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Opportunistic Fish Consumption by Antillean Manatees (*Trichechus manatus manatus*) in Colombia

Dalila Caicedo-Herrera¹, Yenyfer Mona-Sanabria¹, Isabel V. Gómez-Camelo¹, Maria Camila Rosso-Londoño¹, and Antonio A. Mignucci-Giannoni^{2,3,*}

Abstract – *Trichechus* spp. (manatee) are well known to be polyphagous herbivores. Recent accounts in Colombia indicate that manatees may opportunistically consume fish. To ascertain this, we conducted 313 interviews in Colombia covering 4 of the hydrographic basins where manatees are distributed. Over 46% of those interviewed mentioned that they have found their nets with damaged fish, whose flesh and guts had been "stolen", supposedly by manatees. Only 2 species of fish seem to be taken by the manatees. The damage to the fish consists of the head being found intact, with the spine remaining attached, without scales, skin, muscle tissue, or internal organs, as if the fish was sucked from one side of the net. Manatee carnivory has been previously reported for *Trichechus manatus manatus* (Antillean Manatee). This documentation was considered from 3 different perspectives: (1) conflicts created between manatees and fishermen; (2) a form of allotriophagia (pica); and (3) fish as a dietary supplement. In Colombia, Antillean Manatees, whereas believed to be mostly herbivorous, are not strictly so, and this may have various ecological and human–animal interaction implications.

Trichechus manatus manatus L. (Antillean Manatee, hereafter also manatee) is an endangered tropical and subtropical aquatic mammal distributed from Mexico south through Central America, in the Greater Antilles of the Caribbean, and from the northern coasts of Colombia and Venezuela to eastern Brazil (Self-Sullivan and Mignucci-Giannoni 2012). In Colombia, it is found in 4 main hydrographic basins: the Atrato, the Sinú, the Magdalena, and the Orinoco river systems (Montoya-Ospina et al. 2001), where it occupies both rivers and adjacent wetlands (Caicedo-Herrera et al. 2004).

This subspecies of *Trichechus manatus* L. (West Indian Manatee), as well as the other extant sirenian species—*Trichechus inunguis* (Natterer) (Amazonian Manatee), *T. senegalensis* Link (African Manatee), and *Dugong dugon* (Müller) (Dugong)—are well known to be polyphagous herbivores, feeding in the ocean on different species of seagrasses, and in fresh water on emergent, submerged, and floating aquatic vegetation (Borges et al. 2008, Castelblanco-Martínez et al. 2009, Colares and Colares 2002, Conrad-Allen et al. 2018, Heinsohn et al. 1977, Jiménez-Pino 2016, Mignucci-Giannoni and Beck 1998, Navarro-Martínez et al.

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2014, Powell 1996, Reynolds 1981). Recent accounts in Colombia indicate that manatees may, in certain areas and circumstances, opportunistically consume fish. To ascertain this, we conducted 313 interviews of local fishermen (2013–2019) in 8 different areas of Colombia covering 4 of the hydrographic basins where manatees are distributed (Fig. 1). More than 46% of those interviewed mentioned that they have found their nets with damaged fish, whose flesh and guts had been "stolen", supposedly by manatees.

The accounts from the fishermen in these 4 hydrographic basins and 8 locations generally agree on the following. Fishermen typically use 30-40-m gillnets ("trasmallos") made of a 0-polyester twine with a net mesh size of 5 cm, with buoys at the top and weights at the bottom. They often set 15–20 of these gillnets at midmorning in the marsh and wetland channels and stay vigilant with the nets until just before dawn (3:00–4:00 am), when they are collected using a boat and the entangled fishes harvested. The fished species include Leporinus muyscorum (Steindachner) (Liceta), Hoplias malabaricus (Bloch) (Trahira or Moncholo), Cynopotamus atratoensis (Eigenmann) (Cachana), Salminus affinis Steindachner (Rubio), Caquetaia kraussii (Steindachner) (Mojarra Amarilla), Trachelyopterus badeli Dahl (Perico), Notarius bonillai (Miles) (New Granada Sea Catfish or Barbul de Piedra), Prochilodus magdalenae Steindachner (Magdalena River Prochilodus or Bocachico), and Cyphocharax magdalenae (Steindachner) (Carp Headstander or Valúa). Of these, only the latter 2 are found damaged in the nets, most commonly the Carp Headstander (Fig. 2). The fishermen state that these 2 species of fish are smoother and have few dorsal spines that would discourage manatees from sucking on them. The damage consists of the head of the fish being found intact, with the spine of the fish remaining attached, without scales, skin, muscle tissue, or internal organs, as if the fish was sucked ("chupa'o" is the term used by the fishermen) from one side of the net (Fig. 3). The net typically is not damaged.

