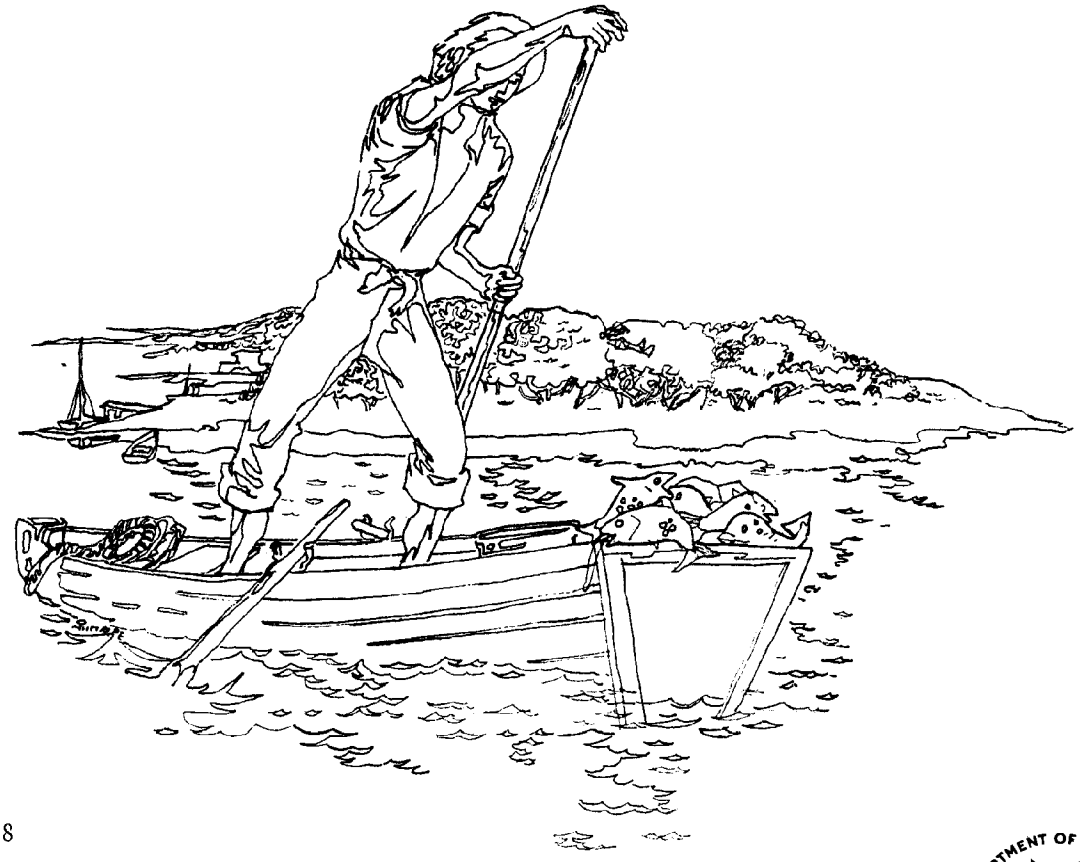
Proposed La Parguera National Marine Sanctuary
Draft Environmental Impact Statement
and
Management Plan



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1983

U.S. Department of Commerce
National Oceanic and Atmospheric Administration
January 1983

UNITED STATES DEPARTMENT OF COMMERCE

DRAFT ENVIRONMENTAL IMPACT STATEMENT AND MANAGEMENT PLAN FOR THE PROPOSED LA PARGUERA NATIONAL MARINE SANCTUARY

JANUARY 1983

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Designation: Draft Environmental Impact Statement/Management Plan

Title: Proposed La Parguera National Marine Sanctuary

Abstract: The National Oceanic and Atmospheric Administration (NOAA) proposes to designate 68.27 square nautical miles of waters off an area of southwest Puerto Rico as a national marine sanctuary. The designation would result in implementation of a plan which will establish a framework for comprehensive management; including surveillance and enforcement, resource studies, and interpretive programs.

Specific regulations are proposed that control the taking of coral, wastewater discharges, cutting of mangroves, and prohibit gear used for the illegal taking of turtles. The Interpretive Program proposes the development of visitor centers at La Parguera and Cabo Rojo; a mangrove boardwalk and trails, and a program of exhibits and educational material for the public. The Resource Studies Plan proposes to assess and monitor water quality and circulation, endangered species and fishery populations. Data from the resource studies would be used by sanctuary managers to make decisions on sanctuary operations. Alternatives to the proposed action include the no action alternative, low and high cost options, and a non-regulatory alternative.

Lead Agency: U. S. Department of Commerce
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National Ocean Service
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DRAFT ENVIRONMENTAL IMPACT STATEMENT AND MANAGEMENT PLAN FOR THE PROPOSED LA PARGUERA NATIONAL MARINE SANCTUARY

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Note to Reader:

This document is both a draft management plan and a draft environmental impact statement for the proposed La Parguera National Marine Sanctuary. Some of the section headings and their order are arranged differently than frequently found in other environmental impact statements. To assist NEPA reviewers, the following table has been developed. Under the heading "NEPA Requirement" are listed those topics normally discussed in an EIS. The corresponding section of this document and the page number are provided in the other two columns.

NEPA Requirement	Management Plan	Page
Purpose and Need for Action	Part I, Introduction and Summary, and Section D--Purpose and Need	1
Alternatives		
Preferred Alternative	Part III, Management Measures	63
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PART I: INTRODUCTION AND SUMMARY

A. National Marine Sanctuary Program

As development accelerates in coastal and marine areas, Federal, State and local governments, and private groups are working with management tools to achieve balanced development of marine resources. As part of the response to this challenge, the National Marine Sanctuary Program provides special protection to valuable marine habitats and associated species with long-term programs of comprehensive management.

Title III of the Marine Protection, Research and Sanctuaries Act of 1972 (amended in 1980), authorizes the Secretary of Commerce with Presidential approval to designate ocean waters as national marine sanctuaries for the purpose of preserving or restoring their conservation, recreational, ecological, or esthetic values. Where State waters are included, gubernatorial approval is also required. The Act is administered by the National Oceanic and Atmospheric Administration (NOAA) through the National Ocean Service's Office of Ocean and Coastal Resource Management (OCRM), Sanctuary Programs Division.

The Program's mission is the establishment of a system of national marine sanctuaries geared towards long-term benefit and enjoyment of the public. The goals of the national program are to:

- Enhance resource protection through the implementation of a comprehensive, long-term management plan tailored to the specific resources;
- Promote and coordinate research to expand scientific knowledge of significant marine resources and improve management decisionmaking;
- Enhance public awareness, understanding, and wise use of the marine environment through public interpretive and recreational programs; and
- Provide for optimum compatible public and private use of special marine areas.

Sanctuary designation provides for the comprehensive management of special marine resources and offers a measure of protection not found under existing authorities. Management plans are developed for each marine sanctuary to guide implementation of the sanctuary's goals and objectives and the research and interpretive/education programs.

The proposed La Parguera National Marine Sanctuary would be the seventh designated site since passage of the Act in 1972 (Figure 1). The other sanctuaries are:

- The Channel Islands National Marine Sanctuary located off the coast of southern California. The sanctuary protects valuable habitats for marine mammals and seabirds and extensive kelp bed communities.

NATIONAL MARINE SANCTUARY SYSTEM

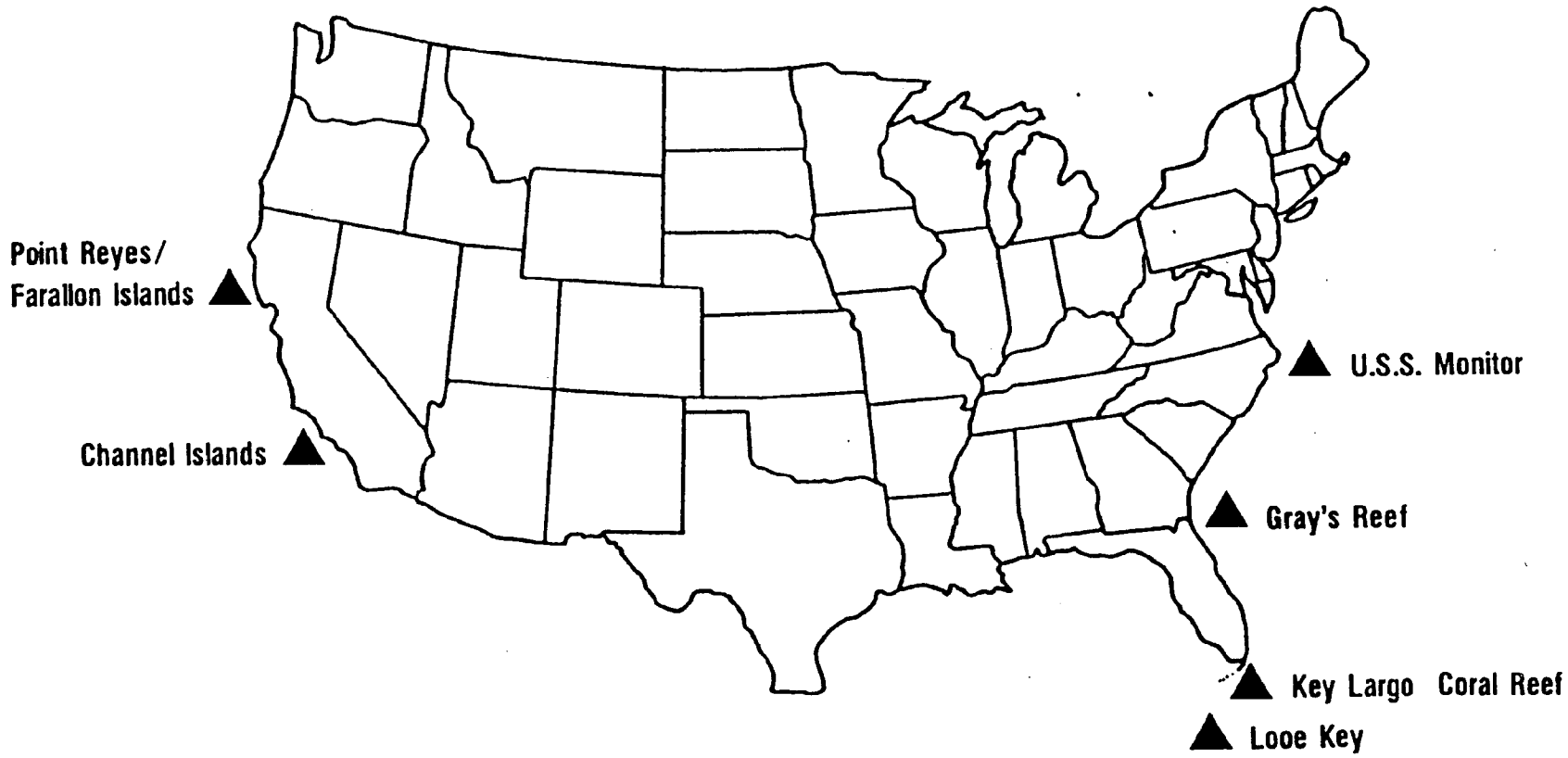


FIGURE 1

- The Gray's Reef National Marine Sanctuary, a live bottom ecosystem, supports a diverse array of temperate and tropical species. The sanctuary, which is located east of Sapelo Island, Georgia, insures that the resources of the site are maintained in their natural state.

- The Key Largo Coral Reef National Marine Sanctuary provides protective management for a highly-utilized coral reef ecosystem south of Miami, Florida and assures the area's continued recreational appeal.

- The Point Reyes - Farallon Islands National Marine Sanctuary consists of marine waters off the California coast north of San Francisco that contain especially noteworthy populations of marine mammals and seabirds.

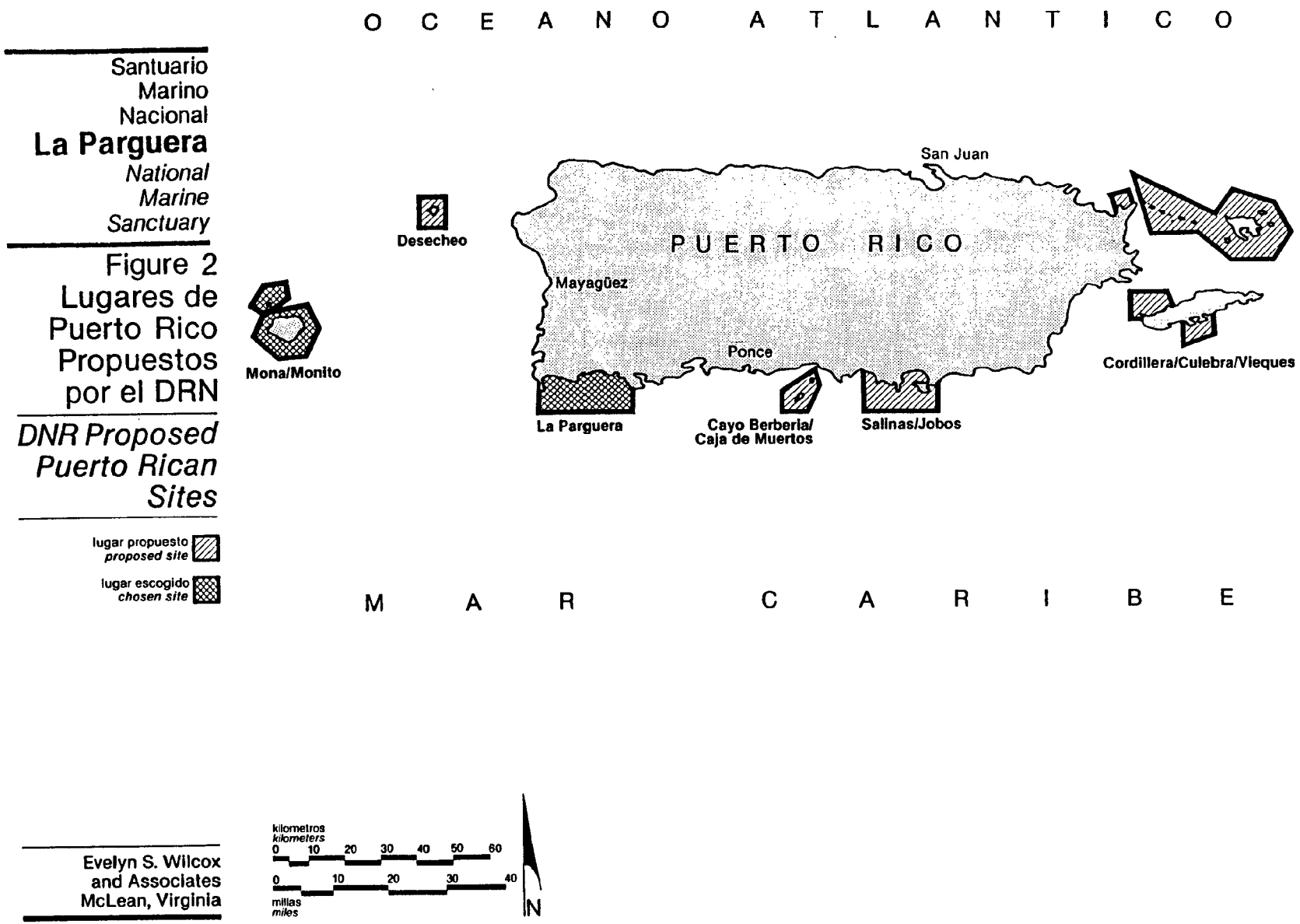
- The Looe Key National Marine Sanctuary consists of a portion of the Florida reef tract off Big Pine Key. It contains a well-developed coral reef and a diverse marine community that support high recreational use.

- The U.S.S. MONITOR National Marine Sanctuary protects the wreck of the well-known Civil War ironclad, which is located in the waters southeast of Cape Hatteras, North Carolina.

B. History of the Proposal

In May 1979, six sites were nominated for consideration as a National Marine Sanctuary by the Department of Natural Resources (DNR) Commonwealth of Puerto Rico. The sites were Cordillera/Culebra/Vieques, Salinas/Jobos, Cayo Berberia/Caja de Muertos, La Parguera, Mona/Monito Islands and Desecheo Island (Figure 2). Information was distributed to the public for comment on the feasibility of these sites as marine sanctuaries. As a result of public review, three sites were selected for further analysis: Cordillera/Culebra/Vieques, La Parguera, and Mona/Monita Islands.

In May 1981, an Issue Paper was distributed and workshops held on the final three sites. Following the workshops a decision was made by NOAA and DNR to develop draft management plans and environmental impact statements on the proposed La Parguera and Mona/Monita sites. A DEIS scoping meeting was held in Washington, D.C. on July 22, 1981. This document contains the draft management plan and environmental impact statement for the proposed La Parguera site.


Santuario
Marino
Nacional
La Parguera
National
Marine
Sanctuary
Figure 2
Lugares de
Puerto Rico
Propuestos
por el DRN
DNR Proposed
Puerto Rican
Sites
lugar propuesto
proposed site
lugar escogido
chosen site
O C E A N O A T L A N T I C O
Desecheo
Mona/Monito
San Juan
PUERTO RICO
Mayagüez
Ponce
La Parguera
Cayo Berberia/
Caja de Muertos
Salinas/Jobos
Cordillera/Culebra/Vieques
M A R C A R I B E
kilometros
kilometers
0 10 20 30 40 50 60
0 10 20 30 40
millas
miles
N
Evelyn S. Wilcox
and Associates
McLean, Virginia

C. General Context for Planning

The island of Puerto Rico is part of the 700 island tropical chain called the West Indies. Volcanic in origin, it is bordered by a shallow, jagged insular shelf, which reaches seaward two to seven miles. Its location, climate, hydrological conditions, and geographic features have created a unique marine environment which supports one of the world's extensive pristine coral reef systems, mangrove forests, and unusual bioluminescent bays. The island also shelters many rare and endangered plant and animal species as well as a variety of marine mammals and species of fish. Thousands of tourists visit Puerto Rico annually to enjoy its spectacular beaches, coral reefs, wildlife, and fishing.

Tourism, primarily from other U.S. territories and states, ranks high among the growth sectors of the Puerto Rican economy. The number of non-Puerto Rican tourists ranged from somewhat more than 900,000 in 1968 to approximately 1.7 million in 1980, with some annual changes reflecting recession and recovery of economic activity in the mainland. Tourist expenditures were at the level of $200 million at the beginning of this period, and $615 million in 1980. It is estimated that about half of the tourists are Puerto Ricans returning to the Island for family visits.

Situated in the semi-arid southwestern sector between two major population centers, La Parguera is a popular weekend recreational area for tourists--both Puerto Ricans and non-resident visitors. It is also a "port-of-entry" for commercial fishermen in southwestern Puerto Rico. The offshore waters boast one of the most extensive coral reef systems in the islands with 23 separate reefs hosting a wide variety of fish and coral species. Extensive mangrove forests line the coast and huge meadows of seagrass cover the bay floors. Sightings of endangered manatees and endangered and threatened sea turtles are frequent in this area and mangrove cays in Bahia Montalva support the largest nesting population of brown pelicans in Puerto Rico.

La Parguera's bioluminescent bays continue to draw scientific researchers from all over the world. Bioluminescence in coastal bays is rare throughout the world. However, light-emitting plankton are found in very high concentrations in Bahia Fosforescente and to a lesser degree in Bahia Monsio Jose located to the east and west of the La Parguera village, respectively. Within these shallow bays, a brilliant display of bioluminescence is created nightly by the churning of the bay waters by boats and/or by schools of fish. Such activity stimulates the dinoflagellates (Pyrodinium bahamense) which actually produce the light.

D. Purpose and Need for Designation

The impacts of human activities in La Parguera have been minimal in the past and as a result, the area is still a living laboratory where visitors can see, study, and enjoy a relatively pristine tropical ecosystem. Each year more and more visitors come to La Parguera to enjoy boating, swimming, scuba diving, snorkeling, fishing and vacationing. While the expected increase in tourism in these areas will boost regional economies, recreational development may also become a cause of concern (for more details on issues and problems, see Part II, Issues and Problems Associated with the Natural Resources of the Proposed LPNMS).

For example, a non-functioning sewage treatment plant at La Parguera and increased vacation homes are creating water pollution problems. The 23 coral reefs which skirt its coastline are facing damage by divers who are unaware of the fragile ecology of these living communities and existing protective regulations. Poaching of threatened and endangered sea turtles for eggs and meat still continues. The phenomena of bioluminescence depends on delicately balanced rates of seawater exchange and may be jeopardized by pollution. Fears that unrestricted development in upland drainage areas causing erosion, sedimentation and pollution, and constant boat tours will upset the unique conditions that make Bahia Fosforescente possible may be legitimate.

Although Commonwealth and Federal laws and regulations extend protection to some La Parguera marine resources, important marine communities such as some mangroves and seagrasses lack legal protection. Onsite surveillance and enforcement actions by DNR Rangers and Federal agents are presently limited by lack of personnel. Only two rangers patrol an area exceeding 68.27 square nautical miles of coastal water and open sea. None of the Federal agencies with law enforcement authority in the area maintain a sufficient onsite presence to adequately protect the resources.

Although the University of Puerto Rico Marine Science Laboratory, located directly offshore of La Parguera village, hosts student and other academic groups, there is no program in La Parguera aimed at resource interpretation and orientation of the visitors who come to La Parguera regarding the resources and the need for conservation.

There are numerous scientific papers on the La Parguera region prepared largely under the auspices of the University of Puerto Rico graduate marine science program by its professors and students. However, there is no clearing house to assess and evaluate research needs or coordinate overlapping studies for the purposes of environmental management.

The concept of increased protection for the La Parguera area is not new. There has been a history of concern and action regarding the resources of La Parguera. In 1960 the National Park Service, in cooperation with the Commonwealth government, completed an investigative report for Bahia Fosforescente. The report concluded that the bay was an extraordinary feature seriously threatened by deterioration from man's use of the area and that measures should be taken to protect it. In 1968 plans were developed and proposed in a report titled "Bioluminescent Bays of Puerto Rico" also advocating the bay's long-range preservation. Although protection has been considered since 1960 a clear management plan has not as yet been adopted.

In 1972, a report to the Governor of Puerto Rico entitled, Puerto Rico and the Sea, proposed the creation of a system of Marine Environmental Sanctuaries. This report was simply another example of the long perceived need for protection and management of this unique environment. A National Marine Sanctuary would finally address this need and ensure the future conservation of the La Parguera marine resources.

The Commonwealth of Puerto Rico, through actions over the past years, has recognized the value of La Parguera as a recreational and prime natural resource area. The area has been designated a natural reserve by the Planning Board and a management plan is being developed as part of the plan to manage

coastal land use and related activities in the Southwest Special Planning Area. In light of the emphasis on protection of the area's resources on one hand and the issues and problems on the other, the concept of a marine sanctuary for the area is compatible with past and present management efforts for the La Parguera region.

E. The Draft Management Plan/Environmental Impact Statement

A draft management plan has been prepared for the proposed La Parguera National Marine Sanctuary. The plan describes the proposed management scheme which seeks to preserve and maintain the tropical marine communities while allowing compatible uses.

Part II, Management Context, provides a general background of the area. It discusses the natural resources, social and economic factors, and issues and problems associated with resource use and protection.

Part III, Management Measures, seeks to meet the concerns and needs for long-term resource protection. Three major programs based upon management goals and objectives for the LPNMS have been developed--an Administration and Operations Program that strengthens onsite surveillance and enforcement measures; an Interpretive Program to expand the user's knowledge of the natural environment and the impacts of human actions; and a Resource Studies Plan focused on identifying priority management related marine research, resource assessment and monitoring at La Parguera.

The Administration and Operations Program will provide a management and enforcement focus for the proposed sanctuary. Implementation will rely upon existing DNR staff in San Juan and the Mayaguez region and will result in additional staff for onsite management. At a minimum, new staff would include a sanctuary manager, a part-time naturalist/ranger, a full-time ranger, and one clerical person. A Headquarters/Visitor Center would be constructed to house interpretive programs and provide office space.

As part of operations, regulations are being prepared to protect and control certain activities affecting resource quality. The regulations include controls on the taking of coral and bottom formations, cutting of red mangroves, certain discharges, removing or damaging submerged cultural resources and a prohibition on the use of nets designed for the illegal taking of sea turtles. The regulations set fines for commission of prohibited activities and establish a permit system under which certain prohibited activities may be allowed.

The Interpretive Program seeks to inform the public about resource issues and concerns by focusing on selected areas and features. It will enhance public understanding of the natural environment and the consequences of human actions. Audiovisual materials, publications, exhibits, activities, and interpreters are examples of the mechanisms to be utilized in accomplishing this goal. In addition to the visitor center, information and exhibits would be provided at Mata de la Gata and Playita Rosada.

Under the proposed Interpretive Program several "hands on" learning experiences will also be provided. Self-guiding trails at Bahia Sucia/Salinas and a mangrove boardwalk tour at La Parguera are proposed. Discrete underwater sites in certain reef/mangrove areas will be evaluated for possible designation as snorkeling and dive trails.

Another component of the proposal is a Resource Studies Plan. Implementation would provide multidisciplinary studies on living marine resources (species composition, abundance, diversity, etc.); community structure and function; and physical, chemical, geological and meteorological conditions within the proposed sanctuary. Information generated from these investigations would be used to further understanding of the importance of marine resources and to develop sound marine ecosystem management practices.

One of the priority resource studies would result in a compilation of literature of past and present research within the proposed sanctuary, and would tie this information into a retrievable data resource information system. Other studies would focus on circulation and water quality assessments, impacts of recreational use and monitoring of underwater trails. Research is also proposed that would analyze use impacts on the bioluminescent bays and grassbeds while another would result in recommendations to enhance the conch fishery. In addition, the resource studies plan includes a proposal to inventory and monitor endangered and threatened species.

Parts IV and V discuss alternatives and the environmental consequences of the proposed sanctuary. The proposed sanctuary would promote resource protection in three ways. First, it would bolster the existing regulatory/enforcement regime. Second, the alternative provides a program of resource interpretation directed at enhancing understanding of the basis for wise resource management and use. Third, the proposal would develop a data/information base from which sound management decisions are made.

The proposal could also have economic impacts beneficial to residents. La Parguera is a "weekend" resort with most visitors arriving for short stays from Friday to Sunday. During the week and at certain times of the year, the several guest houses are not filled to capacity. An emphasis on resource oriented programs may increase the number of visitors to La Parguera.

Economic benefits would also accrue to the fishermen. The information on water quality, circulation, habitat, and particularly the conch assessment study, would provide information on how and where fishery development projects could best be undertaken. In addition, protection of the various fishery habitats (mangroves, reefs, and grassbeds) should help maintain and enhance the long-term ability of the resources to sustain the local fishing industry.

Overall, the environmental consequences of sanctuary designation would be positive, with both short and long-term benefits to residents, visitors and the natural environment.

PART II: MANAGEMENT CONTEXT

A. Introduction

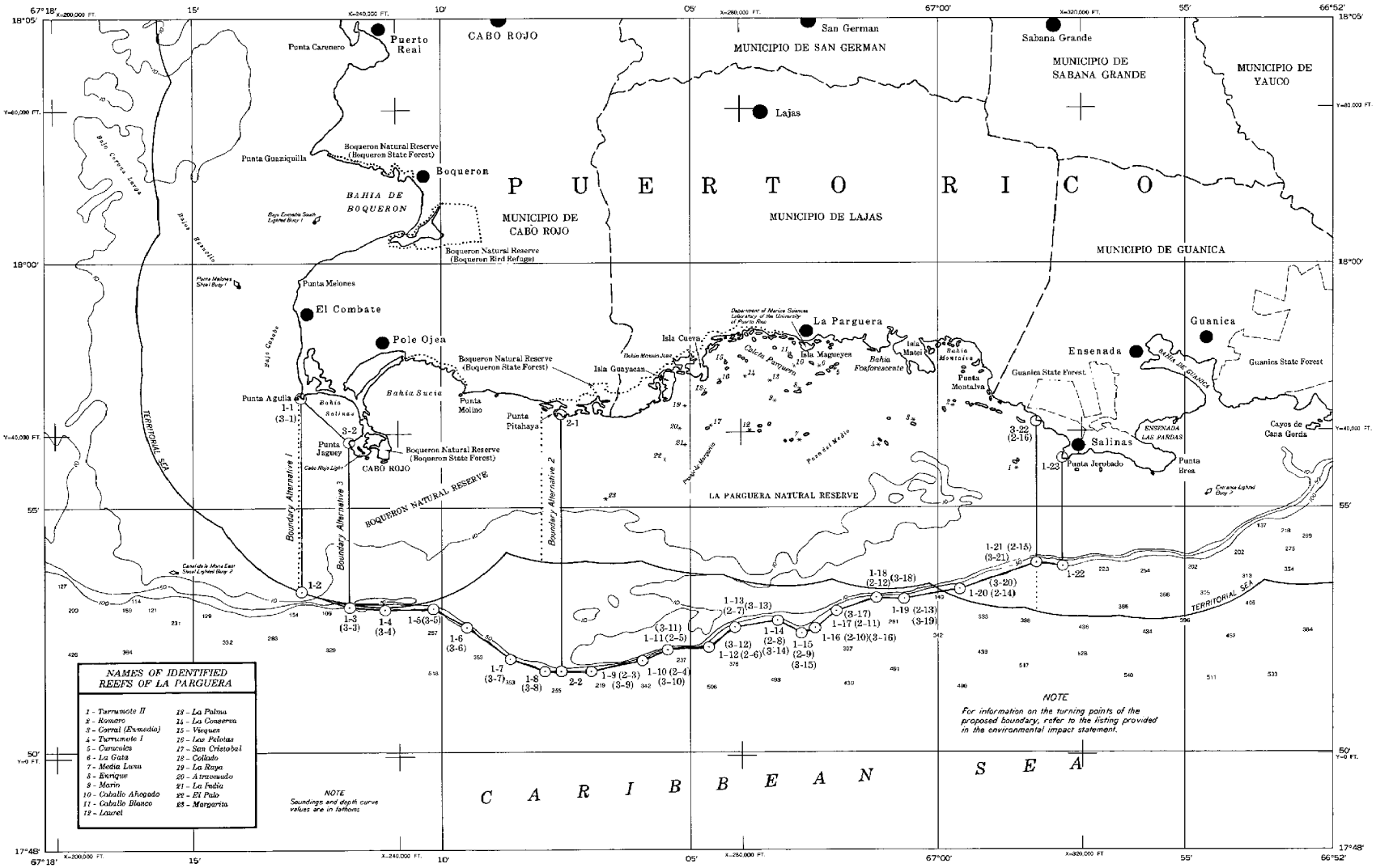
This part of the management plan provides the background information on the area of the proposed sanctuary. Section B, Location and Boundaries, discusses the location and extent of the proposal, providing longitude and latitude coordinates. Section C, Natural Resources, presents those significant resource systems that contribute to making the La Parguera area important and valuable. Discussed are the general physical and biological characteristics of the area; habitats, such as coral reefs, mangroves, grassbeds; and endangered species. Section D looks at the social and economic aspects of La Parguera and discusses the local market economy, profiles visitors and users and presents information on commercial fishing activities. Section E, Legal/Institutional Background, provides information on the Commonwealth and Federal statutes and regulations that are relevant to management of the marine and nearshore resources.

Finally, Section F discusses the issues and problems associated with the resources of the proposed La Parguera National Marine Sanctuary. This section focuses on issues that affect the quality and use of the marine resources, the problems of which are addressed in Part III, Management Measures.

B. Location and Boundaries

The proposed La Parguera National Marine Sanctuary lies off the southwest coast of Puerto Rico and extends east to west from the eastern boundary of the La Parguera Natural Reserve at Punta Sombrero to Punta Aguila on the southwest coast and seaward to the edge of the shelf at the 100 fathom mark. It extends landward to the area subject to the ebb and flow of the tide (Figure 3). Within the proposed boundary, the following major natural resources are found: coral reefs, mangroves, bioluminescent bays, and seagrass beds. The proposed boundary coordinates are:

Pt. No.	Latitude	Longitude	Pt. No.	Latitude	Longitude
1-1	N17°57'15.00"	W67°12'50.00"	1-12	N17°52'08.29"	W67-04'38.59"
1-2	N17°56'20.36"	W67°11'52.00"	1-13	N17°52'33.66"	W67-04'05.56"
1-3	N17°52'58.51"	W67°11'52.00"	1-14	N17°52'41.86"	W67-03'14.66"
1-4	N17°52'54.79"	W67°11'09.16"	1-15	N17°52'25.95"	W67-02'46.07"
1-5	N17°52'56.19"	W67°10'10.18"	1-16	N17°52'32.05"	W67-02'28.82"
1-6	N17°52'32.19"	W67°09'30.74"	1-17	N17°52'53.65"	W67-02'03.24"
1-7	N17°51'53.88"	W67°08'38.85"	1-18	N17°53'10.06"	W67-01'16.09"
1-8	N17°51'39.22"	W67°07'55.81"	1-19	N17°53'08.68"	W67-00'42.29"
1-9	N17°51'39.21"	W67°07'00.57"	1-20	N17°53'19.81"	W66-59'33.56"
1-10	N17°51'51.82"	W67°05'57.46"	1-21	N17°53'51.37"	W66-58'00.00"
1-11	N17°52'05.29"	W67°05'27.63"	1-22	N17°56'43.00"	W66-58'00.00"



LEGEND

- ⊙ 1-1 TURNING POINT OF BOUNDARY ALTERNATIVE 1
- ⊙ 2-1 TURNING POINT OF BOUNDARY ALTERNATIVE 2
- BOUNDARY OF NATURAL RESERVE
- ✕² IDENTIFIED REEF OF LA PARGUERA WITH REFERENCE NUMBER
- ⊙ 3-1 TURNING POINT OF BOUNDARY ALTERNATIVE 3 (Preferred)

MERCATOR PROJECTION
PUERTO RICO STATE PLANE COORDINATE
SYSTEM - ZONE 1
PUERTO RICO DATUM
SCALE 1:100,000

PUERTO RICO - WEST INDIES
SOUTH SHORE OF PUERTO RICO
LA PARGUERA

PROPOSED LA PARGUERA NATIONAL MARINE SANCTUARY

Figure 3

2nd Revision

The site is accessible to visitors using combinations of water, land, and/or air transportation (Figures 4 and 5). Regular flights from San Juan connect Puerto Rico to the major U.S. cities (New York 1,399 m., 2,251 km. - Miami 932 m., 1,500 km.). From San Juan, sanctuary access is available by car along one of Puerto Rico's major highways (Route 52) or by plane to Mayaguez or Ponce. The proposed sanctuary is within easy driving distance from these population centers, (Mayaguez 22 miles away, Ponce 30 miles away) as well as the closer villages of Puerto Real, Boqueron, and El Combate in Cabo Rojo and Ensenada, Guanica, and Playa Santa in Guanica.

C. Natural Resources

1. Introduction

The proposed La Parguera National Marine Sanctuary (LPNMS) is a representative cross-section of the tropical marine and coastal ecosystem. Most of the area is situated on a shelf of limestone lying beneath 15 to 18 m of warm water. This shelf juts out into the Caribbean from the coast some 8 to 10 km (6 miles) and ends suddenly as a spectacular submerged barrier reef along much of its edge. From this shelf rise two elongated major reef systems running from east to west, dividing the shelf into inner, middle, and outer regions. Highly favorable climatic and hydrographic conditions and rich dissolved organics from fringing mangroves have promoted the prolific growth of more than 23 individual coral reef systems (Figures 6 and 7).

Numerous offshore mangrove cays are scattered throughout the shelf, primarily within the inner and middle areas. Some are associated with coral reefs in the outer region of the shelf. These cays, reefs, and mangrove lagoons are also associated with extensive seagrass beds, (Thalassia) distributed almost continuously from Punta Jorobado to Cabo Rojo, where they represent one of the largest turtle grass areas in Puerto Rico (Gonzalez-Liboy, 1979).

Thick mangrove forests line the shore of the proposed sanctuary at Bahia Montalva and Bahia Fosforescente; they extend from the La Parguera village area westward almost continuously to Punta Pitahaya. Between Punta Pitahaya and Punta Molino there is a break in the mangrove development. The mangrove forest then continues along Bahia Sucia except where it is broken by a barrier beach. Parts of eastern Bahia Salinas are also fringed with mangroves.

There are a few beaches interspersed with rocky outcroppings along the shore, but access to the water is generally limited by the great stretches of mangroves along the coast. Beaches of sand or gravel characterize much of the shoreline of Bahia Sucia and Bahia Salinas.

La Parguera's bioluminescent bays continue to draw scientific researchers and tourists from all over the world. Bioluminescence in coastal bays is rare throughout the world. However, light-emitting plankton are found in very high concentrations in Bahia Fosforescente and to a lesser degree in Bahia Monsio Jose located to the east and west of the La Parguera village, respectively. Within these shallow bays, a brilliant display of bioluminescence is created nightly by the churning of the bay waters by boats or by schools of fish. Such activity stimulates the dinoflagellates (Pyrodinium bahamense) which actually produce the light.

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Figure 4
Contexto
Regional

Regional
Context

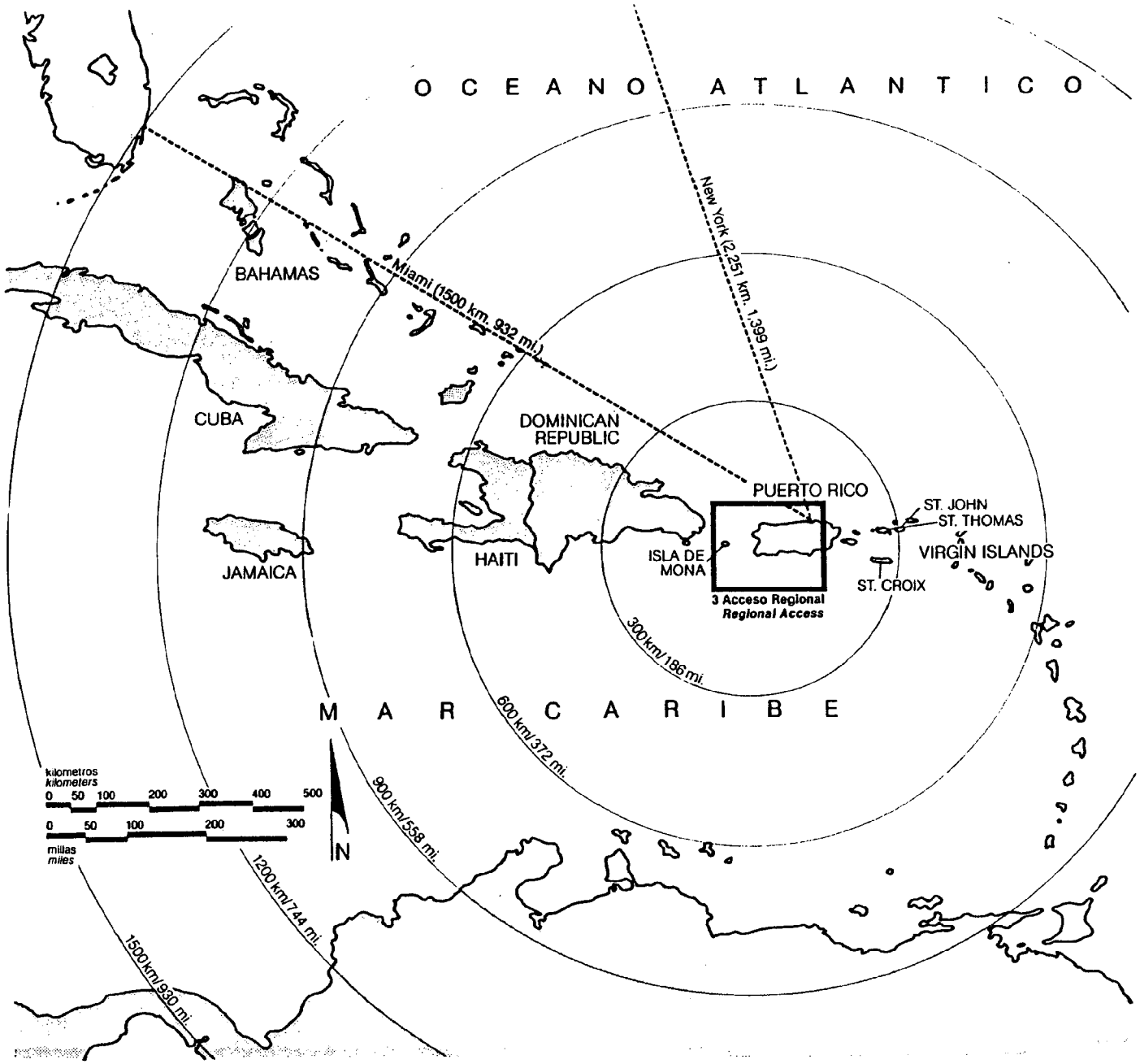

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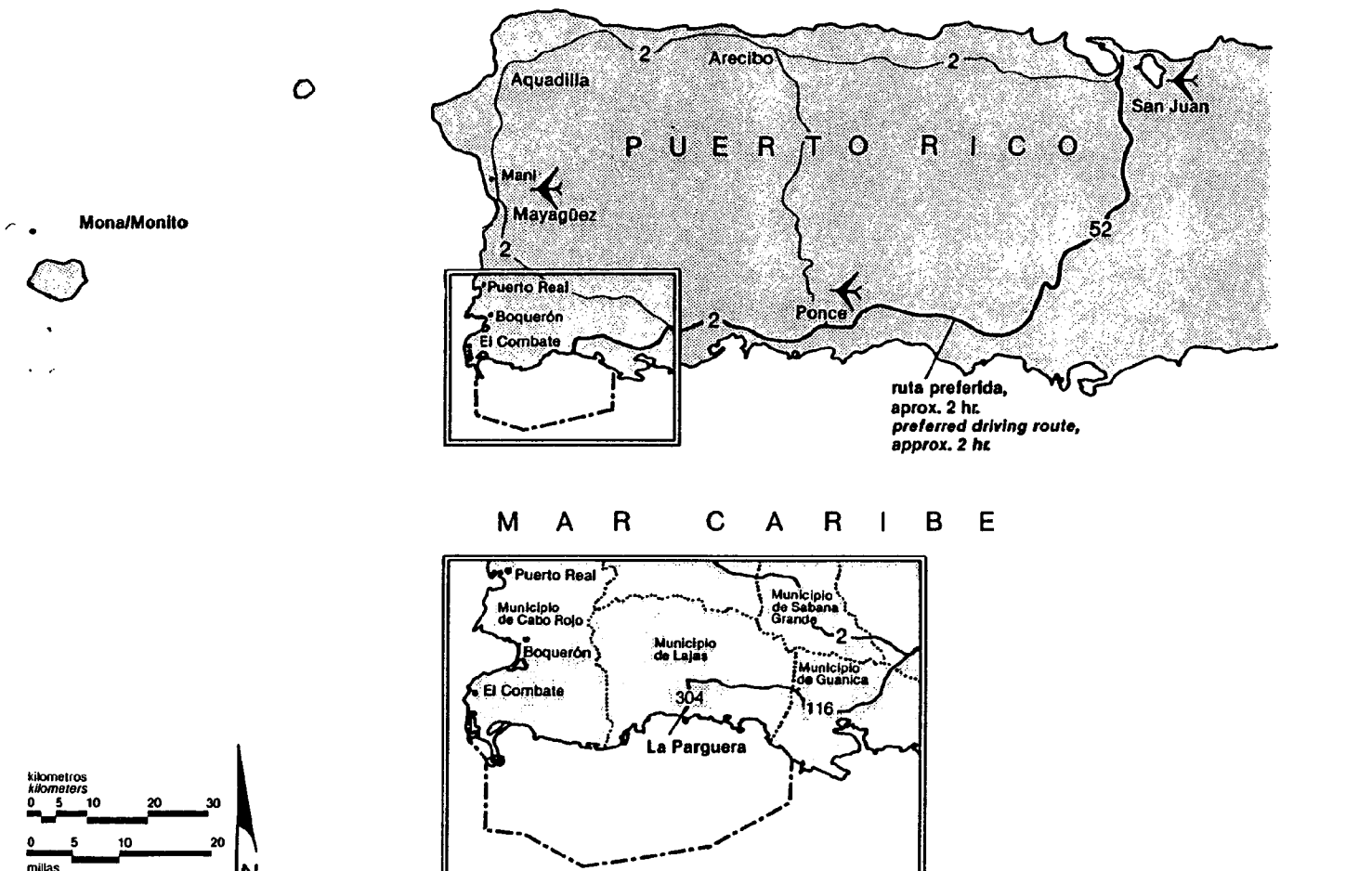
Figure 5
Acceso
Regional

Regional
Access

el aero puerto
airport

colindancias propuestas
proposed boundary



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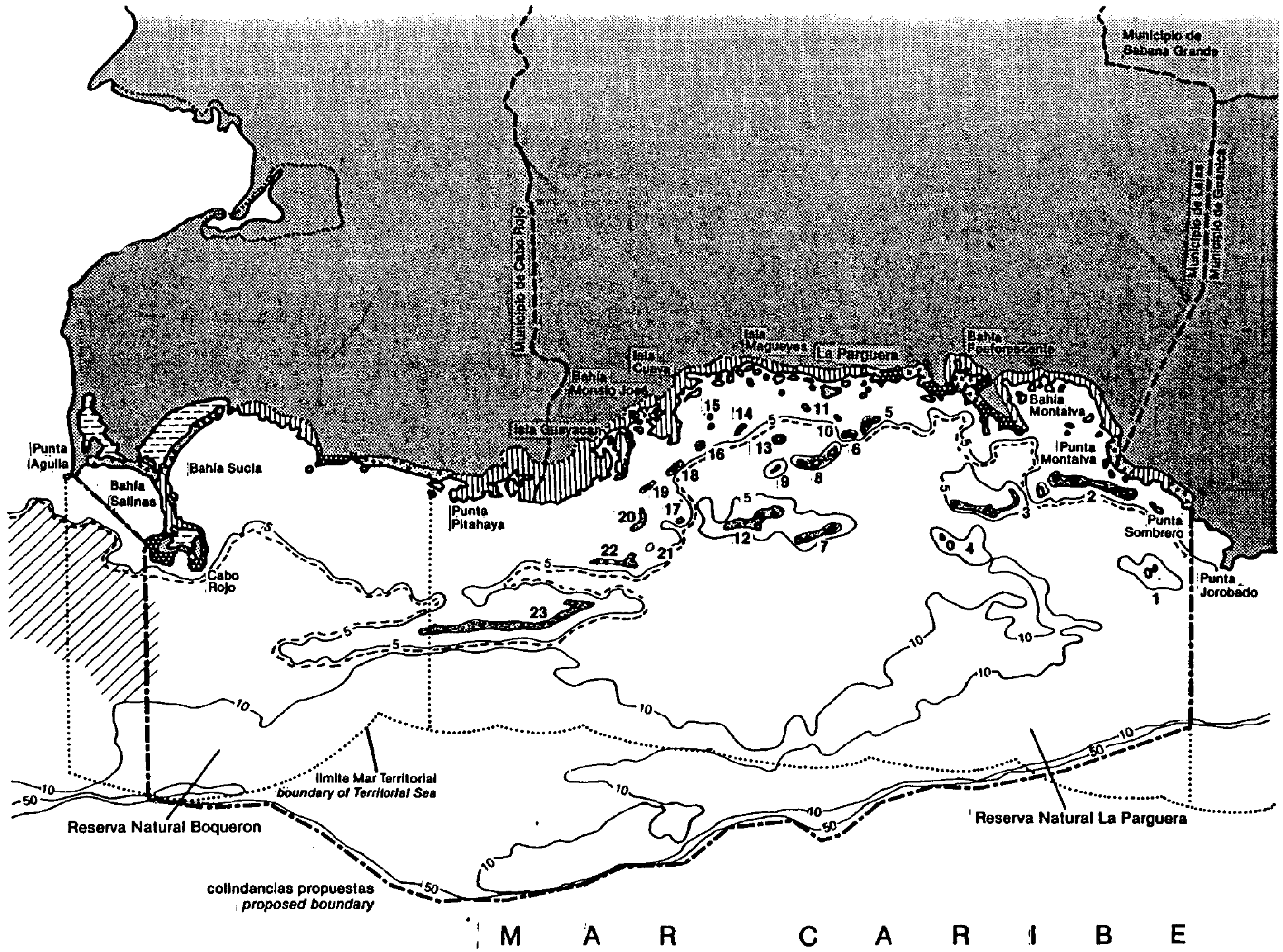
La Parguera
National Marine Sanctuary

Figure 6
Factores Naturales
Natural Factors

- arrecifes de coral / *coral reefs*
- playa / *beach*
- manglares / *mangroves*
- costa rocosa / *rocky coast*
- bahia bioluminescente / *bioluminescent bay*
- laguna hypersalina / *saltwater lagoon*
- depositos de arena / *sand deposits*
- praderas submarinas / *seagrass beds*



indicacion de contornos en brazas
contours shown in fathoms

kilometros / *kilometers*: 0 1 2 3 4 5 6

millas nauticas / *nautical miles*: 0 1 2 3 4

N

arrecifes de coral
coral reefs

1 Turrumote II	9 Mario	17 San Cristóbal
2 Romero	10 Caballo Ahogadó	18 Collado
3 Corral (Enmedio)	11 Caballo Blanco	19 La Raya
4 Turrumote I	12 Laurel	20 Atravesado
5 Caracoles	13 La Palma	21 La India
6 La Gata	14 La Conserva	22 El Palo
7 Media Luna	15 Vieques	23 Margarita
8 Cayo Enrique	16 Las Pelotas	

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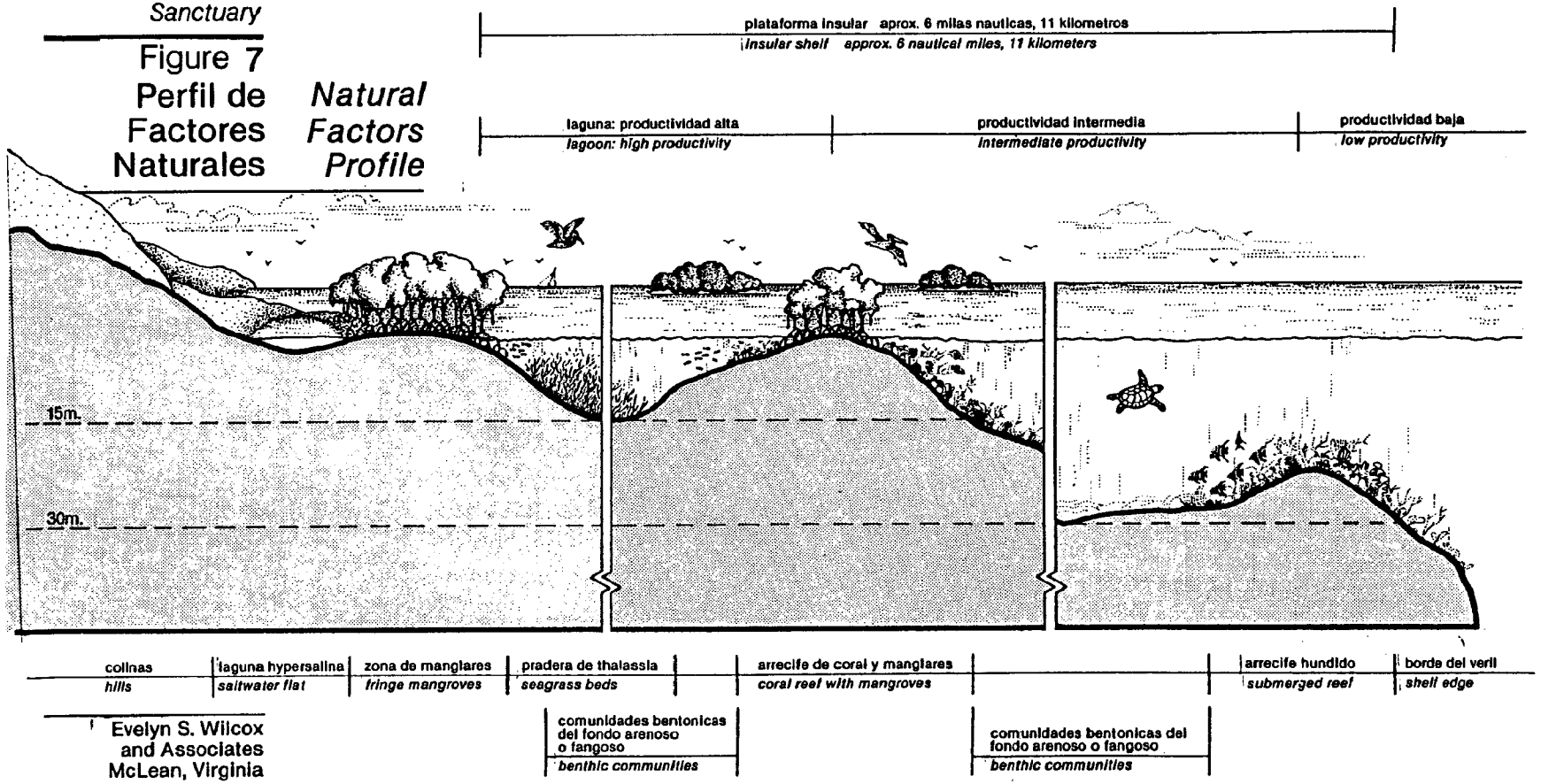
Figure 7
Perfil de Factores Naturales
Natural Factors Profile



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These resources collectively represent some of the most diverse and ecologically valuable marine habitats in Puerto Rico. The information in the following section on sanctuary resources and the potential impacts from visitor and resident uses provides the basis for resource management measures presented in Part III.

