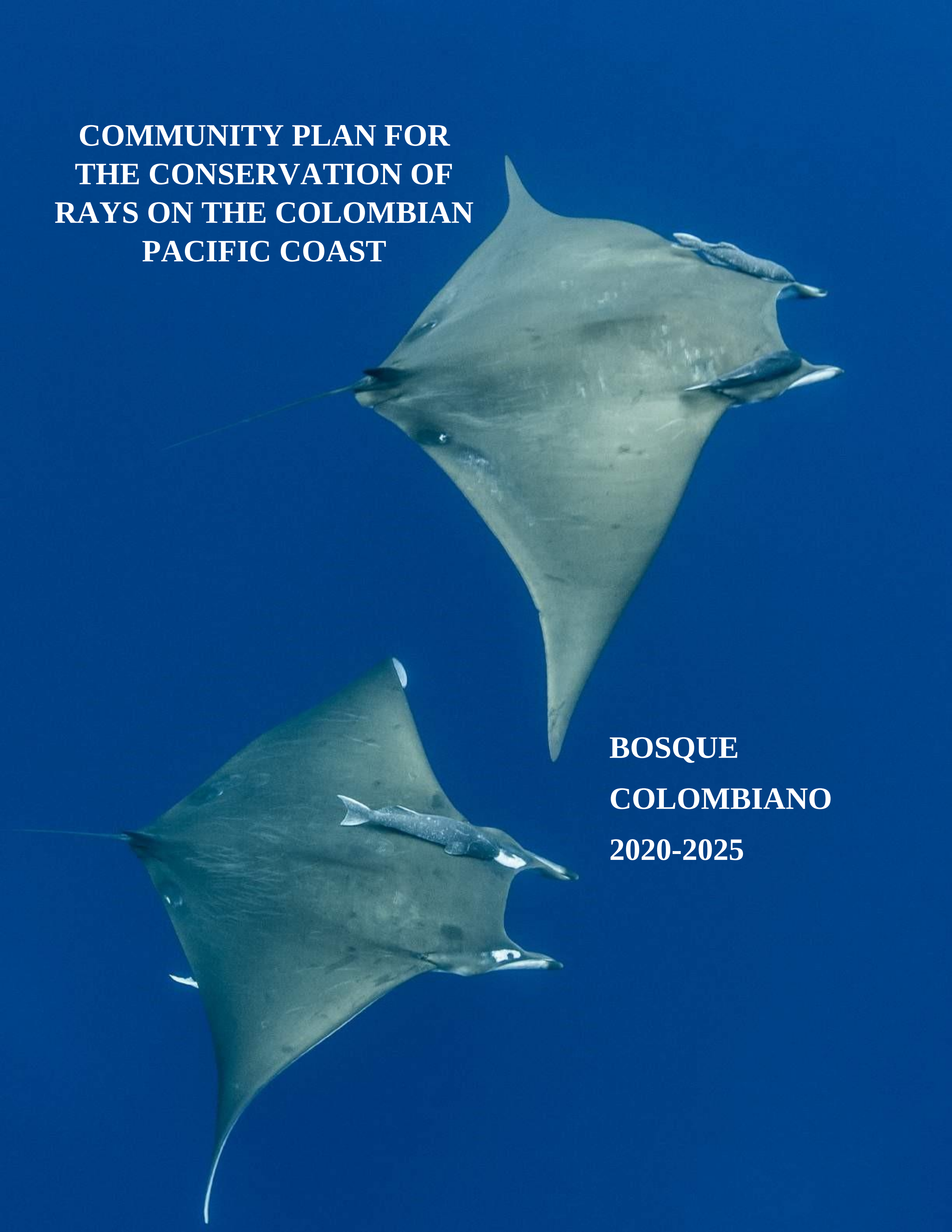


COMMUNITY PLAN FOR THE CONSERVATION OF RAYS ON THE COLOMBIAN PACIFIC COAST

BOSQUE COLOMBIANO

2020-2025

COMMUNITY PLAN FOR THE CONSERVATION OF RAYS ON THE COLOMBIAN PACIFIC COAST

RESUMEN

Ray populations in the Colombian Pacific are being decimated to the point of extermination. The three species of giant rays are targeted by small indigenous Emberá fishermen: Giant Manta Ray (Mobula birostris), Bentfin Devilray (Mobula thurstoni) and Sicklefin Devilray (Mobula tarapacana). Poaching of sea rays off the Colombian Pacific coast is still rampant, but today, instead of traveling with nets, poachers simply buy live rays stored by local (Emberá indigenous) fishermen who hide them on remote islands or in mangrove streams. Because rays need to breathe, poachers keep them in locally constructed rectangular fish cages of floating drums and wood, with nets suspended in the middle, or tied or chained directly to coral in shallow water. The costs and resources required to survey this vast area are prohibitive for local enforcement agencies and logistically complex.

Through this plan, we seek the comprehensive protection of 3 species of rays by strengthening the conservation capacities of the Emberá indigenous community, with conservation, education, sustainability and communication strategies.

The end result will be an increase in the conservation status of the three targeted ray species through population growth and mitigation of threats to this species on the Colombian Pacific coast.

Key words: Ray populations, Colombian Pacific coast, protected marina area, Emberá indigenous community.

