

Whale Watching Spoken Here

Reference and Training Manual on the Gray Whale and Other Cetaceans



Welcome to the World of Whale Watching

WHALE WATCHING

SPOKEN HERE



Nature
HISTORY
Discovery

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The Origins of the Whale Watching Spoken Here program

It was 1978. Don Giles of the Hatfield Marine Science Center in Newport headed out to Yaquina Head Lighthouse with his binoculars and a great idea. Colleagues Bruce Mate and Denise Herzing were counting gray whales migrating past Yaquina Head. They confirmed what Don and others intuitively knew: Gray whale migrations along the Oregon coast peak during two special times of the year. The southbound migration happens during the winter holiday season, and the northbound migration has one of its two peaks near the end of March, during Oregon's spring break.

This knowledge motivated Don to create the Whale Watching Spoken Here® program. Since 1978, it has grown into one of the most organized onshore whale-watching programs in the United States.

There are three main reasons for the program's success:

Location: Thanks to the 1967 Beach Bill, public access is protected along virtually the entire Oregon coastline. In addition, most of the whale-watching spots are located in or near state parks.

Abundant whales: Researchers estimate that 18,000 Gray whales now live in the eastern north Pacific area. About 30 whales per hour migrate past the Oregon coast during the peak southbound migration. By comparison, six per hour pass by on the northbound trip, but that return trip is spread over four months. Some 200 of these whales drop off the migration route and feed along the Oregon coast all summer.

Timing: These migration peaks coincide nicely with times when many visitors are able to visit the coast. Since the main emphasis is on volunteers meeting and greeting visitors interested in whale watching, Don Giles and another colleague, Bev Lund, coined the phrase "Whale Watching Spoken Here."

We hope this manual will be a valuable resource for you as you set out to interpret the Gray whale migrations for others.



Photo: Carrie Newell



Volunteer Information

What are the expectations for a Whale Watching Spoken Here volunteer?

- **Choose the dates you would like to help** and sign up for slots through the Call for Volunteers form.
- **Look for your schedule** in the mail about a week before your shift. Read it carefully to see which volunteer is responsible for site materials.
- **Show up!** If you cannot meet your commitment because of unforeseen circumstances, please call or email the volunteer coordinator as soon as possible so that they can find a replacement. Phone numbers for your fellow volunteers are on the schedule so that, in the event you become ill at the last minute, you can let them know.
- **Sign the Volunteer Injury Coverage** form each year.
- **Arrive at your site on time.** Watch times are 10 a.m. to 1 p.m. Bring binoculars and wear weather-appropriate clothing. Visitors travel long distances expecting to see volunteers at each site; however, safety is our first concern. Please be available (if only in your vehicle) during inclement weather.
- **Stay in touch!** You will be able to download a copy of the Call for Volunteers from our website (www.whalespoken.org) each October. If you've moved, you may need to e-mail or call us to update your information.

Training is available to both new and returning volunteers. If you'd like a refresher, you can "audit" one of the trainings; contact us to find out about availability.

Looking ahead

If you'd like to sign up for a free tent or RV site at an Oregon state park during the whale watching weeks or during your training session, make your reservation as early as possible by  calling 1-888-953-7677. For reservation  Fort Canby near the Lewis and Clark Interpretive Center in Washington, call 1-360-642-3029. For more information, see the Call for Volunteers.

What's in the box, and what do you do with it?

Counters: Use one clicker from the site box to track numbers of visitors with whom you interact. Use the second clicker to track the number of whales sighted between 10 a.m. and 1 p.m. This is not a scientific count; it is used solely by the Whale Watching Spoken Here program to informally monitor the population. Remember, one whale may produce multiple visible spouts. Use your best judgment to convert numbers of spouts to actual numbers of whales.

Stickers: Hand out the "I Saw My First Whale" stickers generously.

Props: Be creative with the provided props, such as lengths of rope to illustrate the size of whales.

Gray Whale Brochures: Distribute sparingly.

Call for Volunteers: Copies are in each site box. Please share them with anyone that might be interested in volunteering.

Guest Register: Ask visitors to sign it, but use it informally. We are primarily interested in counting visitors and finding out where they are from. Some sites simply leave the log available on a table. This information is used solely to evaluate the program.

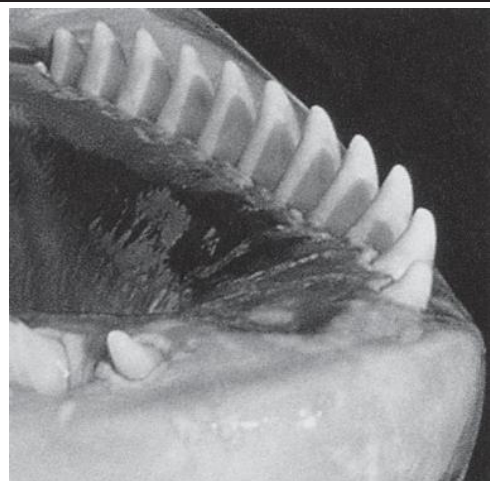
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Order *Cetacea*

All whales are mammals belonging to the order *Cetacea*, which encompasses more than 80 known species of whales, dolphins, and porpoises. There are two suborders: *Mysticeti* (meaning “mustached,” because baleen resembles a mustache) and *Odontoceti* (meaning “toothed”). The Gray whale belongs to the *Mysticeti* suborder. Like the other species in the group, it is a baleen whale, which means it has baleen plates instead of teeth (see *Feeding habits* on page 9).

This chart illustrates the difference between the two suborders:

Suborder <i>Mysticeti</i> (Baleen Whales)	Suborder <i>Odontoceti</i> (Toothed Whales)
<ul style="list-style-type: none"> • 14 species • Three families: <i>Balaenidae</i> (Right and Bowhead whales) <i>Eschrichtiidae</i> (Gray whales) <i>Balaenopteridae</i> (Rorquals, or “grooved-throat” whales—includes Blue, Humpback, Fin, Sei, and Minke whales) • Baleen present (no true teeth). As filter feeders, eat small creatures ranging from zooplankton to small fishes by lunging or gulping near the surface, skimming the surface open-mouthed, or sucking sediment from the bottom. • Two external blowholes • Females generally larger than the males • Echolocation doubtful (it’s unclear how baleen whales navigate and find food) • Symmetrical skull 	<ul style="list-style-type: none"> • 70 species • Five families: <i>Physeteridae</i> (Sperm whales) <i>Monodontidae</i> (Narwhals and Belugas) <i>Delphinidae</i> (Dolphins) <i>Phocoenidae</i> (Porpoises) <i>Platanistidae</i> (River dolphins) • Teeth present. Feed on larger creatures from small fishes to sea lions and other whales. Teeth used for grabbing, not chewing. Depending on the species, number of teeth range from one (narwhal) to 250 (beaked). • One external blowhole • Males generally larger than the females • Echolocation used to navigate and find food • Asymmetrical skull with a large “melon”

