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Short Note

Skull Fracture in a Bryde's Whale (*Balaenoptera edeni*) Specimen from Southern Brazil

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Fractures in cetaceans are frequently mentioned in the literature (Cowan, 1966; Dunn et al., 2002; Knudsen & Øen, 2003; Jensen & Silber, 2004; Fernandez et al., 2005; Sweeny et al., 2005), but descriptions of the pathology of a fracture are rare. Ogden et al. (1981) described a naturally occurring fracture of the distal radius and ulna in a skeletally immature fin whale (*Balaenoptera physalus*) (Linnaeus, 1758), which appeared to be failing to heal. The authors suggest it was possible that the necessity for continued use of the extremity might have been a major contributing factor in the failure of a healing response to that injury. Philo et al. (1990) described a fractured right mandible with mid-length nonunion in a subsistence-harvested female bowhead whale (*Balaena mysticetus*) (Linnaeus, 1758). In that case, good body condition suggested the fracture was not debilitating but healing.

We present a discussion of a partially healed, very large *antemortem* fracture in the left maxilla of a specimen of *B. edeni* (Anderson, 1878) (Bryde's whale), possibly caused by impact with a large vessel. Bryde's whales are from tropical and temperate zones; they represent one of the least well-known species among all Mysticetes (Kato, 2002). An incomplete but well-preserved skeleton was collected in August 1996 along the northern coast of Rio Grande do Sul State, Southern Brazil, that is now at the Mammalian Collection of the Museu de Ciências Naturais, Fundação Zoobotânica do Rio Grande do Sul, Porto Alegre, Brazil (MCN 3049, skull without mandible; all cervical and some thoracic, lumbar, and caudal vertebrae).

A large lesion on the left maxilla indicated an enormous partially healed fracture (Figure 1), likely associated with secondary abnormalities related to a large hematoma and the healing process. It is likely that a significant impact caused the fracture along the anterior surface, close to the lateral margin, which affected the central portion of the bone from where it extends posteriorly along the lateral margin. The total length of the fracture is roughly 60 cm. Other fractured portions of the skull (anterior and posterior) moved a few centimeters medially and ventrally, and were slightly rotated before becoming fused (to

Figure 1. *Balaenoptera edeni* (Anderson, 1878) (MCN 3049): right and left maxillae, ventral view (Scale: 17 cm)

each other and to the main bone) through irregular ossifications and bony bridges during the healing process (Figures 2 & 3). What significantly contributed to the maxillary deformity seems to be a lack of contact between the medial portion of the fragments and the main part of the bone, giving rise to a large opening between the fragments and the main bone (Figure 2).

A large hematoma caused by trauma may have become infected and so delayed the healing process, including the observed bone fragments' displacement. Indirect signs of this process include bone bulges on the cortical area of the external surface, next to the anterior limit of the fracture (Figure 3). Here, the cortical bone is partially avulsed (Figure 3), and the internal surface of bone is porotic (Figure 4). Several left maxilla vascular foramen are enlarged when compared to those of the right side, which is compatible with the inflammatory process, the hematoma, and healing process. There is no evidence of active osteomyelitis. No bone callus is present as would be expected in dermal bone fractures that have begun healing.

The present condition of the specimen includes a severe post-traumatic process, following a severe fracture associated with a large hematoma. Fracture healing in cetaceans is largely unknown, but Ogden et al. (1981) suggest that there is a relatively decreased rate of remodeling in cetacean bones. There are references in the literature concerning the absence of calluses in skull fractures of cetaceans (e.g., Philo et al., 1990), but as a rule, calluses are not formed in dermal bones (Resnick & Niwayama, 1981), be it a cetacean or any other vertebrate.

Although there was not any sign of osteomyelitis, this situation cannot be excluded. It is probable that the presence of a large hematoma might have factored into the lack of observation of osteomyelitis; hematomas frequently become infected and can lead to septicemia and death. Hematic dissemination may have occurred from the hematoma as the primary focus of pathogens. The high stress induced by symptoms associated with this trauma and fracture might have increased the blood level of adrenal steroids, in this way decreasing body defenses (Sapolsky, 1987), favoring pathogen dissemination and eventually leading to death.