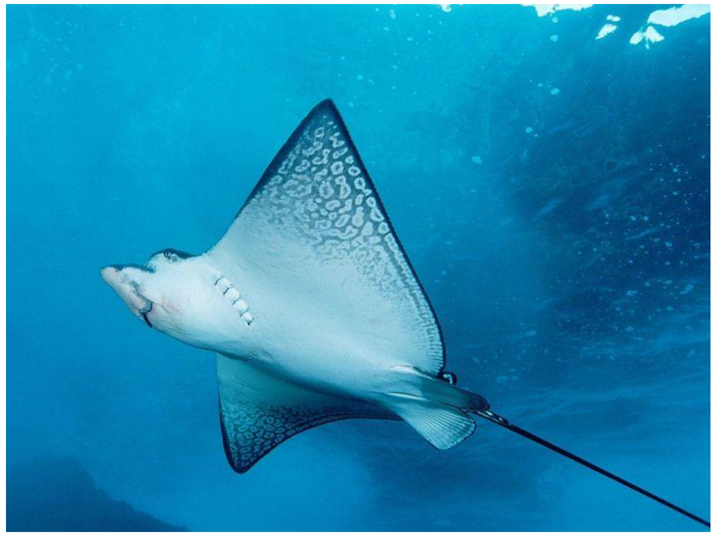
1. TARGET SPECIES

SPECIES	IUCN Status	CITES
Giant Manta Ray (Mobula birostris)	Endangered A2bd+3d	Appendix II
Bentfin Devilray (Mobula thurstoni)	Endangered A2bd+3d	Appendix II
Sicklefin Devilray (Mobula tarapacana)	Endangered A2bd+3d	Appendix II

2. BIOECOLOGICAL ASPECT OF COLOMBIAN PACIFIC RAYS

2.1.IUCN Status

The Giant Manta Ray (Mobula birostris) is a large (to 700 cm disc width) ray with a circumglobal distribution in tropical and temperate waters throughout the Pacific, Indian, and Atlantic Oceans in coastal and pelagic waters from the surface to a depth of 1,000 m. Within this broad range, aggregations are sparsely distributed and while individuals are capable of long-distance movements they do so infrequently and exhibit a degree of philopatry resulting in a high likelihood of local depletion. The global population size is not known, but local and regional abundance has been estimated and is mostly small, numbering less than 500 individuals, except for Ecuador where abundance is estimated at more than 2,000 individuals. The species has an extremely slow life history, producing only 1 pup on average every 4–5 years, and consequently is likely to have one of the lowest maximum rates of population increase (median 0.032 per year) of any elasmobranch. Giant Manta Rays are targeted or taken as bycatch in artisanal small-scale fisheries, as well as taken as bycatch in large-scale tuna fisheries. The meat is consumed locally, and the species is traded internationally due to the rapid rise of the valuable gill plate trade. Where Giant Manta Ray are protected (in over a dozen countries and territories), and hence where they are not being fished, the sighting trends appear stable. Elsewhere, however, very rapid declines have been noted in sightings records and landings where they are targeted or caught as bycatch; these range from 71 to 95% declines over 13- to 21-year periods (all less than one generation length of 29 years). It is suspected that the Giant Manta Ray has undergone a population reduction of 50–79% over the past three generation lengths (87 years), with further population reduction suspected over the next three generation lengths (2018–2105) due to current and ongoing levels of exploitation, and a reduction in area of occupancy due to suspected local and regional extinctions, and it is assessed as Endangered A2bcd+A3d.



2.2.TAXONOMIC NOTES

The previously, monotypic genus Manta was re-evaluated with two species identified, Reef Manta Ray (Manta alfredi) and Giant Manta Ray (Manta birostris) (Marshall et al. 2009). Genetic evidence supported the separation (Kashiwagi et al. 2012). Both species have broad global distributions and are sympatric in some locations and allopatric in others (Kashiwagi et al. 2011, Lawson et al. 2017). A third species of manta ray has also been proposed (Marshall et al. 2009) with increasing genetic support (Hinojosa-Alvarez et al. 2016, Kashiwagi et al. 2017, Hosegood et al. 2018). Genetic evidence has also resulted in the genus Manta being subsumed within the genus Mobula (Poortvliet et al. 2015, White et al. 2018).

Due to the recent taxonomic changes, both present day and historical reports can often be unclear and without adequate descriptions, photographs or geographic locations, it can be difficult to conclusively attribute fisheries data to a single species. Care should be taken when using reports or accounts of the Giant Manta Ray. Melanistic (black) and leucistic (white) colour morphs occur in all species of manta ray (Marshall et al. 2009). Variant colour morphs often contribute an added degree of confusion when attempting to visually discriminate between species of manta rays in the field or in photographs, especially when close examination is not possible. It should be noted that these colour morphs could be a source of error, resulting in misidentifications in past or future studies or surveys of distribution.