2. Physical Characteristics

a. Geology

Low-lying hills consisting of southward dipping limestones from the Cretaceous period line the coastal area of southwestern Puerto Rico (Almy, 1965). Northwest of these hills is an area underlined by serpentinized periodotite of early to early late Cretaceous age (Saunders, 1973). The coastal lowland of and near La Parguera is covered by Quaternary alluvial sand and silt and by tidal swamp deposits of silt and clay (Kaye, 1959). From Punta Pitahaya to Bahia Sucia the coastline features cliffs with developed limestone outcrops composed of tertiary rocks, mostly limestone. Some are volcanic in origin.

Located at the very southwest tip of Puerto Rico is Cabo Rojo. Consisting of two separate limestone knobs tied to the mainland by a forked double tombolo, Cabo Rojo has a beach which encircles a small, triangular lagoon. The general marine geology of La Parguera and adjacent areas is discussed in the coral reef section of this chapter.

b. Climate

The proposed LPNMS falls within the Subtropical Dry Life Zone (Ewel and Whitmore, 1973) receiving 500-1,200 mm (20-48 inches) of rain annually. Wet and dry seasons are not clearly defined. The period of maximum precipitation is usually from May through November, with periods of torrential rainfall during September through October. Most of this rain falls during a period of several weeks and only for short durations (Guinones, 1953). During this period dense flows of mud washed from the soil cover are seen diffusing offshore and are densest adjacent to tidal flats (Saunders, 1973). Runoff is the only local source of terrigenous sediments within the proposed sanctuary since no rivers are present. As a result of low rainfall, salinity fluctuations in coastal areas are slight. This condition is particularly favorable to the development of tropical marine communities, especially coral reefs, which are built mainly by fairly stenohaline organisms restricted by salinity levels. Good water clarity also contributes to the success of these marine communities.

Although Puerto Rico is influenced by a maritime climate and is exposed to the easterly trade winds throughout the year, regular seasonal variations in temperature are clearly evident. The greatest seasonal difference observed by Glynn (1973), during a seven year period was 42°F. The average annual temperature is 77°F. The driest time of the year extends from about December through April with occasional, infrequent, substantial precipitation as cold fronts move in from the north (Smedley, 1961). Potential evaportranspiration is in the order of 1,900 - 2,200 mm annually, giving the region a yearly water deficit.

Extreme maximum temperatures normally occur in the late summer (August-September) and extreme minimums in the winter (December-March). This thermal regime is consistent for regions exposed to the easterly trades of the Atlantic Ocean which interact to produce "oceanic" type temperature curves with late summer maxima and later winter minima (Riehl, 1954 as cited by Glynn, 1973). Estimated diurnal range is in excess of 20°F (Calvesbert, 1970).

The location of Puerto Rico relative to the high pressure belt ("subtropical highs") over the eastern Atlantic Ocean places it well within the influence of the steady trade winds throughout the year, with a fairly regular annual pattern (Glynn, 1973). In La Parguera, winds from the southeast and east prevail 81.1% of the time, with combined velocities from 10 to 25 km/hr (6-15 miles/hr). Weaker winds from the north or northeast with velocities not exceeding 10 km/hr (6 miles/hr) prevail only 12.1% of the time. Winds from the south, southwest, west and northwest are relatively unimportant (Glynn, 1973). Periods of calm occur most often in October and November. There is an important land-sea breeze effect with winds shifting from the east or southeast after 7:00 or 8:00 a.m.

During cyclonic disturbances in the summer or fall, exceptionally low temperatures (61.7°F), torrential rains (about 203 mm in a 12-hour period (i.e., Hurricane Edith, 1963), and very strong winds (close to 80 km/hr--50 knots) can be experienced. These tropical storms and hurricanes are perhaps the most obvious physical factors affecting the survival and geomorphology of shallow marine communities, particularly emergent coral reefs.

Documentation of more recent hurricane damage to marine communities within the proposed LPNMS have been made by Glynn et al. (1964), Glynn (1973), Cintron (personal communication), Goenaga (1981), Armstrong (personal communication) and Matta (1981).

c. Hydrography

Seasonal variation in mean sea water temperature follows closely that of the atmosphere, ranging between 77° and 86°F, and reaching a maximum in August-October and a minimum in February. Annual variations in surface water temperature are generally less than 4.5°F (Coker and Gonzalez, 1980). Increased winds in the spring appear to be related to a slight decline in the surface thermal structure (Glynn, 1973).

Salinity values normally vary less than 2.3 parts per thousand (ppt) in this region. Salinity data collected by Jorge Rivera on the western side of Magueyes Island (La Parguera) indicate a maximum of 36.9 ppt and a minimum of 34.6 ppt between June 1971 and November 1972. These salinity values are similar to offshore values indicating that circulation of the inner shelf region is adequate to maintain open sea salinity conditions (Saunders, 1973). Tropical storms in the region usually lower salinities considerably, thereby temporarily stressing marine communities.

Runoff from heavy rainfall, resuspension of bottom sediments by wave action and plankton blooms occasionally create turbid conditions. Water clarity within the proposed sanctuary, however, is generally good and varies only from about one meter (3.3 feet) near the shore to about 30 meters (100 feet) at the edge of the shelf.

Tides can be characterized, as summarized by Coker and Gonzalez (1980), and confirmed by Glynn (1973):

1) slight vertical range (daily maximum of 40 cm or 16 inches and yearly maximum of 55 cm or 22 inches);

2) largely diurnal and irregular;

3) relatively abrupt seasonal shift in timing; and

4) higher mean elevation of sea level in late summer and fall.

Since tides have a reduced vertical range, their influence on the flushing rate is also small (Cintron, 1969). This slow and reduced water transport probably contributes to the high water transparency of coastal waters, promoting the development of marine communities. On the other hand, entrapment of pollutants near the coast due to reduced tidal action can cause pollution of coastal waters.

The general water circulation pattern is westward, parallel to the coast and appears to be mainly wind-driven. Preliminary measurements of surface current velocities by Glynn (1973) near Laurel Reef (see coral reef section below) indicated that water movement over the shelf is considerably less than in the open sea (4.5 meters/min. vs. 25 meters/min. or 14.8 ft./min. vs. 82 ft./min.).

d. Sand Fields

The southwestern Puerto Rico shelf, including the offshore areas of the proposed LPNMS, may be an important site for offshore commercial quality sand resources (USGS, 1978). Seaward of Bahia Sucia and occupying most of the middle shelf is a Halimeda-mollusk gravelly sand with no observed terrigenous components. Much of the area of this sediment type is covered by a field of large sand waves, with an average wave length of 350 m and heights ranging from 2-3 m. The length of the waves is on the order of 2,500 m. The crests of some of the waves have been partially colonized by Thalassia and other organisms.

The presence of this sand wave field suggests that large volumes of sand with mining potential are locally present in the area considered for sanctuary designation (Figure 6).

As a result of the apparent developing need for offshore sand for construction aggregate for Puerto Rico, the U.S. Geological Survey (USGS) and the Department of Natural Resources of the Commonwealth (DNR) began investigations of potential offshore sand deposits on the Puerto Rican insular shelf in 1974. Three major sand bodies were located on the insular shelf. As might be expected in an area of westward-directed winds and water currents, all three sand areas are located at the western end of the islands. The Isabela area is found at the western end of the northern coast of Puerto Rico; the southwestern area is located near the west end of the south coast of Puerto Rico in the vicinity of Bahia Sucia and Cabo Rojo (but outside the area of the proposed sanctuary); and the Escollo de Arenas area is located north of the western end of Vieques Island. The area of greatest commercial potential in the southwest lies directly south of Cabo Rojo point.

3. Habitats and Biological Characteristics

a. Coral Reefs

Two hypotheses have been postulated to explain the origin of La Parguera reefs. The first one states that the major geological features of La Parguera have resulted from the deformation of upper Cretaceous limestones (with interbedded mudstones and volcanic rocks), forming a west-northwest/east-southeast trending syncline whose axis passes through Magueyes Island (Almy, 1969). The northern limb of the syncline is represented by the La Parguera hills and, possibly, the southern limb by the coral reefs on the shelf. The second hypothesis (Kaye, 1959) claims that these reefs have developed on drowned, limestone cuestas formed as eolianite structures parallel to the shore during the Wisconsin Glacial period.

The following sections describe zonation patterns of representative reefs within the inner, middle, and outer shelves. Although these patterns are often the same, these zonation schemes can sometimes be highly variable within a reef (Goenaga, 1981, Morelock, 1977, 1979). The twenty-three identified reefs of La Parguera are listed in Table 1 and Figures 9 and 10 show the location of the reefs.[1]

(1) Inner Shelf Area

The inner shelf, bordered on the south by La Gata Reef, Enrique Reef, and others, is characterized by fine grained, poorly sorted sediments. This material comes mainly from in situ bioerosion (Morelock et al., 1977) in the back reef aprons. Scattered throughout this protected area are cays in various stages of successional development.

These cays, with the staghorn coral (Acropora cervicornis) dominating their shallower zones, pass through a series of stages eventually becoming mangrove cays (Welch, 1962). Formation of these cays is dependent on the upward growth of Porites hillocks (the Porites biotope). The windward crest

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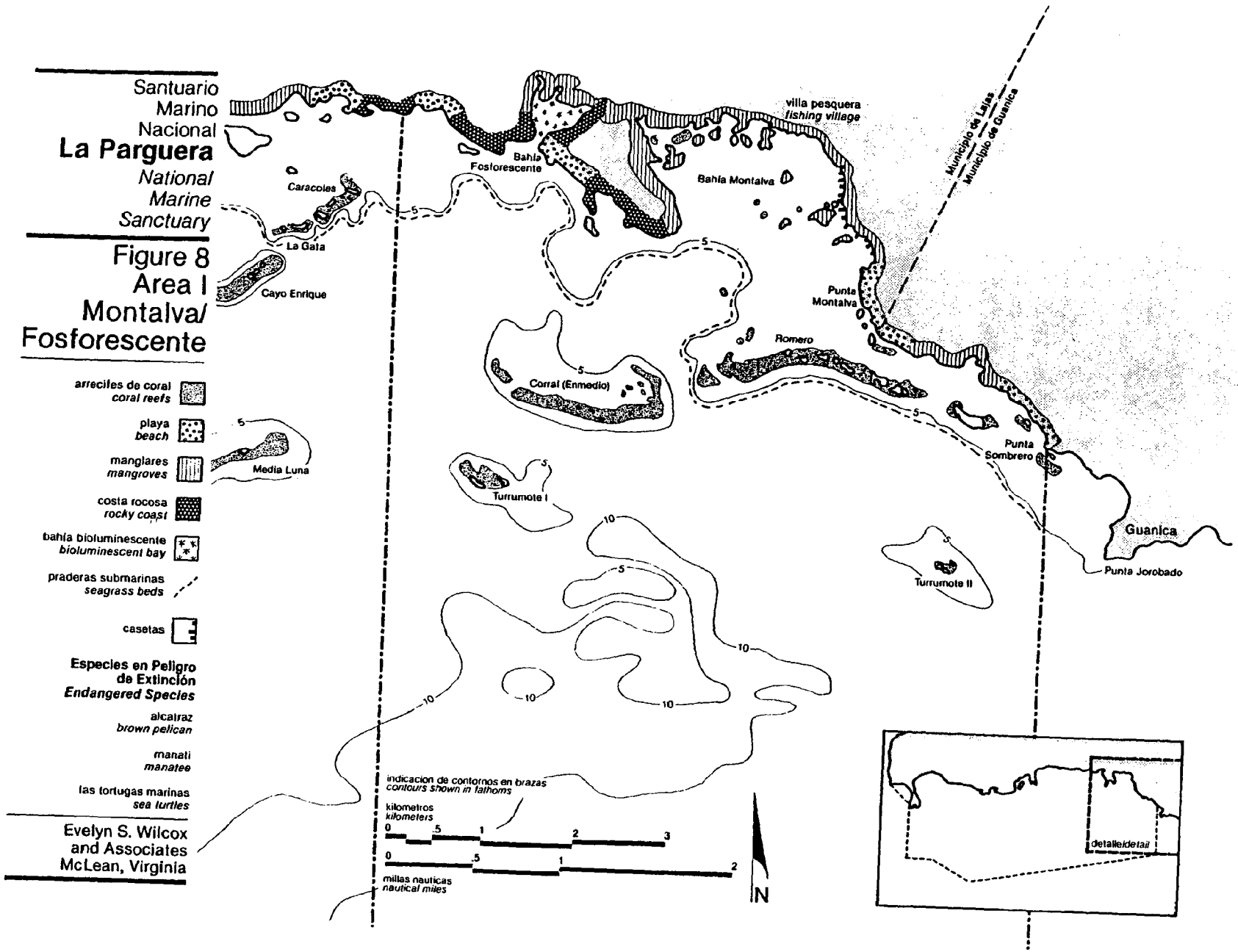
[1] The area shown in (Figure 6), Natural Factors of La Parguera, has been subdivided into three area maps to provide more detail on each area. The easternmost area, Area I, (Figure 8) features the ecological system of Bahia Montalva and Bahia Fosforescente. The central portion, Area II, (Figure 9) contains the recreational center of La Parguera village, the two DNR parks of Playita Rosada and Mata de La Gata, the mangrove forest of the Boqueron State Forest and the majority of the coral reefs. Area III, (Figure 10), the westernmost portion of the proposed LPNMS, features Bahia Sucia and Bahia Salinas with the Cabo Rojo tombolo separating the two.

TABLE 1

CORAL REEFS WITHIN THE PROPOSED LA PARGUERA NATIONAL MARINE SANCTUARY

	REEFS	LATITUDE	LONGITUDE
1.	Turrumote II	17°55.8' N	66°58.4' W
2.	Romero	17°57.1	66°59.7'
3.	Corral (Enmedio)	17°56.8	67°00.5'
4.	Turrumote I	17°56.3	67°01.2'
5.	Caracoles	17°57.9	67°02.1'
6.	La Gata	17°57.9	67°02.4'
7.	Media Luna	17°56.4	67°02.8'
8.	Enrique	17°57.4	67°02.8'
9.	Mario	17°57.2	67°03.3'
10.	Caballa Ahogado	17°57.9	67°02.9'
11.	Caballo Blanco	17°58.1	67°03.0'
12.	Laurel	17°56.6	67°03.8'
13.	La Palma	17°57.6	67°04.4'
14.	La Conserva	17°57.7	67°04.9'
15.	Vieques	17°58.0	67°04.3'
16.	Las Pelotas	17°57.6	67°04.4'
17.	San Cristobal	17°56.7	67°04.2'
18.	Collado	17°57.4	67°04.7'
19.	La Raya	17°57.1	67°05.1'
20.	Atravesado	17°56.6	67°05.2'
21.	La India	17°56.3	67°05.1'
22.	El Palo	17°56.0	67°05.5'
23.	Margarita	17°55.2	67°06.7'

Coordinates of all named identified reefs of La Parguera presented from east to west. Carlos Goenaga, 1981.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La Parguera
National Marine Sanctuary
Figure 8
Area I
Montalva/
Fosforescente
arrecifes de coral
coral reefs
playa
beach
manglares
mangroves
costa rocosa
rocky coast
bahía bioluminescente
bioluminescent bay
praderas submarinas
seagrass beds
casetas
Especies en Peligro de Extinción
Endangered Species
alcatraz
brown pelican
manati
manatee
las tortugas marinas
sea turtles
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Caracoles
La Gata
Cayo Enrique
Media Luna
Bahía Fosforescente
villa pesquera
fishing village
Bahía Montalva
Municipio de Lajas
Municipio de Guanica
Punta Montalva
Romero
Corral (Enmedio)
Punta Sombrero
Turrumote I
Turrumote II
Guanica
Punta Jorobado
indicación de contornos en brazas
contours shown in fathoms
kilometros
kilometers
millas nauticas
nautical miles
N
detalle/detail

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Figure 9
Area II
Poblado

arrecifes de coral
coral reefs

playa
beach

manglares
mangroves

costa rocosa
rocky coast

bahía bioluminescente
bioluminescent bay

praderas submarinas
seagrass beds

caseta

Especies en Peligro de Extinción
Endangered Species

alcatraz
brown pelican

las tortugas marinas
sea turtles

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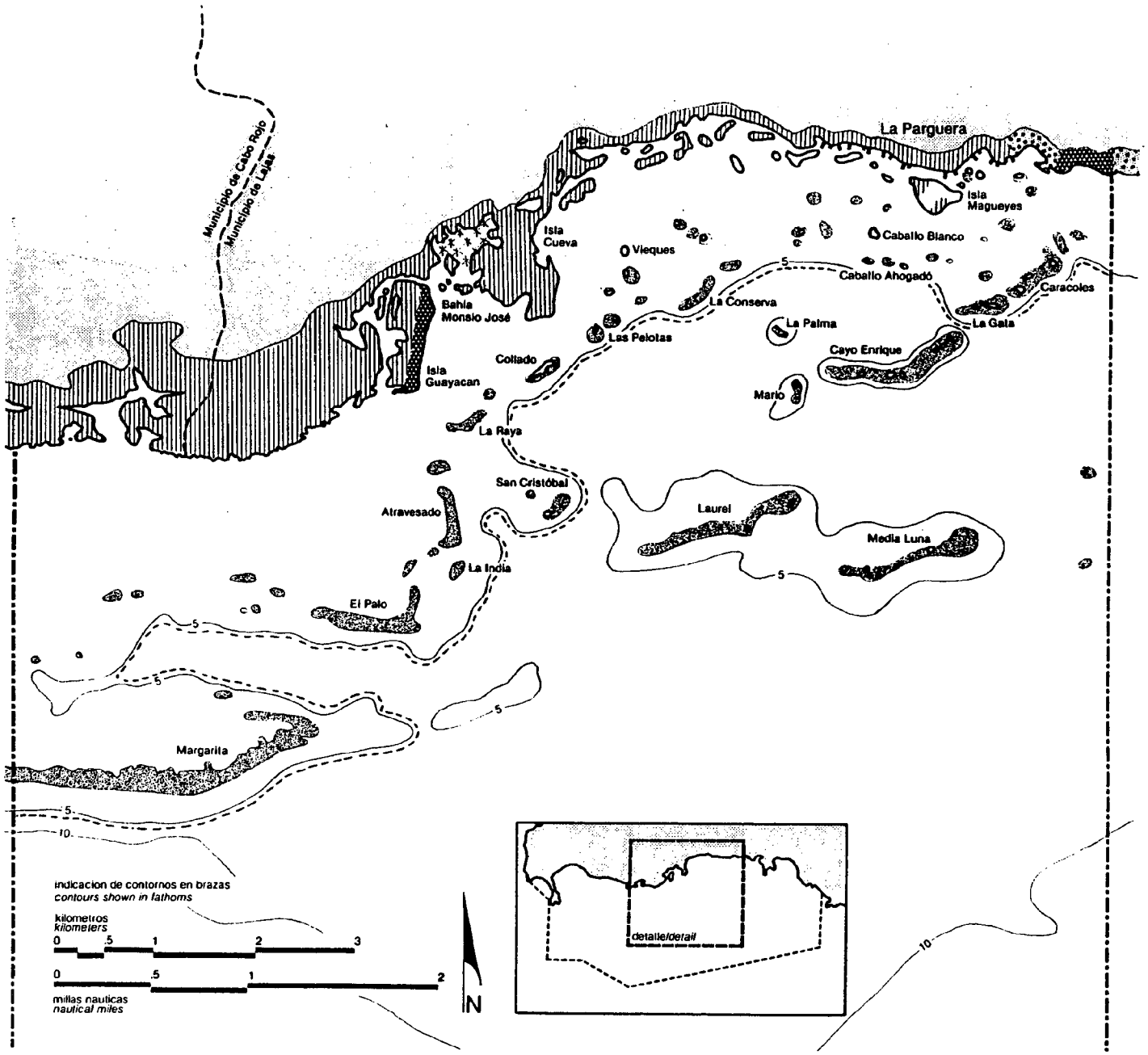

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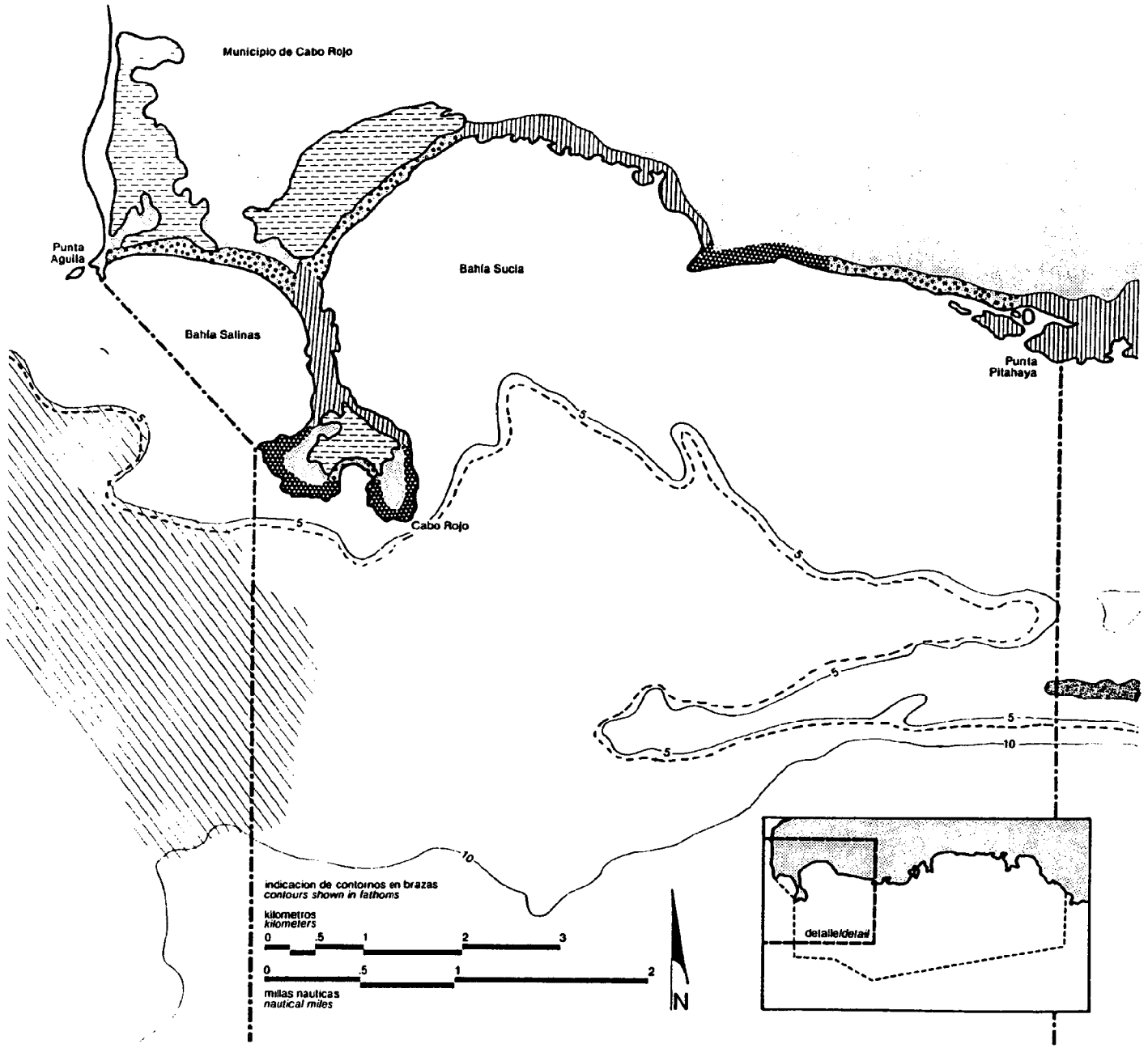
Figure 10
Area III
Sucia/Salinas



- arrecifes de coral / *coral reefs*
- playa / *beach*
- manglares / *mangroves*
- costa rocosa / *rocky coast*
- laguna hypersalina / *saltwater lagoon*
- depositos de arena / *sand deposits*
- praderas submarinas / *seagrass beds*

Especies en Peligro de Extinción
Endangered Species

- manati / *manatee*
- las tortugas marinas / *sea turtles*

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grows more rapidly than the leeward one, eventually interfering with current movement across the central portion of the reef. Reduced circulation impedes leeward coral growth, leading to conditions favorable for the proliferation of seagrasses and calcareous algae. Later, the sediment builds up due to the sediment-accumulating property of seagrasses and encourages the colonization of the red mangrove (Rhizophora mangle). Finally, the subtidal flora adjacent to the mangrove dies because of overshading by tree cover.

The Porites biotope (referred to in the previous paragraph) is a major, although probably transient community of these as well as of the outer shelf reefs. On these reefs extensive beds of Porites colonies are formed leeward from the reef crest. Occasionally, they occur on other protected parts of the reef. These beds sometimes cover several square meters (Glynn, 1973; Goenaga, personal communication) containing a high diversity, biomass and population density of associated biota. This biota includes a wide variety of benthic algae, foraminifers, crustaceans, molluscs, echinoderms, sipunculids, anthozoans, and sponges.

The inner shelf reefs are also generally characterized by a restricted coral fauna, a poorly developed elkhorn coral (Acropora palmata) zone, and the absence of a Millepora-dominated reef crest. Zonation patterns are, generally, not very conspicuous and the reef base is usually about ten meters deep.

These reefs, because of their protected location, are less affected by hurricane-generated waves and may play an important role in providing coral larvae supply to outer reefs, where shallow coral zones are left devoid of coral damaged by tropical storms. (See Appendix A for a detailed description of some of the coral reefs found in this area.)

(2) Middle and Outer Shelf Areas

The fore reef of Enrique Reef as well as that of Mario, La Gata and Caracoles Reefs belong to the middle shelf area with moderate exposure to the incoming waves. The outer area is limited to the north by Laurel, Media Luna, and others. These reefs receive high wave energy and generally present a marked zonation in the fore reef. The palmata zone is usually very extensive. During storms of moderate to high intensity, however, this zone is wiped out completely, depositing broken colonies on the reef crest and forming flat promontories close to three meters in relief (Glynn et al., Goenaga, 1981).

It should be noted that even though storm damage is quite extensive, the areas principally affected are those which contain the fastest growing corals. Thus, the regeneration period is, in the absence of additional stresses (natural or man-made), fairly short (15-25 years).

Apparently, due to the high energy to which these reefs are exposed, deposition of fine sediments is not sufficient to support the establishment of the red mangrove, (Cintron et al., 1978). The white mangrove, Laguncularia racemosa, however, has settled on these substrates. (See Appendix A for a detailed description of some of the coral reefs found in this area.)

b. Mangroves

Mangrove forest development and structure within the proposed sanctuary appear to be related to exposure to wave energy (Cintron et al., 1978). Conditions affecting exposure include: (a) orientation in relation to incoming waves, (b) protection afforded by outer reefs, (c) distance from the border of the insular shelf, and (d) as in the case of Bahia Salinas, protection from the prevailing winds and currents by the Cabo Rojo sand tombolo.

Conditions of minimum exposure to wave energy (as in the near shore areas of Punta Pitahaya and in the core of large mangrove inlets) are apparently associated with a high accumulation of salts and toxic compounds (e.g., ammonia) derived from the anaerobic metabolism of soil biota due to low water flushing rates. Conditions of maximum exposure are associated either with the absence of mangroves due to the impossibility of seed implanting (as west of Punta Molino and northern Bahia Sucia) or with the formation of berms on the outer fringes which reduces circulation of the water to the interior, eventually killing the trees (as in the lagoon area of eastern Bahia Sucia). Intermediate exposure appears to be optimum for mangrove development (as in Caballo Blanco and Enrique Cay).

Of the five mangrove forest types described by Lugo and Snedaker (1974), all but the river type are found within the region. These are (a) the fringe forest which predominates, (b) the overwash forest, (c) the basin forest, and (d) the dwarf forest. Location of the major stands of mangroves is found on (Figures 8, 9 and 10). Figure 11, Mangrove Profile, provides an illustration of a cross-section of a typical mangrove area.

(1) Fringing

As in most of the southwest coast, fringing mangroves grow at the edge of the water and exhibit low structural complexity, low leaf fall, and low rate of growth. They are dominated by the red mangrove, Rhizophora mangle, (Cintron et al., 1978). These mangroves are in continuous contact with sea water.

Associated with the submerged prop roots characteristic of the red mangrove is a rich community containing a wide assortment of organisms. Competition for space on these roots is high. Invertebrates present include crustaceans, molluscs, bryozoans, sponges, echinoderms, polychaetes, and coelenterates. Vertebrates include fish and a wide variety of tunicates. Algae from different taxonomic groups are also very abundant.

Emergent segments of the prop roots, as well as the stems of other mangrove species, are also used as substrate for invertebrates, especially crustaceans and molluscs. Associated with these diverse root and stem communities is a rich variety of abundant wildlife, especially birds.

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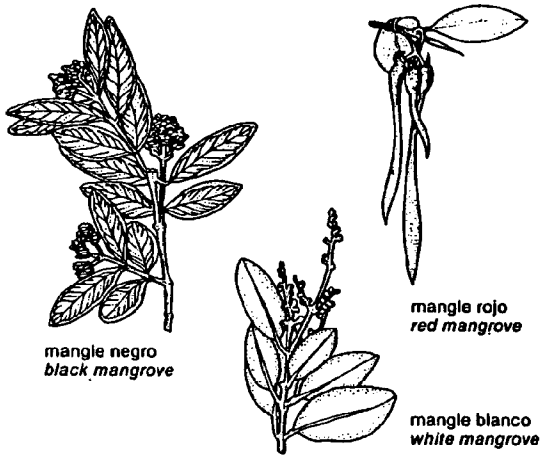
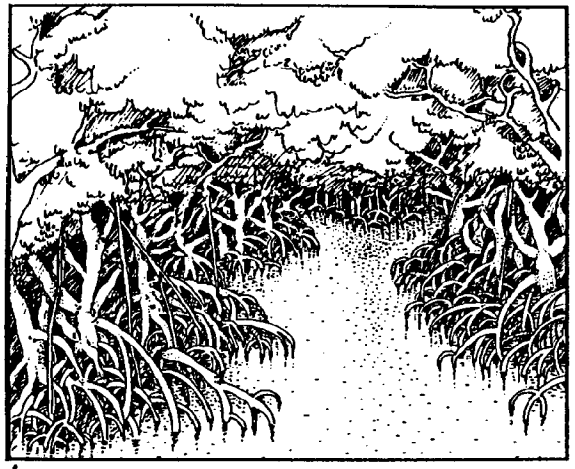
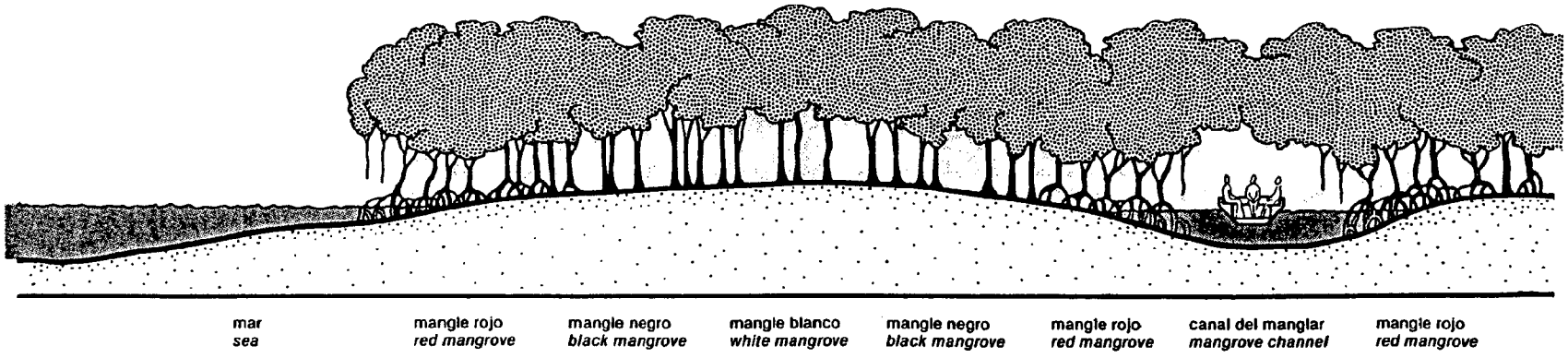
Figure 11
Perfil Típico de Manglar
Typical Mangrove Profile



Tipos de Mangle
Types of Mangrove



Canal del Manglar
Mangrove Channel



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Fringing, as well as other types of mangroves, also serve as nurseries for many species of fish which migrate to adjacent coral reefs or seagrass beds during their life cycle. Dissolved and particulate organic material and other nutrients are also exported to these adjacent subtidal communities.

Because of their location and the land-sea interface, red mangroves play an important role in protecting coastal land. Mangrove stands act as buffers absorbing the force of wave energy, therefore attenuating and preventing coastal erosion.

(2) Overwash

Offshore, overwash mangrove forests develop over shallow platforms or islets (cays) within the inner shelf. These are overtopped daily or less frequently by high tides and extend laterally. With extensive prop root development, water circulation eventually is reduced within the inner zones. The inner red mangrove trees die due to salt accumulations from reduced water circulation (this species is not very tolerant to high salinities) and are replaced by stunted black mangroves (Avicennia germinous), a species more tolerant of high salinities. Finally, salinity increases beyond the threshold tolerance of the black mangroves which die at the core of the islet. A hypersaline lagoon is then formed. This process may be set back by natural or human induced forces such as hurricanes or mangrove cutting, respectively (Cintron et al., 1978). All stages of this process are represented within the proposed sanctuary.

These overwash mangroves also have associated prop root communities and commonly serve as bird rookeries within the area. In La Parguera these islets are critical to large numbers of herons, the endangered brown pelicans, and terns. The only nests of the endangered yellow-shouldered blackbird safe from parasitization by cowbirds are found on these small cays.

(3) Basin

Even though basin mangrove forests are much better developed off the north coast of Puerto Rico, they do appear in La Parguera in close association with the fringing forests (i.e., Pitahaya). These forests are normally separated from direct contact with sea water except during very high tides or during stormy weather.

The dominant species is the more tolerant black mangrove and to a lesser degree, the white mangrove, Laguncularia racemosa. Sometimes the buttonwood, Conocarpus erectus, is found within the innermost reaches of the forest. Various species of decapod crabs are usually associated with either the soils or the tree stems of these forests, for example, the fiddler crabs of the genus Uca, the colorful Gomiopsis cruenata, and others. Many birds also use these habitats.

(4) Dwarf

Even though dwarf mangrove forests within the proposed sanctuary have not been reported in the literature, low stature trees have been observed. Although it is not known whether these are true, nutrient-limited dwarf trees or trees stunted due to high soil salinities, favorable conditions exist for the development of these dwarf types (Cintron, 1982, personal communication).

c. Salt Water Flats and Lagoons

Hypersaline lagoons and salt flats occur inland from the mangrove forests. They are formed as a result of reduced inland runoff, higher evaporation rates, and reduced rainfall (Martinez et al., 1979). Dead black mangrove trees are often seen within these lagoons.

d. Seagrass Beds

The general climatic and oceanographic characteristics of the region as well as the low incident of waves and the protection afforded by the above mentioned cays and reefs, all tend to promote high seagrass development (Gonzalez-Liboy, 1979), (Figures 6, 8, 9, and 10).

Depth, irradiance, atmospheric exposure and wave action appear to be the most important factors affecting the distribution of these beds within the region. Just west of Punta Pitahaya, the protection afforded by outer reefs especially Margarita, ends more or less abruptly, thus exposing the inshore grass beds. As a consequence, grass-free depressions or blowouts are formed probably due to storm generated waves (Gonzalez-Liboy, 1979). Coincidentally, mangroves are not present within the shoreline segment (from Pitahaya to Punta Molino). Their development is also apparently precluded by this condition.

Thalassia testudinum is the dominant seagrass in La Parguera followed by Syringodium filiforme, Halophilla sp. and Halodule wrightii. Turtle grass (Thalassia testudinum) beds in southwestern Puerto Rico are structurally well developed. Their net production is higher than in other beds in Puerto Rico, having high turnover values and being capable of producing 18 crops a year (Gonzalez-Liboy, 1979). Standing crop, biomass and leaf length were found to be higher in deeper beds as opposed to shallower ones (Delgado, 1978).

From the intertidal zone to depths of about 10 m, Thalassia beds are present. Large, well-developed meadows have generally been observed at depths of 2 m or less. These meadows occupy most of the shallow bottom just offshore the mangrove fringe. Off Isla Guayacan, for example, Thalassia and Syringodium grow close to the submerged mangrove roots.

Dense growth of Thalassia has also been observed in semi-enclosed areas with good circulations and clear waters. Two examples are the meadows northeast of Magueyes Island and around Cueva Island. These areas are protected by mangrove islets and have an average depth of 2 m. The sea condition is usually calm allowing for good transparency. Water transparency measured

horizontally near the Cueva and Magueyes sites was 6.5 m. These conditions of clear waters appear to prevail throughout most of the year, except during periods of very heavy rainfall and runoff (October and November).

The distribution of Thalassia near offshore reefs, islets, and mangrove islands with the sector is generally restricted to the lee (north) side of these formations. Exceptions to this are the meadows growing around mangrove islands within the inner shelf province. Protection offered by the rather large system of offshore reefs allows Thalassia to colonize both the leeward and windward sides of these islands; it commonly occurs in association with coral species such as Millepora complanta and Octopora cervicornis.

Thalassia is absent from the exposed reef fronts which continuously receives the impact of the incoming waves. However, on the innundated central portion of the reef flats Thalassia develops among the coral rubble. Thalassia is also present in the shallow lagoon side of the reefs where it occurs in a rather variable band just behind the reef flat.

Seagrass beds within the area display a high diversity of inches which allow for a wide variety of organisms, some of which, like the queen conch, are of high local commercial importance. Other associated organisms include other mollusks, coelenterates (including isolated corals), echinoderms, sponges, fish, sea turtles, and manatees. Algae of different groups are also abundant and diverse (Glynn, 1964; Matthews, 1967). Many species of reef fish are entirely dependent on seagrass beds for nutrition and migrate daily for feeding purposes. The endangered hawksbill sea turtle (Eretmochelys imbricata) have been sighted in the seagrass beds within the proposed sanctuary.

The seagrass beds between Bahia Sucia and Punta Pitahaya are exceptionally well-developed and extend from the shoreline to depths of 10-11 m. They become less dense as depth increases and occupy a great deal of the inner shelf bottom. Thalassia is the dominant seagrass, although Syringodium is also very common. Samples of dead seagrass leaves piled up at the beach at Bahia Sucia after a tropical storm consisted of 52% (dry weight) Thalassia and 45% Syringodium.

e. Beaches

Shoreline beaches are present from east to west, at Caleta Salina, Salinas Salineta, Punta Montalva, east of the entrace to Bahia Fosforescente, Papayo, Playita Rosada, west of Punta Pitahaya, Bahia Sucia, Los Morrillos (Cabo Rojo Point), and northern and northeastern Bahia Salinas. It is reported that sea turtles still nest on the beaches of Bahia Sucia and Bahia Salinas (DNR Rangers, personal communication, 1982).

f. Rocky Shores

Rocky shores, usually found in exposed areas with strong wave action, are located from east to west in southern Isla Matei, eastern Bahia Fosforescente, Isla Guayacan, near Isla de Cuevas, Punta Molino and the eastern, western and southern parts of the sand tombolo at Cabo Rojo.

g. Bioluminescent Bays

Bioluminescence is fairly common in the open ocean, but rarely seen in coastal bays. In the La Parguera vicinity there are two secluded bays which support this environmental phenomenon (Figures 6, 8, and 9). At night the waters of Bahia Fosforescente and, to a lesser degree, Bahia Monsio Jose sparkle when stimulated by a boat's wake, a school of fish, or a hand running through the water. This is caused by the existence, in high concentrations, of the light-emitting plankter, the dinoflagellate, Pyrodinium bahamense.