Collisions with motorized ships are a recognized source of whale mortality (in fact, most severe and lethal whale injuries involve large ships; Kraus, 1990), but records for Bryde's whales and vessel interaction are rare (Laist et al., 2001). The point here is that these small-size rorquals are underrepresented compared to larger species because the former's small size may reduce the likelihood of being caught by and remaining on a bow after a

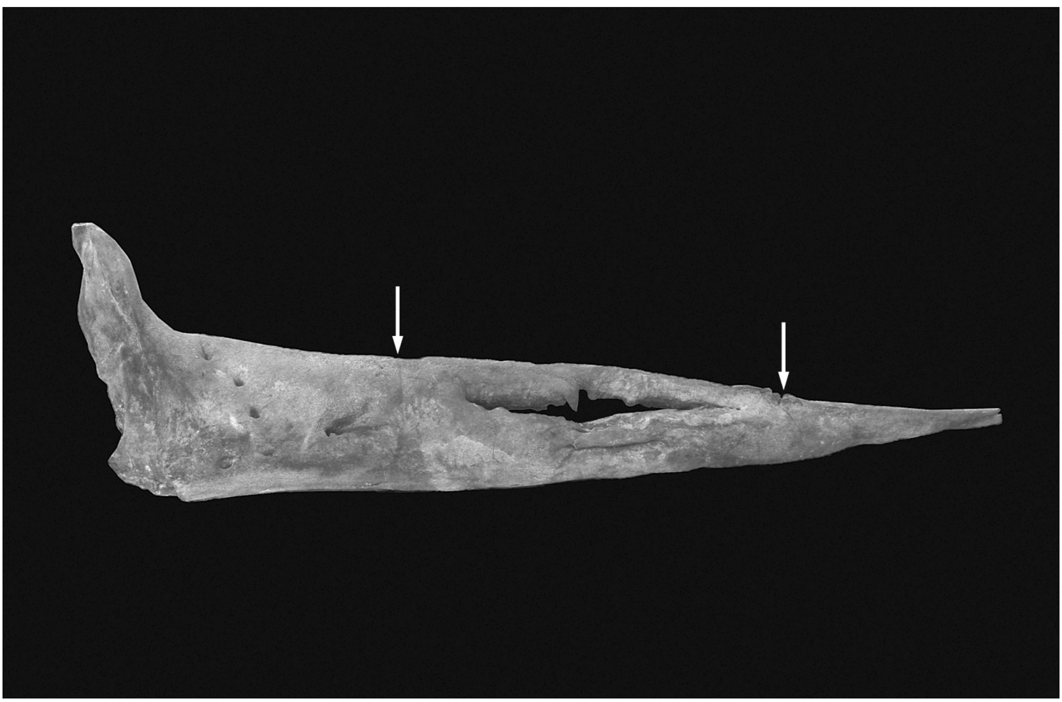

Figure 2. *B. edeni* (Anderson, 1878) (MCN 3049): left maxilla, dorsal view. Arrows: anterior and posterior limits of the fragment after it was fused to the main bone (Scale: 17 cm).

