

Ingestion of yellow tube sponge (*Aplysina fistularis* Pallas, 1766) (Porifera, Demospongiae) by short-finned pilot whale (*Globicephala macrorhynchus* Gray, 1846)

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The interaction between dolphins and sponges has been reported in some species (Parra, 2007; Mann et al., 2008; Smolker et al., 2010). Bottlenose dolphins (*Tursiops* sp.) in Western Australia were observed carrying sponges on their rostrum in a study conducted over several years, with the hypothesis that they used the sponges as tools to aid in foraging (Smolker et al., 2010). Mann et al. (2008) concluded that females carrying sponges had a distinct diving behavior in terms of time and depth, and were more solitary. In adult Indo-Pacific humpback dolphins (*Sousa chinensis*), carrying a sponge on their rostrum as a tool was also observed (Parra, 2007). Few studies have found the presence of sponge fragments in the stomach contents of cetaceans (Meirelles & Barros, 2007; Mann et al., 2010).

Cetaceans are top predators in marine or estuarine environments. They play a crucial role in regulating prey density in the ecosystem, and studies of their diet improves the understanding of trophic relationships and feeding behavior

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(Santos & Pierce, 2017). Studies of pilot whale diet have been carried out through stable isotope analysis for trophic ecology and stomach contents analysis of stranded individuals, among others. Despite limitations on the latter, such as the presence of items consumed only days or hours before the event, these analyses provide valuable ecological information (Mintzer et al., 2008; Becker et al., 2021; Chalcofsky et al., 2021). Diet data for long-finned pilot whale *Globicephala melas* (Cetacea: Delphinidae) are available from various studies around the world (Gannon et al., 1997; Beasley et al., 2019; Becker et al., 2021). However, for short-finned pilot whale *Globicephala macrorhynchus* there is a scarcity of information, and significant differences have been shown between the stomach contents of this species in the Western North Atlantic Ocean (Mintzer et al., 2008). Pilot whales are found in the continental shelf break, slope waters, and areas of high topographic relief; seasonal inshore/offshore movements are related to the distribution of squid, their main prey (Mintzer et al., 2008; Olson, 2008). Studies in individuals from the North Pacific and North Atlantic oceans have shown that the diet of *G. macrorhynchus* consists mainly of pelagic and oceanic squid species: market squid (*Doryteuthis (Loligo) opalescens*), common arm squid (*Brachioteuthis riisei*), peacock cranch squid (*Taonius pavo*), large cranch squid (*Megalocranchia* spp.), cock-eyed squid (*Histioteuthis* spp.), *Chiroteuthis* spp., European flying squid (*Todarodes sagittatus*), shabby octopus squid (*Octopoteuthis deletron*), Boreal clubhook squid (*Onychoteuthis borealijaponica*), robust clubhook squid (*Onykia (Moroteuthis) robusta*), and secondary items such as Bean's bigscale fish *Scopelogadus beanii* (Sinclair, 1992; Mintzer et al., 2008; Fernández et al., 2009). Although the Southwestern Atlantic Ocean lacks data on feeding habits of *Globicephala* sp., a study demonstrated the presence of cephalopods in the diet of *G. melas* in southern Brazil (Santos & Haimovici, 2001). No studies containing sponges in the stomach contents of *Globicephala* sp. were found. The aim of this study is to describe the occurrence of a yellow tube sponge *Aplysina fistularis* (Pallas, 1766) (Porifera, Demospongiae) in the stomach of a short-finned pilot whale.

On 28 October 2019 the carcass of a male juvenile short-finned pilot whale measuring 321 cm in body length was found



Figure 1. Carcass of short-finned pilot whale, *Globicephala macrorhynchus* (Gray, 1846) stranded in Peruíbe (São Paulo state, southeastern Brazil), skin detachment and visceral exposure: A) Ventral view of the specimen; B) Lateral view of the specimen.

