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Case Report

Injury to the melon of a Bottlenose dolphin (Tursiops truncatus) calf in the Mississippi Sound.

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Abstract

Described here is a sighting of a Bottlenose dolphin (*Tursiops truncatus*) calf with healing injuries to the melon, rostrum, and dorsal fin. Little research has been reported on wild cetaceans with injuries to the melon, thus little is known regarding the extent to which a dolphin can function in the wild or in captivity after sustaining such an injury. The formation of scarring and deep granulation tissue may endanger this animal's ability to effectively emit a focused broadband phonation thus impeding its ability to echolocate, due to the anatomical changes in structure and density of the internal tissues surrounding the melon. Documenting unique injuries in free-ranging cetaceans is critical in understanding the survival capabilities of animals with severe injuries. This case report expands upon our limited existing knowledge of such injuries and provides a basis for comparison of cetacean melon traumas. [JMATE 2020;12(1):4-9]

Keywords: Bottlenose dolphin (Tursiops truncatus), human wildlife interaction, melon injury, Mississippi Sound, photo identification.

Introduction

Bottlenose dolphins (*Tursiops truncatus,* heretofore referred to as dolphins) are a long-lived sentinel species and apex marine predators, are widely distributed throughout temperate and tropical waters (8,27). Dolphins are the only cetaceans to reside year-round in the north central Gulf of Mexico (ncGOM) which includes the Mississippi Sound (MSS), Lake Borgne, and Bay Boudreau Bay Sound and Estuarine stock (BSE) (21). As one of the largest BSE stocks in the United States, it is also one of the best studied (23). Abundance estimates for this stock fluctuate greatly in the spring and fall, estimating the region's abundance to range between 738 (95% CI = 397 - 1369) in the spring of 2013 to 3236 (95% CI = 1927–4627) in spring 2012, while remaining relatively constant in the summer and winter months, likely due to the oscillations in both temperature and salinity due to seasonal changes and river output (23,24).

While various congenital malformations within this population have been reported, few serious injuries have been described (1). Here we describe a unique dolphin sighting involving a dolphin calf with healing injuries to the melon, rostrum, and dorsal fin. Implications for this individual's survival are discussed with the intention of informing future veterinary assessments and management decisions related to marine mammal strandings, interventions for injured animals, population health, and anthropogenic conflict mitigation.

The melon is a large ovoid structure located in the dorsocranial aspect of the head which consists primarily of triacylglycerol lipids, rich in oil and wax esters and specifically designed to focus outbound echolocation clicks (2,11). The melon is supported by the bones of the rostrum, which evolved to equalize with the hydrostatic pressure of the water (8,20). The melon, diverticulum, nasal cavity, and facial bones are all critical for the production of controlled phonations ranging from narrowband whistles to broadband clicks, including echolocative clicks (18,22). Dolphins have demonstrated control over the production of these clicks (17). Phonations are generated within the nasal diverticula through the rapid movement of the phonic lips and are then reflected through the nasal diverticula and skull to the melon (8,18). The melon's low-density core plays a critical role in sound transmission into the aquatic environment, facilitating the directional phonations needed for echolocation, by gathering the sounds produced by the phonic lips within the blowhole (2,22). These directional clicks enter the water from the anterior portion of the head, and not the entirety of the melon, rendering the surrounding anatomy responsible for focusing the direction of clicks (2). Clicks are often produced concurrently with whistles, which are omnidirectional, are used only for communication, and are produced solely by the nasal system (18).

Little research has been reported on wild cetaceans with injuries to the melon. Few examples include a bullet wound scar on the right side of the melon of an adult male bottlenose dolphin from the

