

**ENVIRONMENTAL ASSESSMENT OF
TRAINING ACTIVITIES ON PINEROS AND
CABEZA DE PERRO ISLANDS,
U.S. NAVAL STATION ROOSEVELT ROADS**

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1. PURPOSE AND NEED

1.1 INTRODUCTION

During 1987, in the course of preparing a Fish and Wildlife Management Plan for Naval Station (NAVSTA) Roosevelt Roads, the United States Fish and Wildlife Service (USFWS) observed areas of adverse impact on Pineros and Cabeza de Perro islands apparently related to naval training activities. Of particular concern was damage to mangroves because these are designated as critical habitat for the endangered yellow-shouldered blackbird. In 1987, an agreement between the United States Navy (Navy) and USFWS was signed which set restrictions on the area in which military training could take place on Pineros Island. This agreement is to remain in effect until such time as consultation under Section 7 of the Endangered Species Act takes place.

The Navy's proposed action is to modify the training activities permitted under the agreement, in consultation with USFWS, to maximize training opportunities on non-environmentally sensitive portions of Pineros and Cabeza de Perro islands while minimizing impacts to wildlife use zones, sensitive aquatic resources, and mangrove forests sensitive to erosion.

This environmental assessment (EA), which was prepared in accordance with the Council on Environmental Quality (CEQ) Regulations pursuant to the National Environmental Policy Act (NEPA) and the Navy's Environmental and Natural Resources Protection Manual (OPNAVINST 5090.1), evaluates the potential environmental impacts of maximizing the operational training opportunities on Pineros and Cabeza de Perro islands, as well as the environmental impacts of alternatives to this proposed action. Quarterly field surveys were conducted during 1989 to obtain additional information with which to assess the potential impacts of training activities on endangered species.

1.2 HISTORICAL USE OF PINEROS AND CABEZA DE PERRO ISLANDS

Pineros and Cabeza de Perro islands are located in the Caribbean Sea at 18°15'N latitude and 65°35'W longitude, approximately one-half mile east of NAVSTA Roosevelt Roads on the northeast coast of Puerto Rico. The general location of NAVSTA Roosevelt Roads in Puerto Rico is shown in Figure 1-1, and the specific location of Pineros and Cabeza de Perro islands with respect to NAVSTA Roosevelt Roads is shown in Figure 1-2. Pineros is approximately 1 mile by 0.5 mile in size (310 acres). Cabeza de Perro, a small island approximately 0.25 mile in diameter (30 acres), is located 0.25 mile east of Pineros.

The Navy acquired Pineros and Cabeza de Perro islands in the early 1940s as part of its general acquisition of land in the Ensenada Honda area for NAVSTA Roosevelt Roads. Specifically, the two islands were acquired from the Fajardo Sugar Growers Association on January 31, 1942, under court settlement No. 2435 (Morrison 1942). Prior to this, a small area on the northwest coast of Pineros Island was cultivated, probably for sugarcane.

Shortly after the Navy acquired Pineros and Cabeza de Perro islands, the British built a network of roads, gun emplacements, and bunkers on Pineros Island for use during World War II. These facilities were abandoned after the war. Since the late 1950s, Pineros and Cabeza de Perro islands have been utilized by Special Warfare Group Two, Unit Four (SPECWAR), personnel for various training activities. Exercises have included beach landings combined with sea-to-land gunfire and underwater demolitions on offshore coral reefs, and small-arms training.

Prior to 1987, training activities took place on all parts of Pineros Island and in offshore waters around Pineros and Cabeza de Perro islands. Approximately 300 men, in groups of 50, were trained each year. Underwater demolitions teams utilized two beaches on the northern coast of Pineros to practice detonating up to 500 pounds of underwater and land explosives. Training in setting up explosives without detonation also occurred at the south shore beach, which had an emplacement of 12 to 15 obstacles in the water just off the beach. Trails used for small-arms training lead from the aforementioned beaches toward the center of the island. Units also utilized the large mangrove swamp on the southwest corner of the island to train for overland maneuvers and the location of objectives by compass at night.

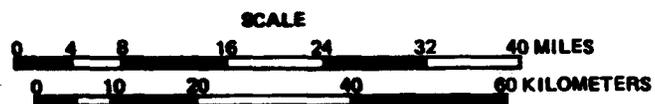
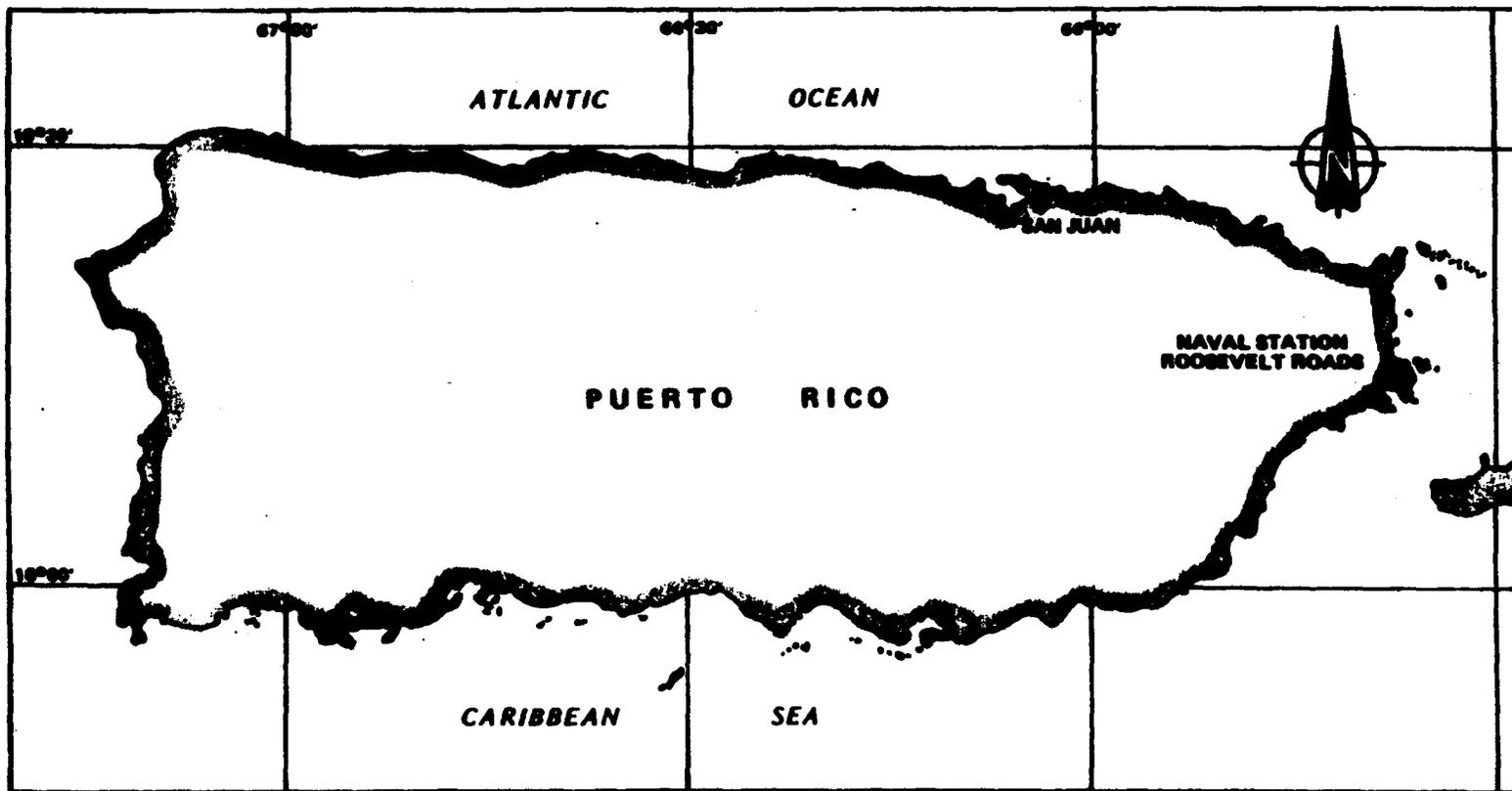


Figure 1-1 GENERAL LOCATION OF NAVAL STATION, ROOSEVELT ROADS, PUERTO RICO

1.3 EXISTING TRAINING

In 1987, the Navy and USFWS signed an agreement which set restrictions on military training operations on Pineros Island until Endangered Species Act Section 7 consultation is completed for the use of Pineros and Cabeza de Perro islands. Copies of correspondence between the Navy and USFWS detailing this agreement are included in Appendix A. Restrictions include off-limits areas in mangrove swamps, the concentration of small-arms firing along an upland area running generally northwest-to-southeast, and the limitation of underwater demolitions to one beach on each of the northern and southern shores (see Figure 1-3).

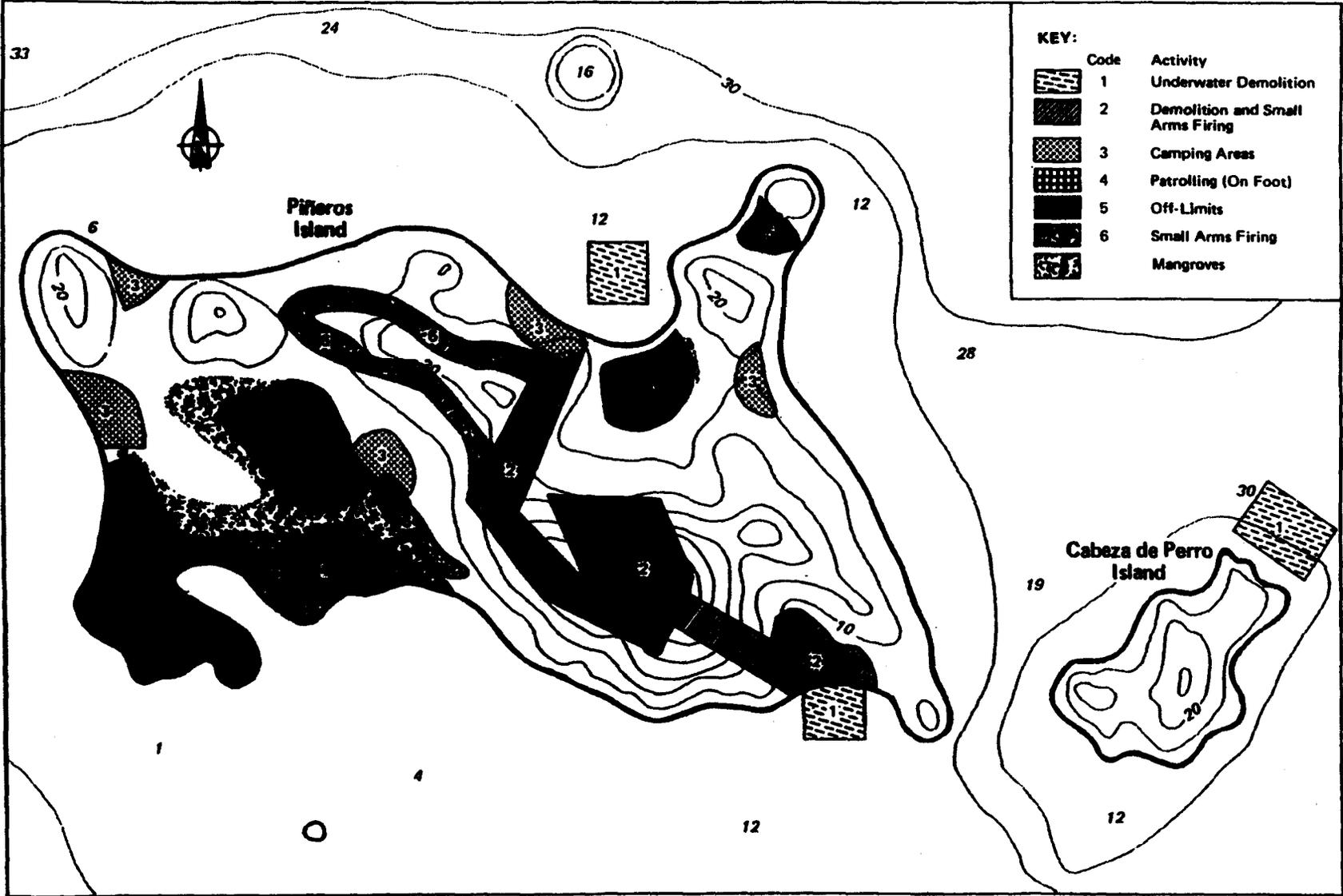
Training on Pineros and Cabeza de Perro islands currently consists of groups of 20 men for two-week sessions six times per year. The first week consists of instruction-based sessions at the main camp on the northern shore. The second week consists of practical missions where small arms, beach approaches, and overland maneuvers are practiced.

1.4 NEED FOR ACTION

Pineros and Cabeza de Perro islands are the primary training areas for SPECWAR. The commanding officer of NAVSTA Roosevelt Roads assigns SPECWAR operational control and exclusive use of Pineros and Cabeza de Perro islands. SPECWAR training activities on Pineros and Cabeza de Perro islands emphasize small-unit tactics in a tropical maritime environment. This training, which is unique to Pineros and Cabeza de Perro islands, is a combination of maritime drop-off and pick-up capabilities and small-unit live-fire and maneuver drills. Other training activities include survival techniques, land navigation, underwater and small-unit demolition, small boat operation, diving, small-arms training (5.56mm, 7.62mm, 9mm, .45 caliber [cal], .38 cal, and .50 cal), pyrotechnics (smoke grenades, pop flares, grenade simulators, etc.), and standard military demolitions (claymore mines, plastic explosives, etc.).

The combination of Navy ownership and exclusive control of the property by SPECWAR, direct access from the ocean, areas for underwater and beach assault training, bunkers from World War II, tropical climate, tropical vegetation, and primitive setting is not offered by any other

1-7



SOURCE: U.S.G.S. 7.5 Minute Series (Topographic) Quadrangle: Punta Puercas, P.R., 1967 Photorevised 1982.

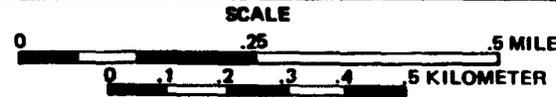


Figure 1-3 INTERIM TRAINING USE AREAS UNDER SPECWAR AND U.S. FISH AND WILDLIFE SERVICE AGREEMENT

location. This realistic training environment is an essential element of the entire SPECWAR training program.

There is no other known area which provides an appropriate maritime environment for this essential training. These training activities are crucial to maintaining the effectiveness and readiness of the Atlantic Fleet as well as the continued maritime superiority of the United States.

The Navy recognizes the importance of conducting military activities in a manner that minimizes adverse impacts on environmental resources, both to protect critical environmental resources and to maintain a realistic training environment. The Navy therefore proposes to maximize the operational training opportunities on Pineros and Cabeza de Perro islands in terms of usable land area and flexibility in scheduling while minimizing environmental impacts and maintaining, to the extent practicable, the natural environmental conditions that ensure a realistic tropical setting for training.

2. ALTERNATIVES

This section summarizes alternatives for action including the proposed action. The alternatives evaluated include:

- o No action;
- o Modified training activity one;
- o Modified training activity two;
- o Relocation of training activities to an alternate Caribbean site; and
- o Discontinuation of all training activities.

No action and modified training activities one and two represent alternate training schedules designed for Pineros and Cabeza de Perro islands. Therefore, the discussion and evaluation of these three alternatives assumes the selection of Pineros and Cabeza de Perro islands as the continued location for training activities.

The remainder of this section describes each of these alternatives and presents a comparative evaluation of them. Each alternative was evaluated using 14 operational criteria, in four basic categories, which support the Navy/SPECWAR mission. The four categories are: site characteristics, access and ownership, location, and facilities. Site characteristics criteria include tropical vegetation, tropical climate, diverse topography, direct ocean access, and beaches suitable for assault. Access and ownership criteria include Navy ownership, minimum civilian presence, designated restricted waters, and exclusive SPECWAR control and use. Location criteria include proximity to a Naval operations base, proximity to medical facilities, and potential for medical evacuation. Facilities criteria include the capability to sustain live fire and the existence of Naval training facilities.

Environmental criteria were developed to compare the impacts of the alternatives on various environmental features. These criteria include biological, physical, and cultural (i.e., archaeological and historic) considerations. Biological considerations consist of the presence of endangered terrestrial wildlife species and habitats, endangered plant species and critical habitats, and endangered aquatic species and unique aquatic features. Physical considerations include the potential for erosion due to steep slopes and erodible soils. Cultural considerations include the potential for significant effects to cultural (i.e., archaeological and historic) resources and conflicts with civilians regarding land use.

2.1 DESCRIPTION OF ALTERNATIVES

2.1.1 No Action

For the purposes of this EA, the no-action alternative would entail the continued use of Pineros and Cabeza de Ferro islands for SPECVAR training at current levels as described under the existing agreement with the USFWS (see Figure 1-3). This agreement restricts training activities in certain portions of the island, as further described below, and these restrictions limit the effectiveness of the training opportunities.

Area and use restrictions imposed under the agreement are shown in Figure 1-3. Zone 1 may be used for underwater demolition training, such as magnetic mines and plastic explosives, small boat training, and dive training. No coral blasting is permitted. Zones 2 and 6 may be used for small-arms training, including 5.56mm, 7.62mm, 9mm, .38 cal, and .45 cal ammunition. Training sessions within these zones are restricted to two per year, and these may be conducted only between the months of November and February. Zone 3 is used for camping areas during the training activities. Zone 4 may be used for on-foot patrolling, and Zone 5 is off limits. SPECVAR is restricted to 15 training sessions per year within Zones 1, 3, and 4.

2.1.2 Modified Training Activity One

Similar to current training, modified training activity one (see Figure 2-1) incorporates the following training activities:

- o Detonation of up to 500 lbs of underwater explosives in three areas off the northeast and southeast coasts of Pineros Island and off the northeast coast of Cabeza de Perro Island; and
- o Use of existing bivouac sites and small-arms firing ranges.

This alternative action differs from current training in that it incorporates the following training activities:

- o Small-arms firing over all of Pineros Island, except in mangroves;
- o Demolition of up to 40 lbs of explosives, over all of Pineros Island except mangroves;
- o Use of beach assault areas on north and south coasts of Pineros, up to 15 times a year; and
- o Addition of an underwater and beach training zone and underwater demolition zone off the northwest coast of Pineros Island for daytime explosions only. Demolitions would be preceded by beach and water reconnaissance by SPECWAR personnel to establish the absence of sea turtles.
- o Use of Pineros and Cabeza de Perro islands for overnight trips up to 14 days' duration, 15 times a year, up to 30 people; and
- o Use of the islands for day trips up to 6 hours in duration with unlimited visits per year.

2.1.3 Modified Training Activity Two

Modified training activity two limits the concentration of SPECWAR training on specified portions of Pineros and Cabeza de Perro islands (see Figure 2-2). This action maximizes training opportunities on non-environmentally-sensitive portions of the islands while minimizing impacts to wildlife use zones, sensitive aquatic resources, and mangrove forests sensitive to siltation.

The modification of training activities for this action considers important wildlife areas, critical habitats such as lagoons, and cultural factors. The modified training activity two incorporates the following:

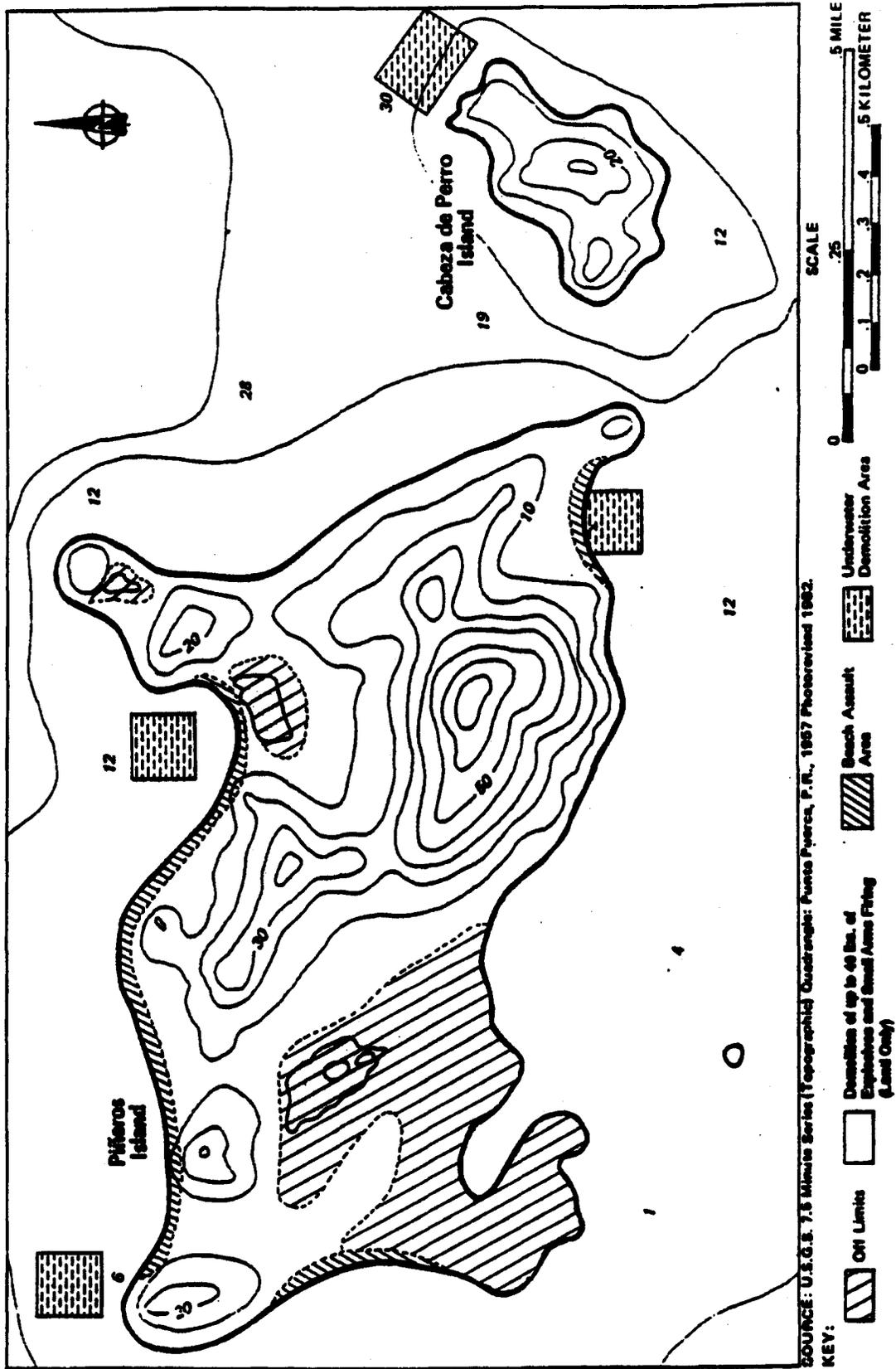
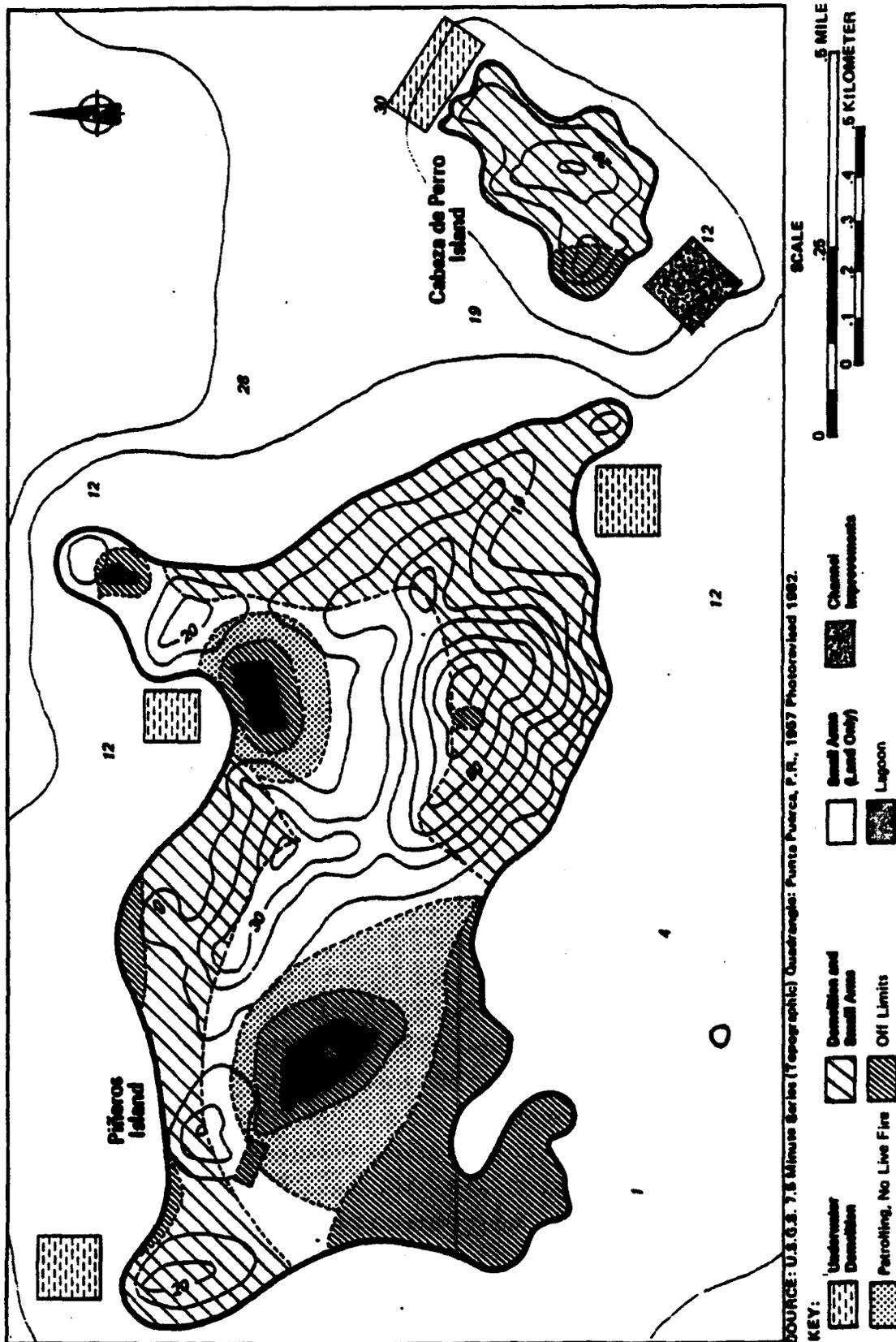


Figure 2-1 PROPOSED USE ZONES UNDER MODIFIED TRAINING ACTIVITY ONE



KEY:

- Underwater Destruction
- Destruction and Small Arms (Land Only)
- Off Limits
- Petroling, No Live Fire
- Small Arms (Land Only)
- Channel Improvements
- Lagoon

SCALE

0 0.1 0.2 0.3 0.4 0.5 MILE

0 1 2 3 4 5 KILOMETER

SOURCE: U.S.G.S. 7.5 Minute Series (Topographic) Quadrangle: Punta Puerca, P.R., 1967 Photorevised 1982.

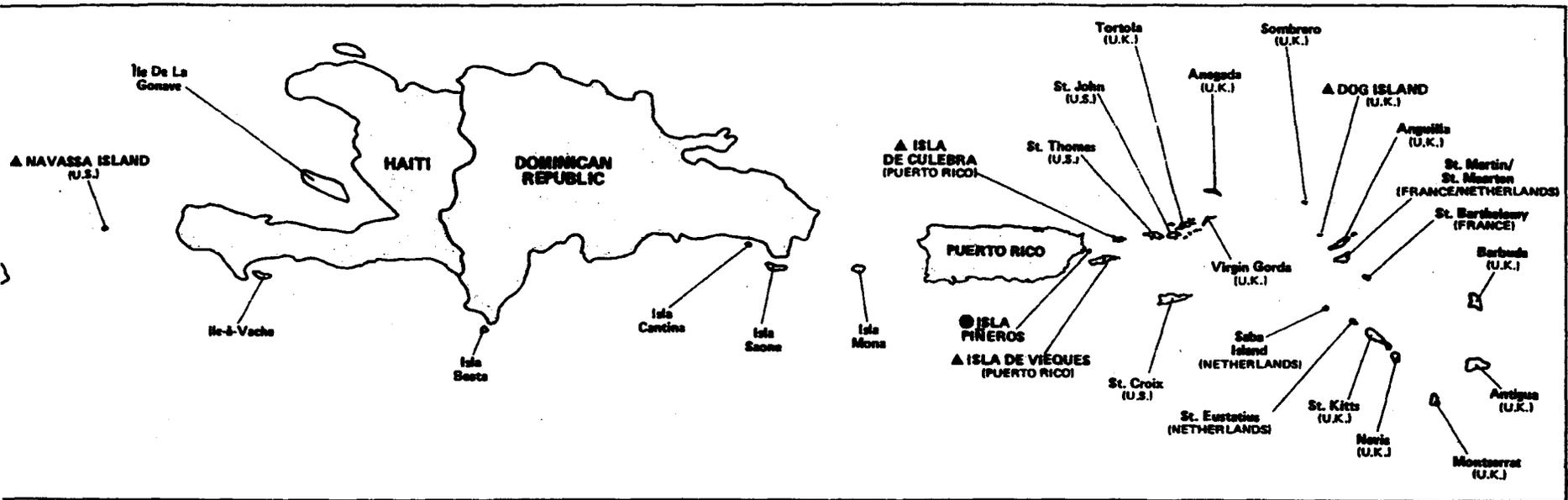
Figure 2-2 PROPOSED USE ZONES UNDER MODIFIED TRAINING ACTIVITY TWO

- o Demolition of up to 40 lbs of explosives be allowed in the majority of upland areas, except in lagoon watersheds and important wildlife zones. Figure 2-1 shows proposed areas for the modified demolition training. An unlimited number of day trips would be permitted;
- o Small-arms firing be permitted in all upland areas, with the exception of land immediately adjacent to critical lagoon habitat and sites determined to be of historic or archaeological significance;
- o The potential use of Cabeza de Perro Island be increased through the use of channel improvements;
- o An underwater and beach training zone and underwater demolition zone off the northwest coast of Pineros Island be added for daytime explosions only. Demolitions would be preceded by beach and water reconnaissance by SPECWAR personnel to establish the absence of sea turtles;
- o Use of the southeastern portion of Pineros Island be increased for beach assaults and sea-to-land firing;
- o The number of training visits and personnel permitted per visit are the same as under the existing agreement with the USFWS.

2.1.4 Relocation of Training Activities to an Alternate Caribbean Site

This section presents a description of potential alternate sites for all or portions of SPECWAR training activities. This alternative entails transferring the training activities currently conducted on Pineros and Cabeza de Perro to other islands, specifically, Vieques, Culebra, Navassa, or Dog islands. Figure 2-3 shows the location of these alternate sites.

The descriptions and analyses of the alternate sites utilize information about Pineros and Cabeza de Perro islands gathered for this EA, as well as environmental and cultural information presented in previous land management plans and EAs of the alternate locations. These sources include the Environmental Assessment of Continued Use of the Atlantic Fleet Weapons Training Facility Inner Range, Vieques, Puerto Rico (Ecology and Environment, Inc. [E & E] 1986), the Land Management Plan for Naval Facilities, Vieques, Puerto Rico (E & E 1986), Dog Island Environmental Reconnaissance Study (TAMS and E & E 1979a), the Draft and



KEY:
 ▲ Alternative Location for Training
 ● Current Location of Training

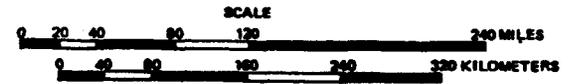


Figure 2-3 LOCATION OF PROPOSED ALTERNATE SITES FOR SPECWAR TRAINING ACTIVITIES

Final Environmental Impact Statement for Continued Use of the Atlantic Fleet Weapons Training Facility Inner Range, Vieques, Puerto Rico (TAMS and E & E 1979b), and the Phase 1 Report Environmental Survey of Navassa Island (E & E 1981).

The alternate sites to be evaluated in detail in this EA were initially chosen by establishing minimum preliminary screening criteria and identifying geographic locations that met these criteria. The preliminary screening criteria employed were based on past evaluations of alternate sites for Naval facilities (E & E 1986; TAMS and E & E 1979a, 1979b) and the specific requirements of SPECWAR training activities.

NAVSTA Roosevelt Roads was chosen as the center of the preliminary study area because it is the Atlantic Fleet's most extensive training facility and represents a major, long-term investment. Two hundred miles was established as the maximum radius of the preliminary study area. This decision was based on the approximate range (150 miles) of the aircraft to be used for medical evacuations (to medical facilities at NAVSTA Roosevelt Roads) plus an additional 50 miles to ensure a comprehensive preliminary study area. Locations where training would occur in close proximity to large civilian populations were eliminated from further consideration. A maximum frequency of 15,000 tourists per year was established to eliminate sites which have undergone extensive development for tourism. Locations where the topography, vegetation, and coastline prohibit a diverse, realistic training environment were also excluded.

The preliminary screening identified five potential sites for conducting SPECWAR training activities in addition to Pineros and Cabeza de Perro islands: Vieques, Culebra, Dog, Navassa, and Saona islands. Isla Saona was eliminated as an alternate site for this EA because it is part of the Dominican Republic's Parque Nacional del Este and holds special ecological and national value to the Dominican Republic. Although Navassa Island is located approximately 300 miles from NAVSTA Roosevelt Roads, it was included for consideration in this EA because it is 100 miles from Guantanamo Bay Naval Station. In addition, Navassa Island is uninhabited and supports tropical forest vegetation suitable for training activities. However, adoption of Navassa as the preferred

site would require the relocation of SPECWAR's training support capabilities to Guantanamo Bay Naval Station.

In September of 1989, Hurricane Hugo swept through the Caribbean, destroying or damaging both natural environmental features and man-made structures on many of the islands in the region, including those considered as alternate sites in this EA. The result was an alteration of the existing environment on the islands in the path of the hurricane. These alterations represent only temporary changes, however, as human cleanup and repair operations and the inherent recovery abilities of tropical ecosystems which have endured similar storm events throughout their evolution will return the environments of these islands to conditions approximating those found prior to Hurricane Hugo within 10 to 15 years (Villella 1989). As a result, the following sections describe conditions as they existed prior to Hurricane Hugo (and are expected to return to within several years) at each of the alternate sites identified for consideration in this EA by the preliminary screening process.

2.1.4.1 Vieques Island

The island of Vieques is located in the Caribbean Sea at 18°08'N latitude and 65°26'W longitude, approximately 9 miles southeast of the main island of Puerto Rico and 22 miles southwest of St. Thomas, U.S. Virgin Islands. The Navy currently owns approximately 22,000 acres of the total 32,000 acres on Vieques (see Table 2-1) and uses these lands primarily for conducting training exercises and storing ammunition. Naval training activities on Vieques are conducted within an area known as the Inner Range, which includes approximately 14,500 acres on the eastern half of Vieques and encompasses the area extending to a limit of 3 miles from the shoreline. Within the Inner Range, the Atlantic Fleet's surface ships, aircraft, and marine forces carry out training in all aspects of Naval gunfire support (NGFS); air-to-ground (ATG) ordnance delivery; air-to-surface mine delivery; amphibious landings; small-arms, artillery, and tank fire; and combat engineering.

Two facilities comprise the Inner Range: the Atlantic Fleet Weapons Training Facility (AFWTF) and the Eastern Maneuver Area (EMA). The AFWTF occupies roughly 3,500 acres on the eastern tip of the island.

Table 2-1
 ALTERNATE SITES FOR TRAINING BY SPECWAR

Name	Location		Distance From Roosevelt Roads (miles)	Area (acres)	Population ^a		
	Latitude (N)	Longitude (W)			On Island	Within 5 mi.	Within 10 mi.
Plaeros	18° 15'	65° 35'	3	310	0	15,000	74,000
Vieques	18° 08'	65° 26'	9	32,000	7,662	7,662	7,662
Dog Island	18° 17'	63° 15'	158	670	0	0	0
Culebra/ Culebrita	18° 19'	65° 17'	23	7,700	1,265	1,265	1,265
Nevassa	18° 25'	75° 00'	300	1,100	0	0	0

^aWilkinson, 1969, U.S. Bureau of the Census, Public Information Office.

The AFWTF is tasked with providing facilities and scheduling and conducting NGFS and ATG ordnance delivery training for Atlantic Fleet ships, North Atlantic Treaty Organization (NATO) ships, air wings, and smaller air units from other allied nations and the Puerto Rico National Guard. The AFWTF also tests and evaluates weapons systems to enhance fleet readiness.

The EMA occupies approximately 11,000 acres west of the AFWTF on Vieques Island. Fleet Marine Force, Atlantic (FMFLANT), conducts training for marine amphibious units, battalion landing teams, and combat engineering units on the EMA. On occasion, other allies having a presence in the Caribbean and the Puerto Rico National Guard also utilize the EMA.

Ammunition storage occurs in the Naval Ammunition Facility (NAF), which occupies approximately 8,000 acres on the western end of the island. Operated by the Weapons Department of NAVSTA Roosevelt Roads, its mission is to receive, store, and issue all ordnance authorized by NAVSTA Roosevelt Roads for support of Atlantic Fleet units. Since 1978, only limited military field training exercises have been conducted at the NAF, including marine landing operations along the south and west beach areas.

Considered together, these three facilities (the AFWTF's area on Vieques, the EMA, and the NAF) constitute 22,000 of the 32,000 acres of the island. The remainder of the island is owned by the Commonwealth of Puerto Rico or is under private ownership. The activities at the AFWTF, EMA, and NAF function under the consolidated command of Commander Fleet Air Caribbean and Naval Forces Caribbean, whose headquarters are at NAVSTA Roosevelt Roads. The commanding office of AFWTF has jurisdiction over the scheduling of all Naval exercises in the Inner Range.

The physical, natural, and socioeconomic environments of Vieques Island were described in detail in the Environmental Assessment of Continued Use of the Atlantic Fleet Weapons Training Facility Inner Range, Vieques, Puerto Rico (E & E 1986). A summary description of Vieques and the other alternate locations is presented in Table 2-1.

2.1.4.2 Culebra and Cays

The island of Culebra is located approximately 17 miles east of Puerto Rico at 18°19'N latitude and 65°17'W longitude. Vieques and

St. Thomas are two important neighboring islands about 12 miles to the south and east, respectively. Culebra Island has a land area of slightly less than 7,000 acres. Its shape is irregular due to many bays and sounds; the largest of these is Ensenada Honda, a natural harbor located on the south coast. Culebra is surrounded by lesser islands and cays located at distances ranging from one to four miles from the main island; the larger of these are Cayo de Luis Pena and Cayo Lobo off the east coast and Cayo Norte and Isla Culebrita off the west coast.

Culebra Island is of volcanic origin. It has an irregular topography with many round crests; the highest hill is Monte Resaca, which has an elevation of 650 feet above mean sea level (MSL). The shores are generally rocky and coastal plain is restricted to a number of beaches. The largest beaches are found along the north coast and are of high aesthetic quality.

The majority of the soils on Culebra are classed as rockland and Descalabrado clay loam on steep and eroded slopes. It is a shallow soil of semi-arid upland with severe limitations for farming, suitable only as pasture or wildlife habitat.

Low precipitation and high evaporation combined with rapid runoff cause arid conditions. Culebra is deficient in surface and groundwater resources. The island lacks permanent water courses, and drainages flow only in response to rainfall. There are five salt water lagoons, of which four are associated with and located behind the north coast beaches: Playa Flamenco, Resaca, Brava, and Larga.

