FROM THE AMERICAN PEOPLE

SAVING THE LAST GREAT PLACES ON EARTH

Coastal Resources Center
University of Rhode Island

MANAGING FRESHWATER INFLOWS TO ESTUARIES
Historical Synthesis Of Biophysical Information Of Samana region, Dominican Republic

A. Herrera - Moreno

Herrera-Moreno, A. (2005). Historical Synthesis Of Biophysical Information Of Samana Region, Dominican Republic. Santo Domingo, DR: Center for the Conservation and Eco-development of Samana Bay and its surroundings (CEBSE, Inc.).

Historical Synthesis of Biophysical Information of Samaná Region, Dominican Republic

Dr. Alejandro Herrera-Moreno

Center for the Conservation and Eco-development of Samaná Bay and its surroundings, CEBSE, Inc.

Santo Domingo, Marzo, 2005

CONTENTS

INTRODUCTION

This report is part of a study made for the Center for the Conservation and Eco-Development of the Bay of Samana and its surroundings (CEBSE), with the objective of compiling physic, biological and fishery information to have a basis for a Rapid Ecological Assessment.

Our specific objective is to characterize the biophysical regimen of Bay of Samana in regard to freshwater contribution of Yuna and Barracote Rivers through the analysis of existing information and identification of the most important lagoons to be address by the REA.

In order to do this we performed the following activities: a) collection and revision of historical information on hydrology, circulation, bathymetry, water flows, habitat distribution and fish resources of the Samana region, b) elaboration of a digital bathymetric model to help future ecological and oceanographic studies, c) revision of the fish captures in some places to complement the compiled information, d) revision and analysis of the information on the shrimp fishery in the estuary complex at the West of the Bay of Samana.

The studied region is the estuary and the interior of Bay of Samana, although if we consider that Samana region extends to Punta Arena in the north of the Samana Peninsula, and to Nisibón in the south, we additionally considered all information in this area that could be relevant for future research.

MATERIAL AND METHODS

INFORMATION COMPILATION AND ANALYSIS

As a starting point of our work we took the previous coast and marine biodiversity review of Samana region made by Betancourt (1998) for the CEBSE, which is here extended and complemented. By visiting libraries and web sites of several national and international institutions we completed the search of all inedited or published information including products of projects and research papers on different themes. We reviewed the libraries of The Nature Conservancy (TNC) and Center for Marine Biology Research (CIBIMA) of University of Santo Domingo.

Special attention was directed to library of CEBSE because this institution has conducted several general investigations of this region in which available information on natural resources of the basin and the north and east of the peninsula has been compiled. In the same way, we made direct contact with researchers or Cornell University and the Sea Education Association of Woods Hole to get the paper research made by these institutions at Samana.

The information on the general biota was complemented with data of CIBIMA (1994) and the most current information of the Project HISPABIOTA MARINA (Herrera-Moreno and Betancourt, 2005, for the information on fishery we used the FishBase by Froese and Pauly (2005), the review of Ramírez and Silva (1994), the report of ICRAFD (2001) and the results of the Chapter on Dominican Republic of the Regional Fishery (Herrera *et al.*, in press.).

During our search we included some international museums that have in their collections material from Samana. They are: National Museum of Natural History (NMNH, 2005), Florida Museum of Natural History (FMNH, 2005), National History Museum of Los Angeles County (NHMLC, 2005) and the California Academy of Science Catalog of Fishes (CASCF, 2005). Information of these museums regards to international expeditions of research ships Caroline, Silver Bay y J. E. Pillsbury, which conducted biological sampling in the Bay of Samana and nearby sea. General data about this is showed in Table 1.

Table 1. Data about some expeditions that have conducted biological surveys in the Samana region.

ship	Month	year	Station	Latitude N	Longitude O	Depth (m)
Caroline	Feb	1933	52	19° 10´ 25´´	69° 20´ 55´´	26-40
Silver Bay	Oct	1963	5174	19° 22´ 00´´	69° 27´ 00´´	68
Pillsbury	Jan	1970	1157	19° 06´ 18´´	69° 01´ 00´´	18-40

Information compiled on species of macroalgae, marine invertebrates and fish for Samana region was organized in tables arranged by taxonomic group, following the order by Ruppert and Barnes (1994). We tried to organized, from an ecological point of view, all species information according to the habitat, such as those from the interior of the basin, those corresponding to studies carried out in areas of the interior of the Bay of Samaná, swamps, marine grasses and reefs of scarce development, and those corresponding to external areas of the Bay of Samaná, in arrecifal habitats that are developed under the oceanic influence, although this subdivision can be in some relative cases.

Total number of species per group were added for the “external” and “internal” areas and compared to get conclusions on regional differences regarding group diversity and species richness.

In connection with the fishing data, information was compiled whenever it was possible of all the places of landing of the region of Samaná that go from Punta Arena until Nisibón.

To supplement the gathered information we carried out visits to several landing places including that of the fishermen in Sánchez, where fishing activity is directly related with the estuarine habitat. To compare the variations of the fishing resources in a gradient from the estuary to the ocean we included the data of the eight landing places proposed by Sang et to the one. (1997): Sánchez, Miches, Los Cacaos, Sabana de la Mar, Las Pascualas, Santa Bárbara de Samaná, Las Galeras and Las Terrenas. The data of these places were organized in order from the interior to the exterior of the bay offering a pattern of the species according to swamp-estuary-prairie-reef-ocean habitats.

Whenever it was possible we took the coordinates of all the points where reports of species or ecosystems/habitat information were found, for cartographic location. Some points where biophysical data were obtained for the present work are indicated in Figure 1, where the places of origin of biological oceanographic or fishing information are explained. In the case of mangrove swamps and the marine grasses, there is not a precise geographical indication of study places because all obtained information corresponds to the whole periphery of the region that is indicated in the map and in particular the mangrove swamps to the coast West of the Bay of Samaná.

CARTOGRAPHY

The digital bathymetric pattern was elaborated starting from the data of Coordenates UTM WGS 84 and depth obtained using the most recent bathymetric map available in the Military Cartographic Institute, scale 1:30,000, adjusted to a previously designed grid. This way we obtained maps of the general bathymetry –two and three-dimensional - both in the GOLDEN SURFER Program Version 8, of the Golden Software, Inc., through the Krigging Model, by a previous calculation of the adjustment variogram. These maps just pretend to offer a general model of the topography of the submarine bottom to analyze its characteristics and to serve as a basis for future work on ecosystem and habitat delimitations.

To support this and because the lack of information on the bottom types of the bay, the points corresponding to the different available bottom types in the bathymetric map were equally mapped, with the interest of having a preliminary idea of the distribution of the muddy habitat associated to the contribution of the rivers.

ACKNOWLEDGEMENTS

We thank the personnel of The Nature Conservancy, the library of the Center for Marine Biology Research (CIBIMA) and especially the Center for the Conservation and Eco-Development of the Bay of Samana and its surroundings (CEBSE), for the facilities offered during the search of information. We thank to the Dr. Erik Zettler, Scientific Coordinator of Sea Education Association of Woods Hole for his collaboration by supplying information of the Cruise C-191 on board of the Research Ship Corwith Cramer from Key West to Samaná. In the University of Cornell we thank to M. Laba, S. D.Smith and S. D. DeGloria for sending us their work on land use in the low basin of the Yuna River and to Ruth Sherman for sending us her excellent works on the mangrove swamps of the Bay of Samaná.

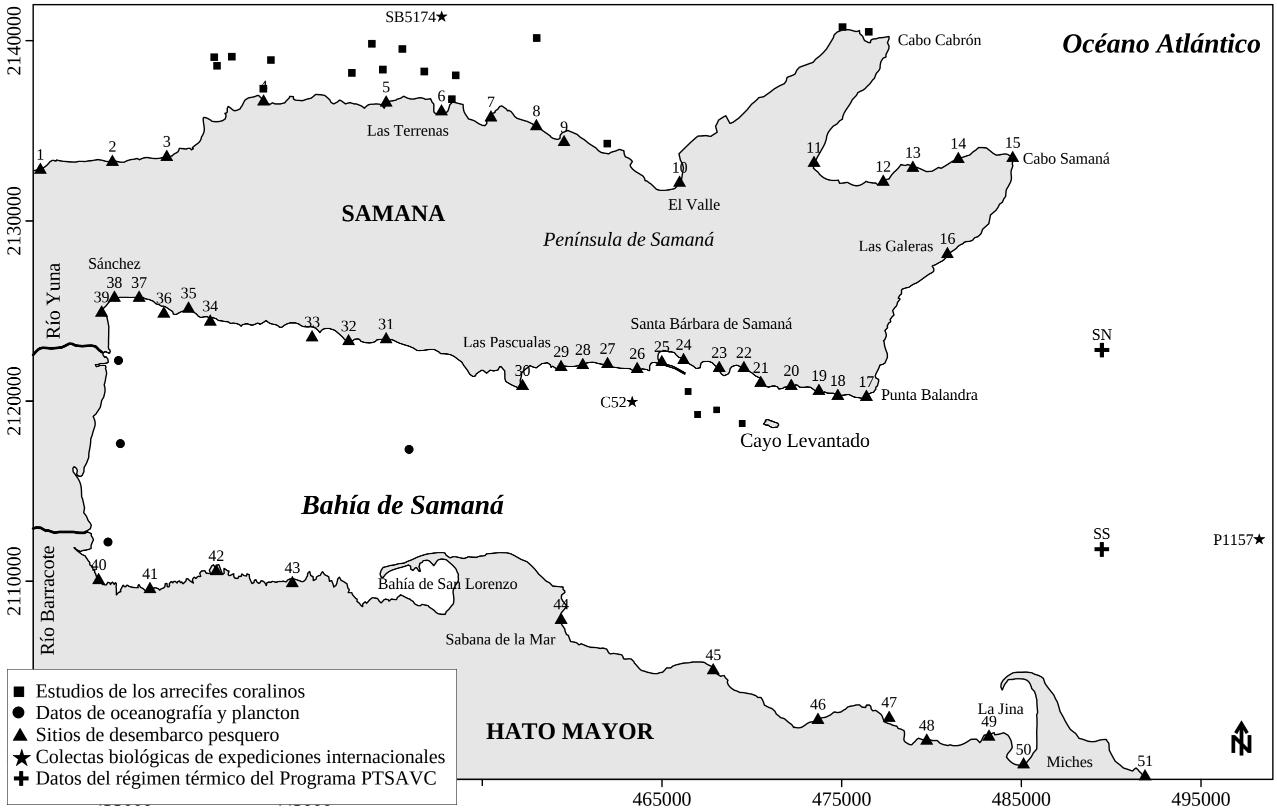


Figure 1. General map of Samana region with several points were biophysical information was obtained. *International expeditions*: SB. BI Silver Bay Estación 5174, C52. BI Caroline, Estación 52 BI Pillsbury Estación 1157. *Landing sites*: 1. Las Cañitas, 2. El Cossón, 3. Bonita Beach, 4. Las Terrenas, 5. El Estillero, 6. Punta Coquito, 7. El Limón, 8. El Morón, 9. Las Canas, 10. El Valle, 11. Rincón Beach, 12. Punta Frillet, 13. La Playita, 14. Las Galeras, 15. Madama, 16. El Francés, 17. Punta Balandra, 18. Los Cacaos, 19. Las Flechas, 20. El Caletón, 21. Simi Báez, 22. Los Gratin, 23. Carenero, 24. Punta Lirio, 25. Villa Clara, 26. Anadel, 27. Samaná, 28. Los Cocos, 29. Las Pascualas, 30. Punta Corozo, 31. Arroyo Barril, 32. Los Róbalos 33. Los Corrales 34. Arroyo Hondo 35. El Majagual 36. Las Garitas 37. Arroyo Higuero 38. Punta Gorda, 39. Sánchez, 40. Naranjo Abajo, 41. Amado Cave, 42. El Coco, 43. Naranjo Arriba, 44. Sabana de la Mar, 45. Capitán, 46. Las Cañitas, 47. Magua, 48. Cabezú, 49. Arroyo Rico, 50. Ensenada de la Jina y 51. Miches (taken from Herrera-Moreno and Betancourt, 2003).

PHYSICAL ASPECTS

It can be said that physical/chemical oceanographic information on Bay of Samana is not available at all. Surprisingly, the biggest estuary in the Dominican Republic -and one of the most important of the Caribbean - it has never been object of a deep oceanographic investigation, with a seasonal approach, including the physical and chemical factors that reveal the hydrological pattern, related with the freshwater contribution of the Yuna and Barracote Rivers.

Ferreras et al (1990) and Ferreras (1991) offer the only well-known data on some oceanographic parameters in the western region of the Bay of Samaná, between November of 1988 and August of 1989. In four stations (Fig. 1) determinations of salinity, temperature, pH, and chlorophyll concentrations were made, but only in the superficial stratum. These studies were carried out with investigations of the plankton (Lysenko, 1991). This early physical-chemical characterization showed big fluctuations of salinity (0 to 25 ‰), temperature (22 to 32 oC), pH (7.5 at 8.5) and chlorophyll concentrations (0.53 to 6.9 mg/m3), which reveals the dynamic nature of the region linked to the fluvial influence (Ferreras et to the., 1990; Ferreras, 1991). However, these data are limited because they only refer to superficial samples that do not allow to determine the position of the saline intrusion neither to describe the estuary type appropriately. On the other hand, the works do not clarify in what phase of the tide cycle the samplings were made every month, and the scarce data are not supplemented with previous meteorological information during the samplings (for example precipitations) and do not cover a complete annual cycle of observations.

In regard to the salinity, without doubts the most excellent parameter for the characterization of the estuary, the data show the biggest variations in the proximity of the Río Yuna (0 to 4 ‰) and the Río Barracote (0 to 12 ‰). The station between both rivers (19 to 25 ‰) it never showed values so low indicating that, at least under the conditions of this sampling, the effect of the fresh water was very located at the river mouth. Finally in their station farthest to the rivers, the values varied between 18 and 25 ‰ indicating that important fluctuations of the superficial salinity can be observed up to about 18 kms from the western coast (Fig. 2), although these can be related with the contribution of other courses that exist in the riversides North and South of the bay. In fact, in the South coast at Miches, Herrera-Moreno and Betancourt (2001) report salinities of the order of 10‰ in the coastal area influenced by the La Mulata Creek and its tributary Los Ranchos stream.

A hydrological study (1993) is mentioned, carried out by the Agency of Spanish Cooperation (AECI) that seems to be the most complete previous oceanographic study of the estuary but we had no access to those data for this work. It would be of great interest to manage such information with comparative purposes, since that study contains values of salinity in surface and bottom in an extensive net of stations in the western region of the bay from 12 years back.

As part of data search on the oceanographic characteristics of breeding areas of the hunchback whales (*Megaptera novaengliae*) at Banco de la Navidad, Banco de La Plata and Samana Bay, Betancourt and Herrera-Moreno (2005a) show information about the seasonal variation of the superficial temperature of the water in the two nearest stations to the mouth of the Bay of Samaná (Fig. 3) from Program PTSAVC[1] (RSMAS, 2002).

[1] PTSAVC (Average Water Superficial Temperature and Wind for the Carribbean) from the Rosentiel School of Marine and Atmospheric Science of Miami University presents twelve maps of Atlantic Ocean and Caribbean Sea, in which every month represents an average of twelve years of observations. From these maps it can be obtained information on superficial temperature if coordenates of the interest point are known.

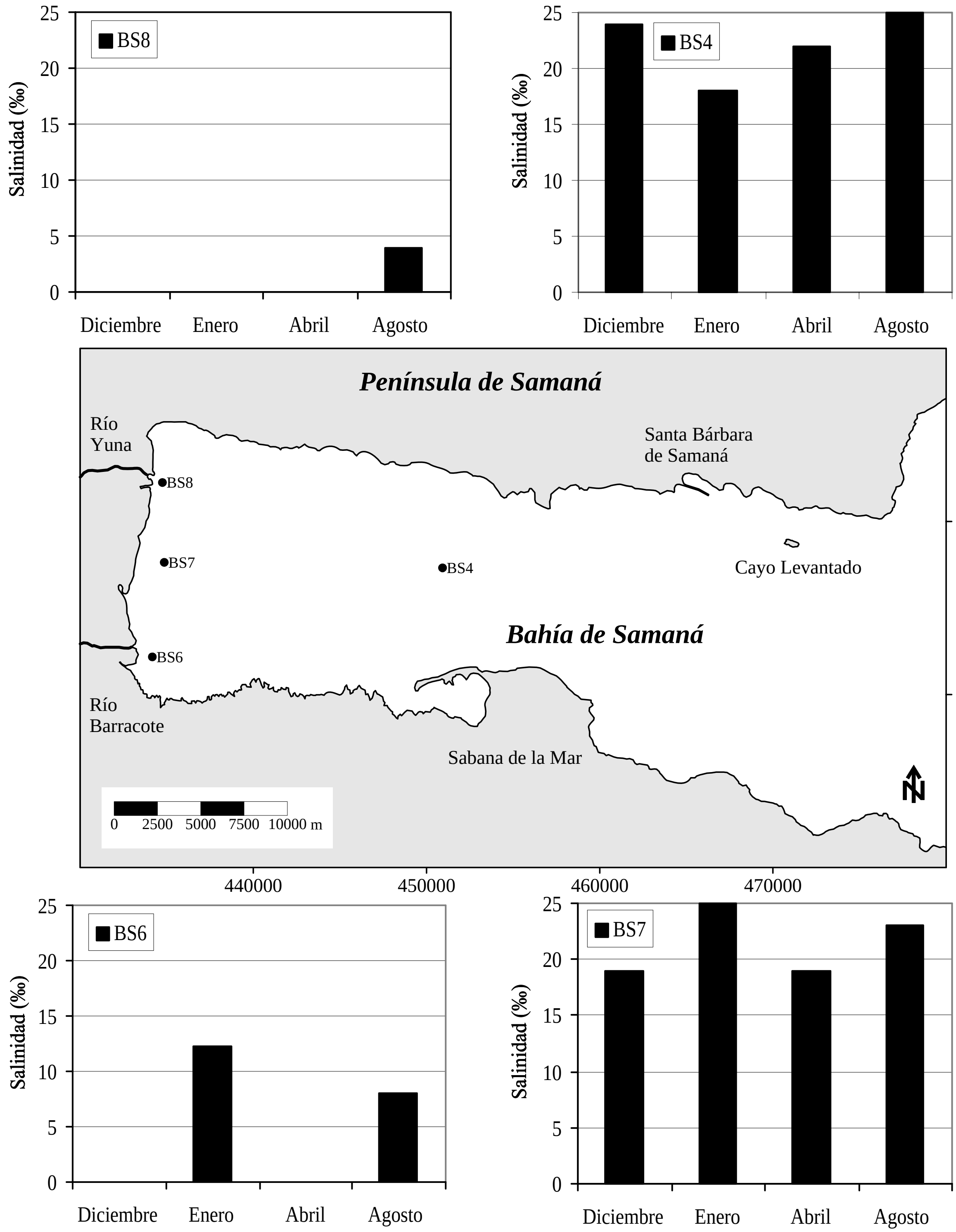
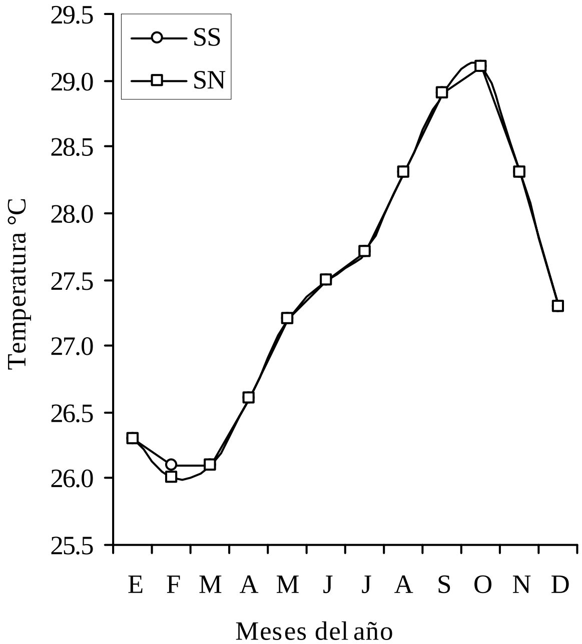


Figure 2. Variation of salinity in four stations (BS4, BS6, BS7 y BS8) in the western of Samana Bay, during four month from 1988 to 1989 (elaborated from data by Ferreras *et al*., 1990 and Ferreras, 1991).



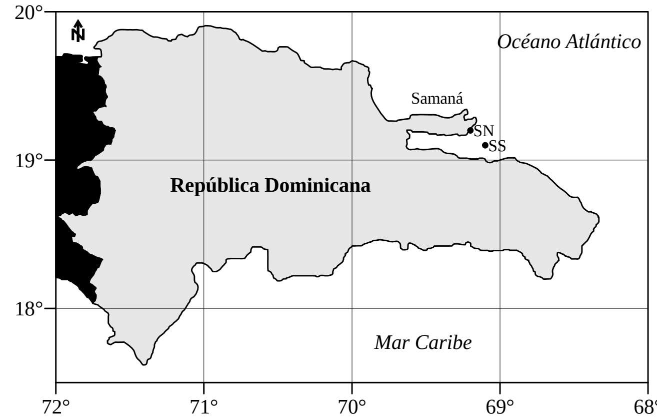


Figure 3. Right. Dominican Republic Map showing the two stations of the Program PTSAVC closest to Samana Bay. Est. SS: 19° 06.0´ 69° 06.0; Est. SN 19° 12.0´ 69° 06.0´ Left**.** Seasonal Variation of Water Superficial Temperature at two the two stations indicated (from Betancourt and Herrera-Moreno, 2005a).

