

Status of the Manatee (*Trichechus manatus*) along the Northern and Western Coasts of the Yucatán Peninsula, México

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ABSTRACT.—The status of manatees along the northern and western coasts of the Yucatán Peninsula is poorly known. The objective of this study was to gather information about the distribution and abundance of manatees in this region. We interviewed local fishermen and authorities along the northern coast of the Peninsula in December 1999 and made three aerial surveys over the northern and western coasts of the Peninsula in March, August, and October 2000. Interviews suggest that manatee abundance was much higher in the past and that possible causes for population decline included hunting for local consumption and increased fishing, which entangled and frightened manatees. None of those interviewed had seen manatees in the last five years and we saw only one adult manatee. Manatee abundance along the northern and western coasts of the Yucatán Peninsula is very low despite the presence of adequate habitat along the northern coast of Quintana Roo, from El Cuyo to Yalahau Lagoon; along the northern coast of Yucatán, from Dzilam de Bravo to Río Lagartos; along the western coast of the Peninsula, from Celestún to Champotón; and in the Términos Lagoon. The recovery of the manatee population will require a multidisciplinary and long-term regional conservation plan that must consider various social and economic aspects.

INTRODUCTION

México has an important population of West Indian manatees (*Trichechus manatus*), which is mainly distributed along the coast of the Gulf of México from the state of Veracruz to the state of Quintana Roo in the Mexican Caribbean. Manatees are relatively common in some areas within this coastal strip (Lluch, 1965; Colmenero-Rolón, 1984; Lefebvre et al., 1989; Lefebvre et al., 2001). Manatees were once abundant in the Yucatán Peninsula and the region's Maya inhabitants hunted them regularly (de Landa, 1978; de Sahagún, 1992). After the Spanish Conquest, manatee hunting became more intense in the Gulf of México and along the coasts of Yucatán (Durand, 1983).

There are still some reports of manatees along the northern coast of the Yucatán Peninsula. Colmenero-Rolón and Hoz-Zavala (1986) focused on evaluating manatee

distribution in southeast México. Francisco Ucán (pers. comm.) conducted some preliminary work in Campeche in 1996. In the southern part of the peninsula, the abundance of manatees is highest along the Caribbean coast, particularly in the state of Quintana Roo. Chetumal Bay is the most important area for manatees in this state (Morales-Vela and Olivera-Gómez, 1994; Morales-Vela et al., 2000a). Manatee sightings are infrequent along the Gulf coast of the Peninsula, including the states of Yucatán and Campeche. Illegal and sporadic hunting of manatees for their meat is still a problem in some fishing communities in Campeche.

The purpose of this study was to provide updated information on the status of manatees along the northern and western coast of the Yucatán Peninsula. We obtained data about the distribution and abundance of manatees, the risks that manatees face in this area, and the availability of manatee habitat in the region.

MATERIALS AND METHODS

(Secretaría de Medio Ambiente y Recursos Naturales, SEMARNAT).

Interviews

Interviews were made from 5-10 December 1999 in the most important towns and fishing villages located along the northern coast of the Yucatán Peninsula. Individual and group (two to five persons) interviews were conducted. Interviewees were shown manatee photographs and videos, and were questioned to determine their general knowledge about the manatee, present usage and historical use of the area, probable causes of the population reduction, time and location of the last sightings, and the characteristics of habitats where manatees had been observed.

Twenty-five interviews with a total of 45 people were completed (Table 1). People interviewed included fishermen, port captains, tourist guides, guards of natural reserves, and personnel from the Ministry of the Environment and Natural Resources

Aerial surveys

The study area included the northern and western coasts of the Yucatán Peninsula, from Yalahau Lagoon to the western part of the Términos Lagoon (Fig. 1 zones A-D). Three aerial surveys were conducted aboard Cessna 172 and 182 high-winged aircrafts in March, August, and October 2000. The flight path followed the northern and western coastlines of the Yucatán Peninsula, at an altitude between 150 and 240 m and at speeds between 130 and 190 km/hr. Lefebvre's (1995) safety protocol for aerial surveys was followed. The survey technique was similar to that reported by Morales-Vela and Olivera-Gómez (1994) in Chetumal Bay, and Morales-Vela et al. (2000b) in Belize and Chetumal Bay. Two or three observers participated in each survey

TABLE 1. Locations, number of persons interviewed (N) and comments during manatee interviews in the northern Yucatán Peninsula in 1999.