The original forest cover of Culebra Island has been largely eliminated due to agriculture. Pockets of upland forest are widely scattered and found along drainages on the slopes of the various prominent elevations. In several of these locations, the presence of a palm (Coccothrinax spp.) has been reported as unique (Junta de Calidad Ambiental 1971). Special value has also been associated with open, park-like forest on the slopes of Monte Resaca. Cayo de Luis Pena, Cayo Norte, and Isla Culebrita are also wooded and include remnant natural forest. In addition, mangroves and patches of lowland forest are found along the shoreline, for example, on Puerto de Manglar, on the east shore of Ensenada Honda (Ensenada del Coronel, Ensenada del Clemente), around the lagoons, and in a few small alluvial valleys near the coast.

Cayo Norte and especially Isla Culebrita include mangroves and lowland forest habitat. Most of Culebra, however, is covered by grassland and microphyllous thorn scrub, including mesquite and Acacia spp.

The vegetation of Peninsula Flamenco, which had been used for naval gunfire training, consists almost exclusively of crabgrass and giant milkweed, with sparse scattered mesquite. In stark contrast, the vegetation of the bird sanctuary for terns at Punta de Molinos consists of tall guinea grass, coastal scrub, and tall pipe organ cactus.

Unique aspects of the fauna of Culebra Island include sea turtles, seabird colonies, the rare Bahama pintail and white-crowned pigeon, and an endangered giant anole, which was last seen in 1932 (Philobosian and Yntema). The various cays and the extreme tip of Peninsula Flamenco, known as Punta de Molinas, are of great significance for seabirds such as sooty terns and gulls. The number of terns breeding on Punta de Molinas and adjacent islets has been reported to exceed 100,000 (Natural History Society 1970). Laguna del Flamenco provides a preferred habitat for the Bahama pintail, and other lagoons can also be expected to be important for waterfowl and shorebirds.

The marine resources of Culebra and the neighboring cays include beautiful beaches, extensive reef systems, and grassbeds and mangrove systems that support a diverse, productive marine fauna. The beaches of Culebrita and Flamenco Bay, and Playa Resaca, Playa Brava, and Playa Larga along the north coast of Culebra are renowned for their overall quality as well as for nesting areas for endangered hawksbill and leatherback sea turtles.

Approximately 80% of Culebra's coasts are covered with coral reefs. Due to the prevailing currents and wave action, coral reef development is most extensive on the southern and eastern sides of the island and of neighboring cays. The reef system associated with Culebrita is very diverse and extensive.

Submerged turtlegrass beds are found in the shallows on the lee side of the islands in the protected bays. These beds are well developed in Ensenada Honda and Laguna Manglar, and these bays with their mangrove lagoons are valuable nursery areas for both lobster and fish. The reefs and seagrass beds support an abundant fish fauna and

constitute some of the best lobster grounds in Puerto Rico. The commercial fishery in 1976 was valued at over \$120,000, with spiny lobster being the most important catch. The commercial fishery included about 38 individuals and 26 craft (U.S. Department of Agriculture 1976). Culebra Island also supports a viable sports fishery for large gamefish in its northern waters and spearfishing on its many inshore reefs.

Culebra is a municipio of the Commonwealth of Puerto Rico, with a population of approximately 2,000. About 85% of Culebra's residents live in the towns of Dewey and Clark, so that the effective population density is 4.5 persons per acre (Culebra CZM Plan 1978). According to the U.S. Census Bureau, the 1985 population of Culebra was 1,265 (Wilkinson 1989).

A little more than one-third of Culebra Island and its cays is federally owned. In 1901, President Theodore Roosevelt transferred jurisdiction of federal land on Culebra to the Department of the Navy, and in 1936, the Navy began Naval ship and aircraft target practice on the island. After years of public opposition beginning in the 1960s, the Navy gave up its targets off the east coast of Culebra in 1971 and, by executive order, ceased training activities on Culebra and its cays in 1975. Manufacturing, agriculture, and commercial fishing are the major sources of employment. Agriculture on the island is primarily restricted to cattle-grazing.

2.1.4.3 Dog Island and Prickly Pear Cays

Dog Island is located from 8 to 12 miles northwest of Anguilla at 18°17'N latitude and 63°15'W longitude. Dog Island is an irregularly shaped island of about 500 acres with a conspicuous promontory to the east and three small cays, West Cay, Mid Cay, and East Cay, off its west and north coasts. The maximum elevation is less than 100 feet above MSL. The three Prickly Pear cays (West, East, and North) are located almost 5 miles to the east of Dog Island. East Prickly Pear Cay is about 73 acres in size; West Prickly Pear Cay is about 81 acres; and North Prickly Pear Cay is less than 1 acre in size.

These islands are limestone caps on volcanic tuff and basalt. The coastline is highly variable, but consists mostly of sharply eroded limestone pavement and cliffs. Sandy beaches are restricted in number

and extend to sheltered coves; well-developed dunes are conspicuous in a number of areas.

The islands lack drainage channels and freshwater surface resources, but there are two salt ponds on Dog Island and one large salt pond on East Prickly Pear Cay.

The vegetation of Dog Island consists mostly of two types of thorn scrub, cotorro and cactus. The island lacks silty shores, and mangrove swamp forest is limited to a restricted stand of buttonwood on the south side of the lagoon near Stoney Bay. The vegetation of Dog Island lacks diversity. As a result of the abandonment of active cultivation and the selective effects of grazing, certain undesirable species have become widely established. Examples are the above-mentioned cotorro and cactus, as well as balsam and manchineel. West Cay, Mid Cay, and East Cay are very rocky and sparsely covered with very few species of low-growing vegetation.

The vegetation of the Prickly Pear cays is diverse in comparison to the Dog Island vegetation. A part of the interior of West Prickly Pear Cay is covered by a forest-scrub association of tall dildo cactus, lignum vitae, cat claw, and others, densely matted with vines. Most of the interior of East Prickly Pear Cay is covered with mixed scrub of balsam, prickly pear cactus, nickerbean, and maidenberry. The shore communities on both East and West Prickly Pear cays are relatively undisturbed and diverse. Coastal communities include beaches with morning glory, dunes with stands of sea grape, buttonwood, limber capes, and juggerman. An extensive community of turk's cap cactus is found on the eastern part of West Prickly Pear Cay.

Dog Island is important for its seabird populations. There is a sooty tern rookery on the eastern promontory of Dog Island, and brown booby nest on the easternmost point. Brown booby and brown pelicans also nest on Mid Cay and East Cay. A small number of white or blue-faced booby also nest on Mid Cay. The brown pelican is on the United States list of endangered species.

With the exception of a few pairs of brown booby on West Prickly Pear Cay, there are no seabird rookeries on the Prickly Pear cays.

The marine resources inhabiting the inshore waters of Dog Island reflect the lack of habitat diversity and the high-energy regime

associated with its unprotected shorelines. These waters are characterized by barren bedrock formations and rock rubble covered by a thin veneer of sand and patchy algal flats. Coral development is limited to scattered colonies of low, flat elkhorn coral and small colonies of encrusting corals, sea fans, and other soft corals growing on the bedrock. No submerged grassbeds are found in the inshore waters. The relatively recent age of the present island system and high-energy regime of the waters account for the lack of coral reef and grassbed development. The fish community is composed of both reef and pelagic species. However, the fish community exhibits a relatively low diversity and abundance, reflecting the limited quality and lack of habitat diversity.

The marine resources associated with the Prickly Pear cays are highly variable and range from the diverse communities associated with the coral reefs found along the north shore of East Prickly Pear Cay to the depauperate communities associated with the wave-washed bedrock formations on West Prickly Pear Cay. The Seal Island complex forms a lagoon-like environment with shallow sandy areas and extensive patch reefs off the north coast of East Prickly Pear Cay. Marine life in this area is diverse and abundant, typical of Caribbean reef systems. Wave-washed bedrock formations and limited stony coral growth characterize the areas along the north coast of West Prickly Pear Cay and the south coast of both cays. The marine communities in these areas are similar to those described for Dog Island.

The inshore waters of these islands do not support an active sport or commercial fishery. However, the deeper offshore waters around these islands are used by Anguillian fishermen. Spiny lobster is the most important catch; however, the catch has declined over the last several years, and unregulated over-fishing is believed to be the primary factor causing this reduction.

Dog Island and the cays are uninhabited, privately owned islands which are territorially part of the British Dependency of Anguilla. There are no structures on any of the islands, with the exception of a small shack and several low stone walls on Dog Island. There are no roads or utilities on the islands, but there is a small grass airstrip on Dog Island.

2.1.4.4 Navassa Island

Navassa is a 1,100-acre island located at 18°25'N latitude and 75°00'W longitude, approximately 300 miles west of NAVSTA Roosevelt Roads and 30 miles west of Haiti. Navassa is under the jurisdiction of the U.S. Coast Guard, which maintains an unmanned lighthouse on the island.

Navassa's topography is characterized by rocky seawalls of 30 to 50 feet that surround the island, except on the northwest coastline, which is a steep slope from a plateau.

Vegetation types found on Navassa are: evergreen woodland forest, sun palm (Thrinax spp.) forest, and grassland or savanna. Twelve species of birds are known to use Navassa island--five species of seabirds and seven species of land birds (E & E 1981). The most common bird species is the red-footed booby. Bats are the only endemic mammals on the island, and there are seven species of reptiles--two species of snakes and five of lizards (E & E 1981).

Navassa Island is uninhabited and is a territory of the U.S. The lighthouse facilities were built in 1916. There is one other structure on the island, a deteriorated structure that was associated with the Navassa Phosphate Mining Company Facilities in the late 1800s. There are also 12 prehistoric archaeological sites on Navassa (E & E 1981).

2.1.5 Discontinuation of All Training Activities

This alternative would involve discontinuing SPECVAR training activities in the Caribbean.

2.2 EVALUATION OF ALTERNATIVES

This section evaluates and rates the alternatives using the operational suitability and environmental impact criteria previously described in Section 2.

2.2.1 Operational Suitability

As discussed previously, there are 14 operational criteria for evaluating SPECVAR training alternatives. Each alternative was rated fully acceptable, partially acceptable, or unacceptable depending on how

well it satisfied the operational criteria. Fully acceptable means that an alternative meets the training requirements of SPECWAR to the fullest extent. Partially acceptable means that an alternative only partially meets SPECWAR's training requirements. Unacceptable means that an alternative would provide little or no opportunity to meet SPECWAR training requirements. Table 2-2 presents a summary matrix of the operational suitability evaluation of the proposed alternatives.

The operational suitability of an alternative is dependent on the qualities of the site being considered. Because no action and modified training activities one and two each assume the selection of Pineros and Cabeza de Perro islands as the continued location for SPECWAR training activities, the evaluation of Pineros and Cabeza de Perro islands for operational suitability will determine the operational suitability of these three alternatives.

Site Characteristics

The first operational requirement is tropical vegetation. Forested, jungle vegetation is required for realistic training. Pineros, Vieques, and Navassa islands all fully meet this requirement. Vegetation on Culebra Island is primarily grassland and scrub; the criteria for jungle training could not be met in the small tracts of remnant forest that exist. Culebra, therefore, is unacceptable. Dog Island also is unacceptable because its vegetation is primarily scrub. The discontinuation of training activities alternative would not meet this criterion (unacceptable) because it would eliminate SPECWAR's access to a realistic jungle training environment.

All alternate locations are located in the Caribbean Sea, and all possess a tropical climate. Therefore, all locations are fully acceptable with regard to the tropical climate criterion. The discontinuation of training activities alternative would not meet this criterion (unacceptable) because it would force SPECWAR out of the Caribbean and eliminate its ability to train in a tropical climate.

Pineros, Vieques, and Culebra all possess adequately diverse topography required for realistic training and, therefore, are fully acceptable. Dog and Navassa islands are only partially acceptable because they are essentially low-elevation plateaus surrounded by sea

cliffs. The discontinuation of training activities alternative does not meet this criterion because it would eliminate SPECWAR's ability to train in variable and realistic terrain and is therefore unacceptable.

All five locations are islands with undeveloped land that abuts the ocean for direct access; therefore, they are all fully acceptable for the direct ocean access criterion. The discontinuation of training activities is unacceptable because it eliminates SPECWAR's ability to train personnel in boat landings.

Not all possess beaches suitable for assault. Pineros, Vieques, and Culebra islands do possess numerous beaches and thus are fully acceptable. Dog Island is surrounded mostly by cliffs and has few beaches; therefore, it is only partially acceptable. Navassa is surrounded only by steep sea cliffs and, therefore, is unacceptable for beach assaults. The discontinuation of training alternative is unacceptable because it eliminates SPECWAR's ability to train units in direct beach assaults.

Access and Ownership

The next set of operational criteria concern Navy access to and ownership of the alternate locations. The discontinuation of training alternative would eliminate the need for Navy access to and ownership of lands in the Caribbean. Thus, these criteria are not applicable to this alternative.

Pineros is owned entirely by the Navy, and the Navy owns more than 60% of Vieques; therefore, both are fully acceptable for this criterion. No portion of Culebra, Dog, or Navassa islands is owned by the Navy; therefore, they do not meet this criterion and are unacceptable.

Regarding the criteria for a minimum civilian presence, Dog and Navassa are both isolated islands with no population within 10 miles; therefore, they are fully acceptable with regard to this criterion. Vieques and Culebra both have civilian populations that utilize beaches and fishing resources; therefore, they are only partially acceptable. Pineros is within 5 miles of approximately 15,000 people and is visited periodically by civilians. In addition, training on the north shore of Pineros occurs within view of the Puerto Rico coastline in the vicinity of Fajardo. Therefore, it also is rated as partially acceptable.

Table 2-2
OPERATIONAL SUITABILITY EVALUATION MATRIX FOR PROPOSED ALTERNATIVES

Functional Area	Relocation of Training Activities to an Alternate Caribbean Site				Pineros Island*
	Vieques Island	Culebra Island	Dog Island	Navassa Island	
ALTERNATIVES					
Discontinuation of Training Activities					
Jungle	Eliminates SPECNAR's ability to train in realistic tropical jungle environment.	Primarily grassland and scrub; insufficient amounts of tropical jungle for training activities; unacceptable.	Primarily scrub; insufficient amounts of tropical jungle for training activities; unacceptable.	Sufficient tropical jungle vegetation for training activities; fully acceptable.	Sufficient tropical jungle vegetation for training activities; fully acceptable.
Climate	Eliminates SPECNAR's ability to train in maritime climate.	Possesses tropical climate; fully acceptable.	Possesses tropical climate; fully acceptable.	Possesses tropical climate; fully acceptable.	Possesses tropical climate; fully acceptable.
Topography	Eliminates SPECNAR's ability to train in realistic terrain.	Topography adequately diverse for realistic training; fully acceptable.	Low elevation plateaus; topography inadequate for realistic training; partially acceptable.	Low elevation plateaus; topography inadequate for realistic training; partially acceptable.	Topography adequately diverse for realistic training; fully acceptable.
Land Access	Eliminates SPECNAR's ability to train personnel in boat landings.	Sufficient undeveloped land abuts ocean for direct access; fully acceptable.	Sufficient undeveloped land abuts ocean for direct access; fully acceptable.	Sufficient undeveloped land abuts ocean for direct access; fully acceptable.	Sufficient undeveloped land abuts ocean for direct access; fully acceptable.
Assault	Eliminates SPECNAR's ability to train personnel in beach assaults.	Numerous beaches suitable for assaults; fully acceptable.	Few beaches; surrounded mostly by cliffs; partially acceptable.	No beaches; surrounded entirely by steep cliffs; unacceptable.	Numerous beaches for assault; fully acceptable.
OWNERSHIP					
Ship	Not applicable if training discontinued.	Over 60% (22,000 acres) owned by Navy; fully acceptable.	No land owned by Navy; unacceptable.	No land owned by Navy; unacceptable.	Owned entirely by Navy; fully acceptable.
Population	Not applicable if training discontinued.	Civilian population (7,662) on island that utilizes beaches and nearshore fishing resources; partially acceptable.	Civilian population (1,265) on island that utilizes beaches and nearshore fishing resources; partially acceptable.	No population within 10 miles; fully acceptable.	Within 5 miles of approximately 15,000 people; periodically visited by civilians; north shore within view of Puerto Rico coastline near Fajardo; partially acceptable.

(Cont.)

Alternatives

Relocation of Training Activities to an Alternate Caribbean Site

Location	Discontinuation of Training Activities	Vieques Island	Culebra Island	Dog Island	Nevesa Island	Piñeros Island*
Waters	Not applicable if training discontinued.	Sufficient surface waters designated as restricted waters to conduct training activities; fully acceptable.	Does not lie within restricted waters; unacceptable.	Does not lie within restricted waters; unacceptable.	Does not lie within restricted waters; unacceptable.	Sufficient surface waters designated as restricted waters to conduct training activities; fully acceptable.
SPECMAR 3 Use	SPECMAR loses control and use of all Caribbean training facilities.	Currently utilized by PFLANT; scheduling conflicts and timing restrictions would prevent sufficient training opportunities for SPECMAR; unacceptable.	Exclusive use and control by SPECMAR not available presently; would require acquisition by Navy and designation for SPECMAR use; fully acceptable.	Exclusive use and control by SPECMAR not available presently; would require acquisition by Navy and designation for SPECMAR use; fully acceptable.	Exclusive use and control by SPECMAR not available presently; would require acquisition by Navy and designation for SPECMAR use; fully acceptable.	Exclusive use and control by SPECMAR other than occasional unauthorized visits by civilians; fully acceptable.
Naval Base	Training relocated away from all Caribbean Naval operations.	9 miles from Roosevelt Roads; distance short enough to allow frequent visits; fully acceptable.	23 miles from Roosevelt Roads; distance short enough to allow frequent visits; fully acceptable.	158 miles from Roosevelt Roads; long distance precludes frequent visits; unacceptable.	300 miles from Roosevelt Roads; long distance precludes frequent visits; 100 miles from Guantanamo Bay Naval Station; would require relocation of SPECMAR training support capabilities to Guantanamo Bay; unacceptable.	3 miles from Roosevelt Roads; distance short enough to allow frequent visits; fully acceptable.
Medical	Not applicable if training discontinued.	Partial medical facilities available on island and within 9 miles of full medical facilities at Roosevelt Roads; fully acceptable.	Limited on-site medical facilities; within 23 miles of full medical facilities at Roosevelt Roads; partially acceptable.	Isolated from medical facilities; unacceptable.	Isolated from medical facilities; unacceptable.	Within 3 miles of full medical facilities at Roosevelt Roads; fully acceptable.
Medical	Not applicable if training discontinued.	Evacuation possible by sea, air, and fully acceptable.	Evacuation possible by air only; partially acceptable.	Isolated from medical evacuation capabilities; unacceptable.	Isolated from medical evacuation capabilities; partially acceptable.	Proximity to Roosevelt Roads allows evacuation by air or sea; fully acceptable.

OWNERSHIP

Alternatives

Relocation of Training Activities to an Alternate Caribbean Site

	Discontinuation of Training Activities	Vieques Island	Culebra Island	Dog Island	Navassa Island	Pinnacos Island ^a
Operational Relocation Criteria						
Ability for Weapons Use	Eliminates SPEDWAR's ability to train in live weapons use; unacceptable.	Sufficient land area away from populated areas suitable for live weapons use; fully acceptable.	Sufficient land area away from populated areas suitable for live weapons use; fully acceptable.	Isolation allows total lack of restriction on size and amount of ammunition and ordnance; fully acceptable.	Isolation allows total lack of restriction on size and amount of ammunition and ordnance; fully acceptable.	Sufficient land area away from populated areas suitable for live weapons use; fully acceptable.
Naval Facilities	Not applicable if training discontinued.	Navy maintains facilities on site but new facilities would have to be constructed to accommodate SPEDWAR training requirements; partially acceptable.	No existing facilities on site; unacceptable.	No existing facilities on site; unacceptable.	No existing facilities on site; unacceptable.	Navy maintains adequate facilities on site to accommodate SPEDWAR training requirements; fully acceptable.

So the operational suitability of an alternative is dependent on the qualities of the site being considered, and no action and modification of training activities one and two would each be warranted on Pinnacos and Cabeza de Perro Islands, all equally meet the operational evaluation criteria and were included under the heading "Pinnacos Island."

Both Pineros and Vieques have all or a portion of their surface waters presently designated as restricted waters on navigational charts and published in Notice to Mariners; therefore, they are fully acceptable. Culebra, Dog, and Navassa islands do not lie within presently restricted waters and are unacceptable.

Vieques and Pineros islands are the only two of the five alternate locations that are currently utilized by other armed forces divisions. On Vieques, SPECWAR training would have to be scheduled during periods of non-use by FMFLANT. Peak requirements for use of Caribbean facilities for both FMFLANT and SPECWAR occur during winter months. Consequently, because of timing restrictions and scheduling conflicts, Vieques is unacceptable because of its insufficient training opportunities for SPECWAR. SPECWAR would have exclusive use (fully acceptable) of the other four locations, assuming Culebra, Dog, and Navassa islands could be obtained.

Location

The third set of operational criteria pertain to location relative to Naval and medical facilities. Pineros, Vieques, and Culebra islands are all within 25 miles of the Naval operations base at NAVSTA Roosevelt Roads, so they are fully acceptable. Dog and Navassa islands are both over 100 miles from the nearest Naval operations, thus precluding frequent visits from a Naval base and making these alternate sites unacceptable.

Distance from a medical facility and the estimated time required for either a boat or plane to evacuate injured personnel were evaluated for this operation criterion. Overall, it was determined that a distance between 0 and 10 miles from a medical facility is fully acceptable because transportation of injured personnel could be accomplished by both air and water; a distance between 11 and 100 miles is partially acceptable because personnel would need to be evacuated by air; and anything over 100 miles away from a medical facility is considered unacceptable due to the amount of time required for transportation of injured personnel.

Pineros ranked the highest in proximity to medical facilities, which are located at NAVSTA Roosevelt Roads, and is considered fully acceptable. Vieques is within 9 miles of NAVSTA Roosevelt Roads, has

partial medical facilities, and is partially acceptable. Culebra has limited medical facilities on site, making it partially acceptable. Dog and Navassa islands are both unacceptable since they are isolated from medical facilities.

Similarly, potential for medical evacuation was considered. Medical evacuation ratings were assigned on the assumption that a distance of 0 to 10 miles could be reached in a reasonable amount of time by boat; anything greater than 10 miles would require air evacuation, and thus be only partially acceptable; and any distance greater than 100 miles from medical evacuation capabilities is unacceptable due to the time required. Evacuation by air takes more time for actual mobilization and evacuation. Pineros Island is fully acceptable because its proximity to NAVSTA Roosevelt Roads allows for evacuation options by sea and air. Vieques Island is located within 9 miles of NAVSTA Roosevelt Roads, which allows for evacuation by sea or air, and thus is fully acceptable. Culebra Island is rated "partially acceptable" because evacuation is possible only by air. Comparatively isolated Dog Island is located over 150 miles from NAVSTA Roosevelt Roads and its medical evacuation would be by air; thus it is unacceptable. The closest medical facility to Navassa Island which might offer evacuation capability is Guantanamo Bay Naval Station, located approximately 100 miles north; therefore, Navassa is partially acceptable.

Facilities

The last operational criteria considered were capability for live weapons use and existing on-site Naval training facilities.

Discontinuation of training would eliminate SPECWAR's ability to train units in live weapons use in a realistic setting, and would preclude the need for on-site training facilities and thus is unacceptable. The isolation of Navassa and Dog islands would allow for a total lack of restriction on the size and amount of ammunition and ordnance to be used. Pineros, Vieques, and Culebra islands all possess sufficient land area away from populated areas suitable for live weapons use. All five alternate sites are fully acceptable for live weapons use capability.

Of the alternate sites considered, only Pineros and Vieques have existing training facilities on site. The other three alternative

sites are unacceptable by this criterion. The training facilities on Vieques are currently being used by units other than SPECWAR and would require modification and expansion to accommodate SPECWAR training activities. Vieques would thus be partially acceptable. The existing facilities on Pineros would require no additional construction, only regular maintenance, to accommodate SPECWAR. Because Pineros minimizes the need for new facilities and the adverse impacts associated with construction activities, it is fully acceptable.

2.2.2 Environmental Impacts

Six criteria were used for evaluating the environmental impacts of SPECWAR training on each of the alternatives. The impacts were defined as significant (i.e., considerable impacts), moderate (i.e., limited impacts), or negligible (i.e., minor or no impacts). The results of these evaluations are summarized in Table 2-3. The discontinuation of training activities alternative would have no environmental impact due to training activities. However, environmental impacts could occur on Pineros as a result of increased use and development of the island by civilians.

The remaining alternatives were evaluated for environmental impacts in the following manner: after each of the proposed alternate sites was evaluated in terms of potential environmental impacts, the preferred location for SPECWAR training activities was chosen based on both operational and environmental considerations. Because Pineros and Cabeza de Perro islands were determined to be the preferred location for training activities, the environmental impacts to these locations resulting from the three on-site alternatives--no action and modified training activities one and two (see Section 2.2.3)--were then evaluated. Based on this final evaluation, modified training activity two was selected as the preferred alternative.

2.2.2.1 Biological

Terrestrial Wildlife and Habitats

The environmental consideration of wildlife includes endangered species. On Pineros Island, wildlife species of primary importance are

the white-crowned pigeon, white-cheeked pintail, and the brown pelican. No yellow-shouldered blackbirds were observed during the quarterly field surveys; however, suitable habitat for this species is abundant. Disturbances to waterfowl on Pineros likely occur due to the detonation of ordnance in proximity to lagoons. However, given the proximity of Pineros to the main island, restricted public access to the beaches of Pineros results in a positive impact to the waterfowl inhabiting the area. Similarly, any sea turtles that may nest on Pineros would benefit from the protection provided by access control. The large majority of beaches on Pineros are not used for training. Use of Pineros Island, therefore, would result in negligible impacts to wildlife for modified training activity two and the no-action alternatives. However, because modified training activity one only protects the mangroves, other important wildlife areas may be impacted, resulting in moderate impacts.

Species of concern on Vieques Island include brown pelicans, white-cheeked pintails, and sea turtles. On Vieques, there is a sufficient amount of land that is not considered critical habitat (see E & E 1986) in which to conduct SPECVAR training without impacting wildlife species of concern. Use of Vieques Island would also result in negligible impacts to wildlife.

Impacts to wildlife on Culebra Island are potentially greater because of the large seabird colonies and extensive turtle nesting beaches. In addition, other rare wildlife species utilize Culebra, including the white-cheeked pintail and the white-crowned pigeon. There would be some benefit to wildlife on Culebra incurred from the protection of habitat. However, because of the variety of rare species that occur on Culebra and the variety of habitats and areas in which they are found, there exists a greater potential for disturbance from training activities. Use of Culebra Island would result in moderate impacts to wildlife.

Dog Island's most important wildlife resource is its seabird colonies, including its colony of brown pelicans. Any human activity in the vicinity of nesting areas could adversely impact species of seabirds. Dog Island is only 670 acres in size; therefore, some disturbance would be unavoidable. Use of Dog Island would result in potentially significant impacts to wildlife.

Table 2-3

ENVIRONMENTAL EVALUATION MATRIX FOR PROPOSED ALTERNATIVES

		Relocation of Training Activities to an Alternate Caribbean Site						
Environmental Evaluation Criteria	Discontinuation of Training	Vieques Island	Culebra Island	Dog Island	Navassa Island	No Action	Modified Training Activity One	Modified Training Activity Two
		GICAL Strial Wild- and Habitats	Moderate impacts to habitats and wildlife on Pinneros Island if public access was no longer restricted.	Brown pelican and white-cheeked plover present; sufficient amount of land not considered critical habitat available to conduct SPECIAR training with negligible wildlife impacts.	Large seabird colonies, white-cheeked plover, white-crowned pigeon, present; utilize variety of habitats found throughout island; no likely to encounter; training activities could impact endangered species; moderate impacts.	Large seabird colonies, brown pelican present; small size prohibits training activities without disturbance to wildlife; impacts significant.	Large seabird colonies, white-crowned pigeon present; training activities would likely impact one or both; impacts moderate.	White-cheeked plover, brown pelican, white-crowned pigeon present; mangroves and other important wildlife areas protected; sufficient amount of land not considered critical habitat available to conduct SPECIAR training with negligible impacts to wildlife.
Red Plants Critical/ ive Habitats	Moderate impact to endangered plants and critical habitats on Pinneros Island if public access was no longer restricted.	Mangroves, unique evergreen scrub and cypress upland forest habitats present; same plant species of concern present; rare species and critical habitats protected; sufficient amount of land not considered critical habitat to conduct SPECIAR training with negligible impacts.	Few or no endangered plants; mangroves and remnant forests present; forests necessary for SPECIAR training impacts moderate.	Brown Pelicans and sea turtles nest on island. Impact significant.	No rare plants or critical habitats present; no impacts.	Several rare plants, mangroves, lagoons present; mangroves avoided but demolitions could occur within mangrove watersheds; minor disturbances to rare plants; impacts moderate.	Several rare plants, mangroves, lagoons present; mangroves avoided but demolitions could occur within mangrove watersheds; minor disturbances to rare plants; impacts moderate.	Several rare plants, mangroves, lagoons present; mangroves and their watersheds protected; minor disturbances to rare plants; impacts negligible.

Table 2-3 (Cont.)

ALTERNATIVES								
Relocation of Training Activities to an Alternate Caribbean Site								
Environmental Evaluation Criteria	Discontinuation of Training	Vieques Island	Culebra Island	Dog Island	Navassa Island	No Action		
Wildlife and Aquatic Resources	Significant impact if public access on Pileas Island was no longer restricted.	Unique aquatic features present but easily avoidable due to large coastline; impacts negligible.	Extensive turtle nesting beaches, extensive reef system, seagrass beds and mangrove nursery areas present; localized impacts in vicinity of destruction of structures; impacts negligible.	Limited unique aquatic features; impacts negligible.	Limited unique aquatic features; impacts negligible.	Coral reefs and seagrass beds present; sea turtles potentially present for nesting; impacts negligible.	Modified Training Activity One Coral reefs and seagrass beds present; sea turtles potentially present for nesting; impacts negligible.	Modified Training Activity Two Coral reefs and seagrass beds present; sea turtles potentially present for nesting; impacts negligible.
Soil Erosion Potential	Negligible impact	Erodible soils, steep slopes, irregular topography; impacts moderate.	Erodible soils, steep slopes, irregular topography; impacts moderate.	Gentle topography but soils susceptible to erosion; impacts moderate.	Gentle topography but soils susceptible to erosion; impacts moderate.	Steep slopes, erodible soils; potential erosion on steep slopes adjacent to mangroves; impacts moderate.	Steep slopes, erodible soils; potential erosion on steep slopes within lagoon watersheds; impacts significant.	Steep slopes, erodible soils; potential erosion on steep slopes within lagoon watersheds; impacts significant; areas of gentle topography; impacts negligible.
Cultural Resources	Negligible impact	Much of island previously disturbed; cultural resources identified and readily avoided; impacts negligible.	No testing done; potential impacts to unknown resources.	No testing done; potential impacts to unknown resources.	Cultural resources identified and readily avoided; impacts negligible.	Two known archaeological sites readily avoided; no impacts.	Two known archaeological sites readily avoided; no impacts.	Two known archaeological sites readily avoided; no impacts.

Table 2-3 (Cont.)

Environmental Evaluation Criteria	Discontinuation of Activities	Relocation of Training Activities to an Alternate Caribbean Site					Modified Training Activity Two
		Vieques Island	Culebra Island	Dog Island	Nevassa Island	No Action	
Conflict with Civilian Land Use	Eliminates any conflicts with civilian land use.	Navy uses 3 training areas to which SPRING training would likely be restricted, thus limiting training capabilities; some of the beaches capable of beach assaults with live fire due to existing land uses and conservation zones; conflict with recreation and tourism; moderate impacts.	Navy attempts to obtain land conflict with existing land uses; impacts significant.	Little development potential; impacts negligible.	Little development potential; impacts negligible.	No tourism, recreation, or fishing; beach assaults and sea-to-land firing conflict with land uses in Puerto Rico; impacts moderate.	No tourism, recreation, or fishing; beach assaults and sea-to-land firing screened from Puerto Rico; impacts negligible.

Navassa Island is also heavily utilized by seabirds for nesting. In addition, the rare white-crowned pigeon is found in its forested areas. Any human disturbances on Navassa could adversely impact seabird colonies. The seabird colonies on Navassa do not include any rare and endangered species, however. Therefore, use of Navassa Island would result in moderate impacts to wildlife. Discontinuation of training activities on Pineros and Cabeza de Perro islands will result in moderate impacts to the terrestrial wildlife and habitats, if public access were no longer restricted. Although detonation of ordnances will cease, nesting waterfowl and sea turtles will be adversely affected by the influx of civilians onto the islands.

Endangered Plants and Critical Habitats

Pineros has critical mangrove and lagoon habitats and several rare plant species throughout upland areas. Both the no action and modified training activity one alternatives avoid demolitions in the mangroves. However, they do not prevent demolitions in the mangrove watersheds; therefore, this would result in moderate impacts to the endangered plants and critical habitats. Mangrove swamp areas are avoided during training, and only minor impacts could occur to individual plants of rare plant species in upland areas; therefore, use of Pineros Island would result in negligible impact to endangered plants and critical habitats for modified training activity two.

Vieques Island also has mangrove habitats in addition to unique evergreen scrub and climax forest upland habitats. There are no endangered plant species known to occur on Vieques, but nine plant species of concern have been identified there (E & E 1986). The extent of rare species and critical habitats on Vieques has been documented (E & E 1986), and they have been protected within conservation zones. There are sufficient areas of land outside of these conservation zones in which to conduct training; therefore, use of Vieques Island would result in negligible impact.

Culebra Island has few potential endangered species of plants. Important habitats include mangroves and remnant forests. Because SPECWAR requires forest for realistic training, areas of forest on Culebra would have to be utilized. Small-arms training and ordnance

explosions would be expected to result in moderately adverse impacts to the remaining forested areas of Culebra.

As identified in a Navy environmental reconnaissance study (TAMS and E & E 1979a), operations on Dog Island would potentially impact the brown pelican population significantly and may impact the sea turtle population moderately. The brown pelican would be impacted primarily by the destruction of both nesting and roosting areas, while sea turtles could be impacted by the disruption to the limited beach areas.

Moderate impacts to endangered plants and critical habitats on Pineros are expected to occur if public access were no longer restricted due to the discontinuation of training.

A limited environmental study of Navassa Island by the Navy (Ecology & Environment, Inc. 1981) did not identify rare species of vegetation or critical habitats on the island. Therefore, no impacts to endangered plants and critical habitats are anticipated.

Aquatic Wildlife and Unique Aquatic Features

On Pineros Island, underwater ordnance detonations can be located to avoid coral reefs, and only minor siltation within seagrass beds will be likely to occur from detonation off the southeast shore. If demolitions are preceded by beach and water reconnaissance by SPECWAR personnel to establish the absence of sea turtles, use of Pineros Island would result in negligible impact potential to aquatic ecology for all three alternatives.

Vieques Island possesses some unique aquatic features, such as coral reefs, seagrass beds, mangrove nursery areas, and a bioluminescent bay. However, given the large area of the Vieques coastline, there are areas around Vieques where training could be located with negligible impact.

Culebra Island possesses an extensive reef system, in addition to seagrass beds and mangrove nursery areas. The island is also important for turtle nesting. Because of the high quality of these resources, it is assumed that SPECWAR training activities would result in impacts to marine resources, such as sedimentation and damage to coral reefs from explosions. However, impacts would be localized in the vicinity of detonation structures; therefore, use of Culebra Island would result in only moderate impacts to aquatic resources.

Neither Dog Island nor Navassa Island possesses any special marine resources. Live coral development on both islands is limited, and no submerged grass beds are present. SPECWAR training would have negligible impact on either island.

Discontinuation of training would result in significant impacts on Pineros' aquatic wildlife and unique aquatic features if public access were no longer restricted. Disturbances to the coral reefs and seagrass beds would greatly increase due to recreational boaters and divers in the area.

2.2.2.2 Physical--Erosion Potential

An additional category of environmental impacts considered was physical: primarily the potential impact from erosion and sedimentation due to steep slopes and erodible soils. SPECWAR training activities such as demolition and the construction of targets result in exposed soils that are subject to erosion.

Pineros possesses steep slopes on approximately 59% of the island and is underlain by soils with a high erosion potential. The no action alternative will result in moderate impacts due to the potential erosion on steep slopes adjacent to mangroves. Modified training activity one has the same potential, as well as the potential for erosion within the lagoon watersheds; therefore, impacts are significant. Impacts resulting from the modified training activity two alternative would be limited to small areas around targets and demolition sites; therefore, the potential impact is rated as negligible.

Both Vieques and Culebra islands are also underlain by soils in upland areas that are susceptible to erosion. Both also are characterized by irregular topography and steep slopes; therefore, both have moderate impact potential.

Both Navassa and Dog islands are characterized by a more gentle topography in upland areas; however, the soils are thin. Navassa, in fact, has only a very thin layer of soil over rock. Because of this, both islands have moderate impact potential.

Discontinuation of training on Pineros Island will allow civilian use of the island but will result in negligible impacts, since areas of steep slope will likely be avoided.

2.2.2.3 Cultural

Cultural resource considerations include the potential for effects on significant cultural resources and conflicts with civilians regarding land use.

Cultural Resources

On Pineros, only two archaeological sites were found, both of which could be readily avoided (see Section 3.8). Therefore, all three alternatives on Pineros Island would result in no impacts to cultural resources.

Much of Vieques Island has been previously disturbed by cattle grazing and Navy activities. Significant cultural resources on Vieques have been identified (E & E 1986) and could be readily avoided by SPECVAR. Use of Vieques would result in negligible impacts to archaeological resources.

Culebra Island has not undergone intensive site testing, although artifacts have been found (TAMS and E & E 1979b). Past Naval activities are likely to have damaged or destroyed most archaeological sites; therefore, additional training activities would probably have negligible impacts. However, because cultural testing has not been conducted on Culebra, it is assumed that use of this island would result in potential impacts to undocumented resources.

Similarly, there has been no archaeological testing on Dog Island (TAMS and E & E 1979a). Because cultural resources are undocumented, it is assumed that there would be potential impacts to unknown cultural resources on Dog Island.

Navassa Island has undergone archaeological testing (E & E 1981). Locations of archaeological sites are known and could be avoided; thus, impacts to cultural resources on Navassa would be negligible.

Discontinuation of training activities would allow the public onto Pineros Island; however, due to the limited cultural resources, this would result in negligible impacts.

Conflicts with Civilian Land Use

There is no tourism or recreation on Pineros or Cabeza de Perro islands, and civilians are not permitted to fish around the island. Both the no action and modified training activity one alternatives propose beach assaults and sea-to-land firing on the north coast of Pineros. These actions may result in moderate impacts since new and future developments on the northeast coast of Puerto Rico may have an unscreened view of these activities. However, the modified training activity two action proposes to utilize the southeast shore for similar activities, thus screening the public from Navy training maneuvers. This alternative would result in negligible impacts to conflicts with civilian land use.

On Vieques Island, the Navy owns three major areas in which it trains: the AFWTF, the EMA, and the NAF. It is likely that SPECVAR training activities would be restricted to these areas because Navy acquisition of additional land would be unreasonable, given the present-day political climate and the large percentage of Vieques already owned by the Navy. The NAF, because of the ammunition stored there, has supported only limited military field training exercises since 1978. The AFWTF is used for large ordnance delivery and weapons testing for ship and air units; therefore, it could not provide training for on-the-ground units.

None of the beaches on Vieques Island are capable of sustaining beach assaults with live fire because of conflicts with civilian land use and conservation zones. The majority of beaches utilized for beach approaches on Vieques are located in designated conservation zones that have established restrictions on the types of naval training activities that can occur. In addition, several beaches support other civilian uses. Small-arms live fire on Vieques is restricted to target ranges, which would not satisfy the need for realistic training. Use of Vieques for training would conflict with potential and existing uses for recreation and tourism, especially on beaches located outside the AFWTF. Therefore, use of Vieques Island would result in moderate impacts.