These data show the temperature seasonal tendency in the oceanic region adjacent to the bay and although they do not correspond to the estuary area of our interest they offer, nevertheless, a general comparative frame on the regional thermal pattern useful for future investigations. Lastly, we have had knowledge that the Sea Education Association of Woods Hole, Massachusetts has carried out oceanographic cruises on board the Research Ship Corwith Cramer, in the Atlantic and Central Caribbean with some stations in the Bay of Samaná (SEA, 2004). We currently are waiting answer from this institution about possible relevant oceanographic information since their investigation includes temperature, salinity, nutrients and photosynthetic pigments.

In regard to sediments, we only know that slime and clay percentages reach 40 to 76% and concentrations of organic matter are high, Ferreras *et al (1990)* and Ferreras (1991). To the present time it has not been carried out any study of the bay that allows knowing the distribution and types of superficial sediments, although the contribution of Yuna and Barracote Rivers are very important, as it is shown in Figure 4. Types of sea bottom in Figure 5 give an idea of the distribution of deposits and show in a general scale a gradient fromWest to East, according to the contribution of the rivers. In the western end, near the mouth river, mud bottom prevails with isolated patches of sand. This muddy area represents a deep basin of more than 30 m. The distribution of the muddy biotope extends and combines with sandy and coralline bottoms toward the East, although at a considerable distance of the West coast muddy patches are observed. Evidence of coralline bottoms appeared at about 24 km from the western coast at coordenates UTM (WGS 84) 457204 east. Such characteristics are shown in the Digital Bathymetric Model of the Annex II.

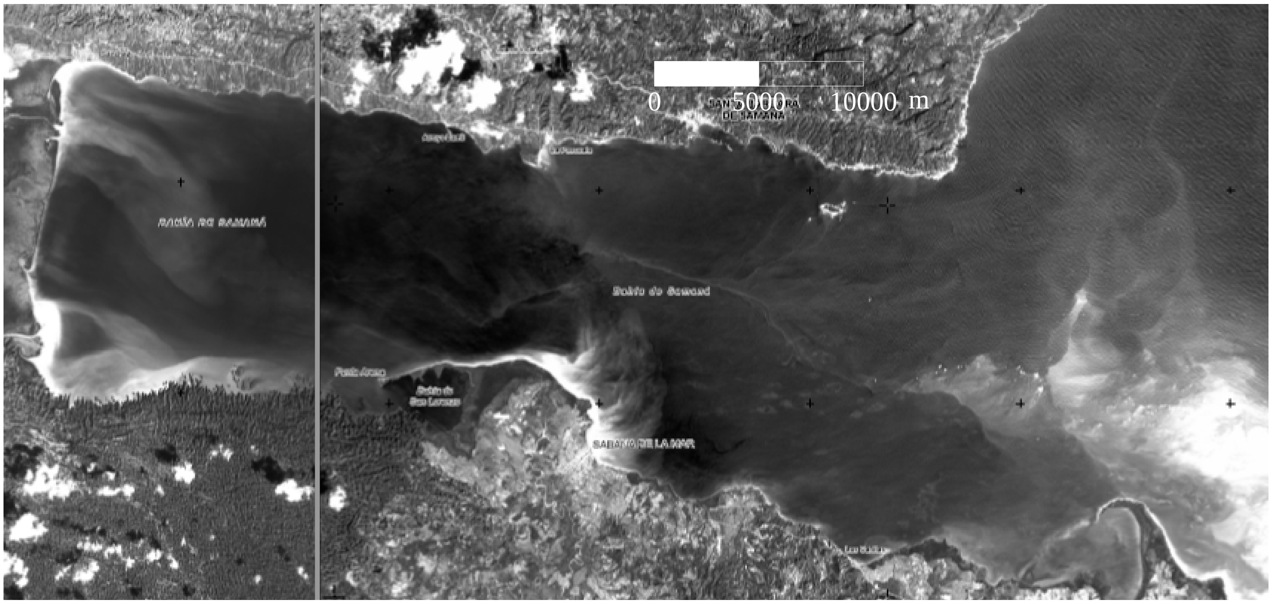


Figure 4. Aerial picture Samana region from Cartographic Military Institute. It can be observed the influence of deposits from Yuna and Barracote Rivers at the west side of the bay.

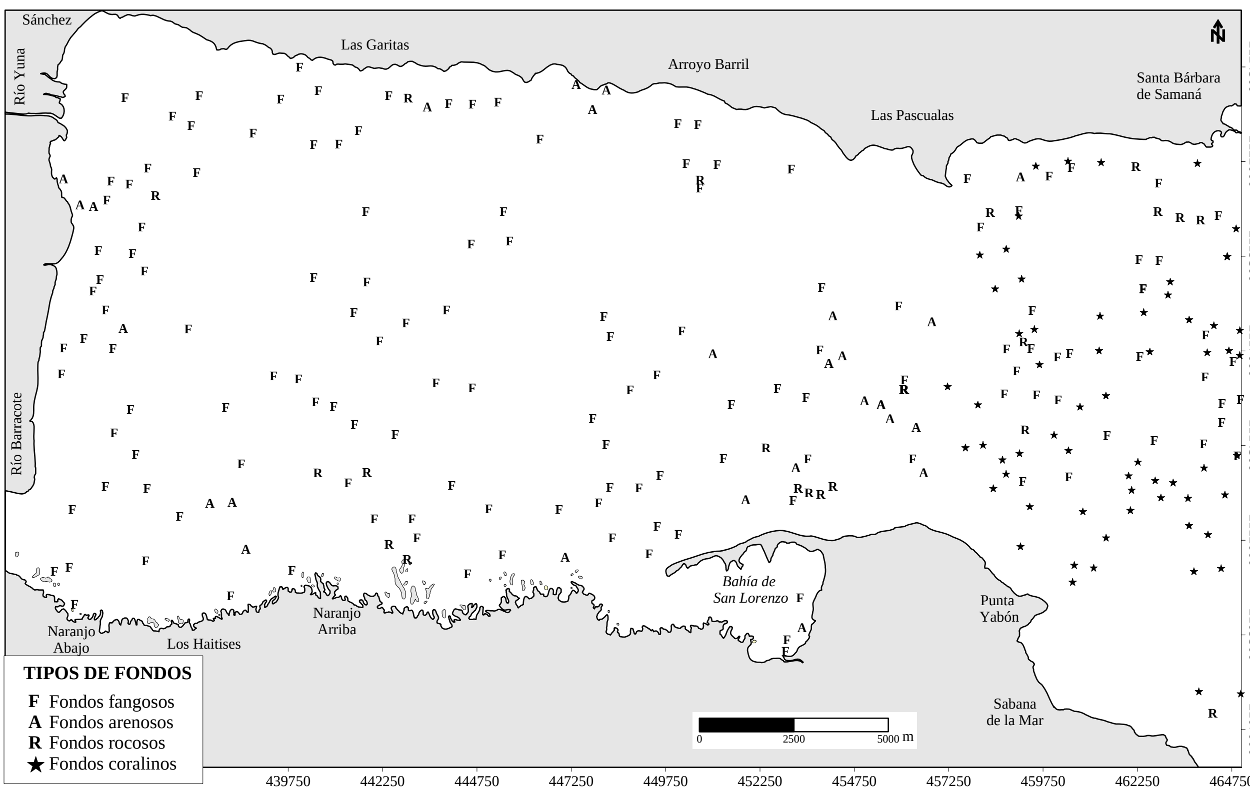


Figure 5. Map of Samana Region used for elaboration of the Digital Bathymetric Model. Types of bottom are shown: mud, sand, rock and coralline.

All these elements indicate that one of the main objectives of future investigations of this estuary should be address to know the characteristics of the hydrological regime during a tide cycle through the analysis of the -horizontal and vertical space variation - of oceanographic parameters. Also, collection of superficial sediments is very important in order to describe physical-chemical characteristics. Such a characterization is key to know the behavior of the estuary, the dynamics of the local deposits, to make inferences about the patterns of currents and to offer the physical basis for the description of benthonic habitats.

BIOLOGICAL ASPECTS

Bay of Samaná characterizes by its marked contrast among highly fluctuating estuarine conditions toward the West -related with the contribution of several courses of water - and more stable oceanic conditions toward the East, in the Atlantic direction. This interaction among terrestrial and oceanic influences, conditioned by the hydrological régime, local climate and the very particular physiography of the region generates a gradient of ecological conditions among the bay, the coastal area and the adjacent ocean that transforms Samana into a mosaic of environments where lives a highly diverse biota, which is exploited with fishing purposes.

Main coastal and marine habitats directly related with the estuary system are: mangrove forest, soft substrate bottoms, marine grasses on mud-to-sand substrate and the coralline reefs. Next chapter is a discussion of a basic review on each of these habitats by Betancourt (1998) of the Center for the Conservation and Eco-Development of the Bay of Samana and its surroundings.

MANGROVE SWAMPS

Mangrove swamps of the region of Samaná have an estimated total surface between 82.1 km² (TRD, 1992) and 130 km², equivalent to near 3% of the vegetable covering of the region (CEBSE, 1993). The knowledge about the distribution of the swamps in the region comes from different individual works whose analysis reveals that the most important extension of swamp forest is located to the occident of the bay. Isolated patches exist –more or less conserved - in the North coast and South of the bay, while in the Peninsula there are scarce mangrove sections to the North and these are practically absent to the East.

According to the available data, the mangrove swamps at the interior of Bay of Samaná, from Punta Palometa in the Northeastern end of the bay to Punta Yabón at the North of Sabana de la Mar, occupy 40 km equivalent to about 92% of the extension of swamps of this region (Sang and Lamelas, 1995). To the North and East of the Peninsula, according to Sang and Lamelas (1995a) the extension of swamps decreases to less than 4 km (Table 2).

Table 2. Extension of the mangrove forest in different areas of Samana region.

Location	Limits	Coast line (km)	Mangrove Extension (km)	Reference
Bahía de Samaná	Punta Yabón to Punta La Palometa	140.0	40.0	Sang and Lamelas, 1995
Península Este	Punta Palometa to Cabo Cabrón	39.5	0.1	Herrera andPeguero, 2004
Península Norte	Cabo Cabrón to Punta Arena	63.4	3.6	Sang and Lamelas, 1995a
	Total	242.9	43.7	

WESTERN COAST OF SAMANÁ BAY

In the western portion of the bay, associated mainly to the contribution of Yuna and Barracote Rivers, it is developed the biggest mangrove forest of Samaná region and the biggest continuous extension of this ecosystem in the Dominican Republic (CEBSE, 1993). With 17.6 km (Sang and Lamelas, 1995), this forest occupies the whole occidental portion of the Samaná Bay, from the town of Sánchez until the south margin of the Barracote mouth. General estimates on their surface give 65 km² (Álvarez and Cintrón, 1984) and 62.6 km² (Pérez et al, 1994) which has been more precise after the calculation from air pictures by Sherman (1996) reducing it to 42 km².

Typical species of the Caribbean mangrove swamps: *Rhizophora mangle* (red mangrove), *Laguncularia racemosa* (white mangrove) and *Avicennia germinans* (black mangrove) are structured in that same order from sea to land, (Sang et al., 1994). Sherman (1994) offers the first quantitative data of the frequency of these species (Fig. 6), the density and basal area of the trees.

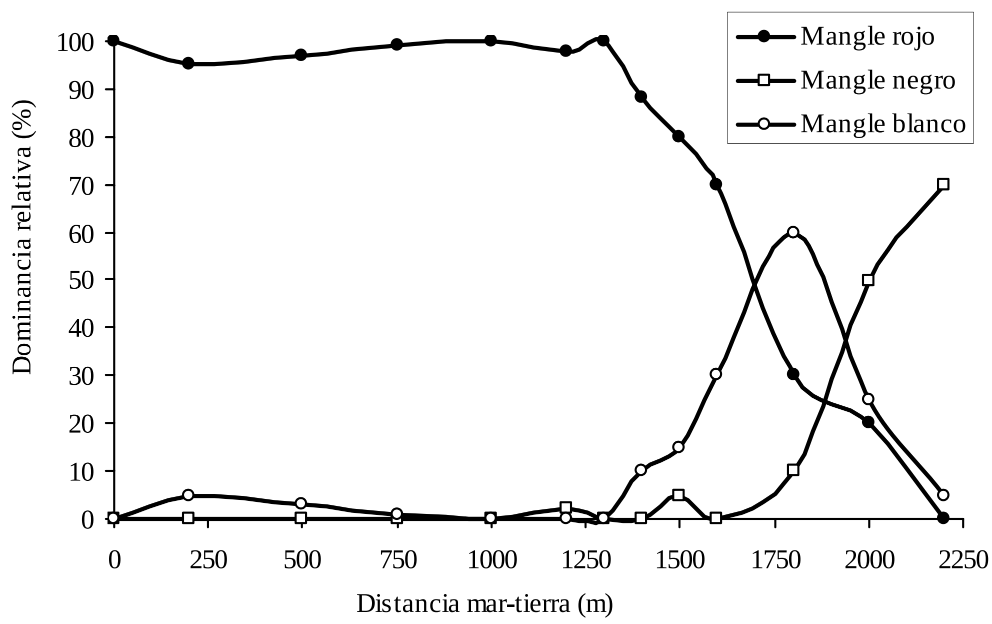


Figure 6. Changes in relative abundance of three species of mangrove in the western portion of Samaná Bay (according to Sherman, 1994).

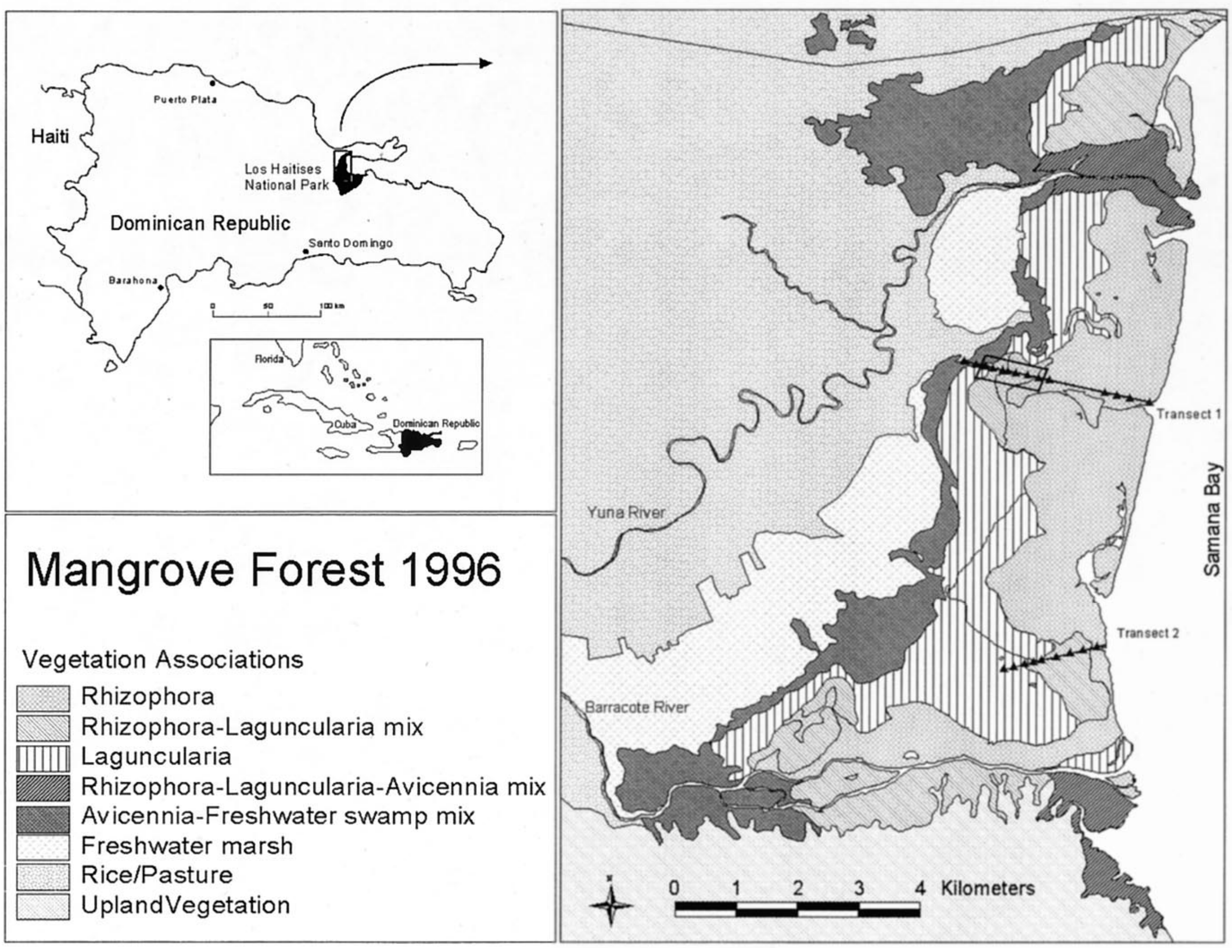


Figure 7. Species associations in the mangrove forest at the western portion of Samaná Bay (Sherman, 2003).

With support of physical-chemical data of the interstitial water (salinity, pH and nutrients) and soil (organic matter, nutrients and soil grain) Sherman (1994) bases the ecological factors that determine the abundance and distribution of mangrove species. This study and their later species associations' cartography (Sherman, 2003) in the mangrove forest (Fig. 7) constitute an important starting point for the understanding of the structure and function of mangrove forests at Samaná Bay, supplementing by this way previous descriptive studies (Álvarez and Cintrón, 1984).

Later investigations of the University of Cornell have offered information on the soil cover in the low basin of Yuna River (Laba et al, 1997), the historical evolution of the mangrove (Fig. 8) through the analysis of aerial pictures (Sherman, 1994; 2000), the relationship between the vegetation and the physical-chemical characteristics of the soil (Sherman, 1998; Sherman et al, 1998b), the roll of small-scale disturbances, like lightning, in the distribution and abundance of mangrove (Sherman, 1998a; Sherman, 2000; Sherman et al, 2000), the disturbance-recovery patterns before hurricanes (Sherman et al, 2001) and the space patterns of the biomass and the productivity (Sherman et al., 2003).

After 1946 tsunami that destroyed great part of the forest (Álvarez and Cintrón, 1984), the mangrove forest has rapidly colonized and expanded increasing its total area from 33 km² in 1959 to 47 km² in 1996, according to aerial pictures by Sherman (2000) (Fig. 8). These results were in fact the starting point from Sherman et al. (2001) who evaluate the structural damage of Georges Hurricane on the mangrove ecosystem in Samaná Bay and their later recovery. This work that values the impact on the density and the interspecific differences in vulnerability constitutes an important contribution to the knowledge of the dynamics of mangrove forests in the case of great scale meteorological events.

NORTH COAST OF SAMANÁ BAY

Sang and Lamelas (1995) describe the mangrove places along the North coast of the Samaná Bay. The biggest swamp forest is reported between Los Corozos and Punta Mangle, occupying 1.6 km of coast line and an area of 0.75 km² (Sang and Lamelas, 1995). Red mangrove areas are observed at Los Caceros, Majagual, Patosa, Escolástica and Cayito associated to freshwater effluents (Sang et al, 1994). The presence of red mangrove is reported in marshes, behind the sandy costs of the beaches Las Pascualas and Las Garitas. More to the east, in the bay of Santa Bárbara de Samaná, there are small patches in the mouth of the stream Pueblo Viejo and in the beach La Aguada (Sang et al. 1994).

SOUTH COAST OF SAMANÁ BAY

Álvarez (1978) offers general information about the mangrove between Sabana de la Mar and Miches and Sang and Lamelas (1995) describe the mangrove places along the south coast of Samaná Bay. The biggest mangrove tract is in San Lorenzo's Bay with an extension of 11 km² associated to Caño Hondo and Chiquito Rivers that end to the southwest of this bay. In the north coast of San Lorenzo's Peninsula, another extension of mangrove of 8.1 km of coast line related with Yabón River is presented (Sang et al., 1994). Álvarez and García (1986) describe the swamps of San Lorenzo's Bay and their associate biota. In the coast of Jina Bay, located to the west of Miches, they are also located an important extension of red mangrove (Ferreras et al., 1990).

NORTH AND WEST COAST OF SAMANÁ PENINSULA

In the north coast of the peninsula mangrove are reported in several isolated points such as: La Majagua, Playa Balatá, El Anclón, El Estillero, The Moron, Playa El Hermitaño and La Ensenada of la Poza (Salazar and Peguero, 1994; Sang and Lamelas, 1995; Peguero, 1995; Herrera-Moreno and Betancourt, 2001). A thick forest of red mangrove (*Rhizophora mangle*) whose width varies between 16 and 65 m and it reaches a total extension of 26,000 m² occurs in the periphery of the Laguna Maricó at Las Terrenas never referred before in the literature (Herrera-Moreno and Betancourt, 2004). In the coast east of Samaná Peninsula, the mangrove areas are much scarcer, being the most interesting one that of Caño Frío River mouth at Playa Rincón (Herrera-Moreno and Peguero, 2004).