In the Ayapel wetland, fishermen tending fishing nets, reported that when they heard the sound of a manatee breathing nearby, they would raise their nets, the manatees would flee, and they would find half-eaten fish still in the gillnet. They further detailed that the behavior began after the flooding events in the Mojana and Momposina Depression regions (Soplaviento, Bolivar, Plato, and Magdalena) between October 2010 and January 2011, when the flooding caused disappearance of macrophytes that served as food for the manatees. These 2010–2011 floods coincided with the La Niña phenomenon (IGAC-IDEAM-DANE 2011, Vargas et al. 2018). Similarly, fishermen in the Canal del Dique in the Zarzal-Tupe-Capote wetlands reported that the behavior of stealing fish increased after the El Niño event of 2015–2016, when, again, the availability of aquatic plants diminished, in this case because of extreme drought. Fishermen also state that the consumption of fish in nets by manatees is generally higher during the dry season, given that there is less vegetation available.

In the Ciénaga Grande de Lorica, which feeds into the Sinú River, a rehabilitated and released female manatee was observed by fishermen in 2015 sucking on netted fish. This manatee had never been fed fish during her rehabilitation process as a calf, and when observed, she had given birth to her first calf in the wild. In the Meta



Figure 1. Current distribution of Antillean Manatees in Colombia, and the 4 hydrographic basins and 8 different areas assessed for manatee carnivory.

River, a manatee was reported to eat moribund fish tossed by fishermen, similar to fishermen accounts from Senegal and Ivory Coast for African Manatees (L. Keith-Diagne, African Aquatic Conservation Fund, Mbour, Senegal, unpubl.data).

Whereas the fishermen we spoke with in Colombia have reported that *Croco-dylus acutus* Cuvier (American Crocodile) and *Caiman crocodilus* L. (Spectacled Caiman) steal fish from nets, in doing so, both crocodiles and caimans break or make large holes in nets. In addition, when they steal fish, they are not selective and take any of the available fish species in the net, and eat them in their entirety. Conversely, fishermen reported that when manatees suck on netted fish, they stealthily do so without breaking the fragile gillnet, only sucking the skin, other tissue, and internal organs posterior to the head; they leave the head, and are selective of the species they choose to eat (only Magdalena River Prochilodus and Carp Head-stander; Fig. 2). No other large fish-predatory animal that is capable of damaging the fish in this manner, other than *Lontra longicaudis* (Olfers) (Neotropical River Otter), is found in these marsh and rivers. Fishermen we surveyed did not mention river otters as one of the culprits, but explicitly stated that only crocodilians and manatees stole fish from their nets in the rivers basins.

Manatee carnivory has been previously reported for Antillean Manatee, African Manatee, and *T. manatus latirostris* (Harlan) (Florida Manatee) (Courbis and Worthy 2003; Keith-Diagne 2014, 2015; Powell 1978, 1996). Florida Manatees under human care in Florida, USA, in the 1970s were fed small amounts of herring and smelt to supplement their diet (Powell 1978). Hartman (1979) and Corbis and Worthy (2003) reported Florida Manatees eating barnacles, bivalves, gastropods,



Figure 2. The two species of fish taken by Antillean Manatees in Colombia: (A) *Prochilodus magdalenae* (Magdalena River Prochilodus or Bocachico); (B) *Cyphocharax magdalenae* (Carp Headstander or Valúa).



Figure 3. Examples of fish damaged by Antillean manatees in fishermen's nets in Colombia.

crabs, tunicates, and other invertebrates. In these instances, the feeding behavior was described as rare. However, both Antillean and Florida Manatees are thought to regularly ingest (albeit inadvertently) snails that are attached to seagrass or freshwater plants they feed on (Hartman 1979; Rivera-Pérez et al., in press). A record of a Florida Manatee scavenging a discarded portion of a *Xiphias gladius* L. (Swordfish) in a marina at Islamorada, FL, USA, was documented on video in January 2019 (Stanczyk 2019).

Similar to information reported in this study, Antillean Manatees were reported to steal fish from fishermen's stationary gillnets on the north coast of Jamaica (Powell 1978). African Manatees have been documented with the same behavior in many African countries (Dodman et al. 2008, Keith-Diagne 2015, Powell 1996), including Sierra Leone (Reeves et al. 1988), and Gabon and Senegal (Keith-Diagne 2014). Stable isotope analyses for determining the diet of the African Manatee revealed that mollusks and fish comprised 10% and 50% of the lifetime diet of sampled African Manatees in Gabon and Senegal, respectively (Keith-Diagne 2014). The behavior reported of manatees removing the fleshy portion by "sucking" and leaving the skeletal remains in nets in both Jamaica and Africa were similar to our Colombian accounts.

