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# NORTHWEST WILDLIFE PRESERVATION SOCIETY

## Northern Elephant Seal

*Mirounga Angustirostris*



Photo credit: Thesealsofnam.org

By Veronica Pagowski

The northern elephant seal is a unique species that has survived, against the odds, from a small population of anywhere from 5-100 individuals on Guadalupe Island, off the coast of Mexico. Elephant seals were hunted to near extinction in the 19<sup>th</sup> century for their blubber which was used to produce lamp oil. This species has made a remarkable comeback and can now be seen along most of the western coast of North America during various parts of the year. Northern elephant seals are named for their characteristic long nose which can be inflated to produce loud roaring sounds and also functions as a water-retention mechanism during long stays on the coast. Northern elephant seals also have incredible diving abilities that are being extensively researched in the hopes that these animals will provide us with more information about the deep ocean and an insight into the mechanisms that allow for such deep dives. An understanding of these mechanisms may allow humans to replicate them in advanced diving equipment, giving us the opportunity to explore the deep sea in the future.

### Characteristics

Male northern elephant seals have a very distinctive appearance which makes them fairly distinguishable from any other seal species within their range. Males can be several times larger than females, can weigh over 1,850 kgs (4,000 lbs), and be around 4.5 m in length. Females, on the other hand, are much smaller and do not have a large inflatable nose, called a proboscis, that is characteristic of males. When the male proboscis is not inflated, it hangs in front of the seal's face like an elephant's trunk. Females typically weigh around 750 kg and are about 3.5 m in length. Female seals are light grey or tan while males are dark brown. As they get older, elephant seals tend to get lighter in color, with males often becoming almost pinkish-grey. This is partially a result of molting, which occurs annually. During molting, elephant seals shed their entire old coat of fur while resting on the shore. The difference in appearance between

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females and males, or sexual dimorphism, is a distinctive feature of this species. It has been hypothesized that variations in habitat range and diet may be partially responsible for this as males tend to dive deeper than females when searching for food and remain closer to the coastline compared to females. In addition, males have to be much more massive as they establish a harem of breeding females.

Northern elephant seals have vibrissae that resemble whiskers, and are able to detect vibrations, likely used to locate prey when diving. These seals have very large eyes with a high concentration of low-light pigments, suggesting that this species also relies heavily on eyesight to find prey in the ocean depths.. The eyes are particularly large in females and sub-adult males. Northern elephant seals have webbed fore-flippers with keratinous black-brown nails which help them move around on land (at up to 8 km per hour) while their hind fins allow for phenomenal maneuverability in the water. Young pups are born with a dark coat, which is shed to reveal a lighter greyish coat when the pup is about a month old. This species has an unusually large amount of blood which contains a high concentration of oxygen-rich blood cells. Additionally, northern elephant seals are able to store blood in their abdomen and spleen and release it slowly as they dive to incredible depths where oxygen levels are low and temperatures can fall to below 0 degrees Celsius. Elephant seals are also able to minimize blood flow to extremities so that vital organs and the brain receive sufficient oxygen during deep dives. While on land, this species typically has a heart rate of about 55-120 beats per minute. During dives, this can drop to an extraordinary 4-15 beats per minute. Before a dive, northern elephant seals will actually exhale, so that their lungs compress. This may minimize the effects of pressure when diving or reduce buoyancy. Arteries are often surrounded by many small veins in order to conserve heat. As warm blood moves away from the heart to oxygenate organs, some of the heat can be retained by these surrounding veins. To conserve water during extended stays on land, these seals use a special bony structure in the nasal passage that is covered in moist tissue and mucus. As air is inhaled, it is warmed and moistened so that the surfaces in the nasal passage cool due to evaporation. Then, as warm air is exhaled, water condenses on these surfaces instead of escaping during respiration.

## Life Cycle

Northern elephant seals are the only known species that migrates twice per year. One of these migrations occurs just before the breeding season in December to March. During this time, seals migrate from northern locations as far up as the Aleutian Islands down to locations near California and Mexico. The peak pupping season is in January. During this time, females typically have one pup which they will nurse for about three weeks. After this period, females abandon their pups and leave for the sea to feed. The pups gather in groups and spend the next 12 weeks learning how to swim and fend for themselves. The second migration occurs during molting season in April to May and occurs as far north as British Columbia. Molting in elephant seals is unusual because the entire coat is shed almost at once while in other animals this process occurs gradually.

