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Coastal-marine environments of Parque Nacional Corcovado, Puntarenas, Costa Rica

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Abstract: Parque Nacional Corcovado is famous for its terrestrial ecosystems but also has important but unappreciated coastal-marine environments. These environments, which have not been studied, include sandy beaches, rocky outcrops, soft and hard bottoms, and coral reefs. We describe three intertidal rocky sites, list the coral species, and describe several coral communities from Corcovado. Species composition and distribution on the intertidal zone are similar to other areas on the Pacific coast of Costa Rica. Eleven species of scleractinian corals were found in the Park, a richness equivalent to other reefs in the country. The most important species were *Pocillopora damicornis, Pocillopora elegans* and *Porites lobata. Pocillopora* reefs were found in Corcovado, they are common in other parts of the eastern Pacific but rare in Costa Rica. The Park is an important refuge for species of commercial value that have been depleted from most of the coast. This National Park, together with most of the other protected areas in the country, *e.g.* Isla del Caño, Santa Rosa and Manuel Antonio, have become the sole reservoirs and sources of larvae, juveniles and adults of many species for adjacent areas.

Key words: Corals, Osa Peninsula, Costa Rica, Corcovado National Park, intertidal zone.

The coastal and marine environments of Parque Nacional Corcovado, Península de Osa, Costa Rica (Fig. 1), have not been studied. However, the Park possesses important marine resources and environments, including sandy beaches, rocky outcrops, hard and soft bottoms, and coral reefs.

In a paper by Glynn *et al.* (1983) they indicate in a map a coral community near Punta Salsipuedes (Fig. 1), but there is no description of it. There are no other publications on the coastal and marine environments of the Park. In this paper we describe three intertidal rocky sites, report on the coral communities, and present a list of coral species from Parque Nacional Corcovado.

MATERIAL AND METHODS

During February 1994, with the help of the German Research Vessel Victor Hensen it was possible to visit the outer part of Península de Osa, one of the most difficult to reach sections of the Costa Rican Pacific coast (Fig. 1). Diver tows were conducted to determine the presence of coral reefs and other benthic communities. This technique consists in towing a diver from a boat. At regular intervals, the boat is stopped and the diver takes notes, and makes more detailed observations (Moran & De'ath 1992). In this way, it is possible to cover extensive areas of the coast and allows for better selection of sites for skin or SCUBA diving.

In August 1994, Parque Nacional Corcovado was visited to study the rocky intertidal zones between Punta Salsipuedes and the mouth of Río Claro (Fig. 1). A total of 49 ten meter long transects parallel to the shore line, and separated 20 m between each one, were done at three sites: 18 at Salsipuedes, 5 at Punta Media and 26 at Río Claro. The organisms present every 20 cm were recorded.

