

Society for Marine Mammalogy - Gray Whale Species Account

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SPECIES: *Eschrichtius robustus*

DISCOVERY

The gray whale (*Eschrichtius robustus*) was first known to science on the basis of a subfossil skeleton from Sweden described by Lilljeborg in 1861. The family and genus names refer to the Danish zoology professor Daniel Eschricht and the species name means “strong” or “oaken” in Latin. The gray whale is the sole species in the family *Eschrichtiidae*.

Once common throughout the Northern Hemisphere, the gray whale became extinct in the Atlantic by the early 1700s. Gray whales are now only found in the North Pacific where there are two extant populations. Recent genetic studies suggest that these two populations, called the “eastern” and “western” North Pacific populations, are discrete.

TAXONOMY

- Order: Cetacea
- Sub-order: Mysticeti
- Family: Eschrichtiidae
- Genus: Eschrichtius

NATURAL HISTORY

Size, shape and distinctive characteristics

Gray whales are intermediate in size and girth, slimmer than right whales but more rotund than most rorquals, and appear somewhat torpedo-shaped when viewed from above. At birth, calves are about 4.6 to 4.9 m long and weigh about 680 to 920 kg. Adults range in size from 11 to 15 m and attain a maximum body weight of about 45,000 kg. Females are slightly larger than males of the same age. The life span of gray whales is unknown but has been estimated to vary from at least 40 to over 80 years.

The contour of the mouth is slightly arched and contains the fewest baleen plates of any whale species, with 130-180 yellowish white plates on each side of the mouth. These plates are relatively short (ranging from 5 to 40 cm long), with very coarse

bristles on the inner fringe; a design well suited for a suction feeder that often forages on benthic invertebrates.

Two to five deep longitudinal creases, but not ventral grooves as found in the balaenopterids, are present on the underside of the throat. Gray whales have a dorsal hump followed by series of 6 to 12 crenulations (often called “knuckles”) along the top of the caudal peduncle. The flippers are relatively short and paddle shaped, with rounded margins and pointed tips. The flukes are broad, often spanning more than 3 m wide in large adults.

Geographical distribution

The range of the extinct North Atlantic population(s) is uncertain but appears to have included coastal waters of Europe and Iceland, as well as the east coast of North America. No evidence exists that gray whales ever occurred in the Southern Hemisphere.

The eastern North Pacific gray whale population summers and feeds mainly in the Chukchi, Beaufort and the northwestern Bering Seas. Although most gray whales utilize their Arctic feeding grounds, a small number (100s) of whales summer and feed along the Pacific coast between southeast Alaska and northern California. The population migrates south along the coast in the autumn to winter breeding grounds on the west coast of Baja California, Mexico, and the southeastern Gulf of California. During winter, large numbers of whales, particularly females with newborn calves, utilize coastal lagoons on the Pacific coast of the Baja peninsula. The summer distribution of the eastern population has greatly expanded, especially to more northern feeding areas, in the past several decades. This range expansion coincides with the northerly retreat of sea ice in the Arctic.

The distribution of the western North Pacific population is less clear. The major known feeding ground is in the Okhotsk Sea off the northeastern coast of Sakhalin Island, Russia, but some animals are also seen off the eastern coast of Kamchatka and in other coastal waters of the northern Okhotsk Sea. The population migrates south in the autumn but the present day migration route(s) and winter breeding ground(s) are poorly known. Scattered information collected since the 1930s suggest that whales migrate along the coasts of Japan and South Korea (although no sightings off South Korea have been reported in over a decade) to wintering areas somewhere in the South China Sea, possibly near Hainan Island.

In May 2010 a gray whale was observed in the Mediterranean Sea off Israel and the same individual was sighted again a month later off Barcelona, Spain. It is impossible to know if this record of a single individual is indicative of a mounting reoccupation of the historic range (especially in light of receding sea ice in the Northwest and Northeast Passage) or simply represents an extraordinary event.

