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ROPE ENTANGLEMENT OF BOWHEAD WHALES (*BALAENA MYSTICETUS*)

Every year, throughout the world, many thousands of cetaceans become entangled in fishing gear (Perrin 1990). Reports of bowhead whales (*Balaena mysticetus*) entangled in harpoon lines or ropes from fishing gear are rare. On 17 September 1982, Reeves *et al.* (1983) sighted a harpooned bowhead whale trailing a line and float west of Kaktovik, Alaska. In 1969, a 6.4-m long bowhead was trapped in a fishing net set for konoshiro in Osaka Bay, Japan (Nishiwaki and Kasuya 1970). In 1980, a 9–10-m long bowhead whale was caught in a net set for white whales (*Delphinapterus leucas*) in northwest Greenland (Kapel 1985). Following are descriptions of (1) scars attributed to harpoon lines or fishing gear on three bowhead whales and (2) entanglements of two bowhead whales in ropes attributed to commercial fishing gear.

Three bowhead whales (78WW2, 86KK2 and 89B3) had scars attributed to rope entanglement. The scars were discontinuous sigmoid or spiral wrap marks predominantly on the dorsal and ventral portions of the peduncle and on the fluke leading edges (Fig. 1A). Locations and descriptions of these scars are given in Table 1. Whale 89B3 also had a healed penetrating injury on the dorsal midline, indicating it may have survived a previous harvest attempt. Such a wound could have resulted from a harpoon whose trailing rope wrapped around the peduncle.

In May 1989, Conrad Oozeva and other Eskimo hunters from Gambell, Alaska found a dead bowhead whale floating about 2.5 km offshore (Table 1, unnumbered whale). The tail and most of the head were below the water surface. The position of the whale precluded the hunters determining the extent of entanglement. There was no harpoon associated with the rope, and the rope itself was not the type used by Eskimo hunters. The hunters could not determine whether the rope had contributed to the death of the whale. They removed a 14-cm long segment of the rope for further examination. This type of rope is commonly used with fishing gear in the Bering Sea.

A year later, a bowhead whale taken by Herbert Ahkivgak was found to be entangled in ropes (Table 1, whale 90B6). When observers arrived, the whale was on the ice, and there were two sets of ropes associated with it. One set consisted of two ropes exiting the mouth near the caudal end of the right baleen rack (Fig. 1B). Scarring and abrasions in the right commissure of the mouth and under the right eye (Fig. 1C) were attributed to these ropes. A second set of ropes was lying on the ice, having been removed while the whale was still in the water. It is likely that these ropes had exited the left baleen rack, but the left side of the head was lying on the ice and could not be examined. A hunter related his observation of ropes on the left side while the whale was in the water, and scarring and abrasions were observed in the left flipper axilla. The orientation of the ropes inside the mouth could not be determined as ice

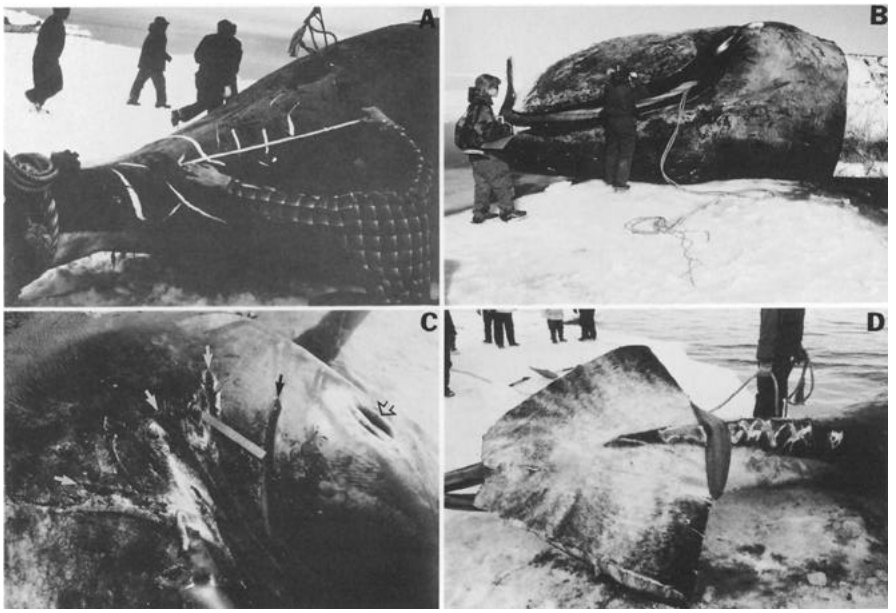

Figure 1. Bowhead whales showing evidence of rope or net entanglement. A. Scars on the peduncle of bowhead whale 78WW2. Note the sigmoid shape of the scars. (Photograph courtesy of the National Marine Mammal Laboratory, National Marine Fisheries Service, Seattle, WA.) B. Bowhead whale 90B6, taken on 24 May 1990 and entangled in two ropes that are seen exiting the right side of the mouth. The whale is lying on its dorsum and left side. C. Scars and abrasions (solid arrows) under the right eye of bowhead whale 90B6. The eye (open arrow) is to the right. The view is toward the tail. D. Scars and abrasions on the peduncle of bowhead whale 90B6. Note the crisscross nature of the scars.

conditions deteriorated and the carcass was lost while only partially butchered. Scars and abrasions on the peduncle (Fig. 1D) and flukes suggested that the ropes had been wrapped around the body. There was no evidence that the ropes had been wrapped around the mouth.

