generally lumped with the tourist industry data and it is therefore difficult to assign a dollar amount to these services but the Keys have been recognized as a major sportfishing destination for nearly a century.

The commercial fishery is probably the third most important industry in the county. Commercial harvest of lobster and finfish alone represented nearly $12,000,000 to Monroe County in 1980 (NMFS, 1981) and more than fifteen and a half million dollars in 1985 (NMFS, 1985). Boat yards, fuel, ice, transportation and processing facilities are accessory industries that employ additional workers who are indirectly dependent upon the fishery.

Commercial harvesting of tropical fish, sponges and 'live rock' are also expanding industries. 'Live rocks' (or reef rock, mat rock, etc.) are fragements of limestone with the living organisms attached. These 'mini environments' support algae, soft and hard corals, as well as, many of the epifaunal and infaunal species associeated with the coral reef and hardbottom communities. The live rock is typically harvested in shallow waters and exported to saltwater aquarium enthusiasts. Especially prized are those with anemones and feather duster worms attached. One firm in Monroe County estimated that their annual export of 'live rock' is 80,000 pounds per year. There are approximately 60 firms in south Florida that are involved in this industry and it is predicted to expand by 10-15% each year. The long-term impacts to local resources at this rate of harvest is of concern (Young, 1989; Wheaton, 1989).

Impacts Associated with Resource Use

The financial interests of both the fisheries and tourist industries are inextricably linked to the presence and products of the reef tract. Yet many scientists, fisherman, divers, and environmentalists have expressed concern for the past and present pressures and stresses exerted upon this unique environment. Some reefs have been reduced to mounds of inanimate rubble by the activities of treasure salvors and negligent or accidental vessel grounding. Still others have been impoverished by coral and tropical fish collecting, spearfishing, and the indiscriminate destruction of corals by

careless or uniformed divers and snorklers who stand on, touch or break coral formations that have take decades to form.

Careless boat operation in shallow water and damages from misplaced boat anchors are a major concern in many of the more popular areas (Davis, 1977). Pleasure boat registrations for Dade County doubled in the period between 1964 and 1978. Registrations for Monroe County quadrupled during the same time period and that pattern is likely to continue as the regional population increases (Mathis et al., 1979). Many new arrivals to the area may be first time boat owners and most are ill equipped for navigation in the shallow waters and around the barely submerged reefs. Without major efforts to educate the boating public, improved navigational aids, and additional mooring buoys, damage from boat groundings and anchoring in the coral will undoubtedly increase in proportion to the number of boats utilizing an area.

Lobster trap placement and retrieval also account for considerable damage to corals. Traps may be placed on corals or so near the patch reefs that buoy lines are entangled and chaff coral heads with wave movement. Wave surge from tropical storms and hurricanes transport traps and they are often dragged into coral formations when placed in close proximity to the seaward side of the reefs. This type of damage was typical in the preserve after the passage of a minor storm (Kate) in November, 1985. Mechanized trap pullers are also a problem. Traps being retrieved are dragged along the bottom and corals may be broken and large heads completely overturned. This type of damage is unfortunately, quite common.

The more obvious disturbances are not the only threat to this underwater resource. As thousands of new residents and tourists come to south Florida and the Keys, so does new construction of homes, resorts, roads, marinas, and facilities for disposal of the tons of solid and liquid wastes of an expanding population. Upland run-off contains heavy metals, petroleum, pesticides and other chemicals that pollute nearshore waters and are dispersed to the reef either by waves and currents or through the food chain. Heavy metal (mercury, zinc, lead, and cobalt) concentrations in sediments and corals have been reported off southeast Florida by Manker (1975). Evidence from studies on the effects of petroleum hyrocarbons has determined that these substances are detrimental to corals and that massive or chronic concentrations would also be harmful to other organisms (Japp, 1984). Other chemicals may be quickly diluted and dispersed, therefore more difficult to detect and the long-term effects more diffiuclt to predict.

Septic effluent is also transported well away from the point of origin and this customary method of sewage disposal has caused much controvery and concern for the health of the

reefs. The porous limestones of the Keys do not retain the effluent long enough for adequate decomposition to occur (Bight et al., 1981). Tidal activity, currents, and wind easily transport seepage from surface water drainage and contaminated sediments to nearshore and offshore areas. Likewise, the deep and shallow well injection of inadequately treated sewage has proliferated without sufficient knowledge of the particular geological features of the injection site (La Pointe, 1989). Deep strata test boring has been primarily limited to the mainland of Florida and little testing has been done in the Keys. Information on the vertical and lateral movement of injected materials and the final disposition of these substances and their mutant byproducts is speculative without further research.

The geologic strata, tidal regime, currents, thermal stratification, chemistry and marine flora and fauna all interact with human occupation of the coastal zone. The ultimate effect upon the biological resources are at best poorly understood and long-term research and monitoring will reveal the foresight or folly of present activities, trends and attitudes towards the protection and conservation of the coral reefs and the productivity of all marine systems. The true value of this unique resource cannot be fully appreciated by its many benefactors without some knowledge of the delicate balances and natural processes and relationships that exist within this community association. Neither can the long term survival of the reefs, as we know them, be guaranteed without adequate research to determine the point at which the system can realistically recover from natural catastrophe and the cumulative impacts of man.

TABLE 8

A PARTIAL LIST OF THE PATCH REEF FAUNA

VERTEBRATES	
Mammals	
Atlantic bottle-nosed dolphin	*Tursiops truncatus*
Reptiles	
Atlantic ridley turtle	*Lepidochelys kempi*
Atlantic hawksbill turtle	*Eretmochelys imbricata*
Loggerhead turtle	*Caretta caretta caretta*
Green turtle	*Chelonia mydas*

Fishes

Ocean surgeon	Acanthurus bahianus
Doctorfish	Achirurgus sp.
Blue tang	Achirurgus coeruleus
Barred cardinalfish	Apogon binotatus
Flamefish	Apogon maculatus
Belted cardinalfish	Apogon townsendi
Trumpetfish	Aulostomus maculatus
Orangespotted filefish	Cantherhines pullus
Slender filefish	Monacanthsu tuckeri
Bar jack	Caranx ruber
Queen angelfish	Holacanthus ciliaris
Gray angelfish	Pomacanthus arcuatus
Roughead blenny	Acanthemblemaria aspera
Wrasse blenny	Hemiemblemaria simulus
Neon goby	Gobiosoma oceanops
Bridled goby	Coryphopterus glaucofraenum
Masked goby	Coryphopterus personatus
Goldspot goby	Gnatholepis thompsoni
Hovering goby	Ioglossus helenae
Herrings	Clupeidea
Bermuda chub	Kyphosus sectatrix
Spanish hogfish	Bodianus rufus
Slippery dick	Halichoeres bivittatus
Yellowhead wrasse	Halichoeres granoti
Hogfish	Lachnolaimus maximus
Clown wrasse	Halichoeres maculipinna
Puddingwife	Halichoeres radiatus
Bluehead wrasse	Thalassoma bifasciatum
Schoolmaster snapper	Lutjanus apodus
Mutton snapper	Lutjanus anelis
Gray snapper	Lutjanus griseus
Yellowtail snapper	Ocyurus chrysurus
Spotted goatfish	Pseudupeneus maculatus
Glassy sweeper	Pempheris schomburoki
Sergeant major	Abudefduf saxatilis
Yellowtail damselfish	Microspathodon chrysurus
Dusky damselfish	Pomacentrus fuscus
Beaurgregory	Pomacentrus leucosticuts
Bicolor damselfish	Pomacentrus parititus
Threespot damselfish	Pomacentrus planifrons
Cocoa damselfish	Pomacentrus variabilis
Porkfish	Anisotremus virginicus
Tomtate	Haemulon aurolineatum
Caesar grunt	Haemulon carbonarium
Smallmouth grunt	Haemulon Chrysargyreum
French grunt	Haemulon flavolineatum
Spanish grunt	Haemulon macrostomum
White grunt	Haemulon plumieri
Bluestriped grunt	Haemulon sciurus
Midnight parrotfish	Scarus coelestinus
Blue parrotfish	Scarus coeruleus

Striped parrotfish	Scarus croicensis
Rainbow parrotfish	Scarus guacamaia
Queen parrotfish	Scarus vetula
Redband parrotfish	Sparisoma aurofrenatum
Redtail parrotfish	Sparisoma chrysopterum
Redfin parrotfish	Sparisoma rubripinne
Bucktooth parrotfish	Sparisoma radians
Spotlight parrotfish	Sparisoma viride
Cubbyu	Equetus umbrosus
Reef croaker	Odontoscion dentex
Barred hamlet	Hypoplectrus puella
Butter hamlet	Hypoplectrus unicolor
Graysby	Epinephelus cruetatus
Red grouper	Epinephelus morio
Nassau grouper	Epinephelus atriatus
Black grouper	Mycteroperca bonaci
Harlequin bass	Serranus tigrinus
Sucereye porgy	Calamus calamus
Jolthead porgy	Calamus bajonado
Great barracuda	Sphyraena barracuda
Sharpnose puffer	Canthigaster rostrata

INVERTEBRATES

Porifera (Sponges)

Variable sponge	Anthosigmella varians
Tube spong	Callyspongia vaginalis
Chickenliver sponge	Chondrilla nucula
	Chondrosia collectrix
	Cinachyra cavernosa
Boring sponge	Cliona spp.
Heavenly sponge	Geodia gibberosa
Finger sponges	Haliclona spp.
Vase sponges	Ircinia spp.
	Neopetrosia longlevi
Loggerhead sponge	Spheciosphongis vesparia
	Spongia graminea
Fire sponge	Tedania ignis
	Tethya sp.
Candle sponge	Verongia longissima

Cnidaria

Hydrozoa

Encrusting stinging coral	Millepora alcicornis

Scyphozoa

Moon Jelly fish	Aurelia aurita
Stinging jellyfish	Dactylometra guinguecirrha
Comb jellyfish	Mnemiopsis spp.
Portugeuse man-of-war	Physalia physalis
	Sertularia inflata

By the wind sailor	Velella velella
Anthozoa	
Octocorallia (soft corals)	
Corky seafingers	Briareum asbestinum
Eunicea	Eunicea knighti
	Eunicea succinea
Venus seafan	Gorgonia flabellum
Common seafan	Gorgonia ventalina
Sea rods	Plexaura flexuosa
	Plexaurella dichototoma
	Plexaurella fusifera
	Plexaurella nutans
	Pseudoplexaura flagellosa
	Pseudoplexaura porasa
Purple sea plume	Pseudopterogorgia acerosa
Slimy sea plume	Pseudopterogorgia americana
Angular sea whip	Pterogorgia anceps
Hexacorallia	
Actiniarians (Sea anemones)	Bartholomea annulata
	Bundosoma cavernata
	Condylactis gigantea
Madreporarians (Stony corals)	
Sheet (lettuce) coral	Agaricia spp.
Ivory tube coral	Cladocora arbuscula
Knobby brain coral	Diploria clivosa
Grooved brain coral	Diploria labyrinthiformis
Smooth brain coral	Diploria strigosa
Flower coral	Eusmilia spp.
Golfball coral	Favia fragum
Rose coral	Manicina areolata
Mountainous star coral	Montastraea annularis
Cavernous star coral	Montastraea cavernosa
Large flower coral	Mussa angulosa
Ivory bush coral	Oculina diffusa
Mustardhill coral	Porites asteroides
Finger coral	Porites furcata
Clubbed finger coral	Porites porites
Rough starlet coral	Siderastrea radians
Smooth starlet coral	Siderastrea siderea
Annelida	
	Arabella sp.
Tube worm	Cistenides sp.
	Eunice spp.
Green bristle worm	Hermodice carunculata
	Loimia sp.
Banded feather dusters	Sabella spp.

Mollusca	
	Adoria sp.
Cerith	Cerithium spp.
White ark	Barbatia sp.
Chiton	Chiton sp.
Scallop	Chlamys spp.
Triton	Cymatium spp.
Cowrie	Cypraea spp.
Spiny lima	Lima lima
Burrowing mussel	Lithophaga spp.
Miter shell	Mitra spp.
Tulip mussel	Modiolus amercanus
Murex	Murex spp.
Joubin's octopus	Octopus joubini
Octopus	Octupus vulgaris
Pectin	Pectin sp.
Pearl oyster	Pinctada radiata
Pin shell	Pinna carnea
Reef squid	Sepioteuthis sepioidea
Slender chiton	Stenoplax floridana
Queen conch	Strombus gigas
Fighting conch	Strombus pugilis
Hawk wing	Strobus raninus
Speckled tellin	Tellina listeri
Arthropoda	
Barnacles	Balanus spp.
	Lepas spp.
Snapping shrimp	Alpheus spp.
Cleaning shrimp	Lysmata intermedia
Spiny lobster	Panulirus argus
Pink shrimp	Penaeus sp.
Pederson's cleaning shrimp	Periclimenes pedersoni
Slipper lobster	Scyllarides nodifer
Squilla	Squilla sp.
Banded coral shrimp	Stenopus hispidus
Snapping shrimp	Synalpheus spp.
Star-eyed hermit crab	Dardanus venosus
Sponge crab	Dromidia sp.
Blue crab	Callinectes sapidus
Stone crab	Menippe mercenaria
Spider crab	Mithrax sp.
Hermit crabs	Paguristes spp.
Hermit crabs	Pagurus spp.
Swimming crabs	Portunus spp.
Decorator crab	Stenocionops furcata
Arrow crab	Stenorhynchusseticornis
Echinodermata	
Agassiz's sea cucumber	Actinopyga agassizi
Furry sea cucumber	Astichopus multifidus

Basket starfish	Astrophyton muricatum
Sea star	Astropecten spp.
Sea biscuit	Clypeaster rosaceus
Long-spined sea urchin	Diadema antillarum
Boring urchins	Echinometra spp.
Slate-pencil urchin	Eucidaris tribuloides
Sea cucumber	Holothuria floridana
Brittle star	Ophiocoma echinata
	Ophioderma sp.
Bahama starfish	Oreaster reticulatus

Chordata (Tunicates)

	Ascidea sp.
	Didemnum amethysteum
	Styela sp.
	Symplegma sp.

(Opersko, 1973; Opresko, et. al., 1976; Schmall and Tilmant, 1980; Kissling IN Multer, 1977; Voss, 1976; Jaap, 1984; Voss, 1982 and Kaplan, 1982)

5. Hardbottom

This community association is referred to as live bottom (Jaap, 1984) or hard bottom (Voss, 1982; Marzalak et al., 1977; and others). It is generally included as a subcategory of the coral reef habitats, as described by these authors, but will be treated as a separate community association within this plan and in the resource maps, as it is a major constituent of the aquatic preserve's resources. Large portions of the Atlantic sea floor and smaller portions of the lagoon bottom are representative of this community association. Marine grassbeds, sand, and mud bars are usually intermixed with the hard bottom, occupying shallow depressions in the limestone. Distribution of macrofauna is generally scattered in random patterns and is never as compact or diverse as are grassbeds or coral reefs. Never the less, this community association supports a diverse invertebrate and vertebrate fauna and is a valuable nursery area for many sport and commercial fish species (Jaap, 1984).

The flora and fauna of this association are highly variable and contain many species of the patch reef association but are not three dimensional reef building communities. Species composition is usually dominated by algae and invertebrate species such as soft corals, sponges, and small stony corals. The algal species are well represented by the calcareous greens, Acetabularia, Batophora, Halimeda, and Udotea spp. These species are instrumental in binding sediments and the

formation of calcareous sands that are the byproducts of their skeletal remains. They are also a food source for herbivorous fish and invertebrates. The brown Sargassum is also common and supports a relatively complex microcommunity within it's delicate leaves and nodules.

The soft corals (octocorals or gorgonians) are visually dominant. The most common species are the sea whips (Pterogorgia spp.), sea fan Gorgonia ventalina), sea rods (Plexaura spp.), and the sea plumes (Pseudopterogorgia spp.). Stony corals found in the live bottom communities include clubbed finger coral (Porites porites), porous coral (P. asteroides), starlet coral (Siderastrea radians), rose coral (Manicina areolata), lobed star coral (Solenastrea hyades), and smooth star coral (S. bournoni). These species vary from a few inches to a foot in height. Colonies of clubbed finger corals may cover several square meters in the clear, shallow waters near shore and their skeletal remains are a large constituent of the "sand" beach and the bars between the islands.

The sponges are also well represented in the hardbottom community. Dominance of this group in areas of the lagoon prompted Lineback (1968) to refer to those areas as the "sandy botton-sponge community". the most prevalent species are the chicken liver sponge (Chondrilla nucula), vase sponge (Ircinia campana), cake sponge (I. etherea), stinking sponge (I. felix), the little blue heavenly sponge (Dysidea etherea), the large loggerhead sponge (Spheciospongia vesparia), and the tube sponges (Aplysina cauliformis and Callispongia spp.). Both sponges and octocorals are host or prey to a wide variety of organisms that live on or in their framework. Both groups glean sustenence from the surrounding water and in doing so act as filtering mechanisms to remove minute particles and nutrients from the water.

Motile fauna of the hardbottom include many invertebrates and fishes of both the patch reef and seagrass communities. This area provides microhabitats for many juvenile fishes as well as infaunal organisms that tunnel the shallow sediments. Marine turtles are also quite frequently observed feeding or resting in these areas. The hawksbill turtle is especially fond of sponges which may comprise as much as 95 percent of it's diet (Weiss, 1988).

The reader is referred to previous sections on coral reefs and marine grassbeds for additional information and species lists.

H. DESIGNATED SPECIES

The many resource types within the preserve support a rich and varied population of plants and animals. Previous sections

have enumerated the many material and aesthetic values accrued to man in conserving and protecting these resources. This section will discuss the often critical importance of these resources to other species of plants and animals that are endangered or threatened with extinction throughout part or all of their geographic range. In most cases, their endangerment is the direct result of man's exploitation of the natural resources of an area. Excessive harvesting, collecting, landclearing, construction, dredging, treasure salvage, ditching, the use of pesticides, and the introduction of exotic plants and animals have contributed to the decline of many of these species and will continue to stress recovery capabilities for most of them.

It shall be a major objective of this plan's management policy to identify, map, and protect the endangered and threatened species habitat within the preserve boundary and provide input in decisions that would affect known habitat of these species on adjacent lands and in marine areas. To the maximum extent possible (where biologically and economically feasible), disturbed habitats will be restored to benefit endangered and threatened species. Educational programs for the general public, organizations, and governmental agencies shall be prepared and disseminated in hopes of informing and enlisting support for the conservation and protection of vital habitats. The small islands in and adjacent to the preserve are host to a large number of endangered and threatened plant species. Most are tropical species of West Indies origin and one is endemic to the lower Keys. A preponderance of the listed species occur within the mangrove/saltmarsh and beach/berm communities. The numbers and degree of endangerment may well reflect the stress imposed by development in these areas. Equally devasting pressure is exerted by plant collectors and poachers whose primary objectives are the epiphytic orchids (Encyclia spp.), air plants (Tillandsia spp.), cacti (Cereus spp., Opuntia spp.), and palms (Thrinax and Coccothrinax spp.). Entire areas may be stripped of these plants. Displacement by exotic (introduced) plants is also a problem where soils have been disturbed.

The often maligned manchineel (Hippomane mancinella), a threatened species, has been totally eliminated from much of its former range in the upper Keys and in many areas of the lower Keys. The often exaggerated toxic properties of this once abundant tree were reason enough to exclude it from inhabited areas. Several large specimens still survive in the more remote wetland areas of Big Pine Key. Other less threatening or less conspicuous plants include the endangered geiger tree (Cordia sebestena), wild cotton (Gossypium hirsutum), sea lavender (Mallotonia gnaphalodes) and bay cedar (Suriana maritima). Garber's spurge (Chamaesyce garberi syn. Euphorbia garberi) is presently classfied as endangered on the state list and its occurence is limited to four known

locations, one of which is near the preserve boundary on the north.

A second large group of endangered and threatened plants are found in the pineland communities of the lower Keys. One endangered species, the Big Pine Partridge Pea (Cassia keyensis), is endemic to the lower Keys pinelands. Other endangered and threatened plants from this community include the ferns (Acrostichum spp., Anemia sp., Pteris sp., Ophioglossum sp., and Vittaria sp.), and the silver palm (Coccothrinax argentata). Plant poaching, filling of freshwater wetlands, and land clearing are primary threats in these areas. Exclusion of fire in the "fire dependent" community may also be deleterious to many of the understory plant species. As more development occurs within a pineland, fire is excluded to protect property. The result is often negative for the community as a whole and may eliminate endangered and threatened species as the community succeeds to a hardwood sere (Gunderson et al., 1983).

Endangered and threatened hardwood hammock species, or small colonies of these species are generally dispersed randomly throughout a hammock. This 'clumping' is often overlooked by those who clear land for development. The generally small building lots are usually cleared of all vegetation to provide a buiding site and yard area. This practice may eliminate an individual or an entire colony of an already limited species.

Table 9 provides a partial species list of plants considered to be endangered or threatened by 1) Florida Department of Agriculture and Consumer Services, the official State list (Preservation of Native Flora of Florida Act, Florida Statutes, Section 581.185, 1978); 2) Rare (R), endangered (E), threatened (T), and spceies of special concern (SSC) from the Florida Committee on Rare and Endangered Plants and Animals (FCREPA) list: and 3) Rare and Endangered Biota of Florida series (P.C.H. Pritchard, ed.). One cactus on the list, (Cereus robinii) is currently designated as endangered by the U.S. Fish and Wildlife Service and 16 plants from the list are under review for federal listing.

The plant communities within and adjacent to the preserve are host to an equally diverse number of endangered and threatened animals. These areas provide food, cover, and nesting habitat for a broad range of resident animals and are equally important to several transitory species. Table 10 lists all species that could be expected to utilize various habitats within the preserve.

The endangered Key deer (Odocoileus virginianus clavium) is known to utilize many habitat types during daily or seasonal movements but is limited to only a few of the lower Keys islands, Big Pine having the largest population. They are

excellent swimmers and are known to traverse open water between islands (Silvy, 1975). Klimstra et al., (1980) estimated mid-1970's population to have been approximately 350-400 animals. The Key Deer National Wildlife Reguge esitmates current populations to be 250-300 animals (Holle, 1987). The deer travel over great distances to procure water and forage and disperse over a wider range during rut and fawning seasons. Loss of habitat and high annual mortalities from road kills, fence intanglement, free roaming dogs and drowning are major impediments to the deer's survival. Most of these factors are directly the result of human occupation of the area and will most probably be compounded as more of Big Pine Key is developed. Conservation and management of this species cannot be accomplished without close coordination and cooperation with local government planning and other resource management plans.

The crepuscular or nocturnal Key Vaca raccoon (Procyon lotor auspicatus), a threatened, endemic subspecies, is also an excellent swimmer and utilizes a broad range of habitats for foraging. Other than road kills, this species has few confrontations with man and may in fact benefit from man's occupation of an area. Cultivated fruit and garbage are perfectly acceptable in their diet.

Originally recorded from the island of Key Vaca (Marathon) where urban development has displaced much of its former habitat, the raccoon has expanded its range to other islands near Big Pine Key. The Key Vaca raccoon is not currently documented for the preserve area but close proximity to known habitat (No Name Key) and the raccoon's amphibious skills would indicate the extremely high probability of eventually encountering this nomad (Lazel, 1984).

The endemic and endangered Silver rice rat (Oryzmoys arentatus) utilizes freshwater and marine wetland areas for foraging, cover, and nesting (Spitzer and Lazell, 1978). A common saltmarsh plant (Batix maritima) is a known food plant and an indicator of preferred habitat when in close proximity to freshwater (Spitzer, 1983). The rice rat has not been formerly recorded within the preserve. However, the area has not been extensively trapped to confirm presence/absence and available habitat would justify further population studies for this rodent (Spitzer-Goodyear, pers. com.)

Other species that are dependent upon freshwater wetlands and upland habitats include several species of reptiles. The threatened Big Pine Key ringneck snake (Diadophis punctatus taeniata) and Florida brown snake (Storeria dekayi victa) are endemics that are especially dependent upon freshwater wetlands within the adjacent hammocks and pinelands (Paulson, 1968 and Weaver, 1978a). A threatened subspecies, the Florida ribbon snake (Thamnophis sauritus sackeni) and the threatened

Eastern indigo (Drymarchon corais couperi) utilize a variety of habitats including mangroves and saltmarsh areas (Weaver, 1978 (a)). The Red rat snake (Elaphe guttata guttata) is listed as a species of special concern in the lower Keys. Loss of suitable habitat is probably the single most important influence on their survival. Public education may be beneficial in erasing the age old predjudice towards snakes in general. All of these snakes are non-poisonous and all are beneficial to man, in that they feed upon insects and rodents that are considered vermin. Yet most of them are systematically eliminated from the environs of man out of fear or ignorance and the introduction of domestic pets.

The Key mud turtle (Kinosternon bauri bauri) and the American alligator (Alligator mississippiensis) utilize fresh and brackish wetlands for feeding, resting and raising their young. The endangered mud turtle is an elusive creature that is often difficult to find even in it's known habitat. Bottoms of ponds and solution holes are often carpeted with thick layers of mud and leaf litter that offer excellent cover for this small turtle (Weaver, 1978 (b)). During periods of dought the turtle may burrow into crevaces or tunnel under rocks to conserve body moisture and await the rains that replenish the pond (Dunson, 1981). The Alligator, once threatened with extinction has been successfully bred and reared in captivity. The success of alligator farming has reduced the pressure on wild populations and the state now considers the wild alligator as a species of special concern.

The American crocodile (Crocodylus acutus) is an infrequent visitor in Coupon Bight. Reported sightings are usually a case of mistaken identity (Alligator) but several reports (one with photographs) are reliable. The proximity of several other individuals on Bahia Honda Key and sporadic reports of an individual near Key West would seem to indicate that certain crocodiles are nomadic and may cover great distances and frequent certain areas on a regular basis. The crocodile usually shuns areas of human occupation and boat traffic (Moler, per. com.) and may well find the shallow water bays and channels of the Bight a a welcome haven from these disturbances.

Although no amphibian species are presently listed, it is anticipated that future research and study of local freshwater areas may reveal morphologically or physiologically unique species. The introduction of exotic species, such as the Giant marine toad (Bufo marinus) and the Cuban treefrog (Hyla septentrionalis) may possibly pose a threat to the smaller native species but the alteration of wetland environments is a much greater threat (Krakauer, 1970).

The avifauna of the area represents the largest group of listed species. All except two species on Table 10 are

dependent upon wetlands for their survival. The Little blue heron (Egretta caerulea), Snowy egret (Egretta thula), Reddish egret (Egretta rufescens), Tricolored (or Louisiana) heron (Egretta tricolor), and the Roseate spoonbill (Ajaja ajaja) are currently listed as species of special concern. These colonial nesters were easy prey for the plume hunters of the early part of the century. Entire rookeries were annihilated as plume hunters killed the adult birds in breeding plumage and left chicks to die or fed them to their hogs. As the demand for plumes declined, the real estate boom began in south Florida. Thousands of acres of wetlands were drained for agriculture and residential development. Depleted breeding stocks and ever vanishing habitat brought these species and others to the brink of extinction. Loss of habitat, water management practices on the mainland, and the introduction of pesticides into the food web may still imperal the survival of many.