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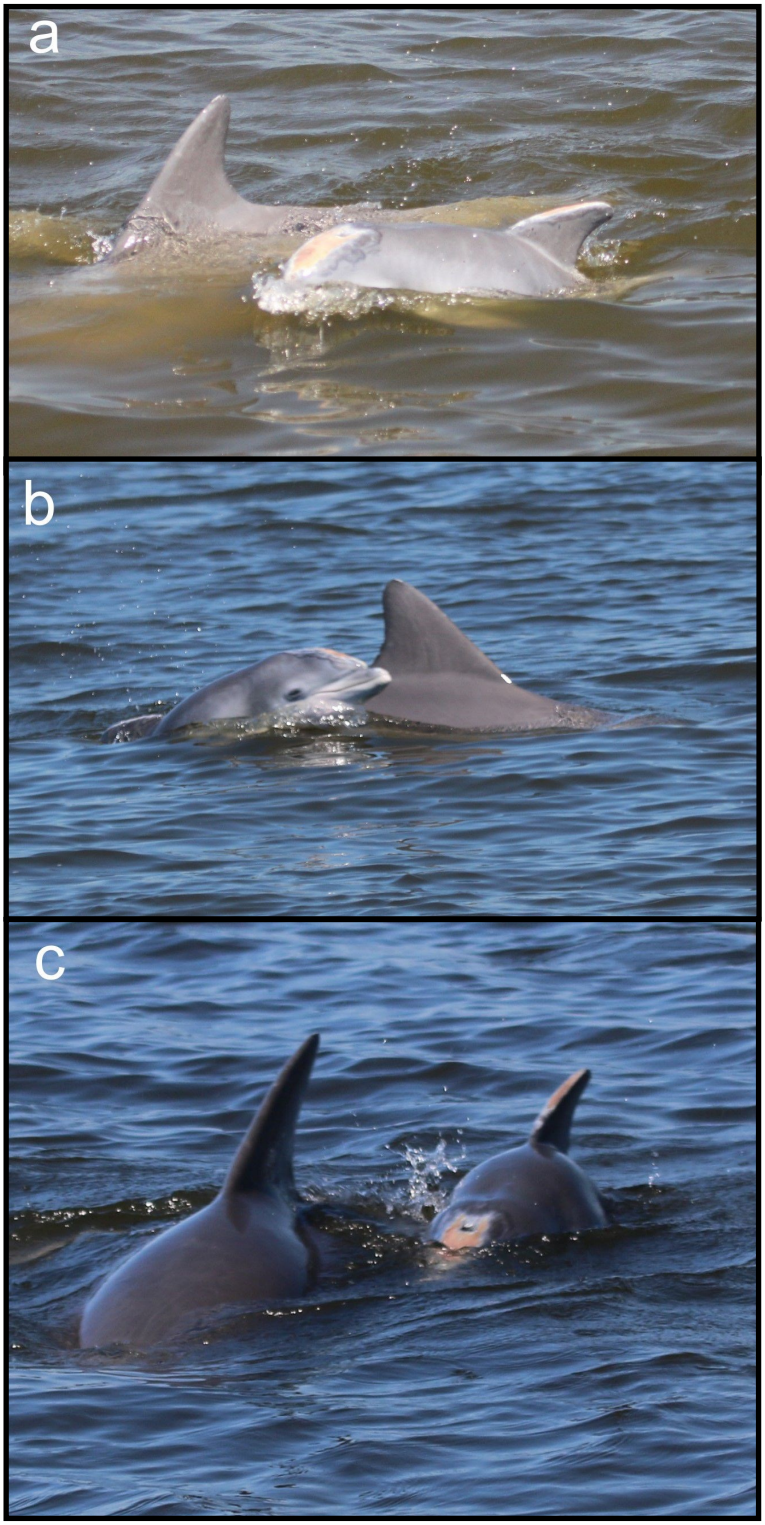

Figure 1: Photos of a bottlenose dolphin calf observed on May 7, 2016, in the western Mississippi Sound, with healing injuries to the melon and dorsal fin. (a) midsagittal view of the head showing that the injury appears to have removed the dermal surface and blubber layer, exposing the melon, (b) further away view , (c) a view showing wound extending just caudal to the blowhole, possibly affecting the diverticulum. Reproduced with permission.

the waters of Great Britain, bullet wound scars on the right and left side of the melon of bottlenose dolphin calf from the waters of waters of Hawaii, as well as a propeller strike causing a deep laceration to the cranium and melon of a neonate Indo-Pacific bottlenose dolphin from the waters of Australia (6,14,19). However, many reports of wild cetacean fin entanglements and propeller strike injuries to the body walls and fins have been reported (3,6,10,12). Thus, little is known regarding the survival implications of a melon injury in a free-ranging dolphin.

