



UNDERWATER WORLD



The Narwhal



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The Narwhal

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Relatives Among the Whales; Description

The narwhal is a "toothed whale", a member of the order Odontoceti (Gr. *odous*, a tooth, *keto*s, a whale), a relative of the sperm whale (*Physeter macrocephalus*), pilot whales, dolphins and porpoises. It is unusual among the whales, as it has no dorsal fin, and its neck vertebrae, instead of being fused together, are jointed like those of land mammals. The beluga, *Delphinapterus leucas*, which like the narwhal is found in icy Arctic seas, shares these characteristics; the fin may have been lost because it was a hindrance under ice. Because of these, and other, shared anatomical features, the two were classified in the same family, the Monodontidae, separate from other odontocetes. Recent biochemical studies have confirmed their close relationship. Both also have a short, broad rostrum; a melon — the hemispherical body of fatty tissue situated in front of the cranium — that is pronounced, forming a steep forehead with no visible beak; and small, rounded, up-curved flippers.

Among the toothed whales, both the narwhal and the beluga are large: average males weigh about 1.6 tonne and are about 4.6 m long, females weigh about 0.9 tonne and are about 4.0 m long. Narwhals have blunt heads and small mouths, and are sleeker than beluga, which look blubbery and lumpy in comparison. On small-scale aerial photographs narwhals may be distinguished from belugas by: their lack of visible flippers; lack of squared shoulders; caudal peduncle fine to the point of being invisible; and recurved fluke tips, where the beluga's tail is more

triangular. Mature narwhals are white, with a darker melon and a dark strip down the back. On either side of the strip, dark flecks and spots become sparser toward the flanks. This pallid, mottled colouring, said to be like that of the body of a drowned man, is supposed to be the source of the common name, from Old Norse *nar*, corpse, and *hvalr*, whale. The narwhal is insulated from the freezing waters it inhabits by a layer of blubber — fatty tissue under the skin — up to 10 cm thick.

The most common external parasites are whale lice *Cyamus monodontis* and *C. nodosus*. They are found in patches where wounds have given them a foothold, although many wounds heal without becoming infested. A ring of louse infestation is always found in males around the base of the tusk, where it breaks through the lip. Small numbers of nematode worms are found in the stomach, and nematode infections of the middle ear are also common.

The Unicorn of the Seas

One difference between belugas and narwhals is in their teeth: belugas have a mouthful of peg-like teeth, but narwhals have no functional teeth at all. Two elongated teeth develop in the upper jaw, but they point forwards, not down into the mouth. In females, both usually remain embedded in pockets in the maxillary bone, and grow no longer than 15 cm or so, but in the males, and a very few females, the left one erupts through the lip and develops as a straight, spiral, tapered tusk, with a left-hand twist, 2.0 to 2.5 m long. From this extraordinary feature, unique among the whales, Linné gave the narwhal its scientific name of *Monodon monoceros* "the one-toothed animal that's like a unicorn" (Gr. *monos*, single, *odous*, a

tooth, *keras*, a horn). Some males also grow a tusk on the right side as well, usually shorter than the other, and occasionally, an abnormal tooth grows out of the tip of the lower jaw of a narwhal. After the tusk has reached its final length, its walls continue to thicken inwardly, as the living pulp runs the full length of the hollow tusk. Perhaps narwhal tusks, arriving in Europe by little-used trade routes, originated the legend of the unicorn; certainly as trade routes improved in the Middle Ages, thousands of narwhal tusks were sold for more than their weight in gold in Europe as unicorn horns or "alicorns", for their supposed magical properties, by traders who were at some pains to suppress the knowledge that these fabulous panaceas were no more than whales' teeth.

