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Laryngeal Displacement and Asphyxiation by a Beheaded Sheepshead (*Archosargus probatocephalus*) in a Bottlenose Dolphin (*Tursiops truncatus*)

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Abstract

A mature, 2.7-m male bottlenose dolphin (*Tursiops truncatus*) with a fish tail protruding from its mouth was found dead on the northern Gulf of Mexico coast near Galveston, Texas, on 26 February 1995. Necropsy revealed a large and beheaded sheepshead (*Archosargus probatocephalus*) directly impacting the base of the laryngeal goosebeak. The larynx was severely dislocated rostroventrally into the oral cavity, which led to death by asphyxiation. An isolated sheepshead head was recovered from the caudal thoracic esophagus. Feeding strategies in dolphins of beheading fish and the sometimes fatal ingestion of inappropriately large and/or spiny prey are discussed.

Key Words: bottlenose dolphin, *Tursiops truncatus*, asphyxiation, laryngeal displacement, stranding, mortality, feeding strategies

Introduction

Bottlenose dolphins (*Tursiops truncatus*) are distributed globally in tropical and temperate waters, primarily in coastal habitats (Wells & Scott, 1999) and are well-known for their highly varied and often opportunistic feeding strategies and catholic diet (Leatherwood, 1975). The bulk of their diet is comprised of a wide range of fish and/or squid. The specific prey and relative importance reflects distinct dolphin populations of the central USA Atlantic (Mead & Potter, 1990), southeastern USA Atlantic (Barros & Odell, 1990), west-central Florida (Barros & Wells, 1998), and northern Gulf of Mexico (Gunter, 1942; Barros & Odell, 1990).

Fisheries interaction is a well-known cause of mortality among bottlenose dolphins (Waring et al., 2000; Fertl, 2002), although choking/asphyxiation is infrequently reported. Occasionally, ingestion of large prey and/or unusual items has been reported as lethal for bottlenose dolphins and other small cetaceans. For example, an immature harbor porpoise (*Phocoena phocoena*) quickly suffocated due to obstruction and overextension of its esophagus when attempting to swallow a small shark (Orr, 1937), and an adult bottlenose dolphin was found dead after the incomplete swallowing of a 1.2-m shark (Harmer, 1927). Two adult bottlenose dolphins died of "apparent asphyxiation" (pp. 229, 232) due to displacement of their larynx by an incompletely swallowed whole fish (Bossart et al., 2003). In Florida, 16 other bottlenose dolphin deaths were associated with ingestion of normal prey species "that were either too large . . . or had dangerous appendages, such as dorsal or pectoral spines in fish, which perforated the wall of the upper gastrointestinal tract and compromised adjacent organs" (Barros & Odell, 1995, p. 54). Additional fatalities have resulted from esophageal obstruction in a juvenile harbor porpoise because of a balled piece of plastic debris (Baird & Hooker, 2000) and laryngeal entrapment by swallowed recreational fishing gear in two bottlenose dolphins (Gorzelany, 1998). The case reported here is of a stranded dead bottlenose dolphin with laryngeal displacement that resulted from an impacted beheaded fish.

Case Report

On 26 February 1995, a large, 2.7-m total body length, 208 kg male bottlenose dolphin (field number GA 683), was found dead, stranded at Beach Pocket Park #3 (29° 13.65' N, 94° 53.75' W) on the gulf side of Galveston Island, Texas, about 13 km southwest from Galveston City. The dolphin carcass, which had minor bloating and bird-inflicted damage to the right eye, was unremarkable in appearance, except for a fish tail protruding from its mouth. The carcass was frozen, then transported to the College of Veterinary Medicine at Oklahoma State University in Stillwater, Oklahoma, where it was necropsied on

8 April 1995. Standard body measurements were as follows: maximum girth – 159.5 cm; length of flipper from cranial insertion – right, 42.5 cm; axilla to tip of flipper – right, 30.5 cm; maximum width of flipper – right, 17 cm; height of dorsal fin – 21 cm; width of flukes – 72.5 cm.

A few parallel, linear, superficial skin abrasions (i.e., tooth rakes) near the genital opening and on the dorsal aspect of the proximal peduncle were judged by their spacing to be caused by the teeth of adult conspecifics. The leading edge of the flippers, flukes, fin, and snout area were examined for net/line markings but showed no signs of incidental entanglement in fishing gear. Numerous (30+) pseudo-stalked barnacles (*Xenobalanus* sp.), or their foot-plates, were attached on the caudodorsal aspect and the trailing edge of the central third of both flukes, and four were attached on the dorsum of the trailing edge of the distal part of the left flipper.