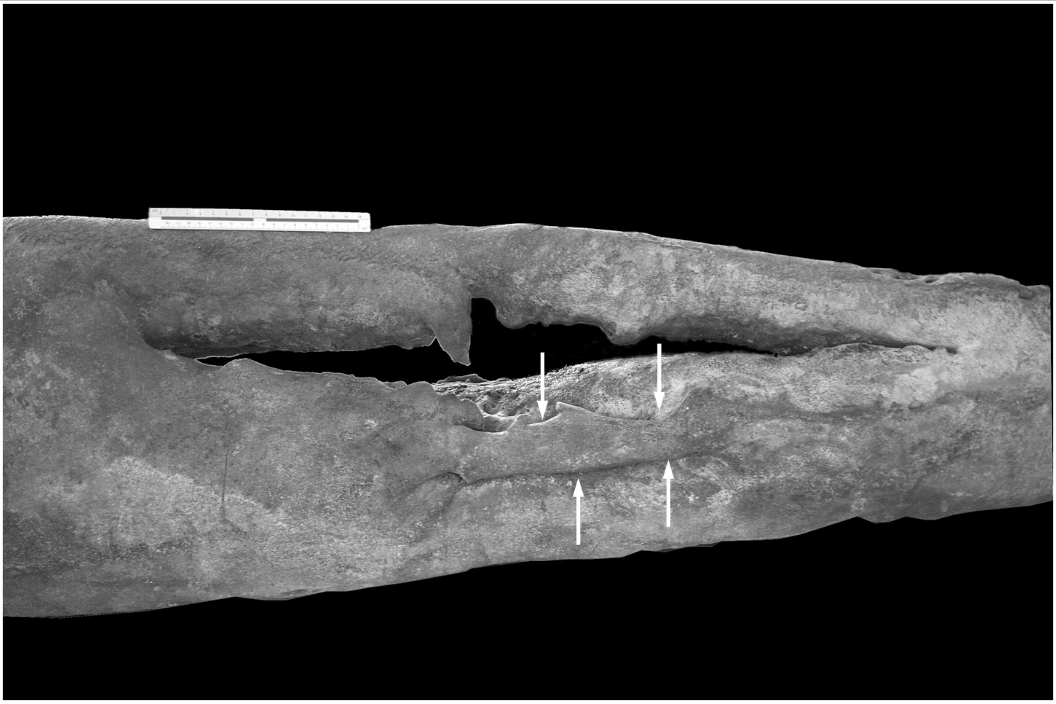

Figure 3. *B. edeni* (Anderson, 1878) (MCN 3049): left maxilla, partial dorsal view. Arrows: bone bridge of big proportions (Scale: 17 cm).

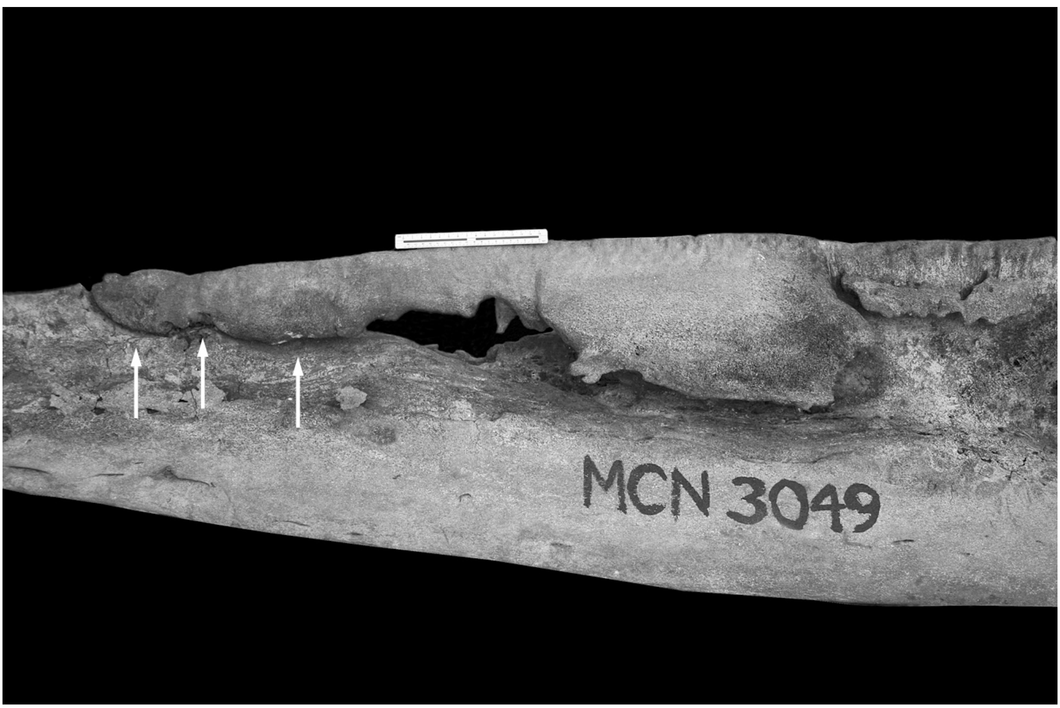

Figure 4. *B. edeni* (Anderson, 1878) (MCN 3049): left maxilla, partial ventral view. Arrows: fractured fragment not yet fused to the main bone (anterior extremity, internally).

