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Monodon monoceros.

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Monodon Linnaeus, 1758

Monodon Linnaeus, 1758:75, type species *Monodon monoceros* Linnaeus, by monotypy.
Ceratodontis Brisson, 1762:366, type species *C. ceratodon* Brisson.
Ceratodon Brünnich, 1772:48, substitute name for *Monodon* Linnaeus.
Diodon Storr, 1780:42, new name for *Monodon* Linnaeus.
Narwalus Lacépède, 1804:xxvii, type species *N. vulgaris* by tautonomy.
Narwhalus Duméril, 1806:28, emendation of *Narwalus* Lacépède.
Narhvalus Fischer, 1814:662, misspelling of *Narwalus* Lacépède.
Tachynices Brookes, 1828:44, type species *T. megacephalus* Brookes.

CONTEXT AND CONTENT. Order Cetacea, Suborder Odontoceti, Family Monodontidae. *Monodon* and *Delphinapterus* are the only genera; both are monotypic, and no subspecies are recognized.

Monodon monoceros Linnaeus, 1758

Narwhal

Monodon monoceros Linnaeus, 1758:75. Type locality "Arctic Seas."
Ceratodontis ceratodon Brisson, 1762:366. Type locality "seas around Iceland, Greenland, and Davis Strait."
Monodon Narhval Borowski, 1781:8. Type locality unknown.
Monodon Narhwal Blumenbach, 1779:142. Type locality unknown.
Narwalus vulgaris Lacépède, 1804:xxxvii, 142, pl. 4, fig. 3. Type locality unknown.
Narwalus microcephalus Lacépède, 1804:xxxviii, 159, pl. 5, fig. 2. Type locality "Boston" (Lincolnshire, England).
Narwalus Andersonianus Lacépède, 1804:xxxviii, 163. Type locality "Elbe River."
Ceratodon monodon Pallas, 1811:295. Type locality "coast of Siberia."
Monodon microcephalus Fleming, 1811:146. Type locality "coast of Scotland."
Tachynices megacephalus Brookes, 1828:40. Type locality unknown.

DIAGNOSIS. The narwhal is readily distinguished from the white whale or beluga, *Delphinapterus leucas*, by external appearance and skull characteristics. Though neonates of the two may be confused [both are slate gray, about the same size (1.5 m), and without a dorsal fin], mature animals can be easily distinguished. Adult white whales are uniformly white; adult narwhals, with rare exceptions, have a noticeable degree of dark dorso-lateral mottling (Fig. 1). In the narwhal the premaxillae are convex anterior to the external nares; in the white whale the premaxillae are flat or concave. The skull is considerably more asymmetric in the narwhal (Figs. 2 and 3). Dentition is the most distinctive feature between the two genera. Narwhals are superficially toothless except that males normally possess an erupted tooth, the long external tusk. White whales have 8 to 10 conical teeth in each upper and lower jaw, all of which are visible and functional.

GENERAL CHARACTERS. Detailed descriptions of external appearance were given by Scoresby (1820), Tomilin (1967), Mansfield et al. (1975), and Arvy (1978). A small, blunt-snouted head comprises 14% of total body length. The mouth is small, narrow, and curved upward toward the corners. In males and infrequently in females a straight, tapered, spiraled tusk protrudes through the upper lip. The tusk grows to a length of 3 m, ranging from 33 to 50% of the length of the animal's body and weighing more than 10 kg in very large individuals. The eye slit is about 25 mm long and is 300 to 350 mm from the tip of the snout. The flippers are elliptically curved along the trailing edge, slightly curved along the leading edge, and rounded at the tip. They are short compared to the flippers of many odontocetes: 0.3 to 0.4 m long and 7 to 10% of total body length. The tips are noticeably upcurled in adults. The narwhal has no dorsal fin, but has an irregular ridge 50 mm high and 0.6 to 0.9 m long along the posterior half of the back. The posterior margin of each fluke is strongly convex rather than straight or concave as in most other cetaceans. There is a median notch between the flukes. Mature animals are commonly 4 to 5 m long exclusive of the tusk, and males are larger than females.

Skin color alters with age. The neonate is an uneven gray or bluish-gray. Soon after weaning the body becomes a uniform bluish-black or black. As the animal matures, white streaks and patches develop around the anus, genital slit, and navel, spreading over the entire ventral surface and onto the flanks. Adults are white to creamy yellow ventrally and mottled gray to black dorsally. Very old animals, especially males, are almost completely white.

The adult narwhal has no evidence of hair, but Eales (1950) found seven pairs of hair germs on the lower jaw of a fetus 137 mm in length.