Bahia Fosforescente has a total surface area of 200,000 square meters while Bahia Monsio Jose contains 89,000 square meters. Water depth in both areas is approximately four meters (National Park Service, 1968). Both bays are small, pocket-like, rocky basins with narrow mouths formed by weathering and erosion. The combination of these narrow entrances and the low rate of seawater exchange (or flushing) create the ideal conditions for bioluminescence. Along with the combination of rich nutrients entering from diverse sources, the restricted water movement within the bays creates a rare and delicate ecosystem. The sources of nourishment for these dinoflagellates are varied. Mangrove trees surrounding the bays support a rich and diverse array of plants and animals. Detrital matter from the mangroves along with waste products from species associated with the mangroves supply necessary nutrients and organic matter. Additionally, materials washed down from nearby uplands as well as nutrients entering from the open ocean add to the nutrient supply.

4. Rare and Endangered Species

Many animal species in Puerto Rico are threatened with extinction as a result of destruction, disturbance of habitat, or hunting. Other species with specialized habitats or limited distribution ranges are endangered, or on the verge of being endangered, as a result of growing development pressures. A list of the "Island's Rare and Endangered Animal Species" was prepared in 1973 by a committee of representatives of Commonwealth and Federal agencies and private organizations for the Puerto Rico Department of Natural Resources.

The committee list described animals by degree of endangerment, cause of endangerment, and location of habitat with respect to Puerto Rico. Some of the species were rare throughout the world and listed in the U.S. as endangered species; others were both rare in the world and in Puerto Rico.

The endangered animal list of the Puerto Rico Department of Natural Resources includes many more local animals than does the Federal endangered species list, since the local document concerns only the status of animals in Puerto Rico. For example, the West Indian Tree Duck (found at Cabo Rojo) is not endangered throughout its entire range, but the local Puerto Rico population is indeed threatened.

The following rare and endangered species selected from that list are those known to occur in La Parguera. Three species endangered worldwide and protected under the U.S. Endangered Species Act, the West Indian Manatee (Trichechus manatus), the hawksbill sea turtle (Eretmochelys imbricata), and the brown pelican (Pelecanus occidentalis) frequent the proposed LPNMS (Figures 8, 9, and 10).

a. West Indian Manatee

The West Indian Manatee or sea cow, Trichechus manatus, is one of only four living species belonging to the unique group of aquatic herbivores, the mammalian Order Sirenia. It is a massive, fusiform, thick-skinned, nearly hairless animal with paddle-like forelimbs, no hindlimbs, and a spatulate, horizontally flattened tail. Most adult manatees are 9 to 11 1/2 feet (2.8 to 3.5 meters) in length. Manatees are usually slow moving, but are able to swim swiftly for short distances (Brownell, 1980).

This species historically was found in shallow coastal waters, bays, lagoons, estuaries, rivers, and inland lakes throughout much of the tropical and subtropical regions of the New World Atlantic, including many of the Caribbean islands. However, at the present time, manatees are now rare or extinct in most parts of their former range (Brownell, 1980).

During the latter half of the 1800's manatees were fairly common around Puerto Rico, although estimates of numbers are not available. They are now less common. The decrease in numbers is attributed to silting of rivers and hunting pressure. Recent surveys indicate a total Puerto Rico population of less than 100 animals. Small groups are frequently sighted on the south coast, and around the mouth of the Fajardo River on the east coast. Current population trends are unclear. A small number of manatees are still taken each year in fishing nets (Brownell, 1980).

b. Hawksbill Sea Turtle

Hawksbill sea turtles (Eretmochelys imbricata) are known to frequent the waters of the proposed sanctuary. This species is usually found in shallower water, usually in depths of less than 50 feet. The hawksbills seem to prefer cleaner beaches and more oceanic exposure. Even though the hawksbill wanders a great deal, it seems more attached to one region than other sea turtles (Rebel, 1974). The mangroves and adjacent seagrass beds provide ideal foraging grounds for these animals. Rangers have seen signs of turtle nesting on the beaches of Bahia Sucia and Bahia Salinas. Although the turtles are endangered and protected under the Endangered Species Act, poaching still occurs.

c. Brown Pelicans

The brown pelican (Pelecanus occidentalis) of the Caribbean is a sea bird that does not venture far from shore. It feeds on fish which it sights from the air and then seizes in plunging dives (Welty, 1975). Historically, brown pelicans nested on Enrique Cay and Turromote Cay in La Parguera. At the present time, however, in the La Parguera area pelicans are nesting only on cays in Montalva Bay, where they represent the largest breeding colony in Puerto Rico.

B. Social and Economic Factors

1. Regional Characteristics

The proposed LPNMS falls within the San German labor market area (Cabo Rojo, Lajas, Subana Grande, and San German municipalities) of the southwest economic sector. The La Parguera region is located between the major population center of Mayaguez and Ponce on the west and south coasts, respectively.

Mayaguez, a seaport, is the sixth largest city in Puerto Rico, with a 1980 population of 96,193. The economy of the city centers largely on shipping, commercial fishing, light industry, and the University of Puerto Rico. San German is ten miles from Mayaguez and the site of the main campus of the Interamerican University. Ponce, the third largest metropolitan area and seaport in Puerto Rico, had a population of 189,046 in 1980.

The San German labor area municipalities in 1980 contained a population of 108,410, or three percent of the population of Puerto Rico (3.2 million). The unemployment level of San German is estimated at 12.6 percent of the work force or 39,000, placing the area in the category of "persistent unemployment." The island-wide rate of unemployment is substantially higher, estimated at 22 percent. Agricultural activity is minor. Government and industry comprise the principal fields of employment.

The municipality of Lajas, of which the barrio of La Parguera is a part, is among the least populated areas of the San German market area. Its economic activity is mostly influenced by its proximity to subregional commercial, service, and governmental activities.

2. Local Characteristics

The population of the La Parguera region is primarily in the village of La Parguera. It has evolved from a small fishing village to a popular recreational area for Puerto Ricans. The barrio (ward) and village of La Parguera, the population center of the region, are practically one and the same. The most recent population count for the barrio was 1,678, of which the village contained 1,278. Reliable social and economic data for the village of La Parguera are limited. The permanent population of the village is reported to have increased from about 1,000 in 1960 to 1,700 in 1980. Housing units apparently increased more dramatically, from about 250 units in 1968 to a reported 680 units in 1980.

It is possible that, based on the reportedly small residential population and the range of labor market opportunities (i.e., recreational infrastructure, commercial fishing, marine research), the work force in La Parguera is presently being supplemented by workers living outside, but within commuting distance of the village.

3. Users

a. Visitors

The fishing village of La Parguera is a center for recreational boating and fishing, snorkeling, SCUBA diving, and sightseeing on the southwest coast (Figure 12, Existing Recreational Use). During the day, charter boats take visitors to Mata de la Gata, a small park with picnicking and swimming facilities on an offshore islet owned and managed by the Commonwealth Department of Natural Resources. Other boat trips take visitors to explore the many reefs offshore. Day trips are available to some of the larger cays. A glass bottom boat, averaging 22 passengers per trip, is also available at the town docks to view submerged reefs and fish. Snorkeling, SCUBA equipment, and boats may be rented at one facility along the waterfront.

Visitors coming to La Parguera from nearby population centers such as Ponce, Mayaguez, Lajas, and San German, and international visitors are particularly attracted to La Parguera's most distinctive feature, Bahia Fosforescente. At night, the two boat companies in La Parguera take visitors to the bay, making as many as four or five trips per night. There are apparently no boat charters for sportfishing at the present time (Pepe, personal communication, 1981).

Although data on visitors to La Parguera are limited, tourism appears to be increasing. There are, of course, the "permanent" visitors: owners and guests occupying vacation or second homes, which presumably account for the spurt in housing units between 1968 and 1980. The interest in recreational fishing, boating, and diving throughout La Parguera waters, as well as the attraction of Bahia Fosforescente to island-wide and overseas visitors is demonstrated by the existence, in La Parguera, of two hotels and nine guest houses (241 rooms), four cafeterias, and seven restaurants.

This variety of attractions, including the DNR recreational facilities at Isla Mata de La Gata, and Playita Rosada (a public beach), the marine sciences laboratory of the University of Puerto Rico situated on Isla Magueyes, directly across the channel from the town, and the outstanding natural scenic beauty of the coastal area is apparently resulting now in an annual tourist visitation rate of more than 35,000 (DNR Mayaguez Office Statistics, 1981). The majority of these visitors, according to residents, are Puerto Rican, who probably come from the urban centers of Ponce, 57 km (30 miles) and Mayaguez, 35 km (22 miles) away. It appears that most "international" or mainland tourists, thus far, prefer the gaming tables and crashing surf of the northern "Gold Coast" to the more natural attractions offered by La Parguera.

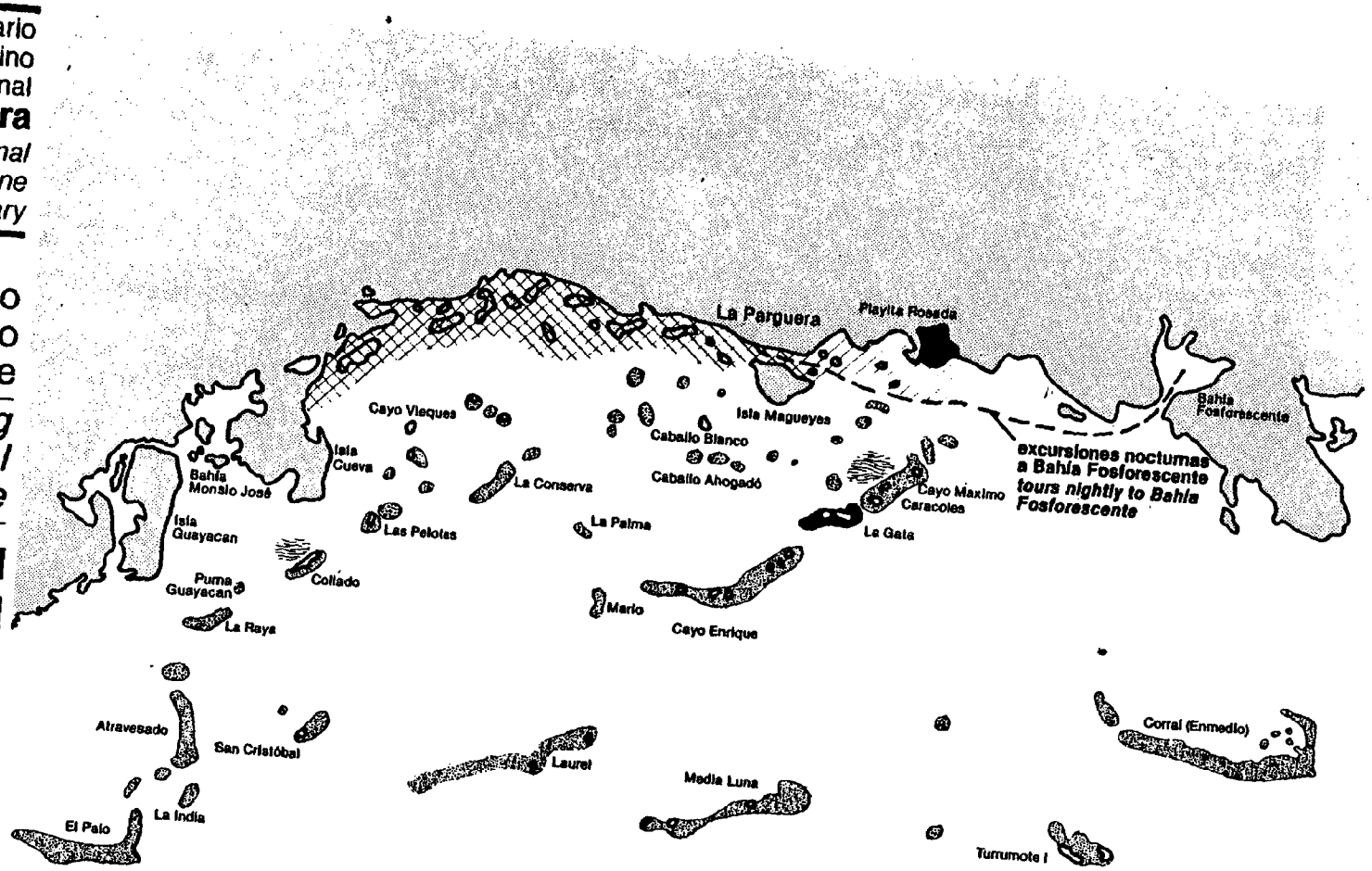
b. Education and Research

Although the Marine Sciences Program of the University of Puerto Rico is based in Mayaguez, most of the teaching and research is carried out on an 18-acre island (Magueyes) directly offshore La Parguera village. The Department of Marine Sciences offers both a Master of Science and Doctor of Philosophy degrees.

Santuario
Marino
Nacional
La Parguera
National
Marine
Sanctuary

Figure 12
Uso
Recreativo
Existente

Existing
Recreational
Use



Evelyn S. Wilcox
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The Magueyes Island Field Station is operated for the purposes of education and research in the marine sciences (biological, geological, physical, and chemical oceanography). A wide variety of shallow water tropical marine habitats are found within a short distance of the station and the facilities and equipment needed for their study are largely available on the island.

There are various small boats available for use in protected inshore waters. For offshore work including deep-ocean capabilities, the R/V Medusae (60 feet), a converted shrimp trawler, the R/V Pezmar (50 feet), and the R/V Crawford (125 feet) are available for students and for charter.

In addition to marine science graduate students, outside visitors, study groups and scientists make use of the facilities for nominal fees. Guided tours are provided, free of charge, for school groups and other interested organizations. Snorkeling and SCUBA diving from university boats are permitted for visitors.

A small three room dormitory with bunk beds is available on Magueyes Island along with modest kitchen facilities. Individuals or small groups use this dormitory, while larger groups usually stay at the Hotel Villa Parguera in the village.

c. Commercial Fishing

The fishing population in the La Parguera area, organized in five fishermens' associations from Guanica to Boqueron, were contacted by Evelyn S. Wilcox and Associates in order to interview "key informants." The president of each association and several of the most active members were interviewed in order to:

- obtain their views on the possible impact of the marine sanctuary program on their activities;
- obtain updated information on fishing activities in the area in order to compare with available statistics; and
- determine fishermen's needs and concerns.

Data collected are presented throughout this section. For more detailed information and a list of associations and persons contacted see Appendix B.

The National Marine Sanctuary Program was viewed positively by most of the fishermen. They were concerned, however, that the sanctuary regulations may limit their fishing activities. These concerns are particularly relevant since the three areas visited, Parguera, Boqueron and Guanica, are experiencing difficult economic situations reflected in current high unemployment rates. Full-time fishermen interviewed reported working in other types of activities to supplement their incomes.

(1) Income

The following fisheries data for these municipalities listed below in Table 2 were taken from Ruiz, Blanca and Edmee Doble, Perfil de los Familias Pobres de Puerto Rico por Area Geografica, 1980, (Servicios Legales de Puerto Rico, October 1981).

Table 2. Annual Income

Municipality	% Fishermen Below Poverty Level*	Median Family Income
Lajas	59	$5,010
Cabo Rojo	60	4,889
Guanica	62	4,807

*Poverty level was estimated at $4,000 annual income for a family of five.

Recent factory closings in Guanica are not reflected in this data, so the present situation could be significantly worse. Recently the sugar mill and two other industries closed operations. Only Ochoa Fertilizers, an industry with very few workers, is still operating. Fostering recreational uses in the La Parguera area could become a means of revitalizing the local economy and providing additional income to the fishermen.

(2) Productivity

In 1974, the waters of Puerto Rico were reported by Brody and Slocum in 1974 to be "very nearly overfished at present," and the shelf was "heavily exploited" according to Kawaguchi (1974).

Observations made of fresh catch at La Parguera, Boqueron, and Guanica during the interviews seemed to confirm the above statement. The size of most specimens was small and weight per pot averaged from 5 to 8 pounds. A review of statistics available at the associations visited was consistent with these observations. Fishermen advised that the average catch per pot was around 8 pounds with 25 pounds as the upper limit when fishing conditions are ideal.

Based on the information obtained in more than 30 island fishing centers over the past few years, fish pot commercial catch per unit of effort has been very close to five pounds per lift per pot (Juhl, 1976).

The greatest concentration of fish pots was reported on the west coast of the Island. The town of Cabo Rojo is the fishing center having the largest number of fish pots and showing the highest production.

(3) Fishing Sites

La Parguera village fishermen go as far as 3 to 9 miles offshore to fish at the shelf's edge. Each fisherman sets 20 to 30 pots and lifts them twice a week. When they don't lift pots, they fish with a troll line or by diving. Fishermen come from Guanica and Boqueron to fish almost everyday.

Boqueron fishermen go daily as far as 4 miles from shore. They also were reported fishing in Mayaguez and occasionally in Guanica.

Guanica fishermen stated that they had from 4 to 100 pots per fisherman, with the average in the 20 to 30 range. They fish mostly off Guanica, but also off Lajas and Guayanilla.

Playa Santa (Guanica municipality) fishermen go out every day and sell their catch daily at the fishermen's association facilities. This was the only fishermen's association that is active and doing well out of the five interviewed. They fish from the El Faro area in Guanica to Bahia Montalva and Cana Gorda most frequently. They also fish in the Lajas area. They go 2 to 3 miles offshore in the eastern area and 1 to 1 1/2 miles in the western area following the shelf edge.

All the fishermen interviewed considered the area from Guanica to Boqueron as one unit. They all know each other and have no problems among themselves with fishing in different areas.

(4) Product Marketing

Fishermen sell their catch through a variety of market channels, but primarily through wholesalers or fishermens' marketing associations. No published statistics are available on the number of dealers handling the catch. It is estimated that 90 percent of the locally caught fish are currently sold through these wholesale channels. A 1965 study (Arnion Torres, 1965) reported that 80 percent of the fish landed in Puerto Rico were handled by wholesalers.

Fish sold are classified into three quality classes:

Class 1: groupers, snappers, kingfish, cero, mullet, and hogfish

Class 2: blue runners, wahoo, smaller groupers, and snappers

Class 3: parrot fishes, squirrel fishes, and trash fishes

Lobster, octopus, conch and large snappers are classified apart and get the highest prices. Table 3 shows data collected from five fishermen's associations.

Table 3. Wholesaler's Price Per Pound to Fishermen
April 1982

Locality	Class 1	Class 2	Class 3	Lobster	Snapper	Octopus	Conch
Parguera	$0.85	$0.55	$0.25	$2.75	$1.15	$1.60	$1.60
Boqueron	1.00	0.60	0.40	3.00	1.50	2.00	2.00
Combate	1.20	0.60	0.35	3.00	1.50	1.80	1.20
Play Santa	0.85	0.65	0.35	1.50	1.15	1.25	1.25
Guanica	1.00	0.80	0.30	3.00	1.50	1.50	1.50

Source: Ruiz, personal interviews with fishermen and fishermen's associations (See Appendix B).

Lajas' role in the commercial fisheries industry of Puerto Rico is important in the consideration of La Parguera as a proposed national marine sanctuary. As noted in the Economic Profile of Commercial Fishing (Appendix C), although Lajas contributed only 3.2 percent of the volume and value of overall Puerto Rico landings, its contribution to the south coast of Puerto Rico appears to be substantial in quantity and value; 21 and 12 percent, respectively, in 1978. The barrio of La Parguera and the village, as the important "port of entry," consequently play a significant part in the subregional fisheries economy.

The proposed LPNMS is most frequently utilized by fishermen from Lajas and Guanica municipalities. According to CODREMAR statistics, the value of landings and number of fishermen and boats have increased since 1970. However, if inflation is considered, there was no real increase in the fisherman's income (Gonzalez-Liboy, personal communication, 1982). Gross earnings per fisherman in Guanica increased from $1,405 in 1970 to $3,258 during the 1977-78 period. In 1970, Lajas fishermen's income averaged $2,027 which increased to $3,044 during the 1977-78 period.

d. Sportfishing

There is no site-specific information available on recreational sportfishing and boating in La Parguera or island-wide. Recreational sportfishing and boating are significant economic activities in Puerto Rico. An estimated average daily value of a day of recreational activity is $47.90 with a range from $32.57 for cruising to $55.79 for line fishing. Approximately 8,200 boats island-wide are currently registered for recreational use. Approximately 15 percent (or 1,250) of the recreational boats leave from points likely to be associated with the proposed sanctuary site (Cato, Prochaska, 1981). Club Nautico of La Parguera, a private club, accommodates approximately 50 power boats.

E. Legal/Institutional Background

1. Introduction

The proposed La Parguera National Marine Sanctuary is almost entirely situated in Commonwealth waters, and their waters are controlled by a variety of Commonwealth and Federal statutes and regulations. Those laws and regulations that control activities both in the water and on the land which might impact the proposed sanctuary are identified and discussed below. In addition, several entities are already charged with implementing and enforcing these laws and regulations. This chapter provides an overview of those relevant laws and enforcement agents.

2. Commonwealth and Federal Laws

Puerto Rico is a territory of the United States in which most, but not all, of the Articles of the U.S. Constitution apply. In its consideration of specific legislation, the Congress may include or exclude the territories. Statutory laws of the United States, not locally inapplicable, have the same force and effect in Puerto Rico as in the United States (48 U.S.C. §734). Laws that are locally inapplicable are determined by the courts (Cordova y Simonpietri v. Chase Manhattan Bank, 649 F.2d 36 (1981)).

The Commonwealth, by Act of Congress, has jurisdiction and authority over the natural resources underlying submerged lands and waters as well as proprietary rights of ownership, management, and administration of fisheries three marine leagues or 10.35 miles from the coast (48 U.S.C. §749).

Although there is no court decision interpreting 48 U.S.C. §749, it may be concluded, under general principles of law, that Puerto Rico has proprietary rights to both the submerged lands and navigable waters to three marine leagues from its coastline and, under old common law principle, Spanish law and modern statutes, to the fish and wildlife within its territorial waters (3 miles). A recent decision by the National Marine Fisheries Service (NMFS) extends fisheries management authority in Puerto Rican waters, from 3 to 10.35 miles without expressly stating ownership or extent of territorial waters.

a. Commonwealth Laws

Puerto Rico has a strong public policy governing the protection of its environment and the conservation and protection of its natural resources. The Environmental Quality Board, the Planning Board, the Regulations and Permits Administration, and the Department of Natural Resources are the four agencies with primary responsibilities for planning and managing public actions and for regulating private sector activity in coastal areas. This section describes their organic laws, supplemental statues, and regulations which affect the LPNMS.

(1) Environmental Quality Board (Law No. 9, June 18, 1970, as amended)

The Environmental Quality Board (EQB) has the following powers and duties relevant to the proposed sanctuary:

- permitting and licensing authority to regulate and control the pollution of air and water, solid waste and noise;
- determination, through studies and sampling, of the degree of purity of the water and air and the establishment of corresponding standards in coordination with concerned agencies;
- adoption of rules and regulations and prescribed orders, establishing adequate policies for the handling and disposal of solid waste; and
- permitting and licensing for the installation and operation of solid waste and treatment plants.

The EQB has initiated negotiations with the Environmental Protection Agency (EPA) to assume responsibility for the National Pollutant Discharge Elimination System (NPDES) permitting program, but has not yet received such authority. There are no NPDES permits operating at the present time within the proposed marine sanctuary site.

EQB has promulgated the following regulations:

- Regulation for Water Quality Standards;
- Regulation for Control of Atmospheric Pollution; and
- Regulation for the Control of Solid Waste.

The Regulation for Water Quality Standards employs classifications similar to those of EPA, including the following:

Class SA - "Coastal waters whose purity is necessary for the preservation of the existing [phenomena]. Toward that end, these waters are not intended to be used for any activity such as swimming, boating, skiing, etc. that might be detrimental to the existing natural phenomena."

Class SB - "Coastal waters intended for uses where the human body may come in direct contact with the water...and for use in propagation and maintenance of species."

The waters of the bioluminescent bays in La Parguera are now classified SA (see Section II.F., Issues Associated with Water Quality and Population Growth, for more discussion).

(2) Planning Board (Law No. 75, June 24, 1975, as amended)

The Planning Board (Board), initially created pursuant to the Planning and Budget Act (Law No. 213, May 12, 1942), was reorganized in accordance with its new Organic Law on July 1, 1975. The Board coordinates all government sector activity and guides private sector actions toward the integrated, balanced development of the Island's resources. The Organic Act provides for a variety of devices which, when adopted by the Board and approved by the Governor, have the force of law. Those that directly affect the proposed LPNMS are the following:

° Integral Development Plan, which sets forth policies and strategies for development. On January 26, 1976, the Board adopted a document entitled, "Integral Development Plan: Public Policies and Specific Objectives;" the Governor gave his approval to the document on April 10, 1979.

° Land Use Plan, which provides specific guidance for physical development, including public infrastructure. On June 8, 1977, the Board adopted a "Statement of Policies and Objectives for the Islandwide Land Use Plan;" the Governor approved the document on June 22, 1977. Elements of that statement are repeated in the Integral Development Plan described above.

° Four Year Investment Program, which provides guidance to the government budget process, establishing fiscal limits and indicating priorities for operating expenditures and capital programs. This document is revised periodically and guides the Bureau of Management and Budget in the preparation of the annual executive budget which is submitted by the Governor to the Legislative Assembly.

Pursuant to the Organic Law, the Board adopted the Puerto Rico Coastal Management Program (PRCMP) as an element of the Land Use Plan on June 22, 1978. The Governor approved the PRCMP on July 12, 1978. The Secretary of Commerce accepted the PRCMP on September 18, 1978, making Puerto Rico eligible to receive continuing Federal assistance under the Coastal Zone Management Program for implementation of the program. Elements of the PRCMP that relate to the proposed sanctuary include the Southwest Special Planning Area, the Parguera Natural Reserve, and the Boqueron Natural Reserve. In addition, all mangrove wetlands are classified generically as a Special Planning Area.

The Planning Board exercises its authority over physical development directly, through the initial review of all development proposals, and through the adoption of major zoning district changes, and indirectly, through the promulgation of Planning Regulations which are implemented by the Regulations and Permits Administration, as described below. The Planning Board is also responsible for assuring consistency of all activity in coastal areas with the PRCMP.

(3) Regulations and Permits Administration (Law 76, June 24, 1975, as amended)

The Regulations and Permits Administration (ARPE) was created to relieve the Planning Board of the administrative effort related to the granting of permits and enforcement of the Planning Regulations. In

addition to the responsibilities assigned under its Organic Law, ARPE may carry out other functions by delegation of the Board pursuant to formal resolution and in accordance with specific regulations. ARPE issues permits for construction and for use of land and structures. It has a small team of building inspectors who work out of regional offices in major cities of the island. ARPE is responsible for prosecuting violations reported to it by other agencies, including the DNR rangers. Current Planning Regulations that affect the proposed LPNMS include the following:

Number 3 - Subdivisions
Number 4 - Zoning
Number 6 - Signs
Number 7 - Construction Code
Number 9 - Neighborhood Facilities
Number 11 - Simple Subdivisions
Number 12 - Certification of Projects
Number 13 - Floodable Area

Other regulations are being developed to guide development related to the following topics: rural areas, tourism, and coastal areas.

(4) Department of Natural Resources (Law No. 23, June 20, 1972, as amended)

The Department of Natural Resources (DNR) was established in accordance with its Organic Law on January 2, 1973. It represents the amalgamation of various powers and duties previously vested in the Department of Agriculture and the Department of Public Works, the Public Service Commission, and other agencies into a single jurisdiction with comprehensive responsibility for the planning and management of all natural resources. The Organic Law makes specific mention of the following: conservation and development of water resources; control over the extraction of materials from the earth's crust; regulation of hunting and fishing; propagation and management of forests and wildlife; and coordination of several programs related to watershed protection that were sponsored by various Federal agencies.

The following statutes supplement the authority of the DNR Organic Law as it applies to the proposed LPNMS:

Law 70, May 30, 1976 (Hunting Law)
Law 83, May 13, 1936 (Fishing Law)
Law 133, July 1, 1975 (Forestry Law)
Law 144, June 3, 1976 (Extraction of Materials from the Earth's Crust)
Law 1, June 29, 1977 (Marine Resources Development Corporation)
Law 145, July 2, 1975 (Mineral Resources Development Company)

The Fishing Law, last amended in 1977, regulates all aspects of residential and non-residential commercial and sport fishing in territorial waters. It prohibits the use of explosives and requires licensing for fishing activities within inland and coastal waters. A Fish Conservation Advisory Committee with one representative each from DNR, Tourism, the University of Puerto Rico, the commercial fishermen's associations and sport fishermen's associations is provided for under this statute.

The 1977 amendment extended the law's jurisdiction to 12 nautical miles from the main island and from all smaller Puerto Rican islands including Mona and Monito. This 12-mile extension has not yet been tested in court. Fisheries management authority, however, out to 10.35 miles, was granted to the Commonwealth by the U.S. Department of Commerce in 1981.

The Forestry Law establishes public policy with regard to forestry and states, among other things, that the Commonwealth will maintain, conserve, protect, and manage the areas for the legacy of future generations. To this end, Article 9 of the Act prohibits certain activities without written authority of the Secretary of DNR. Prohibited activities include:

- damages to property - cutting, killing, destroying, uprooting or injuring any tree;
- burning;
- pasturing cattle;
- unlawful tenancy;
- removing or damaging signs; and
- hunting (although the Secretary regularly establishes a limited season).

The Boqueron State Forest includes approximately 2/3 of the coastal red mangroves within the area of the proposed sanctuary. Within the forest are red mangrove areas extending from Cabo Rojo in the west to the the village of La Parguera in the east (Figures 9 and 10). As a State Forest, the area is subject to the provisions and restrictions of Law No. 133, The Forest Act.

DNR was assigned the responsibility for developing the PRCMP and for its continuing implementation under Section 306 of the Coastal Zone Management Act. The PRCMP, as adopted by the Planning Board and approved by the Governor sets forth public policies to promote the conservation, preservation, and wise use of Puerto Rico's natural environmental and cultural resources. The following marine resources, specifically identified as valuable to the Commonwealth, are found within the boundaries of the proposed La Parguera National Marine Sanctuary: (a) La Parguera - (1) coral reefs--Margarita and Media Noche; (2) mangrove wetlands--La Garray, Bahia Sucia, La Parguera, Bahia Fosforescente, and Bahia Montalva; (3) beaches--Playita Rosada and Montalva; (4) wildlife--the water areas surrounding Cabo Rojo, Bahia Sucia, and the water area between Punta Pitahaya and Punta Montalva were identified as critical areas for endangered wildlife; (5) coastal forests--Boqueron Mangrove Forest; and (6) cultural and historical sites--lighthouse (Faro) at Cabo Rojo.

Under the continuing implementation program, DNR is developing a management plan for the La Parguera Sector of the Southwest Special Planning Area. Pursuant to the PRCMP, DNR promulgated a regulation related to the taking of coral in October 1979. That regulation controls the extraction, possession, transportation and/or sale of coral in Puerto Rican waters. Based on a recent fisheries management decision, this regulation is in force out to 10.35 miles. Major provisions are:

- a general prohibition of coral extraction except for scientific and educational purposes and for the possession (but not extraction) of small quantities of cured coral for personal use;
- the preparation of a DNR Management Plan (not yet completed) of coral resources, to determine among other things, the feasibility of commercial extraction of black and horny coral after a moratorium of three years;
- an exemption for recognized scientific and educational use;
- an exemption for any construction, dredging, or other activities conducted by permit granted by U.S. Army Corps of Engineers, following endorsement by DNR. No coral extraction under such a permit may be transferred to any person for sale or out of Puerto Rico without a written permit from DNR; and
- all coral taken in waters outside the jurisdiction of Puerto Rico and introduced in any manner into Puerto Rico is subject to this regulation and all other applicable laws and regulations.

Penalties for violations of these regulations and the Fishing Law provide imprisonment for not more than six months or a fine of not more than $500 or both penalties at the discretion of the court. Enforcement of these regulations is the responsiblity of the Marine Division of the rangers assigned to the various offshore areas throughout Puerto Rico. Any infractions of the law are reported to the DNR legal division in San Juan where, in most instances, cases have been handled administratively.

DNR regulations are enforced by members of the Ranger Corps (Cuerpo de Vigilantes) which functions through the regional office structure of the Department. The Rangers operate three divisions: land, sea, and air, and are equipped to support other enforcement agencies, such as the police, Coast Guard, and Civil Defense.

The Marine Resources Development Corporation (CODREMAR) is responsible for the commercial development of all marine resources in the Commonwealth of Puerto Rico and is charged with administering the Fisheries Law. The Mineral Resources Development Company (CODREMI) was created to develop the mineral resources of Puerto Rico, including those found in the submerged lands.

b. Federal Statutes

In light of the recent amendments made to 48 U.S.C. §748 and 749, the application of certain Federal laws within the three marine leagues from the coastline of Puerto Rico and its adjacent islands is, at this time, speculative. However, the following Federal laws and regulations are known to be enforceable in the waters proposed for marine sanctuary designation in Puerto Rico.

(1) Clean Water Act (CWA) (33 U.S.C. 1251 et seq.)

The Clean Water Act (CWA) establishes the basic scheme for restoring and maintaining the chemical, physical, and biological integrity of the Nation's waters. The CWA contains two basic mechanisms for preventing water pollution: (1) the regulation of discharges from known sources, and (2) the regulation of oil and hazardous substances discharges. The Act also regulates the disposal of vessel sewage and dredged material.

(a) Discharges

The CWA's chief mechanism for preventing and reducing water pollution is the National Pollutant Discharge Elimination System (NPDES), adminstered by EPA. Under the NPDES program, a permit is required for the discharge of any pollutant from a point source into navigable waters (which include State waters, the contiguous zone, and the ocean). EPA can delegate NPDES permitting to the State for state waters.

(b) Oil Pollution

Discharges of oil and hazardous substances in harmful quantities are prohibited by the CWA. When such discharges do occur, the National Contingency Plan (NCP) for the removal of oil and hazardous substance discharges, will take effect. The Coast Guard, in cooperation with EPA, administers the Plan, which applies to all discharges of oil in the contiguous zone and to activities under the Outer Continental Shelf Lands Act. The NCP establishes the organizational framework whereby oil spills are to be cleaned up.

(c) Recreational Vessels

The CWA (33 U.S.C. §1322) requires recreational vessels with toilet facilities to contain operable marine sanitation devices. The regulations state that boats, 65 feet in length and under, may use either Type I, II, or III MSD's which must be certified by the Coast Guard. Types I and II are chemical treatment devices and Type III is a holding tank. The CWA requires non-commercial crafts to comply with marine sanitation device regulations issued by EPA and enforced by the U.S. Coast Guard.

(d) Dredging and Discharging Dredged Materials

Section 404 permits, from the Army Corps of Engineers (based on EPA developed guidelines), are required prior to filling and/or discharging dredged materials within three miles of shore including wetloads, or the transportation of dredged material for the purpose of dumping it into ocean waters.

(2) Marine Protection, Research, and Sanctuaries Act of 1972, Title I, (33 U.S.C. 1401 et seq.)

The Ocean Dumping Act prohibits the dumping of certain toxic materials into ocean waters and regulates the dumping of other materials into such waters. Section 101 prohibits the transportation of any materials from within or outside the U.S. for the purpose of dumping them into ocean waters without a permit from EPA (or the Corps in the case of dredge material disposal).

(3) Marine Mammal Protection Act of 1972 (MMPA) (16 U.S.C. 1361 et seq.)

The MMPA applies to U.S. citizens and foreign nationals subject to U.S. jurisdiction and is designed to protect all species of marine mammals. The MMPA is jointly implemented by the National Marine Fisheries Service (NMFS), which is responsible for whales, porpoises, and pinnipeds other than the walrus, and the Department of the Interior, Fish and Wildlife Service (FWS), which is responsible for all other marine mammals, including the only marine mammal present, the West Indian manatee. The Marine Mammal Commission advises these implementing agencies and sponsors relevant scientific research. The primary management features of the Act include: (1) a moratorium on the "taking" of marine mammals; (2) the development of a management approach designed to achieve an "optimum sustainable population" for all species of population stocks of marine mammals; and (3) protection of populations determined to be "depleted."

(4) The Rivers and Harbors Act (33 U.S.C. 401 et seq.)

Section 10 (33 U.S.C. 403) prohibits the unauthorized obstruction of navigable waters of the United States. The construction of any structure in the territorial sea or on the outer continental shelf is prohibited without a permit from the U.S. Army Corps of Engineers (COE). As a rule, the COE will not issue a Section 10 permit unless construction or obstruction has been found to be in accordance with the Puerto Rico Coastal Zone Management Program as determined by DNR.

Section 13 of the Rivers and Harbors Act (33 U.S.C. §407, the Refuse Act) prohibits the discharge of refuse and other substances into navigable waters, but has been largely superseded by the CWA. In effect, such discharges are regulated under this section only insofar as they affect navigation or anchoring.

(5) Fishery Conservation and Management Act of 1976 (FCMA) (16 U.S.C. 1801 et seq.)

The FCMA authorizes regional fishery management councils to provide for the conservation and mangement of all fishery resources in the zone generally extending 3 to 200 nmi offshore (the zone beyond the territorial sea). NMFS establishes guidelines and approves fishery management plans for selected fisheries. These plans determine levels of commercial and sport fishing for achieving and maintaining an optimum yield. Note, however, that the territorial sea of Puerto Rico extends beyond 3 nmi. A legal opinion, prepared by the Office of the Assistant General Counsel of Fisheries (GCF), concluded that Congress intended that management jurisdiction over fishery resources within three marine leagues be vested in the Commonwealth. Therefore, the inner boundary of the Fisheries Conservation Zone, adjacent to Puerto Rico, lies three marine leagues or 10.35 miles from the Puerto Rican coastline. The U.S. Department of Justice reviewed the GCF legal opinion and supported its conclusion. As a result fishery management authority within the proposed marine sanctuary belongs to the Commonwealth and all draft fisheries management plans, prepared to manage such resources, are no longer applicable within 10.35 miles of the Puerto Rican coastline. CODREMAR now has the responsibility for fisheries management within the insular shelf. There are no species management plans or other fisheries projects planned for the proposed sanctuary area at the present time.

(6) Endangered Species Act of 1973 (ESA) (16 U.S.C. 1531-1543 et seq.)

The Endangered Species Act of 1973 (ESA) provides protection for listed species of marine mammals, birds, fish, invertebrates, and plants. The FWS and NMFS determine which species need protection and maintain a list of endangered and threatened species. The most significant protection provided by the ESA is the prohibition on taking of listed species. The term "take" is defined broadly to mean "harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect or to attempt to engage such conduct" (16 U.S.C. 1532 (14)). The FWS regulations interpret the term "harm" to include significant environmental modification or degradation and acts which annoy listed species to such an extent as to significantly disrupt essential behavior patterns (50 CFR 17.3).

The ESA also protects endangered species and their habitats. This is accomplished through a consultation process designed to insure that projects authorized, funded, or carried out by the Federal agencies do not jeopardize the continued existence of endangered or threatened species or "result in the destruction or modification of habitat of such species which are determined by the Secretary (of the Interior or Commerce) to be critical" (16 U.S.C. 1536). Critical habitat for endangered species is designated by the FWS or NMFS depending on the species.

(7) Coastal Zone Management Act of 1972 (16 U.S.C. 1451 et seq.)

In 1972, Congress passed the Coastal Zone Management Act (CZMA) in response to public concern about balancing needs for preservation and development in coastal areas. The Act authorizes a Federal grant-in-aid program to be administered by the Secretary of Commerce, who in turn delegated this responsibility to NOAA's Assistant Administrator for Ocean Services and Coastal Zone Management.

The CZMA was substantively amended on July 16, 1976 (P.L. 94-370) and on October 1, 1980 (P.L. 96-464). The Act and its amendments affirm a national interest in the effective protection and careful development of the coastal zone, by providing assistance and encouragement to coastal states (and U.S. territorites) to voluntarily develop and implement management programs for their coastal areas. Financial assistance grants under Sections 305 for program development and 306 for program implementation were authorized by the CZMA to provide coastal states and territories with the means for achieving these objectives.

Broad guidelines and the basic requirements of the CZMA provide the necessary direction to states for developing their coastal management programs. The program development and approval provisions are contained in 15 CFR Part 923, revised and published March 28, 1979, in the Federal Register.

The Puerto Rico Coastal Management Program was approved in two stages. The approval of the plan for the Island of Culebra as a segment was granted on April 1, 1977. The Culebra plan was then integrated into a Commonwealth program upon the approval of the Puerto Rico Coastal Management Program on September 18, 1978. The Program is based on the island-wide land use plan established by the Puerto Rico Planning Board and adopted by the Governor on June 22, 1977. The Department of Natural Resources (DNR) is the agency designated to administer the coastal program. Other major agencies assisting in program implementation include the Puerto Rico Planning Board, which has statutory planning, zoning, and land use responsibilities; the Regulations and Permits Administration, and the Environmental Quality Board.

3. Enforcement Capabilities of Relevant Commonwealth and Federal Agencies

The area of the proposed sanctuary is under the jurisdiction of several Commonwealth and Federal agencies. The Commonwealth agencies are the Marine Police, Puerto Rico Ports Authority, and the DNR Ranger Corps. The Federal agencies with law enforcement authority are the: U.S. Coast Guard, Corps of Engineers, National Marine Fisheries Service, and the U.S. Fish and Wildlife Service.

a. The Marine Division of the Commonwealth Police Force

The Marine Division patrols coastal waters and enforces all regulations of Law No. 19 which is similar to the Federal Boat Safety Act of 1971. The Puerto Rican marine police, the DNR Rangers, and the U.S. Coast Guard help each other by petition or in specific instances of emergencies.

There is a marine police division with 14 personnel and four boats in Boqueron next to the Ranger Station, and another division based at Ponce. These divisions receive their orders from the Police Headquarters at Mayaguez and Ponce. The central offices in San Juan handle administrative, not operational, aspects of marine police enforcement. It appears that the Marine Police seldom patrol La Parguera; rather it concentrates its efforts in the more densely populated areas.

b. Ranger Corps

The Ranger Corps, created as the enforcement arm of DNR in 1978, performs the following:

- arrests for violation of the laws administered by the DNR, when this takes place in their presence. The rangers may trespass into property and waters under state authority. Access to private properties requires previous permission from the owner except when a crime is being committed in the Rangers' presence or during apprehension of a person who has violated the laws administered by DNR;

- demands presentation and inspects any permit, franchise, resolution, license, or document granted by the Secretary of DNR in which authorization is given for any activity or operation under the jurisdiction and powers of the DNR in public or private lands within the limits of the Commonwealth of Puerto Rico;

- verbally orders the cease and desist of any activity or operation that is taking place without the authorization of the Secretary of DNR and issues judicial notices for violations of the laws administered by DNR;

- executes subpoenas issued for the examination, investigation, and processing of any violations to the laws administered by DNR;

- carries arms in accordance with the ordinances of the Police Superintendent and conducts searches related to violations of DNR laws in accordance with the Rules of Criminal Procedure of Puerto Rico that are in force, 34 L.P.R.A.;

- obtains and executes search warrants in accordance with the duties, responsibilities, and obligations established by the law that created the Ranger Corps and confiscates and possesses any wildlife, marine life or land or forest component in possession or under the control of persons who intend to transport them by way of land, air, or water in violation of the laws administered by DNR; and

- confiscates and possesses any arms, machines, equipment or means of transportation that have been used in violation of the laws administered by DNR. Any confiscation will take place according to the dispositions of Law No. 39 of June 4, 1960, as amended.

The Mayaguez Ranger Office is responsible for the land and air patrols in the La Parguera area. The office has one captain, one first lieutenant, one second lieutenant, three sergeants, and ten rangers assigned to the Marine Division. The Boqueron Station on the west coast (within the Mayaquez region) is closest to the area of the proposed sanctuary. The station has a small staff, consisting of a captain, a lieutenant, a sergeant, and four to five rangers. Two of these rangers are assigned to the La Parguera area. Much of their time inside the proposed boundaries of the sanctuary are spent at the two DNR parks--the heavily used offshore island park of Mata de la Gata and the public beach at Playita Rosada, located about one mile from the town of La Parguera. One 28' Bertram Boat patrols the west coast from Guanica to Aquadilla. One 19' Boston Whaler is used to patrol the Parguera area and one 21' Boston Whaler is used to patrol specific areas where larger boats cannot enter.

The Ranger Corps has arrangements and agreements with the Immigration Division of the U.S. Department of Agriculture, the U.S. Coast Guard, the U.S. Fish and Wildlife Service, the Ports Authority of Puerto Rico, and the Department of Police, and appear to be the only law enforcement authority patrolling coastal and marine waters of the proposed sanctuary area on a periodic basis.

Thirty-one DNR rangers have been deputized by the NMFS to enforce NMFS laws, but none of these rangers are presently serving in the area proposed for sanctuary designation. The U.S. Fish and Wildlife Service has not as yet deputized the Rangers, but works cooperatively with them in marine waters, including La Parguera.

c. U.S. Coast Guard

The Greater Antilles Section (GANTSEC) of the U.S. Coast Guard with jurisdiction for Puerto Rico covers 1.2 million square miles. The agency is required to provide search and rescue, law enforcement, and marine navigation and support to and for all Coast Guard units. Both the Corps of Engineers and the Environmental Protection Agency rely on the Coast Guard to enforce their laws in marine waters.

The total number of personnel in 1981 in GANTSEC, including civilian personnel, totalled approximately 420. There were approximately ten surface craft capable of performing certain specified duties. Of these, 30% were non-operational in need of maintenance, repairs, or other such requirements. There were also three helicopters for use in performing a myriad of operations from daily routine patrols for law enforcement, to immediate search and rescue, to emergency medical runs. However, one of these aircraft was down for general maintenance or repairs at any given time according to the Coast Guard.

With the limited number of units and the numerous responsibilities of these units, the Coast Guard will not be able to perform routine daily patrols for the proposed sanctuary. They will be able to perform a one time patrol of these areas when and if they are in the area, on an as-needed basis, or provide emergency patrol of the proposed sanctuary in the event of confirmed poachers, an oil spill, or other such emergencies.

d. National Marine Fisheries Service (NMFS)

There is an NMFS enforcement agent stationed at Ramey on the northwest corner of the Island. His primary responsibilities include the preparation of legal cases to be tried under the ESA, the MMPA, and FCMA, and other authorities out to 200 miles. To assist NMFS law enforcement efforts, three DNR rangers have been deputized to enforce all NMFS legal statutes, following careful on-the-job training by the NMFS agent in Puerto Rico.

In early 1982, thirty-one rangers were deputized by NMFS after a NMFS training session in San Juan, to enforce three of the laws under NMFS jurisdiction--the ESA, the MMPA, and the Atlantic Tuna Convention Act. This training consisted of a briefing on the laws, their accompanying regulations, and enforcement procedures applicable to each law.