It is still uncertain whether the tusk is more to the male narwhal than an advertisement of mature sexuality. It has been suggested that the narwhal uses it for spearing fish, stirring up the bottom, breaking ice, as a wave-guide for its underwater vocalizations and even for propping itself up on ice floes to go to sleep. Broken and worn tusks are common, but this probably shows no more than the difficulty of taking care of 7 feet of ivory when chasing food near the bottom in dark water. That it is not needed for survival is shown by the female's not having one. It may be used as a weapon by the males in fighting for females, but as mating takes place in spring when narwhals are in the offshore pack-ice, their mating behaviour is unknown. Scars found on the foreheads of mature males have been cited as evidence for this use, and so have such findings as a tusk point once discovered embedded in a male's jaw beside the root of the growing tusk. Males are seen in summer lifting their tusks out of the water and crossing them



The narwhal. (Line drawing courtesy of Larry Foster, Alameda, CA 94501, USA.)

with the tusks of one or two other males; but whether this "tusking" has to do with establishing social dominance, or is just a way of passing a summer afternoon, is unknown.

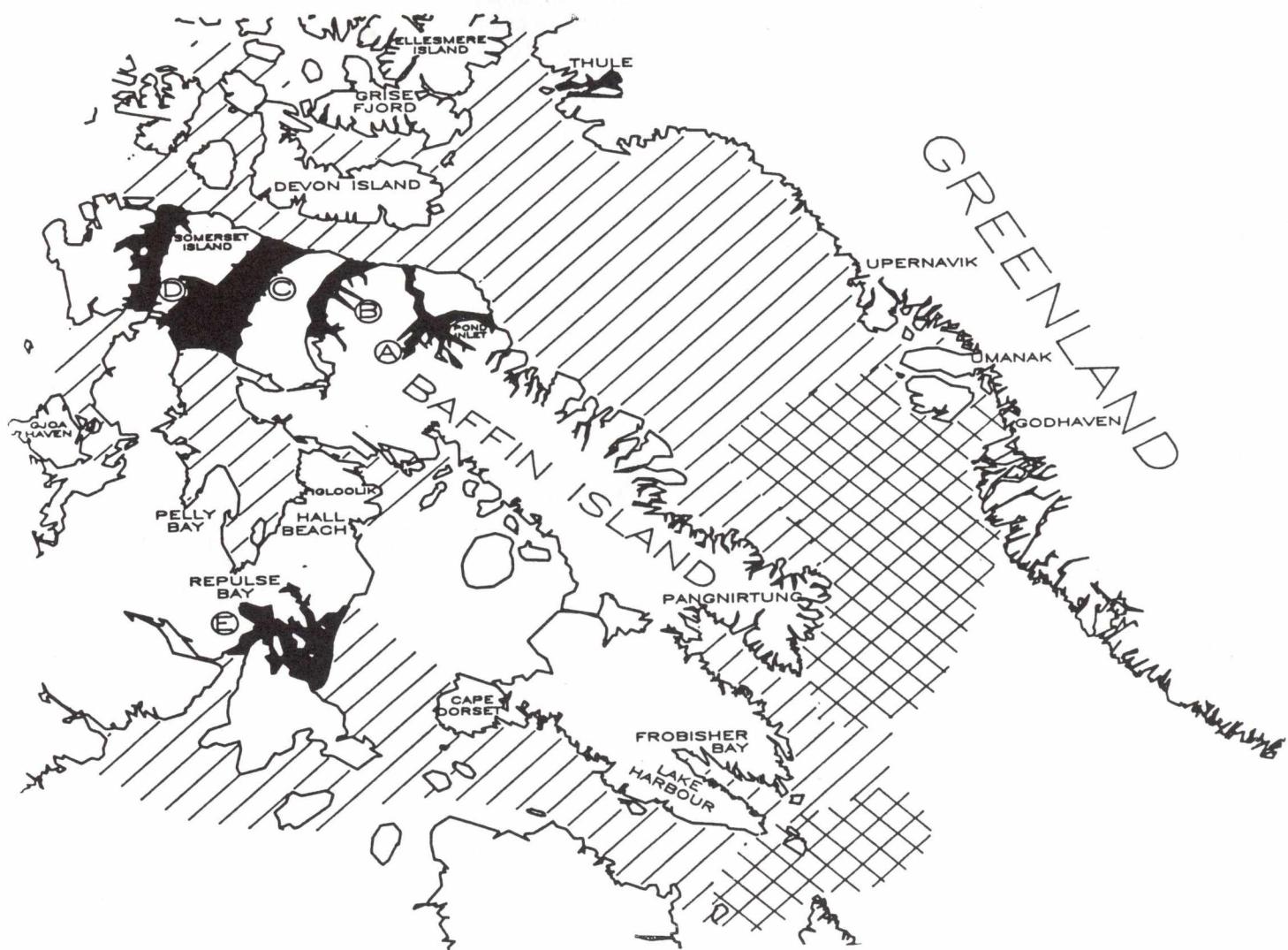
Population Dynamics and Reproduction

