

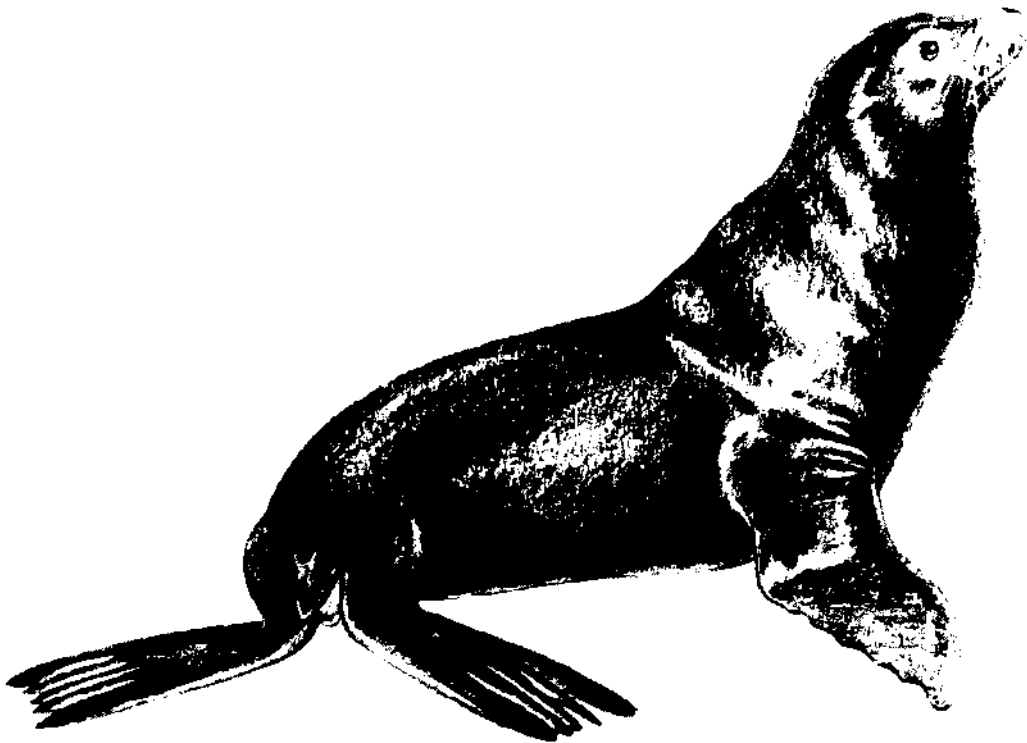


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# Marine Mammals of California



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# **Marine Mammals of California**

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## INTRODUCTION

A question the biologist frequently hears, and which tends to perplex him because he does not think along those lines, is "What good is this animal, or that plant?" The implication is that a particular organism was designed and put on the earth in order to be of some obvious direct or indirect benefit to man; or if it isn't of any such benefit, perhaps it should be eliminated. The biologist, on the other hand, feels that all organisms exist simply because they have adapted successfully to their environment, and are thus able to survive. He would gladly dispense with a few of them, such as those which cause disease to man or his livestock, but most of them he finds interesting, by themselves or as agents in an interlocking scheme of nature. I bring this up because the question has been so often asked about some of the marine mammals. One could, of course, answer the question by mentioning the oil and meat and other products which have been obtained from the larger cetaceans, the fur which has been obtained from the seals and sea otters, and so on. But it seems equally worth saying that these are fascinating and often beautiful creatures, whose structures and ways of life are interesting to study, to the naturalist and to the layman. Both have been thrilled by dolphins running in front of the bow of a boat, or by the sudden and unexpected sight of a whale surfacing, by the sealion barking on the rocks or swimming in the surf, by the sea otter watched through field glasses, and of course by many of these animals as exhibited in captivity. These may be values quite as great as any material ones.

Information about feeding, reproduction, seasonal or other movements, general behavior, etc., of most of the marine mammals is very scant. Whole or skeletal specimens of even the common forms, particularly of the cetaceans, are for the most part very scarce in museums. Many species are very rare. In this publication I have included all the species ever recorded from California, not only for the sake of completeness, but in the hope that knowledge of their rarity and of the value of records and specimens to scientific workers may inspire people to pass on interesting information, and to report findings of beached specimens or to save skulls and turn them over to the museums when these are old and clean enough to be transportable.

Passing on information about beached animals to a nearby college or museum or to a Fish and Game warden or biologist will result in measurements and other information being obtained, and the skeleton or at least the head being saved for future study.

Because of the difficulty in collecting and preserving such large animals, and the consequent rarity of specimens, there are differences of opinion regarding the names that should be used for many of them. For the most part, the Marine Mammal Commission's 1976 list of *Marine Mammal Names* has been followed.

## MODIFICATION OF MARINE MAMMALS

The ancestors of the marine mammals at one time lived on land. Close to 100 million years ago, in some cases, they began evolving into aquatic creatures, resuming life in the water from which their land ancestors had come originally, but with vastly different structures. The earliest known fossil whales go back some 60 million years, to the Eocene epoch. The earliest fossil seals, much less modified than the whales, go back about 20-25 million years, to the Miocene epoch. The sea otters, closely related to present-day land and freshwater mammals, have taken up a marine life very recently. All, however, are peculiarly adapted to their life in the sea.

The cetaceans, as the whales and dolphins together are known, are the most modified in body shape. While they vary one from another, all are streamlined to present a minimum resistance to the water. Projecting parts are kept to a minimum: nipples and sex organs are withdrawn into slits inside the body; there is no external ear or pinna, and the ear opening is reduced to a tiny hole or completely lacking. (Opposing this streamlining are a host of barnacles and other parasites which cover many whales.) The long grooves on the anterior underparts of the porpoises, and other features of the cetaceans, have caught the attention of experts on hydrodynamic friction, who showed interest in applying them to submarine design and other projects. The flexibility of the body, and possibly the way in

which the epidermis is attached to the underlying blubber, may help to change water flow along the body from turbulent to laminar.

The flukes of cetaceans, outgrowths of the skin and connective tissues of the tail, provide the chief source of propulsion. They are horizontal rather than vertical as are the tail fins of the fishes. The up-and-down movement is an advantage to an animal which does frequent rapid diving and surfacing.

The seals are less radically modified than the whales but still are streamlined. External ears are small or lacking. Sea otters are still less modified.

The cetaceans have almost lost their hair—but not quite. I was fascinated to see, on either side of the snout of a well-developed dolphin fetus which I took from the mother, several stiff golden bristles. Some adult whales (the baleen whales) retain hairs: the Greenland right whale, for example, has about 250 bristles on its chin and the tip of its upper jaw; others have smaller numbers, 112, for example, in the gray whale. Toothed whales have them only in the embryo; and the beluga and narwhal have none at any stage. These may represent not hair in the ordinary sense, but vibrissae or whiskers.

Seals have short, thick coats of hair or fur, which impede their progress little. Sea otters have longer, very fine, thick fur.

Whales combat the cold of ocean waters by insulating their bodies with a thick layer of blubber, or fat. Seals have both a fat layer and hair. Sea otters have no fat layer and must depend to a great extent on their dense fur for warmth.

The fat layer found on most marine mammals may also serve the purpose of tiding animals over periods of fasting. Whales migrating through areas where food is scarce can go for considerable periods without eating—though it has been questioned whether they draw on their blubber at such times. Bull seals holding harems may stay on the beach for long periods without eating—in the case of the fur seal for as much as two months or longer. Baby fur seals may stay several days or a week between feedings while the mother goes to sea for fish. The Arctic harp seal mother stays with her baby for two weeks nursing it, then leaves it, the baby stays on the ice floe for two weeks longer, then tumbles into the water and starts catching food for itself. The sea otter, on the other hand, cannot go long without feeding. Fat in a marine mammal's body also aids in flotation.

The milk of cetaceans and seals is very low or lacking in sugar, is low in water (only 40-50% as compared with 80-90% for most domestic mammals), high in protein (twice as much as in the average terrestrial mammal), and very high in fat. Cetacean milk on the average contains 40% fat, that of the Atlantic gray seal 53%, probably the richest known. This compares with 2% in man, 4% in cows, 9% in dogs, and 17% in reindeer. Because of the difficulty of reproducing this milk, attempts to raise orphaned seals found on the beach almost always end in failure. Marineland of the Pacific raised four very husky walruses on a diet of whipping cream and clams, mixed in a blender. Walruses nurse for about 18 months. (I went in the enclosure with them once and found it quite an experience to have a 600-pound baby nuzzling at me affectionately and trying to suck on my finger.) Also, Marineland as an experiment took in a scrawny little sea lion pup and successfully raised it on a diet of whipping cream, liquefied mackerel muscle, calcium caseinate and multi-vitamin syrup.

This marine mammal's rich, concentrated milk served several purposes. In the cetacean, which nurses underwater, it cuts down the necessary feeding time. In both cetaceans and seals it puts on fat which the young need for insulation against the cold, and gives them fuel necessary for metabolism. Young marine mammals are usually born singly (twins being rare), are born with their eyes open, and are fairly large and precocious, as they need to be to cope with the hazards of their exposed marine environment. Little seals, in particular, are very vulnerable on land or on ice floes, and so are their mothers as long as they stay with them. In some cases the growth of the young is phenomenally rapid. The amazing Arctic harp seal, mentioned before, doubles its birth weight in five days. It takes the human baby an average of 180 days to accomplish this (but only nine days for dogs, 60 days for horses). At four weeks its molt from a fuzzy white coat to smooth silver-gray pelage is completed, and it is ready to depart into the safer environment of the water.

Blue whales likewise grow rapidly. They double their birth weight within seven days. Twenty-five feet long and weighing two tons (or a little more) at birth, they have increased to 50 feet and 23 tons in six to seven months.

Cetacean fore-limbs are in the form of flippers. They have the same arm bones as humans, and the same five fingers (except that porpoises lack the thumb). They differ only in having many more bones in the two central digits. A pair of bones embedded in the flesh about where you would expect the hips to be (in the abdominal wall close to the vent) is all that is left of the pelvic girdle. A second pair of bones, present in some species, represents the upper leg bone; and a few species have a third pair, a vestige of one of the lower leg bones. Embryo whales, up to about one inch, show tiny flaps for both fore and hind limbs, possessed by their remote ancestors.

Seals have fore-flippers and hind-flippers as well, the latter in particular showing distinct toes. In the eared seals, these turn forward, giving the animal more mobility on land; in the hair seals, they project backward.

Sea otters have limbs much like those of their land and freshwater relatives, but with the hind feet webbed and flattened.

Baleen whales have no teeth but instead have sheets of baleen, used as strainers. However, their ancestors had teeth, and the tooth buds still appear in the embryos. While some of the toothed whales have large numbers of teeth, others seem to be in the process of losing their teeth, having functional teeth only in the lower jaw, with rudimentary teeth in the upper and sometimes the lower jaw.

The spout, by the way—that jet of vapor particularly characteristic of the large whales—has been the object of much conjecture. People have theorized (i) that it is water blown up from the whale's exhaling before it breaks the surface, (ii) that it is water lying in the depression of the blowhole, (iii) that it is from droplets of a foamy mucous substance produced by the respiratory tract, and (iv) that it is warm gas vapor condensing in colder air (though the spout is nearly as conspicuous in tropical as in polar regions). The best explanation, according to the writer of a recent book on whales, is that it is vapor from a gas which is escaping under great pressure and therefore becomes cooled. Perhaps there is some truth in all of these theories. Dolphins also produce a spout, but it is less conspicuous than that of the great whales, both because of their smaller size and probably because they do not stay under so long nor come up from such great depths.

The respiratory system is one of the most interesting features of the cetaceans. The nostrils have migrated to the top of the head, with two external openings in the baleen whales (one in the toothed whales), with a valve to close them when under water. They are exposed above the surface when the animal is floating. In the sperm whale, the buoyancy of the large head, with its low gravity spermaceti case, causes it to float in such a position that the tip of the snout is exposed; hence the blowhole opens near the tip of the snout with a forward slanting angle, giving the animal its typical forward pointing spout.

In seals and sea otters, the nostrils are at the front of the snout. The openings close when the animal is under water.

A question which often arises is how marine mammals exist in an environment where most of their available drinking water is salty. Seals have not been observed to make use of fresh water in the form of ice. On the other hand, four seals that were shipped in a warm railway car drank fresh water greedily as soon as it was made available to them.

Cetaceans have no possible access to fresh water, except for the few species which live in it all the time, or those which occasionally run up rivers. In common with other marine vertebrates, their blood and other body fluids are less salty than the water around them; those of invertebrates, on the other hand, are about equal to sea water. Marine mammals lose water through the intestines, lungs, etc. However, this water loss is minimized by the fact that they live in an environment of cool and constant temperature, and that they inhale air saturated with water vapor. They apparently swallow only a minimum of sea water when feeding. Those that feed on fish or mammals do not take in much salt in their food; those that feed on invertebrates such as squid or shrimp have more of a problem. There is evidence from the structure of the kidneys that a large amount of

urine is excreted, thereby getting rid of large amounts of salt. It is assumed that cetaceans feeding on invertebrates have more highly lobulated kidneys than those feeding on fish (this is true of shrimp-feeding seals). But there is still a need for extra fresh water from somewhere. This may come from their high metabolism wherein water is liberated as a result of the oxidation of food, especially fats. This occurs with some desert mammals.

Cetaceans have a number of different external parasites. Barnacles are conspicuous among these, and are of kinds peculiar to the whales. In addition, cetaceans are "bothered" by lamprey eels, sucker fishes, and several kinds of crustaceans. These are all strictly marine animals, but seals have parasites in the form of anoplurid lice which, like their hosts, were formerly terrestrial animals. These lice exist in little pockets of air trapped among the hairs. Seals also may have nasal mites. Sea otters, rarely have nasal mites, and even more rarely, lice.

Of all things that have interested people about whales and seals the most fascinating is perhaps how air-breathing animals can dive so deep and stay down so long, and how they can return to the surface without getting the "bends," or decompression sickness. This sickness, which afflicts human divers, is caused by nitrogen gas, which first accumulates in the blood in dissolved form, then separates out in bubbles if the return to the surface is too sudden.