The Roseate tern (Sterna dougallii) and Least ern (Sterna antillarum) are known to nest in the area and both are now listed as threatened species. The roseate population consists of approximately 250-300 nesting pairs and they nest almost exclusively in the lower Keys (Robertson, 1978). Both terns favor unvegetated beaches, berms and spoil islands for nesting. Unfortunately, spoil islands and beaches are usually prime targets for development or other alteration. Development activities and ground nesting are seldom compatible. The decision to remove dredge spoil to restore historic water flow must also be weighed against the possible disruption of nesting habitat.

The Southeastern snowy plover (Charadrius alexandrinus tenuirostris) is a summer visitor to our beaches and shallow-water wetlands but does not nest here (Wofenden, 1978). This threatened species has suffered descimation in many of the Caribbean countries. Excessive hunting pressures and destruction of habitat are instrumental in population declines (Arendt et al., 1979; Wiley,1979).

The White-crowned pigion, a threatened species, is also hunted for sport and food in many of the Caribbean countries. Excessive hunting pressures, egg collecting and removal of tropical hardwood forests have seriously depleted resident populations in at least two countries. Cooperative agreements, closed seasons and complete protection in several areas have slowed the decline of this species. Resident populations in the Keys are protected from hunting but efforts must continue to stem the loss of tropical hardwood trees that the pigeon depends on for food. Poisonwood (Metopium toxiferum) is a favored food during the fruiting period. As the name implies, this tree has certian toxic properties that irritate sensitive human skin (and may cause more severe complications for hypersensitive persons) and it is frequently

eradicated from human environs. Other less objectionable hammock trees and shrubs, such as, Pigeon plum (Coccoloba diversifolia), Snowberry (Chiococca alba), stoppers (Eugenia spp.), Wild coffee (Psychotria nervosa) and wild figs (Ficus spp.) are also staple foods. However, few of these plant species are given explicit protection under local landclearing ordinances. The pigeon feeds in the hammocks and nests in the more remote mangroves. It is shy and sensitive to human habitation or disturbance in both areas (Robertson and Kushlan, 1978; Sprunt, per. com.).

The endangered Peregrin falcon (Falco peregrinus) is a winter visitor to the Keys. Pesticides in the food chain were instrumental in the decline of this raptor. Elimination of certain insecticides and reintroduction of the peregrin are proving successful in reestablishing this species in the former range. Perched upon utility wires or hovering over open areas, it can overtake and capture other birds in midflight. It may be encountered in variety of habitats from September to May (Snyder, 1978).

Open-water piscivorous birds include the endangered Bald eagle (Haliaeetus leucocephalus) and the threatened Eastern brown pelican (Pelecanus occidentalis carolinensis). The eagle population has suffered a 50% decline over the last 30 years. Florida populations have dropped from 1,000 to less that 350 breeding pairs. Currently, only 2-4 pairs are thought to nest between Key Vaca and the Marquesas (Robertson, 1978). Eagles do not presently nest in the preserve but suitable feeding habitat may attract an occassional visitor.

The Eastern brown pelican has suffered a similar fate on a national level. A massive die-off in Texas and Louisiana during the 1960's prompted the federal government to list the pelican as an endangered species until 1984. It appears that local populations have remained fairly stable and the pelican has been deleted from the endangered category and it is now considered to be a species of special concern in Florida. There are 19 breeding colonies of brown pelicans in the Keys. This represents 38% of the Florida population (Schreiber, 1978). The pelican prefers more remote mangrove areas for nesting and will often join other colonial species.

The Osprey (Pandion haliaetus), which is not currently listed, may well reach threatened status if present populations continue to decline. The locally limiting factors are thought to be availability of suitable nesting habitat and adequate food during the nesting season. The osprey is tolerant of human occupation but like the eagle, prefers large, dead trees that rise above the surrounding canopy for nesting. Hurricanes and landclearing have removed many of these suitable trees and the osprey has opted for nesting on utility poles and elevated platforms. The possible addition of

artificial nesting platforms is being investigated as a means to encourage more osprey nesting. Continued protection of mangrove rookeries and the mangrove/detritus food chain are vital for the eagle, pelican, osprey and the many wading birds that depend upon fish and marine invertebrates for food.

Qualitative information on marine fishes and invertebrates are conspicuously absent from the literature. Of those listed, only the Common snook (Centropomus undecimalis) has been extensively studied. This species is a prized sport and food fish and much controversy currently rages regarding the reasons for it's decline and the appropriate measures for ensuring a return to former abundance. Pesticides spraying (EPA, 1981), habitat destruction and overharvesting are the primary concerns. Egg and larval stages of most marine species are adversely affected by insecticides. Removal of larger fish, through uncontrolled commercial or sport fishing, depletes brood stock. The effects of both were quickly evident. Destruction of mangroves and marine grassbeds are additional stresses that have negatively affected the snook statewide.

Discontinued spraying for mosquitos over aquatic preserves and federal refuges may have already contributed to higher hatch success for snook. The long term data will undoubtably prove this policy beneficial. Closing certain areas to commercial net boats and imposing closed seasons and strict size limits for both commercial and sport fisheries may also reverse the previous trend. Current reports from professional guides and sportfisherman indicate that this is the case and that more fish are being taken in the Keys. Those over or under the size and over the bag limits should be returned to the water, uninjured.

The threatened Key silverside (Menidia conchorum) is an endemic of shallow open bays in the Big Pine Key and Cudjoe Key area. It was formerly reported near Key West but this population is thought to have been extirpated. This small (adults up to 2 inches long) fish is primarily a marine species but will tolerate freshwater (Gilbert, 1978). This and other listed fish species are adversely affected by modification or loss of habitat. Alteration of mangroves and marine grassbeds eliminates habitat and often creates turbidity that smothers eggs and clogs gills. Preservation of these and other species requires that disturbances in marine wetlands be kept to a minimum and that these areas be protected from upland drainage that introduces silt and pollution into nearshore habitats.

The marine turtles have suffered depredation similar to that described for the wading birds. The Atlantic green turtle (Chelonia mydas mydas) was once a mainstay to Keys fisherman. Shortly after the turn of the century, most of these turtles

had been eliminated from local waters. Overharvesting and egg collecting in other parts of the Caribbean and Gulf of Mexico have continued to stress survival for all marine turtles. With the exception of the Atlantic loggerhead (Caretta caretta caretta) and the Hawksbill (Eretmochelys imbricata imbricata), those listed would be considered as rare or occasional visitors to the preserve area. The endangered hawksbill may be observed occassionally in coral reef and hardbottom areas and the threatened loggerhead is a frequent visitor to the preserve.

Loss or modification of suitable nesting beaches and nest predation are major concerns in the local management of loggerhead turtles. Present efforts to locate and document turtle nesting sites within the preserve are proving successful. Nests that are not threatened by tidal inundation, vehicular traffic, poaching, or predation are left to their fate. Those nests that are in danger of being destroyed are relocated to an in-ground hatchery at Sombrero Beach by properly permitted individuals. Upon hatching, the turtles are released at or near their point of origin. The local Save-a-Turtle program and similar programs throughout the state have been highly successful in returning large numbers of hatchlings to the sea, in hopes that the survivors may return to our beaches in the future. The cooperation and vigilance of local citizens has contributed significantly to this effort.

The endangered West Indian manatee (Trichechus manatus latirostris) is an occasional visitor to the preserve area. Individual animals or small groups are often reported to appear in residential boat basins and canals during the winter months and occasionally during summer. Cool water temperatures farther north may prompt this migration out of the usual winter range. Well meant offerings of food and fresh water will often entice the manatee to linger in these areas for longer periods. This practice should be strongly discouraged, as it increases the manatee's exposure to danger from boats. Although there are no designated "manatee areas", boaters should be cautious and reduce speed when manatees are in an area. Heavy penalties are imposed for harassing or negligently injuring or killing this highly endangered species.

Invertebrates that warrant special status include several terrestrial and marine species. The four insects listed are currently under review for federal listing. Marine invertebrates of special interest include several species of corals. These species (as well as those from the deep-water reefs) have been subjected to collecting and habitat destruction in many areas of the Keys. The corals are the structural components of the reef and as such are vital to its survival. The labrynthes of the reef offer food and cover to

a large variety of interesting and biologically significant species. The corals themselves are subject to many forms of disease and injury or necrosis from a variety of external forces but man's influence may be most instrumental in the decline or damage to corals in some areas.

Major damage to coral communities stems from the unimformed boating and diving public. Improperly placed boat anchors and poor navigational judgement account for considerable damage to corals that may take decades to repair. Divers and snorklers who touch or stand on living corals also inflict wounds and weaken a colony, leaving it open to infection or decimation by predators. As previously noted, local damage to corals also involves lobster trap placement and retrieval methods. Chaffed, broken,, or overturned colonies are subject to disease, infection, and displacement by other organisms.

Other activities that are generally detrimental to coral communities include nontraditional and traditional hook and line fishing methods and fish and invertebrate collecting. Hook and line fishing introduces monofilament line and lead weights that chaff and damage corals much the same as the bouy lines on lobster traps. Monofilament line is also a hazard to marine turtles. Once entangled, the turtle may suffer deep lacerations or complete amputation of a flipper.
The use of chemicals has often had catastrophic results on local coral populations. Results may only temporarily interupt local fauna (as in the case of Rotenone) or leave more permanent voids when employed on a regular basis, as was customary with sodium hypochloride and other chemicals in the Indio-Pacific regions. The use of these chemicals may result in a high mortality of sessil invertebrates or cause the coral polyp to expell the symbiotic zooxanthellae (Johannes, 1975). Similar chemicals are frequently employed by fish and invertebrate collectors.

Although state law (F.S. 370.110) prohibits the taking of hard corals (Millepora spp. and the Scleractinia) and a few species of sea fans (Gorgonia ventalina and G. flabellum) from State waters, many of the octocorals (gorgonians), tropical fish, molluscs, crustaceans, anemones, and other invertebrates are less stringently regulated. Permits are required for these activities but monitoring and regulating collectors is difficult, if not impossible, given the broad geographic extent of the State's marine waters. Local collecting is still conducted by both professional and amatuer aquarists, often with little regard for federal or state sanctuary or preserve boundaries. And with even less consideration for non-target species when pursueing specimens. Overharvesting is also a potential problem. Intensive collecting of a single species may eliminate that species from a small patch reef. The ecological repercussions are problematic but each organism fills a particular biological niche and mass alteration of

community structure would affect other organisms that interact with the target species (e.g. predator/prey, parasitic, symbiotic, and mutualistic relationships).

Other forms of chemical pollution are potential threats to coral colonies. Sewage leachate, petroleum hydrocarbons (PHC), pesticides, and heavy metals are all lethal to corals in concentrated application. Lower concentrations are extremely difficult to trace in marine systems and qualitative research on long-term, low level, chronic pollution is equally difficult to conduct in the natural environment. Long term, low level concentrations of PHC's have been correlated to low reproductive success in corals (Loya and Rinckevich, 1980). Similar alterations to biological processes have been documented for heavy metals and pesticides in other organisms.

The concern for an individual endangered species may prompt a concerted effort for preservation and has proved successful in a limited number of cases. The Peregrin falcon and the Alligator are such examples. Other efforts have proved only marginally successful. The American bison was reduced from 25 million to less than 600 individuals in three decades. Today, their offspring number in the thousands but most are confined to only a small portion of their former range within National Parks and preserves. Similarly, the Florida manatee has benefited from designated sanctuaries and captive breeding efforts but the steady growth of recreational power boats still imperils this slow moving siren throughout much of it's already diminished range. The most recent population estimate indicates that there may be less than 1,000 individuals statewide.

Other wildlife species have not faired so well. The Florida panther and the Key deer once lived side by side in the Keys. The panther has been extirpated from the islands and much of Florida. The deer now numbers less than 300 individuals and many are skeptical about its continued survival in the path of development. Much the same skepticism exists regarding the endemic species discussed, as well as the American crocodile and the Bald eagle. The onslaught of human populations and development leave little hope for many of these animals. Designated refuges and preserves, stringent laws and a "conservation ethic" are possibly all that seperate them from extinction.

TABLE 9

FLORAL SPECIES OF THE COUPON BIGHT AQUATIC PRESERVE AREA THAT ARE CLASSIFIED AS ENDANGERED, THREATENED OR COMMERCIALLY EXPLOITED

Scientific Name	Common Name	Status	
		FDA	USFWS
Acacia choriophylla	Tamarindillo	E	
Acrostichum aurem	Golden leather fern	E	
Acrostichmu danaeifolium	Giant leather fern	T	
Anemia adiantifolia	Pine fern	T	
Argythamnia blodgettii	Blodgett's wild mercury		UR
Aristida floridana	Florida three-awned grass	E	UR
Campyleneurum phyllitidua	Strap fern	T	
Cassia keyensis	Big Pine partridge pea	E	UR
Catesbaea parviflora	Small-flowered lilythorn	E	
Cereus gracilis	Prickly apple cactus	E	UR
Cereus pentagonus	Dildoe cactus	T	
Cereus robinii	Tree cactus	E	E
Chamaesyce garberi (= Euphorbia garberi)	Garber's spurge	E	T
Chrysophyllum olivaeforme	Satinleaf	E	
Clusea rosea	Balsam apple	E	
Coccothrinax argentata	Silver palm	C	
Cocos nucifera	Coconut palm	T	
Cordia sebestena	Geiger tree	E	
Cupania glabra	Cupania	E	
Encyclia boothiana	Dollar orchid	E	UR
Encyclia cochleata	Clamshell orchid	T	
Encyclia tampensis	Butterfly orchid	T	
Ernodia littoralis	Beach creeper	T	
Euphorbia porteriana var.keyensis	Keys hairy-podded spurge		UR
Gossypium hirsutum	Wild cotton	E	
Hippoman mancinella	Manchineel	T	
Hymenocallis latifolia	Spider lily		UR
Jacquinia keyensis	Joewood	T	
Limonium carolinianum var.angustatum	Narrow-leaved sea lavender		UR
Linum arencila	Sand flax	E	UR
Mallotonia gnaphalodes (= Tournefortia gnaphalodes)	Sea lavender	E	
Melanthera parvifolia	Small-leaved melanthera		UR
Ophioglossum palmatum	Hand fern	E	UR
Opuntia compressa	Prickly pear cactus	T	
Opuntia cubensis	Prickly pear cactus	T	
Opuntia spinosissima	Semaphore cactus	T	UR
Opuntia stricta	Prickly pear cactus	T	
Ppuntia tricantha	Three-spined prickly pear		UR

Phyllanthus pentaphyllus	Florida five-petaled leaf flower		UR
Salvia blodgetti	Blodgett's sage		UR
Scaevola plumieri	Scaevola or Inkberry	T	
Strumpfia maritima	Pride-of-Big-Pine	E	
Suriana maritima	Bay cedar	E	
Swietenia mahogani	West Indian mahogany	T	
Thrinax floridana	Florida thatch palm	C	
Thrinax microcarpa	Brittle thatch palm	C	
Tillandsia balbisiana	Reflexed wild pine	T	
Tillandsia circinata (= T.paucifolia)	Twisted air plant	T	
Tillandsia fasciculata	Wild pine or Air plant	C	
Tillandsia flexuosa	Banded wild pine	T	
Tillandsia setacea	Needle-leaved air plant	T	
Tillandsia utriculata	Giant air plant	C	
Tillandsia valenzuelana	Soft-leaved wild pine	T	
Tragia saxicola	Florida Keys noseburn		UR
Vanilla barbellata	Wormvine orchid	E	
Vittaria lineata	Shoestring fern	T	

Note:

FDA = Florida Department of Agriculture and Consumer Services (list published in Preservation of Native Flora of Florida Act, Section 581.185-187, Florida Statutes).
E = Endangered
T = Threatened
C = Commercially Exploited

USFWS = United States Fish and Wildlife Service (list published in List of Endangered and Threatened Wildlife and Plants, 50 DFR 17.11-12).
E = Endangered
UR = Under review for federal listing

TABLE 10

FAUNAL SPECIES OF THE COUPON BIGHT AQUATIC PRESERVE AREA THAT ARE CLASSIFIED AS ENDANGERED, THREATENED, OR OF SPECIAL CONCERN

Scientific Name	Common Name	Status FGFWFC	Status USFWS
INVERTEBRATES			
Ataenius superficialis	Big Pine Key Ataenius beetle		UR
Belocephalus micanopy	Big Pine Key Conehead katydid		UR
Belocephalus sleighti	Keys short-winged conehead katydid		UR
Cycloptilum irregularis	Keys scaly cricket		UR
Diploria clivosa	Knobby brain coral	*	
Diploria labyrinthiformis	Grooved brain coral	*	
Diploria strigosa	Smooth brain coral	*	
Montastrea annularis	Small star coral	*	
Montastrea cavernosa	Large star coral	*	
Siderastrea siderea	Starlet coral	*	
FISH			
Centropomus undecimalis	Common snook	SSC	
Menidia conchorum	Key silverside	T	
Rivulus marmoratus	Rivulus	SSC	
Starksia starcki	Key Blenny	SSC	
REPTILES			
Alligator mississippiensi	American alligator	SSC	
Caretta caretta caretta	Atlantic loggerhead turtle	T	T
Chelonia mydas mydas	Atlantic green turtle	E	E
Crocodylus acutus	American crocodile	E	E
Dermochelys coriacea	Leatherback turtle	E	E
Diadophis punctatus acricus	Big Pine Key ringneck snake	T	UR
Drymachon corais couperi	Eastern indigo snake	T	T
Elaphe guttata guttata	Red rat snake	SSC	
Eretmochelys i. imbricata	Atlantic hawksbill turtle	E	E
Eumeces egregius egregius	Florida Keys mole skink	SSC	UR
Kinosternon bauri bauri	Key mud turtle	E	UR
Lipidochelys kempi	Atlantic ridley turtle	E	E
Thamnophis sauritus sackeni	Florida ribbon snake	T	

BIRDS

Ajaja ajaja	Roseate spoonbill	SSC	
Charadrius alexandrinus	Southeastern snowy plover	T	UR
Columba leucocephala	White-crowned pigeon	T	UR
Egretta caerulea	Little blue heron	SSC	
Egretta rufescens	Reddish egret	SSC	UR
Egretta thula	Snowy egret	SSC	
Egretta tricolor	Louisiana or Tricolor heron	SSC	
Falco peregrinus	Peregrine falcon	E	T
Falco sparverius paulus	Southeastern Kestrel	T	UR
Haliaeetus leucocephalus	Bald eagle	T	E
Pelecanus occidentalis	Brown pelican	SSC	
Sterna antillarum	Least tern	T	
Sterna dougallii	Roseate tern	T	

MAMMALS

Odocoileus virginianus clavium	Deer	E	E
Oryzomys argentatus	Silver rice rat	E	UR
Procyon lotor auspicatus	Key Vaca raccoon	T	UR
Trichechus manatuslatirostris	Indian manatee	E	E

Notes:

FGFWFC==Florida Game and Fresh Water Fish Commission
(list published in Section 39-27.03-05, F.A.C.)
E = Endangered
T = Threatened
SSC = Species of Special Concern

USFWS===United States Fish and Wildlife Service (list published in List of Endangered and Threatened Wildlife and Plants, 50 CFR 17.11-12).
E = Endangered
T = Threatened
UR = Under review for federal listing

* = Rare and Endangered Biota of Florida. P.C.H. Prichard, Series Editor. Vo. 1-6. University Presses of Florida, Gainesville, FL, 1978. (Species listed are Threatened.)

I. REGIONAL LAND USE DEVELOPMENT AND ASSOCIATED IMPACTS

1. Regional Land Use and Development

The south Florida region may be interpreted to include a variety of locations or features depending upon: political subdivision, county lines, geological formations, climate, watershed or any number of other natural or artificial boundaries. For purposes of this discussion, the south Florida region will include Monroe, Dade, Broward, Palm Beach, Hendry, Glades, Charlotte, Lee, Collier and the southern portion of Martin counties. This delineation is based upon their proximity to the aquatic preserve. All counties except Glades and Hendry, which are principally agricultural lands, are coastal areas with substantial population densities. All are within a five hour driving time of the preserve.

As an ecological unit the south Florida region is often characterized as the Kissimmee-Okeechobee, Everglades-Florida Bay-Coral Reef system. Water quality, accumulation, aquifer recharge, retention, dispersal and use are the common elements that unit this region. Water needs of agricultural and urban development must be balanced with the need to maintain or restore quality, quantity and periodicity of water flow to the larger environmental complex and for aquifer recharge. Pollution, depletion, flooding, drought, salt water intrusion, alteration or loss of environmentally sensitive wetlands, and priority of use are ongoing issues that must be addressed by the public and various management entities.

Potable water for the Florida Keys is provided by pipeline from well fields in south Dade County and thus links the Keys with the Biscayne Aquifer. Overland water flow moves south from the Kissimmee River basin, Lake Okeechobee and the Everglades to enter Florida Bay and eventually waters of the Gulf Stream and the Atlantic Ocean. Because these systems are interconnected, the impacts to one part of the system will eventually impact all of the system, depending upon severity and/or duration. The aquatic preserve lies 'down stream' of this complex system in the Coral Reef zone. It is linked to the larger region both environmentally and economically.

The Keys have historically been a haven for respite from the heavily developed urban areas along the east coast of Florida and the northeastern states. From the early days of Flagler's railroad to the present, a large proportion of the visitors to Keys are from the neighboring counties to the north. Many are seasonal visitors or part time residents. Interstate road system and international airports connect the islands with the region and the world.

U.S. Highway 1 links Key West with the other islands and the mainland of Florida with a series of 43 bridges and several

causeways. This is the only arterial roadway into or out of the Keys. Key West International Airport lies 30 miles southwest of the preserve. Miami International Airport is approximately 130 miles northeast via U.S. 1 and the Florida Turnpike. Marathon Airport on Key Vaca offers local commuter service to Key West, Miami and several other cities in the region.

From earliest recorded history, the Keys have been an important maritime area. European trade routes and Caribbean basin traffic have linked the islands with the rest of the world. Ports in Miami and Key West continue that tradition. They are major points of cultural and economic exchange. Cruise ships and tours provide additional access for the millions of tourists who visit the area annually.

Fisheries were probably one of the primary enticements to the early explorers and settlers of the Keys. Sponges, turtles, finfish, conch and spiny lobster supported many families and entire villages in some areas. All but protected turtles and queen conch are still a mainstay to the local commercial fisheries. Although this industry employees a relatively small proportion of the population, it is probably the third most important industry in the Keys. Economies are also stimulated by the facilities and services related to recreational fishing and accommodations for participants from throughout the region.

Geographically and historically, the region has been a strategic location for national security interests. The U.S. Navy, Coast Guard and Air Force staff and manitain several facilities throughout the Keys. Local populations and economies are affected by the presence of these facilities. Many of the retired staff have remained as residents after service.

The combination of climate, clear clean waters, coral reefs, abundant fish and wildlife and accessibility are the main attractions to both visitors and residents of the Florida Keys. The Keys are the most popular diving destination in the region and state and possibly, the continent. Millions of visitors generate billions of dollars to the local economies of the Keys and the region. Dive shops, schools, boats, lodging, apparel, restaurants, marinas, car rentals, airlines, photography and sundry other shops and businesses are geared to the needs and services for this industry.

2. Local Land Use and Development

A major portion of the land area adjacent to Coupon Bight Aquatic Preserve is undeveloped or is developed with low density commercial and residential use (Figure 4). Such is not the case for most of Big Pine Key. Intense commercial

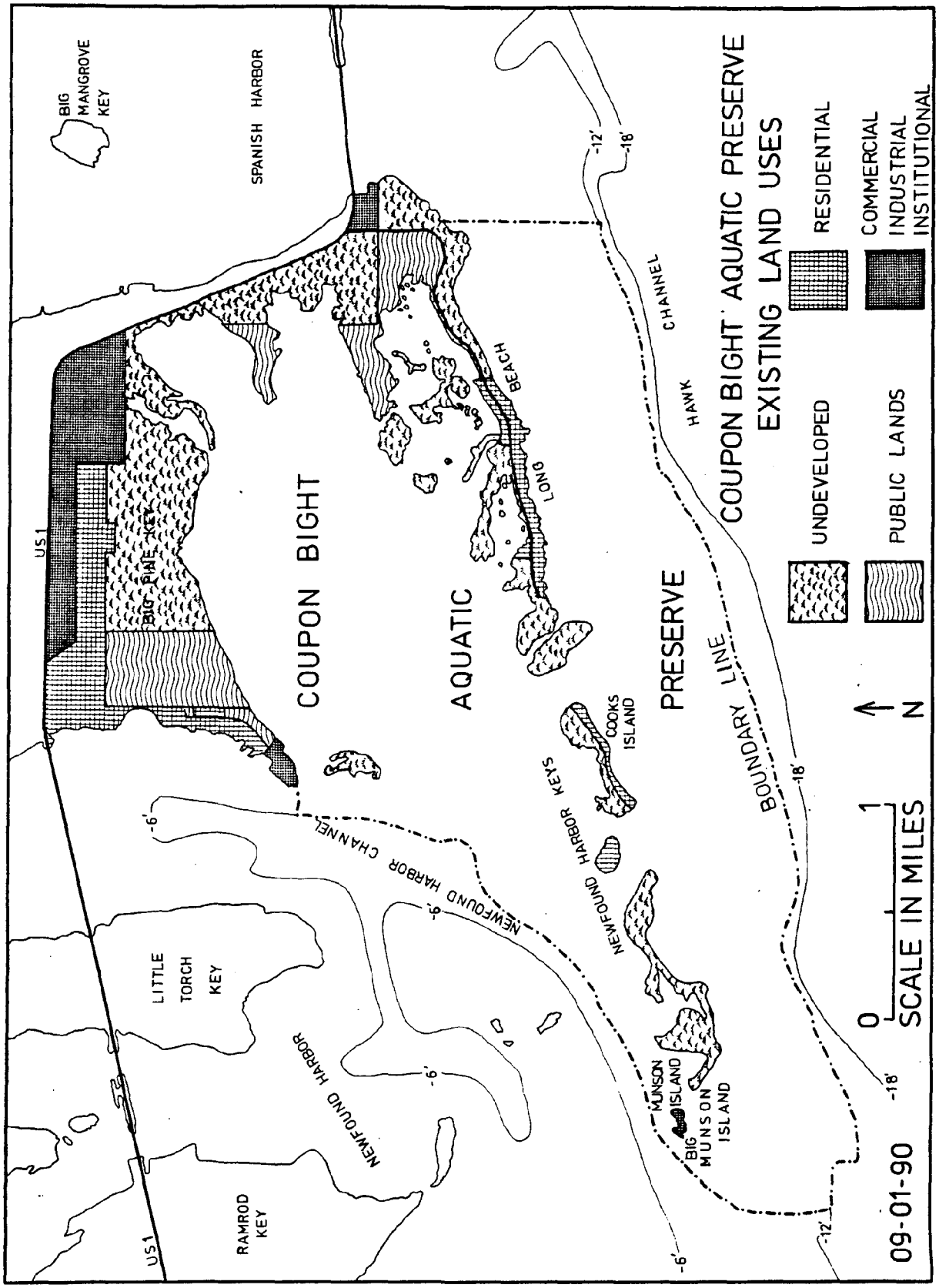
COUPON BIGHT AQUATIC PRESERVE
EXISTING LAND USES
RESIDENTIAL
COMMERCIAL
INDUSTRIAL
INSTITUTIONAL
UNDEVELOPED
PUBLIC LANDS
COUPON BIGHT
AQUATIC
PRESERVE
BOUNDARY LINE
SCALE IN MILES
0
1
N
09-01-90
BIG MANGROVE KEY
SPANISH HARBOR
BIG PINE KEY
US 1
LITTLE TORCH KEY
RAMROD KEY
NEWFOUND HARBOR
NEWFOUND HARBOR CHANNEL
NEWFOUND HARBOR KEYS
COOKS ISLAND
LONG BEACH
HAWK CHANNEL
MUNSON ISLAND
BIG MUNSON ISLAND
-6'
-12'
-18'

FIGURE 4

proliferated along the US 1 corridor through the center of the island. Big Pine is also the fastest growing residential area in the lower Keys. Population on Big Pine/Bahia Honda increased from 806 in 1970 to 2,377 residents is 1980 (194.9%) (Monroe County, 1984). The 1990 census is predicted to witness a similar increase for the last decade.