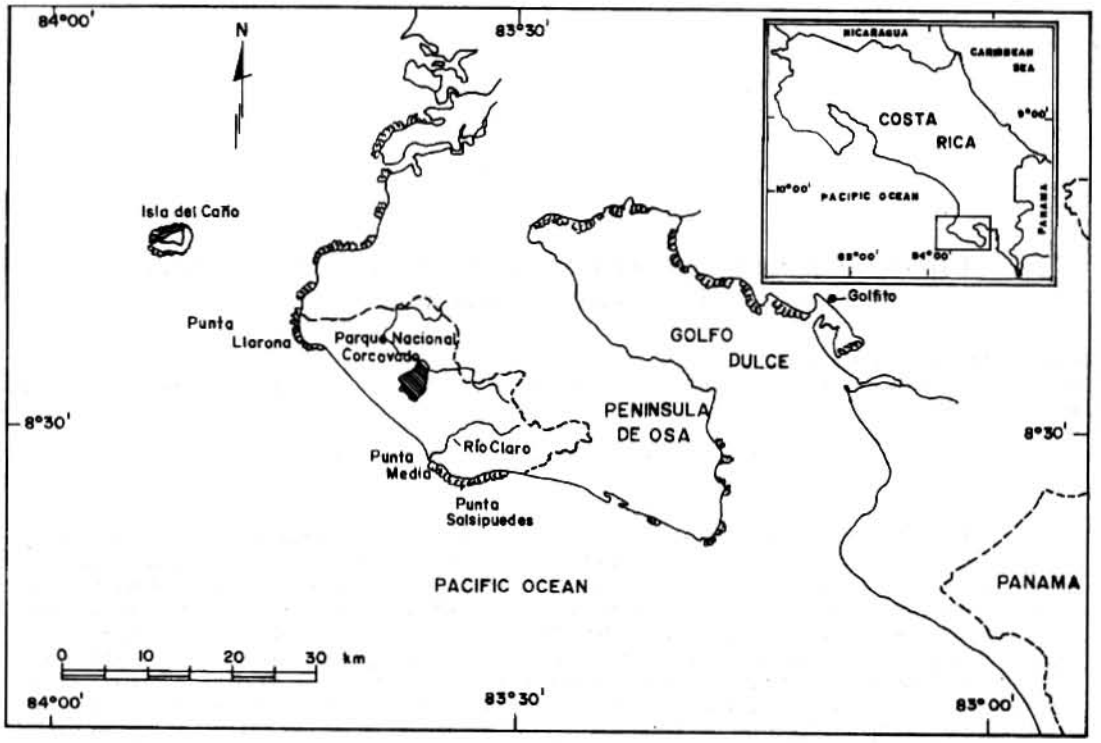

Fig. 1. Studied localities at Parque Nacional Corcovado, Península de Osa, Costa Rica.

RESULTS AND DISCUSSION

Corals and coral communities: The rocky points and islets of Parque Nacional Corcovado have a rich coralline fauna and at some sites there are coral reefs. Also, these rocky zones serve as a refuge for species with commercial importance.

1. Punta Salsipuedes: This large rocky point extends from Playa Madrigal to Playa Sirena, a distance of about 10 km, and includes Roca La Chancha, an islet off-shore. The submarine substrate consists of hard bottoms with dense benthic communities of barnacles, crustose coralline algae, octocorals and a few scleractinians. This site is an important refuge for several species of commercial value, like the conch *Strombus galeatus*. The conch populations of Punta Salsipuedes are the largest we have observed in all the Pacific coast of Costa Rica (> 5/m²). This is of extreme importance since populations of this species have been impacted in most parts of the coast, as is also the case with the pulmonate snail, *Siphonaria gigas* (Ortega 1987a), but abundant at Corcovado. The coastal and marine zones of the National Parks are the last refuges for many species, specially for those of commercial interest. This is one more reason for dedicating efforts to the protection of these zones, because their populations will be the source of larvae, juveniles and adults of the future.

2. Punta Llorona: Punta Llorona extends from Playa Llorona to Playa San Pedrillo, a distance of about 8 km (Fig. 1). The benthic communities are similar to Punta Salsipuedes, mainly barnacles, crustose coralline algae, octocorals and some scleractinians. Three small patch reefs (≈ 10 by 15 m), and one large one (≈ 50 by 50 m) formed by continuous growth of *Pocillopora* were observed near San Pedrillo. This type of coral reef is rare in other parts of the coast of Costa Rica, but not in other regions of the eastern Pacific (Guzmán & Cortés 1993). This site has many coral species (Table 1) and some of them reach relatively large sizes (> 1 m in diameter).

TABLE 1

Coral species from Parque Nacional Corcovado, Península de Osa, Pacific of Costa Rica

Coral Species	Sites	
	Punta Salsipuedes	Punta Llorona
Gardineroseris planulata Dana	X	
Oulangia bradleyi Verrill		X
Pavona clavus (Dana)	X	X
Pavona gigantea Verrill	X	X
Pavona varians Verrill		X
Pocillopora damicornis Linnaeus		X
Pocillopora elegans Dana	X	X
Pocillopora eydouxi Milne Edwards & Haime		X
Porites lobata Dana	X	X
Psammocora stellata (Verrill)	X	X
Psammocora superficialis (Gardiner)		X
Total number of species	5	11

3. Coral species: A total of 11 species of corals have been identified from the Parque Nacional Corcovado (Table 1), and a similar number of octocorals might be present (their identification however has not been possible, because of the little information on this group for the eastern Pacific).