Northern elephant seals have evolved an adaptation called delayed implantation which allows females to delay pregnancy so that mating can occur soon after birthing while the seals remain on land. The gestation period is thus a fairly long 11 months. During the nursing period, pups can gain up to 4.5 kg of weight per day, as they accumulate blubber from their mother's fat-rich milk. Mothers and pups develop a distinctive call to communicate with each other and remain close to each other during nursing. Mothers will often become aggressive towards other females and even other pups while nursing their own. On rare occasions mothers have been known to adopt pups that are not their own. However, in some circumstances, females may kill pups that are without their birth-mother and wander near a mother and her pup. Females will mate within a few days after the birthing period before they depart for their long journey at sea, where they will spend approximately 80 percent of their lives. During the mating period, just before the seals depart to sea, a single alpha male may maintain and protect a group of females (called a harem) as large as 100 individuals. Males will contend for this role by trumpeting through their long proboscis and biting each other's chests. These battles, though rarely fatal, can be bloody. As a result, older males develop a thick pink chest shield that is resilient to many of these blows. The winner of

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these battles can become the protectorate of a harem and may breed with well over 50 females within the harem. Losers are not permitted to mate, but may make an attempt to breed with females on the edges of the harem, if able to successfully avoid an attack from the alpha male. In some cases, intruding males attempting to breed with females can crush or suffocate pups, while maneuvering through the colony. Females seem to be aware of this danger, and will call out to the alpha male if intruding males make an attempt to mate. The alpha male will attack these intruders, protecting the harem. While on land, both females and males will fast for up to 3 months, losing anywhere from 35 to 50 percent of their original body weight. Males become sexually mature at about 4-6 years but rarely gain territorial status or breeding rights until about 9 or 10 years old. Males have a lifespan of around 17 years while females live about 22 years. Most males tend to return to the same location every year to mate while females may travel to various locations from year to year. As the adults return to sea after the breeding period, they embark on long journeys, with male bulls covering as much as 1000 km in 250 days and frequently diving to depths of 800 m and remaining underwater for 20 minutes. The only other mammals known to dive deeper than the northern elephant seal are the pilot whale and sperm whales.

## Habitat

Northern elephant seals can be found along the western North American coast from Baja California to Alaska, now occupying much of their original range, though their entire population was once concentrated on a single island off the coast of Mexico. The northern elephant seal is geographically separated from another species which it resembles in appearance: the southern elephant seal. The southern elephant seal occupies a range from the Antarctic coastline to the southernmost tip of South America.

The northern elephant seal spends most of its time at sea in deep water. It feeds on small sharks such as swell sharks and dogfish, squid, octopus, eels, rockfish, and crabs as well as some other similarly sized prey found in deep waters. Males spend most of their time diving near the coast while females tend to make less regular migrations, traveling further westward. By staying mostly in the deep ocean, this species is able to avoid its predators: primarily orcas and great white sharks. This has also likely allowed these seals to avoid a great deal of human-imposed threats such as fishing nets which are usually set out in much shallower waters. There are about 20 colonies worldwide, including non-breeding populations on British Columbia's coast. There is a limited degree of inter-breeding and mixing of seals from different islands and colonies. During their stay on the coast, northern elephant seals may stay on sandy, rocky, or muddy coastlines for up to three months. Several populations breed or come to molt on islands near North America's west coast. This species can be found feeding along the coasts of Baja California up to Vancouver Island.

## Behaviour

Northern elephant seals are adapted for the extremes: extreme depths, extreme temperatures, extreme mating and intense dryness while on land. As a result, they have many unique behavioural patterns. Northern elephant seals have, for example, been found to eat stones before coming to shore and eliminate them once back at sea. The reason for this is unknown. Males have distinctive loud calls and fighting displays that indicate dominance and allow the males the opportunity to pass on their genes by mating with 50-100 females. Usually, relatively few males will mate with the majority of the females in the colony based on their ability to fight off competitors. Males that lose these battles may be seen retreating to sea, possibly to search for another location where they may be more successful in a fight. When mating, males can overwhelm the female with their large size, restricting their movement. Females often have white scarring patterns around their necks as a result of "love bites" from aggressive mating. Females have distinct calls that may indicate aggression or communication to their pup. Males emit different noises, usually as a way to display dominance. Some of these sounds can be heard at the Marine Mammal Center website (<http://www.marinemammalcenter.org/education/marine-mammal-information/pinnipeds/northern-elephant-seal/>).