Females probably start bearing calves at 6–8 years of age. They mate in April–May, and gestate for 14 months, bearing their calves in June–August of the following year. Like all other marine

mammals, narwhals have only one calf at a time. The newborn calves have only very thin blubber, but the mother's milk is rich in fat and a thicker blubber layer is soon laid down. Calves are nursed for 20 months; other odontocetes also have long lactations, perhaps to give their calves time to learn the skills they need to survive. The association of mother and calf is usually close, and when the whales are travelling the calf remains close to the mother's back, where it may get hydrodynamic assistance. In a travelling group of whales, the little grey

head thrown up to breathe with a jerky bob, quite unlike the smooth curve of an adult, is unmistakable. The newborn calves, 1.6 m long, are uniform dark grey; white patches later appear on the ventral surface and spread with increasing age to the flanks and back.

The death rate among adults is probably quite low — 7 to 9%/yr — and the mortality of the young unknown. The late and slow reproduction means that numbers of narwhals, once reduced, could only increase slowly.



Range of narwhal in eastern Canadian and West Greenland waters. Wintering areas cross-hatched. Summering concentrations in black: (A) Eclipse Sound, Milne Inlet and Tremblay Sound; (B) Admiralty Inlet; (C) Prince Regent Inlet; (D) Peel Sound; (E) Repulse Bay. (Courtesy of Mr. J. T. O. Strong, DFO, Winnipeg.)