NMFS enforcement personnel have been instructed not to confiscate turtle nets, as has recently been the practice of the U.S. Fish and Wildlife Service, because no gear regulation has as yet been promulgated by NMFS. Thus, the arrest of sea turtle poachers is made more difficult because there is no unified approach by NMFS and FWS concerning the enforcement of the ESA in Puerto Rican waters.

e. U.S. Fish and Wildlife Service (FWS)

At the present time, there is virtually no FWS law enforcement presence in the La Parguera area. There is only one senior resident agent with enforcement authority in Puerto Rico and the U.S. Virgin Islands responsible for wildlife inspections and other duties associated with the Migratory Bird Treaty Act, ESA, and the MMPA. His primary responsibilities also include the preparation of legal cases to be tried under the various applicable Federal statutes.

Although the FWS has not yet deputized the Rangers to carry out FWS laws and regulations, it would consider this action as a means of expanding its surveillance and enforcement range, if a training program could be developed (Cotte, personal communication, 1982).

F. Issues and Problems Associated with the Resources of the Proposed LPNMS

This section focuses on the issues and problems associated with the resources that are important to the ecology of the proposed sanctuary; that are valuable to man; and that are threatened or potentially threatened. Discussed are the enforcement of resource protection statutes; public awareness and information; the coral reef system; mangroves and grassbeds; bioluminescent bays; endangered species; and water quality and population growth. Any existing mitigation measures are discussed as well. How the management of the sanctuary will address these roles is presented later in this chapter (Implications for Management).

1. Issues and Problems Associated with Enforcement

Several Federal and Commonwealth agencies are responsible for enforcing statutes and regulations protecting the significant natural resources in the area of the proposed sanctuary: the DNR rangers, U.S. Coast Guard, National Marine Fisheries Service (NMFS), and U.S. Fish and Wildlife Service (FWS). However, lack of sufficient personnel to carry out enforcement duties and lack of coordination among enforcement entities are hampering effective protection of the resources (see Section E, Legal/Institutional Background).

The Ranger Corps appears to be the only law enforcement authority patrolling coastal and marine waters of the proposed sanctuary area on a regular or periodic basis. However, only two rangers are assigned to the La Parguera area. Neither has been deputized by NMFS to enforce the ESA or MMPA. Response time for additional assistance from the Boqueron Station is well over one hour in good weather; but, adverse weather conditions (high seas) can make the boat trip impossible.

NMFS and FWS are not coordinated in their ESA enforcement efforts. FWS has a practice of confiscating turtle nets (Cotte, personal communication, 1982). However, NMFS enforcement personnel have been instructed not to confiscate turtle nets because no gear regulation has been promulgated by NMFS.

Although the FWS has not yet deputized the rangers to carry out FWS laws and regulations, they would consider this action as a means of expanding their surveillance and enforcement range, if a training program could be developed (Cotte, personal communication, 1982).

With its limited number of units and the numerous responsibilities to these units, the Coast Guard is not able to perform routine daily patrols for the proposed sanctuary. They will only be able to check for violations of federal laws when and if they are in the area, or provide emergency patrol of the proposed sanctuary in the event of confirmed poachers, an oil spill, or other emergencies.

2. Issues and Problems Associated with Public Awareness and Information

Relatively little educational information is provided to the general public and visitors regarding the natural marine environment of the La Parguera area. Residents and visitors alike can experience the area without understanding the importance of the individual systems: coral reefs, mangroves, grassbeds, and their interrelationships to other natural systems or their economic value to man. Neither information nor a coordinated and comprehensive approach to providing that information exists. Presently, there are no exhibits, brochures, or other literature readily available either in the village or at the recreational facilities of Playita Rosada or Mata de la Gata. Consequently, users often do not fully appreciate the worth of the resources or the consequences of their actions on the natural environment.

3. Issues and Problems Associated With The Coral Reefs

The extent of adverse impacts from human activity on coral reefs, including water pollution, sedimentation, dredging, trampling, spearfishing, and anchor damage have not as yet been fully documented in the La Parguera area. However, with the magnitude of visitor use it is likely that these activities are beginning to affect the reefs in the waters of the proposed sanctuary. As an example, although the magnitude of anchor damage from boating activities associated with the reefs is not known in La Parguera, anchor damage from fishing, boating, and recreational activities among similar Florida reefs has been documented (Davis, 1977).

The taking of coral regulation (adopted in October 1979) provides a general prohibition on extraction of coral, except for scientific and educational purposes. Subsequently, local residents no longer collect or openly sell coral to tourists and it appears that this small scale harvest has ceased (Gonzalez-Liboy, 1982), but lack of personnel makes surveillance and enforcement difficult. However, the area is used by recreational snorkelers and divers from outside the area who may be unaware of the prohibition. Because coral is such a beautiful specimen of underwater life, underwater swimmers often take it indiscriminately, unaware that coral is a living, growing animal and that coral colonies are essential to the life of the reef. In an area like La Parguera, which experiences large numbers of visitors, the cumulative effect of individuals taking or damaging even small amounts of coral, animals, and plants associated with coral reefs can be a concern.

4. Issues and Problems Associated with Mangrove and Grassbed Areas

Mangroves have already been recognized in La Parguera as an important natural resource for land and marine environments through the establishment, by the Commonwealth, of the Boqueron State Forest and the Boqueron and Parguera Natural Reserves. Approximately 2/3 of the area, containing extensive stands of red mangroves, is within the State Forest. The Forest Act, Law No. 133, makes it illegal to cut, damage, or injure any tree within the State Forest, but lack of personnel makes surveillance and enforcement difficult. The remaining red mangroves are within the "maritime terrestrial zone" over which the Commonwealth has regulatory authority. However, the Commonwealth does not prohibit cutting or damaging red mangroves outside State Forests.

The red mangrove areas are also under the jurisdiction of Section 404 permits (issued by the U.S. Army Corps of Engineers), but the permits are required only when the alteration will result in dredging and filling of wetlands. Simply cutting and removing the trees does not require a permit.

This situation leaves substantial and important stands of red mangroves outside the forest unprotected by law or regulation. Consequently, illegal cutting of trees for fuel, construction of permanent and vacation homes, dumping of cars and other trash, sand extraction, and the disposal of solid and liquid wastes have damaged mangroves within the proposed LPNMS to varying degrees. In particular, those activities which can substantially alter the flow of nutrients to mangroves have severely affected the potential for ecological recovery within certain stressed areas of La Parguera. This piecemeal destruction from clearing for illegal piers and casetas is particularly a problem in the area of the village of La Parguera and at Montalva Bay.

Fringing mangroves and their associated communities are especially susceptible to oil and chemical spills. For example, the Bahia Sucia fringing mangroves were adversely affected by a major oil spill in 1973 (Cintron et al., 1978). The plant roots are also easily damaged by many activities associated with coastal development such as sedimentation and run off resulting from dredging, water pollution from chemicals spilled or dumped through coastal construction, and actual cutting of the plant for use as fuel or building materials.

Basin mangroves are relatively safe from spills, but are particularly susceptible to diking, damming, and channelization due to alteration of circulation patterns (Lugo and Cintron, 1975).

Human activity most detrimental to seagrass beds is scour damage by boat propellers. Permanent damage has occurred when the root and rhizome system are severed or cut (Gonzalez-Liboy, 1979). The exact location and extent of drainage to the grassbeds is not known. However, like damage to coral reefs, the magnitude of visitors to the La Parguera area and the degree of recreational power boat activity would indicate that this is a concern.

5. Issues And Problems Associated With Bioluminescent Bays

In the La Parguera vicinity, there are two secluded bays which support the environmental phenomenon known as bioluminescence. High concentrations of the light-emitting plankter, Pyrodinium bahamense, are present in Bahia Fosforescente and to a lesser degree in Bahia Monsio Jose (Figures 8 and 9).

Because the shape of the bay's basins and the water's physical and chemical makeup are crucial to these tiny microorganisms' existence, any alteration of the flushing rate or pollution of bay waters will diminish or eliminate bioluminescence. Fire Lake, a bioluminescent bay in the Bahamas, lost its luminescent capacity when one bay entrance was dredged to allow larger boats to enter. It has been suggested that this alteration of the natural rate of water circulation upset the nutrient balance necessary for large concentrations

of the bioluminescent dinoflagellate. Relatedly, in Bahia Monsio Jose, west of La Parguera village, a canal built from the bay to the sea and a channel and fence constructed to separate Isla de Cueva from the mainland are believed to have diminished the bay's bioluminescence by altering the circulation patterns (National Park Service, 1968).

Recognizing the unique ecological character of La Parguera and the bioluminescent bays in particular, several land-use plans were drafted to control development. The National Park Service prepared the first comprehensive plan for preservation of the bioluminescent bays in 1968 (National Park Service, 1968). In the same year, the Planning Board in the Office of the Governor of Puerto Rico produced an interim development plan for the La Parguera region (Puerto Rico Planning Board, 1968). In 1970, the Puerto Rico Planning Board adopted special regulations to implement the plan.

In 1978, the Governor of Puerto Rico signed a Memorandum of Understanding with the Corps of Engineers with regard to the many casetas situated in the mangroves. The MOU was oriented toward converting the casetas into a public vacation center by 1990, on the basis of completion of the Parguera sewage treatment plant and acquisition of the casetas by the Commonwealth. The treatment plan has been completed, but the problems of connecting the built-up areas with the plant and of providing sewage service for the casetas has not been resolved. The Corps has expressed a willingness to modify the MOU.

Under the Puerto Rico Coastal Management Program, the Parguera area was designated as a Natural Reserve by the Planning Board. A management plan for the Parguera Sector of the Southwest Special Planning Area is being developed by DNR. An initial draft was prepared and circulated for comments. The document is now being reviewed and will be modified to incorporate materials related to the MOU and to the recently revised provisions of the National Flood Insurance Program, which will impact on shorefront development.

Supplementing efforts of the Commonwealth to protect Bahia Fosforescente, the Conservation Trust of Puerto Rico has already purchased two tracts totalling 325 acres with a third under consideration. These involve the promontories at the entrance to the Bahia Fosforescente, thus protecting the entrance to the bay, which plays such an important role in the maintenance of its bioluminescence.

These efforts not withstanding, pollution of bay waters caused by runoff from adjacent lands, solid waste, and untreated sewage from private and commercial development along the coast are reported to be threatening Bahia Fosforescente. Light from nearby sources is reflected from the clouds and may diminish the viewing experience. Those responsible for future development in the region will need to address the problem and possibly restrict night time lighting in areas surrounding the bays. Salt evaporation ponds adjacent to this bay have periodically upset the nutrient system when heavy rains cause excessive runoff into the bay proving toxic to bay organisms. Boats taking visitors to Bahia Fosforescente often leak fuel and oil into the water which may be affecting the concentrations of Pyrodinium (Cintron et al., 1970).

Several water quality studies have been undertaken since 1968 in an effort to understand and document pollution in the bioluminescent bays and the adjacent coastal areas near the village of La Parguera. These studies were to evaluate public health risks from sewage pollution rather than uncover any fundamental processes existing in the bays. In general the sampling measured coliform bacteria either as total coliforms present or only those present originating from animal intestines (feces). While the results are not quantitative, general trends can be identified for management purposes. Total coliform concentrations were high along the coastal sites and in the class SA waters of Bahia Fosforescente in 1981 and often exceeded allowable EPA standards for class SB waters used for swimming and fishing.

6. Issues And Problems Associated With Endangered Species

a. Manatees

The manatee (Trichechus manatus) is an aquatic mammal sometimes known as the sea cow. Once common off Puerto Rico, manatees have become endangered as a result of past hunting and habitat destruction in mudflats, mangroves, and mangrove lagoons. At present, this West Indian subspecies is rare throughout its range, which covers the West Indies and northern South America. In Puerto Rico, the manatee is found in the following estuaries: Roosevelt Roads, Guanijibo in Mayaguez, Jobos Bay, La Parguera, Guayanilla, and Guanica.

The exact number of manatees in Puerto Rico is unknown; however, there have been sightings in Bahia Montalva and Bahia Sucia within the proposed LPNMS. On two occasions four or five were sighted (June and August 1978) in Montalva Bay when recreational boating was at its peak. Frequent sightings at the eastern edge of the bay by Fish and Wildlife Service personnel indicate a stable population (Cotte, 1982). Motor boats are the most severe threat both to the seagrass habitat and to the animal itself (75% to 85% of Floridian manatees have scars from crushing or cuts caused by large boats). Not enough information exists about the numbers or locations of manatee population in this area.

b. Sea Turtles

Hawksbill sea turtles, (Eretmochelys imbricata), green turtles (Chelonia mydas), leatherback (Dermochelys coriacea), and loggerheads (Caretta caretta) are known to frequent the waters of the proposed LPNMS area. The mangroves and adjacent seagrass beds provide ideal foraging ground for these animals. Rangers have also seen signs of turtle nesting on the beaches of Bahia Sucia and Bahia Salinas (Figure 10). Although the turtles are endangered and protected under the Federal Endangered Species Act (ESA), poaching still occurs. Turtles are frequently caught in certain "fishing nets" used for this purpose. Federal personnel are insufficient to adequately patrol the area; Commonwealth enforcement personnel are also insufficient and more rangers need to be deputized to enforce the ESA (Cotte, personal communication, 1982).

c. Brown Pelicans

Historically, brown pelicans nested on Enrique Cay and Turrumote Cay in La Parguera. At the present time, however, pelicans are nesting only on cays in Montalva Bay, where they represent the largest breeding colony in Puerto Rico. They roost primarily in the mangroves of six islets; Las Pelotas, Caballo Blanco, Laurel, La Conserva, Cayo Vieques, and small cays north of La Conserva.

There has been a rapid decline in population because DDT used on the West and Gulf coasts of the United States severely weakened egg shells and prevented many young from being born. In light of this fact, the policy of the U. S. Fish and Wildlife Service has been to encourage brown pelican nesting in this area.

d. Other Important Species

The yellow-shouldered blackbird, a species found nowhere in the world outside Puerto Rico, is presently in danger of extinction. The U.S. Government has declared La Parguera and surrounding areas as critical habitat for this species. The threat of extinction is primarily due to parasitizing of its nests by the glossy cowbird. The only yellow-shouldered blackbird nests that appear to be safe from parasitism are located on the mangrove cays off La Parguera. These cays are also critical to large numbers of herons, pelicans, and terns. West of the village of La Parguera, salt ponds abut the mangroves on the landward side. These areas are outstanding habitat for thousands of shorebirds and waterbirds, including the black tern (DNR Report, 1979).

7. Issues Associated With Water Quality And Population Growth

Water pollution from various sources throughout the La Parguera region appears to be one of the most serious threats to the proposed sanctuary. Coastal development, related to the increase in the growth of the community, increases threats to nearshore water quality. Tourist-related development is the most serious threat to water quality of the coastal waters and the most significant threat to the resources of the proposed sanctuary is sewage discharge from the the La Parguera community along the waterfront. The discharges come primarily from vacation houses (casetas) built out over the water and on some of the offshore cays. Most of the raw sewage from these sources goes into the water immediately offshore (Figures 8 and 9).

At the present time, disposal of wastes from domestic sources and tourist facilities is still being accomplished with individual septic tanks or cesspools or by direct dumping of raw sewage along the shore. In addition to poorly functioning village septic tanks, which cause coastal water pollution, more than 100 small houses (casetas) lining the shore are without any onsite treatment of sewage. Sanitary discharge for these weekend houses is accomplished primarily through pipes leading into the water through openings

at the floor level (EQB, 1972). These vacation homes, illegally built over public land and waters belonging to the Commonwealth, and a hotel on the waterfront, are considered the main source of sewage pollution in the La Parguera waters. Other sources include 22 piers and numerous house boats lacking sanitary treatment facilities.

Following signs of deterioration of La Parguera's natural resources, including the bioluminescent bays, the Commonwealth took steps to alleviate water quality problems. The Puerto Rico Aqueduct and Sewer Authority (PRASA) proposed in 1973 the construction (with Federal Water Pollution Control Act Section 201 funds) of a tertiary sewage treatment plant and irrigation system along with the needed lateral and main interceptor sewers and pumping station. Capacity was planned, at that time, to handle the area's wastewater up to 1990, with provisions for adding stages to the plant if such additions became necessary. Supplementary funding was obtained from the Economic Development Administration.

The plant's purpose was to correct the serious sanitary waste disposal problem in the La Parguera area where most of the structures had poorly functioning septic tanks, due to the high water table or no holding treatment facility at all. The construction company as well as the bonding company went bankrupt before the project was completed. Although the treatment plant is completed and usable, the gravity main between the village and the plant is defective and must be rebuilt.

The Department of Natural Resources and the U.S. Army Corps of Engineers have already taken steps to resolve the matter of illegal second homes. A Memorandum of Understanding (MOU) on the La Parguera Recreational Area was signed on June 13, 1978 between the Governor of Puerto Rico and the U.S. Army Corps of Engineers (Appendix D). The MOU prohibits further construction in the coastal zone and authorizes the issuance of use permits for three years at a time to present homeowners with certain conditions. In 12 years, it is anticipated that the structures will become State property. Although the homes can be hooked up to the sewer system, there are no funds at the present time to construct a new trunk line to connect them to the treatment plant. Until they are hooked up, the agreement states that these homes will be liable for onsite treatment during the 12-year period. To date, none of the casetas have been hooked up, largely because there is no facility to receive the untreated sewage. DNR, together with other concerned Federal and State agencies, has explored various alternatives aimed at resolving the discharge problem. However, all of the alternatives discussed so far have proven unfeasible because of technical, legal or financial reasons. The Secretary of DNR is asking the Governor to review the circumstance of the MOU and to summon the heads of the agencies involved in implementing the MOU to a special meeting to discuss the situation and assign priorities for funding the necessary activities to repair the main trunkline (Gonzalez-Liboy, personal communication, 1982).

In Bahia Montalva there is also a second-home community developing, along with fishing docks and buildings, bordering the eastern shore. There are now approximately 44 casetas built illegally in the mangroves or out over the water in Bahia Montalva. Their existence in this area has resulted in mangrove alteration and is contributing to the problem of water pollution.

A meeting of DNR, COE, Environmental Quality Board, Planning Board, EPA, and the U.S. Fish and Wildlife Service on November 13, 1981, resulted in an agreement that was necessary to patrol Montalva Bay more closely to prevent the construction of additional illegal structures in the Bay's coastal water. It was further agreed that no new permits for construction would be issued until the regulations for the development of the maritime zone were promulgated (DNR and COE would prepare these regulations). In the meantime, the COE and Regional Planning Director are evaluating the present situation and preparing a plan with detailed information stating who legally owns the area around Montalva Bay.

A further waste discharge pollution problem exists from recreational boats. The U.S. Coast Guard, under authority of the U.S. Clean Water Act, requires that all recreational boats with installed toilet facilities have operable marine sanitation devices (MSD). The Refuse Act of 1899 prohibits the throwing, discharging, or depositing of any refuse matter of any kind (including trash, garbage, oil or liquid pollutants) into U.S. waters within a distance of three miles from the coastline. However, due to lack of staff, the Coast Guard seldom patrols La Parguera waters and therefore the laws go unenforced.

8. Implications for Management

The management activities resulting from sanctuary status would address some of the problems associated with the resources of La Parguera. Some will be dealt with as part of the surveillance and enforcement program, and others would be addressed by the Interpretive Program or the Resource Studies Plan. The following highlights those management strategies as they apply to resources and the set of issues and problems. More detail is found under the individual sections of the management plan: Interpretive Program, Administration and Operations and the Resource Studies Plan.

The Interpretive Program would:

- Provide a Visitor/Interpretive Center;
- Inform the public about reef ecology, stress the importance of healthy coral reefs, and describe ways in which the coral reef resource enhances the fisheries industry;
- Provide underwater trails that focus on the coral reef and mangrove ecosystems;
- Provide interpreters for boat tours;

- Emphasize the importance of the mangroves as part of the coastal ecosystem and their value to man. The program would feature a guided mangrove tour by boat through one or more of the more spectacular channels, and would include a self-guided boardwalk tour;

- Inform the public on the value of Thalassia and other seagrasses to the coastal ecology, emphasizing the necessity of reducing motorboat speed while motoring among seagrass beds; and

- Inform the public on the phenomena of bioluminescence and human actions that my reduce or eliminate the effect.

The Resource Studies Plan would:

- Provide information from monitoring studies when enforcement of the DNR coral and other environmental regulations need to be strengthened;

- Evaluate the long-term impacts of anchoring on coral and explore the feasibility of alternatives to present anchoring methods;

- Provide information on the need for posting speed or boat restrictions in certain sensitive grassbed areas;

- Monitor and assess use impacts on general water quality in the LPNMS and particularly impacts on the bioluminescent bays, and recommend management actions;

- Assess and monitor the manatee and sea turtle populations; and

- Assess the conch fishery and provide recommendations for improvement.

The Administration and Operations Program would:

- Provide administrative staff to manage the resources of the proposed LPNMS;

- Provide a focus for coordination with FWS and NMFS concerning deputization of DNR rangers and policies on ESA enforcement;

- Provide additional personnel for enforcement of Commonwealth natural resource protection statutes, including regulations which protect coral and mangroves; and

- Provide Federal regulations that can be enforced by the Ranger Corps including:

    1. prohibiting the cutting or destruction of red mangroves (Rhizophora mangle) except for routine channel maintenance;

2. prohibiting the taking of coral or bottom formations except by permit for scientific and educational purposes;

3. prohibiting littering, discharges from boats or houseboats and discharges from casetas after the expiration of the MOU between the U.S. Corp of Engineers and the Commonwealth; and

4. prohibiting nets used to poach sea turtles.

Some existing or potential land-use impacts such as light pollution and development upland of Bahia Fosforescente, are beyond the scope of sanctuary authority. However, the sanctuary onsite manager would work cooperatively with the appropriate authorities to remedy or ameliorate potential impacts to the proposed sanctuary.

PART III: MANAGEMENT MEASURES

One of the principal purposes for designating the proposed La Parguera National Marine Sanctuary is to enhance resource protection through a comprehensive management plan tailored to the specific goals of the National Marine Sanctuary Program and the area's unusual and significant resources. Implementation of such a management plan involves coordination of a variety of activities that affect the proposed sanctuary.

This part of the plan presents the strategies for managing the proposed site as a national marine sanctuary. These management measures include the Goals and Objectives, Boundaries, Sanctuary Administration and Operation, Interpretive Program and Resource Studies Plan for the proposed sanctuary. These strategies have been developed following the national goals for the program and emphasize maximum compatible public use with long-term resource conservation. In addition, the program has been based on the analysis and assessment of resources and attempts to address and ameliorate some of the issues and problems presented in Part II, Management Context.

The management plan for the proposed La Parguera National Marine Sanctuary spans five years. Implementation of operations, the Interpretive Program and the Resource Studies Plan is divided into two phases: Stage I and Stage II. Stage I will cover years 1, 2, and 3; Stage II will cover years 4 and 5. The staging concept will allow for some activities, such as the development of certain aspects of the Interpretive Program, hiring of personnel, and the establishment of a headquarters/visitor center to be phased according to anticipated funding and priorities for the proposed sanctuary.

Section A, Goals and Objectives, provides the framework from which the rest of the management strategies develop. The goals and objectives are consistent with the intent of the national program and direct activities to the dual purposes of public use and resource conservation. Sanctuary Administration and Operation, Section B, discusses the various actors involved in operating the proposed sanctuary and their roles. The proposed Sanctuary Headquarters/Visitor Center and staffing levels are presented as well as proposed regulations, and a discussion on how surveillance and enforcement will be undertaken.

The Interpretive Program, Section C, provides information on how the proposed sanctuary will inform and educate the public about the resources of La Parguera while providing an enjoyable recreational experience. Section D, the Resource Studies Plan, is aimed at filling data and information needs about the resources and human use impacts on the area of the proposed sanctuary. Results from these studies will be used to provide information to make decisions concerning management of the resources and activities.

A. Sanctuary Goals and Objectives

The Commonwealth of Puerto Rico, through its actions over the past years, has recognized the value of La Parguera for its significant resources and as a recreational center. The goals of the proposed La Parguera National Marine Sanctuary are consistent with this recognition and will help to ensure that local residents and visitors gain a better appreciation of the natural resources, promote rich recreational experiences, and long-term productivity by means of comprehensive management. Management strategies and specific recommendations for programs within the management plan which are found in later sections, have been designed to implement the goals outlined below.

Goal I - To protect the natural resources of the proposed sanctuary such as habitat for rare and endangered species, mangroves, coral reefs, seagrass beds and bioluminescent bays.

Objectives:

1. Develop and implement an interpretive program that will educate the public about the significance of these particular marine resources and the need for their protection.

2. Develop and implement management strategies for the proposed sanctuary that provide for surveillance and enforcement of existing natural resource protection measures.

3. Adopt additional regulations designed to minimize adverse impacts to important resources.

Goal II - Promote and coordinate research to expand scientific knowledge of significant marine resources and improve management decisionmaking.

Objectives:

1. Develop and implement a data management system.

2. Provide an up-to-date compilation of resource information.

3. Expand scientific knowledge of the marine systems of the proposed LPNMS.

4. Gather information on the physical, chemical, geologic and meteorological processes in the proposed LPNMS.

5. Assess the range and possible impacts of the various human activities on the proposed sanctuary resources.

Goal III - Enhance public awareness, understanding, and encourage wise use of the proposed sanctuary's natural resources through public education and interpretive programs.

Objectives:

1. Prepare a profile of present and potential sanctuary users which identifies their interests and backgrounds.

2. Prepare a list of resources that can be used to implement the interpretive program.

3. Design programs and exhibits which encourage conservation practices and which are in tune with visitor profiles.

4. Inform the public about sanctuary programs and activities.

5. Inform visitors, users and participants in sanctuary activities of rules, regulations, safety procedures, and conservation practices.

6. Establish and utilize a system for interaction with the Resource Studies Plan in the interest of protecting the sanctuary's resources.

7. Prepare a year-round schedule for educational programs that provides for special interest groups as well as the general public.

8. Offer workshops that will provide teachers, volunteers and staff with information and techniques for interpreting the sanctuary to students, tour groups and potential supporters.

Goal IV - Provide for maximum compatible public and private use of the sanctuary.

Objectives:

1. Integrate DNR recreational facilities and activities at Isla Mata de la Gata and Playita Rosada with the recreational plans for the proposed marine sanctuary.

2. Develop sanctuary educational programs through coordination with CODREMAR, the Marine Advisory Sea Grant Program, fisheries organizations and individuals that will benefit fishermen and fishery resources.

B. Sanctuary Administration and Operation

This section of the management plan describes the roles of the three entities that would be involved in sanctuary operations (i.e., NOAA, the Department of Natural Resources of the Commonwealth of Puerto Rico, and the Sanctuary Advisory Committee) and proposes strategies to coordinate their activities and to provide for periodic evaluation of the effectiveness of the management plan.

Aspects of the relationship between DNR and NOAA are embodied in the Designation Document (Appendix E). The Designation Document acts as a "constitution" for the proposed sanctuary and also functions as an interagency agreement between DNR and NOAA specifically naming DNR as the entity responsible for onsite implementation of the management plan. The Designation Document can only be modified by going through the entire designation process again, including a draft and final environmental impact statement and presidential approval.

1. National Oceanic and Atmospheric Administration (NOAA)

The Administrator of NOAA has the primary responsibility for the National Marine Sanctuary Program (Program) pursuant to the delegation of authority from the Secretary of the U.S. Department of Commerce. The Program is administered by the Sanctuary Programs Division (SPD) within the Office Ocean and Coastal Resource Management, National Ocean Service, NOAA. SPD's responsibilities with regard to the proposed La Parguera National Marine Sanctuary are to:

- Develop, and revise as necessary, policy statements, concerning the Program and site-specific sanctuary management issues; synthesize, analyze, and resolve sanctuary management problems and issues over time;

- Coordinate national Program activities with those of the proposed La Parguera sanctuary; ensure that the sanctuary is operated in a manner consistent with established Program policies, and with applicable national, international, state, and local laws, and recommend changes if necessary; cooperate and provide guidance to sanctuary managers including conveying information requests, policy statements, and directives;

- Develop, and revise as necessary, guidelines for the development of national marine sanctuary management plans;

- Develop in cooperation with the onsite manager comprehensive, long-term management plans for designated sanctuaries; and revise management plans as necessary; and

- Advise and assist the sanctuary administrator and manager in the implementation of management plans as necessary.

    - Advise and assist the sanctuary administrator and manager or other contractors to conduct appropriate baseline studies or other research, education/interpretive and recreation programs;

- Prepare or assist the sanctuary administrator and manager in preparing a cost/benefit analysis of proposed or existing management and regulatory activities;

- Evaluate effectiveness of sanctuary management and regulatory regimes; and

- Review recommendations by onsite managers and take appropriate action.

° Prepare Program budget for the sanctuary.

- Determine how the budget for new or existing resources (such as capital and research) can be allocated;

- Advise and assist the onsite manager in the preparation and administration of the sanctuary budget; and

- Monitor the sanctuary's financial performance, including transferred funds, contracted studies, and management grants and contracts.

° Review and grant jointly with the Secretary of DNR sanctuary permit applications for activities to ensure consistency with sanctuary regulations, and provide additional technical review where necessary;

° Establish a data management capability (i.e., storage and retrieval) for information collected on nominated sanctuary sites and designated sanctuaries, transfer relevant information and data from one sanctuary to another and make information available to the public; and

° Pursue in cooperation with the manager the establishment of a Sanctuary Advisory Committee.

- Approve committee chairperson and vice chairperson;

- Approve or reappoint committee members;

- Assist sanctuary manager to convene Sanctuary Advisory Committee meetings and review and approve agenda of topics to be addressed; and

- Review recommendations of the Sanctuary Advisory Committee and take appropriate action.

° Coordinate with Federal and local government agencies, as well as public, private and international entities concerning protection and management of marine resources.

2. Department of Natural Resources

The Department of Natural Resources (DNR) shall act as onsite manager for the proposed marine sanctuary and carry out local day-to-day responsibilities for sanctuary management in accordance with the site-specific management plan.

Responsibilities of the management agency are reflected below:

° Establish an Office of Marine and Estuarine Sanctuaries (OMES);

° Assist in the preparation, evaluation, and necessary revision of the comprehensive, long-term management plan for the proposed sanctuary;

° Implement the management plan:

- Coordinate a monitoring program to obtain information on natural resources and human activities in the sanctuary over time;

- Make recommendations on environmental assessment, research, user activities, interpretation and information programs, and recreation;

- Coordinate and cooperate with interested parties in research, monitoring, interpretation and recreational activities in the sanctuary;

- Establish a data management capability for information collected on the sanctuary compatible with the national Program data management system;

- Coordinate with NOAA/SPO to review research proposals and permit requests; develop and coordinate an on-site process for reviewing and evaluating research proposals and permit requests, ensuring input from concerned individuals, interest groups, and Commonwealth agencies;

- Publicize the sanctuary as appropriate and develop a local constituency by means of brochures, presentations, structured events, articles for publication, and other activities consistent with the management plan;

- In cooperation with NOAA establish and operate a sanctuary information center, where feasible, to increase public awareness and appreciation for the resources of the sanctuary and provide information and interpretive services; and

- Provide quarterly reports on (1) administrative activities; (2) advisory committee meetings; (3) environmental quality of the sanctuary area; (4) research activities; (5) interpretive program; (6) surveillance and enforcement; and (7) additional or future management needs.

° Establish a Sanctuary Advisory Committee in cooperation with NOAA:

- Maintain contact with committee members and initiate periodic mailings to committee members announcing sanctuary activities;

- Convene Sanctuary Advisory Committee meetings and prepare agenda of topics to be addressed; and

- Review recommendations of the Sanctuary Advisory Committee and recommend appropriate action to NOAA/SPO.

° Ensure that onsite management activities are consistent with applicable state and local laws, rules and regulations; and

° Coordinate with Commonwealth agencies, organizations and private citizens concerning sanctuary management.

3. DNR Office of Marine and Estuarine Sanctuaries (OMES)

DNR will establish an organizational entity to administer the proposed marine sanctuary and the national estuarine sanctuary at Jobos Bay. (The Jobos Bay National Estuarine Sanctuary was established in September 1981.) Positions for the office would be funded jointly by DNR and NOAA. Management emphasis at this level would focus on coordinating with existing components of DNR to insure utilization of existing DNR expertise. In addition to the San Juan office, day-to-day operations for the sanctuaries would be handled out of the proposed sanctuary headquarters in La Parguera. Field operations would be managed under the direction of the sanctuary manager, who would report to the administrator. The sanctuary manager would be selected by the Secretary of DNR upon the recommendation of the sanctuary administrator and NOAA/SPO.

a. Sanctuary Administrator

The Sanctuary Administrator, whose office would be in the central San Juan office of DNR, would report directly to the Secretary of DNR and oversee the operations of the proposed sanctuary.

Duties would entail:

° Acting as direct liaison between the Commonwealth and NOAA on sanctuary and sanctuary related issues;

° Coordinating among the various parties involved in sanctuary activities, the Secretary of DNR, NOAA, other DNR offices, and the individual sanctuary manager and the public;

° Tracking plans for land and water development at the San Juan level that may affect the proposed sanctuary;

° Reviewing existing regulations and proposed rules, regulations, and permit procedures and recommending modifications and revisions.

° Disseminating information about the national marine sanctuary program (for assessing public opinion and reaction to the sanctuary); and

° Overseeing development of any facilities constructed for the proposed sanctuary; including awarding contracts, and reviewing site analyses and design specifications, securing leases, easements, etc.

In Stage I the Administrator's responsibilities would focus on the following:

° Developing a detailed operation plan for the proposed sanctuary. This would include:

- Merging the administration of the proposed La Parguera National Marine Sanctuary with existing DNR regional responsibilities in Mayaguez and La Parguera, and the Boqueron State Forest operations;

- Developing detailed surveillance and enforcement designs for the sanctuary (including equipment and staffing needs and patrol schedules); and

- Establishing an onsite presence at the sanctuary; including hiring a sanctuary manager and staff and arranging for operations headquarters consistent with the management plan.

b. Sanctuary Manager

The sanctuary manager shall be hired within the first year of operations, and would be the primary spokesperson for the sanctuary at the onsite level. The manager would report to the Sanctuary Administrator in San Juan. Duties would include:

° Responsibility for day-to-day operations of the sanctuary, including administrative functions such as bookkeeping, financial, personnel, visitor record keeping, and purchasing;

° Supervision of sanctuary staff and other DNR staff assigned to the sanctuary, including the activities of the rangers, maintenance workers, and interpretive employees;

° Representing the sanctuary viewpoint on local issues and at public forums;

° Working with local and Commonwealth authorities to prevent activities outside the sanctuary which might adversely impact sanctuary waters. To this end, the manager would work with the Commonwealth Planning Board and the DNR Planning Division to minimize further degradation of the bays as well as to encourage land use planning for the control of illumination which now is diminishing the quality of night time bioluminescence; and

° Commenting on any requests for permits to conduct prohibited activities (such as coral collecting).

c. Staffing Levels

Management of the proposed sanctuary will rely heavily on the use of the existing DNR personnel to the maximum extent possible. However, new personnel will be hired as part of the proposed sanctuary management. In the first year, four positions will be added. These will include the sanctuary manager, a part-time secretary, a part-time ranger naturalist,

and a ranger. Additional positions would be phased through Stage II (subject to funding constraints) and may include additional rangers, a full-time secretary, and perhaps a seasonal naturalist, or recreation specialist. The details of the proposed staffing levels shall be worked out during the first year of operation.

d. Sanctuary Advisory Committee

In the interest of providing a mechanism for insuring public input into sanctuary operations, an Advisory Committee would be established in Stage I of plan implementation. The Advisory Committee would be structured to provide representation from a wide variety of interested groups. The specific makeup and function of the committee would be determined during the first year of sanctuary operations. However, representatives from the following constitute likely members and would be considered for membership on the Committee:

- Marine Resources Development Corporation of Puerto Rico
- Mayor of Cabo Rojo
- Mayor of Guanica
- Mayor of Lajas
- Tourism Company
- Sea Grant Program
- U. S. Army Corps of Engineers
- U. S. Fish and Wildlife Service
- University of Puerto Rico
- Department of Recreation and Sports
- A Representative of Puerto Rico conservation organization
- A Representative of Puerto Rico fisherman organizations

The Advisory Committee would operate under the following guidelines:

- The committee will meet at least 3 times a year;

- The committee will be limited to between 10 and 15 members to assure a workable and productive body and will include the sanctuary administrator as an ex-officio member;

- Committee members will be asked to serve three-year terms with the initial appointments being staggered to ensure continual committee action and expertise. The committee chairperson and vice chairperson will be selected to serve one-year terms;

- Secretary of DNR will appoint the chairperson with the concurrence of NOAA;

- Criteria for committee membership would require selection of individuals who are experts in specific fields and/or represent sanctuary user groups and whose judgment would be objective, not subject to a conflict of interest due to a particular affiliation; and

- The onsite manager will maintain close contact with the committee. Committee members should be advised of sanctuary activities through periodic mailings or meetings with the onsite manager.

4. Intrarelationships between Sanctuary Administration and Other DNR Components

Implementation of the management plan would necessitate cooperative action by DNR components other than just the OMES. As an example, the Office of Education and Publications would be responsible for the actual printing of sanctuary brochures. The Forest Service would play an active role because a portion of the proposed La Parguera National Marine Sanctuary is within the Boqueron Forest Reserve which is under its management. The Ranger Corps, another DNR component, would have surveillance and enforcement responsibilities. Accordingly, coordination by the sanctuary administrator with the rest of DNR is critical to the operation of the sanctuary. To this end, it is relevant to discuss the major activity areas in DNR and indicate their relationship to the OMES and their role in sanctuary management.

To carry out its responsiblities, DNR is organized into six major activity areas and six offices under the control of the Secretary of DNR as listed below and shown in the Figure 13.

Major Activity Areas

(Headed by Assistant Secretary or Equivalent)

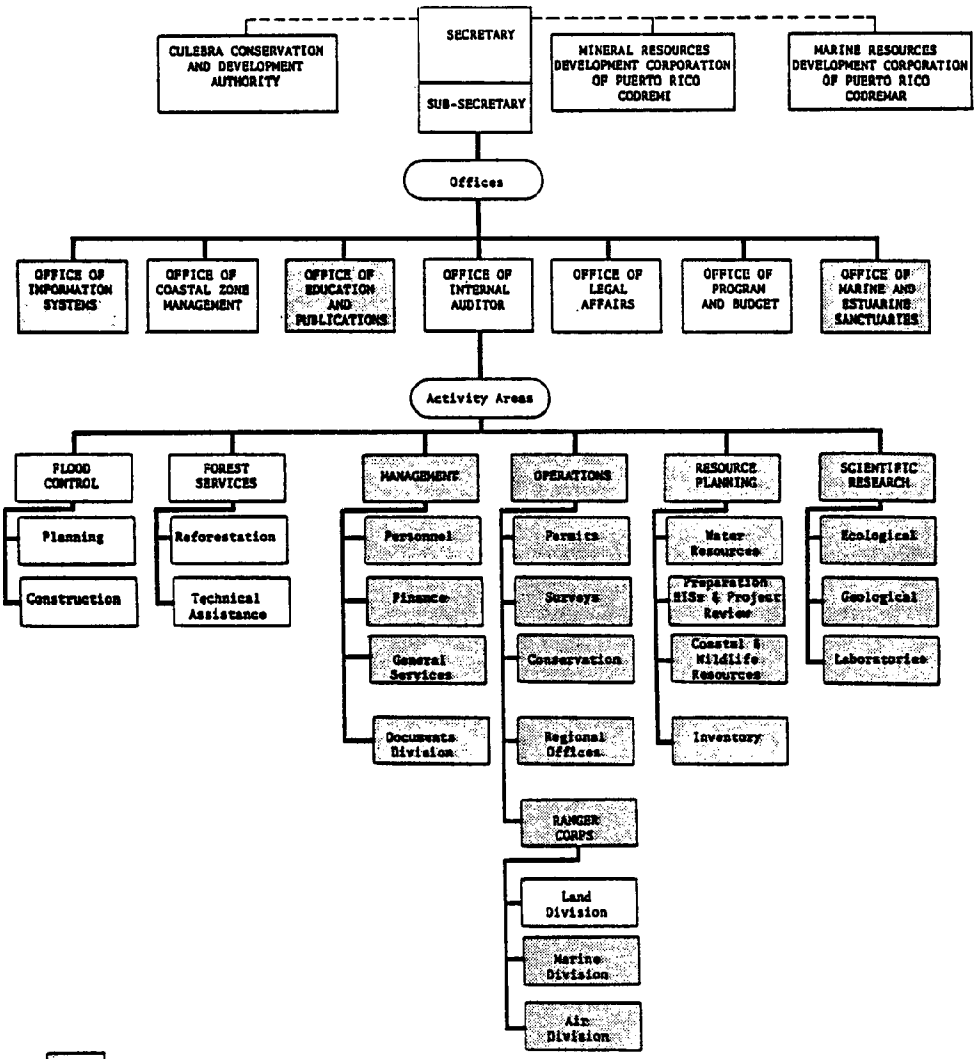
1. Flood Control Area
2. Forest Service
3. Administration Area
4. Operations Area
5. Resources Planning Area
6. Scientific Research Area

Of these six, the Forest Service, Administration Area, Operations Area, Resources Planning Area, and Scientific Research Area are relevant to the administration of the proposed sanctuary.

Offices

1. Programming and Budget
2. Internal Auditor
3. Legal Affairs
4. Education and Publications
5. Information System
6. Coastal Zone Management

DEPARTMENT OF NATURAL RESOURCES ORGANIZATIONAL CHART



- DNR offices with support responsibility for sanctuaries administration and management.

FIGURE 13

In addition, the Secretary of DNR (ex-officio) is the Chairperson of the Board of Directors of the following public corporations that are ascribed to DNR under their enabling acts:

1. Mineral Resources Development Corporation of Puerto Rico (CODREMI);

2. Marine Resources Development Corporation of Puerto Rico (CODREMAR); and

3. Culebra Conservation and Development Authority.

Of these six offices and three public corporations, Education and Publications, and the Information Systems Office would be involved in the proposed sanctuary program management.

a. Functions of Individual Areas

The Department operates from central offices in San Juan and seven regional offices in major urban centers of the island: Aguadilla, Arecibo, Guayama, Humacao, Mayaguez, Ponce, and San Juan. The Operations Area and Forest Service are represented in all regional offices. The Ranger Corps also covers the entire island and is represented in all of the regional offices.

The following DNR areas, under a cooperative agreement, would serve as staff support to the sanctuary administrator and onsite manager.

(1) Management Area (Central Office)

The Management Area will provide basic administrative services for the sanctuary operations including: personnel (recruiting, compensation, training, evaluation, and advancement); finance (payrolls, general accounting, clearance of contracts); general services (purchasing of materials and supplies, property records, transportation and communications services); and records administration (mail room, central files, records disposal).

(2) Ranger Corps (Central Office and Regional Offices)

The DNR division of law enforcement, the Rangers (Vigilantes), provide surveillance and enforcement of Commonwealth rules and regulations for the Department. The rangers will have the surveillance and enforcement authority for the proposed sanctuary. The Administrator, in cooperation with the Commander of the Ranger Corps and the law enforcement agents of the U.S. Fish and Wildlife Service and the National Marine Fisheries Service, will be responsible for selecting and assigning the rangers needed to implement the surveillance and enforcement aspects of this program and any special training they may require (see Part III.B.6., Surveillan and Enforcement Program).

The Ranger Corps will patrol the beaches, marine waters, and mangrove forests to enforce all regulations within the proposed sanctuary boundaries, and will provide emergency assistance in case of disaster. The Ranger Corps regional office in Mayaguez will be in charge of the land and air patrols of the La Parguera area.

(3) Resources Planning Area (Central Office)

The Resources Planning Area develops and maintains a computerized inventory of the natural, cultural, and physical characteristics of the island, and develops resource management plans for coastal resources, fish and wildlife, forests and water as part of its responsibility The office conducts field investigations, evaluates situations and recommends priorities for flood hazard mitigation plans; reviews and evaluates environmental impact statements, and project proposals. The Resources Planning Area also reviews requests for permits to be issued by the Planning Board, Regulations and Permits Administration, U.S. Army Corps of Engineers, (and others); and develops regulations related to ground and surface waters for DNR. The Resources Planning Area will maintain close contact with the proposed sanctuary office in San Juan, informing the administrator of proposed plans which might significantly affect the proposed sanctuary.

(4) Scientific Research Area

This area conducts field studies and surveys; provides the Resources Planning Area with the necessary information to develop plans for the proper management of resources; operates laboratories for testing and experimentation; maintains DNR's scientific library; evaluates the potential impact of development on habitat, and on the survival of specific species, and vice versa; maintains information on terrestrial and marine geology and conducts systematic research to expand the quality and quantity of information available; performs periodic testing of water, soil, and other samples to establish data series; and cooperates with the Resources Planning Area and other agencies in the exchange and evaluation of data and information.

A clearinghouse for resource studies prepared as part of the draft management plan for the proposed sanctuary would be set up within this office to assist the sanctuary administrator, interpreter, and the onsite manager.

(5) Education and Publications Office/Information Systems Office

The DNR Offices of Education and Publications and Information Systems have in-house capability to prepare and print materials for publication such as brochures, posters, booklets, maps and other informational and educational materials, including slide shows and films for public distribution. The sanctuary administrator and interpreter would work closely with this office to provide brochures, audiovisual materials and displays for the proposed sanctuary.

(6) Forest Service

The management of all forests is the responsibility of the Forest Service (Central Office). The Regional Offices are part of the Operations Area. At present, the Regional Offices cooperate and help in forest management, but they are not responsible for the State Forests. The Forest Service (Central Office and Regional Offices) produces and distributes plant materials for reforestation programs; promotes reforestation on private lands, implements reforestation projects on public lands; manages public forests in accordance with plans prepared by the Resources Planning Area and promotes development of the timber and lumber companies. Although not technically a public forest,

Mata de la Gata and Playita Rosada are part of the DNR Forest Service lands. The DNR Regional Office assists in managing the Boqueron State Forest at La Parguera as a public forest.

Aside from cooperation at the proposed sanctuary level between the proposed resident biologist for the Boqueron State Forest and the proposed sanctuary onsite manager, there will be no staff support for the sanctuary coming from the DNR Forest Service office.

