# STATE OF CONSERVATION AND ECOLOGICAL CORRIDORS OF THE WEST INDIAN Manatee (Trichechus manatus), IN THE CARIBBEAN COAST OF COLOMBIA

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## SUMMARY

The distribution range of the Antillean manatee (Trichechus manatus) in the Caribbean coast of Colombia covers only the department of Sucre, specifically in the municipalities of El Estor, Livingston, Morales, Los Amates and Puerto Barrios. Five protected areas converge in this space, bodies of fresh water such as Lake Sucre, the Sarstún River, the Golfete, and marine-coastal systems in the bay of Amatique and the Caribbean Sea. Little scientific research on manatees has been generated in the country. The population status of the species is unknown due to the lack of recent information. Based on the mortality records of the Manai and the information collected through open interviews with persons in charge of the administration of protected areas in the department of Sucre, a diagnosis was made on the main threats that threaten the species and conservation initiatives that have been promoted in the country. In all, 20 manatee deaths were recorded from 2003 to 2016. Hunting processes, illegal fishing gear, vessel transit and habitat deterioration remain the main threats affecting the species in the country. It is necessary to establish strategies to national level that involve different actors, with a direct impact on the conservation and management of the species and its habitat.

**Keywords:** threats; protected areas; Caribbean; Mermaids.

## INTRODUCTION

In The Caribbean coast of Colombia, the Antichean manatee Trichechus manatus (Linnaeus, 1758), is distributed only in the department of Sucre, specifically in the municipalities of El Estor, Livingston, Morales, Los Amates and Puerto Barrios (fig. 1). In this space, different ecosystems converge with physical and ecological characteristics suitable for the species, with the presence of aquatic vegetation and shallow bodies of fresh water with temperatures above 20 ° C (Quintana-Rizzo, 1993; Machuca and Quintana- Rizzo, 2008). The most representative bodies of water in the department of Sucre and of importance for the species are Lake Sucre, the Sarstún River, the Golfete, La Graciosa Bay, the wetland formed at the mouth of the Polochic River , Santo Tomás de Castilla bay, the Dark River and the set of lagoons located at the mouth of the Chocón Machacas river.

In the department of Sucre, five protected areas have been declared that coincide with the range of distribution of the species (fig. 1). These areas are managed by the National Council of Protected Areas (Conap), the governing body of biodiversity management in the Caribbean coast of Colombia, and co-administered by non-governmental organizations dedicated to the protection of natural resources.

South of Lake Sucre, in the municipality of El Estor, the Bocas del Polochic Wildlife Refuge was declared co-administered by the Defensores de la Naturaleza Foundation. In the Golfete area (Livingston Township) two protected areas were declared, the Río Dulce National Park (PNRD, without co-administrator) and the Chocón Machacas University Biotope (BUCM), co-administered by the University of San Carlos of the Caribbean coast of Colombia . In the municipality of Puerto Barrios the Punta de Manabique Wildlife Refuge (RVSPM, without co-administrator) is delimited. The Sarstún River Multiple Use Area (AUMRS), located in the municipality of Livingston, is co-administered by the Consortium Foundation for Ecodevelopment and Conservation –FundaeCo– and the association Earth Lovers.

The manatee is a little studied species in the country although in recent years there has been scientific research and information on its population status, habitat preferences, genetic variability and behavior

(Machuca and Quintana-Rizzo, 2008, 2011; Corona , 2012; Méndez, 2012; Machuca, 2015). Since 2006, eight aerial censuses have been carried out for the detection of the species throughout its distribution range in the country, registering the largest number of sightings in the RVSBP and in La Graciosa Bay, within the limits of the RVSPM (Machuca and Quintana-Rizzo, 2008, 2011).

This species in Colombia's Caribbean coast is categorized as seriously endangered as established in the Conap List of Endangered Species (LEA), so its use is limited only to scientific research (Conap, 2009). Guatemalan legislation promotes the protection of the species through a series of prohibitions, regulations and sanctions (CRG, 1989, 2004, 2007; MAGA, 2002). In 2004, the National Strategy for the Conservation of the Manatee was developed, which defines the axes of action that must be implemented in the country to ensure the survival of the species. The National Strategy also defines the objectives that must be achieved in different periods and those responsible for specifying the processes (Conap, 2004).