(Note: Bahia Honda Key is now entirely under management by the Florida Park Service. Residents on the island include only minimal park staff).

Population growth has placed pressure upon natural resources, infrastructure and services. Destruction of Key deer habitat and the freshwater resources of the island are of paramount concern. To provide compatible use with conservation of species and their habitats, Monroe County designated the Big Pine Key area as an area of Critical County Concern in 1986. This designation provides for a Focal Point Plan to be prepared to address these issues. In 1989 this planning process began. Limited progress has been made to date (Monroe County, 1990).

It should also be noted that most development is serviced by septic tanks rather than central sewage in the Coupon Bight vicinity. Only one commercial facility has a secondary treatment plant. Some new development in wetlands is being required to install secondary treatment plants which incorporate boreholes for injection of effluents.

The land area south of US 1 and north of Coupon Bight is typically developed with residential, institutional, commercial and limited industrial uses. The Long Beach area and the Newfound Harbor Keys south of the Bight are principally low density residential or undeveloped.

For purposes of this management plan, adjoining uplands will be limited to four categories based upon type and intensity of use. These designations do not reflect any particular zoning or planning area districts as applied by Monroe County government. Low density residential will include properties and facilities intended for private single family use. Institutional use applies to those areas that are primarily used by private entities engaged in education, research, religious or civic activities. Commercial and industrial uses will be treated as Commercial/Industrial as intensity of use is similar. The Undeveloped areas category will include those lands that are mangrove and transitional wetlands, mangrove islands and pinelands or hammocks that are publicly owned. It will also include privately owned lands that are deemed unsuitable for development because of environmental sensitivity or lack of facilities improvements.

(a) Low Density Residential: Four improved (access roads and utilities in place) subdivisions lie north of the Bight and south of the US 1 roadway. They contain approximately 400 lots intended for single family use. Cahill Pines and Palms was developed by dredging six dead end canals in the area of the mangrove slough at the western shoreline of the island. Half of the main access canal and the western most canal connect to the waters of Pine Channel. Those in the east are plugged canals with no access to open water. Buildout on the 199 lots is approximately 60% at this time. Water quality in the canal systems is anticipated to be generally poor due to poor design, restricted circulation, septic leachate and hydrogen sulfide generated from mangrove muck sediments in the area.

Piney Point subdivision extends to the southwestern tip of the island. As with Cahill, most of this area was developed from dredged spoil material. Development is almost exclusively limited to the shoreline of Pine Channel with several short dead end canals perpendicular to the shoreline and west of Big Pine Avenue. Several lots east of this roadway have been developed with homes. All of the properties in this area have been targeted for purchase under the Coupon Bight Buffer Project (CARL). Twenty lots and two large parcels have been purchased to date. Ten privately owned, undeveloped residential lots adjoin the northern shoreline of the Bight. Negotiations for these properties is ongoing.

Pine Key Yacht Club Estates does not, as the name implies, abut open water. This 183 lot subdivision was platted in upland habitats with only the southern portion adjoining the saltmarsh buttonwood and impounded mangrove slough. Improvements are minimal, with the few developed sites primarily restricted to the northern one-fourth of the subdivision, closest to US 1.

Improvements and development in the Kinercha subdivision is similar to the Yacht Club, with most residences clustered near the US 1 roadway. Dirt roads that are heavily overgrown provide access to the saltmarsh and mangrove wetlands to the south. Illegal building, land clearing, dumping, poaching, camping, wild fires and other activities are evident in these areas because of accessibility and remoteness.

Two 'paper' subdivisions are also within this area. Tropical Park and Silas Knowles, each with 240 lots were platted with little regard for access or natural features and landforms. Both lie partially within the extensive area of saltmarsh and mangrove wetlands adjoining Coupon Bight. Random dirt trails and mosquito ditches crisscross the wetlands in these areas. They have also been targeted for purchase by the CARL program.

Low density residential development south of the Bight is concentrated in Long Beach Estates and on Cooks and Hopkins Islands. Long Beach Estates is divided into five sections, A-E. The only naturally occurring 'uplands' in this area consists of the low, narrow coastal berm that parallels the Atlantic Ocean in Sections A-C. Access is provided by Long Beach Road that effectively separates the berm from the mangrove wetlands of the Bight. Section A contains 50 lots, 50% of which are platted on undeveloped, privately owned submerged lands. The remaining lots are approximately 75% built out. Section B contains 47 lots. One third are platted on privately held submerged lands. Buildout is near 50% on the remaining lots. Section D is a 9 acre parcel of private, undivided and undeveloped submerged land. Section E contains 111 platted, undeveloped lots on privately owned submerged lands. A 3500 foot access channel, turning basin and dead end canal have been dredged from privately owned submerged lands to provide access to Coupon Bight. Depths in the channel range from 6 to 10 feet. Depths in the basin and canal are much deeper. Dredged material was most probably used to fill the mangrove wetlands that once existed in this area.

The Atlantic side of Cooks Island was platted with 20 parcels intended for single family development. Some of those parcels have been resubdivided and approximately 7 are developed with residences. As with Long Beach, construction is limited to the coastal berm. The north shoreline adjoining the Bight is unplatted, privately owned mangroves. A single dirt road provides access between the parcels. Electricity is available through an aerial transmission line that extends from Long Beach to Little Munson Island over the waters of Coupon Bight. However, no service is presently provided to Cooks Island residents because the transmission line is privately owned by interests on Little Munson Island (City Electric, pers. com.). Potable water is provided via individual rain water cisterns or brought to the island via boat. Sewage is handled with cesspools, outdoor privy and make-shift septic tanks. Private single family docks provide access to Atlantic waters of the preserve.

Hopkins Island is developed with one residence and a small interior boat basin. Water and sewage are provided by the same means as on Cooks Island. Access to the waters of the Bight and the Atlantic are afforded by a mangrove-concealed canal and a 'wheel channel' between Hopkins and Cooks Islands. The 'wheel channel' is also used by residents of Cooks Island to gain access to Coupon Bight. No additional development is anticipated on this island because of its small size.

(b) <u>Institutional Use:</u> Areas north of Coupon Bight and south of US 1 include a marine institute, a church and cemetery. The institute is located on the southwestern tip of Big Pine Key. It is a private educational facility that offers various

terms and courses of study for children and adults. Facilities include administrative and dormitory buildings, classrooms, cafeteria and a marina. Most activities are water oriented and outdoor classrooms are conducted at the marina and in adjacent waters, including those of the preserve. This facility also hosts visiting research scientists and intern staff from various colleges and universities.

The church and cemetery are adjoining properties near the northeast corner of the Bight. The cemetery is not, as the name implies, used for in-ground burials, as geology and parcel size are not suitable for this activity. A modest crematorium is located on the property. Ash is consigned to clients for dispersal or stored in vaults on the site. The church is also of modest proportions with typical buildings, parking and open space.

Big Munson Island is maintained by the Boy Scouts of America who operate a primitive adventure camp on the property. There are no permanent improvements on the island, nor is any future development planned (S.Wampler, pers. comm., 1990)

(c) Commercial/Industrial: Industrial activity is confined to the north side of the Bight. A large barrow pit operation is conducted on 34.87 acres that adjoin the northeastern corner on the US 1 roadway. Two low, narrow berms separate the actual pit and related slurry from the preserve waters. The pit size doubled between 1979 and 1982 and covered approximately 10.5 acres. By 1989 the dredged area covered approximately 17.2 acres of former wetlands. Further development of the pit is limited by the proximity of US 1 roadway and the church to the east and north. Expansion into the wetlands west of the pit is prohibited by DER permits.

A small industrial park lies one quarter mile west of the barrow pit on Industrial Boulevard. Activities and facilities include a automotive junk yard, concrete batch plant, construction supply and storage yard and an animal control impoundment and cremation furnace. This area also accommodates small commercial shops and offices. Total area is approximately 10 acres, about half of which occupies former wetlands or adjoins existing wetlands near the Bight.

Commercial development is principally limited to the US 1 corridor with some expansion to the south toward the Bight. Activities and facilities are principally tourist and resident support retail sales, accommodations, restaurants and offices.

South of the Bight there are two commercial resort facilities. A fishing lodge and campground is located at the eastern end of Big Pine Key with a mix of permanent mobile home sites, campsites and motel rooms. A dead end canal and turning basin offer access to Florida Bay or the Atlantic via Bogie (Spanish

Harbor) Channel. This facility is just outside the preserve boundary but many guests frequent the area.

Little Munson Island was originally developed as a small private fishing camp, known locally as Sheriff's Island. It was recently sold and has been redeveloped as a resort with accommodations, restaurant and multiple docking facilities. Guests are transported to the island from Little Torch Key. Cisterns and transport provide potable water. Electricity is provided by a privately owned aerial transmission line that traverses Coupon Bight from Long Beach. No additional development is anticipated on the island.

(d) Undeveloped Lands: The remaining portions of those lands surrounding Coupon Bight and on the Newfound Harbor Keys may be considered as undeveloped lands. Minor encroachments include vehicle and foot paths, illegal dumping, mosquito ditches, mosquito spraying , small barrow pits and an abandoned oil drilling platform. The majority of those lands still in private ownership are identified for purchase though the CARL fund. Publicly owned lands include those already purchased under the Buffer Zone project, F.D.O.T. right-of-way and federal lands in the Cactus Hammock and adjacent areas along US 1.

Purchase of additional undeveloped lands has been identified as necessary to: 1) protect sensitive wetlands that are vital to the health and productivity of the aquatic preserve; 2) protect valuable and very limited habitat for endangered and threatened species and; 3) maintain the aesthetic qualities of one of the more pristine areas in the lower Keys. To this end, purchased lands will be maintained in or restored to their natural condition, where feasible. Any future development of these lands should be limited to that necessary to provide logistic support for the on-site management of the resources. Other use of and access to these lands should be limited to Department supervised environmental education and research.

3. Associated Impacts

On a regional level, impacts to the preserve may be evaluated both from the economic and environmental perspectives. Visitors and part time residents contribute substantially to the local economy and tax base. Monies distributed for goods and services support existing businesses and foster new development of businesses and residences. The natural resource and aesthetic values of the preserve are more difficult to define but are none the less important to the local economy.

Environmentally, the influx of visitors and new residents place added potential for increasing use and development that

directly affect the aquatic preserve. Increased use by boaters, fisherman, divers and snorkelers may stress certain resources of the preserve and in some cases will require new or revised evaluations of the compatibility of these activities with the long term conservation of biological and aesthetic values for which the preserve was established. Maintenance of water quality, listed species habitat, viable fisheries, healthy benthic communities and a quality recreational experience may be adversely affected by excessive numbers or types of activities in the relatively small area of the preserve. At the minimum, a system of monitoring the types and intensity of use must be established to anticipate some of these impacts.

Commercial and residential development also impacts the quality and utility of the preserve. Excessive or poorly planned development may negatively impact water quality, vegetation, listed species, and the biological and aesthetic qualities for which the preserve was established. Monitoring of these activities and active participation in local planning efforts are seen as one avenue of addressing these concerns.

As control of regional or local populations, economies, planning and politics are beyond the scope of this management plan, many of these existing and anticipated impacts to the preserve will be addressed by the legislated statutes and rules and within the following chapters of the plan.

CHAPTER IV

MANAGEMENT AREAS

A. INTRODUCTION

This chapter of the plan divides Coupon Bight Aquatic Preserve into separate management areas and establishes the general or special rule criteria for allowable uses associated with each management area. The intent is four-fold: 1) to provide a better understanding of the general and special criteria designed to preserve and protect biological resources and habitat through the management of activities and structure design, 2) to identify the types of allowable uses on state-owned lands within a preserve, 3) to provide both the Bureau of Submerged Lands and Preserves' staff and other agencies a continuity of direction in the management of the preserve, and 4) to provide local planners with a guide for land use decisions.

Section B of this chapter will establish management area categories based upon upland land use and relative values of adjacent aquatic preserve resources. Section C delineates minimum criteria for allowable uses in the preserve, as established by statute and rule. Section D delineates each mangement area as to boundaries, description of resources and allowable uses, specific criteria and the rationale for each designation.

B. MANAGEMENT AREA CLASSIFICATIONS

The management areas are determined by identifying and delineating relatively homogenous areas of (1) adjacent upland uses, and 2) natural resources in the aquatic preserve. The upland use classifications acknowledge the local government's decision as to how a specific upland area can be used or developed. By necessity, the classification of management areas in this system is broader than county zoning or planning areas (e.g., Commercial/Industrial (CI) compared to the Monroe County Urban Commercial (UC) and Suburban Commercial Planning Districts). The land use categories employed in this management plan are intended to group similar uses relative to the types of structures and activities that may be associated with each and to establish the types of uses and activities that may be authorized on state-owned submerged lands within the preserve. Thus a portion of the aquatic preserve that is adjacent to an upland area characterized by detached single-family residences in an improved subdivision would be identified as Single-family or SF prefix. Specific land uses to be incorporated in the classification of management areas include:

Single-Family Use (SF): This category is defined by state-owned lands adjacent to lands designated by the local government Land Use Plan as single family residential. Use of the aquatic preserve is solely for private, recreational activities. This category will not include family fisheries operations that are conducted upon a residential property. Fishing is considered a revenue generating activity and will be considered a commercial use.

Multi-Family Use (MF): This category represents state-owned lands adjacent to uplands designated in the local Land Use Plan as multi-family residential. This designation may include preserve lands adjacent to a group of single family property owners, as in the case of a homeowners' association, that may share common areas and amenities for the mutual benefit of the group.

Commercial-Industrial-Institutional Use (CII): This broad category represents state-owned lands adjacent to lands designated for these uses in the local Land Use Plan. It is also intended to incorporate structures or facilities on or over state-owned lands whose use involves the charging of fees or generation of revenue. Exceptions to this are federal, state or county owned properties that may charge a nominal fee, these facilities are considered a public use. Examples of CII uses are marinas that charge fees, business concerns, such as, dive shops, guide services, boat rentals, industry, and private educational facilities, that depend heavily on their direct access to the aquatic preserve in order to function, and establishments such as hotel/motels and restaurants, that use their direct access to the aquatic preserve as an economic enhancement. The structures associated with this category are many and diverse, including docks, marinas, ship stores, fishing piers, boat ramps, mooring buoys, utilities and pilings.

Single-family-Commercial Fishery Use (SF-CF): This category may include structures associated with commercial fishing, lobstering or crabbing, even though these activities may be conducted from a residence. A facility in the SF-CF category will be considered a commercail use and will be required to obtain a submerged lands lease pursuant to Chapter 18-21.005(1)(b).

Public Lands Use (PL): This category includes aquatic preserve areas adjacent or adjoining: facilities owned and/or operated by state, federal or local agencies for use by the general public at no charge or for a minimal fee; public services, such as roadways and utilities; and open waters beyond 500 feet from riparian shorelines or 100 feet from privately owned submerged lands. Certain lands within this category may have restricted or limited access depending upon season and/or management objectives and

existing resources. Examples are identified rookeries, critical habitat of endangered species, patch reefs, controlled research areas, and areas being restored.

The natural resources portion of the classification system is established by evaluating the quality of a particular submerged or emergent resource within the preserve. Resources will be identified either as a **Primary Resource Protection Area (PRPA)** or a **Secondary Resource Protection Area (SRPA)**. The methodology used to determine this resource value shall be consistent with the latest methodology approved by the Bureau of Submerged Lands and Preserves. Discrepancies in Management Area Maps and actual resources on a site will be decided by onsite surveys and evaluation by preserve staff.

The **Primary Resource Protection Areas** are those areas recognized as having the greatest value to the overall biological integrity and diversity of the preserve. They are assigned a value of **"1"**. A PRPA essentially combines Resource Protection Areas 1 and 2, as defined in Sections 18-20.003(31), and 18-20.003(32), F.A.C. Resource attributes which determine a PRPA include:

1. non-exotic and non-invasive aquatic/wetland vegetation (e.g., marine and freshwater grasses, attached algae, mangroves, marsh vegetation) that covers more than 1% of the surveyed area;

2. harvested bivalves (e.g., hard clams and oysters) with a clam frequency of 20% or greater within the survey area or oyster bars with a total surface area greater than five square meters;

3. unvegetated soft-bottom communities (i.e., infaunal invertebrates) with a Shannon-Weaver Diversity Index greater than 1.00;

4. hard-bottom communities (e.g., corals, soft corals, sponges, algal beds) that have a frequency greater than 5% within the survey area;

5. species designated as endangereed, threatened, or of special concern (as contained in the most recent updates of the Florida Game and Fresh Water Fish Commission and the U.S. Fish and Wildlife Service) that occupy or use the area for habitat (e.g., feeding, breeding, refuge or nesting); and

6. nesting sites for solitary or colonial birds.

State-owned lands that are characterized by the absence of the above resource attributes will be identified as a **Secondary Resource Protection Area (SRPA)** and assigned a resource value

of **"2"**. A SRPA is a Resouce Protection Area 3, as define by Section 18-20.003(33), F.A.C.

As stated previously, resource values are to be incorporated into the classification of management areas. For instance, if an area within the preserve is determined to be a Primary Resource Protection Area with a value of 1 and the adjacent uplands is zoned as single-family (SF), then this management area would be classified as **SF/1**.

C. MINIMUM CRITERIA FOR ALLOWABLE USES

Chapter 18-20, F.A.C., provides the minimum standars with regard to the utilization of state-owned submerged lands within an aquatic preserve. The minimum standards for each allowable use are detailed below.

All Dock Structures: Section 18-20.004(5)(a), F.A.C., states that all docking facilities within an aquatic preserve shall meet the following standards and criteria:

1. no dock shall extend waterward of the mean or ordinary high water line more than 500 feet or 20% of the width of the waterbody at that particular location, whichever is less;

2. areas of significant biological, scientific, historic, and/or aesthetic value require special management considerations. Modifications to docks in these areas may be more restrictive and shall be determined on a case-by-case basis;

3. the number, lengths, drafts, and types of vessels allowed to utilize the proposed facility may be stipulated;

4. where local governments have more stringent standards and criteria for docking facilities, the more stringent standards for the protection and enhancement of the aquatic preserve shall prevail;

5. all docking structures will access a depth of -4 feet at mean low water (MLW).

Private Residential Single Docks: Section 18-20.004(5))(b), F.A.C., states that private residential single docks, as defined by Section 18-20.003(23), F.A.C., shall conform to the following specific design standards and criteria:

1. any main access pier shall be limited to a maximum width of four feet;

2. must be designed and constructed to ensure maximum light penetration;

3. terminal platform must access a minimum of -4 feet depth at MLW;

4. when the water depth is -4 feet MLW at an existing bulkhead, the maximum dock length from the bulhead shall be 25 feet, subject to modifications accommodating shoreline vegetation overhang;

5. wave break devices shall be designed to allow for maximum water circulation and built in such a manner as to be part of the dock structure;

6. the maximum size of the terminal platform shall be 160 square feet;

7. dredging to obtain navigable water depths is strongly discouraged.

Private Residential Multi-Slip Docks: Section 18-20.004(5)(c), F.A.C., states that private residential multi-slip docks, as defined by Section 18-20.003(24), F.A.C., shall conform to the following design standards and criteria:

1. the area of sovereignty submerged land preempted by the docking facility shall not exceed the square footage amounting to ten times the riparian waterfront footage of the affected waterbody of the applicant, or the square footage attendant to providing a single dock in accordance with the criteria for private residential single docks, whichever is greater. A conservation easement or other such restriction acceptable to the Board must be placed on the riparian shoreline, used for the calculation of the 10:1 threshold, to conserve and protect shoreline resources and subordinate/waive any further riparian rights of ingress and egress for additional docking facilities;

2. docking facilities and access channels shall be prohibited in Resource Protection Areas 1 and 2 (= PRPA), except as allowed pursuant to Section 258.42(3)(e)1, F.S., while dredging in Resource Protection Area 3 (= SRPA) shall be strongly discouraged;

3. water depths adjacent to and within the proposed mooring area shall have a minimum clearance of one foot between the deepest draft of the vessel and the submerged bottom at MLW;

4. main acccess piers and connecting walks shall not exceed six feet in width;

5. terminal platforms shall not exceed eight feet in width;

6. finger piers shall not exceed three feet in width and 25 feet in length'

7. pilings may be utilized as required to provide adequate mooring capabilities;

8. specific provisions of Section 18-20.004(5)(d), F.A.C., for commercial, industrial, and other revenue generating/income related docking facilities shall also apply to private reidential multi-slip docks.

Commercial-Industrial Docking Facilities and Marinas: Section 18-20.004(5)(d), F.A.C., states that commercial, industrial, and other revenue generating/income related docking facilities, as defined by Section 18-20.003(10), F.A.C., shall conform to the following specific design criteria and standards:

1. docking facilities shall only be located in or near areas with good circulation, flushing, and adequate water depths;

2. docking facilities shall not be located in Resource Protection Areas 1 and 2 (= PRPA); however, main access piers may be allowed to pass throught Resource Protection Area 1 or 2 that are located along the shoreline to reach an acceptable Resource Protection Area 3 (=SRPA), provided that such crossing will generate minimal environmental impact;

3. the siting of docking facilities shall take into account the access of boat traffic to avoid marine seagrass beds or other aquatic resources in the surrounding area;

4. the siting of new facilities within the preserve shall be secondarey to the expansion of existing facilities when such expansion is consistent with other standards;

5. the location of new facilities and expansion of existing facilities shall consider the use of upland dry storage as an alternative to multiple wet slop docking;

6. marina siting will be coordinated with lcoal governments to ensure consistency with local plans and ordinances;

7. marinas shall not be sited within state designated manatee sanctuaries;

8. in any areas with known manatee concentrations, manatee warning/notice and/or speed limit signs shall be erected at the marina and/or ingress and egress channels, according to Florida Marine Patrol specifications.

Exceptions to the standards and criteria for any docking facility may be considered, but only upon demonstration that such exceptions are necessary to ensure reasonable riparian ingress and egress. The following special criteria and

standards are also applicable for use of state-owned submerged lands in the Keys.

Florida Keys Marina and Dock Sitings Criteria: Section 18-21.0041(1) establishes general policies and specific criteria for applications for leases, easements or consent to use sovereignty submerged lands in Monroe County for muli-slip docking facilities. Section 18-21.9941(1)(a) provides that special attention and consideration shall be given to the following:

1. the proximity to and potential adverse impacts on any rare, threatened or endangered species, or species of special concern, or their habitat, or on any portion of the entire Florida Reef Tract and other corals;

2. eliminating any adverse impacts on wetland or submerged vegetation or benthic communities; and

3. requiring adequate tidal flushing and/or circulation; and

4. maintaining or enhancing water quality at levels within or above State water quality standards; and

5. requiring adequate water depths to avoid dredging and other bottom disturbance; and

6. requiring consistency and conformity with local government land use plans, zoning and other land use or development regulations; and

7. requiring consistency and conformity with Chapters 27F-8, 27F-9, 27F-10, 27F-11, 27F-12, 27F-13, and 27F-15, F.A.C., as amended, "Principles for Guiding Development in the Florida Keys Area of Critical State Concern."

Section 18-21.0041(1)(b) 1. provides for a moratorium on all leases in the upper Keys until such time as rules are adopted for a Keys-wide aquatic preserve or until the Monroe County Comprehensive Plan with marina sitings policy is adopted, whichever occurs first.

Section 18-21.0041(1)(b) further requires that:

2. no docking facilities shall be approved which require either dredging or filling to provide access by canal, channel, road, or any other means, except for maintainance dredging of existing canals, basins, or channels, providing such maintenance does not exceed currently acceptable water depths;

3. docking facilities shall only be approved in locations having adequate water depths in the boat mooring, turning

basin, access channels and other such areas to accommodate the proposed boat use;

a. a minimum depth of -4 feet MLW shall be required;

b. greater depths for those facilities designed for or capable of accommodating boats having greater than a 3 foot draft, so that a minimum of one foot of clearance is provided between the deepest draft of a vessel and the bottom;

c. depth requirements shall also apply to the area between the proposed facility and any natural or other navigation channel, inlet or deep water. Where necessary, marking of navigational channels may be required. At the Board's discretion, the conditions of the lease may stipulate the number, lengths, drafts and types of vessels to be moored in a facility.

4. Requirements for the size of the dock:

   a. no dock shall be shall exceed 500 feet in length, unless the Board determines that it is not contrary to the public interest;

   b. no dock shall preempt more than 20% of the affected waterbody;

   c. a dock intended for the use of a **private residence**, which is not subject to obtaining a lease, **shall not exceed 4 feet in width, terminal platform shall not exceed 160 square feet, the width of which shall not exceed 8 feet;**

5. Special conditions for new or expanded docking facilities for 10 or more boats require that water quality standards be maintained, monitored, and that violations of same are to be corrected and establishes penalties for failure to do so;

6. New or expanded docking facilities will identify ways to improve, mitigate or restore adverse environmental impacts caused by previous activities and encourages marina development to locate in already developed or disturbed areas;

7. Docking facilities for 10 or more boats shall be required to have a lease;

8. All applicants will be required to provide documentation to show that there is an economic demand for the number of boat slips requested, if the number is not consistent with the Department's Projections of Marina Needs for Monroe County;

9. multi-slip docking facilities shall not be considered for approval if located over a benthic community, except main access docks that may cross benthic communities to reach acceptable areas. This shall not preclude applications for consent of use for the purpose of using the minimum amount to obtain reasonable ingress and egress; and

10. the Board may grant special considerations to the approval of leases or other consent to use state lands for projects which are approved by the Department of Community Affairs which are for the purpose of furthering the commercial fishing village or commercial fishing enterprise zone concept.

Sale, Lease, or Transfer of Lands: Section 18-20.004(1)(b), F.A.C., states that there shall be no further sale, lease, or transfer of sovereignty lands within an aquatic preserve unless such transaction is in the public interest. Section 18-20.004(2), F.A.C., specifically defines the public interest test (see Appendix A for a copy of Chapter 18-20, F.A.C.). Section 18-20.004(1)(e), F.A.C., states that a lease, easement, or consent of use may be authorized for only the following activities: (1) a public navigation project; (2) maintenance of an existing navigation channel; (3) installation or maintenance of approved navigational aids; (4) creation or maintenance of a commercial/industrial dock, pier, or marina; (5) creation or maintenance of private docks; (6) minimum dredging of navigation channels attendant to docking facilities; (7) creation or maitenance of oil and gas transportation facilities; (9) creation, amintenance, replacement, or expansion of facilities required for the provision of public utilities; and (10) other activities which are a public necessity or which are necessary to enhance the quality or utility of the preserve and which are consistent with the Florida Aquatic Preserves Act (Sections 258.35 and 258.46, F.S.). Section 18-20.004(1)(f), F.A.C., states that structures to be built in, on, or over sovereignty lands are limited to those necessary to conduct water-dependent activities.