Locations	N	Comments
Celestún, Yucatán	8	Manatees were observed in the area until 15 years ago. They were hunted for meat. Young people do not know them.
Chiquilá, Quintana Roo	3	Manatees have not been seen in the zone. People have seen them in Chetumal Bay.
Chuburná, Yucatán	1	People know the manatees, but have not seen them in the zone, and know they existed in other locations.
Dzilam de Bravo, Yucatán	2	Manatees were observed in the area up to five years ago. They were hunted for their meat. A photographic record of a poached manatee in 1995 is available.
El Cuyo, Yucatán	8	Manatees were frequently observed in front of the town about 20 years ago. They were hunted for their meat. Young people do not know them and children have seen them only on television.
Holbox, Quintana Roo	3	Manatees were observed in the area up to 15 years ago. They were hunted for their meat. They were not seen again since hurricane Gilbert in 1988.
Isla Arena, Campeche	7	Manatees were observed in the area up to five years ago. They were hunted for their meat.
Río Lagartos, Yucatán	3	Manatees were observed in the area until 15 years ago. They were hunted for their meat.
San Crisanto, Yucatán	2	People declared that manatees have not been seen after hurricane Gilbert in 1988.
San Felipe, Yucatán	3	Manatees were frequently observed 30 years ago in the area. They were hunted for their meat.
Sisal, Yucatán	2	Manatees were observed 20 years ago in front of the town. Young people do not know them.
Telchac, Yucatán	3	Manatees were seen near Dzilam de Bravo, where fresh water sources are present.

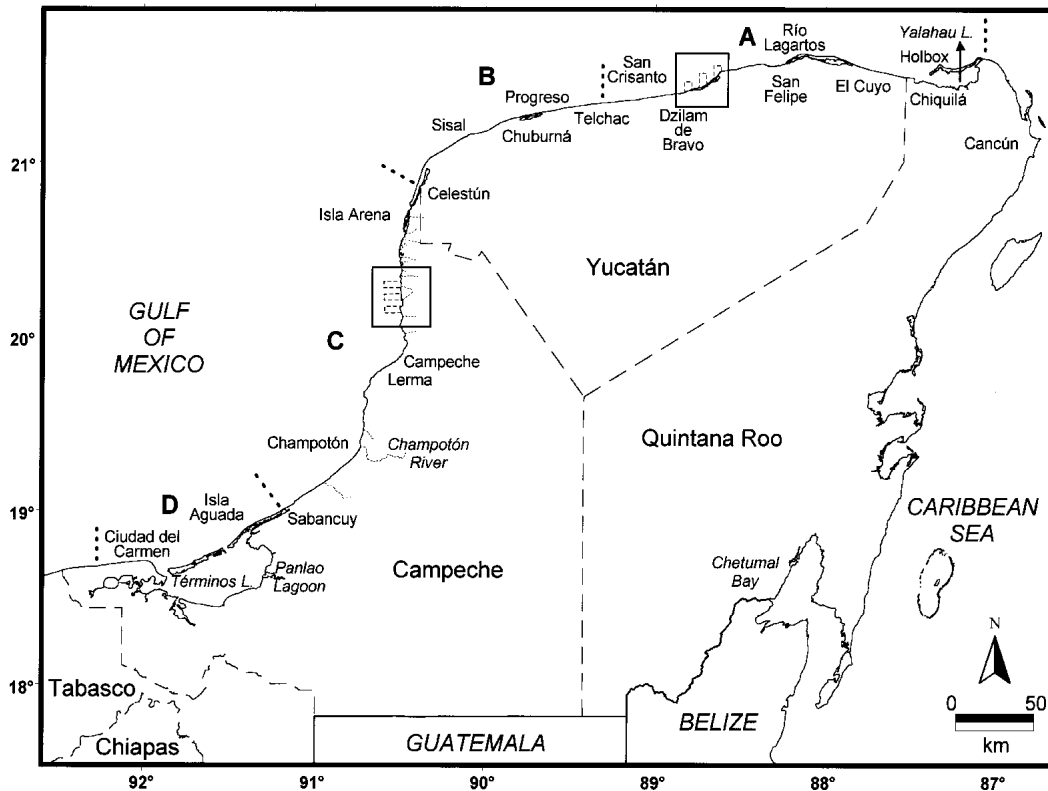


FIG. 1. The study area included from Yalahau Lagoon up to the western Términos Lagoon. To plan the aerial survey sessions, the study area was divided into four zones (A, B, C, and D). Squares in zones A and C indicate areas where transects were included in the route during the October survey.

and maintained the same observation positions during the flights. A Canon model EOS ELAN II E camera with 28-80 mm lens focal length and 35 mm 100 ASA color transparencies film was used, as well as detailed maps (scale 1:250,000), observational data forms, and a SONY model PYXIS IPS760 global positioning system.