Sperm and bottlenose whales, which feed to a great extent on cephalopods, probably dive regularly to 250 fathoms or more, and a sperm whale is known to have gone as deep as 500 fathoms, or 3,000 feet. There are reports of even greater depths; the record is said to be 3,720 feet. Seals are said to go, in some cases, to 140 fathoms, dolphins to 15 fathoms or a good deal more, sea otters commonly to 10 fathoms and rarely to 20, but at times even more. Sperm whales can stay down as long as 60 to 90 minutes, seals 5 to 15 minutes, and southern elephant seals perhaps more than 30 minutes; yet the lung capacity of marine mammals is not notably greater than that of land animals. In the sperm and bottlenose whales it is only half that of many terrestrial mammals in proportion to body weight and up to one and one-half times in others. Answers lie in some of the following facts:

1) They fill their lungs to capacity, the air renewal at each breath being 80 to 90% in the large whales, as compared with 10 to 20% in land mammals. The cetaceans are believed to dive with their lungs full, but the seals exhale most of their air at the time of diving, thus decreasing their buoyancy.

2) There is a high concentration of myoglobin in the muscles. Also, there is a high proportion of blood and amount of oxygen carried by it.

3) The basal metabolic rate of whales is only one-fifteenth that of man in calories per kilogram of body weight, and the blood will hold enough oxygen to maintain this for about 65 minutes.

4) The respiratory center is comparatively insensitive to the increase of carbon dioxide in the blood; it may depend rather on oxygen lack as a stimulus to breathing.

5) As soon as the animal begins a dive, the heart beat slows down to 50% of normal in the bottlenose dolphin, and much less in some others. In the common seal it falls to 20% of that when the animal is in repose. In the gray seal, it may fall from 100 to 150 per minute at the surface to 10 per minute upon diving.

6) Blood vessels to non-essential areas such as the digestive tract, and small vessels on the surface become constricted; only vital organs such as the brain and spinal cords receive blood when the animal is submerged.

7) Lack of damage caused by nitrogen bubbles may lie, mostly in the simple fact that the marine mammal, unlike the diving man, is not breathing underwater, and therefore does not accumulate a large amount of nitrogen in its lungs to pass into the blood. Also, the lungs are compressed, so that the walls are thickened and less apt to absorb air, and air driven into the thick-walled trachea and its branches is not readily absorbed. Even so, an animal returning from great depths may, under normal conditions, do so slowly.

## ORDER CETACEA

Whales and dolphins have always caught the fancy of man, because of their huge size in some cases, because of their beauty and playfulness in others, and because of their amazing adaptation to the strange world of water. Also of course they have for centuries been valuable to man as a source of food and oil, and for a time, of whalebone.

In one sense, all cetaceans might be referred to as whales. The name of the order comes from *cetus*, the early Greek and Latin word for whale (*balaena* is another Latin word for whale). Strictly speaking, members of five of the families are whales, while members of the Delphinidae and another family of freshwater species are dolphins and porpoises. Whales are usually large; however, the pygmy sperm whale reaches only 13 feet at most, and some of the beaked whales reach only 15-17 feet. On the other hand, some of the delphinids reach fairly large sizes—the false killer 18 feet, the pilot whale 22 feet, and the killer as much as 31 feet—and in popular parlance these are often referred to as whales. There are at least 78 species of cetaceans in the world, according to one source, and 91 according to another.

The terms "dolphin" versus "porpoise" almost always create confusion and controversy. Properly speaking, the long-beaked forms are called dolphins, while the small, snubby-nosed forms, especially those of the genus *Phocoena*, are called porpoises. But the terms are often used interchangeably. To further complicate things, a fish also goes by the name "dolphin."

There are two suborders of Cetacea: the Odontoceti, or toothed whales, and the Mysticeti, or baleen whales. The former includes the dolphins, the beaked whales, the sperm whale, the pygmy sperm whale, and members of two other families not found in California. These all have teeth, if only a few or only vestigial ones, and they feed primarily on fishes and cephalopods (squids and octopi), and sometimes on large mammals as in the case of killer whales. The baleen whales include the right whale, the fin whales, and the California gray whale. These have no teeth; instead, they have sheets of a fringed horny material, called whalebone or baleen, hanging from their upper jaws. They use this to strain out plankton—a sort of dilute soup of small, drifting organisms, among which they— are particularly fond of shrimps (one of the best known of which is a one-half inch variety of euphausiid called krill). They also may feed on small fishes. It is interesting that the largest of all the whales, the blue whale, reaches its great size by feeding upon small organisms, as does the largest of the sharks, the whale shark, which uses its gill rakers as strainers. In this way, these animals are feeding low on the food chain, at a level where food is more abundant.

Like most other marine mammals, the cetaceans store fat in the form of thick layers of blubber under their skins. This primarily provides them with insulation against the cold. It also may enable them to go without food for long periods when necessary. The gray whale, as an example, is believed to concentrate most of its feeding during the 4 months of the year it spends in the North, and to do little feeding during the 8 months it is traveling south to the breeding grounds and back. (However, one was found on the beach in Baja California with a quantity of sardines in its stomach. Another was taken off Baja California which had been feeding on "red crabs," *Pleuroncodes*.) This is the more remarkable in that the whales are expending energy in swimming during this time, and the mother is nursing her baby.

In captivity, cetaceans are fed fish of several kinds, often mackerel (or any other small, soft-finned fish), or squid. Striped dolphins may consume 10-15 pounds of fish a day, bottlenose dolphins 15-20 pounds of fish, and pilot whales 60 to 120 pounds of squid. Performing animals are fed less than those not performing, to keep them a little hungry and therefore eager for rewards for their tricks.

Stomach contents of non-captive animals have yielded much more variety. A Pacific bottlenose dolphin was found, through picking out and identifying the fish otoliths, or ear stones, in its stomach, to have eaten over 62 fish of at least 8 kinds (25 white croakers, 9 queenfish, 6 corbina, 19 seaperch of several kinds, 2 topsmelt and a California halibut). A Dall porpoise stomach contained remains of 14 hake, 2 jack mackerel, and 13 squid. The



stomachs of a white-sided dolphin contained otoliths of numerous anchovies upon which it had fed. On several occasions off southern California dolphins have been noted feeding upon schools of sauries and anchovies. Stomachs of *Stenellas* from Mexico have contained squid beaks and otoliths of lanternfishes. As many as 190 squid beaks have been found in a single stomach, and as many as 2,357 otoliths, all from one kind of lanternfish. (These figures should be divided by two to give the minimum number of fishes eaten.) An Atlantic *Delphinus* had 15, 191 otoliths in its stomach, representing one specie of saury and five species of lanternfishes.

In the baleen whales, the female is as large as, and often considerably larger than, the male. In the sperm whale, on the other hand, the male reaches 60 feet, the female only 40. In some delphinids, as the killer whale and the pilot whale, the male is likewise the larger; in others, this does not seem to be the case.

Information about breeding among the cetaceans is very incomplete. Breeding may take place at a specific time of year, or apparently in some species, throughout the year. The gestation period is believed to be 10-12 months for most species, though it may vary from about 9 months to 16 months (sperm whale). They may breed every year, every other year (probably the most common interval), or every third year. Almost invariably one young is born per pregnancy. However, there are rare exceptions: several species have been known to have twin fetuses, and females have been found with up to six embryos. However, it is not known if multiple fetuses result in successful live births. The young are large and well-developed at birth, being about one-fourth to one-third or more the length of the mother. An 80-foot blue whale, for example, may give birth to a baby 25 feet long and weighing 2 tons or more!

The baby bottlenose dolphins born at the Marine Studios in Florida have all been born tail first, with one exception, and this is probably true of other cetaceans. There have been 15 live births (all of *Tursiops*) there between 1939 and 1963, in addition to 12 abortions or stillbirths (most were *Tursiops*, one was a *Delphinus*, one a *Stenella*). The live young all swam unaided to the surface to take their first breaths, though the mother and other helpers might nudge a stillborn young up to the surface. Dolphins often have "aunties," other female dolphins who help care for the young. Nursing takes place underwater; the mother bottlenoses often roll on their sides to help the infants during the first 2 weeks, but not thereafter. The nipples are usually two in number (four in the false killer whale) and lie retracted, each in a slit on either side of the genital and anal openings, in the posterior part of the body. (The males of some cetaceans also show mammary slits.) When the baby attempts to nurse, the nipples are protruded slightly, and it is believed the mother forces the milk out in a quick squirt by a muscular contraction. Baby bottlenoses have been observed to suckle one to nine times at a nursing period, which occurred about once every 26 minutes during the first 2 weeks.

The young grow fast, about doubling their length in the first year of life. A Marine Studios dolphin nursed for 1 1/2 years, in one instance. Nursing periods of 5 to 13 months have been claimed for other cetaceans, in the wild. One of the young captive dolphins began eating bits of squid at 5 months, while still nursing; another took its first solid food (fish) at 11-12 months.

Sexual maturity was reached by a captive-raised bottlenose dolphin at 4 years, though she did not breed until 6. Some cetaceans are believed to be sexually mature at about 2 or 3 years, others not till 6 or older. Only 15 months is claimed for the common porpoise, *Phocoena*. The total life span is estimated to be 15 to 40 years.

Age determination of cetaceans, except for captive-raised specimens, is very uncertain. Several methods have been tried. One involves counting the white bodies formed in the ovaries, one with each ovulation. A second is measuring the color of the eye lens, which turns golden with age. A third is counting the ridges of the baleen plates. A fourth is counting the layers in the dentine of the teeth. A fifth, the latest and most promising method, is counting the rings on the wax plugs from the external auditory passages of baleen whales. It is believed that the rings are caused by differences in metabolism, while the animals are on the feeding grounds and while they are in migration. Finally, a method

providing an exact check on other methods, but one which has been comparatively little used as yet, is that of marking very young animals by firing stainless steel tubes or similar devices into the dorsal muscles. Aristotle, in his *Historia Animalium* (4th century BC) mentions that fishermen sometimes nick the tails of dolphins and set them adrift again, and thus ascertain their ages; he claims that some are known to have lived for 30 years.

Whales grow to be the largest animals known today. In fact, the blue whale, attaining a length of about 100 feet and a weight of over 100 tons (130, according to one authority), is the largest animal that ever lived. The finback whale, reaching 70 to 82 feet (though the average is nearer 68), may attain a weight of something like 70 tons. Other whales may reach lengths of up to 50 to 70 feet. A 44-foot gray whale weighed about 35 tons. Whales can attain these great sizes because their body weight is supported by the water.

Sleep in the cetaceans is accomplished by taking very short catnaps, while the animals drift motionless near the surface. According to one writer, the bottlenose dolphin opens its eyes every 15 to 30 seconds, and gives a few slow strokes of its tail every half minute, when sleeping. In a recent experiment, a pilot whale, kept in a shallow tank and wired for brain wave studies, was found to sleep an average of five hours a night, floating with its blowhole on the surface. The gray whale, sleeping in the lagoons, breathes every 5 to 10 minutes. This doesn't sound very restful, but perhaps the animal doesn't really wake up much more than we do when we turn over in bed. However, it apparently has to exert some conscious control over its breathing. Researchers have found that dolphins cannot be put under total anesthesia for operative purposes, as breathing will then cease. This is probably a provision to ensure that a sleeping animal does not inhale when underwater.

Dolphins normally surface about twice a minute, in the smaller forms, but can stay under a maximum of 5 or 6 minutes. A killer whale can stay under up to 15 minutes, a pilot whale up to 20 minutes. The gray whale usually stays under 3 to 7 minutes, with a maximum observed time of 12-13 minutes. Maximum times for some of the other large whales range from 30 minutes, up to 90 for the sperm whale. This last is a species which goes down deep to feed on cephalopods. On the other hand, the Greenland right (or bowhead) whale, a plankton-feeding species, is able to stay down 80 minutes.

Exact records of the depths to which whales can go are provided by individuals which became entangled in submarine cables. Twelve sperm whales have been caught in cables, at depths of 300 to 3,000 feet, and one humpback whale at 360 feet. The smaller dolphins go down at least 66 feet, and maybe much more, based on evidence from deep-water fish remains found in their stomachs. A pilot whale captured for Marineland of the Pacific took out 200 fathoms, or 1,200 feet, of line, apparently straight down.

The right whale is one of the slowest whales, cruising at 2 knots, with a maximum speed of 10-12. (A knot is a unit of speed equivalent to one nautical mile or 6,080.20 feet an hour, as compared to 5,280 feet in a land mile.) The humpback travels as 1.3 to 5 knots, and can reach 15 knots when chased. The gray whale in migration travels at 4 knots (or less) for a 20-hour day, with a maximum of 10 knots. Sperm whales are a little faster. They have been timed at from 8 to 20 knots, with 10 probably near the average, though they may go slower at times. The rorquals are the fastest of the great whales. Blue and fin whales average 10-12 knots, and may travel up to 20 knots for periods of 10-15 minutes, or 30 miles per hour for a very short time. The sei whale has been said to reach a speed of 35 knots for a short time, though this has been questioned. The small dolphins can maintain 20 knots for some time according to two different observations (not in the bow wave, in which experiments have determined they can maintain their position without exertion); and the bottlenose dolphin in the Red Sea can elude boats making less than 22 knots.

Dolphins have particularly endeared themselves to man for several reasons. One is the human-like interest they take in play. Many species delight in running at the bow of a boat, receiving an impetus from the water pushed ahead by the boat. Bottlenose dolphins, as well as gray whales, have also been seen riding waves in the surf. Many of the leaps taken by dolphins must be made out of exuberance; possibly those of the large whales are also. In aquaria, dolphins play with feathers and other objects, and raise out of the water to throw objects such as balls. Another attractive dolphin characteristic is the concern they

show for one another. There are many instances of dolphins coming to the aid of an injured member of their group, as, for example, a pair supporting a third one between them on their flippers. Stillborn young are helped to the surface, and a mother may carry a dead baby for days. Instances of dolphins pushing a drowning or dead human toward shore may be due to a transference of this helpful tendency, or possibly just to playful curiosity, or even, it has been suggested, to animosity toward a foreign object.