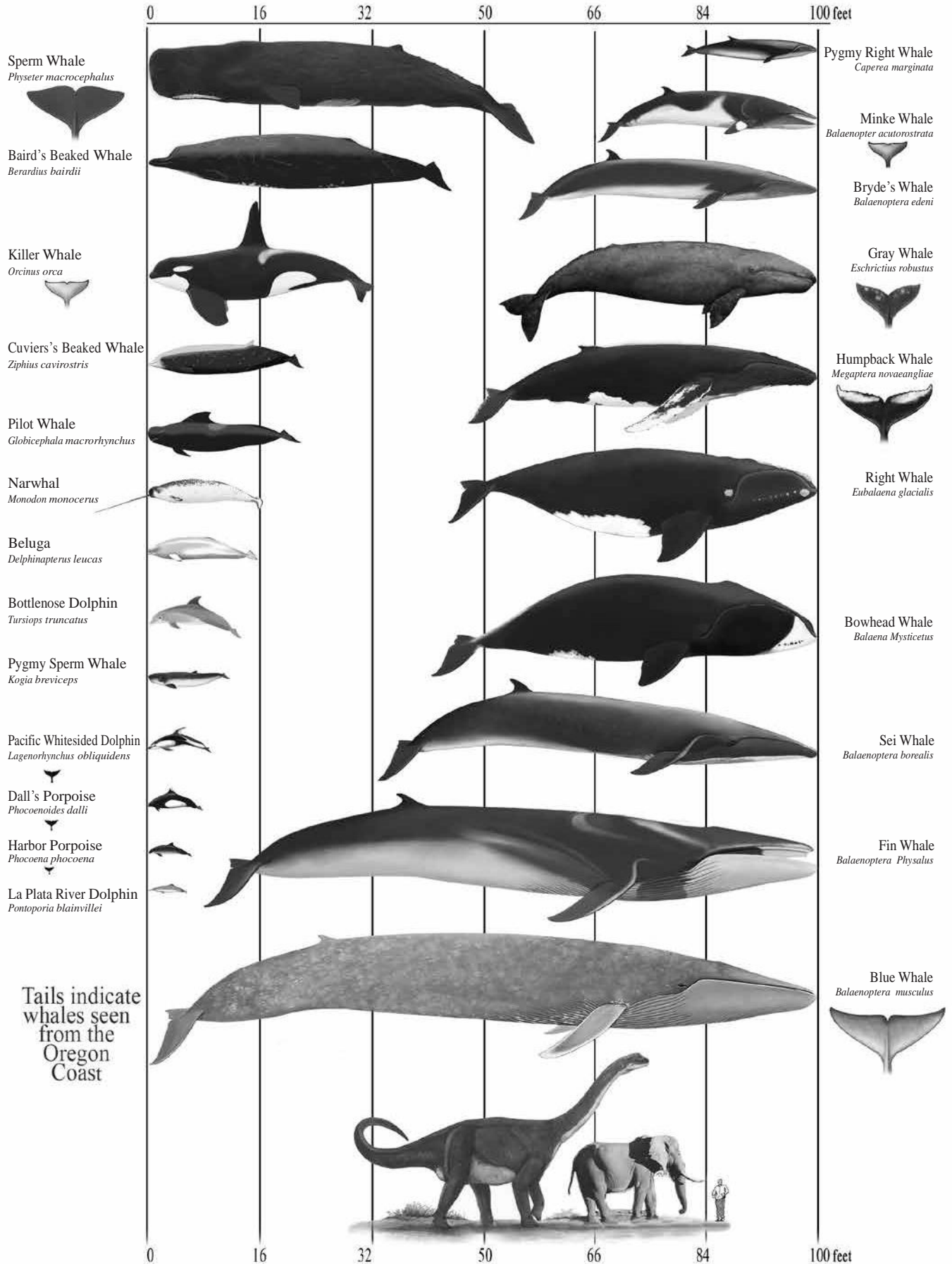


Cetacean Size Comparison Chart

Odontoceti - TOOTHED WHALES

WHALES, DOLPHINS, AND PORPOISES

Mysteceti - BALEEN WHALES



About the Gray Whale

Scientific Name

Eschrichtius robustus (ess-SCHRICK-tee-yuss roh-BUSS-tuss) was named by J.E. Gray of the British Museum in honor of D.F. Eschricht, who found the first skeleton. *Robustus* is Latin for “strong” or “robust.”

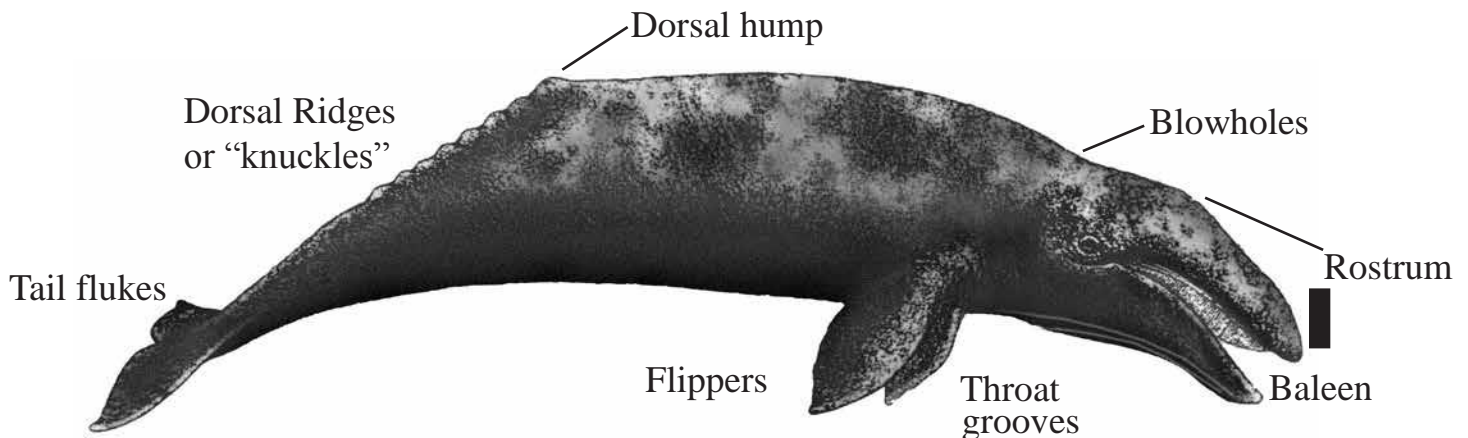
Description

Gray whales are the most commonly seen whales along the Oregon coast and the most primitive of the baleen whales. Their average life expectancy is 50 years, but researchers once discovered a pregnant female estimated to be more than 80 years old.

- **Size:** As adults, females are generally 45 feet long and weigh about 35 tons. Mature males measure up to 35 feet long and weigh between 17 and 30 tons.
- **Coloring:** Ranges from mottled gray to black. Covered with lighter-colored abrasions, blotches, scars, white barnacles, and orange whale lice. Some of the lighter coloring is natural, with scarring from barnacles, orca attacks, or encounters with boat propellers causing the remainder. Barnacles covering large areas of their

heads and backs can make them appear almost white. The whales’ unique color patterns and scars make it possible to identify them.

- **Head:** Makes up about one-fifth of the body length. Appears V-shaped when viewed from above. Upper jaw is narrow and slightly arched. There are two to five deep, broad furrows in the throat region which allow the mouth cavity to expand when the whale is feeding.
- **Blowholes:** When exhaling, sends spout of condensed air, or “blow,” six to 12 feet in the air. When the whale is coming toward you or moving away, the spout from its two blowholes can appear as a “V” or heart-shaped.
- **Dorsal Hump:** Instead of a dorsal fin, the Gray whale has a dorsal hump and a series of six to 12 small humps called “knuckles” along its dorsal ridge.
- **Tail:** Measures as long as 10 feet across from tip to tip and is deeply notched in the center.



Distribution and Migration:

The Gray whale is the most common large whale seen from the western shores of North America. The Gray whales that migrate along our coast are part of the eastern north Pacific population. This group migrates south to Baja California in the fall and north to the Bering and Chuckchi Seas in the spring. During these migrations, about 80 percent of them can be seen within five miles of shore. Approximately 200 feed in shallow waters close to shore from northern California to British Columbia during the summer and early fall.

Gray whales have one of the longest known migrations of any mammal—up to 6,000 miles each way (12,000 miles annually). Their near-shore migration has led to speculation that these animals may not be good navigators. They tend to travel farther from shore during and after stormy weather with high surf. Scientists hypothesize that they may navigate by the sound of the pounding surf, keeping it on their left side while migrating south and on their right while migrating north. When the surf is pounding, they may be able to hear the sounds much farther from shore.

