

Pinnipeds on Land and at Sea

Focus questions

How do California sea lions and northern elephant seals differ, and how are they similar?

How are these two species uniquely adapted to their environments?

What is the story of these species' interaction with humans?

Between 25 million and 30 million years ago, the bear-like ancestors of today's seals and sea lions were land mammals living along the coasts of the prehistoric continents. Gradually, they spent more and more time in the water, feeding on fish and other marine animals. Over millions of years, these land-based, coastal **carnivores** evolved into **pinnipeds**—the fascinating and beautiful seals, walruses, and sea lions that we recognize today. But what are the different kinds of pinnipeds and how do we tell them apart? What are the remarkable **adaptations** that allow them to live for months at a time in the deepest oceans? Why were they hunted until they were nearly all gone? How did they make a comeback? And why do so many thousands of them make their home on the beaches of San Miguel in the Channel Islands?

JASON host researchers Bob DeLong and Tony Orr devote their energies to answering these and other questions about these mysterious and appealing marine mammals.

What are pinnipeds?

The great Swedish scientist Carolus Linnaeus (1707–1778) spent his life developing a **taxonomy** for categorizing and naming plants and animals. It was Linnaeus who placed seals, sea lions, and walruses into the family he called *pinnipedia*, from the Latin words *pinna* (feather or wing) and *pedes* (feet). This is a perfect description of pinnipeds' "feet" and "arms," which allow them to "fly" through the ocean at speeds up to 40 kilometers (25 miles) per hour.

There are three families of pinnipeds: odobenids, which are walruses; **otariids**, the family that includes eared

seals like the California sea lion (*Zalophus californianus*); and **phocids**, which are the true seals, like the northern elephant seal (*Mirounga angustirostris*).

The northern elephant seal lives up to its name: males have an enormous trunk-like proboscis (an extended nose or snout) that they use in competitive dominance displays. Northern elephant seals are the biggest of all the phocids: full-grown males can grow to over 4 meters (13 feet) long and weigh as much as 2,000 kilograms (4,400 pounds). That's as much as a large automobile! Male California sea lions grow to 2.4 meters long (8 feet) and weigh up to 400 kilograms (880 pounds). These are just a few of the differences between the phocid elephant seal and the otariid California sea lion.

How do pinnipeds live on land and sea?

Other marine mammals, like whales and porpoises, spend all their lives in the sea. But pinnipeds have a closer relationship with the land.

Male California sea lions "haul out" (come ashore) frequently when they migrate north from the Channel Islands. Females stay close to shore for several months after giving birth, frequently returning to the beaches to feed their pups.

Northern elephant seals haul out twice a year, once to mate and give birth to pups and once to molt. Early every winter, the bulls (males) arrive at San Miguel Island and compete with each other for mating territory. These 2 ton animals mostly posture and bluff each other. Occasionally, however, they fight by slamming against and biting each other's necks. These violent fights can leave scars, but they rarely result in death.



Northern elephant seals.

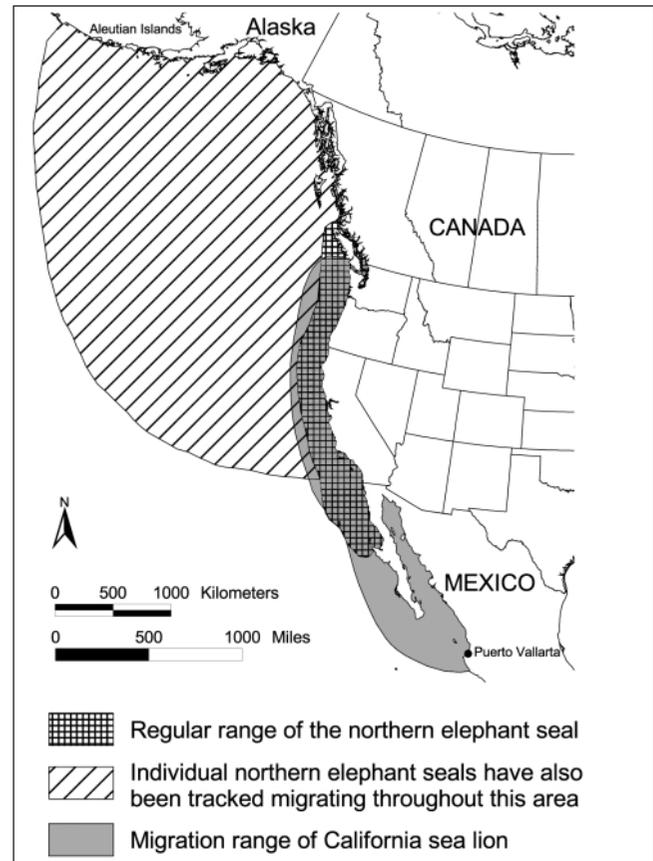
Elephant seal cows (females) arrive at the rookery (breeding ground) after the bulls and give birth to the pups that were conceived in the previous mating season. Newborn elephant seal pups are big babies—they're about 1.2 meters (4 feet) long and weigh close to 36 kilograms (80 pounds). They nurse for 3 to 4 weeks, after which their mothers mate with a male and reenter the sea. The pups stay onshore for another 1 to 2 months, living off their blubber while they begin to venture into the sea and develop their diving and feeding skills. Then they, too, head into the open ocean. The bulls stay onshore for up to 3 months; like the weaned pups and cows, they do not eat while onshore. In fact, adults lose as much as a third of their body weight during their onshore breeding season!

