

The Most Southerly Record of a Stranded Bowhead Whale, *Balaena mysticetus*, from the Western North Atlantic Ocean

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ABSTRACT. An immature female bowhead whale (*Balaena mysticetus*) was discovered stranded dead at Witless Bay Point, just south of Mobile Point (47°14' 68.00"N, 52°47' 90.00"W) on the southern shore of the Avalon Peninsula of the island of Newfoundland (Newfoundland and Labrador, Canada) on 15 April 2005. This is the second bowhead found stranded dead in Newfoundland in seven years. The first, also an immature female, was discovered in a fjord in northeastern Newfoundland near Rattling Brook (49°40' N, 56°10' W) in October 1998. These animals represent the only bowhead whales known to have been sighted, alive or stranded dead, in waters around the island of Newfoundland. Some possible causes of the death of this most recent animal are discussed, including chronic inflammation of the vertebrae and the associated locomotive difficulties.

Key words: bowhead whale, stranding, Newfoundland, Labrador, spondylitis, vertebral injury

RÉSUMÉ. Le 15 avril 2005, on a trouvé un baleineau boréal femelle (*Balaena mysticetus*) en détresse morte à Witless Bay Point, juste au sud de Mobile Point (47°14' 68.00"N, 52°47' 90.00"O), sur la côte sud de la presqu'île Avalon de l'île de Terre-Neuve (Terre-Neuve et Labrador, Canada). Il s'agissait de la deuxième baleine boréale retrouvée en détresse à Terre-Neuve en sept ans. La première, également une jeune femelle, avait été trouvée dans un fjord du nord-est de Terre-Neuve, près de Rattling Brook (49°40' N, 56°10' O) en octobre 1998. Il s'agit des seules baleines boréales à n'avoir jamais été repérées, vivantes ou mortes, dans les eaux entourant l'île de Terre-Neuve. Certaines des causes possibles de la mort récente de ce baleineau sont abordées ici, dont une inflammation chronique des vertèbres et les troubles locomoteurs qui en découlent.

Mots clés : baleine boréale, en détresse, Terre-Neuve, Labrador, spondylose, lésion vertébrale

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The bowhead whale (*Balaena mysticetus* L.) is a large baleen whale adapted to feed on zooplankton in and around sea ice. These whales have a circumpolar distribution. They typically occur along the ice edge but also venture through leads into more solid ice fields (Nerini et al., 1984; Reeves and Leatherwood, 1985). Bowheads display an annual migration pattern that is influenced by changes in sea-ice cover (Braham et al., 1980; Reeves et al., 1983; Rugh et al., 2003). The killer whale (*Orcinus orca* L.) is the only known natural predator of the bowhead, and death caused by ice entrapment has been reported; however, natural mortality is believed to be low (Mitchell and Reeves, 1982; Reeves and Leatherwood, 1985; George et al., 1994).

Currently, the International Whaling Commission (IWC) has recognized five stocks of bowhead whales, of which two occur in the eastern Canadian Arctic: (1) the Hudson Bay-Foxe Basin stock and (2) the Baffin Bay-Davis Strait stock. Until recently, the combined population size of these stocks was thought to range between several hundred

and several thousand animals, and both of these populations are listed as "threatened" by the Committee on the Status of Endangered Wildlife (COSEWIC) in Canada (IWC, 1978, 1992; COSEWIC, 2005; Fig. 1A). However, recent studies using satellite telemetry have raised questions regarding the discreteness of these two stocks and the estimates of their size (Dueck et al., 2006; Heide-Jørgensen et al., 2006). Bowheads from the Baffin Bay-Davis Strait population may come as far south as the tip of northern Labrador during winter, and whales from the Hudson Bay-Foxe Basin stock have been reported to winter in Hudson Strait, northwest of Labrador (COSEWIC, 2005).

In the 16th and 17th centuries, bowheads and northern right whales (*Eubalaena glacialis* Müller) were the primary targets for the European whaling industry, which was expanding beyond coastal European waters (Ross, 1993). Basque whalers were in the Strait of Belle Isle by 1536, hunting bowhead and right whales from various locations on the southern Labrador coast, including Red