stranded in Peruíbe (24°28'21.8" S, 47°07'03.9" W, São Paulo state, southeast coast of Brazil). The animal was in poor body condition, with skin detachment and visceral exposure due to scavenger predation, and dental wear in the caudal region of the oral cavity (Fig. 1A and 1B). It was classified as code 4 (advanced decomposition) (Geraci & Lounsbury, 2005), therefore the cause of death could not be elucidated. Its age was estimated at four years by counting the growth-layer-groups (GLG) in teeth, confirming it to be an immature individual (Perrin & Myrick, 1980; Hohn et al., 1989). The digestive tract was preserved, and the stomach content revealed only the presence of a sponge skeleton in the forestomach (Fig. 2A); there were no intestinal contents, but eight specimens of the parasite *Bolbosoma* sp. were found in the large intestine. The Porifera specimen belonged to the class Demospongiae, and was identified as *Aplysina fistularis*, measuring 20 cm in length, 7 cm in diameter, with a total mass of 11.79 g measured after dried (Fig. 2B and 2C). The specimen was identified based on its external morphology and overall reticulate architecture of relatively stout spongin fibers, according to Pinheiro et al. (2007) and Hajdu et al. (2011).

The short-finned pilot whale is mostly black or dark gray in color, with an exaggerated melon, indistinct rostrum, and sickle-shaped, long pectoral flippers (Olson, 2008; Carwardine, 2020). Although subspecies have not been recognized, at least two genetically distinct populations have been found in the Pacific Ocean (Van Cise et al., 2017; Committee on Taxonomy, 2022). The species exhibits a global distribution in tropical and subtropical

oceans, spanning latitudes ranging from 50° N to 40° S (Olson, 2008; Minton et al., 2018). It is listed as "Least Concern" by the International Union for the Conservation of Nature (Minton et al., 2018). This species is highly social and gregarious, even with other species such as humpback whales (*Megaptera novaeangliae*), sperm whales (*Physeter macrocephalus*), and false killer whales (*Pseudorca crassidens*). Several mass strandings have been reported due to social cohesion (Olson, 2008; Oremus et al., 2013; Carwardine, 2020).

Sponges of the genus *Aplysina* are common in the Southwestern Atlantic Ocean, mostly in tropical zones, where they may represent a large portion of the Porifera biomass (Muricy & Moraes, 1998; Moraes et al., 2003). In Brazil, at least 15 species are recognized, spread out along the coast (Pinheiro et al., 2007). They frequently comprise large specimens, with several shapes and bright colors, with an anastomosing spongin skeleton of polygonal meshes (Bergquist & Cook, 2002). The yellow tube sponge occurs in the tropical western Atlantic, from the Caribbean to the Abrolhos National Marine Park, Brazil (3° - 18° S). The individuals are composed of cylindrical tubes, fusiform or slightly barrel-shaped, single or grouped, and can be as tall as 1 m. In northeastern Brazil, this species has been collected in shallow waters ranging from four to 20 m depth (Pinheiro et al., 2007; Hajdu et al., 2011).

To our knowledge, this is the first case report of ingestion of a sea sponge by a short-finned pilot whale, and an atypical case for cetaceans. Meirelles & Barros (2007) reported the presence of four pieces of sea sponge in the forestomach of an adult male specimen of rough-toothed dolphin *Steno bredanensis* stranded alive on Poço da Draga Beach, Fortaleza (Ceará state, northeastern Brazil). According to the authors, the ingestion may have occurred accidentally during the pursuit of common prey or may be explained by the animal's inability to hunt the usual prey species due to emaciation. Two other rough-toothed dolphins were recorded with sponges in their stomach contents (from Mote Marine Laboratory, Sarasota, Florida). In this case, the animals were about two years old, and it was suggested that they had congenital hearing loss, indicating an inability to forage after weaning (Mann et al., 2010). For *G. macrorhynchus*, considering the stranding of an individual of a gregarious species and the absence of any other food in its digestive tract, the individual's ingestion of *A. fistularis* may have occurred accidentally due to attraction for prey sheltered in the sponge (such as a cephalopod) or even occurred intentionally due to starvation.

The systematic monitoring of cetacean strandings is crucial for establishing species conservation strategies and conducting spatiotemporal studies to determine occurrence patterns and atypical events, as well as to conduct trophic ecology studies, infectious and zoonotic disease studies, and monitor the incidence of anthropogenic interactions. Marine mammals are considered sentinels of the aquatic ecosystem and human health, making the monitoring of these animals critically important (Prado et al., 2016; Alvarado-Rybak et al., 2020). Freshly stranded animals are ideal for carrying out complete anatomic and pathologic examinations (Geraci & Lounsbury, 2005), but even carcasses found in an advanced stage of decomposition can provide relevant information, as in this case.

