

HARBOR SEALS

A SeaWorld Education Department Publication

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HARBOR SEALS

SCIENTIFIC CLASSIFICATION

A. Order – Pinnipedia.

Pinnipeds are seals, sea lions, and walruses. Some scientists classify Pinnipedia as a suborder of Order Carnivora.

B. Family – Phocidae.

Phocidae includes all “true” seals. True seals lack external ear flaps; have a stout, round body; and are unable to rotate their hind flippers forward.

C. Genus, species – *Phoca vitulina*.

Most scientists recognize five subspecies of harbor seals: *P.v. richardsi*, *P.v. vitulina*, *P.v. concolor*, *P.v. mellonae*, and *P.v. stejnegeri*. Each subspecies is separated geographically, and so is reproductively isolated. Historically, scientists classified *P. largha* (the largha seal) as a harbor seal subspecies. Currently, *P. largha* is widely recognized as a separate species. The harbor seal also is known as the common seal.

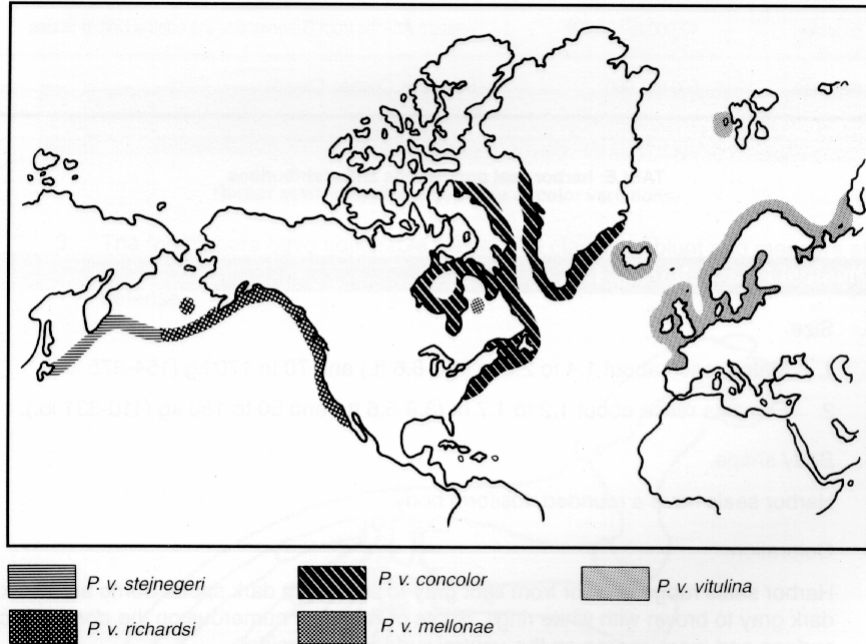
D. Fossil record.

1. The earliest phocid fossils date back 12 to 15 million years.
2. Ancestral phocids gave rise to modern harbor seals, which appeared in the North Pacific two to three million years ago when the Bering Strait formed.
3. The skeleton and limb structure of pinnipeds shows that the ancestors of harbor seals once were able to walk on land. Scientists, however, have not found fossil evidence to identify a common ancestor with living land mammals.

DISTRIBUTION AND HABITAT

A. Distribution.

1. Harbor seals are found in temperate, sub arctic, and arctic waters of the North Atlantic and North Pacific oceans.



Harbor seals inhabit temperate, subarctic, and arctic waters of the North Atlantic and North Pacific oceans. This map shows approximate distributions of the five subspecies.

B. Habitat.

Harbor seals inhabit shallow areas of estuaries, rivers, and places where sandbars and beaches are uncovered at low tide.

C. Migration.

Harbor seals do not migrate regularly but will travel in search of feeding grounds.

D. Population.

Scientists estimate that the world harbor seal population currently is between 300,000 and 500,000 seals.

