

Short Note

Apparent Emergence of Bow-Caught Fin Whales (*Balaenoptera physalus*) Found in the Netherlands

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Ship collisions have been described in 11 whale species of which the fin whale (*Balaenoptera physalus*) is reported most frequently (Laist et al., 2001). Types of injuries resulting from ship strikes range from propeller wounds to blunt trauma, which can cause bruises and fractures of the skull, jaws, and vertebrae, and often can result in death (Laist et al., 2001). Fin whales occur in the deep offshore waters of temperate latitudes with separate populations living in the North Pacific, the Southern Hemisphere, and the North Atlantic Ocean (Bérubé et al., 1998; Shirihai & Jarrett, 2006). Fin whales are rarely seen in the North Sea (Camphuysen & Peet, 2006).

Fin whales are classified as an endangered species on the *IUCN Red List*; the global population has declined by more than 70% over the last three generations (1929 to 2007) (Reilly et al., 2013). Population estimates for the entire North Atlantic Ocean differ but were estimated at 53,000 individuals at the end of the last decade (Reilly et al., 2013). Currently, the leading human-related threats for fin whales are fisheries bycatch (Reilly et al., 2013) and collisions with ships (Laist et al., 2001; Panigada et al., 2006).

This paper describes three additional observations of bow-caught fin whales found and examined in the Netherlands. Information about each of the involved vessels was obtained via personal communication with the shipping insurance company involved (J. Steenbergen, pers. comm., 1 October 2013). The position of the whale on the bow was evaluated from photographic material with the exception of Case #1 (see case study below). The scope of the necropsies was constrained by financial and practical considerations; a standard free-ranging cetacean necropsy protocol was followed for each animal (Kuiken &

Hartmann, 1993). Species identification was based on external characteristics, including the number of ventral grooves, the size and position of the dorsal fin, and the asymmetric color pattern of the baleen and the lower jaw. Gender was based on the location of the genital opening and, when possible, macroscopic examination of the gonads and secondary sex organs. Age class was determined by measuring body length and, again when possible, examination of the gonads. According to literature, sexual maturity is determined at a total body length of approximately 19 m in males and 20 m in females (Lockyer, 1972; Aguilar & Lockyer, 1987; Shirihai & Jarrett, 2006).

Case #1: Bow-Caught Fin Whale – 31 August 2011

The containership was 338 m long and 45 m wide and underway from Singapore to Rotterdam via the Suez Canal. The collision was not noticed during transit and, therefore, the exact speed of the ship at the moment of collision is not known, but the ship had generally travelled at speeds between 18 to 23 kts. The fin whale was carried in left lateral recumbence with the dorsum facing the ship. It was a juvenile male, 13 m total length, and weighing 10 tons, excluding the gastrointestinal tract. It was in normal body condition with a blubber layer of approximately 3 to 4 cm at the height of the dorsal fin with ample pericardial fat. The carcass was moderately decomposed. Just caudal to the left flipper was a linear dorsoventral indentation in the body. On the cut surface, the adjacent tissue showed a large, 4 to 10 cm thick focal area of subcutaneous edema. More dorsally, there was a defect in the skin through which the cranial surface of a vertebral body was visible. Within the mediastinum were hematomas. Caudoventrally in the abdominal wall, slightly to the left of the

midline, there was a large (several meters) irregular wound of which the edges did not show signs of hemorrhage. The acute hemorrhages found macroscopically were confirmed histologically. Ancillary findings included an infestation with *Crassicauda boopis* in a large blood vessel of the kidney with associated pyogranulomatous inflammation.

Case #2: Bow-Caught Fin Whale – 6 June 2012

The containership was 210 m long and 30 m wide and had travelled from Santa Marta, Colombia, to Rotterdam. The collision was not noticed during transit, but the ship had generally travelled at speeds between 15 to 20 kts. The fin whale was carried in left lateral recumbence on the bulb with its dorsum facing the ship. The whale was a juvenile male 18.5 m long, weighing approximately 43 tons and in good body condition, with a blubber layer of 5 to 8 cm laterally and ample fat around internal organs. The carcass was moderately decomposed. There was a $3 \times 4 \times 3$ m, ventrodorsally oriented, triangular, sharp-edged defect on the right tailstock extending through the blubber, exposing the tendons, muscles, and abdomen. Histologic examination of cut edges showed no evidence that this trauma had occurred while the whale was alive. Several ribs were fractured at the site where the whale had been in contact with the bow of the ship, although no hemorrhages were visible surrounding the fractures. The stomach was empty, and the intestines were moderately filled. The main histological findings included multifocal acute hemorrhages in the lungs and submucosa of the stomach, and acute monophasic skeletal muscle degeneration and necrosis. Ancillary findings included mild multifocal perivascular dermatitis. No other significant histological abnormalities were seen in the liver, heart, spleen, lymph nodes, or intestines. Polymerase chain reaction (PCR) for morbillivirus and herpesvirus were tested and appeared negative; no other viruses were isolated.