DISTRIBUTION. *Monodon monoceros*, the northernmost cetacean, inhabits the arctic seas, commonly between 70°N and 80°N, and less often south to 65°N and north to 85°N (Fig. 4). Several records north of 84°N, including the birth of a calf, were summarized by Rutilevskii (1958). Sergeant (1978) described the narwhal as a deepwater species, in contrast to its more coastal relative, *Delphinapterus*.

Tomilin (1967) reviewed distribution in the Eurasian arctic, noting that the large herds of up to a hundred individuals, once known to visit Novaya Zemlya, had diminished to schools of a few individuals by the late 1940's. In the Soviet sector narwhals are most frequently observed around Franz Josef Land and in the northern Chukchi Sea (Yablokov and Bel'kovich, 1968).

The occurrence of narwhals in the cold temperate northeast Atlantic is exceptional. Collett (1911–1912) gave seven records

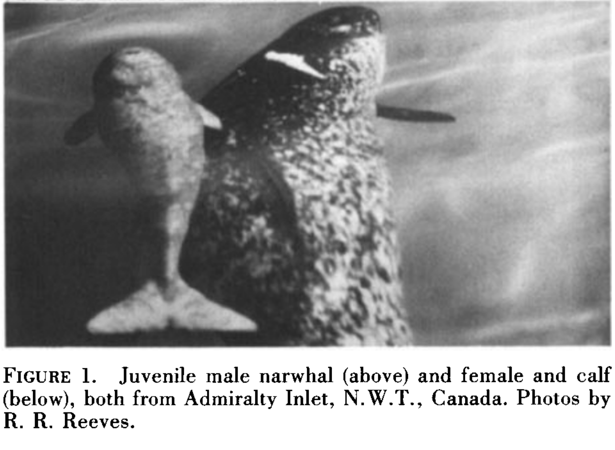

FIGURE 1. Juvenile male narwhal (above) and female and calf (below), both from Admiralty Inlet, N.W.T., Canada. Photos by R. R. Reeves.

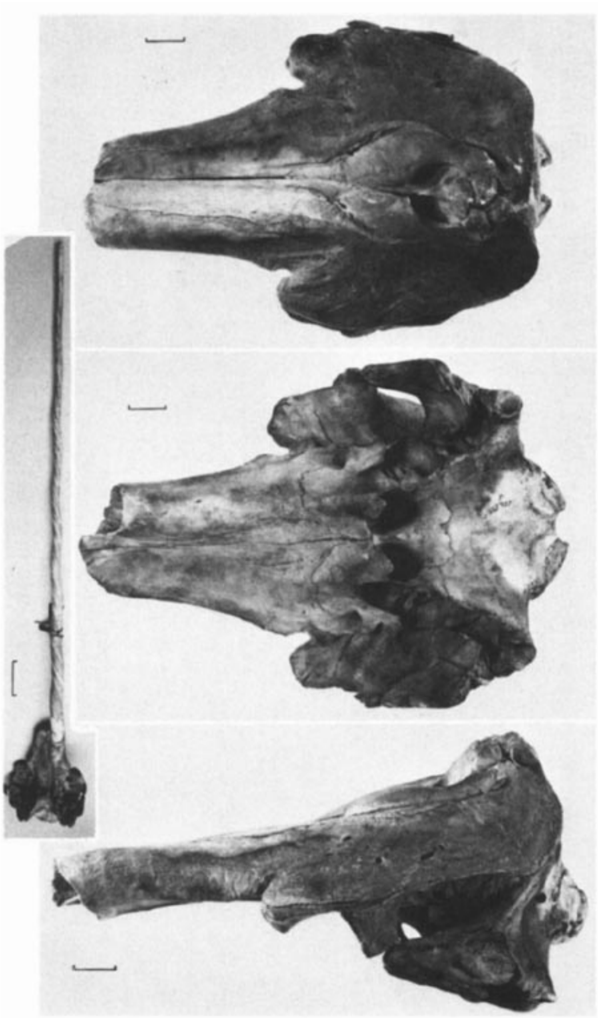

FIGURE 2. Skull of male *Monodon monoceros* (U.S.N.M. no. 267957) in (top to bottom) dorsal, ventral, and lateral views. Scales represent 50 mm.