Utility Easements: Section 18-20.004(3)(c), F.A.C., states that utility cables, pipes, and other such structures shall be constructed and located in a manner that will cause minimal disturbance to submerged resources (e.g., seagrass beds, corals) and do not interfere with traditional uses. It will be policy to place additional utilities within designated corridors or existing easements unless no other reasonable alternative exists.

Spoil Disposal: Section 18-20.004(3)(d). F.A.C., states that spol disposal within an aquatic preserve shall be strongly discouraged and may be approved only where the applicant has demonstrated that there is no other reasonable alternative and

that the spoiling activity may be beneficial to, or at a minimum, not harmful to the quality or utility of the preserve. It will be the policy to prohibit spoil disposal onto a PRPA within the aquatic preserve.

Piers: Piers shall be constructed in accordance with the minimum criteria provided by Section 18-20.004(5)(b), F.A.C. In addition, the following conditions apply to all piers: (1) the entire structure will be elevated to a minimum of 5 feet above the MHWL, (2) hand rails will be installed around the perimeter of the structure, (3) at least one "Docking Prohibited" sign in English and Spanish language will be posted and maintained on each side of the pier, (4) no temporary or permanent mooring of vessels will be permitted, and (5) dredging is prohibited when associated with pier construction and/or maintenance.

Ramps: Boat ramps will be reviewed on a case-by-case basis. Factors to be evaluated will include: (1) the extent of alteration or elimination of natural resources or habitat (e.g., seagrasses, shoreline vegetation, nesting areas), and (2) accessibility to the ramp from water and land routes (e.g., adequate water depths over sovereignty submerged lands). In no event shall dredging or filling of sovereignty lands in a PRPA be authorized.

Additional criteria for the repair, replacment, and expansion of existing structures are provided for in Chapter 18-21, F.A.C. Replacement and expansion of structures must comply with the minimum criteria provided for in Chapter 18-20, F.A.C.

Criteria more restrictive than those listed in Chapter 18-20, F.A.C., will be used if the biological and physical conditions of an area warrant it. As an example, docks may limited in size to protect seagrasses and coral beds. Areas requiring more stringent criteria will be referred to as special management areas and such areas will be labeled with the additional letter **"a"** on resource maps. Again, as an example, if management area SF/1 requires more restrictive criteria, then this special management area would be classified as **SF/1a**.

D. MANAGEMENT AREAS

In this section, each management area is delineated with boundaries, descriptions, and allowable uses. Specific criteria and supporting rationale for each special management area is also provided. Final determination of allowable uses will be made by the Bureau of Submerged Lands and Preserves staff on a case-by-case basis. Figure 5 is a map of all management areas within the preserve. The purpose of providing

this map is to give some general guidance and an understanding of where the management areas lie within the preserve.

Some of the management areas are subdivided to reflect specific upland uses in association with differing boundaries. As and example, two or more upland parcels may have little or no upland development, yet each parcel may have a different designated use. Other management areas may have a specific activity occurring within that is not reflective of the overall upland use. For instance, an upland parcel consists of a motel with a large dock that is adjacent to marine grass beds. The dock may have preceded the aquatic preserve designation, therefore it would be unreasonable to remove the facility. Conversely, future expansion of commercial activities will not be allowed to expand in the management area because of the presence of marine grasses.

The Multi-family Residential Management Area (MF) is established to recognize that certain Monroe County Land Use Districts allow attached residential dwelling units as a minor conditional use (e.g., Native Area District, Sub Urban Residential, Sub Urban Commercial). The Single-family-Commercial Fishery (SF-CF) is also established to recognize certain activities that are conducted from a residence within the Fishing Village Districts or as grandfathered in an Improved Subdivision District.

It should be noted that the following described boundaries include **only state-owned submerged lands and uplands.** Privately held submerged lands and riparian uplands are exluded from the boundaries, as provided for in Section 18-21.0041(3).

MANAGEMENT AREA PL/1 a
(public lands/primary resource protection area) special management area

Boundaries: This management area includes all sovereignty submerged lands within the Coupon Bight portion of the preserve and all submerged lands on the Atlantic shoreline beyond 500 feet from riparian shorelines of Long Beach Estates and the New Found Harbor Keys, exluding those areas described in Management Areas SF and CII. This management area will also include all lands acquired under the Coupon Bight CARL project administered by the Division of State Lands.

Description: The lagoon area is characterized by fringing mangroves, mangrove islands, hardbottom and marine grassbed associations. The shallow baylets and mangrove areas provide feeding and refuge habitat for wading and diving birds. State and federally owned lands adjoining the Bight exhibit beach/berm, salt marsh, buttonwood, pineland and tropical

hardwood hammock associations and are prime habitat for the endangered Key deer and other species. The Atlantic portion is characterized by hardbottom, marine grassbeds, sand/mud banks and coral formations.

Present upland development adjoining the area north and east of the Bight (except Management Areas CII) is limited to abandoned mosquito ditches, dirt roads, an isolated residence and an abandoned drilling platform. Existing land use classification is Native Area and Offshore Island, both of which allow single family dwellings. All lands immediately adjoining the Bight are included within the proposed Coupon Bight CARL project boundary. On the southwest tip of Big Pine Key, lots in Piney Point are zoned Improved Subdivision and 3 of the unpurchased lots are developed with single-family residences that do not have riparian access. The remaining lots adjoining the Bight are undeveloped but have access to improved roads and utilities.

Other upland uses on the eastern shoreline of the Bight include state owned highway right-of-way and private lands zoned as Native Area by local government. The federally owned Cactus Hammock preserve provides a small parking area and nature trails.

A private utility easement traverses open waters of the Bight from Long Beach Estates to Little Munson Island. The northern shorelines of the New Found Harbor Keys are undeveloped (except Management Area CII) fringing mangroves with Native Area or Offshore Island zoning. Submerged resources in this area are typically lush grassbeds.

There are no leases, easements, conveyances or development on submerged lands in the Atlantic portion of this management area.

Allowable Uses: Private residential single docks; utility easements; mooring buoys; navigation aids; and boardwalks built according to the minimum criteria for single family docks and incorporating the specific criteria below.

Specific Criteria: The access pier of a dock shall be elevated to minimum of 4 feet above the mean high water line (MHWL) with the terminal platform elevated to a height sufficient to allow safe access into and out of a moored boat; trimming or removal of fringing mangroves shall be limited to the minimum required for the access pier of the dock or boardwalk to reach open water. Handrails and/or signage may be required to discourage docking at the access pier or other portions of the dock that traverse waters of less than -4 feet MLW.

Boardwalks shall be limited to the riparian upland, with the exception of sovereignty submerged lands adjacent to public

lands, in which case they shall meet the minimum design criteria for single family docks and be constructed in such a manner as to allow maximum light penetration, natural flow of waters and have hand rails to prevent pedestrian access to traversed wetlands. Boat docking or mooring within 500 feet of a boardwark is prohibited and "Docking Prohibited" signs will be displayed on the waterward face(s) of the structure. The only exception to the 4 feet width shall be to accommodate public access for documented handicapped use. If a public boardwalk is intended for handicapped use, it will be allowed to have 3 feet wide by 6 feet long by-pass(es) at 300 feet interval(s) on one or the other side of the main walkway.

Off shore structures will be limited to mooring buoys and navigational aids that will be established in the vicinity of the patch reefs to discourage boat groundings and anchor damage. The design and placement of mooring buoys shall be supervised by appropriate field staff and all aids to navigation shall be Coast Guard approved.

Rationale: The dock criteria are designed to limit impacts to important marine resources, such a mangroves, corals and marine grasses. Dock widths, heights and terminal platform coverage are necessary to prevent shading of these resources. Minimum depths are necessary to prevent scouring of bottom features and to prevent excessive suspension of sediments by prop wash. Public access elevated board walks are preferable to use of foot trails that compact soils, create erosion channels and destroy saltmarsh vegetation in wetland areas. Heights and widths of boardwalks are intended to reduce shading and to eliminate obstructions to Key deer and natural water flow.

MANAGEMENT AREA SF/1
(single family/primary resource protection area)

Boundaries: This area includes those sovereignty submerged lands near the center shoreline of Coupon Bight on Big Pine Key, the Atlantic shoreline of the Newfound Harbor Keys and the platted shoreline of Long Beach Estates from the MHW line out to 500 feet from shore.

Description: Submerged lands are characterized by fringing mangroves, scattered grass beds, coral banks, coral heads and hardbottom communities. Riparian shorelines are typically beach/berm and altered saltmarsh buttonwood or mangrove wetlands. Marine turtles frequent the beach/berm shorelines of Long Beach Estates and Cooks Island for nesting. This area also provides resting and foraging habitat for the endangered Key deer and numerous bird species.

Allowable Uses: Private residential single docks; mooring buoys; and shoreline stabilization incorporating special provisions below.

Shoreline Stabilization: Projects shall be limited to the use of native wetland or beach/berm vegetation. No new seawalls, rip rap, fencing or other structures shall be authorized on state-owned submerged lands and will be discouraged on riparian uplands. Removal of vegetation and/or alteration of shoreline contours shall be strictly discouraged. As with docks, existing structures will be investigated and encroachments upon sovereignty lands will evaluated within the context of whether prior authorization and/or permits were secured and whether the structures are in conformance with the provision of Chapter 18-21.004(1) (Management Policies, Standards, and Criteria) and (2) (Resource Management) for state-owned submerged lands.

Non-conforming Docks: All existing docks not presently in conformance with minimum criteria established in Sections 18-20.004(5) and Section 18-21.0041(b) shall be investigated. Those built prior to March 10, 1970 and having obtained all other valid permits, shall be designated a non-conforming use. Upon application to repair more than 50% or replace these non-conforming structures, any approved application shall reflect adherence to the present single family criteria or it shall be denied.

Those structures built after March 10, 1970 and prior to September 30, 1984, having acquired other valid permits and authorizations but are not in compliance with these criteria shall be deemed not in compliance with single family criteria. Those docks found not in compliance shall be required to be brought into compliance within 1 year (365 days) of adoption of this plan and after appropriate notification to affected owner.

Those structures erected after September 30, 1984 and not in compliance with these criteria, or other structures undertaken without benefit of permit or authorization, or authorized structures not in conformance to approved design and placement shall be deemed not in compliance with single family criteria and shall be cited as a violation of Chapter 18-21.0041 (Florida Keys Marina and Dock Siting Policies and Criteria) and the provisions of this management plan. Such structures deemed to be in violation shall be brought into compliance within 90 days of adoption of this plan and after proper notice to the riparian owner.

Rationale: Dock criteria are established to provide optimum protection of submerged resources and still provide riparian access to waters of the preserve. Preservation of native shoreline vegetation and topography are essential to the

conservation of several endangered and threatened wildlife and plant species and to provide some degree of protection from wind and waves associated with tropical storms.

MANAGEMENT AREA MF
(multi-family area)

Boundary: This management area is tentatively established to accomodate facilities for the exclusive use of **riparian property owners** within the SF/1 and/or PL/1 management areas should multi-family use be approved for riparian uplands adjoining the preserve. This management area may include a dock for a group of single-family homeowners, such as a homeowners association, which may wish to construct a dock for the mutual benefit of the participating riparian property owners. The designation of this management area **does not encourage a greater density or intensity of land use** but is intended to discourage the proliferation of single-family docks and would therefore ameliorate the cumulative impact of these structures on certain valuable resources. Inclusion of any or all riparian property owners, not currently having a dock is encouraged. There are currently no specifically designated areas in the preserve. Applications for multi-family docks will be reviewed on a case-by-case basis.

Description: Locations for private residential multi-slip docks would typically be in Primary Resouce Protection Areas adjoining riparian lands in the Native Area, Sub Urban Residential and Sub Urban Commercial Land Use Districts. A proposed facility would be for the private recreational use of affected riparian owners.

Allowable Uses: private residential multi-slip docks (restricted)

Specific Criteria: Applications for MF/1a shall adhere to the minimum criteria established for private residential multi-slip docks in Section 18-20(5)(c)1-8 and the more stringent criteria for the Florida Keys in Section 18-21.0041(1)(a) and (b). Fueling facilities, covered structures, commercial use (including family fisheries), fish cleaning tables, non-water dependent activities and live aboard vessels shall be strictly prohibited.

Additionally, facilities designed for more than 10 vessels shall be required to obtain a submerged lands lease. Conditions to a lease may include, but are not limited to: 1) installation and maintenance of navigational aids, where deemed necessary to avoid patch reefs, large coral heads and grassbeds; 2) installation and maintenance of appropriate signage informing the owners of the importance of the natural resources of the aquatic preserve; and 3) specific design

criteria for access piers to reduce impacts to shoreline vegetation, topography and endangered/threatened species and thier habitats.

Rationale: The restrictive criteria are intended to reduce impacts to shallow water habitats while providing riparian access to waters of the preserve. Several patch reefs and numerous large coral heads lie within one half mile of the Atlantic shorelines of Long Beach Estates and the New Found Harbor Keys. A single multi-slip dock and navigational aids marking access to safe waters would significantly reduce impacts in these areas. A proliferation of single docks on each lot would disrupt the foraging and resting activities of the Key deer and wading birds, as well as, the nesting activities of marine turtles. Numerous individual docks would also negatively impact marine grassbeds, corals, and shoreline vegetation.

MANAGEMENT AREA CII/1 a
(commercial-industrial-institutional/
primary resource protection area)
special management area

Boundary: This managemnt area will include all sovereignty submerged lands adjoining the U.S. 1 right-of-way and barrow pit at the northeast corner of Coupon Bight from the MHWL to 200 feet from shore.

Description: Adjoining uplands are composed of saltmarsh, buttonwood, beach/berm and impounded mangroves. Submerged lands are shallow baylets with fringing mangroves, marine grassbeds, hardbottom and mud/sand flats. Water depth is less than two feet on high tide. This area provides a valuable corridor for movement for the endangered Key deer from the north to south on Big Pine Key and hosts a multitude of resident and migratory bird species.

Allowable Use: Private residential single docks: utility easement (limited)

Specific Criteria: Activities in this management area will be limited to the following: 1) improvements or repairs to U.S.1 right-of-way and existing public utilities; 2) restoration of lands acquired by the CARL program to their natural topography and condition; 3) applied research directed specifically towards restoration of these habitats or the preservation of endangered or theatened species; 4) protection of wading bird nesting and feeding areas; 5) conservation of listed plant species; 6) limited access for Department supervised public environmental education; and 7) minimal public facilities to conduct these activities.

Rationale: All undeveloped lands within this management area are part of the proposed CARL Buffer Project and are primarily jurisdictional wetlands. South or west expansion of the barrow pit into wetlands is prohibited by FDER permit. Existing uses and activities are negatively impacting wildlife, vegetation, topography, rates of water flow and the quality of water entering the Bight. These activities are not water dependent and can be conducted outside the aquatic preserve. Submerged lands are shallow baylets with fringing and dwarf mangroves, not suitable for navigation or docks.

SUB-MANAGEMENT AREA CII/1 a
(commercial-industrial-institutional/
primary resource protection area)
special management area

Boundary: This management area encompasses a narrow easement for the existing aerial electrical transmission lines that traverses lands of the preserve from the western end of Long Beach Estates to Little Munson Island. This overhead line is privately maintained by the resort facility on Munson Island.

Description: The submerged resources in the area are primarily lush marine grassbeds. The aerial line presents a visual encroachment on the aesthetic resources of the preserve. It also presents a potential hazard to public safety, navigation and bird life.

Allowable Use: Commercial Utility Easement (Limited)

Specific Criteria: The existing aerial line shall be maintained in safe condition to prevent accident or injury to the public and resources of the preserve. Any application to replace or substantially repair all or portions of the line or poles shall be evaluated by the anticipated impacts to marine grassbeds. In no event shall dredging be authorized to access, repair or replace the line. Tug, barge or other equipment to access or operate in the area shall be of a draft that does not substantially disturb or prop dredge the bottom. Applications for such work shall be required to contain a description of the types, draft and numbers of vessels or equipment to be used and a detailed plan and time frame for restoring and replanting areas that may be damaged. Owners will be encouraged to seek an alternate means of supplying electricity to the island. Expansion or upgrading of the facility (involving more or larger poles or supplying service to other properties) will be discouraged.

Rationale: The line and poles traverse extremely shallow waters with lush grassbeds and narrow passes between Long Beach and all of the Newfound Harbor Keys. Conventional marine construction equipment could inflict serious damage to marine grassbeds in the area. The overhead lines are depicted

as a navigational hazard on charts for the area. Passes are too shallow for sailboat (fixed keel) traffic but small sailboats do anchor leeward of the islands. Winds and waves associated with major storms could knock down poles or bring down portions of the power line into waters of the preserve creating hazards to navigation and public safety.

MANAGEMENT AREA CII/2 a
(commercial-industrial-institutional/ secondary resource protection area) special management area

Boundary: Those submerged lands included within Sovereignty Submerged Lands Lease No. 441230285 and the intervening area between the two parcels to a distance of 300 feet from the MHWL of the north shoreline of Little Munson Island (a.k.a. Sheriff's Island, Munson, and Little Palm Island). Additionally, those submerged lands from the MHWL to 55 feet from shore on the southern shoreline of said island for a distance of 1000 linear feet as an approved modification to the above lease.

Description: This management area is established to recognize the existing commercial use on Little Munson Island, consisting of a small hotel/motel, restaurant, two private docks, 800 feet +/- perimeter dock, boat basin, rip rap shoreline and amenities associated with a resort operation. Anticipated uses of the existing facilities on sovereign lands include private dockage for guests and employees of the facility, commercial tours, fishing, snorkeling, swimming, diving and other water dependent activities associated with the docks.

The specific boundary includes all state owned submerged lands currently under lease for the in water structures. The area between the two docks on the north shoreline is included within the management area since submerged resources are relatively sparse as a result of past use and the exposed nature of the shoreline. Natural resources within this boundary include scattered mangroves, scattered grassbeds, hardbottom and mud/sand banks. The remaining submerged lands adjoining the island and this management area are in Management Area PL/1 and shall be managed accordingly.

Allowable Uses: Commercial-Industrial Docks (limited)

Specific Criteria: Existing facilities and use shall be confined to the leased area and management area boundary. No expansion or new facilities will be authorized and all conditions of the existing lease shall be honored. No live aboards and no fueling facilities are authorized. Boats greater than 26 feet in length are strictly prohibited on the

south perimeter dock and all boats moored at either of the three docks are required to maintain at least one foot clearance between the deepest draft of the vessel and the bottom, as provided by Chapter 18-21.0041(1)(b)3(a). All portions of docks over waters less than - 4 feet MLW shall have hand rails or signage to discourage boat mooring in those areas.

Seaplanes, individual internal combustion water craft (jet ski, jet boat, etc.) and ultra light air craft are not considered traditional uses within the preserve and typically encroach upon other management areas and other traditional uses. Therefore, rentals or use of sea planes or ultra light air craft from the management area will be expressly discouraged. Jet skis and jet boats are expressly prohibited.

All commercial activities, other than the water dependent activities listed above must be contained on the riparian uplands. Concerts, conventions, exhibitions, competitions (races, contests, games, etc.), tournaments, entertainments, advertising, and other events or activities that would generate boat density beyond the mooring capacity of the existing dock facilities are discouraged and shall be conducted outside the aquatic preserve.

Rationale: The island and immediate vicinity have been traditionally used as a small private fish camp. Areas immediately adjoining the island have been severely impacted by past dredging, boating and erosion. The area south of the island is an expansive, shallow and productive marine grassbed. The area to the east of the island is composed of fringing mangroves and lush grassbeds. The area to the west and north provides access to deeper waters in New Found Harbor (Pine) Channel and a dredged access channel.

Restrictions and prohibitions of certain aircraft and watercraft are deemed necessary to preserve the biological and aesthetic qualities of the preserve. Boats with greater than 3 feet draft disturb bottom features, suspend sediments with prop wash and are imminently more inclined to prop dredge marine grassbeds in the vicinity of the island. Sea planes, jet boats, jet skis and ultra light aircraft are disruptive to feeding and resting activities of wading and diving birds that frequent shallow waters in the preserve. Operation of sea planes and individual water craft in shallow water also disturbs marine grassbeds and young mangroves and is most often in direct conflict with other traditional activities such as fishing, swimming, and snorkeling. Ultra light aircraft similarity disturb bird life and disrupt feeding activities of certain types of fish thereby encroaching upon feeding success of the birds and interfering with recreational fishing activities. Key deer are easily panicked by low flying aircraft and all aircraft over both the Key Deer Refuge

and the Great White Heron Refuge are restricted to 500 feet altitude by federal law. The aesthetic enjoyment and privacy of other preserve visitors and residents of the area are also encroached upon.

Restrictions and prohibitions of certain commercial activities is deemed appropriate for several reasons. The listed activities are of a nature that would invite broad public participation, thereby generating excessive boat traffic in the vicinity, creating potential hazards to the navigation and disrupting or interfering with other traditional uses and the marine resources of the preserve. These activities are either not water dependent or could be as effectively conducted outside the aquatic preserve.

MANAGEMENT AREA SF-CF
(single family-commercial fishery area)

Boundary: No designated Fishing Village Land Use Districts presently adjoin the aquatic preserve. This management area is tentatively established to accomodate existing or future designations of single family fisheries enterprises that are conducted from a residence that may involve use of a dock on or over state-owned submerged lands.

Description: This management area may potentially include several locations in Management Area SF/1a or PL/1a that exhibit marine grassbeds, mangroves, beach/berm and hardbottom habitats. It shall apply to any future proposed use and to existing uses where the riparian owner has properly filed for grandfathering with Monroe County and/or where a riparian owner holds an occupational license to conduct such activities on said property. Existing and proposed facilities will be reviewed on a case by case basis to evaluate impacts to state-owned submerged lands.

This management area designation shall not apply to privately held submerged lands where such activities are conducted, except by negotiated agreement with the Board of Trustees and the affected owner (Chapter 258.40(1), F.S.). However, fishing facilities, vessels and structures on privately owned submerged lands shall not encroach upon, damage resources of or preempt use of state owned submerged lands in the preserve.

Allowable Use: Private Residential Single Docks, Commercial-Industrial Docks (Limited)

Specific Criteria: All existing and proposed docks on state-owned submerged lands within the management area conducting fisheries operations shall conform to the single family dock design criteria previously established. Additionally, riparian owners having docks in this management area or in other

management areas that are not presently under lease shall make application for a lease within 120 days of adoption of this plan and after appropriate notice by the Division to affected owner.

Those docks that do not presently conform to the single family criteria shall be assessed according to the compliance/ conformance criteria set forth for Commercial/Industrial docks. Those docks found to be not in compliance and/or those found to be in violation of authorized permits or lease shall be brought into compliance as outlined for Management Area SF/1 within one year of adoption of this plan and after appropriate notification of affected owner.

The following criteria shall also apply to these facilities and activities: 1) liveaboard vessels, fueling facilities and/or fuel storage are expressly prohibited; 2) dipping or storage of traps shall be confined to riparian uplands with appropriate buffers to contain run-off on site; 3) there shall be a minimum of 1 foot clearance between the deepest draft of vessel(s) and the bottom at MLW; and 4) in-water holding pens or trap storage, mechanical loading of traps and/or mechanical off loading of catch in not authorized.

Rationale: Residential family fisheries are recognized as a traditional land use in residential subdivisions where grandfathered by Monroe County and in the Commercial Fishing Village District. All revenue generating/income related activities on state-owned submerged lands are required by rule Chapter 18-21.005(1)(b) to lease preempted lands. The single family dock criteria is intended to provide riparian access while providing maximum protection of marine resources within the preserve.

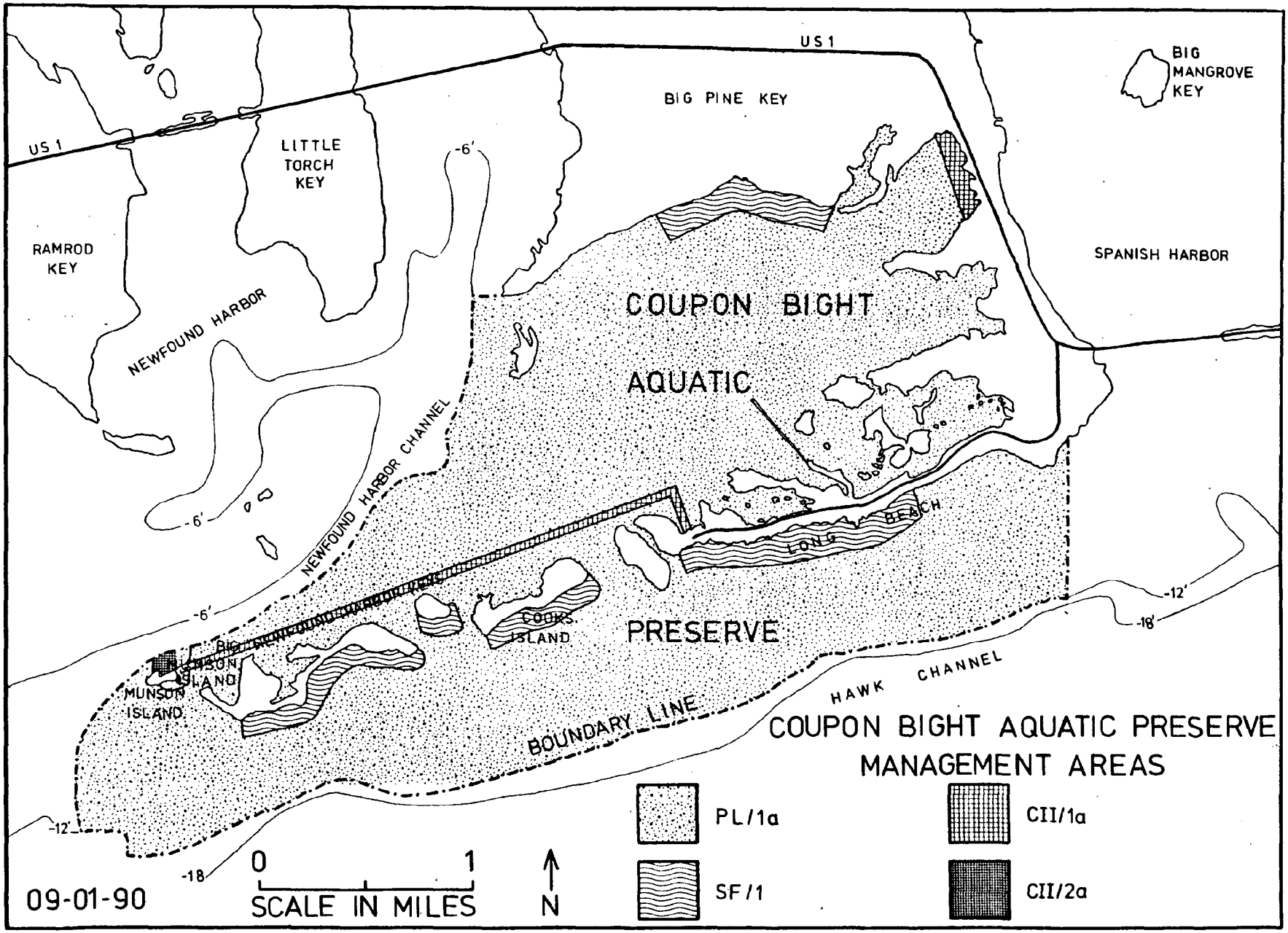
US 1
US 1
BIG PINE KEY
BIG MANGROVE KEY
LITTLE TORCH KEY
RAMROD KEY
NEWFOUND HARBOR
SPANISH HARBOR
COUPON BIGHT AQUATIC PRESERVE
NEWFOUND HARBOR CHANNEL
LONG BEACH
COOKS ISLAND
MUNSON ISLAND
BIG NEWFOUND HARBOR KEY
HAWK CHANNEL
BOUNDARY LINE
-6'
-12'
-18'
COUPON BIGHT AQUATIC PRESERVE
MANAGEMENT AREAS
PL/1a
SF/1
CII/1a
CII/2a
0
1
SCALE IN MILES
N
09-01-90

FIGURE 5

CHAPTER V

SITE SPECIFIC MANAGEMENT ISSUES

The first part of this chapter deals with management issues involving specific activities, as opposed to permitted structures, that directly affect the biological integrity of the Coupon Bight Aquatic Preserve. The issues that are specific to this area include, but are not limited to: conflicting uses, increasing air and watercraft traffic, the protection of designated species and their habitat, the protection of bird feeding and resting areas, research needs, damage to marine resources, acquisition of environmentally sensitive lands, and boundary extension. Other issues may arise as future use intensifies and these will be identified as they develop.

