PINNIPEDIA

INTRODUCTION

The Pinnipeds is composed of 3 families, 17 genera and 33 species and is considered a suborder of the Carnivora Order and has a worldwide distribution in the coastal waters off most continents and many of the world's islands. They are found mostly in colder waters with only a few reaching equatorial regions. They have specialized adaptations to aquatic life.

The Family Otaridae (Sea lions, fur seals) has 14 species in 7 genera.
The Family Odobenidae contains the single genera and species of walrus.
The Family Phocidae (True or Elephant seals) has 19 species in 10 genera.

PHYSICAL AND BEHAVIORAL ADAPTATIONS

Few people have difficulty recognizing a seal or sea lion, with their streamlined, torpedo shaped bodies and all four limbs modified into flippers. The arm and leg bones are similar to other Carnivores, but the bases of the limbs are deeply enclosed within the body. Hands and feet are long and flattened, hence "Pinnipedia" which means 'feather footed'. Each limb has five broadly webbed, oar-like digits that form a flipper. The face is short in most species to aid in rapid propulsion through the water. External ears are small or entirely lacking and nostrils are slit-like. Ears and nostrils can be tightly closed when under water. Eyes are deeply set in a cushion of fat, and are adapted for underwater use. The cornea is flattened and the pupil is capable of great enlargement for better sight in dark water. The neck is generally thick and muscular, yet quite flexible.

There is a reduction in the interlocking processes of the vertebrae, which enables them to bend backwards to a greater degree than most animals. Overall body design is fluid with great power and grace, enabling these animals to absorb the shock of ocean waves, haul out on ice or rocky coast, or execute agile movements to capture prey at sea. Like dolphins and whales, Pinnipeds have thick layers of subcutaneous blubber to provide energy, buoyancy, and insulation. They all have a coarse coat of guard hairs to protect them from sand and rocks while ashore. The fur seals (Callorhinus and Arctocephalus) also possess a dense layer of under fur, which traps small bubbles and keeps the skin dry. All Pinnipeds have whiskers which are extremely tactile and which are kept lubricated by a secretion from their sebaceous glands.

True seals have greater blood volume per unit body weight than other mammals. The Wendell Seal has two and a half times that of an equivalently sized man. Additionally, the blood contains more oxygen-carrying hemoglobin, so that the oxygen capacity is three times that of humans. Even this increased oxygen store would not be sufficient for prolonged diving unless there were associated physiological changes. When a seal dives, a complex response occurs, of which the most obvious is a slowing of the heart rate: the output of the heart drops to 10-20 percent of its pre-dive values and the blood flow is diverted largely to the brain. This enables the seal to use its available oxygen in the most economical manner, and the oxygen requirements of most of its organs are greatly reduced.

Some seals, such as the Northern elephant seals, have been observed to remain submerged in a dive for over seventy-three minutes, staying on the surface for only two to five minutes between dives! The Wendell seal is able to reach depths of 1800 ft and remain down for up to 70 minutes though normal dives are less than 25 minutes. The California Sea lion (*Zalophus californianus*) can dive to 510 ft, Harbor Seal (*Phoca vitulina*) to 270 feet and the Grey seal (*Halichoerus grypus*) 450 feet.

EVOLUTION

While similar behavior seems to have evolved separately in the true seals and the eared seals, it is generally conceded that the Otaridae (eared seals) and Odobenidae (walruses) evolved from bear-like ancestors during the Oligocene some 24 mya whereas the Phocidae (earless or true seals) were early offshoots of the otters during the Miocene some 20 mya.

DENTITION

The dental formula is (**i**3/3, **c**1/1, **pm**4/4, **m**1/1-3) x 2 = 42 carnivore-like teeth. The molars have sharp cusps and are more suitable for grabbing and holding prey than for chewing (an adaptation to the life-style of Pinnipeds). Their prey is generally fish, squid, crustaceans and other marine animals. Less common pinniped prey are birds and other warm-blooded animals. Unlike other pinnipeds, canines of walrus are rootless, chopping instruments: pre-molars and molars are blunt structures modified to the walrus's diet of mollusks and other hard shelled creatures.

