DESIGN OF A MARINE PROTECTED AREA FOR PUNTA COMISARIO, SAN ONOFRE, SUCRE, COLOMBIAN CARIBBEAN COAST.

SUMMARY

Based on an ecoregional planning exercise for the selection of priority conservation sites in the Colombian Caribbean and the qualification of ecological criteria, the ECOCEANOS Corporation identified Punta Commissioner on the coast of Colombia as a potential site for the establishment of a marine protected area (MPA). This area presents a mosaic of marine and coastal ecosystems that cover countless fish, planktonic, benthic communities and species that, together with the environment, constitute an area of high heterogeneity and unique biodiversity in the department of Sucre, Colombia. The purpose of this work was to design an MPA in agreement with the Zenú indigenous community that inhabit the coasts of San Onofre, based on the evaluation of ecological criteria, conservation objectives and proposed management; postulating a management category within the current National System of Protected Areas (SINAP). Therefore, based on secondary information and following The Nature Conservancy's methodological scheme for "Five S Scheme" site planning, five coarsely filtered conservation objects (OCs) or habitats were identified: coral formations, phanerogam meadows, sandy beaches, rocky coastline and mangrove forests. White mangrove (Laguncularia racemosa), red mangrove (Rhizophora mangle), which are in danger of extinction, their presence is conditioned to high water tables and exchange of fresh and saline water, other species present are: Zaragoza (Conocarpus erecta), Smoke mangrove (Avicennia germinans). In the area we also find fish; such as sawfish (Pristis pectinata), tarpon (Megalops atlanticus), guasa grouper (Epinephelus itajara), which are critically endangered. A feasibility analysis was developed for each object finding the area in a good state of biodiversity health. The analysis of criteria, the feasibility and the definition of the management objectives of the area allowed to postulate the management category "National Natural Park" as the most appropriate for the area. On the other hand, from a systematized process and with the help of a decision support system (SSD) called MARXAN (University of Queensland), three intangible zones were identified with which the minimum protection of 30% coverage of each of the objects is guaranteed, as an initial contribution to the internal zoning of the MPA.

Key words: Marine Protected Areas, Gulf of Morrosquillo, Biodiversity, MARXAN, National Natural Park.

By: ECOCEANOS org

INTRODUCTION

Colombia is a country with 1'137,814 km2 of continental area, has approximately 3,531 km of coastline in the Pacific Ocean and the Caribbean Sea, which give it another 892,102 km2 of jurisdictional waters (Invemar, 2012), for a total area of approximately 2,070,408 km2. The first Protected Areas (PA) created in Colombia make up the National Natural Park System (SPNN) and date back to the 70s. The number of PAs in Colombia has been increasing since then, including not only new areas of the SPNN but areas established by regional, local, private and civil society bodies. Protected areas represent the main biodiversity conservation strategy, however, in Colombia as in other regions of the world, many of these areas have been created by opportunity cost and / or political and social decisions and conjunctures that have not considered planning tools and technical criteria for their selection and delimitation.

Within the 54 protected areas belonging to the SPNN only 12 areas are marine protected areas (MPAs) that is, marine and / or coastal character, in total the SPNN represents only 4.4% of the national territory if the 988,000 km2 of marine territory are included. Thus, less than 1% of Colombia's marine areas are protected by protection figures belonging to the SPNN. When protection figures declared by Resolution through MAVDT (Agreement 021 of 2005 and Resolution 679 of 2005) are taken into account, the percentage protected is around 8%. However, when including international figures such as Biosphere Reserves and Ramsar, the figure increases by 32%, mainly due to the extension of the SeaFlower Biosphere Reserve in the Archipelago of San Andrés, Providencia and Santa Catalina (300,000 km2).