Culebra Island is essentially a nonviable alternative from a land use aspect. The Navy no longer owns land on Culebra. Culebra has a

large potential for recreation, and any attempt by the Navy to reobtain land for training would likely meet with strong public opposition. Consequently, use of Culebra would result in significant and unavoidable land use impacts.

Navassa and Dog islands are both isolated islands with little potential for development at this time. Use of either would result in negligible land use impacts.

Discontinuation of training activities eliminates any conflicts with civilian land uses.

2.2.3 Impacts on Pineros and Cabeza de Perro Islands Due to the No Action and Modified Training Activities One and Two

An evaluation of potential environmental impacts was next conducted for the three training alternatives put forth for Pineros and Cabeza de Perro islands, the no action, and modified training activities one and two. Table 2-2 summarizes the environmental impacts to these two islands that would result from each of these alternatives. (As stated previously, these three alternatives equally meet the operational suitability criteria because they would be implemented at the same location.)

The first differentiating criterion considered is endangered wildlife. Both the no action and modified training activity two alternatives protect mangroves and endangered wildlife by restricting or limiting activities within sensitive areas; therefore, their implementation would result in negligible impacts. The modified training activity one places no restrictions on areas used, with the exception of mangroves. Other important wildlife areas could potentially be disturbed; therefore, implementation of this alternative would result in moderate impacts.

In regard to critical habitat, the modified training activity two alternative restricts demolitions in mangrove watersheds, thereby reducing potential impacts to a negligible level. Modified training activity one and the no-action alternative both could potentially affect mangroves by permitting demolitions within mangrove watersheds. Because of potential impact from sedimentation, each alternative would result in moderate impacts.

The next criterion is erosion potential. The modified training activity two alternative greatly restricts demolitions in mangrove watersheds. Additionally, it proposes to increase the use of the eastern portions of Pineros and all of Cabeza de Perro, where fewer steep slopes are located. Therefore, this alternative would have negligible impacts. The modified training activity one action restricts demolitions only in mangroves. Because erosion could occur in a number of areas, most critically on steep slopes adjacent to mangroves, this alternative action would result in significant impacts. The no action alternative permits demolition in some steep-slope areas located in lagoon watersheds but in fewer areas than it is permitted in by the alternative one action. Therefore, the no action alternative would result in moderate impacts.

The last criterion is conflict with civilian land use. The modified training activity two alternative proposes to utilize the southeast portion of Pineros and Cabeza de Perro more extensively. Activities located there would be screened by Pineros' topographic relief and provide a somewhat isolated location for SPECVAR training. Hence, this alternative would result in negligible impacts. Under both the modified training activity one and no-action alternatives, beach assaults and sea-to-land firing occur primarily on the north coast of Pineros. As development continues on the northeast coast of Puerto Rico, public opposition to this type of training, unscreened from view and within earshot, can be expected to increase. Both actions would result in moderate impacts.

2.3 SELECTION OF THE PREFERRED ALTERNATIVE

Based on an analysis of all alternatives, the modified training activity two action is the preferred alternative from both the operational and environmental aspects, as it is fully acceptable from an operational aspect and minimizes environmental impacts as well. The following summarizes why the other alternatives were eliminated from consideration.

The discontinuation of training alternative is unacceptable because it is not consistent with the Navy's mission in general, which is to protect the United States, nor with that of SPECVAR in particular. Lack

of training opportunities in which realistic scenarios under actual maritime combat conditions are simulated would result in SPECWAR forces that are not adequately prepared for combat in support of the Navy's mission. This alternative does not meet any of the operational criteria considered. Discontinuation of training would eliminate any environmental impacts resulting from training activities, but could lead to greater long-term impacts resulting from increased civilian presence on Pineros and Cabeza de Perro islands.

Of the islands considered as alternate sites, only Pineros and Cabeza de Perro islands fully meet all operational criteria considered and would result in minimized environmental impacts. Neither Dog nor Navassa island supports sufficient tropical jungle vegetation or the assault-capable beaches necessary to conduct realistic training activities. The isolation of both from Naval and medical facilities also makes them nonviable. Environmental impacts would not be significantly less to these than to any other proposed site.

Culebra also supports too little jungle vegetation to conduct realistic training. In addition, this island contains no Navy-owned land or facilities and any attempts by the Navy to obtain land and conduct training would likely result in severe conflicts with the civilian population. Other environmental impacts to Culebra would not be significantly different than to Pineros.

Vieques meets all site and facilities criteria considered. However, the presence of a large civilian population and existing FMFLANT operations on the island would likely result in conflicts with SPECWAR training activities and greatly restrict SPECWAR's ability to efficiently train personnel. In addition, medical evacuation on Vieques is possible by air only, while on Pineros evacuation by sea is possible. Beach assaults with live fire also are not possible on Vieques due to conflicts with existing civilian land uses. Other environmental impacts would be similar to those on Pineros.

Overall, the analysis of alternate sites revealed that Pineros and Cabeza de Perro islands are the preferred location for SPECWAR training when operational and environmental factors are considered. The analysis did not identify any alternate site that would justify relocation of SPECWAR training activities from Pineros and Cabeza de Perro islands.

After determining that Pineros and Cabeza de Perro islands were the preferred site on which to conduct SPECWAR training, the three proposed alternative training schedules were evaluated. Each of these schedules would occur on Pineros and Cabeza de Perro islands and therefore fully meet all operational criteria considered.

The no-action alternative results in demolitions within the watersheds of the lagoons on Pineros, which would eventually result in siltation of mangrove and lagoon areas. In addition, it greatly restricts training activities in the less sensitive portions of the island and proposes beach assaults and sea-to-land firing in view of the Puerto Rico coastline.

The modified training activity one action, although prohibiting demolitions in mangroves, would allow such activities in mangrove watersheds and other important habitats. Similar to the no-action alternative, this alternative allows beach assaults and sea-to-land firing to occur within view of the Puerto Rico coastline.

The modified training activity two alternative prohibits demolitions use in the mangrove lagoons and their watersheds, as well as all types of live weapons use in the lagoons, their adjacent mangroves, and in the vicinity of important historical and archaeological sites. In this way, this alternative protects critical environmental and cultural features and expands the use of non-sensitive portions of Pineros and Cabeza de Perro islands where training activities would be less environmentally damaging and better screened from the view of civilians. As a result, this alternative minimizes environmental impacts while maximizing SPECWAR training opportunities and thus represents the preferred alternative.

3. AFFECTED ENVIRONMENT

This section discusses the existing physical, natural, and cultural environment on Pineros and Cabeza de Perro islands. The following descriptions are based on information gathered during field surveys conducted during 1989, existing reports, and contacts with various commonwealth and federal agencies and academic institutions. Existing studies and reports reviewed and incorporated into this report include studies on sea turtles and manatees (Rathbun et al. 1985), wildlife on "NAVSIA" Roosevelt Roads (Rathbun et al. 1988), and mangroves (Villalella et al. 1986).

Quarterly field surveys of Pineros and Cabeza de Perro islands were conducted during the weeks of January 11 to 20, April 3 to 7, June 5 to 9, and December 4 to 8 in 1989, totaling 4.5 weeks of field studies. The final quarterly survey was originally scheduled for September 18 to 22; however, Hurricane Hugo, one of the most destructive hurricanes on record, moved over Puerto Rico on September 17 and forced the postponement of the final field survey until utilities could be restored and cleanup operations completed. The effects of Hurricane Hugo on the environments of Pineros and Cabeza de Perro islands were documented during the final quarterly survey and are described briefly in this section. As discussed in Section 2, the impacts resulting from the hurricane are temporary, and the islands are expected to recover within several years (Villalella 1989). Therefore, alterations to the environment are not discussed at length in this report, and the following description of the affected environment is based on those conditions existing prior to Hurricane Hugo.

3.1 TOPOGRAPHY, GEOLOGY, AND SOILS

Both Pineros and Cabeza de Perro islands are located approximately 0.5 mile east of the northeast coast of Puerto Rico at 18°15'N latitude and 65°35'W longitude. Pineros Island is approximately 1 mile by 0.5 mile in size and approximately 310 acres in surface area. Cabeza de Perro, located 0.25 mile east of Pineros Island, is approximately 0.25 mile in diameter and approximately 30 acres in surface area.

3.1.1 Topography

The topography of Pineros Island is characterized by a series of smooth, round hills and low-lying swampy areas. The hills range in elevation from less than 70 feet in the northwest to a hill of 250 feet above MSL in the south-central portion of the island. The hills run generally in a southeast to northwest direction. These hills are generally very steep, with slopes of greater than 25% found on 45.3% (140.5 acres) and slopes of 15 to 25% on 13.6% (42.2 acres) of the island. Only approximately 12.6% (39 acres) of the surface area on Pineros consists of upland with slopes less than 15%. The remaining 28.5% (88.2 acres) of Pineros is composed of low-lying mangrove swamp or brackish lagoon. Slopes found on Pineros are shown in Figure 3-1. The most significant area of swamp is located on the southwestern portion of the island, and two others are located in the northeastern portion of the island. Pineros Island is surrounded by mostly narrow (less than ten-foot-wide) sandy beaches, except where steep rock cliffs abut the ocean. Coral reefs border the north and east coastlines.

Cabeza de Perro Island is a smoothly rounded cay with a maximum elevation of 100 feet above MSL. The shoreline of Cabeza de Perro consists of rocky beaches and sea cliffs.

3.1.2 Geology and Soils

Pineros and Cabeza de Perro islands are both of volcanic origin. The geology of Pineros and Cabeza de Perro islands consists of lava, lava breccia, tuff, and tuffaceous breccia of lower cretaceous age (Briggs 1964). These volcanic rocks were formed directly from molten rock that cooled quickly in a marine environment. Vesicular structure is prominent in some areas and represents rock formation near the

3-3

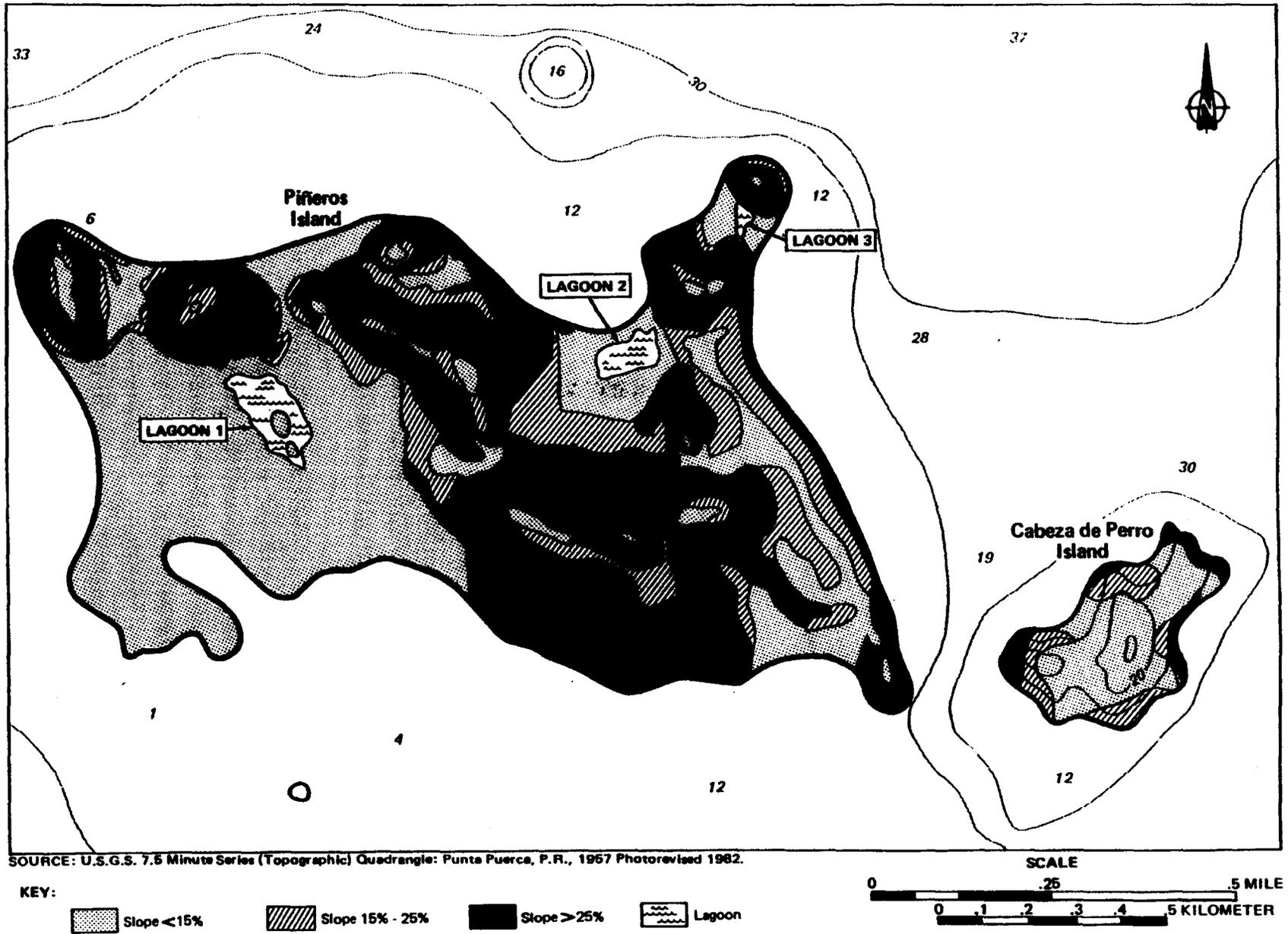


Figure 3-1 STEEP SLOPES AND LAGOONS ON PIÑEROS AND CABEZA DE PERRO ISLANDS

gaseous top of a lava flow. Dense, fine-grained fragments of volcanic rock and ash that exhibit a rough, gritty texture are also present. Thin-bedded sandstone and siltstone are also present in some areas. The total thickness of these rock formations may exceed 30,000 feet. Rock on the two islands is extensively weathered.

Swamp and marsh deposits overlie the igneous rocks on the southwest portion of Pineros Island. Moderately saline swamps containing organic muck, peat, silt, and sand occur in this area (Briggs 1964).

Pineros Island is underlain by two types of soil: Descalabrado clay loam and tidal swamp soils (Boccheciamp 1977). Tidal swamp soils are found on 28% of the island in the salinas and mangrove areas on the southwest quarter of the island and around lagoons in its northeastern section. The remainder of Pineros and all of Cabeza de Perro are underlain by Descalabrado clay loam. These soil types are described below.

Tidal swamp soils are inundated with brackish to saline water for most of the year and typically, as is the case on Pineros, support a thick growth of mangrove trees. They are either sandy or clayey, light colored, saline, nearly level, and contain organic material from decaying mangroves. The tidal swamp soils on Pineros are more clayey than sandy. Tidal swamp soils are underlain by coral, shell, and marl at varying depths and serve as a feeding and breeding place for birds, oysters, and crabs (Boccheciamp 1977).

Tidal swamp soils have no value for farming and possess very severe limitations for nonfarm uses. Because they are poorly drained and subject to frequent flooding, these soils are very poorly suited for roads, paths, and trails. They are also poor sources of road fill and topsoil (Boccheciamp 1977).

The Descalabrado clay loam soil type consists of fine-textured, shallow, eroded soils underlain and derived from volcanic rock. This soil is found on hillsides and ridgetops with slopes of 20% to 40% in semiarid volcanic uplands. The surface layer is neutral clay loam about 6 inches thick. Subsurface layers are friable clay loam interspersed with small volcanic rock fragments. The underlying material is olive-brown loam saprolite that extends to a depth of about 19 inches, where weathered volcanic rock is found (Boccheciamp 1977).

Descalabrado soils are severely limited in their use for farming because of steep slopes, shallowness to bedrock, rapid runoff, low rainfall (30-35 inches annually), and the hazard of erosion. Descalabrado soils are best suited for pasture grazing and wildlife food and cover. The steep slope and shallowness of this soil severely limit its use for paved roads and moderately limit its usefulness for paths and trails where the slope is less than 25%. It is also a poor source of road fill and topsoil due to its shallowness (Boccheciamp 1979). Presently, exposed soils occur along small-arms trails and where targets have been constructed.

3.2 CLIMATE

The climate of Pineros and Cabeza de Perro islands is tropical-marine, with minimal fluctuations in temperature, relatively moderate humidity, and frequent rain showers. The islands are directly in the path of the easterly trade winds, which moderate temperature extremes.

The nearest weather station to Pineros Island is located on NAVSTA Roosevelt Roads, approximately 0.5 mile west of Pineros Island. Climatic data at the station are recorded by the Navy Weather Service and compiled by the Naval Oceanography Command Detachment, Asheville, North Carolina.

The mean annual temperature at the station, based on data compiled from 1957 through 1982, averages 79.9°F. Similar historical data show July and August as the warmest months, at 82.4°F, and February as the coldest month, at 76.8°F. The relative humidity averages 65 to 78%.

Rainfall on the islands generally consists of brief showers throughout the year. The average annual rainfall on Pineros Island is approximately 50 inches, based on data compiled by the weather station located at NAVSTA Roosevelt Roads. This rainfall estimate may be somewhat high; during the field surveys it was noted that rain clouds approaching NAVSTA Roosevelt Roads from the east tend to move in a path that takes them north of Pineros. The majority of the moisture contained in these rain clouds does not precipitate until the clouds reach the Puerto Rican mainland. As a result, Pineros Island likely receives less precipitation than does the weather station at NAVSTA Roosevelt Roads. The rainy season in this region is typically defined as May through November.

Winds in the vicinity of NAVSTA Roosevelt Roads are typically from the east or northeast at an average speed of approximately 6 knots. Tropical storms and hurricanes are most likely to occur during the summer and early fall.

Additional details regarding climate in the vicinity of Pineros and Roosevelt Roads are presented in the Land Management Plan NAVSTA Roosevelt Roads, Ceiba, Puerto Rico (E & E 1986).

3.3 INLAND WATER RESOURCES

Both Pineros and Cabeza de Perro islands lack fresh water resources. Three brackish water lagoons are located on Pineros Island, two of which are perennially flooded and one of which is intermittently flooded. The largest of these is located in the southwest lowland area and is approximately 4.5 acres in size. This lagoon is referred to in the remainder of this report as Lagoon 1. The next largest lagoon is located on the northeast portion of the island at the base of the major southeast-to-northwest-running hill system. This lagoon, which is permanently flooded and approximately 1.9 acres in size, is referred to hereafter as Lagoon 2. The third lagoon is located between two low hills on the extreme northeast area of Pineros. This lagoon, which dries up during the dry season, is approximately 0.6 acre in size and is referred to as Lagoon 3. The locations of Lagoons 1, 2, and 3 are shown in Figure 3-1.

A thin sheen of oil was observed on Lagoon 1 during the June field survey. A potential source of the oil is a number of oil and gasoline storage tanks located on the west-facing slope of the largest hill on Pineros Island. These storage tanks remain from the 1940s, when bunkers and roads were built on Pineros. Heavy rains potentially result in some oil or gasoline being washed into Lagoon 1.

Rainfall on Pineros and Cabeza de Perro islands ranges from 30 to 40 inches per year. Evaporation is high; for example, the amount of water that evaporates is about 90% of the rainfall in the U.S. Virgin Islands (Jordan and Fisher 1977). Runoff, some of which recharges the brackish lagoons, accounts for most of the remaining rainfall. Soils are shallow to volcanic rock; therefore, groundwater resources are considered negligible.

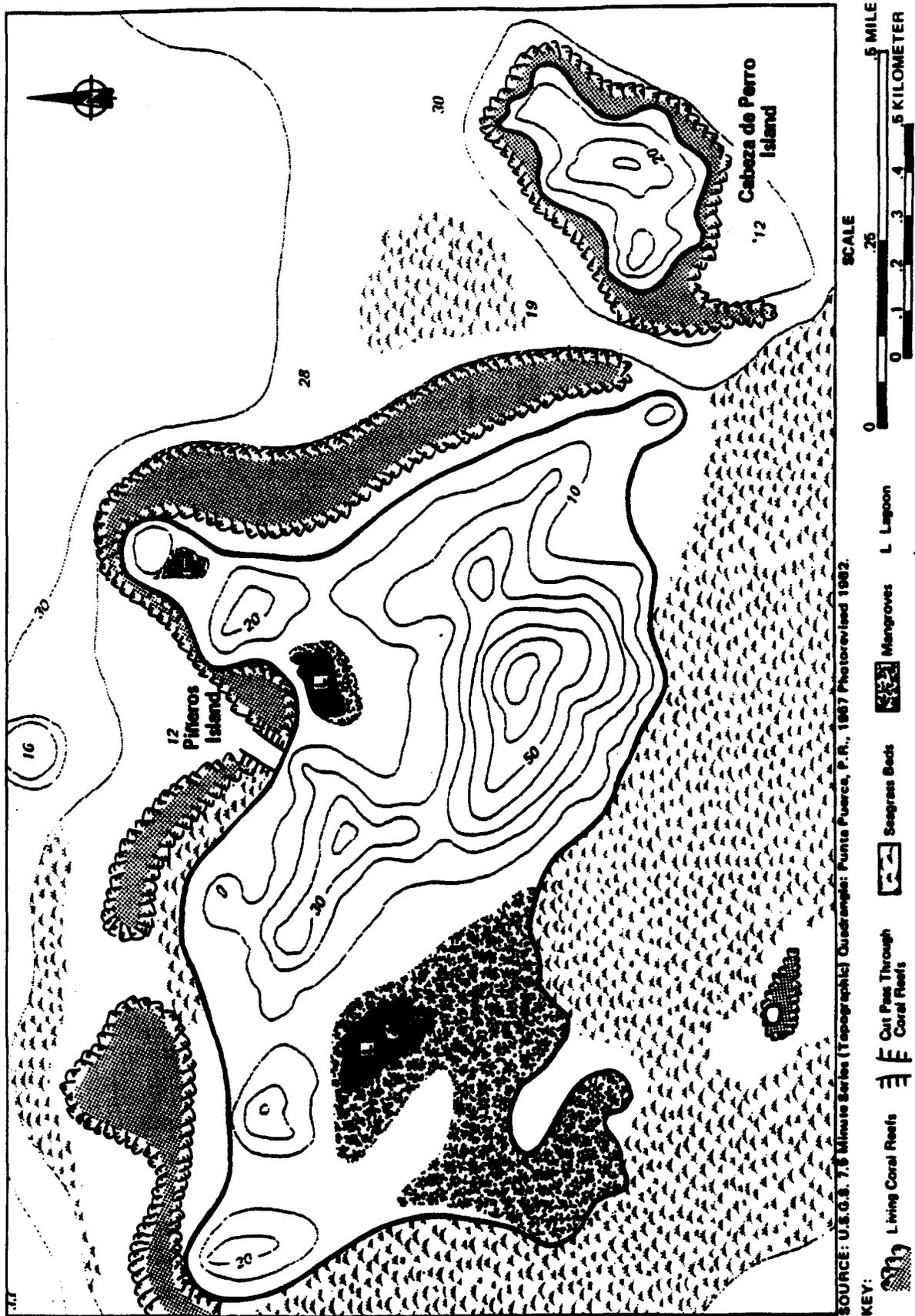
3.4 MARINE RESOURCES

This section describes the existing marine communities identified in the qualitative field survey performed in January 1989 around Pineros and Cabeza de Perro islands. The major communities examined during the field survey were coral reefs, seagrass beds, and rare and endangered species. SCUBA was utilized for the field surveys, as well as aerial photograph interpretation, literature review, and field survey data from nearby Vieques Island.

3.4.1 Seagrass Bed Community

Tropical marine seagrass communities are highly productive and structurally important aspects of the nearshore marine ecosystem. The lateral extent of the seagrass community was assessed with aerial photographs and qualitatively assessed with field surveys both at the surface from a boat and by SCUBA observations over the seagrass beds. Percent cover and general health of each seagrass species, as well as the flora and fauna utilizing the seagrass beds, were qualitatively assessed during the field survey. Underwater transects could not be utilized due to the heavy seas, strong currents, and poor visibility present during the survey period.

The seagrass beds around Pineros Island are concentrated primarily along the western, southwestern, and southern areas of the island (see Figure 3-2). The seagrass beds along the south shore of Pineros are composed of a stand of equal percentages of Thalassia testudinum and Syringodium filiforme near the shore. Seagrass beds are extensive and found out to depths of 4 to 5 meters (see Figure 3-2). Along the western and northwestern shores of Pineros, the seagrass stands were composed almost exclusively of Thalassia, with lesser amounts of Syringodium. The seagrass beds along the northern shore of the island were found at depths of 8 to 9 meters and were comprised mostly of Thalassia. Less extensive beds of seagrass, primarily Thalassia, are found off the north-central coast of Pineros Island, in depths of 1 to 2 meters. The seagrass beds along the northern shore of the island were also patchier and less dense in distribution as compared to the southern or leeward coast of the island. Short seagrass blade length was observed in all seagrass beds during the field survey and was typical for the winter period.



SOURCE: U.S.G.S. 7.5 Minute Series (Topographic) Quadrangle: Punta Puerca, P.R., 1967 Photorevised 1982.

KEY: Living Coral Reefs Cut Piss Through Coral Reefs Seagrass Beds Mangroves Lagoon

Figure 3-2 GENERAL DISTRIBUTION OF CORAL AND SEAGRASS BEDS AROUND PIÑEROS AND CABEZA DE PERRO ISLANDS

Areas of natural disturbance within the seagrass beds were noticed along the southern and western shores of the island in the form of "blowouts," or areas where plant rhizomes were loosened during successive storms and patches of seagrass were torn out of the seagrass bed, and small areas of herbivory (possibly from either manatees, sea turtles, or both). Both of these types of disturbance within the seagrass bed are natural cyclical events from which the seagrass bed community will recover.

Common invertebrate inhabitants were identified during the field survey and are listed in Table 3-1. Fish were not readily identified because of the high turbidity levels present during the field surveys. Overall, the general health of the seagrass bed community was good in the vicinity of Pineros Island.

No seagrass beds were observed to be associated with Cabeza de Perro Island.

Observations of the seagrass beds made from a small boat during the December field survey indicated that Hurricane Hugo had only minor impacts on the seagrass beds around Pineros Island. No evidence of any large-scale blowouts was observed; the seagrass beds remain intact and healthy. These findings are consistent with those of USFWS, which found insignificant impacts to other seagrass beds in the vicinity of NAVSTA Roosevelt Roads during aquatic surveys conducted to assess the damage in the region following Hugo (Villella 1989).

3.4.2 Coral Reef Community

Coral reefs around Pineros and Cabeza de Perro islands were qualitatively surveyed using SCUBA during January 1989. Transect methods could not be used because of the rough seas and strong currents present during the field survey. Invertebrate and fish species abundance and condition were visually assessed and recorded. An effort was made to determine the percent cover of coral living versus the percent dead.

The coral reef community around Pineros and Cabeza De Perro islands can be classified as patch and fringing reefs. The general distribution of coral reefs around each island is shown in Figure 3-2. The patch reefs found along the southern, northwestern, and eastern portions of Pineros Island and the western and southern coasts of Cabeza de Perro

Table 3-1

**SEAGRASS BED INVERTEBRATES OBSERVED
DURING THE JANUARY 1989 MARINE SURVEY OF
PIÑEROS AND CARRERA DE PERRO ISLANDS**

Species Name	Common Name	Abundance
Plants		
<u>Thalassia testudinum</u>	Turtle grass	Very common
<u>Syringodium filiforme</u>	Manatee grass	Very common
<u>Halimeda simulans</u>	Green alga	Very common (inshore) Common (offshore)
<u>Penicillus</u> spp.	Pencil brush algae	Common (inshore)
<u>Udotea flabellum</u>	Green alga	Common (inshore)
<u>Avrainvillea nigricans</u>	Green alga	Common (inshore)
Invertebrates		
<u>Aplysia dactylomela</u>	Spotted sea hare	Uncommon
<u>Clypeaster rosaceus</u>	Sea biscuit	Uncommon
<u>Isostichopus badionotus</u>	Sea cucumber	Uncommon
<u>Oraster reticulatus</u>	Reticulated sea star	Common
<u>Lytichinus variegatus</u>	Variable sea urchin	Uncommon
<u>Triplonustes ventricosus</u>	Sea egg	Common
<u>Strombus gigas</u>	Queen conch	Common
<u>Gonodactylus</u> spp.*	Common rock mantis shrimp	Common
--	Ophiroids	Common
Fish		
<u>Halichoeres bivittatus</u>	Slippery dick	Common
<u>Sphyraena barracuda</u>	Barracuda	Uncommon
<u>Haemulon flavolineatum</u>	French grunt	Common
<u>Equetus punctatus</u>	Spotted drum fish	Uncommon

*Fresh burrows observed but organisms not actually observed.

Island are characterized by the soft coral species Plexaura flexuosa, Gorgonia ventalina, and, to a lesser extent, Briareum asbestinum and some of the hermatypic corals such as Acropora species, Porites species, Diploria species, and Montastrea species (see Table 3-2). The patch reefs found around each island are in good condition (60-90% of the coral species were alive) with well-established populations of fish utilizing the habitat (see Table 3-3). However, in the patch reefs along the southern shore of Pineros Island, Acropora species found in water depths of less than 1 meter were all dead, but still structurally intact. Fire coral has overgrown a considerable amount of the Acropora skeletons. The patch reefs found along the eastern coast of the island have large populations of reef fish, and the shallow portions of the reef are primarily composed of coral, Acropora palmata. Approximately 70 to 90% of the coral species in shallow areas were alive. The deeper portions (from 2 to 5 meters) of these reefs are dominated by algae and soft corals, and 75 to 90% of the coral was alive.

A reef formation similar to that of fringing reefs is found along the northern portions of Pineros Island and the northern and eastern coasts of Cabeza de Perro. This reef formation is characterized by the boulder corals Diploria species, hermatypic species Acropora species, and other hard corals such as Montastrea species, Porites species, Agaricia species, Oculania species, as well as lesser amounts of the soft coral species found on patch reefs. The rear zone and reef flat (from 0 to 3 meters in depth) are dominated by calcareous algal species and large areas of Montastrea and Porites species. The reef crest (0 to 1 meter in depth) and fore reef were found to have very few living corals present. The depth of the fore reef terminated in coral rubble at approximately 10 meters.

Few fish were observed along this reef type, but this could be due to the unusually heavy swells and poor visibility or the lack of living coral species to serve as habitat. The corals along the northern coast of Pineros Island are in poorer health; 10 to 20% of the boulder and hermatypic coral species were alive, and 20 to 40% of the other hard coral species were alive in the rear zones of this reef. Although these corals could have been dead for some time, the fact that the elkhorn and

Table 3-2

CORAL SPECIES OBSERVED DURING THE JANUARY 1969
MARINE SURVEY OF PINNACLES AND
CARRERA DE FERRO ISLANDS

Species	Common Name
Patch Reefs	
<u>Briareum asbestinum</u>	Corky Sea Fingers
<u>Funicia</u> spp.	Knobby Candelabra
<u>Plexaura flexuosa</u>	Tan bushy soft coral
<u>Pseudopterogorgia</u> spp.	Sea feathers
<u>Plexaurella</u> spp.	Sea rods
<u>Gorgonia ventalina</u>	Sea fans
<u>Diploria strigosa</u>	Smooth brain coral
<u>Porites porites</u>	Club finger coral
<u>Porites divaricata</u>	Small finger coral
<u>Porites astreoides</u>	Mustard hill coral
<u>Siderastrea sidera</u>	Smooth starlet coral
<u>Montastraea annularis</u>	Mountainous star coral
<u>Montastraea cavernosa</u>	Cavernous star coral
<u>Acropora palmata</u>	Elkhorn coral
<u>Acropora cervicornis</u>	Staghorn coral
<u>Eusmilia fastigiata</u>	Flower coral
<u>Mycetophyllia</u> spp.	Fungus coral
Fringing Reef	
<u>Acropora cervicornis</u>	Staghorn coral
<u>Acropora palmata</u>	Elkhorn coral
<u>Porites porites</u>	Club finger coral
<u>Porites divaricata</u>	Small finger coral
<u>Porites astreoides</u>	Mustard hill coral
<u>Siderastrea radians</u>	Rough starlet coral
<u>Siderastrea sidera</u>	Smooth starlet coral
<u>Montastraea annularis</u>	Mountainous star coral
<u>Agaricia</u> spp.	Plate or sheet coral
<u>Oculina</u> spp.	Ivory tree coral
<u>Briareum asbestinum</u>	Corky sea fingers
<u>Plexaura flexuosa</u>	Sea rod
<u>Gorgonia ventalina</u>	Sea fan
<u>Diploria strigosa</u>	Smooth brain coral

Table 3-3

**FISH AND INVERTEBRATE SPECIES IDENTIFIED DURING THE
JANUARY 1969 MARINE SURVEY OF PIÑEROS AND
CASELA DE FERRO ISLANDS**

Species	Common Name
Patch Reef	
<u>Sparisoma viride</u>	Stoplight parrotfish
<u>Scarus vetula</u>	Queen parrotfish
<u>Acanthurus coeruleus</u>	Blue tang
<u>Lactophrys</u> spp.	Trunkfish
<u>Thalassoma bifasciatum</u>	Bluehead wrasse
<u>Holocanthus tricolor</u>	Rock beauty
<u>Chromis cyanus</u>	Blue chromis
<u>Chaetodon ocellatus</u>	Spotfin butterflyfish
<u>Diplodus argenteus</u>	Silver pergy
<u>Haemulon flavolineatum</u>	French grunt
<u>Haemulon sciurus</u>	Bluestriped grunt
<u>Anisotrenus virginicus</u>	Forkfish
<u>Caranx crysos</u>	Blue runner
<u>Gramma loreto</u>	Fairy basslet
<u>Holocentrus ascensionis</u>	Squirrelfish
<u>Synodus intermedius</u>	Lizardfish
<u>Pomacentrus leucostictus</u>	Beaugregory
<u>Millepora complanata</u>	Leafy fire coral
<u>Millepora alcicornis</u>	Encrusting fire coral
<u>Hermodice sarunculata</u>	Fire worm
<u>Spirobranchus</u> spp.	Christmas tree worm
<u>Sabellidae</u>	Fan worms
<u>Panulirus argus</u>	Spiny lobster
<u>Stenopus hispidus</u>	Banded coral shrimp
<u>Aplysina</u> spp.	Tube sponges
<u>Spinosella</u> spp.	Tube sponges
<u>Spinosella plicifera</u>	Iridescent tube sponge
Fringing Reef	
<u>Acanthurus coeruleus</u>	Blue tang
<u>Scarus vetula</u>	Queen parrotfish
<u>Pomacentrus fuscus</u>	Dusky damselfish
<u>Chaetodon capistratus</u>	Four-eye butterflyfish
<u>Serranus tigrinus</u>	Harlequin bass
<u>Halichoeres bivittatus</u>	Slippery dick

staghorn corals were still intact leads one to believe that sedimentation or disease (some black line diseased coral heads were observed) had caused the coral deaths. Two areas within this reef formation along Pineros Island had been cut through for beach access channels (see Figure 3-2); no coral species were alive along the cut edges or in the coral rubble found along the bottom of the channel.

No marine surveys were conducted during the December field studies to determine what, if any, impacts Hurricane Hugo had on the coral reefs around Pineros and Cabeza de Perro islands. However, observations made from a boat indicated the reefs were not damaged by the hurricane. In addition, aquatic surveys conducted by USFWS following Hurricane Hugo indicated coral reefs in the region were not significantly impacted by the hurricane (Villegla 1989).

3.4.3 Marine Wildlife

The analysis of marine wildlife for this EA concentrates on rare and endangered species. Threatened or endangered marine species whose ranges extend around Pineros and Cabeza de Perro islands include the West Indian manatee (Trichechus manatus) and the green, hawksbill, loggerhead, and leatherback sea turtles. The results of past studies were reviewed to examine the distribution and abundance of these species around Pineros and Cabeza de Perro islands. There were no direct observations of threatened or endangered marine wildlife species on Pineros during the marine surveys. However, during the January survey, a green turtle (Chelonia mydas) was observed approximately 0.5 mile from Pineros Island. Evidence of herbivory was found within the seagrass beds along the southern coast of Pineros Island, but the species of herbivore that had grazed there could not be identified.

3.4.3.1 Sea Turtles

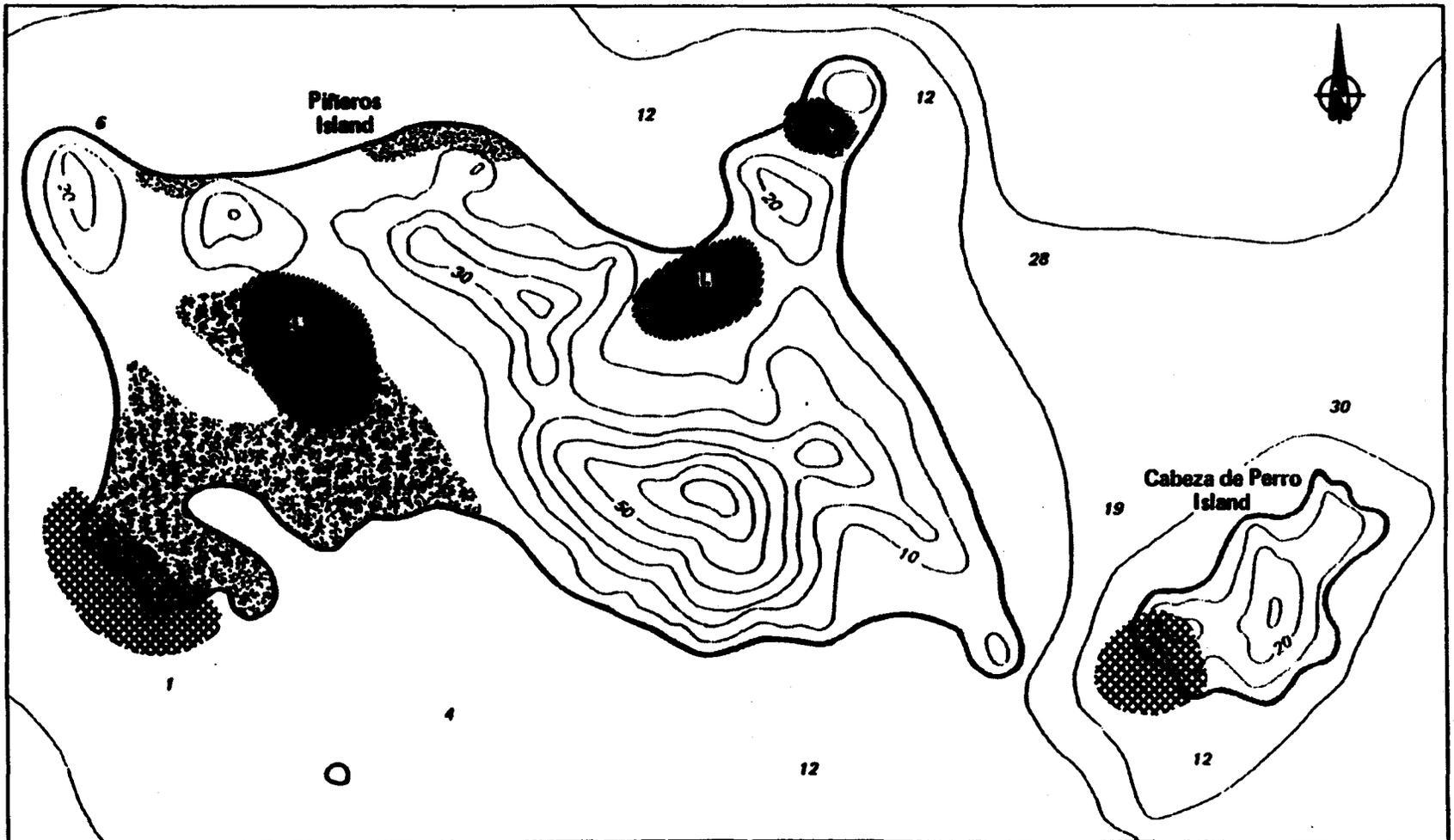
An analysis of the population of sea turtles near Pineros and Cabeza de Perro islands relied on field studies and existing information, especially a study completed by Rathbun, et al. (1985).