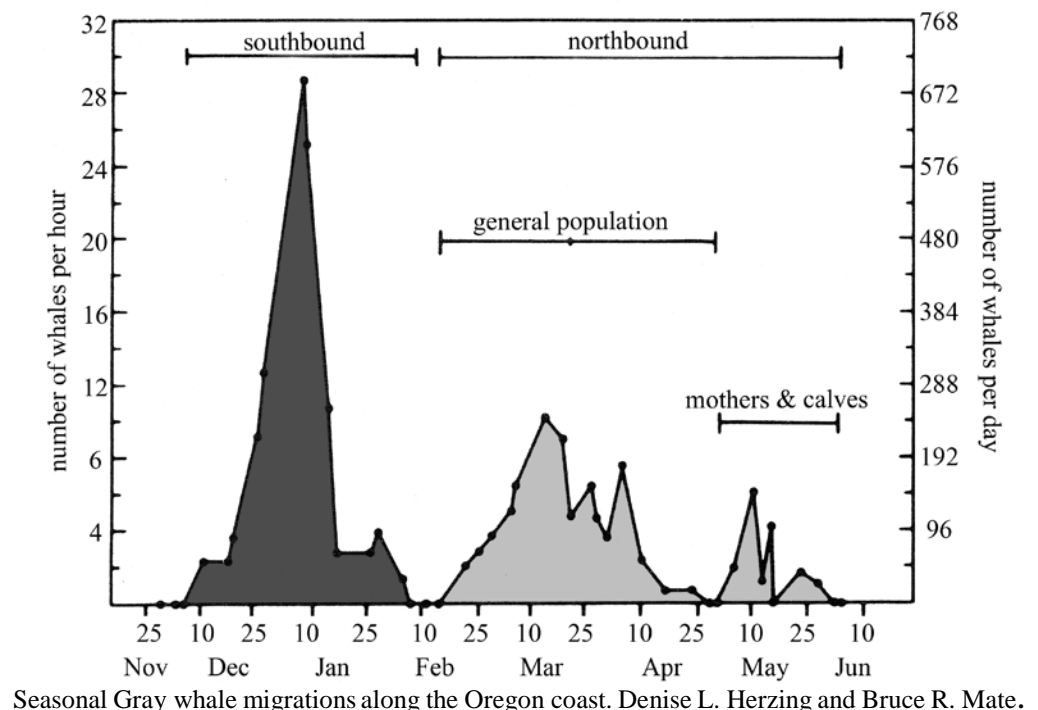
Migration south (winter)

After feeding during the summer and fall in the Bering and Chuckchi Seas, the entire Gray whale population migrates south to the calving and breeding lagoons of Baja California. This southward migration begins in late October, passing by the Oregon coast from December through January. The pregnant females are the first to migrate, followed by the adult breeding

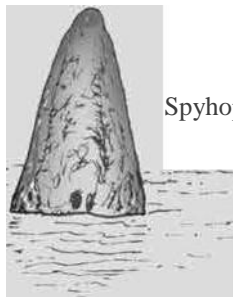
males and females, and finally the juveniles. This southern migration usually peaks off the Oregon coast from late December through early January, with up to 30 whales passing per hour. By mid-February, most of the whales have left Oregon waters. On their southern route, Gray whales travel continuously at speeds up to five mph and are generally seen farther from shore than during their spring migration.

Migration north (spring)

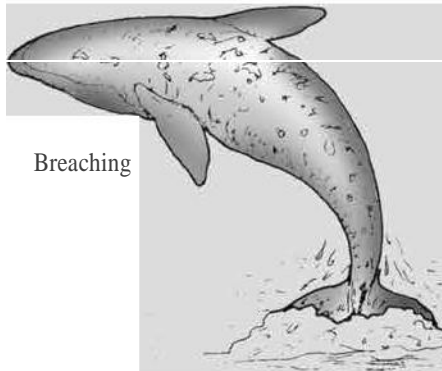
Spread out over a longer period, with two separate peaks, the northward migration begins from Baja in late February and continues through May. The number of adults and juveniles passing the Oregon coast peaks in March and April; mother/calf pairs peak in May (see chart below). The whales tend to travel at a slower rate of speed when moving northward (approximately three mph) and come closer to shore, especially the mothers with calves. Sometimes adults and calves perform spectacular breaches, to the delight of lucky whale watchers.



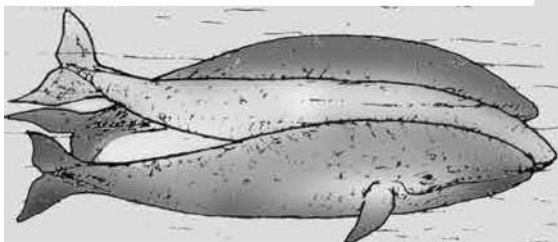
Annual Gray Whale Migration Route and Behaviors



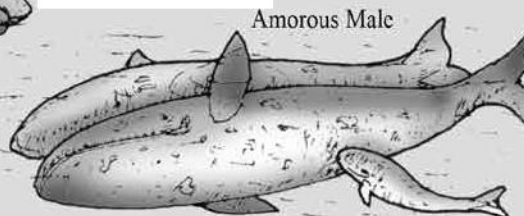
Spyhopping



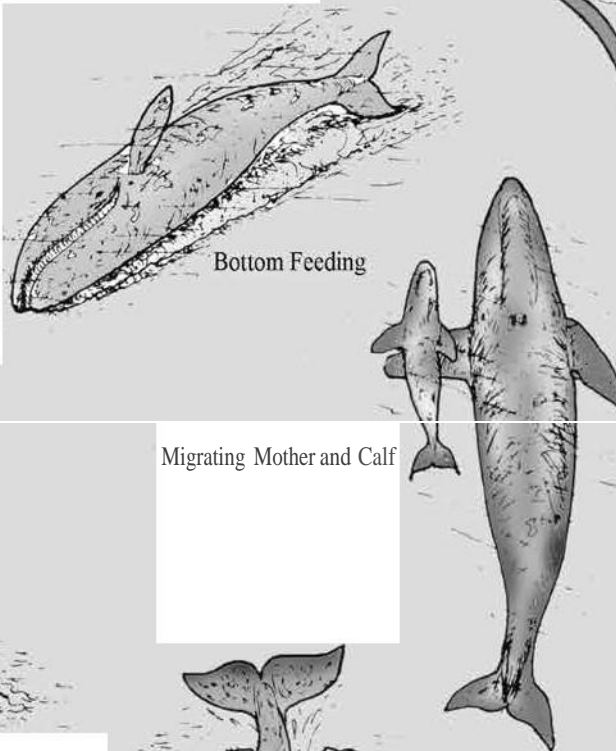
Breaching



Mating Female and Suitor
(courtship-triad)



Nursing Mother and Calf



Bottom Feeding



Fluking or Diving

Feeding Grounds

Migration Routes

Migrating Mother and Calf

Amorous Male

Chukchi Sea

Alaska

Winter Migration
(Southbound)
Mid Dec.-Mid Jan.

Canada

Summer Whales
200 off Oregon Coast
Jun.-Oct.

USA

Spring Migration
(Northbound)
Mar.-Jun.

Mexico

Baja

Mating/Nursing Sites

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For further information, contact Coloring Concepts Inc. at www.coloringconcepts.com.

Reproduction:

Gray whales reach sexual maturity between five and 11 years of age (the average age is eight years), or when they are about 36 to 39 feet in length. Breeding can occur any time from December through April. Although sometimes seen during the southward migration, most mating behavior is observed in Baja and on the northward migration. Females are frequently seen in the company of two males (termed a “courting triad”). Females trying to avoid copulation frequently roll onto their backs with their flippers extended to avoid male advances. They must roll to an upright position periodically to breathe, however, at which times males often attempt to initiate copulation.

Gray whales are solitary in nature. They come together during the mating season, but do not form family units.

A single calf is born in late December to early February after a gestation period of about 12 months. Most females bear a calf once every two years. A newborn calf is about 15 feet long and weighs about one ton. Calves are nursed for six to eight months on fat-rich (53 percent) milk and grow very rapidly during this time. The mother and calf will stay in the Baja area for up to two months while the calf builds up stamina and a layer of blubber for insulation during migration. Calves stay with their mother until they are weaned, usually by October.

Feeding Habits:

Gray whales have 130-180 baleen plates, each up to 18 inches long, growing down from each side of their upper jaw. Composed of material resembling a human fingernail, the baleen plates are three inches wide at the top and taper to a point.

Gray whales have the stiffest of all baleen and are the only whales known to feed extensively

on bottom-dwelling animals. While in the Bering and Chuckchi Seas, Gray whales feed on a variety of zooplankton (small aquatic animals) such as gammarid amphipods, mysid shrimp, mollusks, tubeworms, and hydroids. Their main food source is the shrimp-like amphipods that live in the top three-quarters of an inch of the bottom sediment. They are about the size of an M&M (see photo below).