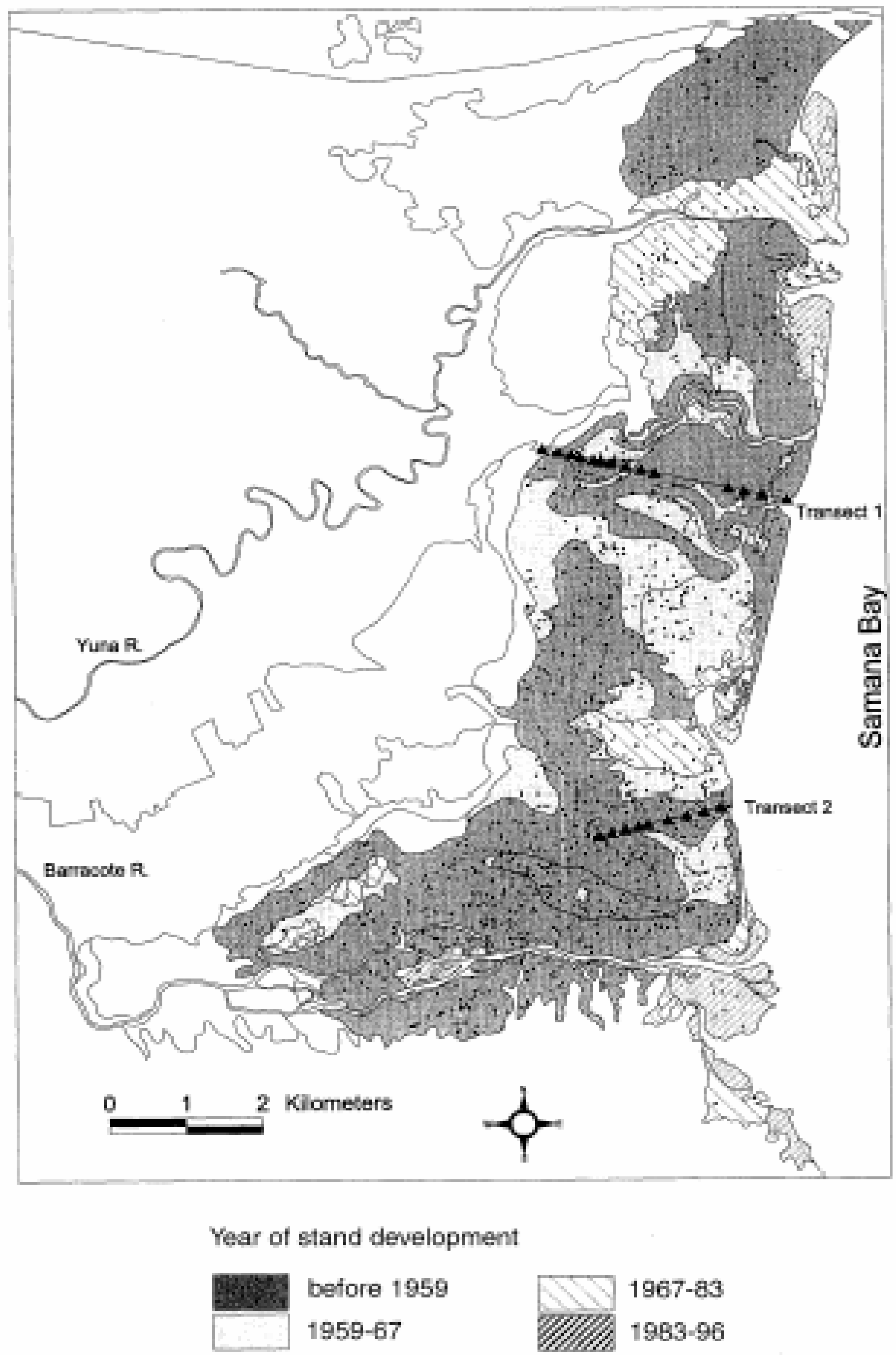


Figure 8. Development of mangrove forest in the west part of Samaná Bay. (after Sherman, 1996; 2000).

SOFT SUBSTRATE ESTUARINE BOTTOM

The presence of numerous pipes and rivers that end in the coast at Samaná Bay contribute to create estuarine conditions at a small scale, but little it is known about these habitats. The biggest estuary in the region, whose influence even determines the distribution of other ecosystems like marine grasses and coral reefs, is related with Yuna and Barracote Rivers. The Yuna River ends in the northwest part of the Samaná Bay, with an extension of 5,495 km² and a flow that it oscillates from 52 $m^3 s^{-1}$ to 57 $m^3 s^{-1}$ (monthly minimum averages) and it reaches an average of 144 $m^3 s^{-1}$ in the month of July (CEBSE, 1993). Barracote River ends in the southwest coast and it is an important tributary of the Yuna River. Among these two rivers other courses of freshwater of smaller flow occur, they are called from North to South: Boca Caimán, Boca Grande, Boca del Barraquito, Boca del Caño La Ceja y Boca del Caño Los Pinitos; to the North of the main outlet of the Yuna River there is a small pipe called Boca Colorao (Sang et al. 1994).

The important contribution of sediments that flows to this coast (Fig. 4) is responsible for an extensive muddy basin that constitutes, for their extension and ecological value, one of the most important biotopes of the bay (Fig. 5). These estuarine bottoms are compound for fine sediments of terrestrial origin, probably lacking macro-vegetation. As we have already described, the physical-chemical characterization of this area shows big fluctuations of all parameters in the water, high slime and clay percentages in the sediments and high concentrations of organic matter. The physical-chemical processes that take place when entering in contact the freshwater with the sea water, make a large quantity of sediments associated to the organic matter to settle down and in fact, the coast west of the bay is defined as of constructive type where the thickness of the sediments can reach 15 m (Ferreras et al., 1990). Annex II Maps show that this deposition seems to be much bigger in the area of the Barracote River where the flow of water is comparatively smaller. This group of estuarine characteristics promotes the development of peneid shrimp populations and other eurihaline species.

PRAIRIES OF MARINE GRASSES

In the Samaná region marine grasses bottoms are represented by the fanerogams *Thalassia testudinum* and *Syringodium filiforme* and in less proportion *Halophila decipiens* and *Holodule wrightii* (Ferreras et al., 1990; CEBSE, 1993). Research carried out on this ecosystem corresponds mainly to qualitative reports of observations from the border of the coast or diving with snorkel to less than 10m (Ferreras et al., 1990; Sang and Lamelas, 1995). Because of this, the compiled information is insufficient to have a complete idea of the limits of the marine prairies in the region that have never been mapped. The most detailed study corresponds to Sang and Lysenko (1994) that in 10 stations in the north coast of the Samaná Bay and to the south in San Lorenzo Bay determined the distribution and extension of the marine grasses and estimated the density and several foliar parameters of the main fanerogam species. In the north bank of the bay development of marine grasses is reported starting from the beach Los Cacaos (Sang and Lysenko, 1994) where the vegetation is developed in muddy to sandy soil. These fanerogam portions are of variable extension with widths from 40 to 150 m growing from the very border to a depth not bigger than 9 m, according to the limit of the observations (Sang and Lysenko, 1994).

Toward the east, starting from Cayo Levantado, these prairies are associated to coralline reefs. In the south coast of Samaná Bay patches of marine herbs occur associated to several areas of the rocky coast of Los Haitises and isolated patches to the south of San Lorenzo Bay. However, starting from this point, it appears an extensive and more or less continuous area of marine grasses that can reach up to 100 m starting from the border of the coast (Sang and Lysenko, 1994). In the west coast of the bay, development of marine grasses is not observed due to the influence of the rivers Yuna and Barracote that impose conditions of high turbidity, sedimentation and wide fluctuations of salinity (Sang and Lysenko, 1994). The marine prairies to the north and east of Samaná Peninsula, from Punta Arena until Cabo Cabrón, have registered in all the costs growing on sandy substrates, most of them related with ecosystems of adjacent coralline reefs (Sang and Lamelas, 1995).

From these results it can be concluded that the presence of the marine grasses in the Samaná Bay is only known by observations from the coast or by means of diving in a reduced interval of depths (Sang and Lysenko, 1994). It allows saying that the marine grasses are broadly distributed along most of the coast border of the bay but when not existing data on the central area, where bigger depths are reached, it is not possible to establish the extension of this biotope. It might possibly be the most extended sublitoral ecosystem in Samaná Bay and their surroundings, with a distribution ruled by the sediment and hydrological conditions.

CORALLINE REEFS

The studies of the reefs in the region of Samaná are scarce and limited. It is known that the development of the coralline reefs inside the Samaná Bay is limited due to the influence of the sedimentation and the turbidity associated to the typical estuarine conditions of this area. However, to the present it has not been defined with accuracy which the limits of this influence are neither mapped the reef formations of the region. For this reason distribution and development is inferred starting from the results of particular studies or evidence of general maps of bottom types (Fig. 5) or bathymetric (Annexed II). Ferrera et al. (1990) make some qualitative valuations on the fluvial influence in the reef development and comment that just starting from the 69^{o} 21’(equals to UTM WGS 84 461054 AND) coralline formations begin to be observed. The coralline development is increased toward the exterior of the bay with a bank in the north entrance: the Canadaigua, and others of more extension to the east of the Ensenada de la Jina (Sang, 1994), but the biggest development is to the north and east of the peninsula where a strong oceanic influence exists. Geraldes (1994) describes the reef at 12 m of depth in front of El Portillo, but the biggest study carried out in the reefs of the region corresponds to Sang (1996) that offers data of the covering and the diversity of the communities of fish, corals, octocorals and sponges from Las Terrenas to Cabo Cabrón at 21m of depth.

MARINE BIOTA

A total of 445 representative species of the coast and marine biota were collected, known for the Samaná region: 262 species in the internal area and 312 in the external area. It includes it 72 species of algae: 24 rhodophyta, 16 phaeophyta and 30 chlorophyta, some 258 species of invertebrates belonging to about 22 high taxonomic groups and 236 species of bony fish, sharks and rays (Annex 1). Table 3 summarizes the number of compiled species -total and for areas- for the best represented taxonomic groups. Although in comparative terms the internal area and the external one have similar total number of species interesting differences can observed at the level of particular groups.

For example, algae have 23 reports of species in the internal area while in the external area 52 species, including two cyanophytic species related with the reef habitat. For the invertebrates, variation of the number of species reported in both areas is reported. This way, sponge, octocorals and corals increase richness of species to the external area and lobsters and crinoids only have reports outside of the bay. On the other hand, bivalve, crabs and gastropods, increase their number of species toward the interior of the bay, where the only found reports of shrimps and holothurians exist.

Table 3. Species number per area and total number of species per taxonomic group, considered in this study.. **AI**. Internal areas of Samana Bay, mangrove habitats, marine grasses and low development reefs. Áreas. **AE:** External area of Samana Bay, reef habitats under strong oceanic influence.

Group	AI	AE	Total
Algae	23	52	72
Esponges	2	22	24
Corals	8	38	38
Octocorals	4	17	17
Gastropods	34	2	35
Bivalve	10	3	13
Shrimp	3	0	3
Crabs	19	2	20

Group	AI	AE	Total
Lobster	0	3	3
Crinoids	0	2	2
Starfish	2	1	2
Sea urchins	5	4	6
Holothurians	3	0	3
Other groups	5	15	20
Fish	144	151	187
TOTAL	262	312	445

Although the heterogeneity of studies does not allow arriving to definitive conclusions the ecological regularity that emerges of this compilation exists. In the first place, toward the external area an increment exists -in some significant cases - of the number of benthonic typically- reef species (for e.g. sponges, corals, octocorals or crinoids). Toward the internal area an increment of macro-benthic groups linked to sedimentary habitats (for e.g. gastropods, bivalve and holothurians). Although in these differences the nature and heterogeneity of the compiled data as well as the intention and depth of the studies influence, we consider that the they are also a reflection of the strong contrast between the richness of species inside of and outside of the bay related with the environmental stability and variability imposed by two different environmental circumstances: an area with fluvial influence and an under oceanic influence.

In the case of fish, total numbers of species are almost same in both areas: 144 in the internal area and 151 in the external one (Table 3). However, it includes 85 species that were only present in the internal area, 92 species only reported for the external area and 59 shared species. It evidences there is an ichthyofauna association typical for each habitat, as well as a movement of species among them, and this is clear when families of fish that are disembarked in places of the interior and in the exterior of the bay are analyzed (Chart 4).

Table 4. Presence and absence of crustacean and fish families in seven fishery places of Samana arranged according to a gradient from estuary to ocean. (after data from Sang *et al*., 1997 and current field data). Letters indicate landing places: SZ: Sánchez, M: Miches, LC: Los Cacaos, SM: Sabana de la Mar, LP: Las Pascualas, LG: Las Galeras y LT: Las Terrenas.

Habitat:	Mangrove-Estuary-Prairies-Reef-Ocean						
	Landing places						
Families	SZ	M	LC	SM	LP	LG	LT
Pristigasteridae	X						
Ophidiidae	X						
Cynoglosidae	X						
Elopidae	X						
Engraulidae	X	X					
Stromateidae	X	X		X			
Trichiuridae	X	X			X		
Clupeide	X	X	X		X		
Penaidae	X	X		X	X		
Synodontidae	X		X		X		
Mugilidae	X	X		X	X		
Centropomidae	X	X		X			
Ephippidae	X	X		X	X		
Gerreidae	X	X	X	X	X	X	X
Scianidae	X	X		X	X	X	X
Carangidae	X	X	X	X	X	X	X
Lutjanidae	X	X	X	X	X	X	X
Haemulidae	X	X	X	X	X	X	X
Sphyraenidae	X	X	X	X	X	X	X
Scombridae	X	X	X	X	X	X	X
Polynemidae		X		X	X	X	
Scaridae		X	X	X	X	X	X
Mullidae		X	X	X	X	X	X
Sparidae		X	X	X	X	X	X
Serranidae		X	X	X	X	X	X
Holocentridae		X	X	X	X	X	X
Priacanthidae		X	X	X	X		X
Balistidae		X	X	X	X	X	X
Belonidae			X	X	X	X	X
Palinuridae		X	X	X		X	X
Labridae		X	X	X		X	X
Acanthuridae			X	X		X	X
Ostracidae			X		X	X	

Pomacanthidae	X	X	X		
Coryphaenidae				X	X

For it, Table 4 has been elaborated starting from the information of the study “Composition and diversity of fisheries in eight places of landing of Samaná Bay” (Sang et al., 1997) and the information obtained during our visits for the present work. Data was arranged following an ecological-geographical sense, from estuary to ocean. Gradual changes are observed in families of fish represented in different landing places that vary according to their geographical position regarding the different adjacent fishing habitats: estuary, mangrove swamps, marine grasses and coralline reefs. In the areas of the interior, in the northwest of the bay (such as Sánchez), the biggest captures of peneids shrimps and typically estuarine ichthyofauna are registered, with demersal species belonging to the families Centropomidae and Mugilidae and pelagic such as Engraulidae.

As we leave the influence of the estuary in the occident of the bay and begins the development of marine grasses and coralline reefs (see Bathymetric Digital Model in Annex II), like it happens toward Las Pascualas, Los Cacaos (to the North and center of the bay), Sabana de la Mar and Miches (to the Southeast almost outside of the bay) it increases the representation of neritic, demersal reef families like Serranidae, Holocentridae, Balistidae and Scaridae although for the gradient effect some estuary and typically pelagic species are also registered.

In Las Galeras y Las Terrenas (outside of the bay and to the north of the peninsula) which represent the end of the gradient toward the ocean, some of the previous families are absent, while others of the marine-reefs grasses complex appear (indicating their relationship with these ecosystems that reach great development outside of the bay) and pelagic families such as Coryphaenidae and Istiophoridae appear, in agreement with the location of these places in the proximities of open sea. This regularity has been the base for a proposal of a new regional fishing classification that supplements the current one (based alone in commercial categories) considering three ecological complexes of fishing for the estuary coast, marine grasses-coralline reefs and oceanic area (Herrera, 2000).

FISHING ASPECTS

Due to the richness in fishing resources, based in the ecological characteristics presented in the previous sections, the region of Samaná has historically been very important place in the national fish captures (CEBSE, 1993), concentrating about 34% of the fishermen of the country (CEBSE, 1996). According to the census of Colom et al (1994), the total number of fishermen estimated for the country was 8,640, from which 3,223 for Samaná region, data has stayed according to the last data that SERCM offers (2004). This chapter discusses information gathered on the fishing activity in the region of Samaná, which has been enlarged and supplemented from the basic compilation of Betancourt (1998).

GENERAL CHARACTERISTICS OF FISHING ACTIVITY

Fishing community of Samaná has shown through the years a continuous tendency of increment in men's number, fishing arts and landing places. From 1991 at 1993, the number of boats passed from 999 to 1029 and the number of fishing arts from 957 to 1120. In a longer interval of time, 1980 to 1993, the number of fishermen was increased from 1197 to 2103 (Silva and Aquino, 1993). In Sabana de la Mar and Miches, Aquino and Silva (1995) report that from 1980 to 1994 the number of boats was increased from 173 to 446, and the number of fishermen from 342 to 846. Currently, about 55 landing places have been detected (Fig. 1).

Technologically, the fishery in Samaná is completely handmade for all the fishing resources, with some regional variations in the fishing means. Silva and Aquino (1993) and Aquino and Silva (1995) reported a total of 1475 fishing crafts divided in wood boat (30), fiber glass boats (181), pivots (26), ships (8) and wood kayaks (1230). According to the last data of SERCM (2004), the proportion seems to have been maintained in a general way.

The fishing arts also vary regionally according to the port location and interest species. They are different types of fishing cages, fishing lines, bottom nests, diving with or without equipment (Silva and Aquino, 1993; Aquino and Silva, 1995) and the drag net locally known "licuadora"(spanish for blender) (Sang *et al.*, 1997). For the pelagic fishery, rafts are used (León, 1996). No current data exist about the fishing arts although it is known that the traditional ones have stayed in a general way and some new ones have been introduced and promoted, especially by japanese specialists, like those used for pelagic or deep fishing (Hara 1999).

IDENTIFICATION OF FISHING TYPES IN SAMANA REGION

In order to organize fishing information gathered for this report we took fishery types by Herrera et al. (in preparation) to adapt them to Samaná fishing situation, considering: a) fish resource type and their importance, b) areas of fishing, c) fishing arts, d) intervals of depth and, d) importance of the resource in the national fishing regulations. With these approaches we identified fishery types that are indicated in Table 5 and described next.

Shrimp Fishery

Colom et al. (1994) they recognize like a national unit the shrimps fishery with gill nets and hand nests of Sánchez in Samaná, described by Núñez and García (1983) and Silva and Aquino (1993). This fishing activity began at the beginnings of 1960 with the closing of the rail operations in Sánchez that forced local residents to look for other income sources. The most important region due to its extension, abundance of the resource and number of fishermen is, with no doubts, the western region Samaná Bay, where the flows of Yuna and Barracote Rivers contribute to define an extensive estuary region.

The high productivity of the region makes this fishing area something unique in the country. In the town of Sánchez, where landing place is located, three species of shrimps are disembarked (Núñez and García, 1983): the Atlantic sea bob or "flechúo" *Xiphopenaeus kroyeri*, the pink shrimp *Penaeus durorarum* and the white shrimp P. *schmitti*. This last shrimp can be considered the key species since its represents around 86% (Sang et al., 1997) and 95% (Then et al., 1995) of the total capture of shrimps.

An interesting aspect of this fishery is that, in spite of the time operating, has not still been able to exhaust the estuary fishing potential due to its handmade character. Fishermen inform that they can only operate their fishing arts in the proximity of the coast (Fig. 5) between Las Pascualas and Punta Yabón (being the areas of more capture near Los Haitises and the river mouth), at a depth not bigger than 7m. This fact limits them to fish in a narrow tract of about 100 km² or smaller, being the deep muddy basin outside (to see Bathymetric Digital Model in Annex II) which might contain an important exploitable potential.

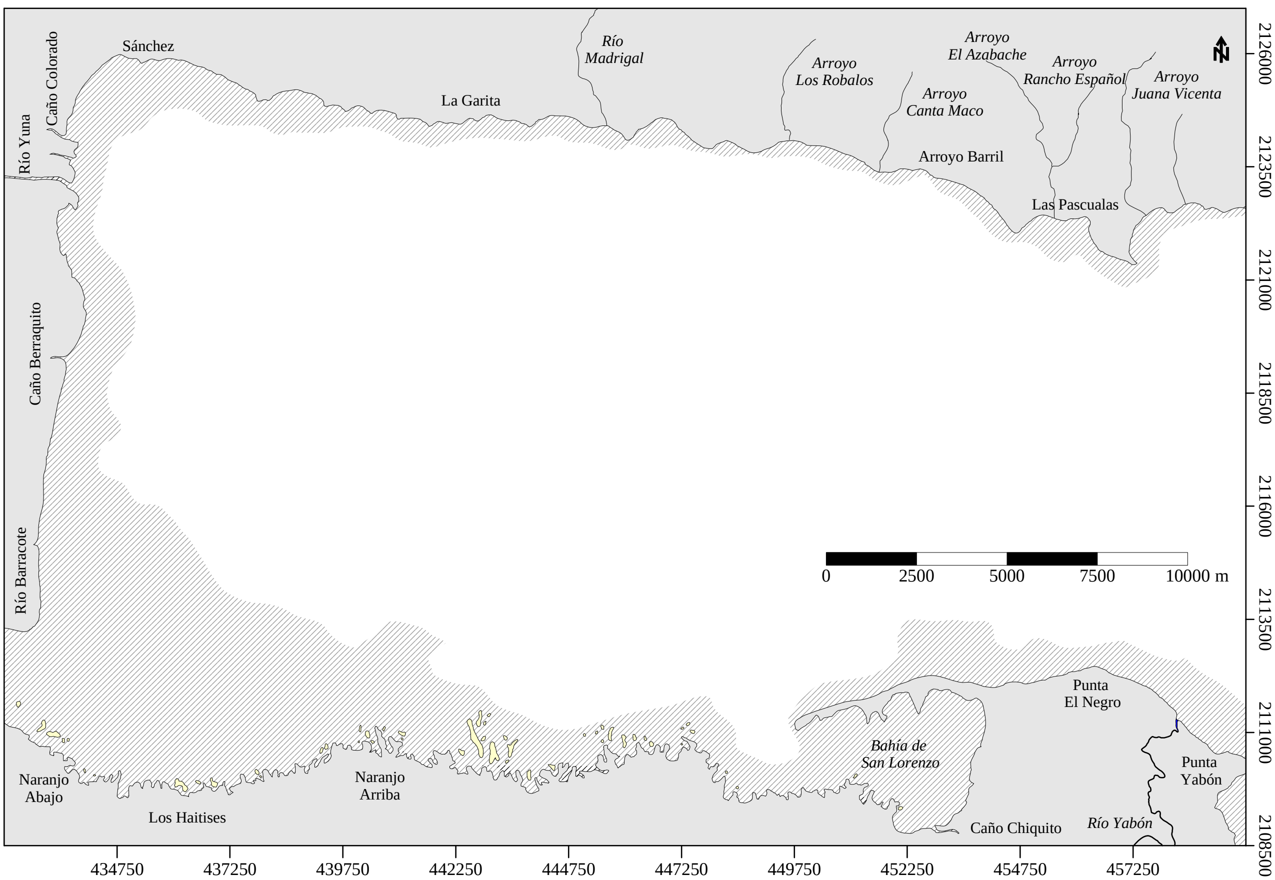


Figure 9. Map of Samaná region showing the 7m depth isobar (striped zone). It indicates the approximate area of shrimp fishery, according to fishermen information.