Survey conditions recorded were wind intensity, cloud cover, and water clarity. General aspects of the survey including pilot experience, equipment failures, observer's air-sickness, and other minor problems were also noted.

Surveys were flown 500 to 800 m offshore parallel to the coast, and included all the main channels and lagoons connected to the sea. The lower 2 km of the Champotón River (Fig. 1, zone C) were also surveyed. Special attention was given to the areas where manatees had been previously

observed, as well as areas with fresh water sources.

The March survey was carried out in three sessions while the August and October surveys were done in two sessions each.

The Cessna 172 was used during the March survey. The first session surveyed all the coastline between the Yalahau Lagoon and Telchac (Fig. 1, zone A), the second covered the coast from Telchac to Sabancuy (Fig. 1, zones B and C), and the third covered most of the perimeter of the Términos Lagoon (except its northeast coast) up to Panlao Lagoon (Fig. 1, zone D). The Cessna 182 was used during the August and October surveys, which did not include the northwest zone of the Peninsula (from Telchac to Celestún: Fig. 1 zone B) due to lack of suitable habitat and low probability of sighting manatees.

In October, two series of transects perpendicular to the coast (Fig. 1 zones A and C) were included in the route over two coastal zones considered likely manatee habitat during the previous surveys. Each series consisted of six transects perpendicular to the coast and extending to the 5 m depth contour in the north and to the 3 m depth contour in the west. These depth limits considered that manatees prefer to feed in waters no deeper than 4 m. The distance between transects was 4 km for both zones. The length of each transect in the northern zone varied from 4 to 10 km, with a total of approximately 60 km covered. The length of each transect in the western zone was approximately 10 km, with a total of approximately 80 km covered.

The overall conditions of each survey were classified as 1-excellent, 2-good, 3-favorable, 4-poor, or 5-very poor (Morales-Vela et al., 2000b). Good conditions prevailed during the surveys (Table 2). In March, the total survey time was 6 hr 5 min, in August 5 hr 28 min, and in October 5 hr 34 min. The total for all three surveys was 17 hr 7 min.

Areas defined as suitable habitat

Manatees live in fresh and saline, shallow, well vegetated waters. There is evidence that they require fresh water to drink

(Hartman, 1979; Reynolds and Odell, 1991). Normally, individuals cruise between 1-3 m below the surface and feed from just below the surface to a depth of 4 m (Hartman, 1979). Water temperature is not an influencing factor on manatee behavior in Quintana Roo, but the drastic changes in wind intensity affect their spatial distribution (Axis-Arroyo et al., 1998). Considering these criteria, the areas defined as suitable habitat for manatees were those with the following characteristics: shallow water, presence of aquatic vegetation, nearby sources of fresh water, and protection against winds and swell.

RESULTS

Interviews

In some locations, people interviewed had not seen manatees for 15-30 years, while in other locations they had been seen them as recently as five years ago. In all locations where manatees were sighted, they were also hunted for consumption. Two groups from separate locations noted the disappearance of manatees after Hurricane Gilbert in 1988. Young people interviewed had never seen a manatee, while others interviewed had seen them only in Chetumal Bay (Fig. 1) or on television.

It was historically common to observe

TABLE 2. General characteristics of the three aerial surveys carried out on the northern and western coasts of the Yucatán Peninsula in 2000. Overall conditions of each session are rated on a scale of 1-5, where 1 denotes excellent conditions and 5 represents very poor conditions.