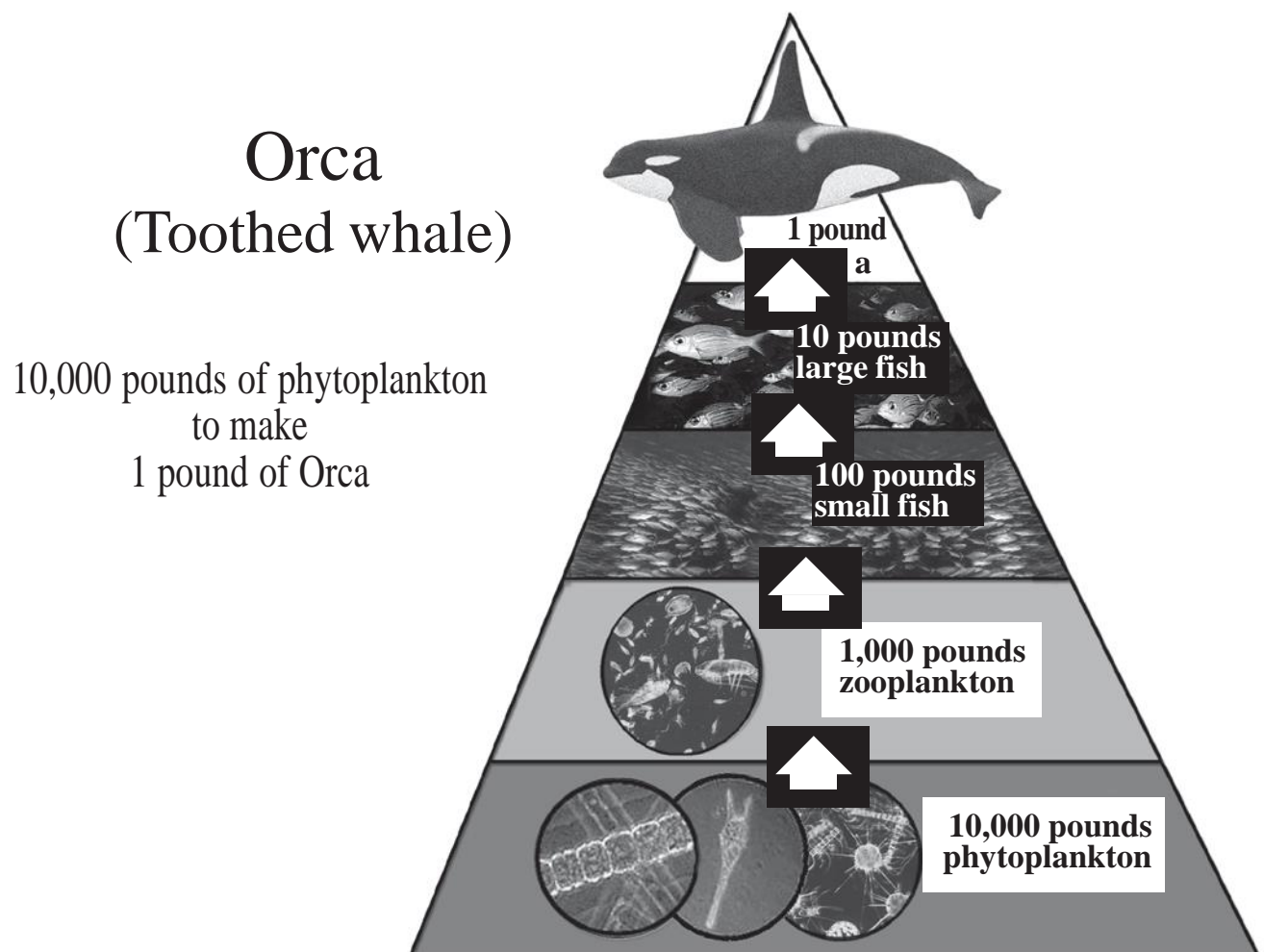
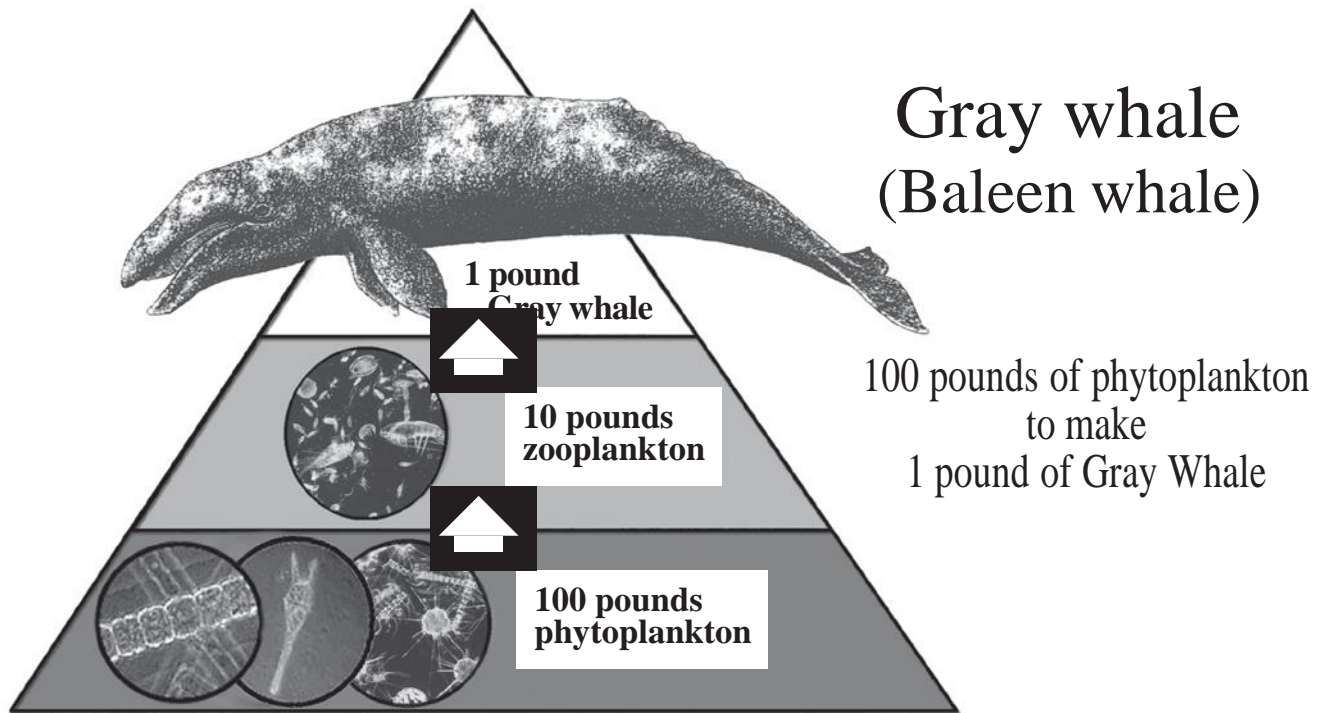
To feed, the whale turns on its side, dives to the bottom, and sucks up mud and sediment in a pulsing fashion, leaving head-sized depressions (about the size of a desk top) in the mud. As it closes its mouth, it expels water and sediment through the baleen plates, trapping the food on the inside before licking it off with its huge tongue and swallowing it. Some whales have been observed with fewer barnacles and more abrasions on one side of the head, indicating that they use one side more frequently (usually the right) while skimming the bottom.

Researchers have calculated that Gray whales need to consume seven percent of their body weight (about 2,600 pounds) per day. Concentrations of 12,000 to 20,000 amphipods per square yard have been found in the southern Chuckchi and northern Bering Seas where the majority of the whales feed during the summer. One Gray whale typically eats about 396,000 pounds of amphipods during the approximately five months it feeds in northern waters.



Amphipods

Comparative Food Chain



A small percentage of Gray whales do not migrate all the way to Alaska, but instead stay along the Oregon coast to feed throughout the summer. Their primary food source is mysid shrimp, which swarm in abundance near the bottom of the kelp beds. While whales engage in this shallow-water feeding behavior, you can often see one half of the tail fluke above water while the whale is head down in a kelp bed. The half fluke looks very much like a shark fin.

Records from the whaling industry indicate that Gray whales usually do not feed during their migration or winter calving periods. For this reason, they can lose up to 30 percent of their body weight between feeding seasons. Whales have been observed, however, coming to the surface with mud streaming from their baleen in the calving areas and along the migration route. Such behavior may indicate attempts at feeding or training the calves to feed.