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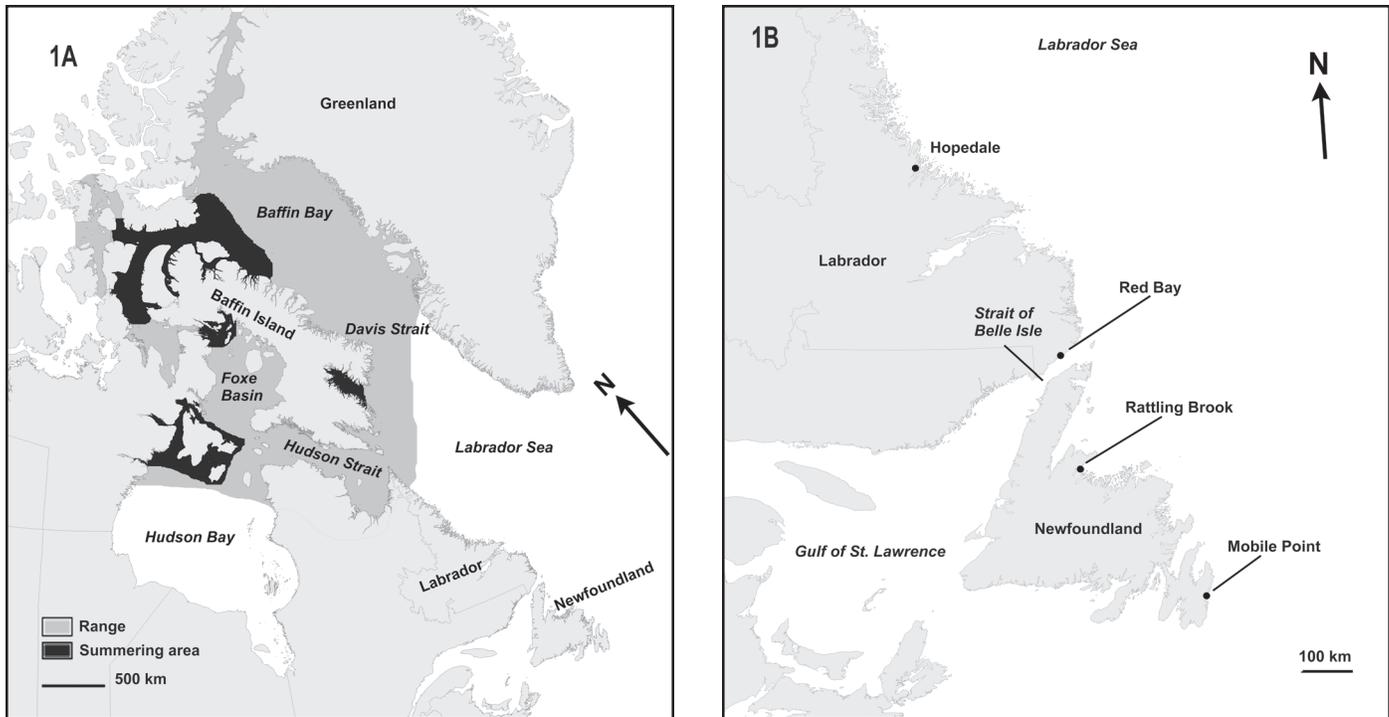


FIG. 1. A) Generalized overview of summering and wintering areas of the two bowhead whale stocks currently recognized in the eastern Canadian Arctic (based on COSEWIC, 2005 and Postma et al., 2006). B) Locations of historic and contemporary sightings of bowhead whales in waters of Newfoundland and southern Labrador, as mentioned in the text.

Bay (Barkham, 1984; Aguilar, 1986; Cumbaa, 1986; Fig. 1B). There they established the first large-scale whaling industry in North American waters, which lasted from the 1530s until the early 1600s. Barkham (1984) estimates that 300 whales were taken annually during the peak years of the 1560s and 1570s.

An archeological and osteological study by Cumbaa (1986) indicates that both the northern right whale and the bowhead were present in these Basque catches in roughly a 50:50 ratio. However, recent analyses of genetic material extracted from the humeri of 21 whales recovered from the archeological excavations of the Basque whaling settlement in Red Bay, Labrador, showed that only one of the bones originated from a right whale, while the other 20 were from bowheads. These 20 bones included 13 that had originally been classified by Cumbaa (1986) as northern right whales through osteological analysis (Rastogi et al., 2004). These results indicate that bowheads were important to the Basque whalers and common in the Strait of Belle Isle area.

In the past seven years, two immature female bowheads have stranded dead on the northeast and southeast coasts of the island of Newfoundland (Newfoundland and Labrador, Canada; Fig. 1B). The first whale, 9 m long, was found at Rattling Brook in Green Bay in northeastern Newfoundland (49°40' N, 56°10' W) (Daoust et al., 1998) in October 1998. The second was discovered at Witless Bay Point (47°14' N, 52°47' W) on the southeastern shore of the Avalon Peninsula of the island of Newfoundland on 15 April 2005 (Fig. 2). These locations represent a

significant extension of the species' known range, and the 2005 stranding is the southernmost occurrence of a bowhead whale reported in the north Atlantic. These strandings are also significant because they represent the only recorded cases of bowheads, alive or dead, reported in this area in recent times. Despite the nearly 400 years of subsequent European settlement all along the coast of Newfoundland, no historical evidence of bowhead sightings or strandings in waters around the island has been documented since the 17th century, when the Basque whaling fishery was active in the Strait of Belle Isle.

