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Short Note

Ingestion of Stingrays (*Dasyatis* spp.) by a Common Bottlenose Dolphin (*Tursiops truncatus*)

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Common bottlenose dolphins (*Tursiops truncatus*) and stingrays (*Dasyatis* spp.) both inhabit shallow, coastal waters of the southeastern United States, and interactions between the two species are common (Walsh et al., 1988; McFee et al., 1997). Dolphins have been observed chasing and teasing stingrays (Jones, 1985); however, interactions can result in injury or even mortality from penetration of the stingray spine into soft tissue (McClellan et al., 1996). Walsh et al. (1988) describes seven cases in which stingray spines found during necropsy of bottlenose dolphins were a contributing factor for mortality. In one case, a stingray spine was observed in the middle portion of the right lung. In addition, there was a large, irregular fibrous mass found in the abdominal cavity involving the pancreas, duodenal ampulla, and pyloric chamber of the stomach. The author suggested that in those cases where stingray spines were present in conjunction with abdominal lesions, ingestion should be considered as a possible origin. We report the first documented case of ingestion of stingrays by a common bottlenose dolphin from the Atlantic Ocean.

On 8 June 2015, a 257-cm male bottlenose dolphin was reported dead, floating in the Cooper River in Charleston County, South Carolina (32° 47' 27.75" N, -79° 55' 29.19" W). The dolphin was transported to the marine mammal necropsy laboratory at the National Centers for Coastal Ocean Science, Center for Coastal Environmental Health and Biomolecular Research facility at Fort Johnson (James Island, South Carolina) for necropsy. At the time of examination, the dolphin was moderately decomposed. The trailing edge of the dorsal fin had unique notches but, when searched against the Charleston bottlenose dolphin dorsal fin catalogue using *Finbase* software (Adams et al., 2006), it did not result in a match. A standard necropsy was performed on 9 June 2015, resulting in an inconclusive cause of death. Externally, there were several raised, partially healed lacerations to the left lateral body, suggestive of shark bites. All organs were examined, both externally and internally, for lesions, color, and texture. Upon examining the abdominal viscera, the fore chamber of the stomach appeared fully expanded. A small incision was made to open the stomach. Two stingrays were first pulled from the fore chamber. Species were identified as a Southern stingray (*Dasyatis americana*) and an Atlantic stingray (*D. sabina*) using field guide measurements and observations from the Florida Museum of Natural History stingray ID guide (https://www.flmnh.ufl.edu/fish/discover/rays-skates/stingray-id-guide). The Southern stingray had a wingspan of 20.6 cm, and the Atlantic stingray had a wingspan of 16.6 cm (Figure 1). Both rays were partially digested with the tail spines still attached but lacked tissue on the spines. Upon further investigation, it was concluded that no puncture wounds had been made to either the esophagus or stomach lining, evidence that the stingrays may have been dead when ingested. Other fore-chamber contents included 12 shrimp, two crawfish, two squid, two fish, five cephalopod beaks, and 1,435 fish otoliths. Seventy-two otoliths were also found in the fundic and pyloric chambers, collectively. The total number of otoliths represented 471 individual fish from 10 different species, predominantly star drum (*Stellifer lanceolatus*) and croaker (*Micropogonias undulates*). Several parasitic cysts ranging from 0.3 to 0.6 cm in diameter were present along the interior lining of the pyloric chamber.

Given the abundance and diversity of prey items in the stomach in addition to the shark bite wounds, it is suggested that the dolphin may have been foraging near or in association with a shrimp trawler. Dolphins have been known to forage in association with trawlers by feeding on caught fish or discarded bycatch (Greenman & McFee, 2014). In a study by Kovacs & Cox (2014), it was determined that dolphins near Savannah, Georgia, approached commercial fishing vessels or actively begged more frequently when fishermen were cleaning or manipulating the nets. During this process, fishermen often discarded their bycatch over the side of the boat. The dolphin presented in this case might have been feeding during this time and could have encountered the stingrays and other prey items after they had been caught and released. The dolphin may also have encountered the rays while foraging behind an active trawl, when benthic species become stirred up as the net passes along the seafloor. During predation, stingrays are likely to display self-defense measures against animals trying to feed upon them by thrusting their tail and stinging upward (Findlay, 1953). The lack of thoracic wounds, multiple species of stingray, and diversity of prey items found in the stomach provide evidence that the stingrays may have been ingested dead or injured as part of a commercial bycatch foraging event.