The sense of smell is poor or nonexistent in the cetaceans, the olfactory lobes and nerves being much reduced, but there is probably some sense of taste. Eyesight is fairly good in at least some cetaceans, both under and above the water. The best-developed cetaceans sense is that of hearing. Whales and dolphins make a great variety of sounds, both for communicating with one another, and in some cases for use as a sonar. There is no external ear and there is only a minute aperture to the outside if any. However, the auditory nerves are the largest of all the cranial nerves in the Odontocetes, the second largest in the Mysticetes. The auditory centers of the brain are well-developed. Experiments have shown that cetaceans are capable of receiving a wide range of frequencies, extending in the upper ranges (in the bottlenose dolphin) to a frequency perhaps exceeded only by the mouse and the bat.

## WHALING AND WHALE CONSERVATION

Whaling has been carried on for many centuries, perhaps longest by natives of the polar region who have depended upon marine mammals for food. Seven thousand years ago Eskimos on the eastern coast of Canada were using toggle harpoon heads; these were not "invented" again until the mid-19th century when they were quickly adopted by the American Yankee whaling fleet. Americans dominated whaling during the 19th century. In 1840 there were approximately 750 whaling ships in the American fleet. Primarily, they were after the right whale and the sperm whale. Right whales were so named because they were the right whale to catch—they were slow swimming and did not sink when dead. They contained valuable baleen used for women's corset stays and whale oil used for lamps. After the demise of most of the right whales, sperm whales were the main target. These were taken for their oil and ambergris.

Modern whaling began with the invention of the explosive harpoon gun in 1868, with the use of fast steam-powered catcher boats, and later with the use of floating factory ships. Modern whaling is characterized by the steady commercial extinction of one whale species after another, that is they have been reduced to such low numbers that they are not economically harvestable.

Currently, only two nations—Japan and the USSR—account for more than 80% of all whaling. A little over one-half of their catch is sperm whales, used primarily for oil. Significantly, whale meat is eaten in Japan, but it accounts for less than 2% of the total of all animal protein, and its use is decreasing. Japan exports approximately five times as much fish and marine food products as her total whale catch. Further, Japan's whale catch accounts for less than 2% by weight of the total fishery industry and it has been declining.

A few whales are still taken each year by American Eskimos who traditionally have been whalers, and the USSR takes a number of gray whales for the subsistence of natives of Siberia. The Eskimos' take consists primarily of bowhead whales—perhaps the most endangered of all large whales—and a few gray whales. Except for Eskimos, whaling is illegal for Americans under both the Marine Mammal Protection Act and the Rare and Endangered Species Act. Additionally, whaling is prohibited in a 200-mile zone of the U.S. waters by the Fisheries Conservation Act of 1976.

Nonetheless, whaling is part of the history of California. Whaling began off the coast of California in the early 1800s by Yankee whalers, and by the late 1800s the gray whale was thought to be extinct. Shore whaling was also practiced in California during the same period. The first whaling station in Monterey was established in 1854. A number of stations were established up and down the coast of California, including a few in Baja California, but most were short-lived. In 1886 only five were operating. These were in

Monterey, San Simeon, San Luis Obispo, Point Conception and San Diego. These early whaling stations were operated strictly by hand methods and were staffed primarily by Portuguese. In 1874 Charles Melville Scammon wrote: "This particular branch of whaling is rapidly dying out, owing to the scarcity of the animals which now visit the coast." Before 1874 it is thought that most of the catch consisted of gray whales; after this date more than 85% of the catch was humpbacks. After 1880 the ancient practice of hand whaling was very sporadic.

From 1940 to 1951 a modern shore whaling station was operating at Fields Landing near Eureka. Subsequently, two modern shore whaling stations were established at Pt. San Pablo, Richmond, in San Francisco Bay. One opened in 1956, the other in 1958. Both operated out of the same large red wooden building that came to be known as "the Richmond Whaling Station". Between them they operated five catcher or killer boats which usually worked in a 125-mile radius of the Golden Gate. They went out almost daily during the open season, which in 1964 was from April 15 through October 15 for most species, and from April 1 through November 30 for sperm whales. These modern diesel-powered catcher vessels with their harpoon cannons mounted high on their bows would usually return to the whaling station late at night after catching a whale. Most of the whale was made into pet food.

The catch of the endangered blue whale was never large, but whaling for them continued until 1965 when blue whales and humpbacks were both given protection in the North Pacific.

The catch of the 841 humpbacks was possibly more consequential than that of the 48 blue whales. Prior to 1905 the North Pacific population of humpbacks was estimated to have been 15,000. Between 1905 and 1929, with the introduction of modern whaling methods, approximately 18,000 humpbacks were reported killed in the North Pacific. This reduced the population to approximately 6,000. From then until 1960 the catch did not exceed the estimated sustainable yield of 240 per year. From 1960 to 1965, however, Russian and Japanese factory ships killed 5,000 of the estimated 6,000 reducing the North Pacific population to 1,000. Presently only the right whale and bowhead are rarer.

Gray whales were once thought to be nearly extinct and for this reason they were given international protection beginning in 1938. However, between 1956 and 1966 a total of 316 gray whales were killed under a scientific permit. Now the gray whale situation is a happier one. The current population of approximately 11,000 animals is close to the estimated 16,000 in existence at the start of the modern whaling area.

Of all the species of whales once taken by California whaling stations, only the sperm whale is still hunted by other nations. All other species are protected because of drastic reductions in populations. The sperm whale population is estimated to be less than half that in existence at the beginning of modern whaling. The fin whale, once the most abundant species caught by California Whaling Stations, is considered depleted and protected in the North Pacific.

In 1966, Golden Gate Fishing Company ceased operations, leaving only three killer boats. The Del Monte Fishing Company, the last whaling station in the United States, was closed at the end of 1971 because of federal laws which prohibited whaling. The last registered whaling vessel in the United States, the Sioux City, now is used for research, fishing and as an ocean-going tug.

Man's toll of whales has been heavy. Nearly all of the great whales are depleted. The need for international regulation has been obvious. It was discussed as early as 1927 by the League of Nations. The International Whaling Commission, established in 1949, has presided over the modern-day decline in whale populations. Before 1976 the yearly catch did not reach the quotas established by the commission, which means that in effect catches were uncontrolled. Since 1976, however, the commission has generally gone along with the advice of its scientific committee, and more restrictive measures have been followed. This change has probably come about as a result of the tremendous international awareness and concern about whales. The best hope for the future of whales and conservation of living resources generally probably lies with continuing public awareness and concern.

**TABLE I**

**California Whale Landings**

Species	1956-1966	1967-1969	1970	1971
Blue ( <i>Balaenoptera musculus</i> )	48			
Bottlenose ( <i>Berdius bairdii</i> )	16			
Bryde's ( <i>Balaenoptera edini</i> )	2			
Finback ( <i>Balaenoptera physalus</i> )	941	113	5	4
Gray ( <i>Eschrichtius robustus</i> )	78	239		
Humpback ( <i>Megaptera novaeangliae</i> )	841			
Killer ( <i>Orcinus orca</i> )	3	1		
Sei ( <i>Balaenoptera borealis</i> )	352	27	4	2
Sperm ( <i>Physeter catodon</i> )	531	252	64*	47
	2,772	632	73	53

\*Of the 64, 30 were taken under Special Scientific Permit 1970-1.

**MARINE MAMMAL PROTECTION ACT**

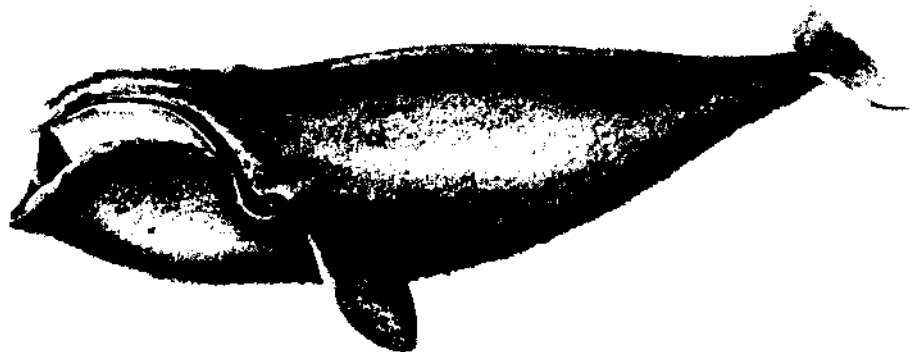
In 1972 the Federal Marine Mammal Protection Act (Public Law 92-522) became law. It changed the goals of marine mammal management. The new goal clearly was protection, and the responsibility for management was removed from the coastal states and given to the federal government. There is provision in the act for return of management to the states, but state plans for management have to be in accordance with the intent of the federal law. Only California and Alaska have applied to regain management of some marine mammals at this time.

In California the Marine Mammal Protection Act has shifted the responsibility for issuing permits for live capture of California sea lions and harbor seals from the California Department of Fish and Game to the National Marine Fisheries Service. It also halted Department of Fish and Game management plans to control the expanding sea otter population as a means of minimizing conflict with the abalone fishery.

The act also makes it illegal for a citizen of the United States to harass a marine mammal. Harassment is interpreted as human activity which changes the behavior of the animals. Thus, the entering a seal rookery or hauling ground or the close pursuit of a whale with a boat are violations of the act.

## NORTHERN RIGHT WHALE

*Eubalena glacialis*



This whale, and its relatives (other right whales and the bowhead) were formerly very numerous. They were slow-moving and easily caught; they lacked the belligerent qualities of the sperm whale; they yielded large amounts of oil and whalebone; and they floated when killed, which was a necessity in the days of small-boat killing. These things made them the "right" whales to catch, hence their name. Consequently, they were hunted almost to extinction, and are now given complete protection by international agreement.

The Northern right whale ranged formerly from the Bering Sea and Alaska to Baja California, being a winter visitor in the southern part of its range. Now it is rarely seen anywhere. Possibly it never was common in California and southward; certainly not by the time the whaling stations opened here in the 1850s. In 1975, the entire North Pacific population was estimated at about 220 individuals. Although perhaps fewer than a dozen have been seen or taken off California during the past 125 years, with full protection it may become more abundant, and is worth watching out for.

This whale reaches a length of 60 feet. It is usually black, but may show irregular white patches, especially on the underside. It has no dorsal or back fin, and no throat grooves. It is stocky-bodied, with a massive head, a horny excrescence on the front of the upper jaw (the "bonnet"), and a peculiarly-shaped, curved mouth opening. The spout is double or V-shaped, which distinguishes it from other kinds seen here, though the gray whale occasionally shows a faint double spout.

## FIN WHALES OR RORQUALS

Five members of this family are found in California waters. The four species of *Balaenoptera* are all long, slim, streamlined forms, while the humpback is stockier. All have small dorsal fins, set well back on the body, particularly so in the first four. Peculiar to this family are the very numerous and very long throat grooves, which extend in the blue, fin, and humpback whales to the midpoint of the body or beyond. There is a theory that these allow distension of the throat, thereby drawing a current of water, when the animals are feeding. They may also increase the animal's speed, by increasing its hydrodynamic efficiency.

These five whales are all found in both the Atlantic and Pacific Oceans, ranging in the latter from the Bering Sea southward. They are also found in the Antarctic, and in some cases in the Indian Ocean. The blue whale and the humpback are found as far south as Central America, the other three only to Baja California.

The fin whales were not taken by the old-type whalers, but now all are utilized to some extent.

## MINKE WHALE

*Balaenoptera acutorostrata*



This is a smaller species than the others of its family, reaching only 33 feet. A 28-1/2-foot female was said to weigh 5 tons. Newborn calves range from 7 to 9 feet in length. It is grayish-black above, white below, and has a prominent white band across the flipper. The small dorsal fin is markedly falcate (i.e. hooked or curved backward). This whale is not taken much by the larger whalers because of its small size; however, it is utilized in some countries for human and pet food.

In the eastern Pacific, minke whales are found from the Chukchi Sea to central Baja California, but they appear to be most common in Alaskan waters. In the winter months they range much farther south. There are no reliable population estimates for the eastern North Pacific stocks. They are rather slow swimmers, and frequently are seen as solitary animals near shore. They feed mainly on shrimp-like euphausiids but also take some small fishes.

## SEI WHALE

*Balaenoptera borealis*



This is pronounced sā (say). The sei (also spelled sej or saithee) is the European pollack, a member of the cod family. The fish feeds on smaller fishes and on euphausiids and other pelagic pelagic crustaceans. Both the whale and the fish appear off the northernmost tip of Norway at the same time of year, both undoubtedly after the same food, hence the name of the whale. The whale usually travels in pods of 2 to 5 individuals.

This species reaches 51 feet in length. It is gray to bluish-gray above and on the posterior half of the undersurface, and white down the middle of the anterior half. It was never greatly sought by Pacific coast whalers because it is low in oil content. The North Pacific catch in 1975 was 504 animals from an estimated population of 9,000. Its peak population in the North Pacific has been estimated at 42,000 individuals. In Japan, it is widely used for human food. Individuals taken in central California had been feeding on anchovies, sauries, sardines, jack mackerel, shrimp-like euphausiids and copepods.

Gestation appears to last for about 1 year and calves nurse for 5 to 7 months.

## BLUE WHALE OR SULPHURBOTTOM

*Balaenoptera musculus*



The largest of all the whales, and of all living or extinct animals, the blue whale reaches a length of about 100 feet and a weight of well over 100 tons. The longest well-authenticated record is for 98 feet, though there is a reported measurement of 111 feet. An 89-foot individual weighed 136.4 metric tons. It is a long, streamlined whale. Its color is bluish-gray with light blue mottling. The name "sulphurbottom" comes from the film of diatoms (minute one-celled or colonial plants) which sometimes cover individuals which have been in cold water for a long time. There is a very small dorsal fin, set far back. Blue whales taken in central California had shrimp-like euphausiids in their stomachs.

Many authorities believe that skull differences warrant this whale's being placed in a separate genus, *Sibbaldus*.

Gestation is thought to last 11 or 12 months. Newborn calves are about 23 feet long (estimated 5,700 pounds), and will reach 50 feet by the time they are weaned approximately 8 months later. Adults typically are found offshore either as individuals or in pods comprising 2 or 3 animals. The North Pacific population, once numbering about 5,000, now contains about 1,700 individuals, but may be increasing.