Case #3: Bow-Caught Fin Whale – 2 August 2013

The containership was 335 m long and 42.8 m wide and had travelled from Asia to Rotterdam via the Suez Canal. The collision was not noticed during transit, but the ship had generally travelled at speeds between 20 to 23 kts. The fin whale was carried in right lateral recumbence on the bulb, with its dorsum facing the ship. The whale was a juvenile female measuring 12.5 m and weighing at least 10 tons, excluding some tissues and fluid that were lost at the time of examination. The carcass showed advanced autolytic changes. The whale was in a normal body condition with a blubber layer at the lateral thorax of approximately

4 cm and ample internal fat stores. The stomach and esophagus were filled with krill. The animal had a 2×1.5 m square defect in the tailstock with both sharp edges and serrated edges in the blubber exposing underlying blubber and muscles. The right flipper was fractured but neither macroscopic nor histologic evidence was found that this trauma occurred during life. Approximately 8 cm of subcutaneous swelling was found at the site where the whale had been in contact with the bulb. There were acute hemorrhages in the blood vessels surrounding the optic nerve. Ancillary findings included a moderate intestinal infestation of *Bolbosoma turbinella*, *Acanthocephala* with mild enteritis, mild multifocal perivascular lymphoplasmacytic dermatitis, and mild multifocal necrosuppurative dermatitis. No abnormalities were seen in the part of the lungs that were examined, pre-scapular lymph node, skeleton muscles, spinal cord, nor liver, although histologic details might have been obscured by the moderate autolysis.

Discussion

Three juvenile fin whales were found bow-caught during the summer season in three consecutive years (2011 through 2013) of which two showed evidence of collision when alive; this remains unclear for the third. The lengths of the ships involved reached between 210 and 338 m. In the Netherlands, only a single case of a bow-caught whale was reported during the period from 1900 to 2010; however, this animal was not carried into a harbor and not further examined (Camphuysen & Peet, 2006). The fin whales described in this paper are the only three reports of bow-caught whale species in the Netherlands. Laist et al. (2001) revealed that almost all records of whales caught on ship bows involve rorquals due to their long sleek body shape. The minimum size of a ship able to bow-catch a whale is unknown, but Laist et al. mention the smallest ship with a bow-caught whale being 121 m in length. Whales have less time to react as vessel speeds increase, and there is evidence that collisions are more likely to occur at faster speeds, particularly at speeds of more than 14 kts (Laist et al., 2001; Jensen & Silber, 2004). Vessel speed in our cases was estimated between 15 and 23 kts (J. Steenbergen, pers. comm., 1 October 2013). An increase in vessel speed over the last decades may account for the observed increase in ship collisions with whales (David et al., 2011); however, the speed of Rotterdam-bound ships has not increased over the years in which these bow-caught whales were found (J. Steenbergen, pers. comm., 8 November 2013). Besides, in general, the ability of a ship to hit and bow-catch a whale is not well understood. Fin whales are known to be fast swimmers with

swimming speeds of 10 to 30 km/h (5 to 20 kts) (Kermack, 1947; Watkins, 1981; McDonald et al., 1995). Also, after a collision, it remains an uncertainty how getting stuck on the bow is influenced by the location of the body when a whale is hit (Laist et al., 2001).

The finding of only juvenile fin whales is consistent with other reports (Panigada et al., 2006) and may support juveniles spending more time at the surface or learning to avoid vessels during maturation (Laist et al., 2001). The finding of bow-caught whales in the summer is consistent with findings in the Mediterranean (Forcada et al., 1996; Panigada et al., 2006). A possible explanation is that during the spring and summer months, whales engage in intensive feeding activities, which makes them more focused on their prey and less aware of approaching boats. It is also possible that the distribution patterns of whales tend to overlap more with shipping routes during the summer.

None of the captains nor crew members were aware of the presence of the dead fin whales on the bows of their ships. In light of this, it is very likely that many collisions between large vessels and whales go unobserved (Laist et al., 2001). In our study, the possibility cannot be excluded that the fin whales were already debilitated or dead when hit. However, large hematomas indicating a functioning circulatory system at the time of death were found for Cases #1 and #3. Additionally, the fin whale in Case #3 had recently fed prior to death, making an acute cause of death more likely than a natural cause of death (i.e., due to illness or a disease). While the infestation of Case #1 with *C. boopis* is not surprising as there is a high prevalence of this parasite in the fin whale population, it is possible that this might have caused severe illness (Lambertsen, 1986). The effect of decomposition on the occurrence of pseudo-hemorrhages is unknown, and findings should be interpreted cautiously.

Based on the advanced state of autolysis seen at the time of examination and the reports of long transport distances of bow-caught whales (Laist et al., 2001), the location where these fin whales were found (port of Rotterdam) does not reflect the actual collision site. All three ships in this study sailed through the Gulf of Biscay where there is a known population of fin whales. This makes it possible that the fin whales came from the North Atlantic fin whale population, although we cannot exclude that the fin whales of Cases #1 and #3 came from the Mediterranean. Shipping routes are recorded by ESA ENVISAT/ASAR (2009) with the use of earth observation satellites. Examination of these records shows a high density of shipping routes throughout the North Atlantic Ocean. An increase was noted in operating ships in the last

decades as an effect of the rising demand for sea transport worldwide (Endresen et al., 2008). For the port of Rotterdam, until 2008, this resulted in a steady increase in the volume of ships entering the port ever since the arrival of the first containership in 1965. In 2008, the start of the economic crisis, a significant decrease was noted. Even though the volume of ships entering Rotterdam increased again by approximately 9% between 2009 and 2012, the volume of ships entering Rotterdam in 2012 is still approximately 10% under the volume of 2007 (J. Steenbergen, pers. comm., 1 August 2014). Though exact numbers of vessels that have travelled through the Gulf of Biscay and entered the port of Rotterdam are lacking, the apparent increase in bow-caught whales in Rotterdam does not seem to be related to an increase in ship traffic. Also, no increase in shipping in the summer months has been found (J. Steenbergen, pers. comm., 6 December 2013).

These cases show the importance of performing a necropsy on bow-caught whales to try to determine the cause of death and underlying debilitating diseases. Reports of the circumstances surrounding bow-caught whales together with the pathology data provide information that makes comparison with similar cases over time possible. Potential trends will become visible, shedding more light on the uncertainty surrounding the causes of this human-related threat to the fin whale population.

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