It is unclear as to what extent venom from the soft tissues surrounding the spines may have contributed to the demise of the dolphin. Stingray venom in marine species is located in protein secretory cells located in the ventrolateral grooves of the spine (Pedroso et al., 2007). Since in this case the epidermis of the spines was gone, either the skin was gone prior to ingestion or removed through mechanical digestion in the fore chamber of the stomach where they were observed. If the latter, then venom could have been released into the stomach but likely was not absorbed since the fore chamber in dolphins is only used for breaking down food remains and is devoid of glands (Berta et al., 2015; Cozzi et al., 2016). Venom proteins can be denatured in an environment with a pH < 3 (Sweeney & Reddy, 2001); therefore, it is likely they would have been denatured as the result of the acidic environment of the dolphin stomach in which pH has been reported to be between 1.5 and 3 (Sweeney & Reddy, 2001; Mitchell et al., 2008) and would not have caused ill-effects to the dolphin.

The presented findings are unusual given that stingray associations with bottlenose dolphins are more frequently related to mortality than a source of prey. It is unclear whether this dolphin ingested the stingrays intentionally or if it occurred inadvertently through opportunistic feeding of bycatch; nevertheless, it highlights the importance of analyzing stomach contents and changes in diet. Long-term studies of the bottlenose dolphin diet in the southeastern U.S. have

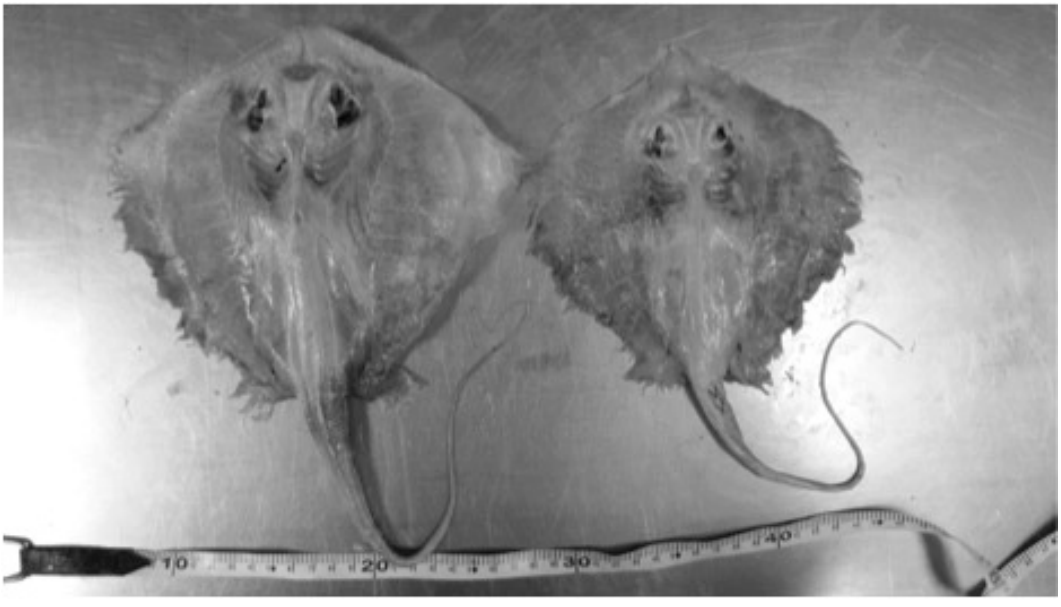

Figure 1. Southern stingray (*Dasyatis americana*) (left) and Atlantic stingray (*D. sabina*) (right) found inside the fore chamber of a bottlenose dolphin *(Tursiops truncatus*) stomach

found a variety of fish and other species as prey items (Barros & Odell, 1990; Gannon & Waples, 2004; Pate & McFee, 2012); however, this is the first documented case of stingrays being ingested by a common bottlenose dolphin. Documenting unusual prey items and changes in a dolphin's diet can increase knowledge of feeding strategies and may be helpful in elucidating changes due to environmental factors and stressors. Resident dolphin populations along the southeastern U.S. coast tend to display strong site fidelity, making them particularly vulnerable to the consequences of environmental stressors such as climate change (Gubbins, 2002; Simmonds & Eliott, 2009). Temperature shifts associated with climate change may indirectly affect bottlenose dolphins by limiting prey availability (Simmonds & Eliott, 2009). The response to these shifts in prey could be reflected in the changes in dolphins' diets. Monitoring changes in dolphin stomach contents could also provide insight into changes in fish distribution, abundance, and top-down cascading effects. For example, if apex predators such as sharks become overfished, mesopredators like stingrays will become more abundant (Baum & Worm, 2009). This may result in dolphins interacting with or ingesting stingrays more frequently, increasing the likelihood of fatality due to stingray spine perforation.

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