## FINBACK OR FIN WHALE

*Balaenoptera physalus*



This whale is similar in build to the blue whale. It reaches a length of 76 feet. It is grayish-black above, white below. The dorsal fin is small and set far back, and is falcate. This is claimed to be the fastest of the large whales. However, with modern whaling vessels and gear, combined with the fact that it is the most numerous of the whalebone whales, it constitutes an important part of the modern whale catch. The finback whale is probably the commonest whale seen in summer off the California coast. Ones taken in central California had been feeding on anchovies and shrimp-like euphausiids.

The finback whale is unique among mammals in having the right side of the head and lower jaw white, the left side all dark.



Gestation is said to last for 11 to 12 months, and the young are suckled for 6 to 8 months. Newborn calves are approximately 20 feet long and weigh about 2 tons.

The catch of finbacks in the North Pacific in 1975 was 504 animals from an estimated population of 17,000. The peak population in the North Pacific has been estimated as 44,000 animals. Finbacks usually travel in pods of 2 to 5 individuals.

## HUMPBACK WHALE

*Megaptera novaeangliae*



The humpback whale reaches 52 feet in length. It is a stockier form than the other fin whales found here, and differs from them—and indeed from all other whales—in having extremely long flippers, 1/4 to 1/3 the total length of the animal, knobbed on the anterior edges. Its top and sides are black, its undersurface white.

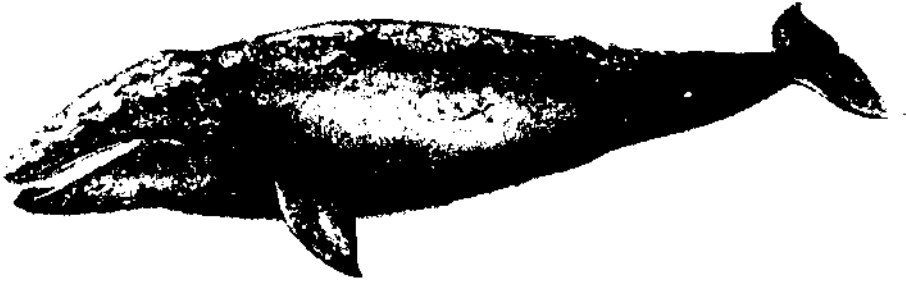
The whale is often found in coastal waters, even in bays. It frequently breeches, leaping clear of the water and partially spinning as it falls back with a mighty splash. Individuals taken in central California had anchovies and shrimp-like euphausiids in their stomachs.

The population of humpback whales in the North Pacific prior to 1905 is estimated at 15,000 animals. By 1965, their numbers had been reduced to about 1,000 so they were given complete protection. The present North Pacific population is estimated at between 850 and 2,500 individuals. Somewhat over 100 animals appear to winter off Baja California each year.

This whale has attracted a good deal of attention because of its "singin". While vocalization has been recorded from some other whales, that of the humpback seems to be unique. Its song is long and complicated, with a definite pattern, which is repeated. It may represent a simple kind of communication, different from briefer sounds made by many dolphins for communication and of course from clicks or other pulsing noises used by many dolphins for echolocation. What has given the humpback its particular fame is that its voice has been taped and issued as a record, "Songs of the Humpback Whale," which has been used as the background of a new symphony.

## GRAY WHALE

*Eschrichtius robustus*



This is the best known of the great whales in California, and the one most often seen. Gray whales feed in summer in the western Bering Sea and adjacent Arctic Ocean. In winter, particularly in December through February, they may be seen traveling south along the California coast in small groups, usually two to five, on their way to Mexico. There, in various of the bays and lagoons of Baja California and the mainland—especially Scammon Lagoon—the females have their calves and breed. In the spring, particularly in March and April, they travel north again along the coast. They travel fairly close to shore, often coming within a few hundred yards of some of the points, or even into the surf zone. A "whale-watch" was set up at Pt. Loma, near San Diego, for several years to get a count of the population, with people taking turns watching during the daylight hours of the main part of the run. The whales have become a great public attraction, and many people visit promontories such as Pt. Loma in hope of seeing some of them, and there are also boats which take out passengers to see migrating whales from Mission and San Diego Bays as well as from San Pedro, Marineland, and Redondo Beach.

These whales travel around 6,000 to 7,000 miles each way, and the trip takes 2-1/2 to 3 months. The distance is calculated to be 60 to 80 nautical miles per day, at a speed of 4 knots for a 15 to 20 hour day. Their top speed is about 10 knots. They frequently raise their heads out of water to look around and get their bearings. They are believed to find their way on the long migration by memory and vision.

The California gray whale once had a much larger population. Whaling off California and Baja California during the latter half of the 19th century reduced their numbers to the point where it was no longer profitable to hunt them. In the 1920's and 30's, whaling was resumed and their numbers again seriously reduced. In 1938, they were given complete protection by international treaty. Counts of migrating whales from the shore, plus counts made in the lagoons from the air, have shown an increase of 11 percent a year. By 1961 there were believed to be about 6,000 and by 1971 over 10,000.

The population in the middle of the 19th century was estimated at 30,000 by the famous whaling captain and writer, C.M. Scammon, but current researchers say the original population couldn't have been much more than 15,000. The present population in the eastern North Pacific is estimated to be about 11,000 to 12,000 animals. About 160 gray whales are killed per year in a Siberian subsistence fishery and fewer than 5 per year by American Eskimos.

In Korean waters, there is another population of gray whales, now believed to be at a very low point. The two populations do not seem to mingle.

Gray whales reach 35 to 50 feet in length and around 20 to 40 tons in weight. The calf is 16-17 feet long at birth. The whale is black, mottled with gray, and covered with barnacles and whitish scars. There is no dorsal fin, but there is a small but distinct ridge on the back, at about the location where a fin would be, followed by a series of humps.

This is one of the baleen whales, feeding mainly on small crustaceans, though also to some extent on fish. Feeding takes place largely, it is believed, during the 4 months of the year spent in the north, though some feeding takes place during the 8 months spent in

migration and in the lagoons. It has been found that some whales do not complete the migration north to the Bering Sea and Arctic Ocean. Instead, they spend the summer loafing and feeding along the coast from the California Channel Islands northward.

This whale has also been known by the generic name of *Rhachianectes* and the specific names *glaucus* and *gibbosus*; the name *robustus* was applied to a subfossil found in Sweden that subsequently has proven to be identical to the living gray whale.

Early in 1971, the skeleton of a fossil gray whale was found at San Pedro, California, and excavated. It is believed to be around 150,000 to 200,000 years old, and may belong to the recent species. Almost complete except for the vertebrae of the posterior part of the body, which had been bulldozed away, it is the first such specimen to be found.

In 1964, the first baleen whale to be kept in captivity—a young gray whale—was harpooned off Baja California and brought to Sea World, in San Diego. It died as a result of the harpoon wound after about 2 months. On March 13, 1971, a second one was captured by use of a tail rope, in Scammon's Lagoon. This was a baby, assumed to have been born about January 5, 1971, and to have weighed 1,500 pounds at birth. At the time of arrival she was 18 feet 2 inches in length and weighed 4,150 pounds. A female, she was named "Gigi". She was fed a formula consisting of whipping cream, ground squid and bonito, cod liver oil, brewer's yeast, vitamins, corn oil, and water. This was fed through a tube inserted into her throat. Before many weeks she began taking squid from a trainer's hand, and by June 4 was observed taking squid from the bottom but would not eat squid floating on top of or suspended in the water. This checks with earlier reports that the gray whale is a bottom feeder by nature. Early June is about the time that some of the gray whales reach the Bering Sea, and thus may be a natural weaning time. The formula was still continued, however, in order to give her extra vitamins.

Meanwhile, Gigi was growing steadily. By May 29, she was 19 feet 10 inches in length and weighed 5,525 pounds. By September she was over 22 feet; by early November, 23 feet 1 inch and 6,300 pounds; by November 18, close to 25 feet and 7,600 pounds. She was eating over 1,000 pounds of food a day and gaining 60 pounds a day.

In addition to being a great public attraction, and I think as with other marine mammals kept in captivity arousing public interest and sympathy which should prove beneficial, these two whales have provided the opportunity to obtain a variety of physiological information. Gigi was released at sea on March 13, 1972, with a transmitter attached. Although the transmitter had been lost, Gigi was identified in San Ignacio Lagoon, Baja California, in January 1977.

## COMMON DOLPHIN

*Delphinus delphis*



To the California fisherman, this is the "white-belly" dolphin. It is a long-beaked form, rather strikingly marked and very beautifully shaped. Dolphins of this group have been depicted in art for thousands of years, and are among the most familiar to people because of their habit of running with ships and leaping out of the water.

The common dolphin ranges from British Columbia to Ecuador. While it sometimes occurs close to shore, it is probably more abundant offshore. It is one of the two most abundant species off southern California. The present population in the eastern Pacific Ocean is estimated at 1.4 million animals. The largest herds are seen from August to January. Group sizes decrease to 50-200 individuals in spring and summer, with movement offshore and northward.

This is a comparatively small dolphin, reaching 7 or possibly 8 feet, and is slim-bodied. It is fast-swimming; in the Atlantic it has been known to reach 18 knots. Its liking for running with a boat is such that it will even stop feeding to do this. While active and playful in the wild, it is quiet and timid and among the least playful in captivity. Its offshore habitat may be a factor in its poor adjustment to confinement.

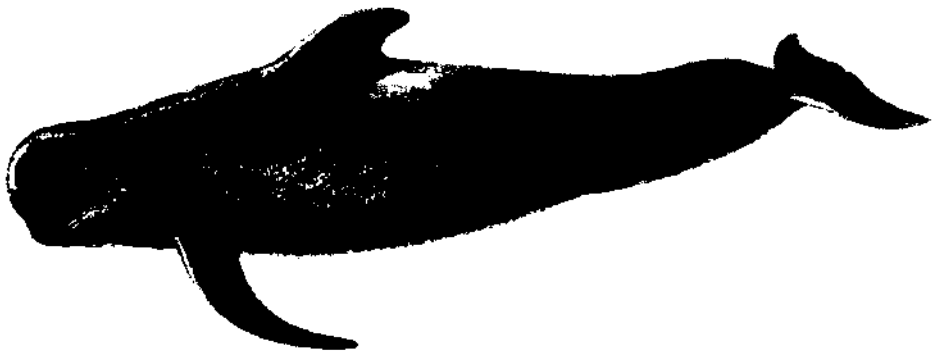
This species feeds primarily on fishes.

Recent studies indicate that two separate populations or stocks of *Delphinus delphis* occur in California waters: a short-snouted form which occurs year round, and a long-snouted form which occurs primarily throughout the Gulf of California, Pacific coast of Baja California, and north to at least the San Diego area. Occasionally, the latter form has been known to occur off the coast of Santa Barbara.

Some researchers have attempted to separate these two populations on a species basis using *Delphinus delphis* for the short-snouted form and *Delphinus bairdi* for the long-snouted form. Others have proposed subspecies names. Due to this confusion, at present it seems best to recognize both under the species *D. delphis*.

## PACIFIC PILOT WHALE

*Globicephala macrorhynchus*



The pilot whale is sometimes known as the blackfish, or on the Atlantic coast by the appropriate name of porthead. It is large for a dolphin, reaching a length of 18 feet, or occasionally 22. Its color is usually entirely black or brownish-gray, with a faintly marked lighter saddle behind the dorsal fin, and a mid-ventral gray blaze-mark. Its most striking feature is its bulbous forehead, or melon. This and its longer flippers help distinguish it from the false killer whale, another all-black species of about the same size. The dorsal fin is low and rounded at the tip, becoming conspicuously hooked in adult animals. In older males the melon enlarges until it extends beyond the tip of the jaw; the pectoral fins become longer, relatively thinner, and sickle-shaped; and the caudal keels become relatively much deeper.

The pilot whale is a slow-moving animal, usually traveling at 4 to 5 knots, but may move faster on occasion. In these waters, it travels in schools of 5 to 50, or occasionally more; in other parts of the world, much larger schools have been seen. This and the closely related Atlantic species have attracted widespread attention through their tendency to strand on the beach in numbers, apparently following their leaders blindly. This behavior, which has been observed in certain other cetaceans, has never been satisfactorily explained.

The Pacific pilot whale ranges from Alaska to Guatemala or Peru. It is fairly common in southern California, where it may sometimes be approached quite closely by a small boat. It also has been known as *G. scammoni* as well as *G. sieholdi*.

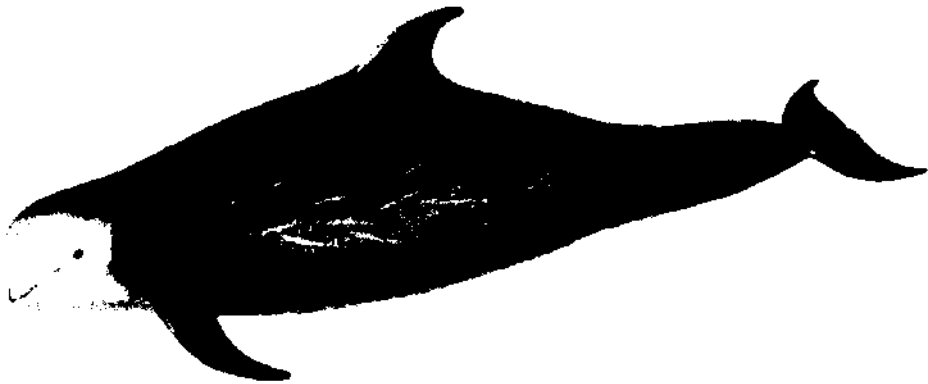
In California, several oceanaria have exhibited these animals, and in captivity they have proven very friendly and appealing and able to learn a number of tricks. They seem to adapt rapidly to aquarium life.

Pilot whales rest or sleep by floating almost motionless at the surface. The buoyancy provided by the fatty melon enables them to float with the blowhole exposed.

Their preferred food in captivity is squid, though they will eat a small amount of mackerel. In captivity they eat from 60 to 120 pounds a day, depending on their size. They probably eat more in nature.