Case report: On May 7, 2016, a dolphin calf was encountered with injuries to the melon, rostrum, and dorsal fin during a photo identification (photo ID) survey in the western MSS (under NMFS permit LOC #18185). This individual was determined to be a calf due to its length and the presence of six faint fetal lines on the left and five on the right lateral aspects of the body respectively (3). Dolphin calves in the MSS are typically born in the spring (February-April) in the ncGOM, thus the calf was estimated to be one to three months of age (25).

Photographs taken during the sighting provided a thorough view of the dorsal and anterior aspect of the body, including the dorsal fin, melon, head, and rostrum, but excluding the majority of the peduncle and tail fluke. The injury extended from the cranial most aspect of the rostrum, the mandible, and the melon, through the entire leading edge of the dorsal aspect of the dorsal fin (Figure 1c). When looking at a midsagittal view of the head of the dolphin, the injury appeared to have removed the dermal and blubber layer, exposing the melon (Figures 1a, 1b). This extended just caudal to the blowhole, possibly effecting the diverticulum (Figure 1c). The laceration on the leading edge of the dorsal fin was shallower and more linear than the curved incisional melon wound (Figures 2a, 2b). On the dorsal fin, the dermal layer was removed, yet the underlying cartilage remained intact (Figures 2a, 2b). When looking at a dorsal view on the longitudinal beak-fluke axis of the dolphin, the cranial most aspect of the rostrum appeared to have curvilinear subdermal exposure (Figure 2b). The dorsocranial most aspect of the mandible appeared to have a minor surface abrasion, affecting only the epidermis (Figure 2b). The wounds on the central face of the melon, leading edge of the dorsal fin, and rostrum were lighter in color than the surrounding edges, with an orange to pink coloration to the tissue, which was evidence of healing and granulation tissue (Figure 2a). The wounds did not appear to be fresh due to the lack of freshly peeling skin. There was no evidence of

hemorrhaging, edema, or erythema. The wounds were presumed to be one to three months old with light gray, fibrous scar tissue encompassing most of the wound area (Figures 1a-c, 2a-b), indicating that this injury would have occurred shortly after birth.

This dolphin was observed in a group of five adults, two juveniles, and two calves (including the described individual), which were primarily milling. The injured calf was observed pair swimming with an adult, presumed to be the mother, and maintaining close spatial proximity to the group. Its movements through the water did not appear to be impaired in comparison with other young dolphins observed by our team. Other behaviors that were observed in the group during the sighting included milling, chuffing, tail slapping, and diving. Behavioral observations of the presumed mother included deviation from milling to place her body between the observers and the calf, as well as aggressive behaviors such as chuffing and tail slapping. These behaviors are common in females accompanied by a young calf and lend to our assumptions that the two animals were related.

Discussion

The north central Gulf of Mexico is home to a wide range of vessel-based activities including commercial and recreational fisheries and boating, the recreational use of personal watercraft, shipping activities, dredging, and oil exploration, mineral extraction, and other activities (23). Neonates, calves, and sub-adult dolphins are more susceptible to boat strikes and other collision-caused injuries, such as blunt force trauma and propeller strikes (10). Propeller strikes are often characterized by parallel incisional wounds and lacerations that are curved to linear in presentation (10). Injuries due to collisions with the main compartment of the vessel will often present as abrasions or a partial thickness dermal wounds, while propeller strikes produce tearing of the skin and deep trauma (10,15). Due to inaccessibility, measurements or histology from the wounds of this animal were unable to be obtained. Thus, a definitive determination of the cause of these injuries was not possible. However, judging by previous accounts, including descriptions of cetacean injuries, we were able to make some conclusions based on visual examination.