The second part of this chapter establishes policy guidelines for these issues. These policy guidelines are intended to provide additional management direction and supplement those set forth by Chapter 258, F.S., Chapters 18-20 and 18-21, F.A.C., or Chapter IV of this plan.

A. MANAGEMENT ISSUES AND SPECIAL NEEDS

1. CONFLICTING USES

To some extent many of the issues identified in this section are directly related to uses that may fulfill one individual or groups needs but are in conflict with another's activities (or safety) and/or the legislative intent for establishing the preserve. Activities that compromise or damage resources may not always seem significant unless cumulative impacts are taken into account. Any of the following activities should be evaluated for the long-term cumulative impacts.

Vessel mooring for extended periods shades submerged grasses and may create hazards to navigation. Liveaboard vessels often compound impacts with wastes and sewage that are introduced to surrounding waters, whether intentional or accidental. Boat operation and anchorage in shallow water disturbs bottom communities and resuspends sediments that affect light penetration to vegetation and coral. (Policy Guidelines 1, 2, 6, & 13.)

Anchoring on or near coral formations causes considerable damage from anchors and anchor lines that break or chaff corals. Lobster trap retrieval methods inflict similar damage when traps are dragged over the bottom or traps are set too close to coral formations and lines become entangled. Divers

(scuba and snorkel) can and do damage corals and other marine life. The inexperienced and uninformed touch and stand on formations, inflicting wounds and opening a colony to infection or predation. (Policy Guidlines 1, 6 and 12.)

Spear fishing and marine life collecting are believed to have seriously altered species, age and size class distribution on the patch reefs in the preserve. Removal of large predatory fish encourages a proliferation of grazing omnivores that feed on algae, as well as corals. Removal of the 'aquarium size' fish and invertebrates alters food webs and ecological partitioning on the patch reef. Diversity and the long term stability of these environments are compromised. Spear fishing may also bring other divers and fishermen into close proximity to one another, creating the potential for serious or fatal injuries. (Policy Guidelines 1, 7, 8 & 10.)

2. INCREASED AIR AND WATER CRAFT USE

The past use of seaplanes in the preserve has given rise to heated outrage by many of local fishermen and residents and is extremely disruptive to bird life and the Key deer. The north half of Coupon Bight (southern boundary of the Great White Heron National Wildlife Refuge) is federally restricted air space. There is no locally specified air port district which allows this type of activity, nor is there a designated federal landing area in the vicinity. The use of commercial or private seaplanes and ultra light air craft are not compatible with the traditional uses recognized for the preserve. Nor are these uses compatible with the resource management goals outlined in Chapter VI of this plan. (Policy Guideline 14.)

Logically, the numbers and types of watercraft within any given body of water must be compatible with the available space and existing water depths. Additionally, one must consider the purposes for designating the preserve; to manage primarily for the maintenance of essentially natural conditions, the propagation of fish and wildlife and public recreation. As populations increase so do the numbers and types of watercraft in the preserve. Increased pressure on limited resources and space invariably generates conflicts with other visitors and the intent of the preserves management philosophy for the natural resources. Preservation of natural conditions is critical to maintaining fish and wildlife habitats. If preserve visitors are to experience safe areas for swimming and snorkeling, quiet areas for fishing and wildlife observation, some regulation of boating traffic is essential. (Policy Guidelines 1, 2, 4, & 10.)

3. PROTECTION OF DESIGNATED SPECIES AND THEIR HABITAT

The Great White Heron and the Key Deer Refuges were federally established to provide minimum habitat for these two designated species. Designated animal species are not sedentary but traverse and utilize a wide variety of habitats, many of which are not included within the refuge boundaries. These and other designated species are frequent visitors to or 'residents' of Coupon Bight Aquatic Preserve. (Policy Guidelines 3, 4, 5, 7, 9, 11, 14, & 15.)

Key Deer: Habitat and corridors for movement from the New Found Harbor Keys and the Cactus Hammock Preserve to the main deer population on Big Pine Key must be maintained and protected to the greatest extent possible. To that end, all activities in the preserve will be reviewed within the provisions of the Key Deer Recovery Plan and will be subject to recommendations from the Key Deer Refuge Management Plan. Proposals to rehabilitate disturbed wetlands will also evaluate such activities as to they would positively or negatively impact the deer. For example, backfilling abandoned mosquito ditches may reduce mortality of young deer that fall or are chased into the ditches and drown. Conversely, some of the ditches may retain fresh water that is vital for the deer during the winter dry season.

Listed Bird Species: Colonial wading and diving birds nest in close proximity to the preserve and use the area extensively for feeding and resting. The shallow baylets, mangroves and saltmarsh buttonwood areas are especially attractive to them. Destruction of grass beds and mangroves, boat traffic in shallow waters and vehicular traffic in the saltmarsh buttonwood areas disrupts or destroys vital habitat and inhibits expansion of nesting areas. Ground nesting birds are equally subject to disturbance from foot and vehicular traffic.

Marine Turtles: The limited beach/berm habitats in the preserve are the only suitable nesting areas for these globally depleted reptiles. Roads, buildings and other structures eliminate much of this needed area. Beach lighting during the nesting season disorients hatchlings and may contribute significantly to mortality when young turtles crawl onto roadways instead of towards the water. Exotic plants and mechanical beach 'cleaning' may also damage nests or discourage nesting crawls. Entanglement with nets, traps, buoy lines and fishing lines, ingested plastics, poaching (eggs or turtles), and wounds from boat propellers are also serious problems.

Other Listed Wildlife Species: As new species are listed or as more information becomes available about the life histories and habitat needs of presently listed species, certain

activities and management policies may need to be established or revised to reflect these changes. For the present, all state owned lands will be maintained in their 'essentially natural condition,' as listed species' affinity for these types of areas has been demonstrated.

Listed Plant Species: To the greatest extent possible, state owned lands within the preserve should be protected from land clearing, mangrove trimming and topographic alterations that would negatively impact habitats for these plants. Collecting, vehicular and foot traffic, altered water flow and herbicides represent serious impacts to the plants themselves and the habitat required for their survival. Pineland communities that would benefit from ecological burning should be identified and appropriate measures taken to institute a fire regime when deemed necessary. Restoration of historic plant communities and eradication of invasive exotic plants would also enhance habitat for these species and wildlife.

4. DAMAGE TO SUBMERGED RESOURCES

Damage may be due to natural events, such as hurricanes or disease but is most often the direct result of man's activities in or adjacent to the preserve. Tropical storms may erode or bury grass beds, topple coral formations or blanket them with sediments. These are natural cyclic events that have occurred for thousands of years and are far beyond the management authorities of any governmental entity. But as previously noted, the capabilities for recovery of these communities may be inhibited by the activities of man.

Inexperienced boaters and careless boat operation in shallow waters are responsible for propeller scouring or dredging of marine grass beds and damage to corals. This is the most visible sort of damage. Less visible is the damage caused by careless divers and snorkelers who touch corals or the alteration of community structure from collecting fish and invertebrates.(Policy Guidelines 1, 4, 5, 6, & 7.)

5. RESEARCH NEEDS

Current research will hopefully provide a better understanding of the origins, processes, extent and severity of black band disease on coral reefs and the extensive mortality of marine grassbeds in Florida Bay. Since both of these phenomena (and others) are a regional concern, and since the coral and grassbed communities are habitat for a broad range of commercially and biologically significant species, all efforts to identify affected areas and garner funding support for research are considered a major priority.

Water quality research and monitoring are also a priority. The shallow, semi enclosed configuration of Coupon Bight is not conducive to good flushing or tidal exchange. Knowledge of the sources, concentrations and long term effects of pollutants that enter waters of the preserve are needed. Chronic or episodic release of polluted water into the Bight could devastate the lagoon. (Policy Guideline 9.)

6. ACQUISITION OF ENVIRONMENTALLY SENSITIVE LANDS

An extensive area of saltmarsh buttonwood and mangrove wetlands lies to the north of the Bight. As noted in Chapter III, most of this area has been targeted for purchase under the CARL program. Several mangrove islands and several tracts of privately held submerged lands should also be included within this program. These areas are presently undeveloped and only minor alterations of natural features has occurred. The islands are potential colonial nesting bird habitats. The submerged land areas are in effect 'out holdings' within the boundary of the preserve. Present Monroe land use regulations provide for a broad range of activities within the Off Shore Island and Native Area Districts. These uses and activities are not compatible with the intent or the management objectives of the aquatic Preserve. (Policy Guidelines 3 & 11.)

7. BOUNDARY EXTENSION

Large coral heads and significant hardbottom and grassbeds lie seaward of the present Atlantic boundary. These areas are in waters from -12 to -18 foot depths. Extension of the boundary to -18 foot contour would create a buffer zone adjacent to the patch reefs. Marking of the boundary at this point would alert boaters to the submerged reefs before they are too near to avoid them.(Policy Guideline 12.)

8. DEVELOP ARTHROPOD CONTROL PLAN

Past and present mosquito control activities have and will continue to impact resources within the aquatic preserve. Ditching and drainage have severely altered natural water flow, vegetation and habitat quality in the preserve. Aerial or ground application of insecticides and carrier substances for aerial mosquito control may introduce toxic substances into waters of the preserve. Coordination and cooperation with the local mosquito control district to develop a mutually acceptable management plan is imperative to protect human health and welfare and the aquatic resources of the preserve. (Policy Guideline 15.)

B. POLICY GUIDELINES

This section of the plan contains a number of management policies that address the issues identified as being particular to Coupon Bight Aquatic Preserve. Adoption of these policy guidelines will provide specific direction for managing those issues not addressed directly by statute or rule. The major policy guidelines for these issues include:

1. Promote recognition of the fact that marine grassbeds and corals provide valuable habitat and food sources for a variety of organisms essential to the biological integrity of the preserve. This biological integrity translates into significant economic value to this region, especially in terms of recreation, tourism and fisheries.

2. Reduce the impacts of marine grassbed prop dredging and coral damage by establishing no (motor) boating zones by seeking appropriate rule changes and/or in combination with local government ordinances, and by establishing navigation aids where needed.

3. Promote the acquisition of privately owned mangrove wetlands and submerged lands to enhance the available habitat for endangered, threatened and species of special concern and to maintain scenic vistas and aesthetic qualities of the preserve.

4. Protect valuable feeding and resting areas for birdlife and Key deer by prohibiting jet skis and (motor) boat operation in shallow waters, by seeking appropriate rule changes.

5. Protect all biological resources by prohibiting fueling facilities and fuel storage in the preserve, by seeking appropriate rule changes.

6. Protect coral patch reefs from boat anchor damage and overuse by establishing a mooring buoy system on larger patch reefs.

7. Protect the biological diversity and ecological balance of the patch reefs, hardbottom and marine grassbed communities by seeking legislation that would prohibit or substantially regulate collecting of algae, fish and invertebrates in the preserve.

8. Protect public health and safety, as well as biological resources by seeking legislation to eliminate spearfishing in the preserve.

9. Identify specific research needs and actively seek support on a Division level for research funding.

10. Promote the protection of marine and upland resources by disseminating literature and conducting environmental education activities, both on and off site.

11. Promote acquisition of privately held, environmentally sensitive lands to protect upland and marine resources.

12. Support extension of the Atlantic preserve boundary to the -18 foot contour to protect large coral formations and provide a buffer zone to the patch reefs.

13. Protect water quality, aesthetic values and benthic communities by seeking appropriate legislation to prohibit liveaboard vessels and restrict transient mooring inthe preserve.

14. Reduce impacts to Key deer, feeding and nesting birds and aesthetic appreciation of the preserve by seeking appropriate federal and state code, statute or rule changes to prohibit commercial and private aircraft from flying less than 500 feet over or landing in the preserve.

15. Reduce or eliminate adverse impacts to biological resources of the preserve by coordination and cooperation with Monroe County Mosquito Control District and the Department of Health and Rehabilitative Services to develop a mutually acceptable arthropod control management plan for the preserve area, pursuant to Chapter 388.411, F.S.

CHAPTER VI

MANAGEMENT ACTION PLAN

The purpose of this chapter is to establish guidelines that allow for the sound management and protection of the aquatic preserves natural resources for the benefit of future generations (Section 258.35, F.S.)

Before an effective program can be designed to manage and protect natural resources, one must complete an inventory of the resources, establish what their functions are, decide the importance of these functions, and where these resources are located. Additional efforts will consist of identifying those activities or parameters that affect these resources, either positively or negatively. This information will form the foundation from which action will be initiated to manage and protect these resources. The management strategies for an aquatic preserve program must consist of a variety of components such as resource management, resource protection, research, and environmental education.

In general, the role of the program in management of the aquatic preserve includes: 1) providing information on the ecological functions and economic importance of resources within the preserve, 2) overseeing those activities that affect the natural resources, 3) ensuring that accurate biological and physical information is considered in permitting and planning decisions, 4) ensuring that all statutes and rules regarding the preserves natural resources are complied with and that violations of these provisions are investigated and corrected by appropriate enforcement agencies, 5) conducting on site surveys for specific activities, 6) coordinating with other resource management and enforcement agencies, 7) educating the public on the inherent values associated with natural resources, 8) conducting or cooperating with a comprehensive management program that can be periodically updated to reflect the dynamics of natural systems and the changing needs of man and the resources. To achieve those ends this section of the plan establishes goals and identifies the supportive objectives and develops policy statements and tasks to accomplish those goals.

A. RESOURCE MANAGEMENT

The overall goals of resource management within aquatic preserves are: 1) conducting and maintaining resource inventories, 2) assessing the impact of human activities on the resources, 3) establishing habitat restoration programs, and 4) cooperating with other agencies in assessing, improving

and/or maintaining conditions that are conducive to preserving the resources and water quality.

GOAL A.1: CONDUCT AND MAINTAIN RESOURCE INVENTORIES

Objective A.1.1: To conduct and maintain a resource inventory of submerged resources for the aquatic preserve.

Task A.1.1.1: Conduct an inventory of marine grassbeds, algal beds, coral banks, patch reefs and hardbottom areas by using LANDSAT imagery, aerial photography, and groundtruthing efforts every three years.

Task A.1.1.2: The data base generated from these inventories will be used to create and maintain biological resource maps that will be consulted when assessing a proposed activity or evaluating potential impacts from manmade or natural events not otherwise anticipated.

Task A.1.1.3: These inventories will be available to public agencies involved in resource management and land planning.

Objective A.1.2: To conduct and maintain a resource inventory of emergent vegetation and habitats for the preserve lands.

Task A.1.2.1: Conduct and maintain an inventory of mangroves, buttonwood/saltmarsh, beach/berm and other shoreline vegetation in and adjacent to the preserve by using LANDSAT imagery aerial photography and groundtruthing efforts every three years.

Task A.1.2.2: The database generated from these inventories will be used to create and maintain biological resource maps that will be consulted when assessing a proposed activity or evaluating potential impacts from manmade or natural events not otherwise anticipated.

Task A.1.2.3: These inventories will be available to public agencies involved in resource management and land planning.

Objective A.1.3: Conduct and maintain inventories of designated species and their habitats for the preserve.

Task A.1.3.1: Conduct and maintain inventories of designated species and their habitats by using data from existing literature, managing agencies, field observations and current research studies every three years or more often if deemed necessary.

Task A.1.3.2: Coordinate with appropriate management and enforcement agencies to ensure that preserve management decisions and public actions or activities are compatible with the viability and management of a species or habitat.

Objective A.1.4: To conduct and maintain inventories of wading and diving birds and their habitats in the preserve.

Task A.1.4.1: Conduct and maintain inventories of coastal waterfowl and migratory bird species that feed, nest, roost and loaf in the preserve and adjacent areas by using existing literature, bird counts, field observations, and current research studies every three years, or more often if deemed necessary.

Task A.1.4.2: Coordinate with appropriate management, enforcement and research agencies to ensure that preserve management decisions and public actions or activities are compatible with the viability and management of a species or habitat.

Task A.1.4.3: Coordinate with public or conservation agencies that may be conducting similar inventories of species, populations, life histories, migration patterns and habitat needs where mutual benefits in knowledge and management objectives are to be gained.

GOAL A.2: ASSESS THE EFFECTS OF HUMAN ACTIVITIES/CUMULATIVE IMPACTS

Objective A.2.1: To inventory and assess the effects of human activities on the natural resources of the preserve.

Task A.2.1.1: Survey and inventory human activities in the preserve every three years. This survey shall contain at a minimum:

a) types of structures (dock, pier, seawall, rip-rap, piling, mooring buoy, utility pole, etc.);

b) design of structures (width, length, height above MHW, square footage of access pier and terminal platform, number of pilings, number and size of finger piers, construction material (wood, boulder or concrete), deck spacing, material treatment (pressure and/or chemical treated), type of anchorage for buoys or pilings, etc.);

c) the water depth at the terminus of the structure and/or relation to MHW line for shoreline stabilization;

d) number of boats using a structure;

e) functional condition of the structure;

f) any accessory facilities and ancillary uses associated with the structure;

g) the structure's use category (e.g., single family, commercial, etc.);

h) an inventory of the biological resources within the preempted area and within 25 feet of the structure or activity;

i) a survey of all dredged areas including:
   1) the location, length, width, and depth of the dredged area;
   2) depth of profiles of the surrounding area;
   3) traditional use of the area;
   4) biological resources in the dredged and surrounding area;
   5) whether the dredged area is a private or public project;
   6) review of information on pre-existing resource conditions;
   7) potential alternatives to alleviate the need for maintenance dredging (shoreline stabilization, wave baffles, etc.); and
   8) whether channel markers may be needed to direct traffic away from adjacent submerged resources.

j) a survey of all shoreline stabilization projects, including:
   1) location and total length of riparian shoreline;
   2) length of the shoreline stabilization;
   3) design of project;
   4) review of existing and pre-existing biological resources in the vicinity of the structure;
   5) whether the project is effective in stabilizing the shoreline; and
   6) whether toe rip-rap or mangrove plantings may improve upon the effectiveness of the structure.

k) a determination as to whether the structure or activity complies with the applicable statute or rule and with lease, easement or consent of use conditions, where appropriate;

<u>Objective A.2.2</u>: To assess cumulative impacts of activities and structures on the resources of the preserve.

<u>Task A.2.2.1</u>: All activities and structures will be surveyed as outlined in Policy A.2.1.1 and appropriate files kept and updated every three years to establish net loss or gain of resources as related to structures and activities.

Task A.2.2.2: Files shall contain at the minimum:

a) size, configuration and preempted area of the structure and related use;

b) a survey of the biological resources within the preempted area and within 50 feet of the preempted area;

c) condition and extent of those resources as related to previous surveys (grassbeds expanding or declining, prop scouring, establishment of different type of community, etc.);

d) whether existing use is consistent with type use activity authorized.

GOAL A.3: HABITAT RESTORATION

Objective A.3.1: Restore or enhance suitable habitats or resources where feasible.

Task A.3.1.1: Using resource inventories generated from Goal A.1., identify those resource areas that have been or are being negatively impacted by external influences. These influences may include, but are not limited to; prop scars, spoil banks, dredged areas, boat grounding areas, clearings, dumping, mosquito ditches, erosion, abandoned traps or vessels, exotic vegetation, and roads.

Task A.3.1.2: Prioritize potential restoration areas according to severity of impact to the immediate resources and to the overall functional integrity of the preserve.

Task A.3.1.3: Develop procedures and guidelines for addressing the priority areas for restoration, such as exotic plant removal, beach clean-up, removal or planting of spoil banks, revegetating grassbed or mangrove areas, enhancing listed species habitats, removal of derelict vessels and abandoned traps, filling in mosquito ditches, reestablishing historic water flows, etc.

Task A.3.1.4: Investigate and contact other agencies, groups, institutions, and individuals who may be available to provide scientific, logistic, financial, enforcement, manpower or other support in accomplishing the habitat restoration or enhancement.

Task A.3.1.5: Monitor and review progress on restoration projects.

(1): Monitor restoration procedures while in progress and restored areas on at least an annual basis.

(2): Maintain accurate records of the project including but not limited to:

a) type of project;
b) anticipated results;
c) benefits to the resource;
d) location, date, parties involved, duration of project;
e) completion date;
f) monitoring schedule;
g) results or changes observed;
h) additional maintenance or monitoring required;
i) estimated cost of project in time and funding;
j) an assessment of the success of the project or an explanation of why anticipated results were not achieved;
k) recommendations as to how the project could or should be improved upon; and
l) if the procedure could or should be used for future or similar projects.

GOAL A.4.: RESTORE, ENHANCE OR MAINTAIN WATER QUALITY

Objective A.4.1.: Coordinate with appropriate agencies to improve and/or maintain water quality in the preserve.

Task A.4.1.1: Acquire, maintain and review all records of water quality data for the preserve area.

Task A.4.1.2: Coordinate with regulatory and management agencies in identifying and managing areas within the preserve that may be contributing to sedimentation or other undesirable impacts to waters of the preserve (mosquito ditches, compaction of soils and channelization of run-off from roads, previous land clearing, etc.).

Task A.4.1.3: Report suspected or identified instances of violations to appropriate regulatory and enforcement agencies.

B. RESOURCE PROTECTION

In order to maintain the biological integrity of the aquatic preserve, it is imperative to protect the resources that comprise the system. In most cases, it is not feasible, nor is it desirable, to provide protection for individual species that are a part of the various habitats that make up the preserve. Therefore, the goals of resource protection outlined in this element will be directed toward protecting the habitats that are vital to the survival of the species and in conjunction with other habitat types are the functional basis of biological integrity and stability within the

preserve. These goals include: 1) protection of submerged resources (patch reefs, coral banks and heads, grassbeds and hardbottom habitats), 2) protection of emergent vegetation (mangroves, saltmarsh/buttonwood, beach/berm and tropical hardwood hammock habitats), and 3) protection of designated species habitats.

GOAL B.1.: PROTECTION OF SUBMERGED RESOURCES

Objective B.1.1.: Minimize potential damage to submerged resources through out the review of applications for use of state-owned lands in the aquatic preserve.

Task B.1.1.1.: Develop a written description of a scientifically based, standardized method to inventory the minimum, this method will contain the following information:

a) The area to be surveyed will be described:
   1) as a polygon, and
   2) it will include a buffer zone surrounding the project of sufficient size to include a majority of the potentially affected area.

b) How the survey is to be performed:
   1) The submerged bottom, including:
      i. a description of all communities/habitats,
      ii. a description of the bottom type,
      iii. depth profiles,
      iv. tidal amplitude and stage,
      v. a physical description of the surrounding waterbody,
      vi. adjacent and adjoining uses, and
      vii. distance to navigation channels:

   2) The shoreline, including:
      i. a description of the vegetation,
      ii. a description of the shoreline type,
      iii. a description of existing structures,
      iv. a description of adjoining and adjacent uses,
      v. presence/absence of listed animal species or their habitat or whether known to occur in the area; and
      vi. presence/absence of other wildlife or their signs.

c) A definition of a Resource Protection Area (RPA). This definition will be used to determine if significant resources or habitats exist within the area of expected impact. An RPA will include, but is not limited to:

   1) Marine grassbeds,
   2) algal beds,

3) mangroves and saltmarsh/buttonwood associations,
4) hardbottom communities,
5) coral banks or heads,
6) patch reefs,
7) beach/berm,
8) listed species or their habitat, and
9) nesting sites for solitary or colonial birds.

Task B.1.1.2.: Coordinate with the appropriate regional DNR staff to process field staff comments to applications for use in a timely manner.

Task B.1.1.3.: Coordinate, when possible, with other appropriate agencies that have regulatory authority for these projects.

Objective B.1.2.: Ensure that projects and activities that have been built or are occurring have been authorized.

Task B.1.2.1.: Report activities that do not appear to have been authorized to the appropriate DNR enforcement agent.

Task B.1.2.2.: Coordinate and cooperate, when possible, with other appropriate agencies that have regulatory or enforcement authority for these projects or activities.

Task B.1.2.3.: Maintain records of reports and subsequent actions taken by regulatory and enforcement agencies. At a minimum, these records will contain:
1) Date, location first observed and observers name;
2) Date reported to appropriate agency, agency name, and reporters name;
3) Action taken by agency; and
4) Resolution of report, if known.

Objective B.1.3.: Ensure that projects and activities are in compliance with the authorization granted.

Task B.1.3.1.: Coordinate with the appropriate regional DNR staff to receive copies of all letters of consent, easement agreements, lease agreements, and other forms of authorization.

Task B.1.3.2.: Report variations from the authorized conditions to the appropriate DNR enforcement agent.

Task B.1.3.3.: Coordinate and cooperate, when possible, with other appropriate agencies that have regulatory or enforcement authority for these projects or activities.

Objective B.1.4.: Ensure that projects and activities do not degrade submerged resources of the preserve.

Task B.1.4.1.: Seek authorizations to establish no motorized vessels or personal watercraft zones in areas of shallow water.

Task B.1.4.2.: Require that all dredge projects use current turbidity control practices.

Task B.1.4.3.: Establish a mooring buoy system near the larger patch reefs in the preserve.

Task B.1.4.4.: Inventory and report all abandoned vessels and traps to the Florida Marine Patrol and encourage removal in a timely manner.

Task B.1.4.5.: Encourage or require the establishment of channel markers, where appropriate, to protect marine grassbeds and corals from boating damage.

Task B.1.4.6.: Seek appropriate legislation to prohibit spear fishing in the preserve.

Task B.1.4.7.: Seek appropriate legislation and rule changes to prohibit the harvesting of live rock, tropical fish and marine invertebrates within the preserve.