## RISZO'S DOLPHIN

*Grampus griseus*



This is a species of wide distribution, found in both the Atlantic and the Pacific. However, records from this coast are very few. It was described under another name from Monterey Bay in 1873, in the same paper that described *Tursiops gilli*, and then reported again as being abundant in 1894. The specimens upon which the descriptions were based were probably taken during what seems to have been a long period of unusually warm water. However, they have been sighted in the winter off central California on several occasions by biologists aboard the fur seal research vessels. Captain Scammon said these dolphins may occur singly, in small numbers, or in large schools, and this observation is borne out by later sightings along this coast. In 1971, a school of about 50 was seen between Pt. Loma and San Clemente Island, and during 1972, over 200 were seen in one group off the Washington coast. There is also a sighting record from Guadalupe Island, off Baja California.

This is a large dolphin, reaching 13 feet in length. It has no beak. It is gray on the back, with black fins and tail, white or whitish below. The entire head area is lightish. The skin is often covered with long, narrow white streaks, presumably scars. The forehead is prominent, the profile suggesting that of the pilot whale. The dorsal fin is high and falcate, the flippers long and pointed. There are two to seven pairs of teeth near the tip of the lower jaw; teeth are usually absent in the upper jaw, or if present, are small. Food is almost exclusively cephalopods.

The famous Pelorus Jack, which for 24 years, from 1888 to 1912, accompanied ships crossing Cook Strait between the two main islands of New Zealand, was of this species. He joined them on a certain stretch off Pelorus Sound and accompanied them in either direction for about 6 miles, then left.

Rizzo's dolphin has also been known as *Grampidelphis*.

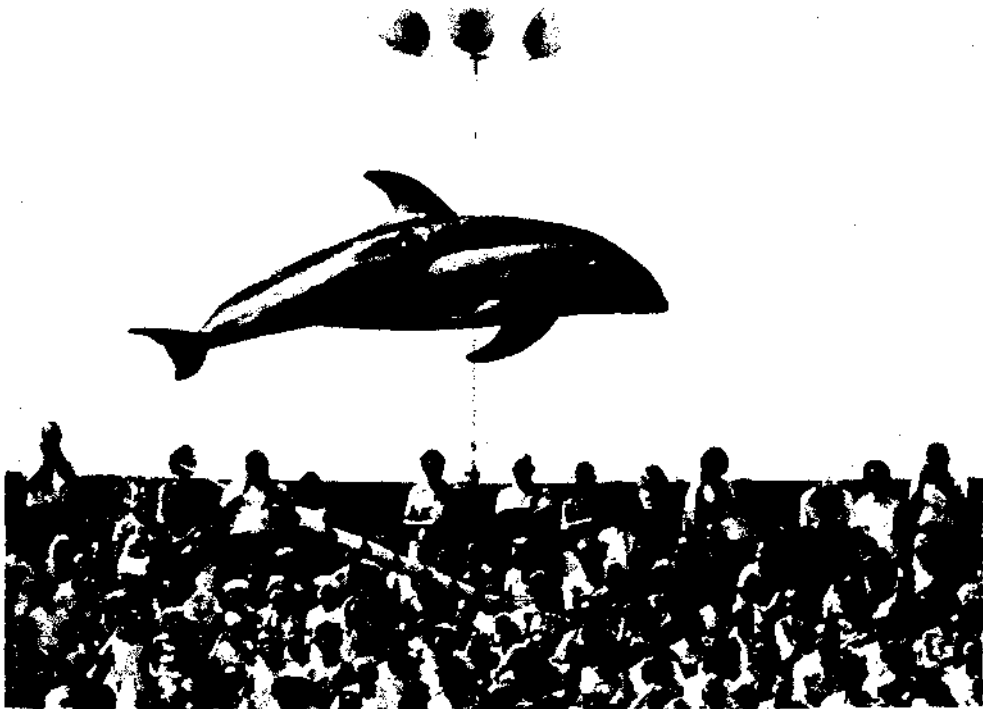
## PACIFIC WHITE-SIDED DOLPHIN

*Lagenorhynchus obliquidens*



This species has been exhibited at several oceanaria in California where it has been kept and trained successfully. Its high leaps out of the water are particularly breathtaking.

The white-sided dolphin occurs in the Pacific from Alaska (Valdez) south to Baja California (Gorda Bank). In southern California, it is one of the most abundant species, frequently traveling in large schools, some estimated to contain about 1,000 animals. It may be the most abundant dolphin north of California, and it is reported to occur in large numbers along the coasts of Japan. Like the common dolphin, it often may run before a ship. It may school alone or with common dolphins. Occasionally they are taken incidentally by purse seiners along with a school of fish. Feeding schools are scattered over a wide area, while traveling schools are more compact. The animals tend to frequent inshore areas during the winter and spring, offshore during the summer and fall. They feed extensively on anchovies, sardines, and herring in the inshore areas and on sauries offshore. Squid are also taken. Captive specimens are fed mainly on Pacific mackerel.



White-sided dolphin making a high jump. Photo from Marineland of the Pacific.

This dolphin reaches at least 7 feet in length; and occasionally more. An exceptionally large individual was 90 inches long and weighed probably 330-350 pounds when in good condition. The snout is pointed, but the beak is short and only faintly defined. The body is blackish dorsally, white ventrally, and has a clear line of demarcation. When seen in the water, it can be most readily identified by the light streak running along either side of the posterior portion in the back. There is usually a light patch on the dorsal fin.

## NORTHERN RIGHT WHALE DOLPHIN

*Lissodelphis borealis*

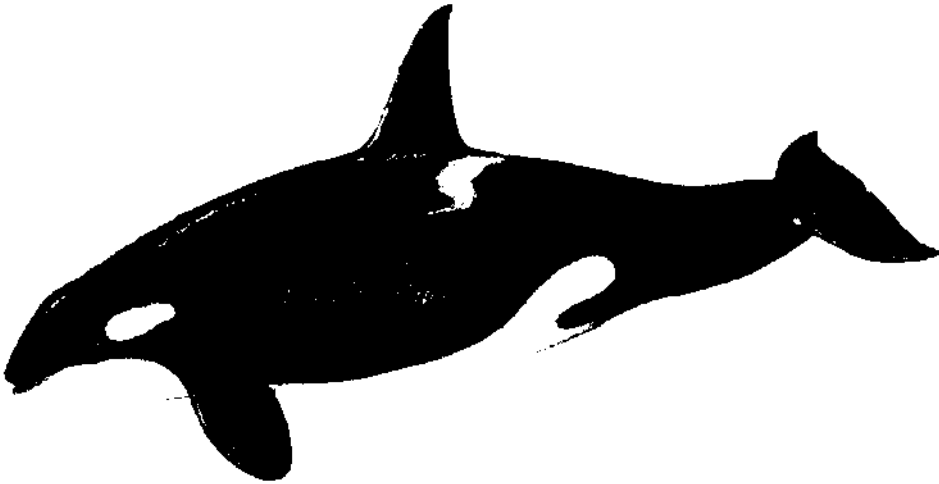


This is a slim, handsome, beaked dolphin, velvet black or brownish-black above and on the sides, sharply contrasting white below. It differs from most other dolphins, and from all found in Californian waters, in lacking a dorsal fin (hence its name, after the finless right whale). It reaches 10 feet in length. It is found in the Pacific Ocean off Japan and from the Bering Sea south to California. Groups of 200 are quite common, but herds containing an estimated 2,000 individuals have been seen off southern California. Numerous groups have been seen and photographed far offshore. Records from outside the state are few, though the original description was based on observation of a large school 500 miles off the Columbia River.

The right whale dolphin is probably an oceanic species, which might account for the comparatively few records of it. The few stomachs that have been examined have contained lanternfish, sauries, and an assortment of other pelagic and mesopelagic fishes and squids. It travels rapidly when alarmed, in a "series of regular low-angle leaps," showing the head very little and showing only a small area of the back.

## KILLER WHALE OR ORCA

*Orcinus orca*



The killer whale is one of the largest of the dolphin family. Unlike most of the other dolphins, which appear to man to be playful, friendly, gentle animals, menacing only to the small fishes, etc., upon which they feed, the killer whale gives the impression of being a very savage and bloodthirsty animal. This is perhaps a highly subjective point of view, since we feel more sympathy with the warm-blooded animals, and particularly some of the larger ones, than we do with other animals; no doubt the mackerel or the squid regards the playful common dolphin as an equally vicious predator. Be that as it may, the killer whale is the only cetacean that habitually preys upon warm-blooded animals. In addition to fish and squid, it eats sea birds, seals, walruses, and other dolphins, and even attacks whales larger than itself. There are several reports of individuals found with remains of prodigious numbers of dolphins or seals in their stomachs. Members of a school cooperate in attacking their prey. They attack nursing calves of the large whalebone whales or may tear out just the tongues of the adults.

Killer whales are potentially dangerous to man, and people running small boats should be cautious about alarming or annoying them, as there are alleged instances of boats being attacked. I do not know of any instances of humans being killed and eaten by them, however. Peter Freuchen, who spent many years in the Arctic, said in one of his books that he had never heard of any attacks on humans, but that when the Eskimos were out in their kayaks and saw one, they headed for shore with all possible haste. (Religious beliefs may affect their behavior; this is the case with some Eskimos.) Also, there are instances of killers bumping the underside of ice floes while men were standing on top: a member of the Scott 1911 expedition, for example, just managed to scramble to safety when the floe upon which he was standing was broken to bits. Killers are said by some to do this deliberately to get seals into the water, though other people think the bumping may be accidental.

A man spilled into the water from a boat or ice floe might be grabbed by a killer without the animal's stopping to find out what he was. On the other hand, I know of several instances in which they had plenty of time to look over swimmers and displayed in some cases interest and curiosity, but did not attack the men.

One of these cases occurred near Anacapa Island in 1960. Three men had dived from a boat and were below the surface when a group of nine or more killers approached. One submerged where the bubbles were coming up from the divers. A diver surfaced, saw the whales, and dived again to warn his friends. All three men surfaced and got aboard, with the nearest killer 25 feet away. In another case, two divers at Pt. Hueneme were in the water when a killer came near; they swam as quickly as possible to their boat. The killer followed, raised up and looked them over, and swam away. One of the same men, on





**Killer whale in captivity. Photo from Marineland of the Pacific.**

another occasion, had just climbed onto his boat when a whale that he had not seen emerged in pursuit of a sea lion, grabbed it, and carried it away. On still another occasion, at Pismo Beach, divers were followed through the surf by one or more curious killers. In 1962, at a competitive skindiving meet at Leo Carrillo State Park Beach, a school of killers worked upcoast just outside the kelp, while one large male traveled slowly through kelp checking each skindiver in turn, finally disappearing to the northward.

It is obvious in almost every one of these cases that the killers might have seized people had they wanted to. The theory has been advanced that these animals, unlike sharks, are so intelligent that they realize that man is not one of their normal prey.

During recent years, numerous killer whales have been captured and kept alive by aquaria for various periods of time. The first, caught off British Columbia in 1961, survived only three months, but two others, captured in 1965, did much better. One of these,

displayed at Seattle, became quite tame and seemed to enjoy cavorting with its trainer and others who spent time in the water with it. This whale, called "Namu", was the subject of at least one movie and numerous magazine and newspaper articles prior to its accidental death by drowning in 1966, presumably while trying to join "friends" during the breeding season. Captive killer whales have proven very gentle and show remarkable intelligence, having learned several "tricks" which they perform for the public each day. Trainers claim killer whales are smarter and easier to train than other delphinids with which they work. Worldwide, there are probably about 25 in captivity at the present time.

Captive killer whales have presented on occasion some behavioral problems which have been attributed to various causes. One source says that when a whale feels good it may playfully buck a trainer off its back, or suddenly submerge to the bottom of the tank. A trainer in another oceanarium states that killer whales like human companionship but don't like having them ride on their backs; a female that he worked with kept knocking him off her back, and finally when he fell against her dorsal fin, turned and nipped him (only bruising him). I have theorized that whales occasionally have "off days" when they are feeling a bit cranky, as is known to happen with other trained animals. A third authority denies this, believing that they merely want to keep people to play with in the tank. He does admit that one male presented a seriously aggressive and dangerous behavioral problem, fortunately at a time when no one was in the water. However, there have been incidents of possible aggressive behavior when swimmers were in the water. In one the whale refused to bring the trainer to the landing stage upon a whistle signal, and when the trainer finally made a jump for it, pinned him against the tank wall, underwater, he was reportedly unconscious when pulled out. In another, a girl who was new to the whale was on his back while some publicity pictures were being made. She slipped off, whereupon the whale grabbed her by the leg and at first refused to let go even when she was pulled to the side of the pool by means of a pole which was extended to her. It required a number of stitches to close the wounds in her leg. It should be noted that in all these cases, the animal could easily have killed the person had it wished to do so.

The killer whale is a strikingly marked animal, black with white underparts, the white extending up on the side a little past the midpoint of the body. There is a white spot on the side of the head, just above and in back of the eye. There is also a light-colored saddle-shaped patch, but not as strongly contrasting (gray rather than white) on the mid-back just behind the dorsal fin. The dorsal fin is sharply triangular and very high. The flippers are rounded. In old males, the dorsal fin becomes particularly high, reaching as much as 6 feet; the flippers and tail flukes also become longer. Off the west coast of North America the largest male measured has been 25 feet, the largest female 20 feet; in other parts of the world, males have been known to reach 31 feet. A 20-foot female weighed 7,000 pounds. These whales, as well as sperm whales, are unusual among cetaceans in that the male reaches a much greater size than the female. Breeding appears to occur year-round but seems to peak from May to July. Most northern hemisphere births occur in autumn. Newborn calves are about 8 feet long and weigh about 400 pounds.

The jaws are heavy, and the conical teeth are strong and set close together so that they interlock.

The killer whales are worldwide in distribution, found in both tropical and polar waters, though they are most abundant in the latter, perhaps due to the greater abundance of food there. They are usually considered one species. In the Pacific, they are known to range from Alaska to Costa Rica.

The killer has also been known by the generic names of *Ocra* and *Grampus*, and by the specific name of *rectipinna*.

## HARBOR PORPOISE

*Phocoena phocoena*



This small, chunky, beakless species reaches a length of 6 feet and a weight of 160 pounds. (Newborn calves are about one-half the mother's length.) Its color is dark gray to nearly black on the back, fading to light gray or white on the underside, sometimes with a pinkish cast on the belly. There is a black or gray line from the corner of the mouth to the flipper. The dorsal fin is low and triangular; most other dolphins found off California have a much higher fin and one that is falcate.