Subspecies	Population	Distribution
<i>P.v. richardsi</i>	120,000-150,000	eastern Pacific; Pribilof Islands to Baja California, Mexico
<i>P.v. stejnegeri</i>	12,500-13,500	western Pacific; Bering Sea along the Kuril Islands to Hokkaido, Japan
<i>P.v. vitulina</i>	68,000-100,000	northeastern Atlantic; along the European coast from Finland to Portugal, and the coast of Iceland
<i>P.v. concolor</i>	90,000-100,000	western Atlantic; Greenland to the central United States
<i>P.v. mellonae</i>	100-600	Seal Lakes in Canada (Quebec)

Harbor seal populations and distribution

PHYSICAL CHARACTERISTICS

A. Size.

1. Males reach about 1.4 to 2.0 m (4.6–6.6 ft.) and 70 to 170 kg (154–375 lb.).
2. Females reach about 1.2 to 1.7 m (3.9–5.6 ft.) and 50 to 150 kg (110–331 lb.).

B. Body shape.

Harbor seals have a rounded, fusiform body.

C. Coloration.

Harbor seals range in color from light gray to silver with dark spots. Some are black or dark gray to brown with white rings. Spots or rings are numerous on the *dorsal* (back) surface and more sparse on the *ventral* surface (underside). In some areas, such as San Francisco Bay, a number of harbor seals have a red or rust coloration from iron oxide deposits on their fur.

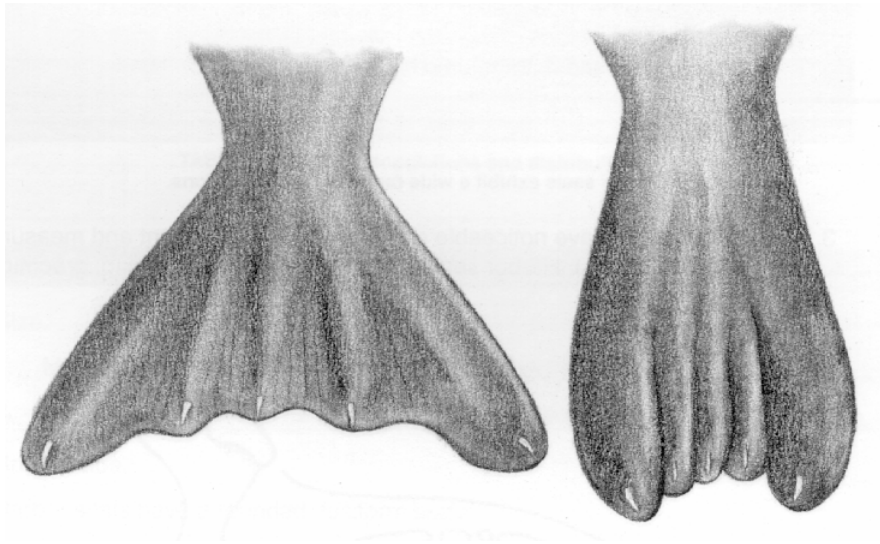
D. Foreflippers.

1. Limbs are modified into flippers. The foreflippers, or pectoral flippers, have all the major skeletal elements of the forelimbs of land mammals, but they are foreshortened and modified.
2. A harbor seal's flippers are short and webbed. Each foreflipper has five digits of about equal length.
3. The foreflippers have noticeable claws. The claws are blunt and measure about 2.5 to 5 cm (1–2 in.). Harbor seals use their claws for scratching, grooming, and defense.
4. Foreflippers are covered with hair.

5. Foreflippers are not as broad as the hind flippers and have less resistance to water flow.

E. Hind flippers.

1. Like land mammals, seals have five bony digits in the hind, or pelvic, limbs. The first and fifth digits are long and stout; the middle digits are shorter and thinner.
2. Digits of the hind flippers are webbed. When a harbor seal spreads its hind flippers, the flippers look like wide fans.
3. Like the foreflippers, the hind flippers have claws and are covered with hair.
4. Harbor seals move their hind flippers side-to-side to propel themselves in water. The hind flippers also function as a rudder.
5. Unlike a sea lion, a seal cannot rotate its hind flippers underneath the pelvic girdle. When on land, a seal moves by bouncing in a caterpillar like motion.