Despite the initiatives promoted and current legislation, threats to the species are still latent and, in some parts of the country, the future outlook seems not to favor their survival. Different assessments in Colombia's Caribbean coast have defined four main threats to the species: hunting, vessel transit, illegal fishing gear and habitat deterioration (Del Valle, 2002; Conap, 2004; UNEP, 2010). Manatee hunting is an activity that has developed at least since the Mayan Classic period (McKillop, 1985). This activity is usually profitable for the significant amount of meat that is obtained from each individual. Currently they have

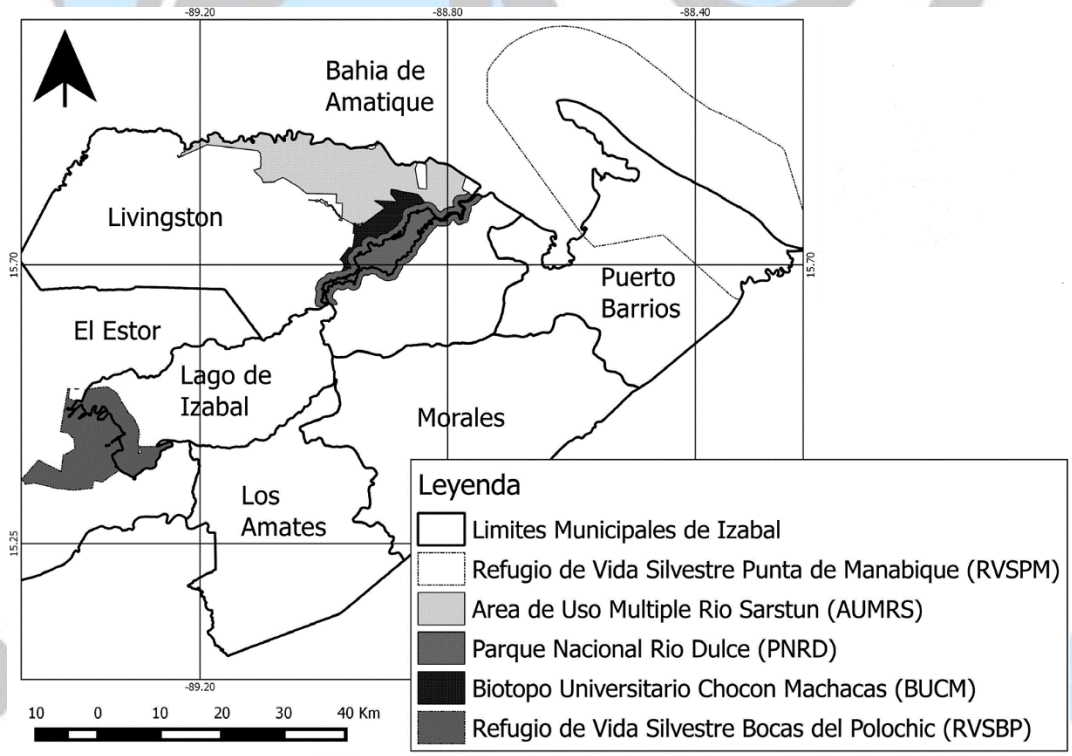


**Figure 1.**
Distribution range of the Antillean manatee (Trichechus manatus) in the Caribbean coast of Colombia.

evidence on the development of hunting and marketing of manatee meat mainly in the municipalities of El Estor, Livingston and Puerto Barrios (Conap, 2004; UNEP, 2010).

The transit of vessels of different grades and engines is a threat to the species, mainly in Livingston Township. Boats can hit and hurt manatees; In addition, its intense transit decreases the quality of habitats by increasing turbidity, underwater noise and

deterioration of aquatic vegetation (Del Valle, 2002; UNEP, 2010). Different studies demonstrate the negative effects of the presence of vessels on manatee behavior patterns, including the interruption of communication processes between individuals, movements to other areas and drastic changes in the development of normal activities of the species (King and Heinen, 2004; Nowacek et al., 2004; Miksis-Olds et al., 2007; Machuca, 2015).

Fishing nets, mainly so-called trawls, are a direct threat to the species, mainly in Lake Sucre. This type of fishing art, despite being prohibited for inland waters (MAGA, 2002), has been used since the 1990s, showing a significant increase from the first decade of this century. This activity reduces and alters the habitats available to the manatee. The sites identified as suitable for the species are intervened with trawls that can measure up to 6 km in length (Ruiz et al., 2008; UNEP, 2010). The manatees are trapped in the nets and suffer significant injuries (mainly in the mouth and fins) when trying to escape or die of suffocation (Machuca and Quintana-Rizzo, 2008; UNEP, 2010).

