Cetaceans: Large Sea Animals

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Cetacea

Cetaceans Fossil range: 55–0 Ma Early Eocene - Present	
	
Humpback Whale breaching	
Scientific classification	
Kingdom:	Animalia
Phylum:	Chordata
Class:	Mammalia
Infraclass:	Laurasiatheria
(unranked):	Cetartiodactyla
Order:	**Cetacea** Brisson, 1762
Suborders	
Mysticeti Odontoceti †Archaeoceti	
Diversity	
Around 88 species	

The order **Cetacea** includes the marine mammals commonly known as whales, dolphins, and porpoises. *Cetus* is Latin and is used in biological names to mean "whale"; its original meaning, "large sea animal", was more general. It comes from Ancient Greek κῆτος (*kētos*), meaning "whale" or "any huge fish or sea monster". In Greek mythology the monster Perseus defeated was called Ceto, which is depicted by the constellation of Cetus. Cetology is the branch of marine science associated with the study of cetaceans.

Cetaceans are the mammals best adapted to aquatic life. Their body is fusiform (spindle-shaped). The forelimbs are modified into flippers. The tiny hindlimbs are vestigial; they do not attach to the backbone and are hidden within the body. The tail has horizontal flukes. Cetaceans are nearly hairless, and are insulated from the cooler water they inhabit by a thick layer of blubber. Some species are noted for their high intelligence.

Respiration

A dolphin in the Strait of Gibraltar

Cetaceans breathe air. They surface periodically to exhale carbon dioxide and inhale a fresh supply of oxygen. During diving, a muscular action closes the blowholes (nostrils), which remain closed until the cetacean next breaks the surface; when it surfaces, the muscles open the blowholes and warm air is exhaled.

Cetaceans' blowholes have evolved to a position at the top of the head, simplifying breathing in sometimes rough seas. When the stale air, warmed from the lungs, is exhaled, it condenses as it meets colder external air. As with a terrestrial mammal breathing out on a cold day, a small cloud of 'steam' appears. This is called the 'blow' or 'spout' and varies by species in terms of shape, angle and height. Species can be identified at a distance using this characteristic.

Cetaceans can remain under water for much longer periods than other mammals, (approximately 7–30 minutes, varying by species) due to large physiological differences. Two studied advantages of cetacean physiology let this order (and other marine mammals) forage underwater for extended periods without breathing:

- Mammalian myoglobin concentrations in skeletal muscle have much variation. New Zealand white rabbits have 0.08 grams (0.0028 oz) +/- 0.6 grams (0.021 oz) myoglobin in 100 grams (3.5 oz) of wet muscle, whereas a Northern Bottlenose Whale has 6.34 grams (0.224 oz). Myoglobin, by nature, has a higher oxygen affinity than hemoglobin. The higher the myoglobin concentration in skeletal muscle, the longer the animal can stay underwater.

- Increased body size also increases maximum dive duration. Greater body size implies increased muscle mass and increased oxygen stores. Cetaceans also obey Kleiber's law, which states that mass and metabolic rate are inversely related. I.e., larger animals consume less oxygen than smaller animals per unit mass.

Vision, hearing and echolocation

Cetacean eyes are set on the side rather than the front of the head. This means that only cetaceans with pointed 'beaks' (such as dolphins) have good binocular vision forward and downward. Tear glands secrete greasy tears, which protect the eyes from the salt in the water. The lens is almost spherical, which is most efficient at focusing the minimal light that reaches deep water. Cetaceans make up for their generally poor vision (with the exception of the dolphin) with excellent hearing.

As with the eyes, cetacean ears are also small. Life in the sea accounts for the cetacean's loss of its external ears, whose function is to collect and focus airborne sound waves. However, water conducts sound better than air, so the external ear is unneeded: it is a tiny hole in the skin, just behind the eye. The highly developed inner ear can detect sounds from dozens of miles away and discern from which direction the sound comes.

Odontoceti are generally capable of echolocation. From this, Odontoceti can discern the size, shape, surface characteristics, distance and movement of an object. With this ability cetaceans can search for, chase and catch fast-swimming prey in total darkness. Echolocation is so advanced in most Odontoceti that they can distinguish between prey and non-prey (such as humans or boats); captive Odontoceti can be trained to distinguish between, for example, balls of different sizes or shapes. Mysticeti have little need of

echolocation, because they prey upon tiny fish such as krill that are impractical to locate with echolocation.

Cetaceans also use sound to communicate, whether it be groans, moans, whistles, clicks or the complex 'singing' of the Humpback Whale.

Feeding

The toothed whales such as the sperm whale, beluga, dolphins and porpoises, have teeth that they use for catching fish, squid or other marine life. They do not chew but swallow prey whole. When they catch large prey, such as when the orca (*Orcinus orca*) catches a seal, they bite off and swallow one chunk at a time.

Mysticeti instead have baleen plates made of keratin (the same substance as human fingernails) which hang from the upper jaw. These plates filter small animals (such as krill and fish) from the seawater. Cetaceans included in this group include the Blue, Humpback, Bowhead and Minke whales.

Not all Mysticeti feed on plankton: the larger species eat small shoaling fish, such as herring and sardine, called micronecton. The gray whale (*Eschrichtius robustus*), is a benthic feeder, primarily eating sea floor crustaceans.

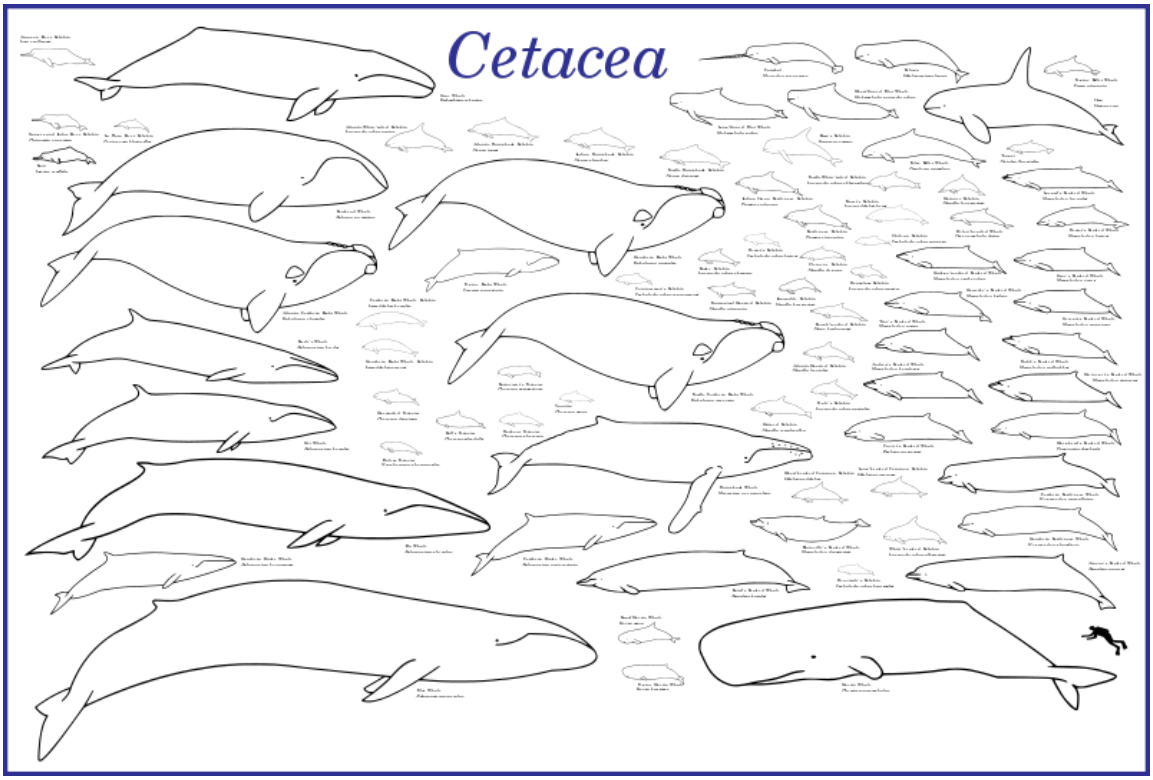
Mammalian nature

Cetaceans are mammals, that is, members of the class Mammalia. The closest living relatives of cetaceans are the even-toed ungulates, such as the hippopotamus and deer.

Mammalian characteristics include warm-bloodedness, breathing air through their lungs, and suckling their young, and growing hair, although very little of it.

Another way of distinguishing a cetacean from a fish is by the shape of the tail. Fish tails are vertical and move from side to side when the fish swims. Cetacea tails—called a fluke—are horizontal and move up and down, because cetacea spines bend in the same manner as a human spine.

Taxonomy



Size comparison of all known extant cetacean species. Note the human diver at lower right for scale.

The order Cetacea contains about ninety species, all marine except for four species of freshwater dolphins. The order contains two suborders, Mysticeti (baleen whales) and Odontoceti (toothed whales, which includes dolphins and porpoises). The species range in size from Commerson's Dolphin, smaller than a human, to the Blue Whale, the largest animal ever known to have lived.

Mysticeti vs Odontoceti

Fossils indicate that before evolving baleen, Mysticeti also had teeth, so defining the Odontoceti via teeth alone is problematic, and paleontologists have instead identified other features uniting fossil and modern odontocetes that are not shared by Mysticetes.

Characteristic	**Odontoceti**	**Mysticeti**
Feeding	Echolocation, fast	Filter feeder, not fast
Size	Smaller (except Sperm whale)	Larger
Blowhole	One	Two
Dentition	Teeth	Baleen plates
Melon	Ovoid, in anterior facial	Vestigial or none

	region	
Skull and facial tissue	Dorsally asymmetric	Symmetric
Sexual dimorphism	Some species have larger males	Females always larger
Mandible	Symphyseal	Nonsymphyseal
Pan bone of lower jaw	Yes	No
Maxillae projection	Outward over expanded supraorbital processes	Under eye orbit, with bony protuberance anterior to eye orbit
Tympanic bulla and periotic bone	Fused, equal sized	Larger, separate tympanic

Tree

The classification here closely follows Dale W. Rice, *Marine Mammals of the World: Systematics and Distribution* (1998), which has become the standard taxonomy reference in the field. There is very close agreement between this classification and that of *Mammal Species of the World: 3rd Edition* (Wilson and Reeder eds., 2005). Any differences are noted using the abbreviations "Rice" and "MSW3" respectively. Further differences due to recent discoveries are also noted.

Discussion of synonyms and subspecies are relegated to the relevant genus and species articles.

- **ORDER CETACEA**
  - **Suborder Mysticeti**: Baleen whales
    - Family Balaenidae: Right whales and Bowhead Whale
      - Genus *Balaena*
        - Bowhead Whale, *Balaena mysticetus*
      - Genus *Eubalaena*
        - North Atlantic Right Whale, *Eubalaena glacialis*
        - North Pacific Right Whale, *Eubalaena japonica*
        - Southern Right Whale, *Eubalaena australis*
    - Family Balaenopteridae: Rorquals
      - Subfamily Balaenopterinae
        - Genus *Balaenoptera*
          - Common Minke Whale, *Balaenoptera acutorostrata*
          - Antarctic Minke Whale, *Balaenoptera bonaerensis*
          - Sei Whale, *Balaenoptera borealis*
          - Bryde's Whale, *Balaenoptera brydei*
          - Eden's Whale *Balaenoptera edeni* - Rice lists this as a separate species, MSW3 does not

                - *Balaenoptera omurai* - MSW3 lists this is a synonym of Bryde's Whale but suggests this may be temporary.
                - Blue Whale, *Balaenoptera musculus*
                - Fin Whale, *Balaenoptera physalus*
            - Subfamily Megapterinae
                - Genus *Megaptera*
                    - Humpback Whale, *Megaptera novaeangliae*
        - Family Eschrichtiidae
            - Genus *Eschrichtius*
                - Gray Whale, *Eschrichtius robustus*
        - Family Neobalaenidae: Pygmy Right Whale
            - Genus *Caperea*
                - Pygmy Right Whale, *Caperea marginata*
    - **Suborder Odontoceti**: toothed whales
        - Family Delphinidae: Dolphin
            - Genus *Cephalorhynchus*
                - Commerson's Dolphin, *Cephalorhyncus commersonii*
                - Chilean Dolphin, *Cephalorhyncus eutropia*
                - Heaviside's Dolphin, *Cephalorhyncus heavisidii*
                - Hector's Dolphin, *Cephalorhyncus hectori*
            - Genus *Delphinus*
                - Long-beaked Common Dolphin, *Delphinus capensis*
                - Short-beaked Common Dolphin, *Delphinus delphis*
                - Arabian Common Dolphin, *Delphinus tropicalis*. Rice recognises this as a separate species. MSW3 does not.
            - Genus *Feresa*
                - Pygmy Killer Whale, *Feresa attenuata*
            - Genus *Globicephala*
                - Short-finned Pilot Whale, *Globicephala macrorhyncus*
                - Long-finned Pilot Whale, *Globicephala melas*
            - Genus *Grampus*
                - Risso's Dolphin, *Grampus griseus*
            - Genus *Lagenodelphis*
                - Fraser's Dolphin, *Lagenodelphis hosei*
            - Genus *Lagenorhynchus*
                - Atlantic White-sided Dolphin, *Lagenorhynchus acutus*
                - White-beaked Dolphin, *Lagenorhynchus albirostris*
                - Peale's Dolphin, *Lagenorhynchus australis*
                - Hourglass Dolphin, *Lagenorhynchus cruciger*

        - Pacific White-sided Dolphin, *Lagenorhynchus obliquidens*
        - Dusky Dolphin, *Lagenorhynchus obscurus*
    - Genus *Lissodelphis*
        - Northern Right Whale Dolphin, *Lissodelphis borealis*
        - Southern Right Whale Dolphin, *Lissodelphis peronii*
    - Genus *Orcaella*
        - Irrawaddy Dolphin, *Orcaella brevirostris*
            - Australian Snubfin Dolphin, *Orcaella heinsohni*. 2005 discovery, thus not recognized by Rice or MSW3 and subject to revision.
    - Genus *Orcinus*
        - Killer Whale, *Orcinus orca*
    - Genus *Peponocephala*
        - Melon-headed Whale, *Peponocephala electra*
    - Genus *Pseudorca*
        - False Killer Whale, *Pseudorca crassidens*
    - Genus *Sotalia*
        - Tucuxi, *Sotalia fluviatilis*
        - Costero, *Sotalia guianensis*
    - Genus *Sousa*
        - Pacific Humpback Dolphin, *Sousa chinensis*
        - Indian Humpback Dolphin, *Sousa plumbea*
        - Atlantic Humpback Dolphin, *Sousa teuszii*
    - Genus *Stenella*
        - Pantropical Spotted Dolphin, *Stenella attenuata*
        - Clymene Dolphin, *Stenella clymene*
        - Striped Dolphin, *Stenella coeruleoalba*
        - Atlantic Spotted Dolphin, *Stenella frontalis*
        - Spinner Dolphin, *Stenella longirostris*
    - Genus *Steno*
        - Rough-toothed Dolphin, *Steno bredanensis*
    - Genus *Tursiops* - Rice and MSW3 tentatively agree on this classification
        - Indian Ocean Bottlenose Dolphin, *Tursiops aduncus*
        - Common Bottlenose Dolphin, *Tursiops truncatus*
- Family Monodontidae
    - Genus *Delphinapterus*
        - Beluga, *Delphinapterus leucas*
    - Genus *Monodon*
        - Narwhal, *Monodon monoceros*
- Family Phocoenidae: Porpoises
    - Genus *Neophocaena*

        - Finless Porpoise, *Neophocaena phocaenoides*
    - Genus *Phocoena*
        - Spectacled Porpoise, *Phocoena dioptrica*
        - Harbour Porpoise, *Phocoena phocaena*
        - Vaquita, *Phocoena sinus*
        - Burmeister's Porpoise, *Phocoena spinipinnis*
    - Genus *Phocoenoides*
        - Dall's Porpoise, *Phocoenoides dalli*
- Family Physeteridae: Sperm Whale family
    - Genus *Physeter*
        - Sperm Whale, *Physeter catodon* (syn. *P. macrocephalus*)
- Family Kogiidae - MSW3 treats *Kogia* as a member of Physeteridae
    - Genus *Kogia*
        - Pygmy Sperm Whale, *Kogia breviceps*
        - Dwarf Sperm Whale, *Kogia sima*
- **Superfamily Platanistoidea**: River dolphins
    - Family Iniidae
        - Genus *Inia*
            - Amazon River Dolphin, *Inia geoffrensis*
                - Bolivian River Dolphin, *Inia boliviensis*
    - † Family Lipotidae - MSW3 treats *Lipotes* as a member of *Iniidae*
        - † Genus *Lipotes*
            - † Baiji, *Lipotes vexillifer*
    - Family Pontoporiidae - MSW3 treats *Pontoporia* as a member of *Iniidae*
        - Genus *Pontoporia*
            - La Plata Dolphin, *Pontoporia blainvillei*
    - Family Platanistidae
        - Genus *Platanista*
            - Ganges and Indus River Dolphin, *Platanista gangetica*. MSW3 treats *Platanista minor* as a separate species, with common names Ganges River Dolphin and Indus River Dolphin, respectively.
- Family Ziphidae, Beaked whales
    - Genus *Berardius*
        - Arnoux's Beaked Whale, *Berardius arnuxii*
        - Baird's Beaked Whale (North Pacific Bottlenose Whale), *Berardius bairdii*
    - Subfamily Hyperoodontidae
        - Genus *Hyperoodon*

        - Northern Bottlenose Whale, *Hyperoodon ampullatus*
        - Southern Bottlenose Whale, *Hyperoodon planifrons*
    - Genus *Indopacetus*
        - Indo-Pacific Beaked Whale (Longman's Beaked Whale), *Indopacetus pacificus*
    - Genus *Mesoplodon*, Mesoplodont Whale
        - Sowerby's Beaked Whale, *Mesoplodon bidens*
        - Andrews' Beaked Whale, *Mesoplodon bowdoini*
        - Hubbs' Beaked Whale, *Mesoplodon carlhubbsi*
        - Blainville's Beaked Whale, *Mesoplodon densirostris*
        - Gervais' Beaked Whale, *Mesoplodon europaeus*
        - Ginkgo-toothed Beaked Whale, *Mesoplodon ginkgodens*
        - Gray's Beaked Whale, *Mesoplodon grayi*
        - Hector's Beaked Whale, *Mesoplodon hectori*
        - Layard's Beaked Whale, *Mesoplodon layardii*
        - True's Beaked Whale, *Mesoplodon mirus*
        - Perrin's Beaked Whale, *Mesoplodon perrini*. This species was recognised in 2002 and as such is listed by MSW3 but not Rice.
        - Pygmy Beaked Whale, *Mesoplodon peruvianus*
        - Stejneger's Beaked Whale, *Mesoplodon stejnegeri*
        - Spade Toothed Whale, *Mesoplodon traversii*
- Genus *Tasmacetus*
    - Tasman Beaked Whale (Shepherd's Beaked Whale), *Tasmacetus shepherdi*
- Genus *Ziphius*
    - Cuvier's Beaked Whale, *Ziphius cavirostris*

†Extinct

Chapter- 2

Whale

Whale

Humpback whale
Scientific classification
Kingdom: Animalia
Phylum: Chordata
Class: Mammalia
Subclass: Eutheria
Order: Cetacea

Whale (origin Old English *hþæl*) is the common name for various marine mammals of the order Cetacea. The term *whale* sometimes refers to all cetaceans, but more often it excludes dolphins and porpoises, which belong to suborder *Odontoceti* (toothed whales). This suborder also includes the sperm whale, killer whale, pilot whale, and beluga whale. The other Cetacean suborder *Mysticeti* (baleen whales), are filter feeders that eat small organisms caught by straining seawater through a comblike structure found in the mouth called baleen. This suborder includes the blue whale, the humpback whale, the bowhead

whale and the minke whale. All Cetacea have forelimbs modified as fins, a tail with horizontal flukes, and nasal openings (blowholes) on top of the head.

Whales range in size from the blue whale, the largest animal known to have ever existed at 35 m (115 ft) and 150 tonnes (150 LT; 170 ST), to various pygmy species, such as the pygmy sperm whale at 3.5 m (11 ft).

Whales collectively inhabit all the world's oceans and number in the millions, with annual population growth rate estimates for various species ranging from 3-13%. For centuries, whales have been hunted for meat and as a source of raw materials. By the middle of the 20th century, however, industrial whaling had left many species seriously endangered, leading to the end of whaling in all but a few countries.

Taxonomy

Cetaceans are divided into two suborders:

- The largest suborder, Mysticeti (baleen whales) are characterized by baleen, a sieve-like structure in the upper jaw made of keratin, which it uses to filter plankton from the water.
- Odontoceti (toothed whales) bear sharp teeth for hunting. Odontoceti also include dolphins and porpoises.

Both cetaceans and artiodactyl are now classified under the super-order Cetartiodactyla which includes both whales and hippopotamuses. Whales are the hippopotamus's closest living relatives.

Evolution

Ambulocetus natans - a primitive whale

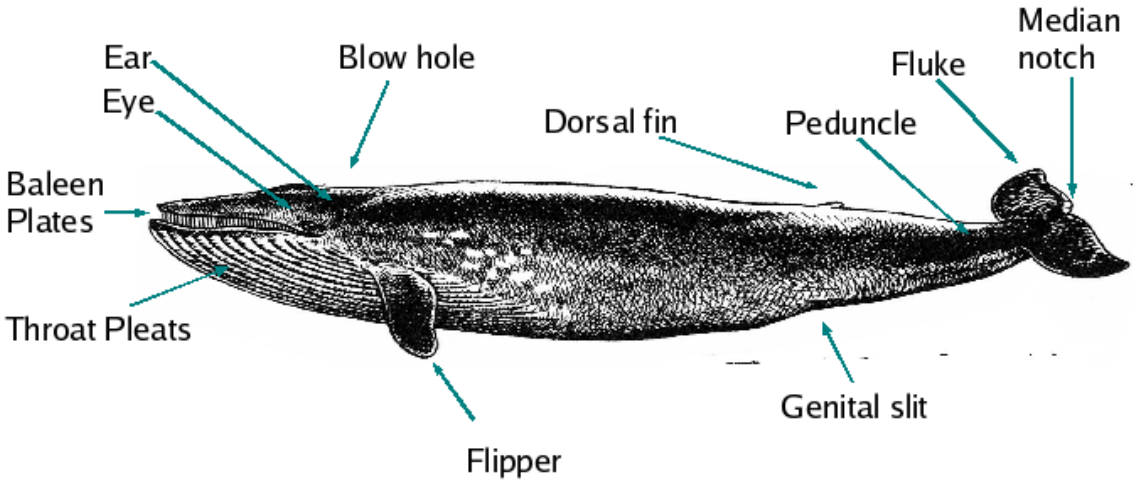
All cetaceans, including whales, dolphins and porpoises, are descendants of land-living mammals of the Artiodactyl order (even-toed ungulates). Both descended from a common ancestor, the Indohyus (an extinct semi-aquatic deer-like ungulate) from which they split around 54 million years ago. Primitive whales probably first took to the sea about 50 million years ago and became fully aquatic about 5-10 million years later.

Anatomy

Like all mammals, whales breathe air, are warm-blooded, nurse their young with milk from mammary glands, and have body hair.

Beneath the skin lies a layer of fat called blubber, which stores energy and insulates the body. Whales have a spinal column, a vestigial pelvic bone, and a four-chambered heart. The neck vertebrae are typically fused, trading flexibility for stability during swimming.

Blowhole(s)



Features of a blue whale

Whales breathe via blowholes; baleen whales have two and toothed whales have one. These are located on the top of the head, allowing the animal to remain mostly submerged whilst breathing. Breathing involves expelling excess water from the blowhole, forming an upward spout, followed by inhaling air into the lungs. Spout shapes differ among species and can help with identification.

Appendages

The body shape is fusiform and the modified forelimbs, or fins, are paddle-shaped. The end of the tail is composed of two flukes, which propel the animal by vertical movement, as opposed to the horizontal movement of a fish tail. Although whales do not possess fully developed hind limbs, some (such as sperm whales and baleen whales) possess

discrete rudimentary appendages, which may even have feet and digits. Most species have a dorsal fin.

Dentition

Toothed whales, such as the sperm whale, possess teeth with cementum cells overlying dentine cells. Unlike human teeth, which are composed mostly of enamel on the portion of the tooth outside of the gum, whale teeth have cementum outside the gum. Only in larger whales, where the cementum has been worn away on the tip of the tooth, does enamel show.

Instead of teeth, Baleen whales have a row of plates on the upper side of their jaws that resemble the "teeth" of a comb.

Ears

The whale ear has specific adaptations to the marine environment. In humans, the middle ear works as an impedance matcher between the outside air's low impedance and the cochlear fluid's high impedance. In aquatic mammals such as whales, however, there is no great difference between the outer and inner environments. Instead of sound passing through the outer ear to the middle ear, whales receive sound through the throat, from which it passes through a low-impedance fat-filled cavity to the inner ear.

Life history/behavior

Reproduction

Males are called 'bulls', females, 'cows' and newborns, 'calves'. Most species do not maintain fixed partnerships and females have several mates each season.

The female delivers usually a single calf tail-first to minimize the risk of drowning. Whale cows nurse by actively squirting milk, so fatty that it has the consistency of toothpaste, into the mouths of their young. Nursing continues for more than a year in many species, and is associated with a strong bond between mother and calf. Reproductive maturity occurs typically at seven to ten years. This mode of reproduction produces few offspring, but increases survival probability.

Socialization

Whales are known to teach, learn, cooperate, scheme, and even grieve.

Sleep

A Humpback Whale breaching.

Unlike most animals, whales are conscious breathers. All mammals sleep, but whales cannot afford to become unconscious for long because they may drown. It is thought that only one hemisphere of the whale's brain sleeps at a time, so they rest but are never completely asleep.

Surfacing behavior

Many whales exhibit behaviors such as breaching and tail slapping that expose large parts of their bodies to the air.

Lifespan

Whale lifespans vary among species and are not well characterized. Whaling left few older individuals to observe directly. R.M. Nowak of Johns Hopkins University estimated that humpback whales may live as long as 77 years. In 2007, a 19th century lance fragment was found in a bowhead whale off Alaska, suggesting the individual could be between 115 and 130 years old. Aspartic acid racemization in the whale eye, combined with a harpoon fragment, indicated an age of 211 years for another male, which, if true would make bowheads the longest-lived extant mammal species. The accuracy of this technique has been questioned because racemization did not correlate well with other dating methods.

Vocalization

Some species, such as the humpback whale, communicate using melodic sounds, known as whale song. Sperm whales have only been heard making clicks, while toothed whales (Odontoceti) use echolocation that can generate about 20,000 watts of sound (+73 dBm or +43 dBw) and be heard for many miles. Whale vocalization is likely to serve many purposes, including echolocation, mating, and identification.

Ecology

Feeding

Whales are generally classed as predators, but their food ranges from microscopic plankton to very large animals.

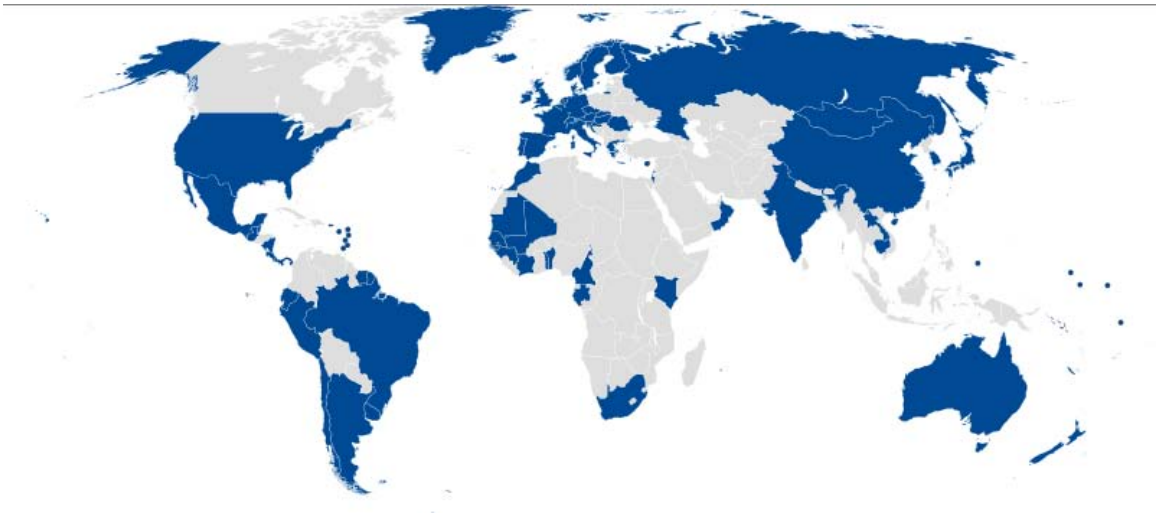
Toothed whales eat fish and squid which they hunt by use of echolocation. Orcas sometimes eat other marine mammals, including whales.

Baleen whales such as humpbacks and blues feed only in arctic waters, eating mostly krill. They imbibe enormous amounts of seawater which they expel through their baleen plates. The water is then expelled and the krill is retained on the plates and then swallowed. Whales do not drink seawater but indirectly extract water from their food by metabolizing fat.