Based on the above, the ECOCEANOS Corporation develops this study called: "DESIGN OF A MARINE PROTECTED AREA FOR PUNTA COMISARIO- SAN ONOFRE, SUCRE, COLOMBIAN CARIBBEAN COAST", where the priority conservation site for the area of the Gulf of Morrosquillo is delimited, particularly for the coasts of San Onofre due to the presence of several species of flora and fauna in danger of extinction, as they are; White mangrove (Laguncularia racemosa), red mangrove (Rhizophora mangle), Sawfish (Pristis pectinata), Tarpon (Megalops atlanticus), Guasa grouper (Epinephelus itajara). A design of an MPA is proposed based on the evaluation of ecological criteria and the selection of viable conservation objects, generating an appropriate management category according to the objectives and advancing in the first inputs for the internal zoning of the area.

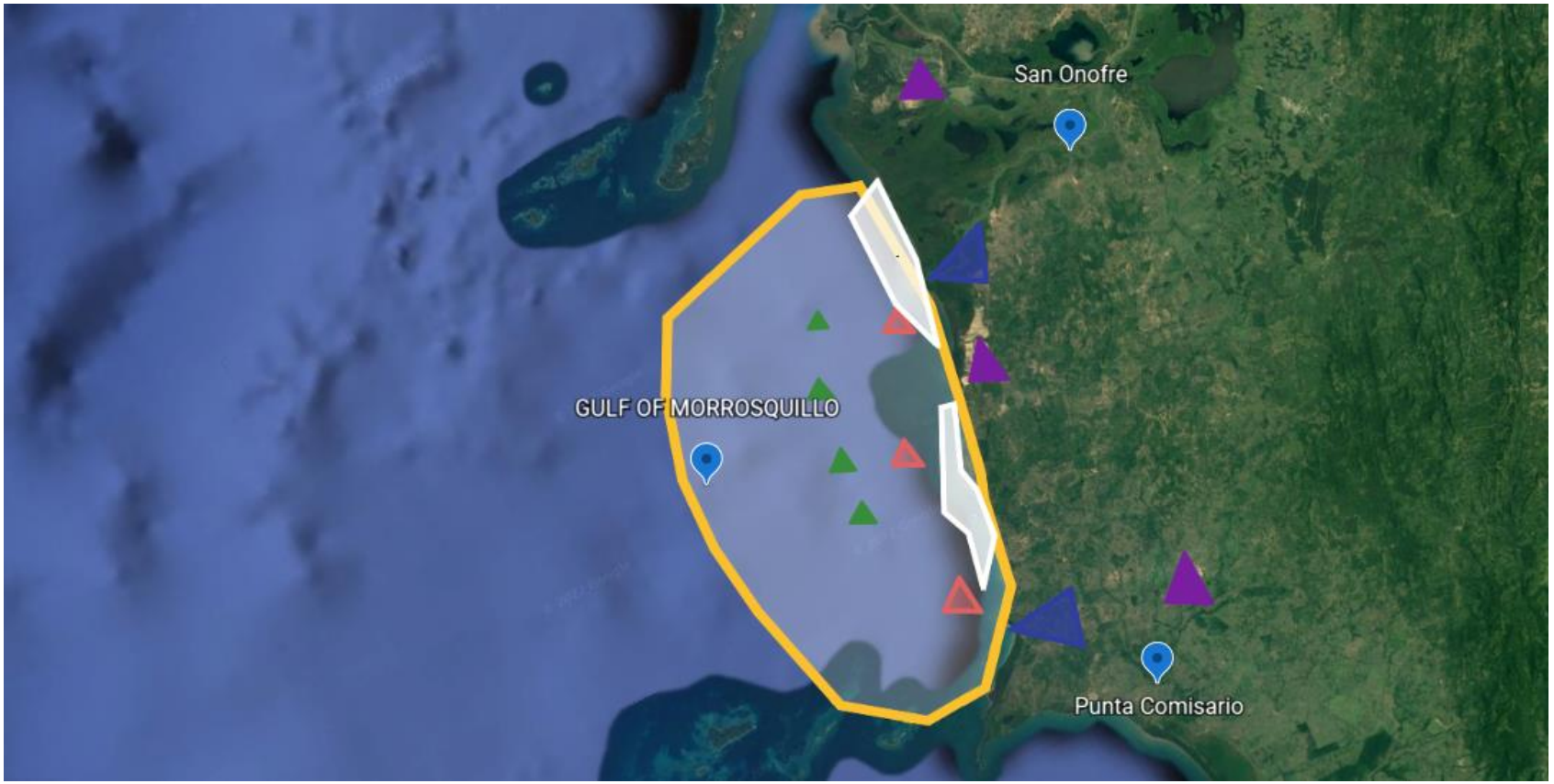
STUDY AREA

The area taken was 120km2 Ha of the coasts between Punta Commissioner and San Onofre, located in the Gulf of Morrosquillo, which is located south of the Colombian Caribbean coast, between the departments of Córdoba and Sucre. Its approximate area is 1000 km2. In general terms, it is a very light gulf, on average it has depths between 15m and 55m. It presents marine conditions with high salinity (34 to 37), restricting continental influence only to runoff during the rainy season (May to November) (Solano, 1994; INVEMAR, 2004).

There are coral formations concentrated on the south and western sides of the bay, which develop from the middle level of the tide to four meters deep (Solano, 1994). The bottom consists mainly of fine clay sediments; however, the southwestern sector is largely dominated by sandy substrates with a considerable bioclastic component (Díaz et al., 2003). The coastline is surrounded by mangrove forests and seagrasses that develop along the coast.