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Some scientists have speculated that these animals may nap during dives, since so much of their lifetime is spent diving. However, this has not been confirmed. Rest intervals at the surface are limited to several minutes. Northern elephant seals are the only animals known to collapse their lungs during dives. A lubricant that allows for this is currently being researched in the hopes that it may offer some insights on improving deep sea diving equipment in the future. Elephant seals feed at night and rarely search for food at depths shallower than 200 m. Generally, these animals are solitary except while in colonies on land.

## Threats

The northern elephant seal is considered a miraculous example of a conservation success story as all of the individuals surviving today are descended from a single population that may have been as small as twenty individuals. At one point, the northern elephant seal was believed to be extinct, before a population of survivors was found on Guadalupe Island. After this, Mexico granted this species official protection in 1890. Since then the species has increased in numbers dramatically. There are, however, reasons to be wary of this quick success. As the entire world population is descended from so few individuals, the world population is not very genetically diverse. In fact, molecular and DNA sequencing data has shown that northern elephant seal populations have very low genetic diversity. When a population has low genetic diversity, there is less variation in the population that may differentiate individuals from each other. This can be particularly harmful in the presence of diseases. Since individuals have a similar genetic makeup, it becomes increasingly likely that a disease that affects one individual will quickly spread to other individuals whereas in a population with high diversity, certain individuals may be resistant to new diseases. Thus, this species is particularly vulnerable to disease transmission caused by parasites and bacteria. Specifically, northern elephant seals can be affected by pneumonia, lung worm, and other parasites. Pups are also particularly sensitive to intense storms which can crush young seals while on shore, especially on crowded beaches. As there seems to be a strong correlation between the frequency and intensity of storms and global warming, this species may face greater threats due to storms in coming years. Currently the species is still protected by the marine mammal protection act but not classified as endangered or at risk.

Currently, northern elephant seal prey is not of great commercial value. However, there is a growing trend of fishing further out and deeper in the ocean, as fisheries closer to shore are over-exploited. If this trend continues, we may end up reducing populations of northern elephant seal prey, thus reducing their ability to survive. As many marine animals, Northern elephant seals are also threatened by pollution, marine debris, and loss of beach habitat. Loss of beach is of particular concern as this species relies on coastlines to breed. As sea levels rise due to global warming, it is likely that some sections of coastline, particularly along islands may be lost if nothing is done to protect them. Fatal collisions with boats and entanglement of northern elephant seals has also been reported.

The northern elephant seal only has two potential predators that can threaten individuals; orcas and great white sharks.

## What We Can Do To Help

Currently, it is estimated that around 45,000 northern elephant seal pups survive and 180,000 individuals are present worldwide. Considering that these individuals are all descendants from a single population of as few as 20 individuals, the northern elephant seal population has made a remarkable comeback in just over a century, an incredibly short amount of time on the biological time scale. There are still lots of ways we can help ensure this incredible species survives for generations to come and doesn't face extinction again. One great way to get involved in marine conservation is to become involved in beach cleanups. To get involved in a shoreline cleanup in Canada visit <http://www.shorelinecleanup.ca>. Another simple way to promote wildlife conservation is to learn more about some of the species in your community and share your knowledge with others. By simply sharing knowledge, we can create a community that is much more aware of the natural environment, and thus much more likely to take steps to protect it. One threat that many marine animals face is strikes from ships. We can help minimize this by ensuring that we follow

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safe boating guidelines when viewing wildlife or in certain areas where marine wildlife is common. For specific boating guidelines in Canada visit <http://www.pac.dfo-mpo.gc.ca/fm-gp/species-especies/mammals-mammiferes/view-observer-eng.html>.