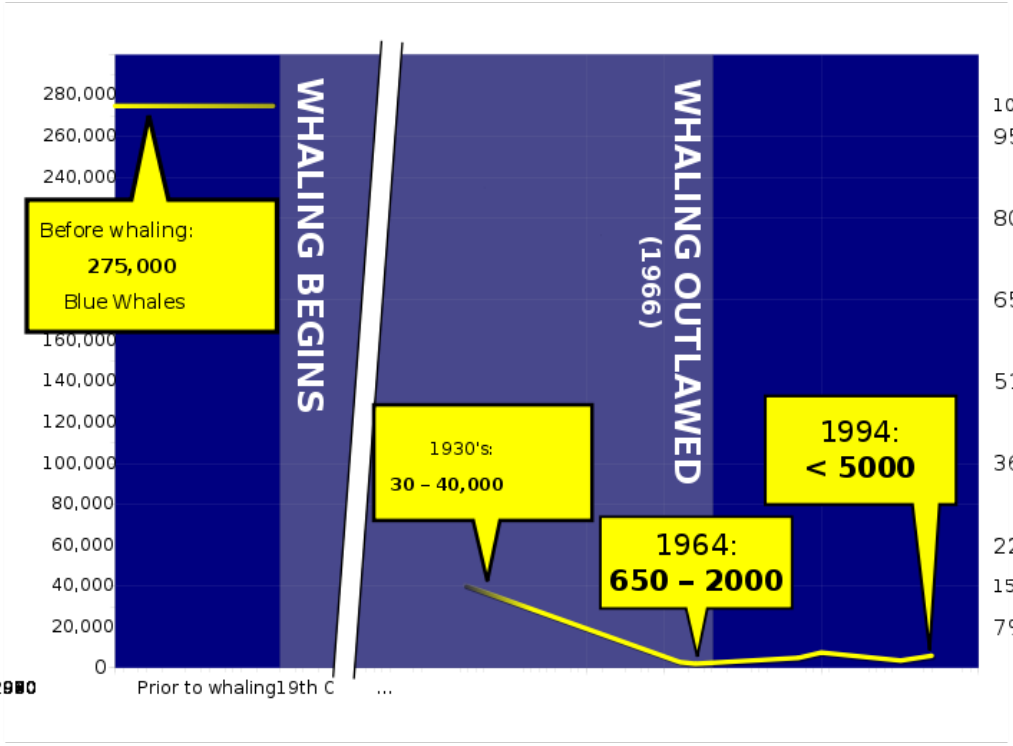
Relation to humans

Whaling

Dutch whalers near Spitsbergen. *Abraham Storck, 1690*



World map of International Whaling Commission (IWC) members/non-members(member countries in blue)



World population graph of Blue Whales (Balaenoptera musculus)

Some species of large whales are listed as endangered by multinational organizations such as CITES along with governments and advocacy groups primarily due to whaling's impacts. They have been hunted commercially for whale oil, meat, baleen and ambergris (a perfume ingredient from the intestine of sperm whales) since the 17th century. At its peak in 1846, 736 vessels and 70,000 people were involved in the American whaling

industry. More than 2 million were taken in the early 20th century, and by the middle of the century, many populations were severely depleted.

The International Whaling Commission banned commercial whaling in 1986. The ban is not absolute, however, and some whaling continues under the auspices of scientific research (sometimes not proved) or aboriginal rights; current whaling nations are Norway, Iceland and Japan and the aboriginal communities of Siberia, Alaska and northern Canada.

Bycatch

Several species of small whales are caught as bycatch in fisheries for other species. In the Eastern Tropical Pacific tuna fishery, thousands of dolphins drowned in purse-seine nets, until preventive measures were introduced. Gear and deployment modifications, and eco-labelling (*dolphin-safe* or *dolphin-friendly* brands of tuna), have contributed to a reduction in dolphin mortality by tuna vessels. In many countries, small whales are still hunted for food, oil, meat or bait.

Naval sonar

Environmentalists speculate that advanced naval sonar endangers some cetaceans, including whales. In 2003 British and Spanish scientists suggested in *Nature* that the effects of sonar trigger whale beachings and to signs that such whales have experienced decompression sickness. Responses in Nature the following year discounted the explanation.

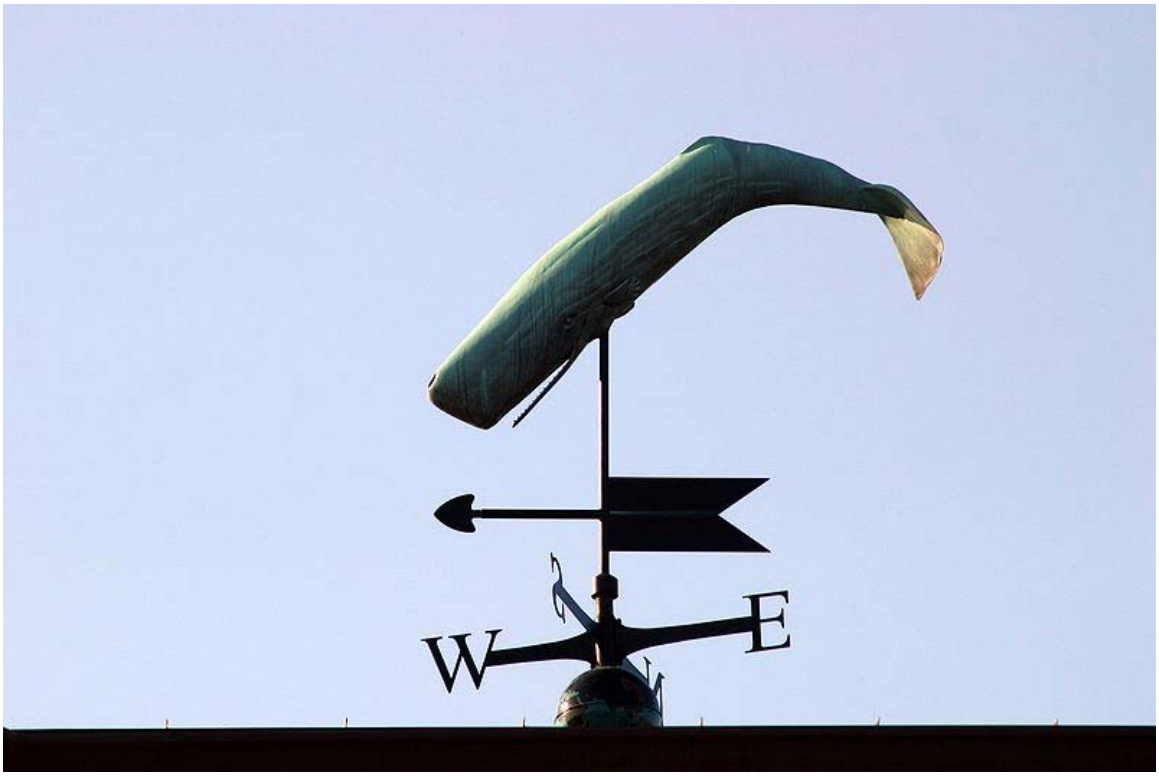
Mass whale beachings occur in many species, mostly beaked whales that use echolocation for deep diving. The frequency and size of beachings around the world, recorded over the last 1,000 years in religious tracts and more recently in scientific surveys, have been used to estimate the population of various whale species by assuming that the proportion of the total whale population beaching in any one year is constant. Beached whales can give other clues about population conditions, especially health problems. For example, bleeding around ears, internal lesions, and nitrogen bubbles in organ tissue suggest decompression sickness.

Following public concern, the U.S. Defense department was ordered by the 9th Circuit Court to strictly limit use of its Low Frequency Active Sonar during peacetime. Attempts by the UK-based Whale and Dolphin Conservation Society to obtain a public inquiry into the possible dangers of the Royal Navy's equivalent (the "2087" sonar launched in December 2004) failed as of 2008. The European Parliament has requested that EU members refrain from using the powerful sonar system until an environmental impact study has been carried out.

Other environmental disturbances

Other human activities have been suggested by marine biologists to adversely impact whale populations, such as collisions with ships and propellers, poisoning by waste contaminants and the unregulated use of fishing gear that catches anything that swims into it.

In mythology



Whale weather-vane atop the Nantucket Historical Association Whaling Museum displaying a Sperm Whale.

Whales were little understood for most of human history as they spend up to 90% of the lives underwater, only surfacing briefly to breathe. They also include the largest animals on the planet, so it is not surprising that many cultures, even those that have hunted them, hold them in awe and feature them in their mythologies.

In China, Yu-kiang, a whale with the hands and feet of a man was said to rule the ocean.

In the Tyrol region of Austria it was said that if a sunbeam were to fall on a maiden entering womanhood, she would be carried away in the belly of a whale.

Paikea, the youngest and favourite son of the chief Uenuku from the island of Mangaia in the present day Cook Islands in New Zealand was said by the Kati Kuri people of Kaikoura to have come from the Pacific Islands on the back of a whale many centuries

before. The novel and movie Whale Rider follow the trials of a girl named Paikia, who lives in such a culture.

The whale features in Inuit creation myths. When ‘Big Raven', a deity in human form, found a stranded whale, he was told by the Great Spirit where to find special mushrooms that would give him the strength to drag the whale back to the sea and thus return order to the world.

The Tlingit people of northern Canada said that the Orcas were created when the hunter Natsihlane carved eight fish from yellow cedar, sang his most powerful spirit song and commanded the fish to leap into the water.

In Icelandic legend a man threw a stone at a fin whale and hit the blowhole, causing the whale to burst. The man was told not to go to sea for twenty years but in the nineteenth year he went fishing and a whale came and killed him.

In East African legend King Sulemani asked God that He might permit him to feed all the beings on earth. A whale came and ate until there was no corn left and then told Sulemani that he was still hungry and that there were 70,000 more in his tribe. Sulemani then prayed to God for forgiveness and thanked the creature for teaching him a lesson in humility.

The King James Version of the Bible mentions whales four times: "And God created great whales" (Genesis 1:21); "Am I a sea, or a whale, that thou settest a watch over me? (Job 7:12); "Thou art like a young lion of the nations, and thou art as a whale in the seas (Ezekiel 32:2); and "For as Jonas [sic] was three days and three nights in the whale's belly; so shall the Son of man be three days and three nights in the heart of the earth" (Matthew 12:40). The story of Jonah being swallowed by a whale also is told in the Qur'an.

Some cultures associate divinity with whales, such as among Ghanaians and Vietnamese, who occasionally hold funerals for beached whales, a throwback to Vietnam's ancient sea-based Austro-asiatic culture.

Chapter- 3

Porpoise

Porpoises Fossil range: 15.970–0 Ma Miocene to Recent

Phocoena phocoena, Harbour Porpoise near Denmark
Scientific classification
Kingdom: Animalia
Phylum: Chordata
Class: Mammalia
Order: Cetacea
Suborder: Odontoceti
Superfamily: Delphinoidea
Family: **Phocoenidae** Gray, 1825

Porpoises (also called **mereswine**) are small cetaceans of the family **Phocoenidae**; they are related to whales and dolphins. They are distinct from dolphins, although the word "porpoise" has been used to refer to any small dolphin, especially by sailors and

fishermen. The most obvious visible difference between the two groups is that porpoises have flattened, spade-shaped teeth distinct from the conical teeth of dolphins, and shorter beaks.

The name derives from French *pourpois*, originally from Medieval Latin *porcopiscus* (*porcus* pig + *piscus* fish).

Porpoises, divided into six species, live in all oceans, mostly near the shore. Freshwater populations of the Finless Porpoise also exist. Probably the best known species is the Harbour Porpoise, which can be found across the Northern Hemisphere. Like all toothed whales, porpoises are predators, using sounds (echolocation in sonar form) to locate prey and to coordinate with others. They hunt fish, squid, and crustaceans.

Taxonomy and evolution

Porpoises, along with whales and dolphins, are descendants of land-living ungulates (hoofed animals) that first entered the oceans around 50 million years ago. During the Miocene (23 to 5 MYA), mammals were fairly modern. The cetaceans diversified, and fossil evidence suggests that porpoises diverged from dolphins and other cetaceans around 15 MYA. The oldest fossils are known from the shallow seas around the north Pacific, with animals spreading to the European coasts and southern hemisphere only much later, during the Pliocene.

Suborder Odontoceti Toothed whales

- Infraorder Delphinida
  - Superfamily Delphinoidea
    - Family **Phocoenidae: Porpoises**
      - Genus †*Haborophocoena*
        - *Haborophocoena toyoshimai*
      - Genus *Neophocaena*
        - Finless Porpoise, *Neophocaena phocaeniodes*
      - Genus †*Numataphocoena*
        - *Numataphocoena yamashitai*
      - Genus *Phocoena*
        - Harbour Porpoise, *Phocoena phocoena*
        - Vaquita, *Phocoena sinus*
        - Spectacled Porpoise, *Phocoena dioptrica*
        - Burmeister's Porpoise, *Phocoena spinipinnis*
      - Genus *Phocoenoides*
        - Dall's Porpoise, *Phocoenoides dalli*
      - Genus †*Septemriocetus*
        - *Septemriocetus bosselaersi*
      - Genus *Piscolithax*
        - *Piscolithax aenigmaticus*
        - *Piscolithax longirostris*

- *Piscolithax boreios*
- *Piscolithax tedfordi*

Recently discovered hybrids between male Harbour porpoises and female Dall's Porpoises indicate that the two species may actually be members of the same genus.

Physical characteristics

A Harbour Porpoise at an aquarium. In the wild, porpoises rarely jump out of the water.

Porpoises tend to be smaller but stouter than dolphins. They have small, rounded heads and blunt jaws instead of beaks. While dolphins have a round, bulbous "melon", porpoises do not. Their teeth are spade-shaped, whereas dolphins have conical teeth. In

addition, a porpoise's dorsal fin is generally triangular, rather than curved like that of many dolphins and large whales. Some species have small bumps, known as tubercles, on the leading edge of the dorsal fin. The function of these bumps is unknown.

These animals are the smallest cetaceans, reaching body lengths up to 2.5 metres (8.2 ft); the smallest species is the Vaquita, reaching up to 1.5 metres (4.9 ft). In terms of weight the lightest is the Finless Porpoise at 30 to 45 kilograms (66 to 99 lb) and the heaviest is Dall's Porpoise at 130 to 200 kilograms (290 to 440 lb). Because of their small size, porpoises lose body heat to the water more rapidly than other cetaceans. Their stout shape, which minimizes surface area, may be an adaptation to reduce heat loss. Thick blubber also insulates them from the cold. The small size of porpoises requires them to eat frequently, rather than depending on fat reserves.

Life history

Porpoises are relatively r-selected compared with dolphins: that is, they bear young more quickly than dolphins. Female Dall's and Harbour Porpoises often become pregnant with a single calf each year, and pregnancy lasts for about 11 months. Porpoises have been known to live 8–10 years although there are some that lived to be 20.

Behavior

"Rooster tail" spray around swimming Dall's Porpoises

Porpoises are predators of fish, squid, and crustaceans. Although they are capable of dives up to 200 m, they generally hunt in shallow coastal waters. They are found most commonly in small groups of fewer than ten individuals; a group is referred to as a pod. Rarely, some species form brief aggregations of several hundred animals. Like all toothed whales they are capable of echolocation for finding prey and group coordination. Porpoises are fast swimmers—Dall's porpoise is said to be one of the fastest cetaceans, with a speed of 55 km/h (34 mph). Porpoises tend to be less acrobatic and warier than dolphins.

Human impact

Accidental entanglement (bycatch) in fishing nets is the main threat to porpoises today. One of the most endangered cetacean species is the Vaquita, having a limited distribution in the Gulf of California, a highly industrialized area.

In some countries, porpoises are hunted for food or bait meat.

Porpoises are rarely held in captivity in zoos or oceanaria, as they are generally not as capable of adapting to tank life nor as easily trained as dolphins.

Chapter- 4

Dolphin

Bottlenose dolphin breaching in the bow wave of a boat

Dolphins are marine mammals that are closely related to whales and porpoises. There are almost forty species of dolphin in seventeen genera. They vary in size from 1.2 m (4 ft) and 40 kg (90 lb) (Maui's dolphin), up to 9.5 m (30 ft) and 10 tonnes (9.8 LT; 11 ST) (the orca or killer whale). They are found worldwide, mostly in the shallower seas of the continental shelves, and are carnivores, mostly eating fish and squid. The family Delphinidae is the largest in the Cetacean order, and evolved relatively recently, about ten million years ago, during the Miocene. Dolphins are among the most intelligent

animals, and their often friendly appearance and seemingly playful attitude have made them popular in human culture.

Etymology

The name is originally from Greek δελφίς (*delphís*), "dolphin", which was related to the Greek δελφύς (*delphus*), "womb". The animal's name can therefore be interpreted as meaning "a 'fish' with a womb". The name was transmitted via the Latin *delphinus* (the romanization of the later Greek δελφῖνος - *delphinos*), which in Middle Latin became *dolfinus* and in Old French *daulphin*, which reintroduced the *ph* into the word. The term **mereswine** has also historically been used.

The word is used in a few different ways. It can mean:

- any member of the family Delphinidae (oceanic dolphins),
- any member of the families Delphinidae and Platanistoidea (oceanic and river dolphins),
- any member of the suborder Odontoceti (toothed whales; these include the above families and some others),
- and is used casually as a synonym for bottlenose dolphin, the most common and familiar species of dolphin.

Here we, uses the second definition and does not describe porpoises (suborder Odontoceti, family Phocoenidae). Orcas and some closely related species belong to the Delphinidae family and therefore qualify as dolphins, even though they are called whales in common language. A group of dolphins is called a "school" or a "pod". Male dolphins are called "bulls", females "cows" and young dolphins are called "calves".

Taxonomy

Common dolphin

Bottlenose dolphin

Spotted Dolphin

Commerson's Dolphin

Dusky Dolphin

Killer Whales, also known as Orcas

The *Boto*, or Amazon River Dolphin

- Suborder Odontoceti, toothed whales
    - Family Delphinidae, oceanic dolphins
        - Genus *Delphinus*
            - Long-Beaked Common Dolphin, *Delphinus capensis*
            - Short-Beaked Common Dolphin, *Delphinus delphis*
        - Genus *Tursiops*
            - Common Bottlenose Dolphin, *Tursiops truncatus*
            - Indo-Pacific Bottlenose Dolphin, *Tursiops aduncus*
        - Genus *Lissodelphis*
            - Northern Rightwhale Dolphin, *Lissodelphis borealis*
            - Southern Rightwhale Dolphin, *Lissodelphis peronii*
        - Genus *Sotalia*
            - Tucuxi, *Sotalia fluviatilis*
            - Costero, *Sotalia guianensis*
        - Genus *Sousa*
            - Indo-Pacific Hump-backed Dolphin, *Sousa chinensis*
                - Chinese White Dolphin (the Chinese variant), *Sousa chinensis chinensis*
            - Atlantic Humpbacked Dolphin, *Sousa teuszii*
        - Genus *Stenella*
            - Atlantic Spotted Dolphin, *Stenella frontalis*
            - Clymene Dolphin, *Stenella clymene*
            - Pantropical Spotted Dolphin, *Stenella attenuata*
            - Spinner Dolphin, *Stenella longirostris*
            - Striped Dolphin, *Stenella coeruleoalba*
        - Genus *Steno*
            - Rough-Toothed Dolphin, *Steno bredanensis*
        - Genus *Cephalorhynchus*
            - Chilean Dolphin, *Cephalorhynchus eutropia*
            - Commerson's Dolphin, *Cephalorhynchus commersonii*
            - Heaviside's Dolphin, *Cephalorhynchus heavisidii*
            - Hector's Dolphin, *Cephalorhynchus hectori*
        - Genus *Grampus*
            - Risso's Dolphin, *Grampus griseus*
        - Genus *Lagenodelphis*
            - Fraser's Dolphin, *Lagenodelphis hosei*
        - Genus *Lagenorhynchus*
            - Atlantic White-Sided Dolphin, *Lagenorhynchus acutus*
            - Dusky Dolphin, *Lagenorhynchus obscurus*
            - Hourglass Dolphin, *Lagenorhynchus cruciger*
            - Pacific White-Sided Dolphin, *Lagenorhynchus obliquidens*
            - Peale's Dolphin, *Lagenorhynchus australis*
            - White-Beaked Dolphin, *Lagenorhynchus albirostris*
        - Genus *Orcaella*
            - Australian Snubfin Dolphin, *Orcaella heinsohni*
            - Irrawaddy Dolphin, *Orcaella brevirostris*

        - Genus *Peponocephala*
            - Melon-headed Whale, *Peponocephala electra*
        - Genus *Orcinus*
            - Killer Whale (Orca), *Orcinus orca*
        - Genus *Feresa*
            - Pygmy Killer Whale, *Feresa attenuata*
        - Genus *Pseudorca*
            - False Killer Whale, *Pseudorca crassidens*
        - Genus *Globicephala*
            - Long-finned Pilot Whale, *Globicephala melas*
            - Short-finned Pilot Whale, *Globicephala macrorhynchus*
        - Genus †Australodelphis
            - †*Australodelphis mirus*
    - Family *Platanistidae*
        - Ganges and Indus River Dolphin, *Platanista gangetica* with two subspecies
            - Ganges River Dolphin (or Susu), *Platanista gangetica gangetica*
            - Indus River Dolphin (or Bhulan), *Platanista gangetica minor*
    - Family *Iniidae*
        - Amazon River Dolphin (or Boto), *Inia geoffrensis*
    - Family *Lipotidae*
        - Baiji (or Chinese River Dolphin), *Lipotes vexillifer* (possibly extinct, since December 2006)
    - Family *Pontoporiidae*
        - La Plata Dolphin (or Franciscana), *Pontoporia blainvillei*

Six species in the family Delphinidae are commonly called "whales", but genetically are dolphins. They are sometimes called *blackfish*.

- Melon-headed Whale, *Peponocephala electra*
- Killer Whale (Orca), *Orcinus orca*
- Pygmy Killer Whale, *Feresa attenuata*

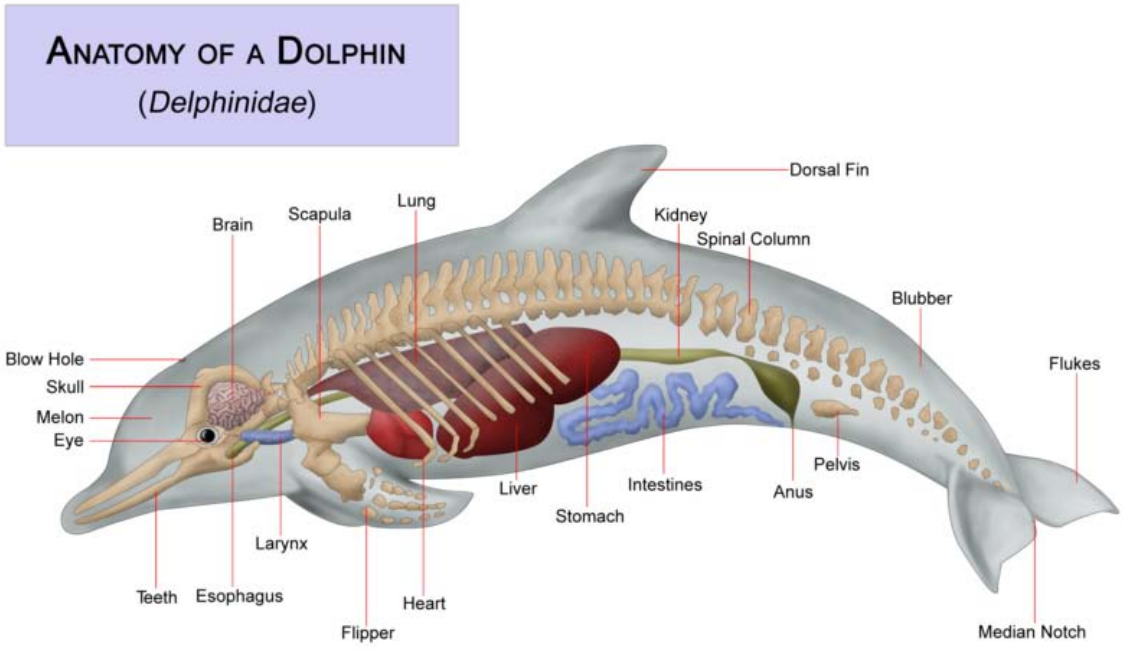
Wolphin Kawili'Kai at the Sea Life Park in Hawaii.

- False Killer Whale, *Pseudorca crassidens*
- Long-finned Pilot Whale, *Globicephala melas*
- Short-finned Pilot Whale, *Globicephala macrorhynchus*

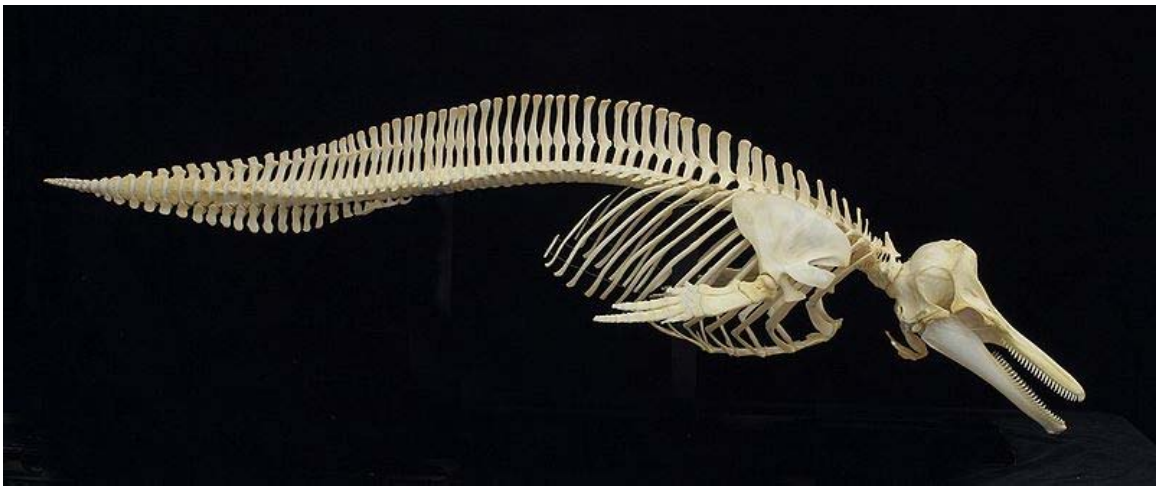
Hybridization

In 1933, three strange dolphins beached off the Irish coast; they appeared to be hybrids between Risso's and bottlenose dolphins. This mating was later repeated in captivity, producing a hybrid calf. In captivity, a bottlenose and a rough-toothed dolphin produced hybrid offspring. A common-bottlenose hybrid lives at SeaWorld California. Other dolphin hybrids live in captivity around the world or have been reported in the wild, such as a bottlenose-Atlantic spotted hybrid. The best known hybrid is the wolphin, a false killer whale-bottlenose dolphin hybrid. The wolphin is a fertile hybrid. Two wolphins currently live at the Sea Life Park in Hawaii; the first was born in 1985 from a male false killer whale and a female bottlenose. Wolphins have also been observed in the wild.

Evolution and anatomy



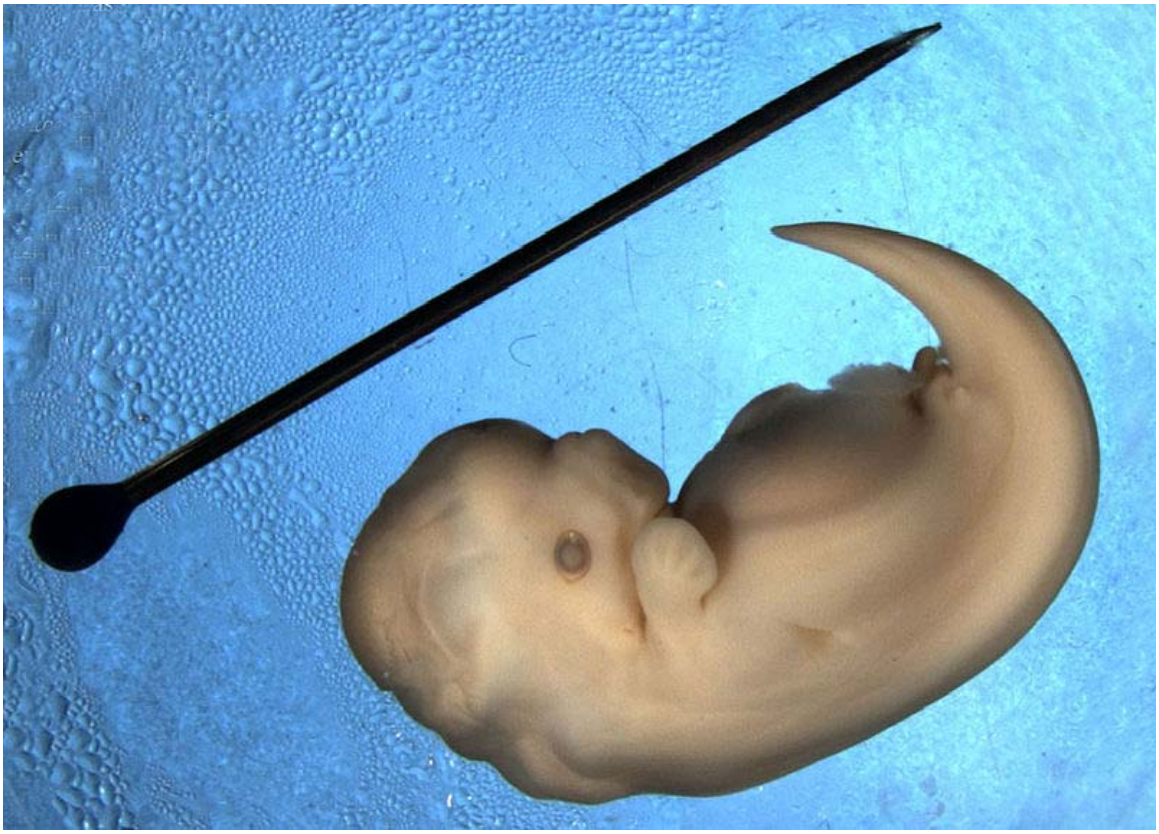
The anatomy of a dolphin, showing its skeleton, major organs, tail, and body shape



Pacific white-sided dolphin skeleton (missing pelvic bones), on exhibit at The Museum of Osteology, Oklahoma City, Oklahoma

Evolution

Dolphins, along with whales and porpoises, are descendants of terrestrial mammals, most likely of the Artiodactyl order. The ancestors of the modern day dolphins entered the water roughly fifty million years ago, in the Eocene epoch.



Hind limb buds are apparent on an embryo of a spotted dolphin in the fifth week of development as small bumps (hind limb buds) near the base of the tail. The pin is approximately 2.5 cm (1.0 in) long.

Modern dolphin skeletons have two small, rod-shaped pelvic bones thought to be vestigial hind limbs. In October 2006, an unusual bottlenose dolphin was captured in Japan; it had small fins on each side of its genital slit, which scientists believe to be a more pronounced development of these vestigial hind limbs.

Anatomy

Dolphins have a streamlined fusiform body, adapted for fast swimming. The tail fin, called the fluke, is used for propulsion, while the pectoral fins together with the entire tail section provide directional control. The dorsal fin, in those species that have one, provides stability while swimming.

Though it varies by species, basic coloration patterns are shades of grey, usually with a lighter underside, often with lines and patches of different hue and contrast.