The human population in the gulf is mostly made up of tribes of the Zenú indigenous community in Punta Commissioner and San Onofre, the approximate population is 16,000 inhabitants, however, the number of inhabitants has varied as a result of displacement due to violence and lack of opportunities. The economy of the Zenú Indians is based on agriculture, livestock, timber trade, handicrafts, hunting and fishing. Likewise, although fishing has economic importance for the indigenous people who live near the coast, it is considered a work of the poor class and of lower hierarchy.

STUDY AREA MAP



Conventions

	Study area map
	Endangered mangroves
	Zenú indigenous town
	Estuaries
	Traditional fishing
	Megalops atlanticus

Scale

1cm = 50,000m

1.Departments: Sucre.
2.Country: Colombia.
3.Geographical coordinates
From Punta Comisario:
9°43'49.1"N75°36'54.5"W, - 9°47'56.3"N 75°45'09.2"W.
To San Onofre:
9°50'49.1"N 75°34'07.1"W, 9°51'40.6"N 75°40'04.3"W.

MATERIALS AND METHODS

As a general method for the design of the MPA, the planning methodology for the conservation of sites or "Five S Scheme for the conservation of sites", developed by The Nature Conservancy (2000a), was followed, where the name "five S" comes from the five elements that are evaluated and that begin with the letter s in English: systems/systems (conservation objects found on the site and the natural processes that sustain them, on which planning will focus), stresses/pressures (types of degradation or destruction that affect conservation objects or ecological processes on the site), sources/sources (agents that generate the pressures), strategies/strategies (types of conservation activities used to mitigate pressure sources and persistent pressures) and Success/success (measures of biodiversity health and threat mitigation at a site). The present investigation only evaluated the first three elements. The definition of conservation objects (systems) and critical threats (pressures and pressure sources) were the first steps in MPA planning; likewise, the evaluation of ecological criteria for its delimitation and zoning was approached from the methodology developed by Roberts. (2003a) and adapted to the conditions of the study.

