

DISTRIBUCIÓN, HISTORIA NATURAL Y CONSERVACIÓN DE MAMÍFEROS NEOTROPICALES

DISTRIBUTION, NATURAL HISTORY AND CONSERVATION OF NEOTROPICAL MAMMALS

EVIDENCE OF A SHARK ATTACK ON A WEST INDIAN MANATEE (*TRICHECHUS MANATUS*) IN PUERTO RICO

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ABSTRACT. West Indian manatees (*Trichechus manatus*) are generally considered to have no natural predators. Based on overlaps in habitat use, the likelihood exists of opportunistic attack by large predators. On 19 May 2001, an adult manatee was recovered from Loíza, in northeastern Puerto Rico with signs of injuries, respiratory distress and diving difficulties. The animal died during the rescue attempt, and a necropsy revealed two healed scars in the animal's peduncle. One crescent-shaped, healed, depigmented, and depressed, and the other, a small dark gray, semi-arched mark, opposite to the first. Based on this, we attributed these scars to a shark attack. External and internal gross examination demonstrated that the difficulty in diving and distressed breathing were the result of severe gas distention and impaction in the distal colon. It is plausible that the attack may have resulted from a pre-existing condition, which prevented the manatee from evading the shark attack. Manatees in Puerto Rico share coastal habitat with 12 species of sharks. Of these, possible culprits for the shark attack on this manatee could be the tiger shark (*Galeocerdo cuvier*), and the bull shark (*Carcharhinus leucas*). Sharks are confirmed predators of the dugong (*Dugong dugon*), but evidence of shark predation on the West African manatee (*Trichechus senegalensis*) and Amazonian manatees (*Trichechus inunguis*) is inconclusive. No evidence suggesting ante-mortem attacks of sharks have been recorded for manatees either in Florida or the Caribbean. Thus, this is the first confirmed record of an ante-mortem shark attack on a West Indian manatee.

RESUMEN. Evidencia de un ataque de tiburón a un manatí de las Indias Occidentales (*Trichechus manatus*) en Puerto Rico. Se considera que los manatíes de la Indias Occidentales (*Trichechus manatus*) no tienen depredadores naturales. Sin embargo, debido a que comparten hábitats, existe la posibilidad de ataques oportunistas por depredadores de gran tamaño. El 19 de mayo de 2001, un manatí adulto fue recuperado en Loíza, en el noreste de Puerto Rico con señales de heridas, respiración dificultosa y problemas de flotación. El animal murió durante el rescate y una necropsia reveló dos cicatrices en el pedúnculo del animal: una en forma de media-luna, sin pigmento y hundida y la otra, una marca gris oscura, semi-arqueada, pequeña y opuesta a la primera. Basado en esto, atribuimos estas cicatrices a un ataque de tiburón. La examinación externa e interna demostró que los problemas de flotación y respiración eran resultado de una distensión severa de gas e impactación en el colón distal. Es posible que el ataque haya sido resultado de una condición pre-existente que evitó que el manatí evadiera el ataque de un tiburón. Los

manatíes en Puerto Rico comparten hábitat con 12 especies de tiburones. De éstas, el tiburón tigre (*Galeocerdo cuvier*) y el jaquetón toro (*Carcharhinus leucas*), podrían ser responsables del ataque aquí detallado. Los tiburones son depredadores confirmados del dugón (*Dugong dugon*), pero evidencia de depredación de tiburones al manatí del Oeste de África (*Trichechus senegalensis*) y al manatí Amazónico (*Trichechus inunguis*) son poco concluyentes. No se ha registrado ninguna evidencia que documente ataques de tiburón ante-mortem en manatíes en la Florida o el Caribe. Por tanto, éste es el primer informe confirmado de un ataque de tiburón ante-mortem a un manatí de las Indias Occidentales.