5. Sanctuary Headquarters/Visitor Center Facilities

In order to ensure that local citizens and visitors to the LPNMS gain a better understanding and appreciation of the rich natural resources of La Parguera and to provide a center of operations for sanctuary management, a Headquarters/Visitor Center is proposed for the area of the village of La Parguera and a satellite center at Cabo Rojo. Three general sites are being considered as possibilities: (1) Village Overlook Site, (2) Village Land Site, and (3) the Village Waterfront Site. Figure 20 (Part IV, Alternatives) shows the location of the three areas. The Village Overlook Site would be composed of approximately one acre of land east of the town overlooking the area of the proposed sanctuary. It is a 7-minute walk or 2-minute drive from the center of La Parguera village. Located on a small elevated knoll, the land overlooks much of the waters of the sanctuary as well as the village providing a panoramic view and setting for a proposed National Marine Sanctuary Visitor Center. The area has access--there are several unimproved roads leading to the area, and at the base of the hill (1/10 mile) is a small inlet where a dock could be built for ranger and staff needs.

The Village Land Site, located on Route 304, the only paved road leading to La Parguera village, is approximately one mile inland from the waterfront area, and a 2-minute walk from the heart of the village. The site is bounded by the village community center on one side and the public school on the other. The land is publicly owned by the Commonwealth's Department of Parks and Recreation and a portion may be obtained for the center.

The proposed Village Waterfront Site is located along the waterfront business area. The exact location has not yet been determined. The site would be within the business/shopping/tourist area in the village.

The visitor center would be constructed during Stage I of operations, house the regular and part-time staff including rangers now based in Boqueron, and provide an orientation and information facility for visitors and village residents. Negotiations between DNR, NOAA, and property owners in the village area would identify the most cost effective and appropriate location for a proposed sanctuary headquarters/visitor center. The exact location on the waterfront/village area, however, would have to be determined following sanctuary designation. It would be the focal point for the proposed LPNMS, offering information and orientation programs to the constant stream of visitors who use the tour boats or stroll about the waterfront area frequenting the stores and food stands found near the docks. The center, by its nature, would have a community-related, informal character where the merchants with nearby businesses and the townspeople, as well as LPNMS visitors, could take advantage of the proposed Information and Reading Room, and events that would be scheduled for an Orientation Room within the building.

The following chart illustrates how the center would meet the needs of staff supported cooperatively by DNR and NOAA:

	Program Services	Onsite Administration	Surveillance and Enforcement
STAFF REQUIRED	* Part time naturalist or botonist-biologist	* Sanctuary Manager	* Rangers (1 in office 2 patrolling)
		* Secretary	
	* Tour personnel	* Maintenance Staff	
FACILITIES REQUIRED	* One office	* One office with space for a secretary	* One office
	* Dock space		* Dock
	* Orientation Room	* Outdoor storage/ maintenance space	* Outdoor storage
	* Information Center		

The proposed center would contain an orientation room large enough for displays and film and slide shows which would prepare the visitor for sanctuary experiences and stress the importance of protecting La Parguera marine communities. It would also contain an information area with a large wall map illustrating the resources within the sanctuary, pinpointing recommended visitor use areas and feature a bulletin board with specific literature about the sanctuary.

The building would be a traditional style, probably of concrete block and wood construction and include a large veranda, either open or screened, to provide comfortable shaded space. It is important that the building have an open, breezy feeling, rather than an enclosed or separate space from the outdoors. If a renovated building is used, the same plans will be adhered to as much as possible. The proposed center would also contain outdoor storage for the rangers and maintenance staff. In addition, a dock is proposed for construction for use by the sanctuary staff.

A satellite visitor center would be constructed at El Faro (the lighthouse) at Punta Cabo Rojo. DNR, in coordination with the Tourism Company, the Office of Cultural Affairs of the Governor's Office, and the Municipality of Cabo Rojo are in the process of developing the Cabo Rojo lighthouse area at Cabo Rojo point as a recreation area. The site is located in the Boqueron Forest, adjacent to the southwestern boundary of

the sanctuary. Puerto Rico State Road #301 serves as access. The lighthouse structure and surrounding land will be transferred to DNR by the U.S. Coast Guard to complete the project development, consisting of the restoration of the lighthouse and an adjoining picnic area, with shelters, picnic tables, grills, restrooms, and parking facilities. The Commonwealth plans to pave P.R. State Road #301 up to the lighthouse site.

This facility is more appropriate as a site for a second visitor center. This area is too far removed from the focus of sanctuary activity at La Parguera to provide the onsite services required by a visitor center/headquarters building. However, the area is important to the sanctuary, and visitors will utilize the area. Accordingly, in Stage II the lighthouse and the adjacent lands, could serve as an auxiliary interpretive center. Sanctuary interpretive materials would be exhibited within the lighthouse. Self-guiding trails at Bahia Salinas and Bahia Sucias could be developed in the surrounding areas to enhance the sanctuary's interpretive and educational experience.

6. Surveillance and Enforcement Program

a. General Enforcement Responsibilities

The DNR rangers will be designated as the primary enforcement authority for the LPNMS and enforce sanctuary regulations. The rangers will carry out their duties as the primary enforcement authority in coordination with other members of the LPNMS staff, the Marine Police, the Ports Authority, the National Marine Fisheries Service, the U.S. fish and Wildlife Service, and the U.S. Coast Guard. Details of the surveillance and enforcement plan, such as patrol schedules and any necessary interagency agreements, will be developed during the first and second years of operation. A high priority will be placed on training that will result in NMFS and FWS deputization for ESA enforcement.

The number of rangers assigned to the La Parguera area will be increased from 2 to 3. These officers will receive special training and additional equipment. One ranger will always be at the Headquarters, manning the radio and coordinating the surveillance and enforcement efforts with the overall operational needs of the proposed sanctuary. The other two rangers will be on patrol wherever they are needed.

While patrolling the waters of the proposed LPNMS, the rangers will check the condition of equipment such as buoys and other markers and report problems to the sanctuary maintenance personnel in order to maintain facilities essential to the safety of sanctuary visitors and users. They will perform search and rescue operations and carry out hurricane and other emergency procedures within the boundaries of the proposed sanctuary.

In line with their surveillance and enforcement duties, they will educate the public to the rationale behind the various laws and regulations and will serve from time to time as guides for visiting sanctuary groups, a manner similar to the park rangers.

The sanctuary manager will train sanctuary staff and volunteers to recognize situations within the proposed sanctuary which could potentially threaten environmental quality and to identify their causes. The manager will also train the staff to assist all law enforcement agents with missions within the proposed sanctuary boundaries. This is probably the most effective surveillance activity and will deserve the highest priority. Enlistment of all staff volunteers to become part of this "early warning system" will be essential to the program. All sanctuary staff and volunteers will be trained to report problems and potential violations in an organized, effective manner to the proper authorities.

b. Stage I

An immediate enforcement presence at La Parguera village will be established during Stage I by conducting ranger operations from the proposed sanctuary dock at the La Parguera village waterfront. The Rangers will patrol from Punta Pitahaya to Bahia Montalva. Rangers operating out of the Ranger Station at Boqueron will continue to patrol between Punta Aguila and Punta Pitahaya on an as needed basis, since visitor use of those waters is likely to be sparse.

c. Stage II

During Stage II, sanctuary ranger operations will be evaluated and the necessary changes made.

d. Sanctuary Regulations

1. Introduction

These regulations were developed to address the resource issues and problems discussed in Part II, Management Context, and protect resource values which make the proposed LPNMS an important natural system.

The boundaries of the proposed sanctuary are delineated in Section 939.3 and Section 939.5 establishing DNR as the onsite manager with responsibility for enforcement in the sanctuary (activities prohibited or controlled) of Section 939.7. The regulations reaffirm the Commonwealth and provide federal penalties for the prohibition on the taking of coral, prohibit destruction of mangroves, provide vessel operation rules, prohibit certain discharges, protect underwater trails, prevent removal or damage to cultural resources, prohibit tampering with legal fish or gear, and prohibit nets used by turtle poachers.

Section 939.9 establishes penalties for committing prohibited activities. Section 939.10 provides for permits to undertake prohibited activities for scientific and educational purposes, and Section 939.11 provides procedures for administrative appeals if a permit is denied.

Activities that do not harm or deplete the resources, including commercial and sportfishing, recreational diving, underwater photography, and non-destructive research and interpretive activities, are not regulated and are encouraged, consistent with sanctuary goals.

The following draft sanctuary regulations will be promulgated and appear in the Federal Register.

Part 939 - LA PARGUERA NATIONAL MARINE SANCTUARY DRAFT REGULATIONS

Sec.
939.1 Authority
939.2 Purpose
939.3 Boundaries
939.4 Definitions
939.5 Management and Enforcement
939.6 Allowed Activities
939.7 Activities Prohibited or Controlled
939.8 Other Authorities
939.9 Penalties for Commission of Prohibited Acts
939.10 Permit Procedures and Criteria
939.11 Appeals of Administrative Action

Authority: Marine Protection, Research and Sanctuaries Act of 1972; Pub. L. 92-532, 86 Stat. 1061 and 1062 (16 U.S.C. 1432-1433).

939.1 Authority

The Sanctuary will be designated by the Secretary of Commerce pursuant to the authority of Section 302(a) of the Marine Protection, Research and Sanctuaries Act of 1972 as amended (the Act). The following regulations are issued pursuant to the authorities of Sections 302(f), 302(g) and 303 of the Act.

939.2 Purpose

The purpose of designating the La Parguera National Marine Sanctuary is to protect and preserve a representative cross-section of tropical habitat and a coral reef ecosystem in its natural state and to regulate uses within the Sanctuary to insure the health and well-being of the coral and associated flora and fauna.

939.3 Boundaries

The sanctuary consists of a 68.27 square nautical mile area of the Caribbean Sea off southwest Puerto Rico. The exact boundaries are:

Pt. No.	Latitude	Longitude	Pt. No.	Latitude	Longitude
1-1	N17°57'15.00"	W67°12'50.00"	1-12	N17°52'08.29"	W67-04'38.59"
1-2	N17°56'20.36"	W67°11'52.00"	1-13	N17°52'33.66"	W67-04'05.56"
1-3	N17°52'58.51"	W67°11'52.00"	1-14	N17°52'41.86"	W67-03'14.66"
1-4	N17°52'54.79"	W67°11'09.16"	1-15	N17°52'25.95"	W67-02'46.07"
1-5	N17°52'56.19"	W67°10'10.18"	1-16	N17°52'32.05"	W67-02'28.82"
1-6	N17°52'32.19"	W67°09'30.74"	1-17	N17°52'53.65"	W67-02'03.24"
1-7	N17°51'53.88"	W67°08'38.85"	1-18	N17°53'10.06"	W67-01'16.09"
1-8	N17°51'39.22"	W67°07'55.81"	1-19	N17°53'08.68"	W67-00'42.29"
1-9	N17°51'39.21"	W67°07'00.57"	1-20	N17°53'19.81"	W66-59'33.56"
1-10	N17°51'51.82"	W67°05'57.46"	1-21	N17°53'51.37"	W66-58'00.00"
1-11	N17°52'05.29"	W67°05'27.63"	1-22	N17°56'43.00"	W66-58'00.00"

939.4 Definitions

(a) "Administrator" means the Administrator of the National Oceanic and Atmospheric Administration (NOAA).

(b) "Assistant Administrator" means the Assistant Administrator for Ocean Services and Coastal Zone Management, National Ocean Service, National Oceanic and Atmospheric Administration or his/her successor, or designee.

(c) "Secretary" means the Secretary of the Department of Natural Resources, Commonwealth of Puerto Rico.

(d) "Persons" means any private individual, partnership, corporation, or other entity; or any officer, employee, agent, department, agency or instrumentality of the Federal government, or any State or local unit of the government.

(e) "The Sanctuary" means the La Parguera National Marine Sanctuary.

939.5 Management and Enforcement

The National Oceanic and Atmospheric Administration (NOAA) has primary responsibility for the management of the Sanctuary pursuant to the Act. The Puerto Rico Department of Natural Resources (DNR) will assist NOAA in the administration of the Sanctuary, and act as the onsite manager, in conformance with the draft Designation Document between DNR and NOAA. DNR shall conduct surveillance and enforcement of these regulations pursuant to 16 U.S.C. 1432(f)(4), or other appropriate legal authority.

939.6 Allowed Activities

All activities except those specifically prohibited by Section 939.7 may be carried on within the Sanctuary subject to all prohibitions, restrictions, and conditions imposed by other authorities.

939.7 Activities Prohibited or Controlled

(a) Unless permitted by the Assistant Administrator in accordance with 939.10, or as may be necessary for the national defense, or to respond to an emergency threatening life, property or the environment, the following activities are prohibited or controlled within the Sanctuary. All prohibitions and controls must be applied consistently with international law. Refer to 939.9 for penalties for commission of prohibited acts.

(1) Taking and Damaging Natural Resources

(i) No person shall break, cut, or similarly damage or destroy the coral, bottom formation, or any marine plant, except institutions conducting scientific or educational activities that were exempted pursuant to Article 4 of the Regulations to Control the Extraction, Possession, Transportation, and Sale of Coral Resources in Puerto Rico (under authority conferred by Law No. 23 of June 20, 1972 and Law No. 83 of May 13, 1936, as amended).

These eligible institutions are the University of Puerto Rico, Administration of Regional Colleges, Interamerican University, Catholic University, Center for Energetic and Environmental Research, Environmental Quality Board, and the Puerto Rico Department of Natural Resources.

(ii) No person shall cut, damage, or similarly destroy any red mangrove (Rhizophora mangle) except as part of a program of routine channel maintenance.

(iii) No person shall use poisons, electrical charges, explosives, or similar methods to take any marine animal or plant.

(iv) There shall be a presumption that any items listed in this paragraph found in the possession of a person within the Sanctuary have been collected or removed from the Sanctuary.

(2) Operation of Vessels

(i) No vessel shall approach closer than 200 feet to a fishing vessel or a vessel displaying a diving flag except at a maximum speed of three knots.

(ii) No vessel or person shall interfere with any fishing activity.

(iii) All vessels from which diving operations are being conducted shall fly in a conspicuous manner, the international code flag alpha "A."

(3) Discharging of Polluting Substances

No person shall litter, deposit, or discharge any materials or substances of any kind except:

(i) Indigenous fish or fish parts.

(ii) Cooling water from vessels.

(iii) Effluents from marine sanitation devices allowable under Coast Guard standards.

(iv) On a temporary basis, sewage from existing shoreline houses known as casetas with recognized permits from COE. This exception shall expire upon the completion and operation of an area wide sewage collection and treatment system or until the expiration of the Memorandum of Understanding between the Governor of Puerto Rico and the U.S. Army Corps of Engineers for the La Parguera area dated June 13, 1978, whichever is earlier.

(4) Underwater Trails

(i) No person shall fish within the underwater trails.

(ii) No person shall mark, deface, or injure in any way, or displace, remove, or tamper with underwater trails, signs, markers, or buoys.

(5) Removing or Damaging Cultural Resources

No person shall remove, damage, or tamper with any historical or cultural feature, including archaeological sites, historic structures, shipwrecks, and artifacts.

(6) Damage to Fish Traps

No person shall disturb, harm, or tamper with any legal fishing gear, nets, traps, or pots.

(7) Taking of Sea Turtles

(i) No person shall ensnare, entrap, or fish any sea turtle while it it is a threatened or endangered species as defined by the Endangered Species Act of 1973.

(ii) No person shall possess or use any nets or similar fishing gear with a mesh size in excess of eight inches.

(b) The prohibitions in this section will be applied to foreign persons and vessels only in accordance with recognized principles of international law, including treaties, conventions and other international agreements to which the United States is signatory.

939.8 Other Authorities

No license, permit or other authorization issued pursuant to any other authority may validly authorize any activity prohibited by Section 939.7 unless such activity meets the criteria stated in Section 939.10 (a), (c) and (d) and is specifically authorized by the Assistant Administrator.

939.9 Penalties for Commission of Prohibited Acts

Section 303 of the Act authorizes the assessment of a civil penalty of not more than $50,000 for each violation of any regulation issued pursuant to the Act, and further authorizes a proceeding in rem against any vessel used in violation of any such regulation. Procedures are set out in Subpart D of Chapter 15 CFR Part 922. Subpart D is applicable to any instance of a violation of these regulations.

939.10 Permit Procedures and Criteria

Under special circumstances where the prohibited activity is research or education needed to better understand the Sanctuary environment and improve management decisionmaking and judged not to cause long-term or irreparable harm to the resources, a permit may be granted by NOAA in cooperation with the Secretary of DNR.

(a) Any person in possession of a valid permit issued by the Assistant Administrator in cooperation with the Secretary of the Department of Natural Resources, Commonwealth of Puerto Rico in accordance with this section may conduct the specific activity in the Sanctuary including any activity specifically prohibited under Section 939.7, if such activity is (1) research related to the resources of the Sanctuary, (2) to further the educational value of the Sanctuary, or (3) for salvage or recovery operations.

(b) Permit applications shall be addressed to the Assistant Administrator for Ocean Services and Coastal Zone Management, ATTN: Sanctuary Programs Division, National Ocean Service, National Oceanic and Atmospheric Administration, 3300 Whitehaven Street, N.W., Washington, D.C. 20235. An application shall include a description of all activities proposed, the equipment, methods, and personnel (particularly describing relevant experience) involved, and a timetable for completion of the proposed activity. Copies of all other required licenses or permits shall be attached.

(c) In considering whether to grant a permit, the Assistant Administrator shall evaluate such matters as (1) the general professional and financial responsibility of the applicant; (2) the appropriateness of the methods being proposed to the purpose(s) of the activity; (3) the extent to which the conduct of any permitted activity may diminish or enhance the value of the Sanctuary as a source of recreation, education, or scientific information; and (4) the end value of the activity.

(d) Permits may be issued by the Assistant Administrator for activities otherwise prohibited under Section 939.7. In addition to meeting the criteria in Section 939.10 (a) and (c), the applicant must also satisfactorily demonstrate to the Assistant Administrator that: (1) the activity shall be conducted with adequate safeguards for the environment, and (2) the environment shall be returned to the condition which existed before the activity occurred. A permit issued according to the provisions for an otherwise prohibited activity shall be appropriately conditioned, and the activity monitored to ensure compliance.

(e) In considering an application submitted pursuant to this Section, the Assistant Administrator shall seek and consider the view of the Secretary of the Department of Natural Resources. The Assistant Administrator may also seek and consider the views of any other person or entity, within or outside of the Federal Government, and may hold a public hearing, as he/she deems appropriate.

(f) The Assistant Administrator may, at his/her discretion, grant a permit which has been applied for pursuant to this section, in whole or in part, and subject to such condition(s) as deemed necessary, and shall attach to any permit granted for research related to the Sanctuary stipulations to the effect that: (1) the Assistant Administrator, Secretary of Department of Natural Resources, or their designated representatives may observe any activity permitted by this section; and (2) any information obtained in the research site shall be made available to the public; and/or the submission of one or more reports of the status of progress of such activity may be required.

(g) A permit granted pursuant to this section is nontransferrable.

(h) The Assistant Administrator may amend, suspend or revoke a permit granted pursuant to this section, in whole or in part, temporarily or indefinitely if, in his/her view, the permit holder (the Holder) had acted in violation of the terms of the permit or of the applicable regulations; or the Assistant Administrator may do so for other good cause shown. Any such action shall be communicated in writing to the Holder, and shall set forth the reason(s) for the action taken. The Holder in relation to whom such action has been taken may appeal the action as provided for in Section 939.11.

939.11 Appeals of Administrative Action

(a) The applicant for a permit, the Holder, or any other interested person (hereafter Appellant) may appeal the granting, denial, conditioning or suspension of any permit under Section 939.10 to the Administrator of NOAA. In order to be considered by the Administrator, such appeal shall be in writing, shall state the action(s) appealed and the reason(s) therefor, and shall be submitted within 30 days of the action(s) by the Assistant Administrator. The Appellant may request an informal hearing on the appeal.

(b) Upon receipt of an appeal authorized by this Section, the Administrator may request the Appellant, and the permit applicant or Holder if other than the Appellant, to submit such additional information and in such form as will allow action upon the appeal. The Administrator shall decide the appeal using the criteria set out in Section 939.10 (a), (c) and (d), any information relative to the application on file, any information provided by the Appellant, and such other consideration as is deemed appropriate. The Administrator shall notify the Appellant of the final decision and the reason(s) therefor, in writing normally within 30 days of the date of the receipt of adequate information required to make the decision.

(c) If a hearing is requested or, if the Administrator determines that one is appropriate, the Administrator may grant an informal hearing before a Hearing Officer designated for that purpose, after first giving notice of the hearing in the Federal Register. Such hearing shall normally be held no later than 30 days following publication of the notice in the Federal Register unless the Hearing Officer extends the time for reasons deemed equitable. The

Appellant, the applicant or permit holder, if different, and, other interested persons may appear personally or by counsel at the hearing and submit such material and present such arguments as determined appropriate by the Hearing Officer. Within 30 days of the last day of the hearing, the Hearing Officer shall recommend a decision in writing to the Administrator.

(d) The Administrator may adopt the Hearing Officer's recommended decision, in whole or in part, or may reject or modify it. In any event, the Administrator shall notify the interested persons of his/her decision, and the reason(s) therefor in writing within 30 days of receipt of the recommended decision of the Hearing Officer. The Administrator's decision shall constitute final action for the Agency for the purposes of the Administrative Procedures Act.

(e) Any time limit prescribed in this section may be extended by the Administrator for good cause for a period not to exceed 30 days, either upon his/her own motion or upon written request from the Appellant, permit applicant or Holder, stating the reason(s) therefor.

D. Interpretive Program

1. Introduction

This section of the management plan establishes a framework for the Interpretive Program for the proposed La Parguera National Marine Sanctuary. As an island community, Puerto Rico's population would benefit from a marine-oriented interpretive program. The program will be administered in close cooperation with the local communities and users of the proposed sanctuary to encourage a better appreciation of the island's marine resources. Working in conjunction with the interpreter, DNR personnel responsible for DNR operations in the proposed sanctuary area would plan and initiate recreational and informational activities which would be compatible with sanctuary goals and objectives.

The Interpretive Program would focus on selected areas and features and seek to educate the public about resource issues and concerns by expanding understanding of the natural environment and how human actions impact upon it. Interpretation of this complex environment would enhance visitor appreciation and enjoyment of the proposed sanctuary and generate concern for the protection of its vital resources. Audiovisual materials, publications, exhibits, activities, and interpreters would provide the information that leads to increased knowledge and understanding of this relatively unspoiled and significant ecosystem.

This awareness of the human and social value of natural systems would enable visitors to better understand some of the issues and problems related to the natural systems and how human actions impact on those systems. These resource issues and problems are discussed in Part II.F., Management Context. The exhibits and media presentations would serve to inform and educate the public and visitors about the bioluminescent bays, and issues such as the effect of light pollution and water quality on the phenomena of bioluminescence. Similarly, the program would educate the public on the importance of grassbeds and help them recognize problems associated with the careless use of motor boats in the shallow nearshore areas. The mangrove boardwalk tour and the media presentation would focus the public's attention on the value of the mangrove system to fishing productivity, wildlife, and protection of coastal property.

Information on rules and regulations would inform the public that taking coral and other bottom formations are illegal. The boat tour to the coral reefs, exhibits, and the audiovisual program would focus on the importance of the reef system and its fragility. In conjunction with the underwater trails, the program would alert users to the value of the reef system and its susceptibility to damage. The information on endangered species--manatees, turtles, pelicans, and other important species--would be related to habitats (grassbeds, mangroves, and reefs) and provide a holistic understanding of the relationship of individual species and habitats to the ecosystem.

2. Methods and Approach

The following methods are planned to carry the message of the proposed sanctuary to the general public island-wide, as well as to visitors and users. Specific programs would have to be developed by the interpreter in the Sanctuary Administrator's Office and incorporated into the sanctuary management plan after designation.

STAGE I

Prepare a Detailed Profile of Users

Step one in the development of the Interpretive Program would be to prepare a detailed profile showing current numbers and patterns of usage, age of users, their cultural and economic backgrounds, length and time of visits, and any other information that would enable the interpreter to design programs that are geared to participant needs and expectations.

Visitor statistics for La Parguera are sparse and difficult to analyze. From the little information available, it appears that over 35,000 people visit the proposed sanctuary area per year. There is a higher attendance on the weekends (Sunday being more popular than Saturday) and Mata de la Gata is a more popular area than Playita Rosada.

Resident and visitor interests include:

- economic, among local fishermen, who derive food and/or income from the proposed sanctuary area resources;
- scientific, among scientists, particularly those professors and graduate students associated with the University of Puerto Rico's research laboratory at Magueyes Island;
- recreational, among most of the visitors, who frequent the village of Parguera, Mata de La Gata and Playita Rosada, and among boating enthusiasts;
- sightseeing, among those who come to see the bioluminescense at night at Bahia Fosforescente; and
- protection, among those groups and individuals who wish to insure long-term conservation of the area's natural resources.

Suggested completion time: 3 months

Gathering information about visitor use would be an ongoing activity which would provide program personnel with the data they need to adjust plans and activities. In order to begin the Interpretive Program as soon as possible, the interpreter would utilize existing data and information as the basis for developing the initial plan while recognizing that adjustments should be made when additional data becomes available.

Prepare a List of Resources to Implement the Interpretive Program

The types of interpretive programs and exhibits that could be presented initially in the proposed LPNMS would depend to some extent on the facilities and other resources that could be obtained. For example, although visitor center exhibits may not be possible immediately, portable touchtable type materials could be used for onsite interpretive activities. A center of operation where visitors could receive information about sanctuary activities, from which programs can emanate and in which staff can prepare exhibits, store materials, and administer the sanctuary are essential from the outset.

While some information was available for use in the development of this prospectus from current DNR statistics, it probably would be necessary for the interpreter to make detailed onsite observations and conduct continuing surveys to establish a complete basis for program design.

Included among the factors to be considered in gathering future information are:

1. the amount of knowledge about the sanctuary that visitors have prior to coming to La Parguera;

2. what users expect from their visit;

3. what kinds of activities they engage in while in the sanctuary;

4. what activities they would like to explore that may or may not be scheduled; and

5. what they did or did not enjoy about their visit.

In preparing the assessment of potential resources, the interpreter would focus on facilities, materials, and equipment.

(1) Facilities

° Tour boats, such as the glass bottom boat now privately operated at the La Parguera public dock, would be inventoried, and arrangements would be made for possible integration into the program.

° Agreements for use of the University of Puerto Rico's facility on Magueyes Island by sanctuary visitors would be investigated with University officials.

° The lighthouse at Cabo Rojo and the Cueva Island site would be investigated as to their availability and potential for adaptation as satellite interpretive program centers.

(2) Materials and Equipment

° An inventory of available exhibit materials and audiovisual equipment would be prepared. Materials and equipment to be acquired and possible sources for them would be listed.

° Persons and groups who are known to have collections of pertinent natural resources that might be loaned or given to the proposed sanctuary would be contacted for assistance in developing program exhibits.

Inform the Public of Sanctuary Rules, Regulations, Programs, and Activities

During Stage I, specific information to be communicated to the user public would be identified along with appropriate media forms to be used for each message. In conjunction, the following tasks would be undertaken:

° A map would be developed showing the location of the proposed sanctuary and pointing out its major features. Directions for driving or going by boat to program centers would be printed on the map.

° One or more different brochures would be published containing information such as: hours of operation; location of trails and displays; tour boat schedules, costs, and embarcation site locations; activity schedules, levels of difficulty, and equipment needs and sources. A small map of La Parguera village and the waterfront area would be included. Flyers would be used to announce special events.

° A bulletin board at visitor contact points would be used to post schedules, special announcements, safety procedures, and rules and regulations.

Develop a System of Interaction with the Resource Studies Plan

The procedures for implementing this action would be developed during Stage I. The principal investigator for each study would be responsible, in addition to his technical work, for the drafting of layman's version of that study suitable for use in the Interpretive Program. It would also be important that the investigator continue to provide updated information for use in the interpretive program for the duration of his study.

Design a Program of Exhibits and Activities

On the basis of an analysis of the user profiles and the resource facilities inventory, the interpreter, during Stage I, would design a program of exhibits and activities for:

(1) Mangrove Boardwalk/Boat Tour

Onsite interpretation of natural features would take place via a guided tour by boat and boardwalk trail in one of the mangrove areas. It is suggested that the tour take place in the small mangrove channel near Cueva Island (Figure 14). The mangrove boardwalk tour would focus on interpreting the ecology

of the mangrove system and provide information on its particular flora and fauna. The boardwalk tour could be established primarily as a self-guided tour or with regularly scheduled talks by a naturalist if staff time allows.

The boat tour has the advantage of controlling the movement of groups of people as well as providing a captive audience. A possible scenario for both the boardwalk and boat tour suggests boarding visitors at La Parguera village dock. The boat, with an interpreter-naturalist aboard, would stop at the beginning of the mangrove trail where the group could walk the trail with the naturalist while the boat tour proceeds to the trail's end (unless it is a loop trail). The group would board again and the boat would stop at a selected coral reef or cay, where, depending on their interests and abilities, participants could observe the mangrove roots and/or coral by snorkeling or through viewing tubes. It is suggested that Collado would be an ideal spot for viewing mangrove root life.

(2) Underwater Trails

Underwater trails would be selected and would include underwater markers showing biota and other interesting features of the reef (Figure 14). Where possible, lines would mark the trails, particularly those which are some distance from shore (i.e., shelf edge, Turrumote I), in an effort to reduce the chances of divers becoming disoriented.

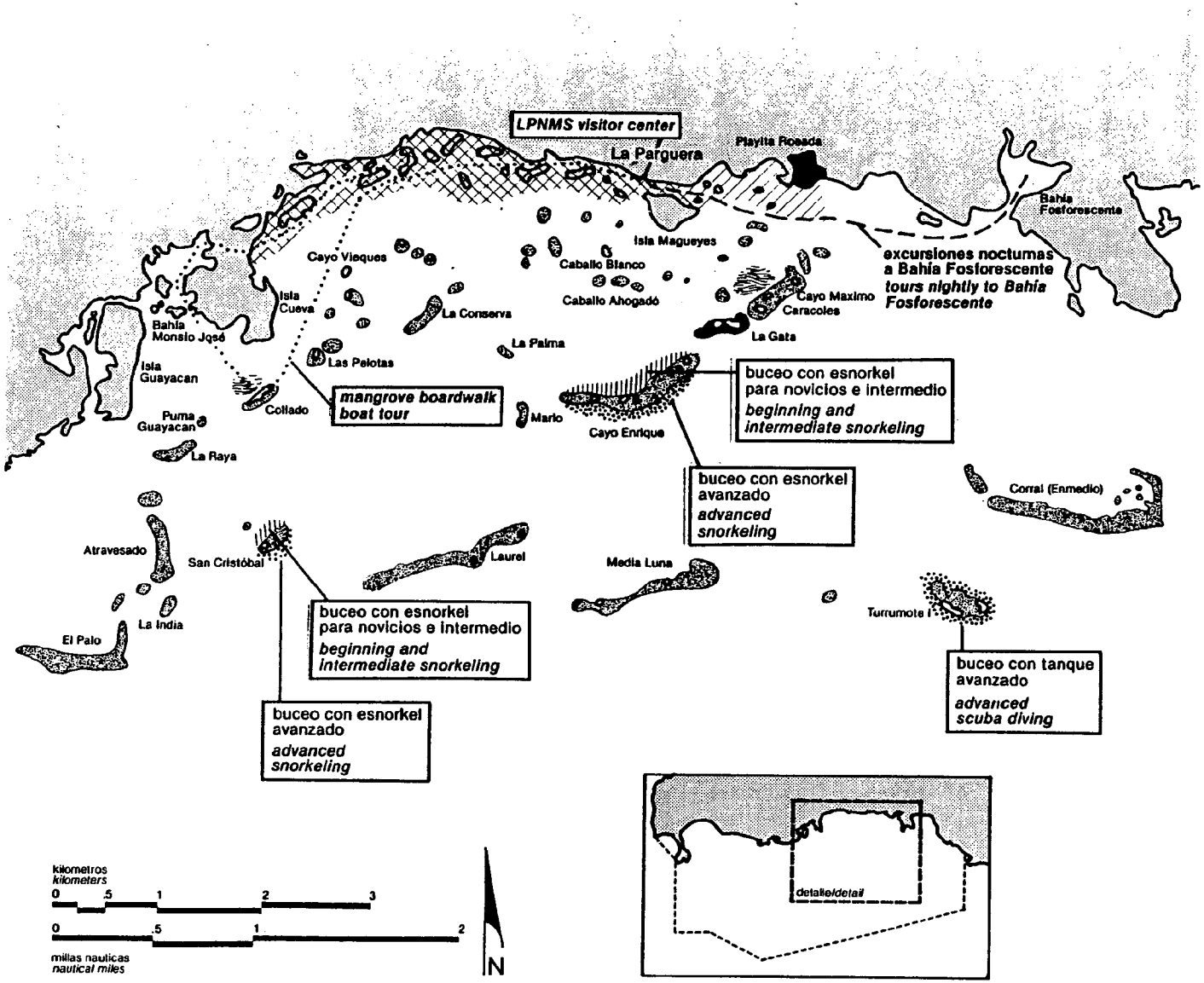
For beginner and intermediate snorkelers, the westernmost section of Enrique's back reef lagoon and San Cristobal's back reef lagoon is recommended.

Enrique Reef. The area at Enrique comprises about .44 km^2 and contains a highly diverse biota. Star and staghorn corals are very common and provide shelter to a great variety of fish and invertebrates. Dense, large stands of soft coral are common among the corals. Crustaceans of different species, sea urchins, and anemones are often seen living together. Alternating with the coral patches described are extensive seagrass meadows containing conch and a large variety of algae. The depth of this site varies between 1 and slightly more than 2 meters. It is very close to the La Parguera village (about 2.5 km) and is completely protected from the wave action.

San Cristobal Reef. The back reef lagoon of San Cristobal Reef, located approximately 4km (2.4 miles) southwest of La Parguera village, provides an interesting area of approximately .1km^2 for beginner and intermediate snorkelers. Within the lagoon a variety of reef habitats exist. Predominant organisms are: (1) large star and brain corals (about 2m in diameter), (2) soft corals, (3) algal patches, and (4) seagrasses. Sandy plains with crustacean burrows are also present. Fish and invertebrate diversities are relatively high. Parrot fish, schools of doctorfish, juvenile snappers, blue head wrasses and lizard fish are abundant. The christmas tree worm, sea cucumber, symbiotic shrimps, anemones, fire, star, brain, staghorn, elkhorn, rose, and lettuce corals, gorgonians, carpet-like colonial anemones, and sea slugs are found throughout. The area also includes a well-protected "wall" dropping from the surface to about 6m (20 ft.) and lined with numerous invertebrates. Very interesting to the visitor are large, overturned head corals; evidence of the passage of hurricanes in past years. The water depth ranges from knee-deep water to about 6m. Underwater horizontal visibility is generally very good.

Santuario
Marino
Nacional
La Parguera
National
Marine
Sanctuary

Figure 14
Uso Recreativo Propuesto
Proposed Recreational Use



parque publico *public park*

natacion *swimming*

esqui acuatico *water skiing*

"wind surfing" *wind surfing*

arrecifes de coral *coral reefs*

underwater trails

Evelyn S. Wilcox
and Associates
McLean, Virginia

Turrumote I. For more advanced swimmers and SCUBA divers, Turrumote I is recommended. Turrumote Reef is located approximately 5 km south of Bahia Fosforescente. Although this area is susceptible to coral damage by hurricane force storms, it is also a prolific growth area and affords the opportunity for more experienced divers to view many diverse species over a wide area. The eastern end of the reef includes a very interesting and high relief area (locally called the Pinnacles). These are coral structures which rise from the bottom and climb to about 10 m from the surface.

Although Turrumote Reef is a good location for more experienced snorkelers and divers, fishing is good in this area and divers may conflict with fishing activities.

As the underwater trail program develops, tours would be organized according to levels of ability. For example:

1. For experienced snorkelers and SCUBA divers, boats with or without guides, would proceed to the reefs where swimmers could swim underwater to observe marine communities, using waterproof interpretive cards as an alternative to underwater trail exhibits.

2. For swimmers without previous snorkeling experience, the tour would be guided and participants would be closely supervised.

3. For swimmers who need security, lines would be floated across an inshore reef and snorkelers could hold onto the line while observing the features.

4. For non-swimmers, a tour boat with pontoons that fold out, would permit visitors to use viewing tubes to observe the underwater environment.

(3) Outdoor Exhibits

An outdoor exhibit would display a map showing the proposed sanctuary boundaries, locating the features along the route of the tour boat, and marking danger areas. This exhibit would be placed at the tour boat dock or visitor center.

(4) Promote Conservation of Fisheries Resources

The solutions to the problems of conserving fisheries resources are ones that will require considerable thought and staff time. La Parguera fishermen, as reported, are under great economic pressure and often lack the technical and management background necessary for evaluating the long-term effects of their present actions. Educational activities focused on the fishery resources within the proposed sanctuary should include:

° interpretive personnel meeting informally with the fishermen to establish mutual understanding and respect;

° an educational program which would be a two-way process for the interpreters to learn the trade peculiarities in the area and use such information to foster sound administration practices; and

° educational materials developed for the sportsfishermen. (This is an expanding population whose influence on fisheries resources will increase over the next years.)

As an example, fishermen prefer "yolas" and use very little additional mechanical gear for fishing. Fishing programs in the past that tried to promote the use of larger boats with more sophisticated equipment encountered strong resistence from the fishermen. In view of the present situation, especially overfishing, the use of larger boats is not cost efficient or good resource conservation. Fishermen's Associations that do have large, fully equipped fishing boats hardly break even between expenses and sales. This is largely due to high costs of fuel, maintenance of equipment, and low catch.

STAGE II

During Stage II (years four and five) of sanctuary management, the Interpretive Program would focus on expanding the awareness of the proposed sanctuary beyond the immediate area and developing programs that explain the cultural and historic aspect of the site.

Interpreting the Natural History of the Sanctuary

Probably the best mode of interpreting the natural history and culture of the area is through visitor center exhibits complemented by audiovisual materials. Using objects as much as possible, exhibits could provide glimpses of the natural history of the proposed sanctuary area and its adjoining waters, show the interrelationship of man and his marine environment, and introduce visitors to those features of the proposed sanctuary that they would be able to see on one of the tours. Emphasis would be placed on the fragility of the reefs, the vulnerability of the mangroves, seagrass beds and bird nesting sites and their importance to the ecological balance in the proposed sanctuary and those conservation practices that man can adopt to protect these resources. Color, patterns, objects, and motion would be integrated to create the effect of natural scenes. In order to keep labor intensive exhibits to a minimum, audio tapes would be used to educate the visitors. The possibility of using videotapes would be explored in the future.

Topics to be considered for exhibit purposes would be selected in consultation with the Puerto Rican Institute of Culture, the Fundacion Arqueologica, Antropoligica e Historica de Puerto Rico, the Smithsonian Institution, and informed individuals. These institutions may have artifacts that could be used in the exhibits, as may the University of Puerto Rico and other museum and educational organizations.

Visitors could arrange for transportation to the underwater trails at the proposed visitor center and headquarters. Additional diving sites where underwater trails could be developed would be explored. Literature and guidelines about the usage of the trails, as well as general information about the coral reefs in the proposed sanctuary, would be available at the headquarters as well as in other selected locations.

There are many reef formations that, if managed correctly, could provide excellent recreational/interpretive underwater sites for the proposed sanctuary users with limited swimming abilities. The sites could be rotated periodically to prevent any long-term damage caused by overuse. Areas within each reef system could also be set aside if human use becomes a problem.

Interpreting On-Going Research Projects Within the Proposed Sanctuary

Should the University of Puerto Rico's research station on Magueyes Island become the research clearinghouse for the proposed sanctuary, an interpretive exhibit would be set up to inform the public about the Resource Studies Plan. A series of mini exhibits such as backlighted transparencies with photographs and labeled exhibits could tell about each particular project. As projects are completed, results could be published and distributed to the visitors and the exhibits replaced with information about current research.

The results of research investigations of interest to the general public should be published in local papers and in the proposed sanctuary newsletter.

Preparation of Year-Round Schedule for Educational Programs

Since most visitation occurs during the summer months and on holidays, there is an opportunity for the interpreter and the naturalists to carry the message of the proposed sanctuary to schools and groups throughout the island during the visitor off-seasons.

(1) Audiovisual Presentations

A slide show with text would be assembled and copied for use by the interpreter, naturalists, and volunteers who are familiar with and eager to interpret the sanctuary's resources. Publications and small portable touchtable type exhibits would be prepared for use in the educational programs.

A 15-30 minute film would be prepared early in the second stage of operation. It would be used for off-site presentations, as well as orientation for sanctuary visitors, to inform people about the proposed sanctuary, its goals and significance in marine conservation. It could also be used for pre-visit presentations to tour groups both on and off-site and in schools. Perhaps a supporting group in Puerto Rico could raise funds for this project. Content would be oriented to a general audience and would present the significant features of the proposed sanctuary; the interrelationships of the coral reefs, mangroves, seagrass beds, bay environments and other living elements; the fragility of the marine environment; the story of the bioluminescent bays; important bird nesting sites; the rules and regulations of the proposed sanctuary; and the necessity of conserving these ecological resources.

(2) Programs for Particular User Groups

A program with slides and printed materials would be prepared for presentations to specific user groups to be selected by the interpreter. Content would be oriented to the special needs and concerns of user groups such as: snorkelers and SCUBA divers, recreational boaters, commercial and recreational fishermen and DNR public park visitors. Programs would address the potential conflicts between these interests and the proposed sanctuary goals.

The interpreter in consultation with the sanctuary manager and the Administrator would prepare these presentations and would schedule only those persons skilled in leading discussions for these program sessions.

(3) Research and Educational Tours

Scientists and conservationists, who visit the proposed sanctuary, would be interested in ongoing research projects as well as in touring the proposed sanctuary.

For undergraduate and graduate students, who are science majors or who have demonstrated a significant interest in the proposed sanctuary, an educational research cruise of the proposed sanctuary area could be organized to introduce these students to the field of marine research. A cooperative arrangement with the research facility at Magueyes Island would help to ensure the success of this project.

A reservation system for groups that want to tour the proposed sanctuary would be established by the sanctuary manager and tours would be modified to accommodate their particular needs to the greatest extent possible.

(4) Workshops for Volunteers, Teachers, and Staff

Marine sanctuary workshops would be held for teachers, volunteers, and staff. The interpreter would seek the assistance of specialists in the DNR Information Systems Office and Education and Public Affairs Office and others in the field of communication and the natural sciences in the preparation and conduct of these workshops. A workshop for volunteers and staff would provide them with the background information and presentation techniques that they would need when speaking to groups and guiding tours. Workshops for teachers would be content-oriented to equip them with useful information and materials for their classes, and in preparation for class site visits to the proposed sanctuary.

E. Resource Studies Plan

1. Introduction

A primary purpose for establishing the proposed La Parguera National Marine Sanctuary (LPNMS) is to promote and coordinate research to expand scientific knowledge of significant marine resources and improve management decisionmaking. Research is an essential part of long-term, comprehensive, and effective sanctuary management. Designating the waters at La Parguera as a national marine sanctuary would provide an excellent laboratory or control site in which research needed for the understanding and interpreting of ocean processes will be undertaken. Projects will include, but will not be limited to, multidisciplinary studies on living marine resources (species composition, abundance, diversity, etc.); community structure and function; and physical, chemical, geological and meteorological conditions within the proposed sanctuary. Information generated from these investigations will be used to further understanding of the importance of coastal resources and to develop sound coastal ecosystem management practices. Management-related research will address practical, use-oriented or "cause-and-effect" studies. Long-term monitoring and its resultant data base will provide the foundation for interpreting or predicting natural or man-induced events in the sanctuaries and related areas. Management areas which could be explored might include: (1) carrying capacity of a given system to withstand varying types and levels of human contact or stresses; (2) the adequacy of protective buffer areas; (3) the effects of different types of development or activities on particular resources such as coral, seagrass beds, fisheries, marine mammals, and seabirds; (4) fisheries research oriented toward solving operational and management concerns; and perhaps (5) innovative ways of enhancing productivity.

2. The Plan

This section of the proposed LPNMS Draft Management Plan establishes a long-term Resource Studies Plan for structuring marine research, resource assessment, and monitoring at La Parguera. It describes needed projects and sets out priorities according to sanctuary management needs. A wide range of potential studies are listed, of which NOAA can only fund a limited number each year. Other funding sources will be encouraged to fund priority projects. A coordination of effort will be established with the following agencies to conduct these studies: Department of Natural Resources, Department of Marine Sciences (University of Puerto Rico), Center for Energy and Environmental Research, Corporation for the Development of Marine, Lacustrive and Fluvial Resources, and the Environmental Quality Board. The Resource Studies Plan spans five years and will be updated annually. The Plan describes proposed studies under four topics:

1. Data and Resource Information Management

2. Marine Ecology

3. Oceanography (physical, chemical and geological)

4. Human Uses of the Proposed LPNMS

The following studies are proposed for the La Parguera National Marine Sanctuary:

TOPIC 1. Data/Resource Information Management

Study 1.1: LPNMS Data/Information Management Feasibility Study

Study 1.2: Compilation of Literature and Ongoing Research in the Proposed LPNMS

TOPIC 2. Marine Ecology

Study 2.1: Distribution and Status of the West Indian Manatee Population

Study 2.2: Conch Fishery Stock Assessment in the Proposed LPNMS

TOPIC 3. Oceanography

Study 3.1: Circulation Patterns in the Proposed LPNMS

Study 3.2: Water Quality Monitoring in the Proposed LPNMS

TOPIC 4. Human Uses of the Proposed LPNMS

Study 4.1: Anchor Damage to Coral Reefs in the Proposed LPNMS

Study 4.2: Coral Reef Underwater Nature Trail Feasibility Study

Study 4.3: Boating Activity in the Proposed LPNMS (Bioluminescent Bay)

Study 4.4: Boating Activity in the Proposed LPNMS (Seagrass Bed Areas)

Study 4.5: Effects of Spearfishing in the Proposed LPNMS

Study 4.6: Effects of Human Activity on Selected Coral Reefs in the Proposed LPNMS

These studies are described below in more detail.

TOPIC NO. 1. Data/Resource Information Management

1. Study 1.1: LPNMS Data/Resource Information Management Feasibility Study

2. Information Needs and Study Objectives

Effective management relies to a great extent on an efficient data classification, storage, and retrieval system. Such a system is essential for day-to-day management as well as for future planning and future resource problem solving. At present a considerable amount of information exists on La Parguera and surrounding environs. It is anticipated that this information base will expand significantly with the establishment of the proposed sanctuary. A data management system therefore is needed to handle this information effectively so that proper management of the proposed LPNMS could be achieved.

The Natural, Cultural and Environmental Resources Inventory (NCERI) of the Department of Natural Resources (DNR) is a data management system which has been in operation since 1973. It has the capability to accept most of the data base for the proposed LPNMS. With certain modifications the system could be expanded to accept additional information.