Selection of conservation objects: The selection of conservation objects (OdC) emerged from the list obtained in the ecoregional planning exercise for the design of the MPA network in the Colombian Caribbean, where the objects were reviewed taking into account the planning of the sites, their possible threats and the subsequent development of strategies and actions to combat the dangers (Alonso et al., 2008). Based on the above, the list of focal objects in the study area was made. From the strategy of "coarse filter" (ecological systems and communities) and "fine filter" (species or sites of congregation of species) eight CMOs were selected that met the following criteria: (1) reflect ecoregional conservation goals, (2) adequately represent the different levels of biodiversity organization and spatial or geographical distribution (from regional to local) and (3) present high levels of threat. Once these objects were identified, the greatest amount of secondary information was collected; In addition, a field trip was carried out where, from the remote sensing tools (ASTER Image 2001) and with the help of a Global Positioning System (GPS) (GARMIN, eTrex Venture), the distribution and extension of coarse filter OdC was verified. At the same time, information was collected on the current state of the objects, their different uses, the state of resources and their possible variations over time and main threats, using two data collection methods called: direct observation (qualitative descriptions of what the group observed) and semi-structured interviews (based on a set of open questions or discussion points) proposed by Brunce et al. (2000) for socioeconomic assessments on coral reef management; the consultations were worked with Zenú indigenous communities, the main inhabitants of the area. Finally, the information was fed into a Geographic Information System (GIS) with the help of ArcView 3.2 Software.

Object feasibility assessment: In order to determine the long-term viability of ODCs on the site, we worked with the automated book in Microsoft Excel, "Workbook for Site Conservation and Conservation Success Measures" developed by TNC (2000b). The information used to incorporate it into the book was compiled from existing literature, expert criteria of the University of the Caribbean CECAR and field observations; finally, each OC was assigned one of the four general hierarchical levels (VjG) defined as follows: very good = 1 (ecologically desirable state, requires little intervention for maintenance); good = 2 (requires some intervention for its support); regular = 3 (requires human intervention) and poor = 4 (needs high levels of protection); this final score was obtained through the evaluation of three ecological criteria: (1) Size (measure of the area or abundance of the ODC locations), (2) Condition (integral measure of the composition, structure and biotic interactions that characterize it) and (3) Landscape context (integral measure of the dominant environmental regimes and processes that establish and maintain the location

of the OdC and connectivity). For the definition of these VjG, the combinations of values proposed by the authors were followed (TNC, 2000a). A weighting value of 1 was used for coarse filter OdC and 0.75 for fine filter objects, because objects of a high biological level (ecological systems) dominate the functioning and health of lower-level objects (TNC, 2000b).

Delimitation: The identification of appropriate ecological boundaries and area size is the biggest problem in the design of an MPA, because there is no general rule for optimal design and size (Roberts and Hawkins, 2000; Salm et al., 2000). The debate of a "large or several small area" or SLOSS (Single Large Or Several Small), much discussed in terrestrial settings, is also the main problem in the design of marine areas (Carr et al., 2003). However, for MPAs to have lasting economic and social value, they must be biologically effective and their long-term stability depends on the protection of entire marine communities. Today, regardless of size, MPAs have shown multiple benefits; however, they should be large enough to include habitats that are viable in the long term (Roberts and Hawkins, 2000; Roberts et al., 2003a). For this research, the following three assumptions were established as the first approximation to the delimitation of the area, namely:

- The area shall contain full coverage of the eight selected OCs.
- The inland boundary will be from a buffer of 200 m (buffer zone) from the outer perimeter of the ground objects. This was estimated as the optimal distance to mitigate possible disturbances by human activities.

Identification of intangible zones: The identification of intangible zones as an initial input to the zoning process of the MPA allows to safeguard a sample of ecosystems with the least possible human interference and where for this case the extraction of resources is prohibited. For the process of selecting intangible zones, the decision support system (SSD) or MARXAN software (version 1.8.2) was used, designed in Australia by Ball and Possingham (2000) and used mainly in recent years for the design of MPA networks, but very little explored to carry out zoning exercises within MPA. As an initial step, a grid of 6632 planning units (UP) of hexagonal shape was generated for the study area, with an area of 2.6 ha each.

The objective function used by the SSD was (Ball and Possingham, 2000):

$$= \Sigma Cost + BLM\ \Sigma Boundary + \Sigma Penalty$$

Where: Cost: is the total cost of all selected UPs, which can be measured as the area of the UP, or the economic, social cost or a combination of these. Boundary: is the perimeter around the selected UPs. BLM (Boundary Length Modifier): is the perimeter length modification factor, which controls the importance of the perimeter length relative to the cost of the selected UPs, where the higher the BLM the less fragmentation. Penalty: is an additional penalty value in the function for all goals that are not met, based on the cost and length of additional perimeter necessary to meet them.