SENSES

Pinnipeds have well developed senses of sight, hearing and touch, but little is known about their sense of smell. Both eared and true seals produce strong odors during the breeding season. Scent is one way females identify their pups

The eyes are generally large with a retina adapted for low light conditions. By having rods only they lack color vision. Like cat they also have a reflective tapetum that enhances low light conditions by reflecting the light through the eye a second time. The structure of the internal ear is similar to most other mammals. Some seals produce click vocalizations under water and it has been suggested that these are used in echolocation though most seals locate their prey by sight. The whiskers of seals are well developed and it is possible that they are used to detect vibrations in the water. It has been shown that removal of whiskers has impaired the ability of Harbor seals to catch fish.

REPRODUCTIVE STRATEGIES

Pinnipeds have not made a complete transition from land to water. Those adaptations that fit them so well for life in the sea make them extremely clumsy and vulnerable on land, to which they must return to reproduce. Since they are so vulnerable to terrestrial predators when ashore, they have had to adopt various strategies to ensure their safety during the period of birth and dependence of the young. Typically, pinnipeds breed in the spring or early summer. After a period of intensive feeding, they assemble at the breeding sites. Most eared seals are polygamous while most true seals are monogamous. All give birth on shore; land or ice and mate once a year. Gestation is 8 to 15 months, with delayed implantation occurring in many species. This is an adaptation that allows births to take place at approximately the same time of year, an important feature for colonial, and in some cases, migratory species. Single births are the rule while twins are exceptionally rare. Newborns can swim, but pups of some species do not have enough blubber for buoyancy and insulation until they are several weeks old. Growth while nursing is rapid, as milk contains about 50 % fat. Weaning age varies from as little as two weeks to as long

as six months. They attain adult pelage by the end of their first summer and sexual maturity at two to five years. It is important to note that, due to competition, most do not breed until they are much older. The bulls of most species arrive at the breeding grounds several weeks before the cows. There is great activity as the stronger bulls attempt to stake out their territories. These "beach-masters" will fight younger bulls in very bloody contests in order to maintain their territories. There are always greater numbers of cows and calves than bulls. The strongest bulls maintain the largest numbers of cows in their harems because they hold the best/largest territories.

LOCOMOTION

The true seals can use only their front flippers on land and so move in the manner of an inch worm though on occasion they may roll. The sea lions and walruses are the only pinnipeds that can fold their back flippers under their bodies thus achieving locomotion by holding themselves erect on their front flippers to accomplish a sort of shuffling gait. In water, the eared seals propel themselves with a rowing motion of their front flippers while the back flippers are mainly used as a rudder. True seals propel themselves with a rowing motion of the hind flippers, and steer with the front.

STATUS AND CONSERVATION

Predators include large sharks, Killer whales, Leopard seals (that prey on a variety of smaller seals) and Polar bears. Since many species gather at specific islands or coastal sites, they have been easy targets for human hunters. Millions have been slaughtered for their blubber, newborn fur seals for their pelts, and walruses for their ivory. Threatened species include five fur seals species, walrus and all three sub species of Monk seal. Once seriously threatened the Elephant seal has increased in numbers in recent years. Today, Russia and other members of the former Soviet Union permit seals and walruses to be taken in the Bering and Chukchi seas. The taking of fur seals is regulated on the Pacific coasts of Canada and Alaska. Eskimos are permitted to take unlimited numbers of many species of pinnipeds. Young Harp and Hooded seals are commercially harvested in Newfoundland and the Gulf of St Lawrence for their pelts. This harvest has been strongly protested by conservation groups. The United States prohibits the taking of seals in its waters (certain specific purposes excepted) since passage of the Marine Mammals Protection Act of 1972.

MARINE MAMMAL PROTECTION ACT OF 1972

Under the provisions of this Act, there is a moratorium, with certain limited exceptions, on the taking and importation of marine mammals and marine animal parts and products. These animals include whales, dolphins, porpoises, seals, sea lions, walruses, sea otters and polar bears, and any parts or products made from these animals such as skins, furs, teeth, bones and oil. Such items will be subject to seizure by agents of the United States Government.