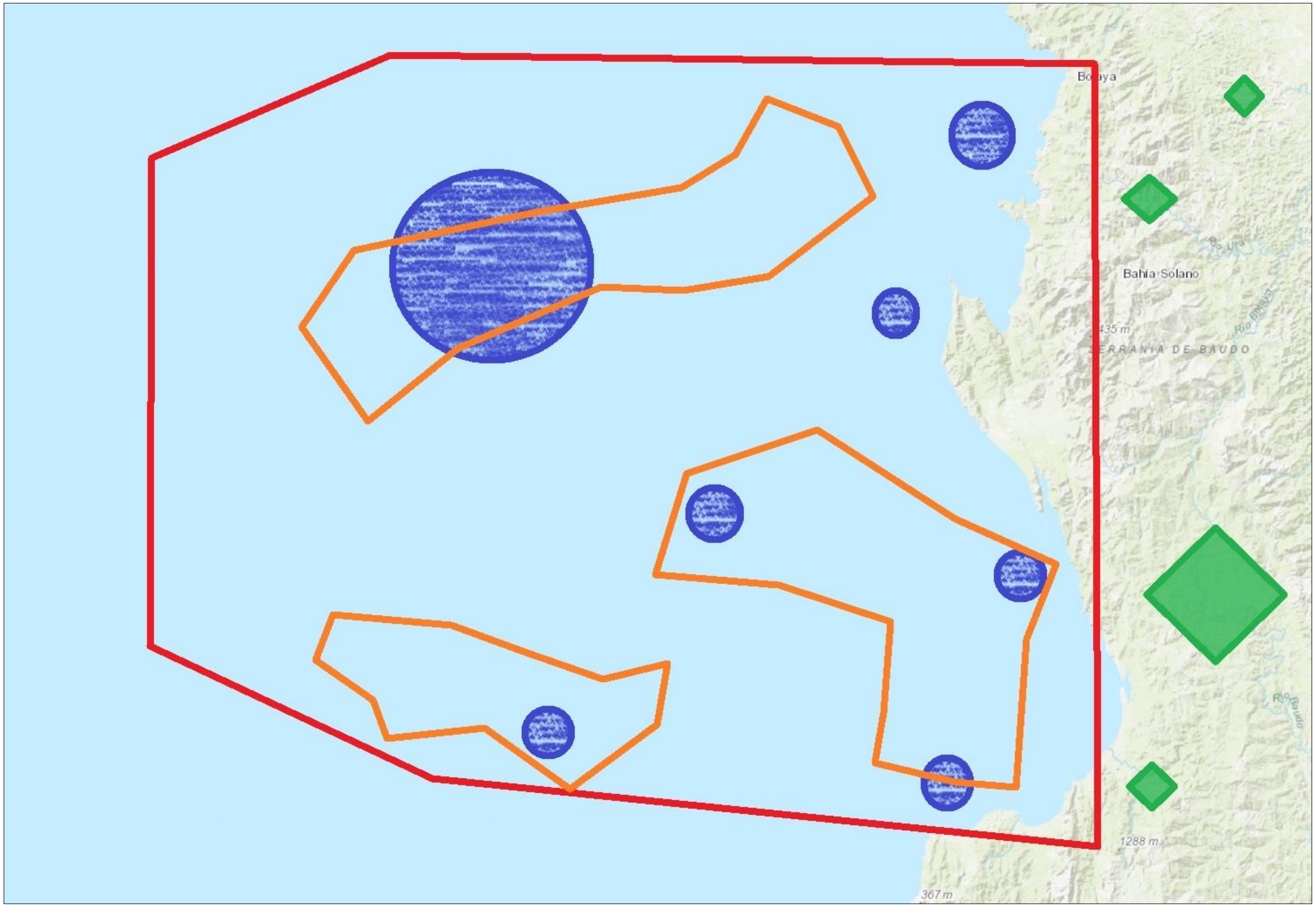
2.3.ECOLOGY

Overfishing and habitat loss are two threats facing the ray that inhabits the great rivers of the Colombian pacific coasts. This is what the results of a study conducted by an interagency team of biologists, published today in the scientific journal Marine and Freshwater Research, indicate. The study was led by Dr. Luis Lucifora, a scientist at the Institute of Subtropical Biology of Puerto Iguazú (IBS-Iguazú, CONICET/Universidad Nacional de Misiones) and a group of collaborators from various institutions in the country, including the Institute of Marine Research and (CONICET/National University of Mar del Plata), the National Directorate of Inland Fisheries of the Ministry of Agriculture, Livestock and Fisheries, the National Institute of Limnology (CONICET/National University of the Litoral) and the Department of Fauna and Fisheries of the Directorate of Fauna and Protected Natural Areas of Chaco.

Rays, along with sharks and chimaeras, form a group of animals known as cartilaginous fish because their skeleton is made entirely of cartilage. These fish are among the aquatic animals most vulnerable to human impact because they have very low reproductive rates and have a hard time recovering from overfishing or alteration of their habitat as a result of pollution or physical modification. Although most species exclusively inhabit marine environments, the large tropical and subtropical rivers of South America are home to a diverse freshwater stingray fauna. “These animals are located at the intersection of two major risk factors for extinction: on the one hand they belong to one of the most vulnerable groups due to their long maturation period and their small number of offspring, on the other, they exclusively inhabit the most modified ecosystems and degraded by man, such as freshwater bodies”, indicates Luis Lucifora. Colombian pacific coasts is home to the largest cartilaginous freshwater fish in the world: the giant ray, scientifically known as Potamotrygon brachyura. This fish has a striking reticulated coloration, similar to that of a giraffe but with dark lines, and can weigh more than 200 kg, far exceeding the size of other giants, such as the surubí or the dorado. In Colombian pacific coasts the capture of giant rays is one of the great attractions of the recreational fishing tourism industry. Rays are also caught commercially, but the volume of this activity and the impact on populations are completely unknown. The recently published scientific study attempts to fill this gap in knowledge and reveals, for the first time, the possible threats facing this imposing fish.

"We use quantitative analytical techniques to estimate the extension of the geographic distribution of the giant ray, and to evaluate the degree of exposure to different levels of fishing pressure and habitat modification of the species throughout the extension of its distribution", says the researcher. "We had to adapt our analysis to the availability of existing data, since there is very little information on river rays in general and, in particular, on those of the Colombian pacific coasts," he adds. The analysis

CONSERVATION ACTION MAP



COMMUNITY PLAN FOR THE CONSERVATION OF RAYS ON THE COLOMBIAN PACIFIC COAST

CONVENTIONS

	Conservations action plan
	IUU fishing zones
	Coastal Ray Populations
	Emberá indigenous cities

MAP SCALE

1cm = 25,000m

GEOGRAPHICAL LOCATION

1. Country: Colombia
2. Departments: Chocó
3. Colombian Pacific coast, in the Emberá indigenous territory
4. Geographic coordinates: From 6°56'59.6"N 77°39'27.9"W and 4°41'59.6"N 77°08'22.6"W; up to 4°26'33.4"N 80°25'48.7"W and 7°00'31.2"N 79°49'36.1"W.