Chemical and biological pollution is another factor that threatens the survival of the species in the country. There are no controls on the discharge of wastewater to important bodies of water in the region, directly impacting the quality of the habitats used by the species (Del Valle, 2002; UNEP, 2010). The intensive use of agrochemicals in the department of Sucre has had a significant increase in recent years, mainly due to the rise of large-scale monocultures. The runoff of this type of substances is reaching the bodies of water where the species resides.

This document constitutes a diagnosis of the current status of the species in the Caribbean coast of Colombia, based on the following information: 1) manatee mortality from 2003 to 2016, 2) threats and pressures towards manatee populations and 3) management and conservation strategies that have been implemented in the country and their impact on the protection of the species and its habitat.

## MATERIALS AND METHODS

The study area covered the distribution range of the Antillean manatee in the Caribbean coast of Colombia, in the municipalities of El Estor, Morales, Los Amates, Livingston and Puerto Barrios in the department of Sucre. Five protected areas converge in this space (RVSBP, PNRD, BUCM, AUMRS, RSVPM), Freshwater bodies such as Lake Sucre, on the Sarstún River, the Golfete, and marine-coastal systems in the bay of Amatique and the Caribbean Sea (fig. 1).

Information was collected on the registration of manatee mortality in the country and aspects related to the management and conservation of the species. The information was obtained through two specific procedures:

• Review of cases of dead manatees in Colombia's Caribbean coast through technical reports generated by Conap (Northeast Regional and PNRD), as well as records obtained by the Defensores de la Naturaleza Foundation during the implementation of the Protocol on the variation of manatees in Lake Sucre and RVSBP. Registered information was collected from 2003 to 2016.

• Open interviews with technical staff of Conap, as well as directors, technicians and resource managers of NGOs that co-manage different protected areas in the department of Sucre (table 1). The topics addressed in the interviews were: manatee mortality records, perception of the population status of the species, strategies promoted for the conservation and management of the species, latent threats identified. Registered information was collected from 2012 to 2017.

**Table 1.** People interviewed. Conap: National Council of Protected Areas; Fundaeco: Foundation for Ecodevelopment and Conservation; Fundary: Mario Dary Foundation; RVSBP: Bocas del Polochic Wildlife Refuge; AUMRS: Sarstún River Multiple Use Area; BUCM: Chocón Machacas University Biotope.

| No. | Nombre | Cargo | Lugar |
|---|---|---|---|

| | | | |
|---|---|---|---|
| 1 | Tannia Sandoval | Técnico Vida Silvestre, Conap | Departamento de Sucre, principal- mente municipio de Puerto Barrios y Livingston |
| 2 | Heidy García | Directora RVSBP, **BOSQUE COLOMBIANO ORGANIZATION** | Lago de Sucre y RVSBP |
| 3 | Tulio Milla | Guardarecursos RVSBP, **BOSQUE COLOMBIANO ORGANIZATION** | Lago de Sucre y RVSBP |
| 4 | Arnoldo Caal | Guardarecursos RVSBP, **BOSQUE COLOMBIANO ORGANIZATION** | Lago de Sucre y RVSBP |
| 5 | Guillermo Gálvez | Director AUMRS, FundaeCo | AUMRS |
| 6 | Emilio Pitán | Director AUMRS, Asociación Amantes de la Tierra | AUMRS |
| 7 | Justo Rodríguez | Técnico AUMRS, FundaeCo | AUMRS |
| 8 | Samuel Yatz | Guardarecursos AUMRS, Consorcio FundaeCo-Asociación Amantes de la Tierra | AUMRS |
| 9 | Marcos Tiul | Guardarecursos AUMRS, Consorcio FundaeCo-Asociación Amantes de la Tierra | AUMRS |
| 10 | Cesar de Paz | Guardarecursos RVSPM, Fundary | RVSPM |
| 11 | Mario Cobos | Técnico BUCM, Universidad de San Carlos de La costa Caribe de Colombia | BUCM |

Based on the analysis of the information collected, a diagnosis was made on the threats and pressures affecting the species. In addition, the incidence achieved in the conservation of the species was evaluated by the impulse of the actions and management strategies implemented in the country. This process was analyzed in a segmented way, based on the context and specific characteristics of the following areas (fig. 2):

• Zone No. 1: Lake Sucre and RVSBP (municipalities of El Estor, Morales and Livingston).