Between March 1984 and March 1985, Rathbun, et al. (1985), conducted aerial surveys for sea turtles and manatees in Puerto Rico, with emphasis on the area around NAVSTA Roosevelt Roads, Vieques Island, and

Pineros and Cabeza de Perro islands. Four species of sea turtles were sighted in the waters around RRNS/VI and Pineros and Cabeza de Perro islands: the green turtle (Chelonia mydas); hawksbill (Eretmochelys imbricata); leatherback (Dermochelys coriacea); and loggerhead (Caretta caretta). The largest identifiable majority were green turtles (30%), slightly over 8% were hawksbill, and 1% were loggerhead and leatherback. The remaining 60% were unidentified. In addition, very few large turtles were sighted. Approximately 94% of the turtles sighted were small (<60 cm long) and likely juveniles.

The highest population counts were recorded between October and January, and low counts were recorded between March and July. The area around Pineros Island accounted for 15% of the sightings in the NAVSTA Roosevelt Roads and Vieques Island area. The turtles sighted around Pineros were most often seen off the high-energy northern coast of the island, where the turtles congregated. Turtles were most often sighted off high-energy coasts and points that protrude into the bay throughout the entire project area, indicating they prefer deep, unsheltered areas.

Using field methods suggested by Dr. Mortimer of the Center for Sea Turtle Research at the University of Florida, all of the sand beaches on Pineros and Cabeza de Perro islands were evaluated to determine their suitability for turtle nesting. This evaluation involved characterizing the physical and biotic features that influence the suitability of beaches for nesting. Factors considered include: an open off-shore approach; a minimum depth of sand of 1 meter above high tide level; sand texture that is neither too fine nor too coarse; and the width of the beach, which should be at least 5 to 10 meters. In addition, each beach was patrolled early in the morning during the April and June field visits to locate any evidence of turtle nesting attempts (i.e., tracks, body pits), but no evidence was found. The field survey scheduled for September was postponed until December due to Hurricane Hugo. Again, no evidence of turtle nesting attempts was observed. However, two beaches on the north coast of Pineros were determined to be suitable for turtle nesting (see Figure 3-3). In a post-Hurricane Hugo study conducted by the USFWS at NAVSTA Roosevelt Roads that included Vieques Island, two transects off the northwest coast of Pineros Island showed evidence of foraging by green sea turtles (USFWS 1989).



SOURCE: U.S.G.S. 7.5 Minute Series (Topographic) Quadrangle: Punta Puerca, P.R., 1957 Photorevised 1982.

KEY:

-  Waterfowl Concentration Areas
-  Most Suitable Turtle Nesting Beaches

-  Pelican Roosting and Feeding Areas
- L Lagoon

-  Mangroves

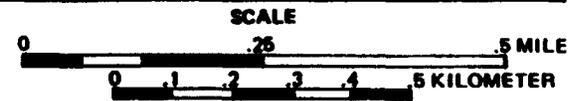


Figure 3-3 IMPORTANT WILDLIFE USE AREAS ON PIÑEROS AND CABEZA DE PERRO ISLANDS

3.4.3.2 Manatees

The West Indian manatee (Trichechus manatus) is the only sirenian that occurs near Pineros Island. It is designated as an endangered species both federally and by the commonwealth. The range of this species extends from the southeastern continental United States southward throughout the Caribbean and eastern Central America to northeastern Brazil (Odell 1982). Presently, the manatee is virtually extinct in the Virgin Islands and Lesser Antilles, and relict populations are found in Puerto Rico, Hispaniola, Cuba, and Jamaica. Its decline is attributed to overhunting, habitat degradation, and boating accidents. The manatee is a herbivore that feeds primarily on seagrasses; therefore, its feeding range is restricted to shallow water seagrass beds.

Powell, et al. (1981), found that nearly a third of Puerto Rico's manatee population lives in the area of NAVSTA Roosevelt Roads, but no studies had previously been done on their distribution in this area. Rathbun, et al. (1985), had similar findings, and over 35% of their sightings around the Puerto Rican coast were made in the segment between NAVSTA Roosevelt Roads and Vieques, which includes Pineros and Cabeza de Perro islands. Manatees are generally found year-round in the vicinity of NAVSTA Roosevelt Roads. Calves are present in all months, and the proportion of calves to total manatees was 7.9%. Manatees were most often seen feeding, which accounted for 75% of all observations. The rest were traveling, interacting socially, or categorized as undetermined. Feeding areas were characterized by dense seagrass beds, while travel lanes lacked seagrass beds and were located between sheltered coves or bays.

Manatees seem to prefer sheltered coves and bays with little wave action, dense seagrass beds, sources of fresh water, and minimal boat traffic and human harassment. The majority of sightings were made in the southernmost coves and bays of NAVSTA Roosevelt Roads; only 4% (32) of all sightings around Puerto Rico were made in the vicinity of Pineros Island. All but one of these 32 sightings were made along the Puerto Rican coast or in the passage between Puerto Rico and Pineros. The

single sighting along the coast of Pineros was made off the northwest coast.

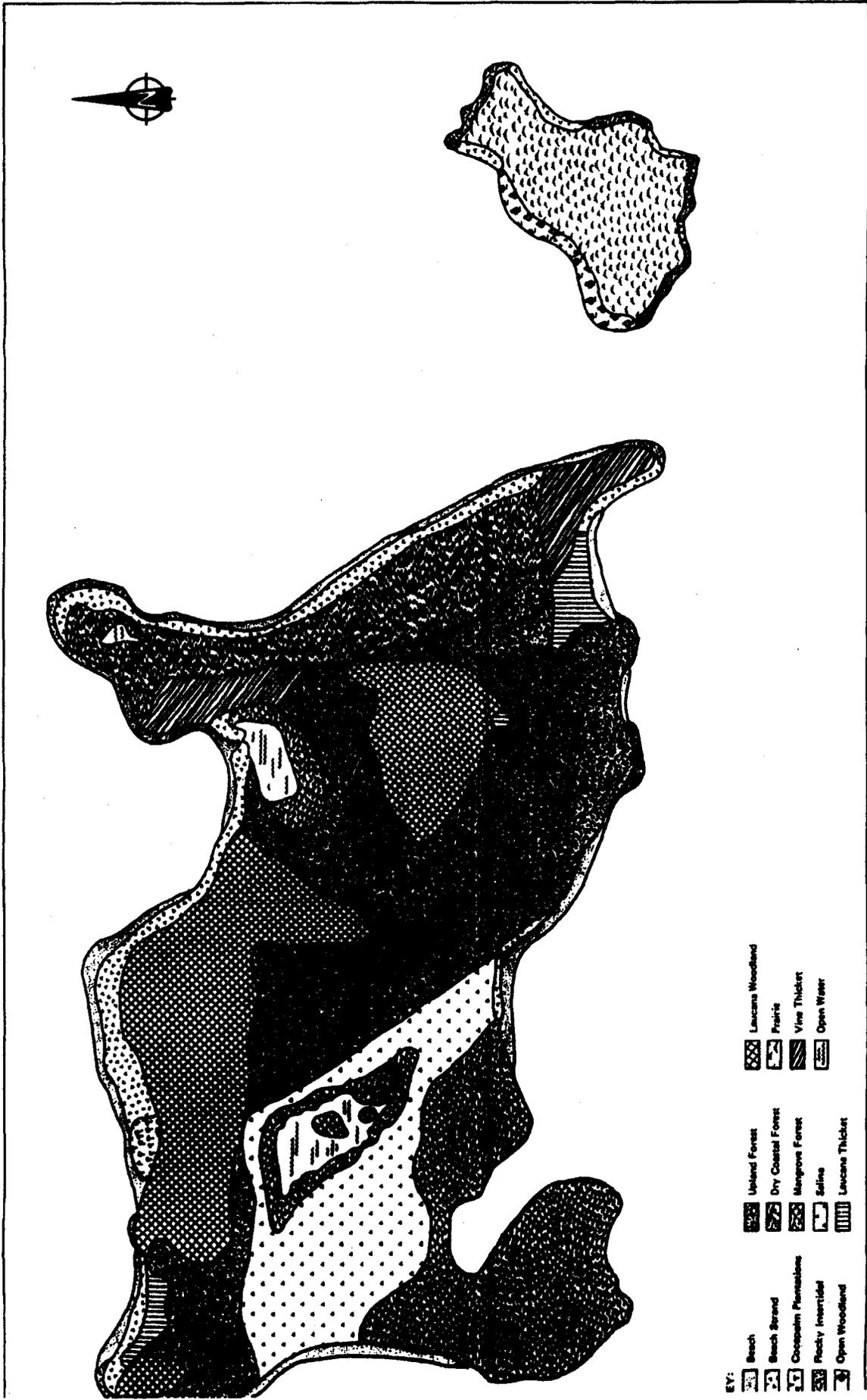
Boat strikes are a common cause of manatee mortality, especially in industrialized areas where there is heavy commercial vessel traffic.

The area around Pineros Island, because of its minimal recreational boat traffic, restricted waters, and extensive seagrass beds, does provide suitable habitat for manatees. Generally, manatees in the vicinity of NAVSTA Roosevelt Roads congregate in the southernmost cover of the naval station, especially in the vicinity of the Cape Hart Sewage Treatment Plant, where outfalls supply freshwater and seagrass beds are abundant. However, in a post-Hurricane Hugo study conducted by USFWS at NAVSTA Roosevelt Roads, including Vieques Island, an Antillean manatee was observed immediately to the south of Pineros (USFWS 1989). No manatees were observed in the vicinity of Pineros and Cabeza de Perro islands during any of the quarterly field surveys.

3.5 TERRESTRIAL VEGETATION

This section discusses the terrestrial vegetation types on Pineros and Cabeza de Perro islands. Methods used to characterize vegetation were interpretation of aerial photographs, review of published literature (Dansereau and Buell 1966; Pace and Vega 1989), interviews with regional scientists (Lioger 1989), and field studies conducted during 1989. Vegetation studies consisted of systematic walkover surveys of all vegetation units on Pineros and Cabeza de Perro islands, during which qualitative estimates were made of the composition and relative abundance of overstory and understory plant species and the presence and abundance of rare, threatened, or special concern plant species.

A preliminary vegetation cover type map was developed based on interpretation of aerial photographs. Vegetation community boundaries were checked and refined during vegetation surveys (see Figure 3-4). Species of vegetation were identified and their growth form was classified as tree, sapling, shrub, vine, or grass. These growth forms are defined in the key that accompanies Tables 3-4 through 3-9. Based on the surveys, all species of vegetation were categorized into qualitative abundance classes for both the overstory and understory



SCALE
0 315 630 1260 FEET

Figure 3-4 DISTRIBUTION OF VEGETATION TYPES ON PINEROS AND CABEZA DE FERRO ISLANDS

- EV:
- 1. Beach
 - 2. Beach Strand
 - 3. Coppain Palmshrub
 - 4. Rocky Intertidal
 - 5. Open Woodland
 - 6. Upland Forest
 - 7. Dry Coastal Forest
 - 8. Mangrove Forest
 - 9. Salina
 - 10. Leucana Thicket
 - 11. Leucana Woodland
 - 12. Prairie
 - 13. Vine Thicket
 - 14. Open Water

Table 3-4
 VEGETATION COMMUNITIES, BY ACREAGE, FOUND ON
 PINEROS AND CABEZA DE PERRO ISLANDS

Community Type	Pineros		Cabeza de Perro	
	Acres	Percent	Acres	Percent
Upland Forest	94.77	31	—	—
Mangroves	83.18	28	—	—
Leucana Woodland	47.86	15	—	—
Dry Coastal Forest	28.96	9	—	—
Beach Strand	15.64	5	1.77	6
Prairie	—	—	22.98	78
Open Woodland	—	—	2.58	8
Leucana Thicket	4.76	2	—	—
Beach	10.47	3	—	—
Cocopalms	0.95	<1	—	—
Vine Thicket	12.24	4	—	—
Rocky Intertidal	3.67	1	2.58	8
Open Water	7.48	2	—	—
TOTAL	309.98	100	29.91	100

Table 3-5

SPECIES COMPOSITION AND RELATIVE ABUNDANCE OF THE UPLAND
FOREST ASSOCIATION ON PINEROS ISLAND, PUERTO RICO

Scientific Name	Common Name	Abundance*		
		Over- story	Under- story	Stratum**
<u>Bussea simaruba</u>	Turpentine tree	A	U	T
<u>Maytenus cymosa</u>	—	C	C	T, Sa, Sh
<u>Cassine xylocarpa</u>	Marble tree	C	C	T, Sa, Sh
<u>Colubrina arboreascens</u>	Coffee colubrina	U	U	T, Sa
<u>Tabebuia heterophylla</u>	White cedar	U	P	T
<u>Cephalocereus royerii</u>	Pipe organ cactus	—	C	Sa
<u>Citharexylum fruticosum</u>	Pendula	U	C	T, Sa
<u>Krugiodendron ferreum</u>	Ironwood	—	C	Sh
<u>Coccoloba microstachya</u>	Uvarillo	P	C	T, Sa
<u>Pictetia aculeata</u>	Fustic	—	P	Sa
<u>Cordia rickseckeri</u>	Manjack	P	U	T, Sh
<u>Randia aculeata</u>	Tintillo	—	C	Sh
<u>Leslecia divaricata</u>	—	—	C	G
<u>Pithecellobium unguisatol</u>	Catclaw	—	U	Sh
<u>Eugenia illustrata</u>	Palo de mulata	—	C	Sh
<u>Comocladia dodonaea</u>	Chicharron	—	C	Sh
<u>Schaefferia frutescens</u>	Florida boxwood	—	C	Sh
<u>Casearia decandra</u>	Wild honey tree	—	P	Sa, Sh
<u>Bucida bucerus</u>	Ucar	P	P	T
<u>Guajira fragrans</u>	Black nampoo	—	U	Sa, Sh
<u>Eugenia foetida</u>	Boxleaf eugenia	—	U	Sh
<u>Margaritaria nobilis</u>	Millo	—	U	Sh
<u>Gymnanthes lucida</u>	Oysterwood	—	U	Sa, Sh
<u>Jacquinia arborea</u>	Barbasco	—	P	Sa, Sh
<u>Maytenus eliotica</u>	Cuero de sapo	—	P	—

*Key to Abundance Classes:

- A = Abundant
- C = Common
- P = Present
- U = Uncommon

**Key to Vegetation Strata:

- T = Tree - a woody plant 5 inches or greater in diameter at breast height and 20 feet or taller.
- Sa = Sapling - Woody vegetation between 0.4 and 5 inches in diameter at breast height and 20 feet or taller in height.
- Sh = Shrub - Woody vegetation usually greater than 3 feet but less than 20 feet tall, including multi-stemmed, bushy shrubs and small trees and saplings.
- V = Vine
- H = Nonwoody, herbaceous plants including grasses, forbs, and ferns.

Table 3-6

SPECIES COMPOSITION AND RELATIVE ABUNDANCE OF THE DRY
COASTAL FOREST ASSOCIATION ON PINEROS ISLAND, PUERTO RICO

Scientific Name	Common Name	Abundance*		
		Over- story	Under- story	Stratum**
<u>Cordia rickseckeri</u>	Manjack	P	C	T, Sa, Sh
<u>Capparis cynophallophora</u>	Jamaica caper	P	P	Sa, Sh
<u>Colubrina arborescens</u>	Coffee colubrina	P	P	T, Sa
<u>Plectis aculeata</u>	Fustic	P	P	T, Sa
<u>Plumeria alba</u>	Milktree	—	C	Sh
<u>Zanthoxylum monophyllum</u>	Yellow prickly	P	C	T, Sa
<u>Capparis hastata</u>	Burro	—	P	Sa, Sh
<u>Capparis flexuosa</u>	Limber caper	—	U	Sh
<u>Gymnada latifolia</u>	West Indian falsebox	P	P	Sa
<u>Jacquinia arbores</u>	Barbasco	U	C	Sa, Sh
<u>Caesalpinia divergens</u>	—	U	C	Sa, Sh
<u>Cephalocereus royeri</u>	Pipe organ cactus	—	C	Sa

*Key to Abundance Classes:

- A = Abundant
- C = Common
- P = Present
- U = Uncommon

**Key to Vegetation Strata:

- T = Tree - a woody plant 5 inches or greater in diameter at breast height and 20 feet or taller.
- Sa = Sapling - Woody vegetation between 0.4 and 5 inches in diameter at breast height and 20 feet or taller in height.
- Sh = Shrub - Woody vegetation usually greater than 3 feet but less than 20 feet tall, including multi-stemmed, bushy shrubs and small trees and saplings.
- V = Vine
- H = Nonwoody, herbaceous plants including grasses, forbs, and ferns.

Table 3-7

SPECIES COMPOSITION AND RELATIVE ABUNDANCE OF THE
LEUCANA-MIXED WOODLAND VEGETATION ASSOCIATION
ON PINEROS ISLAND, PUERTO RICO

Scientific Name	Common Name	Abundance*		
		Over- story	Under- story	Stratum**
<u>Leucaena leucocephala</u>	Leadtree	C	A	Sa, Sh
<u>Bursera simaruba</u>	Turpentine tree	P	—	Sa
<u>Maytenus cymosa</u>	—	P	P	Sa, Sh
<u>Albizia procera</u>	Albizia	—	—	Sa
<u>Acacia farnesiana</u>	Sweet acacia	P	P	Sa, Sh
<u>Randia aculeata</u>	Tintillo	—	C	Sh
<u>Lespedeza divaricata</u>		—	—	—

*Key to Abundance Classes:

- A = Abundant
- C = Common
- P = Present
- U = Uncommon

**Key to Vegetation Strata:

- T = Tree - a woody plant 5 inches or greater in diameter at breast height and 20 feet or taller.
- Sa = Sapling - Woody vegetation between 0.4 and 5 inches in diameter at breast height and 20 feet or taller in height.
- Sh = Shrub - Woody vegetation usually greater than 3 feet but less than 20 feet tall, including multi-stemmed, bushy shrubs and small trees and saplings.
- V = Vine
- H = Nonwoody, herbaceous plants including grasses, forbs, and ferns.

Table 3-8

SPECIES COMPOSITION AND RELATIVE ABUNDANCE OF THE
VINE-THICKET VEGETATION ASSOCIATION
ON PINEROS ISLAND, PUERTO RICO

Scientific Name	Common Name	Abundance*		
		Over- story	Under- story	Stratum**
<u>Schaefferia frutescens</u>	Florida boxwood	P	C	Sa
<u>Casearia decandra</u>	Wild honey tree	—	C	Sh
<u>Leucana leucocephala</u>	Lead tree	P	C	Sa, Sh
<u>Pavonia fruticosa</u>	—	—	C	Sa, Sh
<u>Gaspira fragrans</u>	Black mampoo	P	M	Sa, Sh
<u>Helicteres jamaicensis</u>	Conebush	—	P	Sh
<u>Jacquinia arbores</u>	Barbasco	—	M	Sa, Sh
<u>Randia aculeata</u>	Tintillo	—	C	Sh
<u>Merrilea quinquetolia</u>	—	P	A	V
<u>Galactia striata</u>	—	P	C	V
<u>Bourreria succulenta</u>	Pigeon berry	—	M	Sh
<u>Margaritaria nobilis</u>	Millo	—	P	Sh
<u>Capparis flexuosa</u>	Limber caper	—	P	Sh

*Key to Abundance Classes:

A = Abundant
C = Common
P = Present
U = Uncommon

**Key to Vegetation Strata:

T = Tree - a woody plant 5 inches or greater in diameter at breast height and 20 feet or taller.

Sa = Sapling - Woody vegetation between 0.4 and 5 inches in diameter at breast height and 20 feet or taller in height.

Sh = Shrub - Woody vegetation usually greater than 3 feet but less than 20 feet tall, including multi-stemmed, bushy shrubs and small trees and saplings.

V = Vine

H = Nonwoody, herbaceous plants including grasses, forbs, and ferns.

Table 3-9

SPECIES COMPOSITION AND RELATIVE ABUNDANCE OF THE
BEACH STRAND VEGETATION ASSOCIATION ON
PINEROS AND CABEZA DE PERRO ISLANDS, PUERTO RICO

Scientific Name	Common Name	Abundance*		
		Over- story	Under- story	Stratum**
<u>Coccoloba uvifera</u>	Seagrape	--	A	Sa, Sh
<u>Thespesia populnea</u>	Seaside mahoe	--	A	Sa, Sh
<u>Conocarpus erectus</u>	Buttonwood	--	C	Sh
<u>Casuarina equisetifolia</u>	Australian pine	U	--	T
<u>Caesalpinia divergens</u>		--	P	V
<u>Canavalia rosea (maritima)</u>	Seaside bean	--	U	V
<u>Cocos nucifera</u>	Coconut	P	U	T
<u>Molletonia gnaphalodes</u>	Sea lavender	--	P	H
<u>Sesuvium portulacastrum</u>	Sea purslane	--	C	Sh
<u>Ipomoea pes capre</u>	Beach morning glory	--	P	V
<u>Batis maritima</u>	Saltwort	--	P	Sh
<u>Hymenocallis latifolia</u>	Spider lily	--	U	H
<u>Paspalum distichum</u>	Seashore paspalum	--	P	H
<u>Opuntia rubescens</u>	Prickly pear cactus	--	P	Sh
<u>Cephalocereus rosenii</u>	Pipe organ cactus	--	C	Sh

*Key to Abundance Classes:

A = Abundant
C = Common
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**Key to Vegetation Strata:

T = Tree - a woody plant 5 inches or greater in diameter at breast height and 20 feet or taller.

Sa = Sapling - Woody vegetation between 0.4 and 5 inches in diameter at breast height and 20 feet or taller in height.

Sh = Shrub - Woody vegetation usually greater than 3 feet but less than 20 feet tall, including multi-stemmed, bushy shrubs and small trees and saplings.

V = Vine

H = Nonwoody, herbaceous plants including grasses, forbs, and ferns.

strata. These abundance classes were abundant, common, present, and uncommon.

Hurricane Hugo severely impacted the terrestrial vegetation of Pineros Island. The prairie vegetation of Cabeza de Perro remains fairly intact. The primary effect on Pineros was a drastic change to the structure of the vegetation communities on the island. Almost every large tree was snapped at a height of 10 to 20 feet or uprooted completely by the high winds. Vegetation was stripped bare of small branches and leaves. The result of the initial changes--the partial or total removal of any canopy that previously existed--was to stimulate the rapid growth of understory species. The proliferation of understory shrubs, saplings, and vines, as well as the large amount of debris deposited in the understory by the high winds, has created an extremely dense, almost impenetrable understory. The canopy is recovering fairly rapidly, but remains open and fragmented.

Species composition in the vegetation communities was altered very little; the majority of understory growth consists of new sprouts of existing species. The only changes observed in community composition were small and highly localized, occurring where disturbance species such as sweet acacia (Acacia farnesiana) and lead tree (Leucana leucocephala) colonized exposed areas left by fallen trees. Because the terrestrial vegetation impacted by Hurricane Hugo is rapidly recovering, it is likely that conditions on the islands several years from now will approximate those found prior to the hurricane (Villella 1989). As a result, the following section describes the vegetation types found on Pineros and Cabeza de Perro islands as they existed before Hurricane Hugo.

3.5.1 Description of Existing Vegetation Types

Pineros Island

Eight vegetation cover types are found on Pineros Island: upland forest, dry coastal forest, Leucana woodland, Leucana thicket, mangrove forest (includes salina), vine thicket, beach strand, and cocopalms plantation. The distribution of these cover types is shown in Figure 3-4. Table 3-4 lists the amount and percentage of each vegetation type.

The abundance of each species within each cover type is listed in Tables 3-5 through 3-9.

Upland forest, found on approximately 95 acres (31%), is the most common vegetation type on Pineros. It is most common in the central portion of the island, especially on relatively steep (greater than 15%) slopes where historical disturbances to vegetation were minimal, as discussed later in this section.

A list of species found in upland forest on Pineros is presented in Table 3-5. Dominant overstory tree species are Bursera simaruba, Cassine xylocarpa, and Maytenus cymosa. Associates include Coccoloba microstachya and Cordia rickseckeri. Species that are common in the understory sapling and shrub layers are M. cymosa, C. xylocarpa, Citharexylum fruticosum, Krugiodendron ferreum, Lasiacis divaricata, Eugenia ligustrina, and Schaefferia frutescens.

The structure of the upland forest varies from an open to moderately open understory, with comparatively dense overstory canopy closure. The height of the predominant canopy is 40 to 45 feet. However, Bursera simaruba, which is structurally the dominant tree in the upland forest, commonly contributes a supracanopy at heights of 50 feet or more.

Coastal dry forest is found on approximately 29 acres, or 9%, of Pineros Island. It is found along the windswept eastern coast of the island to an elevation of approximately 60 feet above MSL. Common species are Cordia rickseckeri, Plumeria alba, Zanthoxylum monophyllum, Jaquinia arborea, and Caesalpinia divergens. The pipe organ cactus, Cephalocereus royenii, is a common associate. A list of species identified in this vegetation type is found in Table 3-6.

The structure of the dry coastal forest is characterized by an open understory and a dense overstory canopy. The height of the canopy is approximately 20 to 25 feet.

Leucana woodland and Leucana thicket are found on approximately 48 acres (15%) and 5 acres (2%), respectively. These vegetation types are found in areas that have been, and in some cases continue to be, disturbed by clearing activities, primarily in the north-central and southeast portions of Pineros (see Figure 3-4).

The predominant species in these areas is Leucana leucocephala, which is an indicator of disturbance (Dansereau and Buell 1966). Leucana thickets are found primarily in areas that are continuing to be disturbed, such as the small armor range. The vegetation is comprised almost exclusively of dense growths of L. leucocephala, which has grown to a height of approximately 5 to 7 feet.

Leucana woodlands are found in the areas that were cleared in the early 1940s. L. leucocephala is the most abundant species in these areas. Common associates include Albizia procera, Bursera simaruba, Maytenus cymosa, and Acacia farnesiana. The thorn scrub Randia aculeata is common in the shrub layer. Table 3-7 lists species and relative abundance within Leucana woodlands.

The canopy, dominated by L. leucocephala, ranges in height from 20 to 25 feet. Bursera simaruba and M. cymosa are apparently beginning to overtop L. leucocephala, which, at 25 feet, is reaching its upper limit of growth (Little and Wadsworth 1964). The structure of the Leucana woodland is characterized by a moderately dense to dense growth throughout the understory and canopy.

The mangrove forests are composed of all, or a combination of, red mangrove (Rhizophora mangle), white mangrove (Laguncularia racemosa), black mangrove (Avicennia germinans), and button mangrove (Conocarpus erectus). The greatest expanse of mangrove is located in the southwest quarter of Píneros Island. Additional areas of mangrove are located around the two brackish lagoons in the northeast section of the island. Mangroves, which cover 83 acres (28%) of Píneros, are discussed in detail in Section 3.5.2.

The vine-thicket vegetation-type consists of previously disturbed areas where saplings and woody vines predominate, contributing to a dense "jungle" community. Vine-thicket-type vegetation is found on approximately 12 acres (4%) of Píneros, primarily in the southeastern portion of the island. Common sapling and shrub species include Schaefferia frutescens, Casearia decandra, Leucana leucocephala, and Pavonia fruticosa. Abundant vines include Merrimeea quinquefolia and Galactia striata. The thorn scrub Randia aculeata is also common. Plant species found in the vine thickets are listed in Table 3-8.

The structure of the vine-thicket vegetation-type is characterized by very dense understory and canopy density to an average canopy height of 25 to 30 feet. Vines are present from the ground to the canopy.

Beach strand and beach scrub vegetation covers approximately 16 acres (5%) of Pineros Island. This vegetation type is found, to varying extents, wherever a sand beach fringe exists around the island. It is not found on the southeast coast, where red mangroves face the sea, and at various points around Pineros where rocky headlands meet the sea.

The dominant species in the beach strand association are seaside mahoe (Thespesia populnea), sea grape (Coccoloba uvifera), and button mangrove (Conocarpus erectus). Cactus, especially prickly pear (Opuntia rubescens) and pipe organ (Cephalocereus royanii), are common associates on the dry, east-facing shoreline. Other common species include sea purslane (Sessuvium portulacastrum), beach morning glory (Ipomoea pescapne), and sea lavender (Millotonia gnaphalodes) (see Table 3-9).

Cocopalms (Cocos nucifera) plantation covers approximately 0.95 acre (<1%) of Pineros and is located entirely in a single pocket along the western portion of the north coast. Cocopalms dominates the shrub, sapling, and overstory layers. The canopy is dense and reaches a height of 30 to 40 feet. The understory is moderately open. This area was likely planted with cocopalms by humans at some time during its history to serve as a food source and has since perpetuated through natural reproduction.

Cabeza de Perro

Only three vegetation types are found on Cabeza de Perro: prairie, open woodland, and beach strand. The distribution of these cover-types is shown in Figure 3-4, and the abundance of each is listed in Table 3-4.

Prairie is found on approximately 23 acres (78%) of Cabeza de Perro. Vegetation is comprised of dense grasses to a height of 1.5 meters.

Beach strand is found on approximately 2 acres (6%) of Cabeza de Perro. It is much less extensive on Cabeza de Perro than on Pineros, however, because much of Cabeza de Perro is surrounded by rocky shores and headlands.

The species composition of the beach strand community is similar to that described for Pineros Island. Several species were found in the beach strand of Cabeza de Perro that were not found on Pineros. These include Caribbean sedge (Cyperus lingularis) and barrel cactus (Fimbristylis spadicea), both of which were relatively common.

Open woodland is found on approximately 3 acres (8%) of Cabeza de Perro. Its distribution is limited to the leeward-facing slopes on the west side of the island. Species found within the open woodland include Leucana leucocephala, Bursera simaruba, Carsine xylocarpa, and Maytenus cymosa.

3.5.2 Mangroves

In an effort to evaluate the potential impacts of naval training activities on the mangrove resources of Pineros Island, a reconnaissance-level field investigation was conducted from January 16 through 18, 1989. Specific tasks during the investigation included:

- o Determination of mangrove distribution, species composition, and zonation;
- o Identification of associated plant communities;
- o Qualitative evaluation of overall condition and vigor;
- o Identification of past areas of disturbance;
- o Assessment of natural forces controlling and influencing the condition of the mangroves;
- o Identification of wildlife species, with special emphasis on the endangered yellow-shouldered blackbird (Agelaius xanthomus) and waterfowl.

Mangrove forests are important systems in terms of primary production, support of a detrital food web, and fish and wildlife habitat. All of Pineros and Cabeza de Perro islands are identified as yellow-shouldered blackbird feeding and nesting areas (USFWS 1983). More recently (1988), the USFWS has identified the mangroves of Pineros Island as an important nocturnal roosting area for the yellow-shouldered blackbird.

The mangrove resources of Pineros are concentrated in three discrete lagoonal complexes, designated as Lagoons 1, 2, and 3 (Figure 3-5). The areal extent of each dominant mangrove species, by physiognomic forest type and for each lagoon complex, is presented in Table 3-10. Generally, each system features an open-water lagoon surrounded by a red mangrove (Rhizophora mangle) fringe forest set within a larger basin forest dominated by black mangroves (Avicennia germinans). This basin forest generally abuts the terrestrial lowland forest that dominates the island's vegetative cover, or it grades into a complex assemblage characterized as a beach ridge (back beach)/buttonwood scrub community. Dominant members of the latter community include buttonwood (Conocarpus erectus), seagrape (Coccoloba uvifera), and joewood (Jacquinia arborea), as well as decumbent halophytic succulents typified by sea purslane (Sesuvium portulacastrum), and beach creeper (Ernodia littoralis), and erect salt-tolerant grasses including seashore dropseed (Sporobolus virginicus) and hurricanegrass (Fimbristylis spathacea). White mangroves (Laguncularia racemosa) are also present in this community, as well as in other mangrove forest types; however, no extensive stands of large white mangrove trees were encountered during this survey. Buttonwood was typically encountered at the seaward edge of the beach ridge communities where they exist around the island.

The most extensive mangrove system on Pineros Island is the Lagoon 1 complex and associated red mangrove fringe forest located in the southwestern quadrant of the island (Figure 3-5). The open water area of Lagoon 1 is approximately 5 acres and contains approximately 0.5 acre of seagrass--exclusively widgeon grass, Ruppia maritima -- located to the north of the central red mangrove island. The 5-acre lagoon is surrounded by a 7.47-acre lagoonal fringe of red mangroves with canopy height to approximately 20 meters. Prop root structures of these mangroves are from 3 to 5 meters above the water surface, and their diameters at breast height (DBH) are up to 25 cm. Seedling recruitment was exclusively red mangrove and most abundant toward the landward edge of the red mangrove lagoon fringe.

To the north and east of Lagoon 1, the red mangrove fringe undergoes a rapid transition into a 30-meter-wide zone of black mangroves and then terrestrial lowland forest in response to rapid elevation increase.

Table 3-10

PINEROS ISLAND, AREAL CALCULATION OF MANGROVE
FORESTS AND ASSOCIATED COMMUNITIES

	L-1*	L-2	L-3	Total (acres)	(Percent)**
WATERSHED	47.14	41.12	4.57	92.83	[29]
MANGROVE:					
<u>Rhizophora</u>					
Fringe Forest	40.29	--	--	40.29	
Lagoonal Fringe	<u>7.47</u>	<u>1.04</u>	<u>--</u>	<u>8.51</u>	
TOTAL	47.76	1.04	--	48.80	[15]
<u>Avicennia</u>					
Basin Forest	26.17	3.32	--	29.49	
Lagoonal Fringe	<u>--</u>	<u>--</u>	<u>1.04</u>	<u>1.04</u>	
TOTAL	26.17	3.32	1.04	30.53	[10]
<u>Conocarpus</u>					
Buttonwood Scrub	4.15	--	--	4.15	
Buttonwood Forest	<u>--</u>	<u>--</u>	<u>0.21</u>	<u>0.21</u>	
TOTAL	4.15	--	0.21	4.36	[2]
Mangrove Forest Total	78.08	4.36	1.25	83.69	
LAGOON:					
Open Water	4.48	1.90	0.62	7.50	
<u>Ruppia maritima</u>	<u>0.5***</u>	<u>0.60</u>	<u>--</u>	<u>0.60</u>	
MANGROVE + LAGOON TOTAL	83.06	6.86	1.87	91.79	[29]
(Percent)	[26]	[2]	[<1]	[29]	
BEACH RIDGE:					
Beach Ridge	3.32	--	--	3.32	
Ridge/Buttonwood Scrub	3.12	--	--	3.12	
Ridge/Buttonwood	--	0.83	--	0.83	
Ridge/Mixed Forest	3.74	--	--	3.74	
Buttonwood/Beach Ridge	3.53	--	1.45	4.98	
Beach	<u>2.29</u>	<u>1.66</u>	<u>0.21</u>	<u>4.16</u>	
Beach Ridge Total	16.00	2.49	1.66	20.15	
MANGROVE, LAGOON, + BEACH RIDGE TOTAL	99.06	9.35	3.53	111.94	

*L-1 = Lagoon 1; L-2 = Lagoon 2; L-3 = Lagoon 3

**Percentages shown are based on total area of Pineros Island: 316.7 acres

***Field-verified estimate; not based on photointerpretation.

To the west and southeast of Lagoon 1 is an expansive basin forest dominated by black mangroves, with canopy height to 15 meters and DBH of 50 cm. Central portions of this basin forest are completely covered by a mat of black mangrove pneumatophores. Slightly higher elevations within this forest are dominated by a lush cover of saltwort (Batis maritima). This basin forest is separated from an extensive red mangrove fringing forest to the southwest by a complex assemblage of buttonwood scrub/beach ridge community species. This type of habitat has been considered extremely important to the yellow-shouldered black-bird for forage and nesting area (Post and Wiley 1976, in Furniss 1983).

The fringing forest on the southwest corner of the island represents the largest single mangrove resource on the island. This forest is approximately 40 acres in size and represents a nearly monospecific stand of red mangroves. Canopy height is approximately 8 to 10 meters near the west edge and decreases abruptly to 5 meters approximately 100 meters to the east of the western border. Tree density increases and becomes impenetrable toward the center of this forest.

Lagoon 1 receives upland runoff from a contributing watershed to the north and east. The watershed area is 47 acres, approximately half of the size of the mangrove complex receiving area (Figure 3-6). Important factors influencing the Lagoon 1 complex are water quality and quantity received from the upland watershed, and tidal inundation. No distinct tidal connection (i.e., a ditch or creek) occurs between Lagoon 1 and the surrounding sea.

The hydrodynamics of the Lagoon 1 complex are extremely interesting. The beach ridge/buttonwood scrub community exists at an apparently higher elevation than the basin forest surrounding Lagoon 1 and the red mangrove fringing forest to the southwest. The berm of coarser grain sediments supporting the beach ridge/buttonwood scrub community effectively isolates the Lagoon 1 complex from direct daily tidal inundation. Regular exchange of water may occur in the organic substrates of each forest and below the surface of the beach ridge berm. This berm is probably overtopped during storm events and spring tides, although this was not observed.

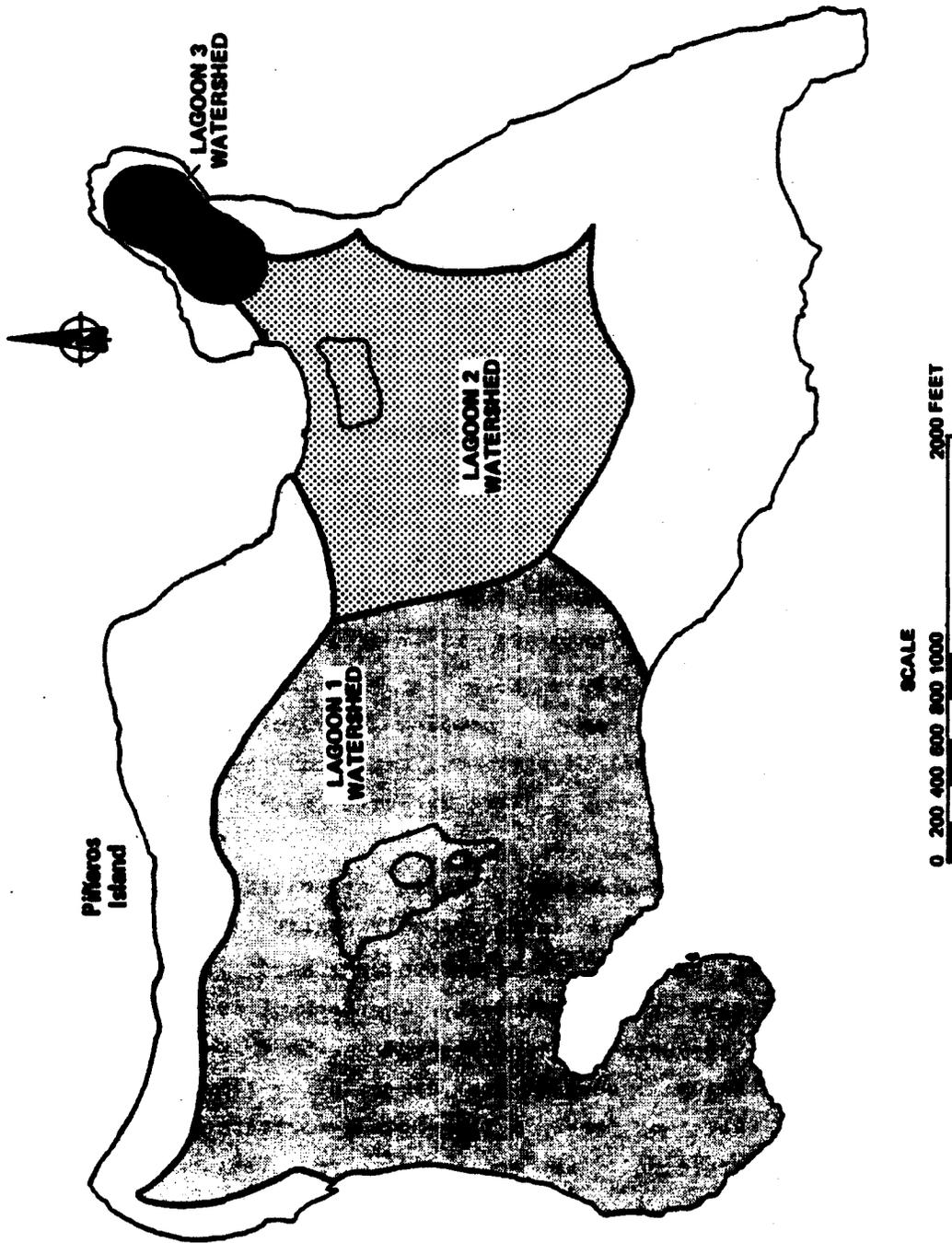


Figure 3-6 WATERSHEDS OF LAGOONS 1, 2, AND 3 ON PIÑEROS ISLAND

The origin of this beach ridge berm is also of interest. The coarse material of which it is composed has apparently been transported through the mangrove forest from an erosional headland at the south central portion of the island by extreme storm events (hurricanes). This type of system and transport of material through mangrove forests have been documented by Jennings and Coventry (1973) and Woodroffe (1982, 1983).