The yellow tube sponge is commonly seen in shallow waters of northeastern Brazil, indicating that this juvenile of short-

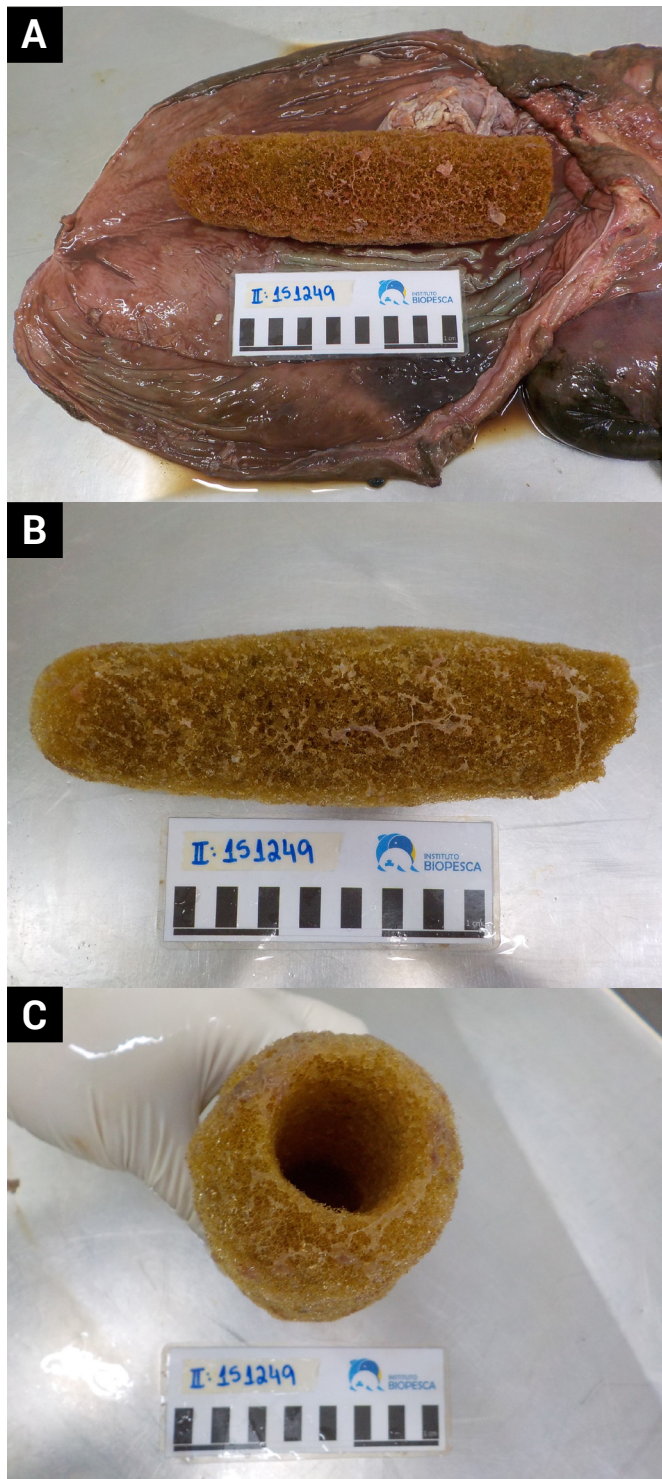


Figure 2. Short-finned pilot whale, *Globicephala macrorhynchus* (Gray, 1846) stomach content: A) Dissected stomach with the presence of Porifera; B – C) Yellow tube sponge, *Aplysina fistularis* (Pallas, 1766) (B, side view; C, apical view).

finned pilot whale ingested the sponge far from its stranding location (over a thousand miles in a straight line to the south from the National Marine Park of Abrolhos to Peruíbe). Due to the advanced decomposition of the carcass, further analyses were limited, and the implications of ingestion and cause of death remain uncertain. This is the first report of sponge ingestion by a short-finned pilot whale.

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