Task B.1.4.8.: Promote the acquisition of privately held submerged lands within the preserve.

GOAL B.2.: PROTECTION OF EMERGENT VEGETATION AND HABITATS

Objective B.2.1.: Minimize potential damage to emergent vegetation and beach/berm through the review of all applications for use of state-owned land in the preserve.

Task B.2.1.1.: Field staff will develop a written format describing a scientifically based, standardized method to inventory the emergent vegetation and characteristics of a project site and it shall include, at a minimum, the following information:

a) Description of the area to be surveyed:
   1) legal description of the subject property;
   2) as a polygon; and
   3) with a buffer zone surrounding the project of sufficient size so as to include a majority of the potentially affected area.
b) Detailing how the survey is to be performed:
   1) a description of the vegetation with notations as listed plant species within the project site and buffer zone;
   2) a description of geological features or formations, including the following, if beach/berm is present:

i. length and width of beach/berm on riparian shoreline;
ii. approximate height of the ridge crest; and
iii. distance from MHW to the ridge crest:

3) a description of existing structures or uses;
4) a description of adjoining or adjacent uses;
5) presence/absence of listed animal species, their or whether known to occur on the site;
6) presence/absence of other wildlife species or their sign.

Task B.2.1.2.: Coordinate with other DNR staff in order to process surveys and related comments in a timely manner.

Task B.2.1.3.: Coordinate with other appropriate agencies that have regulatory authority for these projects.

Task B.2.1.4.: Coordinate and cooperate, whenever possible, with other agencies or conservation organizations that have specific management objectives, research projects or other interests in the area of a project, or that may own lands adjacent to the project site, including but not limited to:

a) Key Deer National Wildlife Refuge;
b) Great White Heron National Wildlife Refuge;
c) Florida Game and Freshwater Fish Commission;
d) National Audubon Society; and
e) Trust for Public Lands.

Objective B.2.2.: Ensure that structures and activities that have been built or are occurring have been authorized.

Task B.2.2.1.: Report activities that do not appear to have been authorized to the appropriate DNR enforcement agent.

Task B.2.2.2.: Coordinate and cooperate, whenever feasible and appropriate, with other agencies that have regulatory or enforcement authority for the project or activity.

Objective B.2.3.: Ensure that structures and activities that have been authorized are in compliance with the conditions of the authorization.

Task B.2.3.1.: Coordinate with the appropriate regional DNR staff to receive copies of all letters of consent, easement agreements, lease agreements and other authorizations for the use of state lands.

Task B.2.3.2.: Report variations from the authorized conditions to the appropriate DNR enforcement agent.

Task B.2.3.3.: Coordinate and cooperate, when feasible and appropriate with other agencies that have regulatory or enforcement authority for these projects or activities.

GOAL B.3.: PROTECT LISTED SPECIES AND THEIR HABITAT

Objective B.3.1.: Determine which portions of the aquatic preserve serve as habitat for listed species.

Task B.3.1.1.: Assimilate a working library of relevant literature and information on listed species expected to occur in the preserve.

Task B.3.1.2.: Coordinate with the Florida Game and Fresh Water Fish Commission, U.S. Fish and Wildlife Service, the Audubon Society, and any other relevant group or agency to determine which listed species use what portion of the aquatic preserve for various aspects of their life cycle.

Task B.3.1.3.: Coordinate and cooperate, whenever possible, with appropriate agencies and groups to conduct monitoring, inventories, habitat evaluations or other activities that relate to the status or distribution of listed species or their habitat.

Task B.3.1.4.: During the course of routine field work and patrols, preserve staff will observe and record, whenever practical, sightings, locations, activity and other information relevant to a listed species.

Task B.3.1.5.: Report all manatee sightings to the Marathon office of the Division of Marine Resources.

Objective B.3.2.: Protect all listed species of plants and animals.

Task B.3.2.1.: Be familiar with listed species, identification, status and relevant laws pertaining to listed species.

Task B.3.2.2.: Report, without delay, any incidence of harassment, poaching, killing, taking or other unlawful activity, including unleashed dogs and artificial feeding stations, to the appropriate enforcement agencies.

Task B.3.2.3.: Maintain a current list of agencies and individuals who enforce relevant laws and those who are permitted or otherwise authorized to rescue, attend, hold,

rehabilitate or salvage listed species or their remains.

Task B.3.2.4.: Coordinate and cooperate with appropriate management and enforcement agencies in identifying any activity or project that may potentially affect a listed species.

Objective B.3.3.: Protect habitat of listed species.

Task B.3.3.1.: Ensure that potential impacts to listed species habitats are identified in the review of projects or activities. Such potential impacts may include, but are not limited.

1) Modification or obstruction of beach/berm;
2) Dock or beach lighting;
3) Fences or other obstructions; and
4) Removal of vegetation, except invasive exotics.

Task B.3.3.2.: Coordinate and cooperate, whenever possible, with appropriate management and enforcement agencies to evaluate potential impacts to listed species as a result of a proposed project or activity.

Task B.3.3.3.: Recommend, where appropriate, modifications to a proposed project or activity that would eliminate or minimize encroachment upon the habitat of listed species.

Task B.3.3.4.: Seek appropriate state statute and rule changes to exclude personal/individual watercraft from listed species habitat, including jet ski, water taxi, jet boat, and similar types of motor powered watercraft.

Task B.3.3.5.: Seek appropriate federal statute changes and enforcement to regulate use of ultra-light, private and commercial aircraft over and in the aquatic preserve.

Task B.3.3.6.: Coordinate and cooperate with appropriate DNR and other enforcement agencies in the investigation of potential violations of state or local codes or ordinances that impact listed species habitats.

C. RESEARCH

Effective management of a biological system relies almost entirely on information as to how that system functions. Research is the progenitor of this information. Great strides have been made in marine grassbed and mangrove ecology, yet large gaps remain in understanding the functions of the various components of these systems and how they interact with on another. Coral reef ecology is a fledgling science that has blossomed only with the improvements in SCUBA equipment.

Understandably, there is much yet to be learned about all of these systems. The goals for research in the aquatic preserve will be directed toward primarily applied research programs, rather than basic, or theoretical research.

The goals of the research program are (1) to gain a better understanding of what factors are essential to the functional, biological integrity of the major habitats within the aquatic preserve and (2) to gain a better understanding of the factors that govern the continued survival and propagation of designated species that use the various habitats of the preserve.

GOAL C.1.: MAINTAIN OR ENHANCE THE FUNCTIONAL INTEGRITY OF HABITATS

Objective C.1.1.: Determine the primary factors that influence
the survival of marine grassbeds and algae.

Task C.1.1.1.: Pursue and support research directed toward identifying physical, chemical and/or pathogenic sources of marine grassbed damage.

Task C.1.1.2.: Pursue, at the bureau level, funding to conduct research on the effects of dock/pier shading on the various species of marine grasses and algae of the preserve.

Task C.1.1.3.: Pursue, review and support, where deemed practical, research directed toward protecting or restoring marine grass beds.

Objective C.1.2.: Determine the primary factors that influence the distribution, survival and productivity of mangrove habitats.

Task C.1.2.1.: Promote and support research on the physical, chemical, and pathogenic factors that influence mangrove habitats.

Task C.1.2.2.: Pursue funding, at a Department level, t o investigate the ecological functions of impounded 'dwarf' mangroves.

Task C.1.2.3.: Pursue funding and support research projects directed toward restoration of artificially altered mangrove systems.

Task C.1.2.4.: Promote and support research on the effects of mangrove trimming.

Objective C.1.3.: Determine the primary and secondary factors that affect the species of the hardbottom and coral patch reefs.

Task C.1.3.1.: Promote and support research that identifies the physical, chemical and pathogenic factors that influence coral growth, recruitment and mortality.

Task C.1.3.2.: Promote and, whenever feasible, participate in compiling an inventory of the benthic infauna present in hardbottom and patch reefs in the preserve.

Task C.1.3.3.: Seek, at a Department level, funding for research on the effects of spear-fishing on the size/class range, distribution and dominance of coral/algal grazing fishes and predatory fishes on the patch reefs.

Task C.1.3.4.: Seek, at a Department level, funding for research on the effects of tropical fish and invertebrate collecting on the species, size range, distribution, density, and diversity of populations on patch reefs.

Task C.1.3.5.: Seek, at a Department level, funding for research on the effects of sponge harvesting on hardbottom communities.

Task C.1.3.6.: Seek, at a Department level, funding for research on the effects of trap placement and retrieval methods on the submerged resources of the preserve.

Task C.1.3.7.: Review and accept, where appropriate, experimental research proposals for the culture of hardbottom sponges in the preserve.

GOAL C.2.: SURVIVAL AND PROPAGATION OF LISTED SPECIES

Objective C.2.1.: Determine which portions of the preserve serve as habitat for designated species.

Task C.2.1.1.: Pursue, at a Department level, funding for research on the distribution of listed species in the CARL Buffer Zone project.

Task C.2.1.2.: Support, and when feasible, participate in research to establish critical habitat areas for listed species of plants and animals in the preserve.

Task C.2.1.3.: Support and pursue funding for research on the distribution, life cycles and habitat needs of listed species of fishes, reptiles, insects and mollusc of the preserve.

Task C.2.1.4.: Coordinate with appropriate agencies, organizations and universities/colleges to promote applied research projects for listed species.

Task C.2.1.5.: Participate, whenever feasible, with agencies or organizations that survey or monitor listed species in the preserve.

Task C.2.1.6.: Cooperate with the Division of Marine Resources in monitoring and reporting manatee sightings and information.

Task C.2.1.7.: Cooperate with the Division of Marine Resources in monitoring and reporting marine turtle nesting and strandings.

(1): Preserve staff or volunteers who participate in strandings and salvage activities shall be properly trained and permitted and shall maintain accurate records and make timely reports of all activities in the preserve.

D. ENVIRONMENTAL EDUCATION

Public awareness and involvement is potentially the most valuable tool a resource management program may utilize. The public is often not aware of the resources of the preserve nor of the various impacts that human activities have upon those resources. The 'public' may be students, property owners, user groups (e.g., divers, fishing enthusiasts, boaters, etc.), special interest groups (realtors, developers and contractors), conservation or preservation organizations, and local, regional and state government agencies that are involved in making planning or regulatory decisions affecting the preserve.

The many values derived from marine habitats, including water quality, viable fisheries, recreation and open space, attract many visitors and residents to the preserve area. These same values may be irreparably harmed, if the public is not environmentally sensitive or informed. Therefore, one of the primary aims of the aquatic preserve program will be to educate the public as to the importance of the resources and to enlist public support and participation in the protection and conservation of those resources for present and future generations to enjoy.

GOAL D.1.: PUBLIC EDUCATION TO PROMOTE WISE RESOURCE USE

Objective D.1.1.: Coordinate and provide assistance to existing environmental education programs at public and private schools.

Task D.1.1.1.: Notify the county school board and private schools of the preserves programs and the availability of its staff to assist or provide guidance for their existing environmental educational programs.

Task D.1.1.2.: Participate in the development and utilization of the Monroe County Environmental Story teaching aids for public and private schools in the county.

Task D.1.1.3.: Seek funding to develop an educational display and literature for the preserve.

Task D.1.1.4.: Seek funding and staffing to establish and conduct classroom programs and field trips in the preserve.

Objective D.1.2.: Produce environmental educational literature and materials that inform the adult public of the preserve's natural resources and the importance of preserving and protecting those resources.

Task D.1.2.1.: Seek funding for the development of educational literature, materials and staffing for presentations to:

1) Homeowners' associations;
2) Civic and church groups;
3) Special interests (realtors, consultants, developers, contractors, utilities, etc.);
4) Boating/sport shows and special events;
5) Camping facilities and tourist resorts;
6) Marinas, tackle shops and boat ramps;
7) Agency and local government staffs;
8) Environmental educators; and
9) Conservation, preservation, conference, and research groups.

Task 1.2.2.: Development media articles and presentations for local radio, television and publications to inform the general public of the preserve, its resources and of relevant protection needs, programs and research findings.

Task 1.2.3.: Seek support, development and education of a Friends of Coupon Bight Aquatic Preserve volunteers group to assist with environmental education programs and special environmental projects.

Task 1.2.4.: Coordinate with other resource management agencies and, where appropriate, co-sponsor exhibits, programs or other public contact activities.

Objective D.1.3.: Pursue coordination with organizations and agencies and, where appropriate, assist in the development of special programs for physically and mentally challenged adults and children.

Task 1.3.1.: Contact appropriate agencies to determine the need for special programs.

Task 1.3.2.: Seek funding for development and staffing of needed programs.

Objective D.1.4.: Seek funding for development and staffing of a permanent environmental education facility for the preserve.

Task D.1.4.1.: Seek funding for development, maintenance, and staffing for permanent displays, specimen collections, a reference library and interpretive programs.

Objective D.1.5.: Provide environmental education workshops to instruct other environmental educators.

Task D.1.5.1.: Pursue development and funding for biannual instructional workshops for environmental, science, and other interested teachers and instructors.

Task D.1.5.2.: Encourage aquatic preserve staff and volunteers to attend conferences and seminars to further teaching skills and become familiar with other education programs.

CHAPTER VII

MANAGMENT COORDINATION NETWORK

This chapter presents a general overview of the various federal, state, regional, and local agencies that regulate or hold any interests in the management or use of Coupon Bight Aquatic Preserve. The success of the aquatic preserve management plan is dependent upon coordination with these agencies to achieve many of the goals and objectives of resource management and protection. A breakdown of the specific jurisdictions is presented in Table 11.

A. FEDERAL AGENCIES

A number of federal agencies have property interests, land and wildlife management programs, research activities, construction activities, and regulation programs that deal either directly or indirectly with the aquatic preserve.

In accordance with the federal consistency review process, the Bureau of Submerged Lands and Preserves reviews many of the federal programs and activities as to their affect on the management objectives of the aquatic preserve programs. This review is coordinated through the Florida Department of Environmental Regulation's Office of Coastal Management in order to enforce the provisions of the Federal Coastal Zone Management Act of 1972, as amended.

U.S. Fish and Wildlife Service (USFWS)
The USFWS has responsibility for fish and wildlife as authorized in the Coastal Resources Barrier Act, National Environmental Protection Act, Migratory Bird Act, Endangered Species Act, and Fish and Wildlife Coordination Act. Locally, their personnel administer and manage wildlife refuge and preserved lands, review dredge and fill projects, and are charged with the protection and recovery of endangered species and bird rookeries.

U.S. Army Corps of Engineers (COE)
The COE has jurisdiction over the navigable waters of the United States under the Rivers and Harbors Act of 1899. A revision of the Rivers and Harbors Act in 1968 extended the COE jurisdiction, allowing them to consider impacts to the fish and wildlife, conservation, pollution, aesthetics, ecological and other relevant factors of a proposed project. The COE regulatory programs were expanded in 1972 with the Federal Water Pollution Control Act Amendments, also known as the Clean Water Act (CWA). Section 404 of this act controls dredge and fill activities and has since been extended to wetlands from Amendments to the CWA in 1977.

U.S. Geological Survey (USGS)
The USGS performs surveys and research pertaining to topography, geology, mineral and water resouces of the United States. USGS also collects and publishes water resouces data.

U.S Environmental Protection Agency (EPA)
The EPA has jurisdiction over surface watew of the state. Enforcement authority was given under the Clean Water Act of 1972 and broadened under the 1977 revision. In general, EPA is responsible for pollution control and abatement, including: air, water, noise, solid waste, toxic waste, and raddiation. Under Section 104 of the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA), as amended by the Sperfund Amendments and Reauthorization Act of 1986 (SARA), EPA may initiate studies, clean-up, and pursue restitution of incurred expenses for pollution violations and damages. Authority is divided between EPA and the U.S. Coast Guard regarding the management of oil or hazardous substances discharged into surface waters. They also review permits issued by DER for the treatment, disposal and storage of hazardous wastes.

U.S. Coast Guard (USGS)
The USGA regulates boating safety, enforces maritime law, operates search and rescue missions, and surveillance and interdiction of contraband importation. USGS also regulates construction of bridges, causeways, and aerial utilities that may pose navigation hazards and the placement and maintenance of public navigation aids. Joint responsibility for response to the discharge or spillage of oil or other hazardous substances into surface waters is shared with EPA.

National Marine Fisheries Service (NMF)
The NMF is under the U.S. Department of Commerce and records commercial fish landing, enforces national fishery laws, and protects vital fishery habitats. Under the Endangered Spcies Act, this agency may also regulate activities and enforce marine turtle and mammal protection legislation.

National Oceanic and Atmospheric Administration (NOAA)
Under the Department of Commerce Office of Coastal Zone Management, NOAA administers to programs of local interest. The National Marine Sanctuaries (NMS) program oversees the management of Looe Key and Key Largo National Marine Sanctuaries, as well a several National Marine Esturies in the region. NOAA also administers the Hurricane Center in Miami, which monitors and issues bulletins on tropical weather for the north and south Atlantic and the Caribbean Basin.

B. STATE AGENCIES

Many state agnecies have property interests, land and wildlife managemnt programs, research activities, regulatory authority and construction activities with the preserve. Additionally, DNR administers programs which may affect the resources and waterwheds of the preserve.

Department of Natural Resources (DNR)
Several Divisions within the Department perform various functions of administration, regulation and enforcement of laws and programs related to natural resources and/or their use.

The Division of Marine Resources has several programs beneficial to the management of aquatic preserves. The Marine Research Laboratory in St. Petersburg and the Marathon Field Office have several projects which include resource protection area mapping, fishery habitat utilization sudies, conch reintroduction programs and spiny lobster research. The Division is instrumental in administering manatee protectio programs and marine turtle data gathering. They also administer a permitting program for the collection of certain marine species and the use of certain chemicals.

The Division of Law Enforcement's Marine Patrol, whose legal authority is granted under Chapter 370, F.S., enforces Florida laws relating to marine resources, fishery laws, boating safety, vessel titling/registration, contraband interdiction, and the protection of endangered and threatened species.

The Division of State Lands, under the provisions of Chapters 253 and 258, F.S., performs the staff duties related to the acquisition, administration and disposition of public lands on behalf of and with the approval of the Governor and Cabinet, sityting as the Board of the Internal Improvement Trust Fund. Staff duties include review and recommendations to the Board regarding applications for the use, sale, lease or transfers of all state-owned lands and enforcement of the provisions for unauthorized use of those lands. Under Chapter 18-21, F.A.C., the Division is charged with management of sovereignty submerged lands and spoil islands.

Aquatic preserves were established under Chapter 258, F.S. Originally administered by the Division of Recreation and Parks, the administration of aquatic preserves was transferred to the Division of State Lands in 1988. Specific management policy, standards and criteria for most aquatic preserves are contained within Chapter 18-20, F.A.C.

The authority for the Conservation and Recreational Lands program (CARL) is also derived from Chapter 253, F.S. This program is the primary vehicle for the acquisition of private

lands that are deemed to be environmentally sensitive or that may serve as potential lands for future recreational needs. Recent passage of the Conservation 2000 legislation will greatly enhance funding for targeted purchases.

The Division of Resource Management is responsible for the management of aquatic plants, mineral resources, oil and gas exploration, and geologic studies. It also supervises state Navigation Districts and the Canal Authority.

Department of Environmental Regulation (DER)
The DER administers programs regulating air, water, noise, wastewater, stormwater, and hazardous waste pollution through a permitting and cetification process. Chapter 376, F.S. directs DER to cooperate with DNR in offering consultation, enforcement, prosecution, and technical advise in pollutant discharge, control and removal.

Chapter 403, F.S. enumerates the DER responsibilities in the areas of water and air quality, facilities siting, resource recovery and management, pollution control and wetland permitting. This chapter serves as the authority for the initiation of dredge and fill applications in conjuction with COE and DNR. The authority to regulate activities and protect water quality granted in Chapter 403 is facilitated by the Water Quality Standards established in Chapter 17-3, F.A.C. This chapter of the admininstrative code sets forth specific criteria for surface water classifications and permitting criteria for those classifications. The Special Protection, Outstanding Florida Waters (OFW) classification is assigned to waters of the aquatic preserve and most waters of the Florida Keys. The OFW classification affords the highest protection for state waters.

Chapter 17, F.A.C. also contains sections governing permitting procedure and criteria for facilities, dredge and fill projects, stormwater discharge, and deepwater ports.

The DER Office of Coastal Management is charged with coordinating activities related to coastal management and reviewing federal actions for consistency with the State Coastal Management Program. The Office of Coastal Management also awards grants for research and management planning.

Chapter 253.77, F.S., as amended by the Warren S. Henderson Wetlands Protection Act of 1984, reuqires that any request for the use of state-owned lands shall have prior approval of the The Trustees. An interagency agreement between DNR and DER provides for DNR staff comments into the DER permitting process for indentifying environmental impacts to the resources of the aquatic preserve.

Department of Community Affairs (DCA)
DCA reviews Developments of Regional Impact (DRI), designates Areas of Critical State Concern (ACSC), and approves comprehensive plans. The DRI process involves major development projects that have impacts on a larger area than is covered by just one county and involves a regional review from neighboring local governments and from state agencies.

The ACSC program is intended to protect the areas of the state where development has endangered or may endanger resources of regional or statewide significance. Under an ACSC designation, the local governments are required to notify the DCA of any application for a development permit. The Florida Keys portion of Monroe County were designated as an ACSC in 1979. In 1984, under authority granted in Chapter 380, F.S. and defined in Administrative Rule 27F-8, the Boundary and Principles for Guiding Development for the Florida Keys Area of Critical State Concern were adopted to conserve and protect the natural, environmental, historic and economic resources, and other values of the lands and waters of the Florida Keys. The Florida Keys ACSC designation and the Principles for Guiding Development are intended to remain in place until such time as Monroe County shall have developed a comprehensive growth management plan and future development regulations as required by Chapter 163, F.S. Such plan shall be consistent with the State Comprehensive Plan, State Statutes, Codes and rules. Conformance to the minimum criteria established in Chapter 9J-5, D.A.C. is also required.

Monroe County is currently involved in this planning process and is expected to submit a completed plan by September 1990. The Coastal Management and Conservation Elements of the future plan are the most significant to the management goals and objectives of the aquatic preserve. These elements should establish goals and objectves that are consistent with those of this plan. Cooperation and coordination in developing the plans is critical to the successful development and implementation of either plan.

Department of Transportation (DOT)
The DOT is involved with aquatic preserves where they maintain the U.S. 1 or Overseas Highway and the bridges and causeways that abut the preserve boundary. Leases or permits for the use of state-owned rights-of-way are coordinated through the DOT. Applications for these uses are not generally circulated for field review. Local cooperation is vital to establish lines of communication regarding projects that may affect the preserve. The DOT also administers funding for environmental restoration projects, which has in the past been available for aquatic preserve projects.

Department of State/Division of Historical Resources (DHR)
Under Chapter 267, F.S. DHR is granted responsibility for the preservation and management of the state's archaeological and historical resouces. This responsibility includes those cultural resouces located on state-owned lands. All activities that may potentially affect a known or suspected resouce must be coordinated with and/or approved by the DRH.

Department of Health and Rehabilitative Serveces (HRS)
HRS administers numerous programs to protect public health by overseeing functions that involve water supplies, sewage disposal and solid waste control. Authority for these responsibilities are found in Chapters 154, 381, and 386, F.S. and in the 10D series of F.A.C., known as the Sanitary Code. HRS is also responsible for mosquito control activities under Chapter 388, F.S. and may delegate that authority to a local mosquito control district (MSD).

Mosquito control and spetic tank permitting are of immediate concern to the managment of the aquatic preser. The Monroe County MSD administers the local program through ground and aerial application of larvicides and adulticides. Chapter 10D-54, F.A.C. requires that any arthropod (mosquito) control activities conducted by local MSDs on environmentally sensitive public lands, such as parks, aquatic preserves and similar properties be coordinated in advance by the responsible mosquito control agency with the Executive Directory of DNR, GFC, and the regional directory of the USFWS. This chapter also establishes areas, types, rates, timing and equipment standards for control activities.

HRS administers the permitting and placement of spetic tanks under Chapter 10D-6, F.A.C. This chapter establishes standards for onsite sewage disposal systems (OSDS). Part II of that chapter establishes specific standards for OSDS installation, operation and monitoring in the Key Largo Limestone or Miami (Oolite) rock formations.

Marine Fisheries Commission (MFC)
The MFC manages marine life by regulating the harvesting of all marine life, except listed species. Their authority covers gear specifications, bag limits, size limits, species that may not be sold, protected species, closed seasons or areas, quality control codes, special considerations related to egg bearing females, and the harvest and relaying of oyster and clams. The MFC makes annual recommendations to the Governor and Cabinet regarding marine fisheries research priorities and changes to existing laws.

Game and Fresh Water Fish Commission (GFC)
The GFC, authorized under Chapters 39.101 and 39.102, F.A.C. implements and enforces specific regulations to protect all

wildlife and their habitats. As such, the GFC is the state coordinatory for species designated for protection in Florida.

C. REGIONAL AGENCIES

In addition to federal and state agencies, two regional agencies have functions and programs that may affect the aquatic preserve. These organizations conduct activities that are on a borader scale than are those of the local governments.

South Florida Water Management District (WMD)
The WMD was estalished by Chapter 61-69, Laws of Florida, as a public corporation for carrying out Chapter 378, F.S> and operates under and is governed by provisions of Chapter 373, F.S. Chapters 40D-4 and 40D-40 were adopted to ensure continued protection of the water resources of the district including wetlands and other natural resources. The statutes resulted from passage of Chapter 84-79, Laws of Florida, also known as the Warren G. Henderson Wetlands Protection of of 1984.

The WMD adminsters permitting programs for consumptive water use, management, strom water discharge, storage of surface water, well drilling and operation, water level control, regulation of artificial recharge facilities, and works of the district. The WMD is also responsible for defeloping Surface Water Improvement Management (SWIM) plans as authorized by Chapter 87-97, Laws of Florida and Chapter 373, F.S. The SWIM plans are designed to improve, restore and manage surface waters.

South Florida Regional Planning Council (RPC)
The RPC serves as a regioanl planning body for the local government of Monroe County, as well as incorporated areas in the Keys and other south Florida counties and municipal areas. The RPC duties include: aid to local government planning efforts; regional representative for the DRI process; regional clearing house for state and federal projects and programs; providing information from the lcoal governments to the state and federal levels; assisting local governments in securing grants in air; and preparing and administering the Regional Policy Plan.

The DRI review of projects which affect the preserve will be reviewed by both the field staff and central office personnel. DRIs for marinas, major developments, subdivisions, and commercial or industrial developments adjacent to the preserve and will be reviewed closely for their potential impact on the preserve.

D. LOCAL GOVERNMENT/AGENCIES (LGT)

Local government consists of unincorporated Monroe County and the incorporated areas of Key Colony Beach, Layton and the City of Key West. The incorporated areas are governed by a city commission and the unincorporated areas are governed by a five member County Commission. Previous efforts to incorporate the island of Big Pine Key failed to garner voter support. However, there is a small consensus of opinion that this issue is not dormant and the proposal may again surface for referendum.

As previously noted, the Florida Keys portion of Monroe County has been designated as an Area of Critical State Concern and both incorporated and unincorporated areas are in the process of formulating Comprehensive Growth Management Plans.

