CRITICAL COASTAL WILDLIFE AREAS OF PUERTO RICO

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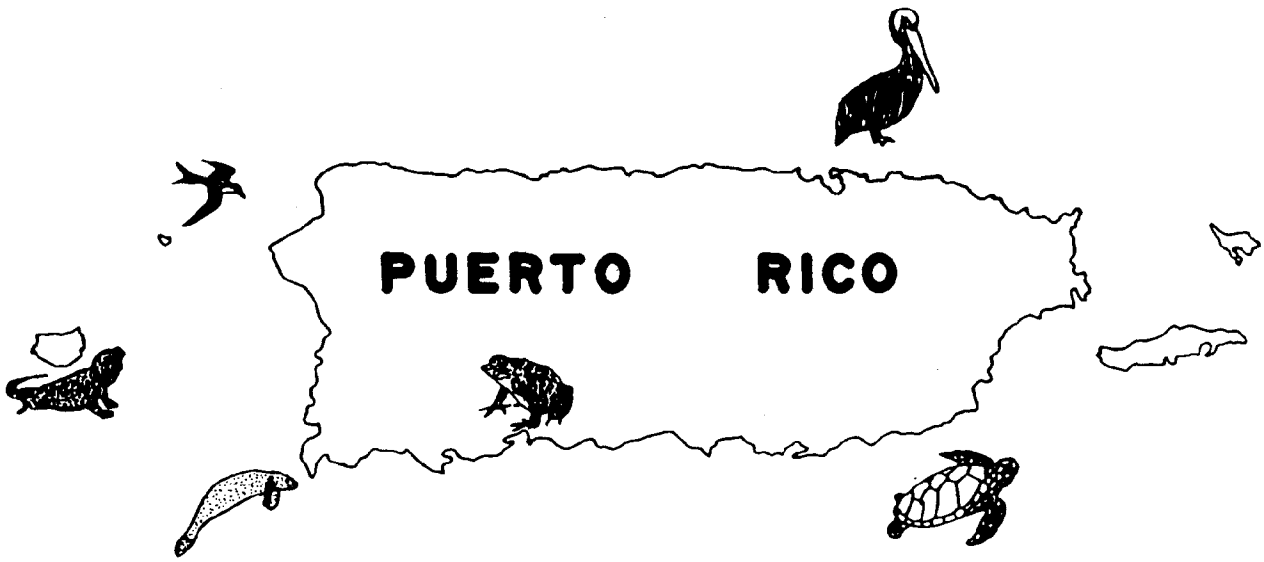

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INTRODUCTION

This document is the result of a two year effort to revise the status of those areas found in the coastal zone of Puerto Rico and its satellite islands that were included in the report "Critical Wildlife Areas of Puerto Rico" (Department of Natural Resources 1979). A supplement to that document (Moreno and Pérez 1980) added eighteen other areas of which eight were considered for this revision. Seventy-four areas are discussed in this document. For the purposes of this document coastal critical wildlife areas are those that support or serve as a refuge for endangered, threatened, rare game and non-game species and are at least partially located up to one kilometer inland from the coastline. Exceptions to the distance rule were made if an area was located not far from this limit and supported critically threatened or endangered fauna usually associated with coastal habitats such as Cartagena and Guánica lagoons.

The main purpose in updating the status of these areas was to assess changes in habitat quality and to incorporate information on wildlife use that has become available after the publication of the 1979 document and 1980 supplement. Regarding habitat quality we were particularly interested in documenting the degree of encroachment by urbanization or other types of development, degradation, wildlife use and changes in vegetation and size of important habitats. A consideration of our findings is found in the discussion.

This study focused on areas supporting critically threatened or endangered wildlife species and those associated with wetlands and marine or aquatic habitats. These species often are of limited distribution or depend on habitats of narrowly defined physical characteristics for breeding, feeding, and other maintenance activities. As in the 1979 document, we focused on areas of unique features. For example, endangered sea turtles and the West Indian Manatee occur throughout all coastal waters in Puerto Rico, but classifying the entire coastline as critical would be impractical.

Wildlife considered in this document includes reptiles, amphibians, birds, and coastal mammals. However, birds are emphasized throughout the text. Even though several endangered

whale species occur around Puerto Rico, these are excluded from consideration. The West Indian Manatee, endangered throughout its entire range, is the only mammal considered in detail. The emphasis on this set of taxa is similar to that of the 1979 document.

Species considered fall under one or more of the following categories:

1- species considered endangered or threatened under the federal Endangered Species Act of 1973, as amended;

2- species considered endangered or threatened under the Regulation to Govern the Management of Threatened and Endangered Species in the Commonwealth of Puerto Rico;

3- species of importance to hunting, even if their hunting is now prohibited and they do not belong to any of the above categories;

4- aquatic, wading and shorebirds, migratory or resident, which largely depend on coastal habitats up to about one kilometer inland

Categories 1-3 are similar to those in DNR (1979). The fourth category was added for this revision. Other wildlife species are mentioned in the text to provide additional information on the faunal composition of the areas. This is particularly the case with species of limited distribution, for which data on their occurrence in the areas were not available in 1979.

In 1977 only fourteen (14) animal species occuring in the Island were considered threatened or endangered under the federal Endangered Species Act. At present (September 1988) eight bird, two amhpibian, eleven reptile, and four mammal species are Federally listed as threatened or endangered. Conversely, the preliminary Commonwealth list of endangered and threatened species of 1973 (which was never formally adopted), on which the second category above was based, contained many more animals than the currently applicable Endangered and Threatened Species Regulation promulgated by the Commonwealth of Puerto Rico in August of 1985.

Species listed as threatened or endangered under the Endangered Species Act of 1973, as amended, which occur in Puerto Rico are automatically included in the Commonwealth list. Thirteen (13) other species are covered by the local regulations, for a total of thirty-eight species under Commonwealth or Federal

protection. In addition, six gamebird species are considered rare enough that hunting them is prohibited in Puerto Rico and its satellite islands. These are the White-crowned Pigeon, three quail-doves, the Purple Gallinule and the Bahama Duck. The focus of this book is directed to these forty-three (43) species and to those that fall under category 4 listed above. Species that are Federally-listed as Endangered or Threatened are indicated by the letters (FE) or (FT), respectively, immediately following their common name. This is done at least once in the description of each area. Similarly, those included in the Commonwealth list as Endangered or Threatened are indicated by (CE) or (CT). Although this is repetitive across areas, we felt it was necessary and convenient for the use we envision for this document.

In general we did not focus on plants occurring in the areas, although a brief description of the vegetation is given. Most maps include vegetational features in some detail. However, we did emphasize the occurrence of Pterocarpus stands throughout the document, as this freshwater association is in great danger in Puerto Rico and to alert users of this document to their presence. Plants are treated in detail by the DNR Natural Heritage Program, and we urge users of this book to seek their orientation whenever necessary. Also the DNR is preparing an wetlands inventory that is in its final stages as of this writing.

Additional data have been obtained on many of the wildlife species considered in this document since 1979. Much of this information is contained in Agency reports and manuscripts. Those that we were able to obtain are referenced in the text. However, we depended more than we would have liked on personal communications with colleagues on the field of ecology, and this is acknowledged when appropriate. We urge these colleagues to make this and other relevant information on the Island's wildlife available through formal forums. Also, we did not attempt to include, except on a very few cases, references cited in the 1979 document. Readers are urged to consult that document for the older references.

We followed the 1979 document in classifying areas as of primary or secondary importance to wildlife. In updating their evaluations, we felt that some changes were warranted in view of more recent information. Some areas have been upgraded to primary status and vice-versa. In the case of Puerto Nuevo Lagoon in Vega Baja, we felt that its extreme degradation and encroachment warranted changing its status and considered it of minimal importance to wildlife. On the other hand, three new areas are described in the text. The Bellaca Creek in Quebradillas is now known to support the threatened Puerto Rican

Crested Toad. Pozo Hondo in Añasco is probably of importance for the regional movements of rare waterfowl, such as the Masked, Ruddy and West Indian Whistling ducks. These species are known to move between localities, and the availability of a network of areas, albeit small, but with adequate habitat appears to be of increasing importance (see Simberloff and Abele 1982, for example). This area is also utilized by migratory waterfowl. Palmas pond, in Arroyo, was formed after failure of draining pumps, similar to the case of the Humacao swamp. Several threatened waterfowl species, as well as species of importance to hunters occur in the area. Its inclusion occurred after two drafts of the document were completed, and we decided to place it at the end of the book. While this breaks the counterclockwise sequence of the descriptions, we felt that its importance outweighs this inconvenience.

The fifty-two maps included illustrate all 74 areas. Several threatened, endangered, or rare species, and in a few cases, species characteristic of the area, are shown by means of numbers identified in each map's legend. Wetland and mangrove vegetation, as well as Pterocarpus stands, are shown except when these were too small illustrate. Also, mangrove and wetland areas in Caño Tiburones (Map No. 9), and Punta Pozuelo and Mar Negro (map No. 33), were not shown because other relevant information, such as the location of these areas' many ponds, would have been lost. Photographs of a number of areas are also included.

A list of the common English and scientific names of all species mentioned in the text is found near the end of the document. We followed Raffaele's (1983) nomenclature for birds whenever possible, because this is a readily available reference for most of the expected users of this document. There are very few exceptions. For example, we use Green-backed Heron instead of Raffaele's Green Heron to avoid confusion with another species not occurring in the Island. Birds are listed in the order they appear in that book. In addition we use the currently accepted Peltophryne lemur instead of Bufo lemur.

DISCUSSION

This section is intended to be a brief summary of findings of the evaluations performed during this study.

Of the seventy-three areas included in this document, sixty-four (about 88 percent) contain wetlands as one of their principal components. Habitat reduction is one of the principal causes of lowered wildlife population levels. Coastal wetlands are under severe pressure for development. Industrial, recreational, agricultural and housing are some of the more common demands for development in coastal areas.

In a small island with high population density, this often results in degradation and sometimes the elimination of areas considered of importance for wildlife. Examples of this can be found in the public and private sectors. The area of Palo Seco peninsula, in Cataño, has been reduced significantly by the construction of a recreational park. At Demajagua Bay, part of the Fajardo Coastline area, construction of a large scale private marina is well underway. At Caño Tiburones, agricultural and industrial pressures compete for the use of what could be restored as the largest swamp in Puerto Rico. The small Puerto Nuevo lagoon has become degraded, probably beyond restoration, due to the widespread encroachment of housing around its margins and the resultingdischarge of sewage that led to its present condition, choked with cattails.

In revising the status of the coastal areas discussed in the 1979 document we had the opportunity to assess changes that have occurred in the span of approximately a decade. Based on field evaluations and analysis of aerial photographs we found that slightly over a third of the seventy-three areas have become degraded. Varying degrees of encroachment were evident in about half of the areas. Loss of habitat was found in one fourth of these. The Puerto Nuevo lagoon is an extreme example. The number with evident habitat loss is equally divided among areas of public and private ownership (five each). Areas with combined public and private ownership were excluded from this tally. Three out of ten such areas evidenced habitat reduction. In the Cabo Rojo salt flats, good shorebird habitat was lost with the expansion of salt production ponds.

On the other hand, the amount of habitat increased in about one tenth of the areas. For our purposes, habitat increase is an extension of one or more features utilized by wildlife beyond the limits of the 1979 document maps. For example, in the Humacao swamp area, desirable habitat (open water, wetland vegetation, etc.) is currently about twice as much compared to 1979. As a result waterfowl populations have either immigrated and colonized or increased in number. Other instances are not as extreme, but in some cases mangroves have recolonized portions of adjacent abandoned agricultural fields, such as in the Guanajibo Mangrove. This was generally the case in areas that increased in size.

The above results may not seem overly encouraging. However, the past decade has seen significant strides concerning wildlife protection. The creation of the DNR's Bureau of Reserves, Refuges and Sanctuaries has resulted in improved protection and management of many areas. Also, management officers of the DNR's Forest Area are generally more aware of wildlife issues and protection, resulting in better protection of wildlife in State

Forests. Furthermore, Federal agencies such as the Fish and Wildlife Service have become involved in research and management of a larger number of species. Several areas have been protected and designated as National Wildlife Refuges. The Department of Defense, which has a number of excellent areas under its jurisdiction, is more concerned about wildlife protection than a decade ago. A number of those areas have been set aside for conservation, such as mangrove forests in the Roosevelt Roads and Vieques naval facilities.

There is room for improvement regarding the preparation and implementation of management plans. Hopefully, there will be considerable progress in these areas over the next few years. Interagency communication and coordination is another aspect that should be improved in the future. Possibly, much of the habitat degradation documented throughout this text might have been avoided had there been better communication. Regulating and zoning authorities should be made better aware of the importance of areas critical to wildlife, so that these are preserved for the benefit of future generations.

In closing this discussion we would like to add that we made preliminary evaluations of several inland areas, and in general these had become substantially degraded relative to 1979. An update of their status is overdue.

CRITICAL COASTAL WILDLIFE AREAS

1- Torrecilla-Piñones, Vacía Talega Complex (Loiza-Carolina) M-1

This site is located east of the metropolitan area of San Juan. More than 10,000 acres in area, its vegetation is dominated by mangrove forests, but other plant communities occur, such as littoral woodland, freshwater swamp and marshes, and coconut plantations. The Piñones State Forest portion of this large and complex area was designated a Natural Reserve in 1979. Several technical documents have been prepared for this area. Information on water quality is found in Rodriguez (1981), an environmental evaluation was prepared by Palacios (1981). Details on the flora are contained in Del Llano et al. (1980). The avifauna was summarized by Perez and Ferrer (1980).

The Forest supports a diverse fauna including birds, reptiles, fish, and crabs, among others. We found four species of fiddler crabs. Reptiles are represented by several lizard species and a considerable population of the native fresh water turtle. The area is popular among fishermen, which harvest a number of species both for commerce and sport.

At least 89 bird species have been recorded from the area (Perez and Ferrer 1980). The large variety of species ocurring in the area was evident during the field evaluation of this area. It supports a large number of herons and egrets, a considerable population of the Brown Pelican (FE), terns and gulls. The Great Egret was observed nesting at Carmelita island. We also observed one individual of the Yellow-shouldered Blackbird (FE) foraging along with a number of Greater Antillean Grackles and Shiny Cowbirds. One pair of Blackbirds was later found nesting in the Forest's recreational area next to the administrative offices. The West Indian Whistling Duck (CT) and Masked Duck (CT) have been reported from the area by hunters (Perez and Ferrer 1980).

A variety of migratory birds such as Waterthrushes, Kingfishers, Ospreys, and a variety of warblers are abundant during the winter months. During one of our trips to the area we observed one Double-crested Cormorant. This species is accidental in Puerto Rico.

The construction of a bridge over the Loiza River and the widening and paving of road 187 connecting Loiza and Piñones have greatly increased vehicular traffic movement through the area. A sand dune was rebuilt by the U.S. Army Corps of Engineers to mitigate beach erosion, which intermittently occurs in a few

areas near the coast. Most of this sand dune was destroyed by heavy seas in late 1987.

Reforestation of the sand dunes and the placement of short posts to keep out off-road vehicles are some of the activities and improvements made by DNR personnel in the State Forest area. There is great pressure for development of large tracts of privately owned lands, especially in the eastern end of the Forest and the Vacía Talega sector. This has been the subject of heated debate in the Commonwealth's Legislature and represents the greatest threat to the future of this magnificent Forest, the largest remaining mangrove forest of the Island.

The area is under great pressure because of the recreational demands of a population pool of nearly one million people, residents of the San Juan metropolitan area. Current recreational demand is concentrated along the coastal segment, especially in the beaches and remnant sand dunes. This demand clashes directly with the reproductive needs of endangered sea turtles. Turtle nest searches are conducted regularly during the breeding season by Forest personnel and volunteers. This has kept poaching and accidental nest destruction to a minimum. The Leatherback (FE) sea turtle nests frequently in the area's sandy beaches. The Hawksbill sea turtle (FE) also nests in the area, although in smaller numbers.

Another major threat to the area, of more lasting and destructive consequences, is in the form of private enterprise. Upscale residential developments and hotels are being proposed for private sectors within the eastern portion of the proposed Natural Reserve of Torrecilla Alta. These projects have received the public support of the town's Mayor and a number of Loiza residents, who apparently believe the Natural Reserve is limiting that town's economic development.

A Management Plan for Boca de Cangrejos Special Planning Area is being prepared by private consultants to the Planning Board, and is due in the near future. Much of the wildlife's wellbeing within both the designated and proposed Natural Reserves will hinge upon the objectives and recommendations of this plan.

With the ongoing accelerated degradation of the Constitution Bridge mudflats, the role of the Torrecilla-Piñones complex for migrant and resident wading and shorebirds is magnified. It is a primary wildlife area.

2- Torrecilla Alta (Loiza-Carolina) M-1

This large complex of freshwater swamps and marshes is located west of the Loiza River, near its mouth, in Loiza. It is adjacent to the Torrecilla-Piñones, Vacía Talega complex. The area is composed, to a large extent, of cattails and other characteristic plants of swamps and marshes. In addition, several Pterocarpus stands are located near the center and near the base of haystack hills to the south of the area. The eastern and western margins of this area are largely surrounded by abandoned agricultural lands and pastures for cattle grazing. A portion of the area is owned by the Commonwealth's Lands Administration and the rest is privately owned.

The Torrecilla Alta area was included in the 1979 Critical Wildlife Areas primarily because of its potential for development as a waterfowl hunting area with appropriate management. It was also believed to support numbers of the West Indian Whistling Duck (CT), as well as the rare White-crowned Pigeon, whose hunting is prohibited in Puerto Rico.

During field evaluation of the area we did not observe either species. However, nearby residents informed us that the Whistling Duck can sometimes be observed at dusk, crossing over to the east of the Loiza River. Two field trips at dusk were unproductive. Portions of the area are popular pigeon and dove hunting grounds, and hunters claim White Crowned Pigeons can be observed with fair regularity. This has not been confirmed in the field by DNR personnel working on a long term research project on columbid game species (Frank Rivera, Pers. Comm.). Great Blue Herons and American Bitterns were observed in the area in the early 1980's (Barbara Cintrón, Pers. Comm.).

Some degree of encroachment is evident along the southern limit of the area. There, an increasing number of houses have been built on the southern face of the haystack hills.

Recommendations in the 1979 document regarding the blasting of potholes to promote and diversify waterfowl use of the area are still applicable and desirable. Portions of the area of little use for agriculture could be leased or otherwise obtained from the Lands Authority for that purpose. Designation of Torrecilla Alta as a Natural Reserve is highly desirable for its adequate management and protection. Torrecilla alta is a primary wildlife area.

3- Constitution Bridge Mudflats (San Juan) M-2

The Constitution Bridge mudflats are located in the eastern end of San Juan Bay, at the confluency of the Martín Peña Canal and the Puerto Nuevo River. The area is one of the richest in avifaunal diversity in the Island. Approximately 62 aquatic and 31 terrestrial species have been recorded in the area (Diaz-Marrero et al. 1983). These figures include migratory, resident, and introduced species. Mudflats in the area along the Martín Peña Canal were extremely valuable for migrating shorebirds. The 1979 document indicated that as many as 5000 birds could be seen in the mudflats in a single day. Diaz et al. (1983) should be consulted for a detailed description of the area's vegetation and fauna.

Two endangered species, the Yellow-shouldered Blackbird (FE) and the Brown Pelican (FE),occur in the area. The Roseate (FT) and Least (FT) terns have also been reported from the area. At present, ten ardeid species have been documented as breeding in the area (Diaz et al. 1983). Several of these nest near the entrance of the Martín Peña Canal.

This area is presently highly degraded due to the construction, in progress, of the Agua-Guagua mass transportation system. An artificial mudflat was constructed north of a narrow mangrove stand at the mouth of the canal as mitigation for the lost mudflats along the Martín Peña Canal.

This site, once one of the best feeding and roosting areas for marine and wading birds in particular may be on its way to disappearing due to the combined effects of this and other projects, such as the projected channelization of the Puerto Nuevo River and the expansion of the docking facilities of the San Juan harbor. Landfill operations for the placement of main electrical wire posts by the Electric Energy Authority and the Municipal Public Works Office have further reduced areas occupied by mangroves.

Other developments that have or will contribute to further degradation of the area include the New Center of San Juan City and the Central Park on opposite extremes of the area. The latter was built for the Pan American Games of 1979. A few years after construction of the Central Park, Yellow-shouldered Blackbirds ceased to be sighted from the area. In addition, plans are well underway for the contruction of a 70 million dollar project including a marina, hotel, mall, and docking facilities capable of accomodating cruise ships in the Hoare sector of Santurce. The project will be located near the mudflat built as mitigation for the lost mudflats along the Martin Peña Canal. It will all but destroy the wildlife value of this once magnificent locality.

At the time of this evaluation, the Constitution Bridge area although extremely degraded relative to 1979, is still a primary wildlife area, but prospects for its continued existence are grim.

4- Palo Seco Peninsula (Cataño) M-3

This 30 acre peninsula located in the north-West Sector of San Juan Bay was created in 1963 with dredged sands from the bay to afford protection from wave action to the Bay View area coastline in the municipality of Cataño. During its 25 years of existence the newly created land surface has become colonized and thickly overgrown by mangroves, Australian Pine (Casuarina equisetifolia), Emajaguilla (Thespesia populnea), grasses, vines, and a variety of other plants.

Since the peninsula is chiefly made up of sand and is subject to strong currents and wave action, its shape and position is quite dynamic. Studies performed in the 1970's estimated a southward migration of its hammer shaped tip at a rate of about 50 m/yr. If that tendency were to continue, it would be a matter of a few decades for the tip to reach the coast, forming a lagoon on the shallow cove on the south side of the peninsula. Much of the wildlife value of this area depends on the attraction of seabirds and waders that forage on the shallow cove. If a lagoon is eventually formed and the dynamics and composition of fish, crustacean, and mollusc populations are significantly altered, the community of migrant and resident birds utilizing the area may also change.

Through the years, the existence of this area has been threatened by development projects that would destroy or greatly diminish its wildlife value. A large marina and tourism complex was proposed for the area in the 1970's. Dredging of the cove for yacht docking facilities probably would have destroyed the hatchery characteristics and fish abundance that attract large numbers of Brown Pelicans (FE)and other seabirds. Authorization for this project was denied by the Commonwealth Planning Board. Plans to build a wide mass transportation canal to and from Bayamon that would empty into the cove were abandoned in the mid-1980's.

These lands, formerly owned by the Commonwealth Lands Administration, are now owned and administered by the municipality of Cataño. A passive recreation facility including picnic areas, a children's park, and bicycle and jogging paths was inaugurated shortly after our field evaluation of the area in

mid-January 1987. This facility is established on the area connected to the mainland, with the bicycle and jogging path extending about two thirds of the way into the peninsula. The path ends abruptly at a drop off point, practically at sea level, where a fence separates and restricts access to the remaining portion, which has been set aside as a wilderness area. It is beyond that point that bird use is concentrated. The easily disturbed Magnificent Frigatebird as well as the Brown Pelican (FE) utilize the taller Casuarina trees as a roost, indicating that the area is relatively isolated from human activities. The pelican also roosts on red mangroves, which dominate parts of the coast facing the shallow cove. During our brief visits we also observed about four to five hundred sandpipers utilizing the north shore, where a strip of rocks of volcanic origin have been placed for erosion control.

The area near the tip has become enlarged by about two acres relative to 1979, extending towards the south. This new area has been colonized by several pioneer plant species such as the sea grape (Coccoloba uvifera), the vine Canavalia maritima, and others.

Analysis of 1977 aerial photographs reveals more open, sandy areas near the base of the tip. Also, the narrow strip joining the boot shaped tip to the basal part of the area lacked the young red mangrove-Thespesia association it now supports. Whereas in 1977 there was a fairly wide sandy strip bordering most of the peninsula, vegetation now reaches the water in many points. The already shallow cove has become significantly shallower, and a small vegetation covered islet of about one acre in area has formed near the mouth of canal, near the Catano coast.

Because of the development of the Esperanza recreation facility, which occupies more than half the area of the peninsula, and the concomitant increase in human presence, which undoubtedly has reduced foraging use of the shallow cove by waterbirds, we conclude that this area is degraded in quality and reduced in size relative to 1979. However, it remains a primary wildlife area.

5- Buchanan Haystack Hills (Bayamón) M-4

The Buchanan haystack hills, largely located within Fort Buchanan, were included in the First Supplement to the Critical Wildlife Areas because it harbored a population of the Puerto Rican boa (FE). Moreno and Pérez (1980) stated that the boa was common in the area, and it should be considered as of primary importance.

During the field evaluation of this site we were informed by Mr. Angel Pérez, Fort Buchanan's Environmental Officer, that Boas are reported almost weekly from the backyards of adjacent urbanizations. These individuals are routinely captured and released within the haystack hills. The urbanizations abut the Fort Buchanan haystack hills on their northeastern side, and are only separated from them by a chain-link fence and a perimeter road. While there is no data available to determine whether the same individual Boas are continuously recaptured, this information suggests that the boa continues to be common in the area. Mr. Pérez also informed us that the Puerto Rican giant anole is relatively common in these haystack hills.

There is no evidence of significant changes in the area within Fort Buchanan relative to 1980. However, portions of a few haystack hills lying just outside the northeastern portion of the Fort's facilities have been mined for construction materials, resulting in habitat loss for the boa and other wildlife. Any developments considered for or around these hills should be viewed in the light of the effect these may cause upon boa abundance in the area. The Fort Buchanan haystack hills continue to be a primary critical wildlife area.

6- Fort Buchanan Pond (Bayamón) M-4

The Buchanan freshwater pond is located in the grounds of Fort Buchanan. It was included in the First Supplement to the Critical Wildlife Areas. It has an area of approximately 3.2 hectares (Molinares 1981). The primary reason for its inclusion was that at the time this was the only locality where the Ruddy Duck (CT) was regularly seen. This species is a candidate for listing under the Federal Endangered Species Act.

Although it is the property of the San Juan Cement Company, the artificial pond is surrounded by facilities of Fort Buchanan, and does not appear to be particularly isolated. However, a buffer zone of several meters has been established by Army personnel around the pond to prevent disturbance to wildlife and provide some isolation to the water body.

Molinares (1981) described the composition of the vegetation surrounding the pond and documented reproduction of Ruddy Ducks there in 1980-1981. Although only a few individuals can be seen at any given time, it is probably the only locality in metropolitan San Juan where the species breeds successfully. There are reports of freshwater turtles attacking Ruddy Duck chicks, and there was an unsuccessful attempt to remove the turtles from the pond according to Mr. Angel Pérez, Fort Buchanan's Environmental Officer.

There have been several attempts to develop the pond for recreational purposes, but so far these have been unsuccessful due to the presence of the Ruddy Duck. During the field evaluation of the site we observed Little Blue and Great Blue herons, Pied-billed Grebes, and Common Moorhen. The area is similar in conditions relative to 1979.

Even though the general impression is that Ruddy Duck populations on the Island are in a relatively better shape than in the late 1970's, the Buchanan pond remains one of the few areas where breeding of the species has been recently documented. Thus, we consider this pond as a prime critical wildlife area.

7- San Pedro Swamp (Toa Baja) M-5

The San Pedro swamp is a large fresh- and brackish- water system that is divided in two by Road 867. Most of this area is located within the Sabana Seca Naval Facility. In 1979 both the northern and southern portion of the area were regarded as of secondary importance to wildlife, primarily because both lacked open water that would make them valuable for waterfowl.

During the field evaluation of this area we were able to visit the northern portion on several occasions, by canoe and by foot. We observed a minimum of twenty-one bird species, of which only eight were land birds. Included among these 21 species were the rare Black-crowned Night Heron, and the Magnificent Frigatebird. We also observed individuals of the Great Blue, Little Blue, Tri-colored and Green-backed herons, and of the Great, Snowy and Cattle egrets. We also observed individuals of the popular game fowl, the Common Moorhen.

Crabbing for Blue Land Crabs is popular in the area, and crabbers informed us that individuals of the rare White-crowned Pigeon are sometimes seen in the area. Also, they informed us that migratory ducks occur in season in small ponds and are sought after by hunters. One of the visits coincided with the

pass of a tropical depression, when substantial portions of the northern segment were flooded or at least partially covered with water. In these temporary ponds we observed Killdeers, Semipalmated Plovers, and Greater Yellowlegs.

In a small saltflat near the southeastern end of the northern portion we observed breeding Black-necked stilts. This salt flat is near an urbanization of recent construction that constitutes the only significant encroachment on the area relative to 1979 as determined from aerial photographs. Parts of the area are leased by the U.S. Navy for cattle grazing. The vast majority of this portion is owned by the U.S. Navy, although some lands on the southeastern end appear to be privately owned. We were unable to conclusively determine ownership of this segment.

We were able to spend less time in the southern portion of San Pedro Swamp, largely located within the Sabana Seca Naval Facility proper. Here we observed the Semipalmated Plover, the Greater Yellowlegs, and the Little Blue Heron, as well as a number of terrestrial bird species. A more extensive survey would probably increase this list severalfold. The map of this portion in the 1979 document was restricted to the freshwater swamp area. We have chosen to include a portion of the well developed subtropical wet forest west of the Facility's residential area because Navy personnel informed us that the Puerto Rican boa (FE) is common in it. The Caribbean Primate Research Center maintains a large operation in this area, and several dozen squirrel monkeys are reported to have escaped to the wild. As this situation has proved problematical elsewhere in Puerto Rico, it is imperative that corrective measures be taken to capture or otherwise remove escaped individuals. The Primate Research Center has contracted personnel to trap the monkeys (Barbara Cintrón, Pers. Comm.).

In our opinion, with the reduction in area for wildlife in nearby Palo Seco Peninsula and the degradation, and possibly eventual disappearance of the Constitution Bridge Mudflats, the importance of areas such as San Pedro Swamp becomes magnified. Also, the filling for urbanization of the freshwater swamp across the Bacardí distillery facilities at Cataño has reduced the availability of this type of habitat for wildlife, especially birds.

The status of San Pedro Swamp is upgraded to primary, principally due to the degradation or disappearance of nearby similar areas.

8- Lakes and forests of Dorado Beach and Cerromar Beach Hotels (Dorado) M-6

This area is located west of the town of Dorado in the northern part of the Island. The importance of lakes in this area in terms of wildlife use is being greatly diminished due in part to human activities around them. Periodic cutting of emergent vegetation, and the use of a backhoe to remove vegetation to the bare ground around edges of the lakes for presumably aesthetic reasons around the golf courses negatively affect use of these lakes by species such as the Caribbean Coot (CT), and possibly by inmigrants such as the Double-crested Cormorant. The latter is apparently an irregular visitor to the Island, but its use of the area may be deterred by current practices. These species have not been observed using the area in recent years, during which DNR personnel conducting an ongoing waterfowl study periodically survey the area (Edward Rodriguez, Pers. Comm.).

There is great pressure for development around the area harboring one of the few remaining stands of Pterocarpus officinalis in the Island. This lowland rain forest supports the Puerto Rican boa (FE), the Puerto Rican giant anole and the uncommon White-crowned Pigeon. Although no recent censuses of the Pigeon have been performed, the area's population appears healthy.

The forest area together with a buffer zone was proposed for designation as a Natural Reserve by the DNR to the Commonwealth Planning Board. The Board withheld approval because an acquisition plan was lacking. At present, the owners are negotiating a deal with the Puerto Rico Conservation Trust that would transfer title to the latter, in exchange for permission to develop approximately 25 acres of nearby land. This deal would guarantee protection of the land where the forest is located, but the area around it would become more encroached with urbanization.

The construction of a large office complex south of route 693 and of luxury type houses near Mata Redonda lake bring about further disturbance and contribute to the degradation of the area as a whole. Inspection of aerial photographs of the area taken in January 1987 revealed heavy sedimentation of several lakes near the construction site of the office complex. The area as a whole has become relatively degraded in comparison to its pre-1979 status. In spite of the above, this complex remains an area of primary wildlife value.

9- Cibuco Swamp (Vega Baja) M-7

The Cibuco swamp is located in the northern coast of the Island, where the Cibuco River meets the ocean. This area has changed compared to 1979. Inspection of aerial photographs taken in January 1987 revealed that portions near the center, which in the 1977 aerial photograph showed dense mangrove stands, now consist of open water, dense cattails, and stands of the freshwater fern Achrosticum sp. A 1969 topographic map of the area shows similar portions occupied by vegetation other than mangrove. This might indicate that local processes, natural or man made, may promote the rapid growth of mangroves, which die again when conditions change, making these portions very dynamic. Field inspection revealed a sector of dead mangrove in the western part of the area, where the intermittent flow of a narrow canal apparently causes rapid vegetation changes, also. The Aquatic Weeds Control Division of the DNR periodically clears the Cibuco river margins from overhanging vegetation (mangrove branches) for flood prevention purposes.

Urban encroachment is occurring in the southwestern portion of the fresh water swamp. Houses are built on stilts in areas formerly occupied by the ubiquitous cattail. Drainage of these areas is accomplished by residents by digging narrow ditches along the margins of each lot. This process continues and results in reduction of the freshwater swamp area and in degradation of the remaining system, also due to direct domestic discharges.

The area remains poorly known in terms of wildlife use, although we observed White-crowned Pigeons, Yellow-crowned Night Herons, and the edible Blue Land Crab (Cardisoma guanhumi). The Cibuco swamp is considered a good hunting grounds for ducks and other waterfowl. Migrant Blue-winged Teal and the Common Snipe, as well as native Common Moorhen are secured by hunters in the area. However, we believe that waterfowl use may depend on the amount of open water available.

Designation of the area as a Natural Reserve is pending until accurate data on Cibuco's ecologic value are obtained. A technical supplement on the area will be prepared in the near future. At present, the vast majority of the area is owned by the Commonwealth's Lands Authority.

During the final field evaluation of this area we concentrated on the portion adjacent to the Cibuco River western margin, where a luxuriant and well developed fringing mangrove forest is found. Here we encountered some of the oldest and largest red mangrove trees we have ever observed. We heard Black-necked Stilts and Common Gallinules, and observed Yellow-crowned Night Herons. Cibuco Swamp is a primary wildlife area.

10- Tortuguero Lagoon, Rica Lake, and Cabo Caribe Swamp (Vega Baja) M-8

Tortuguero Lagoon is faunistically depauperate, possibly owing to its low productivity. Much of the lagoon's water comes from subterranean sources, and generally lacks the nutrient enrichment characteristic of surface waters. Tortuguero Lagoon is one of the few of its kind in Puerto Rico, possessing one of the most beautiful aquatic landscapes of the Island. It supports a uniquely diverse flora, including a number of endemic species, and many that are rare or endangered throughout their range. Many sources agree that this is due to the nature of the soils characteristic to the area.

Waterfowl species are uncommon in Tortuguero Lagoon. During field evaluation we observed that the Least Bittern and the Green-backed Heron are common. A few other species such as wintering Sora Rails are known to use the area, but have not been observed in the last few years. The Caribbean Coot (CT) has been reported from the narrow passage near the center of the lagoon, and Brown Pelicans (CE) also occur here. The rare Puerto Rican subspecies of the Short-eared Owl is occasionally observed around the forested southern shore. The Puerto Rican boa (FE) occurs in the haystack hills south of Tortuguero lagoon. Three species of sea turtles, the Leatherback (FE), the Green (FE) and the Hawksbill (FE) nest in the sandy beach north of the lagoon.

A relatively large population of Spectacled Caimans (Cayman crocodylus), probably resulting from pet releases or escapees, has become established in the Tortuguero Lagoon, as well as in Cabo Caribe Swamp and Rica Lake. The first two are connected by channels. Efforts to erradicate the cayman have been initiated with relative success by management personnel from the Bureau of Reserves, Refuges and Sanctuaries of the DNR Forest Area. Apparently, the Cabo Caribe Swamp serves as one of the most important breeding grounds for the caymans, which then move to Tortuguero Lagoon (Rolando Santos, Pers. Comm.). Additional information on fauna of the area is found in Ferrer (1979).

The Cabo Caribe Swamp is located east of Tortuguero Lagoon. Connected by channels, they are separated by road 687. The area is dominated by cattails, open water being found mainly along the canals. It is considered a prime wildlife area mainly because it supports numbers of the rare Yellow-breasted Crake (CT), and wintering Sora Rails are common. The Least Grebe (CT) also occurs in the Swamp. Hunters often secure specimens of the Common Moorhen, and migrant Blue-winged Teal and Common Snipe. Although several houses have been built right up to the Swamp margins, encroachment does not appear to have changed significantly between 1977 and 1987 on the basis of aerial

photographs. During field evaluation we observed Common Moorhens, Yellow-crowned Night Herons, and a variety of herons. The Cabo Caribe Swamp is similar in condition relative to 1979, and is still a a primary wildlife area. Cabo Caribe Swamp is presently under both private and public ownership.

Rica Lake has become highly degraded for wildlife relative to 1979. During two field evaluations we observed Green-backed herons and the Least Bittern was ubiquitous. No threatened ducks have been observed in this lake in recent years (Rolando Santos personal communication). It supports a population of the introduced Spectacled Cayman that has been estimated at four times the density found at Tortuguero Lagoon (Rolando Santos personal communication).

A natural reserve including the Tortuguero Lagoon, Cabo Caribe Swamp and Rica Lake with associated buffer zones incorporating a small Pterocarpus officinalis stand was designated in 1980, but acquisition of privately owned lands within the Reserve has not been accomplished to date. This Natural Reserve is a primary wildlife area.

11- Lake Puerto Nuevo (Vega Baja) M-8

This small lake is located north of Cabo Caribe swamp and west of Puerto Nuevo Beach. As recently as 1979 this lake was considered a significant area where rare waterfowl, including the Ruddy Duck, Purple Gallinule, and the Caribbean Coot, bred. Other resident as well as migrant waterfowl also used the area. At that time, urban encroachment was proceeding rapidly, and disturbance due to human use or presence was evident. Some open water areas remained within the lake, a necessary habitat component for the species mentioned above. It was considered a primary wildlife area.

Today, urban development virtually surrounds this small lake and no open water areas remain. It is completely covered by cattails, in part due to nutrient enrichment from effluents from the surrounding development. At present this area appears unsuitable for the species it was known to harbor. Restoration at this point appears difficult and costly. This area is extremely degraded and somewhat reduced due to land filling. Unless new information suggests otherwise, Puerto Nuevo lake should be considered of minimal importance to wildlife.

12- Tiburones Swamp (Arecibo-Barceloneta) M-9

Caño Tiburones is located east of Arecibo, in the Island's north coast. This large, mostly freshwater swamp was included in the critical wildlife areas document of 1979 primarily because of its potential for restoration as a waterfowl area. The vast majority of this area is owned by the Commonwealth's Lands Authority. Substantial portions of the area are leased for cattle grazing and pastureland. A detailed description of the area is found in Salles et al. (1983). It is probably the best game waterfowl area in the north section of Puerto Rico.

Field evaluation of this site revealed that even though water is actively pumped out for agricultural purposes and flood control, swampy areas remain. Open water sectors in the central portion of Caño Tiburones support a great variety of birds, including waterfowl, herons, sandpipers and other species. Salles et al. (1983) recorded 81 bird species in the area, including 21 migratory species. Fifteen of these are considered rare in Puerto Rico, according to Salles et al. (1983). The Masked (CT) and Ruddy (CT) ducks, and Caribbean Coot (CT) were observed in the area during that study. The rare White-crowned Pigeon was also found there, especially on button mangrove stands along the north and central canals. Jorge Moreno (Pers. Comm.) and local residents have observed small flocks of the West Indian Whistling Duck (CT). All these species, and the rare Bahama Duck were observed in the area during aerial surveys performed by DNR personnel in 1984-1986.

Caño Tiburones is a popular waterfowl hunting grounds. The area is surveyed annually during the waterfowl hunting season by DNR personnel conducting a long term waterfowl study. Before intensive draining diminished the area's attractiveness for waterfowl, hunters were able to secure a number of migratory species including Blue-winged and Green-winged Teal, Black Duck, Lesser Scaup, Ring-necked Duck, American Wigeon, Common Snipe and others (Edward Rodriguez Pers. Comm.). Native Common Moorhen were also secured with ease in the area.

At present, the Tiburones Swamp is reduced in size compared to 1979. The increased use of this area for pineapple, sugar cane, and until very recently rice, as well as an experimental industrial sewage sludge injection project (likely to increase in area to approximately 700 acres in the near future), have greatly reduced its size. Also, some sections are periodically drained or burned to promote grass growth for cattle grazing and to increase dove use for hunting purposes, further reducing or degrading the freshwater habitat. The magnitude of this reduction is unknown, but is concentrated on the northern section. Drainage has been intensified over the last few years,

as areas formerly occupied by rice fields have been largely converted to pineapple plantations, reducing wildlife use of the area.

Five hundred acres of the swamp, in an undetermined location as of this writing will be used for an aquaculture project for salt- and brackish-water shrimp. In addition, three thousand acres will be used to grow freshwater fish (Tilapia). At this moment, it is impossible to determine the effect these two developments will have on the wildlife value of the swamp, and on efforts for restoration of portions of the swamp.

In spite of this degradation the area could be restored with proper management. Guidelines for the creation of a waterfowl refuge area in the 1979 Critical Wildlife Areas document are still largely applicable and their implementation at present continues to be desirable, especially since the area is important to a number of threatened species. Caño Tiburones is primary wildlife area.

13- La Tembladera Lagoon (Arecibo) M-9

La Tembladera lagoon is located south of road 681 near Punta Las Tunas. This area was included in the First Supplement to the Critical Wildlife Areas. This small lagoon is presently under agricultural pressure. It is used as a watering place for cattle, an activity that is destroying its bordering vegetation. Also, a dirt road that passes about a hundred meters north of the lagoon will be paved and expanded. Increased disturbance in the form of vehicular traffic will affect wildlife use of this lagoon.

The lagoon supports a small population of freshwater turtles. Waterfowl observed using the lagoon include the Pied-billed Grebe, which breeds there, and the Common Moorhen and Purple Gallinule. Hunting of the latter is prohibited. Among wading birds we observed the Cattle and Common egrets. The Caribbean Coot (CT), Ruddy (CT) and Masked (CT) ducks, have been reported to occur at Tembladera by the DNR's Natural Heritage Program. Hunting occurs in the lagoon, as evidenced by spent shotgun ammunition we found in the ground.

This area should be monitored with some frequency to determine its importance to the threatened fauna reported from the lagoon. Proper management, including acquisition, may be necessary to preserve this lagoon. At present, it is of secondary importance to wildlife.

14- Carrizales Mangrove (Hatillo) M-10

Carrizales Mangrove is located east of the town of Hatillo and south of Punta Maracayo near Highway 2. The principal reason for inclusion of this small basin mangrove system among the Island's critical wildlife areas is that it formerly supported breeding populations of the West Indian Whistling Duck (CT). Unusual migrants, such as the Lesser Golden Plover and the Whimbrel, also could be observed along its muddy margins.

The central portion of this area, destroyed by filling in 1972, is now regenerating. Much of this regeneration is mangrove growth. During the field evaluation in late April 1987 we did not observe the West Indian Tree Duck, nor the Cattle Egret rookery that was also mentioned in the 1979 Critical Wildlife Areas document. We observed a variety of migratory and resident shorebirds. A storm water sewer pipe of over seven feet in diameter now discharges into the western portion. This pipe is part of the expansion of nearby highway 2. The change in water regime and deposition of sediments transported by the sewage system probably will bring about changes in the vegetation of the area.

Carrizales Mangrove is suffering encroachment from urban development around its south-east and south-central margins. Also, use by off-road vehicles is destroying the vegetation that covers sand dunes separating the area from the ocean to the north. In spite of the above mentioned regeneration, we believe the area has become degraded compared to its 1979 status. It is of secondary importance to wildlife.

15- Guajataca Cliffs (Isabela-Quebradillas-Camuy) M-11,13

This area is located in the northwestern coastal portion of Puerto Rico. The primary reason for inclusion of the Guajataca Cliffs, both east and west, among the Island's critical wildlife areas is the yearly nesting of the White-tailed Tropicbird. The species nests in cavities in cliff faces no further than a few meters away from the ocean, in both accessible and inaccessible locations. During field evaluation of the area in late February 1987 we were able to locate no fewer than thirteen (13) nests, some with chicks covered with down, and a few with feathers.

A recreational area, including a paved road and several picnic tables, was built along the sea, west of Bellaca Creek, after 1977. Cliffs along that shore, but especially west of the road, are heavily used by Tropicbirds, apparently with no ill effects from increased human disturbance. However, because

several of the cavities that are traditionally utilized are within relatively easy reach, educational signs should be posted to minimize the possibility of harrassment to the birds and their nests.

In general, the area does not appear to have changed since 1979. As far as we can determine, no significant changes have occurred in its vegetation or fauna. Other than the White-tailed Tropicbird, an undetermined species of night heron (either the Yellow-crowned or the Black-crowned) uses this area for breeding and roosting purposes. That species prefers the shadier, more vegetated higher and slopier cliffs, building sloppy nesting platforms about six to eight feet from the floor.

Although White-tailed Tropicbirds also nest to some degree in a few other localities around the Island, notably at the El Morro cliffs in Old San Juan, the Guajataca Cliffs constitute a primary wildlife area.

16- Bellaca Creek (Quebradillas) M-12

Bellaca Creek, an intermittent stream, is located on the eastern side of the town of Quebradillas in Barrio San José. The Puerto Rico Crested Toad (FT) has been reported to occur in this area according to the DNR's Natural Heritage Program. This portion of the Bellaca Creek is located approximately six miles to the east of Barrio Coto in Isabela, another important area for the toad.

The Puerto Rican boa (FE) is common in the area, according to residents. We found fecal pellets that probably belonged to this species. We observed the Puerto Rican giant anole along the banks of this well forested creek.

The creek bed is covered by mature mesic vegetation, however, the area is surrounded by pasturelands, largely denuded of mature vegetation. Also, a new residential development is being constructed upstream of the specific portion of the creek where the toad has been reported to occur. We are concerned that pluvial outflows from this development may affect habitat quality at the creek.

Along Bellaca Creek, the Crested Toad has been observed breeding in cattle drinking tanks at a dairy farm, and in small ponds in the creek. In fact it harbored the largest remaining population of the toad until the recent discovery of breeding activity at Tamarindo Lagoon in the Guánica State Forest.

We recommend that detailed studies be performed at Barrio San José to ascertain the status of the toad in the locality. Also, any possible effects to the toad's population in the area must be considered before any permits are given to proposed developments in the area. Bellaca creek is a primary wildlife area.

17- Barrio Coto (Isabela) M-13

This rural area in the town of Isabela on the Island's northwestern coast was included in the 1979 document because the Puerto Rican Crested Toad (FT) had been collected at the area in 1967. No specimens have been observed or collected in the area since 1967.

Barrio Coto is suffering from increased development, as many new houses are being built. During field evaluation of the site, we interviewed several long time residents inquiring about the threatened Puerto Rican Crested Toad. We were invariably led to specimens of the introduced toad Bufo marinus. We visited the area a few days after substantial rains had that occurred after a relatively dry period. This series of events apparently promotes the onset of a reproductive bout. Although we found a large number of tadpoles of up to about one inch in length in a shallow pond used for cattle drinking, these were later identified as belonging to other species. Not far from this pond we found a decomposing specimen of the Puerto Rican boa (FE). Residents explained that these are not uncommon in the area.

Barrio Coto is considered a primary critical wildlife area in spite of its continuing degradation, lack of recent sightings, and the recent discovery of new populations of the Puerto Rican Crested Toad. The new populations have been discovered during "outbreaks" that occur at irregular intervals, and it is possible that one may still occur at Barrio Coto.

18- Cayure (Aguada) M-14

This area was included in the Supplement to the Critical Wildlife Areas document. The area is located within the Coloso Sugarmill and is bounded on its north side by road 115. It is made up of a series of oxidation ponds operated by the sugarmill and a relatively large pond with abundant open water fringed by cattails.

Such rare waterfowl as the Masked Duck (CT) and West Indian Whistling Duck (CT), as well as the Purple Gallinule are frequently observed in the area. Eight individuals of the Whistling Duck were observed in the area by DNR personnel during an aerial census in mid-September, 1988 (Edward Rodriguez, Pers. Comm.). The Ruddy Duck (FT), a candidate for listing under the Federal Endangered Species Act, has been ocassionally observed in the area during air censuses conducted by DNR personnel in the mid 1980's.

During field evaluation of the site we observed adults and juveniles of the Masked Duck and were informed by locals that these breed commonly in the area. The West Indian Whistling Duck breeds in the area north of road 115, according to locals. We observed a few Brown Pelicans (FE) loafing in the exposed branches of a fallen tree partially submerged near the fringes of the larger pond. Common Moorhen are common in the area.

The oxidation ponds are managed for weed control and their drainage during the duck breeding season undoubtedly affects the successful rearing of young. The Commonwealth's Land Authority owns the lands encompassing the Cayure area.

It remains a prime wildlife area and integrated management to minimize breeding losses may enhance its value. Since the area is utilized by a number of waterfowl species that occur in Puerto Rico in extremely low numbers, we recommend that hunting be prohibited in this area.