In order to execute the SSD, it was necessary to define in advance quantitative conservation goals for each of the eight OCs, which are explicit descriptions of the desired state of viability for an OC (Groves et al., 2000). Some authors claim that at least 20% of each habitat type must be under a strict category or total protection (no extraction) also called intangible or "no take" (Bohnsack, 1996; Schmidt, 1997; NRC, 2001); Likewise, numerous investigations affirm that increasing these goals between 20 and 50% for each habitat generates an enormous biological benefit, which with a good implementation serves as an effective tool

at the economic level, both for the sustainability of fisheries and for snorkeling, among other non-consumptive activities (Robert and Hawkins, 2000; NRC, 2001; Leslie et al., 2003; Roberts et al., 2003a, 2003b, 2003c; Prada, 2004; Loos, 2006). According to the above, a value of 30% was set as a strict conservation goal for all OCs. Table 1 compared the targets proposed by different authors with the specific objective of representing biological diversity.

Meanwhile, the process executed by MARXAN produced two graphic outputs, called the "best solution" and the "added solution"; the last one was the one that directed the exercise of identification of intangible zones, since it identified the number of times that each UP was selected during the total number of runs, indicating the irreplaceable UPs, that is, the units that were always selected to meet the conservation goals. For this exercise the number of runs was 300 with 1 million iterations each and a BLM of 0.2 was identified.

Table 1. Values of the conservation goals used by different authors for the representation objective of biological diversity.

Objective	Goal of conservation	Criterion	Cites
Representation of diversity biological	10 -36 %	Representation of species and complementarity	Turpie (2000)
	36%	Habitat representativeness	Bustamante(1999)
	40%	Species and Habitat Assemblage	Ward (1999)
	10%	Representation or replication of habitats	Halfpenny & Roberts
	37 – 56%	Representative habitats	Sala. (2002)
	5 – 50%	Representative habitats and species	Areces (2003)
	30 – 60%	Representative habitats and species (fishes)	Friedlander(2003)
	28 – 50%	Representative habitats	Alonso(2004)
	30-50%	Representative habitats and species	Airamé(2003)
	30%	Representativeness of habitats and species	Present research

RESULTS AND DISCUSSION

Selection of conservation objects The eight OCs identified that met the three criteria defined for their selection were, at the level of ecological systems or coarse filter: coral formations, phanerogam meadows, sandy beaches, rocky coastline and mangrove forests; and at the fine filter level, areas with the presence of Pristis pectinata, sea turtle feeding areas and seabird congregation areas. This step was made from the hypothesis that by establishing multiple objects at high biological levels (coarse filter) most of the species associated with them (fine filter) will be conserved (Noos et al., 1997; Anderson et al., 1999). In this case,

33 species including fish, corals, mollusks, crustaceans, reptiles, echinoderms and birds present in Gulf of Morrosquillo, identified in the red books of Colombia in some category of threat (Table 2), would be "covered" through the protection of the OdC at the habitat level. In this way, the biological processes between the different threatened species found for the area and the selected objects, allow us to suppose that by conserving these, the protection of the greatest amount of biodiversity present in the study area would be guaranteed.

The selection of the three fine filter objects was based on their relevance and not being captured within the coarse filter OCs that support them. Sea turtle feeding areas and seabird congregation areas were selected for this exercise, as they are important contributions to current and future networks of functional sites that support these populations at broader regional conservation levels (Ceballos-Fonseca, 2004; Franco-Maya and Bravo, 2005) and the areas with the presence of Laguncularia racemosa and Rhizophora mangle, which is an endangered species (Castaño-Mora, 2002), requires special conditions and requirements for its management, as proposed by Abadía (1995) and Rodríguez (2000) for San Onofre and for other areas of the Colombian Caribbean (Rodríguez, 2002). Overall, the selected CMOs represent or encompass the "greatest" biodiversity for the Gulf at different levels of biological organization and geographic scales, thus providing a more ecologically comprehensive conservation strategy, as proposed by Poiani et al. (2000). The identification of only eight OCs is important, as developing feasible conservation strategies and actions for the larger number of sites would be difficult to manage; However, it should not be ignored that this selection must be an iterative process over time, so the bay must continue to be evaluated, and to the extent that the information gaps are filled (in the behavior of the ecological processes of the site and its threats) it will be possible to change objects both for new action strategies, as for new threats or even if the conservation scenario changes definitively. Likewise, developing new biological, ecological, environmental monitoring, among others, research would be an important tool for the continuation of this design.

