# Parque Nacional del Este, Dominican Republic[1]

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The CARICOMP site in the Dominican Republic is located in the Parque Nacional del Este on the southeastern coast of the island of Hispaniola. The site is typical of leeward marine and coastal environments, with frequent calm seas and noticeable currents. The sunny days, average air temperature of 26.5°C, and rainfall of 1,000 mm yr$^{-1}$ contribute to a tropical semi-arid forest growing on coral/limestone bedrock. There are few anthropogenic impacts; boating, diving, and fishing are the primary sources of disturbance. The ecosystems selected are located along a NW-SE transect near Palmillas. The mangrove site (Catuano), is a fringing forest type, with a dense growth of trees no taller than 5 m. The seagrass station (Hierbas los Cocos) is 1.5 km to the northwest in a sandy and rubble shallow (2-4 m) just inshore of a hard platform where soft corals dominate. The coral reef station (El Peñón) is farther north and lies at a depth of 10 m on a rocky platform where diverse species of corals form a low relief spur-and-groove reef system. The park represents one of the largest pristine marine and coastal environments in the Caribbean. It is a protected area under Dominican law, and continuous efforts are being made to maintain it. Mooring buoys are being installed and fishing and navigational regulations are being implemented to minimize the impact of users and visitors.

## Introduction

The Parque Nacional del Este is located on the southeastern coast of the Dominican Republic; it is bordered by San Rafael de Yuma on the north, the Bahía de Yuma on the east, and the Caribbean Sea on the south (Fig. 1). The park, 42,000 ha, was declared a protected area in September of 1975.

Only a few marine research studies have been conducted in the park. In 1973, a physical oceanographic study was conducted by Metcalf *et al.* (1977) using drift bottles. A similar study, but encompassing the entire Caribbean, was performed by Brucks (1971). Metcalf *et al.* (1977) indicated the existence of "an extremely complex current condition in Mona Passage, with some bottles drifting from the Caribbean into the Atlantic Ocean and others in the opposite direction." Geraldes (1983) surveyed

[1] *CARICOMP — Caribbean Coral Reef, Seagrass and Mangrove Sites* (edited by B. Kjerfve), pp 213-220. UNESCO, Paris, 1998, 347 pp.

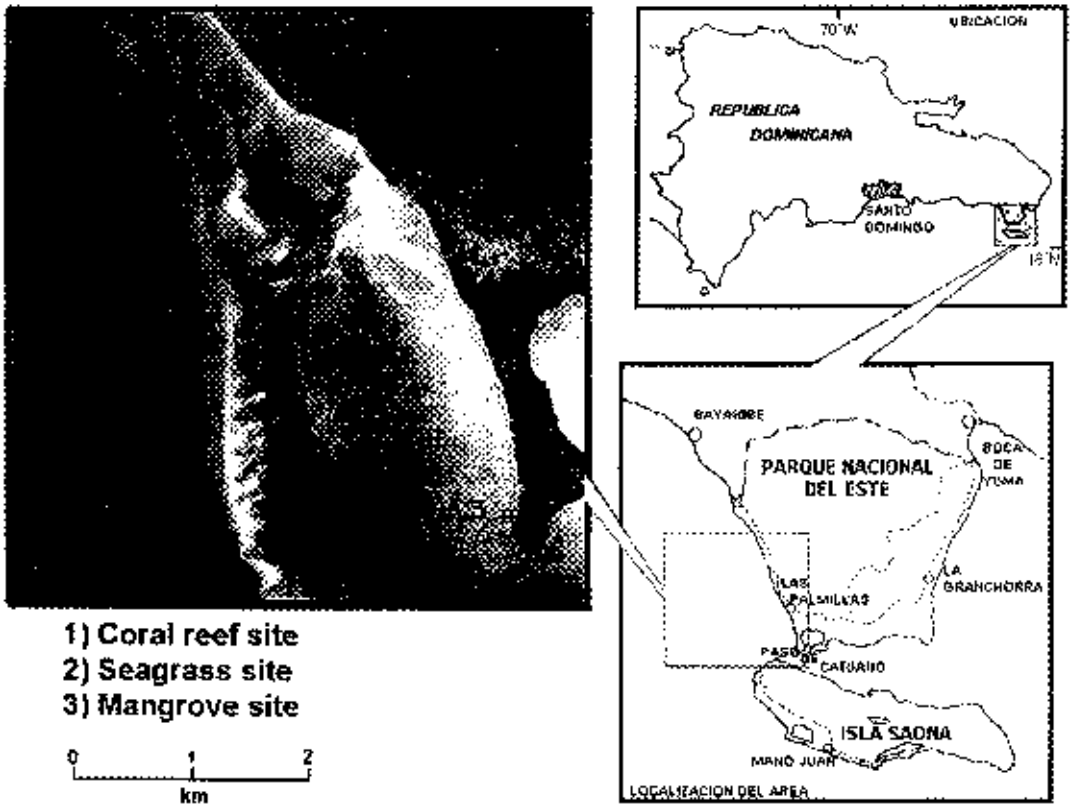


Fig. 1. CARICOMP sites in the Parque Nacional del Este, Dominican Republic.