The head contains the melon, a round organ used for echolocation. In many species, elongated jaws form a distinct beak; species such as the bottlenose have a curved mouth which looks like a fixed smile. Some species have up to 250 teeth. Dolphins breathe through a blowhole on top of their head. The trachea is anterior to the brain. The dolphin

brain is large and highly complex, and is different in structure from that of most land mammals.

Unlike most mammals, dolphins do not have hair, except for a few hairs around the tip of their rostrum which they lose shortly before or after birth. The only exception to this is the Boto river dolphin, which has persistent small hairs on the rostrum.

Dolphins' reproductive organs are located on the underside of the body. Males have two slits, one concealing the penis and one further behind for the anus. The female has one genital slit, housing the vagina and the anus. A mammary slit is positioned on either side of the female's genital slit.

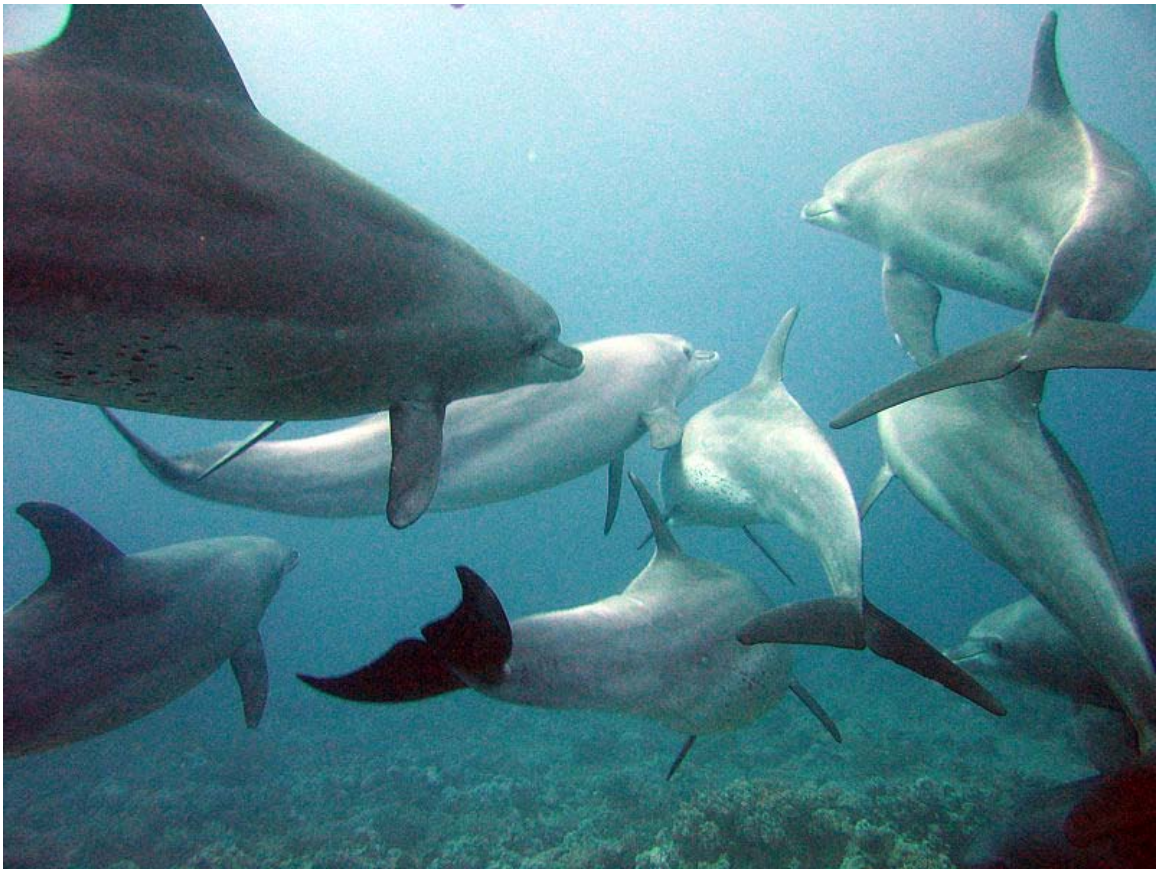
A recent study at the U.S. National Marine Mammal Foundation revealed dolphins are the only animals other than humans that develop a natural form of type 2 diabetes, which may lead to a better understanding of the disease and new treatments for both humans and dolphins.

Senses

Most dolphins have acute eyesight, both in and out of the water, and they can hear frequencies ten times or more above the upper limit of adult human hearing. Though they have a small ear opening on each side of their head, it is believed hearing underwater is also, if not exclusively, done with the lower jaw, which conducts sound to the middle ear via a fat-filled cavity in the lower jaw bone. Hearing is also used for echolocation, which all dolphins have. Dolphin teeth are believed to function as antennae to receive incoming sound and to pinpoint the exact location of an object. The dolphin's sense of touch is also well-developed, with free nerve endings densely packed in the skin, especially around the snout, pectoral fins and genital area. However, dolphins lack an olfactory nerve and lobes, and thus are believed to have no sense of smell. They do have a sense of taste and show preferences for certain kinds of fish. Since dolphins spend most of their time below the surface, tasting the water could function like smelling, in that substances in the water can signal the presence of objects that are not in the dolphin’s mouth.

Though most dolphins do not have hair, they do have hair follicles that may perform some sensory function. The small hairs on the rostrum of the Boto river dolphin are believed to function as a tactile sense possibly to compensate for the Boto's poor eyesight.

Behavior



A pod of Indo-Pacific bottlenose dolphins in the Red Sea.

Dolphins are often regarded as one of Earth's most intelligent animals, though it is hard to say just how intelligent. Comparing species' relative intelligence is complicated by differences in sensory apparatus, response modes, and nature of cognition. Furthermore, the difficulty and expense of experimental work with large aquatic animals has so far prevented some tests and limited sample size and rigor in others. Compared to many other species, however, dolphin behavior has been studied extensively, both in captivity and in the wild.

Social behavior

Dolphins surfing at Snapper Rocks, Queensland, Australia

Dolphins are social, living in pods of up to a dozen individuals. In places with a high abundance of food, pods can merge temporarily, forming a **superpod**; such groupings may exceed 1,000 dolphins. Individuals communicate using a variety of clicks, whistles and other vocalizations. They make ultrasonic sounds for echolocation. Membership in pods is not rigid; interchange is common. However, dolphins can establish strong social bonds; they will stay with injured or ill individuals, even helping them to breathe by bringing them to the surface if needed. This altruism does not appear to be limited to their own species however. The dolphin *Moko* in New Zealand has been observed guiding a female Pygmy Sperm Whale together with her calf out of shallow water where they had

stranded several times. They have also been seen protecting swimmers from sharks by swimming circles around the swimmers or charging the sharks to make them go away.

Dolphins also display culture, something long believed to be unique to humans (and possibly other primate species). In May 2005, a discovery in Australia found Indo-Pacific bottlenose dolphins (*Tursiops aduncus*) teaching their young to use tools. They cover their snouts with sponges to protect them while foraging. This knowledge is mostly transferred by mothers to daughters, unlike simian primates, where knowledge is generally passed on to both sexes. Using sponges as mouth protection is a learned behavior. Another learned behavior was discovered among river dolphins in Brazil, where some male dolphins use weeds and sticks as part of a sexual display.

Dolphins engage in acts of aggression towards each other. The older a male dolphin is, the more likely his body is to be covered with bite scars. Male dolphins engage in such acts of aggression apparently for the same reasons as humans: disputes between companions and competition for females. Acts of aggression can become so intense that targeted dolphins sometimes go into exile as a result of losing a fight.

Male bottlenose dolphins have been known to engage in infanticide. Dolphins have also been known to kill porpoises for reasons which are not fully understood, as porpoises generally do not share the same diet as dolphins, and are therefore not competitors for food supplies.

Reproduction and sexuality

Dolphin copulation happens belly to belly; though many species engage in lengthy foreplay, the actual act is usually brief, but may be repeated several times within a short timespan. The gestation period varies with species; for the small Tucuxi dolphin, this period is around 11 to 12 months, while for the orca, the gestation period is around 17 months. They usually become sexually active at a young age, even before reaching sexual maturity. The age of sexual maturity varies by species and gender.

Dolphins are known to have sex for reasons other than reproduction, sometimes also engaging in homosexual behavior. Various species sometimes engage in sexual behavior including copulation with other dolphin species. Sexual encounters may be violent, with male dolphins sometimes showing aggressive behavior towards both females and other males. Occasionally, dolphins behave sexually towards other animals, including humans.

Feeding

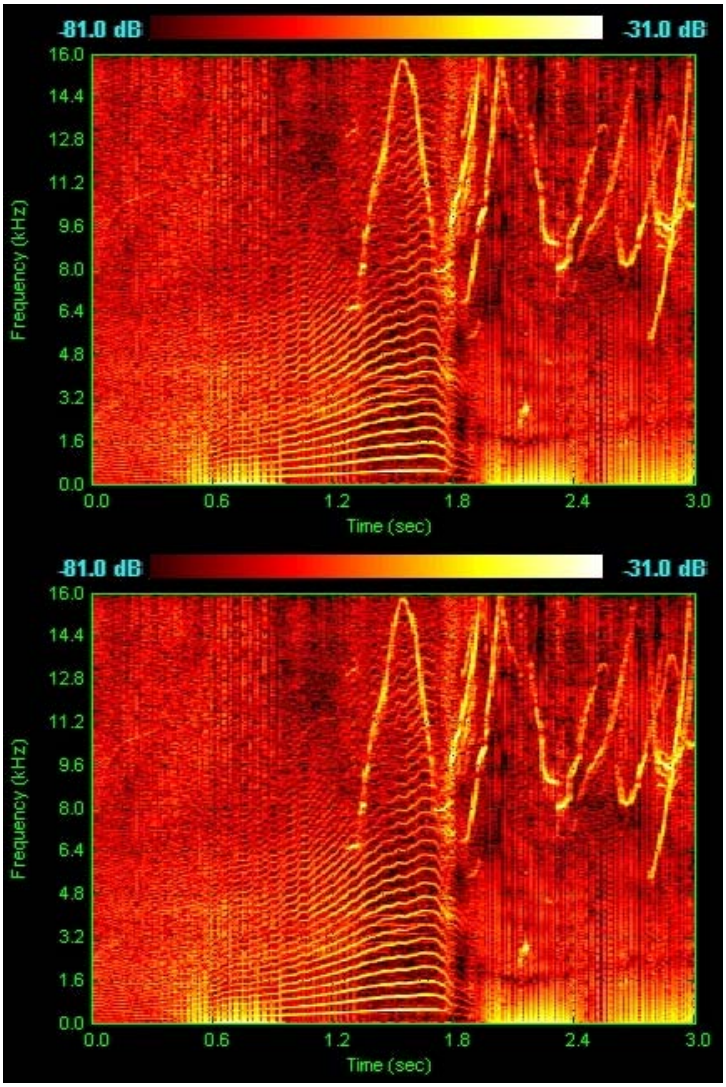
Various methods of feeding exist among and within species, some apparently exclusive to a single population. Fish and squid are the main food, but the false killer whale and the orca also feed on other marine mammals.

One common feeding method is herding, where a pod squeezes a school of fish into a small volume, known as a bait ball. Individual members then take turns plowing through

the ball, feeding on the stunned fish. Coralling is a method where dolphins chase fish into shallow water to more easily catch them. In South Carolina, the Atlantic bottlenose dolphin takes this further with "strand feeding", driving prey onto mud banks for easy access. In some places, orcas come to the beach to capture sea lions. Some species also whack fish with their flukes, stunning them and sometimes knocking them out of the water.

Reports of cooperative human-dolphin fishing date back to the ancient Roman author and natural philosopher Pliny the Elder. A modern human-dolphin partnership currently operates in Laguna, Santa Catarina, Brazil. Here, dolphins drive fish towards fishermen waiting along the shore and signal the men to cast their nets. The dolphins' reward is the fish that escape the nets.

Vocalizations



Spectrogram of dolphin vocalizations, with whistles, whines, and clicks are visible as upside down V's, horizontal striations, and vertical lines, respectively.

Dolphins are capable of making a broad range of sounds using nasal airsacs located just below the blowhole. Roughly three categories of sounds can be identified: frequency modulated whistles, burst-pulsed sounds and clicks. Dolphins communicate with their whistles and burst-pulsed sounds, though the nature and extent of that ability is not known. At least some dolphin species can identify themselves using a signature whistle. The clicks are directional and are for echolocation, often occurring in a short series called a click train. The click rate increases when approaching an object of interest. Dolphin echolocation clicks are amongst the loudest sounds made by marine animals.

Jumping and playing

Pacific white-sided dolphins breaching

Dolphins occasionally leap above the water surface, and sometimes perform acrobatic figures (e.g. the spinner dolphin). Scientists are not certain about the purpose(s) of the acrobatics. Possibilities include locating schools of fish by looking at above-water signs like feeding birds, communicating with other dolphins, dislodging parasites or simple amusement.

Play is an important part of dolphin culture. Dolphins play with seaweed and play-fight with other dolphins. At times they harass other local creatures, like seabirds and turtles. Dolphins enjoy riding waves and frequently surf coastal swells and the bow waves of boats, at times “leaping” between the dual bow waves of a moving catamaran. Occasionally, they playfully interact with swimmers. Captive dolphins have been observed in aquariums engaging in complex play behavior which involves the creation and manipulation of bubble rings.

Sleeping

Generally, dolphins sleep with only one brain hemisphere in slow-wave sleep at a time, thus maintaining enough consciousness to breathe and to watch for possible predators and other threats. Earlier sleep stages can occur simultaneously in both hemispheres. In captivity, dolphins seemingly enter a fully asleep state where both eyes are closed and there is no response to mild external stimuli. Respiration is automatic; a tail kick reflex keeps the blowhole above the water if necessary. Anesthetized dolphins initially show a tail kick reflex. Though a similar state has been observed with wild Sperm Whales, it is not known if dolphins in the wild reach this state. The Indus river dolphin has a different sleep method from other dolphin species. Living in water with strong currents and potentially dangerous floating debris, it must swim continuously to avoid injury. As a result, this species sleeps in very short bursts which last between 4 and 60 seconds.

Threats

Natural threats

Except for humans (discussed below), dolphins have few natural enemies. Some species or specific populations have none, making them apex predators. For most of the smaller species of dolphins, only a few of the larger sharks, such as the bull shark, dusky shark, tiger shark and great white shark are a potential risk, especially for calves. Some of the larger dolphinic species, especially orcas (killer whales), may also prey smaller dolphins, but this seems rare. Dolphins also suffer from a wide variety of diseases and parasites.

Human threats

Dead Atlantic white-sided dolphins in Hvalba on the Faroe Islands, killed in a drive hunt

Some dolphin species face an uncertain future, especially some river dolphin species such as the Amazon river dolphin, and the Ganges and Yangtze river dolphin, which are critically or seriously endangered. A 2006 survey found no individuals of the Yangtze river dolphin, which now appears to be functionally extinct.

Pesticides, heavy metals, plastics, and other industrial and agricultural pollutants that do not disintegrate rapidly in the environment concentrate in predators such as dolphins. Injuries or deaths due to collisions with boats, especially their propellers, are also common.

Various fishing methods, most notably purse seine fishing for tuna and the use of drift and gill nets, unintentionally kill many dolphins. Accidental by-catch in gill nets and incidental captures in antipredator nets that protect marine fish farms are common and pose a risk for mainly local dolphin populations. In some parts of the world, such as Taiji in Japan and the Faroe Islands, dolphins are traditionally considered as food, and are killed in harpoon or drive hunts. Dolphin meat is high in mercury, and may thus pose a health danger to humans when consumed.

Dolphin safe labels attempt to reassure consumers fish and other marine products have been caught in a dolphin-friendly way. The original deal with "Dolphin safe" labels was brokered in the 1980s between marine activists and the major tuna companies, and involved decreasing incidental dolphin kills by up to 50% by changing the type of nets being used to catch the tuna. It should be noted that the dolphins are only netted while fishermen are in pursuit of smaller tuna. Albacore are not netted this way, which makes albacore the only truly dolphin-safe tuna.

Loud underwater noises, such as those resulting from naval sonar use, live firing exercises, or certain offshore construction projects, such as wind farms, may be harmful to dolphins, increasing stress, damaging hearing, and causing decompression sickness by forcing them to surface too quickly to escape the noise.

Chapter- 5

Baleen Whale

Baleen whales Fossil range: latest Eocene – Recent	
	
Humpback Whale breaching	
Scientific classification	
Kingdom:	Animalia
Phylum:	Chordata
Class:	Mammalia
Order:	Cetacea
Suborder:	**Mysticeti** Cope, 1891

Baleen

The **baleen whales**, also called **whalebone whales** or **great whales**, form the **Mysticeti**, one of two suborders of the Cetacea (whales, dolphins, and porpoises). Baleen whales are characterized by having baleen plates for filtering food from water, rather than having teeth. This distinguishes them from the other suborder of cetaceans, the toothed whales or Odontoceti. Living Mysticeti species have teeth only during the embryonal phase. Fossil Mysticeti had teeth before baleen evolved.

The suborder contains four extant families and fifteen species.

Etymology

The taxonomic name *Mysticeti* apparently derives from a transmission error in early copies of Aristotle's *Historia Animalium* in which "*ο μυς το κητος*" ("the whale known as 'the mouse' or 'Gutter whale' ") was mistakenly run together as "*ο μυστικητος*" ("the Mysticetus"). An alternate name for the suborder is *Mystacoceti* (from Greek *μυσταξ* "moustache" + *κητος* "whale").

Anatomy

Baleen whales are generally larger than toothed whales, and females are bigger than males. This group includes the largest known animal species, the Blue Whale.

Humpback whale with two blowholes clearly visible

Baleen whales have two blowholes, causing a V-shaped blow.

Ecology and life history

Behavioral ecology

Solitary or in small groups called pods.

Breaching

In spite of their enormous size, baleen whales are able to leap completely out of the water. They can grow to 190,000 kilograms (420,000 lb) in weight and 33.5 metres (110 ft) in length. Particularly known for its acrobatics is the Humpback Whale, but other baleen whales also break through the water surface with their body or beat it loudly with their fins. Some believe that the male baleen whales try to show off in the presence of females to increase their mating success. Scientists speculate that baleen whales and other cetaceans may engage in breaching to dislodge parasites, or scratch irritated skin. Breaching, and other behaviors like lobtailing, are also used to stun or kill nearby fish or krill.

Importance to humans

From the 11th to the late 20th centuries, baleen whales were hunted commercially for their oil and baleen. Their oil was used to make margarine and cooking oils, whilst their baleen was used to stiffen corsets, as parasol ribs and to crease paper.

Evolutionary history

Parietobalaena palmeri (extinct) skull

Early baleen whales first appeared as far back as the early Oligocene, or perhaps the latest Eocene (39–29 million years ago; e.g., *Llanocetus*). Early baleen whales possessed teeth inherited from their ancestors, as opposed to baleen, in modern species. The Oligocene species *Aetiocetus cotylalveus* is considered the evolutionary link between toothed and baleen whales. This species was discovered by fossil collector Douglas Emlong in 1964 near Seal Rock State Recreation Site, Oregon, in a sandstone formation. In the early 1990s, the species *Janjucetus hunderi* was discovered in Victoria, Australia by a surfer and was described in 2006 by E. M. G. Fitzgerald. *Janjucetus* was a baleen whale with sharp teeth that hunted fish and squid as well as larger prey, potentially including sharks and dolphin-like cetaceans. These fossils hint that early baleen whales were predatory and eventually evolved into the gentler, toothless whales known today. A recent study identified palatal foramina (bony impressions of blood vessels that "feed" the baleen racks) in the palate of a toothed mysticete, *Aetiocetus weltoni*. The scientists involved indicated that this discovery implies that this whale previously possessed both teeth and baleen, and serves as an intermediate adaptive role between primitive toothed

mysticetes and more advanced toothless mysticetes. The first baleen-bearing, toothless baleen whales (such as *Eomysticetus* and *Micromysticetus*) appeared in the late Oligocene. Early baleen whales probably could not echolocate; no anatomical evidence preserved in the skulls and ear regions of any fossil baleen whales show any of the adaptations associated with echolocation as in toothed whales.

Taxonomic classification

The "†"'s denote extinct families and genera.

Suborder Mysticeti: Baleen whales

- Family †Aetiocetidae
  - † *Aetiocetus*
  - † *Ashorocetus*
  - † *Chonecetus*
  - † *Morawanocetus*
  - † *Willungacetus*
- Family †Aglaocetidae
  - † *Aglaocetus*
  - † *Isanacetus*
  - † *Pinocetus*
- Family Balaenidae: Right whales and Bowhead Whale
  - *Balaena* Bowhead whales
  - †*Balaenella*
  - †*Balaenotus*
  - †*Balaenula*
  - *Eubalaena*
  - *Eucetites*
  - †*Morenocetus*
- Family Balaenopteridae: Rorquals
  - †*Archaebalaenoptera*
  - *Balaenoptera*
  - †*Cetotheriophanes*
  - †*Diunatans*
  - †*Mauicetus*
  - *Megaptera*
  - †*Notiocetus*
  - †*Parabalaenoptera*
  - †*Plesiobalaenoptera*
  - †*Praemegaptera*
  - †*Protororqualus*
- †Family Cetotheriidae
  - †*Cephalotropis*
  - †*Cetotherium*
  - †*Herpetocetus*

    - †*Hibacetus*
    - †*Joumocetus*
    - †*Metopocetus*
    - †*Mixocetus*
    - †*Nannocetus*
    - †*Palaeobalaena*
    - †*Piscobalaena*
    - †*Plesiocetopsis*
    - †*Titanocetus*
- †Family Cetotheriopsidae
    - †*Cetotheriopsis*
    - †*Micromysticetus*
- †Family Diorocetidae
    - †*Amphicetus*
    - †*Diorocetus*
    - †*Plesiocetus*
    - †*Thinocetus*
    - †*Uranocetus*
- †Family Eomysticetidae
    - †*Eomysticetus*
- Family Eschrichtiidae
    - †*Archaeschrichtius*
    - †*Eschrichtioides*
    - *Eschrichtius* Grey whales
    - †*Gricetoides*
    - †*Megapteropsis*
- †Family Llanocetidae
    - †*Llanocetus*
- †Family Mammalodontidae
    - †*Janjucetus*
    - †*Mammalodon*
- Family Neobalaenidae: Pygmy Right Whale
    - *Caperea*, Pygmy Right Whale
- †Family Pelocetidae
    - †*Cophocetus*
    - †*Halicetus*
    - †*Parietobalaena*
    - †*Pelocetus*
    - †*Eobalaenoptera*
- Family *incertae sedis*
    - †*Amphitera*
    - †*Burtinopsis*
    - †*Idiocetus*
    - †*Imerocetus*
    - †*Isocetus*
    - †*Mesocetus*

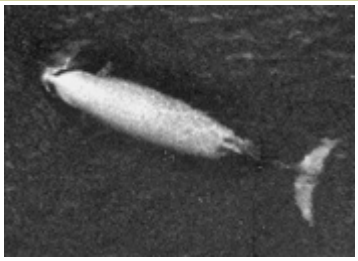
- †*Mioceta*
- †*Otradnocetus*
- †*Peripolocetus*
- †*Piscocetus*
- †*Siphonocetus*
- †*Tiphyocetus*
- †*Tretulias*
- †*Ulias*

The earliest-known baleen whale is *Llanocetus*, discovered on Seymour Island, Antarctica, by E.D. Mitchell in 1989. The species lived during the Latest Eocene/Earliest Miocene, about 35 mya.

Chapter- 6

Toothed Whales

Beaked whale

Beaked whale Fossil range: Miocene–Recent	
	
Ziphius cavirostris	
Scientific classification	
Kingdom:	Animalia
Phylum:	Chordata
Class:	Mammalia
Order:	Cetacea
Superfamily:	**Ziphioidea**
Family:	**Ziphiidae** Gray, 1850

Beaked whales are 21 species of toothed whales, members of the family *Ziphiidae* that are notable for their elongated snouts. They are the only marine mammals whose evolution is believed to have been shaped by a secondary sexual characteristic (the male's teeth). Beaked whales are the world's most extreme divers. They can dive for long periods—20 to 30 minutes is common, and 85 minute dives have been recorded—and to great depths: 1,899 metres (1,038 fathoms) and possibly more. To avoid getting decompression sickness—the potentially fatal build-up of nitrogen bubbles in body tissues—they must surface slowly.

Beaked whales are one of the least known groups of mammals because of their deep-sea habitat, mysterious habits, and apparent low abundance. Several species have yet to be formally described or named; others are known only from remains and have never been sighted alive. Only 3–4 of the 20-odd species are reasonably well-known. Baird's and Cuvier's Beaked Whales were subject to commercial exploitation, off the coast of Japan, while the Northern Bottlenose Whale was extensively hunted in the northern part of the North Atlantic late in the 19th and early in the 20th centuries.

Physical characteristics

Beaked whales are moderate in size, ranging from 4 to 13 metres (13 to 43 ft) and weighing from 1 to 15 tonnes (0.98 to 15 LT; 1.1 to 17 ST). Their key distinguishing feature is the presence of a 'beak', somewhat similar to many dolphins. Other distinctive features include a pair of converging grooves under the throat, and the absence of a notch in the tail fluke. Although Shepherd's Beaked Whale is an exception, most species have only one or two pairs of teeth, and even these do not erupt in females. Beaked whale species are often sexually dimorphic—one or the other sex is significantly larger. The adult males often possess a dramatically bulging forehead. However, aside from dentition and size, there are very few morphological differences between male and female beaked whales.

Individual species are very difficult to identify in the wild, since body form varies little from one species to another. The observer must rely on often subtle differences in size, color, forehead shape, and beak length.

Teeth

Beaked whales are unique among toothed whales in that most species only have one pair of teeth. Most species only have one pair of teeth in the lower jaw, and only males have this pair of tusk-like teeth. Males are presumed to use their teeth in combat for female reproductive rights. In females, the teeth do not develop and remain hidden in the gum tissues. This characteristic helps to distinguish beaked whale species from each other.

In December 2008, researchers from the Marine Mammal Institute at Oregon State University completed a DNA tree of all 21 known species of beaked whales. Among the results of this study was the conclusion that the male's teeth are actually a secondary sexual characteristic, similar to the antlers of male deer. Each species' teeth have a characteristically unique shape. Females are presumed to select mates based on the shape of the teeth, because the different species are otherwise quite similar in appearance. Females may also choose mates based on the size or shape of teeth or the scars they bear.

These teeth also play an important role in competing to control a harem. This is the only known instance of a secondary sexual characteristic having shaped the evolution of a marine mammal.

Taxonomy

Beaked whales comprise at least twenty species of small whale in the family **Ziphiidae**, which is one of the least-known families of large mammals: several species have been described only in the last two decades. Six genera have been identified.

The beaked whales are the second-largest family of Cetaceans (after the dolphins.) They were one of the first groups to diverge from the ancestral lineage. The earliest known beaked whale fossils date to the Miocene, about 20 million years ago.

- **ORDER CETACEA**
- **Suborder Odontoceti**: toothed whales
    - **Family Ziphiidae**
        - Subfamily Berardiinae
            - Genus †*Archaeoziphius*
            - Genus *Berardius*
                - *Berardius arnuxii*, Arnoux's beaked whale
                - *Berardius bairdii*, Baird's beaked whale
            - Genus †*Microberardius*
        - Subfamily Hyperoodontinae
            - Genus †*Africanacetus*
            - Genus *Hyperoodon*: Bottlenose whales
                - *Hyperoodon ampullatus*, Northern bottlenose whale
                - *Hyperoodon planifrons*, Southern bottlenose whale
            - Genus *Indopacetus*
                - *Indopacetus pacificus*, Longman's beaked whale
            - Genus *Mesoplodon*, Mesoplodont whales
                - *Mesoplodon bidens*, Sowerby's beaked whale
                - *Mesoplodon bowdoini*, Andrew's beaked whale
                - *Mesoplodon carlhubbsi*, Hubbs' beaked whale
                - *Mesoplodon densirostris*, Blainville's beaked whale
                - *Mesoplodon europaeus*, Gervais' beaked whale
                - *Mesoplodon ginkgodens*, Ginkgo-toothed beaked whale
                - *Mesoplodon grayi*, Gray's beaked whale
                - *Mesoplodon hectori*, Hector's beaked whale
                - *Mesoplodon layardii*, Strap-toothed whale
                - *Mesoplodon mirus*, True's beaked whale,
                - *Mesoplodon peruvianus*, pygmy beaked whale
                - *Mesoplodon perrini*, Perrin's beaked whale
                - *Mesoplodon stejnegeri*, Stejneger's beaked whale
                - *Mesoplodon traversii*, Spade toothed whale
        - Subfamily Ziphiinae
            - Genus †*Caviziphius*
            - Genus †*Izikoziphius*
            - Genus *Tasmacetus*

        - *Tasmacetus sheperdi*, Shepherd's beaked whale
    - Genus *Ziphius*
        - *Ziphius cavirostris*, Cuvier's beaked whale
- Subfamily *Incertae sedis*
    - Genus †*Nenga*
    - Genus †*Pterocetus*
    - Genus †*Xhosacetus*

Evolutionary history

As many as eight genera predate humans. Some included ancestors of giant beaked whales (*Berardius*), such as *Microberardius*. Cuvier's beaked whale (*Ziphius*) had many relatives, such as *Caviziphius*, *Archaeoziphius*, and *Izikoziphius*. They were probably preyed upon by predatory whales and sharks, including *Carcharocles megalodon*.

Recently, a large fossil ziphiid sample was discovered off of the South African coast, confirming that the extant ziphiid diversity might just be a remnant of a higher past diversity. After studying numerous fossil skulls off the shore of South Africa, researchers discovered the absence of functional maxillary teeth in all South African fossil ziphiids, which is evidence that suction feeding had already developed in several beaked whale lineages during the Miocene. Researchers also found fossil ziphiids with robust skulls, signaling that tusks were used for male-male interactions (speculated with extant beaked whales).

Ecology

Diving

Beaked whales are deep divers with extreme dive profiles They regularly dive deeper than 500 m to echolocate for food, and these deep dives are often followed by multiple shallower dives of less than 500 m. Based on currently available data, beaked whales are thought to spend much of their lives below water.