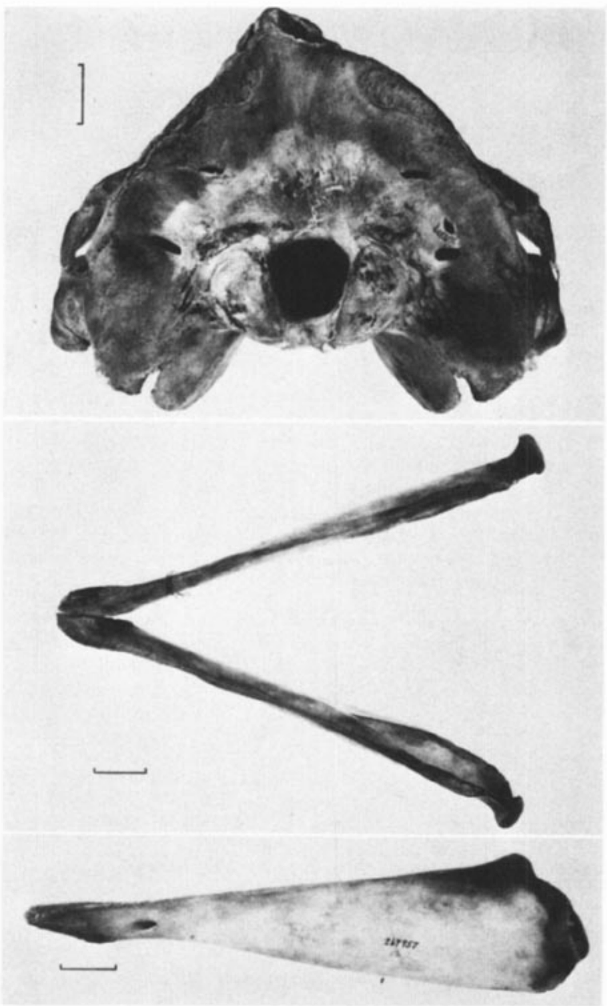

FIGURE 3. Posterior view of skull (top), and ventral and lateral views of left lower jaw (same specimen as shown in Fig. 2). Scale represents 50 mm.

for the north and west coasts of Norway, and Aguayo (1978) mentioned one from Holland, one or two from the mouth of the Elbe River in West Germany, and one from the Baltic coast of West Germany. Only six strandings have been recorded on British coasts (Fraser, 1974). Saemundsson and Degerbøl (1939) recorded seven narwhals stranded between 1800 and 1924 in Iceland, all on the north coast, and Einarsson and Jónsson (1976) added a record for the south coast.

During summer narwhals are common along part of the east coast of Greenland, where they range deep into certain fjords (Pedersen, 1931; Boyd, 1932). Presumably they move out to open waters of the Greenland Sea once winter ice begins to form in the sounds, although some remain all winter at the ice edge. Their distribution in the Greenland Sea was reviewed by Gray (1889) and Gray (1931).

Narwhals occur in greatest abundance west of Cape Farewell, where they frequent coastal waters as well as the pelagic zone. They are believed to winter in the permanently open water of Baffin Bay, but recorded observations there are few. Captain George Tyson observed narwhals breaking through thin ice in February and March 1873, between 68°N and 64°N (Davis, 1876). Turl (1977) confirmed Tyson's report by making similar observations a century later. Many narwhals are caught by hunters in outer Disko Bay, West Greenland, during January to May, and winter ice entrapment is not uncommon in Umanak Fjord and inner Disko Bay (Kapel, 1977).

As the winter ice breaks up during May and June, narwhals move into sounds of the Canadian archipelago and fjords along the northwest coast of Greenland. In Canada the normal summer range extends from Kane Basin in the north, to Cornwallis Island in the west, and south to Southampton Island and Hudson Strait (Mansfield et al., 1975; Sergeant, 1978). A group of 10 sighted in 1976 in MacLean Strait between King Christian Island and Lougheed Island extended the known range in the eastern Canadian arctic westward to approximately 105°W (Roe and Stephen, 1977). In western Greenland narwhals are common close to shore from Disko Bay in the south to the Thule district in the north (Vibe, 1950). They are rarely encountered south of Sukkertoppen (Kapel, 1977).

Mercer (1973) described a large male found on the coast of Newfoundland (50°40′N, 55°30′W) in June 1969. This male and a subadult trapped by ice off northeastern Newfoundland (Fruchtman, 1978), are the only post-Pleistocene records south of Hudson Strait. Probably the narwhal occurs at least sporadically along the relatively uninhabited coast of Labrador.