This is the Pacific relative of the Atlantic harbor, or comon porpoise, a familiar species around the British Isles. The latter was the first to be given the name of porpoise, derived from the Latin *porcus piscis*, or "pig fish". Porpoises are sometimes known in Great Britain today as "herring hogs," from their habit of robbing the herring nets.

In the Pacific, the harbor porpoise ranges from Pt. Barrow, Alaska, to central California. (San Luis Obispo Co.) and occasionally into southern California. It frequents bays and harbors and other inshore waters, occasionally even running up rivers. A small porpoise seen in San Francisco Bay would almost certainly be this one; I do not know of any records from San Diego Bay and only one from Los Angeles Harbor. It has been reported offshore as far as 20 miles. It rarely runs with a boat, and rarely if ever jumps clear of the water.

The food of the harbor porpoise consists mainly of fishes, with some squid and an occasional clam or crustacean. The fishes are primarily bottom-dwelling forms.

In 1958, a new species of harbor porpoise, *Phocoena sinus*, was named from the Gulf of California. It is mentioned here because so many Californians visit the Gulf. It is smaller than the Californian species, 5 feet or less in length, and some at least are brown rather than blackish above. Porpoises at Banderas Bay, in the state of Jalisco (further down the coast of the mainland of Mexico), and at the nearby Tres Marias Islands, formerly thought to be the same as the California one, are instead probably the new species. While the describers of this species saw some live ones, the only specimens they were able to collect were three skulls found on the beach at San Felipe.

## DALL PORPOISE

*Phocoenoides dallii*



The Dall porpoise is a small, chunky, beakless species, a typical porpoise (as opposed to the dolphin type). It reaches a length of 7 to 7-1/2 feet and a weight of 450 to 475 pounds. Dall porpoises range from off Japan into the Bering Sea and south to central Baja California. They are year-round residents in the northeastern Pacific but range further south and nearer to shore during winter months.

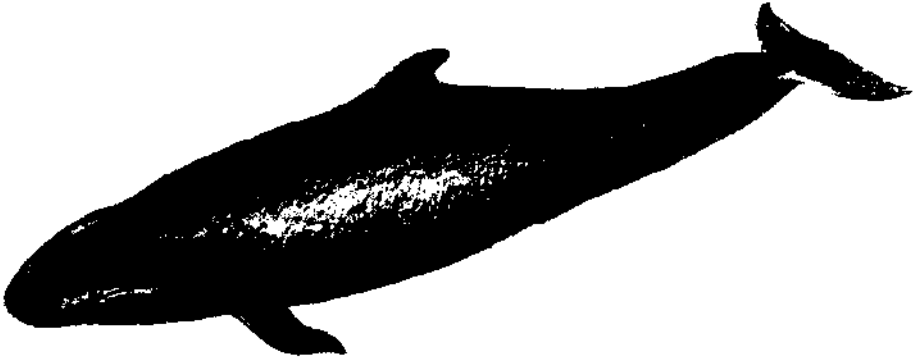
It is a rapid and vigorous swimmer. According to one writer, "It is among the easiest of small cetaceans to identify from a distance by the habit of literally throwing itself along through the water." It is certainly an easy animal to identify when seen close enough to make out the pattern. It is black, with a sharply contrasting large white area extending from the midline of the belly high up on the side. The dorsal fin usually has a light posterior margin, though it is not as white as the area on the side. No other cetacean found in California has such a conspicuous pattern with the exception of the killer whale. The almost triangular dorsal fin is comparatively low.

The Dall porpoise usually occurs in small groups of 2 to 12 individuals, but sometimes in schools of 200 or more. It will sometimes run with a ship. It feeds on squid, mainly, but remains of hake, herring, saury, jack mackerel and deepwater fishes also have been found in their stomachs.

Some marine mammalogists believe the harbor, Dall, and other true porpoises should be placed in a separate family, Phocoenidae. There is some justification for this since the skulls of recent and fossil porpoises are symmetrical while those of delphinids are asymmetrical, being twisted toward the left. Phocoenids also have smaller teeth than delphinids.

## FALSE KILLER WHALE

*Pseudorca crassidens*



This is a large dolphin, with males attaining 20 feet in length and females 16. Newborn calves are about 6 feet long. It is entirely black, except that it may have a ventral medium-gray blaze mark on the anterior belly. The snout is rounded, with no beak. It differs greatly from the true killer whale: the body is more slender; the dorsal fin smaller; the flippers are narrow and pointed, rather than broad and rounded; it lacks the conspicuous white markings of the latter.

The false killer is found in both the Atlantic and Pacific Oceans. In the Pacific, it is known to range from Puget Sound, Washington, to Acapulco, Mexico. It travels in large schools of perhaps 100 or more. In October 1963, a school of 200-300 was seen about 4 miles off the Palos Verdes Peninsula, and an 11-foot female was captured from this school by collectors for Marineland of the Pacific. This animal, the first of its kind to be kept in captivity, proved very docile and fearless, feeding the next day after it was captured and soon learning to jump for its fish. Its formidable teeth are apparently used for seizing large surface fish. Off Hawaii, it has been seen eating *mahi-mahi* (dolphinfish). It is probably more common than once believed; its apparent rarity may be due to the fact that it is mainly a creature of the open seas, seldom coming near shore. When it does, it sometimes gets stranded in large numbers on shallow flats.

These animals feed on squid and some fish.



**False killer whale. *Photo from Marineland of the Pacific.***

## STRIPED DOLPHIN

*Stenella coeruleoalba*



This dolphin, along with the common dolphins (*Delphinus*), I consider perhaps the most beautiful of the cetaceans. It reaches 10 feet in length. Gestation has been found to last 11-12 months, and lactation occurs for an additional 11 months. Newborn calves are about 2 feet 9 inches long. Adults are black or dark brownish above, white below, with black lines extending from eye to anus and from eye to flipper, forming a very striking pattern. The striped dolphin is widely distributed in temperate and tropical waters around the world. In the eastern Pacific it is known from British Columbia, Canada, south to Ecuador. It is probably an open sea form, staying for the most part well offshore. Aerial surveys conducted by the U.S. Navy and Bureau of Land Management have resulted in numerous sightings of this species off California. The size of the striped dolphin population in the eastern Pacific has been recently estimated at 248,000 animals. Their food consists primarily of fish (mostly mesopelagic species) and cephalopods.

This dolphin also has been known as *Stenella euprosyne* and as *S. styx*. Markings may vary, and some believe there is more than one species.

## ROUGH-TOOTHED DOLPHIN

*Steno bredanensis*



This is a slim dolphin, with a pointed beak, not sharply demarcated from the forehead. It reaches 8 feet in length. The external shape and color pattern generally are similar to the Pacific bottlenose dolphin, but in this species the rostrum is not sharply set off from the head. "Yellowish-white spots" ascribed in previous accounts as part of its color pattern now are known to be scars from bites of what has been called the "cookie-cutter shark," *Isistius brasiliensis*. The rough-toothed dolphin is found in both the Atlantic and Pacific oceans, but it does not seem to be common anyplace, and little is known about it. Its most distinctive feature is its teeth, which are roughened or furrowed on the crown with fine vertical ridges, instead of being smooth as in other dolphins.

The name *Steno rostratus* has also been applied to this species.

The few stomachs that have been examined have contained fish almost exclusively.

## PACIFIC BOTTLENOSE DOLPHIN

*Tursiops truncatus*



The bottlenose dolphin is fairly large and stout-bodied, reaching a length of 10-12 feet, though 8 feet is more usual, and a weight of 500 (or even as much as 800) pounds. Gestation lasts about one year, and calves nurse 1-1/2 to 2 years, although they begin to take solid food at 6 months. Newborn calves are 3-1/3 feet long. Estimated life span is about 25 years. As its name suggests, it has a prominent beak. Its mouthline curves to give it an appearance of smiling. In color, it is almost uniform gray, lighter on the ventral surface.

There appear to be two distinct population of *Tursiops* in southern California waters: an offshore form which is found throughout the Channel Islands (frequently in the company of Pacific pilot whales), and an inshore form that rarely stops this far north, but has been seen in and just outside the surf zone off San Diego and Orange Counties on numerous occasions. There is evidence that in the past this inshore form strayed as far north as Monterey and San Francisco Bay. Although numerous specific and subspecific names have been applied to bottlenose dolphins, most current researchers believe it would be premature to assign subspecific names at this time.

The bottlenose is one of the best known dolphins in the world. It shares with the common dolphin in being probably one of the two most familiar kinds to the early Greeks and Romans, who had a great affection for dolphins and told many stories about them. One story, which may be just legend but may equally well be true, tells of a dolphin (I would guess a bottlenose) which nearly 2,000 years ago frequented the waters near Hippo, in the Mediterranean, and became friendly with the people there. It let people handle it, and let one boy ride on its back. In 1955 and 1956, a bottlenose remained near the beach at Opononi, in New Zealand, where it was very friendly with the bathers, especially children, let herself be handled, and played with balls and other objects. Like the dolphin of the earlier story, one particular child was her favorite.

In recent years, marine aquaria in Florida and California have exhibited bottlenose dolphins, both Atlantic and Pacific forms. Their ready adaptation to life in a confined space, their intelligence and quickness in learning tricks, their inventive playfulness (abetted by a greater flexibility of the neck than in most other dolphins, which makes it easier for them to catch and throw objects), have made them very successful exhibition animals. There have been a number of live births at Marine Studios, Florida.

The Atlantic bottlenose has also gained notoriety from its recent use as an experimental animal. Development of electronic and other apparatus, plus military interest in underwater sounds on the part of the U.S. Navy, led first to the discovery that cetaceans, like many other marine animals, are noisy creatures. This led to a series of experiments by one investigator which proved that some of the dolphin sounds served the purpose of a very efficient echo-ranging or sonar system, by means of which the animals could avoid obstacles, locate fish, etc., without any visual help.

Another investigator, a medical researcher who was impressed by the very large and very convoluted brain of the cetaceans, conducted a series of experiments on *Tursiops*, as result of which he was convinced that dolphins are among the most intelligent of



animals, perhaps exceeded only by man. He found that they make a variety of sounds for purposes of communicating with one another (in addition to those used for echo-ranging) and conceived the idea that communication between them and man might one day be possible. One of his dolphins is said to have an imitative vocabulary of at least 60 words. He visualizes them hunting submarines for us, finding and herding fish, making oceanographic observations, and performing many other useful services! (A writer of fiction has expanded on this idea, and written a story in which dolphins direct human research projects.)

An interesting children's book, *Children of the Sea*, tells the story of a fictional bottlenose dolphin and its friendship with a little boy.

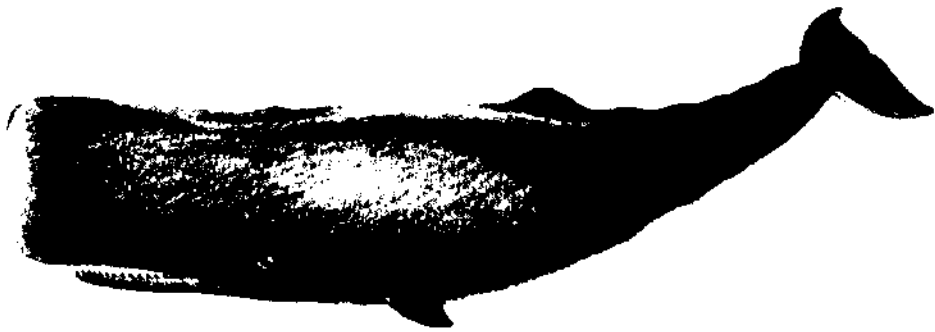
*Tursiops* feed largely on fish. In captivity, an 8-foot one may eat 15 pounds of mackerel per day. In nature, a bottlenose was found to have eaten over 62 fish of at least 8 kinds. It may also feed on shrimp.



**Mother bottlenose dolphin and young. Photo from *Marineland of the Pacific*.**

## SPERM WHALE

*Physeter catodon*



The largest of the toothed whales, male sperm whales reach 59 feet, and females, 39 feet. A 59-foot male weighed 52 tons. The sperm whale's color is dark bluish-gray to black, sometimes with whitish on the lower jaw and belly. The massive squared-off head, with comparatively small lower jaw, distinguishes it from any other cetacean. The dorsal fin is fairly low and rounded or bluntly obtuse, and is followed by a series of projecting bumps along the posterior midline of the back. The spout differs from that of other whales in being directed forward. The teeth are large and conical, and are only in the lower jaw, with rudimentary teeth almost invariably found in the upper jaw.

The sperm whale was one of the kinds greatly sought after in the heyday of whaling, the spermaceti or head oil being of particular value. In 1975, 7,859 sperm whales were taken in the North Pacific from an estimated population of 300,000 animals. These are pugnacious animals, and constituted a real danger to whalers in the days when killing was done from small boats. The fictional *Moby Dick* (based on a real whale) was of this species.

These whales are found in the Atlantic, Pacific, and Indian Oceans, ranging in the Pacific from Alaska (Pribilof Islands) south into South American waters. They feed mainly on squids and octopi, but also eat fishes. Ragfish were reported as occurring commonly in their stomachs, off the Pacific coast of Canada, and there is a California record of 20-some skates being taken from the stomach of one individual. They are known to descend to great depths in their search for food— one became entangled in a cable at a depth of 3,240 feet—and can stay under for more than an hour. Their heads may bear numerous scars 1 to 4 inches in diameter from the tentacle discs or suckers of giant squid.

Newborn calves may be 11-1.2 to 16-1.2 feet long and weigh about 2,200 pounds. Gestation is 14 to 15 months, and lactation lasts 1 to 2 years. Longevity is estimated at 60 years.

Ambergris, a waxy substance produced by the sperm whale's intestine, has long been valued as a fixative for fine perfumes. It is still in some demand, though not as valuable as it once was, due to its replacement by synthetic substitutes. Whereas it once brought as much as \$40 an ounce, in recent years it has brought only \$0.75 to \$13 an ounce. People pick up many substances on beaches hoping they are ambergris, but only a very small percentage turns out to be. It is difficult to identify with assurance, but the following characteristics will help you to recognize it.