Table 5. Fishery types in Samana Region. Abbreviations: Types: Co. Coast, De. Demersal, Es. Estuary. Pe. Pelagic, Re. Coral Reef. CP. Fishery Character: SSC. Commercial Small Scale, MSC. Commercial Medium Scale, SSA. Artesanal Small Scale, SI. Semi-industrial, S. Subsistence, TA. All year, ES. Seasonal. Fishery Arts:. At. Atarraya,

Ba. Balsa, Bu. Buceo, Chah. Chinchorro de ahorque, Char. Chinchorro de arrastre, Cd. Cordel, LC. Línea para calamar, Nb. Nasa del bajo, Nc. Nasa chillera, PA. Palangre (after Herrera *et al*., en preparation).

Name	Key specie (local name/ latin/ common name)	Type	Depth. (m)	Art	CP	Time	References
Shrimp fishery	*Penaeus schmitti* (white shrimp), *P. duorarum* (pink shrimp), *Xiphopenaeus kroyeri* (Atlantic seabob)	De/ Es	0-5	Char, At	SSA	TA	Sang *et al.*, 1997
Reef fishery	Several fish species (Lutjanidae, Haemulidae, Acanthuridae, Balistidae, Holocentridae, Serranidae, Pomacanthidae, Pomacentridae, Sparidae, Labridae) and crustacean (Majidae & Xanthidae), *Panulirus argus* (Caribbean spiny lobster) and *Strombus gigas* (queen conch)	Co/ Re	0-30	Nb, Bu Chah, Cd	SSA	TA	Sang *et al.*, 1997;
Deep fishery at the border of the plataform	Chillo *Lutjanus vivanus* (Silk snapper), chillo oreja negra *L. bucanella* (black-fin snapper), boral *Etelis oculatus* (queen snapper), roamo *Pristipomoides macrophtalmus*, (cardinal snapper), besugo *Romboplites aerorubens* (vermilion snapper), meros *Epinephelus mystacinus,* (misty yellowedge grouper) *E. flavolimbatus* (misty grouper).	De	100-500	Pa, Nc, Cd	SSA	TA	Sang *et al.*, 1997; Arima, 1997; 1998; 19898a; 1998b; 1999; 1999a; 1999b
Pelagic fishery or FAD'S fishery	Atunes, bonitos y albacoras: *Thunnus albacares* (yellowfin tuna), *Euthynnus alleteratus* (little tunny), *Auxis thazard* (frigate tuna), *Katsuwomis pelamis* (skipjack tuna), macarelas *Scomberomorus* sp. (mackerels), guatapaná *Acanthocybium solandri* (wahoo), dorado *Coryphaena hippurus* (dolphinfish) y la aguja *Istiphorus albicans* (Atlantic sailfish)	Pe	-	Co, Ba, Cu	SSA	ES	Sang *et al.*, 1997; León, 1996
Squid Fishery	Calamar diamante *Thysanoteuthis rhombus* (diamond squid)	Pe	300-750	LC	SSC	ES	SERCM, 2004
Coast-Pelagic fishery	Carangidae (jacks), Clupeidae (herrings), Atherinidae (silversides), Hemiramphidae (balyhoo), Gerridae, Scianidae (drums), Centropomidae (snooks), Engraulidae (anchiovies), Sphyraenidae (juvenile barracuda), tiburones (bull, blackfin, hammerhead, nurse, reef, lemon sharks).	Pe/ Co	0-10	At, Co, Cu	SSC	TA	CFRM, 2004

The arts used for the shrimp fishery accidentally capture a great quantity of species that can occupy up to 54% of the total capture. Sang et al. (1997) found that in this sub-capture could be represented up to 24 families of fish and two of crustaceans. Among this species are: *Cetengraulis edentulous* (Atlantic anchoveta), *Cynoscion jamaicensis* (Jamaica weakfish)**,** *Stellifer colonensis* (stardrum), *Micropogonias furnieri* (whitemouth croaker), *Mugil hospes* (hospe mullet), *Centropomus ensiferus* (swordspine snook), *Callinectes sapidus* y *C. danae* (blue crabs). It is known that a small proportion of small fish are discarded before landing, so there is no information available about them. This is a small scale fishery activity that extends all year including the prohibited period from February to March. Se conoce que una proporción de peces pequeños se descartan pero no existen cifras pues éstos no llegan al sitio de desembarco. This is a fishery of small scale that takes place during the whole year excluding the months of prohibited from February to March (Presidential Decree 3546-73).

Coralline Reef Fishery

Coralline reefs fishery in Samaná is typical for its more external areas where reef development exists and takes place approximately until 30 m of depth, Sang et al. (1998). Key species of this type of fishery belong to a group of typically reef families like, Lutjanidae, Haemulidae, Acanthuridae, Balistidae, Holocentridae, Serranidae, Pomacanthidae, Pomacentridae, Sparidae and Labridae. These species are distributed in the interval of depth from the mangrove swamps and marine grasses (juvenile stages) and the coralline reefs (mature stages) for what the value of each one of them in number and weight in the capture can vary locally and according to the art and the fishing place. For example, in the reef fishery with several different arts at Sabana de la Mar, Sang et al (1998) report that half of the capture is occupied by Lutjanidae (33%), Haemulidae (15%) and Scaridae (8%) while in Las Terrenas the most abundant families are Scaridae (28%), Lutjanidae (22%) and Serranidae (14%).

Among the species more frequently reported in the captures of the reef are: *Lutjanus analis* (mutton snapper), L. *griseus* (gray snapper), *L. synagris* (lane snapper), *Ocyurus chrysusrus* (yellowtail snapper), *Cephalopholis cruentata* (graysby), *Epinephelus striatus* (Nassau grouper), *Sparisoma aurofrenatum* and *Scarus taeniopterus* (parrotfishes), *Haemulon aerolineatum, H. flavolineatum, H. plumieri* and *Acanthurus bahianus* (Chart 5).

This fishing also has three species of crabs (Majidae and Xanthidae) as key species: *Carpilius corallinus* (coral crab), *Mitrax spinosissimus* and *Stenocionops furcata* (spider crabs), although the most important crustacean is the lobster *Panulirus argus*, (Herrera-Moreno and Betancourt, 2003). This is a small scale, handmade, coastal fishery dedicated in their biggest part to the domestic market. It is characterized by their variety of arts -in agreement with their diversity of species - that includes fishing cages, gill nets, diving with or without equipment and all line types. This fishery takes place during the whole year (Chart 5). Collected data shows that the resources are subjected to high exploitation. There are not precise information on production.

Deep Fishing in the border of the platform

In the north and east coast of Samaná Peninsula takes place a deep fishing below the bank in depths among 100 to 500 m. The most important areas are those where the 100 m can be reached with a handmade boat at short distance from the coast, because the platform is narrow or because the lines of depth come closer to the coast due to geographical accidents (Sang et al., 1998; Arima, 1997; 1998; 1998a; 1998b; 1999; 1999a; 1999b). The fishing is directed to lutjanids and serranids with seven key species that occupy more than 80% of the captures and in order of importance include Pristipomoides macrophtalmus (cardinal snapper), *Lutjanus vivanus* (silk snapper), L. *bucanella* (blackfin snapper), *Rhomboplites aerorubens* (vermillion snapper), *Etelis* *oculatus* (queen snapper), *Epinephelus mystacinus* (misty yellow-edge grouper) and *E. flavolimbatus* (Table 5). The analyses of captures reveal that this group of species is dominant in capture weight, although their proportions can vary according to the locality, depth and fishing art. Fishing arts include fishing cages, lines and drag net. This is a small scale, handmade fishery that exploits big specimens, takes place along the year and seems to concentrate on annual spawn places well-known places for the fishermen.

Pelagic-Oceanic Fishery or FAD's fishery

Pelagic fishing in Samana is documented by León (1996) and Sang et al. (1997). It is practice with drag nets, gill nets, and others, with or without fish aggregating devices (FAD's). Key species are several migratory species from family Scombridae: *Thunnus albacares* (yellowfin tuna), *Euthynnus alleteratus* (little tunny), *Auxis thazard* (frigate tuna), *Katsuwomis pelamis* (skipjack tuna), *Scomberomorus sp*. (mackerels), *Acanthocybium solandri* (wahoo); *Coryphaena hippurus* (dolphinfish) and *Istiphorus albicans* (Atlantic sailfish) (Table 5). It can include some sharks incidentally. This is a handmade fishery of small scale with seasonal character. Nevertheless, since it involves so many species -the migratory bigger part of them - the fishing stays during the whole year according to availability of the resources.

Pelagic-Coast Fishery

CFRM (2004) reports this fishery type that takes place particularly near the coastal border on bottoms of marine grasses that, as we said before, practically border the coast of Samaná. It includes a big group of species of the families Carangidae (jacks), Atherinidae (silversides), Hemiramphidae (balyhoo), Scianidae (drums), Sphyraenidae (juvenile barracuda), Gerridae (mojarra), Clupeidae (herrings), Centropomidae (snooks) and Engraulidae (anchovies). These last four families are generally associated to freshwater flows near the coast, where we can also include family Mugilidae (mullet). This fishing also includes some juvenile sharks. The captures are carried out along the year, both for key or incidental species, mainly with gill nets, cast nets, lines and sometimes fishing cages, according species. It is considered a moderately exploited fishery, although there is not data for a complete evaluation. Stocks can also be affected by the coastal contamination.

Giant squid fishery

Recently, Japanese specialists introduced in Samaná the fishing of giant squid. The key species is the diamond squid *Thysanoteuthis rhombus*, epipelagic oceanic species that reaches 100m of longitude of the mantel and 20 kg of weight. Their distribution includes tropical and subtropical waters of the world. Fishing depth varies from 300 to 750m and the place of main fishing is located 3 miles to the east of El Francés, in the coast east of Samaná Peninsula. Squids are captured using a squid drop line fishing. This is a small scale, handmade, incipient fishing that takes place seasonally although fishing stations are not clear because migration of this species in oceanic waters are practically unknown (Table 1). According to the authorities at the Subsecretary of Coastal and Marine Resources, this resource will turn to be on of the most important in next years (SERCM, 2004).

CURRENT STATE OF THE MAIN FISHING RESOURCES

White Shrimp *Penaeus schmitti*

Shrimp is fished only in shallow areas (less than 7 m) of the western region of the Bay of Samaná using 250 cast nets and 350 drag nets operated from 512 kayaks with a 2 men average crew. About 900 fishermen participate in this fishing (Colom et al., 1994) and although the resource seems to be over exploited in its traditional areas, the contribution of specimens that come from deep areas, 10m to 30 m where it is not fished, it seems to contribute to maintain certain capture levels, always promoted by the high price of the product (about $180 to $240 Dominican pesos per pound = US$6- 8/pound). Fishermen argue that it has taken place a reduction of the captures and an increment of the fishing effort. There is not any biological study of this shrimp in the Dominican Republic and the stocks have never been evaluated. As the fishermen referred us, the use of no-sustainable fishing arts takes place secretly in hours of the night.

Sang et al. (1998) offer minimum (0.7cm) and maximum (7.3 cm) values of cephalotorax length (including the rostrum), with an average of 3.5 cm, values that are in the order of those that we detect during our visit. There are a serious lack of biological and fishing information of the resource and the levels of exploitation. The Decree 3546-73 prohibits the fishing of the shrimp between February and May, but it doesn't clarify to which species is directed the prohibition and fishermen admit that fishing stays all year. Between 1963 to 1980 landings varied from 125 to 200 MT (Fisheries Development Limited, 1980). According to CFRM (2004), the capture annual averages is in the order of 184 TM, that which is below the productions that are already achieving with culture methods in other regions of the country with amounts of 400 TM (FAO, 2001).

Groupers (Pisces: Serranidae)

In the region of Samaná serranids are represented in the reef fishery with thirteen species (Sang et al., 1998). *Cepalopholis fulva, C. cruentata* (graysby), *Epinepehelus guttatus* and *E. striatus* are registered practically in all fishing areas, although presence and diversity of species in the captures vary according to the landing place. This way, in Sánchez they do not register serranid captures while to the north of the peninsula it is common to find them (Table 6). Serranids are fished with lines, fishing cages (made of wire or fiber similar to those used for lobster fishery), or diving for reef fishing, but for deep fishing, it is used palangre, lines and fishing cages. This indiscriminated fishing and the absence of effective regulations have made that numerous species are in critical situation in some regions. Sizes registered in biological-fishing studies of Samaná (Sang et al., 1998) reveal that all the reef fishing species are being captured before reaching their size of first maturation.

Table 6. Presence and absence of serranid and lutjanid species of fishery places of Samana in seven landing sites, arranged according to a gradient from estuary to ocean (from data by Sang *et al*. (1997) and current field data. Letters indicate landing places: SZ: Sánchez, M: Miches, LC: Los Cacaos, SM: Sabana de la Mar, LP: Las Pascualas, LG: Las Galeras and LT: Las Terrenas.

		Estuary-Prairie-Reef-Ocean							
		Landing places							
Family	Epecies	SZ	M	LC	SM	LP	PS	LT	LG
Serranidae	*Ephinephelus guttatus*		X	X	X	X	X	X	X
	Ephinephelus striatus		X	X	X	X		X	X
	Ephinephelus cruentatus		X	X	X		X	X	X
	Ephinephelus fulvus		X	X			X	X	X
	Alphestes afer		X						X
	Hypoplectrus puella			X					
	Mycteroperca venenosa				X			X	X
	Ephinephelus itajara				X				X
	Ephinephelus adscensionis							X	X
	Mycteroperca bonaci								X
	Serranus tabacarius								X
	Serranus. Phoebe								X
	Paranthias furcifer								X
Lutjanidae	*Lutjanus analis*	X	X	X	X		X	X	X
	Lutjanus synagris	X	X	X	X	X	X	X	X
	Lutjanus apodus		X	X	X	X	X	X	X
	Lutjanus griseus		X		X	X			
	Ocyurus chryrsurus		X	X	X	X	X	X	X
	Rhomboplites aurorubens			X	X	X	X	X	X
	Lutjanus mahogoni					X	X	X	
	Lutjanus buccanella							X	X
	Lutjanus vivanus							X	X
	Lutjanus cyanopterus							X	
	Etelis oculatus							X	X
	Apsilus dentatus							X	X
	Pristipomoides macrophthalmus							X	X

Snappers (Pisces: Lutjanidae)

In the region of Samaná Lutjanidae family is represented in the reef and deep fishery for fourteen species (Sang et al., 1998). *Lutjanus analis, L. griseus, L. synagris* and *Ocyurus chrysusrus* are registered practically in all reef fishing areas, while bigger species as *Lutjanus vivanus, L. bucanella, Etelis oculatus, Pristipomoides macrophtalmus* and *Romboplites aerorubens* are reported in deep fishing in the border of the platform. Lutjanids are fished with the same arts that the serranids: lines, bottom fishing cages, or diving for reef fishing palangre and lines for deep fishing. As we pointed out for the serranids sizes registered in the biological-fishing studies reveal that all species in the reef fishing are being captured before reaching their size of first maturation (Table 6).

Diamond Squid *Thysanoteuthis rhombus*

Diamond squid are captured from boats with a three men crew, using a squid drop line fishing. Currently, only 20 fishermen, 6 boats and 12 fishing arts are involved in this capture that can reach up to 4 to 5 squids per day. There are not any biological study about this species whose migratory patterns, feeding behaviour and breeding are unknown. (Kazunari *et al.*, 2001).

SITUATION OF FISHING INFORMATION

From information analyzed we can conclude that biological-fishing studies in the region of Samaná, as in the rest of the country, have had a descriptive character, for all approaches: economic, commercial, technological, social, taxonomic or evaluation of fishing arts. Strictly biological-fishing investigations of long term, with evaluations of key species stocks are practically nonexistent.

In spite of the importance in fishing biology of studying the composition for sizes and sex of populations under exploitation with a time-space approach, there are not studies in this respect and many population data lack statistical consistency. Some works in Samaná have been directed to carry out estimates of capture and the sustainable maximum effort (Silva, 1995) but they have been single isolated efforts. One of the serious problems of the regional fishing investigation is the lack of evaluations of fishing stock. Resources have generally been exploited without being studied, as has already happened with the shrimp and is beginning to occur with the giant squid. One of the main problems for the regional fishing organization is the lack of continuous series of temporary, properly standardized data that allow analyzing regional and national tendency of the captures. In Samaná the statistical data has been kept for some years by CEBSE (Silva and Aquino 1994; Silva et al., 1995; Aquino and Silva, 1995) but this effort could not have continuity. It has been demonstrated that the concept of the fishing ecological complexes constitute an approach of high methodological and practical value (Silva and Colom, 1996; Herrera, 2000).

REFERENCES FOR TOPICS

MANGROVE

Álvarez, V. 1978. Estudios ecológicos de los manglares de la zona comprendida entre Sabana de la Mar y Miches. Anuario de la Academia de Ciencias de la República Dominicana. Editora Alfa y Omega, Santo Domingo.

Álvarez, V. y G. Cintrón 1983. Manglares de la Bahía de Samaná. En: Los manglares de la República Dominicana: Caracterización de su estructura y factores que determinan su desarrollo. Contribuciones del Centro de Investigaciones de Biología Marina CIBIMA, 53: 1-19.

CIBIMA 1994. El Manglar. En: Estudio preliminar sobre la biodiversidad costera y marina de la República Dominicana. Editora Alfa y Omega, Santo Domingo, 459 pp.

Herrera-Moreno, A. y L. Betancourt 2004. Ecosistemas y zonas ecológicas de la Laguna Maricó, Las Terrenas, Samaná. Reportes del Programa EcoMar, Inc. Santo Domingo, 12 pp.

Laba, M., S.D.Smith, S.D. DeGloria. 1997. Landsat-based land cover mapping in the Lower Yuna River watershed in the Dominican Republic. Int. J. Remote Sensing 18:3011-3025.
Peguero, B 1995. Manglares. En: La vegetación de la Península de Samaná. Centro para la Conservación y Ecodesarrollo de la Bahía de Samaná y su Entorno, CEBSE, Inc., Santo Domingo, 26 pp.
Pérez, Y., J. Mc Cann, P. Lamelas, L. Sang y R. A. Lamelas 1994. Los manglares de la Bahía de Samaná. Centro para la Conservación y Ecodesarrollo de la Bahía de Samaná y su Entorno, CEBSE, Inc.. Santo Domingo, República Dominicana, 23 pp.
Salazar, J. y B. Peguero 1994. Estudio de Vegetación y Flora de la Península de Samaná. Centro para la Conservación y Ecodesarrollo de la Bahía de Samaná y su Entorno, CEBSE. Santo Domingo.
Sang, L., N. Lysenko y P. Martínez 1994. Manglares. En: Caracterización de ecosistemas costeros y marinos en la Bahía de Samaná y su Entorno. Centro para la Conservación y Ecodesarrollo de la Bahía de Samaná y su Entorno, CEBSE, Inc., Santo Domingo, República Dominicana, pp. 24- 46.
Sherman, R. E. 1994. Características de la estructura y función de un ecosistema de manglar en la Bahía de Samaná: resultados preliminares. Reporte del Dpto. de Recursos Naturales, Universidad de Cornell, 9 pp.
Sherman, R. E. 1996. Digitized maps of Samaná Bay mangroves 1959-1996 (GIS database at 1:20,000 scale). Reporte del Dpto. de Recursos Naturales, Universidad de Cornell, 5 pp.
Sherman, R. E. 1998. Chapter 2. Soil-plant interactions in a Neotropical mangrove forest: iron, phosphorus and sulfur dynamics. En: Soil-plant interactions, small-scale disturbance and regeneration dynamics in a mangrove forest of the Dominican Republic. Dissertation presented to the Faculty of the Graduate School of Cornell University in partial fulfillment of the requirements for the Degree of Doctor of Philosophy, 131 pp.
Sherman, R. E. 1998a. Chapter 3. Small-scale disturbance and regeneration dynamics in a in a Neotropical mangrove forest: En: Soil-plant interactions, small-scale disturbance and regeneration dynamics in a mangrove forest of the Dominican Republic. Dissertation presented to the Faculty of the Graduate School of Cornell University in partial fulfillment of the requirements for the Degree of Doctor of Philosophy, 131 pp.
Sherman, R.E., T .J. Fahey, R. W. Howarth 1998b. Soil-plant interaction in neotropical mangrove forest: Iron, phosphorus and sulfur dynamics. Oecologia 115:553-563.
Sherman, R. E. T. J. Fahey y J. J. Battles 2000. Small-scale disturbance and regeneration dynamics in a neotropical mangrove forest. Journal of Ecology, 88(1): 165.
Sherman, R.E., T.J. Fahey, P. Martinez 2001. Hurricane impacts on a mangrove ecosystem in the Dominican Republic: Damage patterns and early recovery. Biotropica 33:393-408.
Sherman, R.E., T.J. Fahey, P. Martinez 2003. Spatial patterns of biomass and aboveground productivity in a mangrove ecosystem in the Dominican Republic. Ecosystems 6:384-398.
TRD 1992. Investigación intensiva de las actividades rurales y urbanas y sus impactos en los recursos de agua y costeros. Tropical Research and Development, Inc. Agencia de los Estados Unidos para el Desarrollo Internacional/ República Dominicana, 200 pp.