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indicates that, in the Colombian pacific coasts the main threat to the giant ray is the modification of its habitat. In that body of water, which constitutes the extreme south of the species' distribution, there is a 41% overlap between the areas occupied by the giant ray and areas of very high human impact, that is, with high levels of contamination, dredging and modification of the coastal environment. In the rest of the basin, including watercourses of neighboring countries, the main threat is fishing, since high levels of fishing pressure occur in almost 60% of the distribution of the species, while exposure to high levels of habitat modification is low (7%).

In addition, the study indicates that the giant ray lives mainly in bodies of water with abundant flow, such as large rivers, and is not found in calm water environments, such as lagoons not connected to large rivers or reservoirs. "This result tells us that, in order to maintain viable populations of giant rays, it is essential to keep the large rivers in the basin free of dams and large infrastructure works that impact the physical structure and the natural flood regime of the ecosystem. Currently we have that possibility, since the enormous fluvial axis formed by the Paraguay and the middle and lower Paraná rivers is free of dams. If we manage to keep it that way, we will have taken a very important step, not only towards the conservation and sustainable use of the giant ray, but of the entire river ecosystem," he concluded.

2.4.THREATS

Mobulid rays, including the Giant Manta Ray, are both targeted and caught incidentally in industrial and artisanal fisheries (Couturier et al. 2012, Croll et al. 2016, Stewart et al. 2018). These rays are captured in a wide range of gear types including harpoons, drift nets, purse seine nets, gill nets, traps, trawls, and longlines. Manta rays are also caught in bather protection nets (Cliff and Dudley 2011, Department of Agriculture and Fisheries 2018). Their coastal and offshore distribution, and tendency to aggregate, makes mobulid rays particularly susceptible to bycatch in purse seine and longline fisheries and targeted capture in artisanal fisheries (Croll et al. 2016, Duffy and Griffiths 2017). In particular, Giant Manta Rays are easy to target because of their large size, slow swimming speed, tendency to aggregate, predictable habitat use, and lack of human avoidance (Couturier et al. 2012).

Mobula rays, including Giant Manta Rays, are caught in at least 13 targeted artisanal fisheries in 12 countries. Some of the largest documented fisheries have been in Indonesia, the Philippines, India, Sri Lanka, México, Taiwan, Mozambique, Palestine (Gaza strip), and Peru (Couturier et al. 2012, Ward-Paige et al. 2013, Croll et al. 2016), where sometimes thousands of manta rays are landed per annum (Alava et al. 2002, Dewar 2002, White et al. 2006, Lewis et al. 2015). While many artisanal fisheries have grown to meet international trade demand for gill plates, some still target these rays mainly for food and local products (White et al. 2006, Essumang 2010, Rohner et al. 2017).

Mobula rays, including Giant Manta Rays, are caught incidentally as bycatch throughout their ranges in at least 21 small scale fisheries in 15 countries and 9 large-scale fisheries in 11 countries (Croll et al. 2016). Despite being unintentionally caught, mobulid rays are typically retained because of their high trade value. Even when discarded alive, e.g. from tuna purse seine fisheries, they are often injured and have high post-release mortality (Tremblay-Boyer and Brouwer 2016, Francis and Jones 2017). Many fisheries remain open and active even after dozens of national fishing bans and international listings on the appendices of both Convention for the Conservation of Migratory Species of Wild Animals (CMS) and the Convention on International Trade in Endangered Species of Wild Flora and Fauna (CITES) (Lawson et al. 2017, Lawson and Fordham 2018).

Global landings of mobulid species, including Giant Manta Ray, have been increasing steadily due in large part to the recent rise (from the 1990s onwards) in demand for gill plates (Croll et al. 2016, O'Malley et al. 2017). Many former bycatch fisheries have become directed commercial export fisheries (Dewar 2002, White et al. 2006, Heinrichs et al. 2011, Fernando and Stevens 2011). Between 2000 and 2007, total landings of 'Mantas, devil rays nei' ('nei' refers to 'not landed elsewhere') increased from 900 tonnes to over 3,300 tonnes according to the FAO Fishstat Capture Production database (Lack and Sant 2009). This equates to an average of 1,593 metric t being landed per annum with this average increasing to 4,462 metric t per annum from 2008 to 2017 (Oakes and Sant 2019); reported landings are likely to estimate only a fraction of total fishing-related mortality (Ward-Paige et al. 2013).