Another way to help lots of marine animals is to become involved in the conservation of wetlands and areas that buffer storm damage to coastal areas. If you live in a region which has natural mangrove forest for example, volunteering for a project that replants mangrove trees can be particularly helpful. Areas such as mangroves, forests, wetlands, and lagoons are a vital part of the marine ecosystem because they can buffer the impact of colossal waves on land and serve as a breeding ground for many species.

One issue that has received increased attention in recent years is deep sea fishing. As fisheries close to shore are exploited, many fisheries have attempted to go either further and deeper out to sea to fish. We know very little about deep sea ecosystems and often have no idea what the consequences might be of removing species from this environment. Be aware of where your seafood comes from and always try to buy sustainable seafood. <http://www.seafoodwatch.org> has a detailed guide to eating sustainable seafood.

One more great way to get involved in wildlife conservation is to volunteer at an organization that is dedicated to conservation. There are many of these organizations located almost anywhere around the world. Usually, a quick google search will give many results for opportunities to volunteer in conservation in your area.

## Other Interesting Facts

- The deepest recorded dive by a northern elephant seal was to a depth of nearly 2 km (6,600 ft) and the longest recorded dive time for these animals is around 2 hours (without coming up for air).
- While on land, water is obtained only from the breakdown of food (through metabolic processes)
- Northern elephant seals are the second largest true seals in the world after the southern elephant seal
- Northern elephant seals are most vulnerable to predators when they leave and arrive on land as sharks have been known to gather around their breeding grounds and wait to attack the seals when they re-enter water. Sharks will usually only take a damaging bite out of the animal first and wait until it is weakened before further attack.
- This species has been used to study the effects of weightlessness on bone density since these animals spend most of their time in a neutral pressure environment (comparable to that of space with no gravity). Under decreased pressure, bone density decreases due to a change in the bone-building and breakdown process. This occurs in astronauts and becomes a problem when these individuals return to a higher pressure environment. NASA had done research on northern elephant seals in the hopes of finding ways to remedy this in astronauts by examining the adaptations this species has for dealing with pressure changes.
- There is a great deal of research being done to improve deep sea technology. One day northern elephant seals could help humans explore the deep sea by being carriers for such mechanisms as attached underwater cameras etc.

## Where & When to view the animal.

Northern elephant seals spend much of their lives in deep water, so it is difficult to view them outside of their breeding and molting season. It is occasionally possible to view northern elephant seals along British Columbia's coast during their molting season in the spring. Breeding occurs in southern locations.

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Año Nuevo State Reserve in California, for example, is a very popular tourist attraction and viewing area for breeding seals during winter months.

## Bibliography

The Seals of Nam is a website with many great photographs of northern elephant seals as well as a personal account of observations on their behavior and a good source for some general information. <http://www.thesealsofnam.org/northern-elephant-seal/>

The Food and Agriculture Organization of the United Nations website provides great general information on the species <http://www.fao.org/fishery/species/18220>

This publication provides information on current and past information on northern elephant seal population data. <http://ctfs.arnarb.harvard.edu/Public/Presentations/seals/DocentsAnoNuevo.pdf>

This short video on northern elephant seals is informative and a great way to watch some of their behavioral patterns. <http://science.kqed.org/quest/video/into-the-deep-with-elephant-seals/>

This website by photographer Jaymi Heimbuch has photographs of northern elephant seals as well as a great deal of general information of the species. <http://www.jaymiheimbuch.com/blog/2015/01/17/an-animal-of-extremes-how-the-northern-elephant-seal>

The Encyclopedia of Life had a great of of information on the species. Sources are all cited and trusted networks are labelled. <http://eol.org/pages/328640/details>

The Ask nature website gives a good description of the water-retention mechanism elephant seals use. <http://www.asknature.org/strategy/924ebec15991f6af8c68c4def4719710#.VVG10nBHak2>

The marine mammal center website gives general information on northern elephant seals and has audio files of northern elephant seal calls. <http://www.marinemammalcenter.org/education/marine-mammal-information/pinnipeds/northern-elephant-seal/>

This video on elephant seals is informative and provides information on behavior and has great images <https://m.youtube.com/watch?v=ai9V012SZro>

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