The objectives of this study are:

° To incorporate the existing data banks and information on the proposed LPNMS into the NCERI of DNR.

° To modify the NCERI so that additional data and information could be incorporated into the system.

3. Study Description

A. Purpose

A study is needed to evaluate the existing data management system within DNR in terms of its compatibility with the proposed LPNMS data/information management needs. Specifically, the study should describe how the data management needs can be incorporated into the existing NCERI.

B. Methods

Available data on the proposed LPNMS would be analyzed to determine the types and amounts of information that fall within the existing data management system. A special computer program would be developed to accommodate those data presently outside the system's capability. Parameters to be inventoried would be selected based on the sanctuary's management needs. It is anticipated that the following parameters would be included: bathymetry, coral reefs, bottom types, seagrass beds, water quality, marine currents, and mangrove forests.

C. Products

Narrative reports discussing the progress of adopting NCERI as the proposed LPNMS data management system would be prepared. The final product of this study would be an operational data management system for the proposed LPNMS. It would provide for classifying, storing and retrieving data relevant to the proposed sanctuary. A standardized data presentation format, including lists and maps, would also be available.

D. Study Area

LPNMS and DNR in San Juan.

E. Related LPNMS Studies

1. DNR operates a data management system (NCERI) that could be adapted by the LPNMS.

2. Study 1.2

F. Timing/Phasing

One year.

TOPIC NO. 1. Data/Resource Information Management

1. Study 1.2: Compilation of Literature and Ongoing Research on the Proposed LPNMS

2. Information Needs and Objectives

It is well known that the proposed LPNMS site and its surrounding marine habitats represent a valuable asset to Puerto Rico in terms of its natural, scientific, aesthetic and recreational attributes. Located on the southwestern sector of the island of Puerto Rico, La Parguera is also representative of a fast growing rural community which in the past years has seen a considerable increase in visitors.

A great amount of information about La Parguera has been produced through the years, mainly about its marine environment. Most of this information exists as scientific publications in a varied number of journals, periodicals, and bulletins which to date, have almost exclusively served the scientific community.

The need to compile and use this storehouse of information in an effort to better understand the La Parguera system as a whole is essential for the management of the proposed LPNMS.

The objective of this study is:

° To prepare a document summarizing the existing information concerning scientific research in La Parguera to aid in the formulation and implementation of management policies.

3. Study Description

A. Purpose

As a baseline for management decisionmaking and for assessing present and future study needs within the LPNMS, it is necessary to identify existing studies on the sanctuary's resources, synthesize applicable information, and assess data gaps. Relevant findings would be placed in the LPNMS data management system (NCERI).

B. Methods

A comprehensive summary document on the research history and opportunities in La Parguera would be developed in order to put in one place the state of understanding of the region. This document is unprecedented for the region and would consist of all known available information arranged according to the following (tentative) outline:

I. General Description of the Research Area

II. Current Activities

- A. Recreation
- B. Research
- C. Management

III. Proposed Activities

IV. Climate

- A. Rainfall
- B. Temperature
- C. Relative Humidity
- D. Wind Velocity and Direction
- E. Solar Radiation

V. Hydrology

- A. Water Temperature
- B. Salinity
- C. Dissolved Oxygen
- D. pH
- E. Turbidity and Transparency
- F. Currents and Tides

VI. Chemistry

- A. Major Nutrients
- B. Minor Constituents
- C. Organic Compounds
- D. Hydrocarbons

VII. Geology

- A. Regional Geology
- B. Shelf Topography and Coastal Features
- C. Bottom Sediments Types
- D. Reefs

VIII. Vegetation

- A. Phytoplankton
- B. Algae
- C. Seagrasses
- D. Mangroves

IX. Fauna

- A. Zooplankton
- B. Invertebrates (Higher)
- C. Vertebrates
  1. Fishes
  2. Marine Mammals
  3. Birds

X. Disturbances

- A. Natural Disturbances
  1. Hurricanes
  2. Extraordinary Tides
  3. Plankton Blooms
  4. Floods
- B. Man Induced
  1. Coastal Eutrophication
  2. Chemical Pollution
  3. Domestic Pollution
- C. Response to Natural Stresses
- D. Response to Man Induced Stresses
- E. Energy Flow

XI. Conclusion

- A. Forcing Function

C. Products

The main product of this study would be a comprehensive document describing the state of knowledge of the proposed LPNMS. In addition, excerpts would be prepared for publication in the scientific literature.

D. Study Area

LPNMS, Mayaguez, and San Juan

E. Related LPNMS Studies

The Draft Management Plan for the proposed La Parguera National Marine Sanctuary contains a great amount of information on the environment and resources. The Department of Natural Resources and the Department of Marine Sciences of the University of Puerto Rico have conducted literature reviews of specific resources which are available as bibliographies. Some of these have been abstracted.

F. Timing/Phasing

One year.

TOPIC NO. 2. Marine Ecology

1. Study 2.1: Distribution of Status of the West Indian Manatee Population

2. Information Needs and Objectives

Implementation of management strategies for the survival of any endangered species depends heavily on a sound estimation of the population size. Reliable estiamtes are essential for evaluation of population trends, habitat preferences, seasonal movements, high risk mortality areas, and the effects of recovery management efforts. In Puerto Rico, adequate evaluation of these factors has not been undertaken for the West Indian manatee (Trichechus manatus), an endangered species protected under the U.S. Endangered Species Act. Similarly, the need for robust inference procedures to fully accomplish the above in the U.S. has been expressed in the West Indian Manatee Recovery Plan.

The objectives of this study are:

° To produce estimates of the current population numbers of the West Indian manatee in Puerto Rico with special emphasis on the proposed LPNMS.

° To develop a suitable censusing technique for the manatee.

3. Study Description

A. Purpose

The purpose of this study is to provide the sanctuary manager with statistically valid data on the distribution and abundance of the West Indian manatee so that management measures regarding this resource could be effectively implemented.

B. Methods

The survey would be conducted by sampling a minimum of 10 randomly selected 5 kms transects in a known sample area. Adjacent transects, if any, would be 1 km apart. Two observers would sit on the right side of the airplan and scan with no specified boundaries. The 1 km between adjacent transects is believed to be the maximum distance at which a manatee can be detected efficiently. Data would be recorded in 50 meter intervals using wing markers placed on the wing struct. A modified version of field data sheet suggested by Burnham et. al (1980) would be used to record data. Transects would be selected by superimposing a scaled 5 km-squared grid over the area sampled. Selection would be done without replacement. These transect segments would be located using landmarks and navigation equipment.

Detailed proceudres for this study are available from the Area of Scientific Research, Department of Natural Resources, P.O. Box 5887, Puerta de Tierra Station, San Juan, Puerto Rico 00906.

C. Products

° Narrative report describing the status of manatee populations in Puerto Rico and the proposed LPNMS.

° Maps identifying manatee population trends, habitat preferences and seasonal movements.

° Recommendations

° Information for the LPNMS Data Management System.

D. Study Area

Coastline of Puerto Rico with emphasis on the LPNMS and Jobos Bay National Estuarine Sanctuary.

E. Related Studies

None

F. Timing/Phasing

2 years.

TOPIC NO. 2. Marine Ecology

1. Study 2.2: Conch Fishery Stock Assessment in the Proposed LPNMS

2. Information Needs and Objectives

Queen conch (Strombus gigas) is used as food throughout its range (Randall, 1964). It is one of the three molluscs of any importance in Puerto Rico besides mangrove oysters and the common octopus. According to the Caribbean Fishery Management Council (CFMC, 1976), a survey is needed to determine areas of existing habitat and the effect of harvesting on the population. In many areas, the conch has disappeared. Evidence from Randall (1964) suggests overfishing of this resource in the proposed sanctuary area, where actual islets have been formed from the heaps of discarded conch in La Parguera. Information is needed to determine the status of conch fisheries in the proposed LPNMS. An appraisal of this fishery should be carried out for practical reasons, as a first step towards management.

The objectives of this study are:

° To determine the status of conch fishery in the proposed LPNMS.

° To determine the effect of harvesting on the conch population.

° To determine and describe areas of existing habitat for conch in the proposed LPNMS.

3. Study Description

A. Purpose

The main purpose of this study is to provide the sanctuary manager with a statistical data base on which to support management decisions concerning conch in the proposed LPNMS. This information should be helpful in providing answers to the following management-related questions:

° Should conch shell fishing be regulated or prohibited in the proposed LPNMS?

° Should certain areas of the proposed LPNMS be set aside for propagation of this species?

° Should more emphasis be placed in current aquaculture projects related to conch?

B. Methods

1. Conduct a survey of conch shell distribution by size, sex and habitat preference. Marking and tagging of specimens would be performed to estimate their numbers and to follow the fate of labelled individuals. This

technique would also provide data on densities, mortality rates, rates of exploitation and recruitment, as well as movements and migrations and growth and age determinations.

2. Conduct a creel census among local fishermen to obtain basic statistical data on landings, catch effort, and abundance of fish stock.

This data would be compared to statistical data currently being collected by the Corporation for the Development of Marine, Lacustrive and Fluvial Resources (CODREMAR). This survey would also yield information on sex, size, weight and in some cases habitat preference of conch shells.

3. Conduct an assessment of the conch shell fishery. Based on the information provided by the sampling survey and creel census described above, the conch shell stock in the proposed LPNMS would be categorized in one of the following: (a) unfished or lightly fished; (b) moderately fished; or (c) overfished.

An appraisal quantitatively relating changes in abundance or composition of the stock to changes in the fishing effort will then be made. Both the production model (Shaefer, 1954, 1957) and the analytic approach (Ricker, 1958, 1975) will be used to make the actual evaluation of the state of the stocks.

C. Products

A narrative report containing information on sex, size, distribution, and habitat preference of the conch shell. The same should also contain the results of creel census conducted in the proposed LPNMS and a complete stock assessment of the conch shell resource. Appropriate graphs, tables, analytical formulae and maps should also be included. The final report should also contain specific management recommendations.

D. Study Area

LPNMS

E. Related LPNMS Studies

1. Selected Marine Fish Population Dynamics (recommended but not described).

2. Extensive studies on conch shell biology and natural history were conducted by Randall (1964). Current research on conch shell culture in artifically controlled conditions is being done by the University of Puerto Rico, Department of Marine Sciences.

F. Time/Phasing

One year.

TOPIC NO. 3. Oceanography

1. Study 3.1: Circulation Patterns in the Proposed LPNMS

2. Information Needs and Objectives

The circulation patterns within the proposed LPNMS have not been thoroughly described. Only some of the complex physical processes associated with coastal circulation in the area have been studied. Coastal currents are the main driving force that contribute to the transport and distribution of sediments, pelagic larvae, and marine pollution. From the management standpoint, it is essential to gather comprehensive field data for description and quantitative analysis of the dynamic processes and water circulation patterns in and surrounding the proposed LPNMS. This information could be used by the sanctuary manager to make predictions regarding the movement of sediments, larvae, and pollutants within the proposed LPNMS.

The objective of this study is:

° To determine, characterize and describe the circulation patterns of the proposed LPNMS.

3. Study Description

A. Purpose

The purpose of this study is to provide the sanctuary manager with information concerning the frequency, direction and magnitude of inner and outer shelf current patterns of the proposed LPNMS. This information would aid the sanctuary manager in assessing the direction of travel and the probable impacts of accidental spills of hazardous substances such as oil. It should also assist in identifying vulnerable areas subject to sedimentation and/or other types of pollution within the proposed sanctuary. Describing water circulation patterns within the sanctuary is also essential for understanding the relationship between water movements and the dispersal of pelagic larvae and other planktonic forms.

B. Methods

Direction and magnitude of currents would be measured by in situ current meters. Surface currents would be measured by means of surface drifters or drogues containing fluorecin dye. Drift patterns would be photographed from an airplane and tracked from shore by a theodolite station. Data from an existing tide station in Magueyes Island would be used to correlate tidal fluctuations with circulation patterns as measured by meters and drogues.

Wind frequency and magnitude data would be obtained from a meteorological station also located at Magueyes Island and correlated with water circulation. A theoretical and statistical survey of the yearly frequency direction and magnitude of winds would be done for wave hindcasting procedures and wave power distribution.

In situ salinity, temperature, depth, and turbidity recorders would be used. Density distribution would be calculated from the values of these parameters and presented in distribution diagrams and statistical tables.

C. Products

A narrative report discussing the various types of analyses of recorded measurements would be prepared. This report would include: (1) progressive vector diagrams for approximately 38 hrs. (theoretical innertial period for Puerto Rico's latitude); (2) North-South and East-West mean vector component curves; (3) correlation graphs of mean current vectors vs. tidal variation curves and directional mean vectors; (4) graphics illustrating mean resultant mass transport during various intervals; (5) Lagrangian current diagrams showing surface and mid-depth drifts; and (6) statistical tables. In addition, efforts would be made to develop a conceptual or dynamic model for making predictions about the system.

D. Study Area

LPNMS and UPR at Mayaguez

E. Related Studies

Information on tides and selected meteorological parameters are available for La Parguera. Shanley (1974) reported on the circulation patterns in the bioluminescent bay. Ongoing research includes a water current and wave transformation study on the coral reefs of La Parguera (Lugo).

F. Timing/Phasing

One year -- (6 months - field work and 6 months - data analyses and report writing).

TOPIC NO. 3. Oceanography

1. Study 3.2: Water Quality Monitoring in the Proposed LPNMS

2. Information Needs and Objectives

Man's activities in the proposed LPNMS and adjacent lands could significantly alter or change the existing ecological conditions within the proposed sanctuary. Only with a measure of the relative ecological conditions of the waters of the proposed sanctuary can managers relate past to present practices and begin to formulate a management program to control adverse effects in the future. It is essential, therefore, that a water quality monitoring program be established in the proposed LPNMS to determine the presently existing condition of its waters and to detect changes over time.

The objectives of this study are:

° To develop and implement a water quality monitoring program for the proposed LPNMS.

° To maintain this program and define the current status of the environment, identify values that should be protected, and suggest means for the restoration of damaged elements.

3. Study Description

A. Purpose

The main purpose of developing and implementing a water quality monitoring program for the proposed LPNMS is to quantify and provide an early warning system of the stresses imposed by man's activities.

Continuous monitoring will aid managers in identifying areas where degradation of the environment is taking place; as background for pollution indicators; and for identifying suitable areas for particular use or multiple uses in the proposed LPNMS.

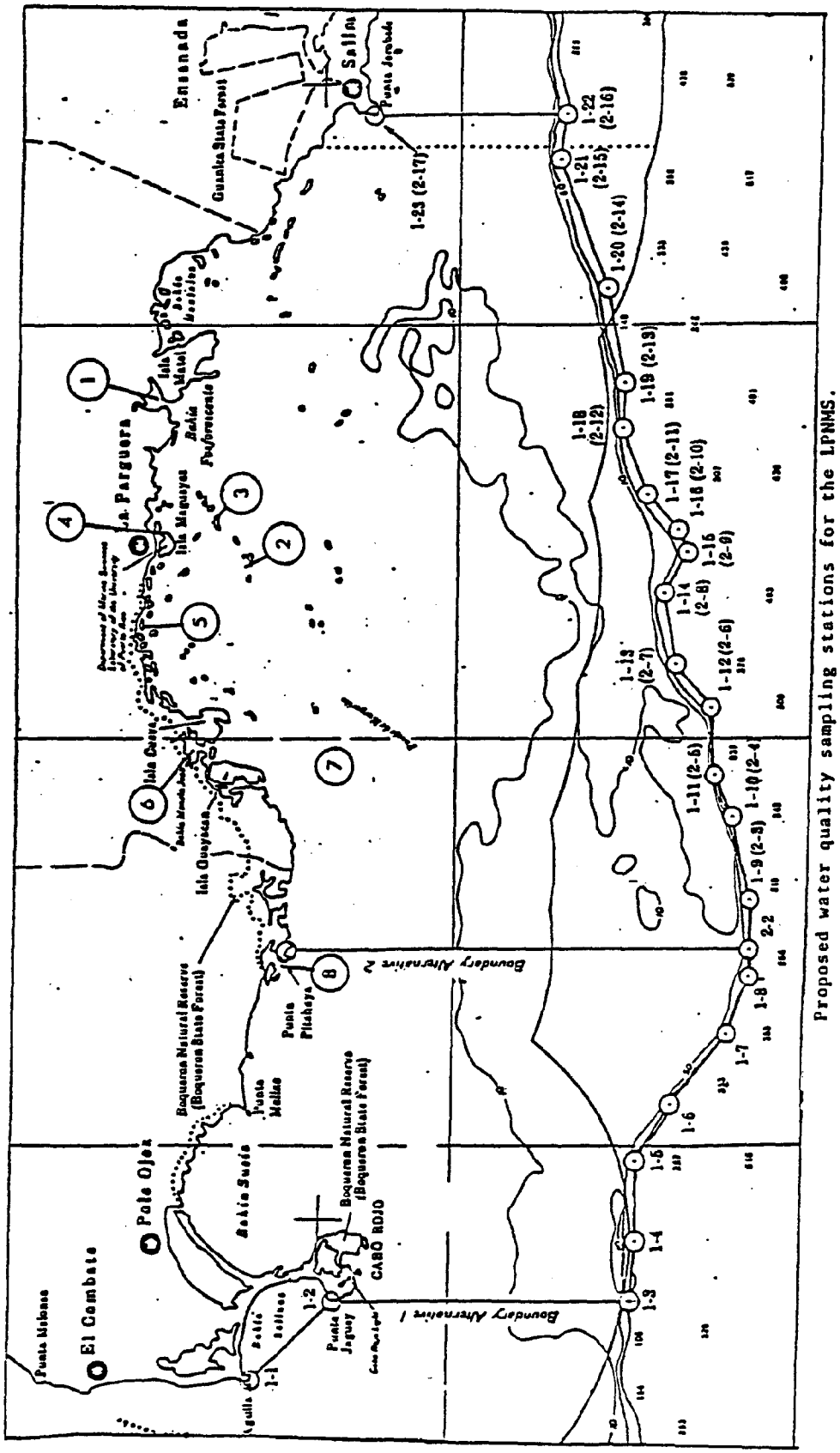
B. Methods

Sampling stations will be selected as representative of the aquatic area and for determining any changes in water quality within the proposed LPNMS. Recommended stations are shown in Figure 15. These are:

1. Luminescent Bay
2. Enrique Reef
3. Mata de la Gata Reef
4. Northeast of Magueyes Island
5. Interior waterway, south of La Parguera village
6. Bahia Monsio Jose
7. El Palo Reef
8. Punta Pitahaya

Station 1 is recommended to determine the water quality of a frequented tropical bay of exceptional ecological value such as bioluminescence. Stations 2 and 3 are typical inner shelf reefs also frequented by visitors and where considerable "land" activity takes place (i.e., Mata de la Gata Reef). Station 4 is recommended to determine the quality of water entering a semi-enclosed system of mangrove channels which extends as far as Station 8 (Punta Pitahaya). Stations 5 and 6 are midpoints within this system. Station 7 is representative of a middle shelf reef system relatively free of significant intervention by man.

A total of 15 physical and chemical parameters would be monitored monthly or bi-monthly to characterize the aquatic ecosystem of the proposed LPNMS. These are summarized below in Table 4.



Proposed water quality sampling stations for the LPNMS.

FIGURE 15

Table 4. Physical and Chemical Parameters and Suggested Frequency of Measurement for Water Quality Monitoring.

Parameter	Suggested Frequency of Measurement
Physical	
- Temperature	monthly
- Turbidity (Secchi disc)	monthly
- Salinity	bi-monthly
Chemical	
- Dissolved oxygen	bi-monthly
- Total nitrogen	monthly
- Nitrate and nitrite nitrogen	monthly
- Ammonia nitrogen	monthly
- Hydrocarbons	monthly
Biological	
- Total coliform	bi-monthly
- Fecal coliform	bi-monthly
- Fecal streptoccocus	bi-monthly
- Total chlorophyll	bi-monthly
- Caratenoids	bi-monthly
- Phaeopigments	bi-monthly
- Plankton (by displacement volume)	bi-monthly

All analyses will be performed following appropriate methods given in:

- EPA manual, "Methods for the Chemical Analyses of Water and Wastes".
- "Standard Methods for the Examination of Water and Waste Water", U.S.P.H.A.
- "A Practical Handbook of Seawater Analysis".

The monitoring program would also identify the locations and strengths of known sources of waste. In addition, the locations of areas of water use and a list of legitimate water uses would be prepared. This would be accomplished by field surveys.

Detailed planning and implementation of the monitoring program would follow the procedures described in the "Water Operations Training Program - Water Quality Surveys" (EPA, 1974).

C. Products

- Narrative reports describing the annual trend of chemical, physical and biological water quality parameters in the proposed LPNMS.
- Maps, graphs, and tables to document data.
- Information for the proposed LPNMS Data Management System.

D. Study Area

LPNMS

E. Related LPNMS Studies

Study 3.1

F. Timing/Phasing

Continuous with possible modifications after the first year.

TOPIC NO. 4. Human Uses of the Proposed LPNMS

1. Study 4.1: Anchor Damage to Coral Reefs in the Proposed LPNMS

2. Information Needs and Objectives

Human impacts on coral reefs are usually categorized in terms of pollution, sedimentation, dredging, coral extraction, and trampling. Access to coral reefs is mostly accomplished by the use of boats. A significant amount of damage to reef structure can be expected from the use of anchoring gear over the reefs. There is a lack of quantitative and qualitative information on the impact(s) of boat anchoring on the coral reefs within the proposed LPNMS. Information is needed to identify anchor-sensitive areas within the proposed LPNMS and to assist the sanctuary manager in assessing the magnitude of the problem and recommending solutions.

The objective of this study is:

° To qualify and quantify the effects of boat anchoring on the coral reefs within the proposed LPNMS.

3. Study Description

A. Purpose

The purpose of this study is to provide the sanctuary manager with information that could be used in delineating effective management measures for the protection of coral resources within the proposed LPNMS, especially in view of the threat of anchor damage to these systems. This information would aid in the identification and designation of safe anchoring areas with the possible establishment of mooring buoys on sensitive areas.

B. Methods

This study will take into account the following:

1. A monitoring schedule to spotcheck visitors on coral reefs. Data collection should include time of day and average length of visits. The area(s) visited (fore reef, reef flat, or reef lagoon) should also be included. A year of data gathering would provide seasonal variability to be matriced with sea, wind, and other climatic conditions.

2. A monitoring schedule to spotcheck boating activities on most frequented coral reefs. The length, type, draft, power and anchoring gear of each visiting vessel would be recorded. The monitoring activity could be done concomitantly with the visitors study or after the visitors study yields results on the most used areas.

3. A transect survey of selected anchoring areas to determine distribution, condition, recovery rates and mortality rates of corals. Underwater photographic and fathometer tracings should be employed to document damage to corals.

4. Mooring buoy feasibility study following the method of Halas, 1982. Mooring buoys would be established at selected locations. Their use and resultant effect on the coral reef would be monitored. Based on results, management would make decisions regarding their full-time use.

C. Products

- Descriptive maps of bottom communities on anchor sites.
- Final report on boating activity and types of vessels/anchoring gear used on coral reefs.
- Maps of most used areas of the coral reefs within the LPNMS showing extent of the area to be overlapped with bottom communities maps.
- Report of coral reef anchoring areas (change through time).
- Possible establishment of mooring buoys.

D. Study Area

The proposed La Parguera National Marine Sanctuary coral reef system (Majimo, Enrique, La Conserva, La Gata, and Turrumote reefs).

E. Related Studies

1. Study 4.2.

2. Information on coral reef ecology and distribution in the proposed LPNMS is available at UPR Department of Marine Sciences. Various studies concerning geomorphological coral reef changes through time at the proposed LPNMS are also available. Studies on anchor damage to coral reefs have been undertaken in Florida--(Davis, 1977) and Key Largo Mooring Buoy Study (Halas, 1982).

F. Timing/Phasing

One year.

TOPIC NO. 4. Human Uses of the Proposed LPNMS

1. Study 4.2: Coral Reef Underwater Nature Trail Feasibility Study

2. Information Needs and Objectives

The proposed LPNMS contains a wide variety of natural habitats of great recreational value. Among these are over 23 coral reefs which support a rich and varied flora and fauna. In order to provide the public with ways and means to value these resources, improved educational aids must be developed and implemented. One way of accomplishing this is by establishing a system of underwater nature trails. Such a system would allow visitors to get acquainted with coral reef ecology while experiencing the joys of snorkeling or SCUBA diving.

The objectives of this study are:

° To determine which specific areas within the proposed LPNMS are best suited for underwater nature trails.

° To design a system of underwater nature trails based on the above information.

° To develop mechanisms for monitoring reef conditions and maintaining a system of underwater trails.

3. Study Description

A. Purpose

The purpose of this study is to provide the proposed LPNMS with a system of underwater nature trails which could be used as a tool for interpreting the ecological value of the sanctuary's coral reefs.

B. Methods

A survey of the most stable and representative coral reefs within the proposed LPNMS would be conducted to determine exact stations that clearly illustrate typical coral reef ecology. Potential candidates include the following reefs: Margarita, San Cristobal, Media Luna, Laurel, Enrique, and Romero.

Selected areas would be analyzed for species composition, dominance, and distribution. Since the purpose of this study leans toward recreation and education, reconnaissance of potential sites would emphasize safety factors such as absence of currents and large waves and accessibility. Biological data should include descriptions of reef types and dominant coral assemblages. Information of known concentrations of endangered, threatened or highly sought after species should also be included.

Design of an underwater nature trail system should take into account the data base obtained through the initial reconnaissance of the potential sites. It should also consider orientation, length, depth, and bathymetry of the trails. Consistent with the Interpretive Program for the proposed LPNMS, trail designers would evaluate and make recommendations as to the various types of interpretive aids that could be established in the trail system.

A monitoring program would be developed to assess the condition of the trail system and its resources. This would consider natural vs. man-related damage to corals and trail structures. Locally pertinent processes of natural damage would be evaluated. Among these: storms, hurricanes, low salinities, low tides, sedimentation and damage due to biological activity. Visitor-related damage would be evaluated in terms of accidental breakage of fragile species (of coral), unauthorized collections, the use by visitors of certain species (of coral) for resting, and deliberate vandalism.

C. Products

Narrative reports with maps indicating feasible sites for establishing a trail system; maps and drawings describing detailed trail design; narrative report describing a monitoring program for maintenance; and recommendations for operation.

Note: The Interpretive Program in the draft management plan already proposes to take and/or direct visitors to Enrique, San Cristobal, and Collado for snorkeling and to Turrumote I for scuba diving. The shelf edge has also been recommended to highly experienced divers. This study would supplement the Interpretive Program and add information. Simple markers could be placed almost immediately (during Stage I) so that snorkelers visiting LPNMS could take advantage of the Interpretive Program.

D. Study Area

LPNMS

E. Related LPNMS Studies

1. Study 2.1

2. Study 3.1

3. Study 3.2

4. Extensive data on coral reef ecology are available from University and Government libraries. Local fish and madreporian corals as well as many other reef dwellers have been thoroughly identified. The Department of Natural Resources has a small reference library on marine parks including several reports on underwater nature trails in the Virgin Islands National Park and Buck Island Reef National Monument.

F. Timing/Phasing

One year.

TOPIC NO. 4. Human Uses of the Proposed LPNMS

1. Study 4.3: Boating Activity in the Proposed LPNMS (Bioluminescent Bay)

2. Information Needs and Objectives

There are no reliable statistics as to the number of boats and people that visit the bioluminescent bay each year. Virtually all visitors to the bioluminescent bay arrive, move about, or stay in boats during their visits. Boating activity constitutes one of the major sources of potential disturbance to the Bay's delicate ecological balance through pollution from fuel, cargo, and sewage. This potential danger is even greater if one considers that most of the boating activity takes place at night. Information is needed to better apportion personnel for visitor services and law enforcement, and to determine levels of disturbance.

The objectives of this study are:

° To determine the number, type, and frequency of boats in the bioluminescent bay.

° To develop a system for monitoring boating activity.

° To develop contingency measures for visitor safety and pollution control.

3. Study Description

A. Purpose

This study would provide information to help apportion visitor services and law enforcement in the proposed sanctuary. It would identify the levels and location of boating activities within the proposed sanctuary which is essential for developing contingency measures for visitor safety and pollution control.

B. Methods

1. Conduct aerial surveys of the proposed sanctuary during peak visitor periods. For FY 1983, these periods will occur around the following dates:

February 19-21, Washington's Birthday

April 1-3, Good Friday

May 27-30, Memorial Day

July 2-4, Independence Day

July 23-25, Commonwealth's Constitution Day

September 2-5, Labor Day

October 7-10, Columbus Day

November 11-13, Veterans Day

December 23-26, Christmas

Weather and sea conditions would be recorded for each flight. The number and location of boats would also be recorded. Vessels observed would be categorized as above. In addition, estimates of the number of visitor-passengers would be recorded as well as the length of time spent inside the bay. The most commonly used access routes to the bay would be evaluated in order to make recommendations as to safety, boat traffic, and aids to navigation.

2. Conduct periodic surveys of boating activity through routine boat patrols in the sanctuary. For patrolled areas, the same data collected on aerial surveys would be recorded.

3. Conduct an inventory of all resident boats in the LPNMS. This inventory would include the following information:

- ° Name of owner
- ° Type/class
- ° Make
- ° Length
- ° Ports Authority Registration Number
- ° Other relevant data

C. Products

- ° Narrative report and maps
- ° Boat and boating activity data for the LPNMS Data Management System
- ° Management recommendations

D. Study Area

LPNMS

E. Related Studies

1. Study 3.2
2. Study 4.1
3. Commercial boat operator licenses issued by the Public Commission.
4. Ports Authority listing by certificate of number for boats and private crafts rented.

F. Timing/Phasing

One Year.

TOPIC NO. 4. Human Uses of the Proposed LPNMS

1. Study 4.4: Boating Activity in the Proposed LPNMS (Seagrass Bed Areas)

2. Information Needs and Objectives

Disturbance of seagrass beds in shallow areas from speeding motor boats has been documented in areas near the village of La Parguera. Other shallow seagrass bed areas within the proposed sanctuary may also be affected.

The objectives of this study are:

° To determine the number, type, and frequency of boats within the proposed sanctuary.

° To develop a system for monitoring boating activity.

° To identify shallow seagrass bed areas.

° To determine measures for protecting these areas.

3. Study Description

A. Purpose

This study will identify the levels and location of boating activities within the proposed sanctuary.

B. Methods

1. Conduct aerial surveys of the proposed sanctuary during peak visitor periods (see Study 4.3).

2. Conduct periodic surveys of boating activity within the proposed sanctuary through routine boat patrols. For patrolled areas, the same data collected on aerial surveys will be recorded (see Study 4.3).

3. Conduct an inventory of all resident boats using the proposed sanctuary (see Study 4.3).

C. Products

° Narrative report and maps.

° Boat data for the proposed LPNMS Data/Information Management System.

° Management Recommendations.

D. Study Area

LPNMS

E. Related Studies

1. Study 3.2

2. Study 4.1

3. Study 4.3

4. Listing of commerical boat operator licenses listed by the Public Commission.

5. Ports Authority listing by certificate of the number of boats and private crafts rented.

F. Timing/Phasing

One year.

TOPIC NO. 4. Human Uses of the Proposed LPNMS

1. Study 4.5: Effects of Spearfishing in the Proposed LPNMS

2. Information Needs and Objectives

Spearfishing in coral reefs within the proposed sanctuary waters has been practiced for several decades by visitors and local fishermen. The increased knowledge of SCUBA has encouraged spearfishing as a sport and for commercial use. Spearfishing statistics in the literature are often fragmentary and of a very general scope for Puerto Rico. Little or no data is available for La Parguera. In order to assess the impact of spearfishing on fish populations within the proposed sanctuary boundaries, it is necessary to obtain statistical data on landings, number of fishermen, and types of gear used. Coral reef areas where spearfishing takes place need to be identified and assessed to determine any damage to reef structure.

The objectives of this study are:

° To obtain a statistical record of fish caught by spearfishing within the LPNMS.

° To identify those areas mostly used by sport and commercial spearfishermen.

° To assess the impact of spearfishing on fish populations and coral reef structure.

3. Project Description

A. Purpose

The purpose of this study is to obtain basic information on spearfishing in the proposed LPNMS to assist the sanctuary manager in developing strategies for optimum management of this activity while protecting the resources.

B. Methods

1. Conduct a one-year census of operations including number of fishermen, landings, areas fished, boats and gear units. This would be conducted through interviews with fishermen and using records of fishing and boat licenses. Sportsfishermen would be asked to provide information upon request from sanctuary enforcement agents or other sanctuary personnel.

2. Monitor all landings obtained by spearfishing, including species, length, weight, and location of catch.

3. Conduct fish population surveys in heavy spearfished areas. These would be done according to the methods outlined by Brock (1954) and Jones and Thompson (1978).

C. Products

° Narrative report describing the status of spearfishing in the proposed LPNMS.

° Maps identifying spearfishing areas within the proposed LPNMS.

° Recommendations

° Information for the LPNMS Data Management System

D. Study Area

LPNMS

E. Related Studies

1. Study 4.1

2. Study 4.2

3. Study 4.3

4. Study 4.4

5. CODREMAR's Fishery Research Laboratory has published an overview of Puerto Rico's small-scale fisheries statistics where spearfishing is included.

F. Timing/Phasing

One year.

TOPIC NO. 4. Human Uses of the Proposed LPNMS

1. Study 4.6: Effects of Human Activity on Selected Coral Reefs within the Proposed LPNMS

2. Information Needs and Objectives

Two coral reefs, such as the ones recommended in Study 4.2, Enrique and San Cristobal, would be set aside where no activity other than passive enjoyment of the reefs would be permitted. Two other reefs of similar marine ecology, would be selected for observation and monitoring where no restrictions would be placed. Findings would stem from a comparison of the reef changes over a period of several years.

The objectives of this study are:

° To identify which coral reefs would be best suited for (1) interpretation and (2) monitoring.

° To determine number and type of visitors to coral reefs.

° To develop mechanisms for monitoring activities in the coral reefs.

3. Study Description

A. Purpose

The purpose of this study is to provide for the visitors of the proposed LPNMS selected coral reefs which could be used for interpretation and monitoring.

B. Methods

A survey of the coral reefs within the proposed sanctuary would be conducted to determine those most representative to illustrate typical coral reef ecology (see Study 4.2).

C. Products

° Narrative report with maps indicating feasible sites for interpretation and monitoring.

° Visitor use data for the Data/Information Management System.

D. Study Area

LPNMS

E. Related LPNMS Studies

1. Study 2.1
2. Study 3.1
3. Study 3.2
4. Study 4.2
5. Study 4.3

F. Timing/Phasing

One year.

A List of Priority Projects for the Proposed LPNMS Resource Studies Plan

The National Oceanic and Atmospheric Administration (NOAA), National Ocean Service, Office of Ocean and Coastal Resource Management, Sanctuary Programs Division would fund the Resource Studies Plan for the proposed LPNMS over time as funds are available. The proposed sanctuary's Administration Office, with NOAA's approval, would encourage and seek other sources of funding to support priority projects in the proposed sanctuary. While fiscal constraints are a consideration in developing a yearly agenda, the recommended priority reflects sound resource study needs rather than monetary reasons.

The following resource studies priority recommendations are made on a scientific and management resource basis.

Project	Topics Involved	Estimated Time Requirements
First Year Program (FY83)		
1.1	Data/Info Mgt.	6 mo.
1.2	Resource Information	6 mo.
3.1	Oceanography	1 year
3.2	Oceanography	6 mo.
Second Year Program (FY84)		
4.1	Human Uses	1 year
4.3	Human Uses	1 year
4.4	Human Uses	1 year
2.1	Marine Ecology	1 year
Third Year Program (FY85)		
2.2	Marine Ecology	1 year
4.2	Human Uses	1 year
Fourth Year Program (FY86)		
4.2	Human Uses	1 year
Fifth Year Program (FY87)		
4.5	Human uses	1 year

PART IV: ALTERNATIVES INCLUDING THE PREFERRED ALTERNATIVE

A. Boundary Alternatives

Alternative boundaries for the proposed sanctuary were developed based upon estimates of the distribution of natural resources in the area, the current and anticipated activities in the area and the logistics for management. The following three alternatives represent reasonable and viable boundary options (Figure 3).

1. Boundary Alternative 1 consists of a 72.95 sq nm (244.90 sq km) area and extends from Punta Jorobado in the east to Punta Aguila in the west and includes the marine areas seaward of Bahia Salinas.

2. Boundary Alternative 2 consists of 47.30 sq nm (166.25 sq km) and extends from the La Parguera Natural Resrve boundary line in the east (Punta Sombrero) and Punta Pitahaya in the west and seaward to the edge of the shelf.

3. Boundary Alternative 3, the preferred alternative, consists of a 68.27 sq nm (234.19 sq km) area and extends from the La Parguera Natural Reserve boundary line in the east (Punta Sombrero) to Punta Aguila in the west and seaward to the edge of the shelf. This alternative includes Bahia Salinas, but not the area seaward of the bay.

B. Alternative Visitor Center Sites

For most visitors, access to the waters of the proposed sanctuary is provided at the village of La Parguera. Almost the entire recreational infrastructure along the coast--the rental boat facilities, docks, stores, restaurants and guest hotels--are located within a two to five-mile radius of the village waterfront centered at the foot of Route 304 (Figure 5, Regional Access). In order to analyze alternative sites for a visitor center and to assess the best location, a matrix was constructed. The criteria used in the Site Selection Matrix (Figure 16) included physical attributes of the site (proximity to marine resources, parking space, etc.) and socio-economic concerns (land acquisition costs, building costs). Eight sites were evaluated and rated by NOAA and DNR using the Site Evaluation Matrix; Mata de la Gata, Playita Rosada, Cueva Island, Cabo Rojo, a wetlands site proposed by the DNR Planning Office, the village land site, village waterfront, and the village overlook (Figure 17). The first five were dropped from further consideration for the reasons discussed below.

1. Alternatives Considered but Rejected

a. Mata de la Gata

Mata de la Gata, a recently developed DNR recreational park, is located offshore on one of the larger islets between Enrique and Carocoles reefs. It offers shelters, picnic tables, grills, restrooms, docking space for small boats, and an enclosed swimming area. The island consists of about 2 acres,

SITE SELECTION MATRIX

SITE SELECTION CRITERIA	SITES CONSIDERED							
	Public Owner						Private Owner	
	1 Mata de La Gata	2 Playita Rosada	3 Cueva Island	4 Punta Cabo Rojo	5 DNR Wetland	6 Village Land	7 Village Water-front	8 Village Overlook
Physical Site Criteria								
• Proximity to Marine Resource	2	2	3	1	3	3	3	3
• Land Access for Visitors	0	2	0	1	3	3	3	3
• Water Access-Dock Space for Rangers	1	1	3	1	2	2	2	2
• Marine Orientation	3	2	3	3	2	0	3	3
• View of Marine Sanctuary	2	1	3	1	0	0	2	3
• Adequate Space for Parking	0	3	0	2	3	2	3	3
• Adequate Space for Building	0	3	3	3	0	3	2	3
• Minimal Disturbance to Resource	0	3	2	3	0	3	3	3
Socio Economic Criteria								
• Near preferred marine use areas	2	2	0	1	2	2	3	2
• Near preferred land use areas	3	1	0	1	3	2	3	2
• High visibility from land	1	1	1	1	1	2	3	3
• High visibility from water	2	1	3	3	0	0	3	3
• Compatible with Nat'l Marine Sanct. Image	1	1	2	1	1	2	2	3
• Land acquisition costs	3	3	3	3	3	3	3	1
• Site improvement costs	1	2	1	2	2	2	2	1
• Building costs	1	2	2	3	2	2	1	2
Total Points	22	30	29	30	27	31	41	40

Highest score meets criteria best

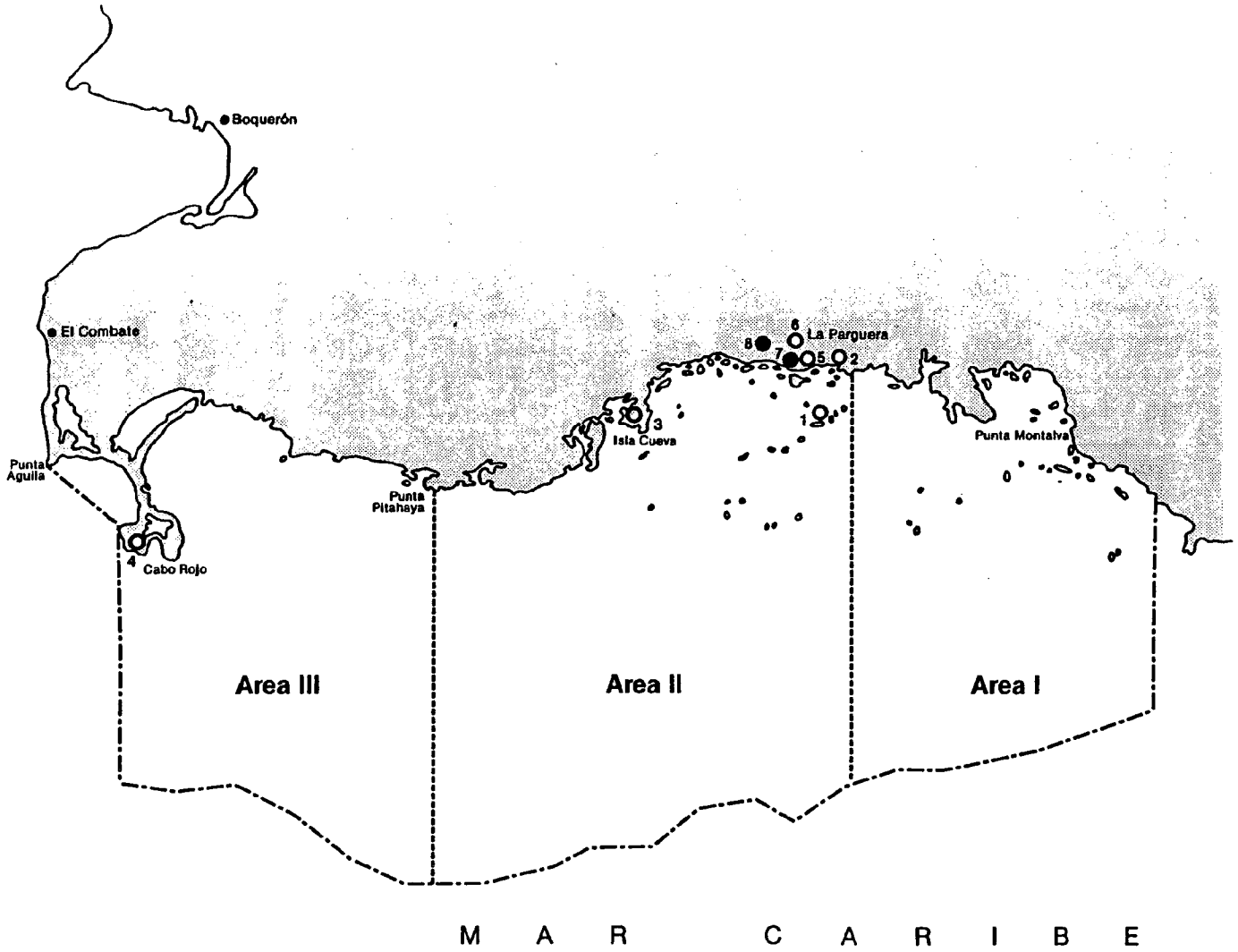
Figure 16

Santuario
Marino
Nacional
La Parguera
National
Marine
Sanctuary

Figure 17
Alternativas de Lugares de Ubicación
Site Alternatives

ubicación de propiedad pública
publically owned properly site ○

ubicación de propiedad privada
privately owned properly site ●



lugares	*sites*
1. Mata de la Gata	1. Mata de la Gata
2. Playita Rosada	2. Playita Rosada
3. Isla Cueva	3. Isla Cueva
4. Punta Cabo Rojo	4. Punta Cabo Rojo
5. DNR Cienaga de Agua Salobre	5. *DNR Wetland*
6. Terrenos del Poblado	6. *Village Land*
7. Frente Marino del Poblado	7. *Village Waterfront*
8. Miradero del Poblado	8. *Village Overlook*

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all of which were developed by DNR. Access to the island is less than 10 minutes from shore by charter or private boat. Although an immensly popular spot for visitors to La Parguera, Mata de la Gata was rejected because the only access is by boat and all the area suitable for development is already devoted to recreational facilities.

b. Playita Rosada

This coastal park, managed by DNR, is located two miles outside of the town of La Parguera. Although located on the water, it is not centrally located with regard to the proposed sanctuary resources and lacks a panoramic view of the marine environment.

c. Cueva Island

Cueva Island, a 55-acre DNR managed island, located about 10-15 minutes by boat from La Parguera village, has a jeep trail surrounding the island and several abandoned buildings on site which could easily be adapted for public use. The farthest part of the island from the coast is elevated sufficiently to provide a beautiful panoramic view of La Parguera's mangrove cays, coral reefs and wide expanse of marine waters. There was a leasing agreement between DNR (which administers Cueva and Guayacan Islands), the Caribbean Primate Center and the University of Puerto Rico, to permit the Center to house monkeys (used in research) on the island. However, the Center is closed and the island is now available for other purposes.

Although Cueva Island has many of the criteria needed for a visitor center site, it was rejected as a potential site for the main headquarters because access is only possible by boat.

d. Cabo Rojo

The site at Cabo Rojo is similar in character to Cueva Island, but much grander in scale. Panoramic views from the cliffs of Cabo Rojo attract many visitors to the lighthouse, located at Punta Cabo Rojo. The site is located in the Boqueron Forest, at the edge of the southwestern boundary of the proposed sanctuary (Figure 18). The lighthouse which is currently owned by the U.S. Coast Guard, is being transferred to the Commonwealth.

The Department of Natural Resources, in coordination with the Tourism Company, the Office of Cultural Affairs of the Governor's Office and the Municipality of Cabo Rojo, is in the process of developing the Cabo Rojo lighthouse area at Cabo Rojo point into a recreation area. The project will consist of restoration of the lighthouse and an adjoining picnic area, providing shelters, picnic tables, grills, restrooms and parking facilities.

Although this site is accessible by car from Route 301 it is too far removed from the village of La Parguera and the focus of the proposed sanctuary and too inaccessible by boat to be suitable for the main headquarters for administrative personnel and visitors.