Ecology and behaviour

Gray whales undertake one of the longest annual migrations of any mammal, traveling some 15,000-20,000 km round trip. By late November, most gray whales are moving south from summer feeding areas to winter calving areas. This southern migration is segregated by age, sex and reproductive condition. The first pulse of migrants is led by: (a) near-term pregnant females, followed by (b) estrous females and mature males and then (c) immature animals of both sexes. The northward migration begins about mid-February and is also segregated according to age, sex and reproductive condition. The first phase of this northern migration includes: (a) newly pregnant females followed later by (b) adult males and anestrous females and then (c) immature whales of both sexes. The second phase consists mostly of mothers with calves. These pairs are observed on the migration route between March and May and generally arrive to the summer feeding grounds between May and June.

Migrating gray whales move steadily in one direction, breathing and diving in predictable patterns. They commonly travel alone or in small unstable groups, although large aggregations can occur on both the feeding and breeding grounds. Except for mother-calf pairs, associations between individuals are relatively fluid. Breaching and other surface behaviors are common in this species.

The eastern gray whale population supports a major whale-watching industry along the west coast of North America. American whalers referred to gray whales as “devil fish” for their ferocity when threatened, particularly when protecting their young, but today the species is recognized for its “friendly” behaviour toward whale watching boats in the wintering lagoons of Baja.

Feeding gray whales are usually alone or in small groups but normally in near proximity to relatively high numbers (10s to 100s) of foraging conspecifics. Feeding behavior is often characterized by predictable surface-dive-respiration patterns. Gray whales are primarily suction-feeders, although not exclusively, consuming benthic amphipods on or near the seafloor. Gular muscles work in combination with the tongue in a piston-like action to create the requisite suction for pulling prey into the mouth. When foraging on benthic prey, whales typically roll on their right side with the head slightly above the bottom and swim slowly while suctioning sediment into the side of the mouth and filtering out the prey with their baleen. This feeding behaviour creates long trails of water-borne sediment called “mud plumes” which are clearly visible in the water column and on the surface.

Life History

Gray whale breeding and calving are seasonal and closely synchronized with migratory timing. Sexual maturity is attained between 6 and 12 years of age. Breeding is highly synchronous, with females coming into estrous during a three-week period from late November to early December, which coincides with the onset of the southward migration. Conception is restricted to a short period between late November and early January. If there is no conception, a second estrous may occur 40 days later when the whales are on the wintering grounds. The gestation period is estimated to be 12 to 13 months, with a mean calving date in mid-January. Some

calves are born during the southward migration while others are born near or on the wintering grounds. Females normally reproduce at intervals of two years, producing a single calf every other year. Calves are weaned and become independent by seven to nine months old while on the summer feeding ground.

Diet

Gray whales feed on a wide range of benthic and epibenthic invertebrates, such as amphipods, that occur in dense colonies in shallow shelf or coastal waters during the summer. In some areas, gray whales also feed on locally abundant swarming species such as cumaceans, mysids, shrimp, mobile amphipods, crab larvae and herring eggs.

POPULATION STATUS

Global Abundance

The North Atlantic population of gray whales became extinct by the early 1700s. The cause of its extinction is unclear but it is suspected that whaling may have played a role. The eastern North Pacific gray whale population was rapidly depleted by commercial whaling but has successfully recovered from low population numbers. The population is presently estimated at about 20,000 animals. In contrast, the western gray whale population, which was also decimated by whaling, remains highly depleted today and its continued ability to survive is of concern. The most recent assessment of this population suggests that about 130 individuals exist.

IUCN status

The eastern North Pacific population is listed by the IUCN as “Least Concern”. The western North Pacific population is listed separately as “Critically Endangered”.

CONSERVATION ISSUES

Commercial whaling had devastating impacts on both gray whale populations in the North Pacific. The eastern North Pacific population had reached such low numbers by the end of the 19th century that commercial whaling ceased. The western population was thought by some to be extinct as recently as the 1970s. Fortunately, the eastern population has recovered to numbers thought to be near its current carrying capacity. Unfortunately, the western population remains precariously perched near extinction.

Both gray whale populations are subject to anthropogenic threats such as entanglements in fishing gear, environmental degradation including exposure to contaminants and disturbance by shipping and noise (e.g. seismic surveys) related to offshore oil and gas development. In addition, the consequences of climate change on gray whales and their habitat, especially the notable reduction of sea ice and increasing water temperatures in the Arctic, are yet to be determined.