When spread, the hind flippers look like wide fans.

F. Head.

1. A harbor seal has a rounded head with a fairly blunt snout.
2. A harbor seal lacks external ear flaps. Its ear openings close when it dives.
3. Harbor seals have 34 to 36 teeth. The front teeth are pointed and sharp, adapted for grasping and tearing (not chewing) their food. Harbor seals often use their back teeth for crushing shells and crustaceans.
4. *Vibrissae* (whiskers) grow from the thick pads of a seal's upper lip and cheeks. *Vibrissae* are attached to muscles and are supplied with blood and nerves. *Vibrissae* continually grow throughout a seal's life.

G. Tail.

A harbor seal has a short, flattened tail tucked between its hind flippers.

H. Hair.

1. Harbor seals have thick, short hair. The coat is made of coarse guard hairs and finer, but denser underhairs. Each guard hair has three to six underhair fibers attached to the root.
2. The density of a harbor seal's hair increases with age.
3. Glands in the skin secrete oil which helps waterproof the hair.
4. The hair provides no insulation for the harbor seal.
5. Molting.
 - a. Harbor seals *molt* (shed their hair) each year after the breeding season. They gradually lose their hair in patches. Molting generally lasts one to two months.
 - b. Females molt after their pups are weaned. In fertilized females, hormonal changes at the end of the molt may trigger blastocyst implantation and embryo development.
 - c. Pups shed a white coat called *lanugo* shortly before or after birth. They do not molt again until they are a year old.
 - d. Based on observations in zoological environments, harbor seals generally seem to decrease their food intake during molting.

SENSES

A. Hearing.

1. Harbor seals have a well-developed sense of hearing, especially in the water.
2. Research shows that under water, harbor seals respond to sounds from 1 to 180 kHz with a peak sensitivity of 32 kHz.
3. In the air, hearing ability is greatly reduced; harbor seals respond to sounds from 1 to 22.5 kHz, with a peak sensitivity of 12 kHz. (The average hearing range for humans is 0.02 to 20 kHz.)

B. Eyesight.

1. Harbor seals have large eyes. Their vision under water is better than a human's, but inferior on land. Lenses are enlarged and almost round, adapted for focusing on light that is refracted upon entering water. The lenses are not as well-adapted for sight in air.
2. Harbor seals' eyes are adapted for sight in dark and murky water.
 - a. Like the eyes of other pinnipeds, harbor seals' eyes contain high numbers of rod cells – photoreceptor cells that are sensitive to low light levels.

- b. Harbor seals have a well-developed *tapetum lucidum*, a layer of reflecting plates behind the retina. These plates act as mirrors to reflect light back through the retina a second time, increasing the light-gathering ability of the rod cells. (The tapetum lucidum is the same structure that makes a cat's eyes appear to "glow" when reflecting light at night.)
 - c. Under water, the pupils dilate (expand) into a wide circle to let in as much light as possible. In bright light, the pupils constrict to a slit.
 - 3. Mucus continually washes over the eyes to protect them. Unlike most land mammals, pinnipeds lack a duct for draining eye fluids into the nasal passages. When a harbor seal is out of the water, mucus surrounding the eyes gives them a wet, "tear-rimmed" look.
 - 4. Good vision does not seem to be essential to harbor seal survival; scientists have found blind but otherwise healthy individuals, including mothers with pups, at sea.
 - 5. Harbor seals probably do not have color vision.
- C. Tactile.
 - 1. A harbor seal uses its sensitive vibrissae to find food, especially in dark, deep waters, or at night. A substantial nerve system transmits tactile information from the vibrissae to the brain.
 - 2. Each vibrissa can move independently. Under water, a harbor seal thrusts its vibrissae to and fro in a sweeping movement by pushing its mobile upper lip in and out.
 - 3. Prey moving under water creates vibrations that the seal may detect with its vibrissae. Studies have shown that harbor seals are able to detect and follow the hydrodynamic wake of a miniature submarine by using their sensitive vibrissae to sense water movement. Hydrodynamic trail-following is probably a way for a seal to locate and catch fish in low visibility conditions.
- D. Taste.