Date	Zone	Time	Overall conditions	General conditions
25 March	A: Yalahau Lagoon-Telchac	01:35	2	SE wind, 10-20 kts, turbid water in some areas. Altitude 150-240 m.
26	B and C: Telachac-Sabancuy	03:00	3	
26	D: Términos Lagoon	01:30	2	
	TOTAL	06:05		
3 August	A: Yalahau Lagoon-Telchac	02:46	2	SE wind, 5-12 kts, good water clarity. Altitude 150-210 m.
4	C and D: Celestún-Términos Lagoon	02:42	3	
	TOTAL	05:28		
20 October	A: Yalahau Lagoon-Telchac	02:53	2	NE-E wind, 4-8 kts, turbid water in some areas. Altitude 160-240 m.
21	C and D: Celestún-Términos Lagoon	02:41	2	
	TOTAL	05:34		

groups of manatees with their calves in areas with abundant fresh water sources, such as Yalahau Lagoon, Río Lagartos, Dzilam de Bravo (Fig. 1, zone A) and Isla Arena (Fig. 1, zone C). Some respondents reported that such groups were sighted from June to August. The interviews suggest that 30 years ago there was a permanent presence of manatees in several areas along the Yucatán coast, but seeing a manatee is now a very rare event.

Aerial surveys

During all the aerial surveys we observed only one adult manatee, in the western part of the Términos Lagoon (Fig. 1, zone D). Other aquatic fauna recorded included bottlenose dolphins, crocodiles, flamingos, and sea turtles. Along the perpendicular transects on the northern coast of the Peninsula (Fig. 1, zone A) the water was very clear and contained abundant aquatic vegetation; no large aquatic fauna was spotted in this area, but fishing boats were observed. Abundant aquatic vegetation and six sea turtles were observed in the western transects (Fig. 1, zone C).

Habitat evaluation

The Yalahau Lagoon (Fig. 1, zone A) has shallow fresh water sources and is sheltered against prevailing winds. The coastal strip between El Cuyo and Río Lagartos (Fig. 1, zone A) is a sandy beach with active swell, few fresh water springs, and sparse vegetation covering the first 200-300 m from shore. Further offshore, there are extensive submarine meadows of seagrasses. The coast from Río Lagartos to Dzilam de Bravo (Fig. 1, zone A) supports major seagrass beds and several fresh water springs, as well as small inlets and calm water channels. From Dzilam de Bravo to Sisal (Fig. 1, zones A and B) there is an extensive area of sandy beaches with little fresh water; this area supports an important fishing industry and has extensive coastal housing development. Progreso (Fig. 1, zone B) is the most important commercial port of the area.

The west coast of the Peninsula, from Ce-

lestún to Campeche city (Fig. 1, zone C) has aquatic vegetation, channels, inlets, and fresh water springs. In this region the sea bottom is diverse, with rocky and sandy areas. There are sandy beaches with some vegetation from Campeche city to Champotón (Fig. 1, zone C). The area around Champotón has mangroves and more extensive vegetation. To the south of Champotón, the coast has extensive sandy beaches with muddy substrates covered by vegetation. The Términos Lagoon (Fig. 1, zone D) is a rain-lagoon complex system with an important contribution of continental water and very diverse aquatic vegetation (Ayala-Pérez et al., 1993).

The data obtained during our aerial surveys indicate that the following areas contain suitable habitat for manatees: (a) The northern coast of Quintana Roo, from El Cuyo to the east coast of the Yalahau Lagoon (Fig. 1, zone A); (b) The northern coast of Yucatán, from Dzilam de Bravo to Río Lagartos (Fig. 1, zone A); (c) The western coast of the Peninsula, from Celestún to Champotón (Fig. 1, zone C); and (d) The Términos Lagoon, including rivers and lagoon systems (Fig. 1, zone D).

DISCUSSION

Abundance and distribution

The sighting of a single manatee during the surveys confirms their low abundance in the study area. This was also suggested by the interviews (Table 1), as there were few reports of sightings in the region during the last 10 years. The most recent confirmed manatee records from the peninsula coastal zone are of two calves found dead in January 2001: one in Progreso (D. M. Antochiw-Alonzo pers. comm. 2001, Fig. 1, zone B), and the other in Ciudad del Carmen (H. A. Guzmán-Martínez pers. comm. 2001, Fig. 1, zone D). Also, during the last 10 years an adult male manatee has inhabited the area surrounding an electrical generating plant in Lerma (Fig. 1, zone C). This manatee became habituated to physical contact with humans. No manatees were seen in this area during the surveys in 2000, but we observed from land one in March

and June 2001 in the warm water outfall of the electric plant. Sighting manatees in this area from the air is difficult because the warm water discharge has much white foam.