Occasionally narwhals are found in Alaskan waters, mostly along the north coast east to Barrow (Bee and Hall, 1956; Reeves, 1978). One stranding occurred on the Alaska Peninsula at 56°N, 161°W (Geist et al., 1960), and a tusk and cranium were found in Prince Albert Sound (71°22′N, 117°21′W), the first reported occurrence in the area of Amundsen Gulf in the western Canadian arctic (Smith, 1977).

FOSSIL RECORD. Owen (1846) reported four post-Pliocene fossils, each a fragment of a tusk—two from England's Tertiary strata, one from Germany, and another of unknown origin. According to Collings (1933), additional narwhal material has been found in an early Pleistocene deposit in England.

Reported finds at Chaleur Bay, consisting of fragments of one specimen and a nearly complete skull and tusk of another, suggest that the narwhal was an inhabitant of the Gulf of St. Lawrence during late Wisconsin or early post-glacial times (Harington, 1977).

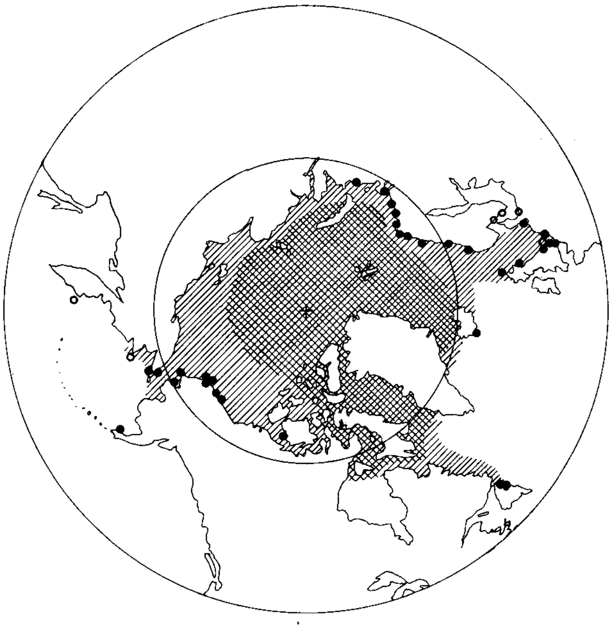

FIGURE 4. North circumpolar projection to 45° showing the probable normal range of the narwhal (as grid). The Arctic Circle is shown. The possible range of occasional occurrences (diagonal lines) and specific outlying records (dots: see text) are represented; open circles show extralimital records with some uncertainty in identification.

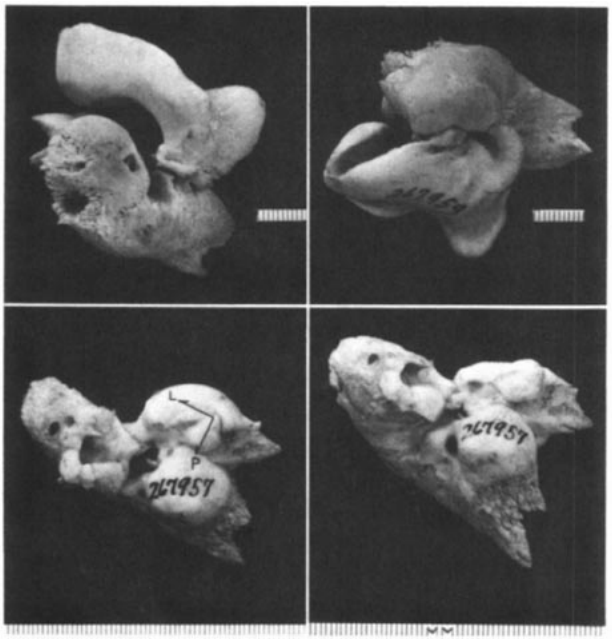

FIGURE 5. Ear bones of narwhal. Upper left: antero-latero-ventral view of fused left periotic complex and tympanic bulla (U.S.N.M. no. 267959). Upper right: posterior (and slightly dorsolateral) view of 267959. Lower left: dorsal view of right periotic complex (U.S.N.M. no. 267957); arrows show lateral and posterior directions. Lower right: anterior (and slightly dorsolateral) view of 267957. Scales are in millimeters.

ONTOGENY AND REPRODUCTION. Extrapolating from the breeding habits of the white whale, Best and Fisher (1974) judged narwhal conception to occur in early April and gestation to last 14 months (Mansfield et al., 1975, assumed 14.5 months). Placentation was described by Turner (1875) who removed a term fetus 1.65 m in length from the left uterine horn.

The newborn narwhal has a 25 mm layer of blubber (Mansfield et al., 1975). A single calf is usual, but Clark (1871) reported a female with two fetuses.