19- Pozo Hondo (Añasco) M-15

Pozo Hondo is located west of Añasco's Municipal Cemetery. It is surrounded by sugarcane plantations and by pastures to the east, adjacent to residential units.

It consists of a channel with some open water bordered by cattails. We did not observe any rare or endangered species in the area. Nearby residents indicated that it is a popular hunting grounds during the waterfowl hunting season. The habitat appears ideally suited for migratory ducks and resident waterfowl such as Pied-billed Grebes, Common Moorhen. Birds such as the West Indian Tree Duck (CT), Masked Duck (CT) and Ruddy Duck (CT) occur at Cayure in a similar habitat, a relatively short distance to the north. It is possible that these species utilize Pozo Hondo as part of their regional movements. However, until more data on wildlife use are obtained the area is considered of secondary importance to wildlife.

20- Sabanetas Swamp (Mayaguez) M-16

The brackish and freshwater Sabanetas Swamp, located in the coast west of Mayaguez airport, was included in the 1979 document primarily because the West Indian Whistling Duck (CT) reportedly occurred there. Other wildlife of significance include the Caribbean Coot (CT), Common Moorhen and a number of other native and migratory bird species. A detailed study of the area's vegetational associations and fauna can be found in Villamil et al. (1981).

Four species of anoline lizards, including the Puerto Rico giant anole are found in the area. The area supports fishes and crustaceans of commercial and recreational value. The Sabanetas Swamp harbors several stands of Pterocarpus officinalis, now a rare association in the Island. The mangrove system is one of only four located on the Island's west coast.

At present the area is owned by no less than twenty-five private landowners. Even though the land is scarcely adequate for many types of development, there is great pressure in the form of multiple proposals for a variety of activities, ranging from camping areas to automobile assembly plants (Villamil et al. 1981).

The Sabanetas Swamp has been proposed as a Natural Reserve by the Departament of Natural Resources under the name Caño Boquilla. This proposal has been turned down, appealed and turned down again by the Commonwealth's Planning Board. The principal cause for rejection is a lack of an acquisition plan.

Twenty-nine bird species were recorded from the site by Villamil et al. (1981). The non-terrestrial species included the Caribbean Coot, Great Blue Heron and Great Egret, among others. The West Indian Whistling Duck was not recorded from the area.

Renewed emphasis on sugar cane plantations, which at present reach right up to the mangrove, may result in a reduction of the area, or probably will result in its degradation due to the burning of sugarcane. However, the mangrove and Pterocarpus stands remain in good condition relative to 1979, even though these have been reached by fire on several occasions (Barbara Cintrón, Pers. Comm.). Based on the rareness of Pterocarpus stands, especially in the western end of the Island, the protection of this area deserves renewed attention.

The Sabanetas Swamp remains in similar conditions compared to 1979. It is an area of secondary importance to wildlife.

21- Guanajibo Mangrove (Mayaguez) M-17

The Guanajibo mangrove area is located south of the town of Mayaguez in the western coast of the Island. There is a Pterocarpus stand in the area (Barbara Cintrón, Pers. Comm.). The principal reason for inclusion of this area in the Critical Wildlife Areas document of 1979 was its potential for development as an educational area for demonstration of ecological and conservation principles. In addition, the rare Yellow-breasted Crake (CT) could be found in the freshwater swamp that borders the mangrove.

A few of the more common species of waterfowl, such as the Common Moorhen and the Pied-billed Grebe still use, and probably breed, in the area. The Brown Pelican (FE) and the West Indian Manatee (FE) as well as the Least Grebe (CT) have been reported from the area, according to the DNR Natural Heritage Program.

Field evaluation of this area revealed that pressures along the margins of Guanajibo mangrove due to burning, filling, cattle grazing, and other activities are causing a reduction in size of this area. Away from the borders, however, mangroves appear to be in good condition.

Analysis of the 1977 and 1987 aerial photographs revealed that lots formerly used for sugarcane plantations adjacent to the area in the east are reverting to wetland with characteristic vegetation. This may be beneficial to the Yellow-breasted Crake (CT) and other freshwater bird species.

Flood control plans are contemplated by the Commonwealth's Department of Transportation and Public Works and the Department of Natural Resources. These plans would primarily benefit residents of adjacent San José and Guanajibo Homes urbanizations. Several alternatives are being considered, including channeling the Guanajibo River and Caño Corazon. If or when these plans are realized, the areas' character and vegetation may be drastically affected due to changes in its hydrologic regime. This in turn would affect wildlife use of the area.

The Guanajibo Mangrove area is similar in condition relative to 1979. If the area's character and educational potential are to be preserved, flood control plans should include provisions for maintaining some water flow into the area. Detailed study is necessary to accomplish this objective.

The Guanajibo Mangrove is a primary wildlife area.

22- Joyuda Lagoon (Cabo Rojo) M-18

The Joyuda Lagoon, of approximately 300 acres, is located in the coast west of the Town of Hormigueros. It was included in the Supplement of Critical Wildlife Areas by Moreno and Pérez (1980). The authors felt that although the lagoon lacked edge cover (probably meaning emergent vegetation such as cattails, etc.), its frequent use by the Ruddy Duck (CT) and rare Purple Gallinule justified its addition to the critical wildlife areas of the Island. The lagoon is periodically bioluminiscent, depending on variations in salinity (Carvajal-Zamora 1976).

Field evaluation of this lagoon, which took place in late March, revealed no signs of the Ruddy Duck nor the Purple Gallinule. We did observe individuals of the Laughing Gull, the Brown Pelican (FE), the Green-backed Heron and migrant Belted Kingfisher. Detailed information on fauna, flora, vegetation, physical parameters, and other aspects of the lagoon are contained in a report by Pérez-Ramirez et al. (1981).

In recent years the mangrove that borders Joyuda Lagoon in the west side near road 102 has been subjected to encroachment, principally by cutting and filling to build small urban developments and parking lots to accommodate the growing clientele of local restaurants. As a result this mangrove sector has been reduced in area. Analysis of the 1977 and 1987 aerial photographs reveal that the condition of the remainder of the narrow mangrove strip that borders the lagoon has not changed.

Increased agricultural use of the hills to the east, including cattle grazing, may result in further nutrient enrichment of the lagoon, which may serve to promote the development of emergent fringing vegetation, subject to salinity and depth tolerance constraints.

The Joyudas lagoon was designated a Natural Reserve in 1980. The reserve includes only the water and a narrow strip surrounding it. The area is slightly degraded relative to 1979. It is of secondary importance to wildlife.

23- Cuevas Lagoon (Cabo Rojo) M-19

Located in the southwestern part of the Island near roads 103 and 311, the Cueva Lagoon is used principally for cattle grazing. Edward Rodriguez, of the DNR's Research Area, periodically performs aerial censuses that include this area. He reports that the Ruddy Duck (CT) and migrant Blue-winged Teal are relatively common in the area in winter. The Ruddy Duck is a candidate for listing under the Federal Endangered Species Act. We did not observe these species during two field evaluations of this area that occurred about one month apart in late winter. Nearby residents, however, reported that the area is hunted intensively, especially near road 103. Water levels vary greatly, and the surrounding areas become inundated during heavy rains.

The area had been included in the 1979 Critical Wildlife Areas Document because it had been reported as formerly supporting the West Indian Whistling Duck (CT). We believe the area currently lacks adequate habitat for this species, although they may use it occasionally as part of their regional movements. Small numbers of the Whistling Duck, the Ruddy (as many as 30 individuals) and the Bahama duck were observed using Cueva Lagoon at irregular intervals during periodic aerial censuses performed by DNR personnel in 1984-1986. We observed migrant Spotted Sandpipers, native Killdeers, the Green-backed and Little Blue herons, Cattle and Great egrets and Common Moorhen.

The area is of some importance to migrant and resident threatened waterfowl. The status of this area is upgraded to primary.

24- Guaniquilla Lagoons (Cabo Rojo) M-20

This area is located in the north-west tip of Boquerón Bay. These small lagoons are owned by the Corporation for the Development of the Marine, Lacustrine, and Fluvial Resources of Purto Rico (CODREMAR) a public corporation attached to the DNR, and are currently administered by the Puerto Rico Conservation Trust. This results in restricted access to the general public and reduced disturbance to wildlife. The lagoons dry seasonally, and during our field evaluation only the westernmost one had a few inches of water in it. Areas surrounding the lagoons are used for cattle grazing and there were cattle tracks in the dry beds of two of these lagoons.

A strip of mangroves between the southernmost lagoon and Boquerón Bay serves as a roost to about one hundred Brown Pelicans (FE). We heard Clapper Rails and observed migrant

Northern Parula Warblers in this stand. The White-winged Dove was observed nesting on mangroves. The more secluded westernmost lagoon, which is surrounded by more developed vegetation has impressive rock formations in and around it. This lagoon supports and serves as a refuge for a variety of shore and marine birds. These include the easily disturbed Frigate Bird, Brown Pelicans, Black-necked Stilts, Tricolored, Little Blue and Great Blue herons, Snowy egrets, Wilson Plover, and migrant Black-bellied Plovers and Greater Yellowlegs, among others. Surrounding areas support the endemic Puerto Rican Tody.

During aerial censuses of waterfowl performed during 1984-1986 by DNR and USFWS personnel the following species were occasionally detected at Guaniquilla: the rare Bahama and Ruddy (CT) ducks (the latter is a candidate for listing under the Federal Endangered Species Act), migrant Blue-winged Teal, Common Moorhen, Pied-Billed Grebe and an undetermined coot species.

We found spent shotgun ammunition on the ground, proof that in spite of the protection afforded by signs and fences, unscrupulous hunters occasionally use these areas. The area should be patrolled regularly, especially during the waterfowl hunting season.

Cattle should be removed from this area. The status of the Guaniquilla lagoons is upgraded to primary, as several threatened or endangered species use the area occasionally or permanently.

25- Boquerón Refuge (Cabo Rojo) M-21

Located east of Boquerón Bay, the Boquerón Refuge was designed as a mitigation measure due to the draining of the Guánica and Anegado Lagoons and the extensive reduction in area of the Cartagena Lagoon as a result of the agricultural development of the Lajas Valley plan. It may perhaps be more appropriately called a hunting reserve as this was the primary reason for its creation. It is owned by the Commonwealth Department of Natural Resources.

More than a hundred and seventy bird species use the Refuge as breeding or wintering grounds. Brown Pelicans (FE), Yellow-shouldered Blackbirds (FE), and migrant Peregrine Falcons (FE) use the area. There are plans to build nest boxes for the Blackbird to encourage its nesting in the area. The Ruddy Duck (CT), Caribbean Coot (CT) and Least Grebe (CT) breed in the area, as does the rare Yellow-breasted Crake (CT).

There has been much progress in the management of this refuge since the writing of the 1979 Critical Wildlife Areas document. In terms of personnel, there are presently one refuge manager and three assistants. This personnel is administered by the DNR's Bureau of Reserves, Refuges and Sanctuaries. The Refuge is used each season by close to a thousand hunters seeking migrant ducks and Common Moorhens. However, a large proportion of the use and much of the take is harvested during the first few weeks of each season.

Boquerón Refuge is not without problems. The Boquerón area in general is under heavy pressure for development. The Montecarlo Estates urbanization project directly abuts the Refuge. In fact, recently uncovered evidence on habitat use of mixed foraging flocks of Yellow-shouldered Blackbirds (FE), Shiny Cowbirds and Greater Antillean Grackles revealed that a substantial amount of critical habitat (open mesquite with grassy ground cover) of the Yellow-shouldered Blackbird was destroyed by this urbanization (Paul McKenzie, Pers. Comm.). This habitat type is extremely important for the Blackbird, especially during the rainy season of August-December, when the birds feed extensively on caterpillars that feed on the grasses. The Cabo Rojo municipal garbage dump, which reached its design capacity in 1978, is also adjacent to the Refuge, and the community of Villa Isabel, to the north of the Refuge, is still increasing in density if not in size.

It is in the southeast corner of the refuge that one hundred acres of cattails are concentrated. This is fully one fifth of the Refuge's area, and is one of the manager's problems in terms of open water availability. Also, as mangroves recolonize the Refuge, there has been a net reduction in open water since the dikes and pumps have been operational.

Plans for the near future call for the construction of an observation tower and two boat docks for educational purposes and a third one for hunter use. Blasting potholes and cattail control measures would improve waterfowl habitat quality in the Refuge.

The Boquerón Refuge is one of the best among the Island's Primary Critical Wildlife Areas.

26- Cabo Rojo Saltflats and Cliffs (Cabo Rojo) M-22

Located in the southwestern tip of Puerto Rico, the Cabo Rojo Saltflats are in all likelihood Puerto Rico's most important site for migratory shorebirds. These also support the Island's only known breeding population of the Snowy Plover (CT). During the summer of 1988 the population of this species in this area was estimated at less than fifty individuals (Gloria Lee-Navas, Pers. Comm.). Migrant Piping Plovers (CT) and endemic Yellow-shouldered Blackbirds (FE), as well as Least Terns (CT) use the area. Three nesting colonies of the Least Tern were found in the area in 1988: however, the largest had only about fourteen nests (Gloria Lee Navas, Pers. Comm.). In the mid-1980's a small flock of American Flamingoes were regularly observed in this area. The species is presently extirpated from Puerto Rico and now occur only as accidental visitors.

The saltflats are under great pressure for development. At least three projects that would probably degrade, or even destroy, parts of the saltflats include a trailer park, an aquaculture industry (saltwater shrimp), and the expansion of an existing salt-evaporation business. All three have sought (and been so far denied) permits to operate on the area. Another problem facing the saltflats and cliffs is the ever expanding use of offroad vehicles. This has been kept in check by DNR by installing stumps that either block entire areas (near the lighthouse) or restrict the vehicles to designated roads. Lands adjacent to the area can be expected to continue under heavy pressure for resort and residential development.

The importance of the area is internationally recognized. The Society for the Study of Caribbean Ornithology has the conservation of these saltflats as one of the top priorities of its agenda. No appreciable degradation of the area has occurred since 1979 based on the analysis of aerial photographs and field evaluation. The Cabo Rojo Saltflats and Cliffs continue to be a primary critical wildlife area.

27- Cartagena Lagoon (Lajas) M-23

Cartagena Lagoon is located in the Lajas Valley floodplain north of the Sierra Bermeja mountain range, in Puerto Rico's southwestern coast. This area was included in the 1979 document of critical wildlife areas primarily because of its historic importance for wildlife. More than half of Puerto Rico's bird species have been recorded at one time or another from the area and the adjacent Sierra Bermeja. Historically, this lagoon was said to have supported perhaps more ducks than the entire Island presently does.

The Lagoon suffered rapid deterioration following the agricultural development of the Lajas Valley in the 1950's and the conversion of the area from a polyculture to one of almost exclusive culture of sugarcane. The deterioration was partly due to excessive nutrient enrichment from agricultural fertilizers and from the Lajas sewage treatment plant, and the diversion, for irrigation purposes, of freshwater that would have reached the Lagoon. This resulted in lowered water levels. These two factors combined to promote the development of a dense emergent vegetation dominated by cattails and floating water hyacinths that further reduced the area occupied by open water.

A few of the important species supported by the Lagoon include the Glossy Ibis, which during recent times is observed only some years while it is not observed at all in others. The rare Yellow-breasted Crake (CT), Caribbean Coot (CT), and Least Grebe (CT) occur at Cartagena. The Ruddy Duck (CT) and the West Indian Whistling Duck (CT), as well as the rare Bahama Duck also have been reported from the lagoon. A variety of migratory waterfowl of importance for hunters also occur at Cartagena. Peregrine Falcons winter in the area. In addition, in the winter of 1986 a hunter accidentally shot and secured a specimen of the Spiny Jacana, a species known from the Island only from one record dating to before 1878. The relatively rare Purple Gallinule, as well as the abundant Common Moorhen is also found in the lagoon.

The Cartagena Lagoon may now be more appropriately called a swamp, as confirmed by our field evaluation of the site and analysis of aerial photographs. It has become degraded even beyond its badly deteriorated state described in the 1979 document. Open water areas are minimal, and the area's importance as a hunting ground has declined even when compared to 10 to 15 years ago. It is currently of little use to many of the species the area was known for.

The 1979 document contains both general and specific guidelines to accomplish restoration of Cartagena Lagoon. A more complete assessment and specific recommendations are contained in a technical supplement document prepared for the proposed designation of Cartagena Lagoon as a Natural Reserve by Toro and Chabert (1986) of the DNR's Technical Assessment Division. That document also contains a detailed historic background of the Lagoon's former status and presently deteriorated state. It is unnecessary to repeat those recommendations here, but they are fully applicable.

Most experts concur that the two principal factors affecting this prime wildlife locality are the pressure for agricultural use in and around the Lagoon (including cattle grazing) and the fact that the area is owned by several private parties.

In a recent development, the Commonwealth of Puerto Rico Government will buy the land encompassing the Lagoon from the private owners and then will lease it to the U.S. Fish and Wildlife Service in a long term agreement. The latter agency will restore and manage it as a National Wildlife Refuge. At the time of this writing the Commonwealth's Land Administration is finalizing the purchase of the area.

The outlook for Cartagena Lagoon appears bright. In this case, unlike the case of Puerto Nuevo Lagoon in the north of the Island, even though restoration is difficult and costly it could be very fruitful. Cartagena Lagoon is much larger and is not as encroached upon by urbanization as Puerto Nuevo Lagoon. In spite of its presently degraded condition Cartagena Lagoon is a primary wildlife area.

28- La Parguera (Lajas) M-24

Located in southwestern Puerto Rico, the critical wildlife area of La Parguera is largely made up of coastal mangrove forests, islets and cays. Coral reefs in the area are among the most developed in the Island. In some areas saltflats in the landward side of the mangroves are utilized by migratory and resident waterbirds. La Parguera was designated a Natural Reserve in 1979.

The area has extensive shallows dominated by Turtlegrass (Thalassia testudinum) that are used by the West Indian Manatee (FE) and the Hawksbill sea turtle (FE). The largest breeding colony of the Brown Pelican (FE) on the main Island of Puerto Rico is found in a mangrove islet near the eastern end of La Parguera at Bahia Montalva. A total of 56 nests were documented in the early 1980's by Jaime Collazo. The area also harbors a large part of what has been determined critical habitat for the Yellow-shouldered Blackbird (FE). Roosts of the latter are concentrated on mangrove islets near the western end of the area.

The 1979 document did not include a map defining the area included in this critical wildlife area. Furthermore, no description was included in the written portion. For the purposes of this evaluation it is convenient to define the area as that included in the Natural Reserve as amended in 1986. This emcompasses the area between Punta Jorobado in the east and Punta Pitahaya in the west.

La Parguera's tranquil waters, bioluminescent bay, and luxuriant coral reefs attract thousands of visitors, and boating is a popular pastime. This has prompted the establishment of an

increasing number of tourist oriented stores and restaurants. In addition, a large number of house-boats and floating and stilt-houses have been all but permanently set up in the shore to the detriment of the mangrove forest, and serve as week-end or permanent residences (Encarnación and Fuentes 1988). Waste waters of these structures are largely discharged directly to the sea resulting in water pollution. The structures also make their immediate surroundings less desirable for wildlife sensitive to disturbance such as herons, egrets and others. Fortunately these structures are concentrated around the La Parguera village, and extensive areas of coastal mangrove remain for wildlife use. The DNR is actively dealing with the problem of these structures within the Natural Reserve.

Recreational, residential, touristic and other developmental demands on the area are tremendous, even when compared to 1979. The La Parguera area was included in the Special Planning Area of the south-west in Puerto Rico's Coastal Zone Management Program to deal with these and other problems.

A Management Office has been recently established at La Parguera that is developing programs related to education on rules, regulations, and conservation practices in addition to its management functions. This office will implement actions to reach the objectives contained on a management plan prepared for the area (Encarnación and Fuentes 1988). The management plan has been submitted to the Commonwealth's Planning Board for approval. The Ranger Corps has established a Ranger Station and are in charge of enforcement and surveillance.

A total of about 60 mangrove islets and cays are found in this Natural Reserve. The island of Magueyes harbors the facilities of the Marine Science School of the University of Puerto Rico and appears to be of no major significance to wildlife. However, we observed small numbers of Yellow-shouldered Blackbirds using mangroves off this island. The islet of Mata de la Gata has been developed as a recreational area by the DNR. Many of the islets serve as occasional roosting areas for the Brown Pelican and other species.

A primate research center with free ranging Rhesus and Patas monkeys ceased operations in Cuevas and Guayacan Islands. Some of these monkeys escaped, reached the coast, and became established. Troops of these monkeys have been observed as far west as the Sierra Bermeja and the Lajas Valley, where they are causing some agricultural damage. The detrimental effect of monkeys on wildlife such as birds has been reported by DNR personnel working with the Yellow-shouldered Blackbird. We recommend that efforts be intensified to erradicate these monkeys.

During the field evaluation of the area we were not able to visit all islets due to transportation limitations. However, all appear in healthy condition. A total of 66 bird species were documented for the area by Diaz et al. (1983). Of this total, 39 were resident species and 27 were migrants.

We observed a minimum of 30 Yellow-shouldered Blackbirds crossing over to mangrove islets off Punta Pitahaya. DNR personnel conducting a Shiny Cowbird control program at Boquerón regularly monitor this roost. The importance of non-mangrove habitats for the Yellow-shouldered Blackbird has been recognized for some time now. This species uses Black Olive trees (Bucida buceras) and a variety of palm trees as well as cavities of dead mangrove trees for nesting. More recently, the importance of open mesquite with grassy ground cover has been found to be important to the species, especially during the rainy season of August-December, when they feed on caterpillars found in the grass (Paul McKenzie, Pers. Comm.). Any actions potentially affecting these habitat types must be reviewed in light of this information.

We observed three West Indian Manatees east of the Playa Rosada Beach recreational area. No estimates of the population of this species in the area are available, but from results of aerial censuses performed in 1984-1985 by Rathbun et al. (1985) we estimate a total of 15-20 individuals in the area west to the Cabo Rojo lighthouse.

Several fishermen perceive an increase in sea turtle numbers in the area, but there is no data base to assess if this is true.

We recommend that regular censuses be performed by personnel of the La Parguera Management Office to document trends in numbers of the endangered species that are found in this Natural Reserve.

Perhaps the most important change in the status of this critical wildlife area relative to 1979 is the wholesale deforestation of the limestone hills that bound the Natural Reserve to the north. A large portion of these privately owned hills has been divided into lots, so that further encroachment is to be expected in the near future. One can only speculate on the magnitude of the effect that superficial runoff and erosion might have on the Turtlegrass meadows during heavy rains occuring while these residential developments are being built, or before the vegetation has had a chance to recover.

In summary, there has been substantial progress in terms of administration and protection of the wildlife resources of the area since 1979. However, the area has become somewhat degraded when compared to 1979, primarily due to the ever increasing encroachment in the area surrounding La Parguera Natural Reserve. It is a primary critical wildlife area.

29- Guánica State Forest-West (Guánica) M-25

This area is separated from the rest of the Forest by Guanica Bay. Improvements have been accomplished in terms of emphazised management by a DNR Management Officer. Increased pressures will probably result from the establishment, in progress, of recreational facilities in Manglillo Beach. On the other hand, proponents for the development of the recreational areas argue that this action will result in a more organized and controlled use of the locality. In turn, this should result in reduced disturbance to wildlife that use the Guánica Forest's western portion.

Beaches in this area have been used for nesting by the Green sea turtle (FE). The West Indian Manatee (FE) has been observed in the area, as reported by residents and during aerial censuses performed by DNR personnel in 1978 and Rathbun et al. (1985). The area may possibly support a number of Yellow-shouldered Blackbird (FE), since these have been observed in the eastern portion of the Forest, across Guánica Bay. Birds observed there with all likelihood come from populations to the west of the Forest. Migrant ducks are frequently observed in the adjacent Providencia and La Jungla salt flats, just outside the Forest's western boundary.

Encroachment in this area is presently very low. However, several projects including Marinas and hotel complexes have been proposed around the area (Miguel Canals., Pers. Comm.). We conclude that this area is in similar condition relative to 1979. Caution should be exercised so that the area's fauna is not adversely affected by the development of coastal areas in the zone.

The status of Guánica State Forest-West is upgraded to primary because it provides habitat to two (probably three) of the Island's endangered species.

30- Guánica-Lagoon (Guánica) M-26

This area is located in the Lajas Valley, north of the town of Guánica. Guánica Lagoon was one of the Island's prime waterbird habitats until it was drained for agricultural purposes in the late 1950's. It was included in the 1979 Critical Wildlife Areas document essentially because of the ease with which portions of it could be restored to become a major waterbird area. The 1979 document included general guidelines to accomplish that goal. To date, no action in this direction has been made. Restoration to wetland may be the best available management option, because agricultural productivity of lagoon soils has failed to meet projections, even by conservative estimates.

Field evaluation of the site revealed that large and medium sized wading birds such as the Great Egret and the Tricolored Heron forage in remnant fresh water swamps in the area, especially along route 331. However, as in 1979 the area is not of importance to wildlife in its present condition.

Restoration of portions of the lagoon is still possible and advisable. With plans to restore Cartagena Lagoon underway, and together with the Boquerón Wildlife Refuge, another area such as a restored Guánica Lagoon would complete a network between which birds could move in southwestern Puerto Rico. Hunting is permitted in the Boquerón Refuge, and Guánica Lagoon could provide an alternative for birds that move out of the former during the hunting season.

Current theory in the field of conservation biology (Simberloff and Abele 1982) suggests that a network of refuges is the most desirable option in the absence of large unveloped tracts for wildlife, and this is especially applicable in the case of far-ranging species such as waterfowl and wading birds. Also, urban development in the vicinity of the lagoon is negligible. This set of conditions provides a unique opportunity that, along with restoration of parts of Caño Tiburones in the north coast would be a significant improvement over present conditions. Possibly, with the added available habitat several species that are now rare or threatened could be removed from such classification.

The area is relatively degraded compared to 1979. Guánica Lagoon is of secondary importance to wildlife, based on its potential for restoration.

31- Guánica State Forest East and Adjacent Lands (Guánica) M-27

This area was included in 1979 primarily because it supported the most important population of the Puerto Rican Nightjar (FE), and because two specimens of the Puerto Rico Crested Toad (FT) had been collected in the Forest. Although the Tamarindo lagoon was considered separately in Moreno and Pérez's 1980 supplement, we discuss it within the context of this area, where it is located.

The eastern portion of Guánica State Forest has long been known to support a high bird species diversity. Nine out of fourteen species of endemic birds occur in the Forest. Other species include the rare Key West Quail Dove. In addition, several individuals of the Yellow-shouldered Blackbird (FE) are being regularly observed within the Forest's confines, according to the Forest's Management Officer, Mr. Miguel Canals. Other wildlife of importance includes the Brown Pelican (FE), of which there is a breeding colony not far away in Bahía Montalva.

Individuals of the Peregrine Falcon (FE) winter fairly regularly around Tamarindo Lagoon. The Least Tern (CT) has been observed along the coast. Migrant Ospreys can sometimes be observed in the area year round, and although these are sometimes seen carrying nesting material, breeding has not been confirmed. The rare Bahama Duck and several migratory duck species such as the Blue-winged Teal are regularly observed in San Jacinto Saltflats.

The West Indian Manatee (FE) is occasionally observed around the Ballena area. In addition, the Forest is known to support one of the Island's largest bat aggregation in Cueva de los Murcielagos. The Hawksbill sea turtle (FE) nests regularly in Tamarindo and Ballena beaches, near road 333. The narrowly distributed Puerto Rican Dryland anole (CT) occurs in areas near the coast. The atypically distributed Whistling Coquí also occurs in the Forest.

In 1982 the Guánica State Forest was designated a Biosphere Reserve by UNESCO in recognition of its value as one of the best preserved dry forests in the world. The Forest has attracted the attention of international scientists. For example, a long term bird banding study by Faaborg and Terborgh (1980) and their colleagues has established that several migratory bird species (principally Passerines) return to the same locations in different years. The Forest is also currently the subject of a long term vegetation study, focusing on the dynamics of succession.

Other studies, including the biology of the Puerto Rican Nightjar by Mr. Francisco Vilella, a doctoral student from Louisiana State University, are currently underway. Preliminary results of the Nightjar study suggest that the population of this species in the Forest is relatively stable when compared with earlier estimates of its abundance. Mr. Vilella believes that a dearth of adequate nesting substrate may be one of the principal limiting factors preventing further increase in density of the species in Guánica Forest. One of the main concerns regarding the continued survival of this species in 1979 was that a sprawling petrochemical industry in Guayanilla could reduce insect abundance in the Forest, causing a food shortage that would in turn affect the nightjars. Several of the petrochemicals closed down, providing some respite for the species. However, several of these industrial complexes have been reestablished as part of the program for economic revitalization of Puerto Rico's south-West.

The Guánica Forest is now known to support the largest remaining breeding population of the Puerto Rico Crested Toad (FT). At least three areas are used for breeding by this species in the Forest. Two of these are near road 333 along the margins of Guánica Bay. The other known area lies near the base of the Barinas hills, which was drained for mosquito control; and although toads still have laid eggs, these have not survived to adulthood (Miguel Canals, Pers. Comm.). At present, the two former areas suffer from fire, which has already affected an estimated 30 acre area along road 333 (Miguel Canals, Pers. Comm.). There has been some debate about whether fires result from natural causes or of human activities. We are inclined toward the latter alternative, since fires have almost exclusively occurred along the road.

During storms, sea water may flow into the Tamarindo Lagoon toad breeding area, resulting in increased salinity that may kill eggs and tadpoles of the species. This is the result of the reduced height of sand dune along Tamarindo Beach (Miguel Canals, Pers. Comm.). A direct restoration of the sand dunes, or management to promote sand entrapment on these, may be necessary to counter the negative effect of salt water upon the toad's population.

Administratively, there has been considerable improvement in the Forest. Formerly only one person was in charge of administrating this relatively large Forest. Now there are seven people, including a Forest Manager. In addition, the western portion of the Forest, across Guanica Bay now has its own Manager. In the eastern part of the Forest roads and trails have been considerably improved and signs have been posted, facilitating patrolling of the area and allowing a safer use by visitors.

Although encroachment around the Forest is presently low, the Forest is under high pressure that might result in habitat degradation. A controversial project to build a large hotel in the Ballena Bay area is under review by the Commonwealth's Planning Board. A road has been proposed to provide easier access to the beach for Yauco residents that, if realized, would further fragment the Forest. It would also probably augment the fire hazard due to increased human presence. A number of other developments, such as several Marinas have been proposed for the area. Most of these projects are centered around the southern coastal portion of the Forest. The construction of these projected developments may adversely affect the Guánica Forest eastern portion and its unique wildlife.

The Guánica State Forest eastern unit and adjacent lands are a primary wildlife area.

32- San Jacinto Salt Flats (Guánica) M-27

The San Jacinto Salt Flats are located south of road 333, east of Guanica Bay and adjacent to Hotel Copamarina in Guánica. These abandoned salinas were included in the 1980 Supplement to the Critical Wildlife Areas by Moreno and Pérez because they support a number of migratory and resident shorebirds. These authors recommended that the salt flats be incorporated to the Guánica State Forest, across the road, to ensure their preservation. The area has been colonized by mangroves that provide some isolation from the small community located on Punta Jacinto. Due to the low rainfall in southwestern Puerto Rico, a considerable portion of this shallow area dries up seasonally.

During field evaluation of this site we observed Black-necked Stilts, Yellowlegs, and a number of plovers and sandpipers, as well as a few heron species. The area is known to support the uncommon Bahama Duck, Common Moorhen, American Coot and large numbers of migrant Blue-winged Teal (Jaime Collazo, Pers. Comm.). The Roseate Tern (FT), and the Sandwich and Royal terns have also been observed in this area by Jaime Collazo of the U. S. Fish and Wildlife Service, who has also observed Brown Pelicans (FE).

A road was formerly located on the western fringe of the salt flats to provide access to the adjacent expanding community. Moreno and Pérez's (1980) recommendation was not followed. In fact, the road has been recently relocated and now divides the salt flats in two (Susan Silander, Pers. Comm). In addition a small unpaved parking lot has been built at the western end of the area, resulting in further habitat degradation. This will

probably make the area less attractive to wildlife. Efforts must be made to prevent additional damage to this area.

We concur with Moreno and Pérez's recommendation for the acquisition of the San Jacinto Salt Flats and its incorporation to the Guánica State Forest. A title survey is needed to determine if the saltflats are Crown lands, in which case their title should revert to the state. They are a primary wildlife area.

33- LLuveras (Guayanilla) M-28

This area includes a combination of mangrove forests, salt flats and freshwater swamps. The area abuts the Guánica State Forest near the Punta Ventana sector. The primary reason for inclusion of LLuveras among the critical wildlife areas of the 1979 document was that it supported a variety of wading birds and shorebirds, both resident and migrant. Brown Pelicans (FE) occur in the adjacent beach, where Hawksbill sea turtles (FE) are also known to nest. A number of Puerto Rican Nightjar (FE) also occur in the area. The West Indian Manatee (FE) has been reported from waters off Punta Verraco according to DNR's Natural Heritage Program.

A considerable portion of the swamps west of Cerro Toro have been drained for cattle grazing. Portions of the mangrove forest west of Punta Verraco is dying off due to the construction of a road whose levee interrupts the natural flow of water. The road is in TEXACO property and crosses the mangrove stand adjacent to the abandoned sugarcane fields. Apparently because the mangrove stand now only receives rain water, the change in water regime is causing mangrove death. The mangrove stand is used as a dumping ground for old tires of sugar cane machinery, causing both ecological and aesthetical degradation. The remainder of the area appears to similar in condition relative to 1979, based on the analysis of the 1977 and 1987 aerial photographs.

The addition of Lluveras to Guánica State Forest, through purchase or other mechanisms, would simplify its protection. This recommendation is also contained in the technical document for the management of the Special Planning Area of the south-West, Guánica sector (Toro and Colón 1986).

Additional development of the Punta Verraco sector would probably contribute to the further degradation of the area. At the time of our field evaluation in late June 1987, active clearing of the dry-forest scrub vegetation along formerly abandoned trails was in progress in the Punta Verraco Hills.

At present the area is under private ownership. More than ten percent of the area has been degraded relative to 1979. Its status is upgraded to primary, given its importance to at least four endangered species, and for migrant species that depend on wetlands.

34- Cabullón Mangrove (Ponce) M-29

This area lies east of the large Ponce docking facilities, and is not far from the metropolitan area of Ponce. Areas adjacent to that delimited in the 1979 Critical Wildlife Areas document are presently under great pressure for development of recreational and tourism facilities. Several of the more accessible salt flats are being used as clandestine garbage dumps and scrap metal deposits (especially old cars and appliances). In spite of this, some increase on the area occupied by mangroves has occurred since 1979 as revealed by the analysis of aerial photographs.

During field evaluation of this area in late November 1987 we observed 14 aquatic species out of a total of 29. This included the Tricolored and Little Blue herons, Snowy and Great egrets, Common Moorhen, and Clapper Rails. We also observed the Brown Pelican (FE), as well as migrant Ospreys and Pigeon Hawks.

This area merits increased protection. It should be developed as an educational facility where students learn about mangrove biology and the phenomenon of bird migration. Wading birds and shorebirds as well as land birds, both migrant and resident can be easily observed taking advantage of the canals that run through the area.

Since the only endangered or rare species known from the area at present is the Brown Pelican, Cabullón Mangrove retains its classification as a wildlife area of secondary importance until more detailed studies are conducted. However, it will take on increased importance as the southern coast of Puerto Rico becomes more developed.

35- Caja de Muertos and Morrillito Islands (Ponce) M-30

Located south of Ponce, the principal change on the status of these two islands has been in terms of increased presence of permanently stationed DNR management personnel. The Ranger Corps also maintains personnel at Caja de Muertos. The islands are administered by the DNR Bureau of Reserves, Refuges and

Sanctuaries. A detailed description of the biology and other aspects of these islands is found in Villamil et al. (1980).

Federally-listed Endangered sea turtles continue to nest in small numbers in the southern, high energy beach of Caja de Muertos. Twenty-four bird species were recorded for the Island by Villamil et al. (1980). Included among these were the Brown Pelican (FE) and the Roseate Tern (FT). During field evaluation we observed that the White-tailed Tropicbird also continues to breed in the Island's cliffs. However, recent landslides caused by erosion in the Island's south side have eliminated at least one known Tropicbird nesting hole. A few others may have been lost as well. We also observed Brown Boobies, Yellow-crowned Night Herons, and Great Blue Herons. The latter apparently fly in from nearby Ponce and fish in the shallow and relatively tranquil waters of the north coast. The introduced Green Iguana and the secretive Agouti are thriving in Caja de Muertos. The latter is often observed by DNR personnel near the picnic facilities west of the mangrove forest in the early morning.

The two Islands, together with Berberia Cay, were designated a Natural Reserve in 1980. The three comprise an area of approximately 500 acres. Caja de Muertos has been developed as a recreational facility as part of the "Ponce en Marcha" development program. During weekends, hundreds of people take a Ports Authority ferry to the Island and enjoy the protected northern beach and guided nature tours. Tropicbird and sea turtle nesting areas are off limits to visitors in season. These islands are an example of how recreation, education and wildlife conservation can be achieved simultaneously. They continue to be primary wildlife areas.

36- Frías Cays (Ponce) M-30

This publicly owned islet of approximately 9 acres is located near the mouth of Inabón River east of Ponce. Cayo Frío is mainly composed by mangrove. A few small mangrove stands are separated from the main islet by exposed substrate composed of dead coral. Other colonizing plant species occur in the islet, principally on elevated portions along its northern coast. A coral reef along its southern shore provides some protection from wave action. However, severe wave action has apparently produced erosion causing the toppling or death of several mangrove trees.

During field evaluation in early August 1988 we observed Brown Pelicans (FE) perched high on mangrove trees in the islet's southern coast. Other bird species observed include the Great Blue Heron, Little Blue Heron, Great Egret and the Sandwich Tern.

We did not find the Cattle Egret breeding colony referred to in 1979. We were not able to search part of the interior of the cay, but no breeding activity was evident in the area. Possibly, breeding for the year had been completed at the time of our visit. Alternatively, the birds may have abandoned Frios Cay as a breeding site. The islet should be monitored with more frequency to determine wildlife use with certainty.

Frios Cay is of secondary importance to wildlife.

37- Berbería Cay (Santa Isabel) M-30

The mangrove islet of Berbería, about 70 acres in area, is located in Puerto Rico's southern coast between Caja de Muertos Island and Santa Isabel. During field evaluation we found that it was not as difficult to traverse as suggested in the 1979 document. We observed Brown Pelicans (FE) foraging near Berbería. Other wildlife observed includes Great Egrets, Little Blue and Great Blue herons and Sandwich and Royal terns. We also found the remains of what probably was a large specimen of the Green sea turtle (FE) that was slaughtered in the islet.

A detailed account of the islet's fauna and quantitative and floristic descriptions of the flora are contained in a technical supplement for the designation of the Caja De Muertos Natural Reserve (Villamil et al. 1980), of which Berbería is part. A total of nine marine and wading bird species, including the Roseate Tern (FT) and the Brown Pelican (FE), were reported for Berbería in 1980. The only terrestrial bird species reported was the Yellow Warbler.

The 1979 document tentatively concluded that Berbería should be considered an area of secondary importance to wildlife, particularly due to its failure to support substantial numbers of doves and pigeons. We did not observe pigeons or doves during our brief stay in the island. However, seabirds sometimes move their nesting colonies due to disturbance or other reasons, and Berbería may serve as an alternate site for species as important as the Brown Pelican.

The importance of remote islands such as Berbería should not be minimized only because at present they do not support breeding populations of endangered species. In our opinion it is a primary wildlife area, even if based on its potential alone.

38- Punta Petrona Mangrove (Santa Isabel) M-31

Located south-east of the town of Santa Isabel, the publicly owned Punta Petrona mangrove was included in the 1979 Critical Wildlife Areas document primarily because it was a fairly extensive and undisturbed area whose physical characteristics appeared to be excellent for a diverse fauna that included the Brown Pelican (FE). This general area has traditionally supported a significant proportion of the Island's population of West Indian Manatees (FE). Punta Petrona, of approximately 570 acres, and several nearby cays were designated a Natural Reserve in 1979. It is part of the Aguirre State Forest.

Punta Petrona is largely composed of mangrove forest interspersed with ponds, meandering channels and various cays. It is surrounded by relatively tranquil and shallow waters dominated by Thalassia beds.

During the field evaluation in mid-August 1988 we observed a fair number of Brown Pelicans foraging and roosting on mangrove trees. We also observed the West Indian Nighthawk and several ardeid species, including the Green-backed and Great Blue herons, the Yellow-crowned Night Heron and Cattle Egrets. The Common Moorhen and the uncommon Bahama Duck were regularly observed in the area during aerial censuses of waterfowl performed by DNR and U. S. Fish and Wildlife Service personnel in the mid 1980's. Migrant Blue-winged Teal and Ospreys were also observed during these censuses.

Puerto Rico, including Vieques Island, was divided in eleven segments for the purposes of twelve aerial censuses for Manatees and sea turtles performed in 1984-1985 by Rathbun et al. (1985). The segment including Punta Petrona ranked first for Manatees and tenth for sea turtles.

Punta Petrona is slightly encroached on its northwestern end by the Playa de Santa Isabel community. Physically, the area remains similar in condition relative to 1979 based on the analysis of aerial photographs.

We recommend that thorough surveys be conducted on the fauna, to assess wildlife use in Punta Petrona more precisely. It is a primary wildlife area.

39- Caracoles Cay (Santa Isabel) M-31

Caracoles Cay is located south of Punta Petrona. Publicly owned, it is made up of several mangrove islets separated by narrow channels totalling approximately six and a half acres in area. The popularity of these islets for week-end boaters has grown immensely over the past few years. People using this area evidently spend much of their time in the water of a pool-like channel that separates two of the islets. Caracoles continues to support a large heron breeding colony in the mangrove stands surrounding that channel. A few pigeon and dove nests were dispersed among the heronry. We counted over one thousand heron and egret nests in a red mangrove stand during field evaluation of this area in early August 1988. However, only a few Yellow-crowned Night Heron nests were active at the time, containing two to three downy nestlings. The great abundance of egg shells that lined the ground indicated that many of these nests had been active in the recent past.

We also observed a previously unreported roost of about 100 of the easily disturbed Magnificent Frigatebird, including adults and juveniles capable of flight. A few adults were displaying with their gular sacs, but we could not find any nesting structures in the roost with the aid of binoculars. The presence of these birds, sensitive to disturbance, at Caracoles is an indication of its remoteness and value for wildlife. We recommend that signs be set up to prevent disturbance to the Frigatebirds and Herons. The islets should be monitored with some regularity to assess the status of these populations.

Other wildlife observed at Caracoles during the field evaluation included the Brown Pelican (FE). The Green-backed and Great Blue herons, as well as the American Oystercatcher were also found at the islets.

The area probably merits the attention of managers so that its recreational use does not disturb wildlife.

Caracoles appears to be similar in condition relative to 1979, as determined from aerial photograph analysis. It continues to be a primary wildlife area.

40- Punta Arenas (Salinas) M-32

Punta Arenas is located south-east of Playa de Salinas in the town of Salinas. The Playa de Salinas community directly abuts the area. It is mainly composed of a relatively large shallow lagoon system and small mangrove islets. Field evaluation of the site and analysis of the 1979 aerial photographs revealed some regeneration of vegetation on the area. New mangrove growth was observed on areas formerly utilized for garbage dumping. The mangrove islets have also increased in area.

Shore and Waterbirds forage on these mudflats. We observed sandpipers, plovers, Black-necked Stilts, as well as Tricolored Herons, Yellow-crowned Night Herons and Cattle Egrets during field evaluation of this area. We also observed the Brown Pelican (FE) loafing on mangrove trees that border the sea. The Bahama Duck and migrant Blue-winged Teal have been recorded in fairly large numbers at nearby Las Mareas, to the east, during aerial censuses performed by DNR personnel in 1984.

Human activities affect this area. Large and medium scale garbage dumping formerly degraded quality of its waters and habitat. Also, water flow between the lagoons is controlled, probably by residents, for purposes that may be related to farm animal use, flood and mosquito control, or other reasons. The unjudicious movement of water may have an adverse effect on wildlife in the area. We recommend that a detailed study be performed to prescribe management actions that promote the protection of wildlife and that is integrated with the needs of residents of this area.

Punta Arenas continues to be a primary wildlife area.

41- Mar Negro (Salinas) M-33

Mar Negro is located at the western end of Jobos bay, west of the Aguirre powerplant. It is included in the Estuarine Reserve of Jobos Bay (Jobanes). This mangrove forest serves as a refuge for shorebirds and marine and terrestrial birds, including those listed for Punta Pozuelo. Portions of Mar Negro have been affected by thermal discharges and small oilspills from the Aguirre power plant and other types of discharges from the Aguirre Sugarmill. A technical supplement for the management plan for the Jobos Bay Area (Berrios et al. 1981) provides data on these problems and on many other aspects of the Mar Negro area. Details on the structure of the mangrove vegetation in this area are found in Cintrón et al. (1978).

A significant change on the status of this area is the continued establishment of summer and some permanent houses on its western end. This results in increased boat traffic along the channels with the resultant disturbance to birds and possibly to West Indian Manatees (FE). There has been a reduction in numbers of the latter in the general area (Rathbun et al. 1985). There are uncomfirmed reports of human take of Manatees for food in the area (Barbara Cintrón, Pers. Comm.). We observed Brown Pelicans (FE) foraging. A roost of about 20 individuals was observed in red mangrove trees in the east-central portion of Mar Negro.

Coral reefs and the root systems of mangroves have suffered some impact due to industrial discharges that have occurred in the area (Berrios et al. 1981). On the positive side, there has been a substantial recovery in an extensive area of mangrove forest that had died off around the late 1970's near the oxidation ponds of the Aguirre Sugarmill.

The area is only slightly degraded relative to 1979, but a continuation of this trend must be prevented if Mar Negro is to remain as a primary wildlife area. This may be accomplished by increased vigilance and especially, by a closer coordination and communication with other regulatory authorities, such as the Permits and Regulations Administration. The posting of signs alerting boaters to the presence of Manatees is desirable also.

Probably of greater importance to the continued wellbeing of Mar Negro is the prevention of impacts that may be caused by industrial and electric power producing facilities of the area. In the past, misguided actions and or accidents have caused considerable damage to the natural systems in the area.

The area is of economic and cultural importance to fishermen that harvest oysters, clams, crabs and fishes in the estuary and the root system of mangroves.

Mar Negro, like Punta Pozuelo, also benefits from the improved protection that results from increased patrolling and management by personnel of the Estuarine Reserve of Jobos Bay. However, additional steps should be taken to deter the possible taking of Manatees in the area.

Mar Negro continues to be a primary wildlife area.

42- Punta Pozuelo (Guayama) M-33

At present this area is included in the Estuarine Reserve of Jobos Bay (Jobanes). There has been an increase in urbanization at the base of Punta Pozuelo, near the emergency landing strip. Road and other infrastructure improvements have been made in the area, so that it has become sligthly degraded relative to 1979.

Punta Pozuelo borders part of the southern portion of Jobos Bay, which is one of the prime areas supporting breeding populations of the West Indian Manatee. Individuals of the Leatherback (FE) and Green (FE) sea turtles have been observed by DNR personnel at several of the sandy beaches of Punta Pozuelo, and in Pájaros and Ratones cays, but no egglaying has been recorded. Brown Pelicans (FE) and migrant Peregrine Falcons (FE) are supported by the area. Puerto Rican Plain Pigeons (FE) are reported from the area with some frequency. The rare White-crowned Pigeon utilizes the Barca and Caribe cays, as well as part of the mainland area for breeding and roosting. Hunting for Blue-winged Teal is popular during winter.

The area benefits from improved protection as there is a headquarters of the DNR Ranger Corps in the nearby community of Jobos. Also, there is now a resident manager and several maintenance personnel permanently in the area.

We found that Little Blue herons, and Snowy and Great egrets are nesting along with the Cattle Egrets reported in 1979 for the Cayos Caribe. We also observed Great Blue Herons, and nesting Black-necked Stilts. In addition, we observed at least nine land bird species, especially on islets with soil substrate. There has been an as yet unexplained reduction in the number of Federally Endangered West Indian Manatees inhabiting the area (Rathbun et al. 1985). Investigators suggest it may be due to increased industrialization in the area. This suggests that a detailed monitoring of the local Manatee population is needed. Given appropriate funding, this could be accomplished by adequately trained personnel of the Jobanes Estuarine Reserve.

Punta Pozuelo remains a primary critical wildlife area.

43- Pandura Mountain Range (Yabucoa-Maunabo) M-34

The Pandura mountain range is located within the Pandura-Guardarraya Special Planning Area designated in the Puerto Rico Coastal Zone Management Program (U. S. Dept. of Comm., O.C.Z. M., 1978). The SPA study for this area has not been conducted to date.