collision (Laist et al., 2001). In this context, this report is relevant for insights into the occurrence, frequency, and significance of potential vessel-related whale deaths and injuries.

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Literature Cited

Cowan, D. F. (1966). Pathology of the pilot whale *Globicephala melaena*. *Archives of Pathology*, *82*, 178-189.

Dunn, D. G., Barco, S. G., Pabst, D. A., & McLellan, W. A. (2002). Evidence for infanticide in bottlenose dolphins of the western North Atlantic. *Journal of Wildlife Diseases*, *38*, 505-510.

Fernandez, A., Edwards, J. F., Rodrigues, F., Espinosa de los Monteros, A., Herráez, P., Castro, P., . . . Arbelo, M. (2005). "Gas and fat embolic syndrome" involving a mass stranding of beaked whales (family Ziphiidae) exposed to anthropogenic sonar signals. *Veterinary Pathology*, *42*, 446-457. http://dx.doi.org/10.1354/vp.42-4-446

Jensen, A. S., & Silber, G. K. (2004). *Large whale ship strike database* (NOAA Technical Memorandum NMFS-OPR). Washington, DC: National Oceanic and Atmospheric Administration.

Kato, H. (2002). Bryde's whales *Balaenoptera edeni* and *B. brydei*. In W. F. Perrin, B. Würsig, & J. G. M. Thewissen (Eds.), *Encyclopedia of marine mammals* (pp. 171-177). San Diego: Academic Press.

Knudsen, S. K., & Øen, E. O. (2003). Blast-induced neurotrauma in whales. *Neuroscience Research*, *46*, 377-386. http://dx.doi.org/10.1016/S0168-0102(03)00101-9

Kraus, S. D. (1990). Rates and potential causes of mortality in North Atlantic right whales (*Eubalaena glacialis*). *Marine Mammal Science*, *6*, 278-291. http://dx.doi.org/10.1111/j.1748-7692.1990.tb00358.x

Laist, D. W., Knowlton, A. R., Mead, J. G., & Podesta, M. (2001). Collisions between ships and whales. *Marine Mammal Science*, *17*, 35-75. http://dx.doi.org/10.1111/j.1748-7692.2001.tb00980.x

Ogden, J. A., Conlogue, G. J., Light, T. R., & Sloan, T. R. (1981). Fractures of the radius and ulna in a skeletally immature fin whale. *Journal of Wildlife Diseases*, *17,* 111-116.

Philo, M., Hanns, C., & George, J. C. (1990). Fractured mandible and associated oral lesions in a subsistence-harvested bowhead whale (*Balaena mysticetus*). *Journal of Wildlife Diseases*, *26*, 125-128.

Resnick, D., & Niwayama, G. (1981). *Diagnosis of bone and joint disorders: Volume 3* (pp. 2042-2130). Philadelphia: Saunders.

Sapolsky, R. M. (1987). Stress, social status, and reproductive physiology in free-living baboons. In D. Crews (Ed.), *Psychobiology of reproductive behavior: An evolutionary perspective* (pp. 291-321). Englewood Cliffs, NJ: Prentice Hall.

Sweeny, M. M., Price, J. M., Jones, G. S., French, T. W., Early, G. A., & Moore, M. J. (2005). Spondylitic changes in long-finned pilot whales (*Globicephala melas*) stranded on Cape Cod, Massachusetts, USA, between 1982 and 2000. *Journal of Wildlife Diseases*, *41*, 717-727.