MARINE GRASSES

Sang, L. y N. Lysenko 1994. Praderas de yerbas marinas. En: Caracterización de ecosistemas costeros y marinos en la Bahía de Samaná. Centro para la Conservación y Ecodesarrollo de la Bahía de Samaná y su Entorno, CEBSE, Inc., Santo Domingo, República Dominicana. pp. 47-72.

CORAL REEF

Geraldes, F. X. 1994. Iniciativa para la conservación de los arrecifes coralinos del Caribe, República Dominicana. Informe final del proyecto 1993-1994, Centro de Investigaciones de Biología Marina, CIBIMA, Universidad Autónoma de Santo Domingo, 74 pp.
Sang, L. 1994. Arrecifes de coral. En: Caracterización de ecosistemas costeros y marinos en la Bahía de Samaná. Centro para la Conservación y Ecodesarrollo de la Bahía de Samaná y su Entorno, CEBSE, Inc., Santo Domingo, Rep Dominicana, pp. 73-93.

Sang, L. 1996. Estudio de los arrecifes de coral de la costa norte de la Península de Samaná. Centro para la Conservación y Ecodesarrollo de la Bahía de Samaná y su Entorno, CEBSE, Inc., Santo Domingo, República Dominicana. 98 pp.

GENERAL BIOTA

Álvarez, V. y M. García 1986. La Bahía de San Lorenzo: su flora y su fauna. Primera Parte. Contribuciones del Centro de Investigaciones de Biología Marina CIBIMA, 76: 1-16.

Betancourt L. 1998 (Compiladora). Propuesta de Plan de Manejo Integrado de la Biodiversidad Marino-Costera para la Región de Samaná. Informe Técnico para el Centro para la Conservación y Ecodesarrollo de la Bahía de Samaná y su Entorno, CEBSE, Inc., Santo Domingo, República Dominicana.

Betancourt, L. y A. Herrera 2001. Algas marinas bentónicas (Rhodophyta, Phaeophyta y Chlorophyta) conocidas para la Hispaniola. Revista Moscosoa 12: 105-134.

DNP 1989. Parque Nacional Los Haitises y áreas periféricas. Dirección Nacional de Parques, Agencia de Medio Ambiente de Andalucía, Artes e Industrias Graficas Minerva, S. A., Sevilla, 68 pp.

García, N. 1981. Número de embriones en tiburón tigre. Naturalista Postal, Universidad Autónoma de Santo Domingo, UASD, Santo Domingo, np 3/81.

Herrera-Moreno, A. y L. Betancourt 2002. Especies de anémonas (Coelenterata: Actiniaria: Corallimorpharia, Zoanthidea y Ceriantharia) conocidas para la Hispaniola. Revista Ciencia y Sociedad, Universidad INTEC, Santo Domingo, (27)3: 439-453.

Herrera-Moreno, A. y L. Betancourt 2003. Especies de estomatópodos (Crustacea: Malacostraca: Stomatopoda) conocidas para la Hispaniola. Revista Ciencia y Sociedad, Universidad INTEC, Santo Domingo, (28)2: 271-278.

Herrera-Moreno, A. y L. Betancourt 2004. Especies de equinodermos recientes (Echinodermata: Crinoidea: Asteroidea: Ophiuroidea: Echinoidea: Holothuroidea) conocidas para la Hispaniola. Revista Ciencia y Sociedad, Universidad INTEC, Santo Domingo.29(3): 506-533.

Herrera-Moreno, A. y B. Peguero 2004. Evaluación ecológica general de la región de Caño Frío, El Rincón, Samaná. Reporte Técnico Centro para la Conservación y Ecodesarrollo de la Bahía de Samaná y su Entorno, CEBSE y Proyecto Guariquén, 45 pp.

Herrera-Moreno, A. y L. Betancourt 2005. Hispaniola Marine Biota Information System. Hispabiota Marina Project, Programa EcoMar, Inc. http://espanol.geocities.com/ongprogramaecomar/HISPABIOTAMARINA.HTML.

Lockward, R., M. A. Pozo y R. Lamelas 1995. Valor y uso económico de los recursos marinos en la Provincia de Samaná. Centro para la Conservación y Ecodesarrollo de la Bahía de Samaná y su Entorno, CEBSE Inc., 29 pp.

Steiner G. y Kabat, A. R. 2004. Catalog of species-group names of recent and fossil Scaphopoda (Mollusca). Zoosystema 26 (4):549-726.

Suriel, C. 1990. Informe preliminar del análisis del bentos en la Bahía de San Lorenzo. En: Proyecto inventario de los recursos naturales de la Bahía de Samaná. Informe Final al Centro de Conservación Marina, 6 pp.

Van Tassell, J. 2002 The American Seven-spined Gobies, Tribe Gobiosomatini. Species Documentation. Dept. of Biology., 114 Hofstra University. http://gobiidae.com/gobspecies.htm

FISHERY

Aquino, A. 1994. Evaluación de la pesquería de profundidad en la Bahía de Neiba, República Dominicana. Reportes del Propescar-Sur 1:99-118.

Aquino, C. y M. Silva 1995. La Pesquería Marina en la Costa Sur de la Bahía de Samaná (Sabana de la Mar y Miches), República Dominicana: Estudio Básico. Centro para la Conservación y Ecodesarrollo de la Bahía de Samaná y su Entorno, CEBSE, Inc. Santo Domingo, República Dominicana. 28 pp.

Arima, S. 1997. Relación sobre la operación de prueba de pesca (No. 2) Palangre vertical de fondo ensayado en el *Guarionex*. Mini-Proyecto en Centro de Entrenamiento y Desarrollo Pesquero, 43 pp.

Arima, S. 1998. Relación sobre la operación de prueba de pescado (No. 1). Pp. 89-110. En: Manual para artes de pesca en el Mini-Proyecto de Samaná. Agencia de Cooperación Internacional de Japón (JICA).

Arima, S. 1998a. Relación sobre la operación de prueba de pescado (No. 3). Pp. 111-145. En: Manual para artes de pesca en el Mini-Proyecto de Samaná. Agencia de Cooperación Internacional de Japón (JICA).

Arima, S. 1998b. Comparación entre palangre de fondo y palangre vertical de fondo. Pp. 146-150. En: Manual para artes de pesca en el Mini-Proyecto de Samaná. Agencia de Cooperación Internacional de Japón (JICA).

Arima, S. 1999. Informe mensual de las actividades de los barquitos del Mini-Proyecto. Agencia de Cooperación Internacional de Japón (JICA), junio 4/1999, No. 21. 12 pp.

Arima, S. 1999a. Informe mensual de las actividades de los barquitos del Mini-Proyecto. Agencia de Cooperación Internacional de Japón (JICA), julio 6/1999, No. 22. 33 pp.

Arima, S. 1999b. Datos de operaciones del palangre vertical de fondo por *Guarionex*, *Marien*, *Magua* y *Higuey*, en el Mini-Proyecto en Samaná. Agencia de Cooperación Internacional de Japón (JICA)/ Centro de Entrenamiento y Desarrollo Pesquero (CEDEP), 87 pp.

CEBSE, 1993. Propuesta descriptiva para la implementación de la reserva de Biosfera Bahía de Samaná y su Entorno. Documento Síntesis. Centro para la Conservación y Ecodesarrollo de la Bahía de Samaná y su Entorno, CEBSE, Inc., Santo Domingo, República Dominicana. 77 pp.

CEBSE 1996. La estrategia para el co-manejo de los recursos pesqueros de la Bahía de Samaná Pp.69-90. En: Plan de Manejo Integrado para la Región de Samaná. Documento 1. Centro para la Conservación y Ecodesarrollo de la Bahía de Samaná y su Entorno, CEBSE, Editora Ozama, 90 pp.

CFRM 2004. Presentation Plan For Managing the Marine Fisheries of the Dominican Republic, Caribbean Regional Fisheries Mechanism, 25 pp.

Colom, R., Z. Reyes y Y. Gil 1994. Censo comprensivo de la pesca costera de la República Dominicana. Reportes del Propescar-Sur, 1: 45-77.

FAO 2001. Fishery Country Profile. República Dominicana. http://www.fao.org/fi/fcp/es/DOM/profile.htm.

Fisheries Development Limited. 1980. Desarrollo pesquero en la República Dominicana. Instituto Dominicano de Tecnología Industrial (INDOTEC), Santo Domingo, República Dominicana.435 pp.

Froese, R. y D. Pauly (Editores) 2005. FishBase. World Wide Web electronic publication. www.fishbase.org,

Hara, Y. 1999 (Editor). Técnicas y conocimiento de la pesca introducidas en la República Dominicana. Proyecto de desarrollo de la pesca artesanal en el área de Samaná (1996-1999). Secretaría de Estado de Agricultura/ Agencia de Cooperación Internacional de Japón, SEA/JICA, 232 pp.

Herrera-Moreno, A. 2000. Clasificación de datos de las pesquerías de Samaná bajo el concepto de los complejos ecológicos de pesca. En: La clasificación numérica y su aplicación en la ecología. Universidad INTEC/Programa EcoMar, Inc. Editorial Sanmenycar, Santo Domingo, 121 pp.

Herrera-Moreno, A. 2001. Evaluación del Mini-Proyecto para desarrollo de la pesca artesanal en Samaná. Informe de consultoría a la Agencia Japonesa de Cooperación Internacional, JICA, Santo Domingo, 50 pp.

Herrera-Moreno, A. y L. Betancourt. 2003. Datos de la pesca de la langosta *Panulirus argus* en la región de Samaná con notas sobre *Panulirus guttatus*. En: Investigaciones ecológico-pesqueras de las langosta *Panulirus argus* en la plataforma dominicana. INTEC/ Programa EcoMar, Inc. Editora Búho, Santo Domingo, 25-44 pp.

Herrera-Moreno, A., L. Betancourt, M. Silva, P. Lamelas y A. Melo en prep. Síntesis de la Evaluación y Manejo de las Pesquerías Costeras en Latinoamérica y el Caribe: República Dominicana. Proyecto Regional.

ICRAFD 2001. Five Year Work Programme for the Dominican Republic (April 2000-March 2005). Integrated Caribbean Regional Agriculture and Fisheries, 42 pp.

Kazunari Y., H. Shimizu y T. Kosuge 2001. Diurnal swimming patterns of the diamondback squid as observed by ultrasonic telemetry. Pelagic and Deep Sea Biology Section, Ishigaki Tropical Station. Seikai National Fisheries Research Institute, Fisheries Research Agency http://www.snf.affrc.go.jp

León, F. D. 1996. Construcción de balsas con materiales desechables, Centro para la Conservación y Ecodesarrollo de la Bahía de Samaná y su Entorno, CEBSE, 19 pp.

León, F. D. 1997. Distribución, Vías de Comercialización y Destinos de los Productos Pesqueros de Samaná y Sabana de la Mar. Centro para la Conservación y Ecodesarrollo de la Bahía de Samaná y su Entorno, CEBSE, Inc. Santo Domingo, República Dominicana, 18 pp.

Núñez, F. y E. García. 1983. Aspectos preliminares de la pesquería camaronera en el puerto de Sánchez, República Dominicana. Tesis de licenciatura, Universidad Autónoma de Santo Domingo, República Dominicana 76 pp.

Ramírez, O. y M. Silva 1994. Co-Manejo de Recursos Pesqueros. Legislación Pesquera Dominicana. Centro para la Conservación y Ecodesarrollo de la Bahía de Samaná y su Entorno, CEBSE, Inc., Santo Domingo, República Dominicana, 153 pp.

Sang, L., D. León, M. Silva y V. King 1997. Diversidad y composición de los desembarcos de la pesca artesanal en la región de Samaná. Centro para la Conservación y Ecodesarrollo de la Bahía de Samaná y su Entorno, CEBSE,

Inc., Proyecto de Conservación y Manejo de la Biodiversidad en la Zona Costera de la República Dominicana GEF-PNUD/ONAPLAN, 52 pp.
SERCM 2004. Los Recursos Marinos de la República Dominicana. Reporte de la Subsecretaría de Estado de Recursos Costeros y Marinos de la Secretaría de Estado de Medio Ambiente y Recursos Naturales, SERCM/ SEMARN Santo Domingo, República Dominicana, 277 pp.
Silva, M. y C. Aquino 1993. La Pesquería Marina en la Provincia de Samaná, República Dominicana: Estudio Básico, Centro para la Conservación y Ecodesarrollo de la Bahía de Samaná y su Entorno, CEBSE, Inc. Santo Domingo, República Dominicana., 26 pgs.
Silva, M. y C. Aquino 1994. Estadísticas Pesqueras. Centro para la Conservación y Ecodesarrollo de la Bahía de Samaná y su Entorno, CEBSE, Inc. El Cayuco, 1 (1): 6-7.
Silva, M. y R. Colom 1996. Guía para el levantamiento de estadísticas pesqueras en la República Dominicana. CEBSE-PROPESCAR-SUR/SEA, Santo Domingo, República Dominicana, 26 pp.
Silva, M., C. Aquino y V. King 1995. Estadísticas Pesqueras. Centro para la Conservación y Ecodesarrollo de la Bahía de Samaná y su Entorno, CEBSE, Inc. El Cayuco, 2 (1): 2-4.
Then, T. M., E. Balbuena y M. A. Casilla. 1995. Situación actual de la pesquería del camarón blanco, *Penaeus schmitti,* en Sánchez, Samaná. 1995. Tesis de licenciatura, Universidad Autónoma de Santo Domingo, República Dominicana, 80 pp.

DATABASES IN INTERNATIONAL MUSEUMS

CASCF 2005. California Academy of Sciences Catalog of Fishes. Sitio Web: http://www.calacademy.org/research/ ichthyology/collection
FMNH 2005. Florida Museum of Natural History. Sitio Web: http://www.flmnh.ufl.edu/scripts/dbs/malacol_pub.asp
NHMLC 2005. Natural History Museum of Los Angeles County. Sitio Web: http://ip.nhm.org/nhmsearch/ findlots.php.
NMNH 2005. National Museum of Natural History. Sitio Web: http://goode.si.edu/mcs/nmnh/AdvQuery.php.

OCEANOGRAPHY AND PLANKTON

Ferreras, J., N. Lysenko y T. G. Domínguez, 1990. Proyecto inventario de los recursos naturales de la Bahía de Samaná. Informe final al Centro de Conservación Marina. Centro de Investigaciones de Biología Marina, CIBIMA, 51 pp.
Lysenko, N., 1991. Estudio del zooplancton en la Bahía de Samaná. En: Contribuciones del Centro de Investigaciones de Biología Marina, CIBIMA, . 33 pp.
RSMAS 2002. Caribbean Mean SSTS and Winds del Rosentiel School of Marine and Atmospheric Sciences de la Universidad de Miami. http://www.rsmas.miami.edu/
SEA 2004. Cruise Report C-191. Scientific data collected aboard SSV Corwith Cramer: Key West-Nassau-Samana-Key West, 10 February 2004-19 March 2004. Sea Education Association, Woods Hole, Massachusetts, 17 pp.
Ferreras, J. 1991. Pigmentos clorofílicos e hidrografía de la porción occidental de la Bahía de Samaná. En: Contribuciones del Centro de Investigaciones de Biología Marina, CIBIMA,10 pp.
Betancourt, L. y A. Herrera 2005a. Características térmicas de las áreas de reproducción de las ballenas jorobadas *Megaptera novaeangliae* en la República Dominicana, Reportes del Programa EcoMar, Inc. Santo Domingo, 7 pp.

STUDIES OF COAST LINE

Sang, L y R. Lamelas, 1995. Línea costera de la bahía de Samaná desde Punta Palometa hasta Punta Yabón. Centro para la Conservación y Ecodesarrollo de la Bahía de Samaná y su Entorno, CEBSE, Inc., Santo Domingo, República Dominicana, 21 pp.

Sang, L y R. Lamelas, 1995a. Línea de costa Norte y Este de la Península de Samaná. Centro para la Conservación y Ecodesarrollo de la Bahía de Samaná y su Entorno, CEBSE, Inc., Santo Domingo, República Dominicana, 49 pp.
Sang, L 1997. Características de la línea de costa de los Haitises-Miches e impactos ambientales más importantes. Centro para la Conservación y Ecodesarrollo de la Bahía de Samaná y su Entorno, CEBSE, Inc., Santo Domingo, República Dominicana.

ENVIRONMENTAL ADMINISTRATION

Betancourt, L. y A. Herrera-Moreno 2001. Estudio de Factibilidad para Uso Turístico: Valoración Ecológica de los Ecosistemas Terrestres y Marinos de la Majagua, Samaná. Consorcio EMPACA-REDES, Santo Domingo.
Betancourt, L. y A. Herrera-Moreno 2001a. Estudio de Impacto Ambiental del Proyecto Cape Jackson Village Resort, La Majagua, Samaná. Consorcio EMPACA-REDES, Santo Domingo.
Betancourt, L. y A. Herrera-Moreno 2001. Evaluación Ambiental del Proyecto Habitacional Sánchez, Municipio Sánchez, Provincia Samaná. International Building Sys-tem, S. A/ Ex-Im Bank, NY.
Herrera-Moreno, A. y L. Betancourt 1999. Mortandades masivas del machuelo *Ophistonema oglinum* (Pisces: Clupeidae) y otras especies de peces en Puerto Escondido, Bahía de Samaná. Informe Técnico. Instituto Nacional de Protección Ambiental (INPRA)/ Instituto Dominicano de Tecnología Industrial, INDOTEC, 20 pp.
Herrera-Moreno, A. y L. Betancourt 2001. Estudio de Impacto Ambiental del Proyecto Jovero Beach Resort, Miches, Samaná. Consorcio EMPACA-REDES, Santo Domingo.
Herrera-Moreno, A. y L. Betancourt 2003. Plan de Manejo y Adecuación Ambiental de la Laguna Maricó, Las Terrenas, Samaná. COR Ingenieria, Santo Domingo.
Herrera-Moreno, A. y L. Betancourt 2004. Caracterización Ambiental Costero Marina del Proyecto Turístico El Morón, El Limón, Samaná. COR Ingenieria, Santo Domingo.

SUPPORT REFERENCES

Ruppert, E. E. y R. D. Barnes 1994. Invertebrate Zoology. Sexta Edición, Saunders College Publishing, 1056 pp.

REFERENCES (Alphabetical order)

Álvarez, V. 1978. Estudios ecológicos de los manglares de la zona comprendida entre Sabana de la Mar y Miches. Anuario de la Academia de Ciencias de la República Dominicana. Editora Alfa y Omega, Santo Domingo.
Álvarez, V. y G. Cintrón 1983. Manglares de la Bahía de Samaná. En: Los manglares de la República Dominicana: Caracterización de su estructura y factores que determinan su desarrollo. Contribuciones del Centro de Investigaciones de Biología Marina CIBIMA, 53: 1-19.
Álvarez, V. y M. García 1986. La Bahía de San Lorenzo: su flora y su fauna. Primera Parte. Contribuciones del Centro de Investigaciones de Biología Marina CIBIMA, 76: 1-16.
Aquino, A. 1994. Evaluación de la pesquería de profundidad en la Bahía de Neiba, República Dominicana. Reportes del Propescar-Sur 1:99-118.
Aquino, C. y M. Silva 1995. La Pesquería Marina en la Costa Sur de la Bahía de Samaná (Sabana de la Mar y Miches), República Dominicana: Estudio Básico. Centro para la Conservación y Ecodesarrollo de la Bahía de Samaná y su Entorno, CEBSE, Inc. Santo Domingo, República Dominicana. 28 pp.
Arima, S. 1997. Relación sobre la operación de prueba de pesca (No. 2) Palangre vertical de fondo ensayado en el *Guarionex*. Mini-Proyecto en Centro de Entrenamiento y Desarrollo Pesquero, 43 pp.
Arima, S. 1998. Relación sobre la operación de prueba de pescado (No. 1). Pp. 89-110. En: Manual para artes de pesca en el Mini-Proyecto de Samaná. Agencia de Cooperación Internacional de Japón (JICA).
Arima, S. 1998a. Relación sobre la operación de prueba de pescado (No. 3). Pp. 111-145. En: Manual para artes de pesca en el Mini-Proyecto de Samaná. Agencia de Cooperación Internacional de Japón (JICA).

Arima, S. 1998b. Comparación entre palangre de fondo y palangre vertical de fondo. Pp. 146-150. En: Manual para artes de pesca en el Mini-Proyecto de Samaná. Agencia de Cooperación Internacional de Japón (JICA).