The most pressing conservation issue for gray whales today is how best to protect the critically endangered western North Pacific gray whale population and ensure its continued survival into the future.

Key References

- Andrews, R.C. 1914. Monographs of the Pacific Cetacea. I. The California gray whale (*Rhachianectes glaucus* Cope). *Memoirs of the American Museum of Natural History* 1(5):227-87.
- Bradford, A.L., Wade, P.R., Weller, D.W., Burdin, A.M., Ivashchenko, Y.V., Tsidulko, G.A. and Brownell, R.L., Jr. 2006. Survival estimates of western gray whales (*Eschrichtius robustus*) incorporating individual heterogeneity and temporary emigration. *Marine Ecology Progress Series* 315:293-307
- Brownell, R.L., Jr. and Chun, C. 1977. Probable existence of the Korean stock of the gray whale (*Eschrichtius robustus*). *Journal of Mammalogy* 58:237-9.
- Calambokidis, J., Darling, J.D., Deecke, V., Gearin, P., Goshō, M., Megill, W., Tombach, C.M., Goley, D., Toropova, C. and Gisborne, B. 2002. Abundance, range and movements of a feeding aggregation of gray whales (*Eschrichtius robustus*) from California to southeastern Alaska in 1998. *Journal of Cetacean Research and Management*, 4: 267–276.
- Cooke, J.G., Weller, D.W., Bradford, A.L., Burdin, A.M. and Brownell, R.L., Jr. 2008. Population assessment of western gray whales in 2008. Paper SC/60/BRG11 presented to the IWC Scientific Committee, June 2008 (unpublished). 10pp.
- Darling, J.D., Keogh, K.E. and Steeves, T.E. 1998. Gray whale (*Eschrichtius robustus*) habitat utilization and prey species off Vancouver Island, B.C. *Marine Mammal Science* 14: 692-720.
- Grebmeier, J.M. et al. 2006. A major ecosystem shift in the northern Bering Sea. *Science* 311:1461-1464.
- Henderson, D.A. 1984. Nineteenth century gray whaling: grounds, catches and kills, practices and depletion of the whale population. In: M.L. Jones, S.L. Swartz and S. Leatherwood (Eds.) *The Gray Whale, Eschrichtius robustus*. Academic Press, Inc., Orlando, FL.
- Highsmith, R.C., Coyle, K.O., Bluhm, B.A., and Kona, B. 2006. Gray whales in the Bering and Chukchi Seas. In: J.A. Estes, D.P. DeMaster, D.F. Doak, T.M. Williams, and R.L. Brownell, Jr. (Eds.) *Whales, Whaling, and Ocean Ecosystems*. University of California Press, CA.
- IUCN 2005. Report of the Independent Scientific Review Panel on the impacts of Sakhalin II Phase 2 on western North Pacific gray whales and related biodiversity. IUCN, Gland, Switzerland. <<http://www.iucn.org>>.
- Jones, M.L. and Swartz, S.L. 1984. Demography and phenology of gray whales and evaluation of whalewatching activities in Laguna San Ignacio, Baja California Sur, Mexico. In: M.L. Jones, S.L. Swartz and S. Leatherwood (Eds.) *The Gray Whale, Eschrichtius Robustus*. Academic Press, Inc., Orlando, FL.
- Jones, M.L. and Swartz, S.L. 2008. Gray Whale. In: W.F. Perrin, B. Würsig, and H. Thewissen (Eds.). *Encyclopedia of Marine Mammals*. Second Edition. Academic

Press, San Diego, CA.

Krupnik, I. 1984. Gray whales and the aborigines of the Pacific Northwest: the history of aboriginal whaling. In: M.L. Jones, S.L. Swartz and S. Leatherwood (Eds.) *The Gray Whale, Eschrichtius robustus*. Academic Press, Inc., Orlando, FL.

Lang, A.R. 2010. The population genetics of gray whales (*Eschrichtius robustus*) in the North Pacific. Ph.D. Thesis, University of California San Diego, 202 pp.

LeDuc, R.G., Weller, D.W., Hyde, J., Burdin, A.M., Rosel, P.E., Brownell, R.L., Jr., Würsig, B. and Dizon, A.E. 2002. Genetic differences between western and eastern gray whales (*Eschrichtius robustus*). *Journal of Cetacean Research and Management* 4:1-6.