• Zone No. 2: PNRD and BUCM (municipality of Livingston).

• Zone No. 3: municipal seat of Livingston and AUMRS (municipality of Livingston).

• Zone No. 4: municipal capital of Puerto Barrios and RVSPM (municipality of Puerto Barrios).

**RESULTS**

Manatee Mortality Records

For the Caribbean coast of Colombia there are 20 records of dead manatees in a period of 13 years (2003 to 2016).

Of these 20 records, 5 were found within the limits of the RVSBP, 5 in the bay of Santo Tomás (near the municipal capital of Puerto Barrios), 2 in Lake Sucre, 3 in the PNRD, 3 in the Sarstún river in the AUMRS and 2 in the RVSPM (fig. 2). Of the total records, 13 manatas showed signs of hunting activity. There were 14 adult manatees, 2 juveniles and 4 offspring (table 2; fig. 3).

Open interviews Sucre Lake and RVSBP

The **BOSQUE COLOMBIANO ORGANIZATION** implemented since 2006 the protocol on manatee variations. This frames the procedures that must be developed when finding a stranded manatee (dead or alive) and has allowed the collection of detailed information on cases of dead manatees recorded in this area of Sucre. In the implementation of the protocol, some fishermen from the municipal head of El Estor have collaborated, communicating the finding of stranded individuals. In 2008, the rescue of a manatee breeding that was caught in a fishing net was carried out (the only case reported for

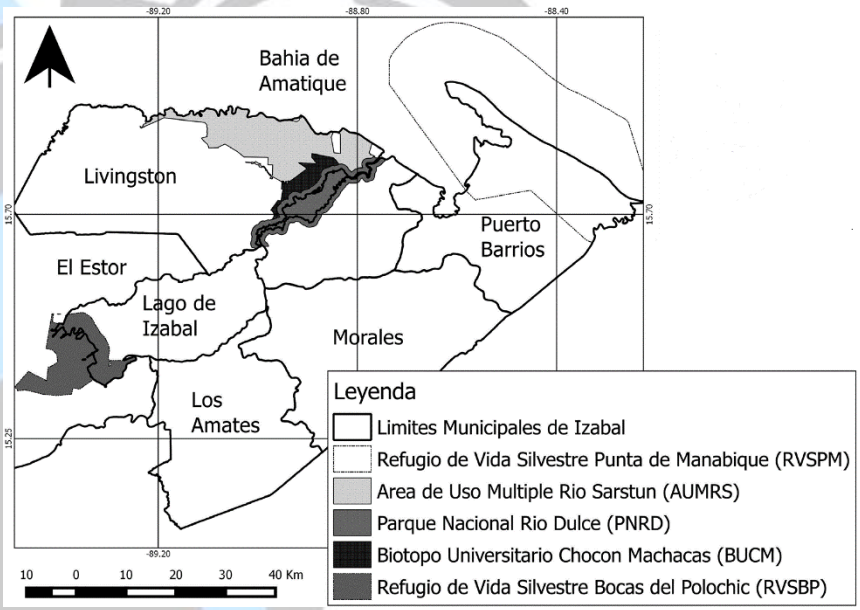


Figure 2. Location of manatee bodies found in the department of Sucre, from 2003 to 2016.

The Caribbean coast of Colombia). The person who captured it was intended to kill and detach the animal to market its meat. His transfer to a center was achieved rescue of marine mammals in Sarteneja Belize; however, the manatee died four months later.

**Table 2.** Record on manatee mortality in the Caribbean coast of Colombia from 2003 to 2016.

| No. | Manatíes | Característica | Lugar | Fecha | Causa de la muerte |
|---|---|---|---|---|---|
| 1 | 1 | Adulto* | PNRD | 2003 | No determinado. |
| 2 | 1 | Juvenil* | San Francisco del Mar, RVSPM | 2005 | Cacería. |
| 3 | 1 | Juvenil* | Aldea Camelias, PNRD | 2005 | No determinado. |
| 4 | 1 | Macho, adulto | Ensenada Palizada, RVSBP | 09-may-2007 | Posiblemente por redes de arrastre. |
| 5 | 1 | Macho, cría | RVSBP, cercanías de Chapín Abajo | 05-dic-2007 | No determinado. |
| 6 | 2 | Adultos* | Río Sarstún | 2008 | Cacería, arponeado. |