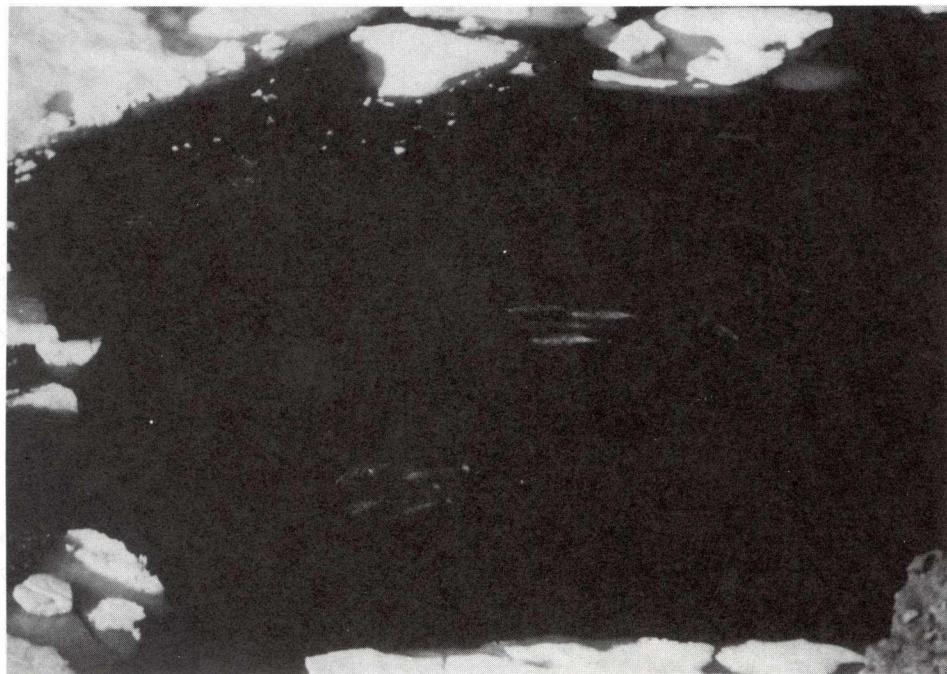
Distribution, Movements, and Numbers

The narwhal inhabits ice-covered Arctic seas, only rarely wandering into temperate waters. In ice-free waters, it is more likely to be preyed upon by killer whales (*Orcinus orca*), and would have to compete for food with other species of whale better adapted to warmer conditions. It has no dorsal fin to hinder it in swimming under the ice, and can break several centimetres of ice with its forehead. Narwhals can travel miles under the ice between breathing opportunities, and can use even the breathing holes made in the ice by the Arctic seals, surfacing head first and then sliding back underwater. In Canadian waters, narwhals winter in the close pack ice of Baffin Bay and Davis Strait, between Baffin Island and Greenland. As the ice melts in spring, they migrate northward up the east coast of Baffin Island. Herds of hundreds, heading north and west, round Baffin Island off the northern end of Baffin Island and crowd at the edges of the fast ice in Pond Inlet, Lancaster Sound and Jones Sound. As these ice edges retreat with the onset of summer, narwhals penetrate leads and cracks into Eclipse Sound, Navy Board Inlet, Admiralty Inlet, and Prince Regent Inlet, and as the ice melts, they tend to stay associated with it. About 1200 narwhal are also found in summer in northwest Hudson Bay; they are probably a separate group wintering in Hudson Strait. Photographic aerial surveys of the main summering areas have estimated the total number inhabiting Canadian waters in summer to be about 20 000. Narwhals summer in the Thule area of northern West Greenland, and over 4000 have been counted there. It is not known whether the groups in the different fjords in summer are always the same, or whether they exchange members on the wintering grounds.

At the height of summer, narwhals are found in greatest numbers in the fjords of northern Baffin Island, moving from place to place in herds of hundreds, but other groups are also regularly found in Peel Sound between Somerset Island and Prince of Wales Island, and narwhals have been seen in

summer as far northwest as Lougheed Island. It seems as though, by choosing particular areas in these restricted waters, they can find shelter from rough seas (which perhaps, living in pack ice of other times of year, they are not accustomed to) or places to stay away from killer whales, from which at other times of year the ice offers some protection. When the days shorten in September, and seas start to freeze, narwhals head out again into Baffin Bay. Herds are sometimes trapped in the forming ice; then tens or hundreds may crowd at a single contracting hole in the ice, where they may become prey for polar bears (*Ursus maritimus*) or Inuit.

The narwhal is also found in other parts of the Arctic: in the waters of West Greenland, and in the northern Atlantic. Although not unknown, it is uncommon in the Bering, Beaufort and Chukchi seas, and in the seas to the north of Siberia.

