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Fractured Mandible and Associated Oral Lesions in a Subsistence-Harvested Bowhead Whale (*Balaena mysticetus*)

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ABSTRACT: A fractured right mandible with midlength nonunion and oral lesions were noted in a subsistence-harvested female bowhead whale (*Balaena mysticetus*) near Wainwright, Alaska (USA). The cause of the fracture was not apparent. The fracture resulted in misalignment of the mandible. The abnormal mobility at the fracture site probably caused irregular baleen stowage within the oral cavity, leading to breakage of many baleen plates and extensive ulceration of the tongue and lips. Good body condition suggested the fracture was not debilitating.

Key words: Bowhead whale, *Balaena mysticetus*, Cetacea, fracture, mandible, jaw, case report.

Bowhead whales (*Balaena mysticetus*) are harvested by Eskimo hunters of nine villages as the whales migrate along the coast of northern and western Alaska (USA) (Marquette, 1978). In the spring the whales are generally hunted from the ice edge as they migrate to the eastern Beaufort Sea; in the fall they are hunted in the open ocean on their return migration. The harvested whales provide opportunities for close examination and documentation of pathological conditions. Such conditions have included scars and skin lesions (Albert et al., 1980; Migaki, 1980b, 1981; Haldiman et al., 1985), wartlike growths on the inner lip (Migaki, 1980a), ulcers in the anorectal canal (Migaki, 1981), parasite-induced gastric nodules (Migaki et al., 1982), a liver lipoma (Migaki and Albert, 1982), presence of ecto- and endoparasites (Heckmann et al., 1987) and exposure to one or more calicivirus serotypes (Smith et al., 1981, 1986, 1987). This report describes a fractured mandible and associated oral lesions in a bowhead whale that was harvested in 1987.

The whale was an 11.4 m long female taken near Wainwright, Alaska (70°55'N,

159°30'W) on 2 June 1987 and was in good body condition. The whaling crew and biologists discovered broken baleen and lesions of the tongue and lips after they pulled the whale onto grounded ice. Approximately 50% of the baleen plates on both sides were broken 8 to 10 cm from the tips. Most of the damaged baleen tips were broken transversely, leaving jagged edges that were up to 2 cm across. Other damaged tips were broken obliquely, also leaving jagged edges. The longest unbroken baleen was 2 m long. There was no pattern to the location of broken baleen plates.

There were several dozen eroded areas on the sides and dorsal surface of the tongue and on the lingual surfaces of both lower lips. The lesions were generally on the cranial half of the tongue and full length of the lips. The largest lesions were on the tongue, some being up to 2 cm deep, 50 cm long and 10 cm wide. The smaller lesions were 0.5 to 1 cm deep, 10 cm long and 10 cm wide.

Some lesions were erythematous and acute. Others were clearly chronic, the edges showing marked thickening and pigment loss and occasionally being covered with grey necrotic material. In a typical chronic lesion, the epidermis at the circumference was white and up to twice the thickness of adjacent, normal, black epidermis. Loss of epidermal pigment in bowhead whales is typical of healed injuries that we and others (Albert et al., 1980) have seen. Ages of the chronic lesions could not be determined.

The fracture was discovered only after the butchering started and the maktak (skin and underlying blubber) was removed from the lower right jaw. The right mandible, which was approximately 3.5 m long



FIGURE 1. Proximal (to the right) and distal (to the left) fragments of fractured right mandible of a female bowhead whale, shown after all overlying tissue had been removed. Curved arrows indicate fracture site, which has been separated by approximately 0.5 m. Straight arrow on proximal fragment indicates demarcation between devitalized tissue (to the left) and apparently healthy tissue (to the right). Note the absence of a callus.

and 25 cm wide in the center, was fractured approximately midlength. The broken ends were not overriding. The bone was gray, apparently necrotic and free of periosteum for approximately 1 m cranial and caudal to the fracture site (Fig. 1). The 1 to 3 cm tissue layer immediately overlying this 2 m of bone was necrotic and stripped easily from the bone. There were two foramina clearly visible on the medial aspect of the proximal mandibular fragment (Fig. 2). One was approximately 0.5 m caudal to the fracture, the second

approximately 1.0 m caudal to the fracture. Examination of a completely stripped normal bowhead whale mandible suggested that the two foramina shown in Figure 2 were the most caudal of approximately 15 such foramina. The fracture could have disrupted the blood supply to the bone and overlying tissue, resulting in necrosis.

