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Fatal Blowhole Obstruction by Eel in Common Bottlenose Dolphins (*Tursiops truncatus*) in Florida, USA

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ABSTRACT: Esophageal and pharyngeal obstruction are commonly reported in marine mammals, but asphyxiation from blowhole and nasal cavity obstruction has been reported only rarely: in two long-finned pilot whales (*Globicephala melas*), several harbor porpoises (*Phocoena phocoena*), and one common bottlenose dolphin (*Tursiops truncatus*). We describe two cases of blowhole obstruction and subsequent asphyxiation in bottlenose dolphins caused by eels. A whip eel (*Bascanichthys scuticaris*) was found obstructing the blowhole of a deceased dolphin from the Indian River Lagoon, Florida, US (2011) and a shrimp eel (*Ophichthus gomesii*) was found obstructing the blowhole of a deceased dolphin from Tampa Bay, Florida (2020). Normally, the respiratory and digestive tracts of cetaceans do not communicate. Consuming large or oddly shaped prey can result in laryngeal displacement and subsequent interaction between the two systems. It is likely the eels entered the oral cavity while the dolphins were consuming or playing with prey, and laryngeal displacement enabled the eels to slither into and become stuck in the nasal passage, causing asphyxiation. These novel findings underscore the importance of continued investigation into causes of mortality in stranded marine mammals and can contribute to the knowledge of feeding ecology in bottlenose dolphins. As changing environmental conditions contribute to shifts in prey availability and abundance, mortality due to prey-related asphyxiation could become more common in odontocetes.

Key words: Asphyxiation, bottlenose dolphin, eel, mortality, *Tursiops truncatus*.

Common bottlenose dolphins (*Tursiops truncatus*) are resident in Florida's estuaries along the east (Indian River Lagoon; IRL) and US west coasts (Tampa Bay; Odell and Asper 1990; Urian et al. 2009). Life history patterns (Stolen and Barlow 2003; Wells 2014) and mortality causes have been well-studied in these regions, including infectious disease (Bossart et al. 2003), anthropogenic factors (Wells et al. 1998; Stolen et al. 2013a), and biotoxins (Twiner et al. 2011). Asphyxiation, although uncommon, has been reported with peracute underwater entrapment involving fishing gear (Epple et al. 2020). Fatal asphyxiation caused by prey lodged in the pharynx, larynx, and esophagus has been reported in bottlenose dolphins (Mignucci-Giannoni et al. 2009; Stolen et al. 2013b) and harbor porpoises (*Phocoena phocoena*; Siebert et al. 2001). There is only one previously documented nasal cavity asphyxiation in bottlenose dolphins, in which a dab (*Limanda limanda)* occluded the nasal cavity of a dolphin off the coast of Wales (Perkins et al. 2015). Nasal obstruction by fish with subsequent asphyxiation also has been reported in two long-finned pilot whales (*Globicephala melas*) in the North Sea (IJsseldijk et al. 2015) and in several harbor porpoises off the US west coast (Wilkin et al. 2012; Elliser et al. 2020; Gross et al. 2020).

We documented two cases of fatal blowhole obstruction in bottlenose dolphins, as part of long-term marine mammal stranding mortality projects in Florida. Complete necropsies were conducted, and tissue samples were processed for histologic evaluation, including, but not limited to, brain, heart, trachea, lung, liver, kidney, spleen, lymph nodes, bladder, skin, esophagus, stomach, pancreas, and intestine. On 8 February 2011, a 164-cm female bottlenose dolphin, estimated to be <2 yr old (Stolen and Barlow 2003), was recovered from the IRL (28.9590583, –80.873686). The carcass was in good nutritional condition with minimal decomposition. A 65-cm whip eel