This scenic mountain range rises from the coast near Punta Toro and steep inclines dominate the landscape. The area is privately owned, and it is sparsely populated. It was included in 1979 because it supports a small frog species, the Guajón Eleutherodactylus cooki that occurs almost exclusively in this area. The species thrives among the dark, humid spaces that exist between large boulders (10 to 20 feet in diameter) of volcanic origin known as Guajonales. Field evaluation revealed a healthy population that in some cases tolerates moderate urbanization. We heard individuals not more than a few meters away from the road.

Evaluation of aerial photographs revealed only a slight urban encroachment during the last ten years, probably owing in part to the ruggedness and steepness of the terrain. There has been some increase in agricultural activity in this area during the last ten years, resulting in the replacement of mature forest by crops. This activity at present does not seem significant and in our opinion the area should retain its classification as an area of secondary importance to wildlife.

44- Humacao Swamp (Humacao) M-35

The Humacao Swamp was designated a Natural Reserve in 1986. The area harbors the largest remaining stand of Pterocarpus officinalis in Puerto Rico. At the time of the write-up for the area in 1979 it was being actively drained with a canal system and pumps. The drained area was used mainly for sugarcane. In late 1979, when David and Frederick hurricanes caused torrential rains on the Island, the pump system malfunctioned and the area became permanently inundated, as pumping was not resumed. However, parts of the area were swampy even before pumping stopped.

The 1979 map for the area basically included only the Pterocarpus forest and an adjacent strip composed of open water and mixed wetland vegetation on both the northern and southern sides, abutting the Anton Ruíz River in the former and Boca Prieta canal in the latter. The entire area then comprised approximately 818 acres. At present the Humacao Swamp Natural Reserve totals approximately 2535 acres. The Reserve now contains within its limits five lagoons; Mandri I, II, and III, and Santa Teresa I and II. These, formed after the above mentioned hurricanes, were added to the Reserve because they now form one of the Island's premier waterfowl habitats.

Parts of Santa Teresa Lagoons formerly harbored coconut stands. These are now permanently inundated and have developed a dense emergent vegetation dominated by cattails. This particular portion is one of the principal breeding areas of the rare Bahama Duck and the West Indian Whistling Duck (CT), which nest on grass clumps that surround and cover the palm stumps that still dot the area. Ruddy Ducks (CT) nest on floating grass mats in this area. This is one of the more productive sites of a long term waterfowl study by the DNR. (Edward Rodriguez, Pers. Comm.).

Ninety four migrant and resident bird species have been documented from the site. The Brown Pelican (FE) forages and roosts on the lagoons and nearby vegetation, respectively. The Peregrine Falcon (FE) also uses the area in winter. Virtually all rare or threatened native ducks occur within the Reserve; the West Indian Whistling Duck (CT), the Ruddy (CT) (also a candidate for listing under the Federal Endangered Species Act), the Bahama (CT), and the Masked (CT) ducks breed and forage among the lagoons. The Black-bellied Whistling Duck, an accidental species in Puerto Rico, also has been observed in the area. The Least Grebe (CT) and Caribbean Coot (CT) breed there. The rare Purple Gallinule, the Pied-billed Grebe and the popular game species, the Common Moorhen also occur in the area. Pigeons and doves are well represented and include the rare White-crowned Pigeon, the Scaly-naped Pigeon and the Zenaida Dove among others.

Among reptiles, the Antillean Painted Turtle, the only freshwater turtle native to Puerto Rico, is a common sight in the lagoons and especially in the interconnecting channels. Sea turtles that nest in the beach west of Morrillo include the Hawksbill (FE) and the Leatherback (FE) sea turtles. The West Indian Manatee (FE) is occasionally observed near the coast.

The Humacao Swamp Natural reserve has a small office center, a resident manager, and several maintenance and research personnel. There is an active research project on the reproductive biology of waterfowl. Also, there is a small hatchery for sea turtle eggs.

The reserve incorporates parcels under both private and public ownership. Public lands are under long term lease to the DNR. Most of the Pterocarpus forest is under private ownership.

The area is greatly improved relative to 1979. Means for acquisition or long term lease of portions under private ownership should be developed to ensure the future of this primary wildlife area.

45- Roosevelt Roads Naval Base (Ceiba) M-36

The Roosevelt Roads Naval Base is located in the Island's eastern coast, south-east of the town of Ceiba. Extensive mangrove stands interspersed with saltflats, shallow ponds and forested hills provide excellent habitat for a variety of wildlife. These areas are of great importance for a large number of resident and migratory bird species. In addition, the area's many bays and coves provide some of the best habitat for the West Indian Manatee (FE). Furthermore, several Federally-listed Endangered sea turtle species occur in the area (Rathbun et al. 1985). Nesting of sea turtles is not common probably due to lack of suitable habitat.

Among bird species, the West Indian Whistling Duck (FE) and Least Grebe (FE), as well as the rare Bahama Duck are found in the area. A number of migrant waterfowl winter among the area's ponds. The Blue-winged Teal is especially common. The Brown Pelican (FE) and Yellow-shouldered Blackbird (FE) also occur in the area.

During field evaluation we observed several flocks of the Bahama Duck at ponds on both sides of the road east of the airport. We also observed the rare White-crowned Pigeon. Other species include the Black-necked Stilt, Common Moorhen, several herons and doves. At the Cape Hart sewage treatment plant we observed seven adult Manatees near the effluent pipe. Rathbun et al. (1985) should be consulted for detailed information on the distribution and abundance of Manatees and sea turtles along the coast in this area.

At the large intermittent shallow lagoon north-east of the Cold Storage Plant facility there has been extensive regeneration of white and black mangrove, resulting in a net reduction of open water and saltflat area. A number of species nest among the roots of these young trees and of dead mangrove stumps. We observed several species of sandpipers, plovers, Black-necked Stilts and a number of land bird species.

Yellow-shouldered Blackbirds nest in this area. However, numbers of this species have been greatly reduced by Glossy Cowbird nest parasitism. In 1975 Post and Wiley (1977) found at least 18 nests of this species. During the 1987 breeding season, less than five nests could be found, and over three consecutive seasons population estimates are of less than thirty individuals (Susan Silander, Pers. Comm.), this in spite of attempts to control the cowbird population in the area.

The area is in similar conditions relative to 1979. Culverts have been placed under the road dividing ponds in the airport area, permitting improved water flow between them. No recent aerial photographs were available for this area, and we were not able to make a precise evaluation of degradation and encroachment. However, during field evaluation the area did not appear to be appreciably degraded or encroached.

The Roosevelt Roads Naval Base continues to be a primary wildlife area.

46- Fajardo Coastline (Fajardo) M-37

This coastal segment was included in the 1979 document because of its importance to the West Indian Manatee (FE). More recent information confirms its importance and in addition reveals that it is utilized heavily by endangered sea turtles (Rathbun et al. 1985). Several recommendations were made in 1979 for the conservation of the area and for an educational campaign, including posting signs and fishermen education. To our knowledge, none of these recommendations were put in effect. As a result, Rathbun et al. report several anecdotal instances of Manatee poaching in the Fajardo River area. At least a few were probably intentional trappings, according to the authors.

Recommendations of the 1979 document regarding strict limits on shoreline development in the area have not been heeded. A large marina complex of about 600 boat capacity, along with shopping malls, restaurants, hotels and apartment buildings is being constructed on Demajagua Bay under the name Puerto del Rey. Another marina will be constructed shortly north of Puerto Chico Marina. An additional large scale project by the name of Marina Real, proposed for the Fajardo River mouth, would involve dredging and cutting of mangrove forests. Increased boat traffic due to these developments will undoubtedly augment the chance of Manatee-boat collisions, a problem that is at present virtually non-existent in Puerto Rico. Also, water quality (due to increased contaminant levels, turbidity, etc.) will be degraded.

Unfortunately, the pressure for shoreline development in this and other portions of the Island continues, so that further degradation is likely. The Fajardo coastline is degraded relative to 1979, but it continues to be one of the Island's primary critical wildlife areas. Now more than ever it will be necessary to post signs, limit boat speeds and to conduct an educational campaign among fishermen of the area.

The Fajardo Coastline is a primary wildlife area.

47- Fajardo Cordillera (Fajardo) M-38

The Fajardo Cordillera is located east of Cabezas de San Juan in Fajardo. It is composed of a large number of rocky islets and a few larger islands. Two of the larger islands, Cayo Lobo and Palominos, are privately owned. The balance is publicly owned. Icacos Island, one of the most frequented by visitors has a number of shallow lagoons that dry intermittently. A few of the larger islands have sandy beaches, and Palominitos is completely made up of sand. Information on the biology of the area's reef fauna and birdlife is contained in McKenzie and Benton (1972).

The Fajardo Cordillera was designated a Natural Reserve in 1980. The main reason for the inclusion of this area in 1979 was that it supports a number of seabird breeding colonies. Roseate Terns (FT), as well as Brown Noddies, Bridled and Sooty terns, Brown Boobies and Laughing Gulls breed in the area. Breeding activity of these species is concentrated around Blanquilla Cay. The rare Bahama Duck has been reported from the small lagoons at Icacos. The species probably uses these lagoons as part of their regional movements.

The Green (FE) and Hawksbill (FE) sea turtles are known to nest at Palominos Island (Benito Pinto, Pers. Comm.). The latter species also nests at Icacos Island. The Virgin Island's Tree boa (FE), a subspecies of the Mona boa, occurs in Diablo Cay. The colubrid ground snake Alsophis portoricensis is found in Ratones Cay (Peter Tolson, Pers. Comm.). Introduced Green Iguanas occur at Icacos.

During field evaluation we observed that the area is similar in conditions relative to 1979. Seabird use of Blanquilla and surrounding rocks remains extensive. At Icacos we observed Brown Pelicans (FE), Black-necked Stilts, Greater Yellowlegs, Semipalmated Plovers, and Laughing Gulls. We also found a large number of spent shotgun shells on the ground around one of the larger lagoons. Hunting is illegal at the Cordillera, and the possibility that Bahama Ducks are being harvested should be investigated. Hunting of this species is closed in Puerto Rico. The lagoons may be used by migrant ducks as well. Introduced Green Iguanas are abundant on Icacos. There is also a fairly large population of feral cats, and rats are abundant.

A detailed study of the feeding habits of iguanas at Icacos is probably desirable to determine if they are affecting this Island's flora or fauna. An effort to remove cats and rats from Icacos should be initiated. Habitat of this Island resembles that of Cayo Diablo, and introduction of the Virgin Island's Tree boa is being contemplated for the near future (Peter Tolson,

Pers. Comm.). The boa is abundant at Cayo Diablo, in all probably due to the absence of rats (Peter Tolson, Pers. Comm.).

The Fajardo Cordillera is administered by the D.N.R. Bureau of Reserves, Refuges and Sanctuaries. A manager regularly patrols the area by boat, and a number of management measures primarily directed to organizing visitor use are contemplated for the near future. The area should be patrolled by the DNR Ranger Corps with more frequency to deter illegal hunting in the Natural Reserve.

The Fajardo Cordillera is a primary wildlife area.

48- Grande Lagoon and Adjacent Lands (Fajardo) M-39

Grande Lagoon is located in northeastern Puerto Rico, west of the town of Fajardo. Lands encompassed by Grande Lagoon and surrounding lands, totalling approximately 500 acres were designated as the Cabezas de San Juan Natural Reserve in 1986. These lands are owned by the Corporation for the Development of the Marine, Lacustrine, and Fluvial Resources of Puerto Rico (CODREMAR), a public corporation attached to the DNR, and are administered by the Puerto Rico Conservation Trust. Lands surrounding the lagoon support avian forms from the Lesser Antilles that do not occur farther east in Puerto Rico, such as the Blue-throated Carib, the Antillean Crested Hummingbird and the Caribbean Elaenia.

A few of the bird species commonly found in Grande Lagoon include the Brown Pelican (FE) and the Magnificent Frigatebird. The Green-backed, Tricolored, and Little-blue herons are also common in the area. Gamebirds include the Common Moorhen, and probably the White-crowned Pigeon. Hunting of the pigeon is closed in Puerto Rico due to low numbers.

Reptiles are represented by eight species of which four belong to the Genus Anolis. The introduced Green Iguana is common in the small lagoons west of the lighthouse. The Hawksbill sea turtle (FE) has been reported to nest at Cabezas de San Juan beach according to records of the DNR's Natural Heritage Program.

Grande Lagoon is one of the more transparent lagoons on the Island. Its connection to the sea by a channel results in what is basically a marine system, permitting the establishment of a wide variety of planktonic and benthic organisms, especially those associated to Thalassia beds (Rivera-Ortíz et al. 1981).

Grande Lagoon is a secondary wildlife area because of its Lesser Antilles faunal element, and because it supports at least one endangered species, the Brown Pelican. If it is determined that the area is important for nesting endangered sea turtles its status should be changed to primary. A relatively intensive monitory of the area will be necessary to ascertain its importance in this respect.

49- Aguas Prietas Lagoon (Fajardo) M-39

The Aguas Prietas lagoon, located in northeastern Puerto Rico possesses one of the most beautiful landscapes to be found in the Island and its scenic value cannot be overstated. The area is owned by the Puerto Rico Industrial Development Corporation.

At least four heron species were found nesting in the mangrove forest that surrounds Aguas Prietas Lagoon by Rivera-Ortíz et al. (1981). This mangrove also serves as a refuge for the rare White-crowned Pigeon and the Brown Pelican (FE). Hunting of the former is closed in Puerto Rico due to low numbers. Thirty-two bird species were reported by Molinares (1981), about twenty-six percent of Puerto Rico's resident birds were represented in the area. A detailed description of the area can be found in Rivera-Ortíz et al. (1981).

Aguas Prietas Lagoon is fairly well protected from human disturbance. It is adjacent to El Convento Beach where one of the Commonwealth Governor's summer houses is located. However, the eastern portion of the area is adjacent to a fairly large camping ground administered by the Commonwealth's Recreation Company. These grounds represent the most obvious example of encroachment to the area. This situation exemplifies a common occurrence throughout Puerto Rico's critical wildlife areas; often there is no buffer zone between them and surrounding developments.

The area has become slightly degraded compared to 1979, principally due to the development of the above mentioned camping area. It continues to be secondary importance to wildlife.

50- Ensenada Comezón (Rio Grande) M-40

Located east of the Espiritu Santo River mouth, the Ensenada Comezón-Punta Picúa mangrove complex is one of the Island's most imperiled areas due to severe development pressure. That pressure was evident before 1979. The Playas del Yunque and Rio Mar residential resorts abut the area to the east, and the Coco Beach Urbanization lies to the west. Rio Mar and Coco Beach are still expanding.

The area lies within the Espiritu Santo Natural Reserve, over 5000 acres in size. This Natural Reserve was designated in 1985 and is the first one that is made up entirely of private lands. The area is divided in lots of about 25 acres, and new houses sprout up overnight, especially in its eastern portion. The area is patrolled continuously by the DNR Ranger Corps, and this has in our opinion greatly reduced the establishment of new, non-complying structures.

The area continues to support the rare White-crowned Pigeon. We observed a number of heron species, including the Little Blue and Great Blue herons, Snowy and Cattle egrets, and the Yellow-crowned Night Heron. We did not find the West Indian Whistling Duck, which has been reported from the locality in the past. A more intensive study of the area may help determine if the species still occurs in the area. Local residents maintain that Blue-winged Teal winter in some of the area's ponds. Common Moorhen breed in the area, and we found several empty shotgun shells near several of the ponds.

At present, encroachment is concentrated along the northeastern portion of Punta Picúa and near the mouth of Espiritu Santo River. Even though the area is degraded relative to 1979, Ensenada Comezón is still a primary wildlife area.

51- Ciénaga Baja (Rio Grande) M-41

The Ciénaga Baja freshwater swamp, west of and adjacent to the Berwind Golf Course, was included in the 1979 document as an area of secondary importance. There was scant information about wildlife use at that time, although it was known that migratory waterfowl wintered in the swamp and it was of some importance to hunters. Most of the area belongs to the Commonwealth's Lands Authority.

Not much more is known about the area today. It is used by crabbers that collect the Blue Land Crab (Cardisoma guanhumi) for their livelihood. Hunters still use the area, harvesting Common Moorhens and Common Snipes at the Miñi-Miñi sector.

Field evaluation revealed that it is drier than in 1979. There is also fairly widespread cutting of the vegetation, presumably for pasture improvement as the area is used extensively for cattle grazing. Also, we observed that there is a fairly extensive and apparently methodical cutting of mangrove trees. These are commonly used around the area for fence posts. This activity results in aesthetic and ecological degradation of the mangrove stands. It affects its value as a refuge for wildlife and may result in a decrease in crab density, ultimately affecting the crabbers that use the area.

Until more thorough surveys are conducted, Ciénaga Baja swamp should retain its classification as an area of secondary importance. We conclude that the site is fairly degraded compared to 1979. The area should be monitored more intensively, especially during the waterfowl hunting season to better determine its actual use by wildlife.

52- Culebra's Surrounding Islets (Culebra) M-42,43,44

All islets and cays surrounding Culebra Island, except privately owned Cayo Norte, are administered by the U.S. Fish and Wildlife Service as part of the Culebra National Wildlife Refuge. A total of 702 acres is encompassed by these islets. A resident manager regularly patrols the cays, and research by graduate students and other groups is encouraged. In addition, the DNR Ranger Corps patrol the cays and Culebra's coast, especially during weekends when boat traffic increases, to minimize disturbance to the cay's wildlife and ecology.

During the field evaluation in mid-August 1988 we observed the tail end of the Sooty Tern breeding season. Even then, several thousand of these birds remained, especially at Cayo Yerba. Other species nesting there and at a few other cays include the Bridled Tern and the Brown Noddy. There is a Laughing Gull breeding colony at Cayo Matojo. This islet is very close to the Culebra's north coast and separates two of Culebra's principal sea turtle nesting areas.

Hawksbill (FE) and Green (FE) sea turtles nest in the larger islets of Luis Peña, Cayo Norte and Culebrita. The Shiny-back Skink (CT) occurs at Luis Peña, Cayo Norte and Culebrita Island, according to records of the DNR's Natural Heritage Program. We observed the rare Bahama Duck at Culebrita Island's lagoon, and Brown Pelicans (FE) were a fairly common sight throughout the area.

Unlike those critical wildlife areas in Culebra, the cays and islets surrounding the island are almost exempt from development pressures since they were designated part of the Culebra National Refuge in 1975.

The status of Culebra's surrounding islets is essentially unchanged relative to 1979 and they remain one of Puerto Rico's prime wildlife resources.

53- Flamenco Peninsula (Culebra) M-42

The Flamenco Peninsula is located in the northwestern tip of Culebra Island. Approximately 164 acres are administered by the U. S. Fish and Wildlife Service as a part of the Culebra National Wildlife Refuge. The remainder of the peninsula is administered by the DNR. The Shiny-backed Skink (CT) occurs in the southeastern basal portion of the Peninsula according to records of the DNR Natural Heritage Program. The most important part of this peninsula is located near its tip, in the sector known as Punta Molinos, where a tern nesting colony is located during the summer months. Several tern species nest there, but the largest number by far is that of the Sooty Tern. Numbers of nesting sooties have been relatively stable since regular data gathering began in 1984 (Jaime Collazo, Pers. Comm.). Human access to the tern breeding area has been restricted by placing two padlocked gates; one near the Flamenco Public Beach and another about midway to the nesting colony. Increased patrolling of the area by personnel of the Culebra Conservation and Development Administration (CCDA) and the U.S. Fish and Wildlife Service during the nesting season has probably resulted in reduced poaching.

Reduced cattle grazing of the Punta Molinos sector during the last few years has promoted the development of thick pasture and shrubby vegetation that apparently discourages tern nesting, causing a reduction in tern use of the area. In our opinion vegetation of the area has become increasingly thick during recent years. Controlled experiments may be necessary to determine whether management of the vegetation (burning, cutting, allowing cattle grazing outside the breeding season, etc.) is desirable to maintain optimal conditions for the continued return of terns.

The field evaluation of this site took place during the tail end of the 1988 Sooty Tern breeding season. Several thousand terns, including Sooty, Bridled and to a lesser degree Noddy terns were observed hovering over the Peninsula. A number of flightless juveniles were seen scurrying about the thick

vegetation that has developed beyond the Peninsula's cattle excluding fence.

The area remains one of primary wildlife value.

54- Flamenco Lagoon (Culebra) M-42

Flamenco lagoon is located in the northwestern portion of Culebra Island, near the base of Flamenco Peninsula. This shallow lagoon was included in the 1979 document principally because it supported the largest remaining population of the uncommon Bahama Duck. This fairly large lagoon, surrounded by mangrove and other woody vegetation, depends entirely on rainfall. It may dry up completely during seasons of severe drought, but usually has enough water to sustain a diversity of waterfowl. Other wildlife using the area include the Ruddy Duck (CT), Common Moorhen, migrant Blue-winged Teal and other ducks, Black-necked Stilts, and a variety of herons and migrant shorebirds such as plovers and sandpipers.

During field evaluation of this site in late October 1987 we observed the Bahama and Ruddy ducks, and a pair of the Least Grebe (CT). Ruddy Turnstones and Spotted Sandpipers were also seen foraging along the lagoon's margins. No hunting is allowed in Culebra, and this is no doubt partly responsible for the extensive use by waterfowl of this area.

The development of recreational facilities at nearby Flamenco Beach and the concomitant increase of human presence on its access road, which borders the lagoon, may adversely affect wildlife use of the area. At the present time, however, this is not apparent. Other developments that might have a negative impact on the area include the increase in size of a nearby garbage dump and the construction of several additional houses in the strip of land between the lagoon and Flamenco bay. Flamenco lagoon is arguably the best area for waterfowl in Culebra. Additional development in its surroundings would probably decrease its value in this respect.

Although there has been an increase in human presence due to the above mentioned expanded recreational development of nearby Flamenco beach and increase in number of housing units, the status of Flamenco Lagoon is similar to that of 1979. Flamenco Lagoon remains one of Puerto Rico's prime wildlife resources.

55- Cornelius Lagoon (Culebra) M-42

This small, shallow lagoon is located on Culebra's western coast at a relatively short distance from Dewey, that Island's largest community. Like most of Culebra's lagoons, Cornelius dries up at times.

The lagoon is checked for waterfowl use on an irregular basis (due to access restrictions) by DNR personnel conducting a long term study of ducks and other game waterfowl. These researchers have observed as many as 60 individuals of the rare Bahama Duck in the lagoon, but the number is usually much smaller (Edward Rodriguez, Pers. Comm.). Although the 1979 document suggested that this lagoon was very important to the breeding of the Bahama Duck, later investigations have failed to confirm this. Only in a very few occasions have very young individuals of the species been observed at the lagoon. However, locals maintain that these ducks often breed in nearby cays (Luis Peña Cay is only several hundred meters away) and then move to the lagoon to spend the duckling period of their life cycle.

The Ruddy Duck (CT), a candidate to the Federal Endangered Species List, is found occasionally at Cornelius Lagoon in small numbers. This is probably due to the lagoon's shallow depth. Another diving duck, the Masked Duck (CT) has also been reported on the lagoon, according to records of the DNR's Natural Heritage Program. Common Moorhen and Coots also utilize the area. Whether the latter are Caribbean or American coots has not been determined with certainty. Black-necked Stilts also use the area.

At least two houses have been built in the near vicinity of the lagoon. The owners of one of the houses built a barbwire fence around what they claim is their property, including Cornelius Lagoon. Nevertheless, the area is classified as Public in a Planning Board Map (1987). Also, powerlines have been installed a few hundred meters away from the lagoon's northern shore in lands whose zoning classification allows for certain forms of housing development. This, together with the controversy over ownership of the lagoon drives us to conclude that the area is somewhat degraded relative to 1979, and that there is a real threat for further degradation.

Cornelius Lagoon is a primary wildlife area.

56- Resaca Mountain (Culebra) M-43

Resaca Mountain is located in the north-central portion of Culebra Island. It is administered by the U.S. Fish and Wildlife Service as a part of the Culebra National Wildlife Refuge. It harbors one of the few relatively undisturbed remaining tracts of dry subtropical forest in that Island.

Resaca Mountain includes the habitat type (moist and dry forest) thought to be critical for the Culebra Giant Anole. This arboreal species has not been observed during the last several decades. A year long study by DNR personnel aimed at finding individuals of the species and which focused heavily on this site failed to reveal any (Ojeda-Kessler 1986). The study recommended that the species be considered extinct on Culebra. It also recommended that further searches be conducted in Vieques, St. John and Tortola in view of recently uncovered evidence of specimens collected in those locations during the 1800's.

The 1979 document suggested that small populations of the Bridled Quail Dove and the P.R. Screech Owl may survive in the area. Neither species were detected during the year long study, nor during field evaluation over two consecutive days. However, much of the habitat type of this area is becoming increasingly rare in Culebra, which supports the only known population of the endangered endemic plant Peperomia wheeleri (EF) a bushy herb.

In our opinion Resaca Mountain is of secondary importance to wildlife.

57- Resaca Beach (Culebra) M-43

Resaca Beach, slightly over a kilometer in length, is located in Culebra Island's northwestern portion, east of the Flamenco Public Beach. This high energy beach is separated from the latter by steep cliffs and exposed rocks that prevent easy access. Reaching Resaca Beach by land and sea is difficult, resulting in little disturbance by humans. It was included in the 1979 document because of its importance for the nesting of several species of sea turtles. It is most often utilized by the Leatherback (FE) and Hawksbill (FE) sea turtles. In 1985 Resaca Beach was second only to Brava Beach in the number of Leatherback nests (Hall and Tucker 1985). Resaca Beach is owned by the Commonwealth of Puerto Rico. There is a cooperative agreement between the U. S. Fish and Wildlife Service and the Puerto Rico Department of Natural Resources for the management and conservation of Culebra's sea turtle nesting beaches.

In 1979, nest poaching and cattle were a severe problem in the area. Poaching continued to be a problem until 1984, when nest protection began (Hall and Tucker 1985). Some poaching still occurs, but levels are minimal compared to before 1979, largely the result of all night patrolling during the nesting season. In recent years the DNR built a fence parallel to the beach to exclude cattle from the turtle nesting area. These management measures have resulted in an increasing number of hatchlings reaching the ocean. Management has been combined with an ongoing research effort, principally by the U. S. Fish and Wildlife Service, to document nesting levels, hatching success and other aspects of sea turtle biology.

Natural events may have a negative impact on the habitat quality of Resaca Beach. Rough seas in late 1987 and early 1988 resulted in significant erosion of the beach and may have made it less attractive to turtles (Theresa Tallevast, Pers. Comm.). Also, researchers are concerned that feral dogs, which are sometimes seen at Resaca Beach, may learn to dig out nests (Hall and Tucker 1985). We concur with the recommendation that dogs should be removed from the area before they become a problem.

Resaca Beach continues to be a primary wildlife area. It is greatly improved relative to 1979.

58- Brava Beach (Culebra) M-43

Brava Beach is located east of Resaca Beach, in Culebra Island's northwestern portion. It is about one kilometer long. This high energy beach is separated from Resaca Beach by Cayo Matojo. This area is of relatively difficult access, resulting in reduced disturbance by humans. It was included in the 1979 document because of its importance for the nesting of several species of sea turtles. The Leatherback (FE) and Hawksbill (FE) sea turtles are known to nest in this area. In 1985 it had the largest number of Leatherback nests (Hall and Tucker 1985) in Culebra. Brava Beach is owned by the Commonwealth of Puerto Rico. There is a cooperative agreement between the U. S. Fish and Wildlife Service and the Puerto Rico Department of Natural Resources for the management and conservation of Culebra's sea turtle nesting beaches.

A fence was built by the DNR to exclude cattle from the turtle nesting area. Poaching of nests continued to be a problem until 1984, when nest protection began (Hall and Tucker 1985). Some poaching still occurs, but levels are minimal compared to before 1979, largely the result of all night patrols during the nesting season. These management measures have resulted in an

increasing number of hatchlings reaching the ocean. Management has been combined with an ongoing research effort, principally by the U. S. Fish and Wildlife Service, to document nesting levels, hatching success and other aspects of sea turtle biology.

Brava Beach, like Resaca Beach, was affected by rough seas in late 1987 and early 1988. This resulted in erosion levels that may have made it less attractive to turtles (Theresa Tallevast, Pers. Comm.). However, seasonal erosion and redeposition of sand are characteristic of high energy beaches (Gilberto Cintrón, Pers. Comm.).

Brava Beach continues to be a primary wildlife area. It is greatly improved relative to 1979.

59- Larga Beach and Zoni Lagoon (Culebra) M-43

This area is located in the northern coast of Culebra Island. It is composed of a shallow lagoon surrounded by mangrove and a relatively long and narrow stripe of sandy beach. An area on the southeastern portion of the lagoon is used intensively by cattle. Unlike other more readily accesible areas of Culebra, the status of the Zoní sector of Larga Beach has remained unchanged relative to 1979. The lagoon is publicly owned, but the surrounding hills are private.

Endangered sea turtles nest in the Zoní sector of Playa Larga. During the 1988 sea turtle nesting season at least 18 nests have been recorded for this beach, a substantial increase over previous years (Theresa Tallevast, Pers. Comm.). Severe erosion at Resaca and Brava beaches during the winter of 1987 apparently made them less attractive to sea turtles, and apparently some sea turtles nested at Zoní Beach instead. In late October 1987 we observed one sea turtle about 100 meters offshore during the early morning, but we found no turtle tracks on the beach.

Zoní is probably only second in popularity to Flamenco Beach. Cattle and off-road vehicles are prevented from damaging sea turtle nests by a barbwire fence built by DNR. At the time of the field evaluation the fence was broken. In addition to repairing the fence, it may be necessary to restrict human use of this beach during the sea turtle breeding season.

Shrubby vegetation has developed in the sloping area formerly dominated by grasses around parts of Zoni lagoon. Possibly reduced cattle grazing has promoted the development of the shrubby vegetation. This area has supported breeding of the

Bahama Duck in the past. Ongoing waterfowl research by DNR personnel failed to find nesting Bahama Ducks in the area during the last two years (Edward Rodriguez, Pers. Comm.). In mid-August 1988 we found several broods of the Bahama Duck (about 30 chicks total) walking on the lagoon's almost dry bed. Bahama Ducks are known to nest in the shrubby pastures on the hills surrounding the lagoon to the south-east. Coots, Pied-billed Grebes, Common Moorhens, and the Ruddy Duck (CT) are regularly observed at Zoni Lagoon by the DNR waterfowl research team (Edward Rodriguez, Pers. Comm.).

During the mid-August visit to the lagoon, about twenty percent of the area was covered with water of a depth of one inch or less. We found at least 13 carcasses of what appeared to be mature sized Bahama Ducks spread around the perimeter of the lagoon, probably the result of some unknown disease since ducks usually move elsewhere when harsh conditions arise.

The hills to the south-east of the lagoon are privately owned and new unpaved roads have been built. Some of the land has been divided into small lots. The area is under threat of development, as the zoning classification (RO-25, RO-1) allows for the construction of housing, albeit with certain restrictions. The area is one of the few known sites supporting reproduction of Bahama ducks in Puerto Rico and increased human disturbance would probably decrease its value in this respect. It may be necessary to designate the area surrounding Zoni Lagoon with a more restrictive classification. Otherwise, its value for threatened or endangered native avifauna and for migratory waterfowl may decrease or be lost in the near future.

In our opinion Larga Beach should be protected from development, given its importance to the nesting of endangered sea turtles. The Zoní sector of Larga Beach and Zoní Lagoon are primary wildlife areas.

60- Puerto del Manglar (Culebra) M-44

Puerto del Manglar is located in the southeastern portion of Culebra Island, south-west of Culebrita. Of approximately 56 acres in area, it is one of Culebra's mainland four units of the Culebra National Wildlife Refuge administered by the U. S. Fish and Wildlife Service. It was included in the 1979 document principally because the rare White-crowned Pigeon occurs in the area. The area's bioluminiscence was cited as another reason for its inclusion. Brown Pelicans (FE) roost in the area.

Details on the structure of the mangrove vegetation in this

area are found in Cintrón et al. (1978). During field evaluation we observed Brown Pelicans in the area's small bay. Other bird species such as the Magnificent Frigatebird and the Sooty Tern were observed in the area, also.

The area is similar in conditions relative to 1979, but at present there are pressures to develop nearby property. Privately owned tracts on the hilly sector surrounding the mangrove area have been divided into relatively small lots and a few houses have been constructed on these. It is not known whether present development levels may have an adverse effect on the bioluminiscence of the area through increased sediment loading caused by erosion and runoff. Sedimentation patterns and intensities, as well as other aspects that may be detrimental to the area's ecology should be considered before additional development is permitted around the area.

The area is of primary importance to wildlife.

61- Cementerio Bay (Culebra) M-44

Cementerio Bay is located on the northeastern portion of Ensenada Honda bay, on Culebra Island's southern coast. The area is composed for the most of medium-sized red mangroves bordering a cul-de-sac near the San Ildefonso facilities of the Corporation for the Development and Conservation of Culebra, assigned to the DNR. The area has escaped the encroachment that has resulted from squatters in other parts of Culebra Island. Details on the structure of the mangrove vegetation in this area are found in Cintrón et al. (1978).

We did not observe the rare White-crowned Pigeon in the area during field evaluation in mid-August 1988. However, DNR Rangers reported to us that these could easily be observed in the area and in adjacent San Ildefonso up to about mid-June. This roughly coincides with the known nesting season of the species at Dorado in mainland Puerto Rico (Wiley and Wiley 1979). Although the evidence is circumstantial, the possibility that White-crowned Pigeons are breeding in the area cannot be discounted. Its importance for reproduction of the declining populations of the White-crowned Pigeon remains to be determined, therefore it is considered as of secondary importance to wildlife.

62- Los Caños (Culebra) M-44

This mangrove forest is located in the coast east of the town of Culebra. Approximately 71 acres in area, it is composed of mangrove stands, islets, and interconnecting channels. It was included in the 1979 document because the rare White-crowned Pigeon and Bahama Duck ocurred in the area. Los Caños is important for migrant and resident shorebirds. It is administered by the U. S. Fish and Wildlife Service as a part of the Culebra National Wildlife Refuge.

We observed the Bahama Duck during field evaluation in mid-August 1988 on a shallow pond. Black-necked Stilts, Greater Yellowlegs and Green-backed herons were observed also at this time.

Los Caños is regularly patrolled by U. S. Fish and Wildlife Service personnel. The area appears similar in conditions as in 1979. Wildlife use of the area is still poorly known, it retains classification as a primary wildlife area until more data is obtained on wildlife use.

63- East Point of Vieques (Vieques) M-45

The east Point of Vieques, defined in the 1979 Critical Wildlife Areas document as including Cerro Matías, lies within the bombing range of the Camp García Marine Base. It was included in the document because of the possibility that a nearly extinct subspecies of the Puerto Rican Screech Owl, Newton's Owl, may survive around Cerro Matías. Other wildlife of importance includes the White-tailed Tropicbird and two unusual geckos, Sphaerodactylus macrolepis iñigoi a subspecies endemic to Vieques, and S. roosevelti, of very limited distribution. Occasionally, the rare Bahama Duck has been observed in water filled bomb craters, and the Zenaida Dove and the Mourning Dove are not uncommon near the simulated airstrip. Leatherback, and to a lesser degree, Green and Hawksbill sea turtles nest in Yellow Beach south of Cerro Matías and in Tortuga Beach in the north shore of the tip. The American Oystercatcher can be seen along the rocky shore east of Bahia Salinas del Sur, one of the few localities other than rocky offshore islets in eastern Puerto Rico where this uncommon species occurs. The species has nested at nearby Conejo Cay (Sorrie 1978).

During field evaluation of this area we were not allowed to venture into the bombing range area. We observed the east tip from the top of Cerro Matías proper, with the aid of binoculars. Anones Lagoon, which lies directly within the bombing range

appears badly degraded even in comparison to 1978 when one of us (J. Cardona) worked in the area. The observation point facilities of Cerro Matias area being expanded, but not to the point of affecting the large Black Olive trees (Bucida buceras) west of Cerro Matías that harbor cavities which that could be used by smal owls, such as the Newton's Owl.

The area has become relatively degraded compared to 1979. The east tip of Vieques is a primary wildlife area.

64- Conejo Island (Vieques) M-45

This cay, located about one mile south of Cerro Matías and owned by the US Navy, harbors one of the largest breeding colonies of the Brown Pelican (FE) in Puerto Rico. Also, several tern species, including the Roseate Tern (FE), as well the White-tailed Tropicbird and the American Oystercatcher nest in this small Island of about 3.8 hectares. Its importance as a wildlife area cannot be overstated. We observed the area from the Cerro Matías Observation Point with high powered binoculars, and could not detect significant changes in its vegetation cover relative to 1978, when one of us (J. Cardona) visited the Island on several occasions.

In 1978 there were a number of bomb craters on the Island, suggesting that bombs hit the area at least occasionally. Most of these craters probably were formed when the Island was used as a bombing target during the 1960's. Also, there were also several flare parachutes lying on the ground, which, if still ignited when they land on the Island, may directly affect the nesting birds or their young.

This primary wildlife area does not appear to be degraded. However, it is important that Naval personnel practicing in the adjacent bombing range be alerted as to the importance of the Island to minimize the possibility of accidental hits. The Navy has entered into a cooperative agreement with the U.S. Fish and Wildlife Service aimed at protecting the Brown Pelican breeding colony of the Island.

65- Ensenada Honda Mangrove (Vieques) M-46

The Ensenada Honda Mangrove area, located east of Chiva bay was included in the 1979 document because it supported the uncommon White-crowned Pigeon, and probably several endangered waterfowl.

A few sea turtles were observed in the Ensenada Honda bay during 49 weekly aerial censuses in the mid-1980's (Rathbun et al. 1985). All sea turtles occurring around Vieques are listed as Endangered under the 1973 Federal Endangered Species Act, as amended. No West Indian Manatees (FE) were observed in the area during that study.

During field evaluation we observed the Common Moorhen in the open water area. We also observed several heron species moving over the relatively tall mangrove trees that grow thickly in the area. The Glossy Cowbird, a nest-parasite , as well as the Yellow Warbler, one of its hosts, were common along the drier margins. We did not observe the White-crowned Pigeon, a situation that prevailed during this five day stay in Vieques Island. Nevertheless, the area is still a primary wildlife area and increased monitoring should help determine its actual use by wildlife.

66- Chiva Swamp (Vieques) M-47

The Chiva Swamp is located in Vieques Island's southern coast, within the U.S. Navy Base of Camp Garcia. It was included among the Island's critical wildlife areas in 1979 primarily because its inaccessibility and physical characteristics appeared ideally suited for species such as West Indian Whistling Duck (FE). The rare Bahama Duck is known to occur in the area.

During field evaluation of the site we observed the Common Moorhen. The Least Tern (FT) has been seen at Chiva Swamp (Sorrie 1975), but we did not observe it. The easily disturbed Magnificent Frigatebird occasionally roosts in Chiva Cay, where Sorrie (1978) has reported about 50 individuals, but no signs of nesting. The area is similar in condition to 1979.

This area remains inaccessible, and still could potentially harbor some of the rare species that are suspected from it. Increased monitoring should be established to help determine actual wildlife use of the area. Chiva swamp is a primary wildlife area.

67-Yanuel Lagoon (Vieques) M-47

Located in the southeastern portion of Vieques Island, this brackish water lagoon supports a variety of bird species including doves and pigeons and a number of wading birds. During the migratory bird season, plovers and sandpipers occur in large concentrations around the shallow fringes of the lagoon and surrounding saltflats. Also, the only recent sighting of the Yellow-shouldered Blackbird (FE) in Vieques occurred in the hills north of this lagoon in 1978 (J. Cardona Pers. Obs.).

During field evaluation the lagoon had little water, but several heron species were observed feeding in the open water areas that remained. Fiddler crabs (Uca spp.) were abundant. At dusk we observed a large pigeon, which could have been a specimen of the White-crowned Pigeonperched on a dead mangrove tree . One of us that had worked in the area in 1977-1978 (J. Cardona) believes that mangrove ingrowth has reduced the potential open water area of this lagoon, but we could not confirm this, since recent aerial photographs of the area are not available.

The Yanuel Lagoon is a primary wildlife area, and should be monitored to better determine its actual use by wildlife.

68- Tapón Bay (Vieques) M-47

Tapón bay is located in the southern central portion of Vieques Island, east of Cerro Caracas, within the Camp García Marine Base. It is composed of a small mangrove forest and a medium sized salt pond that is intermittently flooded. It was included in the 1979 document primarily because the salt pond is used by waterfowl and shorebirds. It was a popular hunting grounds at that time, since doves and pigeons are usually abundant in the surrounding mangroves and forested hills. The uncommon Bahama Duck and White-crowned Pigeon occur in the area. Sorrie (1978) reported migrant Ospreys from Tapón bay. Sea turtles have been observed immediately outside of the relatively shallow bay (Rathbun et al. 1985).

During field evaluation the salt pond was nearly dry and we only observed a few Black-necked Stilts. Conditions were unsuitable for other types of waterfowl and the timing of our visit, around noon on a sunny day, was not the most appropriate to survey the fauna of the area. A fair number of White-winged Doves were observed in the surrounding mangrove forest. We did not observe the White-crowned Pigeon, but this was the rule rather than the exception during our five day stay at Vieques Island. During a later field evaluation at nearby Puerto Ferro

White-crowns were fairly abundant, and their absence from Tapón bay is probably not symptomatical, but rather a reflection of fluctuating activity levels. Hunting in wildlife areas located within military facilities in Vieques Island has been prohibited since around 1981-1982 (Winston Martinez, Pers. Comm.).

The area appeared in similar conditions relative to 1979. Relatively large numbers of migrant shorebirds depend on this and other salt ponds in Vieques Island during winter. Tapón bay should continue to be considered a primary critical wildlife area.

69- Mosquito Bay, Ensenada Sombe and Ferro Bay (Vieques) M-48

This area is located east of La Esperanza community in Vieques', southern coast. The Ensenada Sombe Beach recreational facility borders the area to the west. It is made up primarily of mangrove forests, salt ponds and arid scrub vegetation. This area is pending designation as a Natural Reserve, incorporating the bioluminiscent bays of Puerto Ferro and Mosquito, and extending west to include Cayo de Tierra and Real Cays. Lands of the U.S. Navy, adjacent to the Natural Reserve are set aside as a conservation area. Lands in this area are owned by the Puerto Rico Industrial Development Company (PRIDCO) and of the Commonwealth's Public Works Department (Fuentes-Santiago 1988).

The area supports a diverse avifauna that includes terrestrial birds, waterfowl, wading birds and shorebirds. Forty-nine bird species have been reported from the area (Fuentes-Santiago 1988), including the Peregrine Falcon (FE). West Indian Manatees are occasionally observed around this area. Sea turtles were commonly observed during a one year study of Vieques Island utilizing aerial censuses (Rathbun et al., 1985). All sea turtles that occur around Puerto Rico are listed as Endangered under the Federal Endangered Species Act of 1973, as amended.

During the field evaluation of this area in mid-December 1987 we observed the rare Bahama Duck, several heron species, the Clapper Rail, Black-necked Stilts, migrant Greater and Lesser Yellowlegs and Black-bellied Plovers. Red-billed Tropicbirds nest at Cayo Real (also known as Cayo de Afuera). The Brown Pelican is fairly common in the area. We also observed the Ruddy Quail Dove (but not the rarer Key West Quail Dove, which has been reported from the area) and several warbler species, both resident and migrant.

Dumping of garbage and scrap metal along interior dirt roads aesthetically affect this area. However, patrolling by DNR Ranger Corps stationed in the Ensenada Sombe Beach Recreational Facility has kept this illegal activity to a minimum. Designation as a Natural Reserve will provide additional mechanisms for the protection of this primary wildlife area.

70- West Vieques (Vieques) M-49

The west end of Vieques Island was included in the 1979 document primarily because it supported what then was believed to be the largest population of the rare White-crowned Pigeon in Puerto Rico. Also, there are several brackish water lagoons surrounded by fairly well developed mangrove systems that support the rare Bahama Duck. The West Indian Whistling Duck (CT) has been reported from these lagoons.

Sandy beaches around the area support nesting of several sea turtles, including the Leatherback (FE), Hawksbill (FE), and Green (FE) sea turtles. The West Indian Manatee (FE) occurs in relatively large concentrations in the northwestern end of Vieques Island, especially west of Mosquito pier, and this is one of the prime localities for the species in Puerto Rico. A report on the distribution of Manatees and sea turtles in Puerto Rico (Rathbun et al. 1985) provides information of their seasonal occurrence around Vieques Island.

During field evaluation of areas in Vieques Island on mid-April 1987 only the lagoons in the west end had water in them, with the exception of Boca Quebrada lagoon.

The narrow channel that connects Boca Quebrada lagoon to the sea had become blocked by sand during rough weather. This, together with the drought conditions common to the first few months of the year cause its drying out and result in extensive mangrove death. Mangrove losses in this lagoon date back to at least 1978 according to Sorrie (1978), who had observed the West Indian Whistling Duck (CT). That was the last time the species was reported from the lagoon. We observed several of the more common waterfowl, such as the Common Moorhen. The Great Egret, Louisiana Heron and the Little Blue Heron were also observed in the lagoon. The lagoon has become degraded, but the US Navy was in the process of reopening the natural channel. In fact, a new channel had been built next to the natural one but it failed to work due to poor design.

In the Kiani lagoon complex, which includes the Pobre and Arenas lagoons we observed the Yellow-crowned Night Heron, the

Great Blue Heron, the Great Egret, the Common Moorhen, the rare Bahama Duck, the Clapper Rail, and heard the uncommon White-crowned Pigeon. This was the only instance in which we found evidence of the latter species during our five day stay in the Island, in spite of having searched intensively the west end, including the middle elevations of Monte Pirata. It is possible that our field evaluation coincided with low activity levels for the species but the situation merits further investigation, as White-crowned Pigeons were relatively common in Vieques in 1978 (J. Cardona, Pers. Obs.). In a later field evaluation in late May 1988 we observed about a dozen individuals of this species around Playa Grande lagoon, to the south. The Kiani lagoon complex appears to be in good condition.

Access to Playa Grande Lagoon in the south-west was difficult and we observed the area form a nearby vantage point. We observed several wading bird species including the Louisiana Heron, the Snowy Egret, and the Little Blue Heron. The channel that connects the lagoon to the sea was also blocked by sand. However, in this instance we detected less mangrove death than in Boca Quebrada Lagoon. Possibly less time had elapsed since the blocking of the channel. Corrective action was also planned by the US Navy to restore the channel.

Navy personnel that regularly patrol the west end claimed they had observed a small owl around the vicinity of Monte Pirata on several occasions. We searched the area at night but did not find the bird. The possibility that these are specimens of Newton's Owl, a rare subspecies of the Puerto Rican Screech Owl long suspected from Vieques, merits further investigation.

Wildlife areas in the west end of vieques as a whole appear to be in good condition relative to 1979, but we did not observe several of the important wildlife reported from these localities. Some form of regular monitoring of the area should be implemented to detect wildlife population trends and to provide insights into their causes, if any. Also, channels to the lagoons should be kept operational to prevent degradation of the mangrove systems, as these provide nesting substrate and refuge to many of the species that use the area. These actions could be coordinated with Navy personnel. All areas discussed in this segment lie within lands owned by the navy and are protected from encroachment.

The west end of Vieques contains marine, aquatic and upland forest systems supporting a great variety of wildlife making it a primary wildlife area.

71- Monito Island M-50

Monito Island is located about three miles North-west of Mona Island, in the Mona Passage, west of Puerto Rico. Of extremely rugged topography, this small Island is difficult to reach by boat due to the strong currents that commonly occur around it, and because its only landing spot is difficult to find. Human disturbance is minimal. This, together with its varied topography that includes cliffs, sea-facing cave openings, and a sloping plateau with patches of low vegetation has resulted in one of the most outstanding seabird nesting areas in Puerto Rico. This remote island, along with Mona Island, was declared a Natural Reserve in 1986.

Monito's wildlife value is remarkable. It supports a breeding population of the Yellow-shouldered Blackbird (FE). During field evaluation of this area in mid-July 1987 we observed about 15 to 20 individuals of this subspecies of the Yellow-shouldered Blackbird. Antonio Nieves, a former Resident Biologist in Mona Island, asserts that this number has been stable during the last few years. Most blackbirds were in pairs and apparently nesting in small cavities in sea-facing cliffs. They moved freely and frequently between the plateau and the cliff cavities, probably transporting food for nestlings. The Island also supports the endemic Monito gecko (FE). This small ground dwelling lizard is most frequently found underneath rocks of several inches in diameter. During the field evaluation we inspected more than 200 rocks and were unable to find a single individual. One of us (M. Rivera) had previous experience and great success searching for and finding the Monito gecko several years ago. Additional searches should be conducted to ascertain the current status of this species, one of the rarest reptiles anywhere in the world.