The fractured bone ends had failed to unite and there was no callus (Figs. 1, 3). The disrupted blood supply was thought to be a major cause of this condition. The nature of bone remodelling in cetaceans

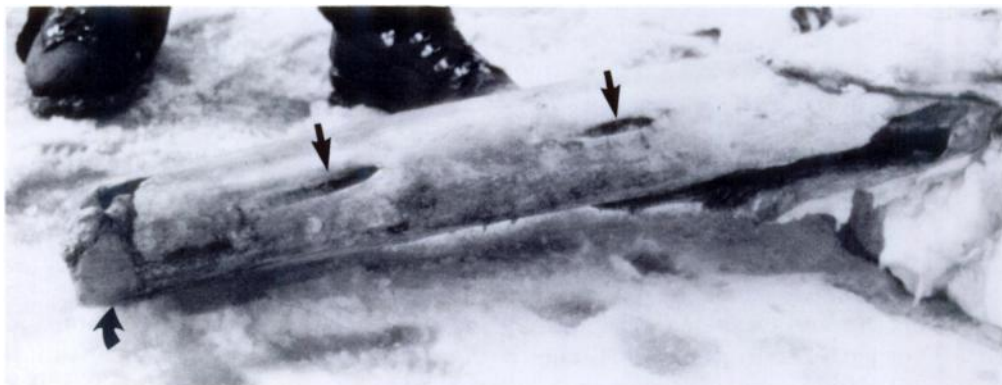


FIGURE 2. Proximal fragment of the fractured right mandible of a female bowhead whale, showing two foramina on the medial aspect (straight arrows). Curved arrow indicates fracture site.

may also have contributed to the non-union. Cetacean bone remodelling is not as extensive as that of terrestrial mammals, perhaps leading to failure of large callus formation after fracture (Felts and Spurrell, 1965, 1966; Ogden et al., 1981).

It appears that the fracture ultimately caused the tongue and lip lesions according to the following scenario. Baleen stowage in the closed mouth and the orientation of baleen with respect to the tongue and lips during feeding were altered because of jaw misalignment and/or false point of motion. The baleen eroded the tongue and lips and either broke or wore abnormally at the tips.

Oral abrasions from baleen have previously been documented in bowhead whales (Migaki, 1980b, 1981); we also have observed oral abrasions in harvested bowhead whales. Such lesions were similar in appearance to those described above but were much smaller (1 to 5 cm in diameter), far fewer in number (no more than two per whale) and located only at the angles of the mouth. Extensive lesions such as those of this bowhead whale were not observed in any of >100 harvested bowhead whales for which we have records.

The cause of the fracture was not apparent. There were no fresh or healed skin lesions over the fracture site, no foreign bodies in or near the fracture and no epithelial scars suggestive of a killer whale encounter or harvest attempt. The fracture may have been pathological or the result of blunt trauma. A pathological fracture could have resulted from neoplasia, osteomyelitis or degenerative bone disease. Since no bone or overlying tissue specimens were collected for histopathological examination, the possibility of a pathological fracture cannot be evaluated further. Blunt trauma could have occurred from collision with a ship (Anonymous, 1978; Ogden et al., 1981) or ice, ice entrapment (Mitchell and Reeves, 1982) or collision or entanglement with an underwater object.

Bowhead whales apparently sustain few



FIGURE 3. Distal fragment of the fractured right mandible of a female bowhead whale. Arrows indicate fracture site. Note the absence of a callus.

mandibular fractures. None has been documented in the literature, and this fracture is the first of any type that we have seen in over 100 harvested bowhead whales.

The mandibular fracture in this whale was not debilitating as evidenced by the good body condition. Based on the body condition, chronicity of the oral lesions and the other findings described above, it is concluded that a bowhead whale can survive trauma sufficient to fracture a mandible.

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