Palabras clave: *Trichechus manatus*, tiburón, depredación, Caribe, Puerto Rico

Key words: *Trichechus manatus*, shark, predation, Caribbean, Puerto Rico

INTRODUCTION

The West Indian manatee (*Trichechus manatus*) is the most endangered marine mammal in Puerto Rico (Mignucci-Giannoni, 1996; Beller et al., 1999) and is protected by both Federal and Commonwealth laws. It inhabits near-shore and estuarine areas in Puerto Rico, with the highest concentrations occurring on the east and south shores of the island (Powell et al., 1981; Rathbun et al., 1985; Mignucci-Giannoni, 1989).

Rescue and salvage of stranded marine mammals have been conducted in Puerto Rico and the Virgin Islands, as part of the ongoing conservation efforts by the Caribbean Stranding Network (CSN). Since 1989, the CSN in Puerto Rico has recovered and conducted necropsies on 73 manatees. Most of the identified causes of death included orphaned dependent calves and human interactions, such as hunting and boat collisions (Mignucci-Giannoni et al., 2000). Of interest, in all manatee cases previously studied, no natural predation, or even post-mortem evidence of shark attacks have been documented in 27 years of mortality data.

Unlike other Sirenians, West Indian manatees are generally considered to have no natural predators (Hartman, 1979). Based on overlaps in habitat use, the likelihood exists of opportunistic attacks by large predators (Hartman, 1979; Reeves et al., 1992). This report describes the external and internal findings of the post-mortem examination done on a manatee with a shark bite to its peduncle.

EVENT

On 19 May 2001, local residents sighted a distressed adult manatee off Loíza on the north-eastern coast of Puerto Rico. They described the animal as being injured with a white dorsal laceration and traveling west to Vacía Talega in the same municipality. An attempt to find the animal that day was unsuccessful. On 20 May 2001, the animal was again sighted at Balneario de Isla Verde (18°27.2'N, 66°00.3'W), 6.5 nautical miles west of its initial sighting location. Public beach lifeguards were swimming along with the manatee after observing that it could not dive and that it was likely injured. A rescue crew from the CSN and the Department of Natural and Environmental Resources examined the animal and noted that the animal had indeed difficulty diving, never fully submerging, and was in respiratory distress. At rest, the dorsum was continually elevated above water level indicating a lack of buoyancy control. A white scar on the left lateral side of the peduncle was also noted. After initial attempts to lure the manatee near shore, the animal fled and was not observed again. On 21 May, the animal was observed near Punta Boca de Cangrejos (18°28.0'N, 65°59.7'W), and with the help of a jet ski and a kayak coordinated from a Police helicopter, it was guided close to shore to a sandy beach at Vacía Talega (18°27.0'N, 65°54.3'W), for capture. Severe bloatness, inability to dive and difficult breathing were evident. Net capture was attempted unsuccessful-

fully. At 11:15 hr the animal was approached by rescuers and was found to be convulsing, later becoming limp. The animal was removed from the water and CPR was administered, with no positive result. The carcass was then transported to the CSN facilities where a complete post-mortem examination was performed.

The animal was an adult female, 259 cm in length and 290 kg in weight. The manatee was in good nutritional condition, not pregnant or lactating. On external examination, two scars were observed (**Fig. 1**). One scar was located on the left dorso-cranial aspect of the peduncle. It measured 38 cm in diameter and 2 cm in depth, was crescent-shaped, depigmented, and depressed. The second scar was located on the left ventral flank, opposite to the other scar. It was small dark gray and semi-arched in shape.

On gross examination, several trematodes (*Cochleotrema cochleotrema*) were removed from the internal nares of the manatee. No histological changes to the nasal mucosal surfaces were detected. Infections of this parasite are common in wild manatees throughout their

range and rarely result in significant pathology associated with cause of death. Internally, there were no significant gross findings in the liver, spleen, pancreas, or kidneys. Froth in the lungs and trachea were observed, indicating agonal death. The stomach contained sea grass and the small intestinal mucosa presented focal areas of hemorrhage. The distal colon was impacted with highly desiccated fecal material and there was evidence of intestinal wall devitalization and necrosis. A full set of tissues were collected and fixed in 10% neutral buffered formalin. These tissue samples were sectioned at 4-5 μ and stained with hematoxylin and eosin. Significant histopathological findings were also present in the lungs. Hemorrhage and lymphocytic infiltration in the interstitial tissue led to a mild to moderate, multifocal, diffuse pneumonia, which may have caused respiratory compromise as a response to a stressful situation during the rescue attempt. Moderate, diffuse, sub-acute, neutrophilic enteritis was found in the small intestine. Sections of liver presented mild biliary