This area is better known for its seabirds. During the field evaluation of the Island we observed fully feathered nestlings of the Magnificent Frigatebird. Close to two hundred flying individuals were seen soaring overhead. We also found nestlings of the three booby species known from the Island; the Brown, Red-footed and Masked boobies. We found eggs only in the nests of the first species. Nestlings were in any stage between covered with down and almost ready to fledge. We found no nests of the Laughing Gull, known to nest there, although we observed about fifty individuals of this species flying overhead. We observed several nests of the Brown Noddy, but were surprised to find no nests of the Sooty Tern. The latter nests in large colonies and we had found it nesting in Mona Island the day before our visit to Monito. Monito probably lacks sufficient adequate nesting substrate to support that species or breeding for the year had been completed in this locality. Rats are

abundant in Monito, and they may prevent successful breeding of ground nesting seabirds, such as Sooty Terns. An intensive rat control campaign prior to the tern nesting season (Cruz and Cruz 1988) may improve their chances of successful breeding in the Island.

We observed at least three individuals of the Green sea turtle (FE) surfacing near Monito's coast. The Island lacks beaches and therefore nesting of this species is not possible.

Monito Island is in similar conditions relative to 1979. It is a prime wildlife area and we recommend that signs be posted alerting boatmen that visits to the Island may be effected only with previous authorization from the DNR secretary. It is a primary wildlife area.

72- Mona Island M-50

Mona Island, together with the rain forest of El Yunque, simbolize wilderness in the minds of most Puerto Ricans. This semi-arid island of 13,683 acres is made up of stratified limestone and dolomite rocks. It lies near the center of the Mona passage and is approximately 42 and 37 miles away from Puerto Rico and the Dominican Republic, respectively. Monito, Mona's satellite island is located about 3 miles to the north-West.

Mona supports a unique array of endemic species among both its flora and fauna. There are seven species endemic to the Island among reptiles and amphibians, including the Mona Island Ground Iguana (FE) that reaches up to four feet in length. Species in this genus are endangered or threatened throughout their range. Feral pigs dig out and feed on their eggs and feral cats often eat their young. A fence was built spanning the Uvero Beach-Sardinera area to exclude pigs from one of the principal nesting areas of iguanas and sea turtles. Uvero Beach, where sea turtle nest predation has been the most severe in recent years of monitoring (Anastasia Konto, Pers. Comm.), is located about three kilometers to the south-west of Sardinera in the same low lying plateau.

Other endemic reptilian fauna include the Mona Blind Snake , the colorful Mona boa (FT), the small litter inhabiting gecko Sphaerodactylus monensis, the teid lizard Ameiva alboguttata, the arboreal anole lizard Anolis monensis, and the tree frog Eleutherodactylus monensis, usually found in moist places such as caves and sinkholes.

Mona Island supports nesting of the Green (FE), Hawksbill (FE) and Leatherback (FE) sea turtles. Research in progress on the breeding biology of these species by Ms. Anastasia Kontos, a doctoral student from the University of Georgia, has already resulted in management recommendations to promote increased survival of these marine turtles. The above mentioned fence is the result of one of these recommendations. Still, the taking of adults by unscrupulous fishermen continues as turtles either leave or approach nesting areas. Although the DNR Ranger Corps maintains personnel on Mona Island, as does the Commonwealth's Police Department, their logistical facilities are currently less than adequate for the patrolling of Mona's waters.

Mona Island's avifauna is not as unique as reptiles and amphibians in terms of endemic species. However, it supports what still is the largest breeding population of White-tailed Tropicbirds in Puerto Rico. During field evaluation of this area in mid-July 1987 we observed upwards of 40 pairs, many of them performing their characteristic mating ritual flights near the Island's inaccessible cliffs. Red-footed and Brown boobies also occur in the Island and maintain breeding colonies in remote portions of Mona, near cliffs. Mr. Antonio Nieves, a former Resident Biologist at Mona, believes the colonies of both species are currently healthy.

Sooty and Bridled terns were almost through nesting when we evaluated the site, as the vast majority of nestlings were fully feathered, and many had fledged. These species nest on large boulders beneath tall cliffs, near sea level. We also observed a fair number of the endemic subspecies of the Yellow-shouldered Blackbird (FE). Several were carrying feeding or nest building materials to nests located in inaccessible sea-facing cliffs. Possibly the impact of the parasitic Glossy Cowbird is less in Mona Island than in mainland Puerto Rico due to the difference in nesting substrate preference between the two subspecies of blackbirds. Alternatively, not enough time has elapsed since the arrival of the cowbird in Mona Island. This has been the subject of debate and of ongoing research by graduate students.

Dove and pigeon hunting has been prohibited for some time in Mona Island, and the rare White-crowned Pigeon was abundant, especially in the interior of the limestone plateau. In spite of the pigeon and dove hunting prohibition, during a recent survey of spent shotgun shells in Mona, approximately one fourth were of the birdshot type. The carrying and possesion of birdshot ammunition should be prohibited in Mona.

Goat and pig hunting is allowed in Mona, and intense monitoring of the resource has been maintained for the last few years. Although the deleterious effect of pigs on the breeding

of iguanas and sea turtles is well documented, whether goats negatively affect the flora is the subject of a polarized debate. Once the debate is resolved, the DNR should decide whether management should be aimed toward goat control or toward sustainable yield for recreational purposes.

Mona and Monito Islands were designated a Natural Reserve in 1986. A modest museum has been established in Sardinera Beach. A resident biologist and supporting staff are permanently stationed on the Island, and research projects are encouraged. In addition, the road between Sardinera and Pájaros has been improved, allowing better patrolling of the area. We conclude that the area's status has improved since 1979. However, steps should be taken to minimize the taking of adult sea turtles near the Island. Mona Island is a primary wildlife area.

73- Desecheo Island M-51

Desecheo Island is located in the Mona Passage, about 15 miles west of the northwest corner of Puerto Rico. The entire island encompasses 360 acres. The Island is extremely rugged and rocky. At the turn of the century Desecheo harbored the world's largest known Brown Booby colony. Other species such as the Magnificent Frigatebird, Red Footed Booby and terns and gulls also bred in the Island. Years of bombing practice, and the later establishment of a free ranging Rhesus monkey colony for medical research by the National Institute of Health (USFWS 1986) resulted in the greatly dimished habitat value of the Island. In late 1976 the Island was returned to the administration of the National Wildlife Refuge System, after having been under the administration of several Commonwealth and Federal entities. By 1979, no seabirds were breeding successfully on Desecheo.

During field evaluation we found about 150 to 200 Magnificient Frigatebirds and about an equal number of Red-footed Boobies roosting on the Island's hills. We did not find any nests. Brown Boobies, terns, and seagulls were observed also flying around the Island.

Efforts to remove the remaining Rhesus monkeys that inhabit Desecheo have been initiated by the USFWS, which administers the Island. But because several monkeys remain at large, these efforts must be sustained to prevent the population from reaching pre-trapping densities. We did not observe any monkeys during two and a half days of evaluation of this island. Only a few surviving individuals were estimated at that time.

Three other infamous introductees, rats, cats and feral goats, also inhabit the Island (USFWS 1986). Rats are extremely numerous and fearless. We believe rats must share part of the blame with monkeys for the island's decline as a seabird sanctuary. The merits of a poisoning campaign to reduce rat density before the breeding season of seabirds should be given consideration. Such campaigns have been successful in protecting endangered seabirds in the Galápagos Islands (Cruz and Cruz 1988). We did not observe cats, and are unaware of any estimates of their abundance in Desecheo. Goats are few, estimated at about thirty. We observed a herd of nine, including several juveniles.

Desecheo, although currently of secondary importance to wildlife, is probably on its way to becoming a primary wildlife area once again.

74- Palmas Pond, Arroyo (Arroyo) M-52

The Palmas pond is located south of highway 3, north of the Punta Guilarte Public Beach facilities in Arroyo, in the southeastern caost of the Island. The pond was created relatively recently, after the failure of drainage pumps. This privately owned area, of approximately 146 hetares in size, was formerly utilized for sugarcane. This area represents an addition beyond those included in the 1979 Critical Wildlife Areas Document and the 1980 Supplement. It is surrounded by several sugarcane fields on its northern and western portions.

Palmas Pond was quickly colonized by a variety of waterfowl and wading birds. It has become a popular hunting grounds. During a field evaluation of the site related to hunting regulations performed in March 1988 by Mr. José L. Chabert of the DNR's Technical Assessment Division, he observed Ruddy Ducks (CT), Masked Ducks (CT), and Caribbean Coots (CT). Also, Chabert noted that Common Moorhen were abundant in the area even though his visit occurred late in the hunting season. During field evaluation of the site in mid-October 1988, we observed Brown Pelicans (FE), rare Black-crowned Night Herons, Caribbean and American Coots and Pied-billed Grebes. Also, we observed five ardeid species, including the Great, Snowy and Cattle egrets, and the Green-backed and Little Blue herons. Migrant Ospreys and flocks of migrant yellowlegs were also observed in the area.

The area is relatively shallow, and standing dead trees and patches of emergent vegetation are two of the factors that make it attractive to waterfowl and other species. Palmas pond should be monitored frequently to determine its importance to the

breeding of the species found there. The area should be acquired by the government or other means should be explored to accomplish its protection. It is a primary wildlife area.

LITERATURE CITED

Berrios, J., M. Canals, H. Ferrer, A. García, J. Gonzalez, A. Molinares, L. O. Nieves, R.A. Pérez, M. Rivera, S. Silander & J. Villamil. 1981. Suplemento Técnico para el plan de manejo del área de Bahía de Jobos. J. Villamil and M. Canals (editores). División Asesoramiento Técnico, Area Investigaciones Científicas. Departamento Recursos Naturales. San Juan, Puerto Rico

Carvajal-Zamora, J. R. 1976. Factores que afectan la bioluminiscencia en algunos sistemas estuarinos y marinos de Puerto Rico. En: Departamento Recursos Naturales. Tercer Simposio Departamento Recursos Naturales. San Juan, Puerto Rico, pp. 18-25.

Cintrón, G., A. E. Lugo, D. J. Pool & G. Morris. 1978. Mangroves of arid environments in Puerto Rico and adjacent islands. Biotropica. 10:110-121.

Collazo, J.A. & E. E. Klaas. 1985. Status and ecology of the Brown Pelican in Greater Puerto Rican Bank region. Final report to the Department of Natural Resources, Commonwealth of Puerto Rico. Iowa Cooperative Fish and Wildlife Research Unit. Iowa State University. Ames, Iowa.

Cruz, F. & J. B. Cruz. 1988. Control of Black Rats (Rattus rattus) and its effect on nesting Dark-rumped Petrels in the Galápagos Islands. Vida Silvestre Neotropical. 6:3-13.

Del LLano, M., R. Woodbury, and G. Cintrón. 1980. Flora del Bosque de Piñones. Borrador preliminar. Departamento Recursos Naturales. San Juan, Puerto Rico.

Department of Natural Resources. 1979. Critical wildlife areas of Puerto Rico. Area of Planning and Resources Analysis, Department of Natural Resources. San Juan, Puerto Rico.

Departamento Recursos Naturales. 1986. Documento de designación Reserva Natural Bosque de Pterocarpus de Dorado. Programa

de Mañejo de la Zona Costanera, Departamento Recursos Naturales. San Juan, Puerto Rico

Departamento Recursos Naturales. 1986. Documento de designación Reserva Natural Pantano y Bosque de Pterocarpus de Humacao. Programa de Manejo de la Zona Costanera, Departamento Recursos Naturales. San Juan, Puerto Rico

Departamento Recursos Naturales. 1985. Plan de manejo del Area de Planificación Especial de la Laguna Tortuguero. División de planificación de Recursos Terrestres, Area Planificación. Departamento Recursos Naturales. San Juan, Puerto Rico.

Díaz, C., B. Cintrón, M. Del Llano & J. Toro. 1983. Informe técnico para el plan de manejo de la Reserva Natural de la Parguera. División de Asesoramiento Técnico, Area de Investigaciones Científicas. Departamento de Recursos Naturales. San Juan, Puerto Rico.

Díaz Marrero, O., J. A. Colón, & B. A. Cintrón. 1983. Inventory of the flora and fauna of Martín Peña channel. Technical Assessment Division, Scientific Research Area. Department of Natural Resources. San Juan, Puerto Rico.

Encarnación, L. & G. I. Fuentes. 1988. Plan de manejo del Area de Planificación Especial del Suroeste, Sector la Parguera. (Revisión 1988). División de Planificación de Recursos Terrestres, Area Planificación. Departamento Recursos Naturales. San Juan, Puerto Rico.

Ecology and Environment Inc. 1986. Land use management plan for Naval facilities, Vieques, Puerto Rico. (Draft). Department of the Navy.

Environmental Quality Board. 1972. Vieques 1972 Survey of the Natural Resources. Environmental Quality Board. Office of the Governor, Commonwealth of Puerto Rico.

Faaborg, J. R. & J. W. Terborgh. 1980. Patterns of migration in the West Indies. In: A. Keast and E. S. Morton (editors). Migrant birds in the Neotropics. Smithsonian Institution Press, Washington D.C. pp. 157-163.

Ferrer, H. 1979. Informe sobre la vida silvestre en el Area de Planificación de la Laguna Tortuguero. División de Planificación de Recursos Costaneros, Pesca y Vida Silvestre. Area de Planificación. Departamento Recursos Naturales. San Juan, Puerto Rico.

Fuentes-Santiago, G. I. 1988. Documento de designación Reserva Natural Bahias Luminiscentes de Vieques. División de Planificación de Recursos Terrestres, Area Planificación. Departamento Recursos Naturales. San Juan, Puerto Rico.

Hall, K. V. & A. D. Tucker. 1985. Leatherback Turtle Dermochelys coriacea Nesting in Culebra, Puerto Rico in 1985. Research Report submitted to the U. S. Fish and Wildlife Service.

McKenzie, F. & M. Benton. 1972. Biological Inventory of the Waters and Keys of North-East Puerto Rico. Division of Natural Resources, Department of Public Works. San Juan, Puerto Rico.

Molinares, A. 1978. Reproduction and morphology of the west Indian Ruddy Duck in Puerto Rico. MS Thesis. Oklahoma State University.

Moreno, J. A. & R. Pérez. 1980. First supplement to Critical Wildlife Areas of Puerto Rico. Draft. División de Planificación de Recursos Costaneros, Pesca y Vida Silvestre, Area de Planificación. Departamento Recursos Naturales. San Juan, Puerto Rico. 16 pp.

Ojeda-Kessler, A. G. 1986. Culebra Giant Anole Status Determination Study. E-S-I Study 4. Final report. Scientific Research Area. Department of Natural Resources. San Juan, Puerto Rico.

Palacios, R. 1981. Evaluación Ambiental. Informe técnico Area Planificación Especial de Piñones. División de Planificación de Recursos Costaneros, Pesca y Vida Silvestre. Area de Planificación. Departamento Recursos Naturales. San Juan, Puerto Rico.

Pérez, N. & H. Ferrer. 1981. Avifauna. Informe técnico Area Planificación Especial de Piñones. División de Planificación de Recursos Costaneros, Pesca y Vida Silvestre. Area de Planificación. Departamento Recursos Naturales. San Juan, Puerto Rico.

Pérez-Ramirez, M. A., Manuel del Llano & Carlos Laboy. 1981. Suplemento técnico para la Reserva Natural Laguna Joyuda y Terrenos Asociados. División de Asesoramiento Técnico, Area de Investigaciones Científicas. Departamento Recursos Naturales. San Juan, Puerto Rico.

Post W. and J. W. Wiley. 1977. Reproductive interactions of the Shiny Cowbird and the Yellow-shouldered Blackbird. The Condor 79:176-184.

Raffaele, H. A. 1983. A guide to the birds of Puerto Rico and the Virgin Islands. Fondo Educativo Interamericano. San Juan, Puerto Rico.

Rathbun, G. B., T. Carr, N. Carr, & C. A. Woods. 1985. The distribution of Manatees and sea turtles in Puerto Rico, with emphasis on Roosevelt Roads Naval Station. Installation Planning Division, Engineering Command. Atlantic Division Naval Facilities.

Reyes de Ruiz, N. B. 1971. Estudio ecológico de la Laguna Tortuguero, Puerto Rico. Universidad de Puerto Rico, Recinto Universitario de Mayaguez. Mayaguez, Puerto Rico.

Rivera-Ortíz, M., J. Villamil, A. Molinares, J. Berrios & W. Ortiz. 1981. Suplemento de información técnica para la Reserva Natural de Las Cabezas de San Juan, Fajardo, Puerto Rico. Area de Investigaciones Científicas, Departamento de Recursos Naturales. San Juan, Puerto Rico.

Rodriguez, J. 1981. Calidad de Agua. Informe técnico Area Planificación Especial de Piñones. División de Planificación de Recursos Costaneros, Pesca y Vida Silvestre. Area de Planificación. Departamento Recursos Naturales. San Juan, Puerto Rico.

Salles, R., M. del Llano, J. Rodriguez, J. Toro, G. Morris, E. Agosto, & B. Cintrón. 1983. Suplemento técnico para el manejo de la Reserva Natural de Caño Tiburones. Area de Investigaciones Científicas, Departamento de Recursos Naturales. San Juan, Puerto Rico.

Simberloff, D., and L. G. Abele. 1982. Refuge design and island biogeographic theory: effects of fragmentation. American Naturalist 120:41-50.

Sorrie, B. A. 1978. Report on the birds of Vieques Island, Puerto Rico. Draft Report. U. S. Navy. 35 pp.

Sorrie, B. A. 1975. Observations on the birds of Vieques Island, Puerto Rico. Caribbean Journal of Science. 15:89-103.

Toro, J. A. & J. A. Colón. 1986. Suplemento de información técnica para el plan de manejo del Area de Planificación Especial del Suroeste, Segmento de Boquerón. Divisón Asesoramiento Técnico, Area Investigaciones Científicas. Departamento de Recursos Naturales. San Juan, Puerto Rico.

Toro, J. A. & J. A. Colón. 1986. Suplemento de información técnica para el plan de manejo del Area de Planificación Especial del Suroeste, Segmento de Guánica. División Asesoramiento Técnico, Area Investigaciones Científicas. Departamento de Recursos Naturales. .San Juan, Puerto Rico.

Toro, J. A. & J. L. Chabert. 1986. Suplemento técnico para la designación de la Reserva Natural de Laguna Cartagena. Divisón Asesoramiento Técnico, Area Investigaciones Científicas. Departamento de Recursos Naturales. San Juan, Puerto Rico.

U. S. Department of Commerce, NOAA, Office of CZM. 1978. Puerto Rico Coastal Management Program and FEIS. Washington, D.C.

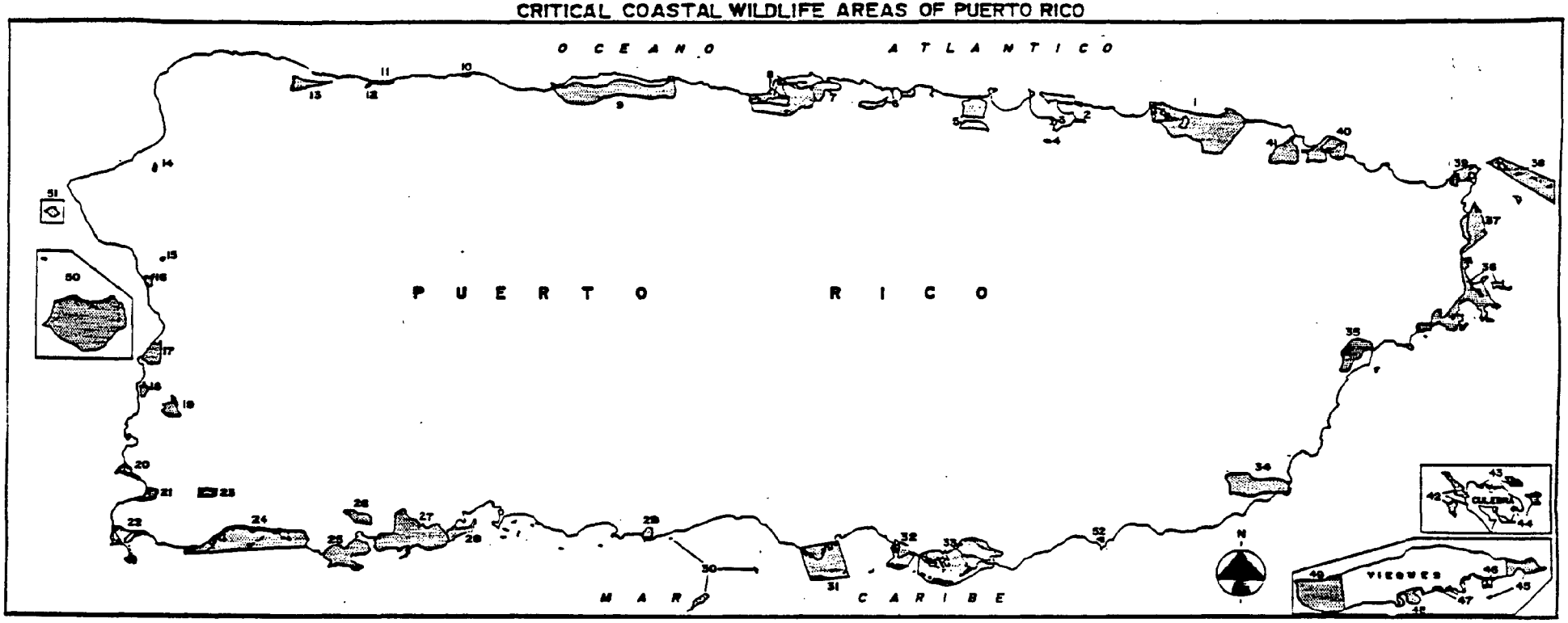
U. S. Fish and Wildlife Service. 1986. Annual narrative report, calendar year 1986. Desecheo National Wildlife Refuge, Caribbean Islands National Wildlife Refuges. National Wildlife Refuge System, Fish and Wildlife Service. U. S. Department of the Interior.

Villamil, J., M. Canals, S. Silander, M. del LLano, J. Gonzalez, E. Questell, M. Pérez, M. Rivera, M. J. Velez, V. Mestey, & R. Pérez. 1980. Suplemento técnico para la Reserva Natural Caja de Muertos. Area de Investigaciones Científicas, Departamento de Recursos Naturales. San Juan, Puerto Rico

Villamil, J., J. A. Colón, M. del Llano, M. Pérez, & I. Corujo. 1981. Suplemento de información técnica para la designación de la Reserva Natural Caño la Boquilla, Mayaguez, Puerto Rico. Area de Investigaciones Científicas, Departamento de Recursos Naturales. San Juan, Puerto Rico.

Wiley, J. W. and B. N. Wiley. 1979. The biology of the White-crowned Pigeon. Wildlife Monographs No. 64.

CRITICAL COASTAL WILDLIFE AREAS OF PUERTO RICO



LEYENDA

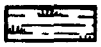
1 T[illegible]-ECOLLA-PENUELAS, VIEQUES TALEGA COMPLEX AND TORRECILLA AUX.
2 CONSTITUCION BRIDGE MANGLATE, SAN JUAN
3 POLO VIEJO PENINSULA
4 GUAYANILLA POND AND ADJACENT LAND
5 SAN PEDRO CREEK
6 LAKES AND PERCENTS OF POINT BRAVO BEACH AND WEST CORNER BEACH HOTELS
7 CEIBOS AND CAGO CIARIE SWAMPS
8 TORTUGUERO WILDLIFE AREAS
9 CAGO TRIANGLE SWAMP
10 CARRIZALES MANGROVE
11 GUAJATACA CLIFFS (EAST)
12 BELLACA CREEK (MATORRILLAL)
13 GUAJATACA CLIFFS AND GUAJANICA CLIFFS WEST
14 CAPARRA SWAMP
15 PUERTO NUEVO SWAMP
16 SABANETAS SWAMP
17 VIRGILIO MANGROVE
18 JOYUDA LAGOON
19 CUEVA LAGOON
20 GUANICILLA
21 GUANICA REFUGE
22 CABO ROJO SALTFLATS AND ADJACENT AREAS
23 CARTAGENA LAGOON
24 LA PARGUERA
25 GUANICA STATE FOREST WEST
26 GUANICA LAGOON
27 GUANICA STATE FOREST EAST
28 LLUVERAS
29 CABALLOS MANGROVE
30 SETENTA CAY, CAJA DE MUERTOS AND MEDIANITO ISLAND AND FISH BAY
31 PUNTA PETRONA
32 PUNTA ARENAS
33 PUNTA PIGUELO AND MAR NEGRO
34 [illegible]
35 MANCHAS SWAMP
36 ROOSEVELT ROADS NAVAL BASE
37 PLAYUELA COASTLINE
38 PLAYUELA CORRALIZOS
39 ARJAS PRIETAS LAGOON, GRANDE LAGOON AND ADJACENT LANDS
40 ENSENADA CORAZON
41 CEIBADA BAY
42 CALICHES SURROUNDING ISLETS, CORRALIZOS LAGOON, FLAMENCO LAGOON AND FLAMENCO PENINSULA
43 SOMBE BEACH, CALICHE'S SURROUNDING ISLETS, RESACA BEACH, RESACA MOUNTAIN, LAGUNA BEACH AND JOBOS LAGOON
44 CEMENTERIO BAY, CALICHES SURROUNDING ISLETS, LAS CABRAS AND PUERTO DEL MANGLAR
45 EAST TIP OF VIEQUES AND CONEJO ISLAND
46 ENSENADA HONDA MANGROVE
47 CHIN SWAMP, TAPON BAY AND MANUEL LAGOON
48 ENSENADA HONDA SWAMP, MOSQUITO BAY AND PUERTO BAY
49 WEST VIEQUES
50 MONA AND MONITO ISLANDS
51 DESECHEO ISLAND
52 Palmas Pond, Arroyo

SYMBOLS UTILIZED ON MAPS

Legend :