We attribute the spiral nature of the described scars to wrapping of the ropes and nets around the bodies of affected whales. Since 1968, approximately 45% of whales struck during the hunt were not recovered (Follmann and Manning 1989). In some of these whales, harpoons remained for unknown time periods, trailing the attached ropes and floats. Ropes could have wrapped around a struck-and-lost whale, entangling the peduncle and flukes. Eskimo hunters tell us that bowhead whales, when struck with a harpoon, often roll vigorously, wrapping the harpoon lines around their bodies. Presumably, whales would react similarly when becoming entangled in fishing ropes or nets and would receive similar scars if they survive.

Rope or line entanglement of the peduncle, flukes and mouth has been described in large cetaceans. Heyning and Lewis (1990), observed that netting and line remaining on previously-entangled gray whales *(Eschrichtius robustus)*

Table 1. Locations and descriptions of scars attributed to rope entanglement in bowhead whales, including description of entangling equipment if known.

Whale no.	Date	Size (m)	Sex	Approximate location	Scar location and description	Entangling equipment description
78WW2	19 May 1978	15.2	M	Wainwright, AK	6 sigmoid scars, each 50 cm × 3 cm[a], around 1.5 m of the peduncle	Unknown
86KK2	17 September 1986	17.2	F	Kaktovik, AK	Sigmoid scars[b] on peduncle and anterior margin of flukes	Unknown
89B3	28 May 1989	16.9	F	Barrow, AK	12[a] spiral scars, each 2–50 cm wide, on ridges of peduncle	Unknown
None	May 1989	15[a]	Unknown	50[a] km south of Gambell, AK	None observed	Rope wrapped around part of head, through mouth, in baleen
90B6	24 May 1990	15.2	M	Barrow, AK	Crisscrossed scars[b] on peduncle, fluke leading edge; straight and curved scars[b] in right commissure of the mouth and under the right eye	2 ropes, 18 and 20 mm diameter, tied together, exiting mouth. One rope with 3 pairs of knots; 1 pair with plastic sleeve between knots and attached to 1.3 m rope with remains of float at other end

[a] Approximate count or measurement.
[b] Uncounted.

tended to "slip posteriorly along the body to the peduncle and get stuck at the base of the flukes." Kraus (1990) reported that the primary cause of "line-like" scars on the peduncles and leading edges of flukes on North Atlantic right whales (*Eubalaena glacialis*) was due to fishing gear entanglement. He noted that right whales also catch ropes and other fishing gear in the gape of the mouth and receive scars at the mouth margin. He observed that 57% of a set of photographed right whales had peduncle scars while 17% showed evidence of entanglement in the mouth.

Commercial fishermen attributed the ropes from whale 90B6 to rigging from a commercial offshore fishing pot, most likely a crab pot (S. Olson, J. Dwyer, B. George, personal communication). One rope was likely the buoy line, the other the line to the pot (Sainsbury 1986). The rope from the 1989 Gambell whale (unnumbered) was similar to one of the 90B6 ropes. It could have been from a pot, but we could not determine its source from the small piece available. It is unlikely that the ropes entangling either whale came from a black cod pot as trawls are the primary gear used for black cod in the Bering Sea (Johnson 1990); bowhead whales have not been recorded in areas where black cod pot gear is used. Sumich and Harvey (1986) reported entanglement of other baleen whales in pot rigging: gear entangling young gray whales off the western U.S. coast was usually fishing nets or float lines from crab or lobster pots.

The actual numbers of entanglements suffered by bowhead whales may be much greater than indicated by our observations. Reports by Eskimo hunters and the finding of healed penetrating injuries in bowhead whales (Albert *et al.* 1980, Philo and George 1990) are evidence that harpoons eventually become dislodged from struck-and-lost whales that survive. Presumably, the line would become entangled in the flukes while the harpoon and float are attached to the whale. Once the harpoon is dislodged, the rope would eventually slide off the peduncle and flukes. Heyning and Lewis (1990) felt that gray whale entanglements in fishing gear occurred at greater rates than observed; such is likely the case for bowhead whales.

There are no data to estimate the number or rate of entanglement fatalities that occur in bowhead whales. Fatalities due to fishing gear entanglement likely occur since other large cetaceans have succumbed to such entanglement (Heyning and Lewis 1990, Notarbartolo-di-Sciara 1990, Perrin 1990). Smaller bowhead whales are probably more likely to die from entanglement than are larger whales because they may not be powerful enough to break the ropes or may not have the stamina to drag the gear. Adult bowheads, like right whales, probably exceed 50 metric tons. A full Alaskan king crab pot can weigh 500 kg or more (Sainsbury 1986). The bowhead whale that became entangled off northwest Greenland was relatively small at 9–10 m in length (Kapel 1985), and the one netted in Osaka Bay was even smaller (6.4 m) (Nishiwaki and Kasuya 1970). The three bowheads with scars described in this paper were all longer than 15 m. The vast majority of stranded, entangled gray whales documented in two studies (Sumich and Harvey 1986, Heyning and Lewis 1990) were young animals. This predominance of young animals may have been due in part to their limited strength, compared to larger animals (Heyning and Lewis 1990).

The effect of entanglement mortality on the bowhead whale population is unknown, but whether it be large or small, it has not prevented at least one stock—the Bering-Chukchi-Beaufort Seas stock—from growing. Zeh *et al.* (1991) calculated a 3.1% increase per year (95% confidence interval from 0.1% to 6.2%) between 1978 and 1988 for that stock. Such findings are not unusual, as gray whale populations do not seem to be markedly affected by the number of entanglements which occur (Heyning and Lewis 1990).

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