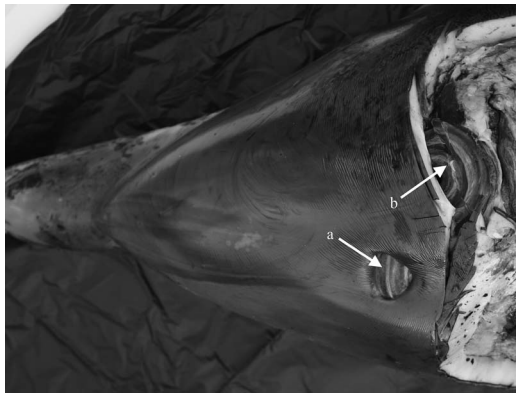

FIGURE 1. Whip eel (*Bascanichthys scuticaris*) in situ within the blowhole (a) and opened vestibular sac (b) of a 164-cm female bottlenose dolphin (*Tursiops truncatus*) observed on 8 February 2011 in the Indian River Lagoon, Florida, USA. Eel presence resulted in fatal obstructive asphyxiation. Rostrum is positioned to the left (Case 1, 2011).

FIGURE 2. Shrimp eel (*Ophichthus gomesii*) in the blowhole and upper nasal passage of an adult female 233-cm bottlenose dolphin (*Tursiops truncatus*) observed on 9 March 2020 in Tampa Bay, Florida, USA. Eel presence resulted in fatal obstructive asphyxiation. Rostrum is positioned to the left (Case 2, 2020).

(*Bascanichthys scuticaris*) was found coiled within the vestibular sac of the upper respiratory system. The broadside of the eel was visible at the blowhole opening, and its head was found in the vestibular sac to the right of the blowhole (Fig. 1). The walls of the vestibular sacs were thin and dilated due to the eel's presence. The lungs contained minimal froth, lungworms, and yellow calcareous deposits (common findings). The esophagus, larynx, and trachea were unremarkable. A nearly intact 15-cm fish and an intact shrimp were present in the forestomach. Histopathologic findings included chronic-active interstitial pneumonia, chronic renal interstitial nephritis, eosinophilic and granulomatous lymphadenitis, and granulomatous dermatitis. There was no evidence of systemic infection or organ-specific changes that would have significantly contributed to death. The findings were consistent with fatal obstructive asphyxiation from the eel in the nasal cavity.

A second dolphin was recovered in Tampa Bay (27.643591, –82.735391) on 9 March 2020. The 233-cm female carcass was moderately decomposed, in good nutritional condition (172 kg), and the mammary glands expressed milk. The head and caudal portion of a 63 cm shrimp eel (*Ophichthus gomesii*) protruded from the blowhole (Fig. 2); the remaining portion was coiled in the distended vestibular sac. The larynx appeared normal. Approximately 150 mL of fish bones, otoliths, and lenses were present in the forestomach. A 5.2-cm-long stingray barb tracked from a well-healed penetration scar on the ventral right lateral aspect of the dolphin's thoracic region, through the parietal pleura and right lung into the pericardial sac. Scar tissue and numerous adhesions suggest that these findings were chronic, not the primary cause of mortality. Histopathologic findings included focal epicardial fibrosis corresponding to the stingray barb, plus mucosal edema, congestion, and hemorrhage of the nasal passage, corresponding to the site of eel entrapment. Cause of death was determined to be asphyxiation due to the eel obstructing the blowhole.

Odontocetes have a unique larynx, commonly referred to as the goosebeak, composed of an elongated epiglottic cartilage and paired elongated corniculate cartilages of the arytenoid (Fig. 3; Reidenberg and Laitman 1987). The goosebeak extends through a small opening in the roof of the pharynx, inserting into a vertical nasal passage. A palatopharyngeal sphincter muscle allows muscular control over the larynx and creates a laryngeal plug, generating greater separation between the respiratory and digestive tract than is seen