Water

Mangrove

Wetland 

Dike

Industrial Area

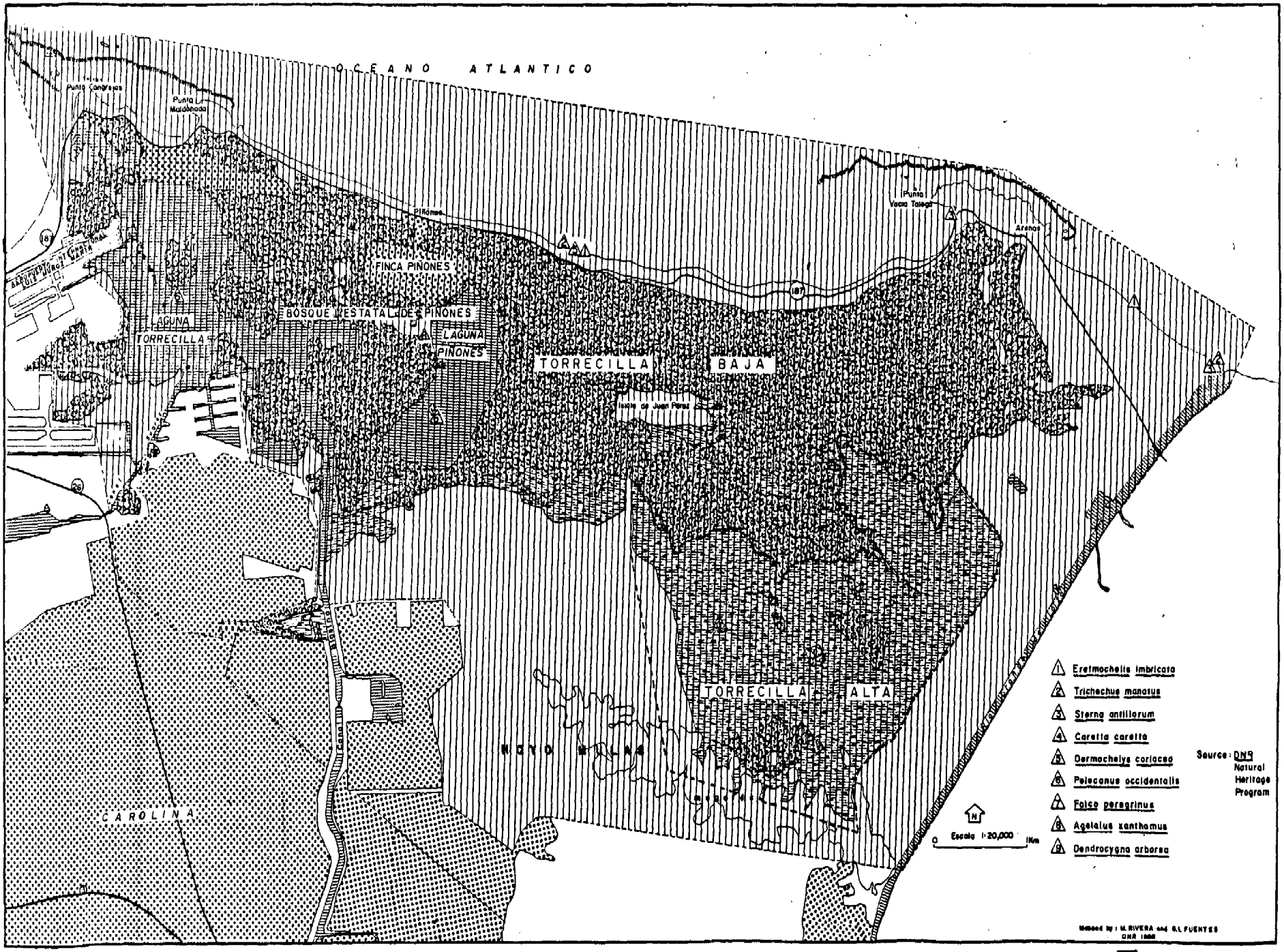
Urban or Residential Area

Name and Location of Critical Fauna in the Area

Area included as Critical Wildlife Habitat

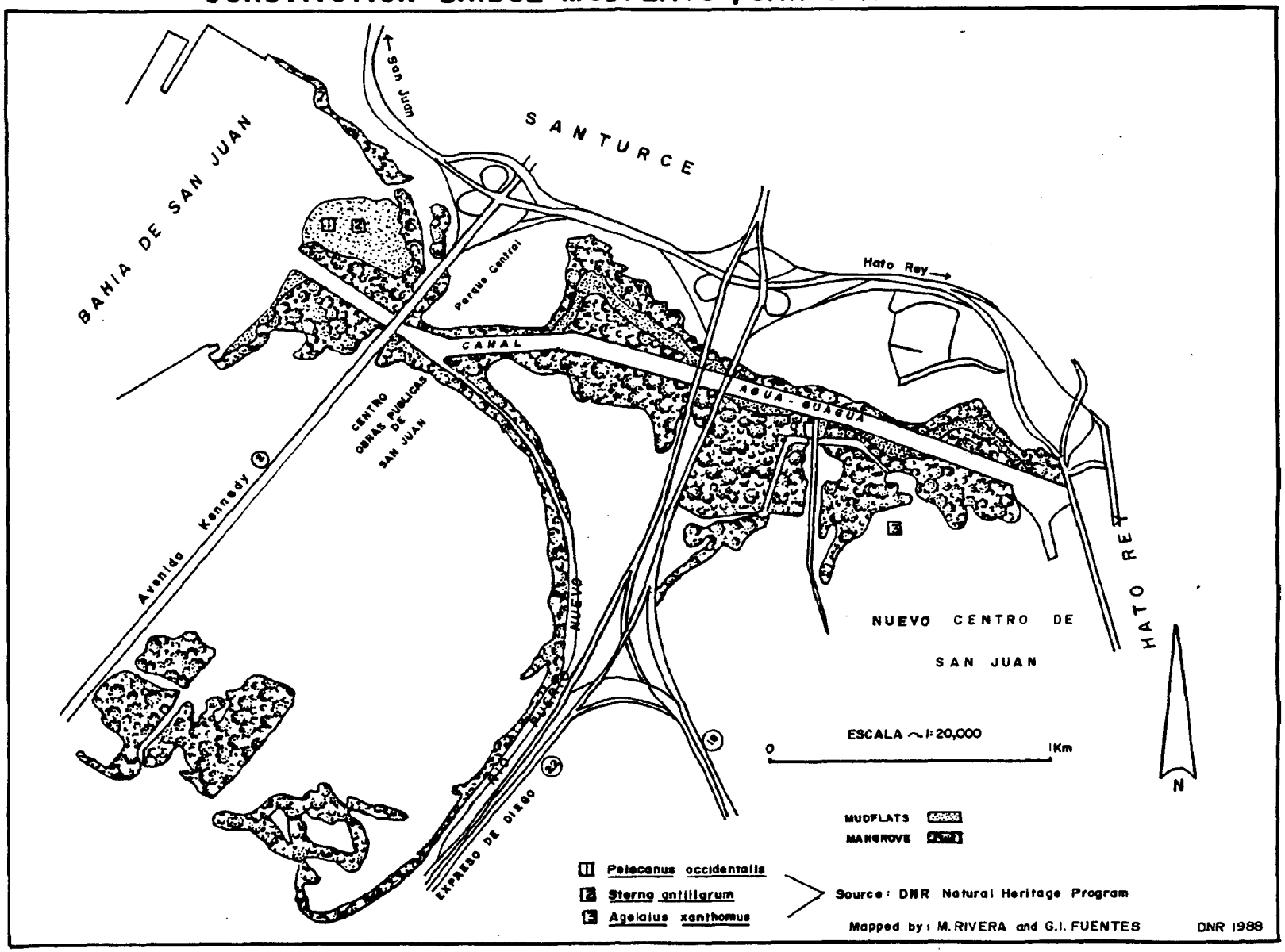
Sand dunes

TORRECILLA - PIÑONES, VACIA TALEGA COMPLEX AND TORRECILLA ALTA



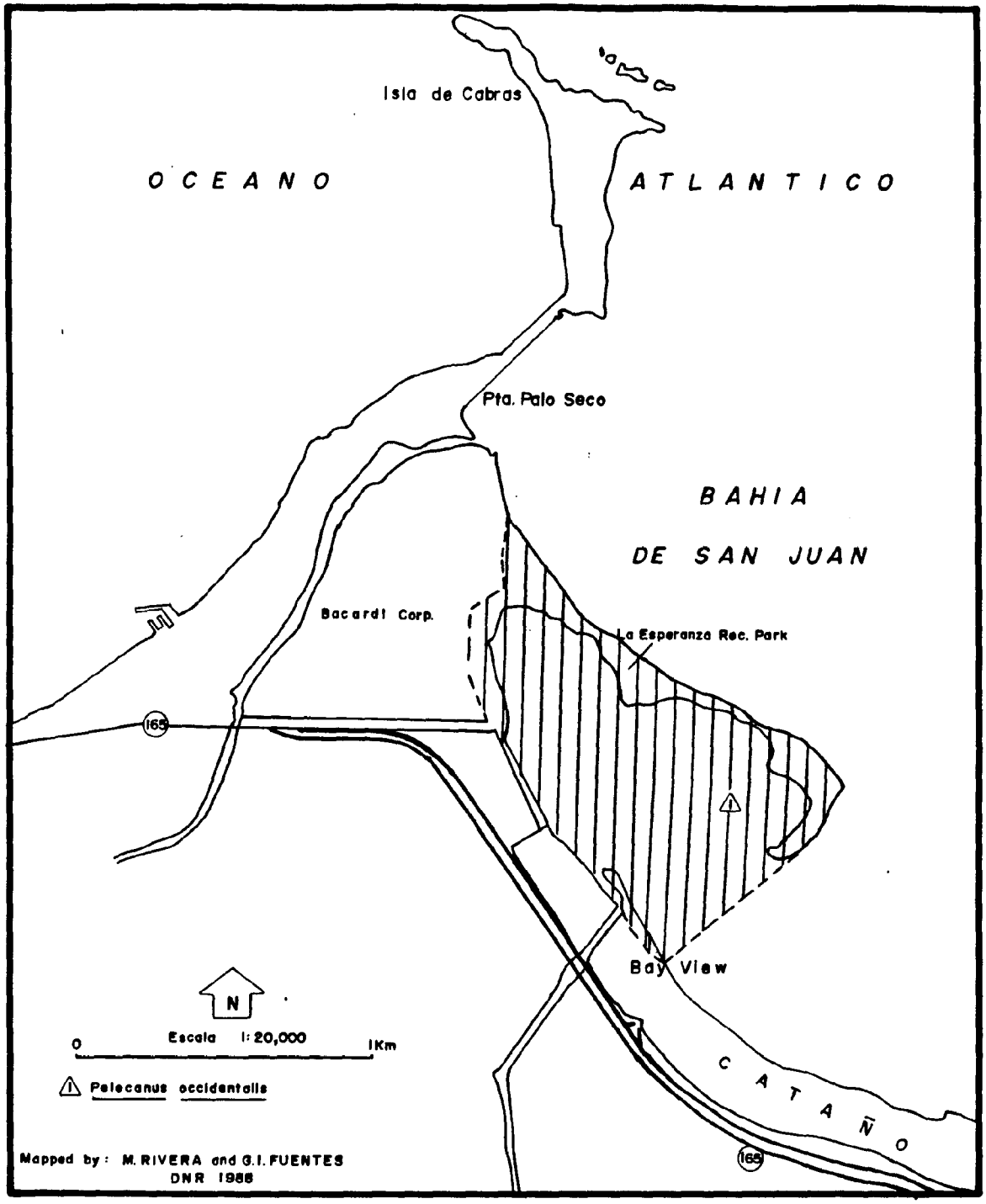
MAP I

CONSTITUTION BRIDGE MUDFLATS , SAN JUAN



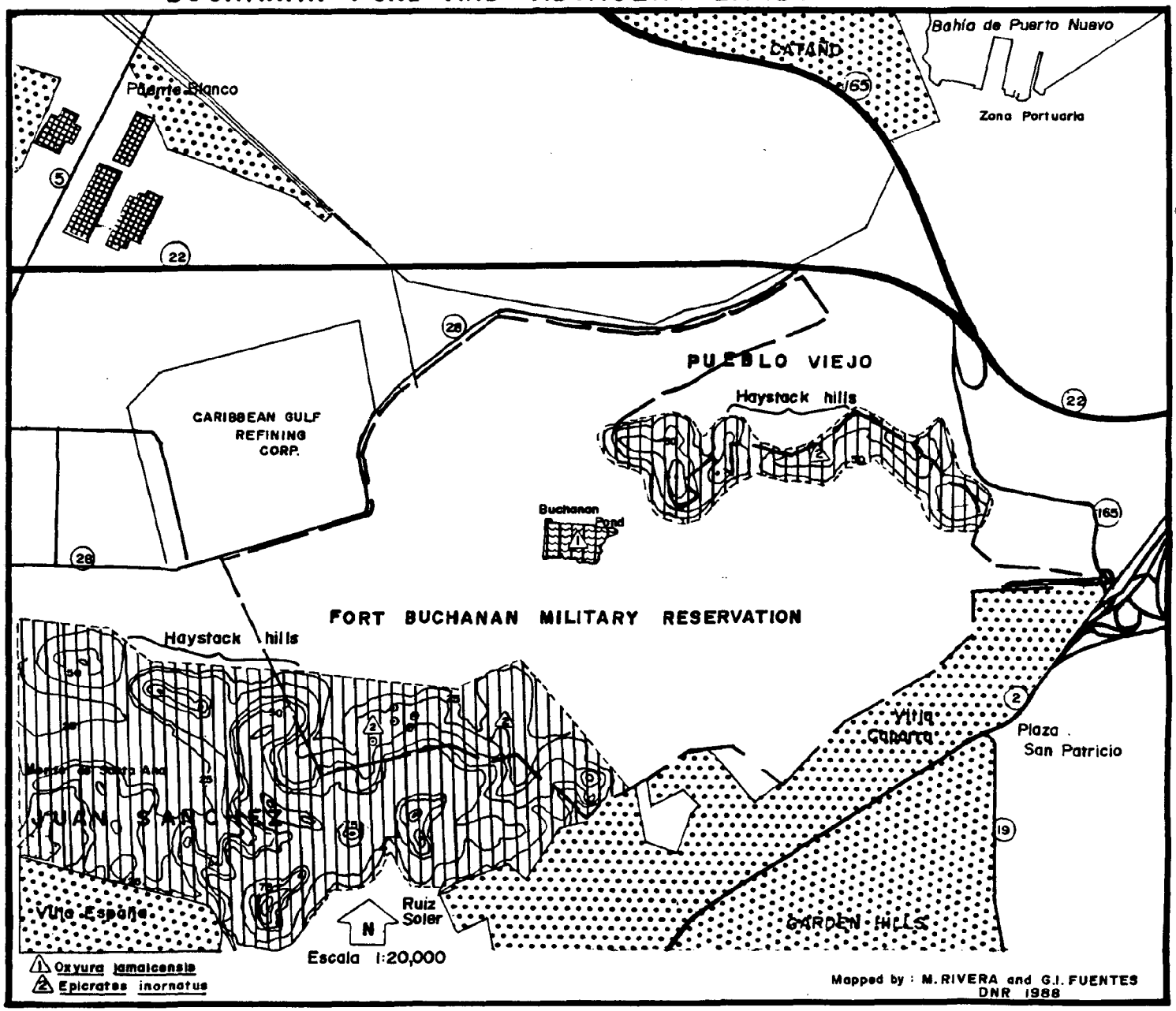
MAP 2

PALO SECO PENINSULA



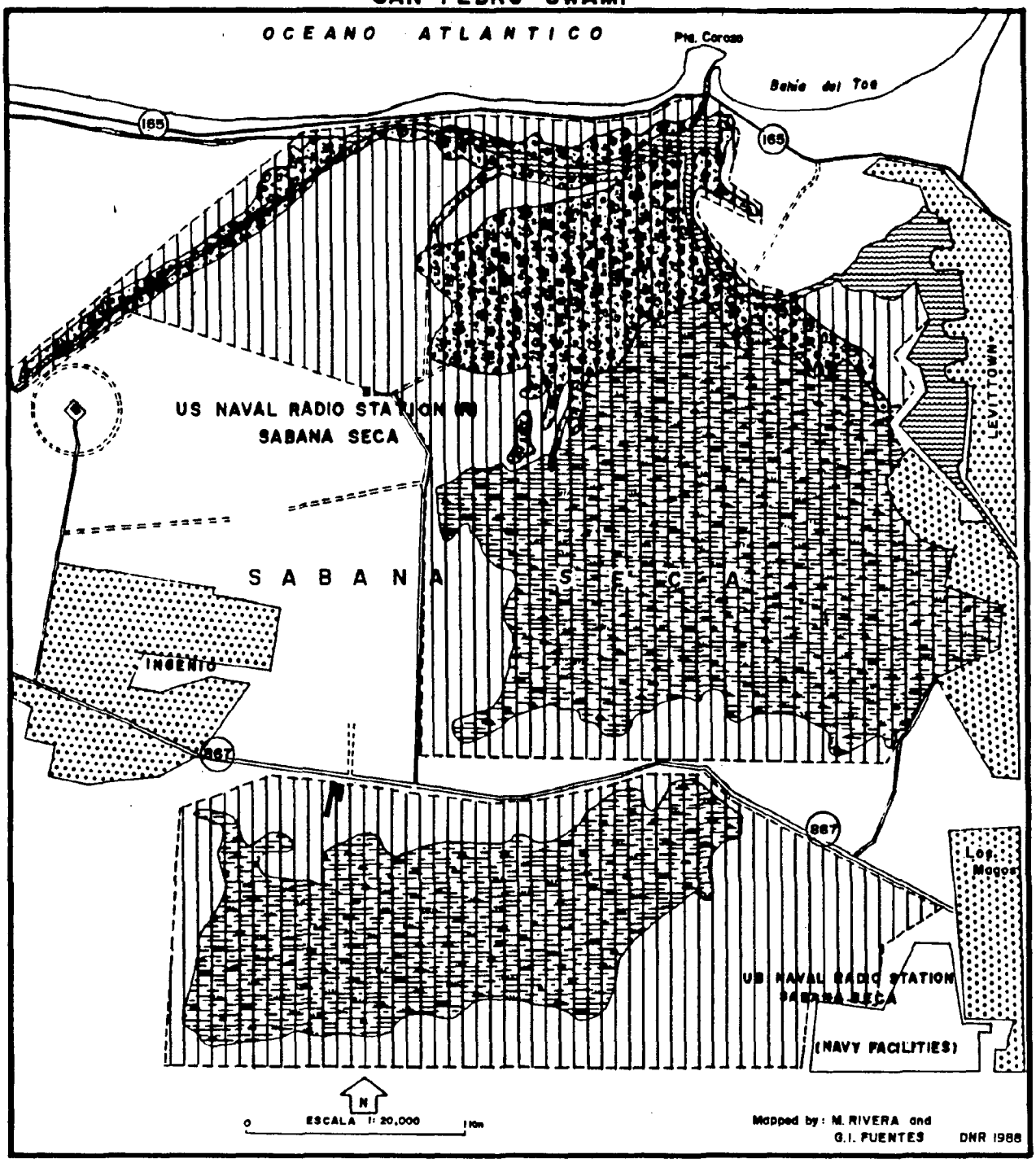
MAP 3

BUCHANAN POND AND ADJACENT LANDS



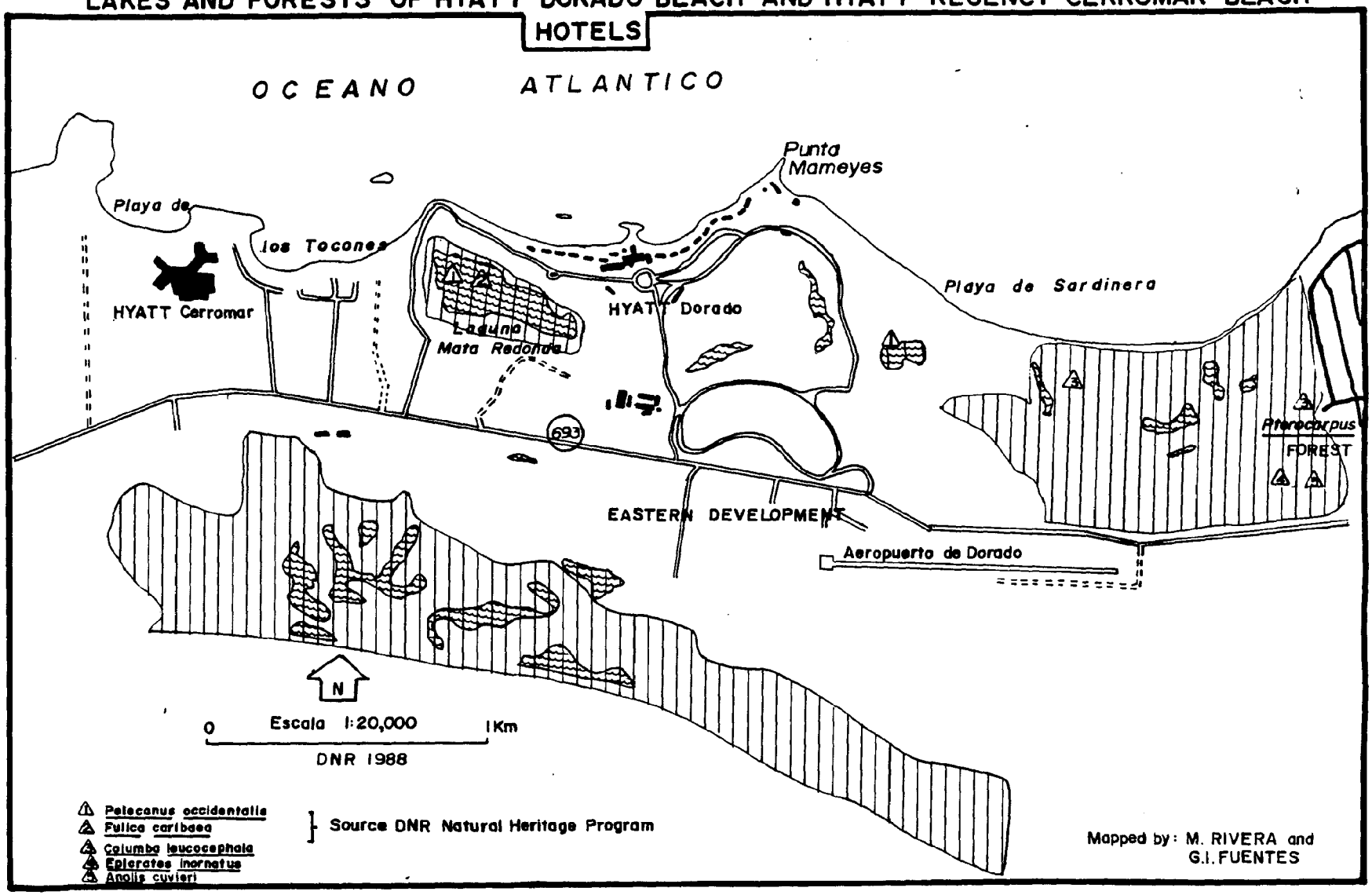
MAP 4

SAN PEDRO SWAMP



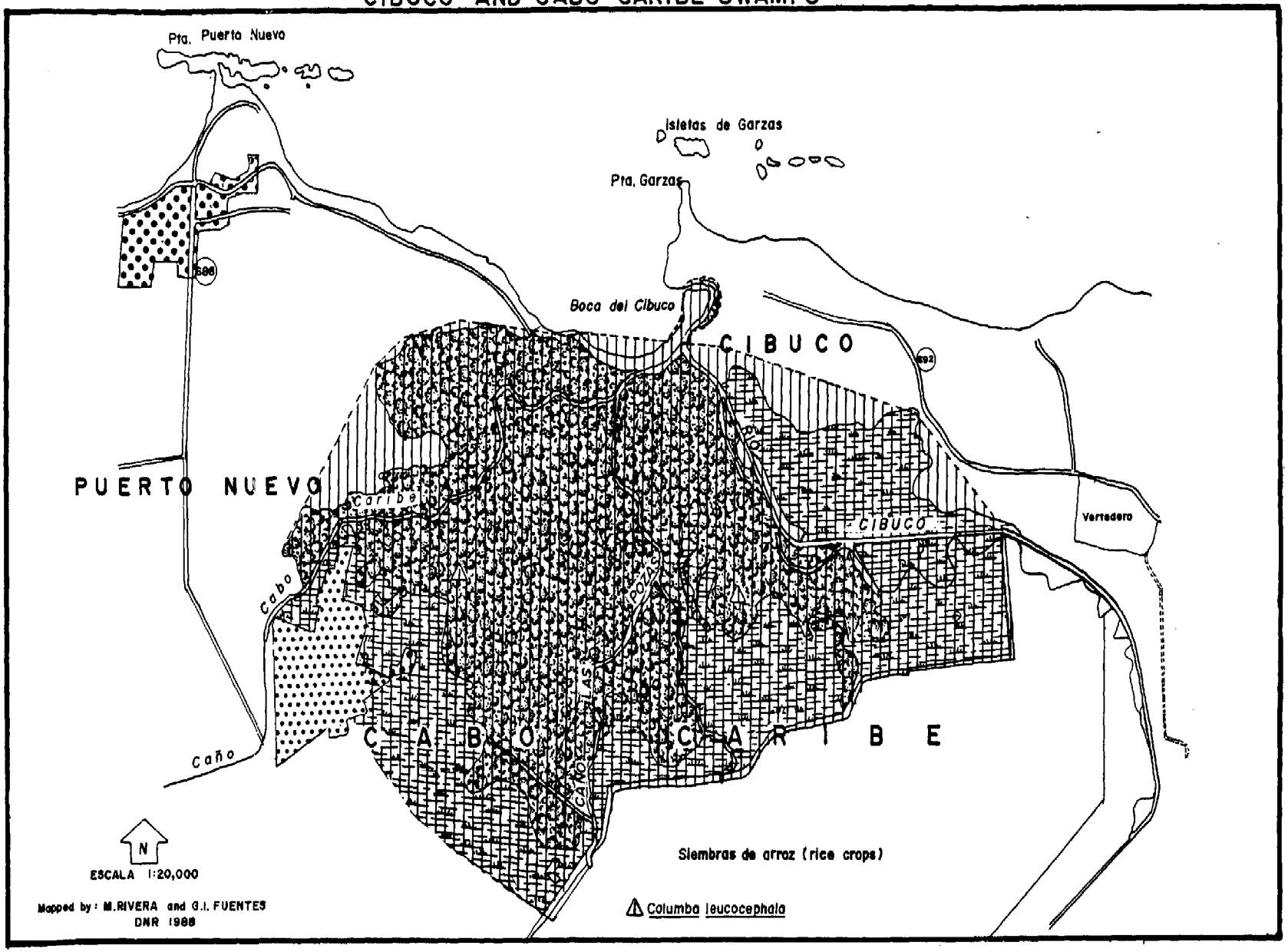
MAP 5

LAKES AND FORESTS OF HYATT DORADO BEACH AND HYATT REGENCY CERROMAR BEACH HOTELS

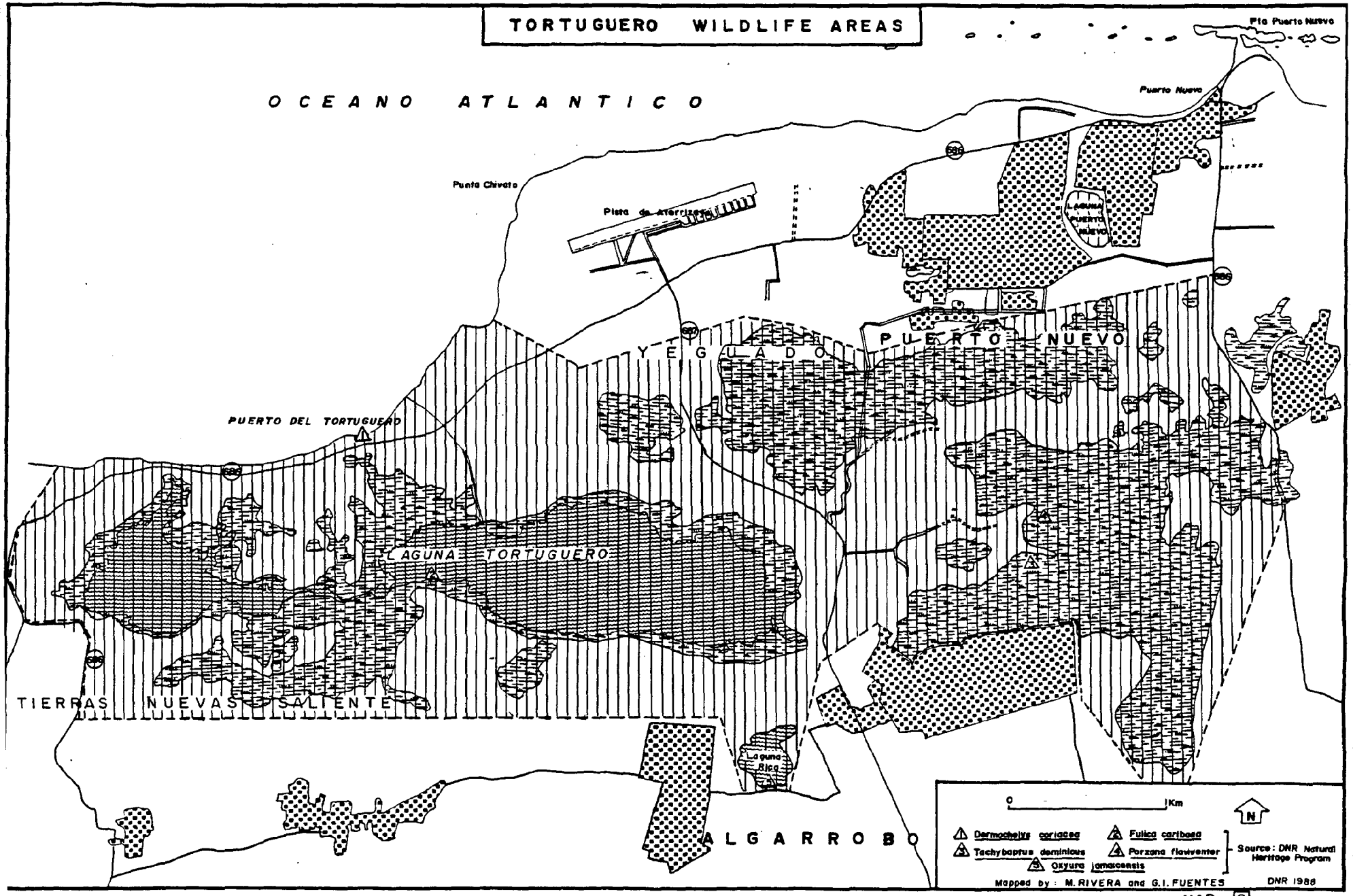


MAP 6

CIBUCO AND CABO CARIBE SWAMPS



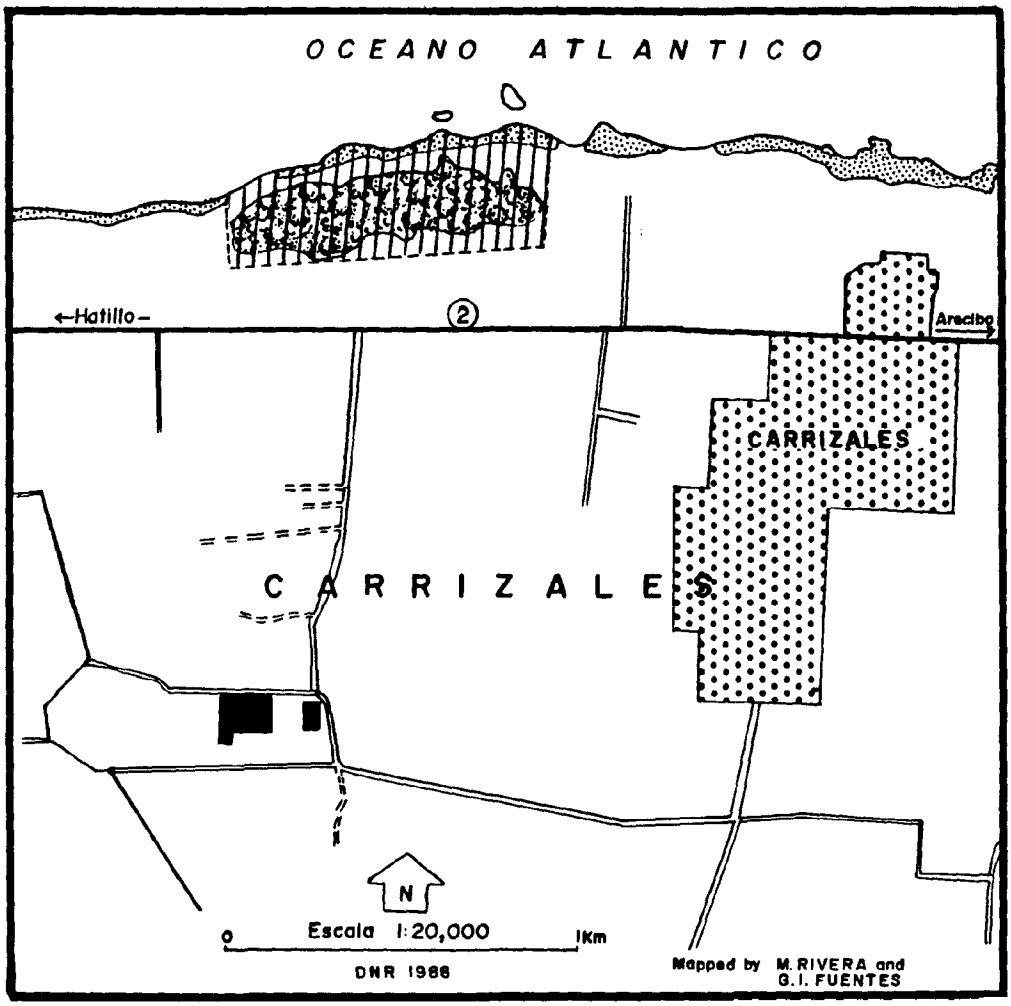
MAP 7


TORTUGUERO WILDLIFE AREAS
OCEANO ATLANTICO
Pta Puerto Nuevo
Puerto Nuevo
Punta Chivato
Pista de Aterrizaje
LAGUNA PUERTO NUEVO
PUERTO NUEVO
Y EGUADO
PUERTO DEL TORTUGUERO
LAGUNA TORTUGUERO
TIERRAS NUEVAS SALIENTE
Laguna Bica
ALGARROBO
0 Km
N
Dermochelys coriacea
Fulica caribaea
Tachybaptus dominicus
Porzana flaviventer
Oxyura jamaicensis
Source: DNR Natural Heritage Program
Mapped by: M. RIVERA and G.I. FUENTES
DNR 1988

MAP 8

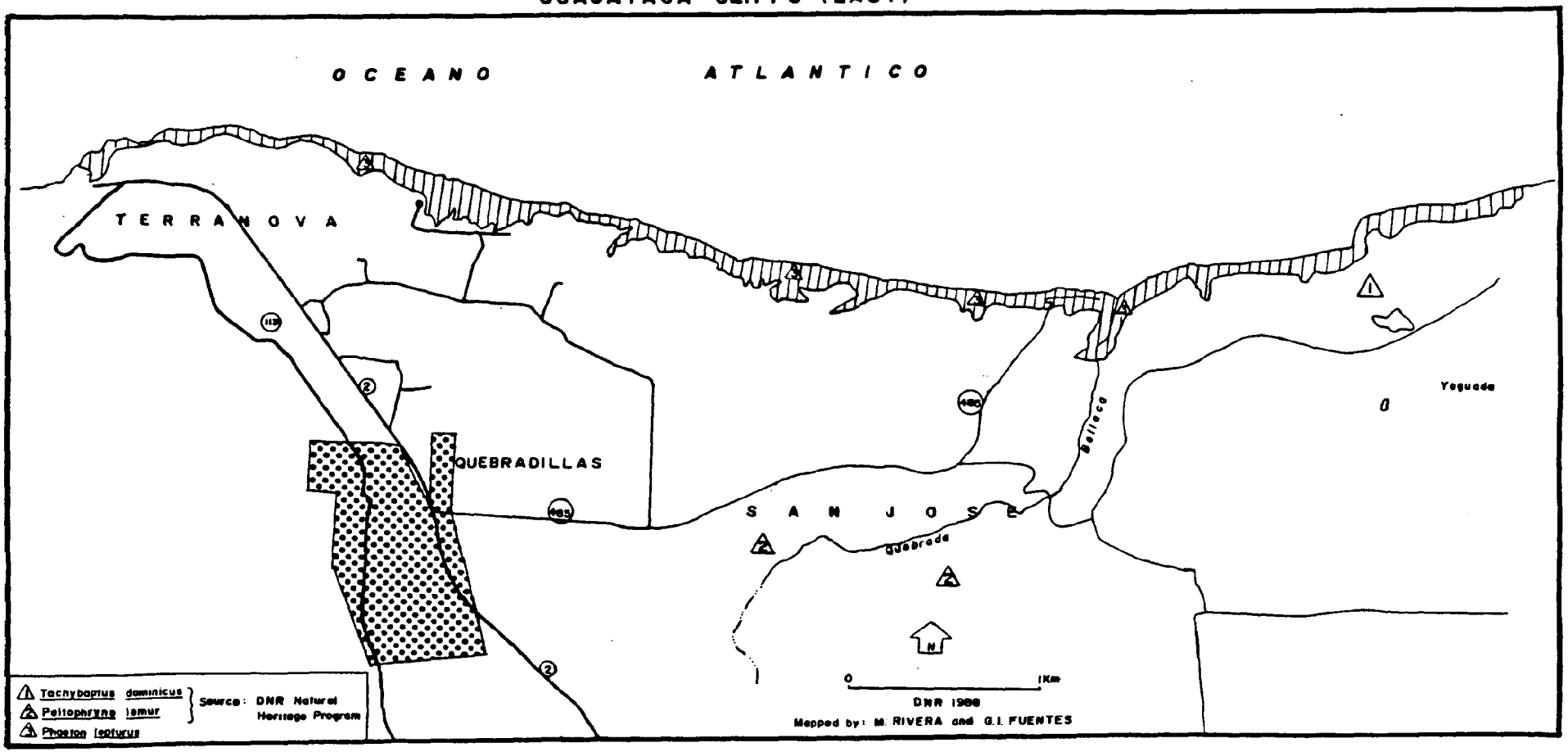
CAÑO TIBURONES SWAMP

CARRIZALES MANGROVE



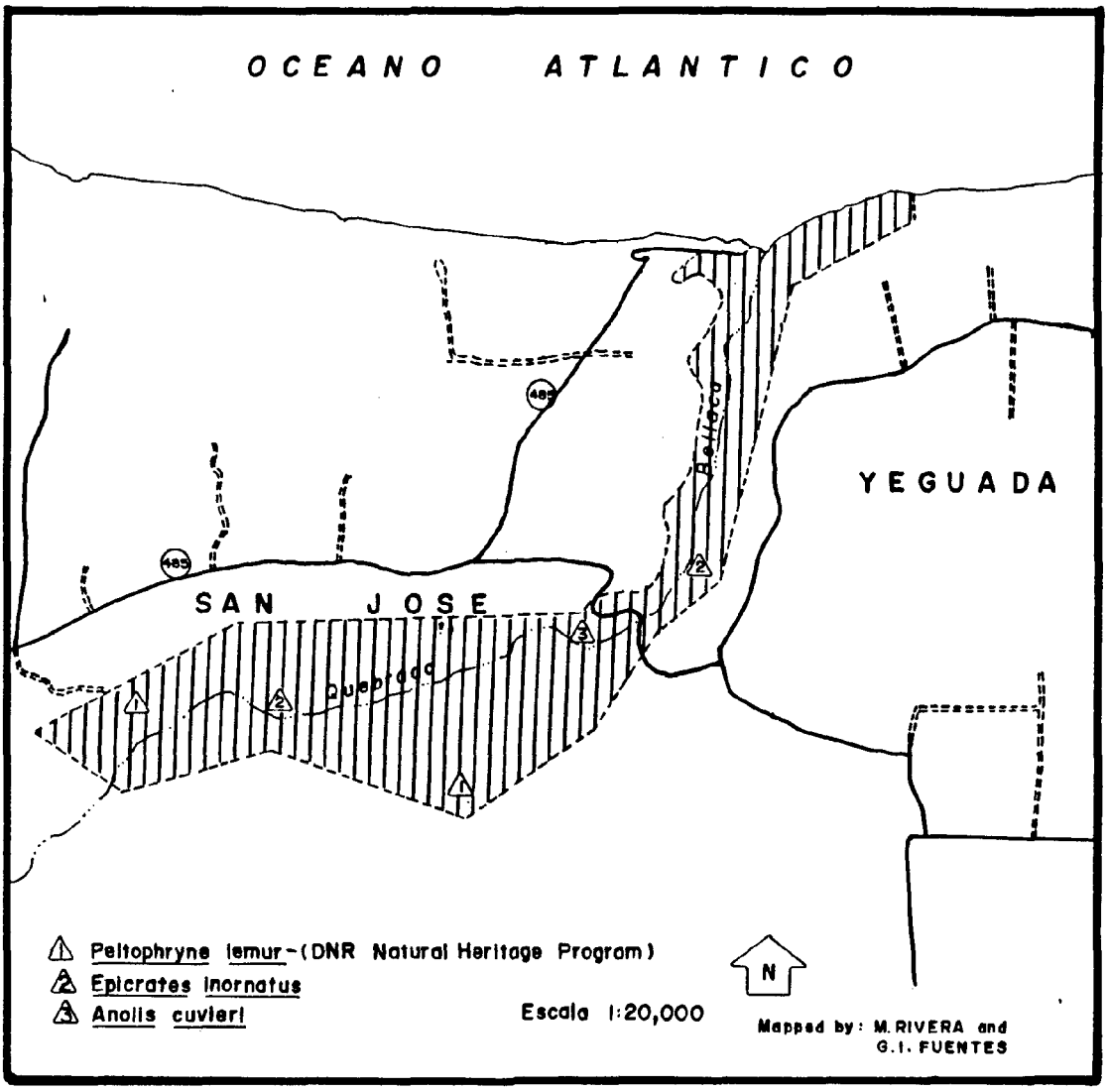
MAP 10

GUAJATACA CLIFFS (EAST)



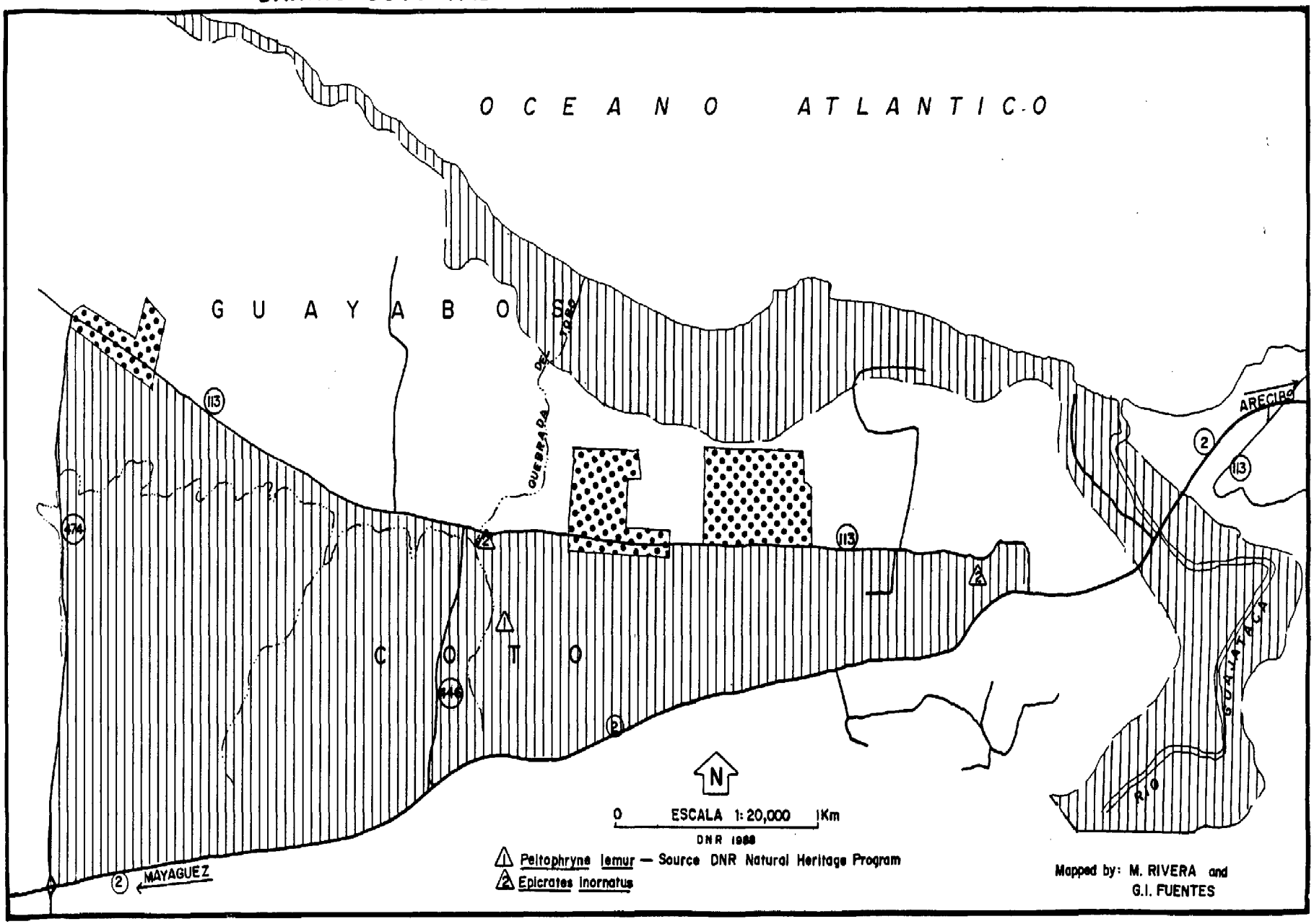
MAP 11

BELLACA CREEK (QUEBRADILLAS)



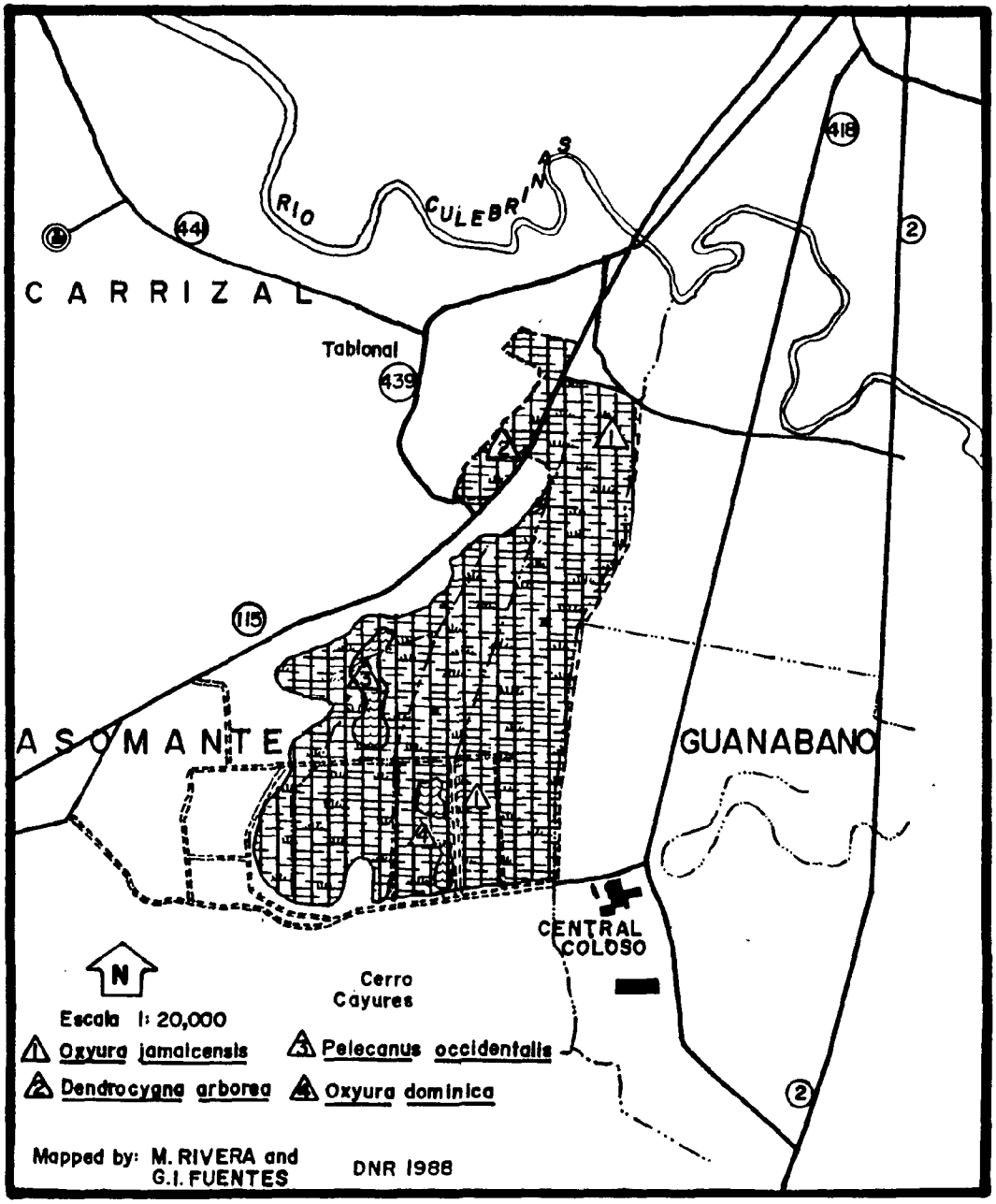
MAP 12

BARRIO COTO AND GUAJATACA CLIFFS WEST



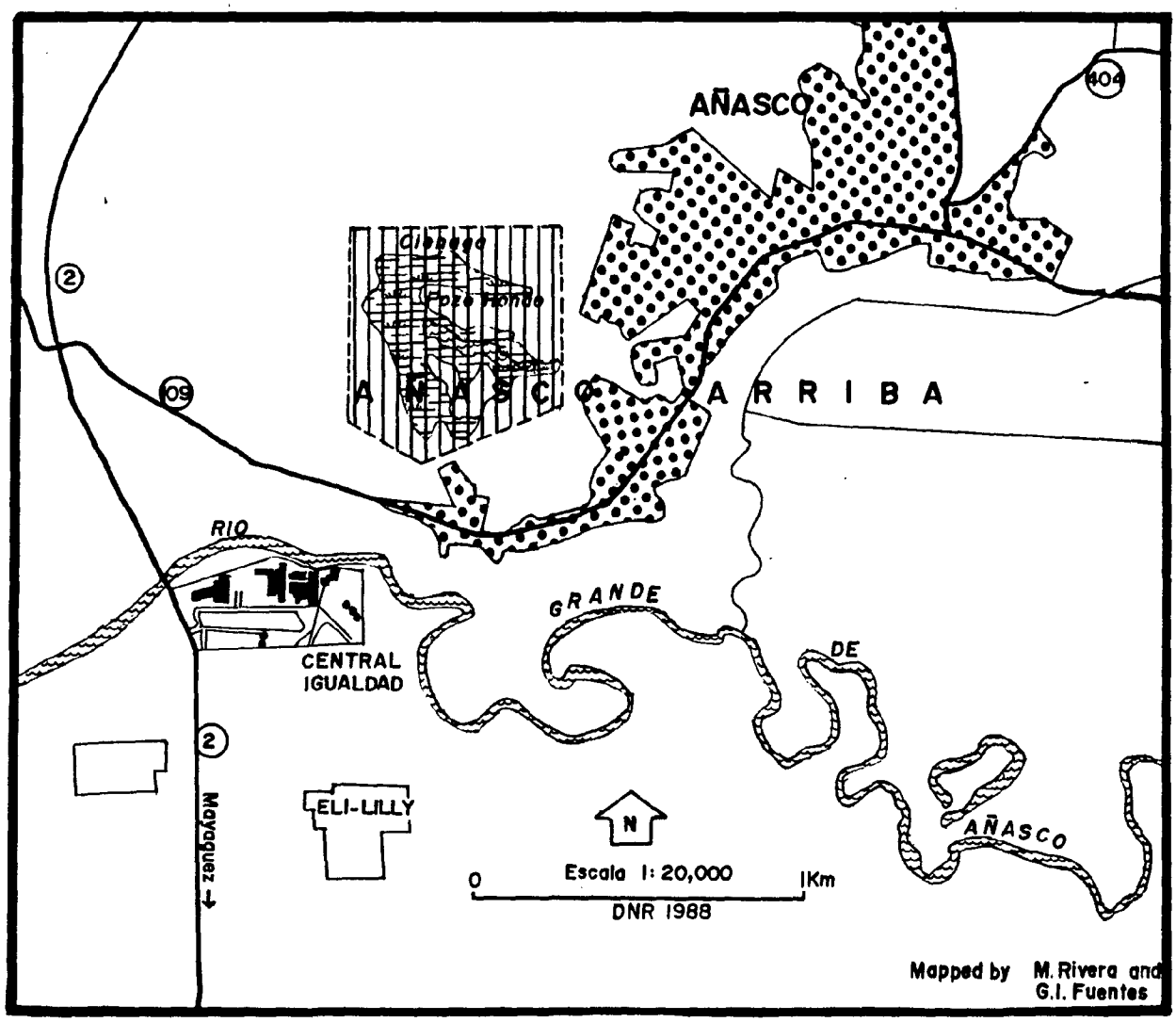
MAP 13

CAYURES SWAMP



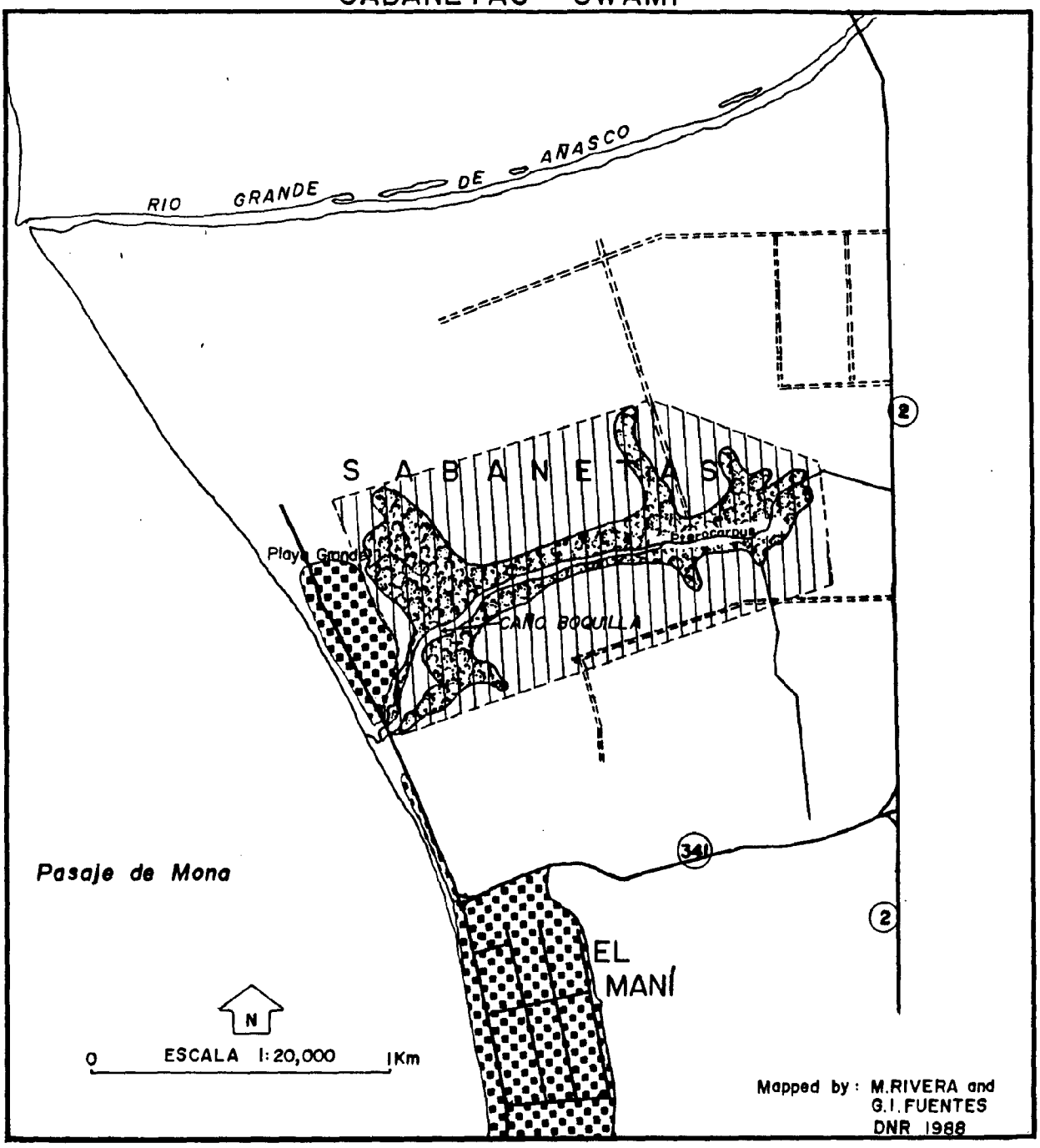
MAP 14

POZO HONDO SWAMP



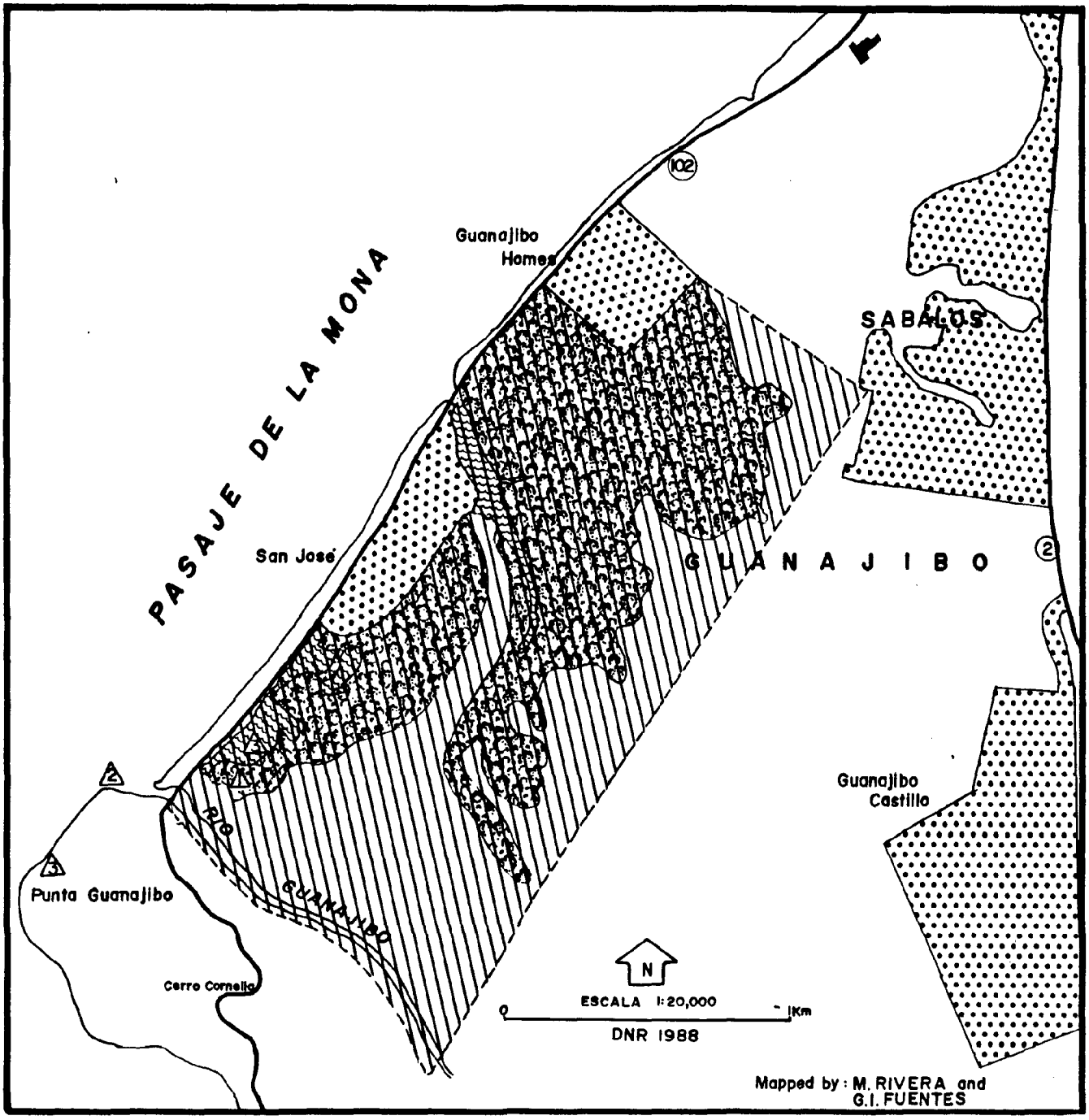
MAP 15

SABANETAS SWAMP



MAP 16

GUANAJIBO MANGROVE

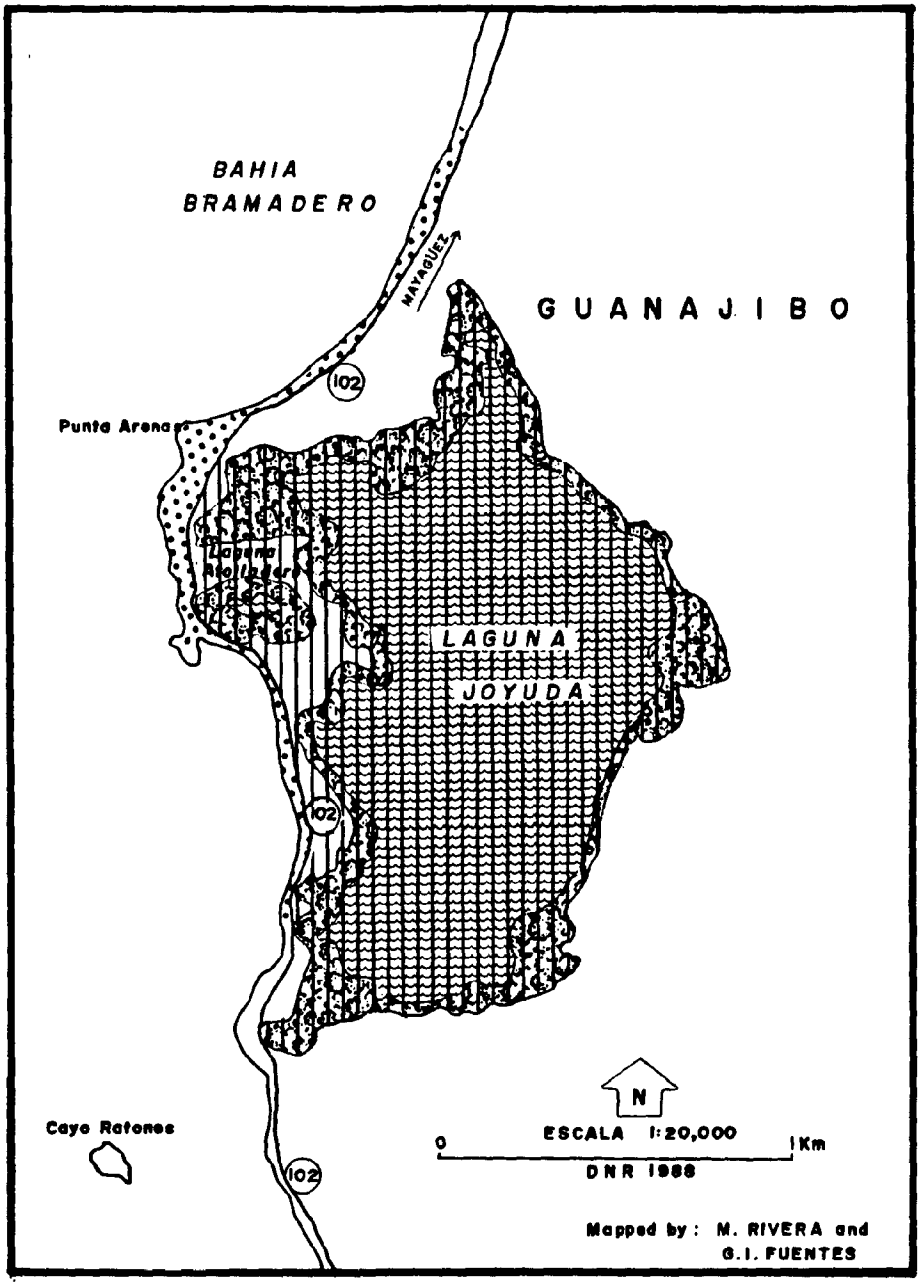


1. Tachybaptus dominicus
2. Trichechus manatus
3. Pelecanus occidentalis

Source: DNR Natural Heritage Program

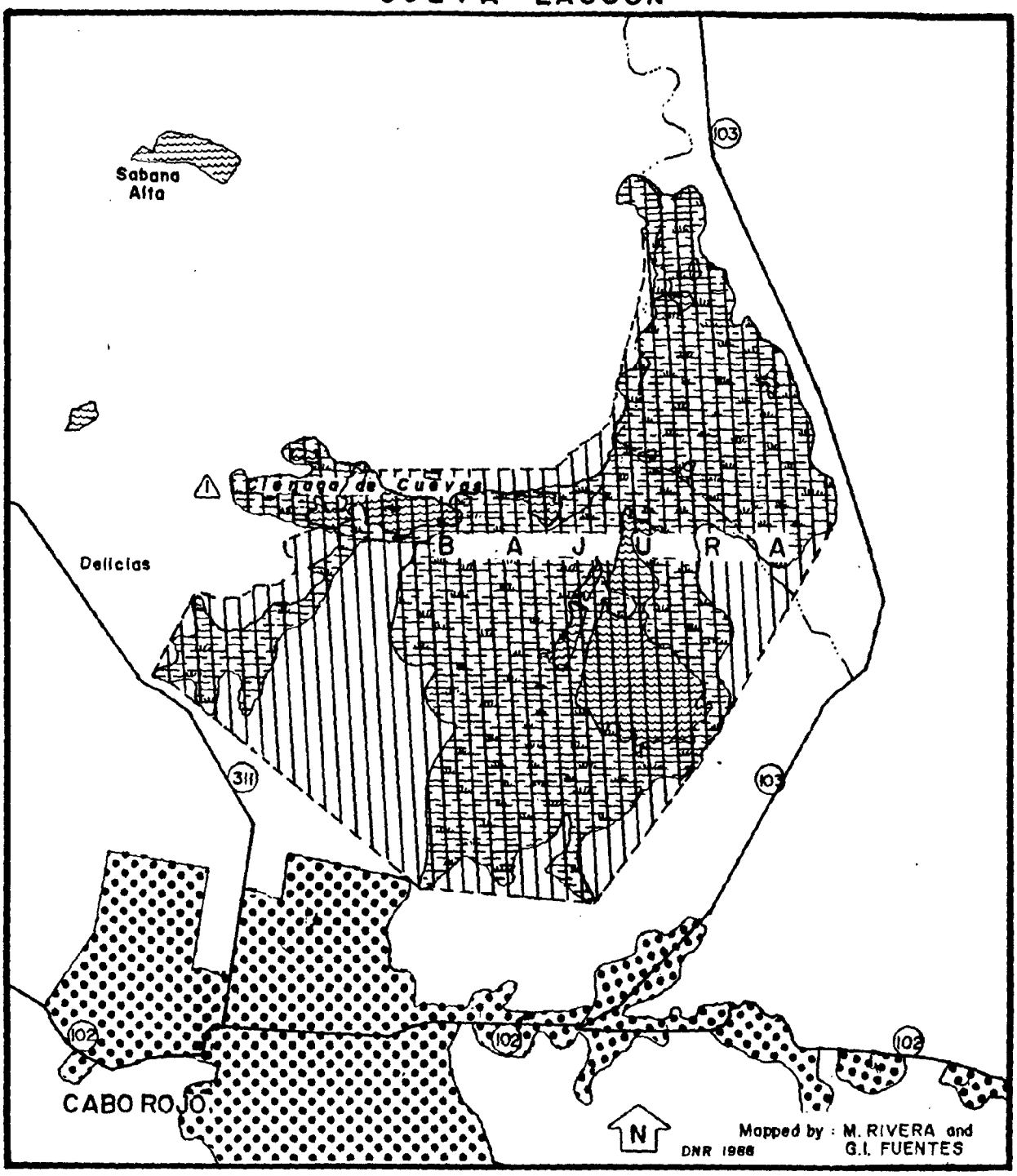
MAP 17

JOYUDA LAGOON



MAP 18

CUEVA LAGOON



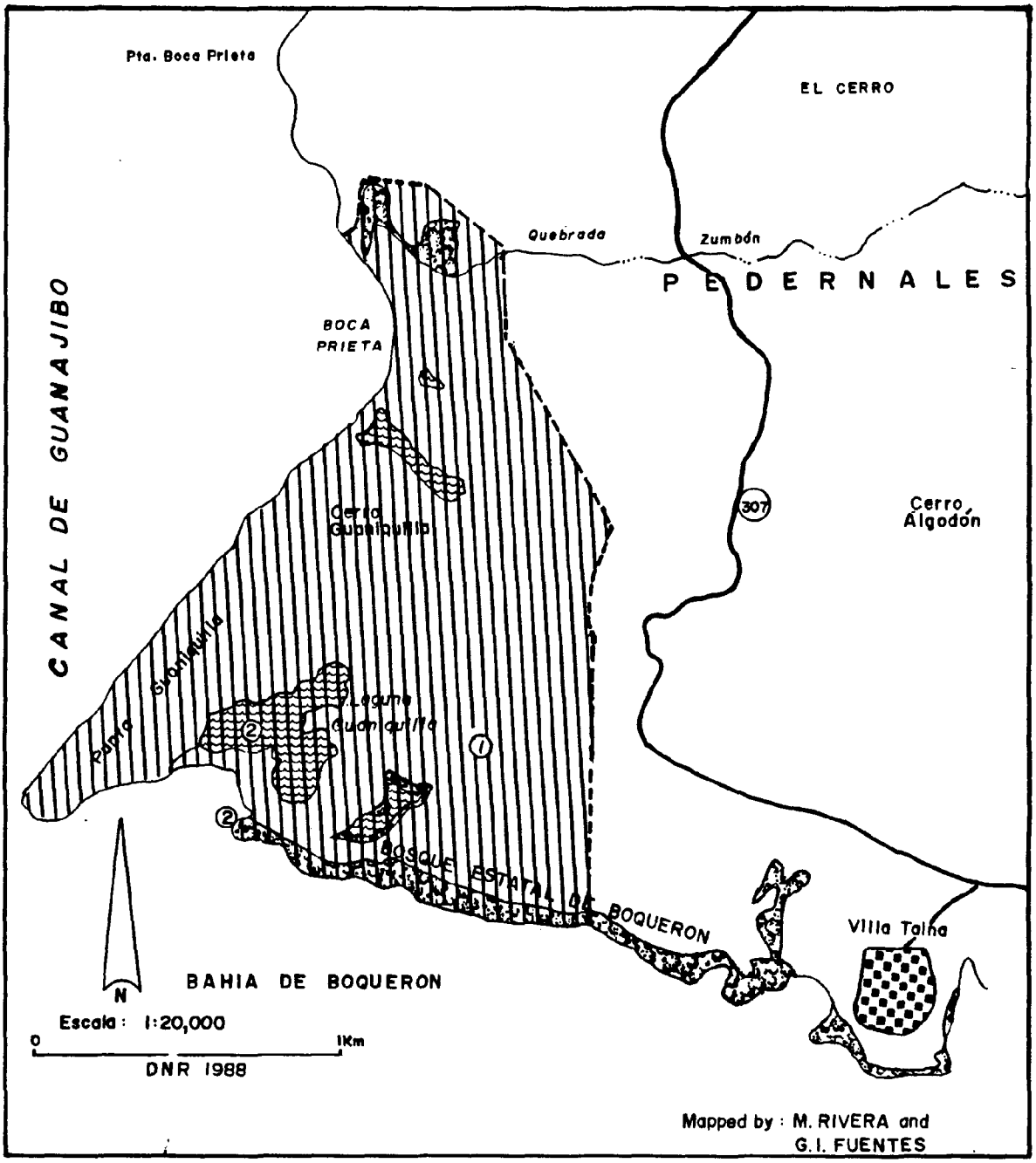
ESCALA 1:20,000

0 1Km

MAP 19

Dendrocygna arborea Source: DNR Natural Heritage Program

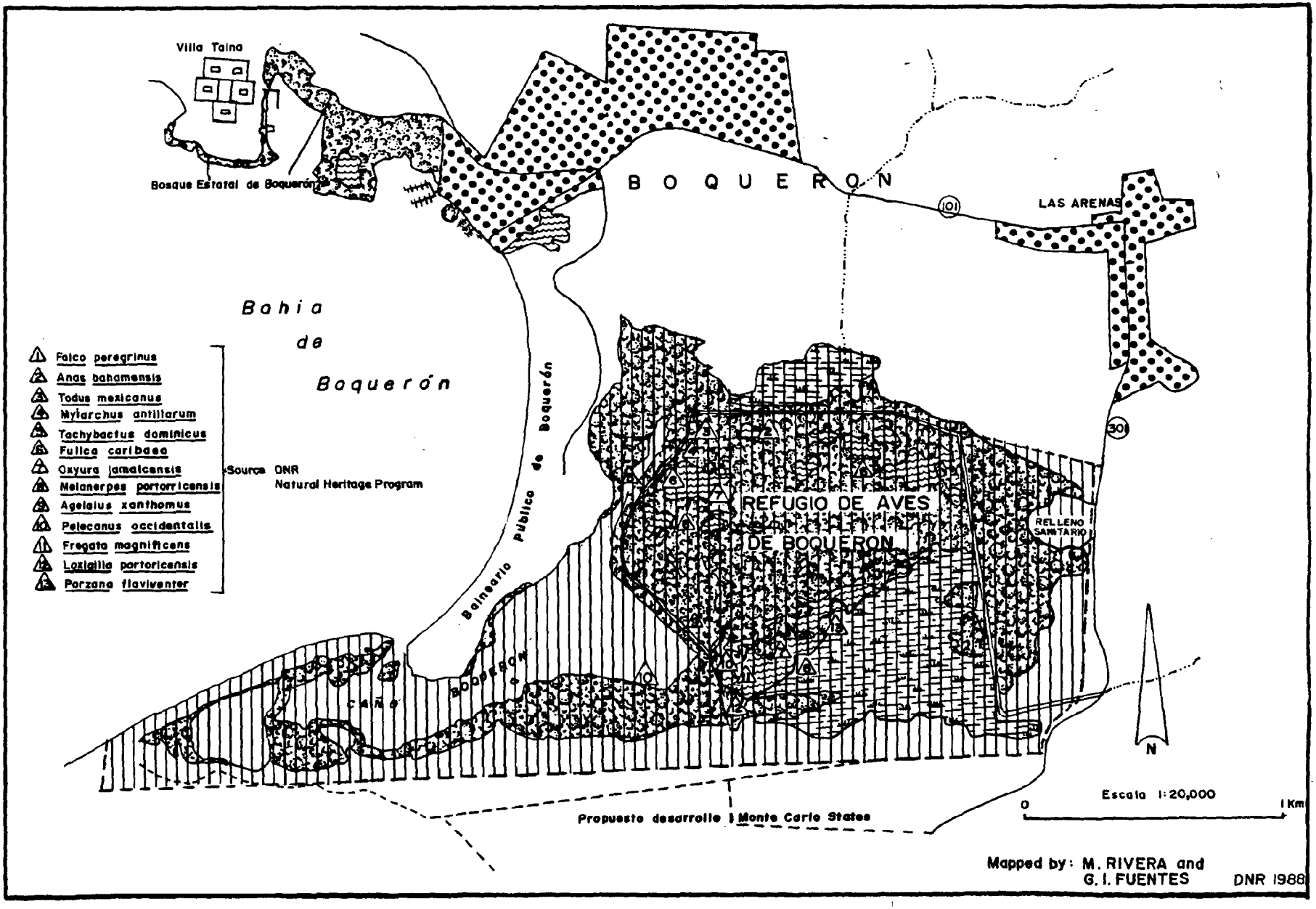
GUANIQUILLA



① Dendrocygna arborea
② Pelecanus occidentalis
> Source: DNR Natural Heritage Program