Behavior:

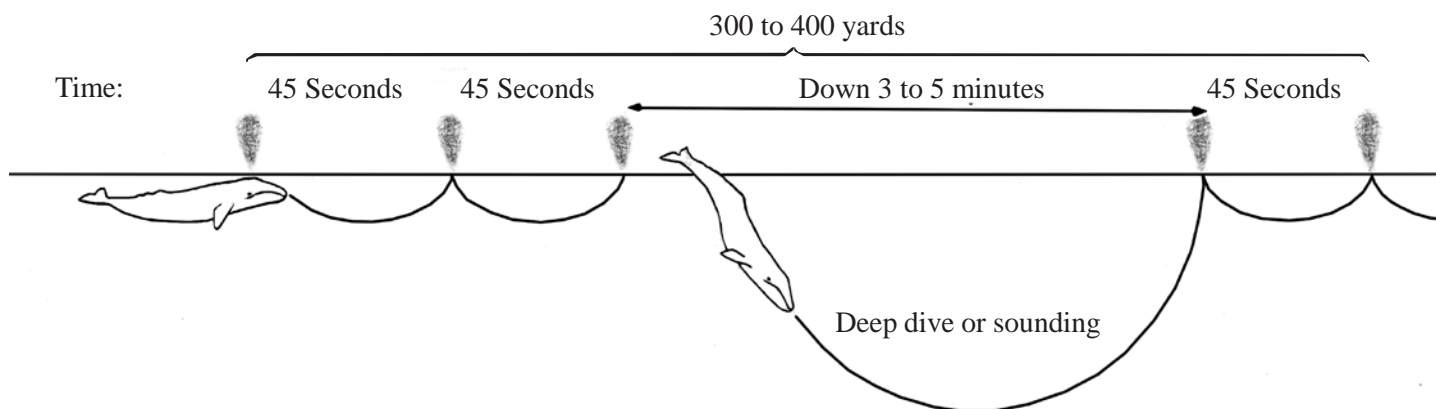
Gray whales are noted for their protective behavior toward their calves. In fact, they were called “devil fish” by early whalers who had their ships rammed and sometimes sunk after they harpooned calves to entice the mothers closer. Today, however, Grays are considered amongst the friendliest of whales, often approaching anglers and whale-watching boats with curiosity.

When a Gray whale comes to the surface, its blow or spout appears as a double-plumed jet of vapor rising six to 12 feet against the horizon.

The blow is not a fountain of water, but a mist of condensed moisture and air exhaled under high pressure from the lungs. The whale can expel as much as 400 liters of air in a single blast.



Generally, Gray whales are slow swimmers, averaging three to five mph during migration. They have a rhythmic breathing pattern. Normally they will make three to five short, shallow dives of less than a minute each and then a long, deep dive. A general rule is that the whale will make one short dive and emit a blow for every minute spent in a deep dive. This breathing pattern enables the whales to store up oxygen and get rid of carbon dioxide built up during a long dive. In a single breath, they can exchange 80 to 90 percent of the air in their lungs, compared with 10 to 20 percent in land mammals. Feeding dives can range from three minutes up to 15 minutes. They can stay underwater for 30 minutes if they need to (see page 18). If the whales are threatened, they can hide on the bottom or travel great distances underwater. Sometimes they will dive and reappear a quarter of a mile away.





When a Gray whale lifts its tail flukes out of the water, it is going into a deep dive. This action, called **sounding** or **fluking**, helps propel the whale downward at a steep angle to the bottom where it can feed on small crustaceans. After the flukes disappear under the water, the turbulence of the dive will cause a circle of smooth water known as a **fluke-print** to appear.

Whales have the largest brain of any animal on earth. They are curious and often seen **spyhopping**, or lifting their heads above the surface of the water to get a better look at their surroundings.



The ultimate in whale sightings is a **breach**, which occurs when a whale launches as much as three-quarters of its body out of the water in a spectacular demonstration of power and grace. Scientists are still not sure why whales breach. They speculate that the whales do it to dislodge parasites, to communicate with each other, or just to have fun. Young Gray whales seem to breach the most frequently along the Oregon coast, although Gray whales are not known for breaching nearly as often as their cousins, the humpbacks.

Previous page: "Rambo" blowing. This page, top to bottom: "Olivia" fluking, calf spyhopping, and "Stretch" breaching. Thanks to Carrie Newell, Whale Research Excursions - Depoe Bay.

Conservation and Current Status:

Three distinct populations of Gray whales once existed. The north Atlantic population is now extinct, and the western Pacific population along the Russian and Asian coast may already have been depleted beyond recovery. The eastern Pacific population along the Canadian, U.S., and Mexican coastline was hunted to the brink of extinction in the 1850s after the discovery of the calving lagoons and again in the early 1900s when floating whale processing factories were introduced. By 1900, observers estimated that only a few thousand Gray whales remained.

In 1947, the International Whaling Commission granted Gray whales full protection, allowing only indigenous peoples to hunt them for subsistence. Less than fifty years later, the eastern Pacific Gray whale population appeared to have recovered, reaching a population peak of more than 22,000. This led to the whale's removal from the U.S. Endangered Species list in 1994. Some reports showed the number reaching a level of 26,000 by 1998. Since then, the number has declined again to approximately 20,000. No one knows why, but some scientists believe the Gray whale's habitat can only sustain this number.

Despite its removal from the list of endangered species, the Gray whale continues to be threatened by:

- whaling by indigenous communities (approximately 180 taken annually);
- deaths resulting from strikes by boats and entanglement in fishing gear;
- loss of breeding grounds and food supplies;
- pollution such as chemicals and garbage (especially plastic) in the ocean;
- commercial activity such as offshore drilling;
- predator attacks (Orcas and sharks are the only natural predators of Gray whales).

Other Whales Commonly Seen from the Oregon Coast

Humpback:



- Listed as an endangered species. (Scientists estimate that the pre-whaling population of the northern Pacific Humpback was about 15,000; the current population is about 7,000.)
- Of those 7,000, about 20 percent (1,200) travel down the coast to breed and give birth in warm-water bays off of Mexico; the bulk of the population migrates to the warm waters near Hawaii to breed and calve in winter.
- Have small dorsal fins, very large flippers, and distinctive tail flukes that can be used to identify them.
- Usually travel farther from shore than Gray whales.
- Known as the “acrobats of the sea” because of their dramatic breaches.
- A baleen whale with a primary diet of fish and krill.

Blue:



- Largest mammal in the world, growing to 110 feet in length.
- Once prized by whalers because of its size and high oil output. Now listed as an endangered species.
- Elusive and normally seen in deeper waters off the continental shelf worldwide.
- Identified by its large, narrow blow that can reach 30 feet in height.
- A baleen whale that feeds primarily on krill.

Sperm:



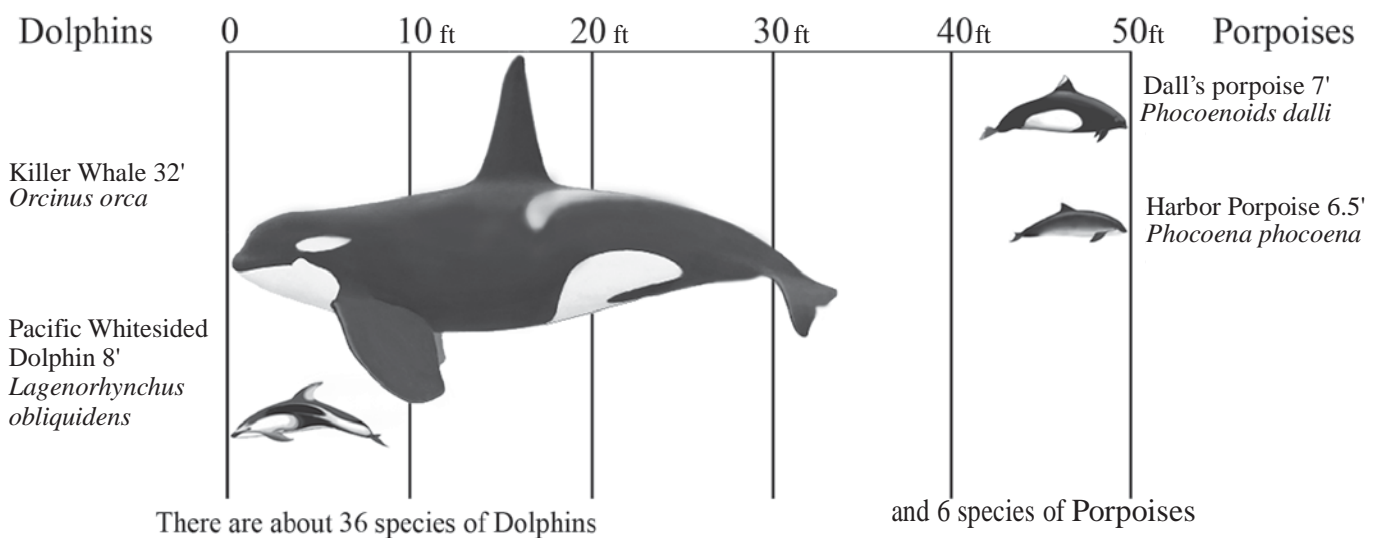
- Endangered species found in deep ocean waters worldwide, normally past the continental shelf.
- Deepest diver of all the whales, able to submerge to 10,000 feet and hold its breath for more than an hour.
- Easily identifiable even at a distance because of its blow, which is angled forward at 45 degrees.
- Have huge heads that contain spermaceti oil, once a highly prized commodity.
- In *Odontoceti* (toothed) suborder. Its usual food is giant squid.