marine habitats on the western shore of the Parque Nacional del Este, especially mangrove forests and the Bahía las Calderas. Olivares (1984) studied the composition, distribution, and abundance of zooplankton community in Bahía de las Calderas on the southern coast of the park. Data were collected on temperature, salinity, and depth of the area; the salinity gradient in nearby Bahía de las Calderas suggests freshwater intrusion in the area. The zooplankton analysis indicates that the composition of the community remains fairly constant as the tide changes.

Using ground-truthed aerial photograph interpretations and helicopter reconnaissance surveys, Island Resources Foundation, Inc. (Towle, 1975) offered well-documented descriptions of marine habitats and biota in the park before the marine Rapid Ecological Assessment in 1994-1995 (Vega, 1994). In 1975, a brief underwater survey was conducted by Caboza and Pierce in marine areas within and adjacent to the present park. Although it is largely a descriptive study, it does point out that there is a lack of large fish and suggests that spearfishermen may be responsible.

After the declaration of the area as a national park, the Dirección Nacional de Parques elaborated the Plan de Manejo del Parque Nacional del Este (Fahrenkrog, 1979). This management plan was the first of this nature in all the parks in the Dominican Republic. The plan not only describes the park and its resources, but it includes preliminary species lists of the marine fishes, marine reptiles and mammals, corals, marine molluscs, and marine seagrasses and algae.

In a series of studies in the Catalinita and Saona Islands (Vega, 1987), Dominican archaeologists discovered and photographed great conch piles, called "conchales" or "concheros," demonstrating the

economic importance of *Strombus gigas* for the Taino Indians as well as for modern fishermen. Vega (1987) noted: "It is interesting to see how the places where the most numerous Precolombian conch piles exist are the same places where, today, the fishermen still dedicate themselves to the same work and create 'modern' parallel conch piles. The place in the country with the greatest modern conch piles is Catalinita Island, between Saona and Boca de Yuma."

## Climate and Oceanography

The inland features of the park consist largely of terraces of Pleistocene coralline rock that emerged from the ocean and whose present elevations are 0, 5, 18, and 60 m above sea level. The coastal limestone is porous and filled with cavities and casts of coralline fossil organisms (Benchmarks, 1973). There are two shore-normal geologic faults: one is in the northeast near Boca de Yuma and extends for almost 20 km from east to northeast, the other is located in the southeast near La Granchorra and extends for approximately 12 km east to southeast (Cano Corcuera, 1993).

The climate of the park is tropical. The mean annual air temperature is 26.5°C with only ±2° variation. The humidity is stable, averaging 79%. Rainfall averages 1,000 mm per year, with 70% of the precipitation occurring May-July and September-October. The northeast tradewinds blow almost continuously (Benchmarks, 1973). A salient feature of the park is the absence of running freshwater; there are no rivers, lakes, ponds, streams, or freshwater swamps (Towle, 1975). However, there are sinkholes that accumulate rainwater. In general, oceanic currents flow east to west, although there is evidence of much variability in the Mona Passage between Puerto Rico and the Dominican Republic (Metcalf *et al.*, 1977).

The geology, geomorphology, and hydrogeology of the park combined with the semi-humid tropical climate indicate that, due to the high porosity of the coralline ground, there is a relatively large flow of groundwater (Cano Corcuera, 1993).

The terrestrial flora and fauna of the park have been previously described (Benchmarks, 1973; Cano Corcuera, 1993); more recently, an extensive Rapid Ecological Assessment was performed concurrently on the terrestrial systems of the park. To summarize, many different types of terrestrial and marine environments occur in the Parque Nacional del Este, including mangrove swamps, coconut plantations, moist subtropical deciduous forests, salt-resistant plant communities, and dry subtropical forests.

The coastline of the park is varied. There are white sandy beaches and relatively shallow waters in the western and southern portions of the park mainland and around most of the southern portion of Saona Island. There are rocky intertidal coasts and cliffs on the eastern side of the mainland and on the northeastern coast of Saona Island. And there are well-developed, varied mangrove forests in some places on the southern coast of the mainland.