Sources:
Seals of the World; © 1982; by King, J.E.; Cornell University Press
Seals, Sea Lions and Walruses © 1958; by Scheffer, V.B.; Stanford University Press
Greizimek's Encyclopedia of Mammals © 1990 Bernard Grizmek, McGraw-Hill, Inc.
The Encyclopedia of Mammals © 1984 David Macdonald, New York: Facts on File
Walker's Mammals of the World © 1999 Ronald M. Nowak, Johns Hopkins University Press

Introduction to Marine Mammals by The Marine Mammal Center

Mammals are a special group of animals, with a combination of characteristics that separate them from all others: mammals breathe air through lungs, bear live young, produce milk for their young, are warm-blooded, and have hair or fur.

Marine mammals have the five characteristics of all mammals, yet they are distinctive in their appearance and survival strategies. Over millions of years, they have adapted or adjusted to life in the ocean. To keep warm in the ocean, most of them depend more upon a thick layer of blubber or fat than on their fur. They have streamlined bodies to help them swim faster. They can stay under water for a long time, but must come to the surface to breathe. To be able to stay under water for long periods, they store extra oxygen in their muscles and blood. They also have more blood than land mammals in proportion to their body sizes, can direct their blood flow to only their vital organs (such as their heart and lungs), and can slow their heartbeat down so they are using less oxygen in a dive. Learning to identify marine mammals is made easier by learning their scientific classification.

I. **Order Carnivora** includes five families of marine mammals:

   A. **Suborder Pinnipedia** is a "flipper-footed" marine mammal. Pinnipeds can safely come out on land to rest, breed, and give birth, and are comprised of three families:

      1. **Family Otariidae**: Sea lions and fur seals have visible external ears and can "walk" on all four flippers by rotating their rear flippers· forward. They are more mobile on land than true seals, and are often seen in circuses and aquariums. Their swimming power comes from their large front flippers. In California, this family includes California sea lions, Steller sea lions, northern fur seals; and Guadalupe fur seals.

      2. **Family Phocidae**: True seals have no external ears and crawl on land because their front flippers are small and their hind flippers cannot rotate forward. Their swimming power comes from their large, almost fan-like rear flippers. In California, this family includes harbor seals and northern elephant seals.

      3. **Family Odobenidae**: Walruses are distinctive for their two long tusks. Walruses inhabit the Arctic seas and ice floes. They have no external ears, but can rotate their hind flippers and "walk" on land. They are set apart from other pinnipeds not only by their tusks, but also by the presence of two large air pouches, or sacs, extending from each side the pharynx (in the neck). These pouches can be inflated to hold the head above water when sleeping, or used as resonance chambers to enhance underwater sound.

   B. **Suborder Fissipedia** includes all other marine mammals in the Order Carnivora except pinnipeds. This suborder is no longer formally recognized, but the adjective "fissiped", meaning paw·footed, is still used to describe these animals.

1. **Family Mustelidae**: Sea otters are the only marine member of the mustelid family, which includes such land mammals as weasels and badgers. Sea otters are the smallest marine mammals. They do not inhabit 'the open ocean, instead they live among coastal kelp beds, where they dive and hunt for a variety of shellfish and marine invertebrates. With their exceptionally thick, dark fur, longer tail, lack of true flippers, and their ability to use a rock as a feeding tool, sea otters are distinguished from other marine mammals. Sea otters are found off the Central Coast of California, and in Washington, Alaska, and Russia.

2. **Family Ursidae**: Polar bears are designated as marine mammals because they depend on the ocean for a majority of their food. Thus, they are protected under marine mammal protection laws. Polar bears range throughout the Arctic regions, including parts of Alaska.