Northwest Dolphins and Porpoises

The names “dolphin” and “porpoise” are often used interchangeably, but actually represent two families of *Odontoceti* (toothed whales) with distinct characteristics.

Eight species of dolphins can be seen along the Oregon coast: Pilot whales, Grampus (Risso’s) dolphins, Orcas, false killer whales, common dolphins, Northern Right whale dolphins, *Stenella* (spinner) dolphins, and Pacific White-sided dolphins. The most commonly seen are shown and described on the following pages.

Dolphins and Porpoises Size Comparison Chart



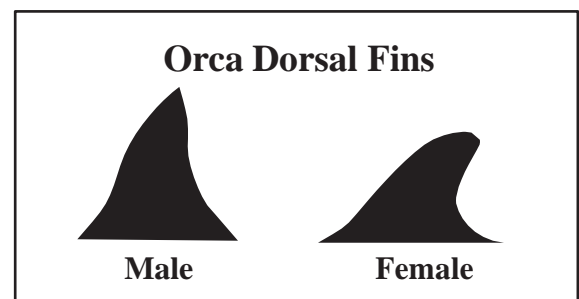
Dolphins	Porpoises
<ul style="list-style-type: none"> • Cone-shaped teeth • Curved or sickle-shaped dorsal fin • Distinct “beak” or snout • Visible “melon” or rounded forehead above rostrum • Generally longer and sleeker 	<ul style="list-style-type: none"> • Flat, spade-shaped teeth • Triangular-shaped dorsal fin • No “beak” • Forehead slopes almost uniformly forward to the tip of the snout • Generally shorter than 7’ and stouter



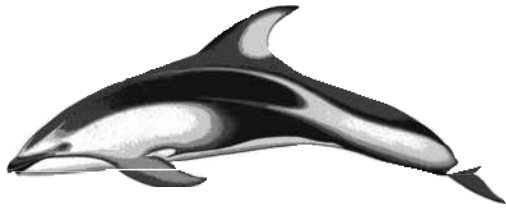


Orca:

- An *Odontoceti* (toothed) mammal also known as the killer whale
- They are the largest member of the dolphin family, but are often mistaken for a great whale because of their size.
- Orcas are found throughout the oceans of the world in transient, resident, or offshore family groups called pods.
- Resident pods have smaller home ranges and feed predominantly on fish.
- Offshore pods are smaller and seldom seen—little is known about them.
- Transient pods tend to travel over a wider area and are occasionally seen off the Oregon coast. They feed primarily on marine mammals, including juvenile gray whales.
- Orcas live in a matriarchal society. The offspring live and travel with their mothers, sometimes even after they are fully grown.
- Individual members of a pod often work together as a team to hunt their prey.
- Orcas have well-developed senses of hearing and vision. They use echolocation, emitting high-pitched clicks which “bounce” off of objects to reveal their location. They also communicate with each other using clicks and whistles.
- They have a single blowhole near the top of the head. The blow is a single, low, bushy cloud.
- Their teeth are large, cone-shaped, and made of enamel. They grow in both the upper and lower jaws.
- Orcas have a tall dorsal fin, measuring up to six feet high in males and three feet high in females.
- Their upper bodies are mostly black with unique white patches behind the eyes and dorsal fins; their undersides are white. These white patches, along with the dorsal fin, allow for the identification of individual whales.



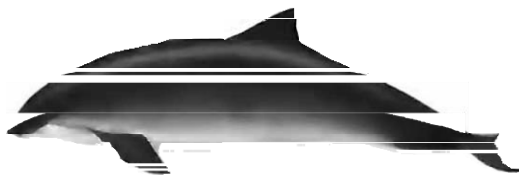
- Mature males can grow to 32 feet. Females can reach 26 feet.
- Males mature between 12 and 16 years old; females between six and ten years. Gestation is believed to last 15-18 months.
- Males live about 50-60 years; longer-lived females may survive for 80-90 years.
- Orcas have no natural predators; whalers do hunt them, but not in large numbers.
- Orcas are susceptible to disease and interference with reproduction caused by pollution and chemical contamination. (San Juan resident pods are listed as endangered because of their high mortality rates.)



Pacific White-sided Dolphin

The Pacific white-sided dolphin is common in Northwest coastal waters. They have a unique skin pattern of white, gray, and black. Their two most distinctive features are a rather blunt beak and a rear-pointing dorsal fin, which is dark on the leading edge and pale gray on the trailing edge. They do not make a distinct blow, but often splash about, producing sprays that resemble a blow. They are commonly seen in groups of 10-50 leaping acrobatically, surfing ocean waves, bow riding, and “porpoising” (making short, quick leaps in the water) in unison.

Pacific White-sided dolphins feed on a variety of small fishes and squid, consuming about 20 pounds of food per day. Calving and mating occur from late spring to fall, with gestation estimated at nine to 12 months. Adults are about seven feet long and weigh about 200 pounds.



Harbor Porpoise

The Harbor porpoise is very common in coastal waters shallower than 600 feet. They are very shy, seldom emerging above the water and almost never performing acrobatics like the dolphins. The best way to identify them is by their small gray body, shy behavior, and the rather distinctive sound they make when they breathe. When a harbor porpoise breaks the surface, it makes a quick “sneezing” sound. They usually live in small groups of two to five individuals.

Harbor porpoises feed on small fish such as anchovies and herring in mid-water or near the bottom. Mating usually occurs in early summer, with gestation lasting 11 months. Adults are about five feet long and weigh about 130 pounds.



Dall's Porpoise

The Dall's porpoise is seen most commonly off the shores of Oregon and Washington in the winter. They do not perform acrobatics, but love to bow ride. They are exceptionally fast swimmers, reaching speeds of up to 35 mph as they dart and zigzag about. They have distinctive black-and-white markings and are often mistaken for plump baby orcas. They do not make a distinctive blow, but produce a V-shaped cone of water called a “rooster tail” that flies back from their head, making them identifiable when they break the surface to breathe. They are commonly seen in groups of 10 to 20.

Dall's porpoises feed both at the surface and in deep water. Squid, lantern fish, hake, mackerel, capelin, and schooling fish are their primary prey. They burn up many calories zooming around and must eat frequently. Two peaks occur in the calving season, one in February-March and one in July-August. The gestation period is about 11 months. Adult Dall's porpoises average about six feet in length and weigh about 300 pounds.

Cetacean Breathing and Diving Chart

Species	Maximum Time Underwater	Maximum Depth
Gray whale	30 minutes	170 meters (560 feet)
Humpback whale	20 minutes	250 meters (820 feet)
Orca	15 minutes	250 meters (820 feet)
Blue whale	30 minutes	300 meters (990 feet)
Sperm whale	140 minutes	3000 meters (9840 feet)
Fin whale	30 minutes	500 meters (1640 feet)
Bowhead whale	80 minutes	300 meters (980 feet)
Pacific White-sided Dolphin	5 minutes	210 meters (690 feet)
Bottlenose Dolphin	10 minutes	535 meters (1755 feet)
Narwhal	20 minutes	1000 meters (3280 feet)
Bottlenose whale	120 minutes	1000 meters (3280 feet)



Fluking or deep diving

Pinnipeds Found on the Oregon Coast

Pinnipeds are carnivorous aquatic mammals that include seals, sea lions, and walruses. Derived from the Latin word *pinna* (meaning “wing” or “feather”) and *pedis* (meaning “foot”), pinniped means “wing-footed.”