A gross necropsy was carried out on the whale stranded at Witless Bay Point during 15–22 April 2005. Members of the Newfoundland and Labrador Whale Release and Strandings Network, accompanied by volunteers, took measurements and collected various muscle, blubber, skin, and baleen tissue samples. Immediately before the necropsy, a winter storm had partially buried the carcass in beach cobbles, which affected the collection of morphometric measurements and samples. The carcass was in fair condition, decomposed but with organs basically intact and a Code 3 carcass condition (Geraci and Lounsbury, 2005). The extent of sloughing precluded assessment of the entire epidermis. However, neither the epidermal area that could be evaluated nor the dermal and subdermal tissues showed any signs of scarring, rope wounds, or other trauma. Muscle and blubber samples were frozen and preserved in the cryoprotectant dimethyl sulfoxide (DMSO) for further analysis. Officials of Newfoundland and Labrador's provincial Animal Health



FIG. 2. Bowhead whale stranded among boulders at Witless Bay Point, Newfoundland, 15 April 2005. Note the sloughing black epidermis exposing the lighter dermis underneath. Average size of small beach cobbles is ~10 cm diameter.

Division were contacted for further pathological analysis of the tissue samples. Tissue and bone samples were fixed in formalin and sent to Dr. Pierre-Yves Daoust at the Atlantic Veterinary College, University of Prince Edward Island for further histological studies.

The Witless Bay Point animal was an immature female 830 cm in length (Table 1). Determining the age of baleen whales is difficult, and it is particularly complicated in bowheads because standard methods (such as counting layers formed in the waxy earplugs inside the auditory passage) cannot be applied. Several techniques developed in recent years allow for more accurate age determination of bowhead whales. These include aspartic acid racemization (AAR) in the eye lens nucleus; measurements of baleen length; counts of corpora lutea in the ovaries of mature females; and analysis of ^{13}C isotope concentration fluctuations in the baleen, which are indicative of annual migratory movements (George et al., 1999; Lubetkin and Zeh, 2004). The ratio of its baleen length to its total length, compared to a scale derived from bowheads from Alaska (Lubetkin and Zeh, 2004), indicates that the Witless Bay Point bowhead was approximately three years old. The blubber, measured in the mid-dorsal region, was 18 cm thick (Table 1). Average blubber thickness over the majority of the adult bowhead body has previously been estimated at approximately 28 cm, although a thickness of up to 50 cm has been recorded (Haldiman and Tarpley, 1993; Lowry, 1993). Circumstances during the necropsy of this animal did not permit a detailed analysis of blubber thickness at various body locations.

The only obvious injury found during the initial necropsy of the Witless Bay Point whale was an injury to its poste-

rior vertebral column. No obvious injuries were present in the adjacent dermal and blubber layers. The ventral surface of lumbar vertebra no. 24, as well as the associated chevron, displayed extensive secondary outgrowth of bone tissue (Figs. 3, 4a). The ventral surfaces of the 22nd and 23rd lumbar vertebrae were damaged, with large pits apparent in the surface of the bone (Figs. 3, 4b). The two chevron bones beneath these two vertebrae appeared shattered, with many small bone fragments crumbled throughout, and the tissue surrounding these chevrons was necrotic. Analysis of this tissue by Dr. Ron Taylor of the Animal Health Division, Newfoundland and Labrador Department of Natural Resources, confirmed that both chevron bones had been fractured extensively in the past and showed evidence of chronic injury. The diseased vertebrae were also associated with an old injury, as a mass of connective tissue was rebuilding around the shattered bone fragments. The cause of this injury was not apparent.

Histological studies of the same tissue by Dr. Daoust at the Atlantic Veterinary College indicated that this bowhead whale had suffered from locally extensive chronic granulomatous spondylitis (inflammation of the vertebrae). The grossly affected chevrons and lumbar vertebrae showed clear microscopic evidence of a chronic inflammatory process, likely infectious and possibly bacterial. No microorganisms were identified that might be responsible for this process, although it was speculated that such organisms could have infected this location through the bloodstream at an earlier date. As no additional pathological analyses were performed, it remains unclear whether this bone infection was the cause of the animal's death (Daoust, 2005).

TABLE 1. Morphometric measurements for the juvenile female bowhead whale stranded at Witless Bay Point, Newfoundland (values rounded to the nearest cm).