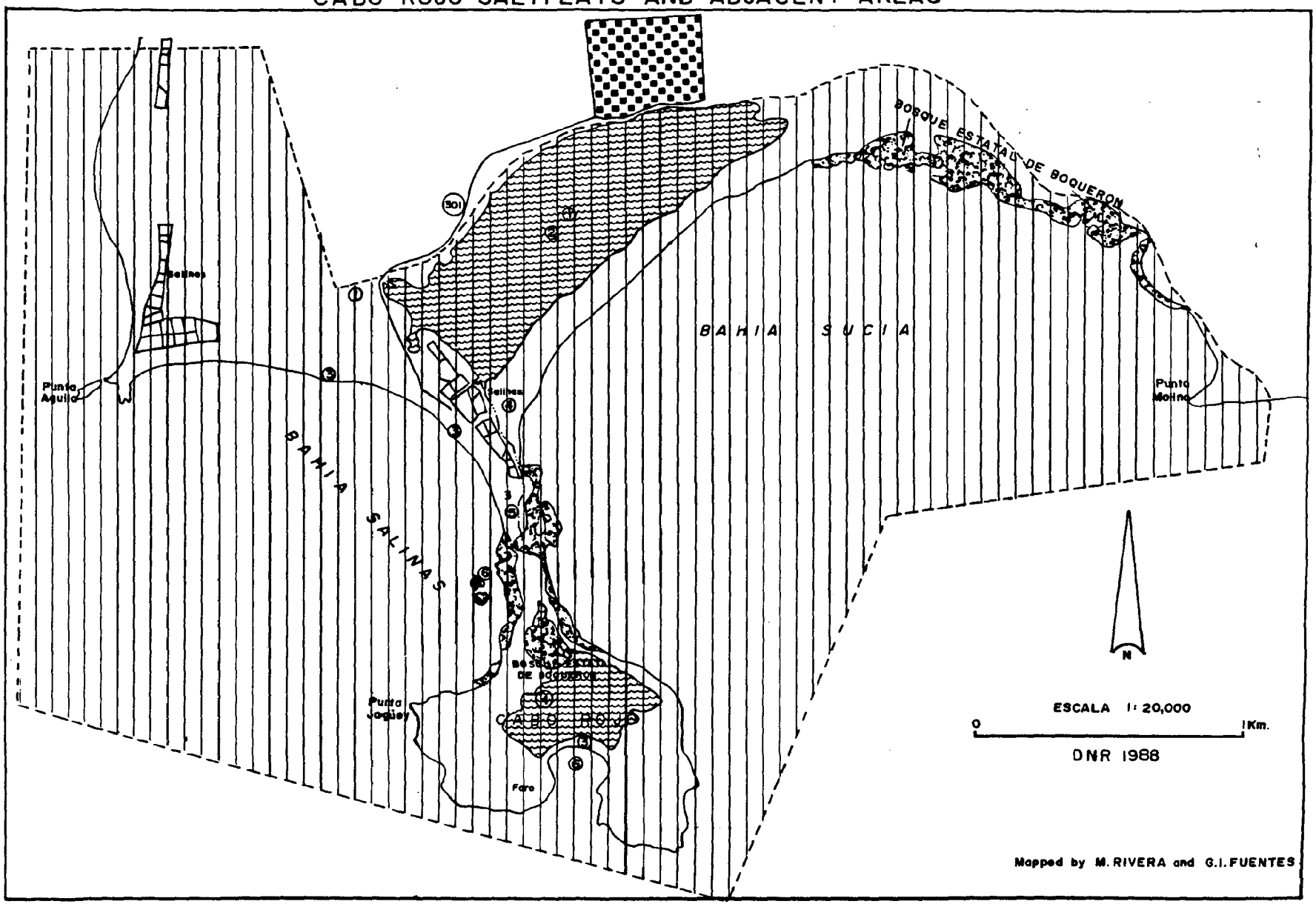
MAP 20

BOQUERON REFUGE



MAP 21

CABO ROJO SALTFLATS AND ADJACENT AREAS

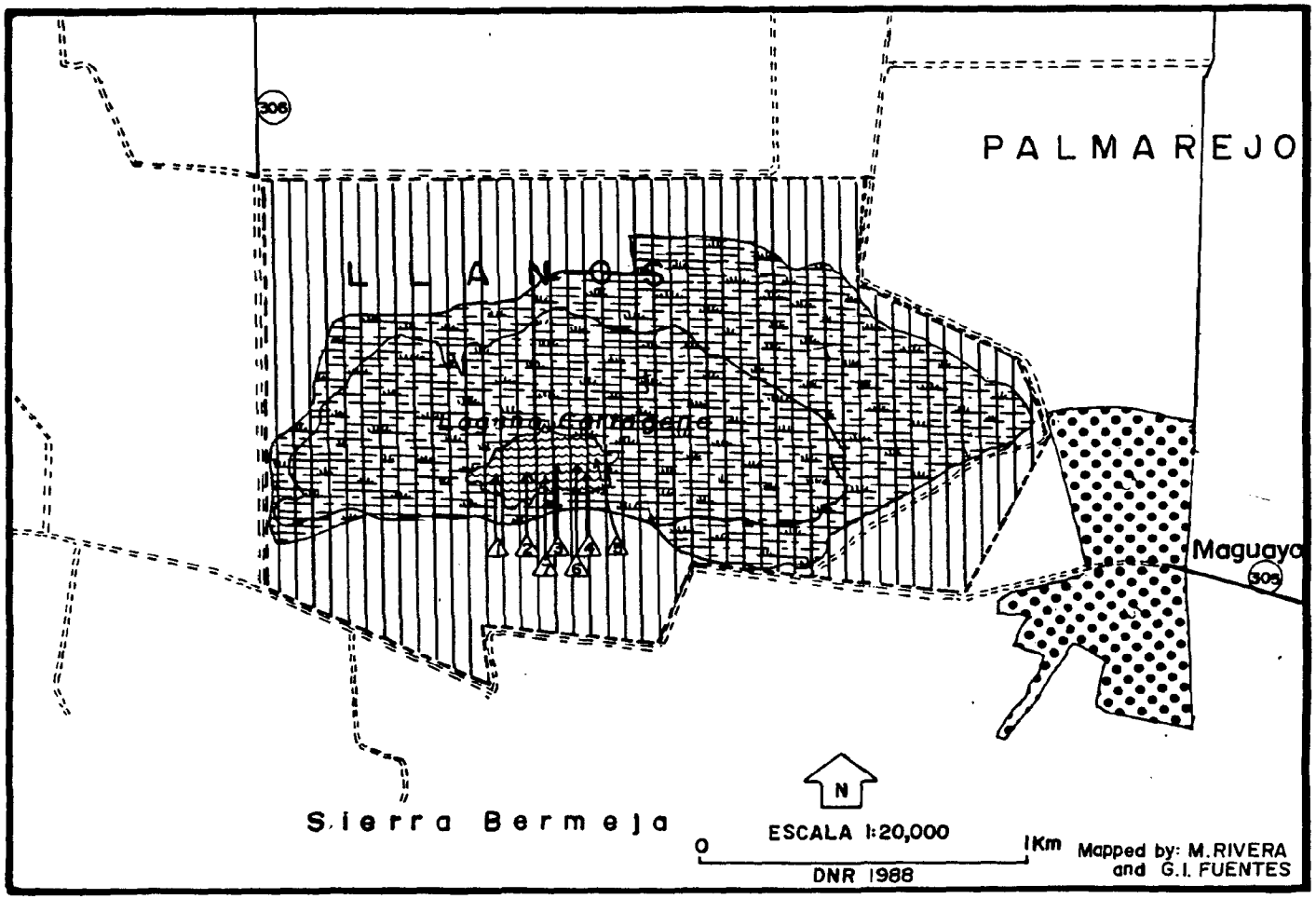


① Charadrius alexandrinus
② Charadrius melodius
③ Anolis cooki
④ Sterna antillarum
⑤ Agelaius xanthomus
⑥ Pelecanus occidentalis

SOURCE DNR NATURAL HERITAGE PROGRAM

MAP 22

CARTAGENA LAGOON

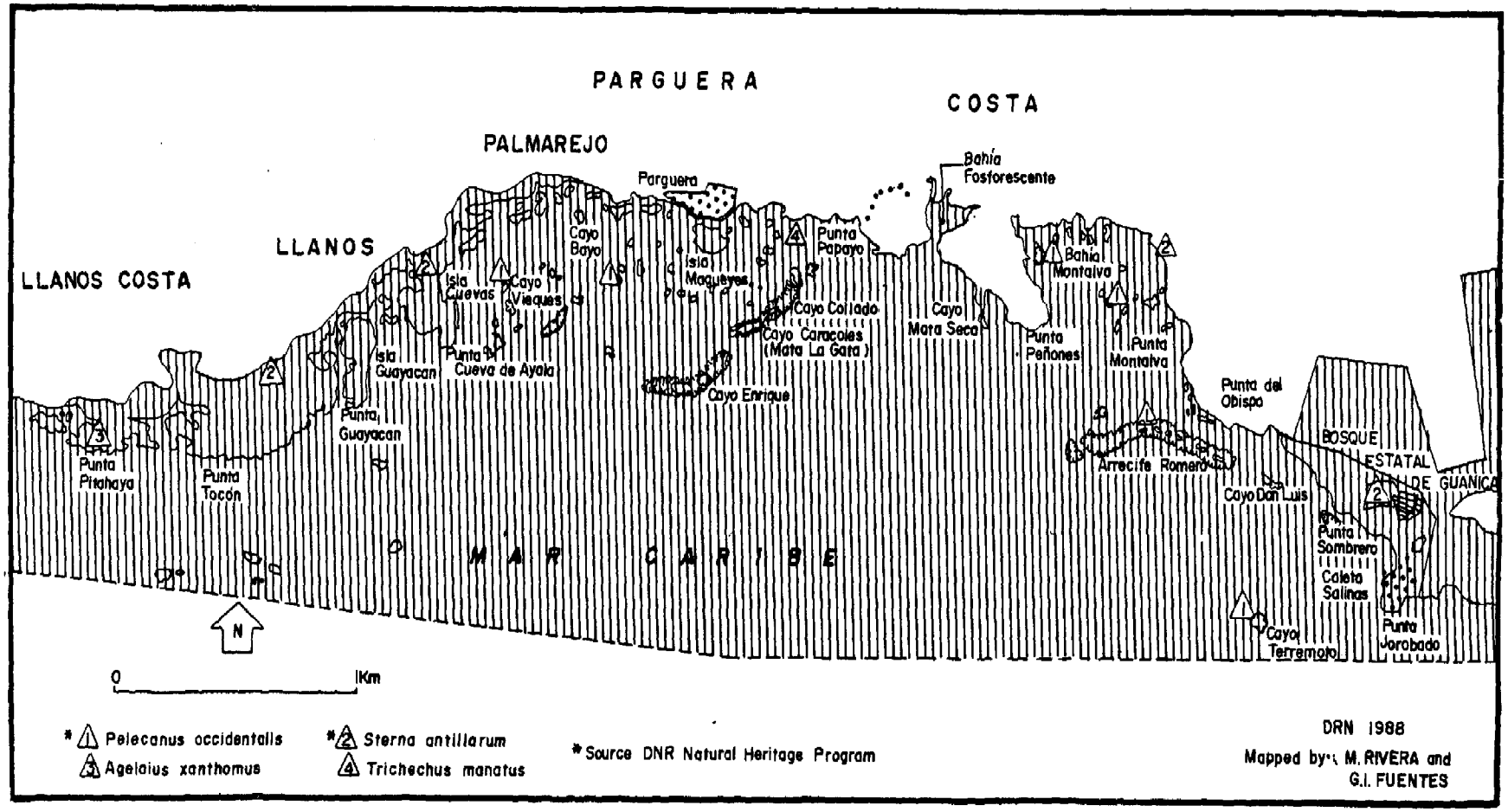


1 Dendrocygna arborea
2 Fulica caribaea
3 Tachybaptus dominicus
4 Porzana flaviventer
5 Oxyura jamaicensis
6 Agelaius xanthomus
7 Falco peregrinus

Source DNR Natural Heritage Program

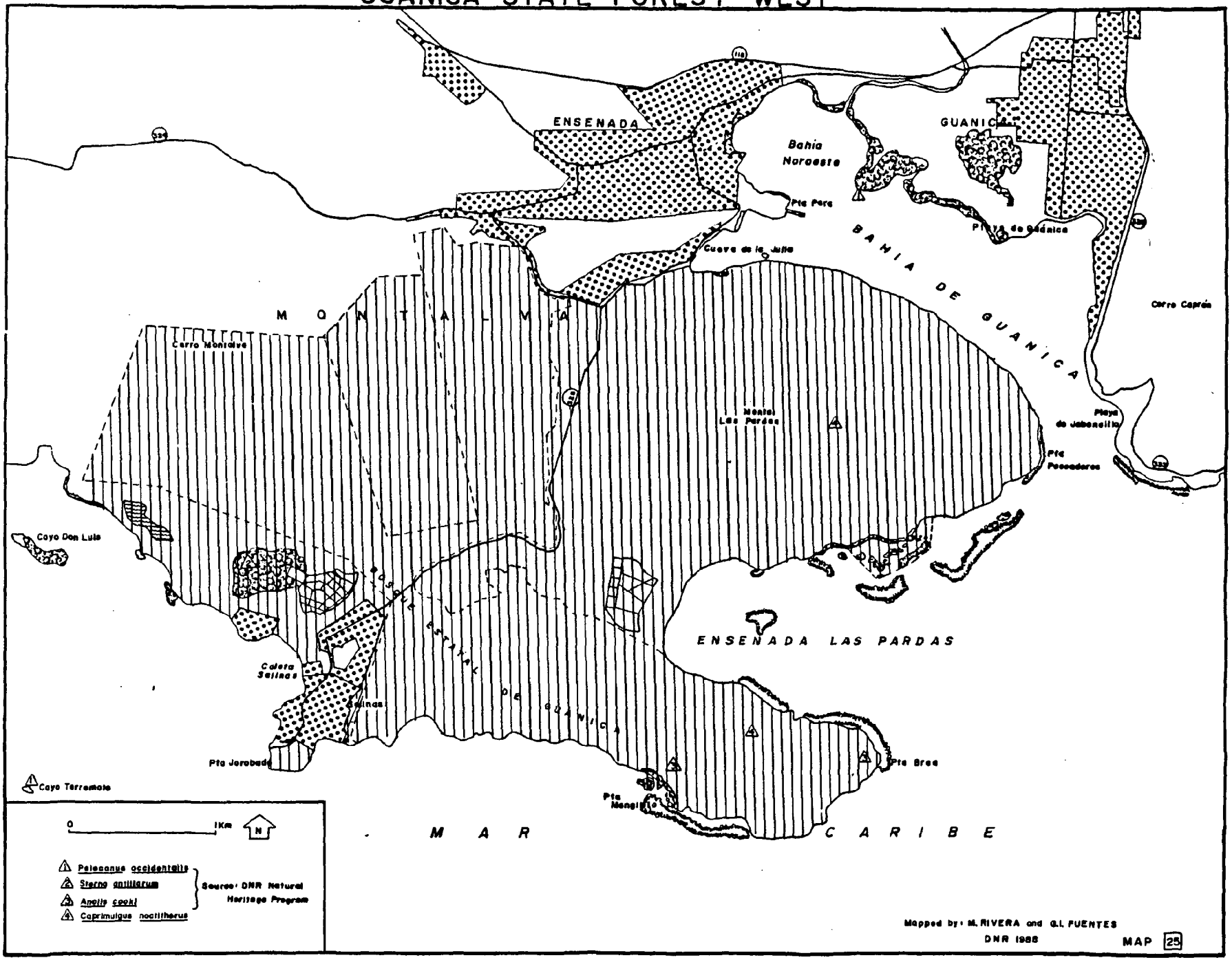
MAP 23

LA PARGUERA

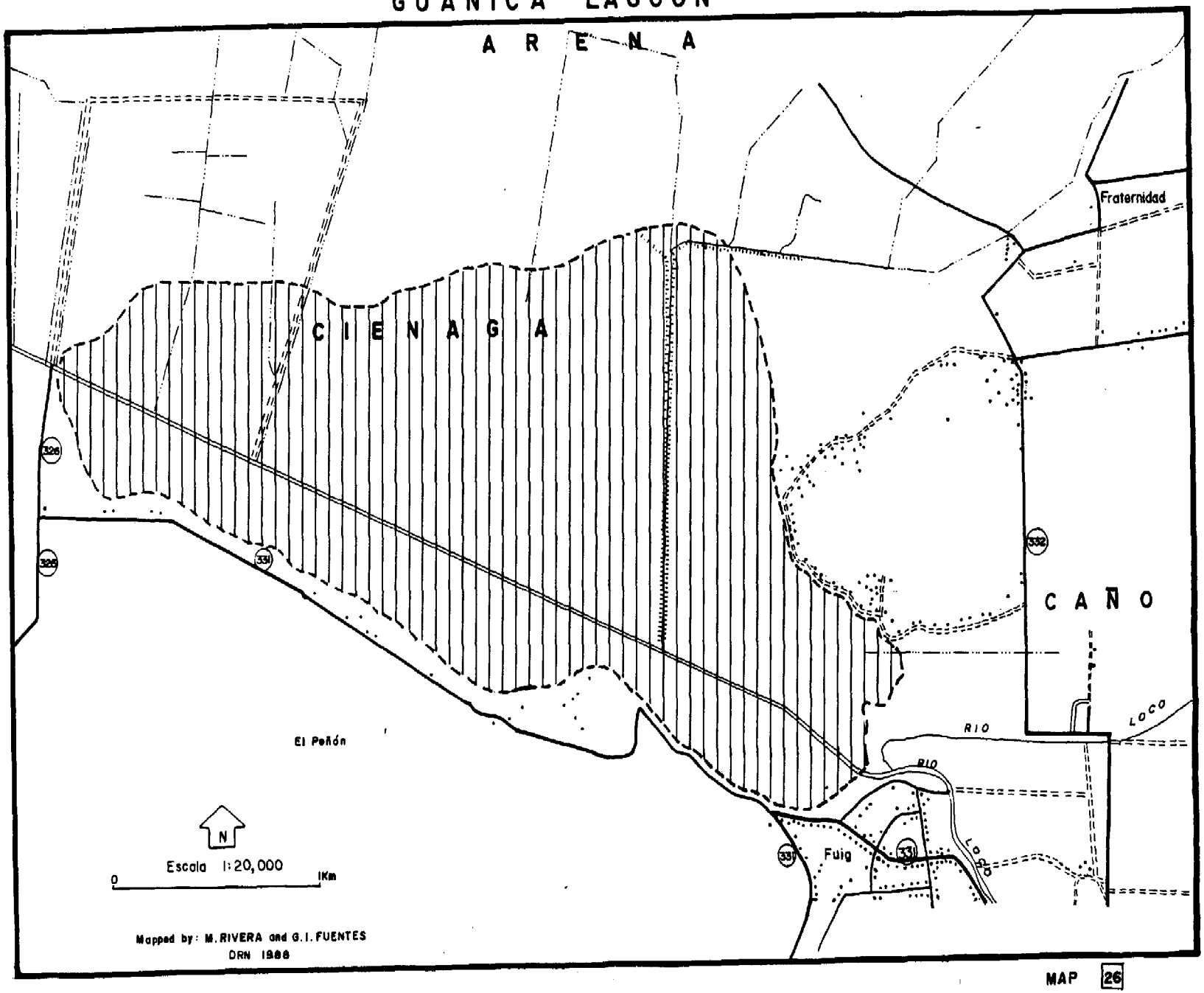


MAP 24

GUANICA STATE FOREST WEST

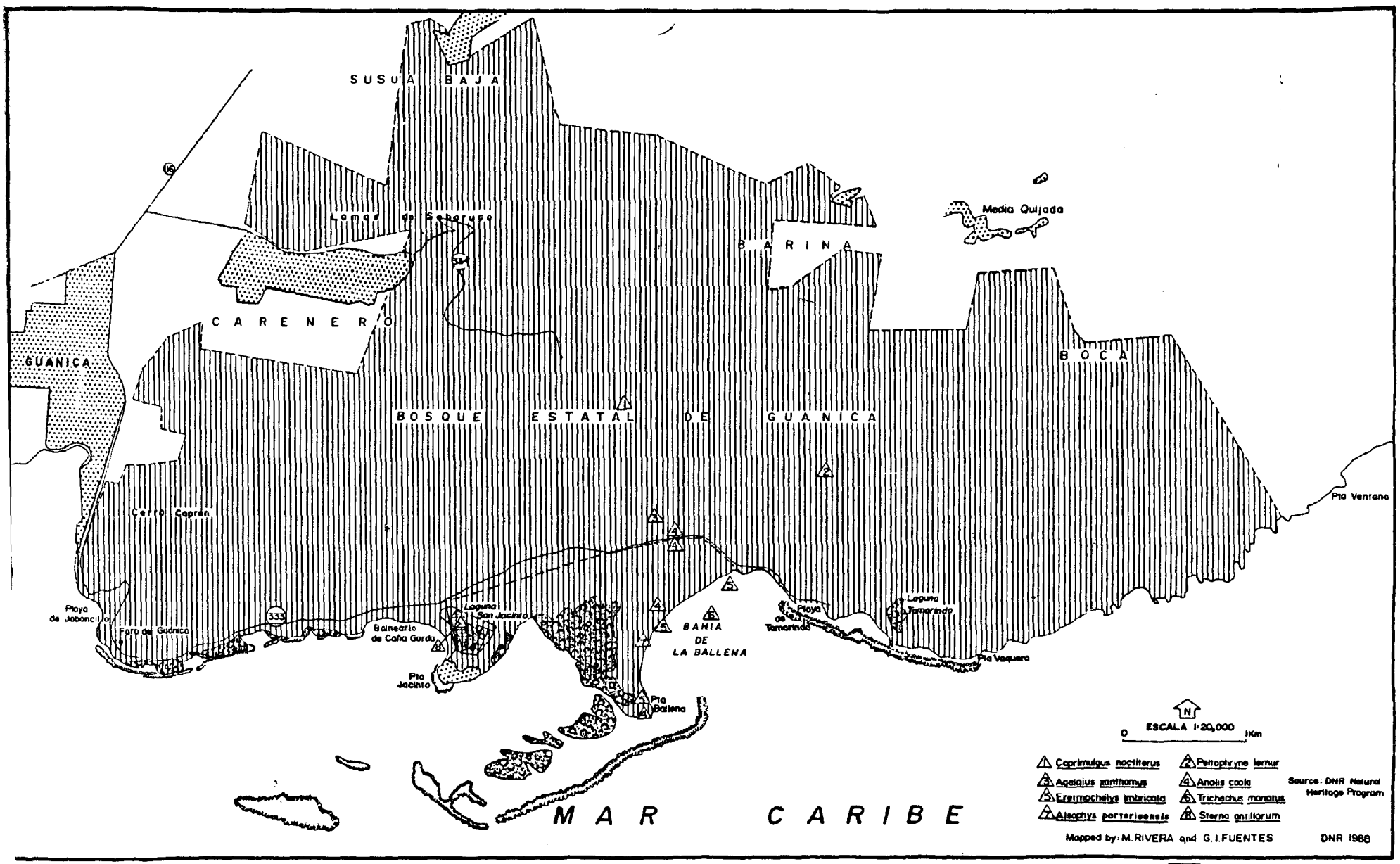


GUANICA LAGOON



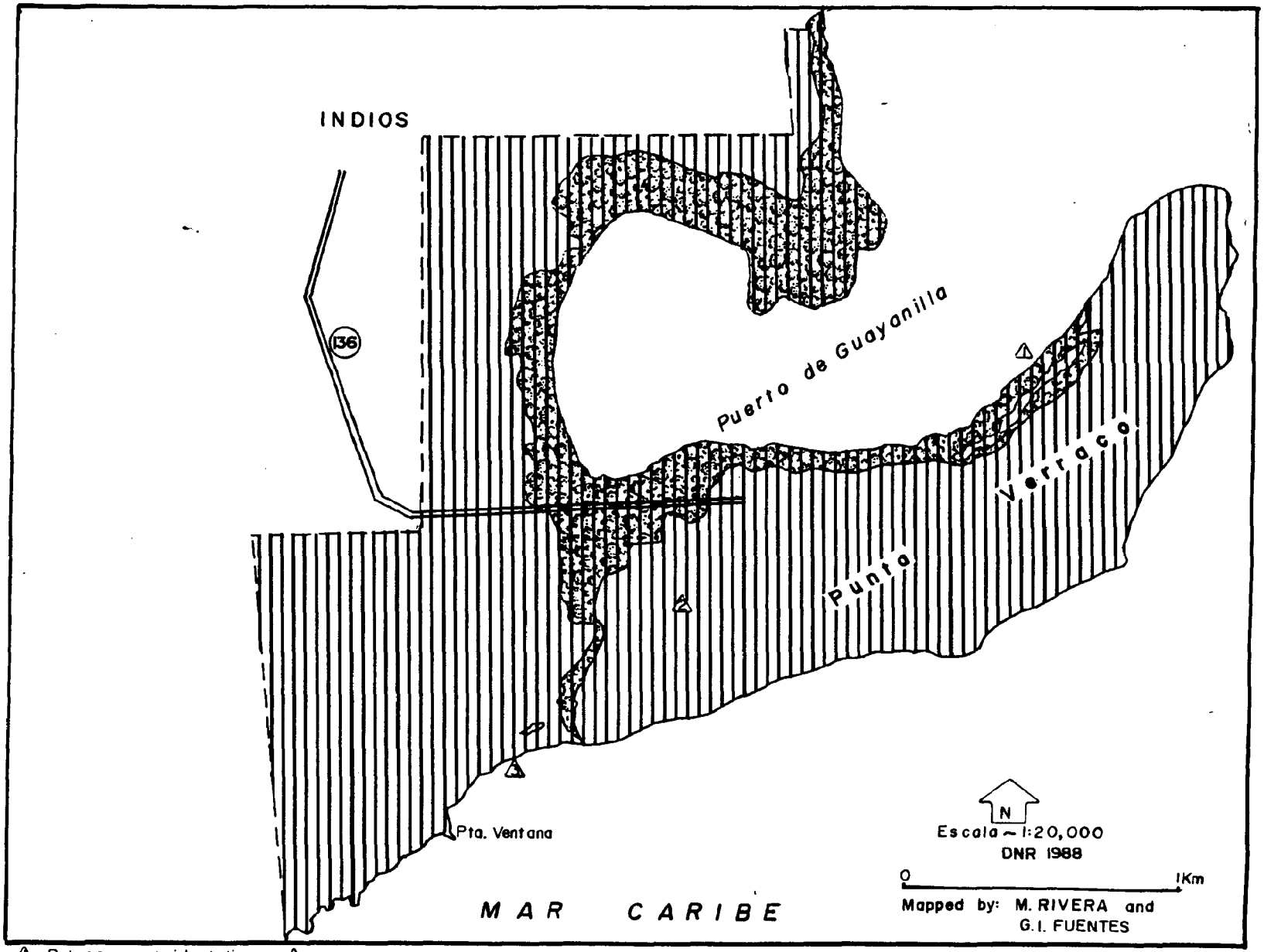
MAP 26

GUANICA STATE FOREST EAST



MAP 27

LLUVERAS



Pelecanus occidentalis

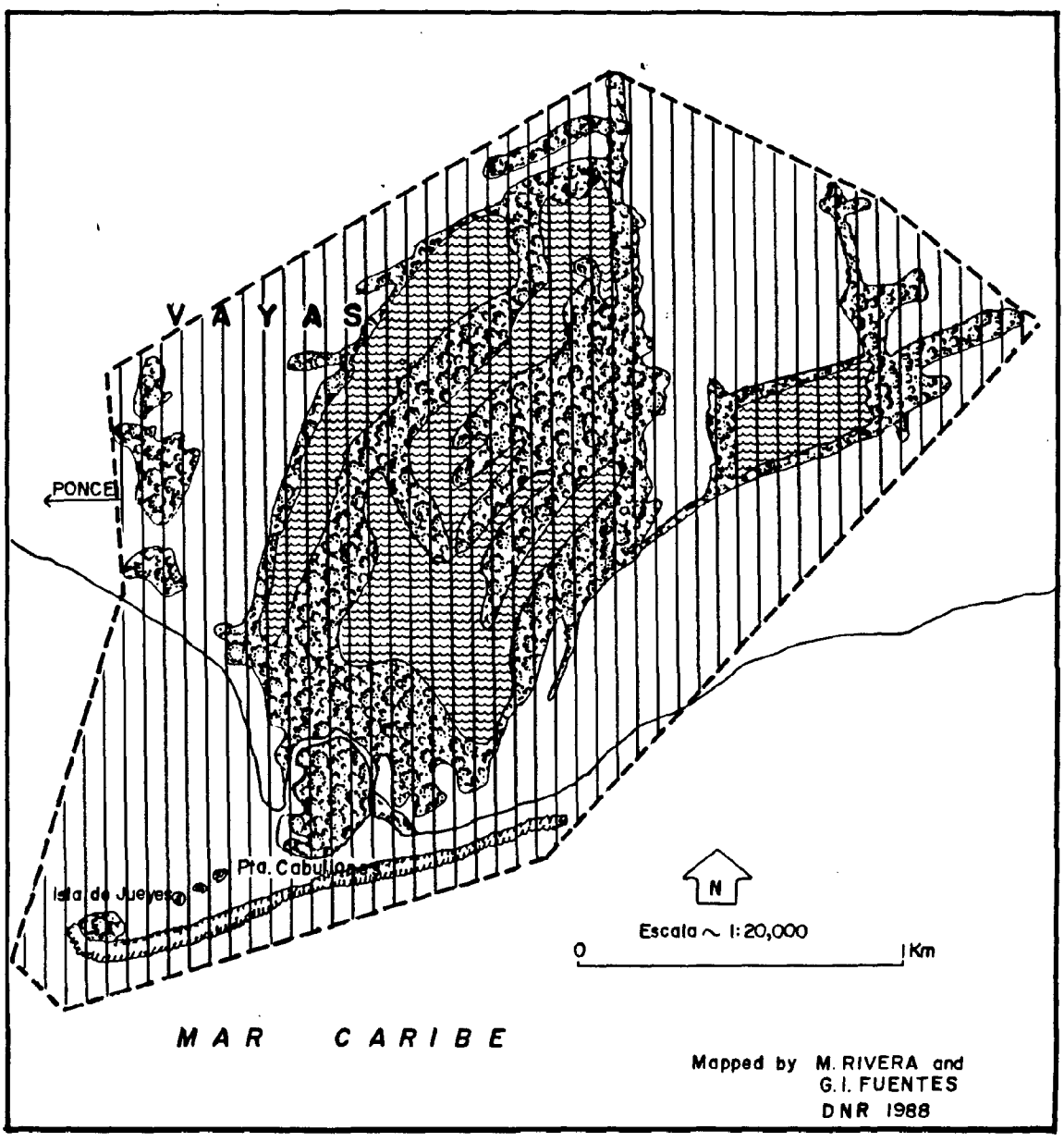
Caprimulgus noctitherus

Eretmochelys imbricata

Source : DNR Natural Heritage Program.

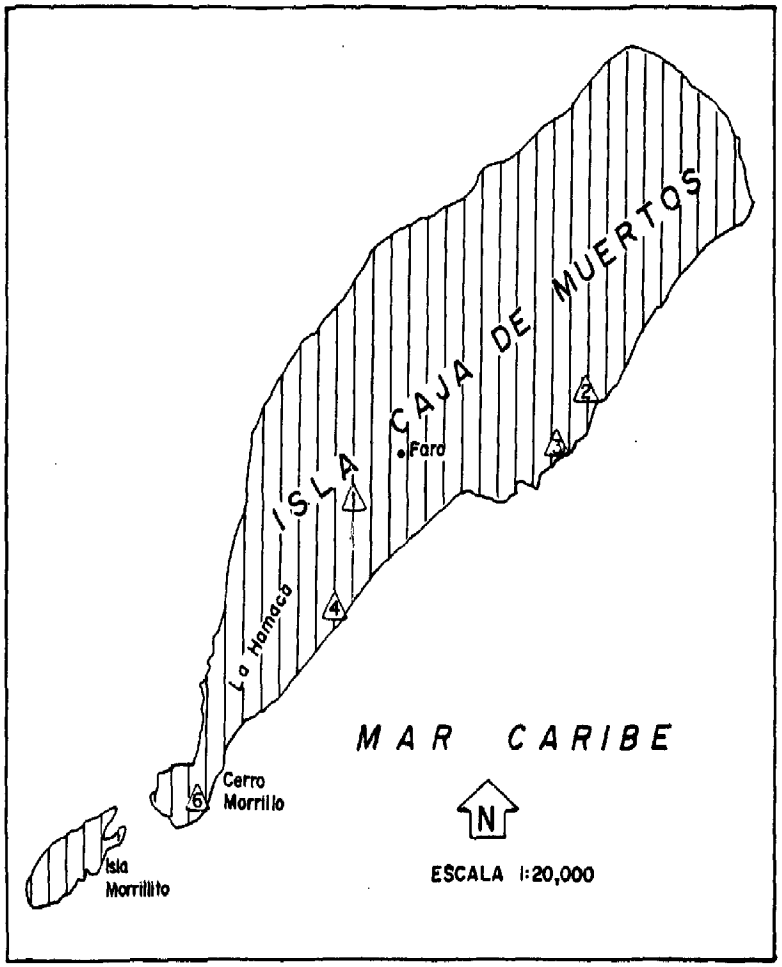
MAP 28

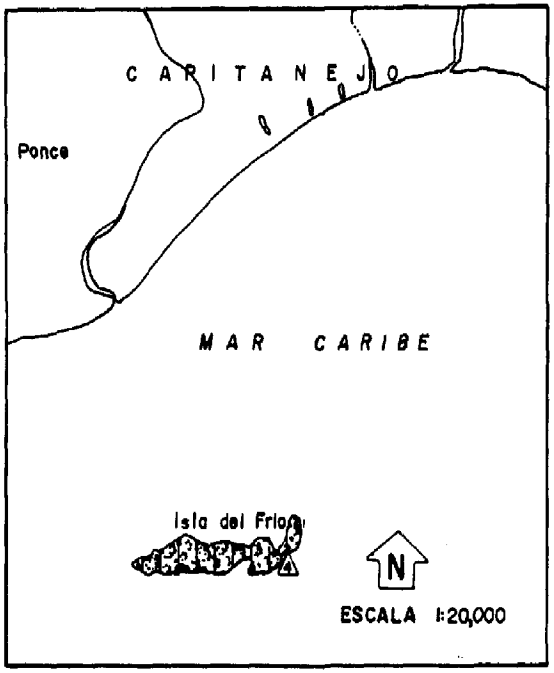
CABULLON MANGROVE

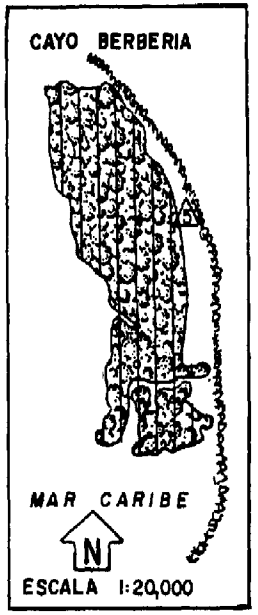


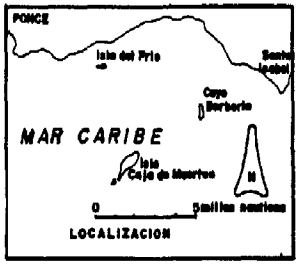
MAP 29

BERBERIA CAY, CAJA DE MUERTOS AND MORRILLITO ISLAND, AND FRIO CAY









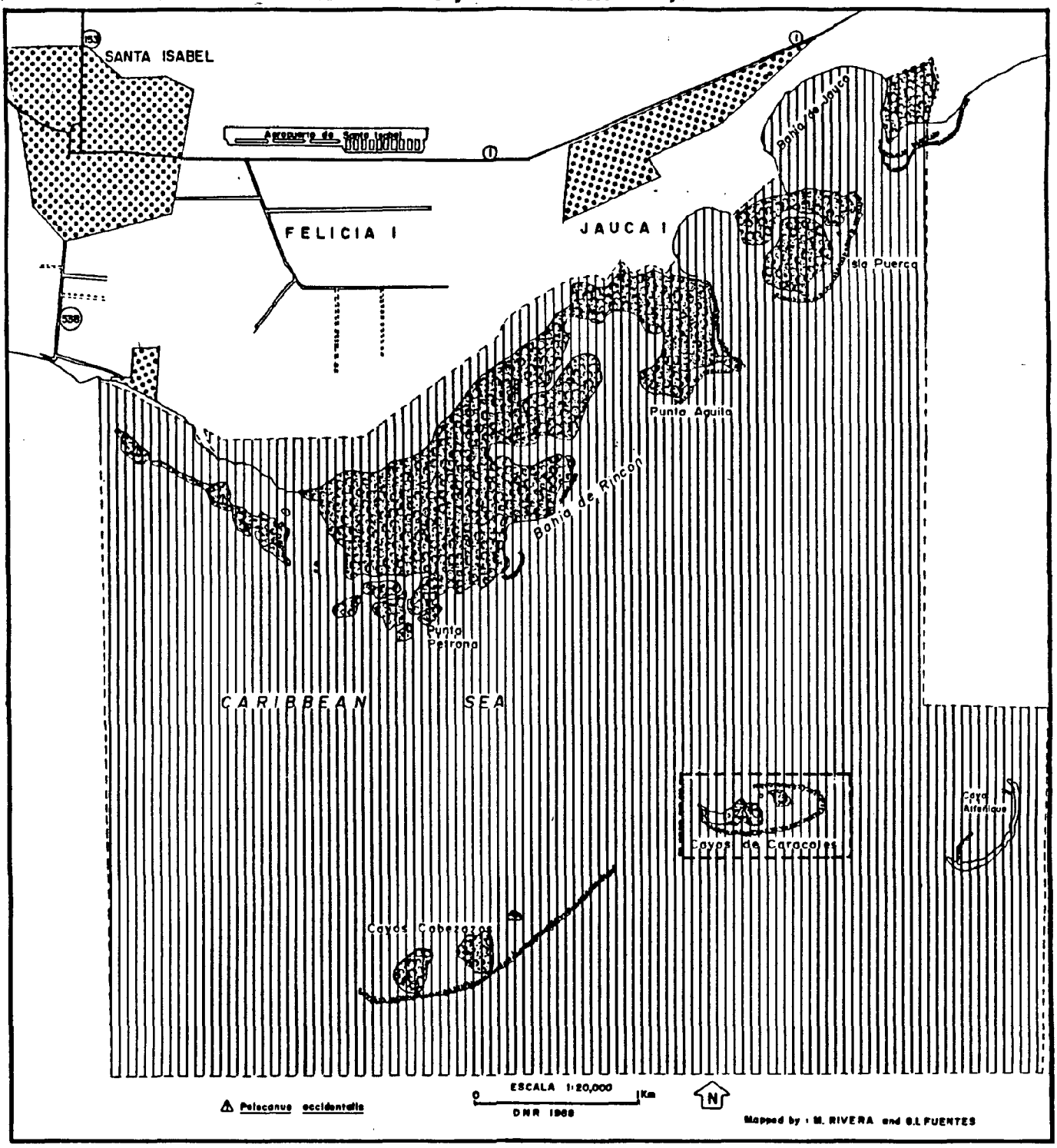
1. Mabuya mabouya
2. Chelonia mydas
3. Anolis cooki
4. Eretmochelys imbricata
5. Pelecanus occidentalis
6. Phaethon aethereus

SOURCE: DNR Natural Heritage Program

Mapped by: M. RIVERA and G.I. FUENTES
DNR 1988

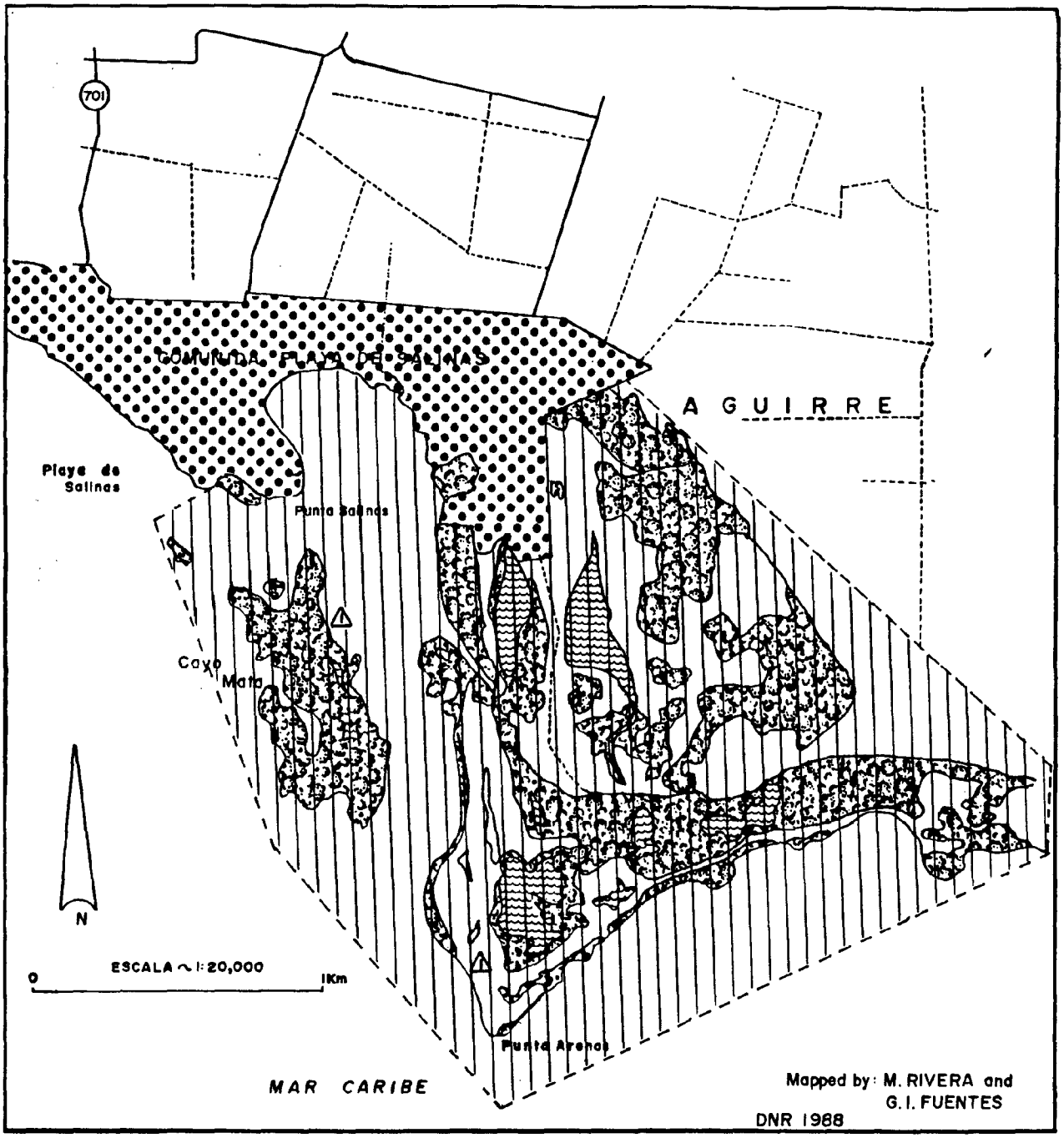
MAP 30

Punta Petrona Mangrove and Caracoles Cays



MAP 31

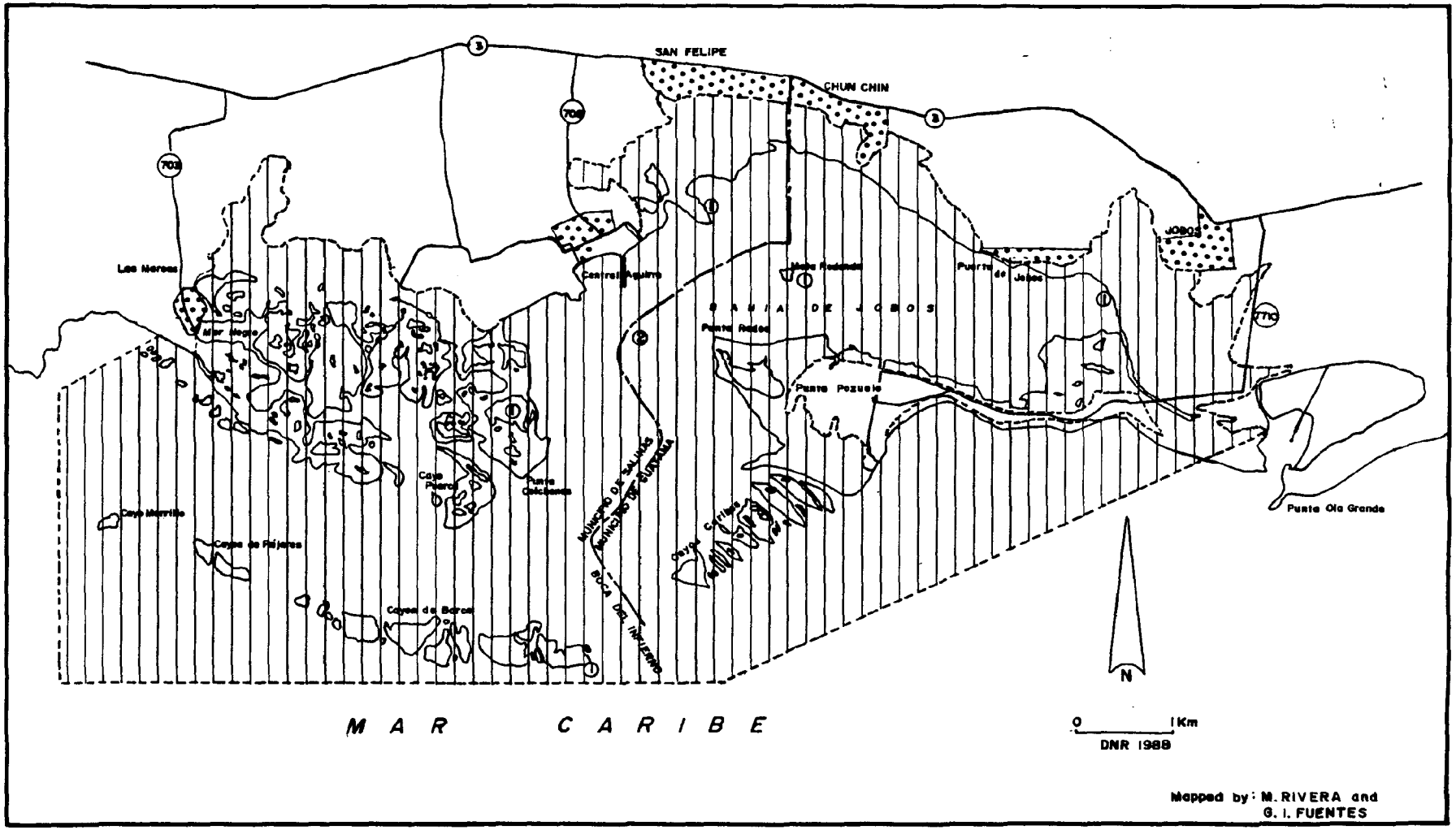
PUNTA ARENAS



⚠ Paleocenus occidentalis

MAP 32

Punta Pozuelo and Mar Negro

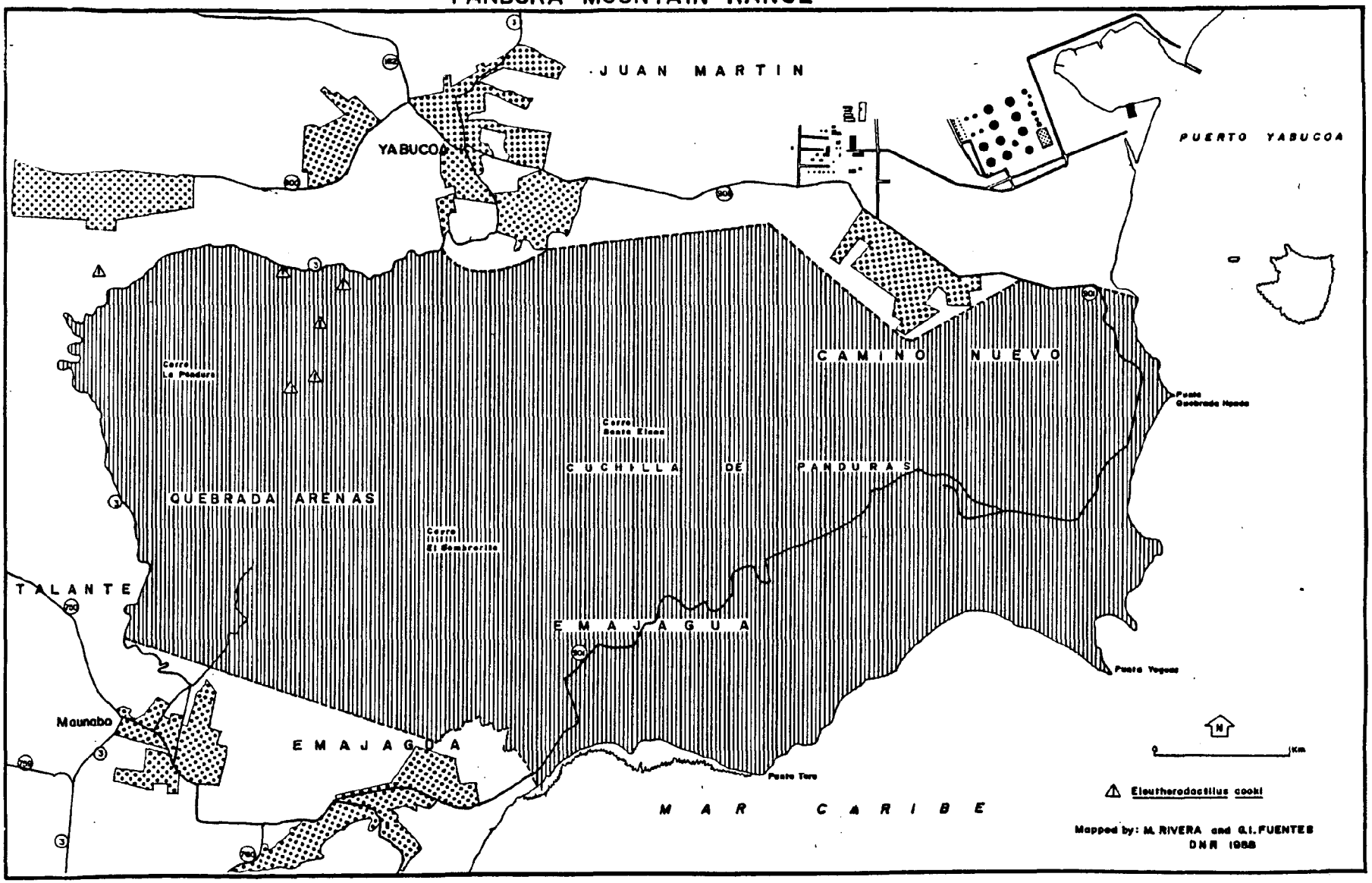


① Pelecanus occidentalis
② Trichechus manatus

Source: DNR Natural Heritage Program.