Seals are pinnipeds belonging to the *Phocidae* family. The harbor seal and northern elephant seal are the two kinds found along the Oregon coast. Both are earless, or true seals.

Sea lions and fur seals belong to the *Otariidae* family. This group includes the California sea lion

Comparison of *Phocidae* (seals) and *Otariidae* (sea lions)

Seals	Sea Lions
<ul style="list-style-type: none">• Lacks externally visible ear flaps• Front flippers are short, blunt, and covered with fur• Hind flippers are short, paddle-like, covered with fur, and webbed• Cannot turn hind flippers forward and has to scoot forward on land	<ul style="list-style-type: none">• Small, furry, external ear flaps• Front flippers are long, wing-like, and usually hairless• Hind flippers are large, paddle-like, hairless, and webbed• Able to turn hind flippers forward to walk on land

Pinnipeds have bodies adapted to moving easily through the water. With circulatory systems specialized to ensure efficient oxygen distribution, some pinnipeds are able to dive to extreme depths and remain there for prolonged periods.

Mature seals and sea lions go through a molt once each year, a critical part of each animal’s life cycle. This process is extremely energy-intensive. The animals eat little and can look so unhealthy that they appear to be dying.

Harbor Seals

Harbor seals are the most commonly seen seals along Oregon's coast. Their population is increasing because of federal protection along the coast of the United States.



Size:

Average five feet in length; adult males weigh around 200 pounds and females 170 pounds.

Description:

Most are bluish-gray with black spots and irregular white rings and loops.

Habitat:

Temperate, ice-free coastal waters of the North Pacific and North Atlantic oceans; found from as far north as Alaska to as far south as Baja California.

Behavior:

- Spend equal amounts of time on land and sea. Graceful swimmers, but movement on land is clumsy.
- Seldom venture far from water; often seen resting on bay and estuary sandbars at low tide.
- Move on land by pulling their bodies forward using their short forelimbs.
- Haul-out areas on protected tidal rocks and reefs along outer coast are hubs of daily activity and annual cycles, providing for rest, reproduction, birth, rearing, and the annual molt.
- Can dive to 600 feet and remain underwater for 12-15 minutes.
- Make little noise.
- Considered non-migratory.

Diet:

Herring, smelt, flatfishes, lampreys, sculpins, squid, and octopus.

Lifespan:

Up to 20 years.

California Sea Lions

The California sea lion has thick fur plus a dense layer of underhairs that stay dry when the animal is underwater and a thick layer of blubber to help maintain its body temperature.

Size:

Males weigh an average of 800 pounds and are seven to eight feet long. Females weigh much less—about 200 pounds—and measure an average of five feet in length.

Description:

Mature males have dark red or chocolate-brown fur that may appear black when wet. Females retain a light brown fur coloring. Males develop sagittal crests, bony bumps on the top of their skulls that turn lighter as they age. Its long snout gives the California sea lion an almost dog-like face.

Habitat:

Bays, estuaries, and waters near shore, from southern Mexico to southwestern California. Most of population migrates to southern California and the Baja peninsula. Females are joined by males during the breeding season, May-August.

Behavior:

- Males migrate to winter feeding areas off Oregon, Washington, and Canada, sometimes taking over docks, piers, and marinas.
- Seldom travel more than 10 miles offshore.
- Usually haul out on beaches or rocky shorelines in densely packed groups.
- Sometimes seen floating together on the ocean surface with flippers in the air in an action called "rafting".
- Walk on land with rear flippers tucked under them.
- Very vocal; makes barking sounds.



Diet:

Squid, octopus, schooling fish, rockfish, occasionally salmon, and waste products from fish plants and canneries.

Lifespan:

17-18 years. Predators include Orcas and Great White sharks.

Stellar Sea Lions

Also known as the northern sea lion, the Stellar sea lion is the largest member of the *Otariidae* family. Its eastern Pacific population is listed as threatened.

Size:

Males weigh up to 2,400 pounds and measure up to 11 feet in length. They are much larger than females, especially in the head, neck, and shoulders. Females weigh up to 770 pounds and are seven to nine feet in length.

Description:

Mature Stellar sea lions are light buff to reddish brown in color with furless flippers that appear brown or black. Males have long hairs that extend from the back of their heads over their necks and shoulders and resemble a lion's mane.

Habitat:

Range restricted to the north Pacific Ocean and southern Bering Sea; 2,000 are estimated to live along the Oregon coast. Found in coastal waters when foraging and migrating, but rarely in bays or rivers.

Behavior:

- Usually haul out on rocky reefs or gravel beaches; in some areas, may haul out on sandy beaches or onto sea ice in the Bering Sea.
- For fear of losing their harem of females, dominant mature males often go hungry rather than leave their territory during the May-July breeding season to eat.
- Make roaring, lion-like noises.

Diet:

Described as opportunistic predators; feed on a variety of fish and occasionally on small seals.

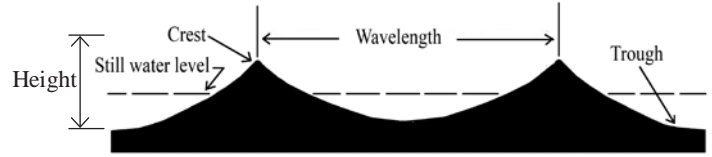
Lifespan:

Up to 30 years for females; up to 20 years for males. Predators include Orcas and sharks.

Wave Physics and Characteristics

Wave parts defined

- Crest:** highest point of a wave
- Trough:** lowest point of a wave
- Height:** vertical distance between a crest and trough
- Wavelength:** horizontal distance between two crests
- Period:** elapsed time during passing of one wavelength
- Frequency:** number of waves that pass a fixed point in set time
- Wind waves:** waves produced by the local wind
- Swell:** wind waves that have left the (often chaotic) area of wind generation and are now orderly wave sets capable of traveling long distances
- Combined seas:** average total height of swell plus local wind waves



Shallow-water waves: Waves that are classified as shallow-water (long waves) include wind generated waves that move into shallow near-shore areas.

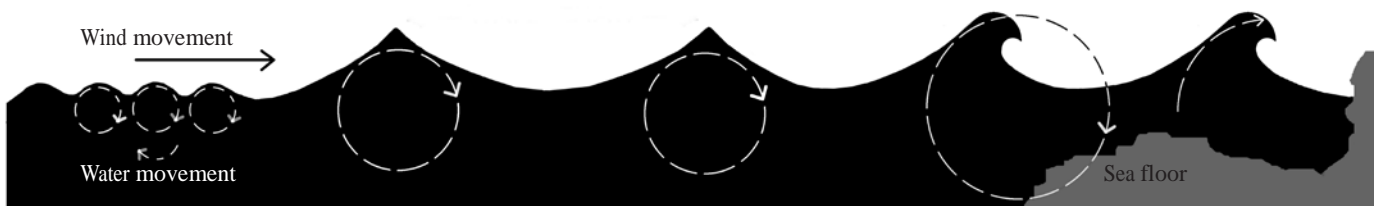
- a) Tide waves: generated by gravitational attraction of the sun and moon.
- b) Tsunami (seismic) waves: generated by disturbances on the ocean floor.

Deep-water waves: include all wind-generated waves that move across the open ocean. These are waves that travel across the ocean where the water depth is greater than one-half of the wave length. These waves can travel thousands of miles because there is little resistance in the open sea.

Wind-generated waves (small): as the wind blows over the ocean surface, the pressure forms small rounded waves with wavelengths less than $4\frac{3}{4}$ inches. These are called capillary waves or ripples, and the dominant force that works to destroy them and smooth the ocean is surface tension. Capillary waves characteristically have rounded crests and V-shaped troughs.

Wind-generated waves (large): as capillary waves increase, the sea surface takes on a rougher character. More energy from the wind is transferred to the ocean. Gravity helps to develop the waves into peaks with rounded troughs; it is the dominant restorative force smoothing the surface. As additional energy is gained, the wave height increases more rapidly than the wave lengths, and the crests become more pointed. This continues until the wave reaches the same velocity as the wind and the wave is at its maximum height.