Arima, S. 1999. Informe mensual de las actividades de los barquitos del Mini-Proyecto. Agencia de Cooperación Internacional de Japón (JICA), junio 4/1999, No. 21. 12 pp.

Arima, S. 1999a. Informe mensual de las actividades de los barquitos del Mini-Proyecto. Agencia de Cooperación Internacional de Japón (JICA), julio 6/1999, No. 22. 33 pp.

Arima, S. 1999b. Datos de operaciones del palangre vertical de fondo por *Guarionex*, *Marien*, *Magua* y *Higuey*, en el Mini-Proyecto en Samaná. Agencia de Cooperación Internacional de Japón (JICA)/ Centro de Entrenamiento y Desarrollo Pesquero (CEDEP), 87 pp.

Betancourt L. 1998 (Compiladora). Propuesta de Plan de Manejo Integrado de la Biodiversidad Marino-Costera para la Región de Samaná. Informe Técnico para el Centro para la Conservación y Ecodesarrollo de la Bahía de Samaná y su Entorno, CEBSE, Inc., Santo Domingo, República Dominicana.

Betancourt, L. y A. Herrera 2001. Algas marinas bentónicas (Rhodophyta, Phaeophyta y Chlorophyta) conocidas para la Hispaniola. Revista Moscosoa 12: 105-134.

Betancourt, L. y A. Herrera 2005a. Características térmicas de las áreas de reproducción de las ballenas jorobadas *Megaptera novaeangliae* en la República Dominicana, Reportes del Programa EcoMar, Inc. Santo Domingo, 7 pp.

Betancourt, L. y A. Herrera-Moreno 2001. Estudio de Factibilidad para Uso Turístico: Valoración Ecológica de los Ecosistemas Terrestres y Marinos de la Majagua, Samaná. Consorcio EMPACA-REDES, Santo Domingo.

Betancourt, L. y A. Herrera-Moreno 2001. Evaluación Ambiental del Proyecto Habitacional Sánchez, Municipio Sánchez, Provincia Samaná. International Building Sys-tem, S. A/ Ex-Im Bank, NY.

Betancourt, L. y A. Herrera-Moreno 2001a. Estudio de Impacto Ambiental del Proyecto Cape Jackson Village Resort, La Majagua, Samaná. Consorcio EMPACA-REDES, Santo Domingo.

CASCF 2005. California Academy of Sciences Catalog of Fishes. Sitio Web: http://www.calacademy.org/research/ichthyology/collection

CEBSE 1996. La estrategia para el co-manejo de los recursos pesqueros de la Bahía de Samaná Pp.69-90. En: Plan de Manejo Integrado para la Región de Samaná. Documento 1. Centro para la Conservación y Ecodesarrollo de la Bahía de Samaná y su Entorno, CEBSE, Editora Ozama, 90 pp.

CEBSE, 1993. Propuesta descriptiva para la implementación de la reserva de Biosfera Bahía de Samaná y su Entorno. Documento Síntesis. Centro para la Conservación y Ecodesarrollo de la Bahía de Samaná y su Entorno, CEBSE, Inc., Santo Domingo, República Dominicana. 77 pp.

CFRM 2004. Presentation Plan For Managing the Marine Fisheries of the Dominican Republic, Caribbean Regional Fisheries Mechanism, 25 pp.

CIBIMA 1994. El Manglar. En: Estudio preliminar sobre la biodiversidad costera y marina de la República Dominicana. Editora Alfa y Omega, Santo Domingo, 459 pp.

Colom, R., Z. Reyes y Y. Gil 1994. Censo comprensivo de la pesca costera de la República Dominicana. Reportes del Propescar-Sur, 1: 45-77.

DNP 1989. Parque Nacional Los Haitises y áreas periféricas. Dirección Nacional de Parques, Agencia de Medio Ambiente de Andalucía, Artes e Industrias Graficas Minerva, S. A., Sevilla, 68 pp.

FAO 2001. Fishery Country Profile. República Dominicana. http://www.fao.org/fi/fcp/es/DOM/profile.htm.

Ferreras, J. 1991. Pigmentos clorofílicos e hidrografía de la porción occidental de la Bahía de Samaná. En: Contribuciones del Centro de Investigaciones de Biología Marina, CIBIMA,10 pp.

Ferreras, J., N. Lysenko y T. G. Domínguez, 1990. Proyecto inventario de los recursos naturales de la Bahía de Samaná. Informe final al Centro de Conservación Marina. Centro de Investigaciones de Biología Marina, CIBIMA, 51 pp.

Fisheries Development Limited. 1980. Desarrollo pesquero en la República Dominicana. Instituto Dominicano de Tecnología Industrial (INDOTEC), Santo Domingo, República Dominicana.435 pp.

FMNH 2005. Florida Museum of Natural History. Sitio Web: http://www.flmnh.ufl.edu/scripts/dbs/malacol_pub.asp

Froese, R. y D. Pauly (Editores) 2005. FishBase. World Wide Web electronic publication. www.fishbase.org,

García, N. 1981. Número de embriones en tiburón tigre. Naturalista Postal, Universidad Autónoma de Santo Domingo, UASD, Santo Domingo, np 3/81.

Geraldes, F. X. 1994. Iniciativa para la conservación de los arrecifes coralinos del Caribe, República Dominicana. Informe final del proyecto 1993-1994, Centro de Investigaciones de Biología Marina, CIBIMA, Universidad Autónoma de Santo Domingo, 74 pp.

Hara, Y. 1999 (Editor). Técnicas y conocimiento de la pesca introducidas en la República Dominicana. Proyecto de desarrollo de la pesca artesanal en el área de Samaná (1996-1999). Secretaría de Estado de Agricultura/ Agencia de Cooperación Internacional de Japón, SEA/JICA, 232 pp.

Herrera-Moreno, A. 2000. Clasificación de datos de las pesquerías de Samaná bajo el concepto de los complejos ecológicos de pesca. En: La clasificación numérica y su aplicación en la ecología. Universidad INTEC/Programa EcoMar, Inc. Editorial Sanmenycar, Santo Domingo, 121 pp.

Herrera-Moreno, A. 2001. Evaluación del Mini-Proyecto para desarrollo de la pesca artesanal en Samaná. Informe de consultoría a la Agencia Japonesa de Cooperación Internacional, JICA, Santo Domingo, 50 pp.

Herrera-Moreno, A. y B. Peguero 2004. Evaluación ecológica general de la región de Caño Frío, El Rincón, Samaná. Reporte Técnico Centro para la Conservación y Ecodesarrollo de la Bahía de Samaná y su Entorno, CEBSE y Proyecto Guariquén, 45 pp.

Herrera-Moreno, A. y L. Betancourt 1999. Mortandades masivas del machuelo *Ophistonema oglinum* (Pisces: Clupeidae) y otras especies de peces en Puerto Escondido, Bahía de Samaná. Informe Técnico. Instituto Nacional de Protección Ambiental (INPRA)/ Instituto Dominicano de Tecnología Industrial, INDOTEC, 20 pp.

Herrera-Moreno, A. y L. Betancourt 2001. Estudio de Impacto Ambiental del Proyecto Jovero Beach Resort, Miches, Samaná. Consorcio EMPACA-REDES, Santo Domingo.

Herrera-Moreno, A. y L. Betancourt 2002. Especies de anémonas (Coelenterata: Actiniaria: Corallimorpharia, Zoanthidea y Ceriantharia) conocidas para la Hispaniola. Revista Ciencia y Sociedad, Universidad INTEC, Santo Domingo, (27)3: 439-453.

Herrera-Moreno, A. y L. Betancourt 2003. Especies de estomatópodos (Crustacea: Malacostraca: Stomatopoda) conocidas para la Hispaniola. Revista Ciencia y Sociedad, Universidad INTEC, Santo Domingo, (28)2: 271-278.

Herrera-Moreno, A. y L. Betancourt 2003. Plan de Manejo y Adecuación Ambiental de la Laguna Maricó, Las Terrenas, Samaná. COR Ingenieria, Santo Domingo.

Herrera-Moreno, A. y L. Betancourt 2004. Caracterización Ambiental Costero Marina del Proyecto Turístico El Morón, El Limón, Samaná. COR Ingenieria, Santo Domingo.

Herrera-Moreno, A. y L. Betancourt 2004. Ecosistemas y zonas ecológicas de la Laguna Maricó, Las Terrenas, Samaná. Reportes del Programa EcoMar, Inc. Santo Domingo, 12 pp.

Herrera-Moreno, A. y L. Betancourt 2004. Especies de equinodermos recientes (Echinodermata: Crinoidea: Asteroidea: Ophiuroidea: Echinoidea: Holothuroidea) conocidas para la Hispaniola. Revista Ciencia y Sociedad, Universidad INTEC, Santo Domingo.29(3): 506-533.

Herrera-Moreno, A. y L. Betancourt 2005. Hispaniola Marine Biota Information System. Hispabiota Marina Project, Programa EcoMar, Inc. http://espanol.geocities.com/ongprogramaecomar/HISPABIOTAMARINA.HTML.

Herrera-Moreno, A. y L. Betancourt. 2003. Datos de la pesca de la langosta *Panulirus argus* en la región de Samaná con notas sobre *Panulirus guttatus*. En: Investigaciones ecológico-pesqueras de las langosta *Panulirus argus* en la plataforma dominicana. INTEC/ Programa EcoMar, Inc. Editora Búho, Santo Domingo, 25-44 pp.

Herrera-Moreno, A., L. Betancourt, M. Silva, P. Lamelas y A. Melo en prep. Síntesis de la Evaluación y Manejo de las Pesquerías Costeras en Latinoamérica y el Caribe: República Dominicana. Proyecto Regional.

ICRAFD 2001. Five Year Work Programme for the Dominican Republic (April 2000-March 2005). Integrated Caribbean Regional Agriculture and Fisheries, 42 pp.

Kazunari Y., H. Shimizu y T. Kosuge 2001. Diurnal swimming patterns of the diamondback squid as observed by ultrasonic telemetry. Pelagic and Deep Sea Biology Section, Ishigaki Tropical Station. Seikai National Fisheries Research Institute, Fisheries Research Agency http://www.snf.affrc.go.jp

Laba, M., S.D.Smith, S.D. DeGloria. 1997. Landsat-based land cover mapping in the Lower Yuna River watershed in the Dominican Republic. Int. J. Remote Sensing 18:3011-3025.

León, F. D. 1996. Construcción de balsas con materiales desechables, Centro para la Conservación y Ecodesarrollo de la Bahía de Samaná y su Entorno, CEBSE, 19 pp.

León, F. D. 1997. Distribución, Vías de Comercialización y Destinos de los Productos Pesqueros de Samaná y Sabana de la Mar. Centro para la Conservación y Ecodesarrollo de la Bahía de Samaná y su Entorno, CEBSE, Inc. Santo Domingo, República Dominicana, 18 pp.

Lockward, R., M. A. Pozo y R. Lamelas 1995. Valor y uso económico de los recursos marinos en la Provincia de Samaná. Centro para la Conservación y Ecodesarrollo de la Bahía de Samaná y su Entorno, CEBSE Inc., 29 pp.

Lysenko, N., 1991. Estudio del zooplancton en la Bahía de Samaná. En: Contribuciones del Centro de Investigaciones de Biología Marina, CIBIMA, . 33 pp.

NHMLC 2005. Natural History Museum of Los Angeles County. Sitio Web: http://ip.nhm.org/nhmsearch/findlots.php.

NMNH 2005. National Museum of Natural History. Sitio Web: http://goode.si.edu/mcs/nmnh/AdvQuery.php.

Núñez, F. y E. García. 1983. Aspectos preliminares de la pesquería camaronera en el puerto de Sánchez, República Dominicana. Tesis de licenciatura, Universidad Autónoma de Santo Domingo, República Dominicana 76 pp.

Peguero, B 1995. Manglares. En: La vegetación de la Península de Samaná. Centro para la Conservación y Ecodesarrollo de la Bahía de Samaná y su Entorno, CEBSE, Inc., Santo Domingo, 26 pp.

Pérez, Y., J. Mc Cann, P. Lamelas, L. Sang y R. A. Lamelas 1994. Los manglares de la Bahía de Samaná. Centro para la Conservación y Ecodesarrollo de la Bahía de Samaná y su Entorno, CEBSE, Inc.. Santo Domingo, República Dominicana, 23 pp.

Ramírez, O. y M. Silva 1994. Co-Manejo de Recursos Pesqueros. Legislación Pesquera Dominicana. Centro para la Conservación y Ecodesarrollo de la Bahía de Samaná y su Entorno, CEBSE, Inc., Santo Domingo, República Dominicana, 153 pp.

RSMAS 2002. Caribbean Mean SSTS and Winds del Rosentiel School of Marine and Atmospheric Sciences de la Universidad de Miami. http://www.rsmas.miami.edu/

Ruppert, E. E. y R. D. Barnes 1994. Invertebrate Zoology. Sexta Edición, Saunders College Publishing, 1056 pp.

Salazar, J. y B. Peguero 1994. Estudio de Vegetación y Flora de la Península de Samaná. Centro para la Conservación y Ecodesarrollo de la Bahía de Samaná y su Entorno, CEBSE. Santo Domingo.

Sang, L 1997. Características de la línea de costa de los Haitises-Miches e impactos ambientales más importantes. Centro para la Conservación y Ecodesarrollo de la Bahía de Samaná y su Entorno, CEBSE, Inc., Santo Domingo, República Dominicana.

Sang, L y R. Lamelas, 1995. Línea costera de la bahía de Samaná desde Punta Palometa hasta Punta Yabón. Centro para la Conservación y Ecodesarrollo de la Bahía de Samaná y su Entorno, CEBSE, Inc., Santo Domingo, República Dominicana, 21 pp.

Sang, L y R. Lamelas, 1995a. Línea de costa Norte y Este de la Península de Samaná. Centro para la Conservación y Ecodesarrollo de la Bahía de Samaná y su Entorno, CEBSE, Inc., Santo Domingo, República Dominicana, 49 pp.

Sang, L. 1994. Arrecifes de coral. En: Caracterización de ecosistemas costeros y marinos en la Bahía de Samaná. Centro para la Conservación y Ecodesarrollo de la Bahía de Samaná y su Entorno, CEBSE, Inc., Santo Domingo, Rep Dominicana, pp. 73-93.

Sang, L. 1996. Estudio de los arrecifes de coral de la costa norte de la Península de Samaná. Centro para la Conservación y Ecodesarrollo de la Bahía de Samaná y su Entorno, CEBSE, Inc., Santo Domingo, República Dominicana. 98 pp.

Sang, L. y N. Lysenko 1994. Praderas de yerbas marinas. En: Caracterización de ecosistemas costeros y marinos en la Bahía de Samaná. Centro para la Conservación y Ecodesarrollo de la Bahía de Samaná y su Entorno, CEBSE, Inc., Santo Domingo, República Dominicana. pp. 47-72.

Sang, L., D. León, M. Silva y V. King 1997. Diversidad y composición de los desembarcos de la pesca artesanal en la región de Samaná. Centro para la Conservación y Ecodesarrollo de la Bahía de Samaná y su Entorno, CEBSE, Inc., Proyecto de Conservación y Manejo de la Biodiversidad en la Zona Costera de la República Dominicana GEF-PNUD/ONAPLAN, 52 pp.

Sang, L., N. Lysenko y P. Martínez 1994. Manglares. En: Caracterización de ecosistemas costeros y marinos en la Bahía de Samaná y su Entorno. Centro para la Conservación y Ecodesarrollo de la Bahía de Samaná y su Entorno, CEBSE, Inc., Santo Domingo, República Dominicana, pp. 24- 46.

SEA 2004. Cruise Report C-191. Scientific data collected aboard SSV Corwith Cramer: Key West-Nassau-Samana-Key West, 10 February 2004-19 March 2004. Sea Education Association, Woods Hole, Massachusetts, 17 pp.

SERCM 2004. Los Recursos Marinos de la República Dominicana. Reporte de la Subsecretaría de Estado de Recursos Costeros y Marinos de la Secretaría de Estado de Medio Ambiente y Recursos Naturales, SERCM/SEMARN Santo Domingo, República Dominicana, 277 pp.

Sherman, R. E. 1994. Características de la estructura y función de un ecosistema de manglar en la Bahía de Samaná: resultados preliminares. Reporte del Dpto. de Recursos Naturales, Universidad de Cornell, 9 pp.

Sherman, R. E. 1996. Digitized maps of Samaná Bay mangroves 1959-1996 (GIS database at 1:20,000 scale). Reporte del Dpto. de Recursos Naturales, Universidad de Cornell, 5 pp.
Sherman, R. E. 1998. Chapter 2. Soil-plant interactions in a Neotropical mangrove forest: iron, phosphorus and sulfur dynamics. En: Soil-plant interactions, small-scale disturbance and regeneration dynamics in a mangrove forest of the Dominican Republic. Dissertation presented to the Faculty of the Graduate School of Cornell University in partial fulfillment of the requirements for the Degree of Doctor of Philosophy, 131 pp.
Sherman, R. E. 1998a. Chapter 3. Small-scale disturbance and regeneration dynamics in a in a Neotropical mangrove forest: En: Soil-plant interactions, small-scale disturbance and regeneration dynamics in a mangrove forest of the Dominican Republic. Dissertation presented to the Faculty of the Graduate School of Cornell University in partial fulfillment of the requirements for the Degree of Doctor of Philosophy, 131 pp.
Sherman, R. E. T. J. Fahey y J. J. Battles 2000. Small-scale disturbance and regeneration dynamics in a neotropical mangrove forest. Journal of Ecology, 88(1): 165.
Sherman, R.E., T .J. Fahey, R. W. Howarth 1998b. Soil-plant interaction in neotropical mangrove forest: Iron, phosphorus and sulfur dynamics. Oecologia 115:553-563.
Sherman, R.E., T.J. Fahey, P. Martinez 2001. Hurricane impacts on a mangrove ecosystem in the Dominican Republic: Damage patterns and early recovery. Biotropica 33:393-408.
Sherman, R.E., T.J. Fahey, P. Martinez 2003. Spatial patterns of biomass and aboveground productivity in a mangrove ecosystem in the Dominican Republic. Ecosystems 6:384-398.
Silva, M. y C. Aquino 1993. La Pesquería Marina en la Provincia de Samaná, República Dominicana: Estudio Básico, Centro para la Conservación y Ecodesarrollo de la Bahía de Samaná y su Entorno, CEBSE, Inc. Santo Domingo, República Dominicana., 26 pgs.
Silva, M. y C. Aquino 1994. Estadísticas Pesqueras. Centro para la Conservación y Ecodesarrollo de la Bahía de Samaná y su Entorno, CEBSE, Inc. El Cayuco, 1 (1): 6-7.
Silva, M. y R. Colom 1996. Guía para el levantamiento de estadísticas pesqueras en la República Dominicana. CEBSE-PROPESCAR-SUR/SEA, Santo Domingo, República Dominicana, 26 pp.
Silva, M., C. Aquino y V. King 1995. Estadísticas Pesqueras. Centro para la Conservación y Ecodesarrollo de la Bahía de Samaná y su Entorno, CEBSE, Inc. El Cayuco, 2 (1): 2-4.
Steiner G. y Kabat, A. R. 2004. Catalog of species-group names of recent and fossil Scaphopoda (Mollusca). Zoosystema 26 (4):549-726.
Suriel, C. 1990. Informe preliminar del análisis del bentos en la Bahía de San Lorenzo. En: Proyecto inventario de los recursos naturales de la Bahía de Samaná. Informe Final al Centro de Conservación Marina, 6 pp.
Then, T. M., E. Balbuena y M. A. Casilla. 1995. Situación actual de la pesquería del camarón blanco, *Penaeus schmitti*, en Sánchez, Samaná. 1995. Tesis de licenciatura, Universidad Autónoma de Santo Domingo, República Dominicana, 80 pp.
TRD 1992. Investigación intensiva de las actividades rurales y urbanas y sus impactos en los recursos de agua y costeros. Tropical Research and Development, Inc. Agencia de los Estados Unidos para el Desarrollo Internacional/ República Dominicana, 200 pp.
Van Tassell, J. 2002 The American Seven-spined Gobies, Tribe Gobiosomatini. Species Documentation. Dept. of Biology., 114 Hofstra University. http://gobiidae.com/gobspecies.htm

ANNEX I. MARINE BIOTA

Lists of bentonic marine algae species reported for the region of Samaná, considering two general areas of distribution. **AI.** interior areas of the Bay of Samaná in mangrove swamps, marine grasses and reef habitats of scarce development. **AE:** external areas of the Bay of Samaná in reef habitats that are developed under the oceanic influence. *References.* **1**. Álvarez and García (1986), 2. Sang and Lysenko (1994), 3. Geraldes (1994), 4. Sang (1996). The order is alphabetical for species inside each Class.