Table 2. List of habitats, places of importance and species with some type of threat to the area of the Gulf of Morrosquillo

Object type	Conservation Object
Habitats	Coral formations, seagrass meadows, beaches sandy beaches, rocky coastline, mangrove forests, muddy bottoms and sedimentary.
Biologically Important Areas	Presence of Pristis pectinata, turtle feeding, aggregation of seabirds, reproductive aggregations, breeding fish and juvenile lobster.
Marine fish species	Pristis pectinata, Megalops atlanticus, Epinephelus itajara, Gerreidae, Centropomus undecimalis and others.

Coral species	Acropora, Dendrogyra cylindrus, fungiidae and Leptopsammia.
Mollusk species	Bittium varium, Parvanachis obesa, Isognomon alatus, and Columbella mercatoria.
Crustacean species	Corophium sp., Liljeborgia sp. , Amphilophus sp., and Paratanais sp.
Echinoderms species	Astropecten nitidus Verrill.
Bird species	Volantina jacarina, Agelaius icterocephalus, Campylorhynchus griceus, Melanerpes rubricapillus.
Reptile species	Eretmochelys imbricata.

VIABILIDAD

Finding the viability of CMOs for the establishment of an MPA is a process of great importance, in which the ability of a species, community or ecological system to persist for generations for a given period is determined, ensuring that in the chosen site they are as functional as possible and that they have the probability of remaining over time (Groves et al., 2000). The final evaluation for the OC in the bay showed a good VjG when adding the partial results of the objects with respect to the three qualifying criteria; however, the exception of the object of "areas with presence of Laguncularia racemosa" where this value was poor was presented, that is to say that its restoration is difficult and requires immediate intervention by man since it could disappear in the area.

Table 3. Feasibility rating matrix for conservation targets versus ecological attributes of size, condition and landscape context, with its hierarchical value (Vj) and ponderation weight (p), value general hierarchical (GvG) of viability and global qualification of the health of biodiversity for the coasts of San Onofre in the Gulf of Morrosquillo.

Conservation objects	Size		Condition		Context landscape		VjG
	VJ	P	VJ	p	VJ	p	
Coral formations	Good	1	Regular	1	Good	1	Good
Seagrass meadows	Good	1	Good	1	Good	1	Good
Sandy beaches	Regular	1	Good	1	Good	1	Good
Rocky coastline	Good	1	Good	1	Good	1	Good
Sites with Megalops atlanticus	Regular	1	Regular	1	Regular	1	Regular
Sites with Laguncularia racemosa	Low	0.75	Low	0.75	Regular	0.75	Low
Sea turtle feeding	Good	0.75	Regular	0.75	Good	0.75	Good

Sites of importance for birds	Good	0.75	Good	0.75	Good	0.75	Good
Global Biodiversity Health Score							Good

In general, there is a good level of viability, which can be translated into a good "state of health of biodiversity" (TNC, 2000b), which is corroborated by the results of the monitoring obtained by INVEMAR (1988, 1992, 2004) regarding the effects produced by coal port facilities on the representative marine ecosystems of the area, as well as those specifically recorded by Díaz et al. (2000) for coral formations and Díaz et al. (2003) for seagrasses. According to Poiani and Richter (1999), biodiversity health is a general measure of functionality at the landscape or site level, so it can be presumed that under current conditions the Gulf of Morrosquillo has a good capacity to maintain healthy OCs in addition to supporting key ecological processes within its natural ranges of variability in the long term.

