



Barbed! Stingray spine injuries to common bottlenose

dolphins (Tursiops truncatus) in central west Florida USA

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Abstract

Stingray spine associated injuries and deaths to marine mammals have been documented in a few locations around the world. The posterior dorsal venomous spines (or barbs) of stingrays are located at mid-tail or tail insertion and used for predator defense. Bottlenose dolphins in central west Florida share shallow coastal habitats with several stingray species and occasionally have been observed interacting with them (e.g., tossing the stingrays with their mouths). Since 1984, a portion of the dolphins in Sarasota Bay, Florida are handled periodically by the Chicago Zoological Society's Sarasota Dolphin Research Program (CZS-SDRP) for health assessment (including evaluation of wounds). In addition, Mote Marine Laboratory's Stranding Investigations Program (SIP) recovers dolphin carcasses in the central west coast region of Florida and examines carcasses for injuries, takes samples for pathology and determines cause of death (COD). Three hundred and two dolphins were evaluated from 1984-2019 during CZS-SDRP health assessments and when possible presence of stingray spines or wounds potentially related to stingray spine punctures was noted. Of these, 31 individuals had wounds from stingray spines (nine confirmed and 22 likely). Of 20 dolphin carcasses from the Sarasota Bay resident community evaluated by Mote's SIP with stingray spines present in body cavity or in the skeletal frame, stingray spine injury was determined to be COD in 11 cases. Stingray spines were found in the spinal canal, aorta, heart, lungs, liver, muscle, and stomach. It is likely that some of the injured bottlenose dolphins came into contact with stingrays while swimming through shallow water when the barbs enter ventrally, while others may have been engaging in "play" or foraging behavior when barbs are found more cranially and are barbed as part of stingray defensive behavior. With dolphins under threat from a variety of anthropogenic and natural sources it is important to document and evaluate the specific contributions from different sources

Background

Stingray spines (or barbs) are located on the caudal tail along the dorsal edge of most Myliobatiform rays and are used in defense against predators (Lowe *et al.* 2007). They are modified dermal denticles composed of vasodentin (a strong cartilaginous material) with venom-secreting cells that run along the ventral side of the barb and with reverse serrated "hook" edges (Figure 1)
Marine mammals have been observed feeding on or interacting with stingrays, sometimes with fatal consequences (Visser 1999, Duigan *et al.* 2000, Hocking *et al.* 2020). Killer whales in Brazil and New Zealand had stingray remains in gut contents (Castello 1977, Duigan *et al.* 2000) as did a bottlenose dolphin in South Carolina (Conway and McFee 2017). Injuries and mortalities have also been documented in bottlenose dolphins in Florida, South Carolina and the Red Sea (Walsh *et al.* 1988, McFee *et al.* 1997, Burdett and Osborne 2010, Spanier *et al.* 2000, Weisbrod *et al.* 2000).
The long-term resident dolphins of Sarasota Bay (a shallow, partial seagrass estuary with barrier islands and inlet passes to the Gulf of Mexico on the west coast of Florida) share their habitat with a variety of Myliobatiform rays such as whitespotted eagle rays, cownose rays and southern rays (Bassos-Hull *et al.* 2014). We investigated how dolphins from this area are impacted from encounters with these stingrays and how the spines from these encounters caused injury and mortality.

Results and Case Studies of Injuries/Mortalities

- Thirty-one dolphins had confirmed or possible stingray spine wounds when examined during CZS-SDRP health assessments. Body region 1 (dorsal anterior portion of body) had the most spine wounds compared to other body regions (Figure 2). Case studies from four of these dolphins are presented in Figures 3-6.
- Twenty dolphins recovered by Mote SIP had stingray spines present 11 were determined to be cause of death. Spines were found in musculature, organs, cavity, and post-cranial skeleton, Case studies from five of these dolphins are presented in Figures 5-9.









Figure 1. (A,B) Stingray spines from spotted eagle ray (*Aetobatus narinari*) and on (C) southern stingray (*Hypanus americanus*). Stingray spines collected under Florida SAL-21-1140-SRP.

Methods

- Dolphins in Sarasota, Florida USA were examined for stingray spine puncture wounds and presence of stingray spines during health assessments 1984-2019. Wound location on the body was scored as presented in Figure 2.
- Mote Stranding Investigations Program recovered carcasses of Sarasota resident dolphins and noted presence of stingray spines during necropsy and if spine was potential cause of death (COD).

Figure 3. Stingray spine entry wound found above left pectoral fin – spine removed by veterinarian (inset).



Figure 5. Stingray spine entry wound found behind blowhole during 15 June 2001 health assessment. Spine was not accessible for removal in the field. F216 (MML0112) carcass was recovered 21 June 2001 with stingray spine found near first cervical vertebra at necropsy. Figure 4. Stingray spine entry wound found behind blowhole – spine removed by veterinarians with ultrasound assistance.



Figure 6. Stingray spine entry wound found near FB99 left eye during 10 June 2004 health assessment. Spine was not accessible for removal in the field. FB99 (MML0535) carcass was recovered 5 October 2005 and stingray spine found lodged in aorta during necropsy.



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Figure 2. Body region (numbers in square boxes) and total number of confirmed/likely stingray spine puncture wounds found per body region (pink circles) across 31 individuals examined during CZS-SDRP health assessments. Thirty individuals had one puncture wound and one individual had two puncture wounds.

Figure 7. Stingray spine found lodged in spinal canal during FB37 (MML9225) necropsy.

Discussion

Figure 8. Stingray spine (5.5 cm) found lodged in right lung during FB05 (MML0904) necropsy.



Figure 9. Stingray spine (4.5 cm) found lodged in right side of C1/C2 penetrating dorsal to ventral and cranial to caudal through full thickness of bone during JOSC (MML1301) necropsy.

- Stingray barbs cause injury and mortality to Sarasota resident dolphins. Evaluating shifting baselines of predator and prey and natural mortality causes is important for management of this species.
- Stingray spine punctures occur most often on the dorsal anterior portion of body likely as a result of dolphins flushing stingrays up and over the top of their body as they forage or travel in shallow seagrass or sand/mudflat areas.
- Veterinarian removal of spines during health assessments probably prevented more serious injury or death from stingray spines migrating in or penetrating vital organs in some of the presented case studies.

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