Class	Specie	AI	AE
Cyanophycea	*Phormidium coralyticum* Ruetzler y Santavy		4
	Schizothrix calcicola (C. Agardh) Gomont		4
Clorophycea	*Anadyomene stellata* (Wulfen) C. Agardh		4
	Avrainvillea longicaulis (Kuetzing) Murray y Boodle		4
	Caulerpa cupressoides (Vahl) C. Agardh		4,3
	Caulerpa mexicana Kuetzing	2	
	Caulerpa racemosa (Forsskal) J. Agardh	1,2	
	Caulerpa sertularoides (S. G. Gmelin) Howe	2	
	Caulerpa verticillata J. Agardh	1	4
	Cladophora sp.	1	
	Codium repens Vickers		4
	Derbesia sp.		3
	Dictyosphaeria cavernosa (Forsskal) Boergesen		4
	Dictyosphaeria ocellata (Howe) Olsen-Stojkovich		4
	Enteromorpha chaetomorphoides Børgesen	1	
	Halimeda copiosa Goreau y Graham		4
	Halimeda discoidea Decaisne		4
	Halimeda goreaui W. Taylor		4
	Halimeda opuntia (Linnaeus) Lamoroux	1	4,3
	Halimeda tuna (Ellis y Solander) Lamouroux		4
	Halimeda incrassata (J. Ellis) J. V. Lamouroux	1	
	Neomeris annulata Dickie		3
	Neomeris annulata Dickie		4
	Penicillus capitatus Lamouroux	1	
	Rhiphocephalus phoenix (Ellis y Solander) Kuetzing		4
	Rhizoclonium sp.	1	
	Udotea cyathiformis Descaine		4
	Udotea flabellum (Ellis y Solander) Lamouroux		4
	Ulva lactuca Linnaeus	1	
	Valonia macrophysa Kütz.		3
	Ventricaria ventricosa (J. Agardh)		3
	Ventricaria ventricosa (J. Agardh) Olsen y West		4
Phaeophycea	*Dyctiopteris delicatula* Lamouroux		4
	Dyctiota bartayresii Lamoroux		4,3
	Dyctiota cervicornis Kuetzing		4,3
	Dyctiota divaricata Lamoroux		4,3
	Dyctiota menstrualis (Hoyt) Schnetter, Hörnig y Weber-Peukert	1	
	Dyctiota jamaicensis W. Taylor		4
	Dictyopteris. justii J. V. Lamouroux	1	
	Giffordia sp.	1	

Class	Specie	AI	AE
	Lobophora variegata (Lamoroux) Womersley		4,3
	Padina boergesenii Allender & Kraft		4

	Padina sanctae-crucis Boergesen		4
	Sargassum hystrix J. Agardh		4
	Sargassum platycarpum Montagne		4
	Stypopodium zonale (Lamoroux) Papenfuss		4,3
	Turbinaria tricostata Barton		4
	Turbinaria turbinata (Linnaeus) Kuntze	1	4
Rodophycea	*Acanthophora. spicifera* (Vahl) Børgesen	1	
	Amphiroa brasilana Decaisne		4,3
	Amphiroa fragilissima (Linnaeus) Lamouroux		4
	Amphiroa rigida Boergesen		4
	Amphiroa tribulus (Ellis y Solander) Lamoroux		4,3
	Caloglossa leprieurii (Mont.) G. Martens	1	
	Chondria. littoralis Harv.	1	
	Coelothrix irregularis (Harvey) Boergesen		4
	Eucheuma isiforme (C. Agardh) J. Agardh	2	
	Flahaultia tegetiformis W. Taylor		4
	Fosliella sp.	1	
	Galaxaura oblongata (Ellis y Solander) Lam.		4
	Gelidium pusillum (Stackhouse) Le Jolis		4,3
	Hydrolithon boergesenii (Foslie) Foslie		4
	Hypnea cervicornis J. Agardh		4
	Hypnea valentiae (Turner) Mont.	1	
	Kallimenia limminghii Montagne		4
	Laurencia intricata J. V. Lamouroux		3
	Martensia pavonia (J. Agardh) J. Agardh		4
	Mesophyllum mesomorphum (Foslie) Adey		4
	Murrayella periclados (C. Agardh) F. Schmitz	1	
	Neogoniolithon strictum (F.) Setchell y Mason		4,3
	Polysiphonia sp.	1	
	Wrangelia argus (Montagne) Montagne		4

Lists of bentonic marine invertebrate species reported for the region of Samaná, considering two general areas of distribution. . **AI.** Interior areas of the Bay of Samaná in mangrove swamps, marine grasses and reef habitats of scarce development. **AE:** external areas of the Bay of Samaná in reef habitats that are developed under the oceanic influence**...** *References.* **1.** Álvarez and García (1986), 2. DNP (1989), 3. Suriel (1990), 4. Silva and Aquino (1993), 5. Sang et al. (1994), **6**. Sang and Lysenko (1994), 7. Sang and Martínez (1994), 8. Sang (1994), 9 Geraldes (1994);

10. Lockward et al. (1995), **11.** Sang (1996), 12. Sang et al. (1997), **13**. Herrera and Betancourt (2003), 14. Herrera and Betancourt (2004), 15. Steiner and Kabat (2004), 16. NHMLC (2005), 17. FMNH (2005), 18. NMNH (2005). Notes. Some taxonomic hierarchies may require bring up to date. Name in alphabetical order for family and species inside each group.

Phyllum	Class/Order	Family	Species	AI	AE
PORIFERA	Demospongiae	Agelasidae	*Agelas clathrodes* (Schmidt)		11
		Agelasidae	*Agelas conifera* (Schmidt)		11
		Aplysinidae	*Aplysina archeri* (Higgin)		11
		Aplysinidae	*Aplysina cauliformis* Carter		11
		Aplysinidae	*Aplysina fistularis* (Pallas)		11
		Aplysinidae	*Aplysina lacunosa* (Lamarck)		11
		Aplysinidae	*Verongula gigantea* (Hyatt)		11
		Aplysinidae	*Verongula rigida* (Esper)		11
		Callyspongiidae	*Callyspongia plicifera* (Lamarck)		11
		Callyspongiidae	*Callyspongia vaginalis* (Lamarck)		11
		Chalinidae	*Haliclona* sp.		11
		Clionidae	*Cliona langae* Pang		11
		Clionidae	*Cliona varians* (Duch. y Michelotti)		11
		Crambidae	*Monanchora unguifera* (Laubenfels)		11
		Desmacellidae	*Neofibularia nolitangere* (Duch. y Michelotti)		11
		Dictyonellidae	*Scopalina ruetzleri* (Wiedenmayer)		11
		Druinellidae	*Aiolochroia crassa* (Hyatt)		11
		Irciniidae	*Ircinia strobilina* (Lamarck)		11
		Mycalidae	*Mycale laevis* Carter		11
		Niphatidae	*Aka coralliphaga* (Ruetzler)		11
		Niphatidae	*Cribochalina vasculum* (Lamarck)		11
		Petrosiidae	*Xestospongia muta* (Schmidt)		11
		Spirophoridae	*Chondrilla nucula* Schmidt	6	
		Tedaniidae	*Tedania ignis* (Duchassaing y Michelotti)	1	
CTENOPHORA	Tentaculata	Mnemiidae	*Mnemiopsis* sp.	6	
COELENTERATA	Stylasterina	Stylasteridae	*Styllaster roseus* Pallas		18
Hydrozoa	Hydroida	Milleporidae	*Millepora alcicornis* Linnaeus	8	11
		Milleporidae	*Millepora complanata* Lamarck	8	11
		Milleporidae	*Millepora squarrosa* Linnaeus		11
Scyphozoa	Rhizostomeae	Cassiopeidae	*Cassiopeia* sp.	1	
Anthozoa	Actiniaria	Aiptasiidae	*Bartholomea annulata*	1	
	Scleractinea	Acroporidae	*Acropora palmata* (Lamarck)	8	11
		Agariciidae	*Agaricia agaricites* (Linnaeus)		11
		Agariciidae	*Agaricia fragilis* Dana		11
		Agariciidae	*Agaricia grahamae* Wells		11
		Agariciidae	*Agaricia humilis* Verrill		11
		Agariciidae	*Agaricia lamarcki* M. Edwards y Haime		18
		Agariciidae	*Agaricia tenuifolia* (Dana)		11
		Agariciidae	*Leptoseris cucullata* (Ellis y Solander)		11
Phyllum	Clase/Orden	Familia	Especies	AI	AE
		Astrocoeniidae	*Stephanocoenia intersepta* Lamarck		11
		Caryophyllidae	*Eusmilia fastigiata* (Pallas)		11
		Faviidae	*Colpophyllia natans* (Houttuyn)		11

		Faviidae	*Diploria clivosa* (Ellis y Solander)	8	11
		Faviidae	*Diploria labyrinthiformis* (Linnaeus)		11
		Faviidae	*Diploria strigosa* (Dana)		11
		Faviidae	*Favia fragum* (Esper)		11
		Faviidae	*Manicina areolata* (Linnaeus)		11
		Faviidae	*Montastraea annularis* (Ellis y Solander)		11
		Faviidae	*Montastraea cavernosa* (Linnaeus)	8	11
		Meandriniidae	*Dichocoenia stokesi* M. Edwards y Haime	8	11
		Meandriniidae	*Meandrina meandrites* Linnaeus		11
		Musiidae	*Isophyllastrea rigida* (Dana)		11
		Musiidae	*Mussa angulosa* (Pallas)		11
		Musiidae	*Mycetophyllia aliciae* Wells		11
		Musiidae	*Mycetophyllia danaana* M. Edwards y Haime		11
		Musiidae	*Mycetophyllia ferox* Wells		11
		Musiidae	*Mycetophyllia lamarckiana* M. Edwards y Haime		11
		Poecilloporidae	*Madracis decactis* (Lyman)		11
		Poecilloporidae	*Madracis formosa* Wells		11
		Poecilloporidae	*Madracis mirabilis* (Duchassaing y Michelotti)		11
		Poritiidae	*Porites astreoides* Lamarck		11
		Poritiidae	*Porites porites* (Pallas)	8	11
		Rhizangiidae	*Colangia immersa* Pourtales		18
		Siderastreidae	*Siderastrea radians* (Pallas)	1,8	11
		Siderastreidae	*Siderastrea siderea* (Ellis y Solander)		11
		Siderastreidae	*Solenastrea hyades* (Dana)		11
	Octocorallia	Anthothelidae	*Erythropodium caribaeum* (Duch. y Michelotti)	8	9,11
		Briareidae	*Briareum asbestinum* (Pallas)	8	9,11
		Gorgoniidae	*Gorgonia flabellum* Linnaeus	8	9,11
		Gorgoniidae	*Gorgonia mariae* Bayer		11
		Gorgoniidae	*Gorgonia ventallina* Linnaeus		9,11
		Gorgoniidae	*Muricea muricata* (Pallas)	8	9,11
		Gorgoniidae	*Muriceopsis flavida* Lamarck		9,11
		Gorgoniidae	*Pseudoplexaura flagellosa*		11
		Gorgoniidae	*Pseudopterogorgia acerosa* (Pallas)		9
		Gorgoniidae	*Pseudopterogorgia americana* (Gmelin)		9,11
		Gorgoniidae	*Pseudopterogorgia bipinnata* (Verrill)		9,11
		Gorgoniidae	*Pseudopterogorgia navia* Bayer		18
		Gorgoniidae	*Pterogorgia anceps* (Pallas)		11
		Plexauridae	*Eunicea mammosa* Lamouroux		9,11
		Plexauridae	*Plexaura homomalla* f. *homomalla* Bayer		9,11
		Plexauridae	*Plexaurella grisea* Kunze		9
		Plexauridae	*Plexaurella nuttans* Duch. y Michelotti		9,11
	Anthipatharia	Antipathidae	*Antipathes gracilis* Gray		18
	Stolonifera	Clavulariidae	*Carijoa rupicola* Muller		18
		Clavulariidae	*Carijoa riisei* (Duch. y Michelotti)		18
		Clavulariidae	*Scleranthelia musiva* Studer		18
		Clavulariidae	*Scleranthelia rugosa* Pourtales		18
	Telestacea	Telestidae	*Telesto* sp.		18
		Telestidae	*Telestula* sp.		18
MOLLUSCA	Scaphopoda	Dentaliidae	*Dentalium callipeplum* Dall		15
Phyllum	Clase/Orden	Familia	Especies	AI	AE
		Dentaliidae	*Dentalium matara* Dall		15
		Gadilidae	*Cadulus acus* Dall		15
	Gastropoda	Bullidae	*Builla striata* Bruguiere	17	

		Cassidae	*Cassis madagascariensis* Lamarck	10	
		Cassidae	*Cassis tuberosa* (Linnaeus)	10	
		Cerithidae	*Cerithium lutosum* Menke	17	
		Cypraeidae	*Cypraea zebra* Linnaeus	10	
		Ellobiidae	*Melampus bidentatus* Say	17	
		Fasciolariidae	*Fasciolaria tulipa* Linnaeus	1,2	
		Littorinidae	*Littorina angulifera* (Lamarck)	1,5	
		Littorinidae	*Littorina meleagris* (Potiez y Michaud)	17	
		Modulidae	*Modulus modulus* (Linnaeus)	17	
		Muricidae	*Phyllonotus pomun* Gmelin	1,2	
		Nassaridae	*Nassarius vibex* (Say)	17	
		Naticidae	*Natica marochiensis* Gmelin	17	
		Neritidae	*Nerita fulgurans* Gmelin	17	
		Neritidae	*Nerita peloronta* Linnaeus	17	
		Neritidae	*Neritina clenchi* Russell	3	
		Neritidae	*Neritina piratica* Russell	5	
		Neritidae	*Neritina virginea* Linnaeus	17	
		Neritidae	*Smaragdia viridis* (Linnaeus)	10	
		Olividae	*Olivella mutica* (Say)	17	
		Potamididae	*Batillaria minima* Gmelin	17	
		Propeamussiidae	*Parvamussium sayanum* (Dall)	18	
		Psammobidae	*Asaphis deflorata* (Linnaeus)	17	
		Psammobidae	*Sanguinolaria sanguinolenta* (Gmelin)	17	17
		Psammobidae	*Tagelus plebeius* Lightfoot	17	
		Ranellydae	*Charonia variegata* (Lamarck)	10,12	
		Strombidae	*Strombus costatus* Gmelin	8, 12	
		Strombidae	*Strombus gigas* Linnaeus	10, 12	
		Strombidae	*Strombus pugilis* Linnaeus	10, 12	
		Terebridae	*Hastula maryeelae* R. D. Burch		16
		Triphoridae	*Triphoris samanae* Dall	18	
		Trochidae	*Cittarium pica* (Linnaeus)	10	
		Trochidae	*Euchelus guttarosea* Dall	16	
		Turbinidae	*Arene miniata* Dall	17	
		Turbinidae	*Turbo castaneus* Gmelin	17	
	Bivalvia	Cuspidariidae	*Cuspidaria* sp.	3	
		Donacidae	*Donax variabilis* Say	17	
		Isognomonidae	*Isognomon alatus* (Gmelin)	5	
		Lucinidae	*Lucina muricata* (Sprengler)	17	
		Mytilidae	*Brachidontes recurvus* Rafinesque	5	
		Ostreidae	*Cassosstrea rhizophorae* Guilding	5	
		Pectinidae	*Chlamys munda* (Reeve)		18
		Pectinidae	*Nodipecten nodosus* (Linnaeus)		18
		Pectinidae	*Pecten chazaliei* Dautzenberg		18
		Pinnidae	*Pinna carnea* Gmelin	6	
		Semelidae	*Semele proficua* (Pulteney)	17	
		Veneridae	*Anomalocardia brasiliana* (Gmelin)	17	
		Veneridae	*Chione cancellata* Linnaeus	3	
	Polyplacophora	Chitonidae	*Chiton squamosus* Linnaeus	7	
	Cephalopoda	Loliginidae	*Sepiotheutis sepioidea* (Blainville)		12
Phyllum	Clase/Orden	Familia	Especies	AI	AE
		Octopodidade	*Octopus briareus* Robson		12
		Octopodidade	*Octopus vulgaris* Cuvier		12
ARTHROPODA	Stomatopoda	Squillidae	*Cloridopsis dubia* (H. Milne Edwards)	13	

	Natantia	Penaeidae	*Penaeus duorarum* Burkenroad	12	
		Penaeidae	*Penaeus schmitti* Burkenroad	12	
		Penaeidae	*Xiphopenaeus kroyeri* (Heller)	12	
	Brachyura	Gecarcinidae	*Cardisoma guanhumi* Latreille	4	
		Grapsidae	*Aratus pisoni* (Milne Edwards)	5	
		Grapsidae	*Geograpsus lividus* (H. Milne Edwards)	1,2	
		Grapsidae	*Goniopsis cruentata* (Latreille)	1,2	
		Grapsidae	*Grapsus grapsus* (Linnaeus)	7	
		Grapsidae	*Pachygrapsus gracilis* (Saussure)	1,2	
		Grapsidae	*Sesarma miersi* Rathbun	1,2	
		Majidae	*Mithrax spinossisimus* (Lamarck)	14	12
		Majidae	*Stenorhynchus seticornis* (Herbst)	1,2	
		Ocypodidae	*Ocypode quadrata* (Fabricius)	7	
		Ocypodidae	*Uca* sp.	2,5	
		Ocypodidae	*Ucides cordatus* (Linnaeus)	2,5	
		Portunidae	*Areneus cribarius* (Lamarck)	12	
		Portunidae	*Callinectes danae*	12	
		Portunidae	*Callinectes sapidus* Rathbun	12	
		Portunidae	*Lupella forceps* (Fabricius)	5	
		Portunidae	*Portunus gigbesi* (Stimpson)	2	
		Raninidae	*Raninoides lamarcki* Milne-Edwards y Bouvier		18
		Xanthidae	*Carpilius coralinus* (Herbst)	12	
		Xanthidae	*Panopeus herbsti* H. Milne Edwards	1,2	
	Palinura	Palinuridae	*Panulirus argus* (Latreille)		11,12
		Palinuridae	*Panulirus guttatus* (Latreille)		11,12
		Scyllaridae	*Scyllarides aequinoctialis* (Lund)		12
	Isopoda	Sphaeromatidae	*Sphaeroma terebrans* Bate	1,2	
ECHINODERMATA	Crinoidea	Comasteridae	*Nemaster rubiginosus*		14
		Comasteridae	*Neocomatella pulchella*		14
	Asteroidea	Ophidiasteridae	*Linckia guildingii* Gray	6,8	
		Oreasteridae	*Oreaster reticulatus* (Linnaeus)	6,10	10
		Cidaridae	*Eucidaris tribuloides* (Lamarck)	6,8	11
		Diadematidae	*Diadema antillarum* (Philippii)		14
		Echinometridae	*Echinometra lucunter* (Linnaeus)	8	11
	Echinoidea	Echinometridae	*Echinometra viridis* (Linnaeus)		14
		Toxopneustidae	*Lytechinus variegatus* (Lamarck)	6	
		Toxopneustidae	*Tripneustes ventricosus* (Lamarck)	6,10	11
	Holothuroidea	Holothuriidae	*Actinopyga agassizi* (Selenka)	6	
		Holothuriidae	*Holothuria mexicana* Ludwig	6	
		Stichopodidae	*Isostichopus badionotus* (Selenka)	6	

Lists of species of bony fish, sharks and rays reported for the region of Samaná, considering two distribution areas. **ES.** Estuary, AI. interior areas of the Bay of Samaná in habitats of mangrove swamps, marine grasses and reefs of scarce development for the estuary influence. **AE:** external areas of the Bay of Samaná in habitas of coralline reefs that are developed under the oceanic influence**.** *References.* **1** García (1981), **2.** Sang (1994), **3**. Sang and Martínez (1944), **4.** Sang and Lysenko (1994), **5**. Sang et al. (1994), **6**. Lockward et al. (1995), **7**. Sang (1996), **8**. Sang et al.

(1997), **9**. León (1997), **10**. Van Tassell (2002) **11**. CASCF (2005), **12**. NMNH (2005). Notes. Some taxonomic hierarchies may require bring up to date. Name in alphabetical order for family and species inside each group.