HANDLING CATEGORY

In recent years, through the coordination of the UAESPNN, the country has turned to strengthening the National System of Protected Areas (SINAP). During this process, a technical proposal on the new possible management categories has been generated (Sguerra, 2005), based on several technical documents (Biocolombia, 2000; Fandiño-Lozano, 2001; 2004; Andrade, 2005) in which an in-depth review of the current categories is made, based on the provisions of Decree 622 of 1977, which establishes the general regulations to be taken into account for the declaration of areas with relevant values for the national heritage. According to the ecological conditions defined for the Gulf of Morrosquillo from the feasibility analysis, it was determined that the main objective of the area is to contribute to the conservation of marine and coastal ecosystems and their associated species, guaranteeing the naturalness and essential ecological processes presented there. However, although a protected area is declared in order to achieve a specific conservation objective in a fundamental and preferential way, this can simultaneously and in a complementary way to the achievement of several general conservation objectives (Sguerra, 2005). Therefore, two secondary objectives were established: (1) to maintain the populations of migratory species (turtles and seabirds and shorebirds) that are associated with the site for feeding, resting and reproduction purposes, as well as threatened species and (2) to guarantee essential environmental goods and services for the benefit of the community in the area of influence, which for this case is the Zenú indigenous community. Once the central objective has been determined and given that the area includes a marine portion, its declaration, management, administration and control falls within the scope of National Management (MAVDT and UAESPNN), therefore, the management category that best suits is that of National Natural Park (PNN), equivalent to category II of the International Union for Conservation of Nature (IUCN) (Davey, 1998). This allows certain types of activities and indirect uses in accordance with what was proposed by Sguerra (2005) and is not incompatible with the presence of an indigenous reservation or reserve within its limits, provided that the pertinent studies are carried out to jointly achieve good management of the area, as explained in the country's regulations through Decree 622 of 1977

CONCLUSIONES Y RECOMENDACIONES

In general terms, Punta Commissioner – San Onofre (Gulf of Morrosquillo) is considered one of the natural areas with the greatest diversity and heterogeneity of habitats in Colombia. This was not only determined in the present research, but by different conservation proposals that several authors have made for the area. However, the Gulf of Morrosquillo currently does not have any protection or conservation figure for

its ecosystems, so it is necessary to implement conservation strategies in the short term, being the creation of an MPA the best instrument to increase the representativeness of biodiversity in this sector of the Colombian Caribbean and avoid its deterioration in the future. Few investigations are available on the study of communities and the spatial distribution of most species recorded in Colombia's red books for the area.

The present design is based on the evaluation of ecological criteria, however for the subsequent route of declaration and implementation of the MPA, the evaluation of social, economic and political-administrative criteria is required within the framework of a participatory process with all the actors involved or "stakeholders". MARXAN has been used mainly for the selection of candidate sites to be marine protected areas, especially marine reserves, and it turned out to be a good tool to support internal zoning allowing the identification of intangible or "no take" zones allowing multiple scenarios to be generated. It is considered the most appropriate management category for the study area is PNN, however because it is one of the strictest within SINAP, the presence of some settlements of the Zenú indigenous community leads to special management measures, being necessary the participation of these actors from the beginning of the declaration process; as well as the zoning with which a gradation of uses is proposed and the fulfillment of the conservation objectives is guaranteed, in addition to the definition of a buffer zone.

REGULATORY AND POLICY FRAMEWORK

Within the framework of the actions that have been developed in Colombia for the strengthening of the National System of Protected Areas - SINAP, since the enactment of Law 99 of 1993, Law 165 of 1994 and the National Biodiversity Policy of 1997, it was considered strategic to position the issue of marine protected areas in the country and thus advance in the "Design and implementation of the Subsystem of Marine Protected Areas of Colombia - SAMP" which is reflected in the goals set by the National Environmental Policy for the Sustainable Development of Ocean Spaces and Coastal and Island Zones of Colombia-PNAOCI" (MMA, 2000).