If these forces continue to act upon the lagoon complex, it is possible that, through further deposition of material, Lagoon 1 could become less frequently inundated with saltwater. This could lead to changes in the plant communities. Furthermore, longshore transport to the west from the erosional headland could eventually lead to the isolation or ephemeral inundation of the open water contained within the southwest fringing forest, resulting in a new lagoon similar in configuration to Lagoon 2.

Application of the understanding of these natural forces acting on the island may allow determination of historical shorelines. It is possible that the historical shorelines of the southwest portion of the island approximated the location of the existing five-foot topographic contour interval and extended north and east of the current Lagoon 1 complex. Further investigations would be necessary to substantiate this.

Qualitatively evaluated, the relative health and vigor of the mangrove complexes associated with Lagoon 1 are excellent. The only evidence of human disturbance encountered was the presence of small parachutes used to slow the descent of flares, and a small foot trail north and east of the lagoon.

The Lagoon 2 complex is a classic example of an ephemeral lagoon. The natural tidal connection to the sea is open only periodically, usually in response to storm events. During most of the year, the natural tidal channel is closed by accumulation of sand derived from longshore movements. During extremely high tides, wind-delivered waves, or large amounts of rainfall, the accumulation of driven sand is washed from the tidal connection (pop-off) and free exchange occurs. As conditions quiesce, sand is again accumulated and the tidal channel is closed.

This cycle is the most important natural phenomenon influencing the condition of Lagoon 2. It is important to note that structures erected on the sand in the natural tidal connection (pop-off) are likely to be lost during storm events. More important to the condition of the lagoon is the fact that erection of permanent structures (i.e., foundations) or hardening of shorelines in this area may interrupt the cyclic exchange of water necessary to promote a healthy lagoon. Placement of such structures in this area should be discouraged. It should be noted that during the field investigation, several non-permanent structures (ply-wood hooches) were seen in this area. While this type of structure is unlikely to interfere with tidal exchange, they may be lost to the sea or carried into the lagoon interior, neither of which would be a desirable alternative.

The open water area of Lagoon 2 is approximately 2.5 acres, of which 0.6 acre of bottom is covered by a dense growth of widgeon grass. This lagoon is surrounded by a one-acre fringe forest dominated by red mangroves. These trees are approximately 10 meters tall and have DBHs to 25 cm. Several large white mangroves surrounding the lagoon margin have developed adventitious root structures to 30 cm above the existing water level. A 3.3-acre basin forest surrounds the red mangrove fringe. The basin forest is dominated by black mangroves 8 to 10 meters tall, with DBHs to 45 cm. The south and southeastern extent of this basin forest and adjacent upland ecotone exhibited the greatest extent of human disturbance. Many large black mangroves displayed a high level of damage, apparently from chronic small-arms fire. Several large, dead red mangroves were present along the lagoon margin in this vicinity. However, no apparent cause of mortality was immediately discernible, and no recent damage to the red mangrove forest was obvious.

Lagoon 2 is an extremely productive lagoon. The expansive seagrass beds within the lagoon provide a lush refuge for juvenile fishes and forage area for ducks. A duck nest was discovered immediately east of the tidal pop-off to the lagoon. Nests with eggs, possibly those of the white-cheeked pintail (Anas bahamensis), were located in a dense stand of Sporobolus virginicus. The large watershed area, 41.12 acres, in comparison with the relatively small size of the lagoonal complex receiving body, 9.35 acres, also enhances the productivity of the system.

Lagoon 3 has an open water area of 0.62 acre. No submerged vegetation exists in this lagoon. Dead tree stumps in the center of the lagoon indicate that this lagoon is probably the result of a drowned basin forest, as does the dominance of black mangroves in the fringe community of approximately one acre. A natural tidal pop-off exists through the beach berm to the east, but apparently it has not been active in a long time due to the thick growth of seagrape and halophytic succulents growing at excessive elevation. The absence of coarse, unvegetated sand suggests that seawater exchange occurs less frequently than at Lagoon 2 and only during extreme storm events (major hurricanes). The bottom sediments of the open water lagoon are high in clays and terrigenous in origin. The watershed (4.57 acres) is only slightly larger than the lagoonal complex receiving body. The soils are extremely erosive and located on steep slopes. A ditch, apparently manmade, is located on the western side of the lagoon and may have provided some historical tidal connection. However, the seaward extent of this ditch has been blocked by a coral rubble beach berm (rampart) and is also inundated only during large storms. This ditch was the only evidence of human disturbance in the Lagoon 3 area.

The red mangrove fringe forests and black mangrove basin forests on Pineros Island were the vegetation types most severely impacted by Hurricane Hugo. The unstable nature of the tidal swamp soils found in these areas allowed a large proportion of the mangroves to be uprooted by the heavy winds. The larger individual trees were either snapped at about 20 feet or felled entirely. These forests have also been slower to recover than the upland forests. Considerably fewer new shoots and leaves have formed since the hurricane than are evident in the upland vegetation communities.

Of the three lagoons on Pineros, the red mangroves of Lagoon 1 experienced the most destruction. The comparatively small mangrove forest areas of lagoons 2 and 3 were not disturbed as much as the red mangroves on the southwest portion of the island. While the mangrove forests and salinas in this area were the most heavily used wildlife habitat during the first three quarterly surveys, no wildlife was observed on Lagoon 1 or in the surrounding forests and salinas during the December survey. The water of Lagoon 1 had turned red in color,

likely as a result of tannins leaching into the water from dead red mangrove roots and stems. These tannins have the potential to cause large-scale die-offs of the small food organisms found in the water and sediments of Lagoon 1, resulting in the abandonment of this lagoon by bird species which feed on these organisms. Lagoons 2 and 3 were both being used by waterfowl and wading birds during the December survey.

Hurricane Hugo did not destroy any of the berms isolating the Pineros Island lagoons from the ocean, and each remains hydrologically intact. This will permit the lagoons to revert to their previous condition within several years (Villegla 1989).

3.5.3 Threatened and Endangered Species

Specific vegetation surveys were conducted on Pineros and Cabeza de Perro islands to document the occurrence and distribution of rare plant species. Three plant species that are categorized as species of special concern by the Puerto Rico Natural Heritage Program were listed as occurring on Pineros: Maytenus cymosa, Malphigia linearis (Stinging-bush) and Ziziphus rignonii.

Maytenus cymosa is widely distributed on Pineros Island within the upland forest, dry coastal forest, and in the Leucana-mixed woodland. It is especially abundant on the east-facing slope of the highest hill on Pineros and in forested areas of the northwest portion of Pineros.

Ziziphus rignonii and Malphigia linearis were not located on either Pineros or Cabeza de Perro islands during the quarterly field surveys.

3.6 WILDLIFE RESOURCES

This section describes existing wildlife species composition and abundance and existing and potential habitat suitability. Information was compiled from published and unpublished literature, interviews with knowledgeable experts, and from field surveys. Field survey work concentrated on threatened, endangered, and rare species.

Field surveys were designed to census wildlife species of concern during key phases of their breeding and wintering seasons. The primary objectives of the wildlife surveys were to:

- o Determine the location, type, and extent of habitat used by the yellow-shouldered blackbird, a species on the USFWS Threatened and Endangered Species list;

- o Determine the extent of waterfowl use of the three brackish lagoons on Pineros Island. In particular, determine the extent of use by the white-cheeked pintail and the ruddy duck, both of which are candidate species for listing on the USFWS Threatened and Endangered Species list;
- o Determine if either the Virgin Islands tree boa or the Puerto Rican boa exist on either Pineros or Cabeza de Perro Island; and
- o Evaluate the suitability of beaches on Pineros Island as turtle nesting habitat.

In addition to these objectives, surveys were also conducted to identify bird, mammal, and reptile species present on the two islands. Four one-week surveys were completed during 1989. Table 3-11 lists the dates of the wildlife surveys and the specific species surveyed. Specific methods used to survey the various species of wildlife are described in the appropriate subsections that follow for each species or species group.

The destruction and alteration of habitat by Hurricane Hugo has caused drastic changes in the wildlife community of Pineros Island. The diversity and abundance of birds on the island has decreased dramatically. Many species formerly common to Pineros were absent during the December survey, and only a few individuals of the remaining species were observed. The number of both ground and tree lizards also declined, but not as dramatically as did the number of birds. The absence of a variety of bird species and low density of birds is likely only a temporary effect of the hurricane. Vegetation is quickly reverting to its previous condition, and the proximity of the Puerto Rican mainland will facilitate rapid recolonization by bird species. Because the islands are expected to revert to pre-hurricane conditions within several years, the wildlife communities of the islands are described in the following sections as they existed prior to Hurricane Hugo.

3.6.1 General Wildlife Distribution

Because of the history of naval use, there is little existing information on the general diversity and relative abundance of wildlife

Table 3-11

WILDLIFE SURVEYS CONDUCTED DURING EACH 1989 QUARTERLY SURVEY
FOR ENVIRONMENTAL ASSESSMENT

Activity	January 11 - 20	April 3 - 7	June 5 - 9	December 4 - 8
Yellow-shouldered Blackbird Roosting Surveys	X	--	--	X
Yellow-shouldered Blackbird Breeding Surveys	--	X	X	--
Waterfowl Surveys In Lagoons - Wintering	X	X	--	X
Waterfowl Surveys In Lagoons - Breeding	--	X	X	--
Boa Surveys	--	--	--	X
Turtle Nesting Beach Suitability	X	--	--	X
General Songbird Censuses	X	X	X	X
Shorebird Census	X	X	--	--
General Surveys of Reptiles and Mammals	X	X	X	X

Key:

X = Conducted
-- = Not conducted

species found on Pineros and Cabeza de Perro islands. No specific field surveys were conducted for species that were not rare, threatened, or endangered. However, observations of any wildlife species encountered on the islands during the 4.5 weeks of fieldwork in 1989 were recorded (see Figure 3-3). Birds and reptiles were censused during the specific surveys completed for the yellow-shouldered blackbird, waterfowl, and vegetation. Information recorded included location, habitat, activity, and general abundance. Species abundance is discussed relatively in text as follows in decreasing magnitudes of abundance: very abundant, abundant, common, uncommon, or very uncommon.

3.6.1.1 Birds

Birds are the most abundant and diverse group of vertebrates on both Pineros and Cabeza de Perro islands. Approximately thirty-eight species of birds were recorded on or around the islands during field surveys, all of which were recorded on Pineros and only six of which were sighted on Cabeza de Perro. The birds can be categorized into broad associations based on general habitat preferences: seabirds, wading birds, shorebirds, waterfowl, raptors, non-passerine terrestrial birds, and passerines. A list of bird species found on Pineros and Cabeza de Perro islands, the habitat in which they were found, and date on which they were observed is found in Table 3-12.

The habitat type that supported the greatest diversity and abundance of birds was the mangrove-lagoon system, which included brackish lagoons, mangrove forest, and salinas. This habitat, which was not found on Cabeza de Perro, supported 20 of the 38 species of birds observed on Pineros Island. Upland forest habitat supported the second greatest diversity of birds; 11 species were found here. The most depauperate habitat type was the coastal dry forest on Pineros, which supported only one species.

Seabirds

Five species of seabirds were observed on or within 100 yards of Pineros and Cabeza de Perro islands, including the brown pelican, brown booby, magnificent frigatebird, and the common and roseate terns. These birds utilize the rocky shores, cliffs, the sea-faring edge of the

Table 3-12

BIRD SPECIES OBSERVED DURING 1969 FIELDWORK ON
PINEROS AND CABEZA DE PERRO ISLANDS

Bird Species	Island*	Habitat**	Breeding (B) or Wintering (W)	Date Observed			
				Jan. 12-17	April 3-7	June 5-9	Dec. 4-8
<u>Seabirds</u>							
Brown pelican (<u>Pelecanus occidentalis</u>)	P,C	RI,M	B	X	X	X	X
Common tern (<u>Sterna hirundo</u>)	P	P	B	X			
Roseate tern (<u>Sterna dougallii</u>)	P	P	B	X			
Brown booby (<u>Sula leucogaster</u>)	P,C	P	B	X	X	X	X
Magnificent frigatebird (<u>Fregata magnificens</u>)	P,C	P	B	X	X	X	X
<u>Wading Birds</u>							
Great egret (<u>Casmerodius albus</u>)	P	BL,BS	B	X	X	X	X
Great blue heron (<u>Ardea herodias</u>)	P	BL,BS	B	X	X		X
Louisiana heron (<u>Hydranassa tricolor</u>)	P	BL,BS	B	X	X	X	X
Green heron (<u>Butorides striatus</u>)	P	BL	B	X	X	X	
Yellow-crowned night heron (<u>Nyctanassa violacea</u>)	P	BL	B			X	
<u>Shorebirds</u>							
Spotted sandpiper (<u>Actitis macularia</u>)	P	BS,BL	W	X	X		
Greater yellowlegs (<u>Tringa melanoleuca</u>)	P	BL,BS	W	X	X		X
Black-necked stilt (<u>Himantopus mexicanus</u>)	P	BL	B	X	X	X	X
Ruddy turnstone (<u>Arenaria interpres</u>)	P	BS	W	X			
Semipalmated plover (<u>Charadrius semipalmatus</u>)	P	BS	W	X		X	
Wilson's plover (<u>Charadrius wilsonia</u>)	P	BS,BL	B	X	X		X
American oystercatcher (<u>Haematopus palliatus</u>)	P	RI	W		X		X

Table 3-12 (Cont.)

Bird Species	Island*	Habitat**	Breeding (B) or Wintering (W)	Date Observed			
				Jan. 12-17	April 3-7	June 5-9	Dec. 4-8
<u>Waterfowl and Miscellaneous Swimming Birds</u>							
White-cheeked pintail (<u>Anas bahamensis</u>)	P	BL	B	X	X	X	X
Blue-winged teal (<u>Anas discors</u>)	P	BL	W	X			
West Indian whistling duck (<u>Dendrocygna arborea</u>)	P	BL	B	X			
Pied-billed grebe (<u>Podilymbus podiceps</u>)	P	BL	B	X			
Common gallinule (<u>Gallinula chloropus</u>)	P	BL	B	X	X	X	
American coot (<u>Fulica americana</u>)	P	BL	B	X	X	X	
<u>Birds of Prey</u>							
Marsh hawk (<u>Circus cyaneus</u>)	P	UF	W	X			
Red-tailed hawk (<u>Buteo jamaicensis</u>)	P	UF	B	X	X	X	X
Osprey (<u>Pandion haliaetus</u>)	P	P	W	X			
Belted kingfisher (<u>Halcyon alcyon</u>)	P	BL	W				X
<u>Non-passerine Land Birds</u>							
Smooth-billed ani (<u>Crotophaga ani</u>)	P,C	UF,P	B		X	X	X
White-winged dove (<u>Zenaidura macroura</u>)	P	S,RI	B		X	X	
Zenaida dove (<u>Zenaidura macroura</u>)	P,C	S,RI	B		X	X	X
White-crowned pigeon (<u>Columba leucocephala</u>)	P	S,M	B			X	
Antillean crested hummingbird (<u>Orthorhynchus cristatus</u>)	P	UF,S	B		X	X	
Green-throated carib (<u>Sericornis holosericeus</u>)	P	UF,LW	B		X	X	
<u>Passerines</u>							
Pearly-eyed thrasher (<u>Margarops fuscatus</u>)	P,C	UF,VT,LW,CF	B	X	X	X	X
Gray kingbird (<u>Tyrannus dominicensis</u>)	P,C	S,UF,BS	B	X	X	X	X
Yellow warbler (<u>Dendroica petechia</u>)	P	S,LW,UF	B	X	X	X	X
Bananaquit (<u>Coereba flaveola</u>)	P	LW,UF	B		X		X

Table 3-12 (Cont.)

Bird Species	Island*	Habitat**	Breeding (B) or Wintering (W)	Date Observed			
				Jan. 12-17	April 3-7	June 5-9	Dec. 4-8
<u>Passerines (cont.)</u>							
Palm warbler (<u>Dendroica palmarum</u>)	P	BS	W				X
Cape May warbler (<u>Dendroica tigrina</u>)	P	S	W		X		
Louisiana waterthrush (<u>Seiurus motacilla</u>)	P	BL,BS	W	X	X		
Caribbean Elaenia (<u>Elaenia martinica</u>)	P	S	B		X	X	
Black-faced grassquit (<u>Tiavia bicolor</u>)	P	UF,LW	B			X	

*Island: P = Pinaeros, C = Cabeza de Ferro

**Key to Habitats:

RI = Rocky Intertidal

M = Mangrove

P = Pelagic (waters within 100 yards of the Islands)

BL = Brackish lagoons

BS = Beach and beach strand

UF = Upland forest

P = Prairie

S = Salina

LW = Leucana woodland

VT = Vine thicket

mangrove swamp, and the small cay south of Pineros, La Pinerita. None of these species were observed breeding during the quarterly field surveys.

Brown pelicans were the most conspicuous and abundant seabird on Pineros and Cabeza de Perro. They were commonly observed roosting on the southeast-facing cliff on Cabeza de Perro and in mangroves on the southeast edge of Pineros. They were also observed feeding, most commonly in the vicinity of their primary roosting areas. These areas correspond to the most calm, leeward waters found around the islands.

The other four seabirds--the brown booby, the magnificent frigatebird, common tern, and roseate tern--were all uncommon and infrequently observed. When they were observed, they were typically feeding on the leeward waters of Pineros and Cabeza de Perro and occasionally were seen roosting on La Pinerita.

Wading Birds

Wading birds were found primarily in the brackish lagoon habitats on Pineros Island. Four species were found in lagoons--great egret, great blue heron, Louisiana heron, and green heron--all of which were common on Lagoons 1 and 2. Additionally, one pair of yellow-crowned night herons were observed in a low-lying wooded area along the northern coast of Pineros. Although no nests were located, Louisiana and green herons were observed daily during the field surveys that corresponded to their breeding seasons (April and June). It is probable that both species of heron nest on Pineros Island. Herons commonly nest in both swamps and upland habitat in the Caribbean. For example, heron rookeries were located in mangrove forests on Vieques (E & E 1986).

Shorebirds

Shorebirds inhabit three habitats on Pineros and Cabeza de Perro islands: brackish lagoons, beach, and rocky intertidal. The majority of the seven species of shorebirds found on the islands are winter migrants. Shorebirds that used the sand beaches, including the semi-palmated and Wilson's plovers, ruddy turnstones, and spotted sandpipers, were seen on all beaches around Pineros. Of these species, semi-palmated and Wilson's plovers were moderately abundant and ruddy

turnstones and spotted sandpipers were common. These species were most often seen during the January and December field surveys, which corresponded with winter migration of these species. Only the Wilson's plover is a potential nesting species on Pineros (Philibosian and Yntema 1977).

Species of shorebirds that utilized the brackish lagoons included the black-necked stilt, greater yellowlegs, and spotted sandpiper. During the first three surveys, each of these species was observed on each of the three lagoons in increasing numbers that corresponded to the size of the lagoon. Black-necked stilts were very abundant, whereas the other two species were common. The stilts are common nesters on mudflats near lagoons (Raffaele 1983). A hatchling stilt was found on Lagoon 2 during the June survey. The yellowlegs and sandpipers are migrants. Black-necked stilts and greater yellowlegs were observed during the December survey on both lagoons 2 and 3.

In addition to these species, American oystercatchers were observed roosting in rocky intertidal habitats on Pineros Island. Oystercatchers were very uncommon, although they are a potential nesting species.

Waterfowl and Miscellaneous Swimming Birds

Waterfowl were observed using all three brackish lagoons on Pineros Island, except during the final quarterly survey, when no birds were observed on Lagoon 1. Species of waterfowl observed included the white-cheeked pintail, blue-winged teal, and the West Indies whistling duck. Other swimming birds observed in lagoons were common gallinules, pied-billed grebes, and American coots. All of these birds were associated with open water habitat in the lagoons.

During the January field survey, which corresponded to winter migration, waterfowl were most common on Lagoon 2, the perennial north-east lagoon. Up to 20 blue-winged teal and 30 white-cheeked pintails were observed feeding in this lagoon at one time. Corresponding daily censuses completed at the three lagoons indicated that 40 to 50 white-cheeked pintails, 20 to 25 blue-winged teal, 4 to 6 pied-billed grebes, 4 to 5 common gallinules, 2 to 3 American coots, and 2 West Indian whistling ducks were using the brackish lagoons at any one time. The West Indian whistling duck was observed on Lagoon 1, the southeast

lagoon. The white-cheeked pintail and the West Indian whistling duck are both candidates for federal and/or Commonwealth protected status and are discussed further in Section 3.6.2.

During the April and June censuses, waterfowl were most abundant on Lagoon 1. Over 50 white-cheeked pintails were observed at one time on this lagoon. Water levels were lower on Lagoon 2, and Lagoon 3, the ephemeral northeast lagoon, was 85% dry. No blue-winged teal or West Indian whistling ducks were observed during these censuses. Approximately the same number of American coots and common gallinules were seen during these censuses as during the January census.

White-cheeked pintails were the only waterfowl observed during the December survey. Between six and eight individuals were seen on lagoons 2 and 3 daily.

Raptors

Three species of raptors were observed on Pineros Island: the red-tailed hawk, marsh hawk, and osprey. The marsh hawk and osprey are both migratory birds; the marsh hawk is a rare winter visitor, whereas the osprey is a common winter visitor (Raffaele 1983). Both were observed during January.

A pair of red-tailed hawks were observed soaring over the western portion of Pineros, and a single hawk was observed roosting in a tree in an upland forest portion of Pineros. Sightings occurred during the April and June surveys. A red-tailed hawk was also observed soaring over Pineros during the December survey. Red-tailed hawks are common residents in wooded areas of Puerto Rico (Raffaele 1983).

A kingfisher was observed daily on Lagoon 2 and once on Lagoon 3 during the December survey. Kingfishers commonly winter in this region but breed in more northern climates.

Land Birds

Land birds include non-passerine land birds and passerine birds, i.e., songbirds. Sixteen species of land birds were observed on Pineros Island, 13 of which are potential nesting species and three of which were winter migrants. Based on this, bird species diversity was relatively low compared to nearby mainland Puerto Rico or on NAVSTA

Roosevelt Roads (Pace and Vega 1989). Three species of land birds were observed on Cabeza de Perro, where habitat structure and diversity are both low due to the dominant prairie vegetation type.

Bird species that were abundant on Pineros Island included pearly-eyed thrashers, yellow warblers, Caribbean elaenias, and bananaquits. All of these species are permanent residents, and all can be considered habitat generalists. Pearly-eyed thrashers were very abundant in all habitats except mangrove, salina, and beach. Bananaquits were abundant in the fringe or ecotone area between lowland areas, which included salina and mangrove, and upland areas, which included upland forest and leucana woodland. The yellow warbler and Caribbean elaenia were very abundant in the salina. Gray kingbirds were common and found in coastal forests and beach strand vegetation. Black-faced grassquits were uncommon and found in upland forest and coastal forests. Palm warblers and Louisiana waterthrush were also uncommon, and were found near the ground among low vegetation which bordered the ocean or lagoons.

Three species of doves were found on Pineros. White-crowned pigeons and zenaida doves were common in mangrove and salina habitats. A zenaida dove was observed along a rocky shore as well. The white-crowned pigeon is listed by USFWS as a candidate for federal listing as rare, threatened, or endangered.

The white-winged dove was common in salina habitat and coastal areas on Pineros. Two nests of this species were discovered in arid scrub vegetation behind rocky intertidal coastland. Antillean crested hummingbirds and green-throated caribs were both common in upland forest, leucana woodland, and salina habitats.

Only three species of land birds were found on Cabeza de Perro. Pearly-eyed thrashers and gray kingbirds were present only in the small pockets of woodland found on the island's western portion. Smooth-billed anis were evidently common on Cabeza de Perro. The grassy habitat with scattered trees and bushes on Cabeza de Perro is highly suitable habitat for the anis.

Generally, the habitat on Pineros with the lowest bird abundance and diversity was the dry coastal forest on the eastern portion of the island, where only pearly-eyed thrashers were found. Songbirds were most abundant overall in the ecotone between salina, mangrove, and upland habitats on the western portion of Pineros.

3.6.1.2 Mammals

Endemic mammals are generally either poorly represented or absent from Pineros and Cabeza de Perro islands. The geographic isolation of Puerto Rico and its associated islands at a geologic period prior to the evolutionary diversification of mammals prevented them from becoming established as a dominant wildlife form (Briggs 1964). Although not observed during field surveys, bats have reportedly been observed by SPECWAR personnel near subterranean bunkers in the upland areas.

The only confirmed species of mammal on Pineros Island is the rat, an introduced species. Qualitative observations indicate that rats are very abundant on Pineros but absent from Cabeza de Perro. Rats greatly influence the abundance of other species of wildlife because they prey on birds and bird nests and reptile eggs and compete with them for the same food items.

3.6.1.3 Reptiles and Amphibians

The most common group of reptiles observed on Pineros and Cabeza de Perro islands was lizards. Ground lizards were common in all upland habitats on Pineros Island and in the tall grass of Cabeza de Perro Island. Common species of ground lizards identified on Pineros were Ameiva exsul, Sphaerodactylus gaigeae, S. nicholsi townsendi, and S. macrolepis. According to Rivero (1978), the variety of S. macrolepis found on Pineros is a subspecies, S. macrolepis stibarus, that occurs only on Pineros Island. Of these four species, Ameiva exsul was the most abundant ground lizard on Pineros and the only species positively identified on Cabeza de Perro.

Two species of tree lizards were identified on Pineros Island. These were Anolis stratulus and Anolis cristatellus. These species of tree lizards were found in all habitats on Pineros. However, they were especially abundant in salina and vine-thicket habitats. Anoles were rare in the open woodlands of Cabeza de Perro Island.

Two species of snakes, both federally endangered, potentially exist on Pineros and Cabeza de Perro islands. The Virgin Islands boa (Epicrates monensis granti) is potentially found on Cabeza de Perro, whereas the Puerto Rican boa (Epicrates inornatus) is potentially found

on Pineros Island (Tolson 1988). Both species utilize dense shrub thickets and vine tangles; therefore, the vine thickets located in the eastern portion of Pineros are the most suitable habitat. Surveys for these species conducted during the December field studies provided no evidence that either species is found on Pineros and Cabeza de Perro islands (see Section 3.6.2.3).

Sea turtles are discussed in Section 3.4.3.1.

3.6.2 Threatened and Endangered Species

This section analyzes the results of field studies, published literature, and interviews with researchers to describe the status of rare wildlife species on Pineros and Cabeza de Perro islands. This section concentrates on terrestrial wildlife. Rare marine wildlife, including sea turtles and manatees, are addressed under Marine Resources in Section 3.4.3. A list of threatened and endangered species found or postulated to exist on Pineros is provided in Table 3-13.

3.6.2.1 Yellow-shouldered Blackbird

A primary objective of this assessment was to determine the extent of the population and habitat use of yellow-shouldered blackbirds (Agelaius xanthomus) on Pineros and Cabeza de Perro islands. In consultation with yellow-shouldered blackbird researcher Dr. James Wiley of the USFWS, a survey plan was designed to census yellow-shouldered blackbirds at various times of the year that corresponded with breeding and non-breeding activities. Four one-week surveys were completed, one each in January, April, June, and December 1989. Nocturnal roosting surveys were conducted during January and December to determine if and where on the islands the blackbirds roosted and to determine if shiny cowbirds (Molothrus bonariensis) and Antillean grackles roosted in association with the blackbirds. Roost surveys were conducted by stationing observers either on the shore of Pineros near the western mangrove fringe habitat or in a rubber raft in the channel between the western shore of Pineros and Puerto Rico. Censuses were conducted between 1600 and 1900 hours. These techniques were based on those suggested by blackbird researcher James Wiley (1988) and Fernando Nunez (1989).

Table 3-13

RARE, THREATENED, AND ENDANGERED SPECIES FOUND OR POSTULATED TO BE ON
PINEROS AND CABEZA DE PERRO ISLANDS

Species	Status ^a			Presence	Notes
	Federal	Commonwealth	Island ^{**}		
<u>Birds</u>					
White-cheeked pintail	C	C	P	Confirmed	Common in brackish lagoons
Brown pelican	E	E	P,C	Confirmed	Uses islands for feeding and roosting
West Indian whistling duck	C	C	P	Confirmed	One pair observed
Ruddy duck	C	C	—	Postulated	None observed
Roseate tern	T	T	O	Confirmed	Single bird feeding
Yellow-shouldered blackbird	E	E	—	Postulated	None observed
White-crowned pigeon	C	C	P	Confirmed	Common in mangroves and salina
<u>Reptiles</u>					
Green sea turtle	T	T	P,O	Confirmed	Observed during underwater survey
Hawksbill sea turtle	E	E	P,O	Postulated	Rathbun <u>et al.</u>
Leatherback sea turtle	E	E	P,O	Postulated	Rathbun <u>et al.</u>
Loggerhead sea turtle	T	T	P,O	Postulated	Rathbun <u>et al.</u>
Puerto Rican boa	E	E	C,P	Postulated	None observed
Virgin Islands tree boa	E	—	P	Postulated	None observed
<u>Mammals</u>					
West Indian manatee	E	E	O	Confirmed	Rathbun <u>et al.</u>

^aC = Candidate for listing on threatened or endangered lists; E = endangered; T = threatened.

^{**}P = Pineros Island; C = Cabeza de Perro Island; O = Oceanic

In addition to roosting surveys, censuses were conducted during the April and June field surveys that corresponded with the breeding season of the yellow-shouldered blackbird. Daily censuses of songbird activity were conducted between dawn and 1200 hours. Observers listened for song and watched for display activities, nest building, or feeding activity. Recordings of the songs and calls of the yellow-shouldered blackbird were obtained from the Cornell University Laboratory of Ornithology. Censuses were concentrated in the habitat most likely to support the blackbirds (i.e., red mangrove fringe forests, salinas, the brackish lagoons, and the upland/lowland ecotone). However, all portions of Pineros and Cabeza de Perro islands were systematically covered during censuses.

The result of the field surveys was that no evidence of yellow-shouldered blackbird activity was observed during either roosting or breeding censuses. An analysis of trends in the blackbird's population is presented below to evaluate their absence from the islands.

The yellow-shouldered blackbird, endemic to Puerto Rico and Mona Island, was both common and widespread in Puerto Rico until the 1940s, after which time there is no information available on its abundance in the region until the 1970s (Post and Wiley 1976). In 1976, only about 2,400 individuals remained concentrated in three population centers: coastal southwest Puerto Rico (about 2,000 individuals), Mona Island (about 200 individuals), and the most eastern coast of Puerto Rico at NAVSTA Roosevelt Roads (about 200 individuals) (Post and Wiley 1976). The yellow-shouldered blackbird's population has declined drastically since that time and currently numbers less than 500 individuals (USFWS 1988). The most seriously depleted population is that at NAVSTA Roosevelt Roads, which experienced a 98% decline from 200 individuals in 1976 to only 2 known nesting pairs in 1986 (Wiley, et al. 1988). This population is currently estimated to number somewhere around 20 individuals (Collazo 1989); however, a survey conducted by USFWS of the damage to the mangrove forests of NAVSTA Roosevelt Roads following Hurricane Hugo found only two individuals on the base (Villella 1989).

The yellow-shouldered blackbird was listed as federally endangered in 1976, and critical habitat was established by USFWS. It is also listed as endangered and is protected by the Commonwealth of Puerto

Rico. The critical habitat of this species includes the entire NAVSTA Roosevelt Roads, including all of Pineros Island. In 1980, the US Navy came to an agreement with the USFWS to restrict naval activities on portions of the station known to be nesting or feeding habitat and eliminated consultation with USFWS about activities in areas which would not impact the blackbirds. In this agreement, both Pineros and Cabeza de Perro islands were designated as known nesting or feeding habitat (USFWS 1988).

The breeding season of the blackbird generally extends from March to August (USFWS 1988). Nests are usually located in close proximity to one another, and both open and cavity nests have been found in a variety of habitat types. These include mangrove pannes and salinas, offshore mangrove cays, dense black mangrove forests, deciduous trees in lowland pastures, ornamental trees in suburban areas, coconut and royal palm plantations, coastal cliffs, cactus scrub, and water-surrounded rocks (USFWS 1983). Of these habitats, mangrove forests are by far the most commonly used (Post and Wiley 1976). Nesting activities at NAVSTA Roosevelt Roads were limited to the dense black mangrove stands on the base until 1987, when royal palm trees near the Auto Hobby Shop were used as a nesting site (Post and Wiley 1976; Nunez 1989).

Yellow-shouldered blackbirds will travel long distances from their nesting and roosting sites to feed in deciduous trees in lowland pastures. They will occasionally feed in mangrove forests and on the ground as well.

A variety of factors are responsible for the decline of the yellow-shouldered blackbird. The conversion of mixed cropland to sugarcane production has reduced feeding habitat; severe reductions in mangrove forest acreage in Puerto Rico have reduced nesting habitat; introduced pests such as the rat and mongoose prey on young; the pearly-eyed thrasher preys on eggs and young and steals nest materials of the blackbirds; and fowl pox disease infects a significant fraction of the population (Post and Wiley 1976). However, the single most important factor in the demise of the species is the rapid increase and expansion of a brood parasite, the shiny cowbird (Molothrus bonariensis) (Wiley 1983). The shiny cowbird appeared in Puerto Rico in the 1950s and has seriously affected the native blackbirds, which have not evolved defenses against brood parasites (Post and Wiley 1977).

Although Pineros and Cabeza de Perro islands were included in the area designated as known feeding and nesting habitat in the 1980 agreement between the US Navy and USFWS, evidence suggests that Pineros and Cabeza de Perro have not recently been used by the yellow-shouldered blackbird. Nesting activity has never been documented on either island (Wiley 1989). During Post and Wiley's studies in the 1970s and early 1980s, the western mangrove and lagoon area of Pineros Island was used as a nocturnal roosting site. Blackbirds regularly traveled to the island on daily feeding forays during this time (Wiley 1989). However, blackbirds have not been observed using Pineros or Cabeza de Perro islands for roosting or feeding since 1984 (Wiley 1989; Nunez 1989). Since that time, there have been no reports of blackbirds on the island (Wiley 1989; Nunez 1989; Callazo 1989).

Although habitat exists on Pineros Island that is suitable for both nesting and roosting, there are an abundance of pearly-eyed thrashers and rats on Pineros, both of which prey on the eggs and young of the blackbirds. No shiny cowbirds have been observed to date; therefore, nest parasitism is not believed to be a contributing negative factor. The presence of suitable habitat in a preserved state under Navy control on Pineros maintains the potential for blackbirds to colonize or recolonize Pineros should populations in eastern Puerto Rico recover.

3.6.2.2 Waterfowl

Species of waterfowl were censused by conducting daily ground inspections of the three brackish lagoons during all four sampling periods. The surveys conducted in January and December corresponded to migration periods, whereas the April and June surveys corresponded to the breeding season of waterfowl.

Protected species of waterfowl observed on Pineros Island include the white-cheeked pintail and the West Indian whistling duck. The ruddy duck, which is considered threatened by the commonwealth, was not observed, although USFWS considers habitat on NAVSTA Roosevelt Roads to be suitable for it (Pace and Vega 1989). The USFWS considers the brackish lagoons on Pineros to be primary waterfowl feeding areas (Pace and Vega 1989). Observations during field surveys supported this contention. The seagrass Ruppia maritima, a prime waterfowl food, was

abundant on lagoons 1 and 2. Figure 3-3 shows the important waterfowl concentration areas.

White-cheeked pintails were the most common species of waterfowl observed on Pineros; up to 50 were observed at one time on Lagoon 1. Feeding was observed on all three lagoons during January and April surveys, and mating behavior was observed during the April survey. A potential pintail nest was located during January on a grassy knoll adjacent to Lagoon 2, near beach strand vegetation on the north coast of Pineros. Edward Rodriguez, a waterfowl biologist with the Puerto Rico Department of Natural Resource (DNR), indicated that the habitat description, nest formation, and egg characteristics were similar to those reported elsewhere for the pintail (Rodriguez 1989). Pintails are known to feed on Vieques and Culebra islands, but nests have recently been located only on Puerto Rico; Pineros has not been censused (Rodriguez 1989). Pintails were also commonly observed on lagoons 1 and 2 during the June census. Two pair of pintails were regularly observed on Lagoon 1, while one pair was consistently observed on Lagoon 2. No chicks were observed on either lagoon in June. Six to eight pintails were observed feeding in lagoons 2 and 3 daily during the December survey.

A pair of West Indian whistling ducks were observed on Lagoon 1 during the January surveys. The brackish lagoons are suitable habitats for this species; however, no nests have been located on NAVSTA Roosevelt Roads (Pace and Vega 1989).

3.6.2.3 Boas

A primary objective of the December field studies was to conduct surveys to determine the presence or absence of boas on Pineros and Cabeza de Perro islands. Two species of boas, both listed as endangered by USFWS, potentially occur on the islands: the Puerto Rican boa (Epicrates inornatus) and the Virgin Islands boa (Epicrates monensis granti) (Tolson 1988b). The Puerto Rican boa is found mainly in the forested limestone hills of Puerto Rico but has also been recorded on Tortola and Culebra islands (Rivero 1978; USFWS 1987; Tolson 1989). The range of the Virgin Islands boa extends from La Cordillera eastward through the Virgin Islands (Tolson 1988a). The historical range of this

species includes nearly the entire Puerto Rico Bank; however, the boa is apparently absent from Puerto Rico and the other large islands on the bank at present (Tolson 1988a).

Both boas are nocturnal, arboreal predators that feed mainly on lizards, but birds and small mammals will be taken when available. The preferred habitat consists of shrubby or forested areas with a high degree of vegetational continuity (i.e., an interlocking of branches in the canopy). By day, the boas seek refuge under rocks or debris at ground level, in old loosened termite nests, or in coconut or palm axils.