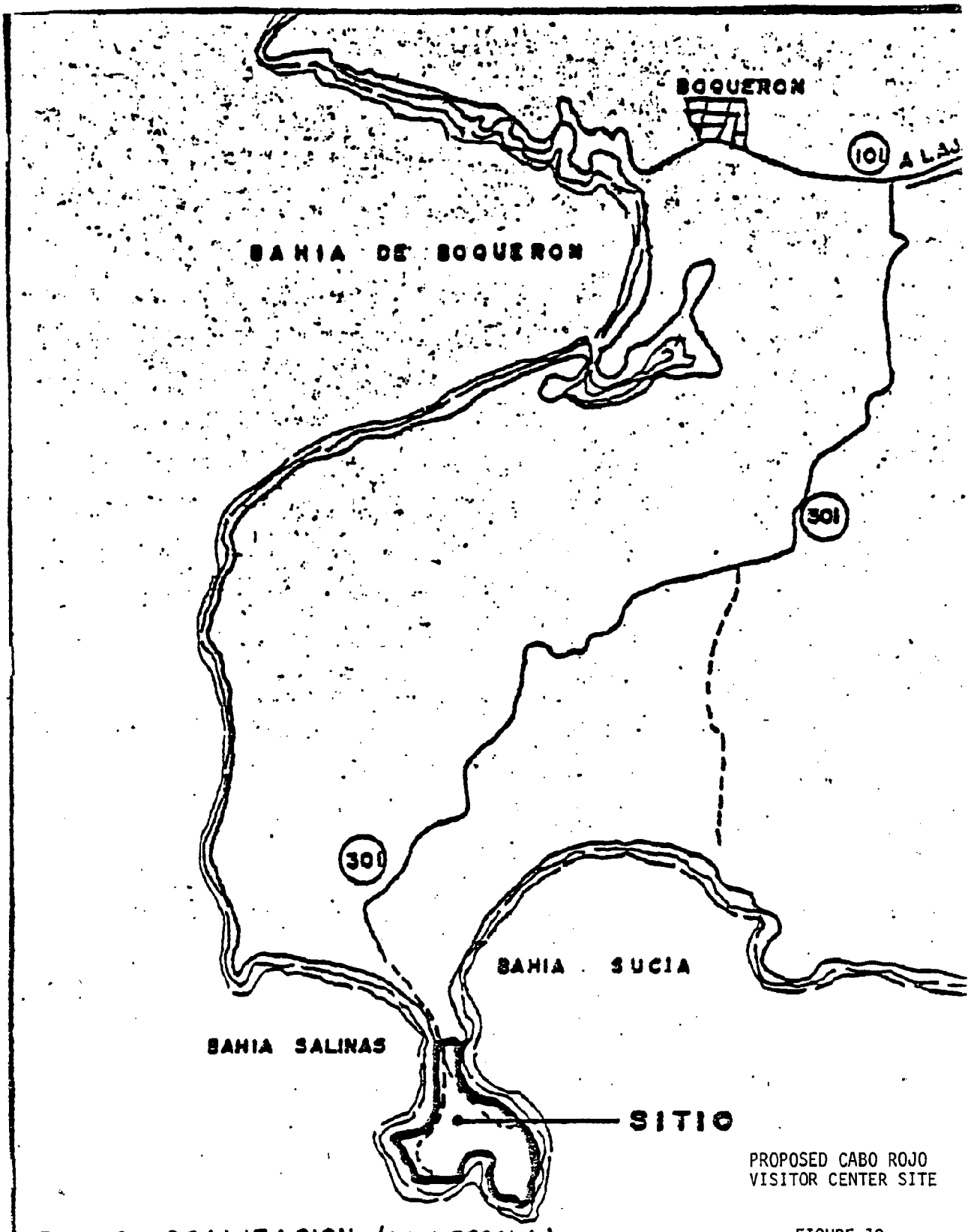

BOQUERON
101
BAHIA DE BOQUERON
301
301
BAHIA SUCIA
BAHIA SALINAS
SITIO
PROPOSED CABO ROJO
VISITOR CENTER SITE
PLANO LOCALIZACION (NO A ESCALA)

FIGURE 18

e. Proposed DNR Visitor Center/Wetlands Site

A plan for the restoration of the La Parguera waterfront, as part of the proposal for the CZM Special Planning Area, was recently prepared by the Planning Office of DNR. The plan proposed the construction of a combined community/DNR visitor center at a site almost directly across the inner channel from Magueyes Island (Figure 19). The DNR planning staff proposed that the Community Center sponsor interpretive programs and exhibits relating to the natural resources of the region and offer a more convenient operations center for the rangers, who must now operate out of Boqueron and Mayaguez. The proposal included the upgrading of one or two of the public docks, removal of other smaller docks, and the construction of trails along the shore (among the casetas) to give pedestrians greater access to the marine environment. The site was also considered as the proposed Sanctuary Headquarters/Visitor Center, but rejected because it is located in a former wetland and now a flood-prone area.

2. Selected Sites for Further Discussion (Preferred Alternative)

The remaining three sites have all been selected as possible sites under the preferred alternative (see Part III, Management Measures, Administration and Operations). All are feasible options, but more information on each is needed before a final selection is made (Figure 20). This decision will be finalized during the first year of operations.

a. Alternative 1 - Village Overlook Site

This site would be composed of approximately one acre of land east of the town overlooking the area of the proposed sanctuary. It is a 7-minute walk or 2-minute drive from the center of La Parguera village. Located on a small elevated knoll, the land overlooks much of the sanctuary area as well as the village, providing a panoramic view and setting for a proposed National Marine Sanctuary Visitor Center. The area is accessible--there are several unimproved roads leading to the site, and at the base of the hill (1/10 mile) is a small inlet where a dock could be built for ranger and staff needs.

b. Alternative 2 - Village Land Site

The Village Land Site, located on Route 304, the only paved road leading to La Parguera village, is approximately one mile inland from the waterfront area, and a 2-minute walk from the heart of the village. The site is bounded by the village community center on one side and the public school on the other. The land is publicly owned by the Commonwealth's Department of Parks and Recreation and a portion could be obtained for the center.

c. Alternative 3 - Village Waterfront Site

The proposed Village Waterfront Site is located along the waterfront business area. The exact location has not yet been determined. The site would be within the business/shopping/tourist area in the village.

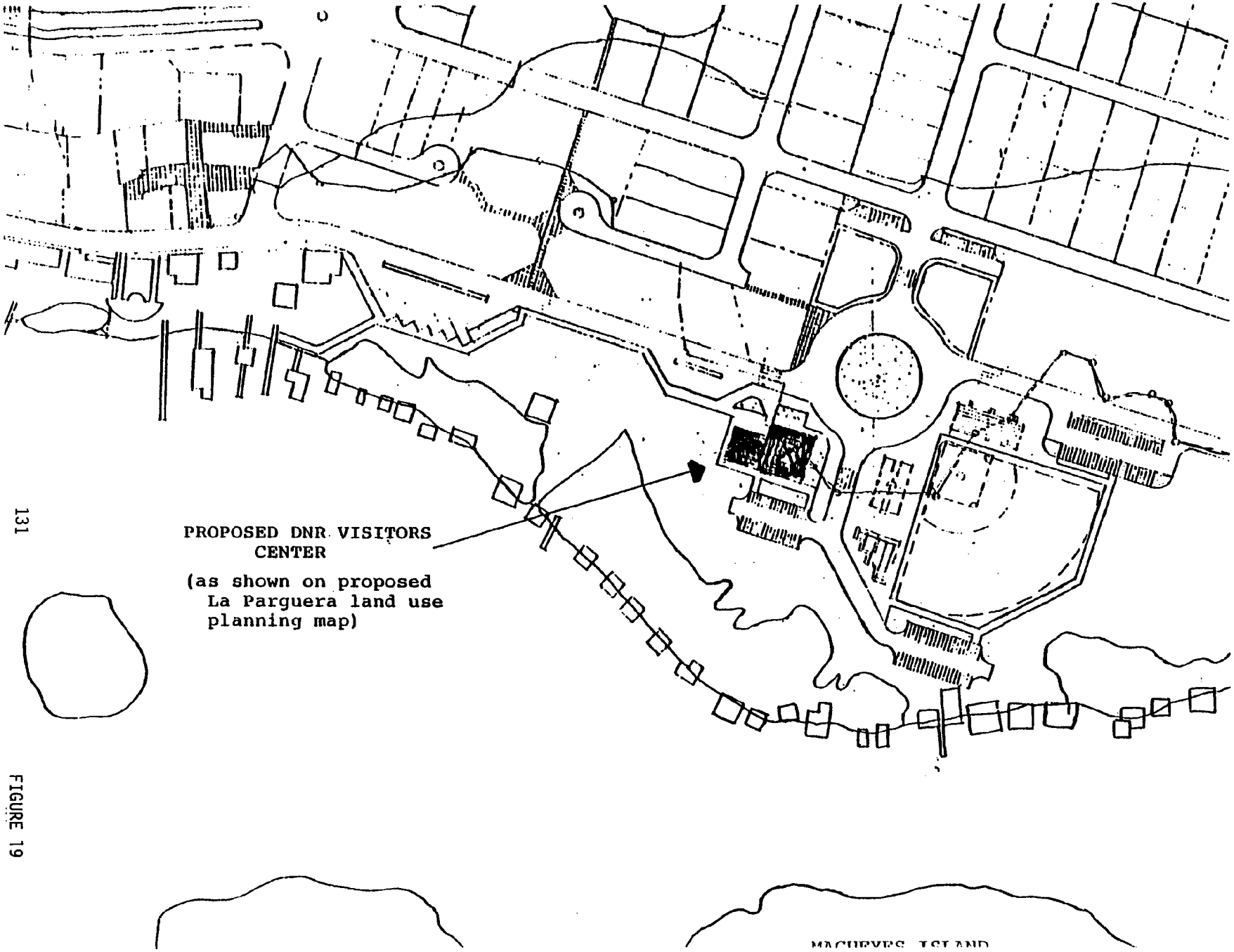
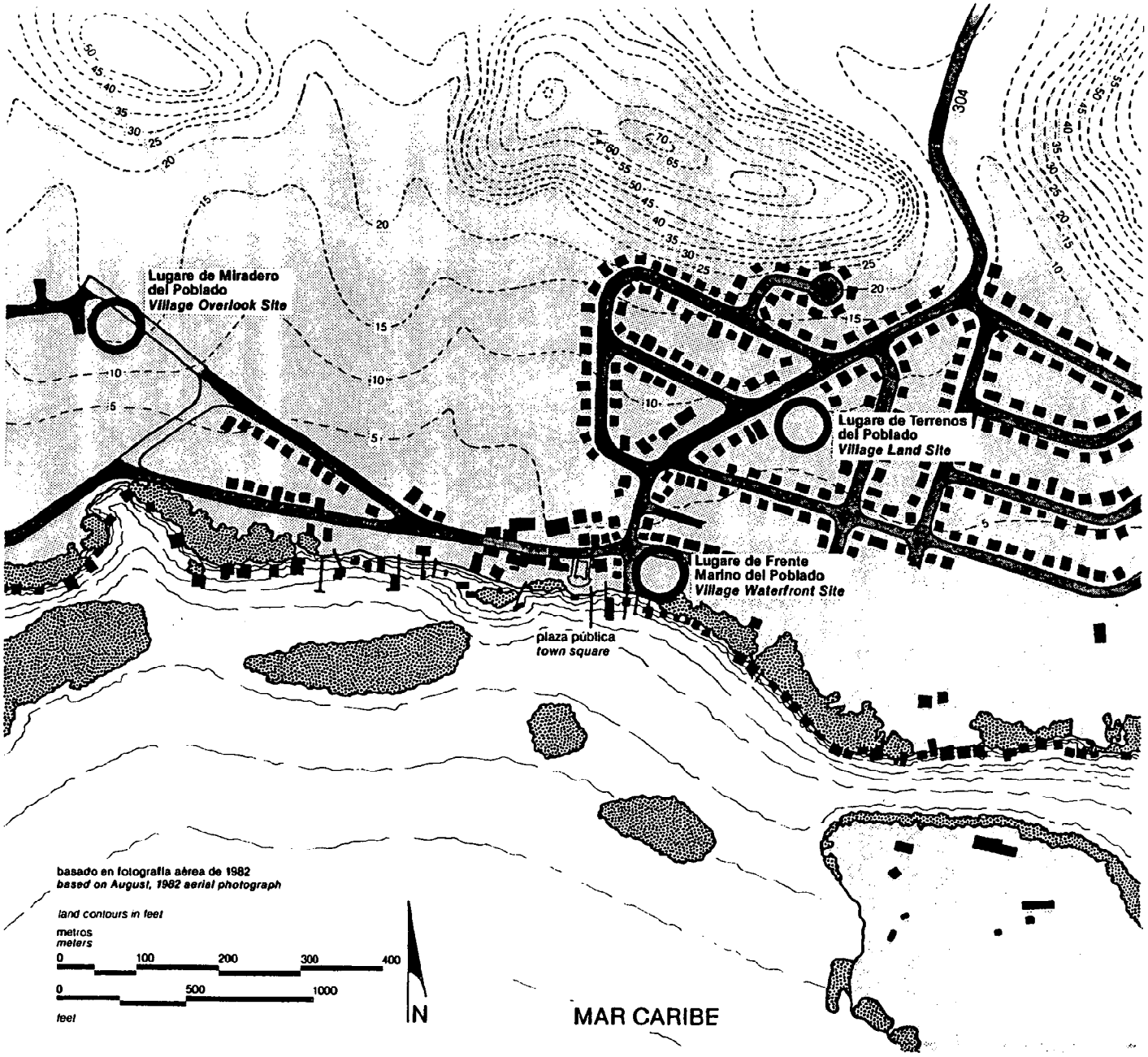

PROPOSED DNR VISITORS CENTER
(as shown on proposed La Parguera land use planning map)
MACHUELES ISLAND

FIGURE 19

Santuario
Marino
Nacional
La Parguera
National
Marine
Sanctuary

Figure 20
Lugares de
Ubicación
Alternos
Escogidos

Selected
Alternative
Sites



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C. Alternative Management Measures

1. Alternative 1 - Status Quo

Without designation of the La Parguera area as a national marine sanctuary the southwestern coastal and marine resources would be managed and protected by the existing regime of laws, regulations and plans for the area. Part II, Section E, Legal/Institutional Background and Section F, Issues and Problems discuss the status quo in detail.

Under the status quo, the applicable Commonwealth laws, regulations, and programs are:

- Law No. 9, empowering the Environmental Quality Board to permit and license most actions regarding air and water pollution, solid waste and noise;
- Law No. 83, the Fishing Law, regulates all aspects of sport and commercial fishing;
- Taking of Coral Regulation, which prohibits taking of coral except for research purposes;
- Law No. 133, The Forest Act, prohibits damaging or cutting any trees within a State Forest;
- Establishment of the Boqueron State Forest, which provides protection for the red mangrove areas within the proposed sanctuary; and
- Puerto Rico Coastal Management Program which links authority and regulation of principle agencies responsible for guiding coastal growth.

Applicable Federal statutes include:

- Clean Water Act which regulates discharges of wastewater and hazardous substances and oil;
- Marine Protection, Research and Sanctuaries Act which regulates dumping of toxic wastes into ocean waters;
- Marine Mammal Protection Act which protects all species of marine mammals; and
- Endangered Species Act which provides protection for listed species of animals and plants.

Enforcement of these statutes and regulations would be provided by existing levels of Commonwealth rangers, National Marine Fisheries Service, and U.S. Fish and Wildlife Service enforcement officers.

Facilities such as a visitor center and docks would rely on implementation of the DNR Special Plan for the La Parguera Southwest Sector. The Plan calls for the eventual construction of a combined DNR visitor/community center in the waterfront area of La Parguera. Under this alternative there would be no NOAA funds for construction of any facility. The DNR proposal includes provision of the upgrading of La Parguera docks and construction of trails along the shore to give visitors greater access to the water.

Under the status quo alternative, Mata de La Gata and Playita Rosada personnel would continue to be housed in Mayaguez, until the community facility is finally approved and completed. There would also be no Interpretive Program or Resource Studies Plan for the waters off La Parguera.

2. Alternative 2 - Preferred Alternative

This alternative is the approach detailed in Part III, Management Measures. It provides for an Administrative Program including surveillance and enforcement, an Interpretive Program, and a Resource Studies Plan. This alternative would cost approximately $800,000 over 5 years subject, of course, to available funding.

Under the preferred alternative, an onsite presence is immediately established for the proposed sanctuary in Stage I. As part of the Administrative Program a main visitor center would be constructed during Stage I on a site chosen in the Village area (one of the 3 sites under the preferred alternative), and a satellite visitor center would be established at El Faro on Caba Rojo in Stage II. Protective regulations would be issued and a San Juan level Office of Marine and Estuarine Sanctuaries would be established with a sanctuary administrator. At the field level four positions would be added--a Sanctuary manager, ranger, part-time naturalist and part-time secretary.

The proposed alternative contains a set of federal regulations that prohibit the damage or taking of coral and red mangroves, prohibit certain discharges, and possession or use of nets used for turtle poaching.

The Interpretive Program would develop a series of exhibits and activities. These include a mangrove boardwalk/tour, underwater trails, kiosks, audio-visual presentations, tours oriented toward students and other special groups, and community interaction.

The Resource Studies Plan would provide a long-term approach to filling priority data needs and gaps. The Resource Studies Plan proposes studies aimed at gaining information on the general marine ecology, oceanography, and human use impacts and distribution of endangered species.

3. Alternative 3 - Low Cost, Low Profile

This alternative would create a low cost, low profile National Marine Sanctuary for La Parguera, integrating sanctuary operations with the existing DNR public park administration at Mayaguez and would offer programs which are low budget and easily implemented. It would rely heavily on the status quo and cost approximately $250,000 over 5 years to implement. There would be an abbreviated interpretive program, no funding for resource studies, and no additional surveillance or enforcement.

Facilities such as a visitor center and docks would rely on implementation of the DNR Special Plan for the La Parguera Southwest Sector. The Plan calls for the eventual construction of a combined DNR visitor/community center in the waterfront area of La Parguera. Under this alternative there would be no NOAA funds for construction of the facility. The DNR proposal also includes a provision for the upgrading of La Parguera docks and construction of trails along the shore to give visitors greater access to the water. Under this alternative there would be no satellite center at the Cabo Rojo lighthouse.

As in the status quo alternative, Mata de la Gata, Playita Rosada, and new sanctuary personnel would continue to be housed in Mayaguez, until the community facility is approved and completed. Staffing would be greatly reduced compared to alternatives 2 and 4. There would be no Office of Marine and Estuarine Sanctuaries at the San Juan level. The only field staff would be the sanctuary manager/naturalist who would act in both administrative and interpretive roles. The manager would be responsible for daily administration functions as well as acting as tour guide or "park ranger."

There would be no additional enforcement personnel. The existing three rangers assigned to the La Parguera area would remain, but there would be essentially no enhancement at this status quo level. The Rangers assigned to the sanctuary would continue to operate out of Boqueron with assistance from the Ranger base at Mayaguez until the DNR Community Center is built. The Rangers would be asked to counsel and educate the public as provided for in the Surveillance and Enforcement Program. The same set of regulations would be promulgated under this alternative as under alternatives 2 (preferred) and 4.

Under this alternative a simple low cost Interpretive Program requiring little or no staff would be developed. The emphasis would be on simple poster exhibits and brochures. A sanctuary map and official brochure would be developed and distributed during Stage I in selected locations in the waterfront area. Information about the sanctuary Interpretive Program would be displayed in the existing shelters at Playita Rosada and Mata de la Gata and would feature a kiosk with photographs and simply written explanations of the resources. Under this alternative there would be no interpreter to provide narratives on boat tours to Bahia Fosforescente or mangroves, no mangrove boardwalk, no underwater trails, and generally no "hands on" learning experience. No research would be funded by sanctuary management.

Under this alternative, the same NOAA regulations proposed for the preferred alternative would be promulgated. These regulations would prohibit the damaging or taking of coral, cutting of mangroves, prohibit certain discharges, and the possession and use of nets used for turtle poaching.

4. Alternative 4 - High Cost, High Profile

This alternative would provide a high profile, very visible effort for the sanctuary. It would require more land for a visitor center, more staff, sanctuary owned and operated tours and boats, and a satellite center at Cabo Rojo developed in Stage I. The cost of this alternative would be approximately $2 million over the five years of the management plan.

The visitor center would be located at the Village Overlook site (see Selected Sites for Further Discussion) 1/2 mile east of the village. The visitor center development would include parking and improvements to an existing road leading to the knoll. A 6' by 30' dock would be constructed along the waterfront and road at the base of the knoll. The visitor center itself would be similar in size and structure to the preferred alternative (alternative 2). The satellite visitor center at the Cabo Rojo lighthouse would be similar to that proposed under the preferred alternative. However, it would be constructed in Stage I rather than Stage II of the management plan.

An additional visitor center would be developed by DNR and NOAA at Cueva Island. This facility would be constructed in Stage II. NOAA would jointly fund an effort to restore some of the buildings and construct a modest but needed observation facility on top of the cliffs of the island nearest the open sea. Several of the seven buildings would be renovated as open air picnic shelters or as simple enclosed buildings for exhibits. A self-guiding trail, using the jeep trail which encircles the island, would be built for the benefit of visitors who would come by boat to picnic and sightsee. The dock, although visible, would be rebuilt to accommodate more boats and rangers could use the dock as a departure point for patrols.

Staffing requirements under this alternative would be greater than the others. Staff would be increased over the preferred alternative. As in the preferred alternative there would be a Sanctuary Administrator in San Juan. At La Parguera there would be a manager, 1 full-time naturalist, 5 additional rangers, an assistant sanctuary manager, an interpreter, 5 tour guides/recreational specialists, and 3 secretaries.

The same NOAA regulations would be promulgated under this alternative as in Alternatives 2 and 3. They would prohibit the damaging or taking of coral, cutting of mangroves, prohibit certain discharges, and the possession and use of nets for turtle poaching.

As under the preferred alternative, DNR Rangers would be given special training similar to that offered to National Wildlife Refuge managers in the U.S. National Parks beyond the training they now receive as part of the new program of DNR. With this added training the Sanctuary Rangers could give informal talks and instruction concerning the wise use and enjoyment of the Sanctuary, not only to visitors, but to the participants of workshops sponsored by the Sanctuary and to teachers in the public schools of Puerto Rico.

The Interpretive Program and Resource Studies Plan would be similar to those of the preferred alternative. However, the sanctuary would purchase its own tour boats in the later stages of the 5 year plan for use in the sanctuary Interpretive Program. These boats would provide service to the underwater trails, Bahia Fosforescente, and the mangrove channel tour.

5. Alternative 5 - Non-Regulatory

This alternative provides for designation of the La Parguera area as a National Marine Sanctuary and implementation of a management plan as provided for by the preferred alternative but without promulgation of regulations by NOAA. This alternative would provide a visitor center, increased staffing and enforcement, an Interpretive Program, and Resource Studies Plan, but would rely on the statu quo for regulatory protection of the resources. For a detailed discussion of these laws, see Part II, Section E, Legal/Institutional Background and Alternative 1, Status Quo in this Section.

The Commonwealth statutes, regulations, and programs upon which this alternative would rely are: Law No. 9 (the Public Environmental Policy Act), Law No. 23 (DNR Organic Act), Law No. 83 (The Fishing Law), Law No. 133 (The Forest Act), the Taking of Coral Regulation, and the Puerto Rico Coastal Zone Management Program. The Federal laws and regulations would be the Clean Water Act, Marine Mammal Protection Act and the Endangered Species Act. The rest of the management plan for this alternative would be the same as the preferred alternative (see Part III, Management Measures, and Alternative 2 in this Section for more detail).

PART V: ENVIRONMENTAL CONSEQUENCES - IMPACTS ON RESOURCES

This section discusses the environmental consequences of the alternatives including the preferred alternative. Section A is an introduction, Section B focuses on the effect of the alternative boundaries, Section C discusses the consequences of the alternative visitor center sites, and Section D discusses consequences of alternative regulations, enforcement program, interpretive program, and resource studies plan.

A. Introduction

1. Preferred Alternative

The preferred alternative would promote resource protection in three ways. First, it would bolster the existing regulatory/enforcement regime. Second, the alternative provides a program of public education/awareness directed at understanding the basis for wise resource management and use. Third, the proposal would develop a data/information base from which sound management decisions are made.

Enforcement staff would be increased through Stages I and II and the focus of protection efforts would be in the area of greatest need. Sanctuary administration would work with NMFS and FWS to achieve deputization of rangers assigned to La Parguera for enforcement of the ESA and MMPA. Penalties for taking coral would be increased. Gear used for illegally taking turtles would be prohibited, all red mangroves would be protected from cutting and damage, submerged cultural resources would be protected, and an additional prohibition on wastewater discharges from casetas after 1990 would be guaranteed.

The Interpretive Program would provide uses with a wide variety of experiences resulting in an enriched appreciation and awareness of the fragility and importance of the natural environment. The program would provide audiovisual material, exhibits, and provide valuable information for individuals, schools and other groups. The proposed underwater trail and boardwalk would provide vital "hands-on" learning experiences. The program would focus not only on the individual resources but their interaction as an ecological unit and in turn the relationship of the natural environment to man and economic factors. The satellite center at El Faro would reach users who might not venture to La Parguera.

The Resource Studies Plan would provide a coordinated approach to obtaining badly needed information about the data base and uses of La Parguera. As a result of the preferred alternative, information on water quality and circulation, fishery habitat, the location and numbers of endangered species would be provided. It would also result in an accurate assessment of the health of important reef and seagrass bed areas, the bioluminescent bays, the feasibility of underwater trails and recreational use of La Parguera.

The preferred alternative would provide a coordinated and comprehensive management scheme that would result in the most effective resource maintenance and protection for the costs involved.

2. The Status Quo

The status quo would not provide the degree of management or protection warranted by the significance of the area's natural resources. Issues and problems associated with the various resources (discussed in Part II, Section F) would continue. Existing laws and regulations (1) provide a degree of protection for coral, red mangroves within state forests, endangered species, and (2) regulate wastewater, hazardous substances and recreational vessel discharges. However, the protection is incomplete on two accounts. First, some important resources are not covered by any protective regulation. Red mangrove areas outside state forests are unprotected. Gear employed specifically for the illegal taking of sea turtles is not outlawed and underwater cultural and archaeological resources are not protected. Secondly, present enforcement efforts are insufficient to adequately implement existing regulations. Both Federal agencies and the Commonwealth lack the necessary enforcement officers and have their focus of operations outside the La Parguera area. Consequently, violators would continue to go undetected and without prosecution.

The status quo would offer no Interpretive Program. Consequently, the public would not be made aware of the importance of the resources and need for their protection and wise use.

No resource studies would be funded. Information gaps would not be filled and managers would have to make decisions with inadequate and questionable data. No monitoring or assessment means that many problems would not be uncovered until irreversible damage had already occurred.

3. Alternative 3 - Low Cost, Low Profile

The low cost alternative would not provide any increased enforcement, although it would provide the NOAA regulations discussed under the preferred alternative. Reliance on completion of the DNR community center to provide a focus for enforcement and information distribution would result in neither action being implemented until Stage II at the earliest. It is also probable that the center would never be constructed. In this case the consequences of the low cost alternative would be more similar to the status quo.

Under this alternative only basic information on the environment would be made available. Copies of the regulations would be provided and several displays and exhibits set up at the waterfront, Playita Rosada and Mata de la Gata. No facilities at El Faro would mean less presence and public awareness in the Mayaguez/Cabo Rojo area. Like the status quo, no resource studies would be funded by NOAA. This alternative would result in minimal public contact, public education and surveillance and enforcement. In turn this alternative would result in little increased resource protection.

4. Alternative 4 - High Cost, High Profile

The high cost alternative would implement the same set of NOAA regulations, but increase the number of enforcement officers to five (raising total to seven), with rangers also placed at El Faro on Cabo Rojo. This would result in an earlier and significantly greater degree of enforcement than any of the other alternatives, including the preferred alternative.

This alternative would provide the same Interpretive Progrtam as the preferred alternative with these exceptions. Cueva Island would be added as a second satellite center. This action would greatly increase costs, but add little, if any advantages over the program recommended in the preferred alternative. It would not reach a larger audience or provide a wider range of experiences. Secondly, it advocates sanctuary owned and operated tours to the bioluminescent bays, an action that is unnecessary and duplicative of private tours currently being operated. Third, interpretive staff would be substantially increased--5 additional guides/recreational specialists would be added. This would provide more involvement with the public than any of the other alternatives and consequently should result in the greater amount of public awareness and understanding than any of the other alternatives, including the preferred alternative. The high cost alternative would implement the same Resource Studies Plan as the preferred alternative. Consequently, the impact would be the same.

B. Environmental Consequences - Boundary Alternatives

All three of the boundary alternatives would include and protect the 23 identified major coral reefs of the La Parguera area and the two bioluminescent bays.

Both the preferred alternative and alternative 2 exclude the area from Punta Sombrero east to Punta Jorobado from the sanctuary. Punta Sombrero is the terminus of the reef, seagrass beds and red mangrove. The area between Punta Sombrero and Punta Jorobado is a sand and rubble bottom area not significant in terms of resource value and not in need of protection.

Alternative 2 would not include the areas of red mangrove west of Punta Pitahaya and the waters of Bahia Salinas and Bahia Sucia. The extensive seagrass bed areas within these bays that serve as habitats for the endangered sea turtles and manatee would not be protected or managed. Alternative 3, on the other hand would include the larger area encompassing Bahia Salinas and Bahia Sucia. Under this alternative the resources in these areas would be protected and managed as part of the sanctuary.

Both alternatives 2 and 3 do not include the extensive sand field south of Bahia Salinas, that may have commercial mining potential.

C. Environmental Consequences of the Main Visitor Center

The same visitor center plan would be adopted for either of the possible preferred sites (see Part III, Management Measures, Section B for details). Construction costs are difficult to predict, but would run approximately $40-45 per square foot (Garcia, personal communication, 1982) therefore, a one story 30' by 40' building would cost approximately $50,000. A visitor center wherever its location would enhance awareness of the significance of local marine resources and foster understanding of the need for their conservation and wise use.

1. Village Waterfront Site

Adoption of the Village Waterfront site as the proposed Headquarters/ Visitor Center would offer maximum public visibility and access to the constant stream of visitors who take tour boats in the evening to Bahia Fosforescente, or who stroll about during the day, patronizing the stores, food stands and the boat and tour boat rentals at the nearby docks. The waterfront areas are both publicly and privately owned and most of the land has existing structures. It is likely that this option would require demolition or renovation of an existing structure. There would be no cost associated with parking for the Village Waterfront site. Parking could be provided by the municipal facility near the waterfront. The final costs would be determined by whether the land would have to be purchased and whether a structure exists and its condition. Because the area is already developed, there would be no disruption to the natural environment and the most significant adverse impact would be in the form of possible increase in vehicle and pedestrian traffic and congestion.

2. Village Land Site

The location of the proposed Visitor Center at the Village Land Site, adjacent to the school and community center, would allow for the best integration of the Center with existing community facilities. The significant drawback of this site is the lack of visual access to the waters of the proposed sanctuary. Although it is physically close to the waterfront, the water cannot be seen and there is a feeling of separation and distance from the marine resources.

This site is already cleared and vacant. There would be no demolition required and no unusual site disturbance during construction. Because the land is owned by the Commonwealth, there is unlikely to be acquisition costs. This option would incur the added expense of a parking lot for about 20 cars estimated at approximately $10,000, raising the total cost for a visitor center under this option to $60,000.

3. Overlook Site

The Overlook Site has the best marine orientation of the three and the setting would greatly enhance the sanctuary programs and exhibits. This site, however, is part of a parcel of land with approved subdivision plans to develop a vacation complex: a small hotel, tennis courts, swimming pool and several rows of vacation homes. At this time land costs for the site are unknown. One drawback is the possible incompatibility of the center with the proposed development. The Center would be open to the public but located in an area developed primarily for private recreational use.

This site would be further removed from the boat docking than either of the other two. The tour boats are located in the village/waterfront area and visitors would have to travel between the waterfront and the center.

This alternative would be more expensive to develop than the others; in addition to construction of parking facilities, the short driveway leading up the hill to the knoll (approximately 2/10 of a mile) would need repair or surfacing. A dock would have to be constructed to accommodate the rangers in the inlet down the hill from the site. A 6' wide by 20-30' long dock would be adequate, with an estimated cost of approximately $10,000 (Garcia, personal communication, 1982). The shore of the inlet has already been altered--the mangroves have been removed and a small area of less than 100 square feet has been filled. A dock of this size would not require dredging or filling and would have no significant environmental impacts.

D. Environmental Consequences - Alternative Management Methods

1. Impacts of Regulations

Alternatives 2, 3, and 4 provide for an identical set of new regulations promulgated by NOAA to protect the resources of the proposed sanctuary. Alternative 1 (status quo) and Alternative 5 (non-regulatory approach) rely on existing Commonwealth and Federal regulations. Under the non-regulatory approaches (Alternatives 1 and 5) some of the significant resources such as coral, endangered species and water quality would be protected in varying degrees by the existing statutes and regulations (see Part II, Section E, Legal/ Institutional Background for a detailed discussion of the laws and regulations and Part II, Section F, Issues and Problems).

The Federal Endangered Species and Marine Mammal Protection Acts would continue to provide statutory protection for the manatee, sea turtles and brown pelican within the area of the proposed sanctuary. The Commonwealth Taking of Coral Regulation would continue to prohibit the taking of coral (except by permit for educational and scientific purposes). Commonwealth Law No. 33 (Forest Law) would continue to prohibit the cutting of mangroves within the area of the proposed sanctuary that is also within the Boqueron State Forest. Commonwealth Law No. 9 (Public Policy Act), the Federal Clean Water Act and the Ocean Dumping Act would continue to address wastewater hazardous substance and recreational vessel discharges. Relatedly, the Memorandum of Understanding (MOU) between the U.S. Corps of Engineers and the Governor of Puerto Rico (signed June 13, 1978) would provide a 12 year discharge permit for existing casetas that expire in 1990. The MOU also prohibits the building of additional new structures. Although these resources are protected by statute under the non-regulatory alternatives, there remain several gaps that are filled by the promulgation of NOAA regulations.

The penalty for illegal taking of coral would be increased and broadened. The Commonwealth coral regulation carries a maximum penalty of 6 months, or a fine of not more than $500 or both penalties at the discretion of the court. Promulgation of the NOAA coral regulation provides for a more stringent civil penalty of not more than $50,000 for each violation. The higher federal penalty would be a stronger deterent to the illegal taking of coral. The NOAA regulation also extends the prohibition on taking to other bottom formations and marine plants such as sponges and encrusting organisms.

The regulatory alternative acknowledges the Commonwealth/Corps MOU and takes it one step further. The discharge regulation provides an outright prohibition on discharges from the casetas upon the availability of a hook-up to the sewer line, or the expiration of the MOU. The regulations would result in an additional guarantee that after 1990 there will be no sewage discharges from the casetas into the waters of La Parguera.

Although the mangroves within the Boqueron Forest are protected by statute from cutting or damage, those outside the forest are not. The unprotected area includes much of the Bahia Montalva region. These red mangroves are vulnerable to clearing or cutting for fuel. The NOAA regulations would make this cutting or damage illegal. Protection and maintenance of the red mangroves will assure the viability of this area as a habitat and nursery for locally harvested fish species. It would also result in maintaining the capability of the wetlands to prevent shoreline erosion and flooding by absorbing the energy of wave action during coastal storms.

The regulations also protect cultural resources such as shipwreck or sunken archaeological sites by prohibiting their removal or tampering. There is no regulatory counterpart in Commonwealth or Federal law.

The regulations would further prevent illegal taking of turtles by prohibiting nets with the mesh size used for turtle poaching. At present neither the Commonwealth nor NMFS regulations prohibit this gear. Turtle net confiscation, now being done by Fish and Wildlife enforcement agents, although recognized as the most effective way of preventing the poaching of sea turtles, has been challenged by the fishermen of the area (Ricardo Cotte, personal communication, 1982). There is presently confusion among the fishermen since NMFS agents are not authorized to confiscate turtle nets as are the Fish and Wildlife agents. The regulation prohibiting turtle nets would clarify this situation within the sanctuary.

2. Impacts of Enforcement

a. Alternatives 1 and 3

Alternatives 1 (status quo) and 3 (low cost) would rely on the existing level of enforcement - 2 rangers assigned to La Parguera from Boqueron and existing U.S. Coast Guard, U.S. Fish and Wildlife and National Marine Fisheries Service agents at the Federal level. Alternative 2 (preferred) and 5 (non-regulatory) would add an additional ranger to increase the number to 3 in Stage I with further assistance provided in Stage II if needed, and if funds are available. Alternative 4 (high cost) would provide five additional rangers (total 7) to be assigned to the the main visitor center in La Parguera and the satellite centers at Cueva Island and El Faro.

The status quo and low cost alternative would not provide sufficient enforcement to adequately protect the resources. The Federal agencies currently have insufficient personnel to provide surveillance and enforcement for the La Parguera area. The Coast Guard enforces the Clean Water Act and other EPA responsibilities. With present staff levels, it would not be able to provide routine patrols and can be available to provide emergency services in the event of confirmed poachers, an oil spill, or other such emergencies. There

is only one NMFS enforcement agent, and he is stationed at Ramey on the northwest corner of Puerto Rico. Similarly, there is only one senior resident FWS agent with enforcement authority in Puerto Rico. Consequently, the Ranger Corps is the only law enforcement authority patrolling the waters of the proposed sanctuary.

The present level of Ranger enforcement is not adequate to enforce Commonwealth statutes and the rangers currently assigned to La Parguera are not deputized to enforce the MMPA or ESA. In addition to insufficient numbers, the rangers assigned to La Parguera are deployed from the station at Boqueron. Response time for additional assistance to La Parguera from Boqueron is well over an hour in good weather, but adverse conditions (high seas) can make the boat trip impossible.

Under the status quo and low cost alternative, the scenario is one where violators of the Commonwealth coral regulation, the Forest Law, the MMPA, ESA, and CWA can easily go undetected and without prosecution. Therefore, under this alternative, the resources which are not adequately protected. There would not be adequate surveillance and enforcement to prohibit the taking of coral, cutting of red mangroves, illegal construction of casetas or protection of endangered species. The increasing numbers of tourists to the area will only exacerbate the situation. Without increased enforcement and a central location for personnel the quality of the resources will deteriorate and irreparable loss and damage will occur.

b. Preferred Alternative

The preferred alternative (alternative 2) would do three things to enhance the surveillance and enforcement efforts. First, it would increase the number of rangers to 3 (one additional ranger), (2) it would deploy rangers from the La Parguera village area, and (3) provide training and FWS and NMFS deputization for the rangers assigned to the sanctuary. These actions would result in more protection for the resources, notably coral, red mangroves and nearshore water quality. However, under the preferred alternative the focus of enforcement efforts would be at the eastern end of the proposed sanctuary (La Parguera Village to Punta Pitahya) at the expense of patrolling the waters west of Punta Pitahya. The net effect of this should be positive, since it would put the enforcement emphasis on the area where the most fragile resources are located, the area with the most use and greater likelihood of resource loss. Deputization would also allow for enforcement of the ESA and MMPA within the sanctuary--an action that would provide increased protection for the endangered manatee, brown pelican and sea turtles.

Alternative 4, (high cost) would provide 5 additional rangers in Stage I (raising the total to 7). Under this alternative the rangers would also act as interpreters in La Parguera and at the satellite visitor centers of El Faro at Cabo Rojo and Cueva Island. Placement of rangers at the satellite centers as well as concentrating on the village area would result in fewer undetected violations and damage to resources throughout the sanctuary. Enhanced enforcement would increase the likelihood that the reefs, red mangrove

areas and endangered species would be protected. Additional enforcement placed at El Faro in the Cabo Rojo/Bahia Salinas/Bahia Sucia area would increase protection for the turtles and manatees that frequent the bays in the western end of the proposed sanctuary; a consequence that would not result from any of the other alternatives, including the preferred alternative.

3. Impacts of Interpretive Program

a. Status Quo Alternative

Under the status quo alternative there would be no Interpretive Program for the La Parguera area. Issues and problems associated with the lack of public awareness and information would continue (see Part II, Section F). It is unlikely that the proposed DNR community center would be built. The site for the proposed building is a wetland (see Visitor Center Alternatives Considered but Rejected), and at a very preliminary stage. It is unlikely that any public facility of this type would be constructed in the Village area until Stage II of implementation at the earliest.

Relatively little resource information would be provided. There would be no exhibits, brochures, or tours of the area. Visitors and residents alike would continue to experience the area without understanding the importance of individual natural systems: coral reefs, mangroves, seagrass beds; and their interrelationship to other natural systems and their economic value to man. As a result the public would not be particularly sensitive to conservation of the resources.

b. Preferred Alternative

The preferred alternative (Alternative 2) would provide an Interpretive Program that is more ambitious than Alternative 3. It would focus on selected areas and features and seek to educate the public about resource issues and concerns by expanding understanding of the natural environment and how human actions may impact it. Interpretation of this complex environment would enhance visitor appreciation and enjoyment of the proposed sanctuary and generate concern for the protection of its vital resources. Audiovisual materials, publications, exhibits, activities, and interpreters would provide the information that leads to increased knowledge and understanding of this relatively unspoiled and significant ecosystem. The program would employ a series of exhibits and activities including a mangrove boardwalk/tour, underwater trails, kiosks, audiovisual presentations and tours for student and special groups. There may be minor disturbances to the site from construction of the exhibits and signs.

The mangrove boardwalk would interpret the resources of the fringing (red) mangrove ecosystem. The experience of walking within a stand of red mangroves with self-guided exploration of the natural processes and a trained interpreter will increase visitor awareness and knowledge about the reasons and need for resource protection. As an example, visitors would gain an appreciation for the role they play in storm protection and as a fishery and wildlife habitat. However, certain adverse consequences may also result. Some mangroves would have to be removed during boardwalk construction and bottom disturbances would occur from setting pilings and supports.

The information on endangered species--manatees, turtles, pelicans, and other important species--would be related to habitats (grassbeds, mangroves, and reefs) and provide a holistic understanding of the relationship of individual species and habitats to the ecosystem. The heightened consciousness and understanding should make individuals more cautious and understanding and decrease the damage to resources and the number of violations of protective regulations. Similarly, the underwater trails will provide an educational experience that increases appreciation of the beauty and ecological importance of coral reefs. Visitors will acquire a better understanding of their value to the total system and their economic worth to society. This increased understanding will result in a significant contribution to long-term conservation. Certain adverse consequences may also result. Concentration of visitors along the underwater trails may lead to increased coral mortality and diseases. The monitoring program proposed in the Resource Studies Plan should alert managers to any problems as they arise.

The exhibits and media presentations would serve to inform and educate the public and visitors about the bioluminescent bays, and issues such as the effect of light pollution and water quality on the phenomena of bioluminescence. Similarly, the program would educate the public on the importance of grassbeds and help them recognize problems associated with the careless use of motor boats in the shallow nearshore areas. Certain outdoor exhibits would be placed to reach individuals whose only contact with information might be at the boat docks.

Information on rules and regulations would inform the public that taking coral and other bottom formations is illegal. In conjunction with the educational information on the resources this effort should result in an increased willingness to obey the regulations and maintain resource quality.

The satellite center at Cabo Rojo established in Stage II would provide interpretation for a potential audience who might not travel to La Parguera. Residents of Mayaguez and southeastern Puerto Rico would have the opportunity to learn about the resources and the importance of their protection and management. Although there would be no full time sanctuary staff at El Faro, interpretation would emphasize exhibits and self-guiding trails to Bahia Sucia and Salinas. These will focus on understanding the manatee and sea turtle habitats, and mangrove, bay, grassbed ecosystem.

c. Low Cost, Low Profile Alternative

Under Alternative 3, (low cost, low profile) very little would be done in the way of interpreting the resources of the area over the status quo. The limited funding for this alternative would result in a public awareness/ educational effort that was not very creative or exciting. Facilities for a visitor center would rely on the implementation of the DNR proposal. Interpretation for alternative 3 would be primarily from simple poster exhibits and brochures placed at Mata de la Gata, the Village, and Playita Rosada.

Under this alternative there would be no interpreter to provide narratives on boat tours to Bahia Fosforescente (other than the talks presently provided by the operators), no mangrove boardwalk, no underwater trails, and generally no "hands-on-learning experience." It is unlikely that much interest would be aroused or that the public would gain much from the limited presentations and that in turn the alternative would not result in any enhanced resource protection.

d. High Cost, High Profile Alternative

The High Cost, High Profile Alternative (No. 4) would implement essentially the same management plan as the preferred alternative. The different environmental consequences would result from the rate of implementation, number of interpretive staff, the increased outreach provided by an additional satellite visitor center at Cueva Island and direct control over boats and tours to Bahia Fosforescente.

The entire Interpretive Program would be implemented in Stage I. The additional rangers and interpretive personnel (4 rangers and 5 more guides/specialists than the preferred alternative) would result in more information better distributed to visitors, users, and residents.

Caba Rojo would be established as a satellite visitor center in the process. This would establish an onsite presence at Cabo Rojo several years before the preferred alternative. There should be an increase in the appreciation and understanding of the natural system and a concomitant increase in resource protection and decrease in violations. The presence of ranger and interpretive staff at El Faro under this option will provide better protection for both the seagrass bed habitat at Bahia Salinas and Bahia Sucia, and the manatees and turtles that frequent the area.

The second satellite site at Cueva Island would increase the outreach to the public. However, some of the facilities would duplicate those planned as part of the main visitor center, or relate more to the terrestrial environment, rather than marine. These media presentations would differ little from those at the main center where most users will come into contact with information before proceeding to Cueva Island.

The self-guiding tours would take visitors near the mangrove fringe and around the island. However this activity would not provide visitors with any greater awareness of the red mangrove than the mangrove boardwalk tour included in the preferred alternative. It is unlikely that the cost of developing Cueva would return a significant increase in public education or awareness and protection for the resources.

This alternative also advocates purchase and operation of tour boats by the sanctuary to take visitors to Bahia Fosforescente. Protection for the bays would be gained by educating the public about their fragility and uniqueness. This objective can be achieved by placing an interpreter on privately owned and operated tours like those presently existing. Sanctuary owned and operated tours would add no degree of protection and would unnecessarily compete with the private sector to provide this service.

4. Impact of Resources Studies Plan

a. Preferred, High Cost and Non-Regulatory Alternatives

The preferred, high cost, and non-regulatory alternatives would provide multidisciplinary studies on living marine resources (species composition, abundance, diveristy, etc.); community structure and function; and physical, chemical, geological and meteorological conditions within the proposed sanctuary. Information generated from these investigations would be used to further understanding of the importance of marine resources and to develop sound marine ecosystem management practices. This management-related research would address practical, use-oriented or "cause-and-effect" studies. Long-term monitoring and its resultant data base would provide the foundation for interpreting or predicting natural or man-induced events in the sanctuary. Other areas which could be explored might include: (1) carrying capacity of a given system to understand varying types and levels of human contact or stresses; (2) the adequacy of protective buffer areas; (3) the effects of different types of development or activities on particular resources such as coral, seagrass beds, fisheries, marine mammals, and seabirds; (4) fisheries research oriented toward solving operational and management concerns; and perhaps (5) innovative ways of enhancing productivity.