Little is known about a harbor seal's sense of taste.
- E. Smell.

Researchers believe that harbor seals have an acute sense of smell on land. This sense may be important for mothers identifying their pups.

ADAPTATIONS FOR AN AQUATIC ENVIRONMENT

A. Swimming.

1. Harbor seals swim with all four flippers: they move their hind flippers from side to side to propel themselves forward, and use their foreflippers to help them steer.
2. Harbor seals can swim forward and upside-down. They rarely swim backward.
3. Harbor seals can swim up to 19 kph (12 mph), but they generally cruise at slower speeds.

B. Diving.

1. Harbor seals can dive to depths exceeding 200 m (656 ft.). They don't routinely dive this deep, however, since most of their food is found in shallow waters.
2. Adult harbor seals can stay submerged for up to 30 minutes, but dives usually last only about three minutes. A two-day-old harbor seal pup can stay submerged for up to two minutes.
3. All marine mammals have special physiological adaptations for diving. These adaptations enable a harbor seal to conserve oxygen while it is under water.
 - a. As with other marine mammals, when a harbor seal dives, its heart rate slows – from 75 to 120 beats per minute to only four to six beats per minute. When a seal surfaces after a long dive, it experiences an accelerated heart rate for a short time.
 - b. When diving, blood is shunted away from tissues that are tolerant of low oxygen levels to the heart, lungs, and brain, where oxygen is needed.
 - c. A harbor seal has a greater volume of blood than a land mammal of similar size; therefore, it can retain more oxygen.
 - d. The muscle of harbor seals also has a high content of the oxygen-binding protein *myoglobin* (about 10 times as much as humans). Myoglobin stores oxygen and helps prevent muscle oxygen deficiency.
4. Before a deep dive, a harbor seal exhales to reduce the amount of air in its lungs. Oxygen is stored in the blood and muscle tissues, rather than in the lungs.

C. Respiration.

Like most other marine mammals, a harbor seal's typical respiration cycle is a short exhalation, a short inhalation, and a longer breath-holding (*apnea*) period.

D. Sleep.

Harbor seals sleep on land or in the water. In the water they sleep at the surface and often assume a posture known as *bottling* – their entire bodies remain

submerged with just their heads exposed. This enables them to breathe when necessary.

E. Thermoregulation.

1. A harbor seal's core temperature is about 37.8°C (100°F). There is a heat gradient throughout the blubber from the body core to the skin. The skin remains about one degree Celsius warmer than surrounding water.
2. Harbor seals have a metabolic rate somewhat higher than land mammals of the same size. This helps them generate body heat for warmth.
3. A thick layer of blubber insulates the harbor seal, reducing heat loss. The blubber of a northern Pacific harbor seal during winter may account for 27% to 30% of its total body mass. Blubber also streamlines the body and functions as an energy reserve from which the harbor seal can draw energy during periods of fasting. A harbor seal's hair provides no insulation.
4. In cold water, blood is shunted inward as blood vessels in the skin constrict, reducing heat loss to the environment.
5. When hauled out on land, blood vessels in the skin dilate, allowing heat to be released to the environment.
6. To prevent heat from escaping through the flippers, seals hold them close to their body.