Most teeth were worn flat, almost to the gum level, and the surfaces were polished smooth with closed central cavities (Figures 1a & 1b). Several teeth were either broken or missing in the caudal-quarter and at the rostral tip of the jaws. Overall, the dolphin was in excellent body condition: blubber thickness varied from 14 to 29 mm over selected trunk sites and was considered normal for the time of year.

The oral cavity was opened from the ventrolateral aspect by first dissecting between the mandibles and lateral to the tongue, and then by removing most of the right mandible. In this manner, the full extent of the oral cavity and the impacted fish could be visualized *in situ* (Figure 1a). A beheaded sheepshead (*Archosargus probatocephalus*) was inside the mouth, head-end pointed toward the esophagus and lying dorsoventrally upside down. Without its head, the specimen was 37 cm long, with an estimated total body length of 44 cm and 2 to 3 kg in weight.

The fish body was largely intact, covered with skin and scales; the tail fin was partially eroded; the ventrum was opened along the mid-belly; and most viscera were absent. The head was roughly transected through the orbit, and caudoventral parts of the head and ventral parts of the cranial trunk were missing

At least six large dorsal sheepshead spines were deeply embedded, up to 3 cm, in the floor of the oral cavity along the right lateral aspect of the root of the tongue. The cranial transected end of the fish was firmly butted into the oro-epiglottic fold at the rostral base of the laryngeal goosebeak. Similarly, the left ventrolateral cut surface of the fish was butted into the dorsolateral aspect of the oro-pharynx on the left, and adjacent bony projections impaled the mucosa of the hard palate. The oral mucosa was intact, other than the puncture wounds from the embedded spines. Significantly, the proximal opening of the larynx was rostroventrally displaced into

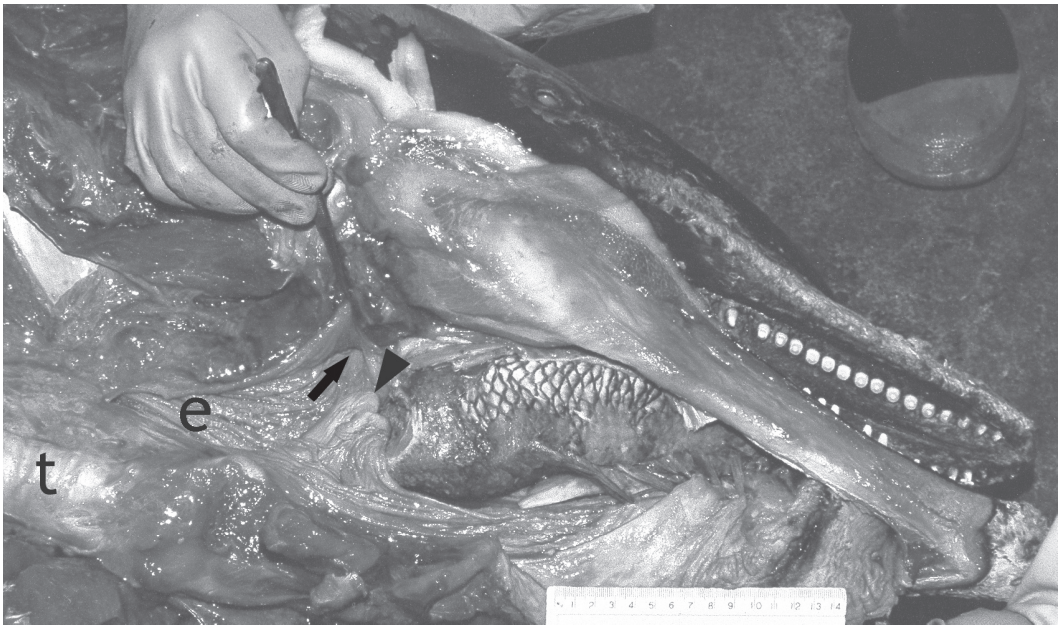

Figure 1a. Right ventrolateral view of partially opened oral cavity of bottlenose dolphin, showing impacted beheaded sheepshead fish; laryngeal goosebeak (arrowhead) is dislocated and displaced rostroventrally 3 to 4 cm from soft palate opening at end of probe (arrow): e, esophageal opening; t, trachea. The ruler is 15 cm.