Relationship to Local Management Plans

The Florida Keys Comprehensive Plan of 1986 (Volume II, Analysis and Policy Element) established several Areas of Critical County Concern (ACCC) and Marine Resouce Areas of Particular Concern (APC), including Coupon Bight and Lignumvitae Key Aquatic Preserves. Management policies for Coupon Bight are directed toward cooperation with DNR and regulation of land and water activities to ensure compatibility with maintenance and preservation of the preserve. Septic tanks are discouraged and storm water management and low intensity uses are encouraged.

Generic designations for Marine Resouce APCs include marine grassbeds, coral formations and fringing mangroves, including associated vegetation within 50 feet of the landward edge of those mangroves. Management policies mandate that these biotic communities be preserved to the fullest extent possible and that creation and restoration of these communities will be encouraged whenever feasible and necessary.

Local governments are required by the Local Government Comprehensive Planning Act of 1975 (Section 163.3163, F.S.), as amended by Chapter 85-55, Laws of Florida, to the Local Government Comprehensive Planning and Land Development Regulation Act (LGCP), to have a management plan with elements relating to different governmental functions (i.e., housing, physical facilities, conservation, land use, coastal zone protection, etc.). Recent statutory amendements require these plans to be updated and for counties to adopt land development regulations and improve coastal management protection. The coastal management element of the LGCP, along with the land use and conservation elements, establishes long range plans for orderly, and balanced development, with particular attention to the identification and protection of environmental resouces in the planning area. Conformance with the criteria, policies, and practices of a local government

comprehensive plan is required for all development within the local government jurisdication.

Monroe County is currently revising and formulating new goals, objectives and policies that are intended to fulfill the requirements for the LGCP act and the criteria of 9J-5, F.A.C. The intent of the aquatic preserve management program, and this plan, is to guide county efforts during the planning process towards developing local plan criteria and standards that will be consistent with and complimentary to the objectives of the aquatic preserve program.

TABLE 11: MANAGEMENT COORDINATION NETWORK

LOCAL AGENCIES

LGT	Local Governments (Cities, Towns, Municipalities)
CGT	County Governments
LDD	Local Drainage Districts
MCD	Mosquito Control Districts
ICD	Inlet Commissions/Districts
SWC	Soil and Water Conservation Districts

REGIONAL AGENCIES

RPC	Regional Planning Council
WMD	Water Management Districts
FIN	Florida Inland Navigation District

STATE AGENCIES

DCA	Florida Department of Community Affairs
DER	Florida Department of Environmental Regulation
DNR	Florida Department of Natural Resources
GFC	Florida Game and Freshwater Fish Commission
DOS	Florida Department of State
DOT	Florida Department of Transportation
FMP	Florida Marine Patrol
FSG	Florida Sea Grant
MFC	Marine Fisheries Commission
DAC	Florida Department of Consumer and Agricultural Services
HRS	Florida Department of Health and Rehabilitative Services

FEDERAL AGENCIES

CG	United States Coast Guard
COE	United States Army Corps of Engineers
EPA	United States Environmental Protection Agency
FWS	United States Fish and Wildlife Service
NMF	National Marine Fisheries
GS	United States Geological Survey

Source: modified from the Indian River Lagoon Joint Reconnaissance Report, 1987

	Local						Regional			State											Federal					
	LGT	CGT	LDD	MCD	ICD	SWC	RPC	WMD	FIN	DAC	DCA	DER	DNR	GFC	HRS	DOS	DOT	FMP	FSG	MFC	CG	COE	EPA	FWS	NMF	GS
Dredge and Fill Permitting	●	●						●	●			●	●	●						●	●	●	●	●		●
Docks, Fishing Piers, Seawalls	●	●										●	●									●				
Marinas	●	●					●				●	●	●							●		●		●		
Submerged Lands Management									●				●													
Habitat Protection	●	●					●	●			●	●	●	●				●		●		●		●	●	
Mangroves/Wetlands Protection	●	●					●	●			●	●	●	●								●		●		
Seagrass Protection	●	●					●	●			●	●	●									●		●	●	
Habitat Restoration		●						●			●	●	●	●			●					●		●		
Mangroves/Wetlands Restoration		●		●				●			●	●	●									●		●		
Seagrass Restoration								●			●	●	●									●		●		●
Resource Inventory							●	●	●		●	●	●	●					●	●				●	●	
Manatees/Porpoises	●	●					●				●		●											●	●	
Endangered Species	●	●					●				●		●	●			●	●	●	●	●			●	●	●
Shellfish/Aquaculture		●		●						●		●	●													
Public Awareness/Education		●						●	●		●	●	●	●				●	●	●	●	●	●	●	●	
Research				●				●				●	●	●					●						●	
Fisheries Research				●							●		●	●					●	●				●	●	
Fisheries Management				●							●		●						●	●				●	●	
Recreational Fishing											●		●	●				●	●	●				●	●	
Commercial Fishing											●		●					●	●	●				●	●	
Wildlife Management								●			●			●				●		●		●		●	●	
Mosquito Impoundments		●		●						●	●		●									●				
Historical/Archeological Sites	●	●					●				●		●			●										
Water Quality	●	●		●		●	●	●		●	●	●	●		●			●					●	●		
Nonpoint Source Pollution	●	●				●	●	●			●	●	●		●		●					●	●	●		
Point Source Pollution	●	●					●	●			●	●	●		●							●	●	●		
Oil/Chemical Spills		●					●	●			●	●	●					●			●	●	●	●		
Drainage/Freshwater Control	●	●	●			●	●	●		●	●	●	●									●		●		
Emergency Response	●	●					●				●	●	●	●				●								
Upland Development	●	●					●	●			●															
Land Use Planning	●	●					●				●															
Navigational/Boating	●	●			●		●		●				●	●	●			●	●		●	●		●		
Recreational Areas	●	●					●		●				●					●	●			●		●		●
Bridges and Roads		●					●	●			●	●	●				●				●	●				●

CHAPTER VIII

STAFFING AND FISCAL NEEDS

Historically, the Aquatic Preserves Program has been largely dependent on federal coastal zone grant funds for its operation, and as a result, the funding of both field positions and central office positions has been limited.

In order for the Coupon Bight Aquatic Preserve to be managed in accordance with the goals, objectives and policies, set forth in this plan, adequate funding, staffing and equipment is essential. It is anticipated that the management and administration of the three aquatic preserves in the Keys (Coupon Bight, Lignumvitae Key and Biscayne Bay-Card Sound portion) could be accomplished with one field office staffed with five full time employees and a part-time maintenence mechanic. An annual review of the accomplishments of the program relative to the tasks listed in Chapter VI will help to determine if the initial staffing estimate is adequate to meet the legislative intent of the program.

A budget covering projected staff time, equipment, travel and other expenses for this area, which would include Coupon Bight Aquatic Preserve, is found in Table 12. The budget is required to fulfill the short range needs of the preserve as described in this management plan, and to accomplish the Department goal of on-site management for all aquatic preserves by 1991, as expressed in the Agency Functional Plan.

TABLE 12

ANTICIPATED TWO-YEAR BUDGET FOR COUPON BIGHT, LIGNUMVITE KEY AND THE CARD SOUND PORTION OF BISCAYNE BAY AQUATIC PRESERVES

SALARY	1ST YEAR	2ND YEAR
ES III (with benefits)	$ 36,463	$ 37,921
ES II (with benefits)	32,109	33,393
ES I (with benefits)	26,784	27,855
Secretary (with benefits)	15,745	16,375
Environmental educator	26,784	27,855
Subtotal	$137,885	$143,399

OPERATING CAPITAL OUTLAY	
Vehicles (3 @ $12,000 each)	$ 36,000
Office equipment	11,500
Computer	5,000
Education materials	2,500
Subtotal	$ 55,000

OPERATING EXPENSES		
Rent/Gas/Phone/Supplies	$ 28,000	$ 32,000
Education supplies	1,500	1,600
Subtotal	$ 29,500	$ 33,600

TOTAL COST	$222,385	$176,999

CHAPTER IX

RESOURCE AND ACTIVITY MONITORING PROGRAM

To ensure that this management plan is effectively implemented, on-site staffing is imperative. Additional staffing will be necessary in order to institute programs targeted at 1) monitoring changes in the natural resources, 2) recording use activities, 3) tracking progress and accomplishments that are directed at retaining the original integrity and value of the preserve, and 4) preparing and conducting environmental education activities.

A. RESOURCE MONITORING

To monitor changes in the natural resources, a geographic information system (GIS) will be necessary. A GIS is a computer based system that is used to capture, edit, display, and analyze geographic information. The first GIS programs were developed about 20 years ago to manage large collections of natural resource and environmental information. Since their development, they have been used in other areas, such as utilities mapping, inventory management, and land use planning. However, their most important application continues to be natural resource monitoring and management.

Future use of a GIS system would include the periodic inventory, compilation, and analysis of temporal and spatial data concerning the present state of the natural resources within the preserve. Historical aerial photography could be computerized for comparison with later data to conduct a temporal analyxix of resource abundance. Detailed monitoring of revegetation/restoration efforts could also be computer analyzed. The on-line access to these natural resource data bases will facilitate informed management decisions concerning the use and protection of lands and their resources. Cooperation and file sharing is possible with other agencies handling such data with identical and similar systems. Similar environments and relationships between various resources may be compared and analyzed to gain a more integrated approach to protection and management.

B. ACTIVITY MONITORING

As human interaction in and around the preserve increases, additional pressures are to be expected in the form of recreational and development activities. Monitoring the types of use and their compatibility, their frequency of occurrence, as well as, proven and expected detrimental effects on the preserve's natural resources, will provide a foundation for developing any additional future plan amendments and restrictions required to protect these resources. Periodic

boat counts, user questionnaires and structure inventories are various methods that may be employed to gather relevant data on activities and user group profiles.

C. PROGRESS MONITORING

For this management plan to be effectively implemented and evaluated, it is necessary to monitor the accomplishments and progress on a regular basis. Sharing this information with other units and agencies, will help develop a team approach to problem solving and implementing management strategies.

The compilation of the monitoring program will be directed to the central office in Tallahassee in the form of a field office annual report. This information will then go into the development of a state-wide status report on the Aquatic Preserve Management Program focusing on resource restoration/deterioration, compatible and non-compatible use activities, and will aid in developing more appropriate management strategies system wide.

The field office annual report should detail the following:

1. The state of the natural environment of the aquatic preserve.

   a. Through the use of the resource inventories and the GIS system, document the status of biological resources (e.g., seagrass loss or gain).

   b. Identify the current number of structures/activities either started or completed in the preserve. These structures/activities will be categorized as follows:
      1) authorized projects (e.g., private residential single docks, multi-family, commercial),
      2) unauthorized projects, and
      3) projects not in compliance with the original authorization

2. A list of accomplishments of those policies and tasks outlined in Chapter VII.

   a. Each task will be listed and the activities required to complete that task will be detailed. If the task was not done or not completed, an explanation will be given. If the explanation was due to insufficient funding/staff, then this fact will be detailed so that an update of Chapter IX can be made.

3. Any new goals and/or objectives will be reflected in an update of Chapter VII.

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APPENDIX A

Relevant Legislation

CHAPTER 18-20
FLORIDA AQUATIC PRESERVES

18-20.001	Intent.
18-20.002	Boundaries and Scope of the Preserves.
18-20.003	Definitions.
18-20.004	Management Policies, Standards and Criteria.
18-20.005	Uses, Sales, Leases, or Transfer of Interests in Lands, or Materials, Held by the Board. (Repealed)
18-20.006	Cumulative Impacts.
18-20.007	Protection of Riparian Rights. (Repealed)
18-20.008	Inclusion of Lands, Title to Which Is Not Vested in the Board, in a Preserve.
18-20.009	Establishment or Expansion of Aquatic Preserves.
18-20.010	Exchange of Lands.
18-20.011	Gifts of Lands.
18-20.012	Protection of Indigenous Life Forms.
18-20.013	Development of Resource Inventories and Management Plans for Preserves.
18-20.014	Enforcement.
18-20.015	Application Form. (Repealed)
18-20.016	Coordination with Other Governmental Agencies.
18-20.017	Lake Jackson Aquatic Preserve.

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18-20.001 Intent.

(1) All sovereignty lands within a preserve shall be managed primarily for the maintenance of essentially natural conditions, the propagation of fish and wildlife, and public recreation, including hunting and fishing where deemed appropriate by the board, and the managing agency.

(2) The aquatic preserves which are described in 73-534, Laws of Florida, Sections 258.39, 258.391, 258.392 and 258.393, Florida Statutes, future aquatic preserves established pursuant to general or special acts of the legislature, and in Rule 18-20.002, Florida Administrative Code, were established for the purpose of being preserved in an essentially natural or existing condition so that their aesthetic, biological and scientific values may endure for the enjoyment of future generations.

(3) The preserves shall be administered and managed in accordance with the following goals:

(a) To preserve, protect, and enhance these exceptional areas of sovereignty submerged lands by reasonable regulation of human activity within the preserves through the development and implementation of a comprehensive management program;

(b) To protect and enhance the waters of the preserves so that the public may continue to enjoy the traditional recreational uses of those waters such as swimming, boating, and fishing;

(c) To coordinate with federal, state, and local agencies to aid in carrying out the intent of the Legislature in creating the preserves;

(d) To use applicable federal, state, and local management programs, which are compatible with the intent and provisions of the act and these rules, and to assist in managing the preserves;

(e) To encourage the protection, enhancement or restoration of the biological, aesthetic, or scientific values of the preserves, including but not limited to the modification of existing manmade conditions toward their natural condition, and discourage activities which would degrade the aesthetic, biological, or scientific values, or the quality, or utility of a preserve, when reviewing applications, or when developing and implementing management plans for the preserves;

(f) To preserve, promote, and utilize indigenous life forms and habitats, including but not limited to: sponges, soft coral, hard corals, submerged grasses, mangroves, salt water marshes, fresh water marshes, mud flats, estuarine, aquatic, and marine reptiles, game and non-game fish species, estuarine, aquatic and marine invertebrates, estuarine, aquatic and marine mammals, birds, shellfish and mollusks;

(g) To acquire additional title interests in lands wherever such acquisitions would serve to protect or enhance the biological, aesthetic, or scientific values of the preserves;

(h) To maintain those beneficial hydrologic and biologic functions, the benefits of which accrue to the public at large.

(4) Nothing in these rules shall serve to eliminate or alter the requirements or authority of other governmental agencies, including counties and municipalities, to protect or enhance the preserves provided that such requirements or authority are not inconsistent with the act and this chapter.

Specific Authority 120.53, 258.43(1) FS. Law Implemented 258.35, 258.36, 258.37, 258.39, 258.393 FS, Chapter 80-280 Laws of Florida. History—New 2-23-81, Amended 8-7-85, Formerly 16Q-20.01, Transferred from 16Q-20.001.

18-20.002 Boundaries and Scope of the Preserves.

(1) These rules shall only apply to those sovereignty lands within a preserve, title to which is vested in the board, and those other lands for which the board has an appropriate instrument in writing, executed by the owner, authorizing the inclusion of specific lands in an aquatic preserve pursuant to Section 2(2) of Chapter 73-534, Laws of Florida, Sections 258.40(1) and 258.41(5), Florida Statutes, future aquatic preserves established through general or special acts of the legislature, and pursuant to Rule 18-20.008, Florida Administrative Code. Any publicly owned and maintained navigation channel authorized by the United States Congress, or other public works project authorized by the United States Congress, designed to improve or maintain commerce and navigation shall be deemed to be excluded from the

provisions of this chapter, pursuant to Subsection 258.40(2), Florida Statutes. Furthermore, all lands lost by avulsion or by artificially induced erosion shall be deemed excluded from the provisions of this chapter pursuant to Subsection 258.40(3), Florida Statutes.

(2) These rules do not apply to Boca Ciega Bay, Pinellas County or Biscayne Bay Aquatic Preserves.

(3) These rules are promulgated to clarify the responsibilities of the board in carrying out its land management functions as those functions apply within the preserves. Implementation and responsibility for environmental permitting of activities and water quality protection within the preserves are vested in the Department of Environmental Regulation. Since these rules are considered cumulative with other rules, a person planning an activity within the preserves should also consult the other applicable department rules (Chapter 18-21, Florida Administrative Code, for example) as well as the rules of the Department of Environmental Regulation.

(4) These rules shall not affect previous actions of the board concerning the issuance of any easement or lease; or any disclaimer concerning sovereignty lands.

(5) The intent and specific provisions expressed in 18-20.001(e) and (f) apply generally to all existing or future aquatic preserves within the scope of this chapter. Upon completion of a resource inventory and approval of a management plan for a preserve, pursuant to 18-20.013, the type designation and the resource sought to be preserved may be readdressed by the Board.

(6) For the purpose of clarification and interpretation, the legal description set forth as follows do not include any land which is expressly recognized as privately owned upland in a pre-existing recorded mean high water line settlement agreement between the board and a private owner or owners. Provided, however, in those instances wherein a settlement agreement was executed subsequent to the passage of the Florida Coastal Mapping Act, the determination of the mean high water line shall be in accordance with the provisions of such act.

(7) Persons interested in obtaining details of particular preserves should contact the Bureau of State Lands Management, Department of Natural Resources, 3900 Commonwealth Blvd., Tallahassee, FL 32303 (telephone 904-488-2297).

(a) The preserves are described as follows:

1. Fort Clinch State Park Aquatic Preserve, as described in the Official Records of Nassau County in Book 108, pages 343-346, and in Book 111, page 409.

2. Nassau River — St. Johns River Marshes Aquatic Preserve, as described in the Official Records of Duval County in Volume 3183, pages 547-552, and in the Official Records of Nassau County in Book 108, pages 232-237.

3. Pellicer Creek Aquatic Preserve, as described in the Official Records of St. Johns County in Book 181, pages 363-366, and in the Official Records of Flagler County in Book 33, pages 131-134.

4. Tomoka Marsh Aquatic Preserve, as described in the Official Records of Flagler County in Book 33, pages 135-138, and in the Official Records of Volusia County in Book 1244, pages 615-618.

5. Wekiva River Aquatic Preserve, as described in Section 258.39(30), F.S.

6. Mosquito Lagoon Aquatic Preserve, as described in the Official Records of Volusia County in Book 1244, pages 619-623, and in the Official Records of Brevard County in Book 1143, pages 190-194.

7. Banana River Aquatic Preserve, as described in the Official Records of Brevard County in Book 1143, pages 195-198, less those lands dedicated to the U. S. A. prior to the enactment of the act, until such time as the U. S. A. no longer wishes to maintain such lands for the purpose for which they were dedicated, at which time such lands would revert to the board, and be managed as part of the preserve.

8. Indian River — Malabar to Sebastian Aquatic Preserve, as described in the Official Records of Brevard County in Book 1143, pages 199-202, and in the Official Records of Indian River County in Book 368, pages 5-8.

9. Indian River — Vero Beach to Fort Pierce Aquatic Preserve, as described in the Official Records of Indian River County in Book 368, pages 9-12, and in the Official Records of St. Lucie County in Book 187, pages 1083-1086.

10. Jensen Beach to Jupiter Inlet Aquatic Preserve, as described in the Official Records of St. Lucie County in Book 218, pages 2865-2869.

11. North Fork, St. Lucie Aquatic Preserve, as described in the Official Records of Martin County in Book 337, pages 2159-2162, and in the Official Records of St. Lucie County in Book 201, pages 1676-1679.

12. Loxahatchee River — Lake Worth Creek Aquatic Preserve, as described in the Official Records of Martin County in Book 320, pages 193-196, and in the Official Records of Palm Beach County in Volume 1860, pages 806-809.

13. Biscayne Bay — Cape Florida to Monroe County Line Aquatic Preserve, as described in the Official Records of Dade County in Book 7055, pages 852-856, less, however, those lands and waters as described in Section 258.165, F. S., (Biscayne Bay Aquatic Preserve Act of 1974), and those lands and waters within the Biscayne National Park.

14. Lignumvitae Key Aquatic Preserve, as described in the Official Records of Monroe County in Book 502, pages 139-142.

15. Coupon Bight Aquatic Preserve, as described in the Official Records of Monroe County in Book 502, pages 143-146.

16. Cape Romano — Ten Thousand Islands Aquatic Preserve, as described in the Official Records of Collier County in Book 381, pages 298-301.

17. Rookery Bay Aquatic Preserve, as described in Section 258.39(31), FS.

18. Estero Bay Aquatic Preserve as described in Section 258.39(28), Florida Statutes.

19. Pine Island Sound Aquatic Preserve, as described in the Official Records of Lee County in Book 648, pages 732-736.

20. Matlacha Pass Aquatic Preserve, as described in the Official Records of Lee County in Book 800, pages 725-728.

21. Gasparilla Sound — Charlotte Harbor Aquatic Preserve, as described in Section 258.392, F.S.

22. Cape Haze Aquatic Preserve, as described in Section 258.39(29), F.S.

23. Cockroach Bay Aquatic Preserve, as described in Section 258.391, F.S.

24. St. Martins Marsh Aquatic Preserve, as described in the Official Records of Citrus County in Book 276, pages 238-241.

25. Alligator Harbor Aquatic Preserve, as described in the Official Records of Franklin County in Volume 98, pages 82-85.

26. Apalachicola Bay Aquatic Preserve, as described in the Official Records of Gulf County in Book 46, pages 77-81, and in the Official Records of Franklin County in Volume 98, pages 102-106.

27. St. Joseph Bay Aquatic Preserve, as described in the Official Records of Gulf County in Book 46, pages 73-76.

28. St. Andrews State Park Aquatic Preserve, as described in the Official Records of Bay County in Book 379, pages 547-550.

29. Rocky Bayou State Park Aquatic Preserve, as described in the Official Records of Okaloosa County in Book 593, pages 742-745.

30. Yellow River Marsh Aquatic Preserve, as described in the Official Records of Santa Rosa County in Book 206, pages 568-571.

31. Fort Pickens State Park Aquatic Preserve, as described in the Official Records of Santa Rosa County in Book 220, pages 60-63, in the Official Records of Escambia County in Book 518, pages 659-662, less the lands dedicated to the U. S. A. for the establishment of the Gulf Islands National Seashore prior to the enactment of the act, until such time as the U. S. A. no longer wishes to maintain such lands for the purpose for which they were dedicated, at which time such lands would revert to the board and be managed as part of the preserve.

32. For the purpose of this section the boundaries of the Lake Jackson Aquatic Preserve, shall be the body of water in Leon County known as Lake Jackson in Sections 1, 2, 3, 5, 10, 11 and 14, Township 1 North, Range 1 West and Sections 11, 12, 13, 14, 15, 21, 22, 23, 26, 27, 28, 29, 32, 33, 34, and 35, Township 2 North, Range 1 West lying below the ordinary high water line. Such lands shall include the submerged bottom lands and the water column upon such lands, as well as all publicly owned islands, within the boundaries of the preserve. Any privately held upland within the boundaries of the preserve shall be deemed to be excluded therefrom; provided that the Board may negotiate an arrangement with any such private upland owner by which such land may be included in the preserve.

33. Terra Ceia Aquatic Preserve, as described in Section 258.393, Florida Statutes.

34. Future aquatic preserves established pursuant to general or special acts of the legislature.

Specific Authority 120.53, 258.43(1) FS. Law Implemented 258.39, 258.391, 258.392, 258.393, 258.40, 258.41, 258.42, 258.43, 258.44, 258.45 FS. History—New 2-23-81, Amended 8-7-85, Formerly 16Q-20.02, Transferred from 16Q-20.002.

18-20.003 Definitions. When used in these rules, the following words shall have the indicated meaning unless the context clearly indicates otherwise:

(1) "Act" means the provisions of Section 258.35 through 258.46, F.S., the Florida Aquatic Preserve Act.

(2) "Activity" means any project and such other human action within the preserve requiring board approval for the use, sale, lease or transfer of interest in sovereignty lands or materials, or which may require a license from the Department of Environmental Regulation.

(3) "Aesthetic values" means scenic characteristics or amenities of the preserve in its essentially natural state or condition, and the maintenance thereof.

(4) "Applicant" means any person making application for a permit, license, conveyance of an interest in state owned lands or any other necessary form of governmental approval in order to perform an activity within the preserve.

(5) "Beneficial biological functions" means interactions between flora, fauna and physical or chemical attributes of the environment, which provide benefits that accrue to the public at large, including, but not limited to: nutrient, pesticide and heavy metal uptake; sediment retention; nutrient conversion to biomass; nutrient recycling and oxygenation.

(6) "Beneficial hydrological functions" means interactions between flora, fauna and physical geological or geographical attributes of the environment, which provide benefits that accrue to the public at large, including, but not limited to: retardation of storm water flow; storm water retention; and water storage, and periodical release;

(7) "Biological values" means the preservation and promotion of indigenous life forms and habitats including, but not limited to: sponges, soft corals, hard corals, submerged grasses, mangroves, saltwater marshes, fresh water marshes, mud flats, marine, estuarine, and aquatic reptiles, games and non-games fish species, marine, estuarine, and aquatic mammals, marine, estuarine, and aquatic invertebrates, birds and shellfish.

(8) "Board" means the Governor and Cabinet sitting as the Board of Trustees of the Internal Improvement Trust Fund.

(9) "Channel" means a trench, the bottom of which is normally covered entirely by water, with the upper edges of its sides normally below water.

(10) "Commercial, industrial and other revenue generating/income related docks" means docking facilities for an activity which produces income, through rental or any other means, or which serves as an accessory facility to other rental, commercial or industrial operations. It shall include, but not be limited to docking for: marinas, restaurants, hotels, motels, commercial fishing, shipping, boat or ship construction, repair, and sales.

(11) "Department" means the State of Florida Department of Natural Resources, as administrator for the board.

(12) "Division" means the Division of State Lands, which performs all staff duties and functions related to the administration of lands title to which is, or will be, vested in the board, pursuant to section 253.002, F.S.

(13) "Dock" means a fixed or floating structure, including moorings, used for the purpose of berthing buoyant vessels either temporarily or indefinitely.

(14) "Essentially natural condition" means those functions which support the continued existence or encourage the restoration of the diverse population of indigenous life forms and habitats to the extent they existed prior to the significant development adjacent to and within the preserve.

(15) "Extreme hardship" means a significant burden, unique to the applicant and not shared by property owners in the area. Self-imposed circumstances caused to any degree by actions of any person subsequent to the enactment of the Act shall not be construed as an extreme hardship. Extreme hardship under this act shall not be construed to include any hardship which arises in whole or in part from the effect of other federal, state or local laws, ordinances, rules or regulations. The term may be inherent in public projects which are shown to be a public necessity.

(16) "Fill" means materials from any source, deposited by any means onto sovereignty lands, either for the purpose of creating new uplands or for any other purpose, including spoiling of dredged materials. For the purpose of this rule, the placement of pilings or riprap shall not be considered to be filling.

(17) "Lease" means a conveyance of interest in lands, title to which is vested in the board, granted in accordance with specific terms set forth in writing.

(18) "Marina" means a small craft harbor complex used primarily for recreation.

(19) "Oil and gas transportation facilities" means those structures necessary for the movement of oil and gas from the production site to the consumer.

(20) "Person" means individuals, minors, partnerships, corporations, joint ventures, estates, trusts, syndicates, fiduciaries, firms, and all other associations and combinations, whether public or private, including governmental entities.