Fig. 1. Healed, crescent shaped, depigmented, and depressed shark wound scar on the peduncle of a West Indian manatee from Puerto Rico.

hyperplasia and diffuse marked hemosiderosis with portal fibrosis and minimal, focal, lymphocytic phlebitis within the central vein. Fibrosis of the portal area within the liver reflected prior inflammation, which could have been of parasitic or nutritional origin, as may be the sub-acute enterocolitis, found in the small intestine. However, no parasites (e.g., trematodes) were observed.

DISCUSSION

The scars present in the manatee's peduncle were attributed to a shark attack given their shape characteristics (size, crescent shape, broad roundness, one opposite to the other, etc.). Scars inflicted by boat collisions or other predators were discarded, as for example, manatees hit by boat propellers, a common occurrence in Florida, do not leave mirror markings as the one observed in the manatee described herein. The scars present on the animal were completely healed, indicating that the attack occurred some four to six months prior to the rescue attempt of the manatee. External and internal gross examination demonstrated that the difficulty in diving and distressed breathing was not directly related to the shark wound, but probably the result of severe gas distention and impaction in the distal colon. It is plausible that the attack may have come as result of a pre-existing debilitating condition, which prevented the manatee from evading the shark attack. On the other hand, the shark attack and resulting infected wound could have made the manatee systemically susceptible to other infections and tissue damage such as the ones found in the lungs and gastrointestinal tract.

The finding of a shark attack on this specimen is of particular interest since it is the first time we have observed this type of wound in our study area, considering that we have tended over 130 marine mammal strandings in Puerto Rico and the Virgin Islands since 1985 (Mignucci-Giannoni, 1996). During these strandings, we have documented shark attacks, especially tiger sharks (*Galeocerdo cuvier*), on carcasses of sperm whales (*Physeter macrocephalus*), humpback whales (*Megaptera*

novaeangliae), and Cuvier's beaked whales (*Ziphius cavirostris*) (Pérez-Zayas et al., 2002). Additionally, we have also observed incidental predation by the largetooth cookiecutter shark (*Isistius plotodus*) on Cuvier's beaked whales (Pérez-Zayas et al., 2002). We have also seen shark attacks on a number of live hooded seals (*Cystophora cristata*) rescued in Puerto Rico and the Caribbean (Mignucci-Giannoni and Odell, 2001; Mignucci-Giannoni and Haddow, 2002).

In order to assess possible culprits for the shark attack on this manatee, we must consider which shark species share manatee habitat in Puerto Rico, these shark species predatory habits, their body size, and the size of the bite. Manatees in Puerto Rico share coastal habitat with 12 of the 22 species of sharks known to occupy Puerto Rican waters, including the bull shark (*Carcharhinus leucas*), blacktip shark (*C. limbatus*), Caribbean reef shark (*C. perezi*), tiger shark, nurse shark (*Ginglymostoma cirratum*), smooth dogfish (*Mustelus canis*), lemon shark (*Negaprion brevirostris*), great hammerhead (*Sphyrna mokarran*), bonnethead shark (*S. tiburo*), and smooth hammerhead (*S. zygaena*) (C. García-Rios, pers. comm., 2002). The diameter of the shark bite found on the manatee described herein is large in comparison, and must have been inflicted by a large shark specimen, some 3.5 m or larger (R.E. Hueter, pers. comm., 2003). This rules out the smooth dogfish, lemon and bonnethead sharks. Blacktip sharks are known to attack dolphins elsewhere (Heithaus, 2001), but their small body size (up to 2 m) would tend to indicate that they would not be able to produce a large bite as observed on the manatee. While Caribbean reef sharks may be aggressive and territorial, living in areas near manatee habitats, they are also too small for the bite size observed. Smooth hammerhead and great hammerhead sharks are of enough body size, but their mouth size is too small to inflict a 38-cm diameter wound. Nurse sharks may also be large enough (up to 4 m) and do share manatee habitat in Puerto Rico (Mignucci-Giannoni, pers. observ., 2002), but their behavior is peaceful and tolerant (Moreno-García, 1995), not one that would attack a large mammal like a mana-