## Ecosystems in the Parque Nacional del Este

The marine nearshore tropical ecosystems (mangroves, seagrass beds, and coral reefs) in the park are found mainly on the western leeward shore. These ecosystems have not been disturbed and are protected. Human interventions and anthropogenic impacts are few; plastics and other debris are found

occasionally. Neither freshwater influences nor pollutants are common in this region or in adjacent ecosystems.

A Rapid Ecological Assessment that was performed in 1994 aboard the Shed Aquarium's R/V *Coral Reef II* by a team of US and Dominican scientists produced the first comprehensive document regarding the coastal and marine ecosystems in the park. Table 1 summarizes the marine biodiversity found after a three-week cruise.

Table 1. Number of species in benthic communities in the Parque Nacional del Este, Dominican Republic.

| | Algae | Sponges | Octocorals | Corals |
|---|---|---|---|---|
| Low-Relief Spur-and-Groove | | | | |
| Parque Nacional | 15 | 29 | 10 | 22 |
| El Peñón | 15 | 36 | 16 | 26 |
| El Toro | – | 28 | 22 | 23 |
| Arrecife de Rubén | 14 | 34 | 16 | 18 |
| Reef Flat | | | | |
| Pasa Grande | 36 | 7 | 5 | 12 |
| Arrecife del Tronco | 27 | 16 | 7 | 14 |
| Arrecife Fuerte Olas | 28 | 5 | 3 | 10 |
| Transitional Reef | | | | |
| El Faro #2 | 24 | – | 22 | 23 |
| Patch Reef | | | | |
| Arrecife del Angel #1 | 21 | 20 | 7 | 11 |
| Arrecife del Angel #2 | 15 | 18 | 3 | 15 |
| El Faro #1 | 19 | – | 18 | 23 |
| Low-Relief Hard Bottom | | | | |
| Arrecife los Cocos | 29 | 28 | 23 | 14 |
| Rocky Coast Platform Reef | | | | |
| Acantilado de Catuano | 29 | 28 | 13 | 20 |
| Puerto Catuano | 17 | 14 | 9 | 12 |
| Soft Bottom | | | | |
| Hierba de Tronco | 25 | 0 | 0 | 2 |
| Pila de Lambí | 9 | 1 | 0 | 1 |
| Los Manglecitos | 11 | 0 | 0 | 2 |
| Ciudad de Penicillus | 17 | 2 | 0 | 0 |
| Hierba los Cocos | 10 | 2 | 0 | 3 |

The CARICOMP sites are located at Palmillas on the western shore of the park near the Catuano Passage that divides the mainland from Saona Island. The names of the CARICOMP sites are: Punta Mangle at Catuano (mangroves), Hierbas los Cocos (seagrasses), and El Peñón (coral reefs). In general, these sites represent seagrasses and coral reefs; however, some variations were found related to the oceanography, geomorphology, and substrate that affect productivity and biodiversity.

***Coral Reef Communities.*** Four of the benthic sites are characterized as belonging to the low-relief spur-and-groove community: Parque Nacional and El Peñón (where the CARICOMP site is located), both of which are on the west side of the park, are the most representative of this category; Arrecife de Rubén is located on the western coast of Saona Island; El Toro is also located on the western coast of Saona but farther south. These sites are relatively protected from direct wave action by land barriers. They lie in water depths of 15-25 m and have well-defined but low relief (<1m) spur-and-groove features. They do not appear to be actively accreting. The substrate in low-relief spur-and-groove communities is mostly hard reef, but crevices, depressions, and space grooves are filled with sediment. The

life form data show that these communities are characteristically dominated by algae, sponges, and octocorals, while hard coral cover is very low. Diversity of all lifeforms is high, and it is in this reef category that we find the sites with some of the greatest octocoral species richness (El Toro with 22 species), sponge species (El Peñón with 36 species), and hard coral species (El Peñón with 26 species). Most algae are calcareous (*Halimeda*) or turf algae, although *Dictyota* is also present. Octocoral and sponge individuals are characterized by large size. Corals, when found, are mostly *Diploria labyrinthiformis, Siderastrea siderea*, or *Montastrnea cavernosa*.