Entanglement is a known source of injury to wild cetaceans, and long-term non-lethal impacts on individuals is not well understood (3,19). Entanglement wounds are often linear to circumscribed abrasions in appearance, can lead to severe loss of tissue, and have pitting granulation tissue present during the healing process (3,15). Shark bites in wild cetaceans often leave distinguishable crescent shaped wounds with jagged edges that depigment and granulate over time, healing from the peripheral edges into the center of the wound (5,26). These wounds can be challenging to assess because they often cause extensive injury to the deeper tissue that is not always apparent at initial assessment (15,26). Gunshot wounds have been previously reported in association with fisherman in the ncGoM, and they

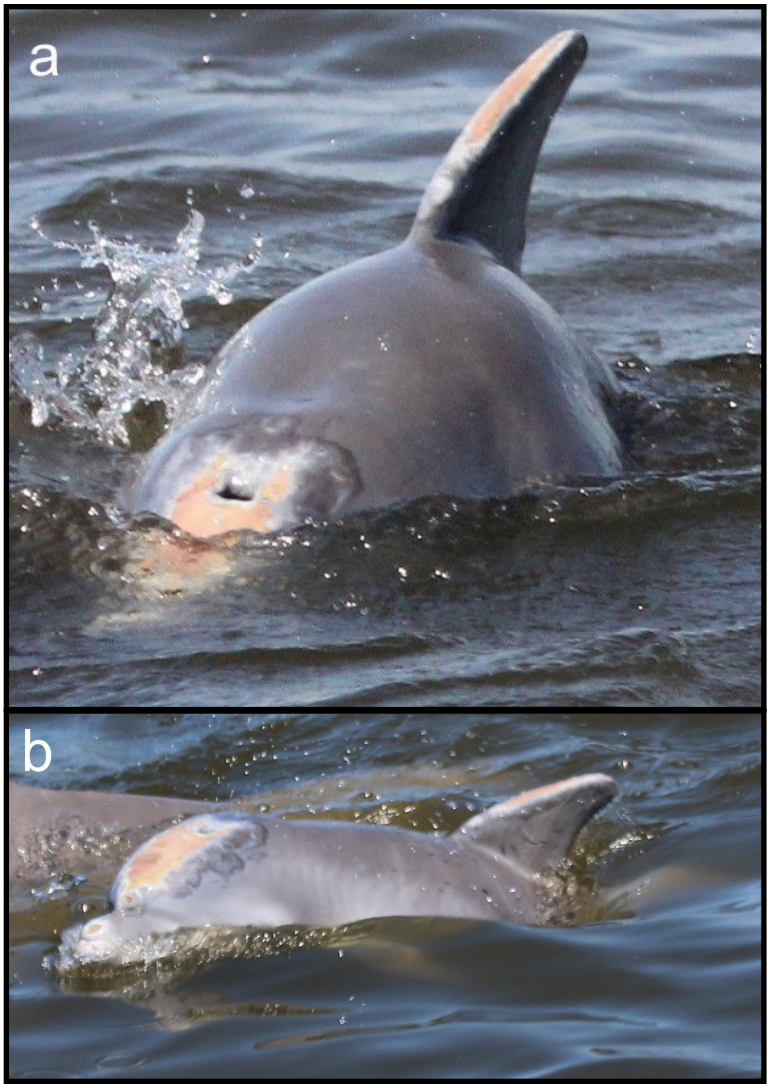

Figure 2: Photos of a bottlenose dolphin calf observed on May 7, 2016, in the western Mississippi Sound, with healing injuries to the melon and dorsal fin. (a) views of the wound on the central face of the melon with an orange to pink coloration to the tissue, which is evidence of healing and granulation tissue, (b) a view of the full extent of the injury extending from the cranial most aspect of the rostrum, the mandible, and the melon, through the entire length of the leading edge of the dorsal fin. Reproduced with permission.

present as irregularly shaped open wounds with visible granulation tissue, having small, round, inverted margins at the entry site and an irregular area with extruding margins at the exit site (14). The lack of an obvious inverted pinpoint entry site suggests that this form of wound is less likely than the others to have occurred, but it cannot be ruled out due to the concave and pitting nature of the melon injury. The wounds of the dolphin presented here are most consistent with a boat strike. The type of vessel that interacted with this dolphin or the exact cause of the wounds was not possible to determine without further investigation. No other obvious signs of emaciation or other deformities were observed.