Best and Fisher (1974) suggested seasonal breeding, based on a series of fetal lengths and records of newborns which demonstrated both an early and late stage of gestation during summer but no intermediate stages. The smallest neonate recorded was 1.53 m long; the largest 1.65 m (Turner, 1875). A newborn usually measures between 1.5 and 1.7 m and weighs just over 80 kg (Mansfield et al., 1975).

Duration of lactation is unknown (it continues for 20 months in the white whale, Mansfield et al., 1975). Age at sexual maturity is thought to be comparable to that of the white whale, 4 to 7 years for females and 8 to 9 years for males. Physical maturity seems to be attained at a length of about 4 m and a weight of 900 kg in females and 4.7 m and 1600 kg in males.

Hay (1978) used growth layers on the polished dentinal surface of the longitudinally sectioned unerupted tooth and thin transverse sections of the periosteal zone of the anterolabial portion of the mandible to estimate age in narwhals. Alternating wide opaque bands and narrow translucent bands are evident on either medium, but the mandible may be preferable since the tooth generally occludes after deposition of 12 to 20 layers. The maximum number of mandibular layers observed was 45. Hay assumed three or four layers are deposited during each of the first two years of life, based on analysis of length frequency distribution. In adult females, for whom ovulation and reproductive rates could be correlated, it appears that one growth layer is deposited per year after 2 years of age.

FORM. Between 30 and 35% of body weight is blubber, 25% muscle, and 10% skin (Mansfield et al., 1975). Blubber thickness ranges from 50 to 100 mm and averages 70 to 80 mm. The skin has a high vitamin C content (Slijper, 1962).

The skeleton includes 50 to 55 vertebrae: 7 unfused C, 11 to 12 D, 6 to 10 L, and 26 to 27 Ca (Tomilin, 1967). There are eight two-headed ribs and four sternal ribs (Beddard, 1900). Eales (1954) described the anatomy of the flipper in fetus and adult, illustrating the decrease in number of phalanges with age. Numbers of digital phalanges are I 1 to 2, II 6 to 9, III 4 to 7, IV 3 to 5, V 2 to 4 for embryos, and I 1 to 2, II 5 to 6, III 4 to 5, IV 2 to 4, and V 2 to 3 for adults.

The unique ivory tusk of the narwhal has an inner layer of dentine, an outer layer of cement, and a pulp cavity extending its entire length. The pulp tissue is similar to that of most mammalian incisors (Dow and Hollenberg, 1977). The elongated tooth has no enamel. In the fetus, there is evidence of six pairs of upper teeth and two pairs of lower teeth (Eales, 1950). In adults only one pair develops, near the maxillo-premaxillary suture. These teeth have been called incisors, modified incisors, and canines. As the narwhal's ancestors probably had undifferentiated dentition, the terms canine and incisor are inappropriate. Tooth development was considered by Owen (1868) and vestigial teeth in the adult were described by Fraser (1938).

The adult female generally has no functional teeth as the two teeth in the upper jaw remain embedded in the skull (Home, 1813). Nevertheless, instances of single-tusked and double-tusked females have been recorded (Scoresby, 1823; Pedersen, 1931; Hay and Sergeant, 1976). Clark (1871) cited 11 cases of bidental specimens, two of which were known to have been females, and Sheppard (1937) reported several others. Porsild (1922) wrote that "in rare cases both tusks are developed in the males."

In males the left tooth normally erupts from the gum and protrudes outward through the upper lip, spiraling sinistrally. The mechanism by which the spiraled texture is achieved has not been explained, although Thompson (1942) presented a lucid if somewhat improbable argument involving a "torque of inertia" caused by the animal's swimming motion. In the right tooth the pulp chamber calcifies before it has developed enough to pierce the gum. In the rare instances when the right tooth does emerge, it is usually shorter than the left; but interestingly enough, its grooves parallel those of the left tusk rather than spiraling in the reverse direction (Winge, 1942). Scoresby (1823), a keen observer and reliable commentator, reported on a female whose single tusk had a dextrorsal spiral. The distal end of every tusk has a polished appearance, while the rest of it is covered by a reddish or green algal growth (Porsild, 1922). This applies to both tusks in bidental specimens. Pedersen (1931) observed a full-grown male with no tusk, and a tuskless immature male was reported by Hay and Sergeant (1976), but no record exists of a developed right tusk in association with a rudimentary condition in the left (Clark, 1871; Collings, 1933). Broken tusks are common (Pedersen, 1931).