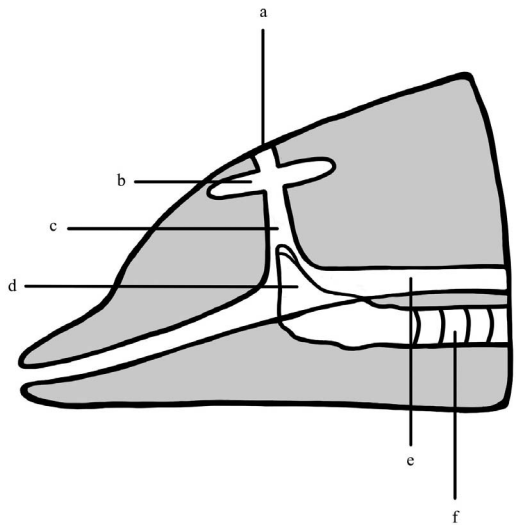

FIGURE 3. Bottlenose dolphin (*Tursiops truncatus*) upper respiratory anatomy: (a) blowhole, (b) vestibular sacs, (c) nasal passage, (d) goosebeak, (e) esophagus, (f) trachea.

in other mammals (Reidenberg and Laitman 1987). Normally, the respiratory and digestive tracts do not communicate, enabling prey ingestion underwater. Although choking and asphyxiation associated with fish ingestion is not unknown in bottlenose dolphins (Mignucci-Giannoni et al. 2009; Stolen et al. 2013b), there is only one previous reported case of nasal asphyxiation (Perkins et al. 2015). Since cetaceans rely upon their nasal passage for breathing, complete obstruction by a foreign body in the nasal cavities will result in insufficient intake of oxygen and subsequent death.

While not a common prey item, eel remains have been observed in the stomach content of bottlenose dolphins in the IRL, Sarasota Bay, Florida, and along the mid-Atlantic coast (Barros 1993; Barros and Wells 1998; Gannon and Waples 2004). In these asphyxiation cases, it is possible that during play or deglutition, the erratic movement of the eel in coordination with the dolphin's reaction allowed the eel access to the goosebeak and ultimately the nasal passage. Dolphins, particularly younger individuals, have been found to play with eels including letting them slither through their jaws (Brown and Norris 1956). In the first case, perhaps the calf was playing with or practicing foraging on an uncommon prey item. Once lodged in the nasal passage, the eel would have impeded the dolphin's ability to breathe. Due to high energetic demands, adult females significantly increase food consumption during lactation; this can include targeting larger or riskier prey species (Reddy et al. 1994; Elliser et al. 2020). Given the strong closure mechanism of the blowhole, it is unlikely the eel entered the blowhole directly in case two but rather that it was consumed as prey.

Shifts to novel prey species such as those that are larger, have longer spines, or have higher agility can pose a risk to dolphins during consumption. In recent years, the IRL has undergone several large-scale ecosystem changes, resulting in catastrophic seagrass loss (Morris et al. 2016). Seagrass meadows provide critical habitat to prey species consumed by dolphins (Barros and Wells 1998); thus, it is feasible that significant IRL habitat alterations could result in shifts in prey consumption (Powell and Wells 2011). Similarly, on the west coast, long-lasting red tide blooms have resulted in massive fish-kills, which can deplete important fish populations and result in shifts in prey (Gannon et al. 2009). Although further research is necessary to understand the effects of shifting prey availability, our report provides evidence that there can be negative consequences associated with novel prey species.

Dolphins are considered obligate nasal breathers, but recent discoveries propose they can breathe through their mouths upon manipulation of the goosebeak (Dawson et al. 2017). One Hector's dolphin (*Cephalorhynchus hectori*) has been observed to breathe only through its mouth rather than blowhole (Dawson et al. 2017). Current hypotheses for this behavior include a blocked or injured blowhole, a tumor, or a foreign object stuck in its nasal passage. Although the duration of the eel's presence in the nasal passageways in case one is unknown, edema, congestion, and hemorrhage in case two suggests that death was acute. The eels also presented with minimal decomposition, sug-

gesting they were not in the nasal passageways very long before each dolphin's death. Accordingly, despite their capacity to shift breathing patterns, it is unlikely these dolphins did so, resulting in asphyxiation.

These novel findings underscore the importance of continued investigation into the cause of mortality in stranded marine mammals. Changing environmental conditions and the introduction of foreign species to new regions can contribute to shifts in prey availability and abundance (Stolen et al. 2013b; Elliser et al. 2020). Mortality due to asphyxiation involving some prey species could create a more significant threat to odontocetes at large.

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