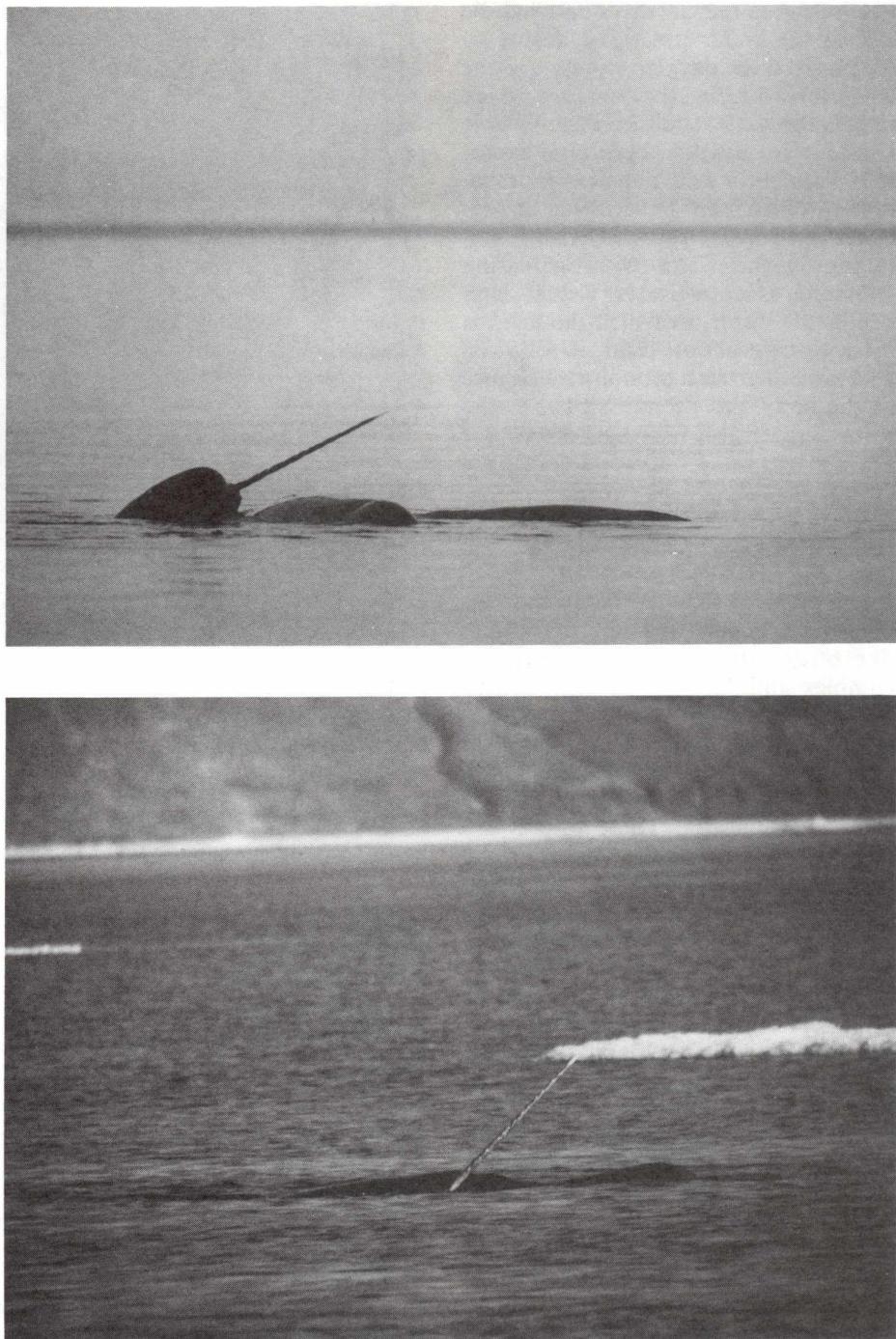


Narwhal often associate in tight groups. (Photo courtesy of Larry Dueck, DFO, Winnipeg.)

Food and Feeding

What information we have on the diet of the narwhal relates mostly to the summer, between the time when narwhals appear at the fast-ice edges and their disappearance in fall. The narwhal has no functional teeth, but it has a wide rostrum and a ridged palate. All these features are thought to be typical of whales that live mostly on squid, and the food species that has been found most consistently is a squid, *Gonatus fabricii*. Narwhal stomachs have been examined that were packed full with squid, and others that contained hundreds or thousands of squid beaks, which stay long after the rest of the squid is digested. Other important food species are: the Arctic cod, *Boreogadus saida*, a small relative of the familiar food fish, which the narwhal feeds on heavily at the ice edges in spring; turbot or Greenland halibut, *Rheinhardtius hippoglossoides*; and a pelagic shrimp *Pasiphaea tarda*. There is no indication that narwhals feed heavily on Arctic char (*Salvelinus alpinus*). From the evidence of stomach contents, adult male narwhals feed more on bottom-dwelling species such as flatfishes than the females or young; unhindered by accompanying calves, they can dive deeper and faster, and stay down longer. There is no information on how much narwhals eat in the wild, but a whale of such size should need about 30 kg (wet weight) of food a day. It has been suggested that narwhals eat less in the summer and loses some weight then, but narwhals have been observed in August engaged in deep diving behaviour typical of feeding, and summer blubber loss is only slight. Feeding narwhals spread quite widely and dive independently; they don't seem to hunt cooperatively for prey.

Although there have not been any direct observations of how deep narwhals can dive, they have been found with bottom-dwelling flatfishes in their stomachs from over 800 m of water. They have good adaptations for deep diving, such as blood and muscle tissue with oxygen-holding capacities well-developed even for a whale, and a complex network of blood-vessels between the lungs and the spine.