The largest single factor in the decline of boas in the Caribbean is the destruction of habitat. The widespread deforestation in the region has eliminated much of the native forests that once served as boa habitat. In addition, the oil in the fat of boas was once highly valued as medicine, and hunting pressure by humans was high prior to their protection. The introduction of exotic mammals to the Caribbean, especially the rat, has also impacted boa populations. Rats may prey directly on boa eggs and young and also compete for food items with boas. A large rat population that is unchecked by mammalian predators (mongoose, house cat) will generally preclude the presence of boas in an area (Tolson 1988a).

The survey methods used to search for boas on Pineros and Cabeza de Perro islands were developed in consultation with Dr. Peter Tolson, curator of amphibians and reptiles for the Toledo Zoological Society. The survey techniques employed included both nocturnal surveys for actively foraging boas and daylight inspections of likely areas of refuge such as termite nests, palm axils, and rock or debris piles. Observations on the density of anoles, the boas' main prey item, were also taken during the surveys. The effects of Hurricane Hugo on Pineros and Cabeza de Perro do not prohibit the finding of boas on these islands if they were present before the hurricane. Boa populations on other islands hit by Hugo were not significantly reduced in number, and boas are actually more easily observed at night where the hurricane has reduced the number of leaves and branches in the canopy (Tolson 1989).

Boa habitat is abundant on Pineros; however, the large unchecked rat population may preclude the presence of boas on that island (Tolson

1988b). The habitat most suitable for boas is the 12 acres of vine-thicket vegetation on the southeastern portion of the island, but all shrubby and forested areas could potentially support boas. A nocturnal survey was conducted that concentrated on the vine-thicket vegetation type, with lesser areas of upland forest, dry coastal forest, and mixed Leucana woodland also surveyed. These nocturnal surveys, as well as the daylight surveys conducted on the island, showed no evidence of the presence of boas on Pineros.

The amount of boa habitat on Cabeza de Perro is small and consists of 3 acres of open woodland vegetation found on the west side of the island. The habitat present is fragmented, consisting of four stands of forest ranging in size from 0.5 to 1.5 acre and separated by 50 to 200 feet of rocky shore. The density of Anolis spp. in these woodlands is relatively low compared to the forests of Pineros. However, given that the vegetational continuity of the forest stands present is fairly high and rats are apparently absent from the island, the presence of boas is possible. According to a local fisherman, there were boas on Cabeza de Perro 20 to 30 years ago, before the Navy took control of the island (Tolson 1989). Discussions with Navy personnel have indicated that no boas have been seen on Cabeza de Perro or Pineros within the past decade. Daylight surveys of likely habitat were conducted on Cabeza de Perro to determine the presence or absence of boas. These surveys concentrated on the piles of rubble associated with several old World War II structures found on the island, as there were very few other places for the snakes to escape the sun and these rubble piles presented excellent cover. Neither boas nor any evidence of boa activity (i.e., shed skins) was observed during these surveys.

In summary, although adequate boa habitat is present on both Pineros and Cabeza de Perro islands, no evidence of boa activity was found on either island. Boas were likely killed whenever encountered by humans during the early occupation of these islands by the British and the Navy, long before boas were protected. Boas would be quickly extirpated from Cabeza de Perro under such conditions due to the small amount of habitat available. Pineros supports a much larger amount of boa habitat, but pressure from humans and the introduction of rats to this island could extirpate a population of boas here as well. The

extirpation of boas from small Caribbean islands similar to Pineros and Cabeza de Perro has been widespread in the past century, and boas are now absent from far more islands than they are resident (Tolson 1988a).

3.6.2.4 Seabirds

The primary seabird of interest is the brown pelican, which is listed as endangered both federally and by the commonwealth. Pelicans were commonly seen roosting on the southeast coasts of both Pineros and Cabeza de Perro islands and feeding off the southeast shore of both islands.

Collazo and Klaas (1986) reported that pelicans did not nest on Pineros or Cabeza de Perro islands, although suitable habitat is present. Brown pelicans will nest in coastal forests, mangroves, low shrubs, or ground vegetation (Collazo and Klaas 1986), all of which are found on both islands. The nearest confirmed nesting area is found on Cayo Conejo off Vieques Island (Pace and Vega 1989). Pineros and Cabeza de Perro islands were not listed by Collazo and Klaas (1986) as important feeding or roosting habitats; however, it was obvious from the surveys that pelicans do commonly feed and roost on the islands. Figure 3-3 shows important feeding and roosting areas for pelicans on Pineros and Cabeza de Perro islands.

3.7 LAND USE

3.7.1 Existing Uses and Improvements

As a result of the meeting of July 15, 1987 between USFWS and the Navy, six land use zones were delineated on Pineros and Cabeza de Perro islands. Various restrictions were placed on the types of training activities permitted within these land use zones: types of ammunition or demolitions that could be used; time of year in which activities could take place; and/or the number of training sessions per year. These land use zones, as per the Navy/USFWS agreement, are shown in Figure 1-3.

Zone 1 corresponds to open water zones in which underwater demolition training is permitted. Zone 1 areas include areas off beaches on the northeast and southeast shore of Pineros and an area northeast of

Cabeza de Perro. Activities permitted in this zone are underwater demolition training, such as detonation of limpet mines and plastic explosives; small boat training; and dive training. No coral blasting is permitted, and only 15 training sessions may take place per year.

Zone 2 areas can be used for small-arms firing and standard military demolitions. These areas include the small-arms firing range in the southeast portion of Pineros and upland areas in the vicinity of the World War II bunkers. Standard military demolitions, including detonation of claymore mines and plastic explosives, pyrotechnics (smoke grenades and pop flares), and small-arms training, are permitted in Zone 2. Small-arms training utilizes the following shell sizes: 7.62mm, 5.56mm, 9mm, .38 caliber, and .45 caliber. This area is restricted to 15 training sessions per year, with no seasonal restrictions.

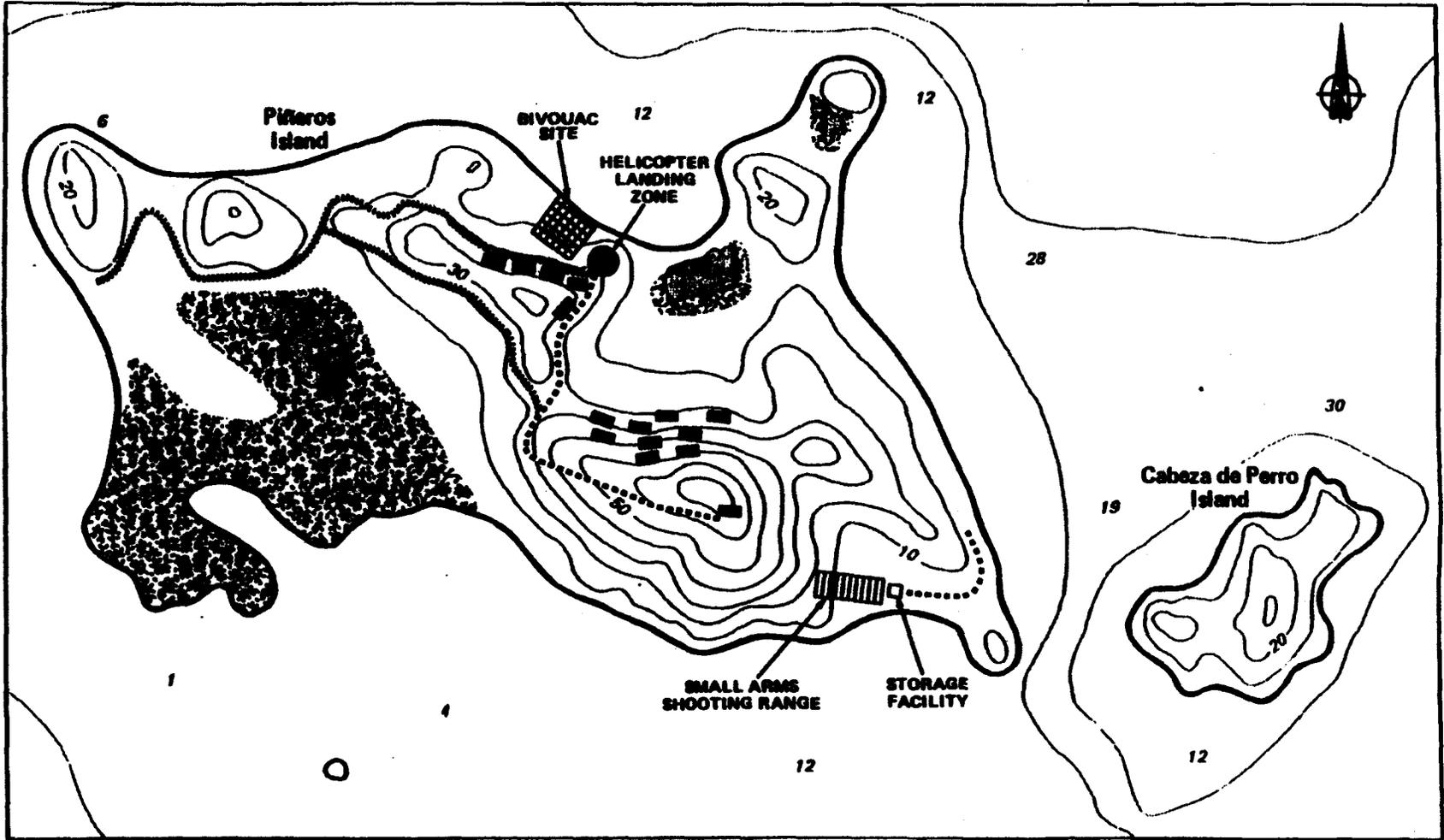
Zone 3 areas are designated as camping areas. Four camping areas are located along the shores of Pineros, and one is located directly east of Lagoon 1. The major camping area is the bivouac site located in the central portion of the north shore of Pineros. Classroom sessions are held there during each two-week training session.

Zone 4 areas are designated for patrolling on foot. Zone 4 is located in the southwestern portion of Pineros, south of Lagoon 1. Small-arms firing is permitted within this area, but its use is restricted to two training sessions per year between November and February.

Zone 5 areas are off-limits to training. These areas encompass the three brackish lagoons and adjacent mangrove vegetation and the red mangrove forest located on the southwest coast of Pineros.

Zone 6 areas are designated for small-arms firing. These areas cover the old road loop in the north-central portion of Pineros. Zone 6 areas are essentially combat trails where small-arms firing is permitted with no seasonal restrictions.

Various improvements have been implemented on Pineros Island to enhance its use as a naval training facility. These include relatively recent improvements in addition to historical improvements that remain useful. Figure 3-7 shows these improvements. Improvements include the small-arms firing area and storage facility in the southeast portion of Pineros. The storage facility is a lockable plywood structure used to



SOURCE: U.S.G.S. 7.5 Minute Series (Topographic) Quadrangle: Punta Puerca, P.R., 1967 Photorevised 1982.

- KEY:
- World War II Bunker
 - Mangroves
 - Lagoon
 - Combat Trail
 - Overgrown Graded Roads

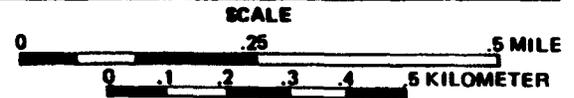


Figure 3-7 EXISTING IMPROVEMENTS ON PIÑEROS AND CABEZA DE PERRO ISLANDS

store paper targets and maintenance equipment. The shooting range is an area approximately 25 meters by 75 meters that is periodically cleared by manual methods to maintain brush below 1 meter in height.

Additional improvements are the bivouac site and helicopter landing zone on the north-central coast of Pineros. The bivouac site consists of about 20 sleeping platforms constructed from, and in, trees. This site is used as a base for classroom activities during the two-week training sessions. The helicopter landing area is a cleared area approximately 25 meters in diameter.

A series of combat trails runs throughout the central and southeastern portion of Pineros. These trails follow primarily overgrown, unpaved roads that were constructed during World War II. These trails are used for realistic jungle training that incorporates stationary and moving target figures. An additional existing improvement is concrete bunkers that remain from World War II. Approximately 20 of these structures exist in various stages of degeneration.

Lastly, 24 warning signs are in place around the shores of Pineros Island that warn of live explosives. These signs are used to deter trespassing by civilians.

3.7.2 Fire Danger

Fire danger is assumed to be a risk from the use of various types of demolition and ordnance exploded during training activities on Pineros and Cabeza de Ferro islands. Ordnance used that poses a potential fire hazard includes pyrotechnics, such as pop flares and smoke grenades, and demolition ordnance, such as plastic explosives and claymore mines.

Based on field surveys that covered the majority of both islands, evidence of small-scale fire damage was observed where lit pop flares had fallen to the ground. The greatest risk of fire occurs along the small-arms combat trail where slash and fallen trunks from bullet-damaged trees are abundant.

The large amounts of forest litter and fallen trees caused by Hurricane Hugo represent a significant fire hazard. The arid climate of Pineros dries such debris quickly so that it is easily ignitable. Special caution should be taken in the near future to avoid starting any fires due to the danger that they may spread to the entire island.

3.7.3 Unexploded Ordnance

The danger from unexploded ordnance on Pineros and Cabeza de Perro islands is minimal because explosive, dud-producing ordnance, such as grenades, are utilized during training activities only in specific underground bunker areas.

Several types of unexploded ordnance were encountered during field surveys. An unexploded smoke grenade and a piece of plastic explosive were encountered.

3.7.4 Litter and Debris

The majority of litter and debris that exists on Pineros and Cabeza de Perro islands consists of sea-carried debris that have washed up on the shore and adjacent upland habitat. This type of debris is especially prevalent on the northeastern and eastern shores of both islands, which face the prevailing currents and winds.

Litter and debris attributable to naval use of the islands is less prevalent. Litter consists primarily of spent small-arms shell casings along combat trails and pop flare casings and parachutes in trees and on the ground on Pineros. No other ordnance-related debris was observed. Some debris is also associated with material and structures that remained after World War II. This consists of old drainage pipes, unidentifiable pieces of metal, and crumbled structures of bunkers.

3.8 CULTURAL RESOURCES

3.8.1 Introduction

This section presents information about cultural resources on Pineros and Cabeza de Perro islands. A cultural resource reconnaissance survey was conducted by E & E for the naval training facilities on the two islands. The survey included a sensitivity assessment for both Pineros and Cabeza de Perro islands and a walkover field reconnaissance of selected portions of the islands. The walkover of Pineros was conducted during the January 1989 quarterly survey, and the walkover of Cabeza de Perro was conducted during the December 1989 quarterly survey.

The cultural resource survey for Pineros and Cabeza de Perro islands was conducted in accordance with the National Historic

Preservation Act of 1966, Executive Order 11593, and the Archaeological and Historic Preservation Act of 1974. The procedures outlined in Title 36, Chapter VII, Part 800 of the Code of Federal Regulations have been used as a guideline for the investigation.

Survey elements included:

- o Identification of all previously recorded cultural resources in the vicinity of the project area;
- o Review and analysis of available information on prehistoric and historic development in the area;
- o Development of a sensitivity assessment of the project areas (see Appendix B);
- o Development and implementation of an appropriate on-ground survey which would (a) test the hypotheses promulgated in the sensitivity assessment and (b) locate unrecorded prehistoric or historic sites in the islands.

3.8.2 Sensitivity Assessment

Background research for this project included a review of recent cultural resource reports and management plans developed for various naval facilities in the Caribbean, including NAVSTA Roosevelt Roads, Vieques Naval Reservation, and the AFWTF. Sources which were consulted for this research are listed in Appendix B, Cultural Resource Sensitivity Assessment of Isla Pineros and Cabeza de Perro, Puerto Rico (E & E 1988). In addition, the State Historic Preservation Office (SHPO) in San Juan reported that there were no recorded sites, National Register or otherwise, located on either Pineros or Cabeza de Perro islands (Sackett 1989).

The Navy's Cultural Resource Management Plan for Naval facilities on Roosevelt Roads; Vieques and Culebra, Puerto Rico; and the Virgin Islands (E & E 1985) presents general expectations about the range of archaeological site characteristics for the various cultural periods that existed in that area of the Caribbean. Appendix B summarizes the management plan and offers expectations about the location of unrecorded cultural resources which might be found on Pineros and Cabeza de Perro islands.

Briefly, the sensitivity assessment indicated that Pineros and Cabeza de Perro had moderate potentials for the location of unrecorded

prehistoric sites. The factors contributing to this particular assessment were the presence of coastal habitat zones (e.g., lagoons and mangroves), proximity to coastline, and habitable soil types. These environmental features were similar to those found to have been sensitive for the presence of cultural resources on the larger islands. However, the sensitivity of these areas on Pineros and Cabeza de Perro islands was mitigated by the small size of these areas and the adjacent resource zones. Areas with low prehistoric archaeological potential on Pineros Island were those containing severe slopes, mangrove swamps, and lagoons (although rocky cliff faces held the possibility of containing petroglyphs). Cabeza de Perro exhibited a much lower sensitivity than Pineros. Although some of the off-shore resources may have been exploitable from sites on the smaller island, the slopes, lack of surface water, and small size of Cabeza de Perro would have precluded most intensive prehistoric activities. The proximity of Cabeza de Perro to Pineros suggests that Pineros could have provided more suitable encampment locations for groups using areas on Cabeza de Perro for resource extraction, although groups may have traveled from the mainland without camping on either small island.

The sensitivity assessment hypothesized that, while the number of sites found on either island would be extremely low, the islands could contain a substantial diversity of prehistoric site types (including petroglyphs); that a majority of the prehistoric sites would be Ceramic Age sites; and that the prehistoric sites would be located primarily in areas with greatest access to marine, reef, and terrestrial (lowland) resources (e.g., Pineros' east and north shores). Similarly, historic use of the islands was not expected to be extensive because of their small size and hilliness (see Appendix B), although the presence of some military and/or civilian structures was thought to be possible.

Data regarding the historic military and, to a lesser extent, civilian use of Pineros Island became available after the completion of the January field investigations. The source of the information came primarily from U.S. Navy (USN) aerial photographs, topographic training maps, and informants (e.g., various Navy personnel). To a large degree, some of the information had already been verified during the January cultural resource field investigations; this is discussed below.

3.8.3 Walkover Reconnaissance Survey

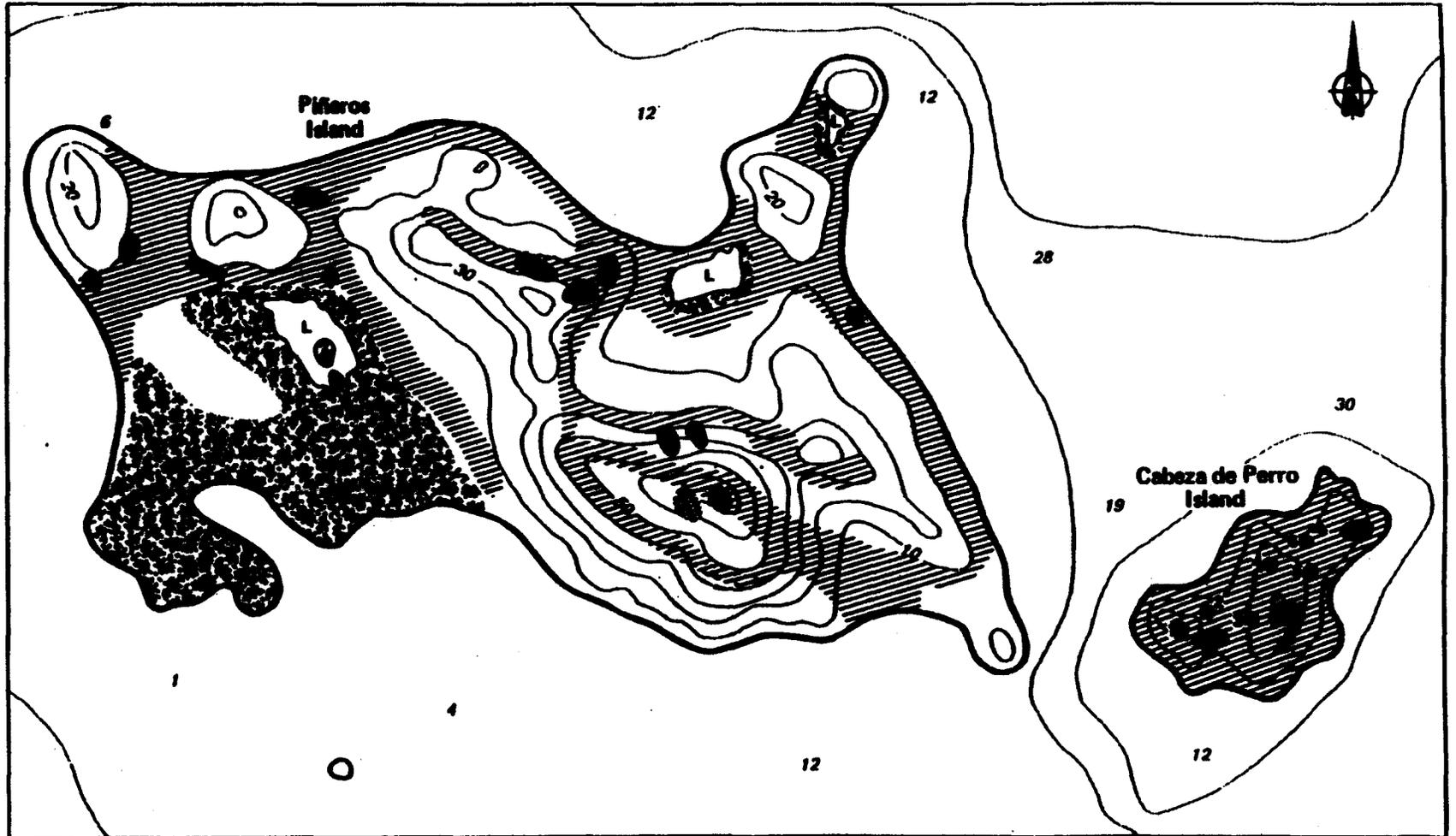
In the sensitivity assessment, Pineros Island was separated into three major types of landforms: hills, coastal lowlands, and tidal swamps, with several smaller divisions within each of these. Based on the results of the assessment, a field survey strategy was developed which included surface examination and limited subsurface testing (trowel probes) of selected areas of the islands. The limited reconnaissance survey of Pineros Island was conducted so that at least a sample of each major environmental zone was inspected. Figure 3-8 indicates the areas of the island that were walked over and inspected.

The field survey of Cabeza de Perro Island included a complete surface examination as well as limited subsurface testing on the flat knoll tops and saddles between the knoll tops. Figure 3-8 indicates the locations of subsurface testing on the island. In addition, a photographic record was taken to illustrate the extent of slopes over the island.

3.8.3.1 Methodology

The density of the vegetation on Pineros Island precluded using the technique of walking parallel transects through sample sectors in order to locate unrecorded sites, as was done for previous Navy archaeological surveys in that part of the Caribbean. In general, the walkover survey was conducted by utilizing now-overgrown roadways or never Navy SEAL training paths, which, while still highly vegetated, were more open (see Figures 3-7 and 3-8). Where such trails were not available or accessible, areas containing a somewhat open understory were walked through. Open beaches and coastlines were used for access into adjacent wooded lowland areas (see Figure 3-8). Extremely steep slopes, lagoons, and mangrove swamps were not specifically surveyed; however, some lands surrounding or adjacent to them were walked over where human activities would not have been prevented by the unfavorable conditions (see Figure 3-8).

Topographic contours were the determining factor for the methodology used on Cabeza de Perro Island. The entire island was visually inspected during the walkover. Shovel testing, however, was



- KEY:**
-  Walkover Survey Sampled Area
 -  Piñeros 1 Findspot
 -  Existing Radio Tower
 -  Mangroves
 -  Tunnel Entrance (Off Limits)
 -  Shell Midden (Off Limits)
 -  Military Ruins
 -  Shovel Test
 -  L Lagoon

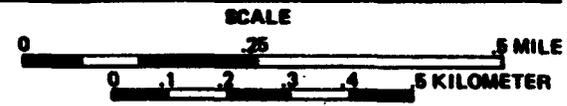


Figure 3-8
CULTURAL RESOURCES LOCATED ON PIÑEROS AND CABEZA DE PERRO ISLANDS
DURING RECONNAISSANCE SURVEY

limited to the areas that had slopes of less than 15% (see Figure 3-8). Rock outcroppings along the shores were examined for evidence of petroglyphs.

Because of the limited nature of these reconnaissance surveys, a no-collection strategy was employed, and no site maps were drawn. Light vegetation covering the ground (e.g., vines, branches, and leaves) was cleared with trowels in selected locations along survey routes on Pineros Island and on Cabeza de Perro Island, where shovel tests were also conducted. Potential prehistoric resources were flagged and marked on USN maps; remains of historic military structures were not flagged. Cliff faces were examined for evidence of petroglyphs not only by the archaeological survey team but by the environmental crew as they gathered data throughout the island.

3.8.4 Survey Results

The limited reconnaissance survey located and identified three types of cultural resources: a sparse shell midden, a prehistoric flake find, and the remains of a historic World War II military complex. Figure 3-8 shows the locations of these resources.

The walkover reconnaissance survey verified that certain areas of Pineros Island had low archaeological potential. In addition to steep slopes, mangrove swamps, and lagoons, the field investigations identified other factors that contributed to a decrease in archaeological sensitivity for the location of intact prehistoric sites. Upon inspection, it was apparent that much of the island had been subjected to a variety of construction-related disturbances, most of them of a range sufficient enough to obliterate any prehistoric archaeological sites that may have been located there. The disturbed areas were distributed across most of the island and generally correspond to the location of the military ruins indicated in Figure 3-8.

Similarly, Cabeza de Perro Island exhibited low archaeological potential during the walkover reconnaissance survey. In addition to the steep slopes throughout the island and its inaccessibility by water (except on very calm days), military construction disturbances (evident in three military ruins) have contributed to a decrease in archaeological sensitivity. Although subsurface testing was conducted

in the most probable areas in which prehistoric archaeological sites may have been located, no cultural material was found. The areas tested were relatively close to the military ruins and could have been disturbed enough to obliterate any possible evidence of prehistoric use. Figure 3-8 indicates the location of the shovel tests as well as the military ruins.

The majority of construction-related disturbances discovered during the walkovers were the result of military occupation on the islands during World War II. The remains of bunkers, batteries, barracks, roadways, and drainage systems were all found during the field surveys. Documentary evidence of this occupation beyond post-war aerial photographs and maps is not readily available (Adkins 1989). Some military structures and roadways seen in USN aerial photographs (USN 1949, 1958) and some military structure locations shown on USN topographic training maps (USN 1959) were located during the walkover reconnaissance of Pineros Island (see Figures 3-7 and 3-8). A potential civilian dwelling shown on the 1941 Stump topographic map was in an area that was not surveyed. (The map identifying the location of this structure was not available until after the survey was completed.)

Ordnance and training maneuvers also contributed to a high degree of disturbance to natural ground surfaces in various locations throughout the island frequented by military personnel.

3.8.4.1 Flake Findspot - Pineros 1

The Pineros 1 site is represented by two quartz flakes (see Figure 3-8), which were not collected. The two flakes were found on surface dirt which was trapped among the exposed roots of a large tree. The findspot is situated in a flat, cleared, and sandy area approximately 20 feet north of an open footpath that skirts the mangroves at the northern and eastern edges of Lagoon 1. Both flakes were of quartz. One flake was approximately 0.5 inch in size, thin, and semi-transparent. The other was 1 inch in length, less transparent, and chunkier than the other. Several large chunks (12 inches in diameter or more) of the same quartz material were found on the surface within a 50-foot radius of the flake findspot; none of them appeared to be culturally altered. An intensive search of the ground surface surrounding the findspot for a

radius of nearly 100 feet did not reveal other cultural material or features (e.g., hearths, post molds, etc.).

The general area surrounding the findspot exhibited a fair amount of disturbance due primarily to Navy training maneuvers and secondarily to crab trapping. Obvious disturbances to the immediate area surrounding the flake find were due to foot traffic and the use of ordnance (e.g., live and expended ordnance shells were also found nearby). It is not known what effect the detonation of ordnance in the project area had on lithic material there. Flaking may be a result of ordnance impact and explosion. Therefore, Pineros 1 should only tentatively be considered as cultural.

3.8.4.2 Shell Midden

Figure 3-8 indicates the location of a thin shell midden discovered during a walkover survey of the western portion of Pineros Island. The midden appears to be situated on the edge of an area which was once an original shoreline (see Section 3.5.2). The midden begins approximately 400 feet east of a modern (1940s) concrete pad and extends for nearly 400 feet farther to the east. There is a slight 30-foot break in the strand of shells before it continues approximately 120 feet to the east. The midden is generally one or two shells deep and no more than 50 feet in width at any given point along its length.

The midden is situated on flat sandy soils just to the north of a relatively open footpath. The area surrounding the midden is moderately wooded, and ground surface visibility is somewhat obscured by light vegetation and seashells. Selective trowel probing into the midden indicated that it was relatively undisturbed, although this has not been positively established. No cultural material was recovered from the midden area.

Evidence of contemporary crab trapping activities on this part of the island, and especially in the vicinity of the midden, is represented by the presence of numerous wooden crab traps. The footpath, ordnance use, and the midden's proximity to a historic roadway are contributing factors to disturbance in its area.

At this time, the midden cannot be chronologically or culturally placed. The limited reconnaissance survey and subsurface probing did

not locate any cultural material. However, the presence of such material cannot be ruled out. The midden obviously represents a resource extraction site; it may be prehistoric or it could possibly be associated with historic use of the island.

3.8.4.3 World War II Military Complex

Field investigations on Pineros and Cabeza de Perro islands revealed the remains of many structures apparently associated with the British military occupation of the islands sometime after 1941. Among the structures represented by the remains are bunkers, batteries, barracks, roadways, and several types of drainage systems. None of the structures or other features appear to be intact, probably as a result of the naval training maneuvers on the islands (which began in the early 1960s) and natural erosion.

Figure 3-7 demonstrates the locations of structures on the island as they appeared on a 1959 USN topographic training map. Also shown in Figure 3-7 are the locations of several roadways which together formed a rather extensive transportation network around the island. The roadway locations have been transferred to Figure 3-7 from aerial photographs taken of Pineros between 1949 and 1958.

Field reconnaissance relocated the remains of a number of the structures seen on both the 1959 map and the aerial photographs. The roadways are somewhat overgrown or are no longer accessible, although many have been slightly maintained to facilitate passage across the island during USN maneuvers.

Dense vegetation has obscured many of the structural remains on Pineros Island. There is very little left of any one structure. Most of the structures that were located had been built of reinforced concrete; some had tin roofing. A six-foot-wide concrete and iron manhole, located on the northeast coast near the beach, was probably associated with an extensive drainage system coming off the structure concentration on the hill area to the south. The facilities and structures that are visible have been subjected to varying degrees of deterioration or destruction by natural erosion as well as training maneuvers. The land surfaces surrounding the structural remains are also highly disturbed for the same reasons.

The three ruins located on Cabeza de Perro Island appear to be the remains of small (8-foot-square by 10-foot-high) post-World War II structures and consist of the lower portions of poured reinforced concrete and cinderblock walls on concrete floor pads. No historic artifacts were visible in the collapsed structures or in the surrounding area. The structures do not appear to be associated with the other military structures on Pineros or identifiable military activities on either island. Furthermore, because of their highly disturbed conditions, the structures do not represent cultural resources with the potential to contribute to the understanding of the historic use of Cabeza de Perro Island.

3.8.5 Summary and Recommendations

A limited archaeological reconnaissance survey was conducted for selected areas of Pineros Island. A complete walkover reconnaissance survey, as well as limited subsurface testing, was conducted on Cabeza de Perro during the December 1989 survey period. The surveys were designed to test hypotheses developed in a sensitivity assessment of Pineros and Cabeza de Perro islands. Although the sensitivity assessment suggested that the northeastern portion of Pineros would be most likely to yield unrecorded prehistoric sites, none were identified there.

Three types of cultural resources were located and identified during the survey of selected areas of Pineros: a prehistoric flake findspot (tentatively designated as cultural); a sparse, culturally unidentifiable shell midden; and the historic remains of an extensive World War II military complex. Only one type of cultural resource was located and identified during the survey on Cabeza de Perro Island: the remains of three military structures.

It is highly likely that the large-scale excavations, grading, and filling associated with the construction of the military complex and contemporary training maneuvers subsequent to its abandonment have obliterated the remains of extant cultural resources, particularly prehistoric ones. No surveyed portion of the island appeared to be undisturbed.

Recommendations for the treatment of the cultural resources identified during the walkover reconnaissance survey of Pineros Island follow.

Flake Findspot - Pineros 1

No further work is recommended for the Pineros 1 archaeological site. The presence of ordnance remains in the immediate vicinity of the flake findspot suggest the possibility that flaking may have been caused by the detonation of the ordnance. In addition, an extensive survey of a 100-foot area surrounding the surface find failed to produce additional cultural material or features. If the site is cultural, it does not appear to possess qualities which would make it eligible for the National Register of Historic Places (NRHP).

Shell Midden

Limited surface inspection and subsurface trowel probing at selected locations within the midden strand failed to produce cultural material. Although no cultural or chronological designation can be applied to this site based on the limited reconnaissance there, additional intensive site testing may be necessary to provide the information required to assess its potential for inclusion in the NRHP.

Intensive site testing should be designed to provide information on both the horizontal limits and vertical extent of the midden, as well as its integrity as evidenced by the degree of prior disturbance. It is assumed that the midden represents a resource extraction site. In addition to this, site testing could result in the determination of cultural affiliation and chronological placement of the site.

World War II Military Complex

Data regarding the historic occupation (civilian and military) of Pineros and Cabeza de Perro islands is not readily available. The military complex identified during field investigations and verified by map and photograph analyses represents an important period in United States and British history, as well as of this portion of the Caribbean. Although for the most part highly disturbed, the underground tunnel complex on Pineros may contain undisturbed and undocumented historically

significant features. In order to determine the complex's eligibility for the NRHP, background literature and site file research should be undertaken. Based on the results of that research, a program of documentation and/or testing can be developed which will provide the information necessary to determine whether or not the underground military complex possesses qualities that would make it eligible for the NRHP.

In addition to the recommendations outlined above, an attempt should be made to locate the civilian structure indicated on the 1941 Stump map. This possible historic site was not in an area that was surveyed during the January 1989 field investigations. (The 1941 map was not available prior to the completion of field survey.)

3.9 SOCIOECONOMIC CONSIDERATIONS

No civilian use of either Pineros or Cabeza de Perro islands is presently permitted. The waters around both islands are designated on sailing charts as restricted waters within the NAVSTA Roosevelt Roads boundaries. However, the local population makes occasional visits to Pineros for fishing and catching land crabs. Numerous land crab traps were observed in the vicinity of Lagoons 1 and 2. During field surveys, pleasure and fishing boats were observed off the north and west coasts of Pineros. Fishermen were observed snorkeling off the north coast of Pineros, for undetermined reasons, daily during the five-day June survey.

An additional socioeconomic consideration is commercial and residential development in the City of Fajardo, located approximately 5 miles northwest of Pineros on the coast of Puerto Rico. Recent development includes expansion of marinas, condominiums, and other residential developments. One marina is located just north of NAVSTA Roosevelt Roads, approximately 3 miles from Pineros Island. Training activities on the north coast of Pineros are within direct view and earshot of the Fajardo coast.

4. ENVIRONMENTAL IMPACTS AND MITIGATION MEASURES

This section describes the impacts of existing SPECWAR training on the physical, natural, cultural, and socioeconomic environments of Pineros and Cabeza de Perro islands. This section also describes the potential immediate, short-term, and long-term impacts from use of the islands for SPECWAR training at levels proposed for the future, which are described in Sections 1 and 2, and recommends measures to minimize unavoidable adverse impacts.

4.1 TOPOGRAPHY, GEOLOGY, AND SOILS

No impacts on geology result from training activities on Pineros Island. Sea-to-land firing, demolitions, and upland small-arms practice impact soils and local topography. These activities disturb soils directly and decrease the vegetative cover, making these areas susceptible to the forces of erosion (wind, rain, human traffic) and the loss of topsoil. The detonation of ordnance results in negligible, highly localized changes in topography and direct loss of topsoil. Sea-to-land live firing has moderate impacts on the topography of steep slopes and sea cliffs on the northern coast of Pineros Island. The impact of shells results in a direct loss of soil and rock from these slopes, exposing new surfaces to the forces of erosion, and increasing the rate of erosion in these areas.

Local and negligible impacts to soils occur from the building and emplacement of target structures along small-arms trails. Some sedimentation of immediate off-shore areas is likely after the construction of targets. In addition, soil along small-arms trails would continue to be exposed. These trails act as drainage swales during heavy rains and therefore are more susceptible to erosion than the surrounding vegetated areas.

In order to mitigate the impacts of current and proposed SPECWAR training activities, maneuvers are conducted mainly in areas already disturbed by past land use activities. For example, the facilities, trails, and roads used by the British forces during World War II are still used extensively for SPECWAR training. Activities conducted in previously undisturbed vegetated areas are comparatively limited in scope and frequency. SPECWAR does not clear large areas of land for training, but rather performs only limited clearing and along existing trails. No heavy equipment that could severely disrupt soils is used on the islands. In addition, the proposed action concentrates training activities in areas outside sensitive watersheds and lacking very steep slopes. Continuation of training on Pineros and Cabeza de Perro islands would have only negligible impacts on local topography.

4.2 WATER QUALITY

Continued SPECWAR training would result in negligible impacts on surface water hydrology, primarily associated with minor alterations of drainage patterns and surface runoff. Past land use activities and Naval operations, ordnance impacts, road construction, and construction of military bunkers, have had a negligible effect on surface hydrology by altering natural drainage patterns. Training does not affect surface water quality, except to the extent that these activities affect soil erosion and sedimentation rates. Eroded soils are transported to the collecting waterbodies by surface runoff, resulting in higher turbidity and decreased water quality in these surface waters. In order to mitigate these impacts to surface water quality, the Navy proposes to limit all demolitions and small-arms firing to areas outside the watersheds of environmentally sensitive waterbodies (i.e., lagoons).

The overall impact of the off-shore detonation of ordnance on the existing marine water quality is negligible. However, the siltation resulting from underwater explosions will continue to have a localized, negligible short-term impact on water quality. Most sediments resuspended in the water column rapidly settle to the bottom in the immediate vicinity of the disturbance. Particles remaining in suspension are carried away by the prevailing currents, and in the process the sediment will be dispersed by the mixing induced by currents and waves.

4.3 MARINE RESOURCES

This section describes the impacts of Naval weapons training to the existing marine communities identified in the qualitative field survey conducted in January 1989 around Pineros and Cabeza de Perro islands, and assesses the potential impacts of continued Naval activities at the proposed levels of operation.

4.3.1 Seagrass Bed Community

The Naval activities to date appear to have had negligible or no impact on the seagrass bed community around either island. A qualitative survey around Pineros and Cabeza de Perro islands has shown that the seagrass beds are quite extensive and appear to be healthy, indicating that sedimentation derived from upland training activities and the off-shore detonation of ordnance is not significantly damaging the seagrass beds. Since the survey was conducted in the winter, productivity could not be assessed. There were several areas where grazing was evident.

The minor damage identified during the field survey appears in the form of blowouts due to storms and the use of explosives during training activities at Pineros. Blowouts are concentrated along the southern shore of Pineros. These damaged areas are small, 1 to 3 meters in diameter and less than 1 meter deep, and usually revegetate within 1 to 2 years. Since these blowout areas are generally small in size and appear to be in various stages of recovery, it is apparent that the seagrass community is able to recover from the existing level of damage.

The continued use of explosives for Naval training around Pineros would not exceed the capacity of the seagrass bed community to repair itself. Although the damage, due to either storms or ordnance impacts, observed in this area might have important local consequences, it would not affect the surrounding seagrass meadows, which appear healthy and productive.