An anomalous mandibular tusk, 30 cm long and curved ventroexternally from the right side, was reported by Mitchell and

Kemper (1978). To our knowledge this is the only documented occurrence of an external tusk in the lower jaw.

Eales (1950) gave a detailed description of the fetal skull, comparing it with that of an adult narwhal and those of other cetaceans. Fraser and Purves (1960) discussed the structure of the skull as it relates to the hearing process. Kasuya (1973) compared the morphology of the tympano-periotic bones among odontocetes and found that *Monodon* and *Delphinapterus* share similar primitive characteristics (Fig. 5).

Howell (1930) suggested that the relatively strong neck muscles might have evolved to support the large tusk. Huber (1934) described the facial musculature, the specialized nasal apparatus and its associated musculature, the outer ear, and the eyelid. Both he and Howell noticed the extensive network of oil sinuses which inundate and give a spongy texture to the intermuscular fascia. This contrasts with the usual fibrous reticular structure in most other odontocetes. The oil sinuses ramify through the blubber and musculature of the head, abdomen, and neck. Howell (1930) explained how oil could flow among the sinuses during muscle contraction and postulated that this might play an important role in thermoregulation.

Wilson (1879) discussed the circulatory system. The brain was diagrammed by Turner (1891). A diagram of the narwhal's auditory apparatus was presented by Kellogg (1928). Hein (1914) described the anatomy of the hyoid and larynx.

The histology and gross anatomy of the digestive system were studied by Woodhead and Gray (1889, 1890) and Hein (1915). The first of the narwhal's five stomach compartments is merely an extension of the esophagus, which it resembles histologically. It has a thick, muscular wall lined with nipple-like structures. Peptic glands are numerous in the second compartment, which is the first digestive, or gastric, cavity, and the last three compartments contain pyloric glands. Hein (1915) found no major differences between the narwhal's stomach and those of other odontocete cetaceans.

Hein (1914) related information on the anatomy of the urogenital system, including descriptions of the external organs, the internal organs, the bladder, and the kidney. Wilson (1879) discussed the circulatory system.

FUNCTION. Triacylglycerols from acoustic tissues and blubber were analyzed by Robisch et al. (1972) who found diisovaleroyl glycerides in acoustic tissues but not in blubber, supporting the hypothesis that these glycerides are important in the echolocation of cetaceans.

Narwhals have been found with what appear to be broken tusk tips embedded in the ends of their own broken tusks, and these have prompted fanciful speculation about one narwhal cooperating to plug another's tooth. However, the findings of Dow and Hollenberg (1977) support Tomilin's (1967) explanation that deposition of reparative dentine generated by the pulp forms an ossified plug at the end of a broken tusk.

Dow and Hollenberg (1977) surmised that the tusk may function to eliminate excess body heat generated by "spurts of abnormal physical activity" (see Behavior section).

Vogl and Fisher (1976) found glycogen pools in thoracic retial vessels and hypothesized that the retial complex may contribute to blood glucose levels during a dive.

Scoresby (1823) claimed that when harpooned, a narwhal could descend about 200 fathoms. Hay and Sergeant (1976) timed periods of submergence during a chase. At the start, the narwhal remained submerged for 15 minutes at a time; after an hour, it was surfacing after dives of one minute.

ECOLOGY. Man is the principal predator of narwhals. Scoresby (1823) and Gray (1927, 1939) witnessed walruses, *Odobenus rosmarus*, feeding on narwhals. No reliable account of predation by killer whales, *Orcinus orca*, exists but narwhals reportedly are sometimes driven close inshore by them (Smith and Taylor, 1977). Beck and Mansfield (1969) noted that Greenland sharks, *Somniosus microcephalus*, attracted by the offal from flensing, attacked narwhals trapped in netting. Sharks also have been known to congregate in the vicinity of ice holes where trapped narwhals die in numbers from suffocation, starvation, or the effects of hunting (Porsild, 1918). The polar bear, *Ursus maritimus*, may attack narwhals, particularly at ice holes.

Narwhals eat fish, cephalopods, and crustaceans. Polar cod, *Boreogadus saida*, Greenland halibut, *Rheinhardtius hippoglossoides*, and decapod crustaceans are inshore staples (Pedersen, 1931; Vibe, 1950; Mansfield et al., 1975). In pelagic regions cephalopods are a primary prey (Brown, 1868; Gray, 1889). A skate, *Raia batis*, and a pleuronectid flatfish were removed from a narwhal stomach in the Greenland Sea (Scoresby, 1823). Freuchen (1935) found sculpins in narwhal stomachs in Eclipse Sound.