Implementation of the Resources Studies Plan would result in increased long-term protection for resources. Data gathered from the scientific investigations would provide the managers with needed information that would be used to make decisions on day-to-day management and long-term modifications in the interpretation program, administration, and regulations.

One of the first resource studies to be undertaken would result in a compilation of literature of past and present research within the proposed sanctuary, and would tie this information into a retrievable data resource information system. It would efficiently utilize and capitalize upon the existing DNR NCERI computer system, rather than develop a sanctuary specific data bank. The immediate impact of the compilation and computerization will be a document providing baseline data to aid in formulating management policy and implementing the management plan.

Other studies would directly benefit the fishing community as well as sanctuary managers. The proposed conch stock assessment, the circulation pattern, and water quality monitoring assessment would provide badly needed information for local fishermen. The conch study would provide specific recommendations for enhancing the industry in the La Parguera area. The circulation pattern and water quality studies would result in information on coastal currents and the distribution of pelagic larvae and identify fishery habitats vulnerable to pollution and ecological damage from degraded water quality.

The circulation and water quality studies would also result in general resource maintenance and protection throughout the proposed sanctuary. Under the preferred alternative sampling stations would be set up at important or vulnerable resource areas: the Bioluminescent Bay, Enrique reef, Mata de la Gata reef, northeast of Magueyes Island, Bahia Monsio Jose, and El Palo reef. This continuous monitoring would provide an immediate identification of where degradation is taking place and an identification of suitable areas for multiple use.

Other studies would provide new information on recreational use and feedback on management actions. One that would result in significant information is the assessment of anchor damage on coral reefs. Little information currently exists on the effects that anchoring gear is having on the coral reefs at La Parguera. The lack of data is so significant that policies could not be formulated for the draft management plan. This assessment would result in identification of anchor sensitive areas, the magnitude of the problem and recommended solutions. In turn, managers can take appropriate actions that would result in protection of the coral reefs.

In a similar manner the underwater trail feasibility study would provide managers with reefs and other underwater habitats that are suitable for development of trails. It would result in the establishment of trails where the resources are able to support such use with minimum degradation and maximum public education and benefit. This study would also provide for monitoring of those sites proposed for trails as part of the preferred alternative and those established pursuant to the feasibility analysis. The result of the monitoring program would provide managers with information on the reef health and condition so that actions could be taken to prevent resource degradation.

Other resource studies would directly result in management actions protecting the bioluminescent bay and significant seagrass beds. An analysis of boating would identify levels of activity, and provide information on what if any ecological disturbance boating has on the bays and seagrass beds. The studies would provide managers with recommendations for mitigating any damaging effects.

As part of the preferred alternative the location of the endangered manatees and endangered and threatened sea turtles would be identified and monitored. The extent of their existence within the La Parguera area is not currently and conclusively known, but their protection is one of the highest priorities for sanctuary managers. A comprehensive assessement would result in management policies and actions realistically geared toward maintaining and enhancing their numbers. This information could directly result in additional enforcement officers or a rearrangement in enforcement schedules or deployment. Any adverse consequences of the assessment would come from possible capture and tagging of animals. This could result in their being frightened or disturbed. However, before any such action is taken, a relevant permit would be obtained from the U.S. Fish and Wildlife Service.

b. The Status Quo and Low Cost Alternatives

The status quo and low cost alternative would provide no reliable data base specifically geared to address management needs. Sanctuary managers would not likely be able to identify resource problems and issues in advance and/or develop sound solutions based on hard data. There would be no regular data on water quality and managers would have to rely on anecdotal information on the impacts from anchoring and distribution of manatees and sea turtles. The health and viability of important resources such as seagrass beds, mangroves and reefs would go unassessed. Without the monitoring and assessments, indications of ecological disturbances would be evident in some situations, only after the problem had reached a stage where resource damage and loss would be irreversible; a situation that is likely with sensitive systems such as coral reefs, some grassbeds and the bioluminescent bays.

PART VI: UNAVOIDABLE ADVERSE IMPACTS AND SOCIO-ECONOMIC EFFECTS

Implementation of the sanctuary could result in minor disturbances to the environment through construction or improvement of a visitor center, parking or trails. These were discussed under the impacts to resources. Any environmental assessments necessary for proposed construction would be undertaken at the time of construction. Except for the minor site disturbances, there are no significant adverse environmental effects. The different consequences resulting from the alternatives (except the status quo) is a difference in the degree of benefit resulting from the designation of a marine sanctuary.

PART VII: RELATIONSHIP BETWEEN SHORT-TERM USES OF THE ENVIRONMENT AND THE MAINTENANCE AND ENHANCEMENT OF LONG-TERM PRODUCTIVITY

Sanctuary designation would provide long-term assurance that the natural resources and resulting benefits of the area would be available for future use and enjoyment. Without implementation of the preferred alternative, continuing increase in recreational use of the waters, illegal taking of endangered species, and destruction of mangrove areas may result in the loss of resource values.

The interpretive, surveillance and enforcement, and administrative programs would provide information, management and protection that develops a foundation for wise public use of the area and that would result in assuring long-term productivity. Similarly, information collected from the Resource Studies Plan would assist Federal and Commonwealth managers make better marine management decisions. Better management would in turn help resolve use conflict and mitigate advance impact of human activities.

PART VIII: LIST OF PREPARERS

Mr. Edward Lindelof - U.S. Department of Commerce/NOAA

Mr. Lindelof is the project manager for the Puerto Rico marine sanctuary proposal. He is the project manager for NOAA's National Marine and Estuarine Sanctuary Programs for the North Atlantic and the Caribbean. His responsibilities in the preparation of the DEIS included overall direction of the project development and organization. Mr. Lindelof had assistance from Ms. Lois Mills and Ms. Leah Miller, Clerk/Typists, Sanctuary Programs Division.

Ms. Gloria Thompson - U.S. Department of Commerce/NOAA

Ms. Thompson is a program specialist with the Sanctuary Programs Division. She works as assistant project manager for estuarine and marine sanctuary proposals in the North Atlantic and Caribbean. Her responsibilities included editing the document and preparing it for publication.

Ms. Evelyn Wilcox - Evelyn Wilcox and Associates

Ms. Wilcox has a masters degree in environmental systems management and is a principal with Evelyn S. Wilcox and Associates (ESWA), an environmental management consulting firm. Ms. Wilcox's experience includes development of a proposal for the Looe Key National Marine Sanctuary for NOAA, and project director for a comprehensive analysis of environmental impact on coastal and marine resources in Port-au-Prince, Haiti. She was responsible for overall data collection, development of management recommendations, and providing the environmental impact assessment. Ms. Darcy Rosenblatt and Ms. Elizabeth Wilcox assisted with the preparation and editing of the environmental impact assessment.

Mr. Jose Gonzalez-Liboy - Puerto Rico Department of Natural Resources (DNR)

Mr. Gonzalez-Liboy is a scientist with DNR and received B.S. and M.S. Degrees from the University of Puerto Rico. He was responsible for the preparation of the Resource Studies Plan and general review of the document.

Mr. Carlos Goenaga - ESWA

Mr. Goenaga is a marine scientist, an expert on oceanography and Caribbean ecological systems and an associate with ESWA. Formerly, Professor of Oceanography at the University of Puerto Rico at Humacao, Mr. Goenaga has served as marine biologist for the Environmental Quality Board and the Department of Natural Resources of Puerto Rico. Mr. Goenaga has participated extensively in field research, including scientific trips to Mexico, the Dominican Republic, Spain, the Virgin Islands and Brazil. Mr. Goenaga assisted in the preparation of the coral reef section of the DEIS.

Mr. Joseph Brown - ESWA

Mr. Brown is the retired Regional Director, Southeast Region, for the National Park Service, with a B.S. Degree in Forestry and Wildlife from the University of Georgia and 33 year's experience in park management/administration. Mr. Brown was involved in developing the administration and operation sections of the management plan.

Ms. Ellamae S. Doyle - ESWA

Ms. Doyle holds B.A. and M.A. Degrees in education. Ms. Doyle has experience in both developing proposals for parks and protected natural areas and park operations. She was involved in preparation of the interpretive and administrative section of the management plan.

Ms. Blanca I. Ruiz Dias - ESWA

Ms. Ruiz has graduate degrees in planning and social work. She was responsible for the socio-economic background information.

Cynthia Barga - ESWA

Ms. Barga is an environmental planner and landscape architect completing her degree in landscape architecture. She has worked on several landscape assessments and urban design projects. She was responsible for recommendations on design and location of the proposed visitor center.

Dr. James Cato and Dr. Fred Prochaska - ESWA

Dr. James Cato and Dr. Fred Prochaska, professors at the University of Florida, are well known in the field of applied research in marine economics. They are an associate firm to ESWA. Among their many accomplishments are the economic analysis for Fisheries Management Plans for Reef Fish and Spiny Lobsters for Puerto Rico and the U.S. Virgin Islands, and economic impact statements for Fishery Management Plans and revisions of the Reef Fish Plan for the Gulf of Mexico Fishery Management Council. Dr. Cato and Dr. Prochaska were responsible for review of the economic data on fisheries.

Mr. Alfred Wolf - ESWA

Mr. Wolf has been actively involved in the direction, planning, and implementation of socio-economic programs and projects in Latin America, the Caribbean, Africa, the Middle East and Southeast Asia. He has served in these capacities with the Inter-American Development Bank, the Ford Foundation, Harvard University, and the U.S. Department of the Interior. Mr. Wolf was responsible for review of the socio-economic data.

Mr. Ariel Mendez - ESWA

Mr. Mendez is the Director of the Legal Division for the Puerto Rico Federal Affairs Administration. He provided the background information for the Legal/Institutional Background section of the DEIS.

Ms. Mary Beath - ESWA

Ms. Beath is a freelance graphics artist located in New York City. She designed and produced the graphics for the DEIS/Management Plan under contract to ESWA.

PART IX: LIST OF AGENCIES, ORGANIZATIONS, AND PERSONS RECEIVING COPIES

Federal Agencies

Advisory Council on Historic Preservation
Department of Agriculture
Department of Commerce
Department of Defense
Department of Energy
Department of Health and Human Services
Department of the Interior
Department of Justice
Department of Labor
Department of Transportation - U.S. Coast Guard
Environmental Protection Agency
Federal Energy Regulatory Commission
General Services Administration
Marine Mammal Commission
Nuclear Regulatory Commission

National Interest Groups

AMERICAN
AFL-CIO
American Association of Port Authorities
American Bureau of Shipping
American Farm Bureau Federation
American Fisheries Society
American Gas Association
American Industrial Development Council
American Institute of Architects
American Petroleum Institute
American Shore and Beach Preservation Association
American Society of Civil Engineers
American Society of Landscape Architects, Inc.
American Society of Planning Officials
American Waterways Operators
Amoco Production Company
Atlantic Richfield Company
Atomic Industrial Forum
Boating Industry Association
Bultema Dock and Dredge Company
Center for Law and Social Policy
Center for Natural Areas
Center for Urban Affairs

Center for Urban and Regional Resources
Chamber of Commerce of the United States
Chevron U.S.A., Inc.
Cities Service Company
Coast Alliance
Conservation Foundation
Continental Oil Company
Council of State Planning Agencies
The Cousteau Society
CZM Newsletter
Edison Electric Institute
El Paso Natural Gas Company
Environmental Policy Center
Environmental Defense Fund, Inc.
Environmental Law Institute
Exxon Company, U.S.A.
Friends of the Earth
Great Lakes Basin Commission
Gulf Energy and Minerals, U.S.A.
Gulf Oil Company
Gulf Refining Company
Industrial Union of Marine and Shipbuilding
  Workers of America
Institute for the Human Environment
Interstate Natural Gas Association of America
Lake Michigan Federation
Marathon Oil Company
Marine Technology Society
Mobil Oil Corporation
Mobil Exploration and Producing, Inc.
Murphy Oil Company
National Association of Conservation Districts
National Association of Counties
National Association of Home Builders
National Association of Realtors
National Audubon Society
National Coalition for Marine Conservation, Inc.
National Farmers Union
National Federation of Fishermen
National Fisheries Institute
National Forest Products Association
National Ocean Industries Association
National Parks and Conservation Association
National Recreation and Park Association
National Research Council
National Society of Professional Engineers
National Waterways Conference
National Wildlife Federation
Natural Resources Defense Council
Natural Resources Law Institute
Norfolk Dredging Company

Outboard Marine Corporation
Resources for the Future
Rose, Schmidt and Dixon
Shell Oil Company
Sierra Club
Skelly Oil Company
Soil Conservation Society of America
Sport Fishing Institute
Standard Oil Company of Ohio
State University Law School
State University of New York
Sun Company, Inc.
Tenneco Oil Company
Texaco, Inc.
Texas A & M University
The Nature Conservancy
The Wildlife Society
Union Oil Company of California
University of Pittsburgh
Urban Research and Development Association, Inc.
Western Oil and Gas Association
Wildlife Management Institute
Woods Hole Oceanographic Institute

Congressional

Baltasar Corrada

Commonwealth Government

Attorney General
Culebra Conservation and Development Authority
Department of Agriculture
Department of Commerce
Department of Health
Department of Housing
Department of Natural Resources
Department of Recreation and Sports
Department of Transportation
Environmental Quality Board
Governor of Puerto Rico
Highway Administration
Land Administration
Marine Resources Development Corporation of Puerto Rico
Mayor of Cabo Rojo
Mayor of Guanica
Mayor of Lajas
Mineral Resources Development Corporation of Puerto Rico
Ports Authority
Puerto Rico Federal Affairs Administration
Water and Sewer Authority

Local Interest Groups

Asociacion pro Mejoramiento del Ambiente
Caribbean Business
Caribbean Fishery Management Council
Centro para Est. Energticos y Ambientales
Club Nautico of San Juan
Comite Pro Defensa de la Calidad Ambiental
Empresas Fournier
Hotel Villa Parguera
Junta de Calidad Ambiental
Junta de Planificacion
Ninos Escuchas de America
Posada Porlamar
San Juan Star
Sociedad de Historia Natural
Boqueron Fishermen's Association
Combate Fishermen's Association
Guanica Fishermen's Association
Playa Santa Fishermen's Association

Research and Education Groups

Catholic University, Biology Department
Center for Energy and Environmental Research, University of Puerto Rico
Department of Economics, University of Puerto Rico at Rio Piedras
Department of Marine Sciences, University of Puerto Rico
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APPENDIX A

CORAL REEF DESCRIPTIONS

1. Inner Shelf Area

a. Las Pelotas Reef

Las Pelotas Reef, with mangrove cover, is an example of an inner most reef of the inner shelf area. The back reef area, south of the mangrove trees, is less than one meter deep and consists of Thalassia intermingled with the zoanthid, Zoanthus sp. Isolated colonies of Porites astreoides and A. palmata are also frequent. The crest or shallowest part is dominated by sparce A. palmata (less then 40% cover) alternating with P. porites. The zoanthid, Palythoa caribaeorum, is a very important component of this zone. Farther seaward, the palmata zone, with a moderate cover, slopes to about four meters giving way to diffuse mixed coral zones where gorgonians, head corals (i.e., Colpophyllia natans, Montastrea annularis and A. cervicornis) dominate. The reef dissipates at about 13 meters, where isolated patches of M. annularis occur.

Like other nearby reefs, Las Pelotas Reef lacks well-defined biotic zones apparently as a result of an extremely reduced inshore wave energy regime.

b. Ahogado Reef

This reef, located north of Enrique Reef and south of Isla Magueyes, has no mangrove trees and is broken along its length by several channels about 7-8 meters deep, that cross it in a north-south direction. It rises to within less than a meter from the surface, breaking the surface of the water during very low tides. Typical of most of the reefs in this area, its orientation is roughly east to west.

The back reef consists of beds of Thalassia testudinum with patches of Acropora Cervicornis. The urchin, Diadema antillarum, is common. The reef crest, or the shallowest section of the reef as in other low energy front reefs, is dominated by A. palmata which merges with an undeveloped palmata zone. Seaward from this zone, the reef begins to gradually slope into the mixed coral zone where head corals and, later, gorgonians predominate. At about eight meters there is an abrupt slope to 15 meters at the reef base. Turbidity is very high due to resuspension of fine sediments by wave created surge.

Other examples of these highly protected reefs are La Conserva and Collado Reef where an "atypical" Thalassia bed occurs between the rudimentary palmata and mixed coral zone.

c. Enrique Reef

This reef is representative of the line of reefs marking the southern boundary of the inner area and contains a mangrove stand with Rhizophora mangle as the dominant species. North of the reef crest is a well developed Porites biotope with a large number of invertebrates. In several places the Porites colonies are intermingled with Thalassia and/or zoanthids of the genus Zoanthus. Isolated coral patches occur in this back reef apron especially on the "head" and "tail" (east and west) sections of the reef where wave energy is felt due to refraction. Coral patches at the "tail" (west) end are specially

interesting due to high species diversity. Because of the calm, protected and shallow waters, this makes a perfect site for beginner snorkelers. The reef apron sands are extensively burrowed by the shrimp, Calianassa, and by holothurians (Mathews, 1974). These form small mounds which cover large sections of the barren sand areas.

The reef crest is dominated by the fire coral, Millepora complanta, A. palmata, the zoanthid, Palythoa caribaeorum, and various types of coralline algae. South of the crest is a very narrow palmata zone (probably due to the steepness of the reef front) followed by a platform containing dead coral that widens to the east and narrows to the west. Some A. cervicornis are also present here. Slightly deeper is a zone clearly dominated by the star coral, Montastrea annularis. Diploria sp., Agaricia agaricites, and Gorgonians are abundant in this zone. The lower part of the slope is of barren, gravelly sand with occasional clumps of Oculina (Morelock et al., 1977).

2. Middle and Outer Areas

a. Turrumote Reef I

Turrumote Reef I is one of the most impressive of the emergent reefs of La Parguera. The back reef apron contains numerous benthic algae and patches of Thalassia. The Porites biotope is very extensive although partially dead. The back reef separated from the fore reef by a high relief (close to three meters above mean sea level) promontory of storm-deposited coral, mainly A. palmata, which extends from one side to the other side of the reef. The reef crest is buttressed with colonies of M. complanata overlying them. Most of these colonies are partially broken as a result of recent storm damage. The sea urchin, Echinometra luncunter, occurs in very high densities; coralline algae is a secondary component. Small colonies of Diploria sp. are very common. The palmata zone, although formerly one of the most impressive in terms of coral cover, is now 100% flattened as a result of recent hurricanes. Seaward is the mixed coral zone with moderate coral cover and very high species diversity. Further south is a spectacular very high relief buttress zone composed mainly of very sizable (some more than three meters in diameter), fungi-like colonies of M. annularis. These colonies are sometimes taller than four meters and are separated by barren sand. They also form very intricate ledges and overhangs which support many other species of corals (mainly Agaricia) and other invertebrates. Icthyofauna is very dense and diverse. South of this zone, the reef gradually dissipates. To the east this reef extends into a very interesting and high relief area locally called The Pinnacles. Here coral structures rise from the bottom to several meters below the surface. Fishing in this area is said to be very productive.

b. Margarita Reef

Margarita Reef (approximately three km from east to west) is the westernmost emergent reef of the area proposed for sanctuary designation. The back reef apron is very extensive and well protected. Patches of Thalassia alternate with coral colonies or with bare sand. Algae are very abundant and diverse. There is an extensive Porites biotope. The reef crest is dominated by broken or lacerated colonies M. complanata (as a consequence of recent storms). A. palmata is a codominant species, in some parts. Seaward is a denuded, very wide palmata

zone, followed by a very long mixed coral zone where gorgonians and M. annularis dominate. Gorgonians are especially dense. The reef continues south for more than .5 kilometers south from the crest until it slopes to about 15 meters and terminates.

Other emergent reefs within the proposed boundaries of the sanctuary are El Palo, Atravesado, Enmedio, and Turromote II.

c. Submerged Barrier Reef

A portion of one of the most spectacular reef systems in Puerto Rico lies at the edge of the southern boundary of the sanctuary. It is a submerged barrier reef bordering much of the shelf edge off the southern coast of Puerto Rico. It has been more extensively studied in the southwest. The shallowest section (15 meters from the surface) lies at the very edge of the shelf. South at 17 to 25 meters, a sharp break in the nearly bottom level occurs, dropping away at an angle of up to 45 degrees into the Caribbean. A buttressed spur and groove formation has been observed for more than three km along the shelf edge (Morelock et al., 1977). Sand channels, up to six meters deep, with vertical walls generally less than two meters apart and 20-30 meters long are cut into the upper insular slope. The walls of these channels are covered with encrusting coral growth, algae and boring sponges. Between the channels is a coral buttress dominated by massive corals and agaricids. These channels appear to be some type of surge channels which allow movement of sand from the outer shelf to the slope (Morelock et al., 1977). These sands form an obvious trail down the slope below each channel which have been traced below 70 meters depth. Coral growth is so intense on the walls that they sometimes form a roof over the grooves providing an excellent habitat for a great variety and number of fish. These grooves diminish in relief to the north, branch and meander occasionally, terminating gradually in coral ridges which are aligned east to west parallel to the shelf edge. Ridges rise slightly to shallower depths and are covered with dense gorgonian stands. Living coral cover is reduced. Sand flats, also parallel to the shelf edge, occur to the north of the ridges (Quinn, 1972).

The slope, south of the spur and groove system, consists of cemented or dead coral pavement with little relief below approximately 30 meters. Zonation is marked with stands of gorgonians and antipatharians increasing steadily downwards in relation to a decrease in stony hermatypic corals.

Along the shelf edge, Morelock et al., (1977) observed areas where the upper 30 to 40 meters of the slope are vertical. Where this occurs, there are no grooves and the general nature of the submerged reef is similar to other Caribbean submerged reefs (MacIntire, 1972).

It is postulated that reefs on the shelf edge built up as barrier reefs during the Pleistocene low sea stand (Goreau and Burke, 1966). The shelf edge was subjected to intermittent surface drainage of water; accumulated by wave action or runoff. Subaerial erosion occurred thus forming drainage channels. No growth occurred on the floor of these incisions as a result of continued scourings. As the reefs were drowned by the waters melted from the glaciers over the last 4,000 years, these erosional features were enhanced by coral growth forming the buttresses.

COMMERCIAL FISHERMEN SURVEY TECHNIQUE

The use of key informants is an established technique for the development of information relative to a "needs" which exist in a given community. The use of this approach is predicated upon the assumption that there exists in any jurisdiction, persons who have intimate first-hand information about the needs and service utilization patterns of populations who are, or should be, clients of human services organizations. These persons constitute a corps or group, only to the extent that they share information about, and an interest in, the needs of a target population within a jurisdiction. They develop this knowledge and concern in a variety of ways:

- They may be elected or appointed officials who have a responsibility to understand the needs of special populations and whose position causes them to be the recipients of expressions or concerns of such groups.

- They may be managers, administrators or staff members of agencies whose direct contact with the population causes them to have an awareness of the nature and volume of needs which exist in a given community.

- They may be professionals who may or may not be members or leaders of organized groups, but whose vocation causes them to have valid insights into community needs.

- They may be representatives of the target groups who can be identified by their leadership and advocacy of the said group.

The use of key informants adds a human dimension to the needs assessment effort. No amount of data, regardless of how valid and appropriate to its intended purpose, can support an adequate understanding of an environment in which the reactions and responses of the affected population to life circumstances are as important as the circumstances themselves. This technique provides important clues to the people's way of viewing their environment. Such understanding is essential if any effort to intervene is to be regarded by the community as truly relevant and useful.

TECHNIQUE AND PROCEDURE

Information can be gathered from key informants in a variety of ways. They range from quite unstructured approaches which seek to yield insights which are useful for the analyst to keep in mind, to well-defined, multi-step procedures in which information is gathered and processed in conformity with a carefully prepared plan.

Unstructured approaches are common in many programs. Advice is sought unfortunately from persons who may have information about clients or utilization of services, but no attempt is made to collect, analyze, or share the information on a broad scale. A structured approach attempts to assess a broad section of the community's key informants through meetings or surveys. An effort is made to collect, tabulate, and analyze data which can be fed back to those participating in meetings or surveys.

If meetings are established, this means of data collection brings key informants together as a work group and charges them with the responsibility of identifying the needs of the community as the participants see them. While this format allows for a free exchange of ideas, the results can be more difficult to collect and tabulate for analysis than the survey.

If a survey instrument is used, data will be limited by the constraints on the questionnaire in terms of the items to be used and the format in which they will be presented. There are three basic formats through which the key informants can be surveyed: the personal interview, the telephone interview, and the written/mail questionnaire.

The most frequently used technique is the personal interview which permits a free exchange of ideas on a one-to-one basis. It is more difficult to implement, in that it requires highly trained and careful interviewers who will strive to maintain consistency in all questions. The personal interview obtains more information per interview as points may be clarified and information expanded.

PROCEDURES USED IN SANCTUARY AREA

A mailing list identifying the Fishermen's Associations in each of the municipalities was obtained from CODREMAR and the Caribbean Fisheries Council. A letter explaining the objectives and scope of the National Marine Sanctuary Program was drafted and mailed to the presidents of each of the Associations. The letter also set a date in which the researcher was going to visit the area and asked for the presence of the president and as many members of the Association as possible for group discussions and interviews.

Upon arrival of the researcher at the Fishermen's Association facilities, the group met. An oral presentation of the Program's scope and purpose was made and a group discussion followed to clarify any doubts and concerns. The group session also provided an opportunity to further identify who should be interviewed following a structured guide in order to assure consistency in the data collected. The president of each one of the Associations was interviewed, as well as at least two or three of the most active members identified in the group session.

The interview outline was followed and the answers to the open ended questions were recorded in a summarized fashion, in writing. The data thus collected in each site was then compared and analyzed by topic.

INTERVIEW OUTLINE

I. Identification information

   A. Association's official name and mailing address.

   B. President's name and address.

   C. Number and name of members.

   D. Number and type of boats used.

   E. Type of fishing gear used and number or average number of gear/fishermen.

   F. Average yield per type of gear.

II. Where they fish?

   A. General area (from _____ to _____).

   B. Distance from shoreline.

   C. Preferred area.

III. Most common catch

   A. Fishes

   B. Crustaceans

   C. Conch

IV. Association's organization

   A. How they operate.

   B. Price paid to fishermen by type of fish.

   C. How and where they sell catch - (Assoc. facilities and other places).

   D. Relationship with non-member fishermen in area.

V. Concerns and recommendations regarding National Marine Sanctuary Program

Brief Description of Community Groups Contacted

Parguera

There is no active fishermen's association here at present. Yet the fishermen work and sell their catch together to mainly one dealer and a few restaurant owners. They use the port and facilities of the former fishermen's association. They reported that there are 23 full-time and 28 part-time or occasional fishermen. Prices are standard for each class of fish.

Boqueron

This association is no longer active and most fishermen work and sell their catch individually to restaurants, wholesalers, and directly to the public. Prices here fluctuate since each fisherman sets his own prices. There are 60 full-time fishermen.

Combate

The fishermen's association is no longer active, though they use the existing facilities. There are 33 full-time fishermen in this area. They have standard prices. Fish sold to wholesalers and to the public are mainly from specific fishermen's houses and sometimes from the Association's facilities.

Guanica

Guanica reported 26 full-time fishermen. This association is partly active. There is another group in Guanica which we were not able to interview. They have standard prices, but not necessarily the same as the other group.

Playa Santa (Guanica)

This was the only fishermen's association in full operation. They have two 42 ft., fully equipped vessels used at least twice weekly with permanent crew members assigned. There are 30 full-time fishermen in the association. They buy all catch from members at standard prices. Members pay weekly dues. They have one full-time employee who is the Program director and accountant. Playa Santa is a fast growing private recreational area where demand for fresh fish may be increasing.

List of Associations and Persons Contacted

1. Parguera

   Cesar Padilla - Wholesaler and owner of fish market.

   Fishermen

   1. Juan J. Irizarry
   2. Rodrigo Irizarry
   3. Jose Luis Lopez
   4. Luis Mendoza
   5. Tomas Padilla (group leader)
   6. Anibel Rosado
   7. Confessor Rosado
   8. Juan Rosado
   9. Pablo Rosado
   10. Ricardo Rosado Ramos
   11. Anibal Santiago

2. Playa Santa, Guanica

   Asociacion de Pescodares Salinas Provindencia
   Programa de Desanollo Pesquero de la Agencia de Accion Comunal

   Fishermen

   1. Eddie Carbonell
   2. Eladio Garcia Cherena
   3. Felix Garcia Cherena
   4. Vicente Mattei
   5. Juan Mattei
   6. Juan Santos Mattei
   7. Hilario Ramos
   8. Israel Mattei Vega
   9. Vicente Mattei Vega

3. Guanica

   Pescadores Unidos
   Bahia de Guanica

   President - Luis Ouinones

   Fishermen

   1. Felita Aguilera
   2. Felix Aguilera
   3. Hector Aguilera
   4. Humberto Artiz
   5. Antonio Cruz
   6. Santiago Feliciano
   7. Santiago Flores
   8. Luciano Garcia

3. Guanica (Cont'd)

9. Enrique Gilbert
10. Felix Gilbert
11. Julio Gilbert
12. Reynolds Gilbert
13. Manuel Gonzolez
14. Junior Luna
15. Juan Martinez
16. Jose Matos
17. Roul Mejia
18. Julio Melendez
19. Andres Padilla
20. Carlos Quiros
21. Orlando Ramos
22. Carlos Rivera
23. Pedro Rivera
24. Jose Rosado
25. Jose Rosado, Jr.
26. Rafael Rosado
27. Rafael Rosado, Jr.
28. Antonio Santiago
29. William Vargas
30. Jose Vasquez
31. Caro Vila
32. Pedro Vila

4. Boqueron

Asociacion Pesquera de Boqueron (not active)

President - Juan M. Montalvo

Fishermen

1. Jose Maldonado
2. Arcadio Negron
3. Enrique Negron
4. Isael Negron
5. Carlos Pabon
6. Estebon Pabon
7. Delvis Ramos
8. Carmelo Vargas
9. Walter Vargas
10. Epifanio Velez

5. Combate

Asociacion de Pescadores del Combote (not active)

1. German Acosta
2. Jarge Acosta
3. Luis Acosta
4. Nelson Acosta
5. Marteniano Comacho

5. Combate (cont'd)

6. Luis Angel Cruz
7. Elay Hernandez
8. Guillermo Hernandez
9. Ivan Hernandez
10. Ramon Hernandez
11. Ruben Hernandez
12. Sadi Hernandez
13. Jose Angel Lopez
14. Luis Angel Lopez
15. Kenny Lund
16. Andres Maldonado
17. Miguel Maya
18. William Ojedo
19. Luis Padilla
20. Monserrate Padilla
21. Rickie Padilla
22. Roberto Padilla
23. Rodolfo Acosta Padilla
24. Julio Ramirez
25. Tomas Ramirez
26. Julio Ramos
27. Jose Rodriguez
28. Santos Rodriquez
29. Freddie Toro
30. Jaime Hernandez Vilez
31. Wilfred Vega

ECONOMIC PROFILE OF COMMERCIAL FISHING

Commercial fishing statistics for Puerto Rico are not published with specific reference to the proposed marine sanctuary site. The approach taken to describe the potentially effected commercial fishery was to identify municipalities associated with fishing activities on the proposed sanctuary site. Specific fisheries likely to be affected were identified by type of gear and by species. Fishery identification by species was made by examining west coast and east coast Puerto Rican island landings of certain species and by reviewing past research and exploratory fishing reports pertaining to the proposed site or adjacent areas. Economic characteristics of fishing activities such as income and pots fished were also identified through similar procedures.

La Parguera

The La Parguera site is located adjacent to the Lajas municipality and is primarily fished by commercial fishermen from that municipality. The majority of the fishermen using the site, due to the proximity, are most likely to come from Lajas. However, some fishermen are reported to come from the Guanica municipality (Jose Figuero, 1981). It also appears reasonable to assume that some fishermen from the Cabo Rojo municipality may fish at least on the western edge of the proposed site. Since most fisheries in the proposed area is conducted out of the Lajas municipality, major emphasis is given in the following discussion to fishing characteristics representative of it. The Guanica municipality is given secondary emphasis.

1. Landings by Municipality

Total volume of landings in Lajas is not available for some years during the 1970's. From available data there appears to be an overall increase in landings with wide annual variations. A low of 80,322 pounds was landed in 1973 and a high of 207,008 pounds was recorded in 1978 (Table 1). Total value of landings for both municipalities increased more significantly for both municipalities due to price increases in addition to the increased volume of landings. Value of landings reached record highs of $147,403 and $280,327 in 1978 for Lajas and Guanica, respectively.

Lajas and Guanica are relatively important fishing centers with respect to both the south coast and all Puerto Rico. Lajas accounted for a high of over 22 percent of south coast landings and 19 percent of value in 1975 (Table 1). The same year Guanica accounted for nearly 34 percent of south coast landings and 33 percent of the value of south coast landings. During recent years these two municipalities combined accounted for at least one-third of south coast landings and 9 percent of total Puerto Rico landings. The relative importance is approximately the same with respect to value of landings.

TABLE 1 LANDINGS BY MUNICIPALITY ON THE SOUTH COAST OF PUERTO RICO 1970-1980[a]

Municipality/ Year	Volume					
	Pounds	South Coast (Percent of Total)	Puerto Rico (Percent of Total)	Dollars	South Coast (Percent of Total)	Puerto Rico (Percent of Total)
Guanica						
1970	181,799	20.5	4.0	63,630	20.5	4.0
1971	125,785	28.2	3.2	46,540	25.9	3.2
1972	137,201	31.8	3.7	63,586	29.7	4.0
1973	150,431	27.1	4.4	84,241	27.8	5.4
1974	239,446	34.8	6.8	124,394	31.9	6.9
1975	280,279	33.7	7.0	164,812	32.7	7.1
1976[b]						
1977	342,050	29.6	6.7	234,484	30.5	6.8
1978	359,351	20.8	5.6	280,327	19.9	5.8
1979[b]						
1980[b]						
Lajas						
1970	115,868	7.3	2.5	40,554	7.2	2.6
1971[c]						
1972[c]						
1973	80,322	14.4	2.3	28,946	9.5	1.9
1974	142,545	20.7	4.0	64,081	16.4	3.6
1975	185,194	22.2	4.6	95,506	19.0	4.1
1976[b]						
1977	162,964	14.1	3.2	104,093	13.5	3.0
1978	207,008	12.0	3.2	147,403	10.5	3.1
1979[b]						
1980[b]						

Source: Dept. of Agric., Annual Issues and Weiler and Suarez-Caabro, 1980

[a]Data for 1970 through 1977 at 80% of actual production
Data for 1978 at 91% of actual production.

[b]Data requested but not available.

[c]Data not reported for Lajas in original source.

2. Fishermen, Gear and Boats

The number of fishermen in Lajas increased from 20 in 1970 to 50 in 1973, but then declined the following years. However, the number currently is significantly higher than in the early 1970's (Table 2). In nearly all years of reported data there has been an average of one fisherman per boat in Lajas, and therefore, the number of boats follows the same trend as the number of fishermen. In 1980, a total of 51 boats fished from Lajas ports (Figueroa, 1981). This implies a record number of fishermen in Lajas in 1980 at approximately 51.

The number of fishermen in Guanica also increased considerably during the 1970's, going from a low of 37 in 1971 to a high of 87 by 1974 and since then remaining relatively stable (Table 2). The number of boats has also increased; since 1971 there has been an apparent increase in number of fishermen per boat. In 1978, there were 86 fishermen reported with 64 boats for an average of 1.3 fishermen per boat. In 1980, a total of 61 boats was reported (Figueroa, 1981) which suggests 79 fishermen if 1.3 fishermen continue to fish per boat.

Puerto Rican fishermen are currently using two basic types of boats. In addition to traditional wooden boats of local construction, a few stock design fiberglass vessels have been financed at low interest rates by various government agencies in their efforts to upgrade fishing efficiency.

The most prevalent type is the "yola" with an outboard motor. The name is Spanish for yawl, but it is, in fact, patterned after the long boats used by sailing ships. It is of a rather graceful design, well-built of local woods, and relatively seaworthy at the upper end of their size range (5-7 m). The outboard motors are of various sizes, but the 25 h.p. is the average. Larger versions, decked over at the bow, have a mast step, and may carry an auxiliary sail, but they are otherwise open and without mechanical aids to fishing. Yolas are principally used to haul fish pots. Under ideal conditions, yolas can be found far offshore at the shelf break where they have been rigged for deep-water fishing, but their range in this regard is obviously limited.

Pots (wirefish traps) are the predominant type of gear used in both municipalities. The number of pots fished increased from the early 1970's to the mid 1970's for both municipalities but then declined for several years (Table 2). However, preliminary estimates for 1980 suggest the total number of pots at record levels. In Lajas, a record of 814 pots were reported while a near record of 711 were reported for Guanica in 1980. Handlines, troll lines, beach seines and gill nets are also used. Most fishermen make their nets or get them from local residents.

The size of fishing units appears to be getting smaller. The number of pots fished per fisherman has declined for both municipalities. Other individual types of gear are not reported by municipality. However, a comparison of total value of landings (Table 1) with number of fishermen (Table 2) shows value of landings per fisherman (gross income) to have increased. In 1970, Lajas fishermen averaged $2,027 in annual value of landings while during the 1977-78 period an average of $3,044 was recorded. In Guanica, gross earnings increased from $1,405 per fisherman in the 1970-71 period to $3,258 during the 1977-1978 period.

TABLE 2 FISHERMEN, BOATS, AND FISHING GEAR IN LAJAS AND GUANICA MUNICIPALITIES, 1970-1980[a]

Municipality/ Year	Fishermen	Boats	Gear Units		
			Pots	Other	Total
Guanica					
1970	41	42	433	126	559
1971	37	38	260	120	380
1972	47	39	296	145	441
1973	76	68	713	365	1,078
1974	87	61	486	191	677
1975	82	60	751	18	769
1976[b]					
1977	72	58	529	152	681
1978	86	64	559	136	695
1979[b]					
1980[b]		61	711		
Lajas					
1970	20	20	376	60	436
1971	21	21	381	65	446
1972	21	21	406	65	471
1973	50	50	808	171	979
1974	44	44	557	183	740
1975	32	32	512	70	582
1976[b]					
1977	37	34	460	98	558
1978	45	44	551	163	714
1979[b]					
1980[b]		51	814		

Source: Dept. of Agric., Annual Issues, Weiler and Suarez-Caabro, 1980 and personal communications for 1980 data.

[a]Data for 1970 through 1977 at 80% of actual production. Data for 1978 at 91% of actual production.

[b]Data requested but not available. Data shown for 1980 are preliminary and based on personal communication from Jose Figueroa.

A cost-production study in Puerto Rico (Argrall, 1975) provides some additional indication of fishing characteristics of fishermen fishing near the La Parguera site. Average boat size of a sample of fishermen fishing in the Guanica area was 16.3 feet in length with an average horse power of 10.4. These fishermen however, were above average for the municipality considering they owned an average of 25.4 pots each. They fished an average of 112 pot days per year, earning a net revenue from trap fishing of $1,548 per year.

Major Fisheries

Published statistics by municipalities do not identify species or specific fisheries. During exploratory fishing activities (Juhl, 1975) spiny lobster, grey snapper, nassau grouper, red hind, queen triggerfish, parrotfish and grunt were caught in the La Parguera area. Grunts and groupers were the primary species landed in Lajas in 1980 (Figueroa, 1981). In Guanica, grunts and snappers were reported to be the primary species.

A review of landings by species for the south coast of Puerto Rico for 1977 and 1978 shows species indicated for the La Parguera area are generally the most important for the total coast (Table 3). Grunts and groupers and all snappers, as a group, are the leading species landed in terms of volume. Spiny lobster was the most important species on the south coast, in terms of value, with an average annual value of $267,000 during the 1977-1978 period.

TABLE 3 CATCH BY SPECIES ON SOUTH COAST OF PUERTO RICO, 1977-1978

Species	1977[a]		1978[b]		Average	
	Pounds	Dollars	Pounds	Dollars	Pounds	Dollars
Tuna	3	2	5	3	4	3
Ballyhoo	33	15	28	15	31	15
Grunt	263	109	290	152	277	131
Hogfish	9	6	19	14	14	10
Trunkfish	16	8	18	11	17	10
Dolphin	6	4	19	12	13	8
Squirrelfish	14	7	29	9	22	8
Mullet	21	11	33	18	27	15
Jack	7	4	5	3	6	4
Parrotfish	44	19	45	17	45	18
Blue Marlin	1	(1)	(1)	(1)		
Grouper	173	95	237	149	205	122
Mojarra	1	1	2	2	2	1
Snappers:						
Lane	45	30	197	143	121	86
Yellowtail	27	16	53	38	40	27
Silk	73	54	97	99	85	77
Mutton	16	10	52	37	34	24
Others	12	7	23	15	17	11
Triggerfish	34	18	28	12	31	15
Barracuda	13	9	16	10	15	10
Porgy	11	5	10	7	11	6
Snook	7	4	14	8	10	6
Goatfish	60	27	79	49	70	38
Sardine	(1)	(1)	(1)	(1)		
Mackerel	73	45	114	76	94	61
Other	24	11	31	20	27	16
Total Fish	986	517	1,444	918	1,215	718
Conch	67	57	115	115	91	86
Crab	(1)	(1)	2	6	1	3
Lobster	93	184	148	350	121	267
Oysters	(1)	(1)	4	4	2	2
Octopus	8	8	14	15	11	12
Other	1	1	1	1	1	1
Total Shellfish	171	252	284	491	228	372
Total	1,155	767	1,728	1,409	1,442	1,088

Source: Weiter and Saurez-Caabro, 1980.
(1)Less than 500 pounds or dollars.

Totals and averages may not add due to rounding or inclusions or quantities less than 500 pounds or dollars.

[a]80% of actual production.

[b]91% of actual production.

Draft Designation Document for the La Parguera National Marine Sanctuary

Under the authority of the Marine Protection, Research and Sanctuaries Act of 1972, PL-92-532, (the Act) certain waters off Puerto Rico, are hereby designated a National Marine Sanctuary for the purposes of preserving and protecting their unique and fragile ecological and recreational resources.

Article 1. Effect of Designation

The Designation of the La Parguera National Marine Sanctuary (the Sanctuary described in Article 2, establishes the basis for cooperative management of the area by the Commonwealth of Puerto Rico (Commonwealth) and the National Oceanic and Atmospheric Administration (NOAA).

Within the area designated as the Sanctuary described in Article 2, the Act authorizes the promulgation of such regulations as are reasonable and necessary to protect the values of the Sanctuary.

NOAA has determined that certain existing Commonwealth natural resource regulations are adequate to protect the values of the Sanctuary. Therefore, this Designation authorizes NOAA to adopt these regulations as set forth in Article 5 and to issue additional regulations only with the consent of the Commonwealth or in the event that an activity is found not to be subject to the jurisdiction of the Commonwealth.

Article 2. Description of the Area

The Sanctuary consists of 68.27 square nautical miles off the southwest coast of Puerto Rico. The precise boundaries are defined by regulation.

Article 3. Characteristics of the Area Which Give it Particular Value

The Sanctuary contains hundreds of species of marine organisms, including Caribbean corals, hawksbill and leatherback turtles, significant mangrove stands, and diverse tropical fauna and floral communities. The area provides exceptional recreational experiences and unique scientific value as an ecological, recreational, and esthetic resource.

Article 4. Scope of Regulation

Section 1. Activities Subject to Regulation. In order to protect distinctive values of the Sanctuary, activities may be regulated within the Sanctuary to the extent necessary to ensure the protection and preservation of the coral and other marine values of the area.

Section 2. Consistency with International Law. The regulations governing the activities listed in Section 1 of this Article will be applied to foreign flag vessels and non-citizens of the United States only to the extent consistent with recognized principles of International Law or as otherwise authorized by international agreement.

Article 5. Relation to Other Regulatory Programs

Section 1. Puerto Rico Program. (a) The Commonwealth regulations described in Article 1 effectively protect the resources of the Sanctuary and shall constitute the primary regulatory regime for it. NOAA may adopt the Commonwealth regulations under the following conditions:

(1) No alteration or modification of any Sanctuary regulation shall become effective without the written concurrence of both the Commonwealth and NOAA; and

(2) The Commonwealth shall be responsible for enforcing all the Sanctuary regulations to ensure protection for the values of the Sanctuary. NOAA will engage in enforcement activities only if requested by the Commonwealth if there has been a significant failure to provide adequate enforcement as determined under this Section.

(b) Where the Commonwealth shall propose any alteration or modification of the regulations described in Article 1, such alteration or modification shall be submitted to NOAA for agreement and simultaneous proposal in the Federal Register. Such alteration or modification shall be finally adopted unless, based on the comments received on the Federal Register proposal and after consultation with the Commonwealth, NOAA determines that the regulations with the proposed amendments do not provide reasonable and necessary protection for the values of the Sanctuary.

(c) Should NOAA preliminarily determine that there has been significant failure to provide adequate enforcement, it shall notify the Commonwealth of this deficiency and suggest appropriate remedial action. If, after consultation, NOAA and the Commonwealth are unable to agree either that a deficiency exists or on an appropriate remedial action, NOAA may issue a final determination in writing specifying the deficiency and the appropriate action together with the reasons therefore. No less than 60 days prior to issuing a final determination that calls for NOAA to take enforcement action, NOAA shall submit the proposed determination to the Governor of Puerto Rico. If the Governor finds that NOAA enforcement is unnecessary to protect the values of the Sanctuary, the Governor shall inform NOAA of his objections within thirty (30) days after the receipt of the proposed determinations and NOAA shall give such finding presumptive weight in making its final determination.

Section 2. Defense Activities. The regulation of those activities listed in Article 4 shall not prohibit any activity conducted by the Department of Defense that is essential for national defense or because of emergency. Such activities shall be conducted consistently with such regulations to the maximum extent practicable. All other activities of the Department of Defense are subject to Article 4.

Article 6. Alterations to this Designation

This Designation can be altered only in accordance with the same procedures by which it has been made, including public hearings, consultation with interested Federal and Commonwealth agencies, and approval by the Governor of Puerto Rico and by the President of the United States.

Article 7. Funding

In the event that a reduction in the funds available to administer the Sanctuary necessitates a reduction in the level of enforcement provided by the Commonwealth, the resulting reduced level of enforcement shall not, by itself, constitute a basis for finding deficiency under Article 5, Section 1.

(End of Designation)

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