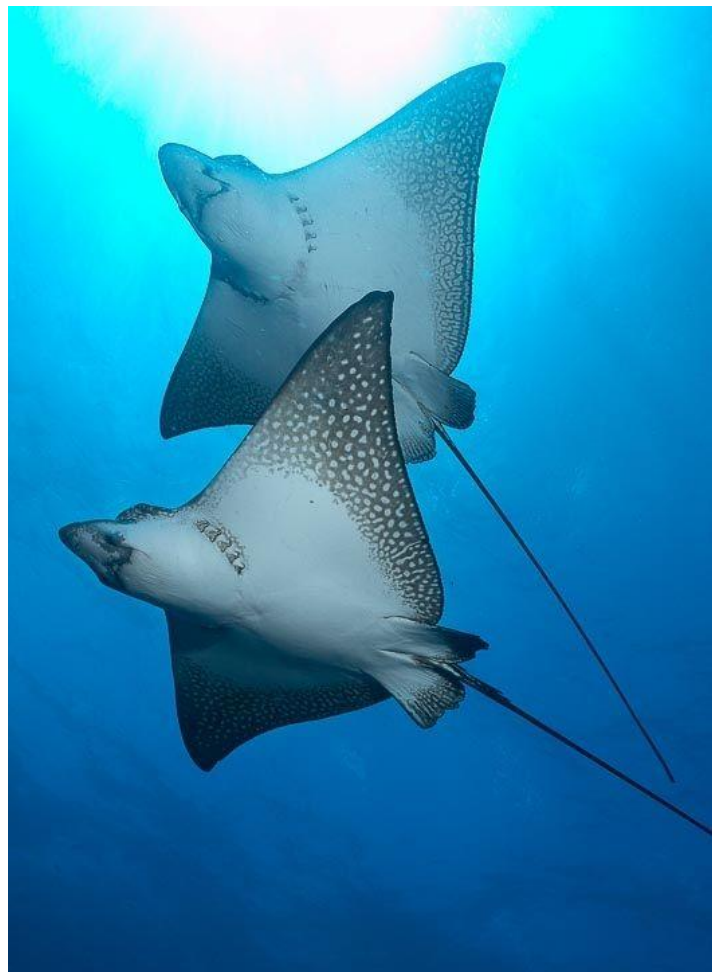
In the markets of Guangzhou, China, where 99% of mobulid products are routed, mobulid products are sourced from over 20 countries and regions (O'Malley et al. 2017). The source locations for the largest amounts of product are Indonesia, Sri Lanka, India, China, and Vietnam (O'Malley et al. 2017). Demand for products has driven up the price and traded volume of these products in recent decades. Between 2011 and 2013, there was an increase from 60 to 120 t of mobulid product moved through shops in Guangzhou (O'Malley et al. 2017).

In the Western Indian Ocean, Romanov (2002) estimated that between 253 and 539 manta rays and devilrays were being caught per year as bycatch in purse seine fisheries, and between 2003 and 2007, 35 manta rays were observed in purse seine bycatch, most of which were likely Giant Manta Ray (Amandè et al. 2012). In the Western and Central Pacific, from 2010 to 2015, observed bycatch of Giant Manta Rays in purse seine fisheries was 4,176 individuals, and in longline fisheries was 226 individuals (based on distribution, some of these were likely Giant Manta Ray) (Tremblay-Boyer and Brouwer, 2016). While a few individuals were released in good condition, post-release mortality is likely to be high as most were released alive but injured, or dead (Francis and Jones 2017). The Eastern Pacific purse seine fisheries show a substantial increase in the bycatch of mobulid rays, including Giant Manta Rays, from 20 tonnes per year before 2005 to 150 tonnes per year by 2006, which then reduced to 10 tonnes per year by 2009 (Hall and Roman 2013). The Inter-American Tropical Tuna Commission (IATTC) purse seine vessels operating from 1993 to 2015 reported an average catch of approximately 135 Giant Manta Rays per year (Miller and Klimovich 2017). A susceptibility analysis indicated that negative interactions with fishing gear and unintended mortality will continue to be an issue with this species as these fisheries coincide with high productivity areas where Giant Manta Rays are likely to aggregate for feeding (Duffy and Griffiths 2017, Duffy et al. 2019).

While the overwhelming cause of population reduction is fishing mortality, sublethal effects and lower levels of mortality occur from numerous lesser threats, such as entanglement in nets, recreational foul hooking, and vessel strikes (Marshall and Bennett 2010, Deakos et al. 2011, Couturier et al. 2012, Stewart et al. 2018). While there is no direct evidence, there are concerns for effects of climate change, ocean acidification, oil spills, and other forms of pollution and contaminants (e.g., heavy metals) (Essumang 2010, Ooi et al. 2015, Stewart et al. 2018). Furthermore, shallow water lagoon nursery habitats are subject to habitat loss and degradation that pose threats to juvenile Giant Manta Rays (Stewart et al. 2018).

2.5.HABITAT AND ECOLOGY

The Giant Manta Ray is a neritic and oceanic pelagic ray that occurs in places with regular upwelling along coastlines, oceanic islands, and offshore pinnacles and seamounts (Marshall et al. 2009). The Giant Manta Ray can exhibit diel patterns in habitat use, moving inshore during the day to clean and socialize in shallow waters, and then moving offshore at night to feed to depths of 1,000 meters (Hearn et al. 2014, Burgess 2017). It can spend long periods of time offshore without visiting shallow coastal waters (Stewart et al. 2016, A. Marshall unpubl. data 2019). The Giant Manta Ray may be the largest living ray species attaining a maximum size of 700 cm disc width (DW) with anecdotal reports up to 910 cm DW (Compagno 1999, Alava et al. 2002). Males mature at 350–400 cm DW and females mature at 380–500 cm DW (White et al. 2006, Last et al. 2016, Stevens et al. 2018). Reproduction is aplacental viviparous with a single large pup of 122–200 cm DW (White et al. 2006, Rambahiniarison et al. 2018). Reproductive periodicity is unknown, but assumed to be 4–5 years, similar to the closely related Reef Manta Ray (M. alfredi). Female age-at-maturity is estimated as 8.6 years of age but first pregnancy may be delayed by up to 4 years (making first age of pregnancy 12 years) depending upon food availability (Rambahiniarison et al. 2018). The maximum age is estimated as 45 years, based on the longevity of the Reef Manta Ray; generation length is therefore estimated as 29 years. Based on this life history, the maximum intrinsic rate of population increase could range between 0.019 and 0.046 per year (median 0.032 per year) (J. Carlson unpubl. data 2019, following methods in Dulvy et al. 2014). The species is among the longest-living rays and has an extremely conservative life history; the average Giant Manta Ray may produce only 4–7 pups during its estimated lifespan, which would contribute to its slow recovery from population reductions due to over-exploitation or other threats.