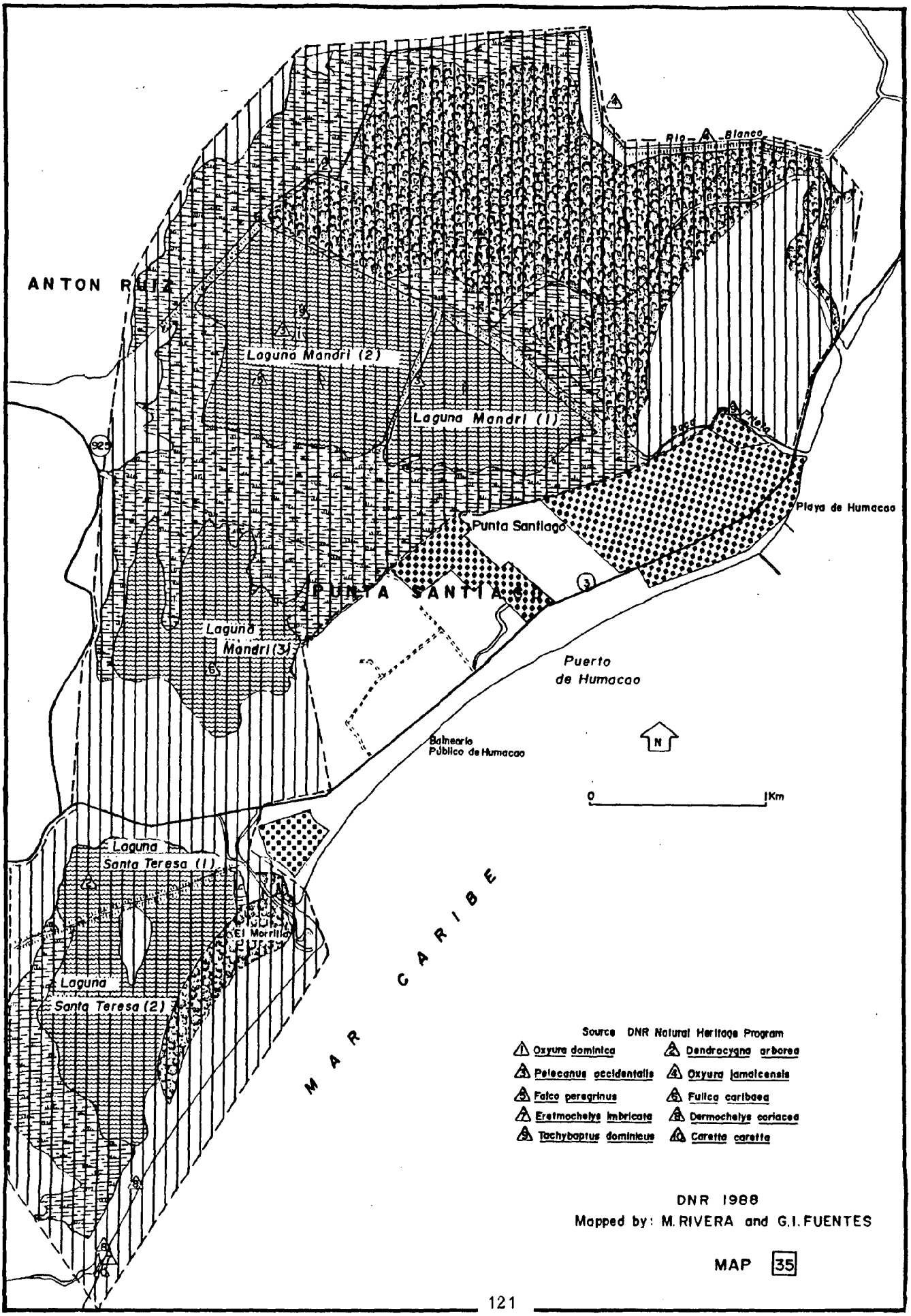
MAP 33

PANDURA MOUNTAIN RANGE

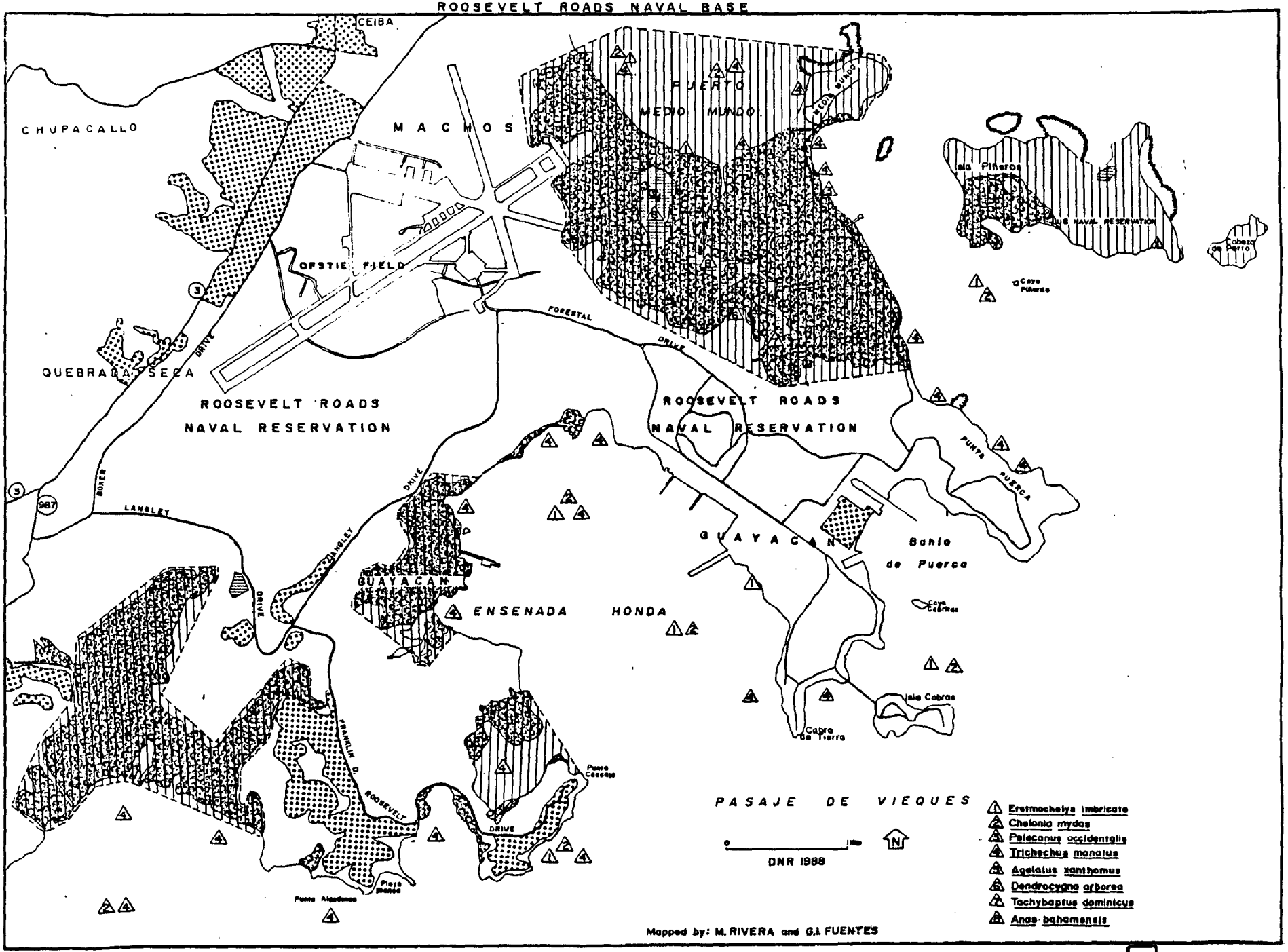


MAP 34

HUMACAO SWAMP

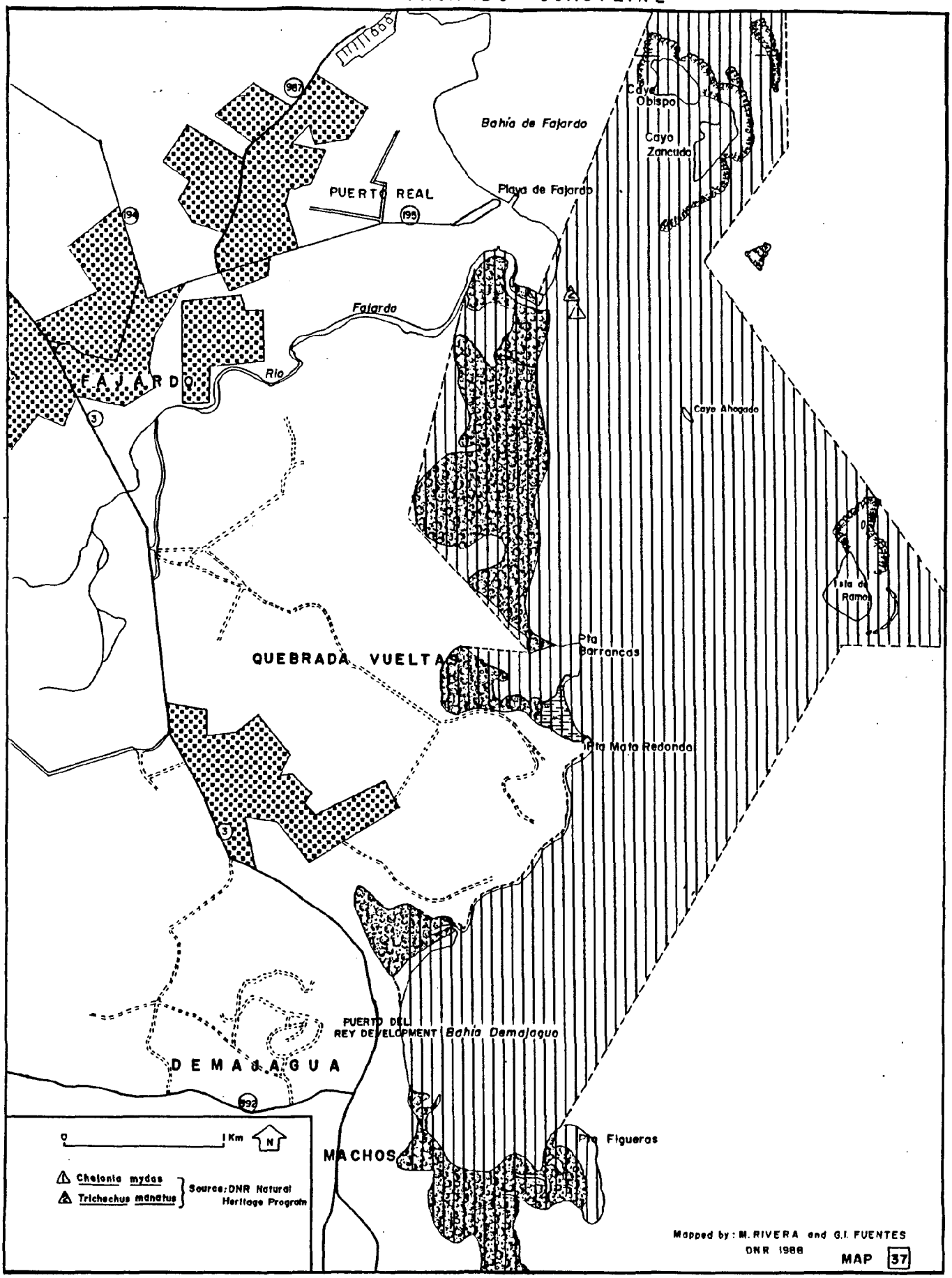


ROOSEVELT ROADS NAVAL BASE

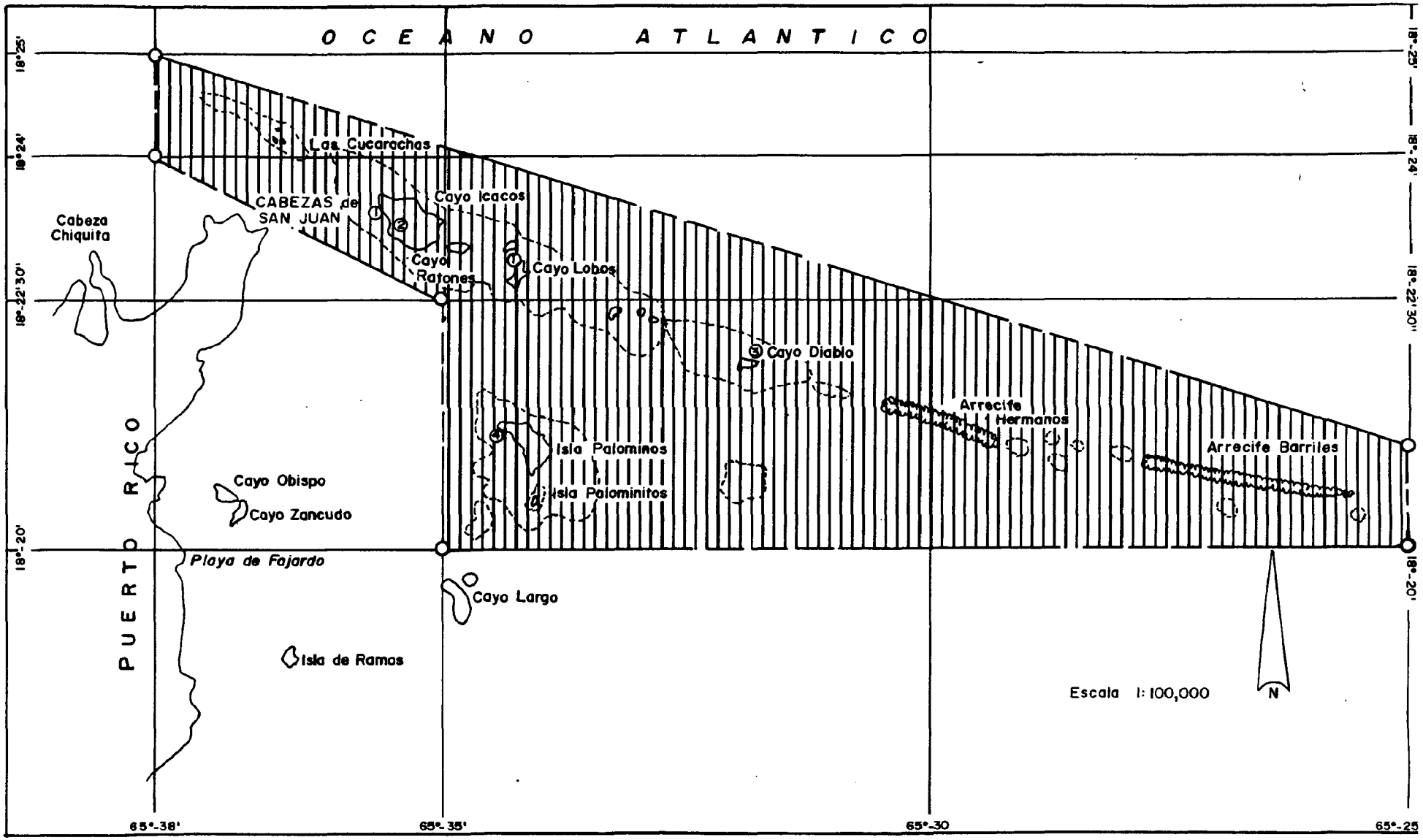


MAP 36

FAJARDO COASTLINE



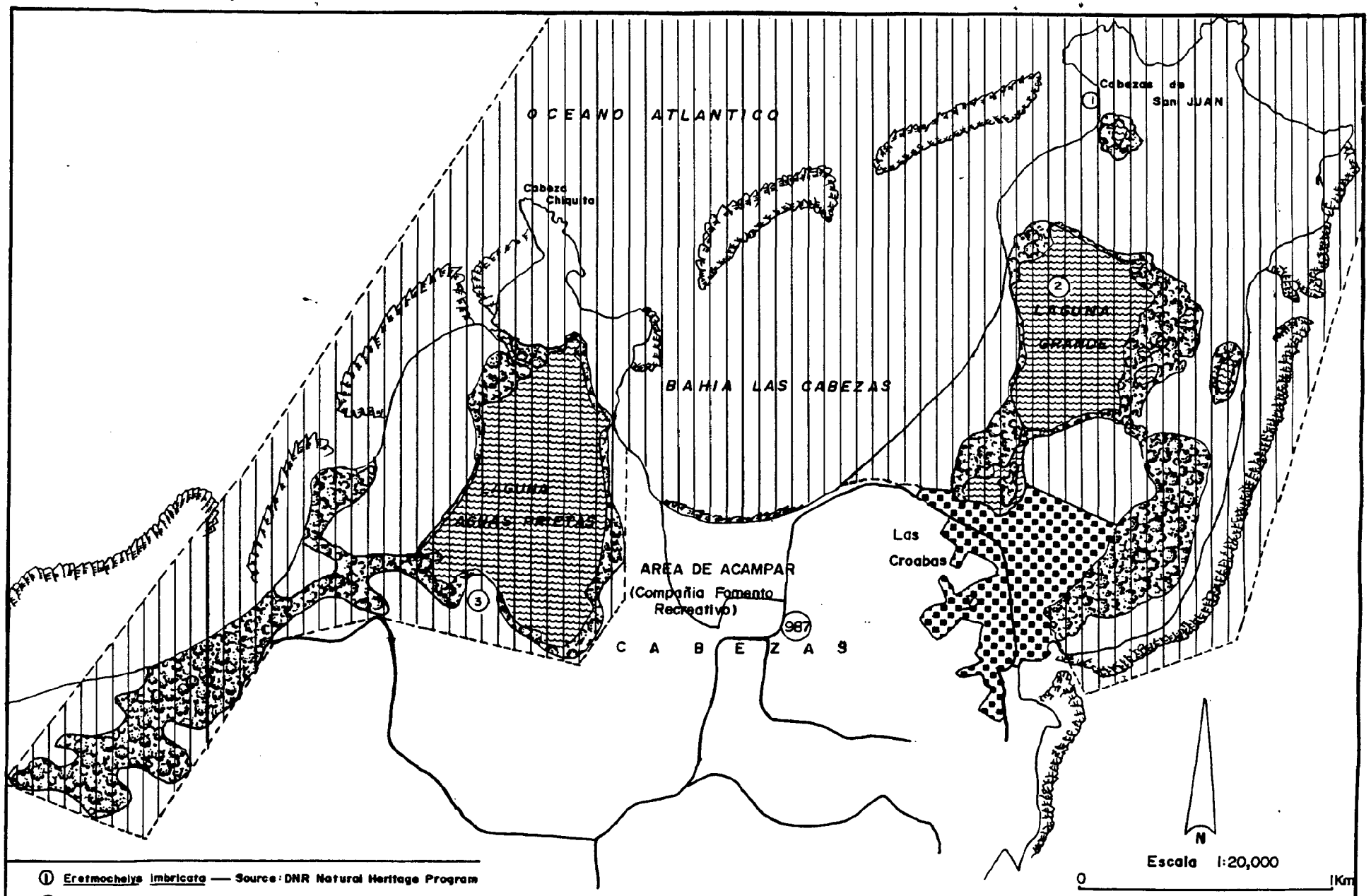
FAJARDO CORDILLERA



① Eretmochelys imbricata ② Mabuya mabouya
③ Epicrates monensis granti ④ Pelecanus occidentalis
> Source DNR Natural Heritage.

Map re-drawn from Cordillera Designation Document 1980.
Mapped by: M.RIVERA and G.I.FUENTES
DNR 1986

MAP 38

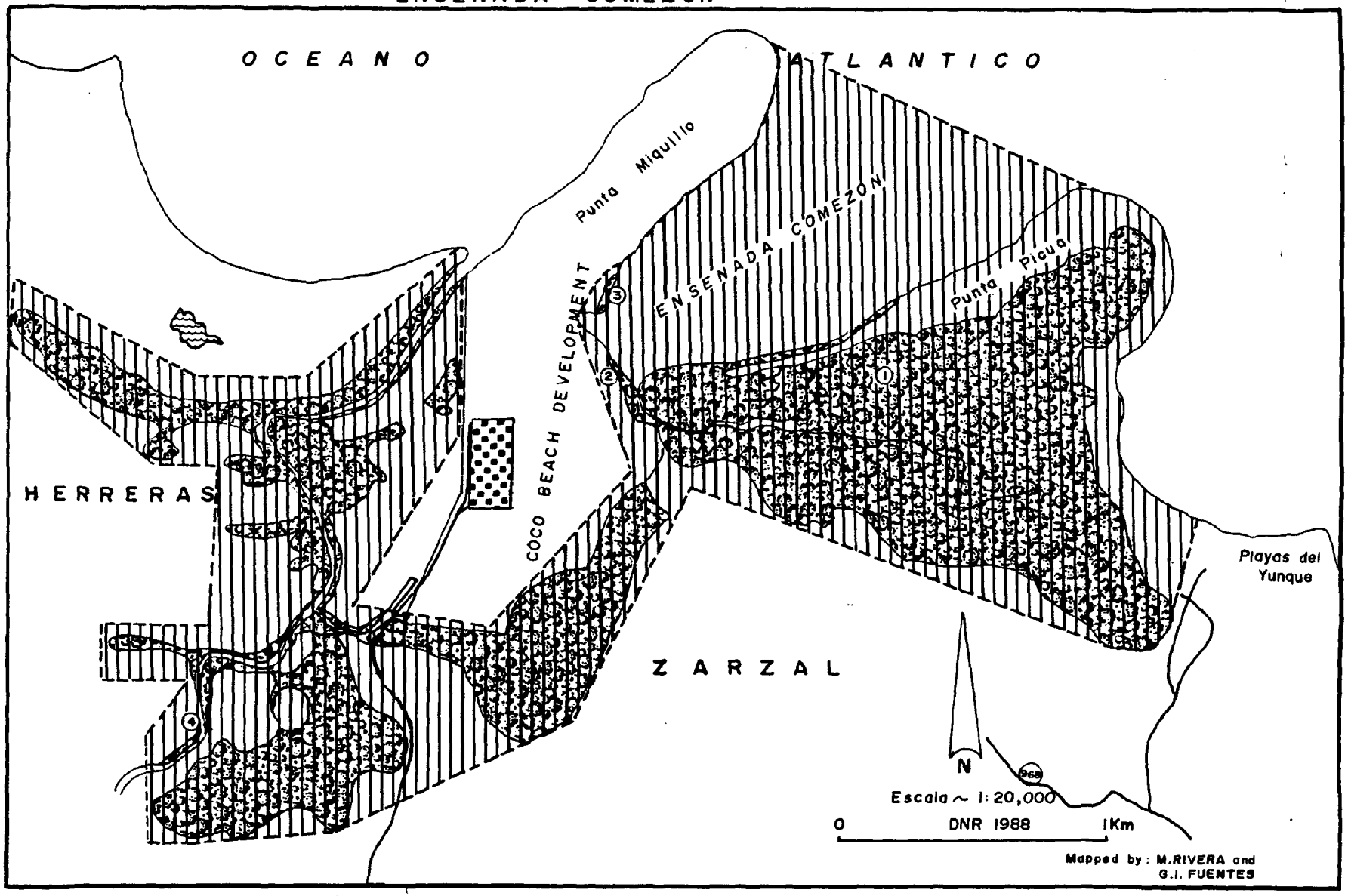


AGUAS PRIETAS LAGOON, GRANDE LAGOON AND ADJACENT AREAS

Mapped by: M. RIVERA and G.I. FUENTES

MAP 39

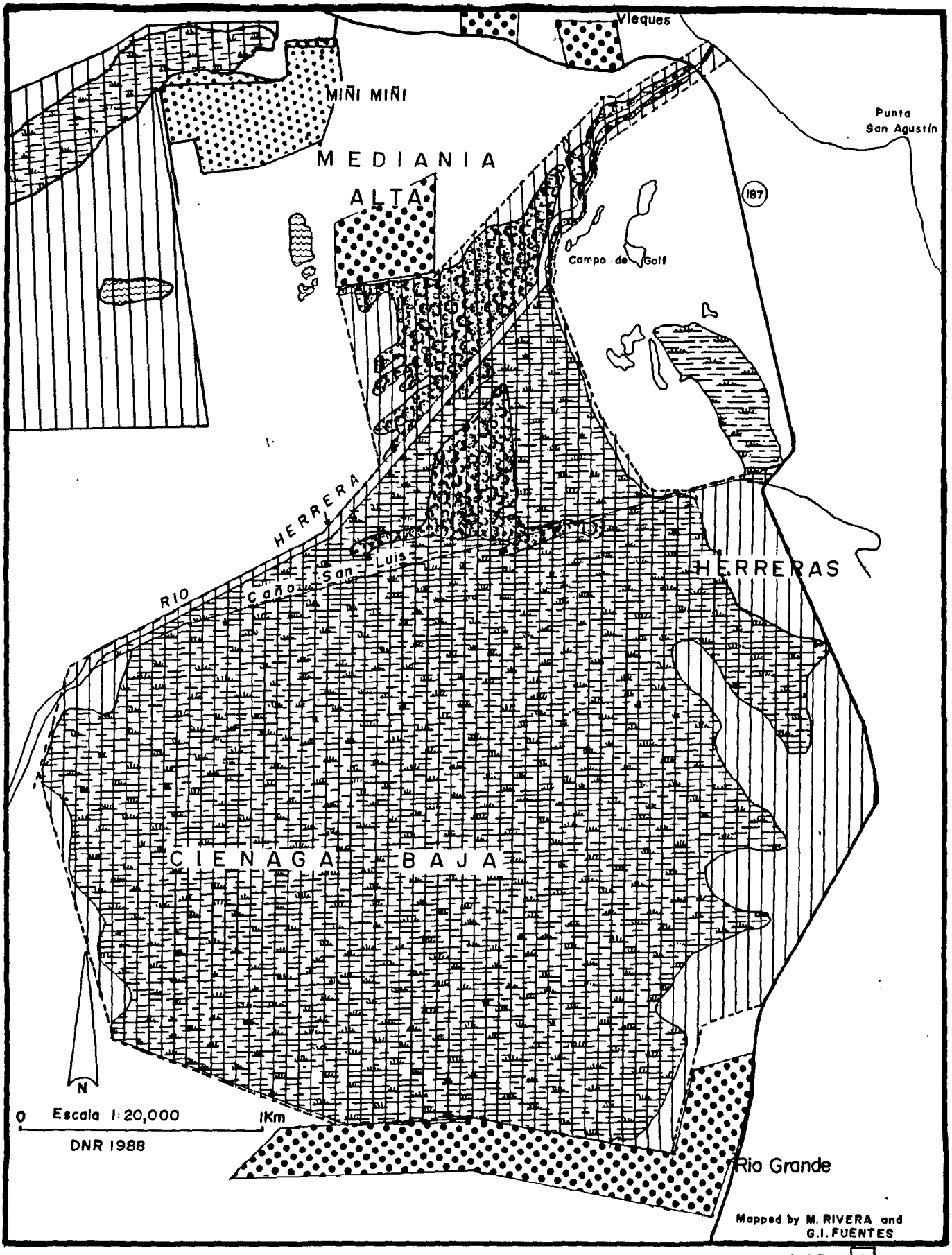
ENSENADA COMEZON



① Dendrocygna arborea ② Sterna antillarum
③ Pelecanus occidentalis ④ Agelaius xantamus > Source DNR Natural Heritage Program

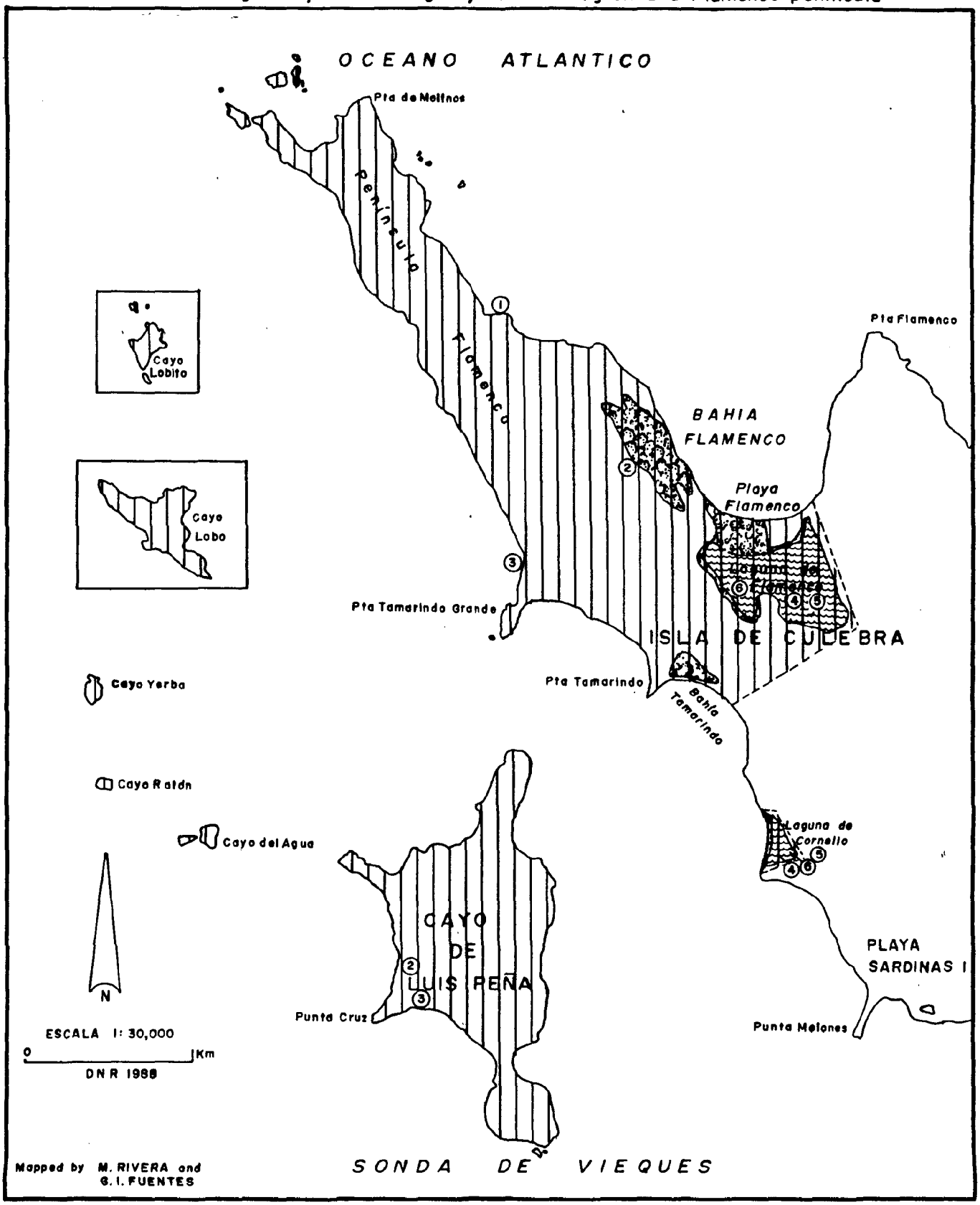
MAP 40

CIENAGA BAJA



MAP 41

Culebra's surrounding Islets, Cornelius lagoon, Flamenco lagoon and Flamenco peninsula

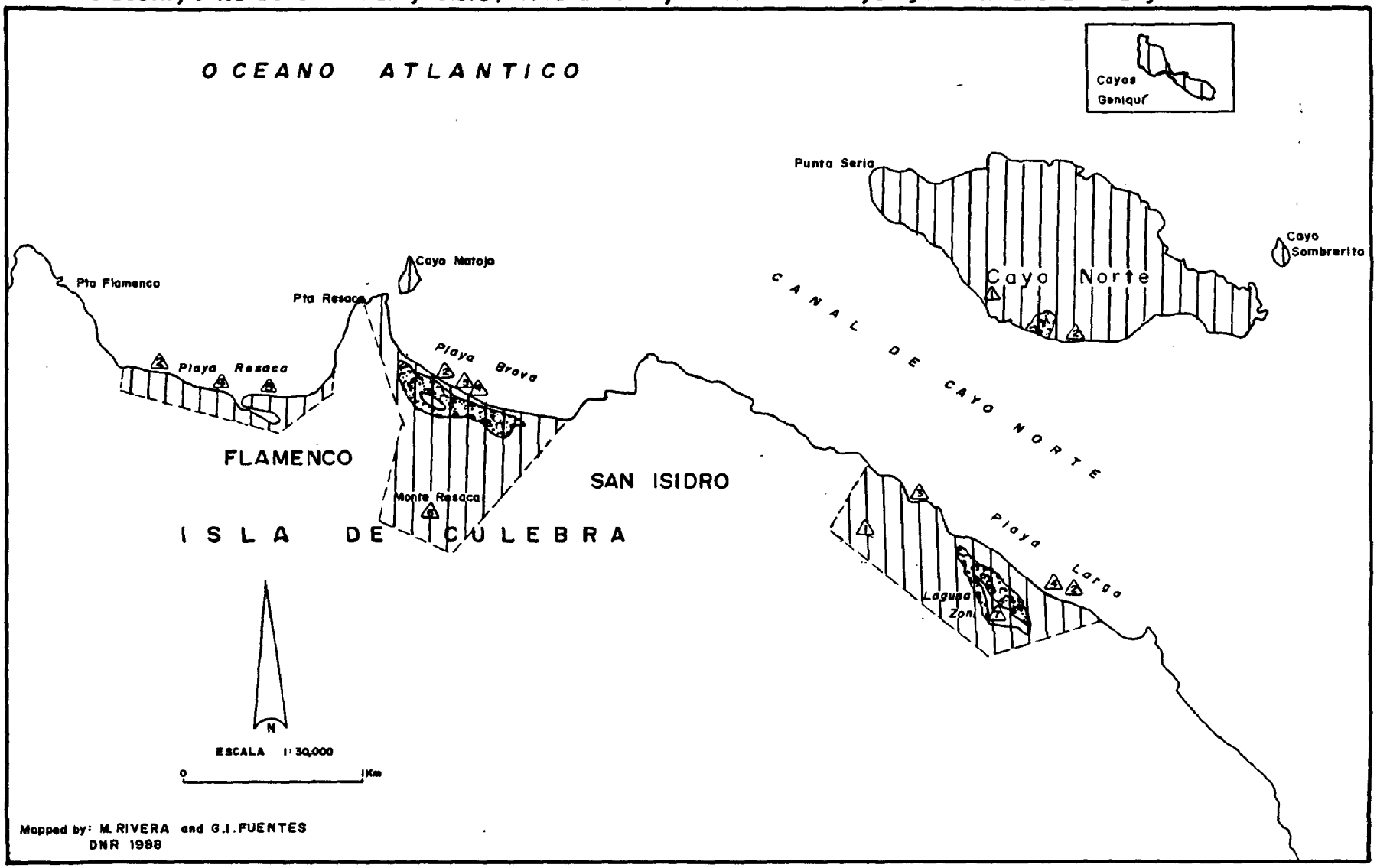


① Eretmochelys imbricata
② Mabuya mabouya sloanii
③ Pelecanus occidentalis
④ Oxyura jamaicensis
⑤ Oxyura dominica
⑥ Anas bahamensis

Source : DNR Natural Heritage Program

MAP 42

Brava Beach, Culebra's surrounding Islets, Resaca Beach, Resaca Mountain, Larga Beach and Zoni Lagoon.

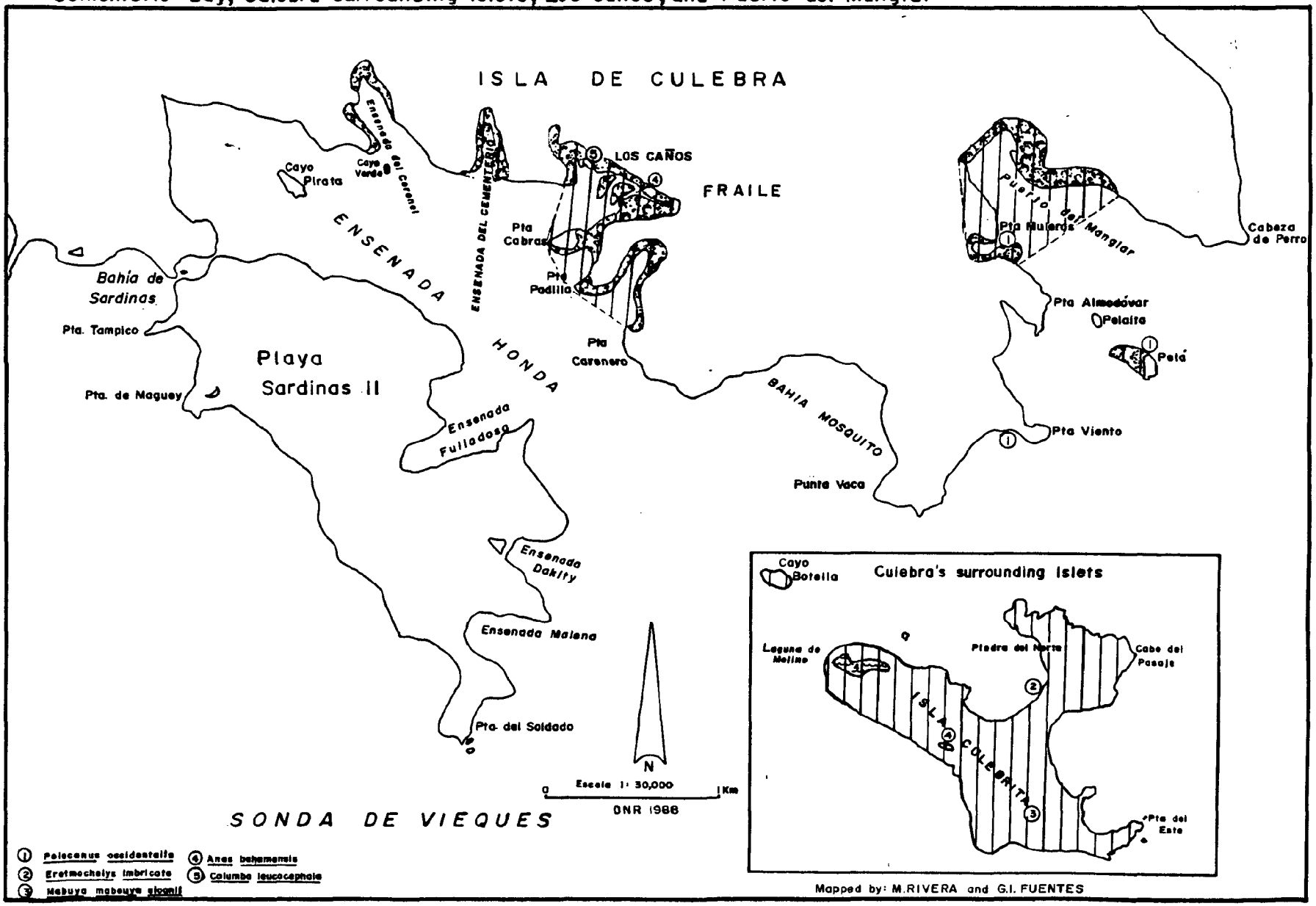


MAP 43

1 Mabuya mabouya sloanii
2 Caretta caretta
3 Chelonia mydas
4 Eretmochelys imbricata
5 Dermochelys coriacea
6 Anolis roosevelti
7 Anas bahamensis

Source: DNR Natural Heritage Program

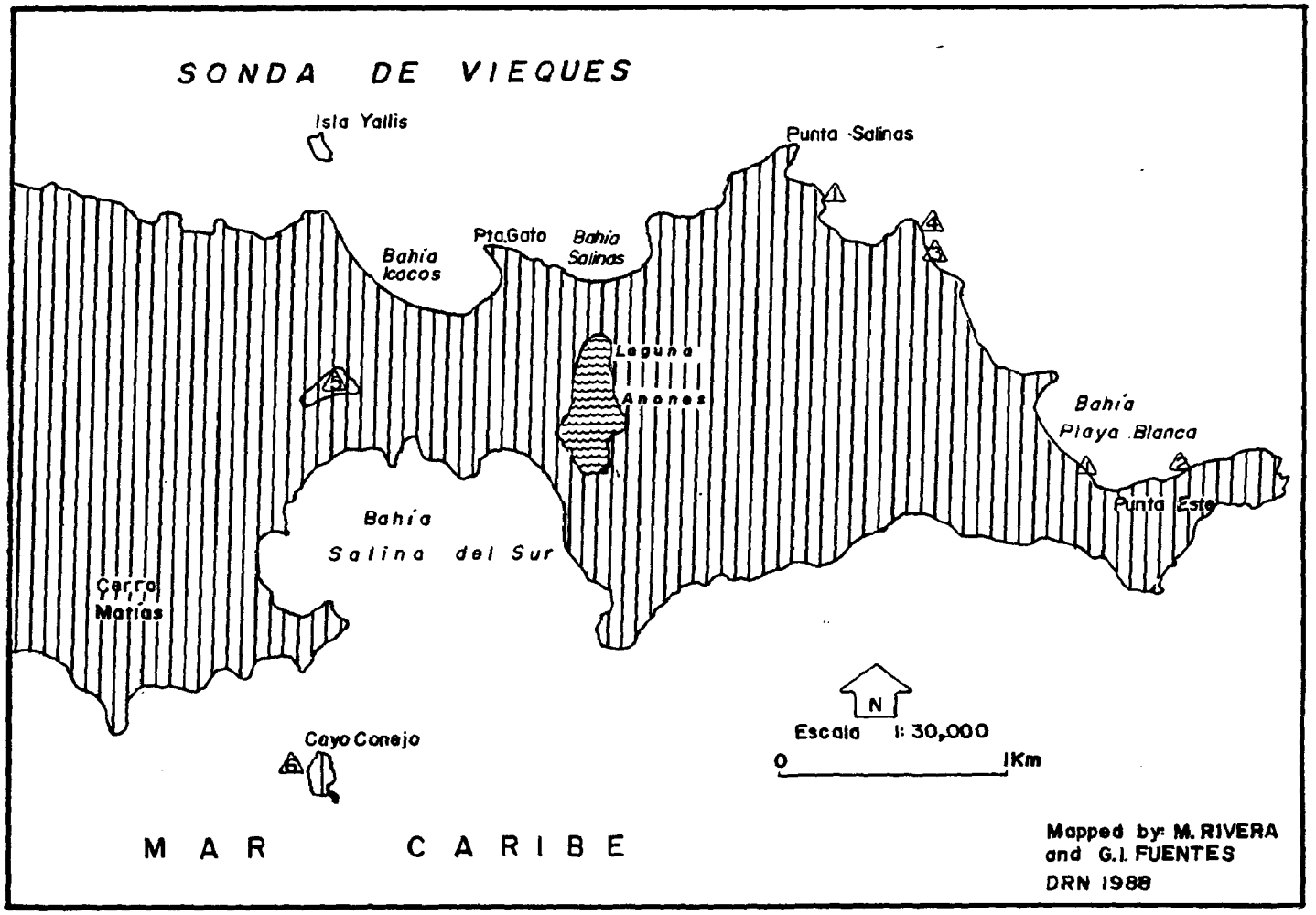
Cementerio Bay, Culebra surrounding Islets, Los Caños, and Puerto del Manglar