Deep diving mammals face a number of challenges related to extended breath holding and hydrostatic pressure. Cetaceans and pinnipeds that prolong apnea must optimize the size and use of their oxygen stores, and they must deal with the accumulation of lactic acid due to anaerobic metabolism. Beaked whales have several anatomical adaptations to deep diving: large spleens, livers, and body shape. Most cetaceans have small spleens. However, beaked whales have much larger spleens than delphinids and may have larger livers as well. These anatomical traits, which are important for filtering blood, could be adaptations to deep diving. Another notable anatomical adaptation among beaked whales is a slight depression in the body wall that allows a beaked whale to hold its pectoral flippers tightly against its body for increased streamlining.

The challenges of deep diving are also overcome by the unique diving physiology of beaked whales. Oxygen storage during dives is mostly achieved by blood hemoglobin

and muscle myoglobin. While the whale is diving, its heart rate slows and blood flow changes. This physiological dive response ensures that oxygen-sensitive tissues maintain a supply of oxygen, while those tissues that are tolerant to hypoxia receive less blood flow. Additionally, lung collapse obviates the exchange of lung gas with blood, likely minimizing the uptake of nitrogen by tissues.

Feeding

The throats of all beaked whales have a bilaterally paired set of grooves that are associated with their unique feeding mechanism, suction feeding. Instead of capturing prey with their teeth, beaked whales suck it into their oral cavity. Suction is aided by the throat grooves, which stretch and expand to accommodate food. Their tongue can move very freely. By suddenly retracting the tongue and distending the gular (throat) floor, pressure immediately drops within the mouth sucking the prey in with the water.

Dietary information is available from stomach contents analyses of stranded beaked whales and from whaling operations. Their preferred diet is primarily deep-water squid, but also benthic and benthopelagic fish and some crustaceans, mostly taken near the sea floor. In a recent study, gouge marks in the seafloor were interpreted to be a result of feeding activities by beaked whales.

In order to understand the hunting and foraging behavior of beaked whales, researchers utilized sound and orientation recording devices (DTAGs) on two species: Cuvier's beaked whale ("Ziphius cavirostris") and Blainville's beaked whale ("Mesoplodon densirostris"). These whales hunt by echolocation in deep water (where the majority of their prey is located) between approximately 200 and 1885 m and usually catch about 30 prey per dive. Cuvier's beaked whale must forage on average at 1070 m for 58 minutes and Blainville's beaked whales typically forage at 835 m deep for an average of 47 minutes.

Range and habitat

The family Ziphiidae is one of the most widespread families of cetaceans, ranging from the ice edges at both the north and south poles, to the equator in all the oceans. Specific ranges vary greatly by species; though beaked whales typically inhabit offshore waters that are at least 300 meters deep.

Beaked whales are known to congregate in deep waters off the edge of continental shelves, and bottom features like seamounts, canyons, escarpments, and oceanic islands including the Azores and the Canaries.

Life history

Very little is known about the life histories of beaked whales. The oldest beaked whale ever recorded was 84 years for a male Baird's beaked whale, and the oldest recorded female Baird's beaked whale is 54 years. For all other beaked whale species that have

been studied, the highest recorded age is between 27 and 39 years. Sexual maturity is reached between seven and 15 years of age in Baird's beaked whales and northern bottlenose whales. Gestation varies greatly between species, lasting 17 months for Baird's beaked whales and 12 months for the northern bottlenose whale. There is currently no data available on the reproductive rates of beaked whales.

It is difficult to determine group size of beaked whales, due to their inconspicuous surfacing behavior. Groups of beaked whales, defined as all individuals found in the same location at the same time, have been reported as ranging from 1 – 100 individuals. Nevertheless, some populations' group size has been estimated from repeated observations. For example, northern and southern bottlenose whales (*H. ampullatus* and *H. planifrons*), Cuvier's beaked whales and Blainville's beaked whales (*Mesoplodon densirostris*) have a reported maximum group size of 20 individuals, with the average ranging in size from 2.5 to 3.5 individuals. Berardius species and Longman's beaked whales (*Indopacetus pacificus*) are found in larger groups of up to 100 individuals.

There is not much information available about group composition of beaked whales. Only 3-4 species have been studied in any detail: northern bottlenose whales, Blainville's beaked whales, and Baird's beaked whales. Female northern bottlenose whales appear to form a loose network of social partners with no obvious long-term associations. In contrast to females, some male northern bottlenose whales have been repeatedly recorded together over several years and possibly form long-term associations. Studies of Blainville's beaked whales have revealed that groups usually consist of a number of females, calves and/or juvenile animals. These whales are assumed to live in "harem-like" groups, where several females and young are accompanied by a single male. Baird's beaked whales are known to occur in multi-male groups and in large groups, consisting of adult animals of both sexes.

Conservation

For many years most beaked whale species were insulated from anthropogenic impacts because of their remote habitat. However, there are now several issues of concern:

- Studies of stranded beaked whales show rising levels of toxic chemicals in their blubber.
- As a top predator beaked whales are, like raptors, particularly vulnerable to build-up of biocontaminants. They frequently ingest plastic bags (which do not break down and can be lethal).
- They more frequently become trapped in trawl nets, due to the expansion of deepwater fisheries.
- **Decompression sickness**:

A major conservation concern for beaked whales (family Ziphiidae) is that they appear to be vulnerable to modern sonar operations. This concern arises out of recent strandings that temporally and physically coincide with naval sonar exercises. Postmortem examinations of the stranded whales in concurrence with naval exercises have reported

the presence of hemorrhaging near the ears or gas and fat emboli, which could have a deleterious impact on beaked whales that is analogous to decompression sickness in humans. Gas and fat emboli have been shown cause nervous and cardiovascular system dysfunction, respiratory distress, pain, and disorientation in both humans and animals. In the inner ear, gas embolism can cause hemorrhages, leading to disorientation or vestibular dysfunction.

Breath-hold divers, like beaked whales, can develop decompression-related problems (the "bends") when they return to the surface after deep dives. This is a possible hypothesis for the mass strandings of pelagic beaked whales associated with sonar-related activities. To illustrate, a diving beaked whale may be surfacing from a deep dive and must pass vertically through varying received sound levels. Since the whale has limited remaining oxygen supplies at the end of a long dive, it probably has limited abilities to display any normal sound avoidance behavior. Instead, the whale must continue to swim towards the surface in order to replenish its oxygen stores. Avoiding sonar inevitably requires a change in behavior or surfacing pattern. Therefore, sonar in close proximity to groups of beaked whales has the potential to cause hemorrhaging or to disorient the animal, eventually leading to a stranding.

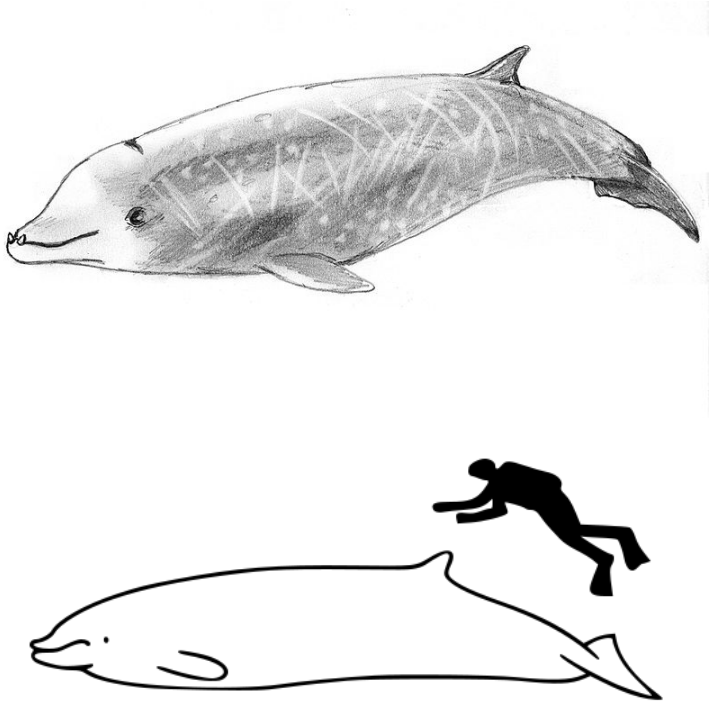
Current research reveals that two species of beaked whales are most affected by sonar: Cuvier's beaked whales (*Ziphius cavirostris*) and Blainville's (*Mesoplodon densirostris*) beaked whales. These animals have been reported as stranding in correlation with military exercises in Greece, the Bahamas, Madeira, and the Canary Islands. The livers of these animals had the most damage.

Though some evidence indicates that sonar-related activities can actually lead to a form of decompression sickness in beaked whales, the topic is still up for debate. A significant limiting factor in determining the likelihood of bubble formation in whale tissues and the risk of decompression sickness is the lack of information on the normal diving patterns and surfacing patterns of beaked whales. More research is necessary to determine the extent of whale tissue damage caused by sonar exercises.

Four species are classified by the IUCN as "lower risk, conservation dependent": Arnoux's and Baird's Beaked Whales, and the Northern and Southern Bottlenose Whales. The status of the remaining species is unknown, preventing classification.

Cuvier's beaked whale

Cuvier's beaked whale



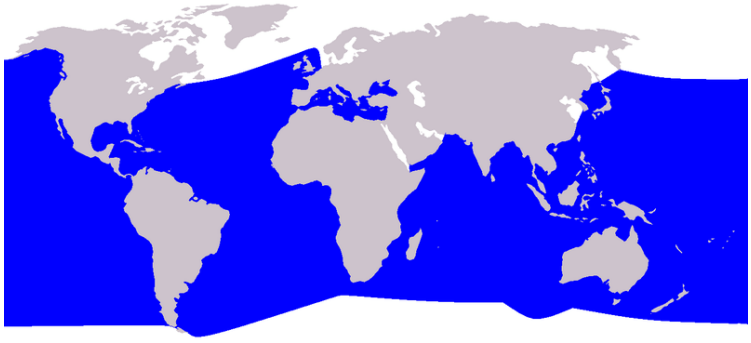
Size comparison against an average human

Conservation status

Least Concern (IUCN 3.1)

Scientific classification	
Kingdom:	Animalia
Phylum:	Chordata
Class:	Mammalia
Order:	Cetacea
Family:	Ziphiidae
Subfamily:	Ziphiinae
Genus:	***Ziphius*** G. Cuvier, 1823

Binomial name
Ziphius cavirostris



Cuvier's Beaked Whale range

Cuvier's Beaked Whale (*Ziphius cavirostris*) is the most widely distributed of all the beaked whales. It is the only member of the genus ***Ziphius***. Another common name for the species is **Goose-beaked Whale** on account of the fact that its head is said to be shaped like the beak of a goose. Georges Cuvier first described it in 1823 from part of a skull found in France in 1804.

Physical description

Cuvier's Beaked Whale has a short beak in comparison with other species in its family, with a slightly bulbous melon. The melon is white or creamy in color and a white strip runs back to the dorsal fin about two-thirds of the way along the back. The rest of the body color varies by individual: some are dark grey; others a reddish-brown. Individuals commonly have white scars and patches caused by cookiecutter sharks. The dorsal fin varies in shape from triangular to highly falcate. The fluke of the whale is about one-quarter the body length. The whale grows up to about 7 meters (23 ft) in length and weighs 2–3 tonnes (2.0–3.0 LT; 2.2–3.3 ST). They live for forty years.

The Cuvier's Beaked Whale is difficult to distinguish from many of the mesoplodont whales at sea.

Range and habitat

Their range is known mainly from strandings. It is widespread across the Atlantic, Pacific and Indian Oceans. Individuals have been found as far north as the Shetland Islands and as far south as Tierra del Fuego. Deep waters are preferred in anything from cool to tropical habitats.

Because of identification difficulties, the global population is unknown.

Conservation

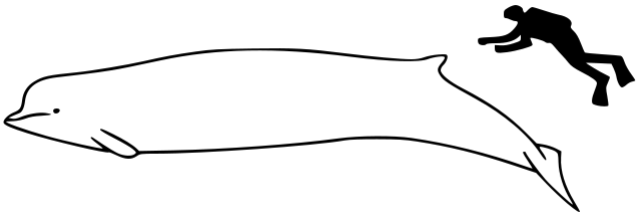
Japanese whalers in the past opportunistically killed Cuvier's. As with many other cetacean species many individuals are believed to be killed each year by gillnets.

Beaked Whales may also be sensitive to noise. A higher incidence of strandings has been recorded in noisy seas such as the Mediterranean. Multiple mass strandings (beachings) have occurred following operations by the Spanish Navy.

Bottlenose whale

Bottlenose whale

Size comparison of a Northern Bottlenose Whale against an average human



Size comparison of a Southern Bottlenose Whale against an average human

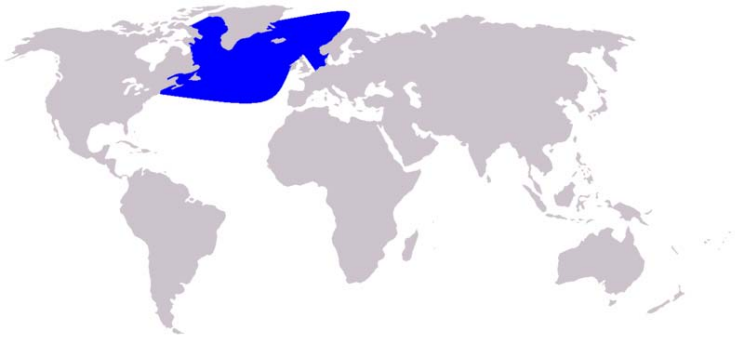
Conservation status

Least Concern (IUCN 3.1)

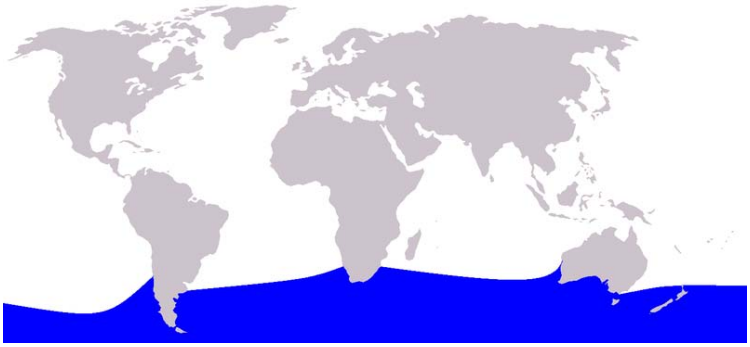
Scientific classification	
Kingdom:	Animalia
Phylum:	Chordata
Class:	Mammalia
Order:	Cetacea
Family:	Ziphiidae
Subfamily:	Hyperoodontinae
Genus:	***Hyperoodon*** Lacépède, 1804

Species

- ***Hyperoodon planifrons*** (Forster, 1770)
- ***Hyperoodon ampullatus*** (Flower, 1882)



Northern Bottlenose Whale (*Hyperoodon ampullatus*) range



Southern Bottlenose Whale (*Hyperoodon planifrons*) range

A **bottlenose whale** is either of two species of whale, members of the ziphiid family. The two species—the **northern bottlenose whale** *Hyperoodon ampullatus* and the **southern bottlenose whale** *Hyperoodon planifrons*—are the sole members of the ***Hyperoodon*** genus. Whilst they are physically similar their stories over the past two hundred years are rather different. The southern bottlenose has been rarely observed, was seldom hunted, and is probably the most abundant whale in Antarctic waters. The northern species on the other hand was hunted heavily by Norway and Britain in the 19th and early 20th centuries.

Physical description

The two species are fairly rotund and measure 8–10 metres (26–33 ft) in length when adult. The melon is extremely bluff. The beak is long and white on males but grey on females. The dorsal fin is relatively small at 30–38 centimetres (12–15 in) and set behind the middle of the back. It is falcate (sickle-shaped) and usually tipped. The back is mid-to-dark grey in the Northern species and light-to-mid grey in the Southern. Both species have a lighter underside.

Weight estimates are hard to come by. For the northern bottlenose whale, 5,800–7,500 kilograms (13,000–17,000 lb) is given somewhat consistently. For the southern bottlenose whale, there is a single figure of 6–8 tonnes.

Population and distribution

The northern bottlenose whale is endemic to the North Atlantic Ocean and is found in cool and subarctic waters such as the Davis Strait, the Labrador Sea, the Greenland Sea and the Barents Sea. They prefer deep water. The total population is unknown but likely to be of the order of 10,000. "The Gully", a huge submarine canyon east of Nova Scotia, has a year-round population of around 160 whales.

The southern bottlenose whale has a circumpolar distribution in the Southern Ocean. It is found as far south as the Antarctic coast and as north as the tip of South Africa, New Zealand's North Island and the southern parts of Brazil. The global population is unknown.

Sightings of apparent bottlenose whales in tropical and subtropical waters probably belong to a poorly known species, Longman's beaked whale. The relationship of that species to other beaked whales has not been established.

There are many ways to tell the difference of males and females besides checking the underside. The males are normally a dark grey or black, and the females and calves are a white or very light gray.

On 20 January 2006, a northern bottlenose whale was spotted in Central London in the River Thames. The River Thames whale reached as far up river as Albert Bridge. It was moved onto a barge and rescuers hoped to take it out to sea, but it died following a convulsion on 21 January during its rescue. Its skeleton is now in the Natural History Museum in London.

The northern bottlenose whale, stranding in Nes, Hvalba 24 August 2009

Conservation

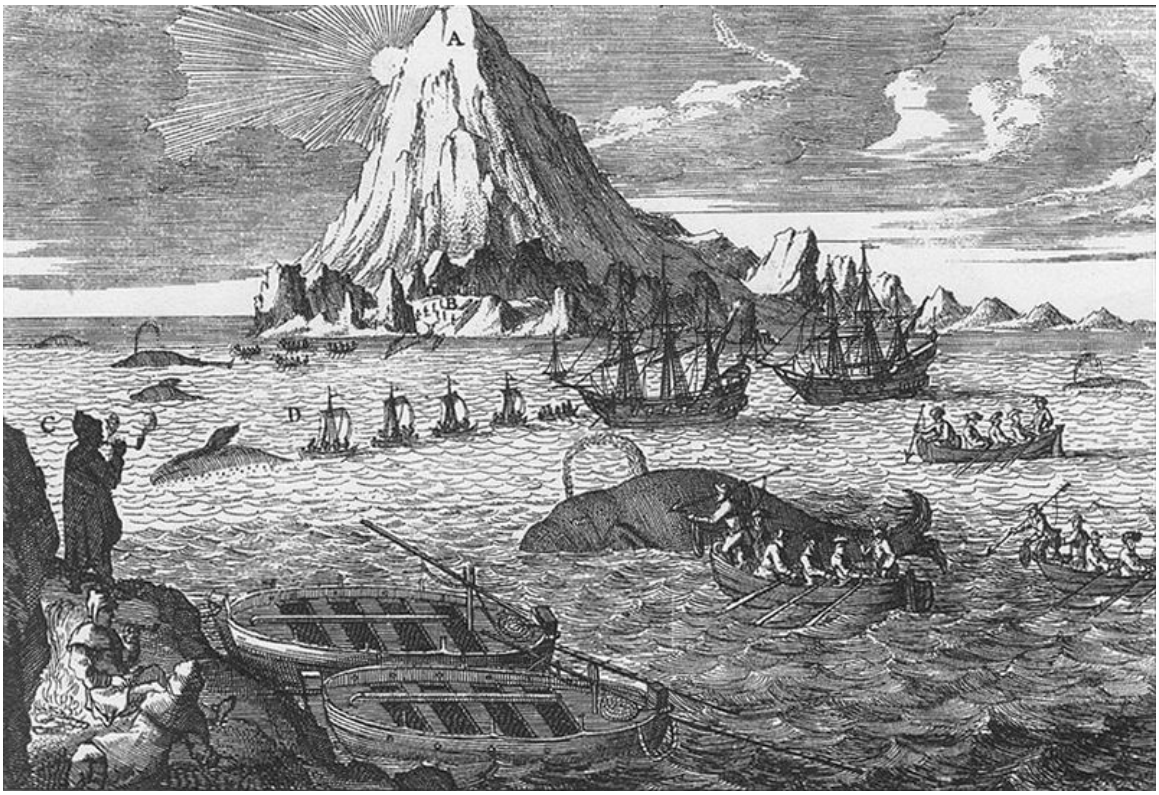
Prior to the beginning of whaling of northern bottlenoses it is estimated that there were 40,000–50,000 individuals in the North Atlantic. Between 1850 and 1973 88,000 individuals were caught, primarily by Norwegian and British whalers. The population is very likely to be much reduced compared to pre-whaling figures. Since whaling ended the primary concern to conservationists is the number of oil and gas developments around the Gully.

Norway stopped hunting the whale in 1973 but northern bottlenose whales are still hunted in the Faroe Islands, especially in the villages of Hvalba and Sandvík on Suðuroy.

The southern bottlenose whale is not believed to be threatened by human actions. The species has seldom been hunted. Forty-two were caught in the Antarctic by Soviet whalers between 1970 and 1982.

Chapter- 7

Whaling



Eighteenth century engraving showing Dutch whalers hunting bowhead whales in the Arctic

Engraving by J. H. Clark of the harpooning of a whale (c.1814)

Whaling is the hunting of whales. As technology increased and demand for the seemingly vast resources remained high, catches far exceeded the sustainable limit for whale stocks. In the late 1930s more than 50,000 whales were killed annually and by the middle of the century whale stocks were not being replenished. In 1986 the International Whaling Commission (IWC) banned commercial whaling so that stocks might recover.

While the moratorium has been successful in averting the extinction of whale species due to overhunting, contemporary whaling is subject to intense debate. Pro-whaling countries wish to lift the ban on stocks that they believe have recovered sufficiently to sustain limited hunting. Anti-whaling countries and environmental groups contend that those stocks remain vulnerable and that whaling is immoral and should remain banned.

History of whaling

Whaling began in prehistoric times and was initially confined to (near) coastal waters. Early whaling affected the development of widely disparate cultures—for example, in Norway and Japan. Although prehistoric hunting and gathering is generally considered to have had little ecological impact, early whaling in the Arctic may have altered freshwater ecology. The development of modern whaling techniques was spurred in the 19th century by the increase in demand for whale oil, sometimes known as "train oil" and in the 20th century by a demand for margarine and later meat.

A modern whaling vessel

Modern whaling

Whale oil is little used today and modern commercial whaling is done for food. The primary species hunted are the common minke whale and Antarctic minke whale, two of the smallest species of baleen whales. Recent scientific surveys estimate a population of 103,000 in the northeast Atlantic. With respect to the populations of Antarctic minke whales, as of January 2010, the IWC states that it is "unable to provide reliable estimates at the present time" and that a "major review is underway by the Scientific Committee."

International cooperation on whaling regulation began in 1931 and culminated in the signing of the International Convention for the Regulation of Whaling (ICRW) in 1946. Its aim is to:

> provide for the proper conservation of whale stocks and thus make possible the commercial whaling and the orderly development of the whaling industry.

The International Whaling Commission (IWC) was set up under the ICRW to decide hunting quotas and other relevant matters based on the findings of its Scientific Committee. Non-member countries are not bound by its regulations and conduct their own management programs.

The IWC voted on July 23, 1982, to establish a moratorium on commercial whaling beginning in the 1985–86 season. Since 1992, the IWC's Scientific Committee has

requested that it be allowed to give quota proposals for some whale stocks, but this has so far been refused by the Plenary Committee.

Canada

Canadian whaling is carried out in small numbers by various Inuit groups around the country and is managed by Fisheries and Oceans Canada. Harvested meat is sold through shops and supermarkets in northern communities where whale meat is a component of the traditional diet, but typically not in southern cities such as Vancouver, Toronto, or Montreal. The Whale and Dolphin Conservation Society says:

> Canada has pursued a policy of marine mammal management which appears to be more to do with political expediency rather than conservation.

While Canada left the IWC in 1982, the only species currently harvested by the Canadian Inuit that is covered by the IWC is the bowhead whale. As of 2004, the limit on bowhead whale hunting allows for the hunt of one whale every two years from the Hudson Bay-Foxe Basin population, and one whale every 13 years from the Baffin Bay-Davis Strait population. This is roughly one fiftieth of the bowhead whale harvest limits in Alaska.

Killed pilot whales on the beach in Hvalba, Faroe Islands

Faroe Islands

Around 950 long-finned pilot whales (*Globicephala melaena*, actually a species of dolphin) are slayed annually, mainly during the summer. Occasionally, other species are hunted as well, such as the northern bottlenose whale and Atlantic white-sided dolphin. The hunt is known as the Grindadráp.

Faroese whaling is regulated by Faroese authorities but not by the IWC, which does not regulate the catching of small cetaceans.

Most Faroese consider the hunt an important part of their culture and history and arguments about the topic raise strong emotions. Animal-rights groups criticize the hunt as being cruel and unnecessary. Hunters claim that most journalists lack knowledge of the catch methods used to capture and kill the whales or of the hunt's economic significance.

Greenland

Greenlandic Inuit whalers catch around 175 whales per year, making them the third largest hunt in the world after Norway and Japan, though their take is small compared to Japan's or Norway's, who averaged around 590 and 730 whales in 1998-2007.. March 2010 The IWC treats the west and east coasts of Greenland as two separate population areas and sets separate quotas for each coast. The far more densely populated west coast accounts for over 90 percent of the catch. In a typical year around 150 minke and 10 fin whales are taken from west coast waters and around 10 minkes are from east coast waters. In April 2009 Greenland landed its first bowhead whale in nearly forty years after being given a quota by the IWC in 2008 for two whales a year until 2012.

Icelandic whaling vessels

Minke whale meat kebabs, Reykjavik

Iceland

Iceland did not object to the 1986 IWC moratorium. Between 1986 and 1989 around 60 animals per year were taken under a scientific permit. However, under strong pressure from anti-whaling countries, who viewed scientific whaling as a circumvention of the moratorium, Iceland ceased whaling in 1989. Following the IWC's 1991 refusal to accept its Scientific Committee's recommendation to allow sustainable commercial whaling, Iceland left the IWC in 1992.

Iceland rejoined the IWC in 2002 with a reservation to the moratorium. Iceland presented a feasibility study to the 2003 IWC meeting for catches in 2003 and 2004. The primary aim of the study was to deepen the understanding of fish–whale interactions. Amid disagreement within the IWC Scientific Committee about the value of the research and its relevance to IWC objectives, no decision on the proposal was reached. However, under the terms of the convention the Icelandic government issued permits for a scientific catch. In 2003 Iceland resumed scientific whaling which continued in 2004 and 2005.

Iceland resumed commercial whaling in 2006. Its annual quota is 30 minke whales (out of an estimated 174,000 animals in the central and north-eastern North Atlantic) and nine

fin whales (out of an estimated 30,000 animals in the central and north-eastern North Atlantic).

Indonesia

Lamalera, on the south coast of the island of Lembata, and Lamakera on neighbouring Solor are the two remaining Indonesian whaling communities. The hunters obey religious taboos that ensure that they use every part of the animal. About half of the catch is kept in the village; the rest is bartered in local markets. In 1973, the UN's Food and Agriculture Organization (FAO) sent a whaling ship and a Norwegian whaler to modernize their hunt. This effort lasted three years, and was not successful. According to the FAO report, the Lamalerans "have evolved a method of whaling which suits their natural resources, cultural tenets and style."

Japan

When the commercial whaling moratorium was introduced by the IWC in 1982, Japan lodged an official objection. However, in response to US threats to cut Japan's fishing quota in US territorial waters under the terms of the Packwood-Magnuson Amendment, Japan withdrew its objection in 1987. However, according to the BBC, America went back on this promise, effectively destroying the deal. Since Japan could not resume commercial whaling, it began whaling on a scientific-research basis. Australia, Greenpeace, the Sea Shepherd Conservation Society and other groups dispute the Japanese claim of research "as a disguise for commercial whaling, which is banned."

The stated purpose of the research program is to establish the size and dynamics of whale populations. The Japanese government wishes to resume whaling in a sustainable manner under the oversight of the IWC, both for whale products (meat etc.) and to help preserve fishing resources by culling whales. Anti-whaling organizations claim that the research program is a front for commercial whaling, that the sample size is needlessly large and that equivalent information can be obtained by non-lethal means, for example by studying samples of whale tissue (such as skin) or faeces. The Japanese government sponsored Institute of Cetacean Research (ICR), which conducts the research, disagrees, stating that the information obtainable from tissue and/or faeces samples is insufficient and that the sample size is necessary in order to be representative.

Japan's scientific whaling program is controversial in anti-whaling countries. Countries opposed to whaling have passed non-binding resolutions in the IWC urging Japan to stop the program. Japan claims that whale stocks for some species are sufficiently large to sustain commercial hunting and blame filibustering by the anti-whaling side for the continuation of scientific whaling. Deputy whaling commissioner, Joji Morishita, told BBC News:

The reason for the moratorium [on commercial whaling] was scientific uncertainty about the number of whales. ... It was a moratorium for the sake of collecting data and that is why we started scientific whaling. We were asked to collect more data.

Japanese narrative screen showing a whale hunt off Wakayama

Norway

Norway registered an objection to the International Whaling Commission moratorium and is thus not bound by it. Commercial whaling ceased for a five year period to allow a small scientific catch for gauging the stock's sustainability and resumed 1993. Minke whales are the only legally hunted species. Catches have fluctuated between 487 animals in 2000 to 592 in 2007. The catch is made solely from the Northeast Atlantic minke whale population, which is estimated at 102,000.

Boy in Bequia in the Grenadines carrying meat of a humpback whale (2007)

A traditional whaling crew in Alaska

Russia

Russia had a significant whaling hunt of orcas along with Iceland and Japan. In 1970 a study published by Bigg M.A. following photographic recognition of orcas found a significant difference in the suspected ages of whale populations and their actual ages. Following this evidence, the Russians continued a scientific whale hunt, though the verisimilitude of the intentions of the hunt over the last 40 years are questioned. Currently Russians in Chukotka Autonomous Okrug in the Russian Far East are permitted under IWC regulation to take up to 140 gray whales from the North-East Pacific population each year.

Saint Vincent and the Grenadines

Natives of Saint Vincent and the Grenadines on the island of Bequia have a quota from the International Whaling Commission of up to four humpback whales per year using traditional hunting methods and equipment.