II. **Order Cetacea**: Whales, dolphins, and porpoises are completely aquatic, they cannot live on land. They have two front flippers, and their tails are uniquely shaped into two horizontal extensions, called flukes, which provide tremendous swimming power. There are two suborders of cetaceans:

   A. **Suborder Odontoceti**: Toothed whales include dolphins, porpoises, and whales, such as the sperm whale, Orcas, narwhal, and beluga whale. Toothed whales breathe through a single blowhole.
   B. **Suborder Mysticeti**: Baleen whales include blue, gray, humpback, and bowhead whales, to name a few. Instead of teeth, baleen whales have rows of strong, closely spaced baleen plates along either side of their upper jaws. These plates filter out and trap small fish and floating plankton, which the whale then swallows. Baleen whales breathe though a pair of blowholes.

III. **Order Sirenia**: Dugongs and manatees live in warm or tropical waters and. feed on plants. 'Manatees are found in areas of coastal Florida. Another 'species of sirenian, called the Steller sea cow, once inhabited Arctic waters, but was hunted to extinction by 1768, within 27 years of its discovery.

Differences between Sea Lions and Seals

Order: Carnivora **Suborder: Pinnipedia** **Family: Otariidae =** ***sea lions and fur seals***	**Order: Carnivora** **Suborder: Pinnipedia** **Family: Phocidae =** ***seals***
1) 15 species	1) 19 species
2) Move on land by walking on all four flippers, hind flippers are rotated up under the body for support	2) Move on land by crawling, using front flippers and stomach muscles, while dragging their hind flippers, which cannot rotate forward
3) Use mainly front flippers to move through the water	3) Use mainly hind flippers to move through the water
4) Small external ear pinnae (flaps)	4) No external ear pinnae
5) Large front flippers (~25% of body length)	5) Small front flippers (<25% of body length)
6) No claws on front flippers, 3 claws on hind flippers	6) Claws on each digit of front and hind flippers
7) Cartilaginous extensions of digits (i.e. hind claws are not at the end of the flippers)	7) No cartilaginous extensions of digits
8) Flippers lack or have sparse fur	8) Flippers are covered with fur
9) Pelage is a uniform color and may have underfur	9) Pelage is often spotted or banded, with no underfur
10) Smooth vibrissae (whiskers)	10) Beaded vibrissae
11) Four teats	11) Two or four teats
12) Sexual dimorphism	12) Little sexual dimorphism
13) All species are polygamous	13) Most species thought to be monogamous
14) All species are exclusively marine	14) Breeding may occur in rivers, some species live permanently in lakes
15) Testes are scrotal	15) Testes are internal

A GUIDE TO CALIFORNIA PINNIPEDS

-ear pinnae present
-beige & brown whiskers
-short fur

-fore flippers mostly hairless
-fur extends down onto flipper
-nails rudimentary

-hind flippers hairless
-nails present on middle 3 digits
-nails located 1/4 of the length of the flipper from the trailing edge
-able to bring hind flippers under the body

CA. SEA LION

-long ear pinnae present
-beige & brown whiskers
-long fur

-fore flippers hairless
-fur line stops at the top of the flipper, cutting straight across
-nails rudimentary

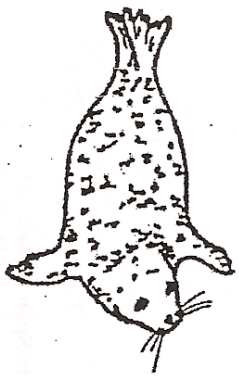
-hind flippers hairless
-nails present on middle 3 digits
-nails located 1/3 of the length of the flipper – from the trailing edge
-able to bring hind flippers under the body

NORTHERN FUR SEAL

-no pinnae; ear hole visible
-white whiskers

-fore flippers haired
-nails present

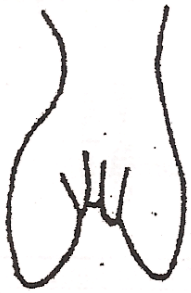
-hind flippers haired
-nails present
-hind flippers always behind body



HARBOR SEAL

-no pinnae; ear hole not visible
-black whiskers

-fore flippers haired
-nails present
-first digit elongated

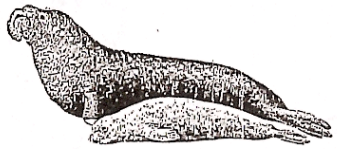


-hind flippers haired
-nails absent
-hind flippers always behind body

NO. ELEPHANT SEAL

Six California Pinnipeds

Phocids (seals)