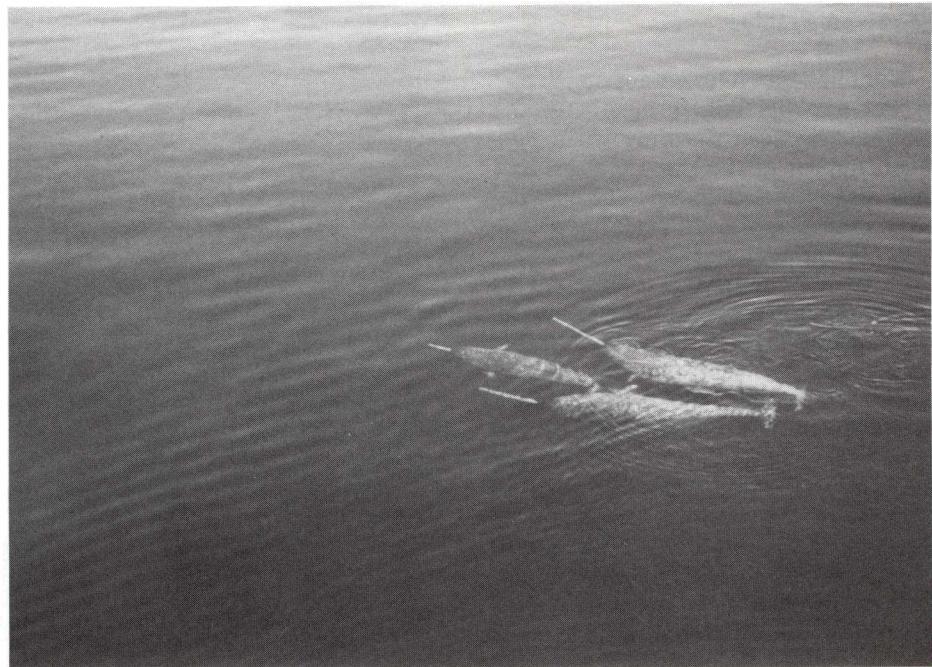


Examples of tusk display behaviour. Note the pronounced melon. (Photos courtesy of Larry Dueck, DFO, Winnipeg.)

Between deep feeding dives narwhals lie still in the water breathing deeply to replenish their oxygen stores. As the whale breathes in, the long grey back rises in the water, and then the blowhole is closed for a while, before an explosive exhalation and the next indrawn breath. When it has finished ventilating, it starts to swim forward, rising and falling in the water with increasing amplitude as it accelerates. The last high rise in the water, in which the head is often thrown almost clear, is followed by a deep dive, with pronounced flexure of the body and the tail stock, as the whale submerges; narwhals often, but not always, fluke out when starting a deep dive.

Sound and Communication

It is hard to see very far in the sea, but sound travels well, and narwhals, like other odontocetes, have evolved complex and sophisticated systems to use sound to investigate their environment and to find food. By the controlled passage of air between chambers near the blowhole, the narwhal can create clicks and whistles. These sounds are reflected off the sloping front of the skull and focused by the melon, which is filled with a special mix of blubber oils and can be altered in shape under muscular control. Clicks and knocks can come slowly, like knocks on a door, or in faster sequences, like a stick on a picket fence, or in very rapid trains that can produce a trumpeting blare or the sound of a squeaking door. Click trains are used by odontocetes for echolocation of prey, and for detecting obstacles, at short ranges. Individual bangs may also be strong enough to disorient or incapacitate prey and make it easier to catch. Whistles are rarely heard — another contrast with the beluga, which whistles so much that it earned the nickname “sea canary”. The narwhal’s repertoire of whistles is small, and they are usually short, and simply modulated as a single upward or downward glissando. Trumpetings, whistles, and squeaking-door sounds may be used for communication. Males have the larger vocal repertoire, and make a wide range of calls when socialising.



A group of younger males. The leading one is a dark subadult. Note the neck articulation shown by the upper one. (Photo courtesy of Larry Dueck, DFO, Winnipeg.)