United States

In the United States, whaling is carried out by nine different indigenous Alaskan communities. The whaling program is managed by the Alaska Eskimo Whaling Commission which reports to the National Oceanic and Atmospheric Administration. The hunt takes around 50 bowhead whales a year from a population of about 10,500 in Alaskan waters. Conservationists fear this hunt is not sustainable, though the IWC Scientific Committee, the same group that provided the above population estimate, projects a population growth of 3.2% per year. The hunt also took an average of one or two gray whales each year until 1996. The quota was reduced to zero in that year due to sustainability concerns. A future review may result in the gray whale hunt being resumed. Bowhead whales weigh approximately 5-10 times as much as minke whales.

The Makah tribe in Washington State also reinstated whaling in 1999, despite protests from animal rights groups. They are currently seeking to resume whaling of the gray whale, a right recognized in the Treaty of Neah Bay.

Season	Catch
2003	48
2004	43
2005	68
2006	39
2007	63

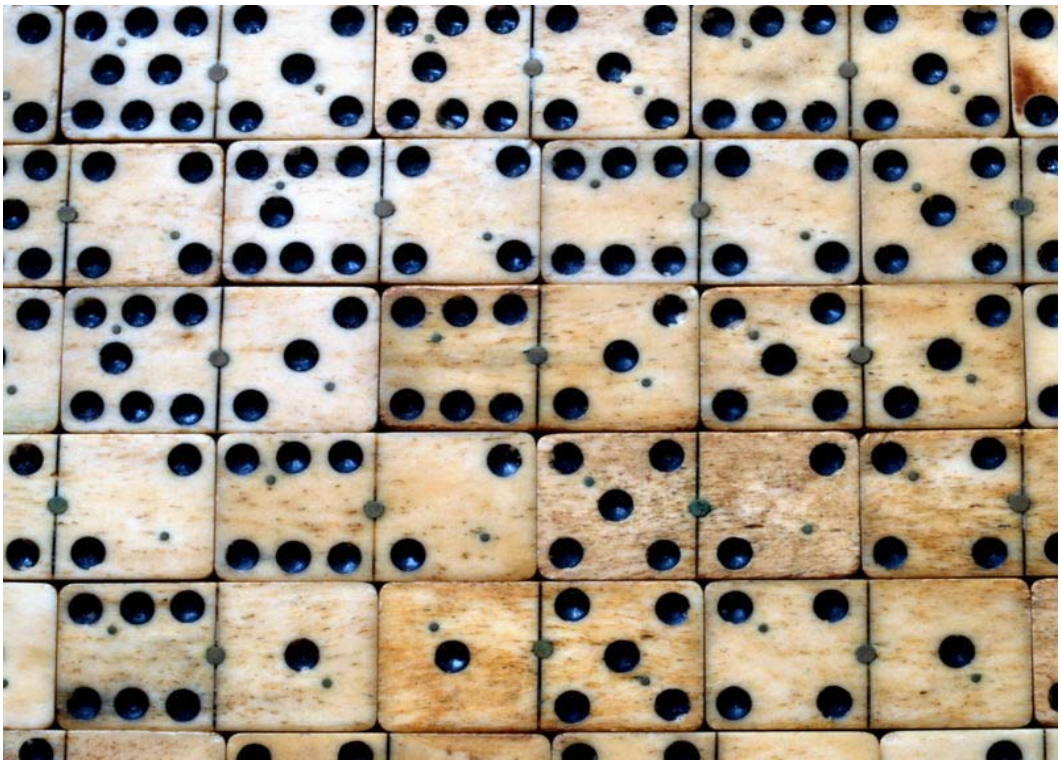
All catches in 2003–2007 were Bowhead whales.

Threats

The World Wide Fund for Nature says that 90% of all northern right whales killed are from ship collision, calling for restrictions on the movement of shipping in certain areas. By-catch also kills more animals than hunting. Some scientists believe pollution to be a factor. Moreover, since the IWC moratorium, there have been several instances of illegal whale hunting by IWC nations. In 1994, the IWC reported evidence from genetic testing of whale meat and blubber for sale on the open market in Japan in 1993. In addition to the legally-permitted minke whale, the analyses showed that the 10-25% tissues sample came from non minke, baleen whales, neither of which were then allowed under IWC rules. Further research in 1995 and 1996 shows significant drop of non-minke baleen whales sample to 2.5%. In a separate paper, Baker stated that "many of these animals certainly represent a bycatch (incidental entrapment in fishing gear)" and stated that DNA monitoring of whale meat is required to adequately track whale products.

It was revealed in 1994 that the Soviet Union had been systematically undercounting its catch. For example, from 1948 to 1973, the Soviet Union caught 48,477 humpback whales rather than the 2,710 it officially reported to the IWC. On the basis of this new information, the IWC stated that it would have to rewrite its catch figures for the last forty years. According to Ray Gambell, then Secretary of the IWC, the organization had

raised its suspicions with the former Soviet Union, but it did not take further action because it could not interfere with national sovereignty.



Dominoes made from whale bones

Controversy

Key elements of the debate over whaling include sustainability, ownership, national sovereignty, cetacean intelligence, suffering during hunting, the value of lethal sampling to establish catch quotas, the value of controlling whales' impact on fish stocks and the rapidly approaching extinction of a few whale species.

2010 IWC meeting

At the 2010 meeting of the International Whaling Commission in Morocco, representatives of the 88 member nations discussed whether or not to lift the 24 year ban on commercial whaling. Japan, Norway and Iceland have urged the organization to lift the ban. A coalition of anti-whaling nations has offered a compromise plan that would allow these countries to continue whaling, but with smaller catches and under close supervision. Their plan would also completely ban whaling in the Southern Ocean. More than 200 scientists and experts have opposed the compromise proposal for lifting the ban, and have also opposed allowing whaling in the Southern Ocean, which was declared a whale sanctuary in 1994. Opponents of the compromise plan want to see an end to all commercial whaling, but are willing to allow subsistence-level catches by indigenous peoples.

Chapter- 8

Different Types of Whales and Dolphins

Killer whales of Eden, Australia

The killer whale known as Old Tom swims alongside a whaling boat, flanking a whale calf. The boat is being towed by a harpooned whale (not visible here).

The **killer whales of Eden, Australia** were a group of killer whales (*Orcinus orca*) known for their co-operation with human hunters of other whale species. They were seen near the port of Eden in southeastern Australia between 1840 and 1930. A pod of killer whales, which included amongst its members a distinctive male called Old Tom, would assist whalers in hunting baleen whales. The killer whales would find target whales, shepherd them into Twofold Bay, and then alert the whalers to their presence and often help to kill the whales.

Old Tom's role was commonly to alert the human whalers to the presence of a baleen whale in the bay by breaching or tailslapping at the mouth of the Kiah River, where the Davidson family had their tiny cottages. This role endeared him to the whalers and led to the idea that he was “leader of the pack,” although such a role was more likely taken by a female (as is typical among killer whales), probably the whale known as Stranger. After

the harpooning, some of the killer whales would even grab the ropes in their teeth and aid the whalers in hauling. The skeleton of Old Tom is on display at the Eden Killer Whale Museum, and significant wear marks still exist on his teeth from repeatedly grabbing fast-moving ropes. In return for their help, the whalers allowed the killer whales to eat the tongue and lips of the whale before hauling it ashore, providing a rare example of mutualism between humans and killer whales. The killer whales would then also feed on the many fish and birds that would show up to pick at the smaller scraps and runoff from the fishing.

Many of the Eden killer whales were individually known and named, often after whalers who had died. Some of best known killer whales included Tom (who died 15 September 1930), Hooky, Humpy (died 1926/7), Cooper, Typee (died 1901), Jackson, Stranger, Big Ben, Young Ben, Kinscher (female), Jimmy, Sharkey, Charlie Adgery, Brierly, Albert, Youngster, Walker, Big Jack, Little Jack, Skinner and Montague.

The unique behaviour of killer whales in the area was recorded in the 1840s by whaling overseer Sir Oswald Brierly in his extensive diaries. It was recorded in numerous publications over the period and witnesses included Australian members of Parliament. The behaviour was recorded on movie film in 1910 by C.B. Jenkins and C.E. Wellings and publicly projected in Sydney, although the film is now missing and believed to have been destroyed/damaged in the 1930s when bank vaults in Sydney, where they were kept, were flooded.

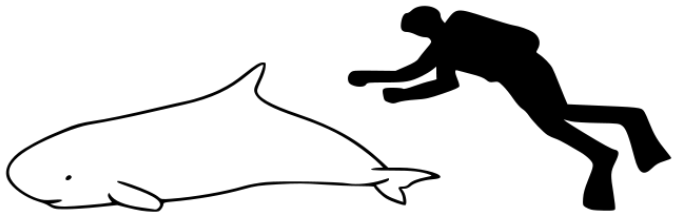
The story of the Davidson family and the killer whales was dramatised by Tom Mead in the book Killers of Eden.

In 2005, the Australia Broadcasting Corporation produced a documentary, *Killers of Eden*, based on the book of the same name. The documentary featured numerous period photographs taken by C.E. Wellings and W.T. Hall of the phenomenon and also featured interviews with elderly eyewitnesses.

While co-operative hunting between humans and wild cetaceans in other parts of the world, the relationship between whalers and killer whales in Eden appears to be unique, despite the widespread co-occurrence of whalers and killer whales elsewhere. It seems likely that the origin of this co-operative relationship stems from the beliefs of the Nullica people, who formed a significant part of the whaling workforce and who had formed a strong spiritual relationship with the killers whales before the advent of European whaling.

Dwarf sperm whale

Dwarf Sperm Whale



Size comparison against an average human

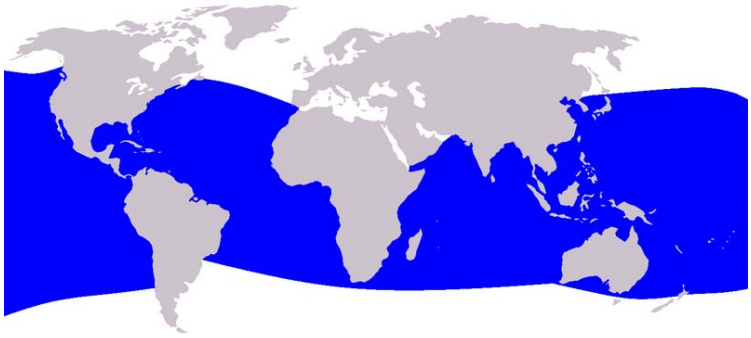
Conservation status

Data Deficient (IUCN 3.1)

Scientific classification	
Kingdom:	Animalia
Phylum:	Chordata
Class:	Mammalia
Order:	Cetacea
Family:	Kogiidae
Genus:	*Kogia*
Species:	***K. sima***

Binomial name

Kogia sima
Owen, 1866



Dwarf sperm whale range

The **Dwarf Sperm Whale** (***Kogia sima***) is one of three species in the sperm whale family. They are not often sighted at sea. As such, most information is a result of the study of stranded carcasses.

Taxonomy

Nowadays the dwarf sperm whale is generally classified as one of two species, along with the Pygmy Sperm Whale, in the Kogiidae family and *Kogia* genus, however it was not until 1966 that the two species were regarded as separate, and even more recently that Kogiidae was regarded as a subfamily (Kogiinae) of Physeteridae.

Physical description

The Dwarf Sperm Whale is the smallest species commonly known as a whale. It grows up to 2.7 meters (9 ft) in length and 250 kilograms (551 lb) in weight— making it smaller than the bigger dolphins. The species makes slow, deliberate movements with little splash or blow and usually lies motionless when at the sea's surface. Consequently it can be observed only in very calm seas.

The Dwarf Sperm Whale is similar in appearance and behavior to its cousin the Pygmy Sperm Whale. Identification may be close to impossible at sea – however, the Dwarf is slightly smaller and has a larger dorsal fin. The body is mainly bluish gray with a lighter underside with slightly yellow vein-like streaks possibly visible. There is a white false gill behind each eye. The flippers are very short and broad. The top of the snout overhangs the lower jaw, which is small. Dwarfs have long, curved and sharp teeth (0–6 in the upper jaw, between 14 and 26 in the lower). These teeth led to the species being described as the "rat porpoise" in the Lower Antilles.

Like other Sperm Whales, the Dwarf Sperm Whale has a spermaceti organ in its forehead. Like the pygmy, the dwarf is able to expel a dark reddish substance when frightened or attacked—possibly to put off any predators.

Dwarf sperm whales are usually solitary but have occasionally been seen in small groups. They feed mainly on squid and crab.

Population and distribution

The Dwarf Sperm Whale prefers deep water, but is more coastal than the pygmy sperm. Its favorite habitat appears to be just off the continental shelf. In the Atlantic, strandings have been observed in Virginia, United States in the west and Spain in the east, and as far south as southern Brazil and the tip of Africa. In the Indian Ocean, specimens have been found on the south coast of Australia and on many places along the Indian Ocean's northern coast - from South Africa right round to Indonesia. In the Pacific, the known range includes the Japanese coast and British Columbia. No global population estimates have been made. One survey estimated a population of about 11,000 in the eastern Pacific.

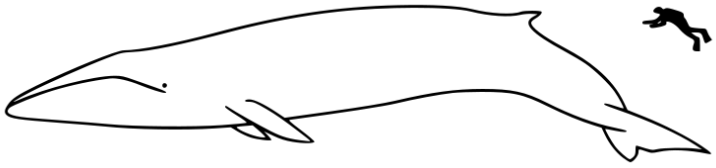
Human interaction

The Dwarf Sperm Whale was actively hunted by commercial whalers. Occasional harpoon kills are still made by Indonesian and Japanese fishermen. Since the dwarf is more coastal than the pygmy, it may be more vulnerable to human activities such as fishing and pollution. Insufficient data exists as to whether such activities threaten the species survival.

Fin whale

Fin whale

A fin whale surfaces in the Kenai Fjords, Alaska



Size comparison against an average human

Conservation status

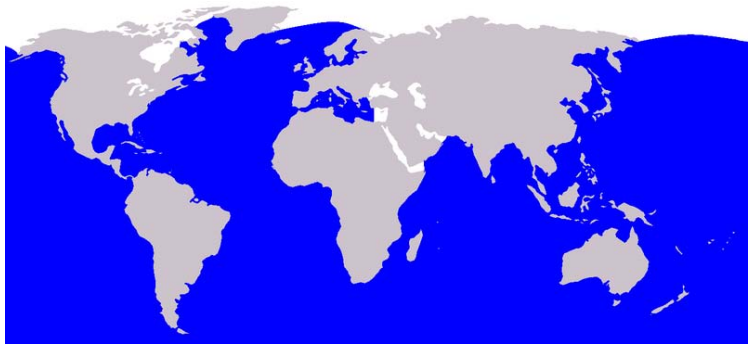
Endangered (IUCN 3.1)

Scientific classification

Kingdom:	Animalia
Phylum:	Chordata
Class:	Mammalia
Subclass:	Eutheria
Order:	Cetacea

Suborder: Mysticeti
Family: Balaenopteridae
Genus: *Balaenoptera*
Species: ***B. physalus***

Binomial name
Balaenoptera physalus ((Linnaeus, 1758)



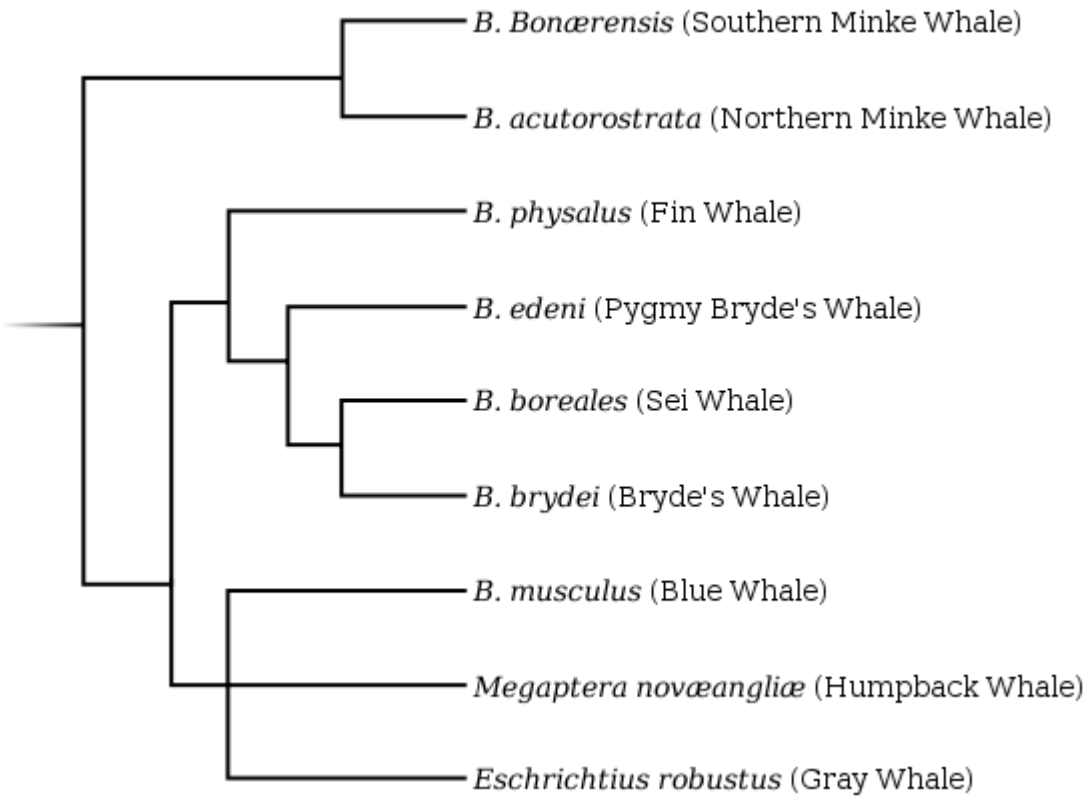
Fin whale range

The **fin whale** (*Balaenoptera physalus*), also called the **finback whale**, **razorback**, or **common rorqual**, is a marine mammal belonging to the suborder of baleen whales. It is the second largest whale and the second largest living animal after the blue whale, growing to nearly 27 meters (88 ft) long.

Long and slender, the fin whale's body is brownish-grey with a paler underside. There are at least two distinct subspecies: the Northern fin whale of the North Atlantic, and the larger Antarctic fin whale of the Southern Ocean. It is found in all the world's major oceans, from polar to tropical waters. It is absent only from waters close to the ice pack at both the north and south poles and relatively small areas of water away from the open ocean. The highest population density occurs in temperate and cool waters. Its food consists of small schooling fish, squid, and crustaceans including mysids and krill.

Like all other large whales, the fin whale was heavily hunted during the twentieth century and is an endangered species. Almost 750,000 fin whales were taken from the Southern Hemisphere alone between 1904 and 1979 and less than 3,000 currently remain in that region. The International Whaling Commission (IWC) has issued a moratorium on commercial hunting of this whale, although Iceland and Japan have resumed hunting: in 2009, Iceland took 125 fin whales during its whaling season, and Japan took 1 fin whale in its 2008-2009 Antarctic season. The species is also hunted by Greenlanders under the Aboriginal Subsistence Whaling provisions of the IWC. Collisions with ships and noise from human activity also significantly threaten recovery.

Taxonomy



A cladogram of animals related to the fin whale

The fin whale has long been known to taxonomists. It was first described by Frederick Martens in 1675 and then again by Paul Dudley in 1725. These descriptions were used as the basis of the species *Balaena physalus* by Carl Linnaeus in 1758. The Comte de Lacepede reclassified the species as *Balaenoptera physalus* early in the nineteenth century. The word "*physalus*" comes from the Greek word *physa*, meaning "blows".

Fin whales are rorquals, members of the family Balaenopteridae family, which also includes the humpback whale, the blue whale, the Bryde's whale, the sei whale and the minke whale. The family diverged from the other baleen whales in the suborder Mysticeti as long ago as the middle Miocene, although it is not known when the members of these families further evolved into their own species. Hybridization between the blue whale and the fin whale is known to occur at least occasionally in the North Atlantic and in the North Pacific. Recent DNA evidence indicates that the fin whale may be more closely related to the gray whale (*Eschrichtius robustus*) and humpback whale (*Megaptera novaeangliae*), two whales in different genera, than it is to members of its own genus, such as the minke whales. If further research confirms this theory, this taxonomy would need revision.

As of 2006, there are two named subspecies, each with distinct physical features and vocalizations. The Northern fin whale, *B. p. physalus* (Linnaeus 1758), inhabits the North Atlantic, and the Antarctic fin whale, *B. p. quoyi* (Fischer 1829), occupies the Southern Ocean. Most experts consider the fin whales of the North Pacific to be a third, as yet unnamed species. The three groups mix at most rarely.

Description and behavior

The fin whale is usually distinguished by its great length and slender build. The average size of males and females is 19 and 20 meters (62 and 66 ft), respectively. Subspecies in the Northern Hemisphere are known to reach lengths of up to 24 metres (79 ft) and the Antarctic subspecies reaches lengths of up to 26.8 metres (88 ft). A full-sized adult has never been weighed, but calculations suggest that a 25 metres (82 ft) animal could weigh as much as 70,000 kilograms (150,000 lb). Full physical maturity is attained between 25 and 30 years. Fin whales live to 94 years of age, although specimens have been found aged at an estimated 135-140 years. A newborn fin whale measures about 6.5 metres (21 ft) in length and weighs approximately 1,800 kilograms (4,000 lb). The animal's large size aids in identification, and it is usually only confused with the blue whale, the sei whale, or, in warmer waters, Bryde's whale.

The fin whale has a brownish grey top and sides and a whitish underside. It has a pointed snout, paired blowholes, and a broad, flat rostrum. Two lighter-colored chevrons begin midline behind the blowholes and slant down the sides toward the tail on a diagonal upward to the dorsal fin, sometimes recurving forward on the back. It has a large white patch on the right side of the lower jaw, while the left side of the jaw is grey or black. This type of asymmetry can be seen occasionally in minke whales, but the fin whale's asymmetry is universal and thus is unique among cetaceans and is one of the keys to making a full identification. It was hypothesized to have evolved because the whale swims on its right side when surface lunging and it often circles to the right while at the surface above a prey patch. However, the whales just as often circle to the left. There is no accepted hypothesis to explain the asymmetry.

The whale has a series of 56–100 pleats or grooves along the bottom of the body that run from the tip of the chin to the navel that allow the throat area to expand greatly during feeding. It has a curved, prominent 60 centimetres (24 in)dorsal fin about three-quarters of the way along the back. Its flippers are small and tapered, and its tail is wide, pointed at the tip, and notched in the center.

When the whale surfaces, the dorsal fin is visible soon after the spout. The spout is vertical and narrow and can reach heights of 6 metres (20 ft). The whale will blow one to several times on each visit to the surface, staying close to the surface for about one and a half minutes each time. The tail remains submerged during the surfacing sequence. It then dives to depths of up to 250 metres (820 ft) each dive lasting between 10 and 15 minutes. Fin whales have been known to leap completely out of the water.

Life history

Mating occurs in temperate, low-latitude seas during the winter, followed by an eleven months to one year gestation period. A newborn weans from its mother at 6 or 7 months of age when it is 11 or 12 metres (39 ft) in length, and the calf follows the mother to the winter feeding ground. Females reproduce every 2 to 3 years, with as many as 6 fetuses being reported, but single births are far more common. Females reach sexual maturity at between 3 and 12 years of age.

Feeding

Overhead view of a fin whale feeding

The fin whale is a filter-feeder, feeding on small schooling fish, squid, and crustaceans including mysids and krill. It feeds by opening its jaws while swimming at a relatively high speed, 11 kilometres per hour (6.8 mph) in one study, which causes it to engulf up to 70 cubic metres (18,000 US gal; 15,000 imp gal) of water in one gulp. It then closes its jaws and pushes the water back out of its mouth through its baleen, which allows the water to leave while trapping the prey. An adult has between 262 and 473 baleen plates on each side of the mouth. Each plate is made of keratin that frays out into fine hairs on the ends inside the mouth near the tongue. Each plate can measure up to 76 centimetres (30 in) in length and 30 centimetres (12 in) in width. The whale routinely dives to depths of more than 200 metres (660 ft) where it executes an average of four "lunges", where it feeds on aggregations of krill. Each gulp provides the whale with approximately 10 kilograms (22 lb) of krill. One whale can consume up to 1,800 kilograms (4,000 lb) of food a day, leading scientists to conclude that the whale spends about three hours a day feeding to meet its energy requirements, roughly the same as humans. If prey *patches* are not sufficiently dense, or are located too deep in the water, the whale has to spend a

larger portion of its day searching for food. One hunting technique is to circle schools of fish at high speed, frightening the fish into a tight ball, then turning on its side before engulfing the massed prey.

Behavior

The fin whale is one of the fastest cetaceans and can sustain speeds of 37 kilometres per hour (23 mph) and bursts in excess of 40 kilometres per hour (25 mph)have been recorded, earning the fin whale the nickname "the greyhound of the deep". Fin whales are more gregarious than other rorquals, and often live in groups of 6–10, although feeding groups may reach up to 100 animals.

Vocalizations

Like other whales, the male fin whale makes long, loud, low-frequency sounds. The vocalizations of blue and fin whales are the lowest-frequency sounds made by any animal. Most sounds are frequency-modulated (FM) down-swept infrasonic pulses from 16 to 40 hertz frequency (the range of sounds that most humans can hear falls between 20 hertz and 20 kilohertz). Each sound lasts one to two seconds, and various sound combinations occur in patterned sequences lasting 7 to 15 minutes each. The whale then repeat the sequences in bouts lasting up to many days. The vocal sequences have source levels of up to 184–186 decibels relative to 1 micropascal at a reference distance of one meter, and can be detected hundreds of miles from their source.

When fin whale sounds were first recorded by US biologists, they did not realize that these unusually loud, long, pure and regular sounds were being made by whales. They first investigated the possibilities that the sounds were due to equipment malfunction, geophysical phenomena, or even part of a Soviet Union scheme for detecting enemy submarines. Eventually, biologists demonstrated that the sounds were the vocalizations of fin whales.

Direct association of these vocalizations with the reproductive season for the species and that only males make the sounds point to these vocalizations as possible reproductive displays. Over the past 100 years, the dramatic increase in ocean noise from shipping and naval activity may have slowed the recovery of the fin whale population, by impeding communications between males and sexually receptive females.

Range and habitat

Fin whales may reach lengths of up to 26.8 metres (88 ft)

Like many large rorquals, the fin whale is a cosmopolitan species. It is found in all the world's major oceans, and in waters ranging from the polar to the tropical. It is absent only from waters close to the ice pack at both the north and south extremities and relatively small areas of water away from the large oceans, such as the Red Sea, the Persian Gulf, the eastern part of the Mediterranean, and the Baltic Sea. The highest population density occurs in temperate and cool waters. It is less densely populated in the warmest, equatorial regions. It prefers deep waters beyond the continental shelf to shallow waters.

The North Atlantic fin whale has an extensive distribution, occurring from the Gulf of Mexico and Mediterranean Sea, northward to the edges of the Arctic ice pack. In general, fin whales are more common north of approximately 30°N latitude, but considerable confusion arises about their occurrence south of 30°N latitude because of the difficulty in distinguishing fin whales from Bryde's whales. Extensive ship surveys have led researchers to conclude that the summer feeding range of fin whales in the western North Atlantic was mainly between 41°20'N and 51°00'N, from shore seaward to the 1,000 fathoms (1,800 m) contour.

Summer distribution of fin whales in the North Pacific is the immediate offshore waters from central Baja California to Japan, and as far north as the Chukchi Sea bordering the Arctic Ocean. They occur in high densities in the northern Gulf of Alaska and southeastern Bering Sea between May and October, with some movement through the Aleutian passes into and out of the Bering Sea. Several whales tagged between November and January off southern California were killed in the summer off central California, Oregon, British Columbia, and in the Gulf of Alaska. Fin whales have been observed feeding in Hawaiian waters in mid-May, and several winter sightings have been made there. Some researchers have suggested that the whales migrate into Hawaiian waters primarily in the autumn and winter.

Although fin whales are certainly migratory, moving seasonally in and out of high-latitude feeding areas, the overall migration pattern is not well understood. Acoustic readings from passive-listening hydrophone arrays indicate a southward migration of the North Atlantic fin whale occurs in the autumn from the Labrador-Newfoundland region, south past Bermuda, and into the West Indies. One or more populations of fin whales are thought to remain year-round in high latitudes, moving offshore, but not southward in late autumn. In the Pacific, migration patterns are poorly characterized. Although some fin whales are apparently present year-round in the Gulf of California, there is a significant increase in their numbers in the winter and spring. Antarctic fin whales migrate seasonally from relatively high-latitude Antarctic feeding grounds in the summer to low-latitude breeding and calving areas in the winter. The location of winter breeding areas is still unknown, since these whales tend to migrate in the open ocean.

Population and trends

Poor understanding of migration patterns combined with contradictory population surveys makes estimating the historical and current population levels of the whale difficult and contentious. Due to a long history of hunting this whale, pre-exploitation population levels are difficult to determine.

North Atlantic

North Atlantic fin whales are defined by the International Whaling Commission to exist in one of seven discrete population zones: Nova Scotia-New England, Newfoundland-Labrador, western Greenland, eastern Greenland-Iceland, North Norway, West Norway-Faroe Islands, and Ireland-Spain-United Kingdom-Portugal. Results of mark-and-recapture surveys have indicated that some movement occurs across the boundaries of these population zones, suggesting that each zone is not entirely discrete and that some immigration and emigration does occur. J. Sigurjónsson estimated in 1995 that total pre-exploitation population size in the entire North Atlantic ranged between 50,000 and 100,000 animals, but his research is criticized for not providing supporting data and an explanation of his reasoning. In 1977, D.E. Sergeant suggested a "primeval" aggregate total of 30,000 to 50,000 throughout the North Atlantic. Of that number, about 8,000 to 9,000 would have resided in the Newfoundland and Nova Scotia areas, with whales summering in U.S. waters south of Nova Scotia presumably omitted. J.M. Breiwick

estimated that the "exploitable" (above the legal size limit of ft50) component of the Nova Scotia population was 1,500 to 1,600 animals in 1964, reduced to only about 325 in 1973. Two aerial surveys in Canadian waters since the early 1970s gave numbers of 79 to 926 whales on the eastern Newfoundland-Labrador shelf in August 1980, and a few hundred in the northern and central Gulf of Saint Lawrence in August 1995–1996. Summer estimates in the waters off western Greenland range between 500 and 2,000, and in 1974, Jonsgard considered the fin whales off Western Norway and the Faroe Islands to "have been considerably depleted in postwar years, probably by overexploitation". The population around Iceland appears to have fared much better, and in 1981, the population appeared to have undergone only a minor decline since the early 1960s. Surveys during the summers of 1987 and 1989 estimated of 10,000 to 11,000 between eastern Greenland and Norway. This shows a substantial recovery when compared to a survey in 1976 showing an estimate of 6,900, which was considered to be a "slight" decline since 1948. Summer population estimates in the British Isles-Spain-Portugal area range from 7,500 to more than 17,000. The aggregate population level is estimated to be between 40,000 and 56,000 individuals.