Figure 1b. Closer view after right mandible was resected to demonstrate blunt beheaded end of the fish abutted onto the rostral base of laryngeal goosebeak and its displacement; the soft palatal opening is indicated at end of probe (arrow). The large dorsal spines are visible after retraction of ventral oral mucosa.

the oral cavity, 3 to 4 cm from the palatal opening of the nasal passages (Figure 1b).

The caudal half of the thoracic esophagus was dilated and contained a skin-intact isolated fish head of a sheepshead, a partially digested dorsal skull of another fish, and sundry fish bones. The forestomach compartment contained 908 g of digesta, including many fish bones and beaks of cephalopods, as well as a fairly intact vertebral column of a large fish and a semidigested fish tail stock, measuring some 37 cm in combined length. Otoliths belonging to three sheepshead, one sand seatrout (*Cynoscion arenarius*), and two unidentified teleosts were found. Cephalopod beaks belonging to 34 brief squid (*Lolliguncula brevis*) and two inshore squid (*Loligo* cf. *L. plei*) also were present. A total of 16 half-jaws of sheepshead (representing four specimens), with their characteristic dentition, were retrieved from the forestomach. The different stages of digestion of these remains suggest that these fish were consumed at different times. Numerous trematodes (*Braunina cordiformis*) were attached in the second, or enzymatic compartment, of the stomach, and the liver was rounded and extensively adhered to the diaphragm and stomach. Otherwise, examination of other thoracic and abdominal organs did not reveal obvious gross lesions. The testes measured 11.9 x 5.5 cm on the right and 19.5 x 7.0 cm on the left. The necropsy findings suggested that death resulted from severe laryngeal displacement and asphyxiation.

The impacted fish at the larynx and the isolated head in the caudal esophagus had been separated by a blunt-force transection through the orbital region of the skull. Both items were identified as sheepshead, and, based on comparable size, it is likely that they were two parts of the same fish.

Standard, plain film, ventrodorsal radiographs were taken of both flippers and the caudal vertebrae. The skeleton was defleshed and then cleaned by bacterial and fly-larvae maceration. Both flippers had similar appearance of bones. In the manus, there were six carpal bones in two rows. The proximal row consisted of a large, dumbbell-shaped radial; an intermediate; an ulnar; and a small accessory carpal bone caudally. The distal row consisted of two bones—carpal three and carpal four-plus-five; five metacarpals; and the phalangeal formula (phalanges only) for both flippers was I0, II7, III6, IV3, and V2. The vertebral formula was C7, T12, L14, and Cd 30. There were

no signs of separate bony epiphyses or epiphyseal growth plates in any of the limb bones, ribs, nor on any vertebral bodies. Through the caudal part of the sternum, immediately caudal to the third costosternal articulations, there was a slightly oblique old malunion fracture. Grossly, aside from the sternal fracture, the skeleton revealed a normal, but particularly mature dolphin. Based on the degree of tooth wear and by extrapolating from the asymptotic length of 2.68 m for male dolphins greater than one year of age stranded on the Texas coast (Fernandez & Hohn, 1998, Figure 3), we conservatively estimate that this 2.7-m male was at least 15 to 20 years of minimum age.

The skull was measured to investigate possible ecomorph determination. Specific skull measurements were as follows: condylobasal length (CBL) – 45.5 cm, zygomatic width (ZW) – 24.1 cm, and internal nares width (NW) – 5.1 cm. This internal nares width is less than the 6.7 cm predicted by equations for West Atlantic "offshore" individuals (NW = 0.129 CBL + 0.84 and NW = 0.202 ZW + 1.85; Mead & Potter, 1995), but it is within the range for bottlenose dolphins from Texas inshore habitats (Turner & Worthy, 2003).

Discussion

The large sheepshead the dolphin of this report attempted to swallow is a normal prey fish for bottlenose dolphins; however, it is not one of the more commonly consumed species in the northern Gulf of Mexico or southeastern USA Atlantic (based on frequency of occurrence and by relative numbers of consumed fish, this species is not in the top six prey selections) (Barros & Odell, 1990). Furthermore, the majority of fish consumed by these bottlenose dolphins are 5 to 30 cm in length, much smaller than the 44 cm of this impacted specimen. In addition, although bottlenose dolphins eat a diverse variety of fish species, and they have seasonal, locality, and individual preferences in diet (Barros & Wells, 1998), both healthy and sick dolphins eat from the top of this prey list (Barros & Odell, 1990). According to the forestomach analysis of this dolphin, sheepshead were a major component of his diet, and recently he had captured more than one large (30+ cm) fish. Thus, the sheepshead captured by this particular dolphin was a normal prey item, albeit a considerably larger specimen than those ordinarily ingested.