Family	Specie	AI	AE
Acanthuridae	*Acanthurus bahianus* Castelnau		2,7,8
	Acanthurus chirurgus (Bloch)	4,8	2,8
	Acanthurus coeruleus Bloch y Schneider		2,7,8
Albulidae	*Albula vulpes* (Linnaeus)	8	
Apogonidae	*Apogon* sp.		7
Atherinidae	*Hypoatherina harringtonensis* (Goode)	8	
Aulostomidae	*Aulostomus maculatus* Valenciennes		2,7
Balistidae	*Balistes capriscus* Gmelin	8	
	Balistes vetula (Linnaeus)	9	7,8
	Canthidermis sufflamen (Mitchill)		7,8
	Melichthys niger (Bloch)		8
	Xanthichthys ringens (Linnaeus)		8
Belonidae	*Tylosurus crocodilus* (Peron y LeSueur)	8	
Bleniidae	*Ophioblennius atlanticus* (Cuvier y Valenciennes)		7
Bothidae	*Citharichthys spilopterus* Gunther	8	
	Bothus lunatus (Linnaeus)		7
Carangidae	*Alectis ciliaris* (Bloch)	8	
	Caranx bartholomaei Cuvier	8,9	
	Caranx crysos (Mitchill)	8,9	
	Caranx hippos (Linnaeus)	9	7,8
	Caranx latus (Agassiz)	8,9	8
	Caranx lugubris Poey	9	
	Caranx ruber (Mitchill)	4,9	7,8
	Chloroscombrus chrysurus (Linnaeus)	5,8	
	Decapterus punctatus (Cuvier)	8	
	Oligoplites saurus (Bloch y Schneider)	8,9	
	Selene setapinnis (Mitchill)		8
	Selene vomer (Linnaeus)	8	
	Selar crumenophthalmus (Bloch)	8,9	8
	Seriola dumerili (Risso)		8,9
	Seriola rivoliana Cuvier		8,9
	Trachinotus falcatus (Linnaeus)	8,9	
	Trachinotus goodei Jordan y Everman	8,9	
	Uraspis secunda Poey	9	
Carcharhinidae	*Carcharhinus perezi* (Poey)		6
	Carcharhinus limbatus (Müller y Henle)		9
	Galeocerdo cuvier (LeSueur)		1,8
	Rhizoprionodon porosus (Poey)		7.8
Centropomidae	*Centropomus ensiferus* Poey	5,8	
	Centropomus undecimalis (Bloch)	8	
Chaetodontidae	*Chaetodon capistratus* Linnaeus		2
	Chaetodon striatus Linnaeus		7
	Chaetodon ocellatus Bloch		7
Family	Specie	AI	AE
	Chaetodon aculeatus (Poey)		7
Cirrhitidae	*Amblycirrhitus pinos* (Mowbray)		7
Clupeide	*Anchovia clupeoides* (Swainson)	5	
	Harengula clupeola (Cuvier)	8	
	Opisthonema oglinum (LeSueur)	8	

	Sardinella aurita Valenciennes	8	
Coryphaenidae	*Coryphaena hippurus* Linnaeus		8,9
Cynoglossidae	*Symphurus plagusia* (Bloch y Schneider)	8	
Dasyatidae	*Dasyatis americana* Hildebrand y Schroeder	6,8	
	Himantura schmardae (Werner)	8	
	Urolophus jamaicensis (Cuvier)	4	2,7
Eleotridae	*Gobiomorus dormitor* Lacepede	3	
Elopidae	*Elops saurus* Linnaeus	8	
Engraulidae	*Anchoa filifera* (Fowler)	8	
Engraulidae	*Anchoa lamprotaenia* Hildebrand	12	
	Centengraulis edentulus (Cuvier)	8	
Ephippidae	*Chaetodipterus faber* (Broussonet)	8	
Gerreidae	*Diapterus auratus* Ranzani	8	
	Diapterus rhombeus (Cuvier)	8	
	Eucinostomus gula (Cuvier)	8	
	Eucinostomus argenteus Baird y Girard	8	
	Eucinostomus melanopterus (Bleeker)	9	
	Gerres cinereus (Walbaum)	8,9	
Gobiidae	*Awaous tajasica* (Lichtenstein)	3,12	
	Bollmannia litura Ginsburg	10	
	Bathygobius sp.	3	
	Gobionellus sp.	3	
	Coryphopterus personatus (Jordan y Thompson)		2,7
	Coryphopterus sp.		2
	Gobisoma sp.		7
Grammidae	*Gramma loreto* Poey		7
Grammistidae	*Rypticus saponaceus* Scheneider		7,8
Haemulidae	*Anisotremus surinamensis* (Bloch)	8	8
	Anisotremus virginicus (Linnaeus)	8	8
	Conodon nobilis (Linnaeus)	8	
	Haemulon aerolineatum Cuvier		7,8
	Haemulon album Cuvier		8,9
	Haemulon bonaeriensi Cuvier	8	
	Haemulon carbonarium Poey	8	7,8
	Haemulon flavolineatum (Desmarest)	4	7,8
	Haemulon macrostomum Gunther	4,9	7,8
	Haemulon parrai (Desmarest)	8	7,8
	Haemulon plumieri (Lacépede)	9	7,8
	Haemulon sciurus (Shaw)	9	2,7,8
	Haemulon striatum (Linnaeus)		8
	Haemulon chrysargyreum Gunther		7
	Pomadasys corvinaeformis (Steindachner)	8	
Hemiramphidae	*Hemiramphus brasiliensis* (Linnaeus)	8	
Holocentridae	*Holocentrus ascencionis* (Osbeck)	8	7,8
	Holocentrus rufus (Walbaum)	8	2,7,8
	Holocentrus marianus (Cuvier)		7
	Holocentrus vexillarius (Poey)		7
Family	Specie	AI	AE
	Myripristis jacobus Cuvier		7,8
Istiophoridae	*Tetrapturus albidus* Poey		8,9
Kyphosidae	*Kyphosus sectatrix* (Linnaeus)	9	7,8
Labridae	*Bodianus rufus* (Linnaeus)	9	7,8
	Halichoeres bivittatus (Bloch)	4,9	2,7,8

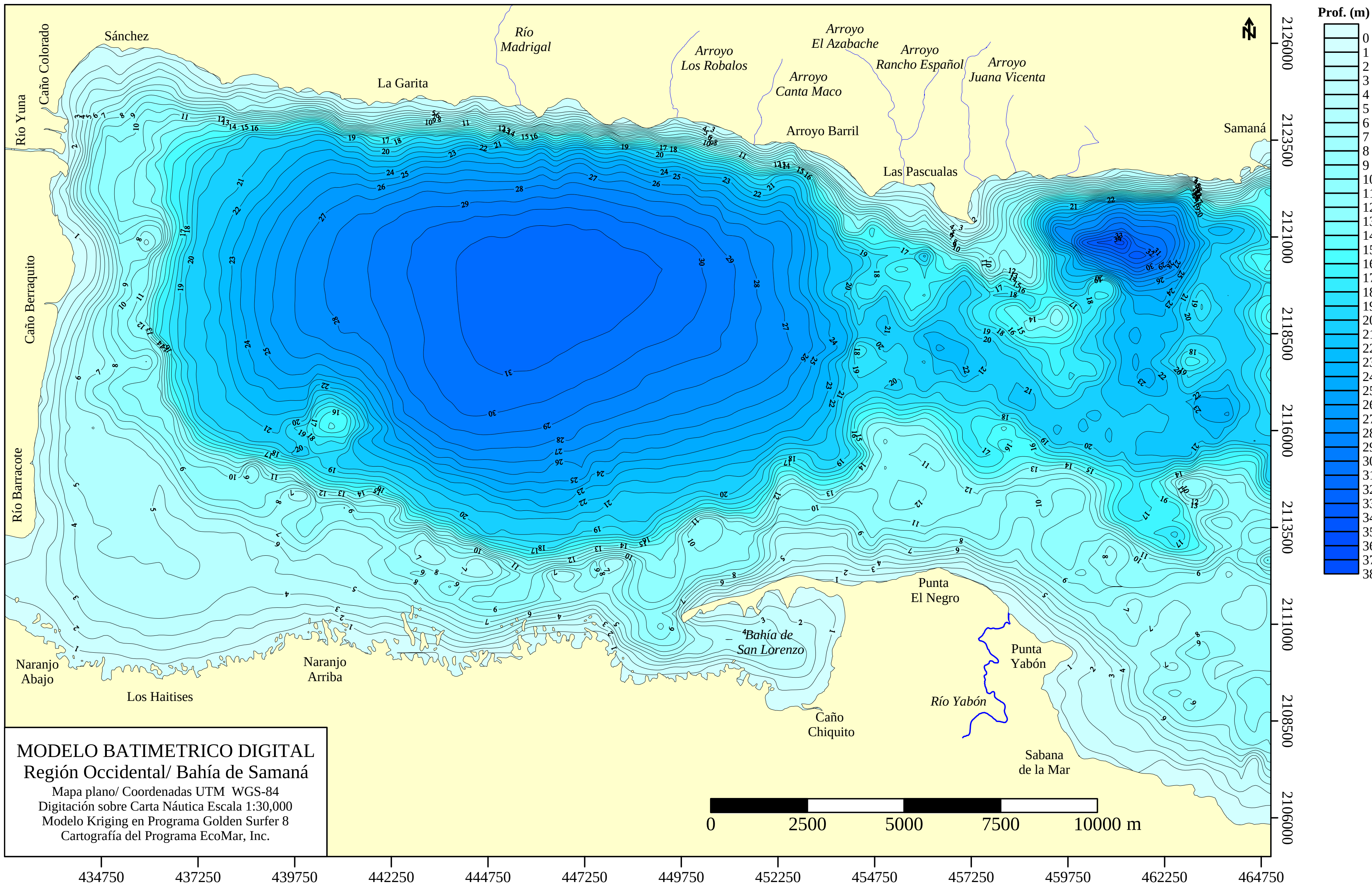
Family	Specie	AI	AE
	Halichoeres garnoti Valenciennes		2,7
	Halichoeres macupilinna (Muller y Troschell)		2,7
	Halichoeres poeyi (Steindachner)	4,9	2,7,8
	Halichoeres radiatus (Linnaeus)	9	7,8
	Lachnolainus maximus (Walbaum)		8
	Thalassoma bifasciatum (Bloch)		7,8
	Clepticus parra (Bloch y Schneider)		7
	Xyrichthys cf. splendens (Castelnau)		7
Labrisomidae	*Malacoctenus triangulatus* Springuer		7
	Malacoctenus gilli (Steindachner)	12	
	Labrisomus filamentosus (Springer)		7
Lobotidae	*Lobotes surinamensis* (Bloch)	8,9	8
Lutjanidae	*Apsilus dentatus* Guichenot		8
	Etelis oculatus (Valenciennes)		8, 9
	Lutjanus analis (Cuvier)	4,8,9	8
	Lutjanus apodus (Walbaum)	9	7,8
	Lutjanus bucanella (Cuvier)		8,9
	Lutjanus cyanopterus (Cuvier)		8
	Lutjanus griseus (Linnaeus)	3,5,8,9	
	Lutjanus jocu (Schneider)	9	7
	Lutjanus mahogoni (Cuvier)	9	7,8
	Lutjanus synagris (Linnaeus)	8,9	8
	Lutjanus vivanus (Cuvier)		8,9
	Ocyurus chrysurus (Bloch)	4,8,9	2,7
	Pristipomoides macrophthalmus (Muller y Troschel)	8,9	
	Rhomboplites aurorubens (Cuvier)	8,9	8
Malacanthidae	*Malacanthus plumieri* (Bloch)		7,8
Megalopidae	*Tarpon atlanticus* (Valenciennes)	8	
Monacanthidae	*Aluterus monoceros* Linnaeus	8	
	Cantherhines macrocerus (Hoolard)	8	7,8
	Cantherhines pullus (Ranzani)		7
	Monacanthus sp.	2,4	
Mugilidae	*Agonostomus monticola* Bancrofti	3	
	Mugil curema Valenciennes	8	
	Mugil hospes Jordan y Cuvier	8	
Mullidae	*Mulloidichthys martinicus* (Cuvier)	9	7,8
	Pseudupeneus maculatus (Bloch)	9	2,7,8
Muraenesocidae	*Cynoponticus savanna* (Brancroft)	8	
Muraenidae	*Gymnothorax vicinus* (Castelnau)	4	
	Gymnothorax funebris (Ranzani)	4	
	Muraena miliaris (Kaup)		7
Myliobatidae	*Aetobatus narinari* (Euphrasen)	8	
Ophidiidae	*Lepophidium brevibarbe* (Cuvier)	8	
Orectolobidae	*Ginglymostoma cirratum* (Bonnaterre)		7
Ostracidae	*Lactophrys bicaudalis* (Linnaeus)	8	7,8
	Lactophrys quadricornis (Linnaeus)	8	
	Lactophrys triqueter (Linnaeus)		7,8
	Lactophrys tricornis Linnaeus	12	
Pempheridae	*Pempheris schomburgkii* Müller y Troschel		7
Polymixidae	*Polymixia lowei* Gunther		8
Polynemidae	*Polydactylus virginicus* (Linnaeus)	8,9	8
Pomacanthidae	*Holacanthus ciliaris* (Linnaeus)	8	7,8

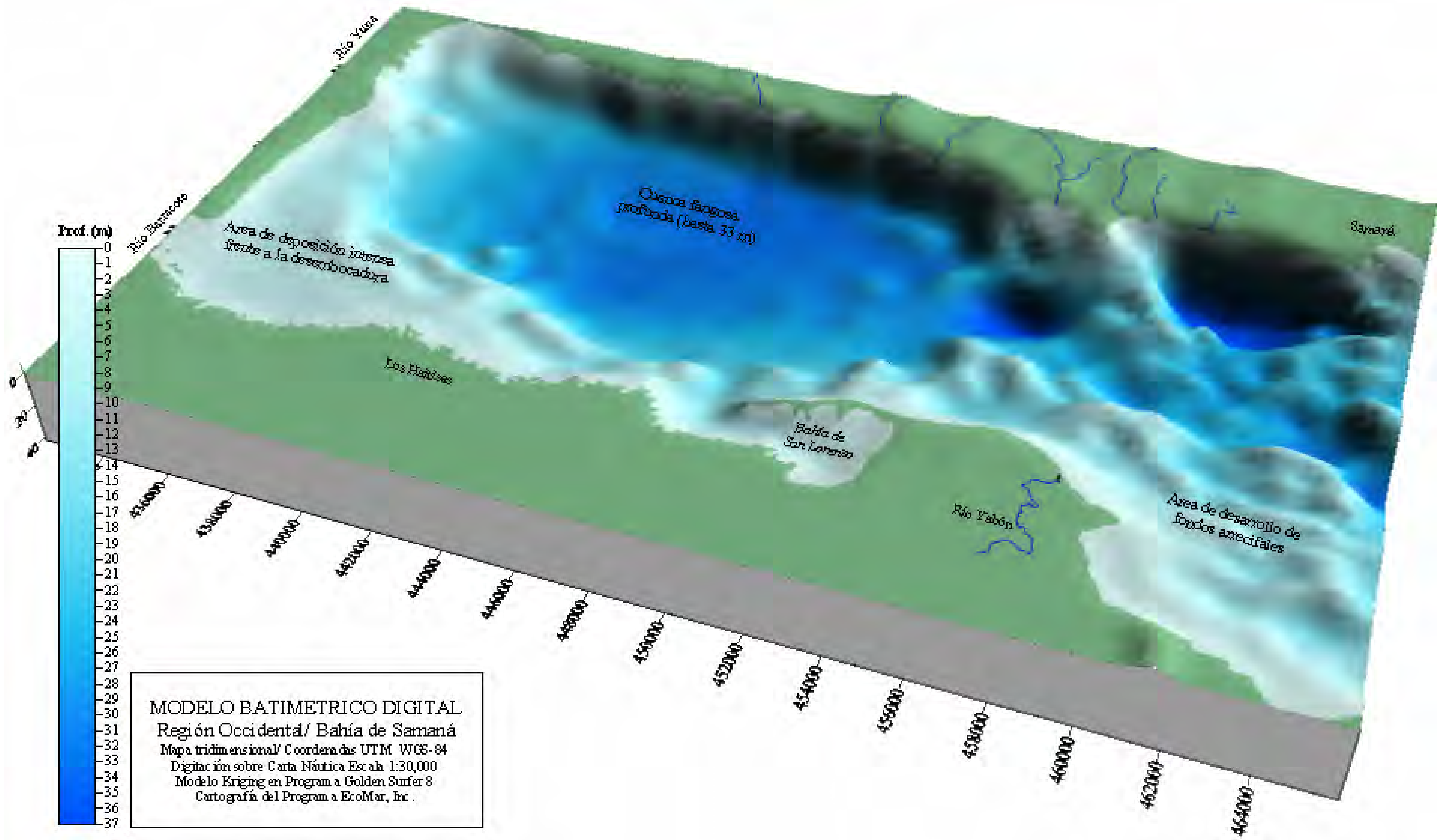
	Holacanthus tricolor (Bloch)		7
	Pomacanthus arcuatus (Linnaeus)	2,8,9	
Pomacentridae	*Abudefduf saxatilis* (Linnaeus)		7
	Chromis cyanea (Poey)		7
	Chromis multilineata (Guichenot)		7
	Microspathodon chrysurus (Cuvier)		2,7
	Stegastes variabilis (Castelnau)		2
	Stegastes dorsopunicans (Poey)		2
	Stegastes partitus (Poey)		2,7
	Stegastes planifrons (Cuvier y Valenciennes)		2
	Stegastes fuscus Cuvier		7
	Stegastes leucostictus (Muller y Troschel)		7
	Stegastes diencaeus Jordan y Rutter		7
	Stegastes variabilis (Castelnau)		7
Priacanthidae	*Cookeolus japonicus* Cuvier		8
	Priacanthus cruentatus (Lacepede)	8	7,8
Pristigasteridae	*Chirocentrodon bleekerianus* (Poey)	8	
Rachycentridae	*Rachycentron canadum* (Linnaeus)	8	
Scaridae	*Nicholsina usta* (Cuvier y Valenciennes)	8	
	Scarus coeruleus (Bolch)	9	2,12
	Scarus iserti (Bloch)	4	2, 7,8
	Scarus taeniopterus Desmarest	4	7,8
	Scarus vetula Bloch y Schneider	9	7,8
	Scarus guacamaia Cuvier	7	
	Sparisoma aurofrenatum (Valenciennes)	9	2,7,8
	Sparisoma chrysopterum (Bloch y Schneider)	9	7,8
	Sparisoma radians (Valenciennes)	8	
	Sparisoma rubripinne (Cuvier y Valenciennes)	4, 9	7,8
	Sparisoma viride (Bonaterre)	9	2,7,8,12
	Sparisoma atomarium (Poey)		7
Sciaenidae	*Bairdiella ronchus* (Cuvier)	8	
	Bairdiella sanctae-luciae (Jordan)	8	
	Cynoscion jamaicensis (Vaillant y Bocourt)	5,8,9	
	Larimus breviceps (Cuvier)	5,8	
	Menticirrhus americanus (Linnaeus)	8	
	Micropogonias furnieri (Desmarest)	8,9	
	Stellifer colonensis Meek y Hildebrand	8	
	Odontoscion dentex (Cuvier)	8	2,7,8
	Umbrina coroides (Cuvier)	8	9
	Equetus acuminatus (Schneider)		7
Scombridae	*Acanthocybium solandri* (Cuvier)		8,9
	Scomberomorus cavalla (Cuvier)	8	8
	Scomberomorus regalis (Bloch)	9	7,8
	Scomberomorus maculatus (Mitchill)		9
	Thunnus obesus (Lowe)		8,9
	Thunnus albacares (Bonnaterre)		8,9
	Katsuwomus pelamis (Linnaeus)		8

Family	Specie	AI	AE
Scyliorhinidae	*Apristurus riveri* Bigelow y Schroeder		12
	Apristurus laurussoni (Saemundsson)		12
Serranidae	*Alphestes afer* (Bloch)		8
	Diplectrum formosum (Linnaeus)	4	
	Ephinephelus adscencionis (Osbeck)	9	7,8

	Ephinephelus cruentatus (Lacépede)	9	7,8
	Ephinephelus fulvus (Linnaeus)	8	7,8
	Ephinephelus guttatus (Linnaeus)	2,8	8,9
	Ephinephelus itajara (Lichtenstein)		6,8,9
	Ephinephelus striatus (Bloch)	9	7,8
	Hypoplectrus puella (Cuvier y Valenciennes)	4	2,7,8
	Hypoplectrus nigricans (Poey)		2
	Hypoplectrus unicolor (Walbaum)		2
	Hypoplectrus chlorurus (Valenciennes)		7
	Mycteroperca bonaci (Poey)		8
	Mycteroperca venenosa (Linnaeus)	9	7,8
	Mycteroperca tigris Valenciennes		7
	Serranus tabacarius (Cuvier)		8
	Serranus phoebe (Poey)		8
	Serranus tigrinus (Bloch)		7
	Paranthias furcifer (Valenciennes)		7,8
Sparidae	*Archosargus rhomboidalis* (Linnaeus)	8,9	
	Calamus penna (Valenciennes)	8	
	Calamus pennatula Guichenot	8,9	8
Sphyraenidae	*Sphyraena barracuda* (Walbaum)	6, 9	7,8
	Sphyraena guagancho Cuvier	8,9	
	Sphyraena picudilla (Poey)	8	
Stromateidae	*Peprilus paru* (Linnaeus)	8	
Synodontidae	*Synodus foetens* (Linnaeus)	8	
	Synodus intermedius (Agassiz)	8	2,7,8
Syngnathidae	*Cosmocampus elucens* Poey		11
Tetraodontidae	*Canthigaster rostrata* (Bloch)		2,7
	Lagocephalus laevigatus (Linnaeus)	8	
	Sphoeroides testudineus (Linnaeus)	4	
	Sphoeroides spengleri (Bloch)		2,7
Trichiuridae	*Trichiurus lepturus* (Linnaeus)	5,8	
Triglidae	*Prionutus punctatus* (Bloch)	8	

ANEXX II.
DIGITAL BATHYMETRIC MODEL:
2 AND 3-DIMENSIONAL


MODELO BATIMETRICO DIGITAL
Región Occidental/ Bahía de Samaná
Mapa plano/ Coordenadas UTM WGS-84
Digitación sobre Carta Náutica Escala 1:30,000
Modelo Kriging en Programa Golden Surfer 8
Cartografía del Programa EcoMar, Inc.
Prof. (m)
Sánchez
Caño Colorado
Río Yuna
Caño Berraquito
Río Barracote
Naranjo Abajo
Los Haitises
Naranjo Arriba
La Garita
Río Madrigal
Arroyo Los Robalos
Arroyo Canta Maco
Arroyo El Azabache
Arroyo Rancho Español
Arroyo Juana Vicenta
Arroyo Barril
Las Pascualas
Samaná
Punta El Negro
Bahía de San Lorenzo
Caño Chiquito
Punta Yabón
Río Yabón
Sabana de la Mar
0 2500 5000 7500 10000 m
434750 437250 439750 442250 444750 447250 449750 452250 454750 457250 459750 462250 464750
2126000 2123500 2121000 2118500 2116000 2113500 2111000 2108500 2106000


Río Yuna
Río Barracote
Prof. (m)
Area de deposición intensa frente a la desembocadura
Cuenca fangosa profunda (hasta 33 m)
Samaná
Los Haitises
Bahía de San Lorenzo
Río Yabón
Area de desarrollo de fondos arrecifales
436000
438000
440000
442000
444000
446000
448000
450000
452000
454000
456000
458000
460000
462000
464000
MODELO BATIMETRICO DIGITAL
Región Occidental/ Bahía de Samaná
Mapa tridimensional/ Coordenadas UTM WGS-84
Digitación sobre Carta Náutica Escala 1:30,000
Modelo Kriging en Programa Golden Surfer 8
Cartografía del Programa EcoMar, Inc.