2.6.POPULATIONS

The global population size of the Giant Manta Ray is difficult to assess, but abundance trajectories have been estimated based on long time series of sightings at diving sites. Generally, divers encounter the Giant Manta Ray less frequently than the Reef Manta Ray (Mobula alfredi) and this is thought to be due to their more oceanic habitat preferences and behaviour.

Locally, abundance varies substantially and may be based on food availability and the degree that they were, or are currently, being fished. In most regions, Giant Manta Ray population sizes appear to be small (less than 1,000 individuals). Photo-identification studies at specific aggregation sites have yielded minimum estimates of 42 to 500 individuals over almost a decade of monitoring in most locations, including: Mozambique, Thailand, Myanmar, Indonesia (Holmberg and Marshall 2018), Japan (Kashiwagi et al. 2010), Brazil (Luiz et al. 2008), and Mexico (Rubin 2002). A 6-year study has catalogued more than 2,000 individuals in a single site, off mainland Ecuador (Holmberg and Marshall 2018).

Giant Manta Ray aggregation sites are widely separated and the lack of genetic substructuring indicates occasional large-scale movements have occurred. Crossing referencing of regional photo-identification databases has not detected inter-region individual movements (e.g. across ocean basins) (Holmberg and Marshall 2018), indicating a low degree of interchange between ocean basins. Unlike the Reef Manta Ray, no significant genetic substructuring has been detected within the Giant Manta Ray (Stewart et al. 2016, Hosegood et al. 2019). Long-term studies, including those which have incorporated telemetry, have shown low resighting rates but a degree of philopatry.

The trend of the number of individuals varies widely across the range of the Giant Manta Ray, but trends appear stable where they are protected and declining rapidly where fishing pressure is greater. The sighting trends appear stable where they receive some level of protections, such as Hawaii (Ward-Paige et al. 2013) and Ecuador (Holmberg and Marshall 2018), although individuals sighted in Ecuador seasonally migrate to Peru (A. Marshall unpubl. data 2019) where directed fishing occurs (Heinrichs et al. 2011). Elsewhere, the number of individuals is likely to be declining in places where the species is targeted or caught regularly as bycatch. There are two estimates based on sightings-per-unit-effort. In southern Mozambique, a 94% decline in diver sighting records occurred over a 15-year period in a well-studied population (Rohner et al. 2017). In Cocos Island, Costa Rica there has been an 89% decline in diver sighting records of Giant Manta Rays over a 21-year period (White et al. 2015). These steep declines have occurred in less than one generation length (29 years).

Along with these sightings data, it is suspected (based on historical sightings, distribution data, and habitat suitability), that the Giant Manta Ray may have been depleted in areas where significant fisheries or threats for manta rays exist, such as the west coast of mainland Mexico (Booda 1984, Rubin 2002), Madagascar, Tanzania (Bianchi 1985), Kenya, Somalia, Pakistan (Nawaz and Khan 2015, Moazzam 2018), India, Sri Lanka, Bangladesh, Myanmar, China, Indonesia, and the Philippines. In these densely populated and heavily fished countries, fishing pressure may have more swiftly depleted resident populations of Giant Manta Rays.

There are narratives consistent with rapid local depletion, and disappearance of manta rays, particularly in Indonesia. In Lamakera, eastern Indonesia, increasing international trade demand for manta ray products in the 1990s resulted in increased fishing effort with up to 2,400 manta and devilrays landed per year. Consequently, manta ray catches (including Giant Manta Ray) declined sharply in this region, forcing fishers to travel further afield to find manta rays (Dewar 2002). Furthermore, landings of

Manta spp. (including Giant Manta Ray which was the main target) continued to decline in Lamakera despite increased effort, with a reduction in landings of 75% over a 13-year period from 2001 to 2014 leading to possible local extinction of Manta spp. from Lamakera (Lewis et al. 2015). Landings of Manta spp. also declined significantly during the same 13-year period in two other regions in Indonesia where effort also increased: Tanjung Luar (Lombok) (95% declines) and Cilicap (Central Java) (71% declines) (Lewis et al. 2015). Aggregations of manta rays have entirely disappeared from three other locations within Indonesia, that is Lembeh Strait, South Sulawesi and Northwest Alor, with the cause strongly suspected as targeted and bycatch fishing (Lewis et al. 2015). In East Flores and Lembata, Indonesia, manta rays (including the Giant Manta Ray) had historically been fished by indigenous villagers since 1959, with up to 360 individuals caught a year (Barnes 2005). By 2001, less than 10 manta rays had been seen per year for the previous 6-year period (Lewis et al. 2015).

In the Bohol Sea, Philipines, manta rays (including Giant Manta Rays) were targeted for over a century with landings estimated to have declined since the 1960s by 50–90%, despite increasing fishing effort (Alava et al. 2002). Concern for the species led to a ban on targeting of Giant Manta Rays in the Philippines in 1998, yet other Mobula species could still be targeted and Giant Manta Ray continued to be caught (Acebes and Tull 2016, Rambahiniarison et al. 2018). In 2017, all targeted Mobula fisheries in the Bohol Seas were banned, yet Mobula species may still be taken as bycatch in tuna fisheries in the Bohol Sea (Rambahiniarison et al. 2018). Declining trends in the abundance and body size of mobulid fisheries landings occurred both in India and Sri Lanka (Fernando and Stevens 2011, Pillai 1998, Nair et al. 2013, Raje et al. 2007). In Papua New Guinea, local declines have been noted and are attributed to fishing pressure (Rose 2008). Unspecified manta rays (some of which, based on distribution records, were likely Giant Manta Rays) were caught as non-target species in purse seine sets from 1995 to 2006. There was a distinct and significant rise in the number of manta rays caught in these fisheries in 2001, which steadily rose until 2005/2006 when sharp declines were noted in the catch (Rose 2008).