BEHAVIOR

A. Social behavior.

1. Unlike most pinnipeds, adult harbor seals are usually solitary and rarely interact other than to mate. However, they often haul out in loosely organized groups. These groups may include both sexes and all ages.
2. Harbor seals generally do not touch each other when hauled out. They maintain a space between them of a meter (several feet) or more. If touched by another harbor seal, they respond with growling, snorting, flipper-waving, head-thrusting, scratching, or biting.
3. Young harbor seals interact with each other on the fringes of the group and stay away from the adults. Harbor seals become less playful and less tolerant of close contact as they mature.

B. Individual behavior.

1. Harbor seals often haul out onto rocks or beaches. Harbor seals can haul out any time of the day or night. Haul out time is often limited by tide height. At many sites harbor seals are more likely to haul out at certain times of the day, such as afternoon and evening hours, although this behavior may vary with the season.

- a. While on land, harbor seals rarely move from one location. They remain alert and wary, however, and turn their heads frequently to watch for potential danger. When alarmed, harbor seals will *flush* (quickly rush) into the water.
 - b. Studies show that, within a season, harbor seals tend to return to one or two particular haul-out sites with regularity. The preferred sites may change seasonally.
2. Harbor seals show aggression by growling, snorting, and waving threateningly with a foreflipper. Another aggressive behavior is head-thrusting – sharp, rapid extension and retraction of the neck. Fighting is rare, except between competing males during the mating season.
- C. Interaction with other species.
- Harbor seals often are found sharing haul-out space with other pinnipeds, such as California sea lions and Northern elephant seals. Harbor seals rarely interact with other species but show aggression if threatened.

COMMUNICATION

A. Vocal communication.

1. Harbor seals are probably the least vocal of all pinnipeds.
2. In air, they may snort, hiss, growl, or sneeze – often as a threat to another seal. Harbor seals vocalize mainly underwater.
3. Pups vocalize more frequently than adults, especially with their mothers. Pups' sheep-like cries are individually distinctive to their mothers.
4. Mature males vocalize underwater as part of a display during the breeding season.

B. Visual communication.

A harbor seal may slap the water or its own body with a pectoral flipper to show aggression, or during courtship.

FOOD AND FORAGING

- A. Food preferences and resources.
1. Adult harbor seals eat squid; crustaceans; molluscs; and a variety of fish, including rockfish, herring, flounder, salmon, hake, and sand lance.
 2. A harbor seal's diet varies seasonally and regionally and often is subject to local prey availability.
- B. Food intake.
- Adult harbor seals eat 5% to 6% of their body weight per day, about 4.5 to 8.2 kg (10–18 lb.).
- C. Feeding habits.
- Harbor seals don't chew their food. They swallow their food whole or tear it into chunks. With their back molars, they crush shells and crustaceans.
- D. Foraging:
- In dark or low light conditions, a harbor seal uses its sensitive vibrissae to find food.
- E. Water intake.
- Harbor seals generally obtain the water they need from their food. If food intake is decreased, the metabolic breakdown of fat produces water. The metabolism of 0.45 kg (1 lb.) of fat produces 0.64 kg (1.4 lb.) of water.

REPRODUCTION

- A. Sexual maturity.
- Most male harbor seals become sexually mature when they reach a weight of about 75 kg (165 lb.), at three to seven years. Most females become mature when they reach about 50 kg (110 lb.), at three to six years.
- B. Mating activity.
1. Mating season varies among the subspecies but generally occurs in late spring through fall, when females come into *estrus* ("heat" or "season") usually about six weeks after their pups are born. Females remain in estrus for one to nine weeks.
 2. Harbor seals usually return to the same breeding grounds every year.
 3. Prior to the pupping season, males and females exhibit pre-mating activity such as rolling, bubble-blowing, and mouthing each other's necks. This pre-mating behavior ends with the beginning of the pupping season.
 4. During the mating season, male harbor seals exhibit underwater vocal displays during short dives, which are probably associated with mating. These displays take place near haul-out sites, foraging areas, and travel

routes between the two areas and also increase during times that females are more likely to be in the water.