It does not appear that past use of ordnance on land has had any effect on the surrounding seagrass community through increased sedimentation, and the proposed level of ordnance use would not affect the seagrass meadow.

The Navy proposes to increase the area available for underwater demolitions training by adding an underwater demolition zone off the northwest coast of Pineros Island. This area is located a sufficient distance away from other such zones to prevent any impacts from becoming additive; the impacts to any one demolition zone will remain negligible, localized, and isolated, allowing the seagrass community within each zone to eventually recover as it has in the other underwater demolition areas. In addition, ordnances in the proposed new zone will be placed away from seagrass beds, to the extent possible.

4.3.2 Coral Reef Community

Direct impacts of current weapons training activities to the coral reef community around Pineros and Cabeza de Perro islands are localized and negligible; indirect impacts of weapons training to the coral reefs appear to be adverse. Direct damage is localized and restricted to the areas indicated in Figure 3-2 where channels were cut through the coral reef on the north side of Pineros Island. In these areas, the coral community has been replaced by dead coral and limestone rubble and algal communities. While the damage to these areas of the reef is long-term, the extent is limited and the impact to the overall reef community is negligible. Direct adverse impacts to the coral reef around Cabeza de Perro Island can also be expected. The Navy proposes to cut a channel to the island so that it may be more fully utilized, as it is less environmentally sensitive than much of Pineros Island. Although long-term, these impacts will be negligible and highly localized.

Ordnance use on Pineros, in addition to cutting through the coral reef itself, may have indirect adverse impacts to the coral reef. The increased sedimentation caused by the detonation of ordnance can smother the corals, resulting in decreased productivity or mortality if siltation is sufficiently severe. The corals along the northern shore of Pineros may be adversely impacted due to ordnance use. Since the coral heads along the northern shore of Pineros are intact, it is likely that sedimentation or disease were the historical causal factors. Only 10 to 40% of the corals on the northern reef are living, the lowest percentage of any of the reefs. Because a significant amount of off-shore ordnance use occurs here, it is likely that it is a contributing

factor to the high mortality of these corals. The increase in sedimentation could also be due to ordnance use on the island itself creating runoff of silty sediments, land use activities which increased sediment runoff thereby causing the destruction of corals in the recent past, altered nearshore current patterns from the channels cut through the reef causing increased sedimentation, or an increase in storm frequency and severity over the recent past. In addition, coral diseases are still evident throughout much of the Caribbean and do not appear to be prompted by changes in the ambient environment. As a result, although all of the above factors are potential contributing agents to the mortality of the corals, it is difficult to determine which, if any, are the direct cause of mortality without further intensive study of the dynamics of this coral reef.

The patch reefs along the southern and eastern shores of Pineros Island and the reefs around Cabeza de Perro Island appear to be in good health, with no adverse impacts due to ordnance use or sedimentation evident. The coral reef fish community could not be properly assessed due to inclement weather conditions; therefore, the species and numbers identified during the January 1989 field survey might not be indicative of community health. The better condition of these reefs as opposed to the northern shore of Pineros Island is likely due to the prevailing current which carries sediment away from the island towards the south.

Continued use of ordnance in Naval training exercises would have little or no impact to the coral reefs along the eastern and southern coasts of Pineros Island and around Cabeza de Perro Island. However, the continued use of ordnance in the waters along the northern side of Pineros could prevent the recovery of the reef through continued sedimentation effects. Continued use of ordnance on Pineros may also enhance the destruction of coral species along the northern side of Pineros through land-derived sediment runoff. The proposed additional underwater demolition zone, located off the northwest coast of Pineros, is positioned to allow prevailing currents to rapidly carry the resuspended sediment (from demolitions) west of the island and then south, preventing damage to the northern reef.

4.3.3 Threatened and Endangered Species

Training activities have negligible adverse impacts to threatened and endangered marine species as a result of explosions in the seagrass beds and disturbances on the turtle nesting beaches. The Navy proposes to add an underwater demolition zone off the northwest coast of Pineros Island. In order to mitigate the impacts due to this additional demolition zone, ordnances will be located away from seagrass beds, and detonation will occur only in daylight. Off-shore detonation of ordnance could potentially result in direct mortality of rare species such as sea turtles and manatees. However, to minimize any adverse effects during detonation of underwater explosives and to adequately protect these species, the Navy will incorporate the following precautionary actions:

- o Scuba divers will patrol the area for sea turtles and manatees up to 30 minutes prior to detonation;
- o A helicopter will patrol the area for sea turtles and manatees as close as possible to time of detonation;
- o The explosives will not be detonated until the area is cleared of protected species (i.e., marine mammals and listed sea turtles); and
- o Observers will be provided by Navy personnel to ensure there are no hazardous effects on marine life as listed above.

There were no direct observations of threatened and endangered marine species in the vicinity of underwater demolition zones during the field surveys. However, evidence of grazing along the southern shore of Pineros was evident during the January 1989 field survey and could be due to manatees or sea turtles. Since little or no impacts to the seagrass beds were observed, it is likely that only negligible indirect impacts from continued Naval training exercises will occur to threatened and endangered marine species around Pineros and Cabeza de Perro islands.

Proposed training activities may actually have beneficial impacts to rare marine species. Past studies indicate low densities of manatees and sea turtles around Pineros and Cabeza de Perro islands. Sea turtles

may use the beaches on the northern shore of Pineros for nesting. The restriction of civilian access to these waters and beaches has beneficially impacted these species by protecting them from exploitation.

4.4 TERRESTRIAL ENVIRONMENT

4.4.1 Vegetation

Training activities have both direct and indirect impacts on terrestrial vegetation on Pineros and Cabeza de Perro islands. Negligible direct adverse impacts occur primarily from short-term disturbance to vegetation resulting from demolitions or small-arms fire. In addition, overall ownership and management of Navy-owned lands has had both beneficial and adverse indirect impacts on the islands' vegetation. Both direct and indirect adverse impacts are likely to continue as a result of the proposed training activities. However, these impacts are generally minor. This section identifies direct and indirect adverse impacts to terrestrial vegetation resources on Pineros and Cabeza de Perro islands resulting from continued Naval operations and permitted civilian activities. This section then briefly summarizes measures to mitigate these impacts.

Clearing vegetation for maintenance of the small-arms range or along combat trails involves short-term impacts primarily to scrub vegetation, which is abundant and of no special ecological or aesthetic value. Cleared areas rapidly reestablish vegetative cover, typically with the same scrub species, such as Leucana leucocephala, that existed before impacts. To minimize extensive damage to vegetation from small arms along combat trails and in firing ranges, and subsequent alteration of vegetation to undesirable scrub species like Leucana, combat trails and firing ranges used for training will remain relatively constant. Combat trails are, at present, located primarily within previously disturbed and less desirable vegetation types, such as leucana woodlands and vine thickets.

Fires that result from ordnance or flares have the potential to burn areas of vegetation, especially where tree litter exists along small-arms trails. The impact of these fires is short-term, as only the above-ground vegetation is killed, and vegetation reestablishes by sprouting from undamaged root systems. However, this vegetation is

subtropical dry coastal forest, and growth rates are extremely slow. In addition, frequent fires often result in a change in species composition and the invasion of grasses. Therefore, precautions must be taken to minimize the risks of uncontrolled fire.

Potential increases in training beyond the no action alternative (i.e., modified training activities one and two) will result in a slight increase in disturbance to vegetation in areas where demolitions are exploded. However, in the case of the proposed action, these areas are located away from environmentally sensitive habitats.

Beneficial indirect impacts to vegetation result from Navy ownership and training on the islands. Beneficial indirect impacts result from the protection from commercial development of various vegetation cover types for recreation or agriculture which are either unique or of special ecological or aesthetic value. These cover types include mangroves and upland forest which supports several rare plant species.

4.4.2 Mangroves

The modified training activity two allows patrolling only in mangrove areas, with no small-arms firing or demolition. The impacts associated with this alternative would therefore result in no direct adverse impacts to mangroves other than those associated with patrolling. Low-level usage of the mangrove forest for patrolling would not be expected to present an adverse impact. Patrols comprised of squads of six to ten persons maximum, without small-arms activity (including blank ammunition), would result in only small foot-trail impacts.

Mangrove forests can be indirectly affected by alterations which occur in two primary locations: surrounding uplands and coastal areas. The soils of Pineros Island are prone to erosion and occur on steep slopes. Increased erosion within the contributing watershed has an indirect adverse impact on the adjacent mangrove community. Excessive upland-derived sedimentation due to improper management activities was identified as one of the most severe impacts to the mangrove forest of Vieques Island, Puerto Rico (Mangrove Systems 1985).

Any erosion caused by demolition in adjacent uplands can result in reduced water quality in the receiving lagoon. Increased turbidity in a lagoon can reduce the light necessary to sustain growth of seagrasses.

Additionally, accumulations of upland-derived sediments could increase elevation of substrate above the threshold water level where mangroves can grow, resulting in plant community changes and precluding intertidal vegetation. The modified training activity one and no action alternatives allow demolitions and small-arms firing in mangrove watersheds, while modified training activity two only allows patrolling in these areas and thus minimizes impacts.

The coral reefs and rock outcroppings along the coast of Pineros Island dictate the physiognomic structure of the coastline. Demolition of these coastal features could result in increased energy realized on other portions of the shoreline. For instance, several acres of sand have apparently been lost along the eastern section of the north coast of Pineros Island. It is suspected that demolition of the coral reef, which acted as a breakwater and had accumulated sand in a tombolo formation in its wave-energy shadow, resulted in the loss of this sandy material due to the increased wave energy at the shoreline. In similar context, if the reef (or protective rock promontory) is altered and a mangrove lagoon had persisted in the energy-shadow of the structure, then adverse impacts to the mangrove forest could result from increased wave energy. Because modified training activity two prohibits demolition of coral reefs, any energy-related impacts are expected to be negligible.

Generally, the mangrove resources of Pineros Island are probably in the best condition of any forest in eastern Puerto Rico. It is believed that the Navy's presence on the island is largely responsible for this fact. Many mangrove areas in the public trust in Puerto Rico are in an extremely stressed condition.

4.4.3 Wildlife

SPECWAR activities on Pineros and Cabeza de Perro islands have had and will continue to have both beneficial and adverse impacts on terrestrial wildlife. Because terrestrial wildlife species are closely associated with vegetation communities, changes in terrestrial vegetation as discussed in Sections 4.4.1 and 4.4.2 will also affect the associated wildlife populations. Potential adverse impacts to terrestrial wildlife include destruction of habitat in areas where demolitions and small-arms

fire is permitted and by displacement of individuals from these areas during training activities. Temporary disturbances to wildlife habitat will be short-term, as the vegetation rapidly reestablishes itself and proposed training activities will occur in areas which were previously disturbed. Current training activities on Pineros and Cabeza de Perro islands do not appear to have had major adverse impacts on wildlife. Although modified training activity two would increase the area where training activities are conducted, the impact on wildlife due to additional disturbed vegetation should be negligible. The additional areas proposed for training are of no special value as wildlife habitats. In addition, training activities are restricted or prohibited in all important wildlife use areas under modified training activity two, resulting in negligible impacts to wildlife in general and endangered species (white-cheeked pintail, West Indian whistling duck, brown pelican, white-crowned pigeon) in particular.

Naval occupation and management of the islands have had major indirect beneficial impacts on wildlife by limiting civilian access, thus preventing the exploitation of wildlife resources and the destruction of habitat. Wildlife species of concern that may be hunted elsewhere but receive protection on Pineros include the white-cheeked pintail and the white-crowned pigeon.

In summary, while SPECWAR activities result in negligible short-term and long-term impacts to wildlife habitat, the beneficial impacts to wildlife resulting from the sanctuary effect of restricting civilian access to Navy property help to compensate for the adverse impacts.

4.4.4 Threatened and Endangered Species

Training activities on Pineros and Cabeza de Perro islands will have negligible adverse impacts on terrestrial threatened and endangered species.

There was no evidence of nesting, breeding, or roosting by the yellow-shouldered blackbird on either Pineros or Cabeza de Perro. Field surveys were conducted using procedures suggested by a recognized authority on this species (see Appendix A). Suitable habitat for this species was found on both islands; however, there is no evidence of yellow-shouldered blackbird use of either island since 1984. There is

no documentation of any nesting by this species on either island. Recent surveys of NAVSTA Roosevelt Roads (Collazo 1989, Wiley et al. 1988, Vicente et al. 1989) suggest that the local population of the yellow-shouldered blackbird is declining. Given current population trends, it is unlikely that this species could utilize all of the potentially available habitat. Taken together, evidence of species occurrence and population status suggest that the proposed training activities on Pineros and Cabeza de Perro will not adversely impact this species.

Diurnal and nocturnal surveys for the Virgin Islands and Puerto Rican boas failed to locate either species on Pineros or Cabeza de Perro. There is abundant boa habitat on Pineros, but a large, uncontrolled rat population may preclude the occurrence of these species. Very little suitable habitat or prey for this species were found on Cabeza de Perro. Based on survey results, rat populations, available habitat, and prey base information, it is believed that proposed training activities will not adversely impact these species.

No threatened, endangered, or candidate plant species were located on either island.

4.5 LAND USE

The impacts of modified training activity two on land use would be to provide SPECVAR access to a greater proportion of Pineros Island for training than it currently has. As a result, impacts from ordnance would be spread over a larger area. However, impacts to any one location can be expected to be reduced.

The number of overnight training sessions would not increase under modified training activity two. The various improvements implemented on Pineros would continue to be used, as necessary, to support SPECVAR training. As a result, impacts to land use are expected to be negligible.

4.6 CULTURAL RESOURCES

The large-scale excavation, filling, and grading necessary for construction of the World War II military complex were sufficient to impact original land surfaces as well as to obliterate any prehistoric

sites that might have been in those locations. The bunkers, batteries, barracks, roadways, and drainage systems located on Pineros and Cabeza de Perro islands all required large-scale excavations, filling, and grading.

Use of Pineros Island for Naval training maneuvers has contributed to a high degree of disturbance to natural ground surfaces in various locations across the island where maneuvers are conducted. However, these maneuvers take place mainly in areas previously disturbed by construction activities during World War II. Maneuvers at Pineros Island include demolitions and small-arms practice.

Maneuvers have also had a negative impact on the integrity of most of the structural remains associated with the military complex and, to a lesser degree, the shell midden site. All of the structures observed during the cultural resource survey showed at least some evidence of being used for target practice. The structures were in various states of disrepair and disintegration; a variety of ammunition and other types of ordnance were found in the walls of the structures and on the ground nearby. The shell midden site is in an area where evidence of ordnance was also prevalent. The extent of the ordnance impact on the shell midden site has not been determined.

Archaeological field investigations at Pineros Island did not substantiate the hypotheses about potential site distributions promulgated in the sensitivity assessment (see Appendix B). If prehistoric sites were located in the eastern and northern portions of the island, as suggested in the sensitivity analysis, they were not evident during the reconnaissance survey. On both Pineros and Cabeza de Perro islands, locations that might have been potentially archaeologically sensitive have been subjected to disturbances sufficient to remove any evidence of archaeological sites.

The proposed training activities involve opening up the entire island of Pineros, except for the mangrove watersheds and important wildlife habitats, to activities that would include the use of small arms and demolition devices.

However, of the identified historic resources on Pineros and the remains of the structures on Cabeza de Perro, only the underground military tunnel complex appears to have the potential to meet NRHP

eligibility criteria. Although they constitute a part of this complex, the defensive emplacements found flanking the tunnel entrance have already been extensively disturbed, as have the majority of surface features on the island. Further military activities involving these surface fixtures will not affect their potential to meet NRHP eligibility criteria. Activities with the potential to adversely affect the actual tunnel entrance or the tunnels themselves, such as demolition and, to a lesser extent, small arms fire, will be avoided until further documentation of the complex is undertaken.

Cursory examination of the mouth of the tunnel suggests that the interior of the complex may be largely undisturbed. Documentation should therefore focus on background and archival research, mapping, and photographic documentation of the complex.

Similarly, maneuvers will be restricted in the immediate area of the shell midden site until its NRHP status can be determined, even though the preliminary testing did not indicate that diagnostic artifacts were likely to be recovered from this type of site. Further field testing, including mapping, shovel testing, and/or limited test excavations, may be required to more completely define the horizontal limits of the site, determine its internal integrity, and establish its final NRHP status. The locations of the tunnel complex entrance and the shell midden site are shown on Figure 3-8. These locations are shown as areas to be avoided during military operations in Figure 2-1. These two small areas are the only cultural resource data locations incorporated in Figure 2-1. The remains of the other 12 military structures and the other archaeological resources that have been located on the two islands (see Figure 3-8) do not appear to have the potential to meet NRHP eligibility criteria. This lack of apparent NRHP eligibility is primarily due to the sites' severely disturbed and dilapidated conditions and the absence of additional field data associated with them. No further investigations are recommended for these sites, and their presence should not affect military activities.

The military tunnel complex and the shell midden site may, upon further investigation, be found to meet NRHP eligibility criteria and, therefore, must be protected from adverse impacts until their NRHP status can be established. It is therefore proposed that activities be

limited to walk-throughs or walk-overs and small arms firing with plastic bullets in the immediate areas of these two resources (see Figure 3-8) pending further investigation.

4.7 CUMULATIVE IMPACTS

As a result of the Navy's training maneuvers, negligible impacts and some localized moderate impacts are expected to affect the topography of the islands. In addition, negligible to moderate impacts are expected to occur on the soils, primarily because of their potential for erosion. No impacts are expected to occur to the geology of the islands.

Surface water hydrology, surface water quality, and marine water quality will undergo negligible impacts, with some localized direct impacts occurring to the marine water quality. Negligible impacts to no impacts will result in the seagrass beds. However, along the northern shore, localized, adverse long-term impacts on the coral reefs may result from underwater demolitions.

Direct and indirect negligible impacts to the islands' vegetation and wildlife may result from continuation of naval training maneuvers. These adverse impacts, both short- and long-term, result from the clearing of paths, detonations, and live ammunition firing. The mangroves on Pineros will not sustain any direct adverse impacts; however, siltation resulting from soil erosion may cause negligible impacts.

Rare, endangered, and threatened species (both terrestrial and marine) will suffer negligible impacts due to Navy training. In addition, any negligible impacts sustained may be compensated by the added protection from human disturbances provided by the Navy's restricted access on the islands.

Cultural resources on the islands have already been disturbed and are in a dilapidated condition. Two areas being considered for the NRHP, the bunker and shell midden, will be avoided. Therefore, no impacts to the cultural resources are expected to occur from naval training maneuvers on Pineros and Cabeza de Perro islands.

Overall, utilization of Pineros and Cabeza de Perro islands for naval training maneuvers will result in negligible impacts. The general

character of the islands' natural resources will be somewhat altered; however, without restricted public access, these same problems and/or new problems may result.

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APPENDIX A

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Ecology and Environment Incorporation
195 Holtz Road
Buffalo, NY 14225

Dear Ms. Gunther:

Enclosed is the information you requested during our April 23, 1987, telephone conversation concerning the distribution and habitat of selected Federally-listed endangered and threatened species in Puerto Rico which will be used as reference material in the land management plans you are developing for various Navy facilities. I have included information on the following species:

Puerto Rican parrot	<u>Amazona vittata</u>	E
Caribbean brown pelican	<u>Pelecanus occidentalis</u>	E
Puerto Rican plain pigeon	<u>Columba inornata wetmorei</u>	E
Yellow-shouldered blackbird	<u>Agelaius xanthomus</u>	E
Red Siskin	<u>Carduelis cucullata</u>	E
Golden coqui	<u>Eleutherodactylus jasperi</u>	E
Puerto Rican boa	<u>Epicrates inornatus</u>	E
Leatherback sea turtle	<u>Dermodochelys coriacea</u>	E
Green sea turtle	<u>Chelonia mydas</u>	T
Loggerhead sea turtle	<u>Caretta caretta</u>	T
Hawksbill sea turtle	<u>Eretmodochelys imbricata</u>	E
West Indian manatee	<u>Trichechus manatus</u>	E
Puerto Rican nightjar	<u>Caprimulgus noctitherus</u>	E
Roseate Tern	<u>Sterna dougalli</u> proposed	T
Puerto Rican crested toad	<u>Peltophryne lemur</u> proposed	T
Beautiful goetzea	<u>Goetzea elegans</u>	E
Vahl's boxwood	<u>Buxus vahlii</u>	E
St. Thomas prickly-ash	<u>Zanthoxylum thomsonianum</u>	E
Palo de Ramón	<u>Banara vanderbiltii</u>	E
Palo de nigua	<u>Cornutia obovata</u> proposed	E
Bariaco	<u>Trichilia triacantha</u> proposed	E
No common name-soon to be proposed-	<u>Daphnopsis hellerana</u>	E

The only published information available on the distribution and habitat of the Puerto Rico red siskin population is found in Raffaele (1983) and reads as follows: "...is established...between Coamo, Aibonito, and Guayama. It inhabits fairly thick, scrubby areas of the dry hills." In addition, a biologist from this office has observed siskins in overgrown, abandoned sugar cane fields within this region.

Roseate terns breed on offshore cays and prefer to feed inshore and within bays throughout coastal Puerto Rico.

Sea turtles are under the jurisdiction of the U.S. Fish and Wildlife Service only when the turtles are on land (nesting), and are under the jurisdiction of the National Marine Fisheries Service when in water. Green sea turtles prefer to nest on high-energy beaches and require sand that is deep enough to allow for deposition of eggs below 1 meter. Leatherbacks also prefer high-energy beaches but require a deep-water approach (no coral reefs). Conversely, hawksbills may climb over reefs, rocks, or rubble to nest among roots of trees and bushes on small islets or isolated mainland shores. Finally, loggerheads nest in well-drained dunes with clean sand and scattered grassy vegetation.

We suggest that you also include the following advice in the land management plans: Section 7 of the Endangered Species Act of 1973, as amended, requires the Navy to consult with the U.S. Fish and Wildlife Service if any activity they conduct, permit, or fund may effect listed or proposed species. The Navy should contact this office for further information on species present in specific locations, possible effects of specific Navy actions, and an update on the status of listed species.

Additional information is enclosed concerning the remaining species. If you have further questions on this matter, please do not hesitate to contact this office.

Sincerely,

Debbie Mignogno
Fish and Wildlife Biologist

Enclosures

Reference

Raffaele, H. A. 1983. A Field Guide to the Birds of Puerto Rico and the Virgin Islands. Fondo Educativo Interamericano Incorporado. 255pp.



United States Department of the Interior

FISH AND WILDLIFE SERVICE

CARIBBEAN FIELD OFFICE

P.O. BOX 491

BOQUERON, PUERTO RICO 00622

July 9, 1987

Ms. Pam Gunther
Ecology and Environment, Inc.
195 Holtz Drive
Buffalo, N.Y. 14225

Dear Ms. Gunther:

I am enclosing the Commonwealth list of threatened and endangered species you requested. The list is taken from an August 1985 Department of Natural Resources publication entitled "Regulation to Govern the Management of Threatened and Endangered Species in the Commonwealth of Puerto Rico". Although this is the English version, one of the letters in the status column reflects a Spanish word--the "V" stands for "vedado" which means threatened. Any letter followed by an "F" in this same column indicates the species' Federal status.

I hope this will fulfill your needs.

Sincerely yours,

Mary Conser
Mary Conser

APPENDIX 1. LIST OF THREATENED AND ENDANGERED SPECIES

Scientific name	Common name	Status	Date	Critical Habitat	Special Rules
ANIMALIA - CLASE AMPHIBIA					
<u>Bufo lemur</u>	Crested toad	V	08/85	no	no
<u>Eleutherodactylus eneidae</u>	Eneida's coqui	V	08/85	no	no
<u>Eleutherodactylus jasperii</u>	Golden coqui	V; VPP	08/85	yes	no
<u>Eleutherodactylus karlschmidti</u>	Karl Schmidt's coqui	V	08/85	no	no
ANIMALIA - CLASE REPTILIA					
<u>Anolis cooki</u>	Dryland anole	V	08/85	no	no
<u>Anolis roosevelti</u>	Culebra giant anole	E; EP	08/85	yes	no
<u>Caretta caretta</u>	Loggerhead turtle	V; VP	08/85	no	no
<u>Chelonia mydas</u>	Green turtle	E; EP	08/85	no	no
<u>Cyclura stejnegeri</u>	Mona iguana	V; VP	08/85	yes	no
<u>Dermochelys coriacea</u>	Leatherback turtle	E; EP	08/85	no	no
<u>Epicrates inornatus</u>	Puerto Rican boa	E; EP	08/85	no	no
<u>Epicrates monensis</u>	Mona boa	V; VP	08/85	yes	no
<u>Eretmochelys imbricata</u>	Hawksbill turtle	E; EP	08/85	no	no
<u>Lepidochelys kempi</u>	Kemp's ridley	E; EP	08/85	no	no
<u>Mabuya mabouya sloanii</u>	Sloan's skink	V	08/85	no	no
<u>Microglossus micropithecus</u>	Moni gecko	E; EP	08/85	yes	no

A-9

V = threatened

V; VPP = extremely rare

V = endangered

ANIMALIA - CLASE AVES

<u>Accipiter striatus venator</u>	Sharp-shinned hawk	V	08/85	no	no
<u>Agelaius xanthomus</u>	Yellow-shouldered BB	E; EF	08/85	yes	no
<u>Amazona vittata</u>	Puerto Rican parrot	E; EF	08/85	no	no
<u>Caprimulgus noctitherus</u>	P. H. whip-poor-will	E; EF	08/85	no	no
<u>Charadrius alexandrinus tenuirostris</u>	Snowy plover	V	08/85	no	no
<u>Columba inornata wetmorei</u>	Plain Pigeon	E; EF	08/85	no	no
<u>Dendrocygna arborea</u>	W. I. Whistling duck	V	08/85	no	no
<u>Falco peregrinus tundrius</u>	Peregrine falcon	E; EF	08/85	no	no
<u>Fulica caribaea</u>	Caribbean coot	V	08/85	no	no
<u>Oxyura jamaicensis</u>	Ruddy duck	V	08/85	no	no
<u>Oxyura dominica</u>	Masked duck	V	08/85	no	no
<u>Pelecanus occidentalis</u>	Brown pelican	E; EF	08/85	no	no
<u>Porzana flaviventer</u>	Yellow-bellied rail	V	08/85	no	no
<u>Sterna antillarum</u>	Least tern	V	08/85	no	no
<u>Tachybaptus dominicus</u>	Least grebe	V	08/85	no	no

ANIMALIA - CLASE MAMMALIA

<u>Megaptera novaeangliae</u>	Humpback whale	E; EP	08/85	no	no
<u>Monachus tropicalis</u>	Caribbean Monk seal	E; EP	08/85	no	no
<u>Physeter catodon</u>	Sperm whale	E; EP	08/85	no	no
<u>Trichechus manatus</u>	Manatee	E; EP	08/85	no	no

PLANTAE CLASE DICOTYLEDONEAE

8-V <u>Banara vanderbiltii</u>		E	08/85	no	no
<u>Buxus vahlia</u>	Vahl's boxwood	E	08/85	no	no
<u>Goetzia elegans</u>	Beautiful goetzia	E	08/85	no	no
<u>Zanthoxylum thomsonianum</u>	Prickly ash	E	08/85	no	no

6200
SER 102/3218
19 Aug 87

Mr. Robert T. Pace
Acting Field Supervisor
Caribbean Field Office
U.S. Fish and Wildlife Service
P.O. Box 491
Boqueron, PR 00622

Dear Mr. Pace:

This is to confirm our verbal agreement to continue limited military training operations on Pinaros Island until the Endangered Species Act Section 7 consultation and National Environmental Policy Act requirements are completed for the use of Pinaros and Cabeza de Perro Islands.

By this agreement military training activities will be limited to those depicted on the enclosed map of Pinaros Island. We appreciate your cooperation on the resolution of this matter which will both allow continued military training operations and preservation of Pinaros Island valuable resources.

For additional information, please contact the undersigned at 863-2907.

Sincerely,

FELIX HESTER
Director, Environmental
Engineering Division
Public Works Department
By direction of the
Commanding Officer

Enclosure

Blind Copy to:
NSWU Four
COMNAVACTCARIB (Code 008)
COMNAVAILANT (Code 611)
LANTNAVFACENGCOM (Code 2032E1 and 24231)

PINEROS ISLAND
LAND USE MASTER PLAN

COLOR	CODE	ACTIVITY
BLUE	1	UNDERWATER DEVIATION
BROWN	2	DEMOLITION & SMALL ARMS FIRING
YELLOW	3	CAMPING AREAS
GREEN	4	PATROLLING (ON FOOT)
RED	5	OFF-LIGHTS
PURPLE	6	SMALL ARMS FIRING



PINEROS ISLAND

A-11

OFFICER IN CHARGE
PINEROS ISLAND





DEPARTMENT OF THE NAVY
COMMANDING OFFICER
NAVAL SPECIAL WARFARE UNIT FOUR
BOX 3400
FPO MIAMI 31051-3400

6288
Scr CO/148
October 26, 1987

A
OCT 1987
PUBLIC WORKS DEPT
ENVIRONMENTAL DIV

Mr. Robert T. Pace
Acting Field Supervisor
Caribbean Field Office
U.S. Fish and Wildlife Service
P.O. Box 491
Boqueron, PR 00622

Dear Mr. Pace:

As discussed during a telephone conversation between you and my representative, QM1 Hinch on October 27, 1987, my command will construct a temporary target structure out of rubber tires and wood on Pineros Island. This target will be built in the location depicted in the enclosed map. The target location is in an area that you and QM1 Hinch had previously agreed would be used for demolition and small arms training.

On October 23, 1987 QM1 Hinch discussed this project with Mr. Felix Mestoy of the Naval Station Roosevelt Roads Environmental Engineering Division. Mr. Mestoy had no objections to this project as long as it was agreed upon with your office.

As I have the approval of your office and that of the Naval Station, I will be starting the project in the near future. If you have any questions or any general information on Pineros Island, feel free to call me at (809) 865-2000 Ext 4721/5298.

Sincerely,

W. F. VAGTS
Lieutenant Commander, U. S. Navy
Commanding Officer

Encl:

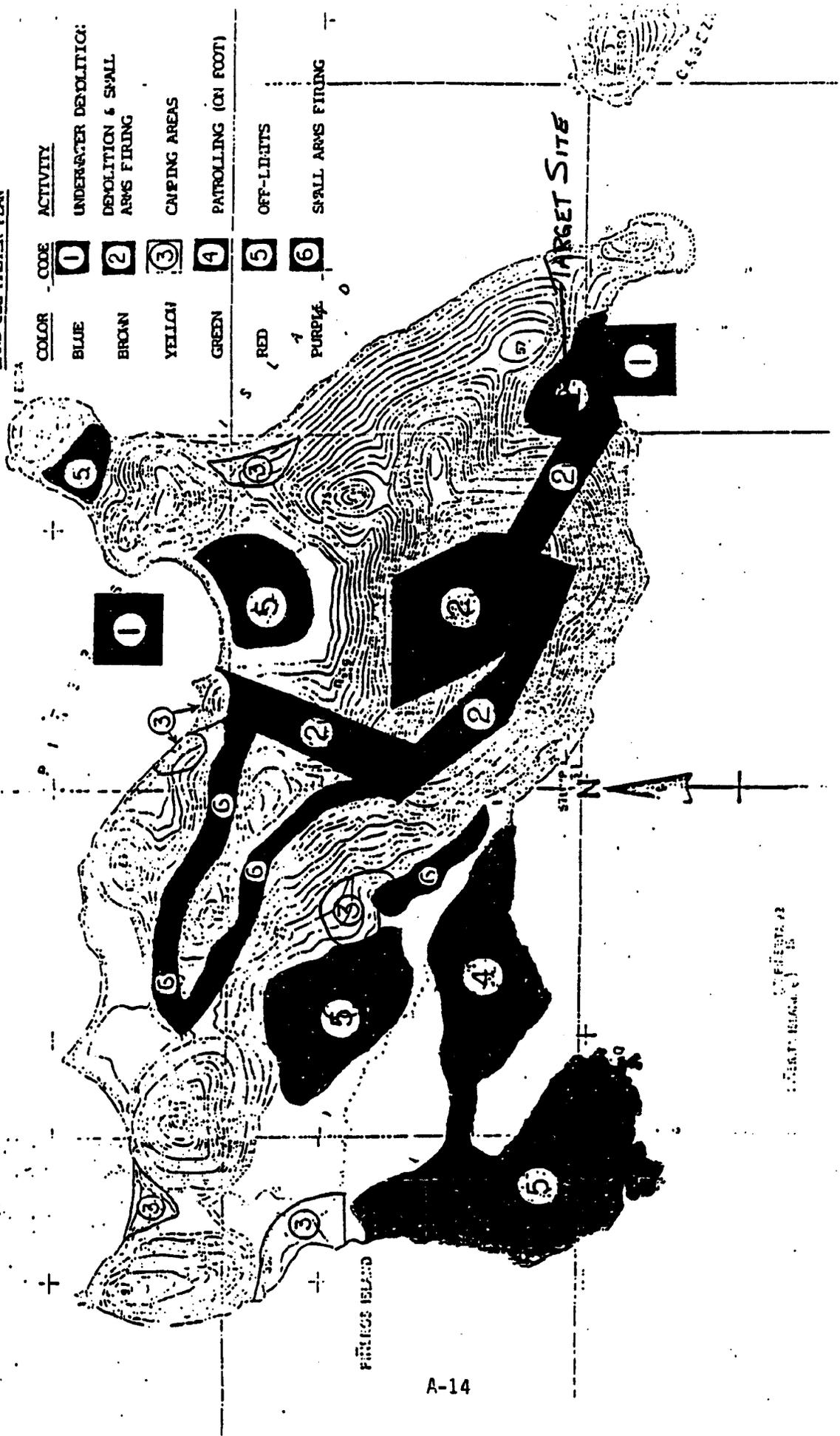
(1) Map of Pineros Island

Copy to:

Commanding Officer, Naval Station Roosevelt Roads, PR
Commander, Special Warfare Group TWO
Director Environmental Engineering Division,
Naval Station, Roosevelt Rds, PR

PINEROS ISLAND
LAND USE MASTER PLAN

COLOR	CODE	ACTIVITY
BLUE	1	UNDERWATER DEVIATION:
BROWN	2	DEMOLITION & SMALL ARMS FIRING
YELLOW	3	CAMPING AREAS
GREEN	4	PATROLLING (ON FOOT)
RED	5	OFF-LIGHTS
PURPLE	6	SMALL ARMS FIRING



PINEROS ISLAND

FIGURE 12
PINEROS ISLAND



**UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE**

**Southeast Regional Office
9450 Koger Boulevard
St. Petersburg, FL 33702**

November 24, 1987 F/SER23:TAH:td

**Mr. R. L. Warren, Head
Environmental Intergovernmental Section
Department of the Navy
Atlantic Division
Naval Facilities Engineering Command
Norfolk, Virginia 23511-6287**

Dear Mr. Warren:

This responds to your November 12, 1987, letter requesting a list of endangered/threatened species that may be present in the vicinity of Pineros Island, Puerto Rico. You also requested the names of persons who are familiar with distributions of listed species in the area, and some examples of previous consultations. This information is enclosed.

Based on your brief description of the proposed activity and telephone conversations between Terry Henwood and John Evans, we suggest that the species most likely to be impacted are the green, hawksbill and leatherback turtles. The extent of impacts, however, will depend on the types and size of explosives to be detonated, the turtle habitat present in the area, and whether turtles nest on Pineros Island.

For a major federal action, the agency must conduct a biological assessment to identify any endangered or threatened species which may be affected by such action. The biological assessment must be complete within 180 days after receipt of the species list, unless it is mutually agreed to extend this period. The components of a biological assessment are also enclosed.

At the conclusion of the biological assessment, the Federal agency should prepare a report documenting the results. If the biological assessment reveals that the proposed project may affect listed species, the formal consultation process shall be initiated by writing to the Regional Director at the address on the letterhead. If no effect is evident, there is no need for formal consultation. We would however, appreciate the opportunity to review your biological assessment.



If you have any questions, please contact Dr. Terry Henwood,
Fishery Biologist, at FTS 826-3366.

Sincerely yours,

Charles A. Oravetz

Charles A. Oravetz, Chief
Protected Species Management
Branch

Enclosures

Suggested Contacts:

Paul Gertler
Caribbean Field Office
U.S. Fish and Wildlife Service
P.O. Box 491
Boqueron, Puerto Rico 00622
(809) 851-7297

Kathy Hall
University of Puerto Rico
Department of Marine Sciences
Mayaguez, Puerto Rico 00708
(809) 834-4040 Ext. 25117

**Endangered and Threatened Species and Critical Habitats under
NMFS Jurisdiction**

Puerto Rico

<u>LISTED SPECIES</u>	<u>Scientific Name</u>	<u>Status</u>	<u>Date Listed</u>
Fin Whale	<u>Balaenoptera physalus</u>	E	12/2/70
Humpback Whale	<u>Megaptera novaeangliae</u>	E	12/2/70
Sei Whale	<u>Balaenoptera borealis</u>	E	12/2/70
Sperm Whale	<u>Physeter catodon</u>	E	12/2/70
Green Sea Turtle	<u>Chelonia mydas</u>	Th	7/28/78
Hawksbill Sea Turtle	<u>Eretmochelys imbricata</u>	E	6/02/70
Leatherback Sea Turtle	<u>Dermochelys coriacea</u>	E	6/02/70
Loggerhead Sea Turtle	<u>Caretta caretta</u>	Th	7/28/78
Olive (Pacific)			
Ridley Sea Turtle	<u>Lepidochelys olivacea</u>	Th	7/28/78

SPECIES PROPOSED FOR LISTING

None

LISTED CRITICAL HABITAT

None

PROPOSED CRITICAL HABITAT

None

Guidelines for Conducting a Biological Assessment

- (1) Conduct a scientifically sound on-site inspection of the area affected by the action. Unless otherwise directed by the Service, include a detailed survey of the area to determine if listed or proposed species are present or occur seasonally and whether suitable habitat exists within the area for either expanding the existing population or reintroducing a new population.
- (2) Interview recognized experts on the species listed, including those within the Fish and Wildlife Service, the National Marine Fisheries Service, state conservation agencies, universities and others who may have data not yet found in scientific literature.
- (3) Review literature and other scientific data to determine the species distribution, habitat needs, and other biological requirements.
- (4) Review and analyze the effects of the action on the species, in terms of individuals and population, including consideration of the cumulative effects of the action on the species and habitat.
- (5) Analyze alternative actions that may provide conservation measures.
- (6) Conduct any studies necessary to fulfill the requirements of (1) through (5) above.
- (7) Review any other information.



United States Department of the Interior

FISH AND WILDLIFE SERVICE

CARIBBEAN FIELD OFFICE

P.O. BOX 491

BOQUERON, PUERTO RICO 00622

January 11, 1988

Mr. John Evans
Naval Facilities Engineering Command
Norfolk, Virginia 23511-6287
(CODE 2032E4)

Dear Mr. Evans:

As we agreed in our meeting at Naval Station Roosevelt Roads on December 8, 1987, we have enclosed our recommended revisions to the draft scope of work for the Environmental Assessment of military training activities on Piñeros and Cabeza de Perro islands. Although we agree completely with your statement that the goal of this assessment "...is to evaluate the environmental consequences of continued training on these islands and recommend acceptable training parameters", we found that your original draft scope of work was too general to ensure that adequate field surveys are conducted to provide a basis for a Biological Assessment under the Endangered Species Act.

The field studies we have described are not in the nature of scientific research, but simply aimed at defining the abundance and habitat use of the pertinent species on the two islands. We have defined the surveys we think are the minimum required to obtain this information and have, whenever possible, indicated times of year and times of day when field workers are most likely to observe activity by the species to help minimize the contractor's effort.