Ambergris is waxy and moist when fresh, dry and brittle when old. The color varies from dull gray through brown to almost black, or may be mottled throughout in alternate layers of light and dark color. There is a characteristic somewhat pleasant earthy odor, intensified by warming in the hand; it has been compared by some to the odor of damp, decomposing grass or to sweet hay. It floats, even in fresh water. When slowly heated, it commences to soften at about 140°F, and melts between 145° and 150°F to a dark, oily liquid. Test it by insertin a heated wire into it; it will melt around the wire forming a dark opaque liquid. Touched with the finger when partially melted, it is tacky; it adheres and

strings. If the wire to which it adheres is reheated over a flame, it soon emits a white fume with the characteristic odor, and then burns with a luminous flame. It is soluble in absolute alcohol, in ether, in fat, or in volatile oils. It may contain squid beaks.

One of the by-products of the sperm whale, in particular, is " scrimshaw " work, carvings done by the seamen in their spare time on whale bones and teeth. Many examples of these have been saved, and can be seen in museums and private collections.

## **PYGMY SPERM WHALE**

*Kogia breviceps*



A small species, reaching only 9 to 13 feet, this is a true whale. It is black above and grayish-white below. There is a falcate dorsal fin. The mouth is small and is inferior, like that of a shark, the teeth are small and sharp-pointed, and are found only in the lower jaw. Among foods eaten are squids, fishes and crustaceans.

The pygmy sperm whale is found in the Atlantic, Pacific, and Indian Oceans, in temperate and tropical waters. It is a rather rare animal, and population estimates are unavailable. Most records from the eastern North Pacific are based upon strandings, including its northernmost occurrence on the Washington coast. Gestation is thought to last about 9 months, and the calves appear to accompany their mothers for up to a year. Food items found in their stomachs have been mostly squids and shrimp-like crustaceans.

## **DWARF SPERM WHALE**

*Kogia simus*

This species, named in 1866, was recognized only recently by current workers as distinct from *K. breviceps*. It is smaller (adults are 7 to 9 feet long) and has a high dorsal fin near the center of the back, there are also tooth and skull differences. There are very few eastern Pacific records. A mature male stranded at Oceano, San Luis Obispo County, was 5 feet 8 inches long. In other areas of the world oceans, they are known to be solitary or to travel in small pods. They are said to feed mostly upon squids and shrimp-like crustaceans, but stomachs of several individuals from off Japan contained a wide assortment of deep-sea fishes.

## **ZIPHIIDAE**

*Beaked or Bottlenose Whales*

The whales of this family are of moderate size and have dolphin-like shapes. They are rather rare in California waters, or at least are seldom collected or recorded. The dorsal fin is very small and is set far back on the body. Functional teeth are found in the lower jaws of adult males only, in young males and in females (except rarely), they remain embedded in the gums. In addition, there may be numerous small vestigial teeth in both jaws.

## BAIRD'S BEAKED WHALE

*Berardius bairdii*



This whale is uniformly slate-gray or brownish-gray, with irregular white blotches sometimes present ventrally. Its body shape and beak are those of a typical long-beaked dolphin, with a prominent bulging forehead in the adult male. It is the largest of the family, reaching 42 feet. There are two pairs of teeth in the lower jaw. It feeds on cephalopods and fishes. It is confined to the Pacific ocean, where it has been recorded from Alaska (Bering Sea) to California, and also off Japan. In California, the southernmost record is off Monterey. While fairly abundant off central California from at least June to October, it is infrequently taken by whalers because of its small size. In 1951, a group of about 20 was seen in the vicinity of Eureka, Humboldt Co., and one of these was taken by a whaler. From 1956-1966, 16 individuals were taken by the two whaling stations at Richmond, being recorded as "bottlenose whales."

## HUBB'S BEAKED WHALE

*Mesoplodon carlhubbsi*



This is probably a rare animal throughout its range. It reaches at least 17 feet. Until 1965 there were only three published California records: one from a stranding at La Jolla, San Diego Co., in 1945; one at Drake's Bay, Marin Co., in 1950; and one at San Simeon, San Luis Obispo Co., in 1962. This is a recently described species. Formerly the local ones were considered to be *stejnegeri*, with *howdoimi* considered by some to be a synonym. The describer regards *carlhubbsi* as a north temperate form, with records from Japan, Washington, and California; *stejnegeri* as boreal or subarctic, extending from Japan up through the Bering Sea and south to Oregon; and *howdoimi* as south temperate, from New Zealand.

This whale is black all over, except for the whitish beak; in addition, the Drake's Bay specimen had a white hump on top of the head. Both the La Jolla and Drake's Bay animals were crisscrossed with many light-colored scratches, and also had round or oval marks which may have been scars from barnacles or lampreys. Origin of the scratches, found also on other kinds of beaked whales, is uncertain, though some believe they were caused by the teeth of other individuals. The skin is thin and easily broken. There is one set of teeth in the lower jaw.

## CUVIER'S BEAKED WHALE

*Ziphius cavirostris*



This whale is usually grayish or fawn colored throughout, lighter on the anterior back and the face in adult males. It has a shorter beak than the other two members of the family recorded from California, and lacks contrast between the beak and the rest of the head. It reaches 32 feet in length. There is one pair of teeth - at rare times two - in the lower jaw.

Cuvier's beaked whale occurs in both the Atlantic and Pacific Oceans. In the Pacific it has been recorded from Alaska to Baja California, off Japan, and New Zealand. It is probably the most common beaked whale in the North Pacific, but most records are of stranded animals. The species travels in tight schools of as many as 10 individuals, but older males often are solitary. Food items consist primarily of squids and fishes, including many deep-dwelling forms.

## ORDER PINNIPEDIA

This is a group of specialized animals, well-adapted for life in the sea. Thick hides with heavy layers of fat underneath, and in some cases fur, protect them from the cold. Their fore and hind limbs are modified to form flippers, as their name Pinnipedia, or feather-feet, suggests. The tail is short or obsolete. The seals are excellent swimmers, and at times spend long periods at sea.

There are three families in this group: the Otariidae, comprising the sea lions and fur seals; the Phocidae, comprising the hair seals or so-called true seals; and the Odobenidae, the walruses, which are restricted to Arctic waters.

The Otariidae, sometimes known as eared seals, are characterized by having a small external ear pinna and by having a hind flipper which turns forward for locomotion, enabling them to move on land at a comparatively rapid gallop. The fore-flippers are large, and are the chief source of propulsion in swimming. The fur seals have a dense, soft undercoat, protected by longer, coarse guard hairs, while the sea lions have a harsh coat of no value as fur. The members of this family have a small number of breeding spots, or rookeries, to which they may return year after year. These are located mostly on offshore islands. The males of breeding age arrive first at these spots and battle other males until relatively few are left, each in possession of his own territory; the rest are forced out to lead celibate lives. The victorious males acquire large harems, the northern fur seal 20 to 50, the Steller sea lion 10-20, the California sea lion probably about the same as the Steller or a little less (about 10 the most common, with the highest count 18, according to one authority). The female gives birth to a single pup, then breeds within a few days to a week. The breeding habits of the northern fur seal are the best known of the family, but the pattern is somewhat the same in all. These seals spend up to several months on land at breeding time, the breeding males sometimes going longer than 2 months (in the fur seal) without ever leaving to feed, the females going to sea to feed and returning every 2 or 3 days to a week to nurse their young. They haul up to rest and sleep at other times on whatever is available. However, in the case of migrating northern fur seals, they may spend months at a time without touching land, and sleep floating on their backs in the water.

The Phocidae are unable to turn their hind flippers forward and use them for propulsion on land, so are much less motile there than the eared seals and can only worm their way along. They have smaller fore-flippers than the eared seals, and propel themselves in water chiefly with the hind flippers. They have no external ears. Breeding habits vary. The harbor seal does not breed in organized colonies nor have harems, though it has been variously described as polygamous or promiscuous. The elephant seal, on the other hand, does breed in colonies, but much more loosely organized ones than those of the eared seals.

Ages of most pinnipeds can be determined by making sections of their teeth and counting the growth rings.

Like the cetaceans, the seals seem to use a form of sonar. This may explain the finding of blind seals which are fat and in good condition.

## THE SEA LION CONTROVERSY

The California and Steller sea lions are the best known and most often seen of all our marine mammals. The general public sees them as interesting and very appealing wild animals cavorting in the water near shore, or hauled out on rocky spots or other resting places; as amusing hams, and beggars for food, in pools where they are confined for public display; and, in the case of the California sea lion, as very intelligent performers when trained. The commercial fisherman, on the other hand, sees them as unmitigated nuisances: consumers of tons of valuable fish, destroyers of valuable gear and interferers with fishing operations, species of no value which ought to be exterminated. He addresses them in uncomplimentary terms when they come near his boat, and shoots them when they become too annoying. Their nuisance value to fishing operations cannot be denied, nor the loss to the fisherman who pulls in his white seabass gill nets and finds three whole fish and five heads out of a scanty catch of eight fish, for example. I saw this happen to a

friend with whom I went fishing in Monterey Bay, and his remarks about the Fish and Game protecting the sea lions were far from complimentary. In the north, the fur seal and the harbor seal are looked upon with an unfriendly eye by salmon fishermen.

But what are the facts of the case, looked at from all angles? The overall picture of the feeding habits of sea lions and other seals throughout the year is still very little known. The total poundage of food they consume is not known, though it is probably less than the fishermen claim. Also, the percentage of fish eaten which are of value to commercial or sport fishermen compared with the percentage of those of little or no value, or those which might actually be harmful, is not known. For example, sea lions at times feed on salmon, taking them from gill nets or from hooks. But how often do they catch free-swimming salmon? And since they have been known to feed on lampreys, which are serious predators on the salmon, who knows but that in the long run they might not do more good than harm? Of the stomachs examined, many have been found to contain so-called scrap fish, or squid, or crustaceans, and many biologists feel that these constitute the major portion of their diet. Also, it is claimed that fish are always abundant in the vicinity of large rookeries. But much still remains to be found out.

The battle over sea lions in California has raged for many years. In the 1860s and 1870s, before there was any regulation, many were killed for their oil; this was during a time of widespread exploitation of marine mammals for their oil or fur. In more recent years, the policy has varied between protecting them strictly and making sporadic attempts at cutting down their numbers in response to public pressure. The latter action has had many of the bad features of other attempts at cutting down so-called predators, plus some special ones of its own. As had been suggested, the overall relationship of the sea lions to other life in the sea is not well known. There are strong objections from people who like sea lions. The animals are difficult to kill in the water, many are merely injured, which few people would condone. The bodies of those that *are* killed in the water are difficult to recover, with the result that many carcasses wash up on beaches, creating a nuisance. One of the easiest methods, that of killing pups on the rookeries, is distasteful to all but the most hardened. Moreover, many of the rookeries are almost inaccessible. Control is expensive.

What is the end result of trying to cut down the sea lion population? None, it has been found, except very temporarily. There is a shortage of desirable space for rookeries in California. Thinning down the numbers of sea lions could merely create more space for new ones to move in from Mexico and from Oregon, or from wildlife sanctuaries. Moreover, since mortality of pups from trampling on the crowded rookeries is high, thinning them out would result in higher survival, and the population would soon be back to where it was before.

In the past several years there has been great concern about pollutants in the marine environment and their possible effects on marine animals. An associative relationship has been found between high residue levels of the insecticide DDE and the industrial chemical PCB and premature popping in California sea lions.

The California Department of Fish and Game has conducted shore and aerial censuses of sea lions at intervals over much of the past half century, and these counts, admittedly low, indicate the population has stabilized at about 25,000 animals. Other researchers place this figure nearer 40,000. Whichever estimate is correct, the vast majority of these are California sea lions.

Some people have been disturbed by finding dead sea lions on beaches, and have speculated that this was due to pollution-caused disease or to large-scale shooting by humans. I think the general public is simply more conscious of the environment these days. People who live near beaches always have been aware of dead sea lions. People who operate oceanarias also can tell you that many pups that are brought in to them are infested with lung worms or other parasites, and do not survive. Mortality in pups is high from disease and other natural causes; I think losses from willful shooting by humans or from pollution has been and is very small.

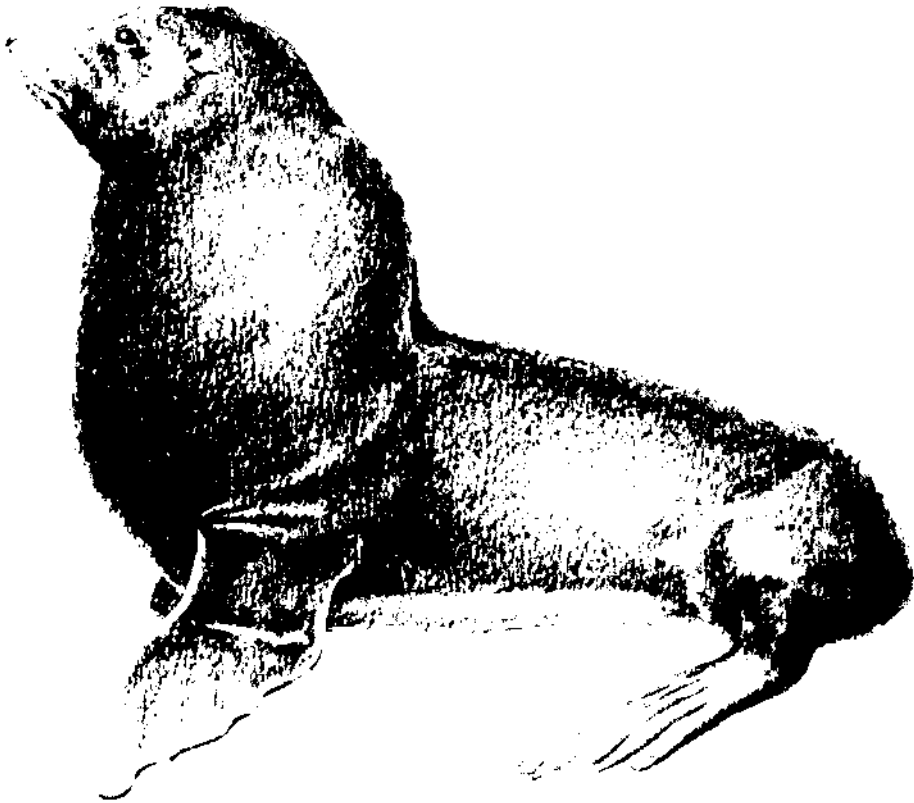
It is no longer legal to take sea lions for their meat or hides, and the Marine Mammal Protection Act of 1972 moved the responsibility for issuing permits for live capture of

California sea lions and harbor seals from the California Department of Fish and Game to the National Marine Fisheries Service.