Three reef flat communities, consisting of low-relief consolidated carbonate platforms, are identified in the park: Pasa Grande, Arrecife del Tronco, and Arrecife de Fuertes Olas. All are in relatively shallow water (0.5-3.0 m) on the eastern portion of the channel between the mainland and Saona Island. They are thus subjected to heavy wave action and strong currents from the Mona Passage. Life form characteristics in reef flats vary substantially. Pasa Grande is dominated by algae cover (in more than three quarters of the quadrats, the coverage is 72%), although sparse hard coral colonies (*Acropora palmata, Diploria clivosa, Porites astreoides, Porites porites*) are also present. The greatest algal species richness, especially of phaeophytes, occurs at this station. The most important algae here are the genera *Dictyota, Turbinaria, Stypopodium*, and *Halimeda*. Arrecife del Tronco is also dominated by algae, although not as strongly as Pasa Grande. There is sparse to moderate sponge and hard coral (mostly *Porites porites forma furcata*) cover at this site. Arrecife de Fuertes Olas is also strongly dominated by algae, with some sparse hard corals and seagrasses present.

Three patch reef communities were identified in the park. Arrecifes del Angel #1 and #2 are both relatively circular in shape and are surrounded by a sand halo and then a seagrass bed (*Thalassia testudinum*). It has been shown that these sand halos can be caused by nocturnal grazing activities of long-spined *Diadema antillarum* sea urchins, which move out of their hiding places on the reef at night to feed on the adjacent seagrass beds (Vega, 1990). The substrate at Arrecife del Angel #1 consists of nonconsolidated rubble or cemented dead *Porites porites* corals, with sediment increasing towards the periphery of the reef. The substrate at Arrecife del Angel #2 is a mixture of hard reef, sediment, and rubble. El Faro #1 is a heterogeneous series of patches separated by sediments and rubble from *Acropora cervicornis*. The substrate itself consists of a consolidated reef platform with some coral heads. The dominant biota in all three patch reefs is algae. At Arrecifes del Angel #1 and #2, algae covers >50% of the quadrats in 72% of the area. *Dictyota* are very common at El Faro #1. Although sponges, octocorals, and hard corals occur in all three patch reefs, El Faro #1 and Arrecife del Angel #2 are also characterized by having a diverse octocoral and hard coral fauna. For example, El Faro #1 is the only place where *Agaricia tenuifolia* is found and where colonies of *Millepora squarrosa* are also common. This latter coral species is found only at the El Faro #1 and #2 stations. Hard coral and octocoral species are also very common at Arrecife del Angel #2, where large colonies are abundant.

***Seagrass and Algae Communities.*** *Thalassia testudinum* and *Syringodium filiforme* characterize the mixed seagrass and mixed seagrass/algae communities along the western nearshore coastline in the park, with six different hard bottom and three different soft bottom community types. In the shallow areas, there are moderate to dense seagrass and algal communities. In the leeward, western portions of the park, low-relief spur-and-groove and hard bottom communities are the types of bottom typically

found. The substrate of all soft bottom benthic communities surveyed in the park is composed mostly of sediment with small amounts of rubble and patches of hard reef.

Hierba del Tronco is the only soft-bottom station whose biota is dominated by the seagrass *Syringodium*. Hierba del Tronco is located in the eastern portion of the passage between Saona and Catalinita Islands and is subject to heavy wave energy. As expected, its biota is predominantly seagrasses, although some patches of algae were encountered. A comparison of the relative cover and frequency of occurrence of the different seagrass species shows that although *Syringodium* is dominant, *Thalassia* is also present in moderate amounts. The algal species richness here is surprisingly high, with 25 species found. Most dominant of these algal species is *Halimeda incrassata*, followed by *Penicillus dumetosus* and *Udotea flabellum*.

The Pila de Lambí site is located NNW of Catalinita Island, 8 km from the mainland, where large white piles of dead *Strombus gigas* are clearly visible — hence the name of the site. Its biota consists of moderate to dense cover by different seagrasses (*Thalassia*, *Syringodium*, and *Halodule*), with some algae dispersed throughout. Algal species richness is low, and no single species of algae is dominant in terms of cover, although *Penicillus dumetosus* individuals are quite numerous (occurring in 84% of the quadrats).