The field work to identify the presence of threatened and endangered species amounts to a minimum of 36 weeks, and if other studies are conducted concurrently, represents the minimum data-gathering period for the entire EA. Each segment of the surveys for threatened or endangered species (i.e. yellow-shouldered blackbird nesting, sea turtle nesting, and waterfowl use) should be completed as a unit within the time periods specified in the revised scope of work. However, not all the surveys need be completed in the same calendar year. Since this information is considered essential to development of even a preliminary draft Environmental Assessment, your originally proposed completion schedule (and consequently the payment schedule) should be extended. Our proposed changes to those sections are also found in the enclosure.

Although preparation of a slide/tape show for personnel about to use the islands is a good idea, we recommend that the contractor prepare the text for the presentation after developing a proposal to minimize

activities in sensitive areas. Education per se of military personnel about the resources of the islands will not modify the real impact on the physical environment of explosions, live fire, etc.; unless it is combined with some zonation or regulation of activities.

Thank you for the opportunity to provide comments. If you have any questions, please call me at (809) 851-7297.

Sincerely,



Robert T. Pace
Acting Field Supervisor

1 Encl.
cc (w/encl.):

Felix Mestey, NSRR



ecology and environment, inc.

195 SUGG ROAD, P.O. BOX D, BUFFALO, NEW YORK 14225, TEL. 716-832-4491, TELEX 91-9183

International Specialists in the Environment

February 22, 1988

Mr. Bob Warren
Planning Division
Naval Facilities Engineering Command
6500 Hampton Blvd., Building B
Norfolk, VA 23508-1297

Dear Bob:

Enclosed is a draft letter to Mr. Robert Pace concerning the scope of work for field surveys associated with the Environmental Assessment for Isla Pineros. I have proposed a quarterly sampling plan similar to that which I briefly outlined to Mr. Pace, and which he said his office would be willing to consider.

If, after you and John have had a chance to review the letter, you would like any changes made, you may contact either Dick Heiderstadt or Dave Santillo at (716) 684-8060, as I will be out of the office February 22 through February 26, 1988.

If, on the other hand, you would prefer to send the letter from your office, please feel free to use any or all of it, and simply refer to my telephone conversation with Mr. Pace.

Sincerely,

David J. Santillo for:

Craig R. Ferris, Ph.D.
Project Manager

CRF/wj
Encl.



ecology and environment, inc.

195 SUGG ROAD, P.O. BOX D, BUFFALO, NEW YORK 14225, TEL. 716-632-4491, TELEX 91-9183

International Specialists in the Environment

February 22, 1988

Mr. Robert T. Pace
Acting Field Supervisor
U.S. Fish and Wildlife Service
Caribbean Field Office
P.O. Box 491
Boqueron, Puerto Rico 00622

Dear Mr. Pace:

This letter is in reference to our telephone conversation of February 12, 1988, during which we discussed the scope of work for preparing an Environmental Assessment (EA) for continued naval training activities on Isla Pineros. The purpose of this letter is to propose a modified field survey program which will be consistent with the objectives of the Navy while at the same time providing the necessary data with which to assess potential impacts on wildlife in general, and endangered species in particular.

The recommended field program is prompted primarily by information developed in conversations between Dr. J.W. Wiley of the U.S. Fish and Wildlife Service and Mr. John Evans of the Navy's Atlantic Divisions. It is Dr. Wiley's opinion that quarterly observations of the yellow shouldered blackbird population on Isla Pineros is sufficient for the purposes of this study. In addition, at this early stage in the environmental assessment process, extensive and detailed field surveys may not be necessary if it is found that there would be no significant adverse impacts resulting from existing training activities. We feel that the field survey program we have proposed will document whether or not the species in question are present, which habitats are utilized, and the seasonal occurrence. It can then be determined whether or not naval training activities would affect the species or their habitats, and whether or not mitigation measures are feasible to alleviate any adverse impacts.

If, as a result of these initial surveys, it is determined that potential significant adverse impacts may occur, the initial field data can be used as a baseline from which additional focused surveys can be conducted.

Below is a brief summary of a proposed field survey program. If your office agrees in principle to the extent of the surveys, the exact details as to timing the field work and the types of data collected can be worked out in conjunction with your office as well as with input from Dr. Wiley and other experts on potential species of concern.

The basic field survey program would involve quarterly sampling. As discussed above, Dr. Wiley has indicated to John Evans that quarterly sampling would be adequate for evaluating impacts to yellow shouldered blackbirds (YSBB).

The initial sampling period would encompass approximately 2 weeks of field work to be conducted as soon as possible, but preferably sometime in later March or early April. This would fall within the time period of peak migration for the white-cheeked pintail. In addition, the nesting season for the YSBB would have commenced.

During this initial period, field activities would include:

- o Delineation of major habitat types, identification of dominant overstory and understory plant species, and specific searches for plant species of concern. Estimates of relative abundance of the major plant species will be made;
- o Surveys to identify bird, mammal, and reptile species present on the island, relative abundance and habitat preference;
- o Specific searches to identify presence of endangered or threatened species or other species of concern;
- o Intensive searches for YSBB in suitable habitats, noting location and habitat utilization, nest-building and feeding activities, movements and relative abundance. The occurrence of glossy cowbirds and Antillean grackles also will be noted;
- o Daily censuses of waterfowl and wading bird use of lagoon and mangrove areas, noting species composition and relative abundance;
- o The Navy recently completed a detailed aerial survey of turtles and manatees of Puerto Rico, and sufficiently detailed data are available to evaluate the occurrence and seasonal use of the waters around Isla Pineros by these species. However, each of the beaches on Isla Pineros will be evaluated for its potential as turtle nesting habitat. In addition, daily surveys of potential nesting beaches will be conducted. (As part of the marine survey program, qualitative and quantitative data on Seagrass beds in the vicinity of Isla Pineros will also be collected and evaluated).

Following the initial survey, three additional 1-week field surveys will be conducted to provide additional information on waterfowl use of lagoons, turtle nesting activity, and nesting and roosting activity of YSBB. In addition, incidental observations of other wildlife species will be made during the specific data-gathering efforts discussed above.

These additional surveys will be scheduled approximately every three months, although the exact timing will be coordinated with your office so as to be coincident with critical life history periods for the wildlife species of concern.

We look forward to discussing the above outlined scope of work with you after you have had a chance to review this with your staff. I am confident we can develop a mutually acceptable field survey program that will insure the wildlife resources of Isla Pineros are evaluated thoroughly in the preparation of the EA.

If you have any questions, please feel free to call me at (716) 684-8060.

Sincerely,


For:

Craig R. Ferris, Ph.D
Chief Ecologist

CRF/wj



ecology and environment, inc.

BUFFALO CORPORATE CENTER
368 PLEASANTVIEW DRIVE, LANCASTER, NEW YORK 14086. TEL. 716/684-8060
International Specialists in the Environment

February 9, 1989

Edward Rodriguez
Puerto Rico Department of
Natural Resources
Terrestrial Ecology Section
P.O. Box 5887
Puerto de Tierra, Puerto Rico 00906

Dear Mr. Rodriguez:

Thank you for the information regarding Bahama pintails you provided in our recent telephone conversation. As we discussed, Ecology and Environment, Inc. (E & E) has been contracted by the U.S. Navy to conduct an Environmental Assessment of the impact of Naval training Activities on Isla Pineros, which is located east of Roosevelt Roads. Species targeted for survey during the assessment include Bahama pintails, West Indian whistling ducks, and ruddy ducks.

As we discussed, I have enclosed two photographs of a nest we located on a grassy area adjacent to a brackish lagoon. This nest contained a total of 5 eggs; 3 in a main depression and 2 scattered within 0.2 m of the nest. Approximate dimensions of the eggs were 6 cm x 3.4 cm. The size and color of the eggs indicated they could be Bahama pintail eggs.

I would appreciate any assistance you could provide us in confirming whether these eggs are from the Bahama pintail. In addition, any information you could provide on general population status, habitat, and behavior of Bahama pintails, West Indian whistling ducks, and ruddy ducks in Puerto Rico would be very helpful. If you have any questions or would like to discuss the photographs, please don't hesitate to call me at (716) 684-8060.

Sincerely,

David J. Santillo
Associate Wildlife Ecologist

DJS/vj
Encl.



DEPARTAMENTO DE RECURSOS NATURALES

February 28, 1989

David Santillo
Ecology and Environment, Inc.
Buffalo Corporate Center
368 Pleasantview Drive
Lancaster, N.Y. 14086

Dear Mr. Santillo:

My study in Puerto Rico involves collecting population data on both migatory and endemic waterfowl. I am in the process of preparing a final report on population statuses, trends, habitat uses, etc. for the White-cheeked pintails, Ruddy ducks, West Indian whistling ducks, and Common moorhens. This report should be completed sometime in July, 1989.

To help you to locate and identify nests of waterfowl in Ilsa Pinero, a brief account is given on nest locations and egg descriptions. Also provided is a list of some the in-house reports on waterfowl in Puerto Rico.

The dimensions of several White-cheeked pintail eggs measured were on the average 50.80 mm x 35.77 mm. All nests were located in stumps. From the centers of these stumps guinea grass was growing. These stumps are found in water and stand approximately 3 to 4 feet above the water line. The average clutch size was 9 eggs. Color of the eggs were white and the shells were smooth in texture. After four or five eggs are layed, down is sparsely added to the nest. No other waterfowl nesting in Puerto Rico has this behavior.

The few nests of West Indian whistling duck found were in the same areas and stumps as the White-cheeked pintails. Average egg size for this species was 61.86 mm x 45.17 mm. Average clutch size was 8 eggs. Egg color was white and the shells were smooth to the touch. A few nests were also found in leather fern which grows in standing water.

Ruddy duck nests were located along the edges of cattail or on small islands of spikerush. Average egg length and width were 61.92 mm x 45.44 mm. Egg color was white and the shells had a rough granular texture. Egg sizes and shapes were similar in both the Ruddy and West Indain whistling ducks. The only way we were able to distinguish between the two nests were by egg textures and differences in nest placement.

A-29

I showed your letter and photographs to Julio Cardona who worked on the White-cheeked pintails with Mr. Belitsky ten years ago. The habitat description and nest formation given seems similar to the White-cheeked pintail nests they found in a pasture on Culebra Island approximately 100 feet from a mangrove swamp. For two years I've searched this area several times and haven't as yet located a White-cheeked pintail nest.

I suggest that you either bring egg samples to my office or visit areas with us where White-cheeked pintails, West Indian whistling ducks and Ruddy ducks are nesting so you become familiar with nests and habitats of these species. We are currently checking nests of these three species on a regular bases.

The following is a list of references you may ask for at DNR library:

Raffaele, Herbert. 1974. Puerto Rico waterfowl research annual performance report 1973-74. W-8-17. Department of Natural Resources of Puerto Rico.

Raffaele, Herbert. 1975. Puerto Rico waterfowl research annual performance report 1974-75. W-8-18. Department of Natural Resources of Puerto Rico.

Sedgwick, James. 1977. Puerto Rico waterfowl research annual performance report 1976-77. W-8-20. Department of Natural Resources of Puerto Rico.

Belitsky, David. 1978. Puerto Rico waterfowl research annual performance report 1977-78. W-8-21. Department of Natural Resources of Puerto Rico.

Belitsky, David. 1979. Puerto Rico waterfowl research annual performance report 1978-79. W-8-22. Department of Natural Resources of Puerto Rico.

Rodriguez, Edward. 1986. Puerto Rico waterfowl studies 1985-86. W-12. Department of Natural Resources of Puerto Rico.

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Rodriguez, Edward. 1988. Puerto Rico waterfowl studies 1987-88. W-12. Department of Natural Resources of Puerto Rico.

I hope the information provided will help you in your work and that you take me up on my offer. I would be interested in visting Isla Pinerio.

Sincerely,


Eduardo Rodriguez Araujo
Wildlife Research Biologist



ecology and environment, inc.

BUFFALO CORPORATE CENTER
368 PLEASANTVIEW DRIVE, LANCASTER, NEW YORK 14086, TEL. 716/584-8060
International Specialists in the Environment

April 10, 1989

Mr. Roberto Sackett
Office of Historic Preservation
Box 82
La Fortaleza
San Juan, Puerto Rico 00918

Re: Cultural Resource Investigations - Isla Pineros/Cabeza de Perro

Dear Mr. Sackett:

Attached please find three (3) copies of the appropriate sections of the maps for the above-referenced project. The project area(s) can be found on the USGS Punta Puerca 7.5 Minute Series Quadrangle. The scale, however, is at 1:20,000 rather than 1:24,000. I understand that the maps also are produced by the Puerto Rico Department of Transportation in San Juan. I hope that they will prove to be useful to you.

We are interested in the locations of all recorded cultural resources within or in the vicinity of our study area. Could you please provide us with any information in that regard or references to other studies done in the area?

Thank you again for your consideration. We are looking forward to hearing from you soon.

Sincerely yours,

Carolyn A. Pierce
Senior Archaeologist

Attachments

Gobierno
del
ESTADO LIBRE ASOCIADO
de la
ISLA DE PUERTO RICO



OFICINA DEL GOBERNADOR
LA FORTALEZA
SAN JUAN DE PUERTO RICO

MARIANO GERARDO CORONAS CASTRO
DIRECTOR / OFICIAL

June 27, 1989

Ms. Carolyn A. Pierce
Senior Archaeologist
Ecology and Environment, Inc.
Buffalo Corporate Center
368 Pleasantview Drive
Lancaster, New York 14086

RE: SHPO#05-10-89-02 CULTURAL RESOURCE INVESTIGATION DE LA
ISLA PINEROS Y CABEZA DE PERRO, U.S. NAVAL RESERVATION,
ROOSEVELT ROADS, CEIBA, PUERTO RICO

Dear Ms. Pierce:

Per your request, we have examined our site files for the above referenced project. No known sites are recorded in our files for these islands. However, this area has a high sensitivity for locating cultural resources. If any project is planned in this area an intensive cultural resource investigation (Stage I) should be conducted to determine if any potential impacts will occur to cultural resources. Please consult our office for guidance concerning these investigations.

It appears that the previous investigations conducted by Ecology and Environment, Inc. are one of the few reports prepared for this area. Our office requests a copy of these reports for our archival record. We appreciate your cooperation.

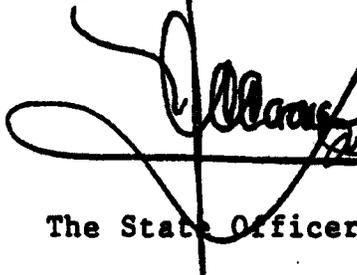
A-33

Mariano G. Coronas Castro

Ms. Carolyn A. Pierce

Page 2

If you need additional information, please do not hesitate to call State Archaeologist Dr. Michael A. Cinquino of my staff. Your interest and cooperation in helping protect Puerto Rico's archaeological and historical resources are appreciated.


The State Officer



NGCC/lsc



ecology and environment, inc.

BUFFALO CORPORATE CENTER
368 PLEASANTVIEW DRIVE, LANCASTER, NEW YORK 14086, TEL. 716/684-8060
International Specialists in the Environment

August 2, 1989

Dr. James Wiley
U.S. Fish and Wildlife Service
2140 Eastman Ave.
Suite 100
Ventura, CA 93003

Dear Dr. Wiley:

As discussed in your telephone conversation of August 2, 1989, with Kevin Dominske, Ecology and Environment, Inc., (E & E) is currently conducting field surveys to establish the presence and habitat use of yellow-shouldered blackbirds (Agelaius xanthomus) on Pineros and Cabeza de Perro islands in Puerto Rico. These surveys are part of the "Environmental Assessment of Training Activities on Pineros and Cabeza de Perro Islands, U. S. Naval Station Roosevelt Roads."

The survey plan was developed in accordance with your recommendations to the U. S. Navy prior to 1988 when the scope of work was being developed. Field surveys are designed to census yellow-shouldered blackbirds at various times of the year that correspond with breeding and non-breeding activities. Specifically, four one-week surveys will have been completed by September 1989, with one each during the weeks of January 12-17, April 3-7, June 5-9, and September 25-29, 1989.

The January and September censuses include nocturnal roosting surveys to determine if and where on the islands the blackbirds roost and to determine if shiny cowbirds and Antillean grackles roost with the blackbirds. Roost surveys are conducted by stationing observers along the western shore of Pineros between 1600 and 1900 hours to watch for blackbirds moving between Puerto Rico and Pineros Island.

The censuses conducted during April and June field surveys correspond with the breeding season of the yellow-shouldered blackbird. Observers listened for song and watched for display activities, nest building, or feeding activity daily between dawn and 1200 hours. Censuses were concentrated in the habitat most likely to support the blackbirds (i.e., red mangrove fringe forests, salinas, brackish lagoons, and the upland/lowland ecotone); however, all portions of Pineros and Cabeza de Perro islands were systematically covered during the censuses.

Dr. James Wiley
August 2, 1989
Page 2

To date, after the completion of 3 of the 4 quarterly surveys, no evidence of yellow-shouldered blackbird activity has been observed during either roosting or breeding censuses.

The survey plan outlined above was based on your recommendations. We would appreciate it if you would review the methodology used for the surveys to verify if you believe they are sufficient to confirm the presence or absence of yellow-shouldered blackbirds on Pineros and Cabeza de Perro islands. After reviewing the field survey plan, or if you have any questions concerning this request, please contact me at 716-684-8060 or the address shown above. Thank you for your assistance in this matter.

Sincerely,

David Santillo

David Santillo
Project Manager *KRD for*

oio/NZ3090



United States Department of the Interior

FISH AND WILDLIFE SERVICE
PATUXENT WILDLIFE RESEARCH CENTER

10 August 1989

Southwest Research Group
2140 Eastman Ave., Suite 100
Ventura, CA 93003

Mr. David Santillo
Ecology and Environment, Inc.
Buffalo Corporate Center
368 Pleasantview Drive
Lancaster, New York 14086

Dear Mr. Santillo,

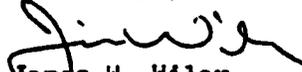
Thank you for allowing me to comment on your studies of the status of the yellow-shouldered blackbird (Agelaius xanthomus) on Pineros and Cabeza de Perro islands in Puerto Rico.

I have reviewed your methods, as you presented in your letter of August 2, 1989. These methods (nocturnal roosting surveys, listening for song, searches for nesting and feeding activities in suitable habitat) follow those I successfully used during earlier years. The intensity and extent of your surveys (i.e., four one-week periods) seem quite suitable for the amount of area you are surveying and the nature of the animal.

In summary, I believe you have been using appropriate survey methods to confirm the presence or absence of breeding and roosting yellow-shouldered blackbirds in Pineros and Cabeza de Perro islands.

Please let me know if I can provide further assistance in your project.

Sincerely yours,


James W. Wiley
Leader

APPENDIX B

**CULTURAL RESOURCE SENSITIVITY
ASSESSMENT OF ISLA PINEROS AND
CABEZA DE PERRO, PUERTO RICO**

April 1990

**DEPARTMENT OF THE NAVY
Atlantic Division
Naval Facilities Engineering Command
Norfolk, Virginia 23511**

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1. INTRODUCTION

As part of its responsibility to address the potential impacts of the proposed action on critical environmental resources as early as possible in the planning process, the Department of the Navy, Atlantic Division Naval Facilities Engineering Command, contracted Ecology and Environment Inc. (E & E), to develop a cultural resource sensitivity assessment of Isla Pineros and Cabeza de Perro, Ceiba, Puerto Rico. This assessment presents expectations about the types and locations of cultural resources which may potentially exist on the islands. After a background review of previous research in the area, limited field surveys were used to evaluate and refine those expectations. The final cultural resource sensitivity assessment utilized the data to identify and locate known cultural resources and areas where resources may be located on Isla Pineros and Cabeza de Perro.

2. PREVIOUS CULTURAL RESOURCE STUDIES

In 1983 Ecology and Environment, Inc., (E & E) conducted a preliminary cultural resource reconnaissance survey of U.S. Naval Station Roosevelt Roads, Ceiba, Puerto Rico to evaluate cultural resources at the Naval Station and potential impacts which might result from continued use of the area by the Navy (E & E 1984a). Part of this study included a sensitivity assessment. The sensitivity assessment consisted of examination of data from seven previously recorded archaeological sites, including slope, distance to water source and soil characteristics. Other environmental variables (e.g., presence of mangrove swamps) were eliminated from consideration because they are too ubiquitous to be used as criteria and/or their locations have changed through time. It would require greater temporal controls than are presently possible to establish relationships between archaeological site locations and the locations of these environmental features. Critical environmental factors determined to be associated with site locations were slopes between 5 to 40%; locations within 150 meters (500 feet) of a water source; and well-drained medium-textured soils. Areas of Roosevelt Roads Naval Station which exhibit all of these factors were identified as areas of archaeological potential, while areas which did not exhibit these factors were considered to have no archaeological potential. Isla Pineros and Cabeza de Perro were also included in the sensitivity assessment. All of Cabeza de Perro and most of Isla Pineros were categorized as having the potential to yield archaeological remains. Only the area mapped as tidal swamp soils (Ts) on USDA soil maps (USDA 1977) were considered to have no archaeological potential on Isla Pineros.

A predictive model was developed for the Naval facilities on Vieques. The model was used in an attempt to rank areas of the island

into areas of high, medium, and low potential for yielding cultural resources. The model was evaluated against findings of sites from field studies on Vieques. Factors considered to be associated with high archaeological potential included soil characteristics similar to those used in the Roosevelt Roads study; and locations with elevations less than 10 meters above mean sea level (MSL) and within 125 meters of the seacoast. Areas of moderate potential exhibited similar soil drainage and texture and either elevations of less than 10 meters above MSL or were within 125 meters of shore, but not both.

The evaluation of the model showed that the factor of elevation (i.e., whether a location was within 10 meters above MSL) was probably overemphasized. This was possibly due to biases with regard to areas of early investigations (the findings of which were the basis for the model). Field investigations conducted prior to the E & E studies in the area may have focused on areas close to the shore, neglecting the interior of the island.

3. APPLICABILITY OF PREVIOUS STUDIES TO ISLA PINEROS AND CABEZA DE PERRO

The Roosevelt Roads and Vieques studies provide insight into the types of environmental factors with which site locations appear to be associated, and, to a lesser extent, the types and cultural periods of the sites which have been identified in the area. Sensitivity assessments for Isla Pineros and Cabeza de Perro, however must consider basic differences between these small islands, on the one hand, and the Roosevelt Roads and Vieques Area, on the other. Isla Pineros is a relatively small island (approximately one half square mile) that lies approximately 0.5 miles northwest of the Roosevelt Roads Naval facility across the Passaje Medio Mundo. Cabeza de Perro is an island of approximately 0.04 square miles situated 650 feet off the southeastern end of Isla Pineros.

Several factors identified as associated with site locations in previous studies are only somewhat appropriate to a discussion of Isla Pineros and Cabeza de Perro. Both the Roosevelt Roads and Vieques cultural resource assessments cite soil drainage and texture characteristics as closely correlated with site locations and therefore of predictive value. Isla Pineros, however, contains only two soil types: tidal swamps (Ts) in the lower southwestern section of the island, and Descalabrado clay loam 20-40% slope eroded (DeEr). Cabeza de Perro is exclusively Descalabrado clay loam. Soil types are therefore of little utility in determining areas of the island in which archaeological sites are likely to be found. Distance to water is also not a useful criterion, since there is currently no apparent source of surface water on either island, although some of the hill sides may provide runoff water during rainy periods. The other factors used in the earlier sensitivity assessments, elevation and distance from the shoreline, are also not

useful in this case, since no part of Isla Pineros is more than approximately 1,150 feet from shore and elevations are also somewhat limited.

Topographic classifications assigned to site locations in the Vieques study are also not completely transferable. Landforms such as valley slopes, quebradas, and coastal bluffs and terraces are not found on Isla Pineros. A variety of landforms, some in association with or adjacent to distinctive environmental areas (e.g., mangrove swamps, coastal lowlands), are present on Isla Pineros. They are, however, much smaller in scale than some of the similar landforms on the larger islands.

Isla Pineros can be separated into three major types of landforms: hills, coastal lowlands, and tidal swamps, with several smaller divisions within each of these (see Table 1). Each of these landforms offers a unique combination of natural resources which could be potentially exploited by humans. However, the size and hilly character of the islands suggest that they would not have been able to support large or permanent resident populations. It is most probable that Isla Pineros, and to a lesser extent because of its smaller size, Cabeza de Perro, provided bases from which to conduct specific resource collection activities rather than long-term settlement. Sites from all cultural periods would probably be similar in this regard, although the specific locations of different period sites may vary, depending on the specific resource utilized.

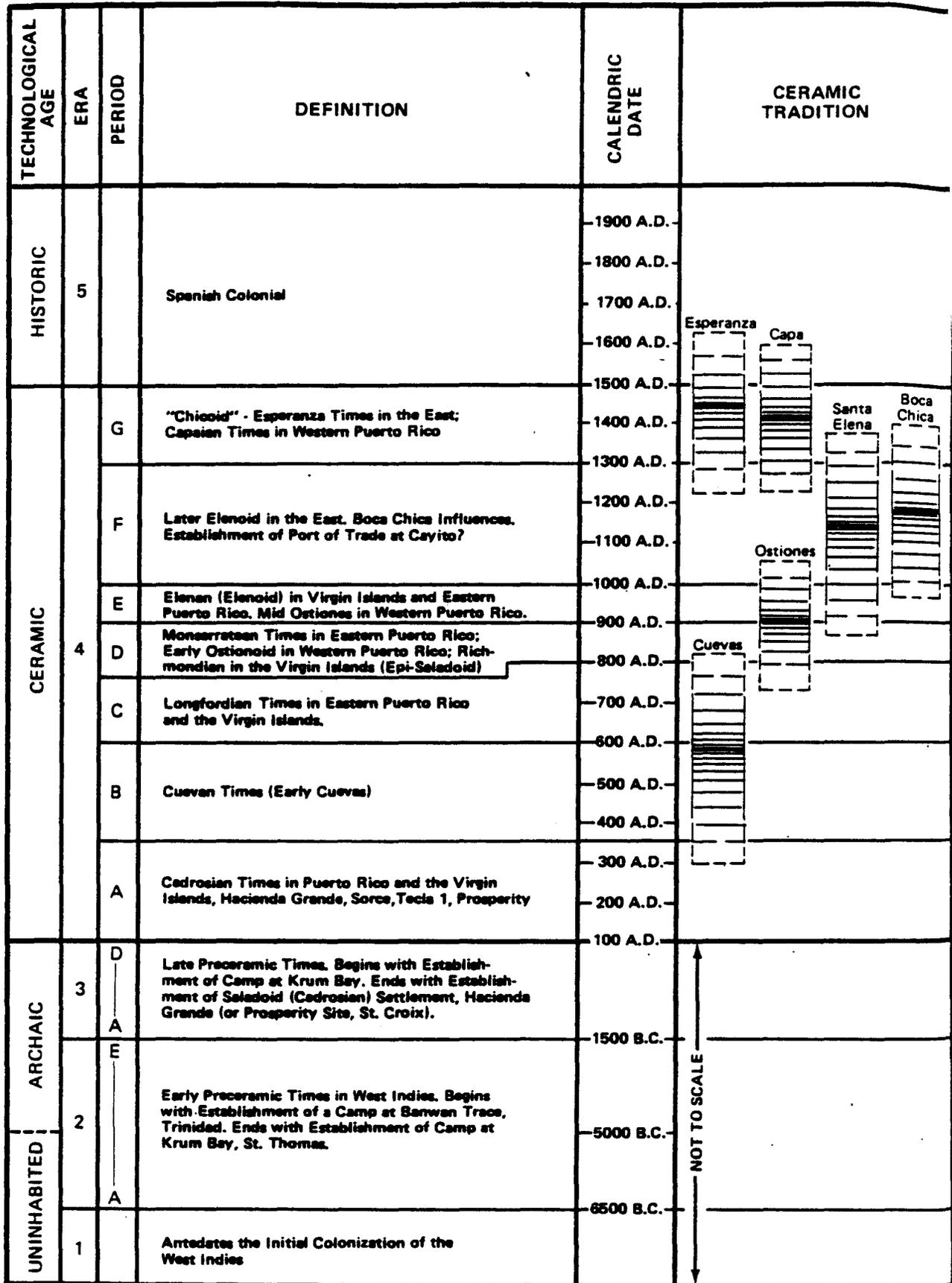
In general, the archaeological complexes identified on Isla Pineros and Cabeza de Perro are expected to be consistent with those already recorded on Vieques and Puerto Rico.

Cultural complexes expected to be found on Isla Pineros should fit within the general historic framework outlined in previous reports of cultural resource investigations for Roosevelt Roads and Vieques Naval facilities. This framework, drawing heavily on Rouse (1948 and 1964); Rouse and Allaire (1978); and Vescelius (1979 and n.d.), utilizes a four-age chronological structure (i.e., Lithic, Archaic, Ceramic, and Historic ages) for major cultural divisions of the circum-Caribbean area which have, in turn been further refined into regional chronologies (see Figure 1). Whenever identification was possible, the general cultural

Table 1

LANDFORMS OF ISLA PINEROS

-
1. Hill Areas
 - a. Hill tops and terraces
 - b. Saddles between hill tops
 - c. Middle and upper slopes of hills
 - d. Peninsula rises
 2. Coastal Lowlands
 - a. Coastal plains (Descalabrado soils)
 - b. Elevated margins of coastal lowlands and lower hill slopes
 - c. Peninsula lowlands
 3. Tidal Lowlands
 - a. Tidal lowlands (tidal swamp soils)
 - b. Elevated margins of tidal lowlands
 - c. Mangrove swamps
 - d. Land-side margins of mangrove swamps
-



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SOURCE: E & E 1984, after G.S. Veselius (n.d.); Rouse (1952); and Rouse and Allaire (1978).

Figure 1 CULTURAL FRAMEWORK FOR PUERTO RICO AND THE VIRGIN ISLANDS

series term of Banwadian for Archaic sites, and Saladoid, Ostionoid, Elenoid, and Chicoid for Ceramic sites have been used. These terms will also be used in the present study whenever sufficient data exists to permit chronologic placements of any new site identified.

4. TYPES OF CULTURAL RESOURCES EXPECTED

The Cultural Resource Management Plan developed by E & E for Naval Facilities on Roosevelt Roads; Vieques and Culebra, Puerto Rico; and the Virgin Islands (E & E 1985) presented general expectations about the range of archaeological site characteristics for the various cultural periods that existed in the area. The following summary, drawn from that report, illustrates the range of archaeological sites that constitute elements of the settlement system of the different cultural groups that inhabited the eastern Puerto Rico area, archaeological sites which have been or may be expected to be found on Isla Pineros and Cabeza de Perro.

Lithic Age complexes for Puerto Rico or the Virgin Islands are not well understood. Lithic Age sites were not anticipated, nor were any identified during any of the previous E & E surveys. None are anticipated to be identified on Isla Pineros and Cabeza de Perro, although it is possible that sites which lack chronological data may date to the Archaic period.

Different kinds of aboriginal sites (e.g., camps, fishing and shell gleaning stations, etc.), particularly of the Archaic period, may be found differentially distributed throughout the various environmental ecozones (habitats) in the area. These distributions will be correlated with differential resource availability and exploitation.

Recent survey work has shown that Archaic Age (pre-ceramic) sites are present at several locations throughout Puerto Rico and the Virgin Islands. This work has shown that these sites are found associated with the mangrove swamps and adjacent mudflats present in many areas. Pre-ceramic sites, frequently recognized as shell mounds, are not anticipated to be as well represented as the later Ceramic Age sites. This is

based on the assumption that populations in the area during pre-ceramic times were considerably smaller than during the Ceramic Age. Moreover, many of the Pre-ceramic shell mounds with coastal locations may now be underwater as a result of minor changes in sea level and cultural and natural alterations occurring to coastal ecosystems.

It is expected that the majority of sites located on Isla Pineros and Cabeza de Perro will be Ceramic Age sites. Based on postulated migration patterns for the Caribbean area, these sites will likely be less represented in early ceramic times and will increase in number over time. Furthermore, a considerable variability in the kinds of sites representative of the Ceramic period (e.g., camps, hamlets, and villages) is evident throughout the area because a variety of wild subsistence resources, in addition to domesticated crops, were exploited by Ceramic Age populations. Also, different kinds of Ceramic Age sites should be differentially distributed throughout the different environmental ecozones as a function of the different resources exploited in those ecozones. Ceramic Age sites are identified by the presence of pottery and other ceramic objects, as well as artifacts made primarily of stone, bone, shell, coral, and wood.

Given the available evidence documenting increasing population density and site sizes in the Ceramic Age, organizational/social complexity should be greater and the settlement system more complex for that period than for the Archaic Age. Accordingly, it is expected that there will be substantial diversity of site types.

The general types of historical properties found at Naval installations are already known. Hundreds of structures including headquarters, officers' quarters, troop barracks, hospitals, and various other buildings associated with training and development are present on the various facilities. Civilian properties consist of the remains of haciendas and plantations, including quintas, centrales, windmills, and the village, hamlet, and homestead occupations of agricultural laborers, as well as slave quarters. Although some of these properties retain a good deal of their original integrity, many now exist as archaeological deposits. Isla Pineros and Cabeza de Perro, however, are too small and hilly for one to expect extensive historic use of the islands, although some military and possibly civilian structures may be identified.

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As stated above, Isla Pineros and Cabeza de Perro differ from Puerto Rico and the larger islands of Vieques and Culebra. Archaeological site types that may be located on the smaller islands are likely to represent only a segment of the settlement systems of the cultural groups of which they are evidence. The types of sites can be expected to be restricted in variety, density, and probably size.

The locations of sites on Isla Pineros and Cabeza de Perro must be examined from the perspective of those environmental features (e.g., landforms) available on these islands. However, since the archaeological sites identified on Puerto Rico, Vieques, and Culebra are components of the same cultural complexes as can be expected on Isla Pineros and Cabeza de Perro, some degree of continuity in site type and location can be assumed. The existing locational data for archaeological sites on Vieques were reviewed for 112 chronologically identified site components (see E & E 1984, Tables 3-3 and 4-1).

The current review indicated that, with several exceptions, the cultural components identified for each of the periods (i.e., six Banvadian components, 22 Saladoid components, 22 Ostionoid components, 35 Elenoid components, and 27 Chicoid components) tend to be located on the same three types of landforms. Nearly 75% of the Saladoid, Ostionoid, and Chicoid components are located on coastal bluffs or terraces, valley slopes, or coastal lowlands. No Banvadian and only 17% of the Elenoid components were located on coastal bluffs or terraces. The locations of Elenoid components also differed in that greater use was made of peninsula areas (20% of the Elenoid components) and knolls (17%).

Based on examination of the Vieques data, expectations about the aboriginal occupation of Isla Pineros and Cabeza de Perro can be formulated. Archaic (Banvadian) period sites will be least frequent, and although they may occur on all types of landforms, hilltops and knolls will be preferred. The types of Archaic sites may also be varied. Ceramic period sites (with the exception of Elenoid sites) will exhibit clustering on a limited number of landforms. Since these populations practiced agriculture, Isla Pineros would have been too small and hilly to support all phases of their settlement system. Seasonal resource extraction camps and fishing sites on the small islands to supplement

the permanent agricultural settlements on Puerto Rico would be expected. Ceramic period sites will therefore be limited in variety and location and will be primarily oriented towards marine and reef resources which are not as readily accessible from Puerto Rico. The tidal swamp (i.e., mangrove) area of Isla Pineros should not have been as heavily used, since Puerto Rico in the area of Roosevelt Roads has extensive mangrove swamps which are accessible to populations in the area.

Elenoid sites may represent a divergence from the above general pattern for Ceramic Age sites. Data from Vieques are not sufficient to determine if this is due to a change in settlement systems during this period. If there was a change in settlement patterns on a regional basis during Elenoid times, then Elenoid period sites should also exhibit differences in location on Isla Pineros. If no such differences are noted, the variation in site location on Vieques may represent local adaptations to new environments.

In general, aboriginal settlement on these small islands is indicated by sites of all periods that are expected to exhibit a pattern that reflects its use as a base for resource collection activities rather than for permanent settlement. Isla Pineros can be divided into four types of resource areas, each of which is associated with a different combination of land forms. Not all of these areas, however, can be expected to be exploited equally. Large mangrove swamps exist on Puerto Rico in the area of Roosevelt Roads Naval Station. These mangrove areas could have been exploited by Puerto Rican-based groups more easily than the mangrove swamps on Isla Pineros. The usually favored site locations at the elevated margins of mangrove swamps can therefore be expected to be underutilized on Isla Pineros. In contrast, the locales from which marine resources could be exploited would be more heavily used at Isla Pineros. This would be especially true of areas which border offshore reefs (Rouse and Watters 1983). Three extensive and several smaller reefs are located along or just offshore of Isla Pineros' north and east shores.

Several areas of coastal lowlands are also located along the north shore. The margins of these lowlands, especially near the coastline, offer immediate access to marine, reef, and terrestrial (lowland) resources and should exhibit the greatest density of sites from all

periods and the greatest number of multi-component sites if the use of Isla Pineros, and to a lesser extent Cabeza de Ferro, as marine (and reef) resource extraction sites is appropriate.

The data needed to evaluate the above observations about the aboriginal settlement that can be expected on Isla Pineros and Cabeza de Ferro consists, initially, of site location information. Based on field surveys on Vieques, soil formation has been minimal. The site location data can therefore be collected during the proposed 3-day field period by walkover reconnaissance surveys of each island. The walkover reconnaissance surveys would be designed to sample each of the different type areas found on the islands (see Table 1).

Without intensive artifact collections and excavations at discovered sites, it is unlikely that the detailed chronological identification of the cultural components present will be possible. The specific questions dealing with settlement systems by period will therefore not be possible. The general site information will, however, allow for the evaluation of the general hypothesis that these small islands were, primarily, marine and reef extraction sites.

Data collected during walkover surveys will also permit the evaluation of the potential eligibility of the located sites for inclusion in the National Register of Historic Places.

5. SUMMARY

While the populations that have occupied Isla Pineros and Cabeza de Perro can be expected to have been groups belonging to the same sequence of cultural development as found on the surrounding larger islands of Puerto Rico, Vieques, and Culebra, the small size of these islands and their location so close to Puerto Rico suggests that they may have served a much more restricted function in the overall settlement systems of these cultural groups. Comparison of data from the two islands with data from Vieques indicates that Isla Pineros and Cabeza de Perro lack a number of types of environmental areas which were utilized prehistorically, and their limited area would have restricted their usefulness during the Historic period. The sensitivity models developed for Vieques and Roosevelt Roads are therefore not directly transferable for use on the small islands. Some comparisons can be made, however.

Aspects of site distribution on Vieques for which data have been recorded have indicated that locations from which maritime and/or reef resources can be exploited will probably be the most heavily utilized areas of Isla Pineros. Mangrove swamps, in contrast, may have been underutilized because of the proximity and therefore accessibility of large mangrove swamps in the area of Roosevelt Roads, Puerto Rico. Coastal lowland areas will have been exploited, but site locations where lowlands open to the beach would be favored because of the availability to more than one set of resources. Under such expectations, the areas adjacent to the lowlands along the north shore of Isla Pineros, especially the margins along the lowland near the northeast corner of the island, should have been the most densely occupied, while the lowland at the southeast corner of the island should have been the least occupied.

The limited reconnaissance survey of Isla Pineros and Cabeza de Perro involved a walk-over survey of each island to locate evidence of cultural resources. The survey was conducted so that at least a sample of each environmental zone was inspected. This provided the locational data against which the assumptions of resource utilization and site location were evaluated in the final environmental assessment report.

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6. REFERENCES

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of the Lesser Antilles, St. Kitts and Nevis.

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the Virgin Islands.

APPENDIX C

SHOVEL TEST DATA