The elephant seals next come ashore to **molt**, beginning with the immature seals in late winter and ending with the bulls in mid-summer. Molting takes about 3 weeks, during which the seals' skin comes off in large sheets. Afterward, the seals go back to sea. They do not return to shore until the next breeding season. For the ones that molted early, that can be as long as 10 months away.

When northern elephant seals enter the sea to hunt for food, their onshore clumsiness disappears. They become diving machines, reaching average depths between 300 and 760 meters (between 1,000 feet and 2,500 feet). Some have been recorded as deep as 1,570 meters (5,150 feet, nearly a mile!). They stay under water for an average of about 20 minutes, though they have been recorded to stay down for up to 1.5 hours. They spend little time at the surface, just about 3 minutes to breathe, before plunging into the depths again. They eat and sleep during these dives, while migrating thousands of miles from the Channel Islands. The elephant seal is the only animal known to make a **double migration**: two long journeys to and from the Channel Islands each year.

How do we know so much about the elephant seal's behavior at sea? Host researcher Bob DeLong and his colleagues take advantage of the seals' consistent habits to glue radio transmitters and data recording equipment to their backs. This equipment records how deep the elephant seals dive and how long they surface. In addition, by measuring the light and time of day when they surface, Bob DeLong's team can cal-

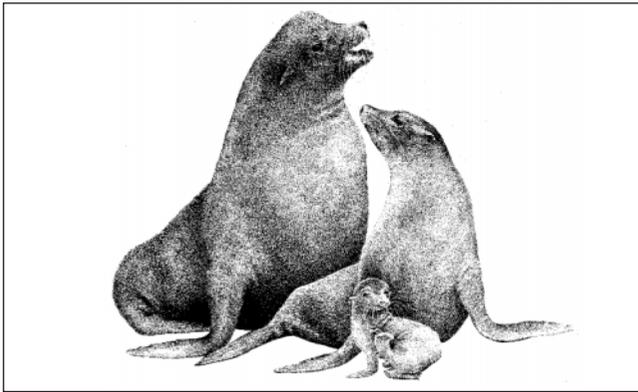
culate their location as they migrate. When the seals haul out again on San Miguel Island, the radio transmitters emit signals that allow the scientists to find each animal and recover the equipment. Before Bob DeLong's project, elephant seals' behavior at sea was a mystery. They were rarely seen by anyone on the surface, because they spend so much time diving to the ocean's depths.



Migration ranges of the northern elephant seal and California sea lion.

How do California sea lions differ from northern elephant seals?

While the northern elephant seal may seem sluggish and clumsy on land, the female California sea lion is familiar to us as the graceful, intelligent, acrobatic, and amusing performer in many aquariums and marine parks. The female is often chosen as the star of these shows because of her manageable size, friendly disposition, and great capacity for learning. In fact, the intelligence of sea lions is so marked that their learning skills are being extensively studied by scientists at the University of California at Santa Cruz.



Diana Dee Tyler

Zalophus californianus is distinguished by the large crest on the forehead of the adult male.

One of the scientists' subjects has learned to recognize over 7,000 different complex commands!

In nature, sea lions display similar qualities of playfulness and intelligence. California sea lions lead lives that we might see as more relaxed than those of elephant seals. They do not dive nearly as deep or as long. The deepest recorded dive for a sea lion is 376 meters (1,234 feet), and the longest is 8 minutes. They do not travel as widely when they migrate, and they migrate once a year instead of twice. They eat 12 kilograms (26 pounds) of fish and squid a day, while elephant seals eat 34 kilograms (75 pounds) or more. There are also important differences in how the two animals reproduce and care for their newborns.

Elephant seal females nurse their pups for 30 days after giving birth. They then mate with a male and leave the island for several months to feed at sea.

California sea lions nurse their newborns for up to 11 months. During this time, they will go out and feed for a few days, then return to land to nurse their pups for a couple of days.

What is the story of pinnipeds and humans?