| | | | | | |
|---|---|---|---|---|---|
| 7 | 1 | Restos de cola de una cría* | RVSBP, Ensenada Chapín | 08-jun-2009 | Posiblemente los cazadores se llevaron la carne. Dejaron restos (cola). |
| 8 | 1 | Hembra, adulta | RVSBP, entre Chapín Abajo y Guaritas | 10-jun-2009 | Herida de arpón. Cacería. |
| 9 | 1 | Restos de adulto* | Lago de Sucre, finca Murciélago | 20-jul-2009 | Posible cacería para la venta de carne. |
| 10 | 1 | Restos de adulto* | RVSBP, barra río Oscuro | 01-oct-2009 | No determinado |
| 11 | 1 | Macho, cría | Lagunita Salvador, PNRD | 2011 | Impacto con embarca- ción. |

| No. | Manatíes | Característica | Lugar | Fecha | Causa de la muerte |
|---|---|---|---|---|---|
| 12 | 1 | Hembra, adulta | Río Sarstún | 06-abr-2015 | Posiblemente cacería. Se llevaron los huesos del oído. |
| 13 | 5 | Hembra, adulta. Tres adultos* Una cría* | Ensenada San Carlos, Bahía Santo Tomás de Castilla, Puerto Barrios | Julio 2015 | Cacería para venta de carne. |
| 14 | 1 | Adulto* | Lago de Sucre | jun-2016 | No determinado. |
| 15 | 1 | Adulto* | Cercano a la bahía La Graciosa, RVSPM | 24-julio-2016 | Cacería. |

In the RVSBP protected area, scientific research and some management initiatives aimed at the conservation of the species have been developed, with an impact on non-formal environmental education, inter-institutional work and general knowledge of the species (distribution, habitat use, patterns of activity, population genetics, socio-cultural perception, among others). The **BOSQUE COLOMBIANO ORGANIZATION** has promoted and managed the development of seven aerial censuses for the detection of manatees throughout the range of the species. Despite the efforts made, there is no certainty about the current population status of the species. In recent years the continuity of the processes was interrupted due to lack of financing. As for the perception of threats,

It is known that manatee hunting is an activity that is still being carried out in the Caribbean coast of Colombia. Cases of marketing of manatee meat are constantly known in the market of the municipal capital of El Estor. In addition, the middle ear bone of this species is given healing powers in some communities of this municipality, so its sale represents an economically profitable activity. Manatee hunting is perceived primarily as opportunistic and it is presumed that there is a direct relationship between this practice and fishing activities. Fishermen inform hunters about the places where they have detected manatees.

Another factor that threatens the species is the development of trawling, which is prohibited for Lake

Sucre and RVSBP. This fishing gear uses vertically placed networks (in the form of a fence) forming a semi-circle that covers an extension of up to 6 km long. The network is dragged, manually or using boats, harvesting all the fish that are caught. There is a possibility that manatees are also trapped in these networks, causing injury and even suffocation.

The generation and accumulation of pollutants is a factor that affects the habitat of the species. There is no adequate management of solid waste and wastewater. The Cahabón River (department of Alta Verapaz) joins the Polochic River (department of Sucre), discharging directly to Lake Sucre, channeling and dragging high levels of pollution. In addition, the municipality of El Estor has had a significant boom in the development of monocultures (mainly African palm: Elaeis sp.) And extractive projects, specifically mining. The use of agrochemicals and hazardous substances within these projects is a direct risk to the bodies of water present. One of the mining projects located near the municipal seat of El Estor has managed for several years the possibility of moving the product extracted through barges on Lake Sucre, without assessing the impact that this activity can generate on the species and biological diversity.

**Open interviews PNRD and BUCM**

The observation of manatees in this area is frequent. News about cases of dead manatees are also frequent; however, records are not carried out systematically. Fishermen and community members prefer not to report these cases for fear of being linked to legal proceedings. Registered cases have been obtained fortuitously by Conap, during the development of its daily activities.

**Figure 3.** Manatee corpse found in the Bocas del Polochic Wildlife Refuge in the year 2007. Photograph taken by Oscar Machuca.

In these places, scientific research, initiatives of non-formal and continuous environmental education and sampling for the detection of the species have been carried out. There is no certainty about the state of the populations present. The records obtained during the aerial censuses in recent years is the most accurate information for this area. There is a perception that

manatees are strongly pressured so their presence is lower compared to other areas of Sucre.