(21) "Pier" means a structure in, on, or over sovereignty lands, which is used by the public primarily for fishing, swimming, or viewing the preserve. A pier shall not include a dock.

(22) "Preserve" means any and all of those areas which are exceptional areas of sovereignty lands and the associated water body so designated in Section 258.39, 258.391, and 258.392, F.S., including all sovereignty lands, title to which is vested in the board, and such other lands as the board may acquire or approve for inclusion, and the water column over such lands, which have been set aside to be maintained in an essentially natural or existing condition of indigenous flora and fauna and their supporting habitat and the natural scenic qualities and amenities thereof.

(23) "Private residential single dock" means a dock which is used for private, recreational or leisure purposes for a single family residence, cottage or other such single dwelling unit and which is designed to moor no more than two boats.

(24) "Private residential multi-slip dock" means a docking facility which is used for private recreational or leisure purposes for multi-unit residential dwellings which shall include but is not limited to condominiums, townhouses, subdivisions and other such dwellings or residential areas and which is designed to moor three or more boats. Yacht clubs associated with residential developments, whose memberships or utilization of the docking facility requires some real property interest in the residential area, shall also be included.

(25) "Public interest" means demonstrable environmental, social, and economic benefits which would accrue to the public at large as a result of a proposed action, and which would clearly exceed all demonstrable environmental, social, and economic costs of the proposed action. In determining the public interest in a request for use, sale, lease, or transfer of interest in sovereignty lands or severance of materials from sovereignty lands, the board shall consider the ultimate project and purpose to be served by said use, sale, lease, or transfer of lands or materials.

(26) "Public navigation project" means a project primarily for the purpose of navigation which is authorized and funded by the United States Congress or by port authorities as defined by Section 315.02(2), F.S.

(27) "Public necessity" means the works or improvements required for the protection of the health and safety of the public, consistent with the Act and these rules, for which no other reasonable alternative exists.

(28) "Public utilities" means those services, provided by persons regulated by the Public Service Commission, or which are provided by rural cooperatives, municipalities, or other governmental agencies, including electricity, telephone, public water and wastewater services, and structures necessary for the provision of these services.

(29) "Quality of the preserve" means the degree of the biological, aesthetic and scientific values of the preserve necessary for present and future enjoyment of it in an essentially natural condition.

(30) "Resource management agreement" means a contractual agreement between the board and one

or more parties which does not create an interest in real property but merely authorizes conduct of certain management activities on lands held by the board.

(31) "Resource Protection Area (RPA) 1" — Areas within the aquatic preserves which have resources of the highest quality and condition for that area. These resources may include, but are not limited to corals; marine grassbeds; mangrove swamps; salt-water marsh; oyster bars; archaeological and historical sites; endangered or threatened species habitat; and, colonial water bird nesting sites.

(32) "Resource Protection Area 2" — Areas within the aquatic preserves which are in transition with either declining resource protection area 1 resources or new pioneering resources within resource protection area 3.

(33) "Resource Protection Area 3" — Areas within the aquatic preserve that are characterized by the absence of any significant natural resource attributes.

(34) "Riparian rights" means those rights incident to lands bordering upon navigable waters, as recognized by the courts of this state and common law.

(35) "Sale" means a conveyance of interest in lands, by the board, for consideration.

(36) "Scientific values" means the preservation and promotion of certain qualities or features which have scientific significance.

(37) "Shore protection structure" means a type of coastal construction designed to minimize the rate of erosion. Coastal construction includes any work or activity which is likely to have a material physical effect on existing coastal conditions or natural shore processes.

(38) "Sovereignty lands" means those lands including, but not limited to: tidal lands, islands, sandbars, shallow banks, and lands waterward of the ordinary or mean highwater line, to which the State of Florida acquired title on March 3, 1845, by virtue of statehood, and of which it has not since divested its title interest. For the purposes of this rule sovereignty lands shall include all submerged lands within the boundaries of the preserve, title to which is held by the board.

(39) "Spoil" means materials dredged from sovereignty lands which are redeposited or discarded by any means, onto either sovereignty lands or uplands.

(40) "Transfer" means the act of the board by which any interest in lands, including easements, other than sale or lease, is conveyed.

(41) "Utility of the preserve" means fitness of the preserve for the present and future enjoyment of its biological, aesthetic and scientific values, in an essentially natural condition.

(42) "Water dependent activity" means an activity which can only be conducted on, in, over, or adjacent to, water areas because the activity requires direct access to the water body or sovereignty lands for transportation, recreation, energy production or transmission, or source of water and where the use of the water or sovereignty lands is an integral part of the activity.

Specific Authority 258.43(1) FS. Law Implemented 258.37, 258.43(1) FS. History—New 2-25-81. Amended 8-7-85. Formerly 16Q-20.03. Transferred from 16Q-20.003.

18-20.004 Management Policies, Standards and Criteria. The following management policies, standards and criteria are supplemental to Chapter 18-21, Florida Administrative Code (Sovereignty Submerged Lands Management) and shall be utilized in determining whether to approve, approve with conditions or modifications or deny all requests for activities on sovereignty lands in aquatic preserves.

(1) GENERAL PROPRIETARY

(a) In determining whether to approve or deny any request the Board will evaluate each on a case-by-case basis and weigh any factors relevant under Chapter 253 and/or 258, Florida Statutes. The Board, acting as Trustees for all state-owned lands, reserves the right to approve, modify or reject any proposal.

(b) There shall be no further sale, lease or transfer of sovereignty lands except when such sale, lease or transfer is in the public interest (see Section 18-20.004(2) Public Interest Assessment Criteria).

(c) There shall be no construction of seawalls waterward of the mean or ordinary high water line; or filling waterward of the mean or ordinary high water line except in the case of public road and bridge projects where no reasonable alternative exists.

(d) There shall, in no case, be any dredging waterward of the mean or ordinary high water line for the sole or primary purpose of providing fill for any area landward of the mean or ordinary high water line.

(e) A lease, easement or consent of use may be authorized only for the following activities:

1. a public navigation project;

2. maintenance of an existing navigational channel;

3. installation or maintenance of approved navigational aids;

4. creation or maintenance of a commercial/industrial dock, pier or a marina;

5. creation or maintenance of private docks for reasonable ingress and egress of riparian owners;

6. minimum dredging for navigation channels attendant to docking facilities;

7. creation or maintenance of a shore protection structure;

8. installation or maintenance of oil and gas transportation facilities;

9. creation, maintenance, replacement or expansion of facilities required for the provision of public utilities; and

10. other activities which are a public necessity or which are necessary to enhance the quality or utility of the preserve and which are consistent with the act and this chapter.

(f) For activities listed in paragraphs 18-20.004(1)(e)1.—10. above, the activity shall be

designed so that the structure or structures to be built in, on or over sovereignty lands are limited to structures necessary to conduct water dependent activities.

(g) For activities listed in paragraphs 18-20.004(1)(e)7., 8., 9. and 10. above, it must be demonstrated that no other reasonable alternative exists which would allow the proposed activity to be constructed or undertaken outside the preserve.

(h) The use of state-owned lands for the purpose of providing private or public road access to islands where such access did not previously exist shall be prohibited. The use of state-owned lands for the purpose of providing private or public water supply to islands where such water supply did not previously exist shall be prohibited.

(i) Except for public navigation projects and maintenance dredging for existing channels and basins, any areas dredged to improve or create navigational access shall be incorporated into the preempted area of any required lease or be subject to the payment of a negotiated private easement fee.

(j) Private residential multi-slip docking facilities shall require a lease.

(k) Aquaculture and beach renourishment activities which comply with the standards of this rule chapter and Chapter 18-21, Florida Administrative Code, may be approved by the board, but only subsequent to a formal finding of compatibility with the purposes of Chapter 258, Florida Statutes, and this rule chapter.

(l) Other uses of the preserve, or human activity within the preserve, although not originally contemplated, may be approved by the board, but only subsequent to a formal finding of compatibility with the purposes of Chapter 258, Florida Statutes, and this rule chapter.

(2) PUBLIC INTEREST ASSESSMENT CRITERIA

In evaluating requests for the sale, lease or transfer of interest, a balancing test will be utilized to determine whether the social, economic and/or environmental benefits clearly exceed the costs.

(a) GENERAL BENEFIT/COST CRITERIA:

1. any benefits that are balanced against the costs of a particular project shall be related to the affected aquatic preserve;

2. in evaluating the benefits and costs of each request, specific consideration and weight shall be given to the quality and nature of the specific aquatic preserve. Projects in the less developed, more pristine aquatic preserves such as Apalachicola Bay shall be subject to a higher standard than the more developed urban aquatic preserves such as Boca Ciega Bay; and,

3. for projects in aquatic preserves with adopted management plans, consistency with the management plan will be weighed heavily when determining whether the project is in the public interest.

(b) BENEFIT CATEGORIES:

1. public access (public boat ramps, boatslips, etc.);

2. provide boating and marina services (repair, pumpout, etc.);

3 improve and enhance public health, safety, welfare, and law enforcement;

4. improved public land management;

5. improve and enhance public navigation;

6. improve and enhance water quality;

7. enhancement/restoration of natural habitat and functions; and

8. improve/protect endangered/threatened/unique species.

(c) COSTS:

1. reduced/degraded water quality;

2. reduced/degraded natural habitat and function;

3. destruction, harm or harassment of endangered or threatened species and habitat;

4. preemption of public use;

5. increasing navigational hazards and congestion;

6. reduced/degraded aesthetics; and

7. adverse cumulative impacts.

(d) EXAMPLES OF SPECIFIC BENEFITS:

1. donation of land, conservation easements, restrictive covenants or other title interests in or contiguous to the aquatic preserve which will protect or enhance the aquatic preserve;

2. providing access or facilities for public land management activities;

3. providing public access easements and/or facilities, such as beach access, boat ramps, etc.;

4. restoration/enhancement of altered habitat or natural functions, such as conversion of vertical bulkheads to riprap and/or vegetation for shoreline stabilization or re-establishment of shoreline or submerged vegetation;

5. improving fishery habitat through the establishment of artificial reefs or other such projects, where appropriate;

6. providing sewage pumpout facilities where normally not required, in particular, facilities open to the general public;

7. improvements to water quality such as removal of toxic sediments, increased flushing and circulation, etc.;

8. providing upland dry storage as an alternative to wetslip; and

9. marking navigation channels to avoid disruption of shallow water habitats.

(3) RESOURCE MANAGEMENT

(a) All proposed activities in aquatic preserves having management plans adopted by the Board must demonstrate that such activities are consistent with the management plan.

(b) No drilling of oil, gas or other such wells shall be allowed.

(c) Utility cables, pipes and other such structures shall be constructed and located in a manner that will cause minimal disturbance to submerged land resources such as oyster bars and submerged grass beds and do not interfere with traditional public uses.

(d) Spoil disposal within the preserves shall be strongly discouraged and may be approved only

structures shall be constructed and located in a manner that will cause minimal disturbance to submerged land resources such as oyster bars and submerged grass beds and do not interfere with traditional public uses.

(d) Spoil disposal within the preserves shall be strongly discouraged and may be approved only where the applicant has demonstrated that there is no other reasonable alternative and that activity may be beneficial to, or at a minimum, not harmful to the quality and utility of the preserve.

(4) RIPARIAN RIGHTS

(a) None of the provisions of this rule shall be implemented in a manner that would unreasonably infringe upon the traditional, common law and statutory riparian rights of upland riparian property owners adjacent to sovereignty lands.

(b) The evaluation and determination of the reasonable riparian rights of ingress and egress for private, residential multi-slip docks shall be based upon the number of linear feet of riparian shoreline.

(c) For the purposes of this rule, a private, residential, single docking facility which meets all the requirements of Rule 18-20.004(5) shall be deemed to meet the public interest requirements of Rule 18-20.004(1)(b), Florida Administrative Code. However, the applicants for such docking facilities must apply for such consent and must meet all of the requirements and standards of this rule chapter.

(5) STANDARDS AND CRITERIA FOR DOCKING FACILITIES

(a) All docking facilities, whether for a single or multi-slip residential or commercial, shall be subject to the following standards and criteria:

1. no dock shall extend waterward or the mean or ordinary high water line more than 500 feet or 20 percent of the width of the waterbody at that particular location whichever is less;

2. certain docks may fall within areas of special or unique importance. These areas may be of significant biological, scientific, historic and/or aesthetic value and require special management considerations. Modifications may be more restrictive than the normally accepted criteria. Such modifications shall be determined on a case-by-case analysis, and may include, but shall not be limited to changes in location, configuration, length, width and height;

3. the number, lengths, drafts and types of vessels allowed to utilize the proposed facility may also be stipulated; and

4. where local governments have more stringent standards and criteria for docking facilities, the more stringent standards for the protection and enhancement of the aquatic preserve shall prevail.

(b) Private residential single docks shall conform to the following specific design standards and criteria:

1. any main access dock shall be limited to a maximum width of four (4) feet;

2. the dock decking design and construction will insure maximum light penetration, with full consideration of safety and practicality;

3. the dock will extend out from the shoreline no further than to a maximum depth of minus four (− 4) feet (mean low water);

4. when the water depth is minus four (− 4) feet (mean low water) at an existing bulkhead the maximum dock length from the bulkhead shall be 25 feet, subject to modifications accommodating shoreline vegetation overhang;

5. wave break devices, when necessary, shall be designed to allow for maximum water circulation and shall be built in such a manner as to be part of the dock structure;

6. terminal platform size shall be no more than 160 square feet; and

7. dredging to obtain navigable water depths in conjunction with private residential, single dock applications is strongly discouraged.

(c) Private residential multi-slip docks shall conform to the following specific design standards and criteria:

1. the area of sovereignty, submerged land preempted by the docking facility shall not exceed the square footage amounting to ten times the riparian waterfront footage of the affected waterbody of the applicant, or the square footage attendant to providing a single dock in accordance with the criteria for private residential single docks, whichever is greater. A conservation easement or other such use restriction acceptable to the Board must be placed on the riparian shoreline, used for the calculation of the 10:1 threshold, to conserve and protect shoreline resources and subordinate/waive any further riparian rights of ingress and egress for additional docking facilities;

2. docking facilities and access channels shall be prohibited in Resource Protection Area 1 or 2, except as allowed pursuant to Section 258.42(3)(e)1., Florida Statutes, while dredging in Resource Protection Area 3 shall be strongly discouraged;

3. docking facilities shall only be approved in locations having adequate existing water depths in the boat mooring, turning basin, access channels, and other such areas which will accommodate the proposed boat use in order to insure that a minimum of one foot clearance is provided between the deepest draft of a vessel and the bottom at mean low water;

4. main access docks and connecting or cross walks shall not exceed six (6) feet in width;

5. terminal platforms shall not exceed eight (8) feet in width;

6. finger piers shall not exceed three (3) feet in width, and 25 feet in length;

7. pilings may be utilized as required to provide adequate mooring capabilities; and

8. the following provisions of Rule 18-20.004(5)(d) shall also apply to private residential multi-slip docks.

(d) Commercial, industrial and other revenue generating/income related docking facilities shall conform to the following specific design standards and criteria:

1. docking facilities shall only be located in or near areas with good circulation, flushing and adequate water depths;

2. docking facilities and access channels shall be prohibited in Resource Protection Area 1 or 2, except as allowed pursuant to Sections 258.42(3)(e)1., Florida Statutes; while dredging in Resource Protection Area 3 shall be strongly discouraged;

3. the docking facilities shall not be located in Resource Protection Area 1 or 2; however, main access docks may be allowed to pass through Resource Protection Area 1 or 2, that are located along the shoreline, to reach an acceptable Resource Protection Area 3, provided that such crossing will generate minimal environmental impact;

4. beginning July 1, 1986 new docking facilities may obtain a lease only where the local governments have an adopted marina plan and/or policies dealing with the siting of commercial/industrial and private, residential, multi-slip docking facilities in their local government comprehensive plan;

5. the siting of the docking facilities shall also take into account the access of the boat traffic to avoid marine grassbeds or other aquatic resources in the surrounding areas;

6. the siting of new facilities within the preserve shall be secondary to the expansions of existing facilities within the preserve when such expansion is consistent with the other standards;

7. the location of new facilities and expansion of existing facilities shall consider the use of upland dry storage as an alternative to multiple wet-slip docking;

8. marina siting will be coordinated with local governments to insure consistency with all local plans and ordinances;

9. marinas shall not be sited within state designated manatee sanctuaries; and

10. in any areas with known manatee concentrations, manatee warning/notice and/or speed limit signs shall be erected at the marina and/or ingress and egress channels, according to Florida Marine Patrol specifications.

(c) Exceptions to the standards and criteria listed in Rule 18-20.004(5), Florida Administrative Code, may be considered, but only upon demonstration by the applicant that such exceptions are necessary to insure reasonable riparian ingress and egress.

(6) MANAGEMENT AGREEMENTS

The board may enter into management agreements with local agencies for the administration and enforcement of standards and criteria for private residential single docks.

(7) In addition to the policies, standards and criteria delineated in subsections (1) through (6), the provisions of the following management plans apply to specific aquatic preserves and are incorporated herein by reference. Where regulatory criteria in 18-20, F. A. C., may differ with specific policies in the management plans listed herein, the general rule criteria shall prevail.

	Date Adopted
Alligator Harbor	September 23, 1986
Banana River	September 17, 1985
Cockroach Bay	April 21, 1987
Estero Bay	September 6, 1983
Charlotte Harbor (Cape Haze, Gasparilla Sound-Charlotte Harbor, Matlacha Pass and Pine Island Sound)	May 18, 1983
Indian River-Malabar to Vero Beach	January 21, 1986
Indian River Lagoon (Vero Beach to Fort Pierce and Jensen Beach to Jupiter Inlet)	January 22, 1985
Loxahatchee River-Lake Worth Creek	June 12, 1984
Nassau River-St. Johns River Marshes and Fort Clinch State Park	April 22, 1986
North Fork of the St. Lucie River	May 22, 1984
St. Joseph Bay	June 2, 1987
St. Martins Marsh	September 9, 1987
Terra Ceia	April 21, 1987
Wekiva River	August 25, 1987

Specific Authority 258.43(1) FS. Law Implemented 258.41, 258.42, 258.43(1), 258.44 FS. History—New 2-25-81, Amended 6-7-85, Formerly 16Q-20.004, Transferred from 16Q-20.004, Amended 9-4-88.

18-20.005 Uses, Sales, Leases, or Transfer of Interests in Lands, or Materials, Held by the Board.

Specific Authority 258.43(1) FS. Law Implemented 253.02, 253.12, 258.42 FS. History—New 2-25-81, Repealed 8-7-85, Formerly 16Q-20.05, Transferred from 16Q-20.005.

18-20.006 Cumulative Impacts. In evaluating applications for activities within the preserves or which may impact the preserves, the department recognizes that, while a particular alteration of the preserve may constitute a minor change, the cumulative effect of numerous such changes often results in major impairments to the resources of the preserve. Therefore, the department shall evaluate a particular site for which the activity is proposed with the recognition that the activity may, in conjunction with other activities adversely affect the preserve which is part of a complete and interrelated system. The impact of a proposed activity shall be considered in light of its cumulative impact on the preserve's natural system. The department shall include as a part of its evaluation of an activity:

(1) The number and extent of similar human actions within the preserve which have previously affected or are likely to affect the preserve, whether considered by the department under its current authority or which existed prior to or since the enactment of the Act; and

(2) The similar activities within the preserve

which are currently under consideration by the department; and

(3) Direct and indirect effects upon the preserve and adjacent preserves, if applicable, which may reasonably be expected to result from the activity; and

(4) The extent to which the activity is consistent with management plans for the preserve, when developed; and

(5) The extent to which the activity is permissible within the preserve in accordance with comprehensive plans adopted by affected local governments, pursuant to section 163.3161, F.S., and other applicable plans adopted by local, state, and federal governmental agencies;

(6) The extent to which the loss of beneficial hydrologic and biologic functions would adversely impact the quality or utility of the preserve; and

(7) The extent to which mitigation measures may compensate for adverse impacts.

Specific Authority 258.43(1) FS. Law Implemented 258.36, 258.43, 258.44 FS. History—New 2-25-81, Formerly 16Q-20.06, Transferred from 16Q-20.006.

18-20.007 Protection of Riparian Rights.

Specific Authority 258.43(1) FS. Law Implemented 258.123, 258.124(8), 258.44 FS. History—New 2-25-81, Repealed 6-7-85, Formerly 16Q-20.07, Transferred from 16Q-20.007.

18-20.008 Inclusion of Lands, Title to Which Is Not Vested in the Board, in a Preserve.

(1) Lands and water bottoms which are within designated aquatic preserve boundaries, or adjacent thereto and which are owned by other governmental agencies, may be included in an aquatic preserve upon specific authorization for inclusion by an appropriate instrument in writing executed by the agency.

(2) Lands and water bottoms which are within designated aquatic preserve boundaries or adjacent thereto, and which are in private ownership, may be included in an aquatic preserve upon specific authorization for inclusion by an appropriate instrument in writing executed by the owner.

(3) The appropriate instrument shall be either a dedication in perpetuity, or a lease. Such lease shall contain the following conditions:

(a) The term of the lease shall be for a minimum period of ten years.

(b) The board shall have the power and duty to enforce the provisions of each lease agreement, and shall additionally have the power to terminate any lease if the termination is in the best interest of the aquatic preserve system, and shall have the power to include such lands in any agreement for management of such lands.

(c) The board shall pay no more than $1 per year for any such lease.

Specific Authority 258.43(1) FS. Law Implemented 258.40, 258.41 FS. History—New 2-25-81, Formerly 16Q-20.08, Transferred from 16Q-20.008.

18-20.009 Establishment or Expansion of Aquatic Preserves.

(1) The board may expand existing preserves or establish additional areas to be included in the aquatic preserve system, subject to confirmation by the legislature.

(2) The board may, after public notice and public hearing in the county or counties in which the proposed expanded or new preserve is to be located, adopt a resolution formally setting aside such areas to be included in the system.

(3) The resolution setting aside an aquatic preserve area shall include:

(a) A legal description of the area to be included. A map depicting the legal description shall also be attached.

(b) The designation of the type of aquatic preserve.

(c) A general statement of what is sought to be preserved.

(d) A statement that the area established as a preserve shall be subject to the management criteria and directives of this chapter.

(e) A directive to develop a natural resource inventory and a management plan for the area being established as an aquatic preserve.

(4) Within 30 days of the designation and establishment of an aquatic preserve, the board shall record in the public records of the county or counties in which the preserve is located a legal description of the preserve.

Specific Authority 258.43(1) FS. Law Implemented 258.41 FS. History—New 2-25-81, Formerly 16Q-20.09, Transferred from 16Q-20.009.

18-20.010 Exchange of Lands. The board in its discretion may exchange lands for the benefit of the preserve, provided that:

(1) In no case shall an exchange result in any land or water area being withdrawn from the preserve; and

(2) Exchanges shall be in the public interest and shall maintain or enhance the quality or utility of the preserve.

Specific Authority 258.43(1) FS. Law Implemented 258.41(5), 258.42(1) FS. History—New 2-25-81, Formerly 16A-20.10, Transferred from 16Q-20.010.

18-20.011 Gifts of Lands. The board in its discretion may accept any gifts of lands or interests in lands within or contiguous to the preserve to maintain or enhance the quality and utility of the preserve.

Specific Authority 258.43(1) FS. Law Implemented 258.42(5) FS. History—New 2-25-81, Formerly 16Q-20.11, Transferred from 16Q-20.011.

18-20.012 Protection of Indigenous Life Forms. The taking of indigenous life forms for sale or commercial use is prohibited, except that this prohibition shall not extend to the commercial taking of fin fish, crustacea or mollusks, except as prohibited under applicable laws, rules or regulations. Members of the public may exercise their rights to fish, so long as not contrary to other statutory and regulatory provisions controlling such activities.

Specific Authority 258.43(1) FS. Law Implemented 258.43(1) FS. History—New 2-25-81, Formerly 16Q-20.12, Transferred from 16Q-20.012.

18-20.013 Development of Resource Inventories and Management Plans for Preserves.

(1) The board authorizes and directs the division to develop a resource inventory and management plan for each preserve.

(2) The division may perform the work to develop the inventories and plans, or may enter into agreements with other persons to perform the work. In either case, all work performed shall be subject to board approval.

Specific Authority 258.43(1) FS. Law Implemented 253.03(7), 253.03(8) FS. History—New 2-25-81, Amended 8-7-85, Formerly 16Q-20.13, Transferred from 16Q-20.013.

18-20.014 Enforcement. The rules shall be enforced as provided in Section 258.46.

Specific Authority 258.43(1) FS. Law Implemented 258.46 FS. History—New 2-25-81, Formerly 16Q-20.14, Transferred from 16Q-20.014.

18-20.015 Application Form.

Specific Authority 253.43(1) FS. Law Implemented 258.43 FS. History—New 2-25-81, Repealed 8-7-85, Formerly 16Q-20.15, Transferred from 16Q-20.015.

18-20.016 Coordination with Other Governmental Agencies. Where a Department of Environmental Regulation permit is required for activities on sovereignty lands the department will coordinate with the Department of Environmental Regulation to obtain a copy of the joint Department of Army/Florida Department of Environmental Regulation permit application and the biological survey. The information contained in the joint permit application and biological assessment shall be considered by the department in preparing its staff recommendations to the board. The board may also consider the reports of other governmental agencies that have related management or permitting responsibilities regarding the proposed activity.

Specific Authority 253.43(1) FS. Law Implemented 258.43 FS. History—New 2-25-81, Formerly 16Q-20.16, Transferred from 16Q-20.016.

18-20.017 Lake Jackson Aquatic Preserve. In addition to the provisions of Rules 18-20.001 through 18-20.016, the following requirements shall also apply to all proposed activities within the Lake Jackson Aquatic Preserve. If any provisions of this Rule are in conflict with any provisions of Rules 18-20.001 through 18-20.016 or Chapter 73-534, Laws of Florida, the stronger provision for the protection or enhancement of the aquatic preserve shall prevail.

(1) No further sale, transfer or lease of sovereignty lands in the preserve shall be approved or consummated by the Board, except upon a showing of extreme hardship on the part of the applicant or when the board shall determine such sale, transfer or lease to be in the public interest.

(2) No further dredging or filling of sovereignty lands of the preserve shall be approved or tolerated by the Board of Trustees except:

(a) Such minimum dredging and spoiling as may be authorized for public navigation projects or for preservation of the lake according to the expressed intent of Chapter 73-534, Laws of Florida; and

(b) Such other alteration of physical conditions as may be necessary to enhance the quality or utility of the preserve.

(3) There shall be no drilling of wells, excavation for shell or minerals, and no erection of structures (other than docks), within the preserve, unless such activity is associated with activity authorized by Chapter 73-534, Laws of Florida.

(4) The Board shall not approve the relocations of bulkhead lines within the preserve.

(5) Notwithstanding other provisions of this act, the board may, respecting lands lying within the Lake Jackson basin:

(a) Enter into agreements for and establish lines delineating sovereignty and privately owned lands;

(b) Enter into agreements for the exchange and exchange sovereignty lands for privately owned lands;

(c) Accept gifts of land within or contiguous to the preserve.

Specific Authority 258.39(26) FS. Law Implemented 258.39(26), 258.43 FS. History—New 8-7-85, Formerly 16Q-20.017, Transferred from 16Q-20.017.