Three of the communities surveyed in the park are mixed algae/seagrass communities: Los Manglecitos, La Ciudad de Penicillus, and Hierba de los Cocos. These communities are characterized by their location in relatively shallow water (<3 m) and the co-dominance of seagrasses and algal species. Los Manglecitos is less than 100 m from the southeastern coast of the mainland. It has a highly variable cover of both algae (*Halimeda*, *Laurencia intricata*, and *Dictyota*) and *Thalassia testudinum*. The most common algal species in terms of numbers are *Penicillus capitatus*, *P. dumetosus*, and *Laurencia intricata*. In terms of cover, however, the dominant species are *Halimeda opuntia*, *Laurencia intricata*, and *Dictyota cervicornis*. Ciudad de Penicillus has the same characteristics in terms of dominant biota as Los Manglecitos, but there are more anemones and sponges present in this soft bottom community. The dominant seagrass is *Thalassia testudinum*. The most important algal species in terms of cover are *Penicillus dumetosus*, *Halimeda monile*, and *Halimeda incrassata*. In terms of number, the most important are various species of *Caulerpa*, *Halimeda*, *Penicillus*, and *Udotea*. It is interesting to note that the density of seagrass shoots and blades in Ciudad de Penicillus is low compared to Hierba del Tronco, which is dominated by *Syringodium*, although blade length is greater there. Finally, Hierba los Cocos is dominated by the alga *Lobophora variegata*, although *Udotea* and *Avrainvillea* species are also common. Both *Thalassia* and *Syringodium* are found at this station.

***Mangrove Communities.*** The mangroves in the park are typically fringing mangroves with an average height of 4 m. No large trees have been found, but they may have been cut down; this part of Hispaniola was impacted by indigenous inhabitants, pirates, and smugglers and, more recently (until about 1930), by timbermen and cattle ranchers. About 1,500 ha of the park consists of fringing mangrove forest of the species *Rhizophora mangle*, *Laguncularia racemosa*, *Avicennia germinans*, and *Conocarpus erecta*, which are found mostly around low-lying shorelines where wave action is minimal. The mangroves also are part of a series of coastal lagoon habitats, where juveniles of the spiny lobster *Panulirus argus*

and other fish species use them as refuges and nursing grounds. There are some dwarf mangroves at Bahía las Calderas.

Mangrove-associated fauna include frigate birds (*Fregata magnificens*), pelicans (*Pelicanus occidentalis*), and white crown pigeons (*Columba leucocephala*); about 26 species of fishes; molluscs, including *Crassostrea* sp. *Isognomon* sp., and *Littorina* sp.; and crustaceans, including *Cardisoma guahsuumi*, *Gerarcinus* sp. and others of the family Ocipodidae. The sponges *Tedagnia ignis* and hydorids are relatively abundant. The up-side-down jellyfish *Cassiopea frondosa* is occasionally found in backwaters and lagoons. *Halimeda* is the most common algae found.

### Coral Reef Site

The El Peñón station (18°15.24'N; 68°46.79'W) is located on the leeward side of the mainland, facing west, 8 km north of Punta Catuano and 1.5 km northwest of Punta Palmillas at mooring buoy #2 of the El Peñón dive site (Fig. 1). The depth of this station is 9 to 12 m (averaging 10 m). The base of the reef lies on a hard coralline bedrock, which is the substrate for corals, octocorals, sponges, and other benthic organisms in a low-relief spur-and-groove system perpendicular to shore. This system ends in a sand channel that parallels the shore. This station represents one of the healthiest coral reef communities in the Parque Nacional del Este; continuous visitation is possible due to the oceanic conditions in the area: wave heights average 0.2 m, winds are usually from the southeast at an average speed of 2-3 m $s^{-1}$, currents usually flow to the northwest at a rate of 0.1 m $s^{-1}$, and temperature is normally 28-29°C.

### Seagrass Site

The Hierba los Cocos station (18°13.527'N; 68°46.107'W) is located on the leeward side of the mainland, half-way between Punta Mangle at the Catuano Passage and El Peñón (Fig. 1). The site is characterized by a dense seagrass bed, located towards the shallow side of Arrecife Los Cocos. This seagrass bed lies on top of a soft substrate mixed with gravel. The principal species occurring here are *Thalassia testudinum* and *Syringodium filiforme*, together comprising more than 75% of the cover; the remainder of the cover includes eight species of algae (most commonly *Avrainvillea* and *Udotea*, but *Lobophora* is also quite abundant).

### Mangrove Site

The Canal Punta Mangle al Catuano station (18°12.217'N; 68°45.215'W) lies in the northern section of the Catuano Passage (Fig. 1). When the winds and tides are active in this sector, strong currents flow through the mangrove system forming channels, some of which are navigable. Large deposits of organic sands, originating mainly from *Halimeda* and other sand-producing organisms, are created by current eddies. The CARICOMP site is located at the edge of one of these channels in the middle of the forest. It was chosen as representative of a young and stable mangrove community that is always inundated. Trees are mainly *Rhizophora mangle*, 5-6 m high with trunk diameters generally 0.4 m.

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