5. After the pupping season, males initiate true mating behavior by chasing, neck- and flipper-biting, and embracing. When approached, females respond by growling, head-thrusting, and flipper-waving. Copulation usually takes place in the water.
6. A male harbor seal may mate with several females.

BIRTH AND CARE OF YOUNG

A. Gestation.

1. Harbor seals have a total gestation of about 9 to 11 months.
2. Gestation includes a period of *delayed implantation*: when the fertilized egg divides into a hollow ball of cells one layer thick (blastocyst), it stops growing and remains free-floating in the uterus for one-and-a-half to three months. The blastocyst then implants on the uterine wall and continues to develop.
3. Delayed implantation gives the mother time to recover from her last pregnancy. It also assures that the ensuing pup will be born when environmental conditions are optimal for its survival.
4. Implantation of the blastocyst may be triggered by hormonal changes at the end of the molting season.

B. Pupping season.

1. Although most pups are born in February through July, the pupping season varies widely among the regional populations.
2. Harbor seals of the northern Pacific population give birth from May to July. Farther south, the pupping season becomes progressively earlier; in Baja California, the season is February and March.
3. Harbor seals inhabiting the coasts of British Columbia and Washington give birth from June to September.

C. Frequency of birth.

Females generally give birth to one pup each year. Multiple births are extremely rare, but twin fetuses have been documented.

D. Pupping.

Female harbor seals give birth on land, ice, or in the water near shore.

E. Pup at birth.

1. Pups are about 75 to 100 cm (30–39 in.) and weigh 8 to 12 kg (18–26 lb.).
2. Pups are well-developed at birth. Their eyes are open and they can swim and follow their mothers.

- F. Care of the young.
1. Nursing.
 - a. Unlike most seals, which fast while nursing, harbor seal mothers leave their pups during the nursing period to forage at sea. Researchers believe they may do this because their relatively small body size cannot store enough fat to withstand a fast.
 - b. A female harbor seal has two mammary glands on her lower abdomen.
 - c. On average, harbor seal milk is about 45% fat, 9% protein, and 45.8% water, with traces of lactose (milk sugar). These figures may vary among individuals and may fluctuate throughout the nursing period. The extremely high fat content of the milk helps the pups more than double their weight by the time they are weaned.
 - d. Harbor seals have been observed nursing both on land and in the water.
 - e. A pup nurses for about one minute every three to four hours.
 - f. Pups nurse for about four to six weeks.
 2. The female is an attentive parent during the nursing period. She noses the pup often. The pup may ride on her back, nip at her flippers, and chase her through the water.
 3. Females recognize their own pups by vocalizations and by smell.
 4. After her pup is weaned, a mother shows no interest in the pup.
- G. Pup growth and development.
1. A pup learns to catch and eat shrimp and bottom-dwelling crustaceans after it is weaned. Later, it learns to catch fish.
 2. Pups do not wander far from adults.

LONGEVITY AND MORTALITY

- A. Longevity.
1. Harbor seals may live a maximum of about 25 to 30 years. Males tend to have a shorter lifespan, possibly due to the stress of fighting during breeding seasons.
 2. Pup mortality is about 21% in the first year; not unusually high compared to most species of animals in the wild. Pups may starve, be abandoned, wash away from pupping areas during high seas, or become ill or injured.
- B. Aging studies.
- As a harbor seal ages, it periodically produces growth layer groups of dental material. Age can be estimated by examining a sliced section of a tooth and counting these layers.

C. Predators.

Harbor seal adults and pups can be preyed upon by killer whales, sharks, polar bears, Steller sea lions, walruses, coyotes, and eagles.