Although sparse, the available data suggest that localized populations of the Giant Manta Ray have been rapidly depleted by target fisheries in some regions and that local extinction is suspected to have occurred in many parts of their historical range. Globally, the suspected population reduction is 50–79% over three generation lengths (87 years), with a further population reduction suspected over the next three generation lengths (2018–2105), based on current and ongoing threats and exploitation levels, steep declines in monitored populations, and a reduction in area of occupancy. In the few places where manta rays are protected, the number of individuals is stable.

2.7.USE AND TRADE

Mobulids are widely used for their meat, skin, liver oil, and gill plates (Couturier et al. 2012). The gill plates fetch high prices in Asia and are used for Chinese health tonics (O'Malley et al. 2017). The meat from mobulids is often used for food and shark bait or attractant, and the skin of mobulids is sometimes used for leather products (shoes, wallets, and knife handles). Giant Manta Rays are sometimes caught and transported to aquariums for use in display tanks. Some of these captive animals have been released into the wild.

3. COMMUNITY PLAN FOR THE CONSERVATION OF RAYS ON THE COLOMBIAN PACIFIC COAST

As in the first edition, the National Action Plan responds to the alert call in which shark populations are found at the national level, due to a lack of regulations that allow responsible fishing activity and how long they take to recover. populations that are being exploited, from which rays do not escape. The purpose of this update of the National Action Plan is to ensure the sustainability of shark and ray populations in the long term, through five (5) objectives:

1. Promote and facilitate processes for the development of knowledge, research and monitoring of sharks and rays, their critical habitats and their fishery, in which technical personnel from the State and those present in academic, non-governmental and sector organizations participate. productive, in order to achieve the conservation and proper management of the resource, its critical habitats and fishery.

2. Strengthen regulatory, planning and management capacity to guarantee the sustainable use and/or conservation of sharks and rays in Panama and their critical habitats.

3. Have a control and surveillance program aimed at guaranteeing compliance with existing rules and regulations to reduce illegality.

4. Ensure that information on initiatives for the conservation and sustainable use of sharks and rays reaches the population in general, with emphasis on the government and fisheries sector, through inter-institutional coordinated work and with the support of various sectors of the the society.

5. Achieve the financing and institutional strengthening necessary for the execution of the projects and activities of the PAN Sharks and Rays.

Next, the programs (5), projects (11) and actions (29) of the plan are presented, while in the section of annexes the information is repeated, but including information no less relevant for each of the actions, such as the presentation of the indicators (of implementation and impact), as well as the key actors to be involved and the institutions responsible for each task and the schedule for their execution.

It can be interpreted that the execution schedule represents a guideline for the establishment of priorities, so it is important to attend to those actions proposed for the first year, since therein lies the basis for the success of the plan in the following four.

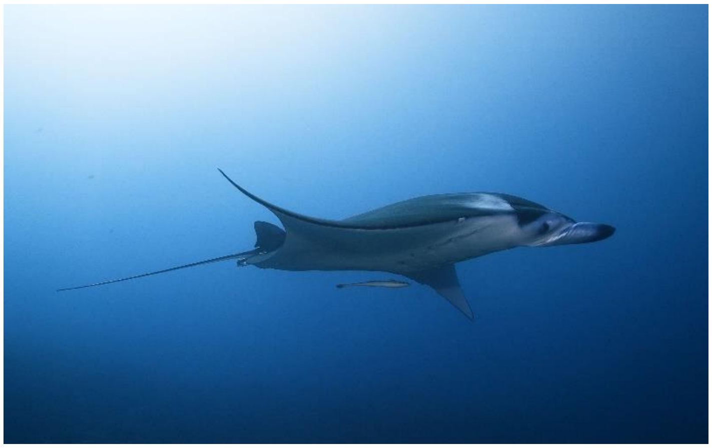
Obtaining biological, ecological, population, fishing, social and economic information related to sharks and rays, as well as their fishery, classified by species based on a prioritized list.

Action 1.1.1: Establish the list of species whose research and monitoring is prioritized.

Action 1.1.2: Create synergies between personnel from the fishing, government and academic sectors in order to review and, if necessary, design a standardized monitoring protocol (eg, OSPESCA), applicable by personnel on board the vessels and/or present in port facilities.

Action 1.1.3: Selection of at least two (2) ports where the landing of sharks and rays is permanent, to implement a catch and landing monitoring program using a standardized monitoring protocol.

Action 1.1.4: Promote calls from the National Secretariat of Science and Technology (SENACYT) for the development of projects related to the biology, ecology and population dynamics of sharks and rays, based on a prioritized list, as well as oriented to a study economic and social of the fishery in order to know the dependency that fishermen have with respect to shark and ray resources.



Action 1.1.5: Develop pilot projects that explore the design and use of fishing gear that allow responsible fishing of sharks and rays and/or reduce their bycatch.

Action 1.1.6: Manage and apply coordinated multinational actions for research, favoring the exchange of scientists at regional and international level.

PROJECT 1.2: Train and strengthen the staff of State institutions in fisheries monitoring and management programs and academic centers in fisheries research and engineering.

Action 1.2.1: Design and implementation of a Diploma for the training of public officials in biology, fisheries and management of sharks and rays.

Action 1.2.2: Promote a call by the National Secretariat for Science and Technology (SENACYT) to equip academic research and fisheries engineering centers, as well as train the professionals required to collect information

PROJECT 2.1: Review, analyze and update the regulatory legal framework, including legal gaps, to guarantee the sustainable use and/or conservation of sharks and rays in Panama má, as well as its critical habitats.