The narwhal is host to a number of endoparasites and ectoparasites, which were listed by Dailey and Brownell (1972). The nematodes *Porrocaecum decipiens* and *Anisakis simplex* infest the intestine, and *Stenurus alatus* infests the inner ear. Hay and Sergeant (1976) referred to unidentified nematodes in the stomach and intestine, unidentified cestodes, trematodes, and acanthocephalans in the intestine, and "visceral parasites" in the liver, lungs, and kidneys. Webster et al. (1973) described a new species of nematode, *Halocercus monoceris*, found in the lungs of narwhals. Two species of whale lice, *Cyamus nodosus* and *Cyamus monodontis*, live in wounds and the skin around the base of the tusk (Porsild, 1922; Leung, 1965; Tomilin, 1967). Hay and Sergeant (1976) reported that *Cyamus* is sometimes found in the tail notch as well.

Yablokov (1974) surmised that two main populations of narwhals exist in the Eurasian arctic, one near Svalbard and Novaya Zemlya and the other in the vicinity of the Chukchi Sea. He estimated a total population of several thousand in Soviet waters. Mansfield et al. (1975) made a conservative estimate of 10,000 for Canada and northwest Greenland. Greendale and Brousseau-Greendale (1976) counted more than 6,000 moving westward in Lancaster Sound in 1976. Davis et al. (1978), after monitoring migration into Lancaster Sound during summer 1976 by aerial surveys over both offshore and coastal waters, estimated between 20,000 and 30,000 for this area.

Movements north in spring and south in winter along the west coast of Greenland may depend on temperature fluctuations and wind and water currents (Vibe, 1967). Mass migrations into and out of inshore areas are dramatic and predictable (Vibe, 1950; Greendale and Brousseau-Greendale, 1976). Such migrations appear to be closely related to the breakup of ice in late spring and the formation of ice in autumn.

Occasionally narwhals are trapped in fjords when ice prevents them from returning to the open sea. This entrapment is referred to as *savssat* by the Eskimos of Greenland, where it is most frequent. The crowded animals sometimes splash water onto the icy rim of their breathing hole as they surface to breathe, thereby inadvertently reinforcing the ice trap. As freezing continues, the whales are restricted to an ever-smaller area of open water. Whales confined in this manner become an easy target for hunters. *Savssats* have been reported and described by Porsild (1918), Freuchen (1935), Vibe (1950), and Kapel (1977).

Attempts to maintain narwhals in captivity have failed. The first one to be exhibited was a neonate flown from Grise Fjord to the New York Aquarium; it died after one month (Bruemmer, 1969). In 1970 six were captured, one from near Grise Fjord and the others from Eclipse Sound, and exhibited at the Vancouver Public Aquarium. All died within four months (Newman, 1971).

Primitive hunting techniques (using kayak, harpoon attached to seal-skin float, and lance) are still used in North Greenland for hunting narwhals (Durham, 1977), and the average annual landed catch there is 300 whales (Kapel, 1975). This catch is similar to that of the entire eastern arctic of Canada (Smith and Taylor, 1977). In most areas aborigines now hunt with motorized freight canoes and high-powered rifles, and often with harpoons and floats to ensure retrieval (Reeves, 1976).

Some hunting with rifles and harpoons is done from the ice during spring and summer breakup (Wilkinson, 1955), and many wounded whales are lost as they swim or sink beneath the ice (Smith and Taylor, 1977; Kapel, 1977). Open-water hunting in summer often involves driving the animals into coastal shoals before shooting them, a practice which significantly reduces loss.

Eskimos traditionally used narwhal blubber oil for heating and cooking, and sinews were dried and split for use as thread (Vibe, 1950). The skin (called muktuk or mattak) is a delicacy in narwhal-hunting communities. Much of the carcass is now discarded (Land, 1977), although according to Kapel (1977), skin, meat, and blubber are still important as human food and dog food in North Greenland.

There is a long history of casual, or opportunistic, hunting of narwhals by commercial whalers, whose principal quarry was the bowhead whale, *Balaena mysticetus* (Scoresby, 1820, 1823; Murdoch, 1917; Lubbock, 1937). White traders sometimes bartered for narwhal tusks from Eskimos (Ross, 1975). The tusk's commercial value derives mainly from its ornamental and superstitious appeal.

BEHAVIOR. *Monodon monoceros* is gregarious, commonly found in pods of six to 20 individuals (Scoresby, 1820; Vibe, 1950).

Greendale and Brousseau-Greendale (1976) observed migrating groups of one to 21 animals, although most groups included three to eight. These smaller groups seem to coalesce during migrations to form loosely associated herds of many hundreds.