D. Human impact.

1. In the 1900s, fur traders hunted harbor seal pups for the fine coats they have when they are less than four weeks old.
2. Harbor seals were hunted by salmon fishermen who viewed the seals as competitors for fish. Hunting was so extensive that many harbor seal populations abandoned traditional haul-out areas.
3. Marine debris is a threat to harbor seals. They can become entangled in nylon fishing nets or plastic packaging materials, causing severe injury or drowning. Harbor seals also ingest plastic debris, which can cause starvation or obstructions in the digestive tract.
4. Indigenous Arctic peoples legally hunt harbor seals for food, clothing, and other raw materials. For centuries, hunting harbor seals has been an important part of their culture and traditions.
5. In some areas, industrial run-off has resulted in high levels of toxic chemicals, especially polychlorinated biphenyls (PCBs) and dichlorodiphenyltrichloroethane (DDTs), to be present in harbor seals. High levels of these chemicals may be associated with immune dysfunction.

E. Disease and parasitism.

1. Harbor seals are susceptible to a number of diseases and parasites.
 - a. Harbor seals may suffer from viral and bacterial infections.
 - b. Harbor seals are host to a variety of parasites, which may attack the heart, lungs, blood vessels, stomach, intestines, nasal cavities, and skin.
2. In 1988, a devastating *epizootic* (animal equivalent of an epidemic) wiped out more than 18,000 harbor seals throughout northern Europe. The epizootic was caused by a previously undiscovered virus resembling canine distemper. The virus was named phocine distemper virus (PDV). The harbor seals died from the PDV virus itself as well as from secondary viral and bacterial infections. Another PDV outbreak swept through the same harbor seal population in 2002 resulting in a loss of 10,000 to 30,000 seals.

CONSERVATION

- A. The U.S. Marine Mammal Protection Act (MMPA).
1. The U.S. Marine Mammal Protection Act (MMPA) of 1972 made it illegal to hunt or harass any marine mammal, including seals, in U.S. waters.
 2. The MMPA does allow for certain exceptions: native subsistence hunting; collecting or temporarily restraining marine mammals for research, education, and public display; and taking restricted numbers of marine mammals incidentally in the course of fishing operations.
 3. The primary objective of the MMPA is to maintain the health and stability of the marine ecosystem and to obtain and maintain an optimum sustainable population of marine mammals.
 4. According to the MMPA, all seals and sea lions in U.S. waters are under the jurisdiction of the National Marine Fisheries Service.
- B. IUCN/The World Conservation Union.
1. IUCN/The World Conservation Union is a worldwide conservation organization. This organization links together government agencies, non-government agencies, and independent states to encourage a worldwide approach to conservation.
 2. IUCN lists one subspecies of harbor seal (*P. v. mellonae*) as “data deficient” (there is not enough information to assess the risk of extinction).
- C. Marine zoological parks.
1. Having harbor seals at marine zoological parks provides the opportunity for the public to learn about these animals and how human activities may impact their survival.
 2. In the protected environment of a marine zoological park, scientists can examine aspects of harbor seal biology that are difficult or impossible to study in the wild. Data gathered from these animals are valuable in the fight to conserve endangered species of pinnipeds.
 3. SeaWorld San Diego rescues, rehabilitates, and releases harbor seals each year that strand along Southern California beaches. About 85% of the rescued animals are injured, orphaned, or ill pinnipeds – especially California sea lions, harbor seals, and elephant seals. Many of the rescued animals are weaned pups or yearlings that were dehydrated and emaciated due to an inability to find enough food. These animals are given fluids and any necessary medical care. Usually after a couple months of steady food and care, they are healthy and ready for release back into their natural environment. Newborn pups are also rescued, and it is often necessary for them to be hand-raised by the animal care staff in a two- to three-month long process beginning with tube-feeding a special high-fat formula, teaching the pups to bottle feed, and then weaning the pups onto fish.

If you see a marine mammal that you think might be in need of help, it is very important **not** to approach or try to return the animal to the water. Instead,

notify the local marine mammal rescue facility, a lifeguard, or a park ranger and provide the location, type, approximate size and condition of the animal.