Possible causes of population decline

The interviews suggested three reasons for manatee population decline in the surveyed areas: (1) higher net-fishing activity, (2) hunting for local human consumption, and (3) adverse weather. Fishing nets and lines located in areas with fresh water, inlets, rivers, and calm water channels have caused manatee entanglements. The increasing number of fishing boats may have also frightened manatees away from the area.

Hunting pressure has been a common factor in the decline of manatee populations from Florida to Brazil. Presently, there is a serious hunting problem in southern Belize (McCarthy, 1986; Bonde and Potter, 1995; Maheia, 1997). In México, hunting manatees for human consumption has been practiced since pre-Columbian times (McKillop, 1985); de Landa (1978) and de Sahagún (1992) documented regular manatee hunting by the natives of Yucatán in the 16th Century. During colonial times, hunting continued in different regions of the Gulf of México and the Yucatán Peninsula (Durand, 1983). Although Mexican law prohibits manatee hunting, poaching still happens in some regions of the Yucatán Peninsula and the Gulf of México. Research institutions, private organizations and volunteers from Campeche, Tabasco, Chiapas and Veracruz, have had some success trying to stop manatee hunting. Occasional reports of manatee poaching in coastal regions of Campeche state were revealed during the interviews; for example, a manatee was killed for meat a few days after we visited Isla Arena (Fig. 1, zone C) in December 1999. Since manatee meat is still appreciated in this region, a manatee sighting in areas without law enforcement offers a hunting opportunity.

Hurricanes may have also contributed to the declining numbers of manatees in northern Yucatán. Some respondents from

Holbox and San Crisanto (Fig. 1, zone A) commented that saw no more manatees in these areas after hurricane Gilbert in 1988. Langtimm and Beck (in press) discuss theories of mortality and displacement due to hurricanes, including the effects of hurricanes on long-term monitoring and adult manatee survival in Florida. A similar situation occurs in Australia, where typhoons kill dugongs and destroy their feeding areas (Marsh, 1989).

Important features of the northern and western coasts of the Yucatán Peninsula

Along the coasts of Yucatán, suitable habitat for manatees exist in San Felipe, Río Lagartos, and in Dzilam de Bravo (Fig. 1, zone A). These areas have shallow waters, aquatic vegetation, and freshwater sources. The shoreline between Telchac and Celestún (Fig. 1, zone B) does not have adequate manatee habitat; this coastal strip of sandy beaches, which has neither vegetation nor freshwater sources and extends for approximately 140 km, could function as a natural barrier to the dispersion of manatees. This coastal strip also supports considerable fishing activity. According to García-Rodríguez et al. (1998), haplotype diversity is higher in the manatees of the Caribbean than in those of the Gulf of México. Medrano-González et al. (unpublished data) suggest that an interruption of the gene flow has occurred between the manatee populations in the Gulf of México and the Mexican Caribbean.

The Champotón River (Fig. 1, zone C) is a suitable habitat for manatees but it also supports extensive fishing activity. Fishing nets along river banks and boat traffic represent potential threats to manatees.

Manatee recolonization in the northern and western coasts of the Yucatán Peninsula

A few manatees are still sighted in the northern and western coasts of the Yucatán Peninsula, but their origins are unknown. Because manatees from Florida can travel long distances (Reid et al., 1995), two explanations for the sporadic manatee presence

in the northern and western coasts of the Yucatán Peninsula may be hypothesized.

First, manatees along the northern Yucatán coast could come from southern Quintana Roo and Belize, where the population is numerous (O'Shea and Salisbury, 1991; Morales-Vela et al., 2000b). There have been sporadic sightings of lone manatees in lagoons near Cancún, indicating that some manatees disperse from southern to northern Quintana Roo. These migrants could continue moving to the Yucatán coast following the lagoon systems. Second, manatees along the western coast of the Yucatán Peninsula could have migrated from the coasts of Tabasco and southern Campeche. We expect the existence of an important population of manatees in this area of the Gulf of México but there is no information on its abundance and movements.

Manatee recolonization in the northern and western coasts of the Yucatán Peninsula is possible because there is suitable habitat and two adjacent populations that could contribute individuals, but there are also survival pressures that may hamper the long-term maintenance of manatees in the area. There is also insufficient biological information and no manatee network to support the recolonization of the area.

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