North Pacific

Fin whale skeleton

The total historical North Pacific population was estimated at 42,000 to 45,000 before the start of whaling. Of this, the population in the eastern portion of the North Pacific was

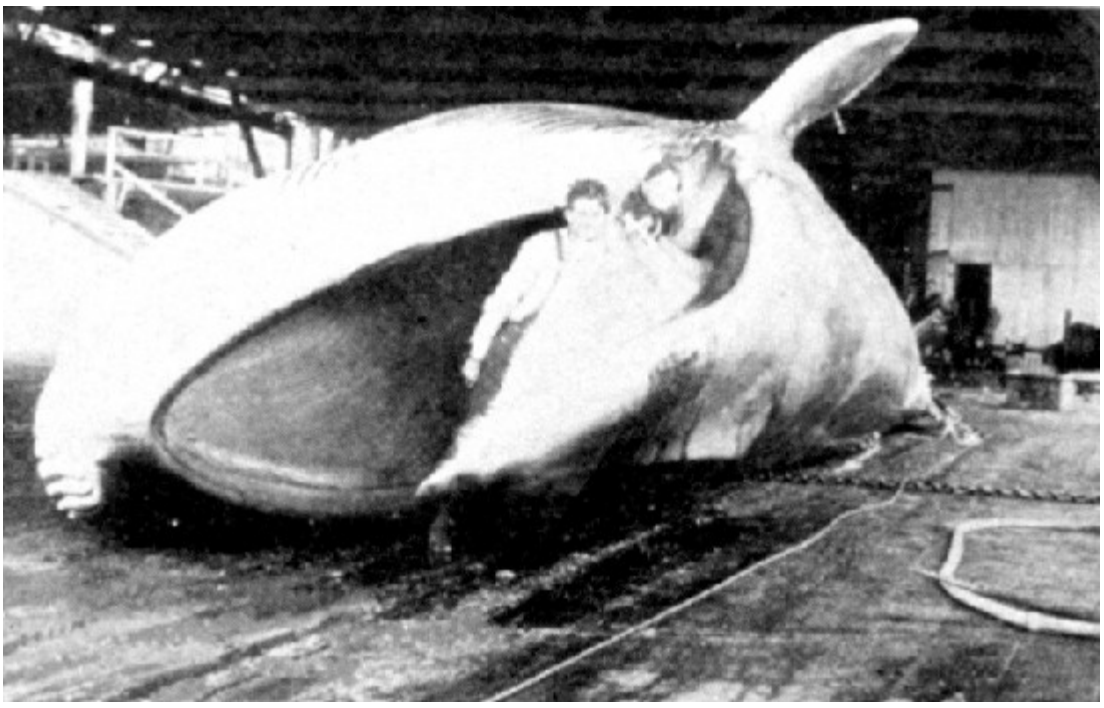
estimated to be 25,000 to 27,000. By 1975, the estimate had declined to between 8,000 and 16,000. Surveys conducted in 1991, 1993, 1996, and 2001 produced estimates of between 1,600 and 3,200 off California and 280 to 380 off Oregon and Washington. The miniumum estimate for the California-Oregon-Washington population, as defined in the *U.S. Pacific Marine Mammal Stock Assessments: 2005*, is about 2,500. Surveys in coastal waters of British Columbia in summers 2004 and 2005 produced abundance estimates of approximately 500 animals (95% confidence intervals: 201-1,220). Surveys near the Pribilof Islands in the Bering Sea indicated a substantial increase in the local abundance of Fin Whales between 1975–1978 and 1987–1989. In 1984, the entire population was estimated to be at less than 38% of its historic carrying capacity.

Antarctica

Relatively little is known about the historical and current population levels of the Antarctic fin whale. The IWC officially estimates that the Southern Hemisphere pre-whaling population was 400,000 whales, and that the population in 1979 (at the cessation of Antarctic large scale whaling) was 85,200. Both the current and historical estimates should be considered as poor estimates because the methodology and data used in the study are known to be flawed. Other estimates cite current (late 1980s-early 1990s) population levels of no more than 5,000 whales and possibly as low as 2,000 to 3,000.

As of 2006, there is no scientifically accepted estimate of current population or trends in abundance.

Human interaction



A 65 long tons (66 t), 72 feet (22 m) fin whale caught at Grays Harbor circa 1912

In the 19th century, the fin whale was occasionally hunted by open-boat whalers, but it was relatively safe because of its speed and the fact that it often sank when killed. However, the later introduction of steam-powered boats and harpoons that exploded on impact made it possible to kill and secure them along with blue whales and sei whales on an industrial scale. As other whale species became over-hunted, the whaling industry turned to the still-abundant fin whale as a substitute. It was primarily hunted for its blubber, oil, and baleen. Approximately 704,000 fin whales were caught in Antarctic whaling operations alone between 1904 and 1975.

The introduction of factory ships with stern slipways in 1925 substantially increased the number of whales taken per year. In 1937 alone, over 28,000 fin whales were taken. From 1953 to 1961, the catch averaged around 25,000 per year. By 1962, sei whale catches began to increase as fin whales became scarce. By 1974, fewer than 1,000 fin whales were being caught each year. In the North Pacific, a reported total of approximately 46,000 fin whales were killed by commercial whalers between 1947 and 1987.

The IWC prohibited hunting in the southern hemisphere in 1976. The Soviet Union engaged in the illegal killing of protected whale species in the North Pacific, rendering reported catch data incomplete. The fin whale was given full protection from commercial whaling by the IWC in the North Pacific in 1976, and in the North Atlantic in 1987, with small exceptions for aboriginal catches and catches for research purposes. All populations worldwide remain listed as endangered species by the US National Marine Fisheries Service and the International Conservation Union Red List, and the fin whale is on Appendix 1 of CITES.

The IWC has set a quota of 19 fin whales per year for Greenland. Meat and other products from whales killed in these hunts are widely marketed within Greenland, but export is illegal. Iceland and Norway are not bound by the IWC's moratorium on commercial whaling because both countries filed objections to the moratorium. In October 2006, Iceland's fisheries ministry authorized the hunting of nine fin whales through August 2007.

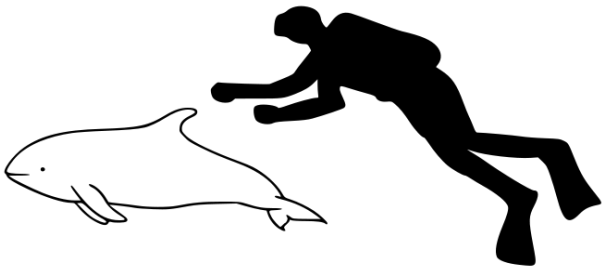
In the southern hemisphere, Japan permits annual takes of 10 fin whales under its Antarctic Special Permit whaling program for the 2005–2006 and 2006–2007 seasons. The proposal for 2007–2008 and the subsequent 12 seasons allows taking 50 per year, but by the close of the 2007-2008 season in April 2008, no fin whales had been caught.

Collisions with ships are a major cause of mortality. In some areas, they cause a substantial portion of large whale strandings. Most serious injuries are caused by large, fast-moving ships over or near the continental shelf.

Hourglass dolphin

hourglass dolphin

A rare look at the hourglass dolphin



Size comparison against an average human

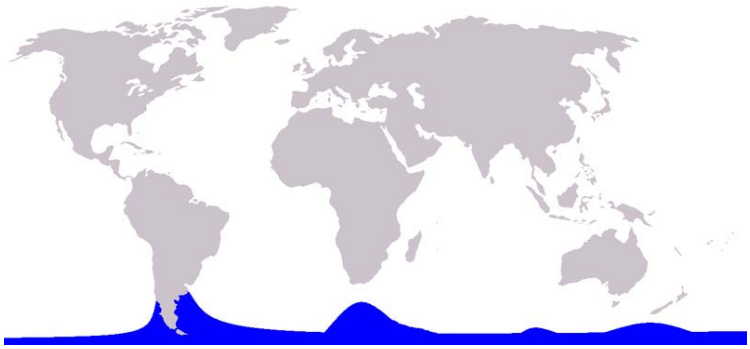
Conservation status

Least Concern (IUCN 3.1)

Scientific classification	
Kingdom:	Animalia
Phylum:	Chordata
Class:	Mammalia
Order:	Cetacea
Family:	Delphinidae
Genus:	*Lagenorhynchus*
Species:	***L. cruciger***

Binomial name

Lagenorhynchus cruciger
(Quoy & Gaimard, 1824)



Hourglass dolphin range

by logan gould

The **hourglass dolphin** (*Lagenorhynchus cruciger*) is a small dolphin in the family Delphinidae that inhabits Antarctic and sub-Antarctic waters.

The dolphin has rarely been seen. It was identified as a new species by Qouy and Galmard in 1824 from a drawing made in the South Pacific in 1820. It is the only cetacean to have been widely accepted as a species solely on witness accounts. By 1960, despite decades of whaling in the Southern Ocean, only three specimens had been recovered. As of 2010 only 6 complete and 14 partial specimens had been examined.

Though it is traditionally placed in the genus *Lagenorhynchus*, recent molecular analyses indicate that the hourglass dolphin is actually more closely related to the dolphins of the genus *Cephalorhynchus*.

Physical description

The hourglass dolphin is colored black and white and for this reason was colloquially known by whalers as a "sea cow". Each flank has a white patch at the front, above the beak, eye and flipper, and a second patch at the rear. These two patches are connected by a thin white strip, creating, loosely speaking, an hourglass shape and hence the common name of the dolphin. The scientific name *cruciger* is Latin for "cross-carrier". This refers to the area of black coloration, which, viewed from above, vaguely resembles a Maltese cross or cross pattée.

In its usual range the dolphin is easily identifiable. Only the southern right whale dolphin is of comparable size and lives as far south. The right whale dolphin does not have a dorsal fin, so the two species are easily distinguished. The fin considerably varies across individuals. It is generally tall and curved, and the curve may be particularly pronounced in older animals.

A fully grown adult is about 1.8 meters (6 ft) length and weighs 90–120 kilograms (200–260 lb). Males are thought to be slightly smaller and lighter than females, although the small number of specimens does not permit a firm conclusion.

Population and distribution

The range is circumpolar from close to the Antarctic ice pack to about 45°S. The most northerly confirmed sightings were 36°S in the South Atlantic Ocean and 33°S near Valparaíso, Chile, in the Pacific. Sightings have been made most commonly from the south of New Zealand, around the South Shetland Islands and off Tierra del Fuego, Argentina. The species is unlikely to be particularly densely populated close to these lands.

One survey estimated the population size at more than 140,000 individuals.

Behavior

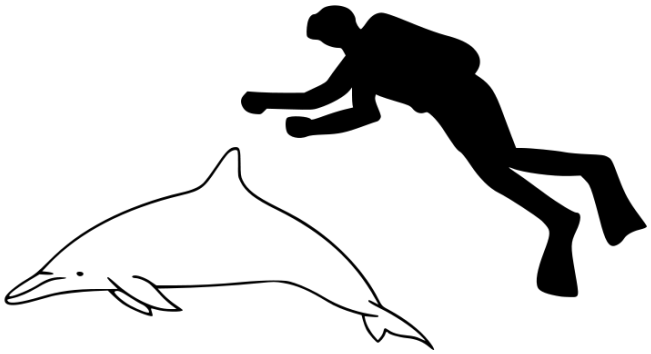
Hourglass dolphins tend to move in groups of about 5 to 10. One International Whaling Commission study recorded a group of 60.

They share feeding grounds with other cetaceans such as sei, pilot, bottlenose and minke whales and southern right whale dolphins. They are regularly seen with fin whales. Whalers who were hunting these much larger animals used hourglass dolphins as "look-outs" to aid them in their hunt. Hourglass dolphins are keen bow-wave riders.

Examinations of the stomach contents of the few specimens indicate they eat various (unrecorded) types of squid and small fish.

Spinner dolphin

Spinner Dolphin


Size comparison against an average human

Conservation status

Data Deficient (IUCN 3.1)

Scientific classification	
Kingdom:	Animalia
Phylum:	Chordata
Class:	Mammalia
Subclass:	Eutheria
Order:	Cetacea
Suborder:	Odontoceti
Family:	Delphinidae
Genus:	*Stenella*
Species:	***S. longirostris***

Binomial name

Stenella longirostris
(Gray, 1828)

Spinner Dolphin range

The **Spinner Dolphin** (***Stenella longirostris***) is a small dolphin found in off-shore tropical waters around the world. It is famous for its acrobatic displays in which they spin longitudinally along their axis as they leap through the air.

Taxonomy

The Spinner Dolphin is sometimes referred to as the **Long-snouted Dolphin**, particularly in older texts, to distinguish it from the similar Clymene Dolphin which is often called the Short-snouted Spinner Dolphin. The species was described by John Gray in 1828. There are four named subspecies:

- **Eastern Spinner Dolphin** (*S. l. orientalis*), from the tropical eastern Pacific.
- **Central American** or **Costa Rican Spinner Dolphin** (*S. l. centroamericana*), also found in the tropical eastern Pacific.
- **Gray's** or **Hawaiian Spinner Dolphin** (*S. l. longirostris*), from the central Pacific Ocean around Hawaii but represents a mixture of broadly similar subtypes found worldwide.
- **Dwarf Spinner Dolphin** (*S. l. roseiventris*), first found in the Gulf of Thailand.

However the species display greater variety than these subspecies might indicate. A hybrid form characterized by its white belly inhabits the eastern Pacific. Other less distinct groupings inhabit other oceans.

The name comes from the Latin term for long-beaked.

Physical description

The Spinner Dolphin is usually dark gray, with darker patches in the tail stock, back and throat. Usually it has a creamy-white patch on the belly, though this varies considerably. Their beaks are distinctively long and thin, with a dark tip. The fins, also, are lengthy for

dolphins of this size. The dorsal fin is erect and leans forward in older males found in the Eastern Pacific Ocean. Spinner Dolphins are the most variable in form of all cetaceans.

Adults vary in length from 129–235 centimetres (51–93 in) and weight from 23–78 kilograms (51–170 lb). Gestation requires about 10 months. Females reach maturity at four to seven years. Males require seven to ten years. Their longevity is unknown.

Group sizes vary from just a few animals up to thousands.

They often ride boats' bow-waves.

Spinning

A possible reason for the animal's spinning is that males spin to attract females. Another suggestion is that the bubbles may act as a target for echolocation by other individuals in the school. Spinning may also be play.

Individuals have been spotted completing at least 14 spinning jumps in quick succession.

In the Atlantic Ocean spinner dolphins may be mistaken for the Clymene dolphin which also spins, but not to such a regular and dramatic extent. Spinner dolphins may successfully mate with other species such as bottlenose dolphin and both varieties of spotted dolphin.

Population and distribution

Spinner Dolphin at Midway Atoll

Spinner Dolphins occur in deep tropical waters in all of the world's tropical oceans. Although mainly inhabiting the open ocean, they are sometimes found near the shores of island chains such as Hawaii. Their greatest density occurs between the Tropic of Cancer and Tropic of Capricorn. The species roughly divides up into geographical areas corresponding to the different subspecies. Total population is unknown, and it was dramatically reduced by fishing activity in the eastern Pacific Ocean. This species is still regarded as endangered.

Communication

A pod of Spinner Dolphins in Kauai, Hawaii

Dolphin echolocate and communicate using click-whistles and pulsed sounds. Echolocation enables dolphins to track objects in dim or dark water and to, in effect, see much further than their eyes will allow. Their complex array of whistle sounds allow dolphins to talk to one another. Spinners can identify themselves with sounds they make by trailing bubbles from their blowholes—sounds called signature whistles.

Spinner dolphins also communicate by slapping the water with various body parts. For instance, “nose-outs” occur when the beak is thrust above the surface. This action is common when the pod is emerging from a rest period. Tail slaps often indicate impending danger or indicate a dive. Head slaps, side slaps, and back slaps are most frequently seen as the pod accelerates. Last, and most spectacular, are the spins themselves. Many animals spin repeatedly, with each spin tending to get smaller and smaller, finishing with an emphatic side slap.

The power of the spin can pick up through their echolocation—may be the real purpose of the spin.

Spinner dolphins maximize their splash by twisting around to land in a belly-flop, or back-flop. Spins are most frequently performed while the school is spread out across the water. A spinning dolphin may be signaling to the others: "here I am. . . . here is where I am going. . . " The effect of many dolphins spinning and leaping at once, defines the *envelope* of the pod—that is, its size, direction, and speed of travel.

Feeding

Dolphins hunt mostly at night as the “scattering layer” of marine life, which has spent the day at depths of 3,000 feet (910 m), rises toward the surface to feed on plankton. They eat fish, jellyfish, krill, squid, shell-less snails, as well as copepods. Before diving into the layer, the pod assembles, possibly to protect themselves from other predators who feed there, such as sharks, which are natural dolphin predators. The spinners form small subgroups and spread out across the sea. Time after time, the dolphins dive into the utter darkness at 800 feet (240 m) or more. They use their teeth to grasp and immobilize their prey rather than to chew.

Spread across miles of water, the school coordinates its activities through sound—and through spinning—which can reach an explosive crescendo in the darkness. Echolocating pod-mates, spinners can use their whistles to unite with others for defense. By dawn, the spinners regroup and eating stops. They likely will shelter during the day near shore.

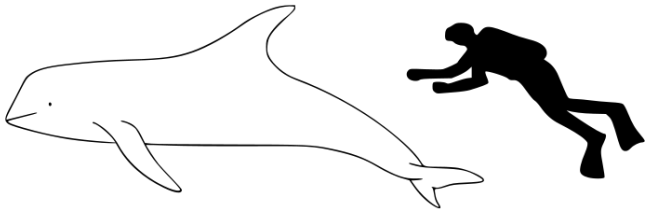
Human interaction

Sancho Beach - beyond is a reserve for some 600 spinner dolphins

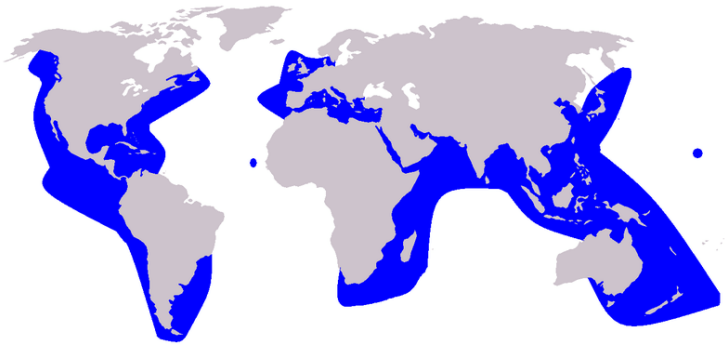
Spinner Dolphins have been studied both in the wild and in captivity in Hawaii. Up to two million Spinner Dolphins, mostly eastern and white-bellied varieties, were killed in the thirty years after purse seine fishing for tuna was introduced in the 1950s. The process killed probably half of all Eastern Spinner Dolphins.

Risso's dolphin

Risso's Dolphin


Size comparison against an average human
Conservation status

Least Concern (IUCN 3.1)
Scientific classification
Kingdom: Animalia
Phylum: Chordata
Class: Mammalia
Order: Cetacea
Family: Delphinidae
Genus: ***Grampus***
Species: ***G. griseus***
Binomial name
Grampus griseus (G. Cuvier, 1812)



Risso's dolphin range

Risso's dolphin (*Grampus griseus*) is the only species of dolphin in the genus ***Grampus***.

Taxonomy

Risso's dolphin is named after Antoine Risso, whose description formed the basis of the first public description of the animal, by Georges Cuvier, in 1812. Another common name for the Risso's dolphin is *grampus* (also the species' genus), although this common name was more often used for the orca. The etymology of the word *grampus* is unclear. It may be an agglomeration of the Latin *grandis piscis* or French *grand poisson* both meaning big fish. The specific epithet *griseus* refers to the mottled (almost scarred) grey colour of its body.

Description

Risso's have a relatively large anterior body and dorsal fin, while the posterior tapers to a relatively narrow tail. The bulbous head has a vertical crease in front.

Infants are dorsally gray to brown and ventrally cream-colored, with a white anchor-shaped area between the pectorals and around the mouth. In older calves, the non-white areas darken to nearly black, and then lighten (except for the always dark dorsal fin.) Linear scars mostly from social interaction eventually cover the bulk of the body. Older individuals appear mostly white. Most individuals have 2-7 pairs of teeth, all in the lower jaw.

Length is typically 10 feet (3.0 m) although specimens may reach 14.1 feet (4.3 m). Like most dolphins, males are typically slightly larger than females. This species weighs 300–500 kilograms (660–1,100 lb) making it the largest species called "dolphin".

Range and habitat

They are found worldwide in temperate and tropical waters, usually in deep waters rather than close to land. As well as the tropical parts of the Indian, Pacific and Atlantic Oceans, Rissos are also found in the Persian Gulf, Mediterranean and Red Seas, but not the Black

Sea. They range as far north as the Gulf of Alaska and southern Greenland and as far south as Tierra del Fuego.

Their preferred environment is just off the continental shelf on steep banks with water depths varying from 400–1,000 metres (1,300–3,300 ft) and water temperature at least 10 °C (50 °F) and preferably 15–20 °C (59–68 °F).

The population around the continental shelf of the United States is estimated in excess of 60,000. In the Pacific a census recorded 175,000 individuals in eastern tropical waters and 85,000 in the west. No global estimate exists.

Ecology

They feed almost exclusively on neritic and oceanic squid, mostly nocturnally. Predation does not appear significant. Mass strandings are infrequent.

These dolphins typically travel in groups of 10-50, but that may reach 400. Smaller, stable subgroups exist within larger groups. They also travel with other cetaceans. They harass and surf the bow waves of gray whales as well as ocean swells.

Reproduction

Gestation requires an estimated 13–14 months, at intervals of 2.4 years. Calving reaches seasonal peaks in the winter in the eastern Pacific and in the summer and fall in the western Pacific. Females mature sexually at ages 8–10, and males at age 10-12. The oldest specimen reached 34.5 years.

Human interaction

Risso's dolphins generally do not approach boats (they occasionally surf bow waves.) A notable exception was an individual named Pelorus Jack who accompanied boats in Admiralty Bay in New Zealand's Marlborough Sounds for more than 20 years. Hunting of this species has never been particularly widespread, and the species is recognised as abundant and safe.

Risso's have successfully been taken into captivity in the United States and Japan, although not with the regularity of bottlenose dolphins or orca. Hybrid Risso's-bottlenose dolphins have been bred in captivity.

Strandings

At least one case report of strandings in Japan's Goto Islands has been associated with parasitic neuropathy of the VIIIth cranial nerve by a trematode in the genus *Nasitrema*.

Chapter- 9

Cetology

A researcher fires a biopsy dart at an orca. The dart will remove a small piece of the whale's skin and bounce harmlessly off the animal.

Cetology (from Greek κῆτος, *kētos*, "whale"; and -λογία, -*logia*) is the branch of marine mammal science that studies the approximately eighty species of whales, dolphins, and porpoise in the scientific order Cetacea.

Cetologists, or those who practice cetology, seek to understand and explain cetacean evolution, distribution, morphology, behavior, community dynamics, and other topics.

History

Observations about Cetacea have been recorded since at least classical times. Ancient Greek fishermen created an artificial notch on the dorsal fin of dolphins entangled in nets so that they could tell them apart years later.

Approximately 2,300 years ago, Aristotle carefully took notes on cetaceans while traveling on boats with fishermen in the Aegean Sea. In his book *Historia animalium* (History of animals), Aristotle was careful enough to distinguish between the baleen whales and toothed whales, a taxonomical separation still used today. He also described the Sperm Whale and the common dolphin, stating that they can live for at least twenty-five or thirty years. His achievement was remarkable for its time, because even today it is very difficult to estimate the life-span of advanced marine animals.

After Aristotle's death, much of the knowledge he had gained about cetaceans was lost, only to be re-discovered during the Renaissance.

Many of the medieval texts on cetaceans comes mainly from Scandinavia and Iceland, most come about around the mid-13th century.

One of the better known is *Speculum Regale*. In this text is described various species that lived around the island of Iceland. It mentions "orcs" that had dog-like teeth and would demonstrate the same kind of aggression towards other cetaceans as wild dogs would do to other terrestrial animals. The text even illustrated the hunting technique of Orcs, which are now called Orcas.

The *Speculum Regale* describes other cetaceans, including the Sperm Whale and Narwhal. Many times they were seen as terrible monsters, such as killers of men, and destroyers of ships. They even bore them odd names such as "Pig Whale", "Horse Whale", and "Red Whale".

But not all creatures described were said to be fierce. Some were seen to be good, such as whales that drove shoals of herring towards the shore. This was seen as very helpful to fisherman.

Many of the early studies were based on dead specimens and myth. The little information that was gathered was usual length, and a rough outer body anatomy. Because these animals live in water their entire lives, early scientists did not have the technology to go study these animals further. It was not until the 16th century that things would begin to change. That cetaceans would be proved to be mammals rather than fish.

Aristotle, as said above, argued they were mammals. But Pliny the Elder stated that they were fish, and it was followed by many naturalists. However, Pierre Belon (1517–1575) and G. Rondelet (1507–1566) persisted on convincing they were mammals. They argued that the animals had lungs and a uterus, just like mammals. Not until 1758, when Swedish botanist Carolus Linnaeus (1707–1778) published the tenth edition of *Systema Naturae*, were they seen as mammals.

Only decades later, French zoologist and paleontologist Baron Georges Cuvier (1769–1832) described the animals as mammals without any hind legs. Skeletons were assembled and displayed in the first natural history museums, and on a closer look and comparisons with other extinct animal fossils led zoologists to conclude that cetaceans came from a family of ancient land mammals.

Between the 9th-20th century, much of our information on cetaceans came from whalers. Whalers were the most knowledgeable about the animals, but their information was regarding migration routes and outer anatomy, and only little information of behavior.

During the 1960s, people began studying the animals intensively, often in dedicated research institutes such as the Tethys Research Institute in Milan. This came from both concern about wild populations and also the capture of larger animals such as the Orca, and gaining popularity of dolphin shows in marine parks.

Studying cetaceans

Humpback Whales often have distinct markings that enable scientists to identify individuals.

Studying cetaceans presents numerous challenges. Cetaceans only spend 10% of their time on the surface, and all they do at the surface is breathe. There is very little behavior seen at the surface.

It is also impossible to find any signs that an animal has been in an area. Cetaceans do not leave tracks that can be followed, nor do they leave dung that can tell important information about their diet. Many times Cetology consists of waiting and paying close attention.

Cetologists use equipment including hydrophones to listen to calls of communicating animals, binoculars and other optical devices for scanning the horizon, cameras, notes, and a few other devices and tools.

An alternative method of studying cetaceans is through examination of dead carcasses that wash up on the shore. If properly collected and stored, these carcasses can provide important information that is difficult to obtain in field studies.

Identifying individuals

In recent decades, methods of identifying individual cetaceans have enabled accurate population counts and insights into the lifecycles and social structures of various species.

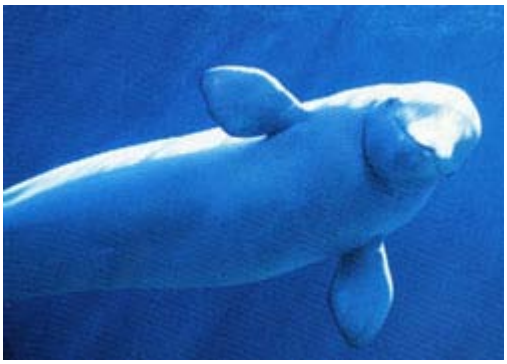
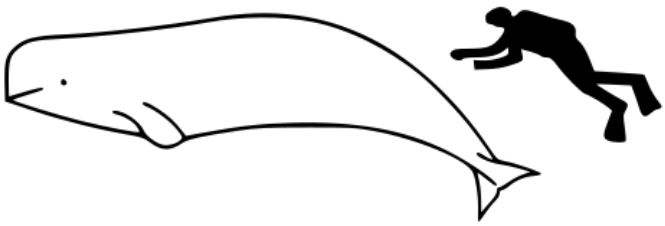
One such successful system is photo-identification. This system was popularized by Michael Bigg, a pioneer in modern orca (killer whale) research. During the mid 1970s, Bigg and Graeme Ellis photographed local orcas in the British Columbian seas. After examining the photos, they realized they could recognize certain individual whales by looking at the shape and condition of the dorsal fin, and also the shape of the saddle patch. These are as unique as a human fingerprint; no one animal's looks exactly like another's. After they could recognize certain individuals, they found that the animals travel in stable groups called pods. Researchers use photo identification to identify specific individuals and pods.

The photographic system has also worked well in humpback whale studies. Researchers use the color of the pectoral fins and color of the fluke to identify individuals. Scars from orca attacks found on the flukes of humpbacks are also used in identification.

Chapter- 10

Arctic Cetaceans

Beluga whale

Beluga


Size comparison against an average human
Conservation status

Near Threatened (IUCN 3.1)
Scientific classification
Kingdom: Animalia
Phylum: Chordata

Class:	Mammalia
Order:	Cetacea
Family:	Monodontidae
Genus:	***Delphinapterus***
Species:	***D. leucas***

Binomial name

Delphinapterus leucas
(Pallas, 1776)

Beluga range

The **beluga** or **white whale**, ***Delphinapterus leucas***, is an Arctic and sub-Arctic species of cetacean. It is one of two members of the family Monodontidae, along with the narwhal. This marine mammal is commonly referred to simply as the **beluga** or **sea canary** due to its high-pitched twitter. It is up to 5 meters (16 ft) in length and an unmistakable all-white color with a distinctive protuberance on the head. From a conservation perspective, the beluga is considered "near threatened" by the International Union for Conservation of Nature; however the subpopulation from the Cook Inlet in Alaska is considered critically endangered and is under the protection of the United States' Endangered Species Act. Of seven Canadian beluga populations, two are listed as endangered, inhabiting eastern Hudson Bay, and Ungava Bay.