The number of coral species in Punta Llorona (Table 1) is higher that the number of species found within Golfo Dulce (Cortés 1992), but it is comparable to other areas in Costa Rica (Cortés & Murillo 1985; Guzmán & Cortés 1989, 1992). The low number of species found in Punta Salsipuedes (Table 1) may be due to the short time of exploration that we had or to the lack of adequate habitats for the stablishment of corals.

Rocky intertidal:

1. Punta Salsipuedes: This rocky outcrop, located southeast of Río Claro, has many different environments because of its very heterogeneous topographic relief. There are inlets of varied depths and extensive, highly eroded, tectonic mélange platforms, consisting of sandstones, volcanic pelites and hemipelagic limestone (Di Marco 1994).

The molluscs as a group, represented the highest abundance (11.7%), the gastropods *Nodilittorina aspera* and *Siphonaria gigas* were the predominant organisms in the transects (Table 2). These were followed by the brown algae and the crustaceans (11. 0 and 2.4 %, respectively, Table 2). Shells of many subtidal molluscs were washed onto the platforms, indicating a rich fauna that should be studied. Also, in the sandy patches in this area there are populations of hermit, *Coenobita compressus* Milne-Edwards, and fiddler, *Uca* sp. crabs.

Several coral species are present in the tidepools and in the inlets, though their abundance is low (0.4%, Table 2), but increasing towards the sea. These coral colonies are growing in an environment with extreme temperatures (22 to 40 °C) salinity range (0 to 45 ‰), and solar radiation, for short periods of time.

2. Punta Media: This small site is located between Punta Salsipuedes and the platforms of Río Claro (Fig. 1). It is isolated from the other rocky outcrops by two bays and extensive sandy beaches. It contains more beachrock than Punta Salsipuedes and more basalt than the platforms of Río Claro. Relief is poor with few depressions and channels.

The gastropod *Nerita scabricosta* was the most abundant animal in these transects (14.2%, Table 2), but as a group, the brown algae were more abundant than the molluscs (33.1 and 17.4% respectively, Table 2). The low topographic relief of this platform, combined with the intensive wave action and loose boulders may explain the low abundance and diversity.

3. Río Claro: The platforms from the Río Claro area (Fig. 1) have the most beachrock. Their extension and heterogeneity is high.

TABLE 2

Abundance of organisms from the rocky intertidal zone at three sites in Parque Nacional Corcovado. Total number of transects = 49

	Punta Salsipuedes	Punta Media	Río Claro	% of TOTAL
Chiton spp.	0.1	0	0	0.03
Pliopurpura patula panza	0	0	0.1	0.03
Brachiodontes sp.	0	0	0.2	0.07
Mytilus sp.	0.1	0	0.1	0.07
Vermetids	0.3	0	0	0.10
Crepidula sp.	0.3	0	0.1	0.13
Pocillopora elegans Dana	0.4	0	0	0.13
Ostrea sp.	0	0.5	0	0.17
Conus patricius Hinds	0.6	0	0	0.20
Balanus spp.	0.6	0	0	0.20
Melongena patula (Broderip & Sowerby)	0	1.1	0.1	0.40
Siphonaria palmata Carpenter	0.6	0.5	0.2	0.43
Thais melones (Duclos)	0.4	0.5	0.5	0.47
Tetraclita panamensis Pilsbry	1.5	0	0.1	0.53
Fissurella virescens Sowerby	0.8	0.5	0.8	0.70
Siphonaria gigas Sowerby	2.8	0	0.8	1.20
Nodilittorina aspera (Philippi)	4.0	0	0.3	1.43
Anemones	0	0	5.1	1.70
Calcareous algae	2.1	0	5.4	2.50
Nerita scabricosta Lamarck	1.8	14.2	13.0	9.67
Brown algae	11.0	33.1	10.1	18.07
Sand, basalt, and beachrock	72.5	49.5	63.2	61.73
H'	0.88	0.39	0.73	
J'	0.73	0.46	0.62	

Some are made up exclusively of beachrock and others by combinations of unconsolidated basalt and beachrock. Wave action is intense there.