Measurement	Value (cm)
Snout to fluke notch	830
Snout to front of blowhole	218
Blowhole length	18
Blowhole width	10
Blubber thickness (mid dorsal)	18
Skin thickness (mid dorsal)	2
Baleen length (mid-mouth)	150
Anterior pectoral length	120
Posterior pectoral length	93
Pectoral width (middle)	55
Pectoral width (base)	52

Bowheads are rarely reported stranded anywhere in their range, and those reported are usually juvenile whales or animals that were struck and lost during the subsistence hunt (Taylor, 1988; Finley, 1990; Burns et al., 1993; J.C. George, pers. comm. 2005). The lack of obvious external injuries to the Witless Bay Point whale suggests that death is likely to have resulted from chronic processes rather than from acute trauma caused by predation, collision with a vessel, or ice entrapment. The thick layer of secondary connective tissue around the shattered chevrons indicates that this injury could not have been the immediate cause of the whale's death. However, the injury may have interfered with locomotion, making it more difficult for the whale to dive and to keep up with other bowhead whales (R. Taylor, pers. comm. 2005).

Only limited information is available on vertebral pathologies in cetaceans, but cases of spondylitis and associated conditions have been reported in some species (Paterson, 1984; Alexander et al., 1989; Sweeny et al., 2005). It has been suggested that spondylitis or injuries to the vertebral column would be slow to heal in a marine animal like a cetacean because its vertebral column is in near-constant motion throughout most of its life (Sweeny et al., 2005). Histological studies indicated that the injury to the Witless Bay Point bowhead might have not only interfered with locomotion, but also caused toxemia through continuous release of mediators of inflammation and other products from associated microorganisms (Daoust, 2005). Bowheads are comparatively slow swimmers that use a skimming mode of filter-feeding to capture and concentrate zooplankton (Lowry, 1993); it is unclear whether the vertebral injury reported here would have significantly impaired the whale's feeding efficiency.

Bowhead whales from the eastern Canadian Arctic stock are reported to overwinter off northernmost Labrador and at the entrance to Hudson Strait (Reeves et al., 1983; Moore and Reeves, 1993; COSEWIC, 2005). It is possible that the Witless Bay Point whale originated from this area. The reduction in mobility due to the vertebral injury could have left the whale in a weakened state, potentially unable to swim against the Labrador Current, which flows southward along the Labrador coastline to



FIG. 3. Detailed view of lumbar vertebrae 24 (left, with associated chevron) and 23 (right). The damaged ventral surfaces of the vertebrae are clearly visible. The ruler is 30 cm long.

Newfoundland. A similar scenario might have caused the arrival of the Rattling Brook bowhead whale carcass in 1998. The Rattling Brook carcass was in an advanced state of decomposition, limiting the potential for more detailed study into the causes of the whale's death. It was eventually concluded that the Rattling Brook whale displayed evidence of moderate emaciation (e.g., a relatively thin blubber layer) and could have died from lack of food some time before stranding (Daoust et al., 1998). It will never be determined whether these bowheads died in Newfoundland and Labrador waters or in the wintering areas farther north. In waters off the northern Labrador coast, observer effort has been limited in recent years, particularly during winter, but southern Labrador waters have been surveyed in late winter as part of a harp seal survey. No bowhead whales have been reported (J. Lawson, unpubl. data).

Currently, bowhead whales are rarely reported south of Hudson Strait, but archeological evidence indicates that 16th- and 17th-century Basque whalers encountered this species regularly in the Strait of Belle Isle area. Until the late 18th century, Inuit also hunted bowhead whales along the Labrador coast as far south as Hopedale (55°27' N, 60°11' W; Taylor, 1988). It has been suggested that the bowhead whales in the Strait of Belle Isle formed a separate stock that was exterminated by Basque whaling activities (Barkham, 1984; Rastogi et al., 2004; COSEWIC, 2005).

The present report significantly extends the southern limit of Atlantic Canadian waters within which bowhead whales (or at least their carcasses) may potentially be discovered. It is unknown whether the recent appearance of two bowhead carcasses, after the species had been absent for several hundred years, might indicate a range expansion or an increase in abundance of the Eastern Arctic bowhead stock. However, it is important to be aware that future bowhead stranding events may occur in Newfoundland and Labrador. A continued effort should therefore be made to engage the public in reporting such occurrences.



FIG. 4. a) Ventro-lateral view of lumbar vertebrae 23 (bottom) and 24 (top), displaying extensive secondary growth of bone tissue. Scale bar = 5 cm. b) Ventral view of lumbar vertebrae 22 (bottom) and 23 (top). The damaged ventral surface of the vertebral centers is clearly visible. Scale bar = 5 cm.

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