Mapped by: M.RIVERA and G.I. FUENTES

MAP 44

EAST TIP OF VIEQUES AND CONEJO ISLAND



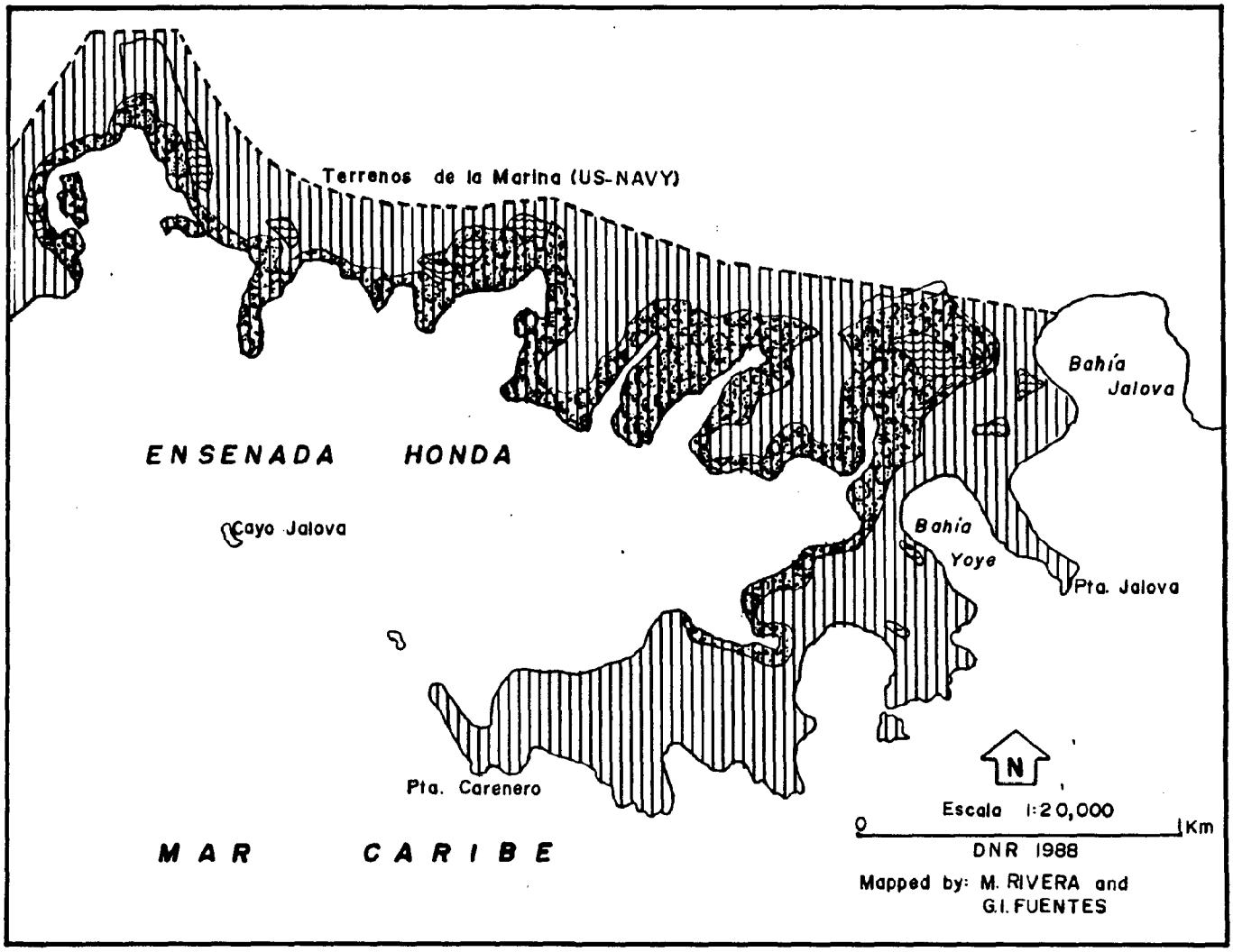
△ Caretta caretta △ Chelonia mydas △ Dermochelys coriacea

△ Eretmochelys imbricata △ Oxyura jamaicensis △ Pelecanus occidentalis

→ Source: DNR Natural Heritage Program

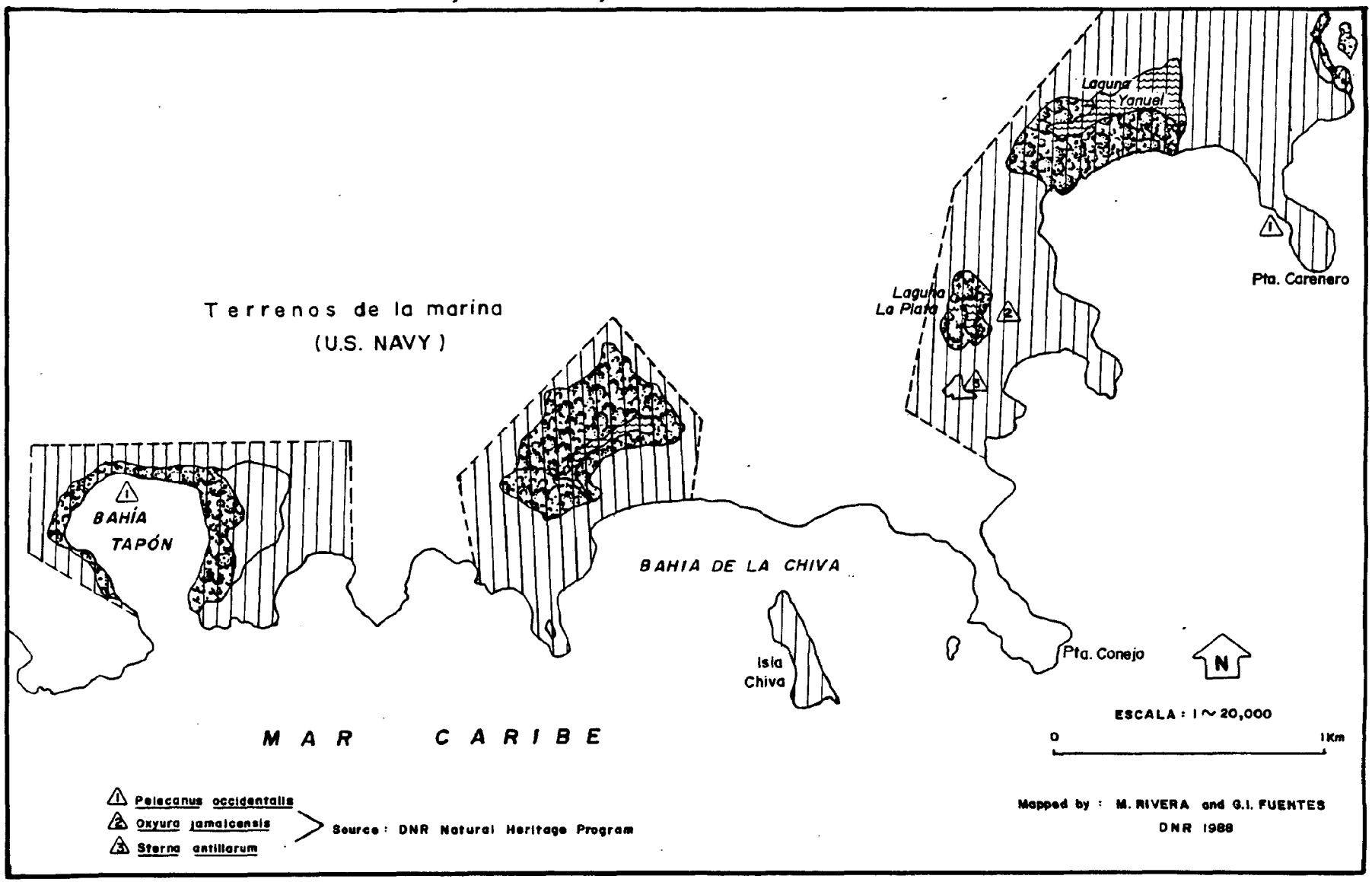
MAP 45

ENSENADA HONDA MANGROVE



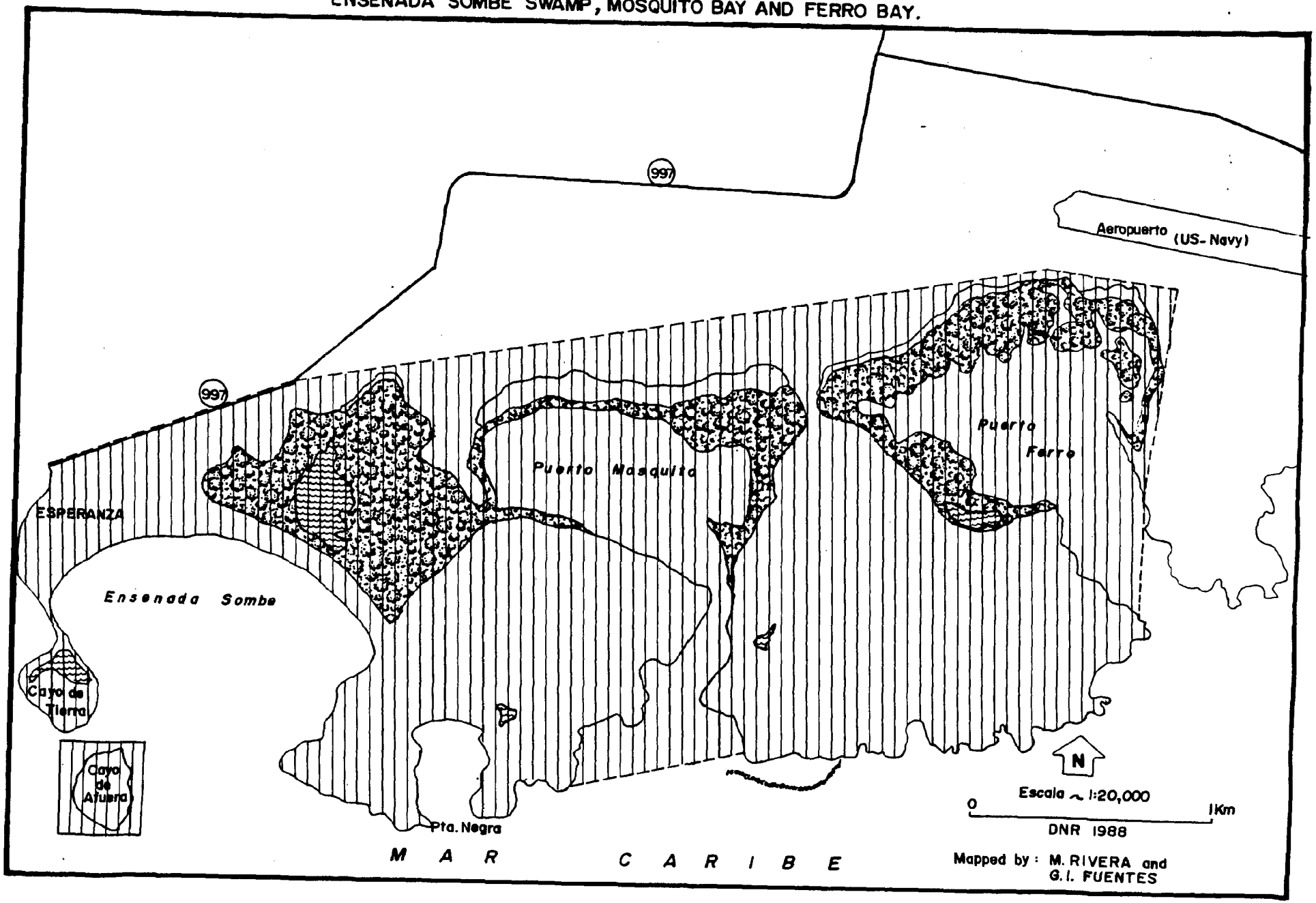
MAP 46

CHIVA SWAMP, TAPON BAY, and YANUEL LAGOON



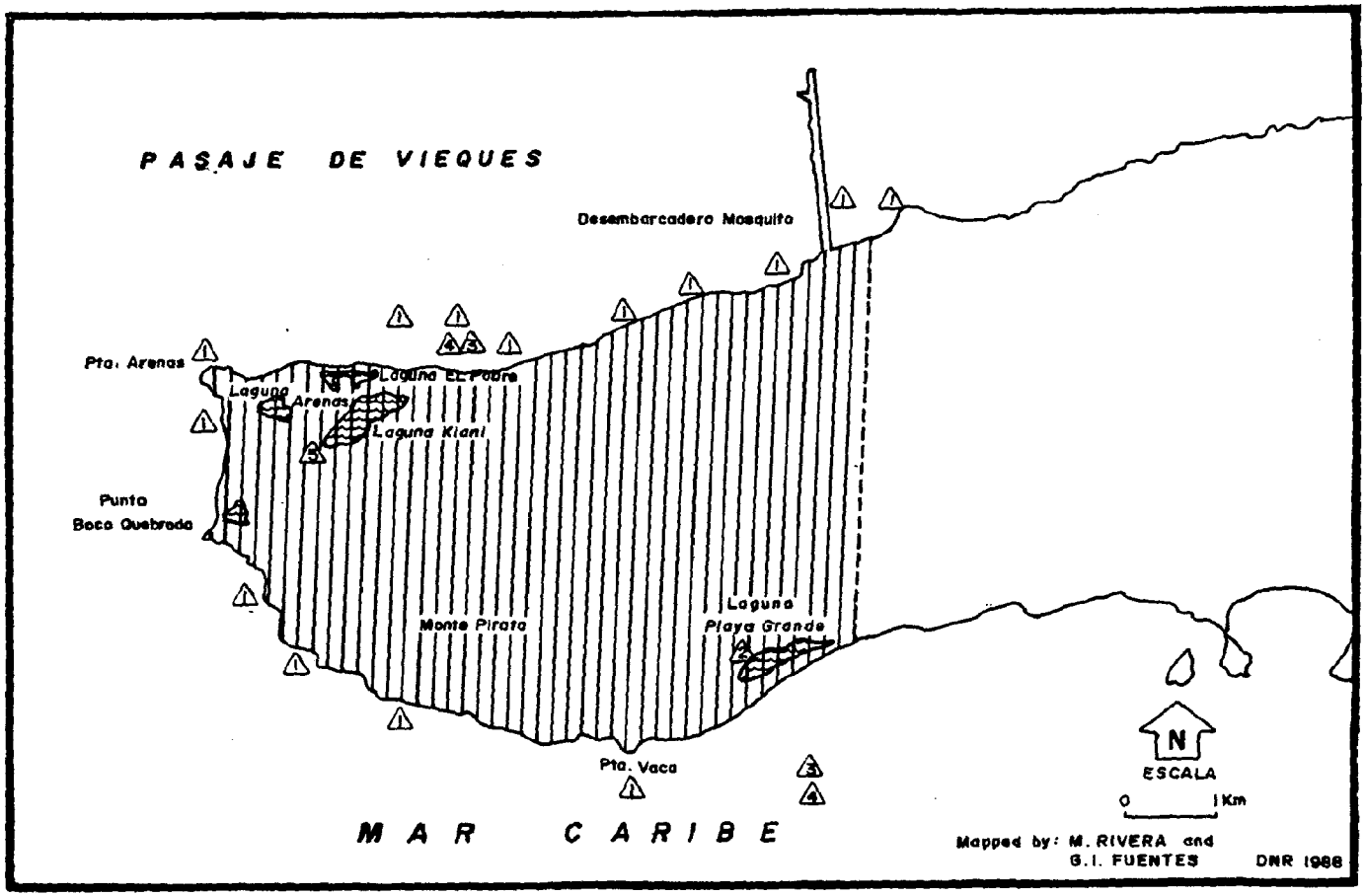
MAP 47

ENSENADA SOMBE SWAMP, MOSQUITO BAY AND FERRO BAY.



MAP 48

WEST VIEQUES

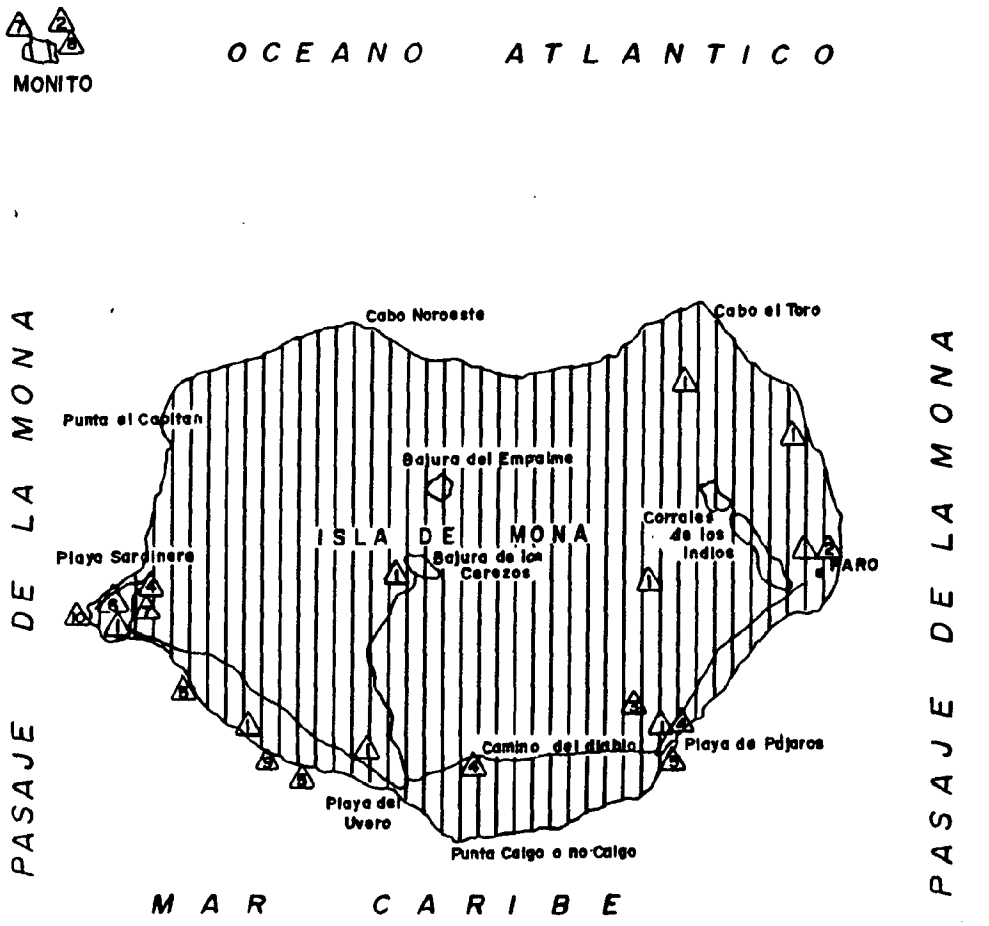


1 Trichechus manatus 2 Fulica caribaea 3 Eretmochelys imbricata
4 Chelonia mydas 5 Dendrocygna arborea

Source : DNR Natural Heritage Program.

MAP 49

Mona and Monito Islands



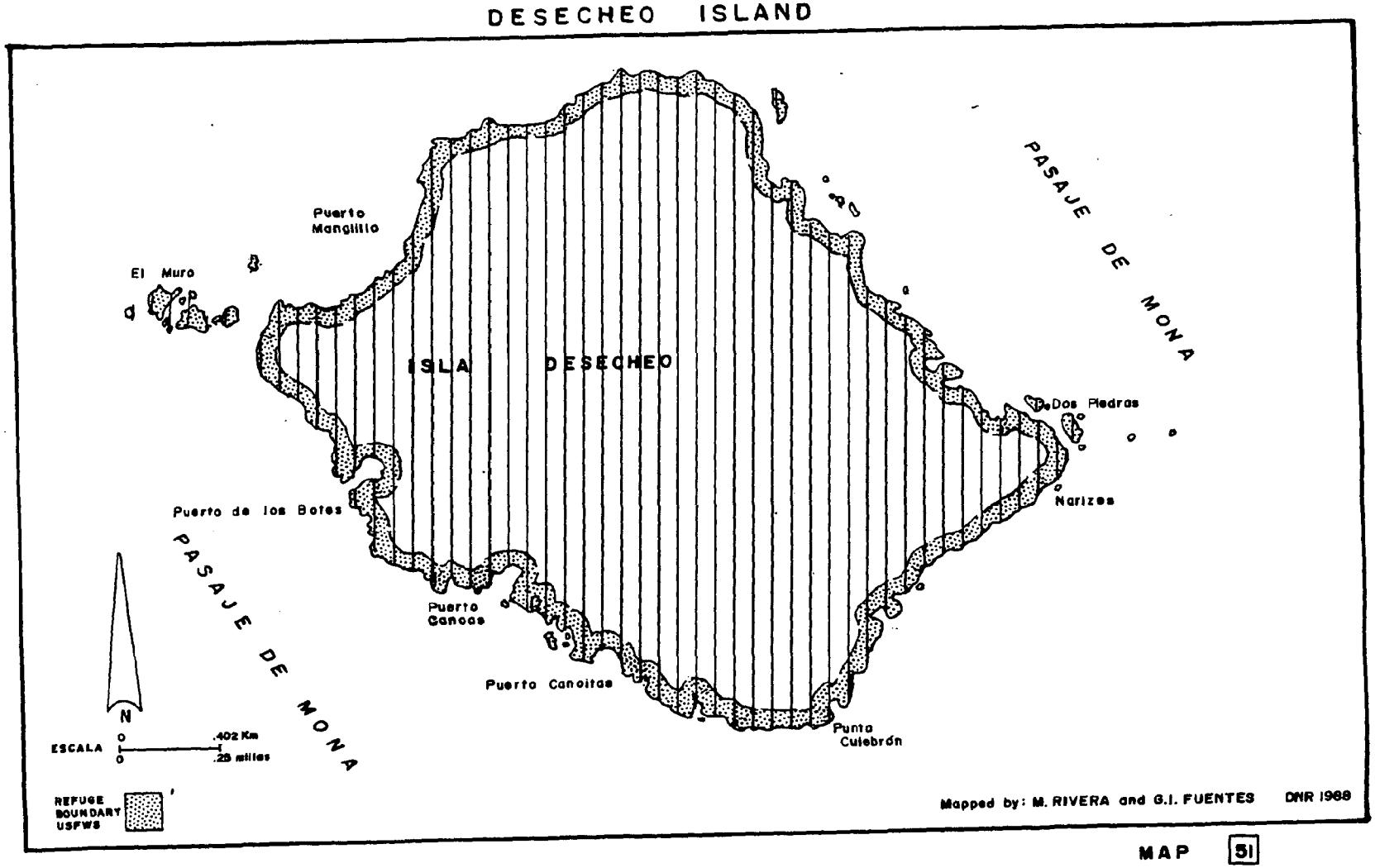
1. Cyclura stejneyeri
2. Ageiaius xanthomus
3. Mormoops blainvillii cinnamomeum
4. Epicrates monensis monensis
5. Eretmochelys imbricata
6. Falco peregrinus
7. Mabuya mabouya
8. Sphaerodactylus micropithecus
9. Dermochelis coriacea
10. Chelonia mydas

Source : DNR Natural Heritage Program

Mapped by : M. RIVERA and G.I. FUENTES

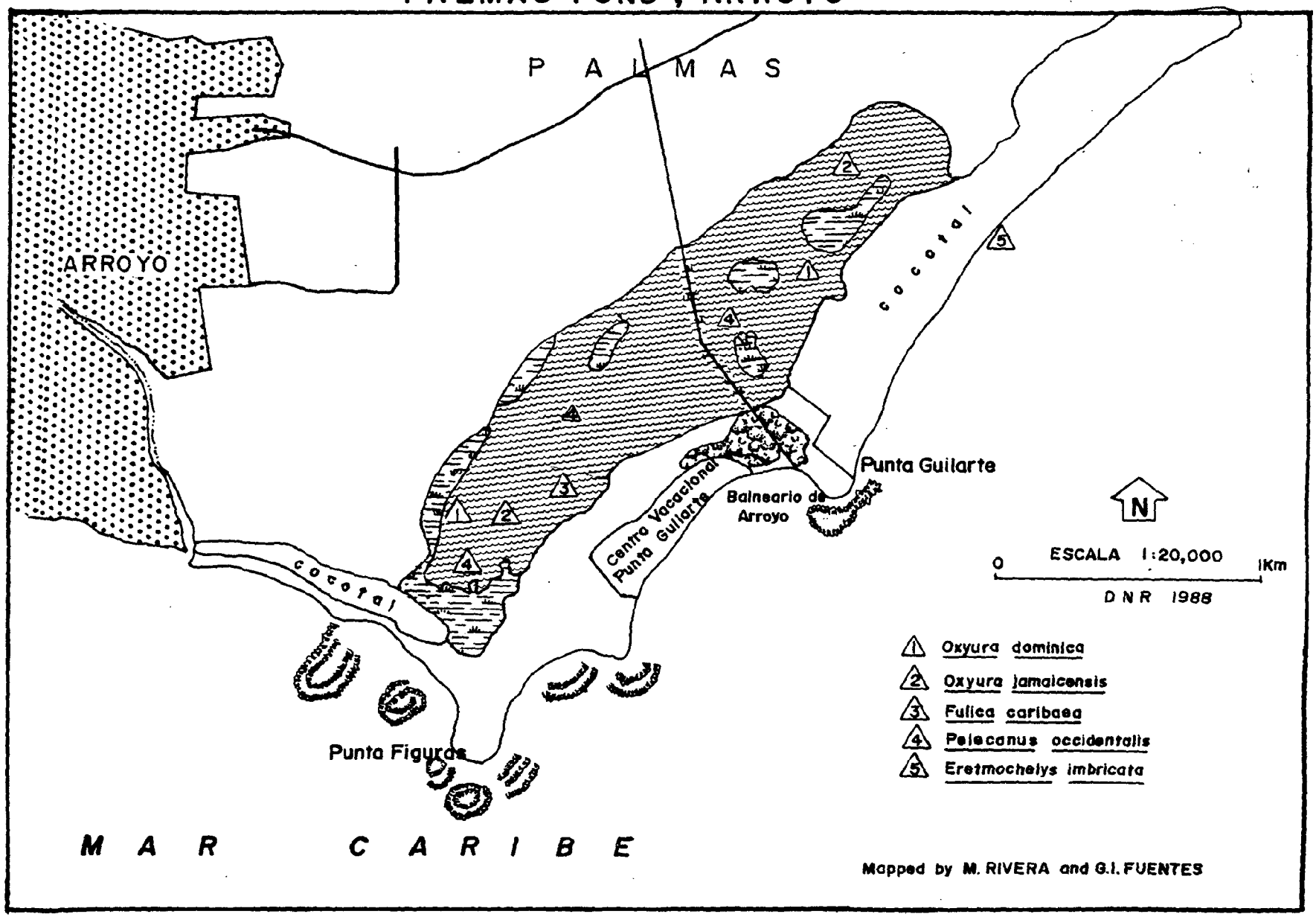
MAP 50

DESECHEO ISLAND



MAP 51

PALMAS POND , ARROYO



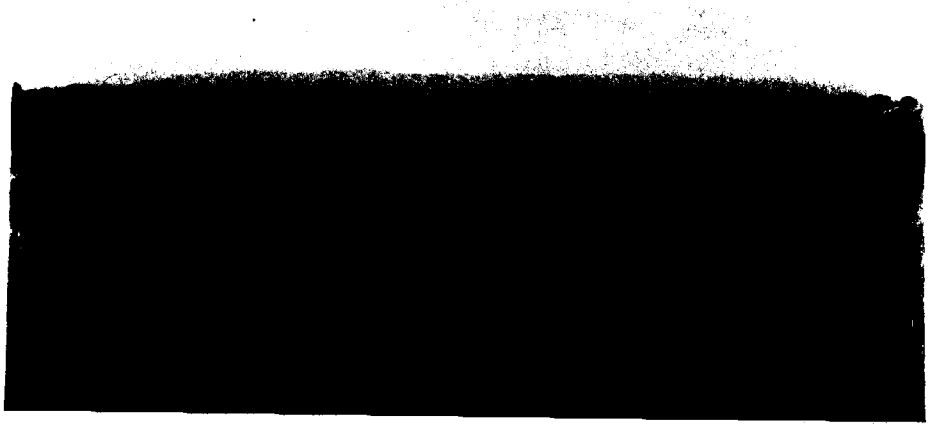
MAP 52

PHOTOGRAPHS OF SELECTED CRITICAL WILDLIFE AREAS

Constitution Bridge Mudflats. This artificial mudflat near the mouth of Martin Peña channel will probably disappear, as more developments are planned for the area.

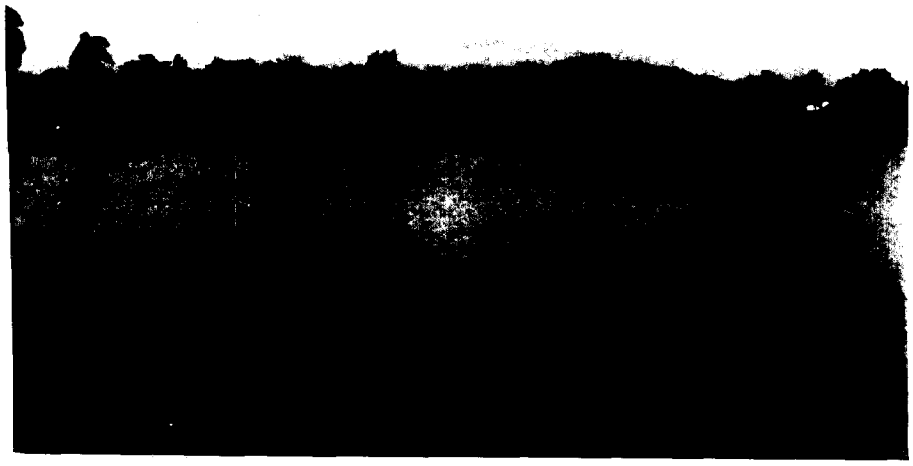
Palo Seco Peninsula. Aerial view of area set aside for wildlife by the municipality of Cataño. A recreational park occupies the base of the peninsula.

Buchanan Pond. This small privately owned artificial lake is located within the Buchanan Army Reserve. Ruddy ducks nest in small numbers in the surrounding vegetation.



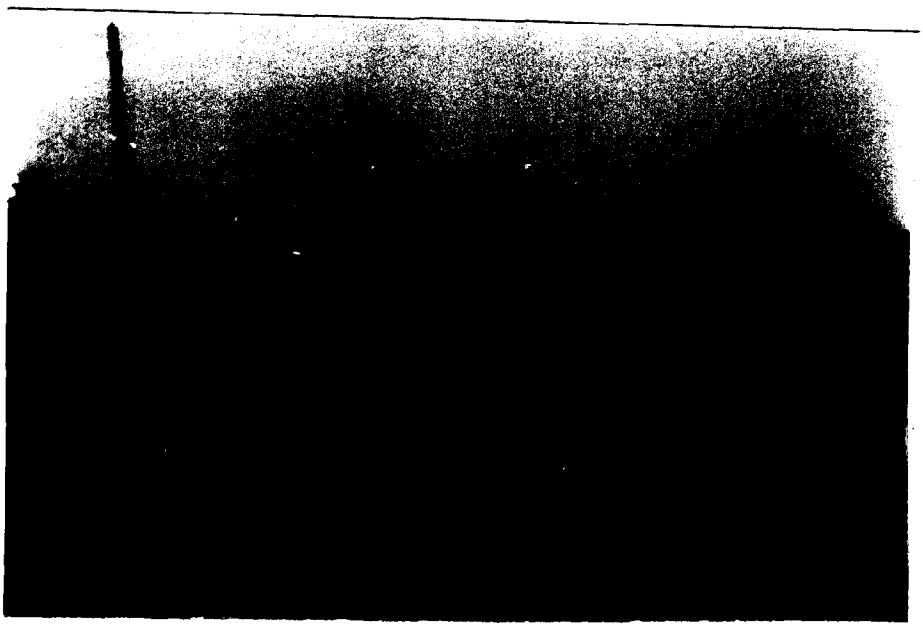
San Pedro Swamp. This large, mostly freshwater swamp, can be made more attractive for waterfowl by creating open water areas.

A dirt road crosses the swamp through cattail and mangrove stands in the north-central section. Shorebirds forage on these short-lived open water areas after heavy rainfall.



Lake Mata Redonda at Hyatt Dorado Beach Hotel. Housing development near its margins contribute to its degradation as a wildlife area.

Cibuco Swamp. Reduction of wildlife habitat is often the result of draining of wetlands for agricultural uses, such as cattle grazing.



Puerto Nuevo Lagoon. Formerly an excellent wildlife locality, this small lagoon is currently degraded and encroached to the extreme. No open water is available, as the lagoon is choked with cattails. Utilities, recreation areas and housing around the area make restoration of this area unlikely.

Carrizales Mangrove. A large diameter storm sewer pipe discharges into the mangrove. Changes in water regime and sedimentation may affect vegetation composition in the area.

Guajataca Cliffs- East. A recreative area was built after 1979 near cliffs where tropicbirds nest. Birds continue to use the area despite increased disturbance.

Bellaca Creek. The Puerto Rican Crested Toad was found breeding in this area after 1979. The creek bed is covered by mature mesic vegetation, however the area is surrounded by pasturelands.

Cayures Lagoon. Open water interspersed with aquatic vegetation provides excellent habitat for rare waterfowl, such as the West Indian Whistling, Ruddy and Masked ducks.

Cueva Lagoon. Small shallow ponds in this area are frequently used by migratory and native waterfowl. It is a popular hunting grounds.

Cueva Lagoon after an extraordinary amount of rainfall. Dramatically fluctuating water levels may have an effect on wildlife use of this area.

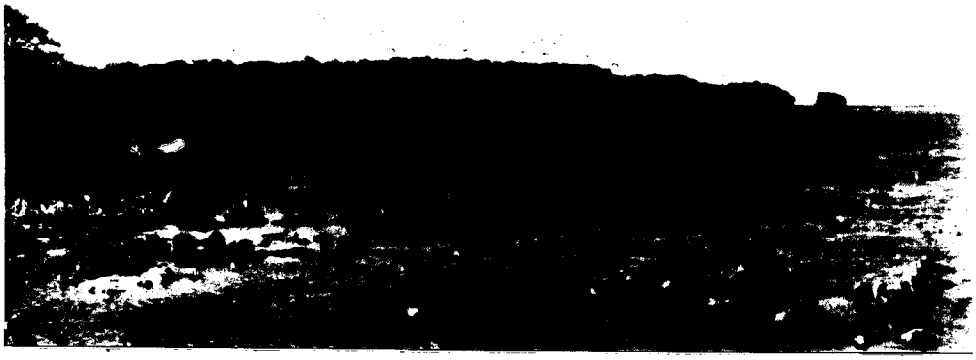
Guaniquilla Lagoons. The smaller of these lagoons dries up during the drier months of the year. They support a large variety of resident and migratory wading and shorebirds.

Boquerón Refuge. Although primarily managed for hunting, open areas and shallow ponds between mangrove stands are used by a wide variety of wildlife.

Cabo Rojo Saltflats. Mangrove trees invading a saltflat near the Cabo Rojo lighthouse. The threatened Least Tern and the Snowy Plover breed elsewhere in this area.

Tropicbirds nest on cliffs around the Cabo Rojo lighthouse. Brown Pelicans forage in the small bay in the foreground.

Guánica Lagoon. Although drained for agriculture in the 1950's, this area becomes flooded during periods of heavy rains attracting large numbers of wading birds.



Caracoles Cay. Recreational use of this remote islet should be organized to minimize disturbance to a heron breeding colony and a roost of the easily disturbed Magnificent Frigatebird.

La Pandura mountain range. Large boulders are the most important habitat for the narrowly distributed Guajón (Eleutherodactylus cooki), which thrive in dark crevices underneath them.

Roosevelt Roads Naval Base. Breeding of the Yellow-shouldered Blackbird in this area has decreased to alarming levels. Resident and migrant waterfowl occur in this pond.

Fajardo Coastline. Development of marinas, on the increase in the eastern end of the Island, degrades important habitat for the West Indian Manatee. Boat-manatee collisions become more likely with increased boat traffic.

Fajardo Cordillera. Shorebirds, Black-necked Stilts, and Bahama Ducks occur on this small lagoon in Icacos Island. Seabirds breed in several islets in this chain.

Ciénaga Baja. The Miñi-Miñi sector of Ciénaga Baja is a popular hunting grounds. It supports large numbers of Common Moorhen, resident and migrant waterfowl, and herons.

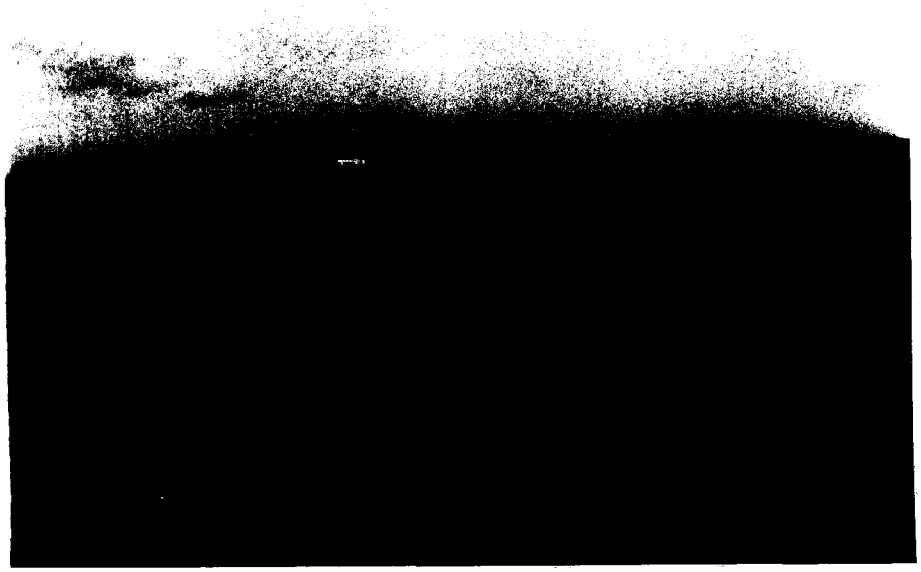
Open water areas interspersed with aquatic vegetation are ideally suited for a variety of waterfowl.

Flamenco Lagoon. Bahama Ducks remain in the lagoon even though large areas dry up seasonally. This lagoon also supports large numbers of the Ruddy Duck and migrant waterfowl.

The improvement of recreational facilities at Flamenco Beach and construction of additional housing near the lagoon increase human disturbance to wildlife.

Flamenco Peninsula. Large numbers of Sooty and Bridled terns nest near Punta Molinos each year during the summer months.

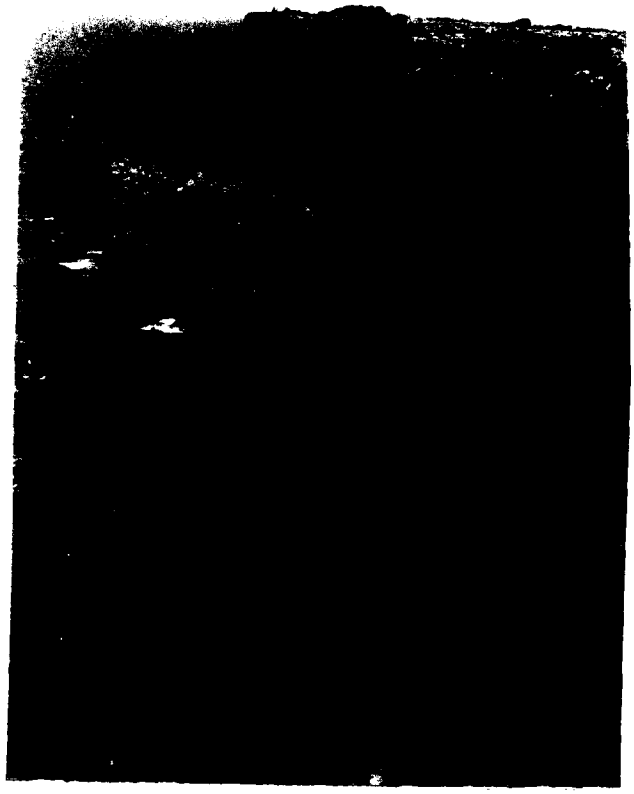
Resaca Beach. Difficult human access and a cattle-excluding fence promote survival of sea turtles in this beach. The foreground shows habitat of the Culebra Giant Anole in Resaca mountain.



Puerto Del Manglar. Brown Pelicans roost in the mangrove area in the foreground. Construction of housing uphill from the mangrove may increase sedimentation rates.

Culebra Islets. Large numbers of terns nest in several cays. Cayo Yerba is shown. Tropicbirds, boobies, and doves breed in this wildlife area of primary importance.

West End of Vieques. Mangrove death has resulted in Boca Quebrada lagoon due to the closing of the channel that connects it to the ocean by heavy seas. The West Indian Whistling Duck was reported from this area before death of the vegetation occurred.



Mona Island. The endemic subspecies of the Yellow-shouldered Blackbird nests in crevices on these cliffs. Sooty Terns nest on inaccessible boulders near ocean level.

Monito Island. One of the few breeding colonies of Magnificent Frigatebirds is located in this Island. Monito supports a wide variety of seabirds and the endemic Monito Gecko.

SCIENTIFIC AND COMMON NAMES OF SPECIES MENTIONED IN THE TEXT

Birds

Phaeton lepturus	White-tailed Tropicbird
Pelecanus occidentalis	Brown Pelican
Sula leucogaster	Brown Booby
Sula dactylatra	Masked Booby
Sula sula	Red-footed Booby
Fregata magnificens	Magnificent frigatebird
Larus atricilla	Laughing Gull
Sterna dougalli	Roseate Tern
Sterna fuscata	Sooty Tern
Sterna antillarum	Least Tern
Sterna maxima	Royal Tern
Sterna sandvicensis	Sandwich Tern
Anous stolidus	Noddy Tern
Ardea herodias	Great Blue Heron
Butorides striatus	Green-backed Heron
Florida caerulea	Little Blue Heron
Bubulcus ibis	Cattle Egret
Casmerodius albus	Great Egret
Egretta thula	Snowy Egret
Hydranassa tricolor	Tricolored Heron
Nycticorax nycticorax	Black-crowned Night Heron
Nyctanassa violacea	Yellow-crowned Night Heron
Ixobrichus exilis	Least Bittern
Botaurus lentiginosus	American Bittern
Plegadis falcinellus	Glossy Ibis
Phoenicopterus ruber	American Flamingo
Charadrius semipalmatus	Semipalmated Plover
Charadrius alexandrinus	Snowy Plover
Charadrius melodus	Piping Plover
Charadrius wilsonia	Wilson's Plover
Charadrius vociferus	Killdeer
Pluvialis dominica	American Golden Plover
Pluvialis squatarola	Black-bellied Plover
Arenaria interpres	Ruddy Turnstone
Capella gallinago	Common Snipe
Numenius phaeopus	Whimbrel
Actitis macularia	Spotted Sandpiper
Tringa solitaria	Solitary Sandpiper
Tringa flavipes	Lesser Yellowlegs
Tringa melanoleuca	Greater Yellowlegs

Calidris pusilla	Semipalmated Sandpiper
Haematopus ostralegus	American Oystercatcher
Hymantopus mexicanus	Black-necked Stilt
Rallus longirostris	Clapper Rail
Porzana carolina	Sora Rail
Porzana flaviventer	Yellow-breasted Crake
Porphyrula martinica	Purple Gallinule
Gallinula chloropus	Common moorhen
Fulica americana	American Coot
Fulica caribaea	Caribbean Coot
Jacana spinosa	Spiny Jacana
Podylimbus podiceps	Pied-billed Grebe
Tachibaptus dominicus	Least Grebe
Phalacrocorax auritus	Double-crested Cormorant
Dendrocygna arborea	West Indian Whistling Duck
Dendrocygna autumnalis	Black-bellied Whistling Duck
Dendrocygna bicolor	Fulvous Whistling Duck
Anas platyrhynchos	Mallard
Anas rubripes	Black Duck
Anas bahamensis	Bahama Duck
Anas crecca	Green-winged Teal
Anas acuta	Pintail
Anas discors	Blue-winged Teal
Anas americana	American Wigeon
Aythya collaris	Ring-necked Duck
Aythya affinis	Lesser Scaup
Oxyura jamaicensis	Ruddy Duck
Oxyura dominica	Masked Duck
Buteo jamaicensis	Red-tailed Hawk
Pandion halietus	Osprey
Falco peregrinus	Peregrine Falcon
Otus nudipes newtoni	Newton's Owl
Asio flammeus	Short-eared Owl
Columba leucocephala	White-crowned Pigeon
Columba squamosa	Scaly-naped Pigeon
Columba inornata	Puerto Rican Plain Pigeon
Zenaida macroura	Mourning Dove
Zenaida aurita	Zenaida Dove
Zenaida asiatica	White-winged Dove
Geotrygon montana	Ruddy Quail Dove
Geotrygon chrysia	Key West Quail Dove
Caprimulgus noctitherus	Puerto Rican Nightjar
Chordeiles gundlachii	West Indian Nighthawk
Sericotes holosericeus	Green-throated Carib
Orthorhyncus cristatus	Antillean Crested Hummingbird
Todus mexicanus	Puerto Rican Tody
Elaenia martinica	Caribbean Elaenia
Parula americana	Northern Parula
Dendroica petechia	Yellow Warbler
Agelaius xanthomus	Yellow-shouldered Blackbird

Quiscalus niger	Greater Antillean Grackle
Molothrus bonariensis	Glossy Cowbird

Reptiles and Amphibians

Eleutherodactylus cooki	Puerto Rican Cavern Coquí
Eleutherodactylus cochranae	Whistling Coqui
Eleutherodactylus monensis	Mona Coqui
Peltophryne lemur	Puerto Rican Crested Toad
Anolis cooki	Puerto Rican Dryland Anole
Anolis cuvieri	Puerto Rican Giant Anole
Anolis monensis	Mona Anole
Anolis roosevelti	Culebra Giant Anole
Chrysemis decusata	Antillean Painted Turtle
Dermochelis coriacea	Leatherback sea turtle
Chelonia mydas	Green sea turtle
Caretta caretta	Loggerhead
Eretmochelys imbricata	Hawksbill sea turtle
Sphaerodactylus microphitecus	Monito Gecko
Sphaerodactylus monensis	Mona Island Gecko
Ameiba alboguttata	Teid Lizard
Cayman crocodylus	Spectacled Cayman
Alsophis portoricensis	Puerto Rican Ground Snake
Epicrates monensis monensis	Mona Island Boa
Epicrates monensis granti	Virgin Island's Tree Boa
Epicrates inornatus	Puerto Rican Boa

Mammals

Trichechus manatus	West Indian Manatee

COMMON AND SCIENTIFIC NAMES OF THREATENED AND ENDANGERED FAUNA MENTIONED IN THE TEXT

Birds

Pelecanus occidentalis	Brown Pelican (FE)
Sterna dougalli	Roseate Tern (FT)
Sterna antillarum	Least Tern (CT)
Charadrius alexandrinus	Snowy Plover (CT)
Charadrius melodus	Piping Plover (FT)
Porzana flaviventer	Yellow-breasted Crake (CT)
Fulica caribaea	Caribbean Coot (CT)
Tachibaptus dominicus	Least Grebe (CT)
Dendrocygna arborea	West Indian Whistling Duck (CT)
Oxyura jamaicensis	Ruddy Duck (CT)
Oxyura dominica	Masked Duck (CT)
Falco peregrinus	Peregrine Falcon (FE)
Columba inornata	Puerto Rican Plain Pigeon (EF)
Caprimulgus noctitherus	Puerto Rican Nightjar (FE)
Agelaius xanthomus	Yellow-shouldered Blackbird (FE)

Reptiles and Amphibians

Peltophryne lemur	Puerto Rican Crested Toad (FT)
Anolis cooki	Puerto Rican Dryland Anole (CT)
Anolis roosevelti	Culebra Giant Anole (FE)
Dermochelis coriacea	Leatherback sea turtle (FE)
Chelonia mydas	Green sea turtle (FE)
Caretta caretta	Loggerhead (FE)
Eretmochelys imbricata	Hawksbill sea turtle (FE)
Sphaerodactylus microphitecus	Monito Gecko (FE)
Epicrates monensis monensis	Mona Island Boa (FT)
Epicrates monensis granti	Virgin Island's Tree Boa (FE)
Epicrates inornatus	Puerto Rican Boa (FE)

Mammals

Trichechus manatus	West Indian Manatee (FE)

CT : Commonwealth-listed Threatened
FT : Federally-listed Threatened
FE : Federally-listed Endangered

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