The most abundant animal again was *Nerita scabricosta*, followed by sea anemones (13.0 and 5.1% respectively, Table 2). Brown algae and crustose coralline algae have also relatively high abundances (10.1 and 5.4% respectively, Table 2). In some sections densities of *N. scabricosta* were of more than 50 individuals per m^2.

Salsipuedes had the highest Shannon diversity (H' 0.88) and equitability (J' 0.73) values followed by Río Claro (0.73, 0.62), and Punta Media with the lowest values (0.39, 0.46). These relationships may be due to spatial heterogeniety. Salsipuedes has the most diverse substrates. When the number of similar species and their abundances are compared (Morisita Index of Similarity) Salsipuedes and Punta Media are more alike, while Salsipuedes and Río Claro are the most dissimilar.

Species composition and distribution on the intertidal zone is similar to other areas on the Pacific coast of Costa Rica (pers. obs.), but different to what was observed by Ortega (1987b) at Punta Mala on the central section of the Pacific coast of Costa Rica. *Nerita scabricosta*, the most abundant gastropod from Corcovado was absent at Punta Mala, which Ortega (1987a) attributes to human predation. Some sections of the rocky intertidal at Parque Nacional Corcovado are similar to areas in Panamá were bare rock and algae cover high percentages of the substrate (Lubchenco *et al.* 1984).

Concluding remarks and some recommendations for management: Parque Nacional Corcovado has important marine resources and environments, including coral reefs. The marine and coastal zone of the Park, as also its terrestrial counterparts have become the last refugia of many species, specially of species that are commercially exploited elsewhere. If

adequate protection is not provided immediately to all the marine resources, they will be lost in a short time due to illegal fishing, as was observed at Corcovado last year, when several thousand conchs were taken (R. Avilés, com. pers. 1995).

Diving activity in Costa Rica has increased in the last five years, and it is starting in the Osa Peninsula. For this reason the Park personnel must be prepared and regulations regarding dive sites and diving ethics must be in place as soon as possible. The impact of uncontrolled diving activity has been demonstrated to be deleterious to coral reefs in others areas, *e.g.*, Virgin Islands (Rogers 1988), Florida (Talge 1992) and Egypt (Hawkins & Roberts 1992).

Public education programs directed to the adjacent communities and to the dive operators are necessary. Corcovado National Park, as all Parks, needs community support in order to subsist and persist. As mentioned above diving activities are increasing in the Park, and as pressure mounts on Isla del Caño, and as new regulations are going into effect there, more diving operations will move to Corcovado. It is imperative that the dive groups be guided by Dive Masters, trained not only on diving but also in resource protection.

Finally, long term monitoring to evaluate both natural and anthropogenic impacts in the marine-coastal zone must be initiated. Corcovado presents an interesting case in which evaluations can be made before diving activities start. It will be one of the few places where it will be possible to collect before and after data. Parallel to the monitoring of natural and anthropogenic impacts, a program to evaluate the management measurements on the marine-coastal environments must be implemented.

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RESUMEN

El Parque Nacional Corcovado es famoso por sus ecosistemas terrestres, mientras que los ambientes marino-costeros han quedado de lado. Estos, incluyendo playas arenosas, afloramientos rocosos, fondos duros y blandos y arrecifes coralinos son variados e importantes, aunque no hay ningún estudio de ellos. En este trabajo describimos tres localidaes intermareales rocosas, presentamos una lista de corales, y la describimos varias comunidades coralinas del Parque Nacional Corcovado. La composición y la distribución de especies de las zonas intermareales son similares a otras localidades de la costa Pacífica de Costa Rica. Se encontraron once especies de corales escleractinios, una riqueza de especies similar a otros arrecifes del país. Las especies más importantes fueron *Pocillopora damicornis, Pocillopora elegans* y *Porites lobata.* En Corcovado hay arrecifes de *Pocillopora,* que son comunes en otras zonas del Pacífico Oriental pero poco representados en Costa Rica. El Parque se ha convertido en un importante refugio para especies explotadas comercialmente. Este Parque Nacional, como la mayoría del país, se ha convertido en la principal fuente de larvas, juveniles y adultos de muchas especies, principalmente las de interés comercial que han sido eliminadas del resto de la costa.

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