Taxonomy

In 1776 Peter Simon Pallas first described the beluga. It is a member of the Monodontidae family, which is in turn part of the toothed whale suborder. The Irrawaddy dolphin was once placed in the same family; however, recent genetic evidence suggests otherwise. The narwhal is the only other species within the Monodontidae family besides the beluga.

The Red List of Threatened Species gives both beluga and white whale as common names, though the former is now more popular. The English name comes from the Russian белуга (*beluga*) or белуха (*belukha*), which derives from the word белый (*belyy*), meaning "white". It is sometimes referred to by scientists as the belukha whale in order to avoid confusion with the beluga sturgeon.

The whale is also colloquially known as the Sea Canary on account of its high-pitched squeaks, squeals, clucks and whistles. A Japanese researcher says he taught a beluga to "talk" by using these sounds to identify three different objects, offering hope that humans may one day be able to communicate effectively with sea mammals.

Description

A beluga in the shallow waters of the Vancouver Aquarium

Male belugas are larger than females. Males can reach 5.5 metres (18 ft) long, while females grow to 4.1 metres (13 ft). Males weigh between 1,100 and 1,600 kilograms (2,400 and 3,500 lb) while females weigh between 700 and 1,200 kilograms (1,500 and 2,600 lb). This is larger than most dolphins, but is smaller than most other toothed whales.

The adult beluga is rarely mistaken for another species, because it is completely white or whitish-gray in color. Calves, however, are usually gray. Its head is unlike that of any other cetacean. Like most toothed whales it has a melon—an oily, fatty tissue lump found at the center of the forehead. The beluga's melon is extremely bulbous and even malleable. The beluga is able to change the shape of its head by blowing air around its sinuses. Unlike many dolphins and whales, the vertebrae in the neck are not fused together, allowing the animal to turn its head laterally. The rostrum has about 8 to 10 teeth on each side of the jaw and a total of 34 to 40 teeth.

Belugas have a dorsal ridge, rather than a dorsal fin. The absence of the dorsal fin is reflected in the genus name of the species—*apterus* the Greek word for "wingless." The evolutionary preference for a dorsal ridge rather than a fin is believed to be an adaptation to under-ice conditions, or possibly as a way of preserving heat. As in other cetaceans, the thyroid gland is relatively large compared to terrestrial mammals (proportionally three times as large as a horse's thyroid) and may help to sustain higher metabolism during the summer estuarine occupations.

Its body is round, particularly when well-fed, and tapers less smoothly to the head than the tail. The sudden tapering to the base of its neck gives it the appearance of shoulders, unique among cetaceans. The tail fin grows and becomes increasingly and ornately curved as the animal ages. The flippers are broad and short—making them almost square-shaped.

Range and habitat

Beluga at the mouth of Churchill River into Hudson Bay, Canada

The beluga inhabits a discontinuous circumpolar distribution in Arctic and sub-Arctic waters ranging from 50° N to 80° N, particularly along the coasts of Alaska, Canada, Greenland, and Russia. The southernmost extent of their range includes isolated populations in the St. Lawrence River estuary and the Saguenay fjord, around the village of Tadoussac, Quebec, in the Atlantic and the Amur River delta, the Shantar Islands and the waters surrounding Sakhalin Island in the Sea of Okhotsk.

In the spring, the beluga moves to its summer grounds: bays, estuaries and other shallow inlets. These summer sites are discontinuous. A mother usually returns to the same site year after year. As its summer homes clog with ice during autumn, the beluga moves away for winter. Most travel in the direction of the advancing icepack and stay close its edge for the winter months. Others stay under the icepack—surviving by finding ice leads and polynyas (patches of open water in the ice) in which they can surface to breathe. Beluga may also find air pockets trapped under the ice. The beluga's ability to find the thin slivers of open water within a dense ice pack that may cover more than 96% of the surface mystifies scientists. Its echo-location capabilities are highly adapted to the sub-ice sea's peculiar acoustics and it has been suggested that belugas can sense open water through echo-location.

In 1849, while constructing the first railroad between Rutland and Burlington in Vermont, workers unearthed the bones of a mysterious animal in the town of Charlotte. Buried nearly 10 feet (3.0 m) below the surface in a thick blue clay, these bones were unlike those of any animal previously discovered in Vermont. Experts identified the bones as those of a beluga. Because Charlotte is over 150 miles (241 km) from the nearest ocean, early naturalists were at a loss to explain the bones of a marine mammal buried beneath the fields of rural Vermont. Today, the Charlotte whale aids in the study of the geology and the history of the Champlain Basin, and this fossil is now the official Vermont State Fossil (making Vermont the only state whose official fossil is that of a still extant animal).

On June 9, 2006, a young beluga carcass was found in the Tanana River near Fairbanks in central Alaska, nearly 1,700 kilometers (1,056 mi) from the nearest ocean habitat. Belugas sometimes follow migrating fish, leading Alaska state biologist Tom Seaton to speculate that it had followed migrating salmon up the river at some point in the prior fall.

Life history

Pod of belugas swimming

Belugas are highly sociable. Groups of males may number in the hundreds, while mothers with calves generally mix in slightly smaller groups. When pods aggregate in estuaries, they may number in the thousands. This can represent a significant proportion of the entire population and is when they are most vulnerable to hunting.

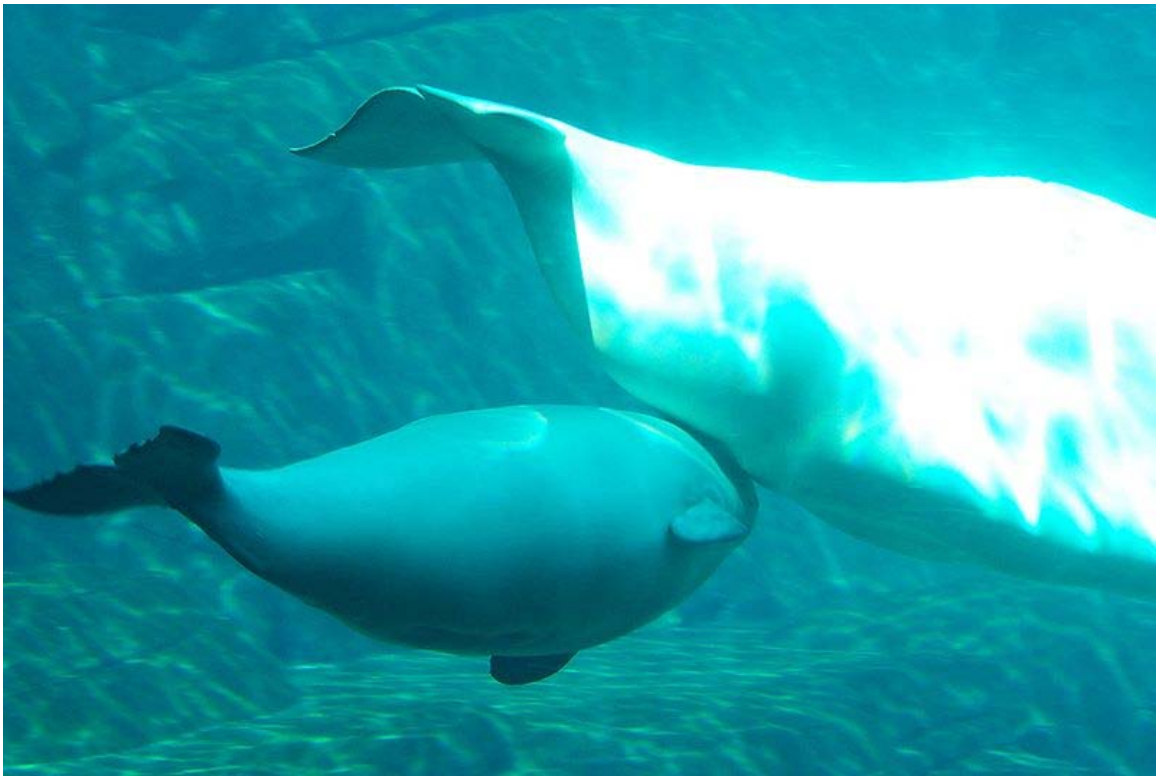
Pods tend to be unstable, meaning that they tend to move from pod to pod. Radio tracking has shown that belugas can start out in a pod and within a few days be hundreds of miles away from that pod. Mothers and calves form the beluga's closest social relationship. Nursing times of two years have been observed and lactational anestrus may not occur. Calves often return to the same estuary as their mother in the summer, meeting her sometimes even after becoming fully mature.

Belugas can be playful—they may spit at humans or other whales. It is not unusual for an aquarium handler to be drenched by one of his charges. Some researchers believe that spitting originated with blowing sand away from crustaceans at the sea bottom.

Unlike most whales, it is capable of swimming backwards.

Males reach sexual maturity between four and seven years, while females mature at between six and nine years. The beluga can live more than 50 years.

Reproduction



Female and calf

Female belugas typically give birth to one calf every three years. Most mating occurs between February and May, but some mating occurs at other times of year. It is questionable whether the beluga has delayed implantation. Gestation last 12 to 14.5 months.

Calves are born over a protracted period that varies by location. In the Canadian Arctic, calves are born between March and September, while in Hudson Bay the peak calving period is in late June and in Cumberland Sound most calves are born from late July to early August.

Newborns are about 1.5 metres (4.9 ft) long, weigh about 80 kilograms (180 lb), and are grey in color. The calves remain dependent on their mothers for at least two years.

Ecology

Feeding

The beluga is a slow swimmer that feeds mainly on fish. It also eats cephalopods (squid and octopus) and crustaceans (crab and shrimp). Foraging on the seabed typically takes place at depths of up to 1,000 feet (300 m) but they can dive at least twice this depth. A typical feeding dive lasts 3–5 minutes, but belugas submerge for up to 20 minutes at a time.

Predation

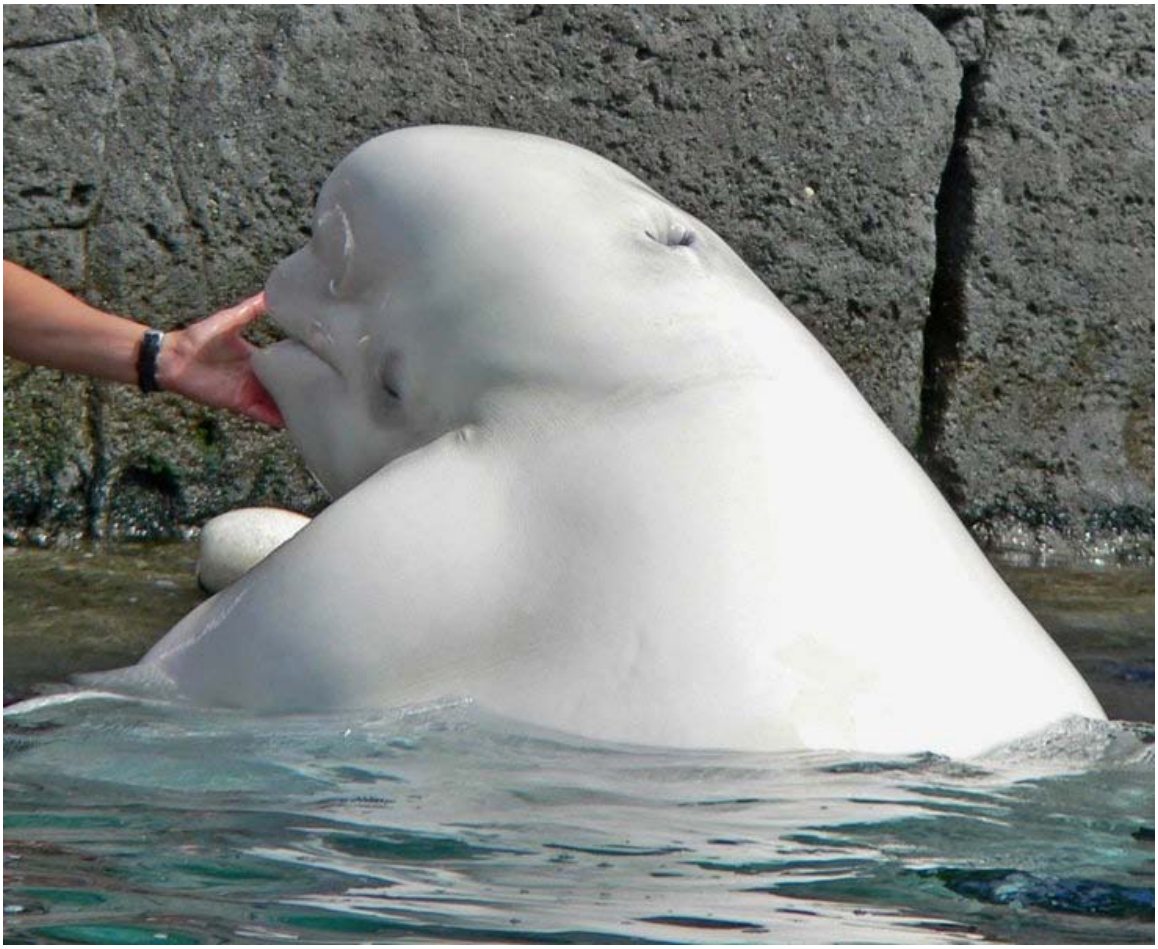
Polar bears take particular advantage of situations when belugas become trapped by ice and are thus unable to reach the ocean. The bears swipe at the belugas and drag them onto the ice. The orca is its other significant natural predator.

Relation to humans

Belugas were among the first whale species in captivity. The first beluga was shown at Barnum's Museum in New York City in 1861. Today it remains one of the few whale species kept at aquaria and sea life parks across North America, Europe, and Asia. Its popularity there with visitors reflects its attractive color, and its range of facial expressions. While most cetacean "smiles" are fixed, the extra movement afforded by the beluga's unfused cervical vertebrae allows a greater range of apparent expression. Most belugas found in aquariums are caught in the wild, though captive breeding programs enjoy some success.

Both the United States Navy and the Russian Navy have used belugas in anti-mining operations in Arctic waters. In one instance, a captive beluga helped bring a distressed diver who was performing a stunt in his pool up to the surface, possibly saving the diver's life. Another time, a captive beluga brought a cramp-paralized diver from the bottom of the pool up to the surface by holding her foot in its mouth, certainly saving the female diver's life.

Population and threats



A beluga whale in an aquarium with a trainer

The global population of belugas today stands at about 100,000. Although this number is much greater than that of many other cetaceans, it is much smaller than pre-hunting populations. There are estimated to be 40,000 individuals in the Beaufort Sea, 25,045 in Hudson Bay, 18,500 in the Bering Sea, and 28,008 in the Canadian Low Arctic. The population in the St. Lawrence estuary is estimated to be around 1,000. It is considered an excellent sentinel species (indicator of environment health and changes). This is because it is long-lived, on top of the food web, bearing large amounts of fat and blubber, relatively well-studied for a cetacean, and still somewhat common.

Because the beluga congregates in river estuaries, pollution is proving to be a significant health danger. Incidents of cancer have been reported to be rising as a result of St. Lawrence River pollution. Local beluga carcasses contain so many contaminants that they are treated as toxic waste. Reproductive pathology has been discovered here, possibly caused by organochlorines. Levels between 240 ppm and 800 ppm of PCBs have been found, with males typically having higher levels. The long-term effects of this pollution on the affected populations is not known.

A beluga resurfaces

Indirect human disturbance may also be a threat. While some populations tolerate small boats, others actively try to avoid ships. Whale-watching has become a booming activity in the St. Lawrence and Churchill River areas.

Because of its predictable migration pattern and high concentrations, the beluga has been hunted by indigenous Arctic peoples for centuries. In many areas, hunting continues, and is believed to be sustainable. However, in other areas, such as the Cook Inlet, Ungava Bay, and off western Greenland, previous commercial operations left the populations in great peril. Indigenous whaling continues in these areas, and some populations continue to decline. These areas are the subject of intensive dialogue between Inuit communities and national governments aiming to create a sustainable hunt.

Pathogens

Papillomaviruses have been found in the gastric compartments of belugas in the St. Lawerence River. Herpesvirus as well has been detected on occasion in belugas. Encephalitis has sometimes been observed and the protozoa *Sarcocystis* can infect the animals. Ciliates have been observed to colonize the blowhole yet may not be pathogenic or especially harmful.

Erysipelothrix rhusiopathiae bacilli, likely from contaminated fish in the diet, can endanger captive belugas, causing anorexia, dermal plaques, and lesions. This may lead to death if not diagnosed early and treated with antibiotics.

Conservation status

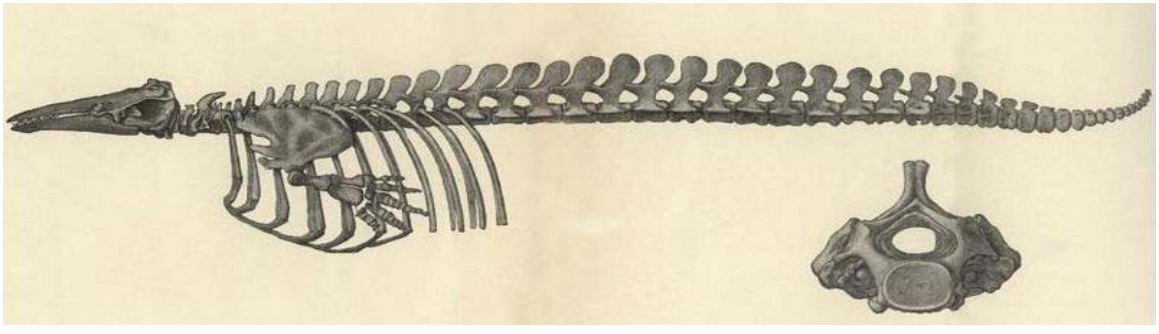
As of 2008, the beluga is listed as "near threatened" by the IUCN. This is due to uncertainty about the number of belugas over parts of its range (especially the Russian Arctic) and the expectation that if current conservation efforts cease, especially hunting management, the beluga population is likely to qualify for "threatened" status within five years. Prior to 2008, the beluga was listed as "vulnerable", a higher level of concern. IUCN cited the stability of the largest subpopulations and improved census methods that indicate a larger population than previously estimated.

To prevent hunting, belugas are protected under the International Moratorium on Commercial Whaling; however, small amounts of beluga whaling are still allowed. Since it is very difficult to know the exact population of belugas because their habitats include inland waters away from the ocean, it is easy for them to come in contact with oil and gas development centers. To prevent whales from coming in contact with industrial waste, the Alaskan and Canadian governments are relocating sites where whales and waste come in contact.

To prevent captive whales from dying, researchers from the Vancouver Aquarium Marine Science Centre are finding ways to prevent fungi from entering the habitats and to constantly check their health. Healthy captive belugas are important because they are one of the only whales found in many marine aquariums. The high numbers of captives adds to the threat to the beluga population, while their carcasses contribute to scientific research.

Subpopulations are subject to differing levels of threat and warrant individual assessment. The Cook Inlet subpopulation is listed as "Critically Endangered" by the IUCN as of 2006. The Cook Inlet beluga population is listed as Endangered under the Endangered Species Act as of October 2008. This was due to overharvesting of belugas prior to 1998. The population has failed to recover even though the reported harvest has been small. The most recent published estimate as of May 2008 was 302 (CV=0.16) in 2006. In addition, the National Marine Fisheries Service indicated that the 2007 aerial survey's point estimate was 375.

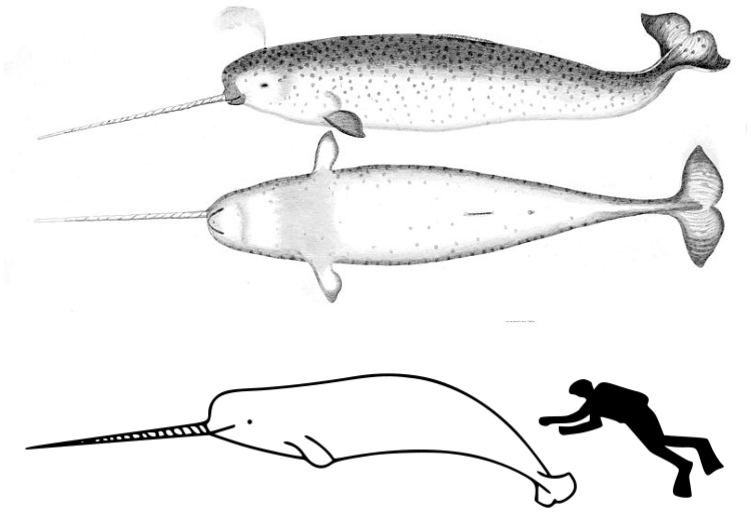
Evolution



Skeleton of D. leucas

The beluga's earliest known ancestor is the prehistoric *Denebola brachycephala* from the late Miocene period. A single fossil from the Baja California peninsula, indicates that the family once inhabited warmer waters. The fossil record also indicates that in comparatively recent times the beluga's range varied with that of the polar ice packs—expanding during ice ages and contracting when the ice retreats.

Narwhal

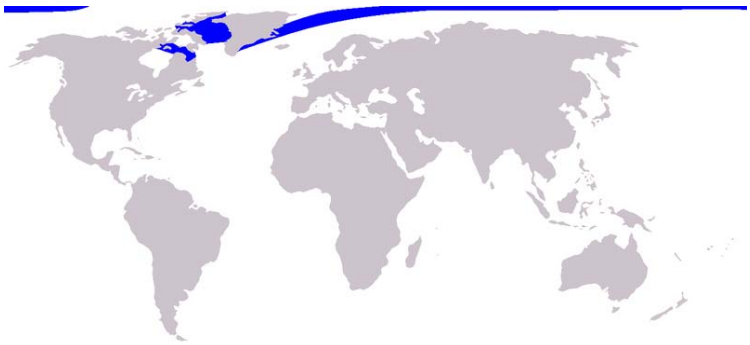
Narwhal

Size comparison with an average human
Conservation status

Near Threatened (IUCN 3.1)
Scientific classification
Kingdom: Animalia
Phylum: Chordata
Class: Mammalia
Order: Cetacea
Suborder: Odontoceti
Family: Monodontidae
Genus: ***Monodon*** Linnaeus, 1758

Species: ***M. monoceros***

Binomial name

Monodon monoceros
Linnaeus, 1758



Narwhal range (in blue)

The **narwhal**, ***Monodon monoceros*** is a medium-sized toothed whale that lives year-round in the Arctic. One of two living species of whale in the Monodontidae family, along with the Beluga whale, the narwhal males are distinguished by a characteristic long, straight, helical tusk extending from their upper left jaw. Found primarily in Canadian Arctic and Greenlandic waters rarely south of 65°N latitude, the narwhal is a uniquely specialized Arctic predator. In the winter, it feeds on benthic prey, mostly flatfish, at depths of up to 1500 m under dense pack ice. Narwhal have been harvested for over a thousand years by Inuit people in Northern Canada and Greenland for meat and ivory and a regulated subsistence hunt continues to this day. While populations appear stable, the narwhal has been deemed particularly vulnerable to climate change due to a narrow geographical range and specialized diet.

Taxonomy and etymology

The narwhal was one of the many species originally described by Linnaeus in his *Systema Naturae*. This is based on the Old Norse word *nár*, meaning "corpse", in reference to the animal's greyish, mottled pigmentation, like that of a drowned sailor. The scientific name, *Monodon monoceros*, is derived from Greek: "one-tooth one-horn" or "one-toothed unicorn".

Description

A narwhal skull with double tusks, a rare trait in narwhals. Usually males have a single long tusk protruding from the incisor on the left side of the upper jaw. (Zoologisches Museum in Hamburg)

Male narwhals weigh up to 1,600 kilograms (3,500 lb), and the females weigh around 1,000 kilograms (2,200 lb). The pigmentation of the narwhal is a mottled black and white pattern. They are darkest when born and become whiter in color with age.

The most conspicuous characteristic of the male narwhal is its single 2–3 meter (7–10 ft) long tusk. It is an incisor tooth that projects from the left side of the upper jaw and forms a left-handed helix. The tusk can be up to 3 meters (9.8 ft) long—compared with a body length of 4–5 meters (13–16 ft)—and weigh up to 10 kilograms (22 lb). About one in 500

males has two tusks, which occurs when the right incisor, normally small, also grows out. A female narwhal has a shorter, and straighter tusk. She may also produce a second tusk, but this occurs rarely, and there is a single recorded case of a female with dual tusks.

The most broadly accepted theory for the role of the tusk is as a secondary sexual characteristic, similar to the mane of a lion or the tail feathers of a peacock. This hypothesis was notably discussed and defended at length by Charles Darwin, in *The Descent of Man, and Selection in Relation to Sex* (1871). It may help determine social rank, maintain dominance hierarchies or help young males develop skills necessary for performance in adult sexual roles. Narwhals have rarely been observed using their tusk for fighting, other aggressive behavior or for breaking sea ice in their Arctic habitat.

Behavior and diet

Narwhals "tusking"

Narwhals have a relatively restricted and specialized diet. Their prey is predominantly composed of Greenland halibut, polar and Arctic cod, shrimp and Gonatus squid. Additional items found in stomachs have included wolffish, capelin, skate eggs and sometimes rocks, accidentally ingested when whales feed near the bottom.

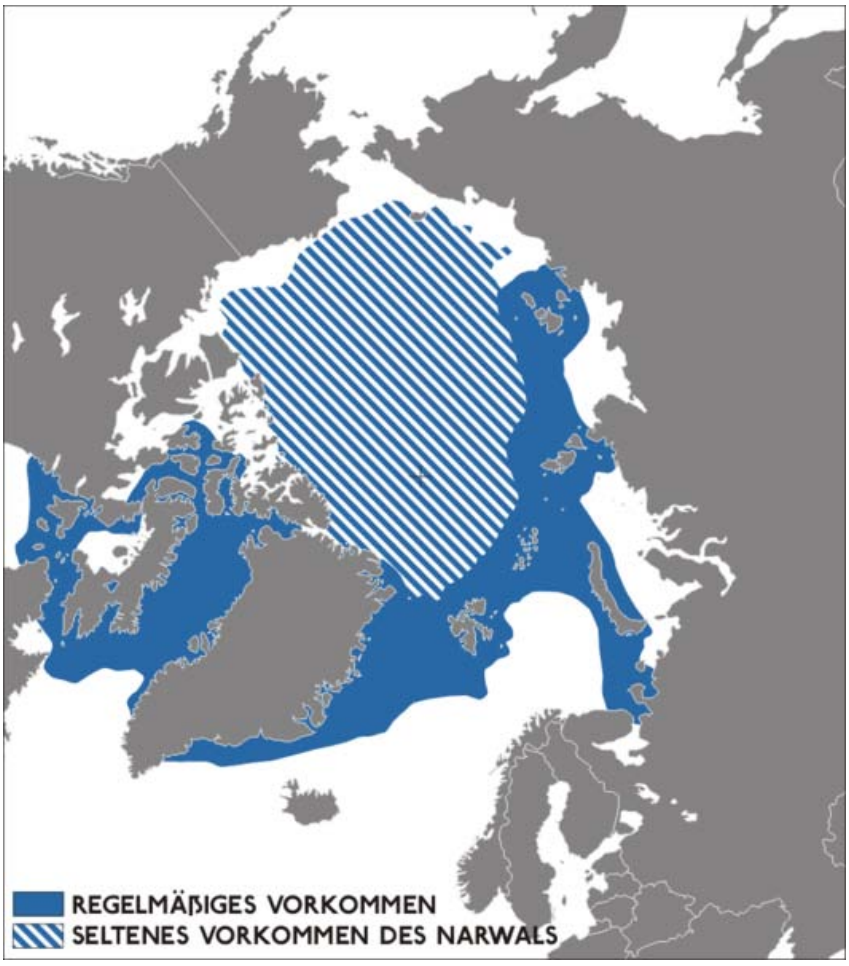
Narwhals exhibit seasonal migrations with high fidelity of return to preferred ice-free summering grounds, usually in shallow waters. In the winter, they are found primarily in offshore, deeper waters under thick pack ice, surfacing in narrow fissures in the sea ice, or leads. Narwhals from Canada and West Greenland winter regularly in the pack ice of Davis Strait and Baffin Bay along the continental slope with less than 5% open water and

high densities of Greenland halibut. Feeding in the winter accounts for a much larger portion of narwhal energy intake than in the summer and, as marine predators, they are unique in their successful exploitation of deep-water arctic ecosystems.

Most notable of their adaptations is the ability to perform deep dives. When on their wintering grounds, the narwhals make some of the deepest dives ever recorded for a marine mammal, diving to at least 800 meters (2,625 feet) over 15 times per day with many dives reaching 1,500 meters (4,921 feet). Dives to these depths last around 25 minutes, including the time spent at the bottom and the transit down and back from the surface. In the shallower summering grounds, narwhals dive to depths between 30 and 300 meters (90–900 feet).

Narwhals normally congregate in groups of about five to ten individuals. In the summer, several groups come together forming larger aggregations. At times, male narwhals rub their tusks together in an activity called "tusking". This behavior is thought to maintain social dominance hierarchies.

Population and distribution



The frequent (solid) and rare (striped) occurrence of narwhal populations

The narwhal is found predominantly in the Atlantic and Russian areas of the Arctic Ocean. Individuals are commonly recorded in the northern part of Hudson Bay, Hudson Strait, Baffin Bay; off the east coast of Greenland; and in a strip running east from the northern end of Greenland round to eastern Russia (170° East). Land in this strip includes Svalbard, Franz Joseph Land, and Severnaya Zemlya. The northernmost sightings of narwhal have occurred north of Franz Joseph Land, at about 85° North latitude.

The world population is currently estimated to be around 75,000 individuals. Most of the world's narwhals are concentrated in the fjords and inlets of Northern Canada and western Greenland.

Narwhals are a migratory species. In summer months they move closer to coasts, usually in pods of 10-100. As the winter freeze begins, they move away from shore, and reside in densely packed ice, surviving in leads and small holes in the ice. As spring comes, these leads open up into channels and the narwhals return to the coastal bays.