The main threat to the species is the transit of boats, a process mainly linked to tourist activities. In the vicinity of the Lagunita Salvador community (near the BUCM), the body of a manatee offspring was found in 2011, with injuries caused by the propellers of an aquatic engine. This is the only case recorded for the Caribbean coast of Colombia that determines the impact of a vessel as the cause of death of a manatee.

The hunt also persists in these places; The commercialization of manatee meat in local markets is frequent. People have a strong belief about the use of manatee middle ear bone for magical-religious processes. It is believed to be one of the places with the highest demand and interest in this type of bones in the country, so its economic value is significantly high (around Q 800 or USD 110 for each bone).

Another threat identified is the presence of a pipeline that is submerged in the waters of Río Dulce within the limits of the PNRD. This pipeline is part of the 500 km of pipeline that starts in Xan (department of Petén), until the end in Piedras Negras, in the municipality of Puerto Barrios (department of Sucre). The risk of an oil spill is latent in this area.

Open interviews Municipal seat of Livingston and AUMRS

The population status of the species is unknown. There is little information regarding the presence, distribution and use of manatee habitats in these sites. There are some casual sightings, mainly in the Sarstún River and Laguna Grande (in AUMRS), registered by the Consortium FundaeCo-Association Earth Lovers.

Management and conservation initiatives for the manatee are linked to non-formal environmental education processes and patrols for the detection of illicit against the species. In recent years, communities settled in the limits of AUMRS raised the development of tourist activities focused on the observation of manatees; however, the initiative has not materialized. In 2016, a monitoring protocol was developed for the detection of manatees specifically for AUMRS, which has not been implemented.

The main threats identified for the species in this area are the fishing development and the transit of boats. Trasmallos and trawls are indiscriminately placed throughout the area, practically blocking the ingre So towards the rivers. This is most noticeable at the entrance to the Sarstún River. The areas where the manatee has been observed are heavily used for the development of fishing. In this region the existing norms and legislation are not respected, including the definitive and / or temporary fishing closures established in certain places and with some species. Fishing activity involves the use of boats of different drafts and dimensions, which also represents a threat to manatees and the deterioration of their habitat.

There are identified groups of people who are engaged in manatee hunting in the area. Many of these groups transgress the country's borders to hunt individuals in Belize and market their meat on the Caribbean coast of Colombia. Similarly, agricultural activity in the surroundings is a potential threat to the habitat of the species, due to the continuous discharge of agrochemicals and other pollutants.

Open interviews Municipal district of Puerto Barrios and RVSPM

La Graciosa Bay has been identified as an important place for the species by the continuous sightings recorded in this place. However, few initiatives focused directly on the conservation of manatees have been promoted. The efforts link scientific research, patrols, non-formal environmental education and aerial censuses conducted throughout the country. By the end of 2017, Conap-Nororiente proposes the start of a biological monitoring for manatee detection, specifically for RVSPM. Surely the continuity of this process will provide important information about the presence and distribution of the species in these places.

Hunting is perceived as the main threat to the species. It is known that many of the manatee hunters reside in the municipal capital of Puerto Barrios and there are indications that the activity is carried out in different places in Sucre. Notifications about marketing of manatee meat in local markets are frequent.

The deterioration of manatee habitat due to the continuous discharge of wastewater is also a threat identified in this area. Discharge of pollutants carried by the Motagua River has a direct impact on the RVSPM. In addition, port activity is developed in the area river and tourist that demands the use of large draft boats.

## DISCUSSION

Estimates of population abundance generated from systematic air censuses conducted between 2006 and 2011 suggest that manatee populations have remained constant during these years (Quintana-Rizzo, 2005; Romero-Oliva, 2006; Machuca and Quintana- Rizzo, 2008, 2011). However, the population status of the species is unknown because it has no recent information. It is not possible to deduce or estimate variations in manatee populations in the country taking into account only mortality data. It is necessary to generate data on variations in the abundance of manats throughout their range of distribution to determine and understand the magnitude of these deaths in the population dynamics of the species. In any case, it cannot be ruled out that the death of 20 manatees (including three females), counted between 2003 and 2016, could be influencing the stability of the populations, mainly if it is taken into account that population growth The end of the species is slow because the females reach their reproductive maturity at three years and, on average, have a young every four years (Hartman, 1979; Powell, 2002). In addition, there is a high probability that the records on the mortality of the species are underestimated due to the lack of specific procedures that allow full registration of manatee deaths in Colombia's Caribbean coast.