Action 2.1.1: Continue updating the system for issuing and classifying fishing licenses, within the framework of what is established by current regulations.

Action 2.1.2: Review and strengthening of the existing regulations in Panama, dedicated to sharks and rays, which includes the analysis of what exists at the regional/world level, in order to generate a new comprehensive regulation, after consultation with experts. This review should consider the different fishing gear and modalities used in the country, with an impact on the capture of sharks and rays.

Action 2.1.3: Carry out public consultation workshops to evaluate the future new regulations for the conservation and sustainable use of sharks and rays.

Action 2.1.4: To the extent that scientific information is generated, adjustments will be considered in decisions involving minimum catch sizes, spatial and/or temporal closures, as well as catch quotas when these can be estimated with an acceptable degree of accuracy. Confidence or maximum percentage of bycatch following principles of precautionary fishing.

PROJECT 2.2: Promote international coordination initiatives in order to guarantee the sustainability of sharks and rays.

Action 2.2.1: Promote, participate in, and consider the adoption of inclusion proposals, agreements, conventions, and/or international conventions for the management, control, and surveillance of shark and ray resources.

OBJECTIVE 3: Promote inter-institutional work in surveillance and control tasks.

Action 3.1.1: Implement a satellite tracking system (VMS) for the artisanal or related fleet, similar to what exists for the industrial fleet.

Action 3.1.2: Establish authorized areas for unloading sharks and rays, based on a general regulation of fishing activity.

Action 3.1.3: Strengthen patrol programs among the institutions involved.

PROJECT 3.2: Monitoring of international trade.

Action 3.2.1: Give training, with priority to Customs, ARAP and MiAMBIENTE staff, for the recognition and differentiation of shark and ray species found in CITES, in order to achieve proper registration and control of exports.

Action 3.2.2: Start of efforts to update the tariff codes for fishery products derived from shark and ray resources, in line with the provisions of the Central American Integration System (SICA).

Action 3.2.3: Generation of a manual for the control of shark products and by-products that enter (for subsequent export) or transit through national territory.

Action 3.2.4: Implement the establishment of at least two (2) ports and one (1) airport authorized for the international commercialization of sharks and rays, in which the effort, control and surveillance of shark products can be focused. leave and enter the country.

Action 3.2.5: Integration of the competent authorities in fishing matters in the export control systems (single window).

OBJECTIVE 4: Monitoring and evaluation of the National Action Plan.

Action 4.1.1: Establishment by regulations of the National Commission for the Conservation and Management of Sharks and Rays (CoNaCOTyR), with inter-institutional representation and the fishing sector, to monitor the execution of the PAN and its review every 4 years. If the CoNaCOTyR does not conform, these tasks will be carried out by the National Commission for Responsible Fishing.

Action 4.1.2: Development of inter-institutional strategies in support of the PAN Sharks and Rays.

PROJECT 4.2: Improve coordination with the government sector, fishermen and non-governmental organizations.

Action 4.2.1: Generate mechanisms that promote collaboration and synergy between social actors involved (eg, exchange workshops and conflict resolution).

Action 4.2.2: Conduct workshops for all interested audiences (eg fishermen, officials, general public) on the identification of species and information on the biology, ecology and population dynamics of sharks and rays.

PROJECT 4.3: Raise awareness in Panamanian society, at the local and national levels, about the importance of sharks and rays, and to enforce the National Action Plan for their conservation and sustainable use.

Action 4.3.1: Dissemination of the PAN Shark and Rays, as well as the biological, ecological, commercial and social importance of these species, through talks, workshops and seminars, both to the private and public sectors.

PROJECT 5.1: Manage the necessary funds for the implementation of the PAN Shark and Rays of Panama with national and international entities, including proposing a self-financing plan.

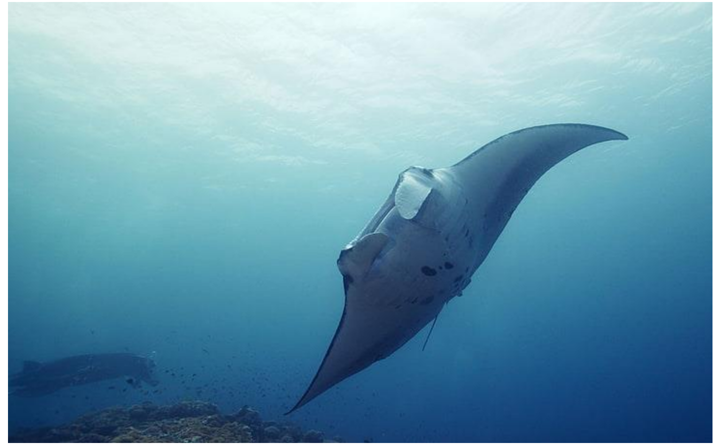
Action 5.1.1: Management of financing (eg, percentage committed within the institutional budgets, create a fund that feeds on taxes or payments related to export activity) for the implementation of the PAN.

PROJECT 5.2: Achievement and consolidation of trained personnel for the execution of the actions of the PAN Sharks and Rays, as well as obtaining financing, with the support of non-governmental organizations and the fishing sector.

Action 5.2.1: Identification of the needs and administrative actions for the hiring of specialized technical personnel for the execution of the actions of the PAN Sharks and Rays.

Action 5.2.2: Carry out training aimed at the thematic areas that require it.

As Action 4.1.1 points out, the National Commission for the Conservation and Management of Sharks and Rays (CoNaCOTyR) will be in charge of monitoring the development of each of the activities of the National Action Plan and of calling the review of the same after 4 years of its execution, since future programs, projects and actions must be adjusted to the new reality, product of the weaknesses detected or goals achieved.



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