Behaviour

This whale is in general a placid species, little given to spontaneous exuberance. Its normal swimming speed is low. As it is in general a social species, few individual behaviour patterns have been recorded. The usual social unit is a group of 2 to 12. Groups often consist only of adult males, or only of sub-adults and females with young, but mixed groups do sometimes occur. There is no information on how long these groups last, nor whether they represent enduring social bonds. When travelling, these groups may be tightly cohesive: the individuals often seem to

be almost touching. Such tight groups vocalise little, if at all. Travelling herds may adopt more open distributions, and are then more vocal, giving click series and trumpetings. Narwhals on the summering grounds seem to spend much time loafing, logging (i.e. lying inactive at or below the surface), and socialising, and a wide variety of behaviour patterns have been observed and recorded. Males in particular display to each other, crossing and “comparing” their tusks. However, there is no information on the social significance of these behaviour patterns, nor on the functional structuring of narwhal society.

Exploitation and Management

Narwhals are hunted by the Inuit of the Canadian Arctic and in Greenland. The skin, known as "muktuk", is an esteemed food — especially the narrow strips taken from the back edges of the tail and flippers — and is eaten raw or boiled. It is rich in vitamin C. The meat is often left in a cache to age through the summer and fall, and is eaten as cured meat in the winter.

The tusks at one time commanded a high price on international markets. Narwhal, like other toothed whales, are listed in Appendix II of the Convention on International Trade in Endangered Species, so trade in tusks requires an export permit. Even so, concern for the species has led the European Economic Community to ban the import of tusks into member states (tusks taken by the Inuit of Greenland are exempted).

Inuk villages where narwhals occur have quotas on how many they can take, which range from 100 in Arctic Bay and Pond Inlet in north Baffin Island where narwhals come in great numbers every year, to 5 or 10 for communities away from the zone of greatest abundance.

The total quota for the Canadian Arctic is 527 animals yearly. Tags authorising a hunter to take a whale are distributed in the communities by the local Hunters' and Trappers' Associations. The average estimated kill in Canada in recent years is 450–500.

Current Research

Some areas of recent research on the narwhal have been the search for a reliable way to age individuals, so that more and better information on the population dynamics can be obtained. Layers in teeth are often used to age animals, but although the embedded teeth in narwhal do have layers, they become confused once the tooth has grown to fill the maxillary pocket that encloses it. Tusks have readable layers, but sawing a tusk in half is not only an expensive way to age a narwhal, but cannot be used to age females. Scientists have looked for layers that may be related to age in other hard structures, such as bones, and have examined age-related changes in the amino-acid composition of the tip of the embedded tooth.

The movements of the narwhal within their summering areas in Eclipse Sound

and some of the adjacent fjords have recently been studied by flying repeated aerial surveys over the same track every 3 or 4 days. By observing where the narwhal go as the ice melts or moves, or as the wind or weather change, scientists have been trying to deduce what factors make them select the areas they do.

Also recently studied have been the reactions of narwhal to ice-breaking ore-carriers which come into the eastern Canadian Arctic in early summer: whether they show signs of alarm, flee, or change their vocalization patterns. To compare with such results, the undisturbed vocalizations of narwhal have been recorded in one of the narrow fjords where they summer, while their behaviour was simultaneously observed from the top of a cliff. This has helped to show which sex or age-groups give particular vocalizations, and what they might be doing at the time, and so interpret the communication function of the various calls; and to indicate whether vocalizations might be usable to tell the numbers of narwhals at times or in places where they can't be counted visually.

A research activity that has recently started is to monitor the movements of narwhal using tusk-mounted radios that transmit signals to orbiting satellites. As well as yielding information on movements of the whales in their summering areas, this could also allow it to be tracked into the dark and cold of the Arctic winter. More complicated tags, capable of storing, and then transmitting, information on how deep, and how often, a narwhal dives, could provide valuable information on underwater behaviour.



Inuk hunters removing muktuk. (Photo courtesy of Larry Dueck, DFO, Winnipeg.)

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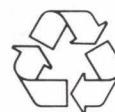
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