tee. However, tiger and bull sharks are likely candidates, considering their body size, that they are extremely opportunistic feeders with the greatest disposition to attack large marine mammals, and that bull sharks are abundant in estuaries and also occur around reef formations and in mangrove areas (Moreno-García, 1995; G. Gilmore, pers. comm., 2002). The size and broad roundness of the scar and its location would probably incline the balance towards the tiger shark as culprit. Tiger sharks ambush their prey, and given the location of the wound, the shark probably snuck up on the manatee, tried to take a large massive bite, but was unsuccessful. Bull sharks predatory habits are similar, but they do not often grow larger than 3 m.

Sharks and killer whales (*Orcinus orca*) are confirmed predators of the dugong (*Dugong dugon*) (Anderson and Prince, 1985), and fishermen believe dugongs are preid upon by both sharks and salt-water crocodiles (*Crocodylus porosus*) (Macmillan, 1955; Jarman, 1966; Kingdon, 1971, Husar, 1975). Husar (1975) reported that African fishermen claimed that hammerhead sharks (*Sphyrina* spp.) are predators of the dugong. Macmillan (1955) reported an attack by a 5.5-m tiger shark on a large dugong, and a disabled dugong was recorded being attacked and demolished by a tiger shark in Shark Bay, Australia (P. Anderson, pers. comm., 2002). While Husar (1975) stated that very few dugongs exhibit wounds or scars in Queensland, Australia, Anderson (pers. comm., 2002) noted that he has observed a number of dugongs carrying healed scars indicating survival of attacks by large sharks. Sharks and crocodiles (*C. cataphractus*, *C. niloticus*, *Osteolaemus tetraspis*) also share habitat with the West African manatee (*Trichechus senegalensis*), but no records exist about natural predation (Cadenat, 1957; Husar, 1978; Reeves et al., 1992; J.A. Powell, pers. comm., 2002). Amazonian manatees (*Trichechus inunguis*) are reported to have been predated by sharks, jaguars (*Panthera onca*) and caimans (*Caiman crocodiles*, *Melanosuchus niger*, *Paleosuchus palpebrosus*, *P. trigonatus*) (Pereira, 1947), but documentation is not convincing (Reeves et al., 1992). This species may

also fall prey to piranhas (*Serrasalmus* spp.) (Bertram and Bertram, 1973). West Indian manatees in Florida share marine habitat with several species of large sharks and American crocodiles (*Crocodylus acutus*), but no evidence suggesting ante-mortem attacks have been recorded (Hartman, 1979). However, predator/prey interactions have been recorded between manatees and American alligators (*Alligator mississippiensis*) in Florida along with post-mortem scavenging by sharks, but no ante-mortem shark attacks have been documented (D.K. Odell, T. Pitchford, and R.K. Bonde, pers. comms., 2002). There are no records that confirm previous shark attacks on manatees in the Caribbean, however Belitsky and Belitsky (1980) stated that poaching and shark predation were mentioned during interviews as causes of manatee mortality in the Dominican Republic, although the latter may represent scavenging. Cuban fisherman reported during interviews of two shark attacks on manatees near Gibara and Pilón, north and south coast of eastern Cuba in 1987 (A.R. Estrada, pers. comm., 2002), but it was not clear if these were ante-mortem or post-mortem. Thus, this is the first confirmed record of an ante-mortem shark attack, probably by a tiger shark, on a West Indian manatee.

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