This documentation of manatees stealing and feeding on netted fish can be considered further from 3 different perspectives: (1) the user conflicts this creates between the manatees and the fishermen; (2) as a form of allotriophagia (pica); and (3) as a dietary supplement.

First, stealing fish from the fishermen's nets, while not damaging nets, causes loss of catch which fishermen are dependent on for their livelihood. Contrary to a similar behavior of dolphins cooperatively fishing with fishermen (Peterson et al. 2008, Pryor et al. 1990), this manatee behavior is a nuisance for fishermen. Upon seeing a manatee near boats and nets, fishermen scare them so they do not approach to steal their fish. Whereas Colombian fishermen do not ostensibly hurt or kill the manatees over this conflict, it is certain that fishermen actively harass manatees to scare them from fishing areas. Conversely, Reeves et al. (1998) and Mayaka et al. (2019) report fishermen killing manatees in retribution for stealing fish in African locations. Such behaviors and situations complicate the implementation of conservation initiatives for the species; additional efforts are required to change the negative perception of manatees by fishermen and others who depend on the fishery.

Second, allotriophagia or pica is the abnormal and compulsive ingestion of non-food substances (Campuzano 2011), such as sand, dirt, stones, metals, inanimate objects, trash, or other plant or animal parts not considered typical food for a species. Pica is well described in domestic animals, such as *Canis familiaris* L. (Domestic Dog), *Felis catus* L. (Domestic Cat), *Bos taurus* L. (Domesticated Cattle), *Equus caballus* L. (Horse), *Capra hircus* L. (Domestic Goat), and *Ovis aries* L. (Domestic Sheep) (Cardona et al. 2017, Elshahawy and Aly 2016, Firyal 2007, Nikvand et al. 2018). Some *Tursiops truncatus* (Montagu) (Bottlenose Dolphin) under human care are observed exhibiting pica behavior (Roberto Sanchez-Okrucky,

Dolphin Discovery, Cancún, Mexico, pers. comm.). In the Ayapel and Canal del Dique areas of Colombia, fishermen also reported manatees chewing on foam buoys from fishing nets, a clear example of pica. However, given the widespread reported consumption of fish by manatees in Colombia (as is seen in African Manatees; Keith-Diagne 2014, 2015; Reeves et al. 1988), and the fact that their consumption is of possible nutritive value, manatee ingestion of fishes in Colombia does not seem to be an aberrant behavior of pica.

Third, manatees are not the first herbivore to be found engaging in opportunistic carnivory. Some herbivores are known to engage in placentophagia upon giving birth (Mills et al. 2010) or osteophagia to supplement mineral deficiencies (Hutson et al. 2013). Odocoileus virginianus (Zimmermann) (White-tailed Deer) and Cervus elaphus L. (Red Deer) are well known to occasionally eat fish that have washed onto river banks, as well as rabbits, bird nestlings, bird eggs, or other carrion (Dice 1924, Furness 1988, Pietz and Granfors 2000). Duikers, particularly Sylvicapra grimmia (L.) (Common Duiker), Philantomba monticola Thunberg (Blue Duiker), Cephalophus zebra Gray (Zebra Duiker), and Cephalophus dorsalis Gray (Bay Duiker), have also been observed (in Africa) eating ants, termites, beetles, frogs, small birds, small mammals, bird eggs, and carrion (Dubost 1984, Kingdon and Hoffman 2013). Hippopotamus amphibius L. (Hippopotamus) also exhibit cannibalism, scavenging on dead animals and killing livestock (Arnold 2015, Dudley et al. 2016, Eltringham 1999). Ancestral sirenians, such as Miosiren kocki Dollo in the Miocene, were believed to have had a shellfish diet (Clementz et al. 2009). For manatees in Colombia, the dietary benefit would be derived from a concentrated source of protein that otherwise would take longer to acquire from the plants that they usually feed on. At times of plant scarcity (perhaps from habitat flooding or drought), or during periods of rapid growth, gestation, or lactation, situational carnivory could be advantageous.

In Colombia, Antillean Manatees, whereas believed to be mostly herbivorous, are not strictly so, as they show opportunistic carnivory by stealing fish from gillnets, likely as a way of supplementing their diet. Future work is warranted to further understand this opportunistic carnivory, e.g., using stable isotopes to determine the relative importance of fishes such as was done by Keith-Diagne (2014), further documentation of the fishes consumed by manatees (e.g., species and size), and identifying possible or emergent manatee–fishermen conflicts stemming from this behavior. Such information will provide for a broader understanding and management of this species.

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