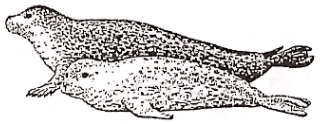


Northern Elephant Seal

Measurements at Birth
Length: 2' 6" - 4' 1" (0.8-1.25 m)
Weight: 60-80 lb (27-36 kg)

Adult Measurements
Length: Male: 13' 6" (4.1m)
Female: 10' 0" (3m)
Weight: Male: 4,500 lb (2,000 kg)
Female: 1,300 lb (600 kg)

Life Span Male: 12-14 yrs.
Female: 18-20 yrs



Harbor Seal

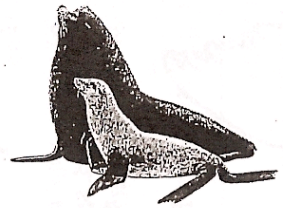
Measurements at Birth
Length: 28-40" (70-100 cm)
Weight: 18-26 lb (8-12 kg)

Adult Measurements
Length: Male: 4' 6" - 6' 3" (1.4-1.9 m)
Female: 4' 0" - 5' 7" (1.2-1.7 m)
Weight: Male: 180-370 lb (80-170 kg)
Female: 150-320 lb (70-145 kg)

Life Span Male: 25 yrs.
Female: 35 yrs.

Otariids (sea lions and fur seals)

California Sea Lion

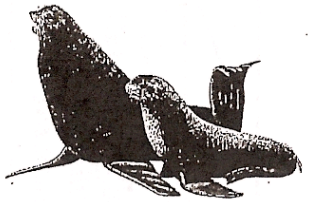


Measurements at Birth
Length: 31" (80 cm)
Weight: 13-20 lb (6-9 kg)

Adult Measurements
Length Male: 6' 0" - 7' 10" (1.8-2.4 m)
Female: 5' 0" - 6' 6" (1.5-2 m)
Weight Male: 600-850 lb (270-390 kg)
Female: 200-250 lb (90-115 kg)

Life Span Male: 15-20 yrs.
Female: 20-30 yrs.

Northern Fur Seal

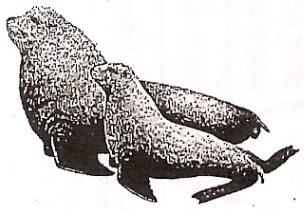


Measurements at Birth
Length: 24-26" (60-65cm)
Weight: 9-13 lb (4-6 kg)

Adult Measurements
Length: Male: 6' 11" (2.1m)
Female: 4' 6" (1.4 m)
Weight: Male: 400-600 lb (180-270 kg)
Female: 65-130 lb (30-60 kg)

Life Span Male: 18-20 yrs.
Female: 20-25 yrs

Steller Sea Lion

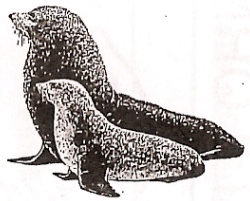


Measurements at Birth
Length: 3' 4" (1 m)
Weight: 35-51 lb (16-23 kg)

Adult Measurements
Length: Male: 11' 0" (3.3 m)
Female: 7' 6" - 9' 6" (2.3-2.9 m)
Weight: Male: 2,400 lb (1,100 kg)
Female: 600-750 lb (270-340 kg)

Life Span Male: slightly less than female
Female: 18-25 yrs.

Guadalupe Fur Seal



Measurements at Birth
Length: 24" (60 cm)
Weight: 4-9 lb (2-4 kg)

Adult Measurements
Length: Male: 6' 6" - 7' 3" (2.0-2.2 m)
Female: 4' 6" - 6' 3" (1.4-1.9 m)
Weight: Male: 490 lb (220 kg)
Female: 120 lb (55 kg)

Life Span Male: 18 yrs.
Female: 23 yrs.