Two things are unusual in this case: (1) the fish was beheaded, and (2) the fish was directly impacted on the base of the laryngeal goosebeak. Bottlenose dolphins have remarkably plastic feeding behaviours, which can vary according to habitat, circumstance, and population (Leatherwood, 1975; Lewis & Schroeder, 2003; see also review in Shane et al., 1986). Beheading fish, however, is not one of the usual feeding strategies of dolphins (Shane, 1990), although beheading hardhead catfish (*Arius felis*) by "cutting them off just behind the pectoral and dorsal spines, [and] leaving the heads floating around" (p. 273) has been noted for dolphins in the northern Gulf of Mexico (Gunter, 1942). Bottlenose dolphins along the Florida coast have been observed to prey on large fish, however, including snook (*Centropomus undecimalis*), up to 1 m in length (Shane, 1990) and are known to behead large fish prior to consuming them. The list of observed prey species beheaded include snook, sheepshead, hardhead catfish, and permit (*Trachinotus falcatus*) (Barros, pers. comm.). Moreover, beheaded fish, along with their matching heads, have been recovered from the stomach of a bottlenose dolphin stranded on the east coast of Florida. These beheaded fish, specifically two sheepshead, were most likely decapitated by the dolphin that ate them; the sheepshead were estimated to be 27 and 28 cm in total body length, respectively, and unrelated to the cause of the dolphin's death (Barros, pers. comm.). In another mortality of a 36-year-old bottlenose dolphin, a sheepshead was found in the distended esophagus hooked to recreational fishing gear, but the asphyxic death was attributed to the attached monofilament line tightly wrapped around the goosebeak (Gorzelany, 1998).

Spiny fish, including sheepshead, are part of the bottlenose diet in the southeastern USA Atlantic and the northern Gulf of Mexico (Gunter, 1942; Barros & Odell, 1990; Barros & Wells, 1998). Unfortunately, some dolphins, including the one described here, "occasionally underestimate the danger of attempting to swallow unusually large fish or fish with dangerously sharp spines, and may die as a result" (Barros & Odell, 1995, p. 54). In two other reported cases, bottlenose dolphins died from asphyxiation following displacement of the laryngeal goosebeak concurrent with esophageal obstruction by a large spiny fish (Bossart et al., 2003). In one, the fish was a blackchin tilapia (*Sarotherodon melanotheron*), an exotic prey species; whereas in the other, the fish was a striped mojarra (*Eugerres plumieri*), a resident, but unusual, prey species. A similar scenario occurred when a subadult northern elephant seal (*Mirounga angustirostris*) died of apparent asphyxiation resulting from a Pacific ocean perch (*Sebastes alutus*) impaled in its oropharynx (Stroud & Roffe, 1979). Misjudging prey size also had fatal consequences for an immature harbor porpoise, which died of asphyxiation while attempting to swallow a small grey smooth-hound shark (*Mustelus californicus*), which was 55% its

body length (Orr, 1937). Attempted ingestion of large prey fish in other dolphins, harbor porpoises, and a beluga (*Delphinapterus leucas*) also has been fatal (Harmer, 1927; Barros, 1987; Rosario-Delestre, pers. comm.).

It is possible that some large fish that are mistakenly ingested, and that might choke a small cetacean, are successfully regurgitated when the predator is unable to completely swallow the prey. Perhaps only those fish with particularly sharp spiny appendages become fatally impaled in the upper digestive tract as the dolphin or porpoise attempts to dislodge the breath-threatening obstruction.

In this bottlenose dolphin, the necropsy suggests that the key event that caused death was a direct impaction on the base of the laryngeal goosebeak. That circumstance, coupled with impaled spines in the oral and pharyngeal mucosa, differentiates this case from others in which a large fish fatally obstructed the esophagus (Barros & Odell, 1995) and dislodged the upper airway (Bossart et al., 2003). Presumably, the blunt, rough-endedness of this large beheaded sheepshead hindered a smooth swallowing reflex and prevented normal passage around the goosebeak and laterally through the piriform recess, leading to a direct impaction on the goosebeak. Any subsequent attempts by the dolphin to regurgitate the fish would have resulted in deep impalement of the spines in the oral mucosa—clearly double jeopardy for this dolphin.

It is tempting to suggest that some ill and/or aged dolphins prey on inappropriate items, sometimes with fatal outcomes. In this present case, the dolphin was apparently in good health, although particularly mature as suggested in part by greatly worn teeth. Further investigations, especially those including known-aged dolphins, could help explicate our supposition.

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