Dolphins have a unique skin structure. Their dermis contains an abundance of dermal papillae, which facilitate the folding of the germinal layer, enabling rapid epithelial repair, followed by a layer of blubber composed of fat and connective tissue (7,19). Cetacean epithelial cells multiply much faster than those of terrestrial mammals, increasing the density of the epithelium and providing an additional layer of protection (19). During the healing process, damaged skin tissue is first replaced by a fibrous scar, which is then covered in regenerated epithelium (7). If the wound is large and deep, it requires an additional step of the creation of a bed of granulation tissue, eventually causing the wound to contract (7). Additionally, as the wound heals, depigmentation and deformation of the adjacent tissue occurs, creating a permanent scar (7). Dolphins have been observed to heal from extreme injuries, which is facilitated by their ability to by-pass the production of scabs by creating a buffer layer of degenerating cells which protect the underlying tissue (10,19). Due to this rapid healing ability, most deep wounds have been shown to heal in five to eight months, with scarring lasting years to a lifetime (12).

Due to the concave and pitting nature of the melon wound, it is likely that it required deep granulation tissue formation. Because dolphin bisonar beams are focused through a series of contributions from the skull, nasal, diverticula, melon, and connective tissue structures, the contracting of the surrounding tissue in the formation of scarring could endanger the animal's ability to echolocate, due to this change in the structure and sensitivity of the tissues surrounding the melon (9). Echolocation is critical for odontocete foraging and navigation, as it allows individuals to orient without visual perception, by detecting objects and other spatial information (7,13,24). From this sighting, the dolphin did not appear to have loss of echolocation. However, without further investigation, the ability for possible compensation is unpredictable.

The mother- calf relationship in dolphins lasts up to four years; however, in many cases they will maintain affiliative interactions for years (16). This prolonged time with the mother allows young dolphins the opportunity to learn necessary skills for both social and functional survival (16). Epimeletic behavior in dolphins has been documented in the form of assisting and/or protecting a wounded calf from predators and/or consistently remaining with an injured animal, to aid in the recovery and survival of the injured animal and other essential functions (5). In this case, it is possible that the calf's survival and healthy body condition was dependent upon this epimeletic care. Whether or not the individual will be able to survive after the mother is no longer providing the necessary nutrition for survival is unknown.

Photo ID surveys were continually conducted monthly since 2016 with attempts to locate and document this animal's progress. However, this animal has not been identified on any subsequent routes since 2016. Dolphins from the ncGOM can be a difficult population to study for several reasons. This stock is a mixing area, with dolphins shifting in an out of the area seasonally, retaining approximately 900 year-round dolphins which have a seasonal east-west shift due to the salinity and river output, and these dolphins represent a mixture of two genetically different groups, including an island and coastal group (21). Survival from these injuries can be difficult to establish due to dolphins' ability to heal extreme injuries, the challenges of monitoring a highly mobile species, and recovering a viable carcass for necropsy (10). Because there have been no further sightings since 2016, it is possible that this animal is deceased. It is also possible that due to the population's seasonal mobility, this calf ranged outside of the stock boundary and sample region or was missed in further photo identification surveys.

Stranding rates for calves and juvenile dolphins in Mississippi vary from year to year, with survival rates ranging from around 58-82% (25). If a live stranding incidence occurs, in such cases, an initial health assessment would need to be performed to determine the extent of the injury. Diagnostic recommendations include measurements, photographs, and histology from the wounds. In addition, an Auditory Evoked Potential (AEP) test to assess the hearing range and sensitivity, and radiographs and a CT scan to assess the extent of the internal damage should be completed (24). It should be noted that even though this is the first known reported sighting of a live dolphin calf with a melon injury in the

MSS, it is possible that others contained within this population exist but are undocumented.

Although not possible in this case, wound progression could be monitored with future photo ID surveys, whenever prolonged monitoring is possible. Documenting unique injuries in free-ranging cetaceans is critical in understanding the survival capabilities of animals with severe injuries. To assess the status of the dolphin population in the MSS, continued photo ID studies are necessary. Despite the healing capabilities of cetaceans, steps should be taken to avoid injury via human interaction, including increased educational outreach to fisherman and the public, greater law enforcement presence on the water, and proper disposal of fishing gear. This case report expands upon our limited existing knowledge of such injuries and provides a basis for comparison of cetacean melon traumas. This could better inform future rehabilitative efforts by improving the ability of stranding agencies response to make determinations of live stranded animals. In addition, this information could help in determining if unassisted recovery is the best option for high stress wild cetacean intervention.

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