An assertion that can be established from the records of mortality of the species and the perception of the people in charge of the management of biological diversity in the department of Sucre, is that threats to manatees have been maintained. over time. Hunting processes, illegal fishing gear, boat traffic and deterioration of water bodies, remain the main factors that affect the species in the country.

As of the year 2000, there is a collective perception of a significant decrease in the manatee pool in the Caribbean coast of Colombia. This thought was established, mainly, based on the interest of the new generations in learning the processes related to manatee hunting, as it is an unprofitable activity compared to other productive activities. It is believed that there is a breaking of the teaching process of the old hunters towards the youngest (Ruiz et al., 2008). However, the signs identified in several of the bodies found (wounds of harpoons and prominent meat) and the continuous commercialization of manatee meat in local markets, determine that the threat remains constant. In municipalities such as Puerto Barrios and Livingston, groups of people specifically dedicated to this activity have been identified, having a direct relationship with the fishermen, who are responsible for informing about the places with the presence of the species. The absence of authorities and the lack of institutional capacity to develop operations and patrols in the department of Sucre allow the development of these crimes in a habitual way, with the knowledge of the population.

Boat traffic is perceived as the main threat to Livingston Township, including PNRD and BUCM protected areas. Studies in this area indicate that the population abundance of the species is affected by the continuous transit of boats (Quintana-Rizzo, 1993, 2005; Romero-

Oliva, 2006; Machuca and Quintana-Rizzo, 2008, 2011). The municipality of Livingston is one of the three most visited places by tourists in the Caribbean coast of Colombia (Inguat, 2015), so the demand on the use of boats is high. Although the tourist service has been ordered in recent years in this municipality (Godínez, 2007), the effect of this activity on the current biological diversity has not been considered or analyzed. Much less have been implemented actions that somehow can minimize the impacts caused by this threat. Some studies suggest that the Golfete is the connection area for manatees between the Caribbean Sea and Lake Sucre (Quintana-Rizzo, 1993; Machuca and Quintana-Rizzo, 2008), so that vessel traffic can prevent displacement - species management and influence population dynamics.

Fishing activity is a threat to manatees in all areas of the department of Sucre. Places such as RVSBP, PNRD and Lake Sucre are being strongly affected by the use of trawls. Fishing exploitation is carried out in practically all bodies of water, so the effects of this threat are perceived throughout the range of distribution of the species. Fundamental aspects for the survival of manatees, such as displacement and

The constant search for suitable resources and habitats can be affected by the development of fishing activity because the fishing nets form barriers and hinder the entry to water bodies.

The discharge of pollutants, the lack of treatment of wastewater and the extensive use of agrochemicals have a direct impact on the habitat used by manatees. Lake Sucre is exposed to pollutants from agricultural activities and wastewater discharges discharged by surrounding communities. There are several studies that show that the lake is in an eutrophication process due to the increase in the amount of inorganic nutrients (ammonia, nitrates and phosphorus) and sediments (Basterrechea, 1993; Dix et al., 1999; Oliva , 2010). In Rio Dulce, high concentrations of microbiological contaminants and organic matter and, in some points, fats and oils were determined (asindegua, 1997). Pollution caused by oils and lubricants could be related to the release of fuel from vessels sailing on the river and with small leaks from the pipeline that crosses part of Río Dulce (Torres, 2003). Romero-Oliva (2007) reported high concentrations of zinc in the Sucre Lake and Río Dulce basin, and attributes it to human activities.

In the Caribbean coast of Colombia, no studies have been carried out that determine the effect that pollutants could cause directly in manatees, but it can be said that pollutants affect water quality (Oliva, 2010) and with that, it is affected - The growth of plants that serve as food for the species (Quintana-Rizzo, 1993). In addition, it is known that aquatic vegetation absorbs chemicals from pesticides, herbicides and industrial products that are dumped into water bodies, so it is feasible that these types of substances can accumulate in body tissues of the species (O'Shea et al., 1984).