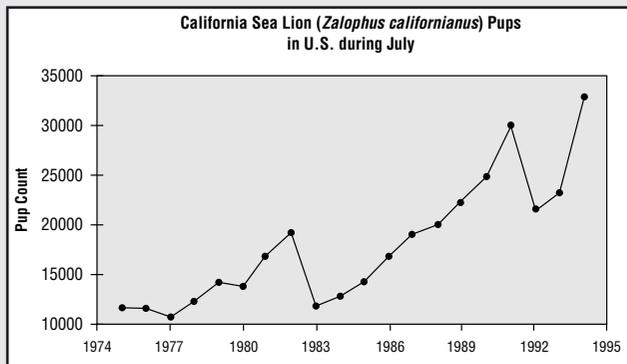
Today, it is a thrill to see California sea lions and northern elephant seals hauled out by the thousands on the beaches of San Miguel Island, resting, mating, giving birth, and caring for their young.

It hasn't always been this way. Before European settlers came to California, the native Chumash hunted in ways that changed the abundance and distribution of animals. Then, from the early 1800s, pinnipeds encountered hunters and fishermen using modern methods, and their numbers in California diminished rapidly. Hunters killed pinnipeds in part for their blubber (which was turned into oil), but also to use some body parts for home medical remedies and for their whiskers (which were used as pipe cleaners). People and pinnipeds competed for fish in the same waters, and the seals and sea lions often became entangled in fishing nets and died.

How Does El Niño Affect Pinniped Populations?

Every few years, the warming currents of El Niño create a floating "lid" of warmer water on top of vast stretches of the Pacific ocean. The warmer water has less nutrients, which means there are fewer of the smaller creatures that pinnipeds eat in the waters near the Channel Islands.

This means that females about to give birth or nursing pups have a hard time getting enough nutrients to raise healthy offspring. Pups are not as strong and grow more slowly. Many more fail to survive than is usual. Major storms often wash weaker pups out to sea.



This chart shows times when the population of California sea lion pups declined. In which years do you think El Niño occurred?

Year	Northern Elephant Seal Population
1925	1
1938	13
1946	21
1950	50-70
1958	455
1964	1,922
1965	3,000
1966	3,000
1967	3,700
1969	3,000
1970	3,833
1971	3,200
1972	4,297
1973	3,600

Census of northern elephant seals on San Miguel Island, 1925 to 1973.

The hunting of the sea lion herds was so unrestrained that in 1908, only one lonely sea lion was found on the Channel Islands. The state of California passed a law in 1909 that forbade the killing of sea lions, and the government of Mexico began protecting sea lions in 1911. But the California law was repealed in 1927, and by 1938, a survey found only 2,020 sea lions along the entire California coast. Eventually, however, protection of the species began to take effect: by 1967 there were an estimated 40,000 sea lions in California, mainly on the Channel Islands. Today, approximately 200,000 California sea lions use the Channel Islands (primarily San Miguel) as their home base. This population has been increasing steadily since the passage of the Marine Mammal Protection Act in 1972.

The northern elephant seal population developed in a similar pattern. They were hunted close to extinction and for a time they were thought to be extinct. Conservation has saved this species, so that now there are an estimated 150,000 northern elephant seals. Fifty thousand of them haul out on San Miguel Island each year.



Journal Question

Why is it important to protect species like the northern elephant seal and the California sea lion?



Scientists track northern elephant seals on their dives and migrations by securing radio transponders to their backs.

Fact or Fallacy?

Because northern elephant seals are mammals and breathe through lungs (like whales and porpoises), they can only spend a few minutes under water before coming up for air.



Fallacy: Northern elephant seals have adaptations that allow them to conserve oxygen in their blood. They can dive close to a mile under the surface, and stay down for over an hour at a time.

Vocabulary

Adaptation *n.* A physical feature or ability, developed over many generations, that helps a species survive in its environment.

Carnivore *n.* A flesh-eating animal.

Double migration *n.* Two annual round trips made by the northern elephant seal between its feeding grounds in the north Pacific and the Channel Islands.

Molt *v.* To shed the skin, fur, or feathers periodically. Northern elephant seals are said to do “radical molting,” because their skin comes off in sheets.

Otariid *n.* Any of approximately 14 species of pinnipeds, including the California sea lion, that have outer ear flaps and hind flippers that can be rotated underneath the body.

Phocid *n.* Any of approximately 19 species of pinnipeds known as “true seals,” including the northern elephant seal. Phocids do not have extended ear flaps. They do not use their flippers for moving on land. Instead they wriggle from side to side or hunch their bodies like caterpillars.

Pinniped *n.* A walrus, sea lion, or seal.

Taxonomy *n.* The science of classification and categorization of living things. Linnean taxonomy categorizes all plants and animals into the following seven subgroupings, each more specific than the one before: kingdom, phylum, class, order, family, genus, species.