In this sense, the current regulatory and policy framework that regulates various elements for SINAP is Decree 2372 of 2010, which is compiled in the Single Regulatory Decree of the Environment and Sustainable Development Sector 1076 of May 26, 2015 and CONPES 3680 of 2010, which establish the guidelines and guidelines to advance in its consolidation as a complete system. ecologically representative and effectively managed and well connected in a way that contributes to environmental and territorial planning, the fulfillment of national conservation objectives and the sustainable development in which the country is committed. In this regard, Colombia has undertaken international commitments aimed at the protection of marine and coastal ecosystems; as well as contributing through the application of norms and policies to the fulfillment of the country's conservation objectives, which aim to: 1. Ensure the continuity of natural ecological and evolutionary processes to maintain biological diversity; 2. Ensure the supply of environmental goods and services essential to human well-being; 3. Guarantee the permanence of the natural environment, or some of its components, as a basis for maintaining the cultural diversity of the country and the social valuation of nature.

BIBLIOGRAPHY

Airame, S., Dugan, J. E., Lafferty, K. D., Leslie, H., Mcardle, D. A. & Warner, R. R. (2003).

Applying ecological criteria to marine reserve design: a case study from the California channel islands. Ecological Applications 13, S170-S184.

Ban, N. C. (2008). Minimum data requirements for designing a set of marine protected areas, using commonly available abiotic and biotic datasets. Biodiversity and Conservation 18, 1829-1845.

Ban, N. C. & Klein, C. J. (2009). Spatial socioeconomic data as a cost in systematic marine conservation planning. Conservation Letters 2, 206-215.

Brazeiro, A., Acha, E., Mianzan, H., Gómez, M. & Fernández, V. (2003). Aquatic priority areas for the conservation and management of the ecological integrity of the Rio de la Plata and its Maritime Front. Technical Report PNUD Project/GEF RLA/99/G31, 81pp (www.freplata.org/documentos/).

Brazeiro, A. & Defeo, O. (2006). Bases ecológicas y metodológicas para el diseño de un Sistema Nacional de Áreas Marinas Protegidas en Uruguay. Bases para la conservación y el manejo de la costa uruguaya. (ed. by R. Menafra, L. Rodríguez-Gallego, F.

Scarabino and D. Conde), pp. 379-390. VIDA SILVESTRE (Sociedad Uruguaya para la Conservación de la Naturaleza), Montevideo, Uruguay.

CMS (2004). Conservation Measures Partnership. 2004. Open standards for the practice of conservation. Conservation Measures Partnership, Bethesda, Maryland. Available from http://conservationmeasures.org/CMP/ Library/CMP Open Standards v1.0.pdf (accessed April 2005).

Defeo, O. & Castilla, J. C. (2005). More than one bag for the world fishery crisis and keys for co-management successes in selected artisanal Latin American shellfisheries.

Reviews in Fish Biology and Fisheries 15, 265-283. Defeo, O., Horta, S., Carranza, A., Lercari, D., de Álava, A., Gómez, J., Martínez, G.,

Lozoya, J. & Celentano, E. (2009). Hacia un Manejo Ecosistémico de Pesquerías. Áreas Marinas Protegidas en Uruguay, Montevideo, Facultad de Ciencias-DINARA.

Fernandes, L., Day, J., Lewis, A., Slegers, S., Kerrigan, B., Breen, D., Cameron, D., Jago, B., Hall, J., Lowe, D., Innes, J., Tanzer, J., Chadwick, V., Thompson, L., Gorman, K.,

Simmons, M., Barnett, B., Sampson, K., De'ath, G., Mapstone, B., Helene Marsh, Possingham, H., Ball, I., Ward, T., Dobbs, K., Aumend, J., Slater, D. & Stapleton, K.

(2005). Establishing Representative No-Take Areas in the Great Barrier Reef: LargeScale Implementation of Theory on Marine Protected Areas. Conservation Biology 19, 1733-1744.