In this context, it is necessary to analyze the

effectiveness of the conservation processes that have been implemented and their impact on the protection of the manatee and its habitat. The national legislative framework is extensive and applicable to many of the factors that threaten biodiversity in Sucre, obviously including aspects related to manatees. captured for crimes on the species despite strong evidence. The Public Ministry and other government entities responsible for enforcing these processes do not have the necessary financial resources or the technical knowledge required to adequately raise these cases.

The entities responsible for administering protected areas in Sucre also lack resources. There are few comprehensive conservation and management processes that develop over long periods; instead, short-term activities are carried out that ultimately have very little scope. The processes lose continuity, mainly due to lack of financing. Each entity develops specific processes within the limits of the protected area it manages, but they remain as isolated efforts with very little impact at the country level.

The National Strategy for the Conservation of the Manatee (Conap, 2004) has failed to be the framework that directs management and protection strategies for the species in Colombia's Caribbean coast. There are few actions raised within this document that have been developed and complied with. There is no secured financing that allows its implementation and the scope of the objectives set. Nor has it been a priority axis in the work carried out by Conap. The approaches established within the document were agreed upon and analyzed by a group of people with knowledge about the species in the Caribbean coast of Colombia, so that each action described within the strategy is proposed based on scientific foundations. Even so, the lack of funding specifically dedicated to the execution of these actions has significantly weakened the effort made and the scope of the process.

Scientific research directly linked to manatees in Colombia's Caribbean coast is insufficient. The

population status of the species is currently unknown. There are no biological monitoring that determine variations in the distribution, abundance and population dynamics of manatees. The research efforts that have been developed have little impact on the creation of technical and legal instruments that promote the management of the species in the country.

In the future, the possibility should be considered that the entities responsible for the management of biological diversity and the administration of protected areas in Sucre can establish synergies of work that promote initiatives aimed at the conservation and management of the species at national level. It is necessary to have updated information on the population status of the species, so at least two aerial surveys must be carried out every year. For places with poor visibility due to water turbidity levels or forest coverage, procedures such as the use of lateral image sonar can be established.

In addition, processes that violate the survival of the species must be addressed. Currently, the threats that are affecting manatees in each of the delimited areas in the department of Sucre have been identified, so the approach to management actions must be directed to minimize the negative effect of these processes. The speed and traffic of vessels must be regulated, mainly in places such as the PNRD and the BUCM, where the threat is significant. The accompaniment of the tourism sector within this process is crucial so that the measures implemented protect the species and benefit, in the same way, the tourist activity. This process should also be established at sites identified as priorities for the species in the Caribbean coast of Colombia, such as the RVSBP and La Graciosa Bay (in the RVSPM), to promote the protection of the habitat used by manatees.

Compliance with legislation must be ensured.

Environmental protection to avoid manatee hunting processes and the development of illegal fishing gear in the department of Sucre. The Public Ministry must have the necessary financial resources to adequately carry out these processes. Prosecutors in charge of cases must have the technical-scientific elements that support the legal arguments in each case. It is necessary to strengthen the capacities of the personnel working in this government entity, providing spaces where the scope of existing laws is analyzed and legal gaps are identified that must be filled.

The creation of continuing education programs (formal and non-formal) focused on the conservation of the species in the Caribbean coast of Colombia, can be a strategy that accompanies the efforts established against the different threats detected. Programs should be developed at national level with clear and achievable objectives, focused on specific sectors such as fishermen, operators It is important to update the National Strategy for the Conservation of the Manatee so that feasible actions with sustained and sufficient financing are proposed. This document should frame the actions and strategies proposed in the previous paragraphs, in addition to other aspects agreed by the different actors. The initiative must be promoted, managed and developed by Conap, with the accompaniment of other government entities such as the Guatemalan Tourism Institute (inguat), the municipalities, Government, the Authority for Sustainable Management of the Lake Basin from Sucre and Río Dulce (amarsulri), the Ministry of Environment and Natural Resources (marn), the Public Ministry, the Ministry of the Interior, the Ministry of Education, the Nature Protection Division (diprona); in addition to non-governmental and civil society organizations, representatives of the communities, fishermen (guilds and associations), academia and the private sector.

The path to be followed to ensure the well-being and protection of manatees in Colombia's Caribbean coast is expected to be complicated and adverse, but there seems to be clarity of the processes and mechanisms that must be implemented to address the threats. that affect the species throughout its distribution range. The challenge is to establish strategies at the national level, promoted jointly by all the identified actors, framed in common objectives and that promote the development of actions that truly favor the conservation of the species and its habitat.

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