Mead, J.G. & Mitchell, E.D. (1984) Atlantic gray whales. In: In: M.L. Jones, S.L. Swartz and S. Leatherwood (Eds.) *The Gray Whale, Eschrichtius robustus*. Academic Press, Inc., Orlando, FL.

Mizue, K. (1951) gray whales in the East Sea area of Korea. *Scientific Reports of the Whale Research Institute* 5:71-79.

Moore, S.E. et al. 2001. Are gray whales hitting "K" hard? *Marine Mammal Science*, 17:954-958.

Moore, S.E. 2008. Marine mammals as ecosystem sentinels. *Journal of Mammalogy*, 89:534-540.

Moore, S.E. and Ljungblad, D.K. 1984. Gray whales in the Beaufort, Chukchi, and Bering Seas: distribution and sound production. In: M.L. Jones, S.L. Swartz and S. Leatherwood (Eds.) *The Gray Whale, Eschrichtius robustus*. Academic Press, Inc., Orlando, FL.

Moore, S.E., Grebmeier, J.M. and Davies, J.R. 2003. Gray whale distribution relative to forage habitat in the northern Bering Sea: current conditions and retrospective summary. *Canadian Journal of Zoology* 81:734-742.

Nerini, M. 1984. A review of gray whale feeding ecology. In: M.L. Jones, S.L. Swartz and S. Leatherwood (Eds.) *The Gray Whale, Eschrichtius robustus*. Academic Press, Inc., Orlando, FL.

Perryman, W.L., Donahue, M.A., Perkins, P.C., and Reilly, S.B. 2002. Gray whale calf production 1994-2000: are observed fluctuations related to changes in seasonal ice cover? *Marine Mammal Science* 18:121-44.

Reilly, S.B., Bannister, J.L., Best, P.B., Brown, M., Brownell, Jr., R.L., Butterworth, D.S., Clapham, P.J., Cooke, J., Donovan, G.P., Urban, J. and Zerbini, A.N. 2008. *Eschrichtius robustus*. In: IUCN Red List of Threatened Species. Version 2010.2 <www.iucnredlist.org>

Rice, D.W. and Wolman, A.A. 1971. The Life History and Ecology of the Gray Whale (*Eschrichtius robustus*). Special Publication No. 3, The American Society of Mammalogists, 142pp.

Rugh, D.J., Shelden, K.E.W. and Schulman-Janiger, A. 2001. Timing of the gray whale southbound migration. *Journal of Cetacean Research and Management*, 3:31-39.

Rugh, D.J., Hobbs, R.C., Lerczak, J.A., and Breiwick, J.M. 2005. Estimates of abundance of the eastern North Pacific stock of gray whales (*Eschrichtius robustus*) 1997–2002. *Journal of Cetacean Research and Management* 7:1–12

Shelden, K.E.W., Rugh, D.J., Schulman-Janiger, A. 2004. Gray whales born north of Mexico: Indicator of recovery or consequence of regime shift? *Ecological Applications*, 14:1789-1805.

Swartz, S.L., Taylor, B.L. and Rugh, D.J. 2006. Gray whale *Eschrichtius robustus* population and stock identity. *Mammal Review* 36:66-84.

Urbán-R., J., Rojas-Bracho, L., Pérez-Cortés, H., Gómez-Gollardo, A., Swartz, S., Ludwig, S., and Brownell, R.L., Jr. 2003. A review of gray whales (*Eschrichtius robustus*) on their wintering grounds in Mexican waters. *Journal of Cetacean Research and Management* 5:281-295.

Weller, D.W., Burdin, A.M., Würsig, B., Taylor, B.L. and Brownell, R.L., Jr. 2002. The western North Pacific gray whale: a review of past exploitation, current status and potential threats. *Journal of Cetacean Research and Management* 4: 7-12.

Weller, D.W., Bradford, A.L., Kato, H., Bando, T., Ohtani, S., Burdin, A.M. and Brownell, R.L., Jr. 2008. Photographic match of a western gray whale between Sakhalin Island, Russia, and Honshu, Japan: First link between feeding ground and migratory corridor. *Journal of Cetacean Research and Management*, 10:89-91.