Predation and conservation

The only predators of narwhals besides humans are polar bears and orcas. Inuit people are allowed to hunt this whale species legally for subsistence. The northern climate provides little nutrition in the form of vitamins which can only be obtained through the consumption of seal, whale, and walrus. Almost all parts of the narwhal, meat, skin, blubber and organs, are consumed. *Mattak*, the name for raw skin and blubber, is considered a delicacy, and the bones are used for tools and art. In some places in Greenland such as Qaanaaq, traditional hunting methods are used, and whales are harpooned from handmade kayaks. In other parts of Greenland and Northern Canada, high-speed boats and hunting rifles are used.

The head of a lance made from a Narwhal tusk with a meteorite iron blade

Narwhal have been found to be one of the most vulnerable arctic marine mammals to climate change. The study quantified the vulnerabilities of 11 year-round Arctic sea mammals.

Narwhals that have been brought into captivity tend to die.

In culture

In Inuit legend, the narwhal's tusk was created when a woman with a harpoon rope tied around her waist was dragged into the ocean after the harpoon had struck a large narwhal. She was transformed into a narwhal herself, and her hair, which she was wearing in a twisted knot, became the characteristic spiral narwhal tusk.

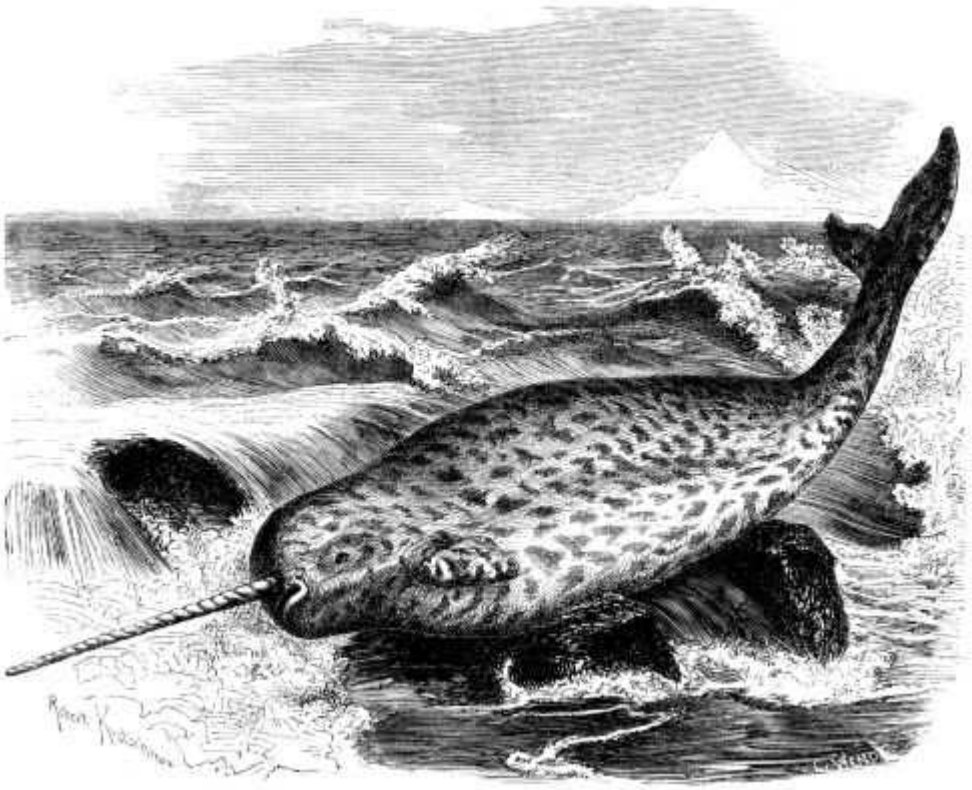


Image of narwhal from *Brehms Tierleben*

Some medieval Europeans believed narwhal tusks to be the horns from the legendary unicorn. As these horns were considered to have magic powers, such as the ability to cure poison and melancholia, Vikings and other northern traders were able to sell them for many times their weight in gold. The tusks were used to make cups that were thought to negate any poison that may have been slipped into the drink. During the 16th century, Queen Elizabeth received a carved and bejeweled narwhal tusk for £10,000—the cost of a castle (approximately £1.5—2.5 Million in 2007, using the retail price index). The tusks were staples of the cabinet of curiosities.

The truth of the tusk's origin developed gradually during the Age of Exploration, as explorers and naturalists began to visit Arctic regions themselves. In 1555, Olaus Magnus published a drawing of a fish-like creature with a horn on its forehead, correctly identifying it as a "Narwal".

Literary references

The narwhal was one of two possible explanations of the giant sea phenomenon written by Jules Verne in his book *Twenty Thousand Leagues Under the Sea*. The other possible explanation was a man made vessel, but that was not likely in the opinion of the narrator.

Herman Melville wrote a section on the narwhal in Moby Dick, in which he claims that a narwhal tusk hung for "a long period" in Windsor Castle after Sir Martin Frobisher had given it to Queen Elizabeth.

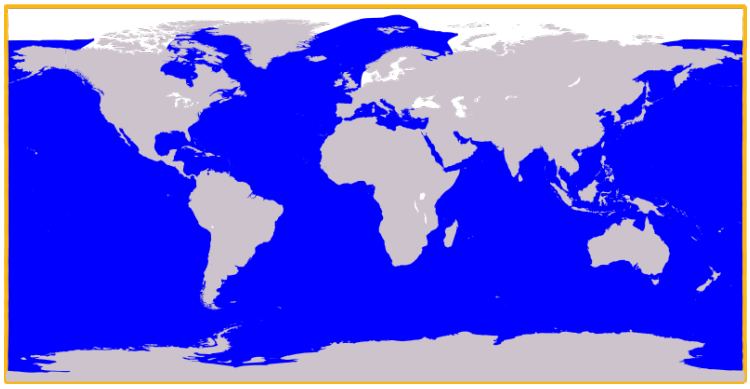
Killer whale

Killer whale

Transient killer whales near Unimak Island, eastern Aleutian Islands, Alaska
Conservation status

Data Deficient (IUCN 3.1)
Scientific classification
Kingdom: Animalia
Phylum: Chordata
Class: Mammalia
Order: Cetacea
Suborder: Odontoceti
Family: Delphinidae
Genus: ***Orcinus***
Species: ***O. orca***
Binomial name
Orcinus orca

(Linnaeus, 1758)



Orcinus orca range (in blue)

Synonyms

Orca gladiator

The **killer whale** (*Orcinus orca*), commonly referred to as the **orca**, and less commonly as the **blackfish**, is a toothed whale belonging to the oceanic dolphin family. Killer whales are found in all oceans, from the frigid Arctic and Antarctic regions to tropical seas. Killer whales as a species have a diverse diet, although individual populations often specialize in particular types of prey. Some feed exclusively on fish, while others hunt marine mammals such as sea lions, seals, walruses and even large whales. Killer whales are regarded as apex predators, lacking natural predators and preying on even large sharks.

Killer whales are highly social; some populations are composed of matrilineal family groups which are the most stable of any animal species. Their sophisticated hunting techniques and vocal behaviors, which are often specific to a particular group and passed across generations, have been described as manifestations of culture.

The IUCN currently assesses the orca's conservation status as data deficient because of the likelihood that one or more killer whale types are separate species. Some local populations are considered threatened or endangered due to prey depletion, habitat loss, pollution (by PCBs), capture for marine mammal parks, and conflicts with fisheries. In late 2005, the killer whales known as the "southern resident killer whales" were placed on the U.S. Endangered Species list.

Wild killer whales are not considered a threat to humans, although there have been cases of captives killing or injuring their handlers at marine theme parks. Killer whales feature strongly in the mythologies of indigenous cultures.

Taxonomy and evolution

Orcinus orca is the only recognized species in the genus *Orcinus*, one of many animal species originally described by Linnaeus in 1758 in *Systema Naturae*. Konrad Gessner wrote the first scientific description of a killer whale in his "Fish book" of 1558, based on

examination of a dead stranded animal in the Bay of Greifswald that had attracted a great deal of local interest.

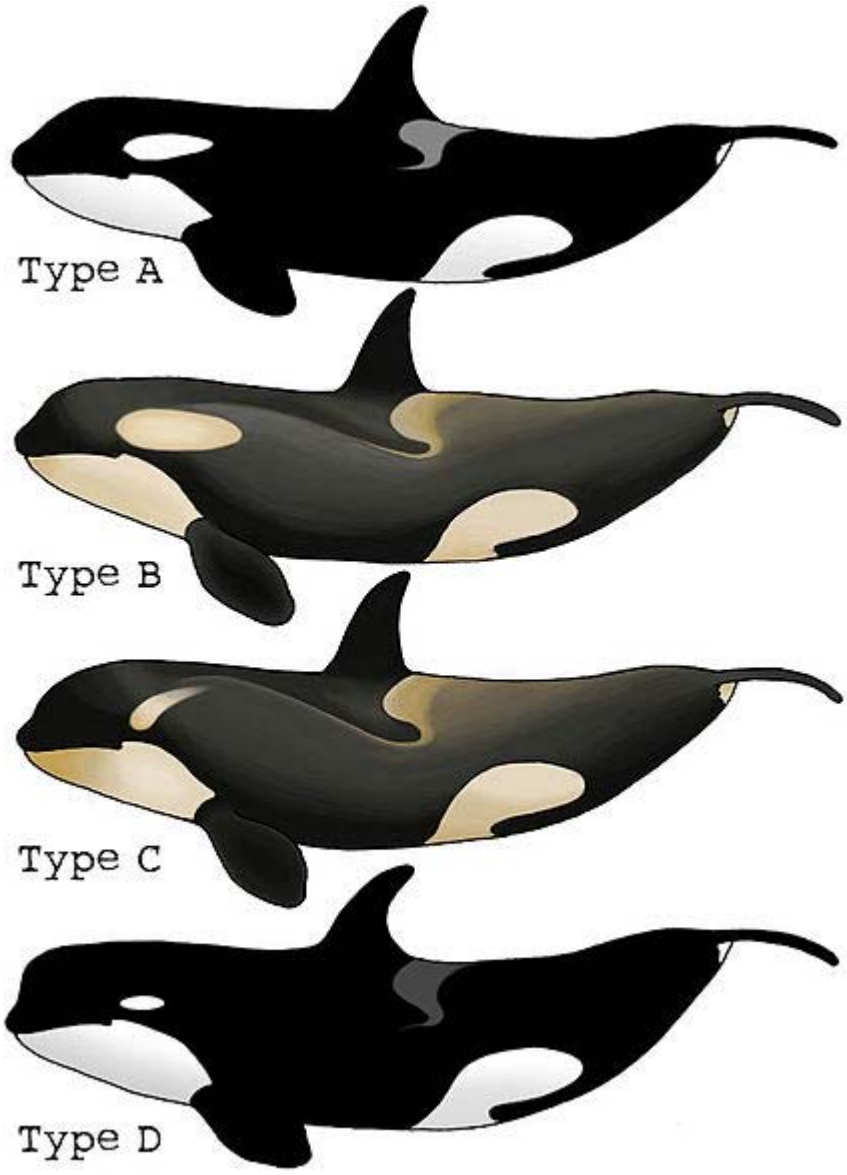
The killer whale is one of 35 species in the oceanic dolphin family, which first appeared about 11 million years ago. The killer whale lineage probably branched off shortly thereafter. Although it has morphological similarities with pilot whales and pygmy killer whales, its closest relative is the Irrawaddy dolphin.

Common names

English-speaking scientists most often use the term *killer whale*, although the term *orca* is increasingly used. *Killer whale* advocates point out that it has a long heritage. Indeed, the genus name *Orcinus* means "of the kingdom of the dead", or "belonging to Orcus." Ancient Romans originally applied *orca* (plural *orcae*) to these animals, possibly borrowing it from the Greek ὄρυξ, which referred (among other things) to a whale species. Since the 1960s, *orca* has steadily grown in popularity; both names are now used. The term *orca* is preferred by some to avoid the negative connotations of "killer", and because the species is more closely related to dolphins than to whales.

They are sometimes referred to as blackfish, a name used for some whale species as well. *Grampus* is a former name for the species, but is now seldom used. This meaning of grampus should not be confused with the *Grampus* genus, whose only member is Risso's Dolphin.

Types



Some examples of variations in Killer Whales

There are three to five types of killer whales that may be distinct enough to be considered different races, subspecies, or possibly even species. The IUCN reported in 2008, "The taxonomy of this genus is clearly in need of review, and it is likely that *O. orca* will be split into a number of different species or at least subspecies over the next few years." In the 1970s and 1980s, research off the west coast of Canada and the United States identified the following three types:

- **Resident**: These are the most commonly sighted of the three populations in the coastal waters of the northeast Pacific. Residents' diet consists primarily of fish and sometimes squid, and they live in complex and cohesive family groups called

pods. Female residents characteristically have a rounded dorsal fin tip that terminates in a sharp corner. They visit the same areas consistently. British Columbia and Washington resident populations are amongst the most-intensively studied marine mammals. Researchers have identified and named over 300 killer whales over the past 30 years.

- **Transient**: The diet of these whales consists almost exclusively of marine mammals; they do not eat fish. Transients generally travel in small groups, usually of two to six animals, and have less persistent family bonds than residents. Transients vocalize in less variable and less complex dialects. Female transients are characterized by more triangular and pointed dorsal fins than those of residents. The gray or white area around the dorsal fin, known as the "saddle patch," often contains some black colouring in residents. However, the saddle patches of transients are solid and uniformly gray. Transients roam widely along the coast—some individuals have been sighted in both southern Alaska and California.
- **Offshore**: A third population of killer whales in the northeast Pacific was discovered in 1988 when humpback whale researcher Jim Darling observed them in open water. As their name suggests, they travel far from shore and feed primarily on schooling fish. However, because of the large scarred and nicked dorsal fins resembling those of mammal-hunting transients, they may also eat mammals and sharks. They have mostly been encountered off the west coast of Vancouver Island and near the Queen Charlotte Islands. Offshores typically congregate in groups of 20–75 with occasional sightings of larger groups of up to 200. Currently, little is known about their habits, but they are genetically distinct from residents and transients. Offshores appear to be smaller than the others, and females are characterized by dorsal fin tips that are continuously rounded.

Type C killer whales in the Ross Sea. The eye patch slants forward.

Transients and residents live in the same areas, but avoid each other. The name *transient* originated from the belief that these killer whales were outcasts from larger resident pods. Researchers later discovered that transients are not born into resident pods or vice-versa. The evolutionary split between the two groups is believed to have begun two million years ago. Genetic data indicates that the types have not interbred for up to 10,000 years.

Other populations have not been as well studied, although specialized fish-eating and mammal-eating killer whales have been distinguished elsewhere. Separate populations of fish-eating and mammal-eating killer whales have been identified around the United Kingdom. Fish-eating killer whales in Alaska and Norway have resident-like social

structures, while mammal-eating killer whales in Argentina and the Crozet Islands behave more like transients.

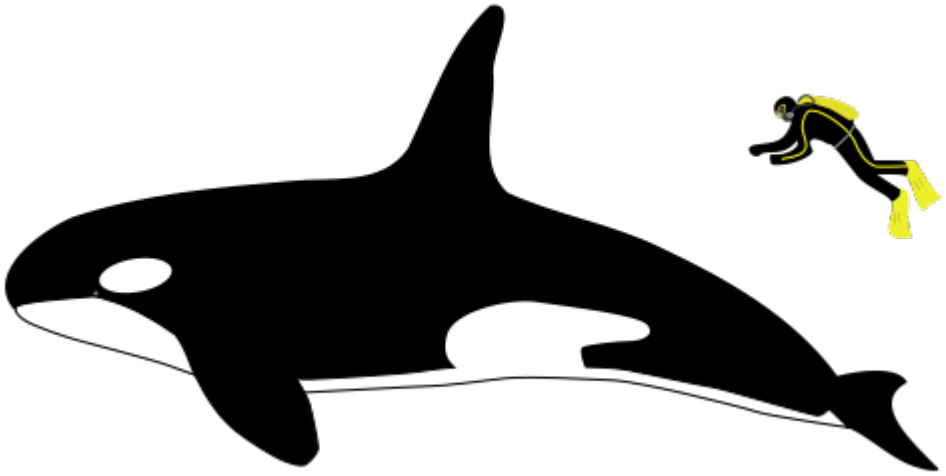
Three types have been documented in the Antarctic. Two dwarf species, named *Orcinus nanus* and *Orcinus glacialis*, were described during the 1980s by Soviet researchers, but most cetacean researchers are skeptical about their status, and it is difficult to link these directly to the types described below.

- **Type A** looks like a "typical" killer whale, a large, black and white form with a medium-sized white eye patch, living in open water and feeding mostly on minke whales.
- **Type B** is smaller than Type A. It has a large white eye patch. Most of the dark parts of its body are medium gray instead of black, although it has a dark gray patch called a "dorsal cape" stretching back from its forehead to just behind its dorsal fin. The white areas are stained slightly yellow. It feeds mostly on seals.
- **Type C** is the smallest type and lives in larger groups than the others. Its eye patch is distinctively slanted forwards, rather than parallel to the body axis. Like Type B, it is primarily white and medium gray, with a dark gray dorsal cape and yellow-tinged patches. Its only observed prey is the Antarctic Cod.
- **Type D** was identified based on photographs of a 1955 mass stranding in New Zealand and six at-sea sightings since 2004. Immediately recognizable by its extremely small white eye patch, shorter than usual dorsal fin that curves back, and bulbous head (similar to a pilot whale). Its geographic range appears to be circumglobal in subantarctic waters between latitudes 40°S and 60°S. And although nothing is known about the Type D diet, it is suspected to include fish because groups have been photographed around longline vessels where they reportedly depredate Patagonian toothfish (Dissostichus eleginoides).

Types B and C live close to the ice pack, and diatoms in these waters may be responsible for the yellowish coloring of both types. Mitochondrial DNA sequences support the theory that these are separate species that have recently diverged. More recently, complete mitochondrial sequencing indicates that the two Antarctic groups that eat seals and fish should be recognized as distinct species, as should the North Pacific transients, leaving the others as subspecies pending additional data.

Research is ongoing into the genetic relationships among killer whale types, and whether the types that have been identified represent deep evolutionary trends. For example, it was long thought that mammal-eating killer whales were likely to be closely related to other mammal-eating killer whales from different regions, but genetic testing refuted this hypothesis.

Description



Size comparison to an average human.

The dorsal fin and saddle patch of a resident killer whale in the northeastern Pacific Ocean. It may be either an adult female, or a juvenile of either sex.

Killer whales distinctively bear a black back, white chest and sides, and a white patch above and behind the eye. Calves are born with a yellowish or orange tint, which fades to white. Killer whales have a heavy and robust body (more so than other dolphins) and a large dorsal fin up to 2 metres (6.6 ft) tall. Behind the fin, they have a dark grey "saddle patch" across the back. Antarctic killer whales may have pale grey to nearly white backs. Adult killer whales are very distinctive and are not usually confused with any other sea creature. When seen from a distance, juveniles can be confused with other cetacean species such as the false killer whale or Risso's dolphin.

Males typically range from 6 to 8 metres (20–26 ft) long and weigh in excess of 6 tonnes (5.9 LT; 6.6 ST). Females are smaller, generally ranging from 5 to 7 metres (16–23 ft) and weighing about 3 to 4 tonnes (3.0 to 3.9 LT; 3.3 to 4.4 ST). The largest male killer whale on record was 9.8 metres (32 ft), weighing over 10 tonnes (9.8 LT; 11 ST), while

the largest female was 8.5 metres (28 ft), weighing 7.5 tonnes (7.4 LT; 8.3 ST). Calves at birth weigh about 180 kilograms (397 lb) and are about 2.4 metres (7.9 ft) long. The killer whale's large size and strength make it among the fastest marine mammals, able to reach speeds in excess of 30 knots (56 km/h).

Killer whale pectoral fins are large and rounded, resembling paddles. Males have significantly larger pectoral fins than females. At about 1.8 metres (5.9 ft) the male's dorsal fin is more than twice the size of the female's and is more of a triangular shape—a tall, elongated isosceles triangle—whereas hers is shorter and more curved. Males and females also have different patterns of black and white skin in the genital area.

Individual killer whales can often be identified from the dorsal fin and saddle patch. Variations such as nicks, scratches, and tears on the dorsal fin and the pattern of white or grey in the saddle patch are unique. Published directories contain identifying photographs and names for hundreds of North Pacific animals. Photo identification has enabled the local population of killer whales to be *counted* each year rather than *estimated* and has enabled great insight into lifecycles and social structures.

White killer whales occur sporadically among normal killer whales, but are rare. They have been spotted in the northern Bering Sea and around St. Lawrence Island, and near the Russian coast. In February 2008, a white killer whale was photographed 2 miles (3 km) off Kanaga Volcano.

Killer whales have good eyesight above and below the water, excellent hearing, and a good sense of touch. They have exceptionally sophisticated echolocation abilities, detecting the location and characteristics of prey and other objects in their environment by emitting clicks and listening for echoes.

Life cycle

An adult male killer whale with its characteristic tall dorsal fin swims in the waters near Tysfjord, Norway

Female killer whales mature at around age 15. They then have periods of polyestrous cycling with non-cycling periods of between 3 and 16 months. Gestation varies from 15 to 18 months. Mothers calve, with usually a single offspring, about once every 5 years. In resident pods, birth occurs at any time of year, although winter is the most popular. Mortality is extremely high during the first six months of life, when 37–50% of all calves die. Weaning begins at about 12 months and completes by the age of two. According to observations in several regions, all male and female killer whale pod members participate in the care of the young. Killer Whales and Pilot whales are the only species in which the females go through menopause and live for decades after they have finished breeding.

Females breed until age 40, meaning that on average they raise five offspring. The lifespan of wild females averages 50 years, with a maximum of 80–90 years. Males sexually mature at the age of 15 but do not typically reproduce until age 21. Wild males live around 29 years on average, with a maximum of 50–60 years. One male, known as Old Tom, was reportedly spotted every winter between the 1840s and 1930 off New South Wales, Australia. This would have made him up to 90 years old. Examination of his teeth indicated he died around age 35, but this method is now believed to be inaccurate for older animals. One male well known to researchers in the Pacific Northwest called Ruffles (J1) is estimated to have been born in 1951, making him 58 years old in 2009. Captive killer whale lifespans are typically significantly shorter, usually less than 25 years; however, numerous individuals are alive in their thirties, and a few have reached their 40s. In many instances, the lifespans of killer whales depend on the will of the animal.

Range and habitat

To travel quickly, killer whales leap out of the water when swimming—a behaviour known as porpoising

Killer whales are found in all oceans and most seas. Due to their enormous range, numbers and density, distributional estimates are difficult to compare, but they clearly prefer higher latitudes and coastal areas over pelagic environments.

Systematic surveys indicate the highest densities of killer whales (>0.40 individuals per km²) in the northeast Atlantic around the Norwegian coast, in the north Pacific along the Aleutian Islands, the Gulf of Alaska and in the Southern Ocean off much of the coast of Antarctica. They are considered "common" (0.20–0.40 individuals per 100 km²) in the eastern Pacific along the coasts of British Columbia, Washington and Oregon, in the North Atlantic Ocean around Iceland and the Faroe Islands. High densities have also been reported but not quantified in the western North Pacific around the Sea of Japan, Sea of Okhotsk, Kuril Islands, Kamchatka and the Commander Islands and in the southern hemisphere off the coasts of South Australia, Patagonia, off the coast of southern Brazil and the tip of southern Africa. They are reported as seasonally common in the Canadian Arctic, including Baffin Bay between Greenland and Nunavut, and around Tasmania and Macquarie Island. Information for offshore regions and tropical waters is more scarce, but widespread, if not frequent, sightings indicate that the killer whale can survive in most water temperatures. There have been sightings, for example, in the Mediterranean, the Arabian Sea, the Gulf of Mexico and the Indian Ocean around the Seychelles.

Probably the largest population lives in Antarctic waters, where they range up to the edge of the pack ice and are believed to venture into the denser pack ice, finding open leads much like beluga whales in the Arctic. In contrast, killer whales are seasonal summer visitors to Arctic waters, where they do not approach the ice pack. With the rapid Arctic sea ice decline in the Hudson Strait, their range now extends deep into the northwest Atlantic.

Migration patterns are poorly understood. Each summer, the same individuals appear off the coasts of British Columbia and Washington State. After decades of research, where these animals go for the rest of the year remains unknown. Transient pods have been sighted from southern Alaska to central California. Resident killer whales sometimes travel as much as 160 kilometres (100 mi) in a day, but may be seen in a general area for a month or more. Resident killer whale pod ranges vary from 320 to 1,300 kilometres (200 to 810 mi).

Occasionally, killer whales swim into freshwater rivers. They have been documented 100 miles (161 km) up the Columbia River in the United States. They have also been found in the Fraser River in Canada and the Horikawa River in Japan.

Population

Worldwide population estimates are uncertain, but recent consensus suggest an absolute minimum of 50,000. Local estimates include roughly 25,000 in the Antarctic, 8,500 in the tropical Pacific, 2,250–2,700 off the cooler northeast Pacific and 500–1,500 off Norway. Japan's Fisheries Agency estimated there were 2,321 killer whales in the seas around Japan.

Feeding

A killer whale skeleton

Killer whales hunt varied prey; however, different populations/species tend to specialize. For example, some populations in the Norwegian and Greenland sea specialize in herring and follow that fish's autumnal migration to the Norwegian coast. Other populations prey on seals. Salmon account for 96% of northeast Pacific residents' diet. 65% of them are large, fatty Chinook. Chum salmon are also eaten, but smaller sockeye and pink salmon are not a significant food item. Depletion of specific prey species in an area is therefore cause for concern for local populations, despite the high diversity of prey. On average, a killer whale eats 227 kilograms (500 lb) each day.

Since some killer whales prey on large whales and sharks, they are considered to be apex predators. They are sometimes called the wolves of the sea, because they hunt in groups like wolf packs.

Fish and other cold-blooded prey

Fish-eating killer whales prey on around 30 species of fish, particularly Chinook, salmon, herring, and tuna. In New Zealand, rays are killer whales' most frequent prey, and they have also been observed hunting sharks (particularly makos, threshers and smooth hammerheads). Squid and sea turtles are also taken.

Resident (fish-eating) killer whales. The curved dorsal fins are typical of resident females.

Killer whales can induce tonic immobility in sharks and rays by holding them upside down, rendering them helpless and incapable of injuring the whale. Some sharks suffocate within about 15 minutes while the whale holds them still, because these sharks need to move to breathe. In one incident filmed near the Farallon Islands, a female killed a 3–4-metre (9.8–13 ft) long great white shark, apparently after swimming with it upside-down in her mouth and inducing tonic immobility in it. She and another pod member ate the shark's liver and allowed the rest of the carcass to sink.

In July 1992, two killer whales attacked, killed and fed on an 8-metre (26 ft) long whale shark, *Rhincodon typus*, in the waters off Bahia de los Angeles in Baja California.

While salmon are usually hunted by an individual or a small group of individuals, herring are often caught using carousel feeding: the killer whales force the herring into a tight ball by releasing bursts of bubbles or flashing their white undersides. They then slap the ball with their tail flukes, either stunning or killing up to 10–15 at a time. The herring are then eaten one at a time. Carousel feeding has only been documented in the Norwegian killer whale population and with some oceanic dolphin species.

Mammal prey

California sea lions are common prey for mammal-eating killer whales on the west coast of North America.

Killer whales are very sophisticated and effective predators. Twenty-two cetacean species have been recorded as killer whale prey, from examining either stomach contents, scarring on the prey's body, or feeding activity. Groups even attack larger cetaceans such as minke whales, gray whales, and rarely sperm whales or blue whales.

Hunting large whales usually takes several hours. Killer whales generally choose to attack young or weak animals instead. However, a group of five or more may attack a healthy adult. When hunting a young whale, a group chases it and its mother until they wear out. Eventually they separate the pair and surround the calf, preventing it from

surfacing to breathe, drowning it. Pods of female sperm whales sometimes protect themselves by forming a protective circle around their calves with their flukes facing outwards, using them to repel the attackers.

Other marine mammal prey species include most species of seal, sea lion and fur seal. Walruses and sea otters are less frequently taken. Often, to avoid injury, killer whales disable their prey before killing and eating it. This may involve throwing it in the air, slapping it with their tails, ramming it, or breaching and landing on it. Sea lions are killed by head-butting or after a stunning blow from a tail fluke. In the Aleutian Islands, a decline in sea otter populations in the 1990s was controversially attributed by some scientists to killer whale predation, although there is no direct evidence of this. The decline of sea otters followed a decline in harbour seal and Steller sea lion populations, the killer whale's preferred prey, which in turn may be substitutes for their original prey, now decimated by industrial whaling.

In steeply banked beaches off Península Valdés, Argentina, and the Crozet Islands, killer whales feed on South American sea lions and Southern elephant seals in shallow water, even beaching temporarily to grab prey before wriggling back to the sea. Beaching, usually fatal to cetaceans, is not an instinctive behavior, and can require years of practice for the young.

Killer whales swim by an iceberg with Adélie penguins in the Ross Sea, Antarctica. The Drygalski Ice Tongue is in the background.

"Wave-hunting" killer whales spy-hop to locate Weddell seals, Ross seals, crabeater seals and leopard seals resting on ice floes and then swim in groups to create waves that wash

over the floe. This washes the seal into the water where another killer whale waits to kill it.

Killer whales have also been observed preying on terrestrial mammals, such as deer and moose swimming between islands off the northwest coast of North America. Killer whale cannibalism has also been reported based on analysis of stomach contents, but this is likely to be the result of scavenging remains dumped by whalers. One killer whale was also attacked by its companions after being shot. Although resident killer whales have never been observed to eat other marine mammals, they occasionally harass and kill porpoises and seals for no apparent reason.

Birds

Killer whales in many areas prey on several bird species, including penguins, cormorants and gulls. A captive killer whale at Marineland discovered that it could regurgitate fish onto the surface, attracting sea gulls, and then eat the birds. Four other killer whales then learned to copy the behavior.

Behavior

Killer whales often raise their bodies out of the water in a behaviour called spyhopping.

Day-to-day killer whale behavior generally consists of foraging, traveling, resting and socializing. Killer whales are frequently active at the surface, engaging in acrobatic behaviors such as breaching, spyhopping, and tail-slapping. These activities may have a variety of purposes, such as courtship, communication, dislodging parasites, or play. Spyhopping, a behaviour in which a whale holds its head above water, helps the animal view its surroundings.

Resident killer whales swim with porpoises, other dolphins, seals, and sea lions, which are common prey for transient killer whales.