Narwhals occur in either mixed or segregated groups. Males, females, and juveniles have been observed together (Pedersen, 1931; Vibe, 1950). Scoresby (1820, 1823) reported groups of one sex only. Greendale and Brousseau-Greendale (1976) saw all-male groups, family or mixed groups, and groups of females with young. Judging from the smaller than expected numbers of adult males in catch statistics (Vibe, 1950; Mansfield et al., 1975; Hay and Sergeant, 1976), females and young may penetrate deeper into fjords and remain closer to shore than adult males. This is particularly interesting when one considers that hunting is often selective for animals with large tusks, which are usually adult males.

When chased, narwhals generally remain in tight swimming formation and respire simultaneously (Reeves, unpublished observation). Hay and Sergeant (1976) observed that small pods stay together under the stress caused by helicopter overflights and open-water hunting forays.

Narwhals remain in the vicinity of pack ice throughout the year. Behavior of narwhals trapped in *savssats* was described by Porsild (1918, 1922) and Vibe (1950). Breathing holes are maintained with thrusts of the thick melon, sometimes by several animals at once. Porsild measured ice cakes 180 mm thick that were broken by trapped narwhals. Freuchen (1935) described narwhals being lifted from the water by companions struggling to reach the surface. Porsild (1918) described large males pushing away weaker males and females.

The probable function of the tusk has attracted much speculation. Scoresby (1823) and Gray (in Buckland, 1890) observed narwhals "fencing" with their tusks, but Porsild (1918) and Freuchen (1935) described how carefully they avoid contacting each other with their tusks in *savssats*. Scoresby (1823) conjectured that the tusk might be used like a spear to procure food and Freuchen suggested it could be used as a rake to stir up food from the bottom sediments. As most females are tuskless, its importance for the procurement of food is doubtful. The most likely hypothesis is that the tusk is a secondary sex characteristic (Slijper, 1962; Mansfield et al., 1975).

The sounds of the narwhal, audible in the air, have been likened to a "guggling of water in the throat" (Scoresby, 1823), a "deep growl or groan, something like a bear or a cow" (Murdoch, 1917), and a "shrill, whistle-like sound . . . sometimes relieved by a short blast with deep tones" (Freuchen, 1935). Most of these sounds are probably associated with respiration (Ford and Fisher, 1978). Analysis of hydrophone recordings led Watkins et al. (1971) to conclude that narwhals are less vocal than white whales, but Ford and Fisher used a much longer recording and described narwhals as "extremely loquacious underwater."

Narwhals produce click series and rapidly pulsed sounds; less often they emit pure-tone signals, or whistles. Unlike those of most odontocetes, echolocation clicks produced by narwhals have narrow-band rather than broad-band frequency content. Nevertheless, they are probably used for echolocation. The pulsed tones, on the other hand, which often occur in long, repetitive series, are believed to be communication signals. Ford and Fisher (1978) hypothesized that each individual narwhal has its own type of pulsed tone, a kind of "signature." The pure-tone whistles of narwhals are similar to those of other odontocetes and probably serve primarily as social signals.

GENETICS. Andrews et al. (1973) reported a diploid chromosome number of 44, and noted that the karyotype of the narwhal is similar to those of most other cetaceans.

REMARKS. The root, nar-, is generally assumed to have come from Old Norse, referring to a human corpse (Lehmann, 1965). The animal's pale underside and mottled flanks could account for such an association. So also could the medieval notion that ingestion of narwhal flesh leads to sickness and death. Bartholin in 1645 (quoted in Beer, 1977) thought it was "known as the narwhal because it feeds on dead bodies." Lehmann rejected the link with death, arguing instead that the name derived from the proto-Germanic *narwa* (=narrow), designating the species as "the whale with a narrow projection or tusk."

The narwhal's tusk is clearly the basis for many artistic renditions of the unicorn horn. Beer (1977) adduced evidence that the unicorn myth antedated by many centuries the discovery of the narwhal by Europeans, and was at least partly built around observations of terrestrial animals like the oryx and rhinoceros. It has been suggested that a brisk trade in "unicorn" horns from the Greenland Sea was established by the first half of the 13th century (Dunbabin, 1956). Apparently it was in the interest of merchants to maintain the mystery shrouding the source of their supply of unicorn horns. So it was not until 1638 that the Danish naturalist, Øle Wurm, established the link between the coveted alicorn (as unicorn horn was often called) and the narwhal (Bonner, 1951).

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