Wave Cycle: When we look at a wave, we're only seeing half of it; the returning cycle of water is underneath. Waves can theoretically travel indefinitely, as there is little friction slowing them down. When waves strike an object on the sea floor, the cycle of energy is interrupted at the bottom. Because of this disruption, the back of the wave then breaks over the front, forming "breakers."



ON A CLEAR DAY YOU CAN SEE...

Location	Height in feet	Miles to horizon
Fort Stevens Tower	45	8.4
Seaside Promenade	20	5.6
Ecola State Park	100	12.5
Neahkahnie Mt. Viewpoint	574	29.9
Cape Meares	200	17.7
Cape Lookout.	432	26.0
Boiler Bay	80	11.2
Depoe Bay	60	9.7
Rocky Creek State Scenic Viewpoint	80	11.2
Cape Foulweather	454	26.6
Devil's Punchbowl (Otter Rock)	80	11.2
Yaquina Head Lighthouse (viewing platform).	80	11.2
Yaquina Bay Lighthouse	119	13.6
Yaquina Bay Bridge.	138	14.7
Devil's Churn.	120	13.7
Cape Perpetua Overlook	803	35.4
Heceta Head, Cape Creek Bridge	120	13.7
Sea Lion Caves.	320	22.4
Umpqua Lighthouse	80	11.2
Shore Acres State Park.	100	12.5
Cape Arago State Park	160	15.8
Cape Blanco.	203	17.8
Cape Sebastian.	700	33.1
Cape Ferrelo.	280	20.9
Harris Beach State Park	80	11.2
Six-foot person at sea level	6	3.1

All figures are approximate.

Note: The distance to the horizon in miles was calculated by multiplying 1.25 by the square root of the elevation in feet.

Dr. Bruce Mate

Thousands of miles from the nearest ocean, a high school biology teacher in the Midwest stood before a sophomore class more than 35 years ago. His enthusiasm for marine biology inspired a young man named Bruce Mate to pursue a career in the subject. Neither student nor teacher had any idea that Mate was destined to become one of the leading whale researchers in the world.



Dr. Bruce Mate

Dr. Mate first made history when his colleagues encouraged him to develop a way to track whales. After several years of mulling it over, he thought he might have a way to do it, although he had no funds to underwrite the experiment. His wife Mary Lou told him, “If you really believe in this, we’ll use all our savings to do it.” They spent about \$14,000 on a 1979 project that tracked three gray whales from Baja to Alaska. One of the animals went through the base of the Aleutians just 95 days after it was tagged in Mexico. Dr. Mate’s team found that Grays are the easiest to track because 90 percent of the animals travel within five miles of shore.

Today, Dr. Mate is a tenured professor of Fisheries and Wildlife and adjunct professor of Oceanography at Oregon State University, as well as the director and endowed chair of the OSU Marine Mammal Program. He has conducted marine mammal research since 1967, including a study to determine the migration routes of sea lions along the west coast of the United States; a post doctorate in biochemistry

investigating heavy metals and organochlorines in pinnipeds; analysis of marine mammal/fishing conflicts; and VHF telemetry studies of seals and Gray whales. He has become a leader in the development of satellite-monitored radio telemetry for marine mammals. Using this technique, he has not only tagged and tracked Gray whales, but also manatees, pilot whales, bottlenose dolphins, white-sided dolphins, right whales, bowhead whales, humpback whales, sperm whales, fin whales, and blue whales. Much of this work has been on behalf of the TOPP (Tagging of Pacific Predators) program off the coasts of Oregon and northern California.

The effect of the environment on whale populations

There has been an increase in the number of whale deaths both along our own coast and around the world. Could environmental factors be contributing to the spread of disease in marine mammals? According to Dr. Mate, it is a serious possibility.

“Have the animals’ immune systems been compromised by manmade toxins that are having a cumulative effect?” he asks. “We don’t know. But we know the potential for that kind of synergism is a concern. From the 1950s to the early 1970s, ddT and PCB were manufactured regularly, and we have animals still living that were alive then.

“These chemicals have very long lives in the environment, so they continue to circulate and affect new populations,” Mate adds. “We have seen very high levels of PCB and ddT in at least two dead killer whale calves. These are newborn babies! These chemicals also cause neurological and immune system dysfunction when they accumulate in large concentrations.”

There are many environmental issues affecting marine mammals. The greatest threat, Dr. Mate says, is loss of critical habitat, which is directly influenced by levels of pollution.

“Pollution to me is a broad term, not just chemicals dripping in the water,” explains Dr. Mate. “It can be harassment. It can be a matter of physical space. Habitat is under attack, not because people are against whales, but because they see the value of the places where whales go as being higher if it’s used for something else.”

Other risks come from net fishing, pollution from oil spills and fuels, and constant noise. For example, in just the past 40 years, humans have increased the noise level in the ocean tenfold.

In fact, about 90 percent of the noise in the ocean is manmade.

The cumulative impact of all of these forms of pollution is felt not just by the whales, but by all who live on the coast. “If our generation and our children’s generation don’t learn more about what whales need and start actively considering how to provide for their future, they will go the way of the dodo bird and the passenger pigeon, and that is no exaggeration,” Dr. Mate warns.

Vanishing Whales: We Made Them Endangered—That Makes Us Responsible

The Gray whale was hunted almost to extinction twice: once in the 1880s and again in the 1920s. The International Whaling Commission was formed in 1946 by several nations, including the United States, to divide the annual catch into national quotas. Not until the early 1970s did it change to become a means of controlling commercial whaling so that populations could recover.

A massive public outcry (Save the Whales) in the 1970s culminated in the International Whaling Commission’s adoption of a 10-year moratorium on commercial whaling beginning in 1986. Many nations have since decided that whaling is no longer profitable because products once supplied by whales have been replaced by plastics and petroleum.

Some nations, however, are still actively campaigning for commercial whaling to resume. Minke whales are still quite abundant and are the main species taken today under “scientific” permits, but the numbers killed typically exceed a sustainable level.

All endangered whales are internationally protected from commercial harvest, but Japan is

leading the demand for a return to commercial whaling and is currently hunting endangered whales even in the Southern Ocean Whale Sanctuary around Antarctica.

Whales face a wide variety of threats today, far more than were present even in the old whaling days. They face severe degradation of their habitat and elimination of their food sources. Large ships frequently cut across their migratory routes and cause them injury. And each year, many whales die as a result of entanglement in fishing gear.

What Can We Do to Help?

1. Avoid using plastic, which often ends up in the ocean.
2. Pick up litter and put it in receptacles.
3. Don’t pour paint and other waste down drains, where it can eventually reach the ocean.
4. Use non-toxic household cleaners.
5. Use lawn and garden chemicals sparingly.
6. Recycle used motor oil and old tires.
7. Conserve energy, materials, and water.
8. Be thoughtful: reduce - reuse - recycle.
9. Volunteer and spread the word!

Online Resources

Whale Watching Spoken Here
whalespoken.org

Mark Hatfield Marine Science Center
hmsc.oregonstate.edu

Oregon Sea Grant Marine Mammals
seagrant.oregonstate.edu/category/multiple-uses-and-marine-spatial-planning/marine-animals

Oregon State University Marine Mammal Program
mmi.oregonstate.edu

Oregon Institute of Marine Biology
oimb.uoregon.edu

Oregon Coast Aquarium
aquarium.org

Shoreline Education for Awareness—Friends of the
Southern Oregon Coastal National Wildlife Refuges
sea-edu.org

Haystack Rock Awareness Program
cannon-beach.net/hrap

Marine Mammal Protection Act
nmfs.noaa.gov/pr/laws/mmpa

American Cetacean Society
acsonline.org

International Whaling Commission
iwc.int/home

National Oceanic and Atmospheric Administration
www.nmfs.noaa.gov/pr/species/mammals/cetaceans

Humane Society of the United States
www.humanesociety.org/animals/whales

U.S. Geological Survey fact sheet on Gray Whales
marine.usgs.gov/fact-sheets/whales

America's Whale Alliance
americaswhalealliance.org

This manual has been adapted from the original training manual developed by Don Giles and Bev Lund. Additional information was gathered from some of the websites listed here.



Notes