In the past, commercial and sport fishermen who were fishing from boats were allowed to kill sea lions if they were destroying gear or otherwise interfering with fishing operations. Under the provisions of the act, such killing is unlawful, but permits to capture and take sea lions which are interfering with fisheries can be issued by the National Marine Fisheries Service.

## GUADALUPE FUR SEAL.

*Arctocephalus townsendi*



This animal is related to the northern fur seal, but is even more closely related to several species found in the southern hemisphere. The male gets to 5 or 6 feet; the female is slightly smaller. The color of both male and female is dark brown or blackish-gray, with yellowish-gray head and neck; the silvery-appearing mane of long guard hairs surrounding the neck and shoulder region is quite conspicuous. It is readily distinguished from the northern fur seal, and especially the very short-faced male of the latter, by its long, pointed muzzle, described as "collie-like"; its profile is concave, or what is known as dish-faced. The Guadalupe seal's voice is quite different from that of the sea lion, the most commonly heard sounds being a deep growl or deep roar.

The story of this seal is another of the stories of marine animals man has brought to extinction or near-extinction. Unlike some of the others, which have made successful comebacks, this one is still in a precarious position. Formerly common from the Farallon Islands off San Francisco to the San Benito Islands off Baja California, Mexico, it was the object of such heavy exploitation for its fur that by the middle of the 19th century it was



near extinction. It was then found again and hunted until 1894. Several scientific expeditions to Guadalupe Island next found and collected what they believed to be the last remaining specimens -- a deplorable act on the part of what should be conservation-minded institutions.

Then, in 1926, two fishermen found some again at Guadalupe, and one of them told the director of the San Diego Zoo of his find. He said he had counted 60, though his companion said there were 35-40. The director engaged him to capture some, and in 1928 he delivered to the zoo two males, which lived about a year. Unfortunately, he quarreled with the director, swore he would kill the whole herd, and reportedly did so.

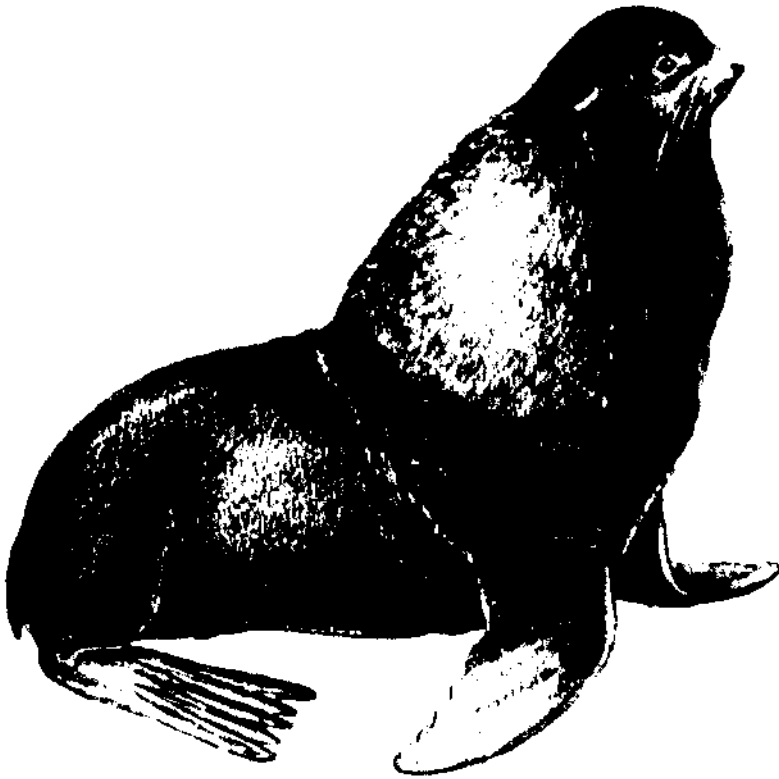
Numerous subsequent expeditions to the island failed to find any, though one individual saw several there on each of several trips during the 1930s, always at the same spot. Then, in 1954, an expedition visited this spot and counted 14. In 1955 they returned and counted more than twice that number, and they were seen on four subsequent visits. A subsequent count gave 107, and a still later count (January or February 1964), made from on land, revealed 240. Three years later 372 animals were counted and the total population estimated at 500. Conditions have continued to be favorable for the fur seal at Guadalupe Island and in 1977 a count of about 1,000 was made. A live individual was taken in 1964 for the San Diego Zoo, and two more for exhibit in Mexico.

Meanwhile, in Californian waters, fishermen claimed they had seen them near the Santa Barbara Islands in the summer of 1929, and three young males were seen at Piedras Blancas, San Luis Obispo Co., during the 1938 California Fish and Game Department sea lion census. In 1949, a biologist saw a single male, estimated to be 5-1 1/2 feet long and weighing 300 pounds, on each of four trips to San Nicolas Island. On two subsequent trips, in 1949 and 1950, he did not see it; however, there are many caves on the island where these animals could hide. A small adult male was seen on San Miguel Island in 1968, and from 1969 to 1977 two to three males were seen there each summer, but so far only one small, immature female has been sighted at this island.

Little is known of the habits of the Guadalupe seal. Its breeding behavior is probably quite similar to that of the northern fur seal.

## NORTHERN (ALASKA) FUR SEAL.

*Callorhinus ursinus*



This is possibly the best known of all the seals in the world. Much has been written about its habits. One of the most interesting accounts, and a fairly accurate one, is given in Kipling's story of "The White Seal"

The factors that have made these animals known are the value of their fur, plus the great numbers in which they congregate on breeding rookeries where they are readily available to man. The story is well known how the fur seals, threatened with extinction by heavy killing, were given protection by international treaty in 1911, and brought back to a good-sized herd by wise management. The original herd was estimated to have contained at least 2 million animals. In 1911, there were fewer than 125 thousand. The treaty stopped pelagic sealing (that is, killing at sea) north of the 30th parallel (except for Eskimos and Indians using primitive methods). Shore sealing management was left to the country having jurisdiction over the rookery area. There are now believed to be 1.3 million in the Pribilof Islands, Bering Sea (owned by the United States), about 265,000 in the Commander Islands (owned by the Soviet Union), 165,000 on Robben Island and 33,000 in the Kuril Islands (both owned by the Soviet Union). In the Pribilofs and Commander and Robben Islands a certain number of young (2 to 5-year-old) surplus males are cropped. About 40,000 to 50,000 pelts are taken each year, with the majority coming from the Pribilof Islands. The average value of the sealskins was about \$100 apiece in 1977. The original agreement involved Russia, Japan, Great Britain, and the United States. Russia managed her own territory; the United States managed the Pribilofs, giving 15% of the profits to Japan and 15% to Canada for their cooperation. In 1941, the Japanese cancelled their participation in the treaty, claiming damage to their fisheries from the seals; the United States took 80% and gave 20% to Canada. In 1957, the Interim Convention on Conservation of North Pacific Fur Seals came into force. The United States and Russia gave 15% of their take to Japan and 15% to Canada.

The northern fur seals have rookeries to which they return year after year; a seal usually returns to the rookery on which it was born. The conservatism of these and the Guadalupe fur seals in returning to the same spots regardless of molestation by man has been one of the factors leading to the heavy toll taken of them. (It has been reported that sea lions, on the other hand, will move to new rookeries if disturbed too much.) The old males come first to the rookeries. There is incessant fighting, and each of the successful ones claims and holds a territory of usually less than 40 feet square. The females come later, have their pups, and in 5-7 days breed again. After breeding, the mother gives the pup a heavy feeding of very rich milk, then may leave it a week or more while she goes off to sea to feed, perhaps as far as 100 miles. She nurses the pup for 3 months, then leaves it. The male, meanwhile, stays on land without eating or drinking for about 2 months, mainly during June and July, or perhaps longer. He lives on his accumulation of fat, and may lose many pounds. The successful male may get and hold a harem of 20 to 50 females, with an average of about 40.

After the breeding season is over, the older males stay in the north, younger males go south a ways, and the females and youngest males make long migrations, with round trips of up to 6,000 miles. Most go down the coast to opposite California, occasionally as far as between Guadalupe and San Benito Islands, Baja California; a few go to the vicinity of northern Japan. They usually stay well out to sea, 10 to 100 miles or more, and spend months without coming ashore, sleeping while floating on their backs.

On November 28 and 29, 1967, two pups were found on the beach in Monterey Bay. One was captured and found to be in poor condition, and died in a week. Disease, malnutrition, or injury would probably be the only factors which would normally cause these seals to come ashore away from their northern breeding grounds. However, in July 1968, biologists made the surprising discovery of a colony of about 100 northern fur seals on San Miguel Island. The colony consisted of one adult male, approximately 40 females, and 60 young ranging in age from an estimated few days to several weeks. Five females bore tags or tag scars, indicating they had been born on American or Russian islands in the Bering Sea. Thirty-three females and 36 pups in the San Miguel herd were tagged. All females examined has white vibrissae showing that they were older than 5 years.

Investigators later learned from a Santa Barbara commercial fisherman that from his boat he had counted between 8 and 10 adults on San Miguel in 1965, and between 15 and 20 adults in 1966, and about the same number in 1967. Since its discovery, the San Miguel Island fur seal colony has grown rapidly. A second breeding colony was reported on Castele Rock offshore San Miguel Island in 1972. By 1977 about 1,000 pups were born in the two small colonies at San Miguel Island.

The males are dark brown, with gray neck and shoulders; the females and young are more grayish. There is a light patch visible across the chest. The males get very large, reaching a length of 7-8 feet and a weight of up to 700 pounds, while females get to only 4-5 feet and a weight of 130 pounds. Males have a very short muzzle; they are easily distinguished from the Guadalupe fur seals or from sea lions. Also, they have longer hind flippers than the sea lions.

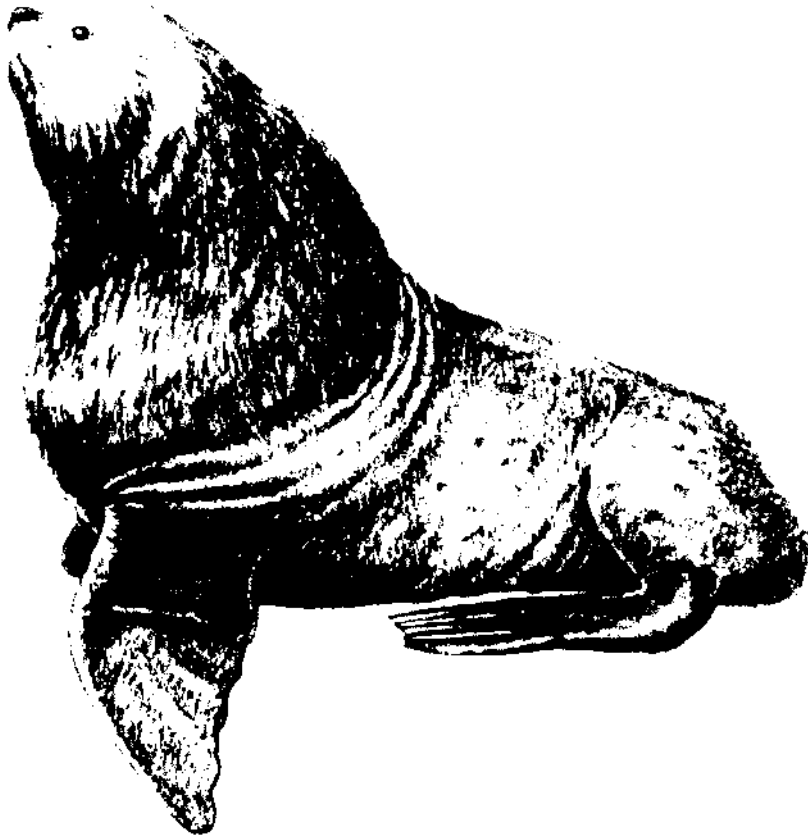
Some males and females mature sexually at age 3, almost all are reproducing by age 7. At least one seal is known to have lived in the wild to 26 years.

About 60 kinds of food remains have been found in fur seal stomachs, mostly small schooling fishes and squid. Herring is said to be an important item in their diet. Off California, anchovies, sauries, hake, and squid compromise the great part of their diet.

Their enemies, aside from man, are killer whales and large sharks, and a parasitic nematode worm which kills up to 20% of the pups each season. Many of the pups are crushed to death on the rookeries by fighting males. The greatest mortality to pups is probably from exposure as they make the transition to a pelagic life. During their first year at least 50% of the pups die from various causes.

## STELLAR SEA LION

*Eumetopias jubatus*



The Steller, or northern, sea lion is found from Bering Strait, Alaska, to southern California. Its breeding grounds extend throughout most of this range, from the Pribilof Islands to the southern California Channel Islands; however, only a small percentage breeds south of Ano Nuevo Island (between Monterey and San Francisco). The breeding grounds are usually rocky spots on islands. The females arrive on the rookeries in mid-May or early June, give birth to their pups, and breed in June or early July. Each male has a harem of 10 to 20 females.

The number of Stellers counted in Department of Fish and Game censuses from 1927 through 1970 remained fairly constant at 4,000 to 7,000, but this has been based upon the erroneous assumption that breeding colonies north of Point Conception were Stellers, while those south of there were Californias. A critical census conducted by the National Marine Fisheries Service during the height of the breeding season in 1976 showed over 1,500 California sea lions between Point Arquello and Ano Nuevo Island, and fewer than 1,000 Stellers. Refined estimates indicate the total breeding population of Stellar sea lions in California is 1,500 to 1,700 animals. The largest colonies are at Ano Nuevo and the Farallon Islands.

The Steller sea lion is tawny or yellowish-brown, as contrasted with the darker color, of the male in particular, of the California sea lion. The male lacks the characteristic head crest of the male California. The Steller attains a much greater size. Males reach 1,500-1,800 pounds, or even 2,200, and lengths of 13 feet. Females reach a little over 600 pounds, and lengths of 9 feet.

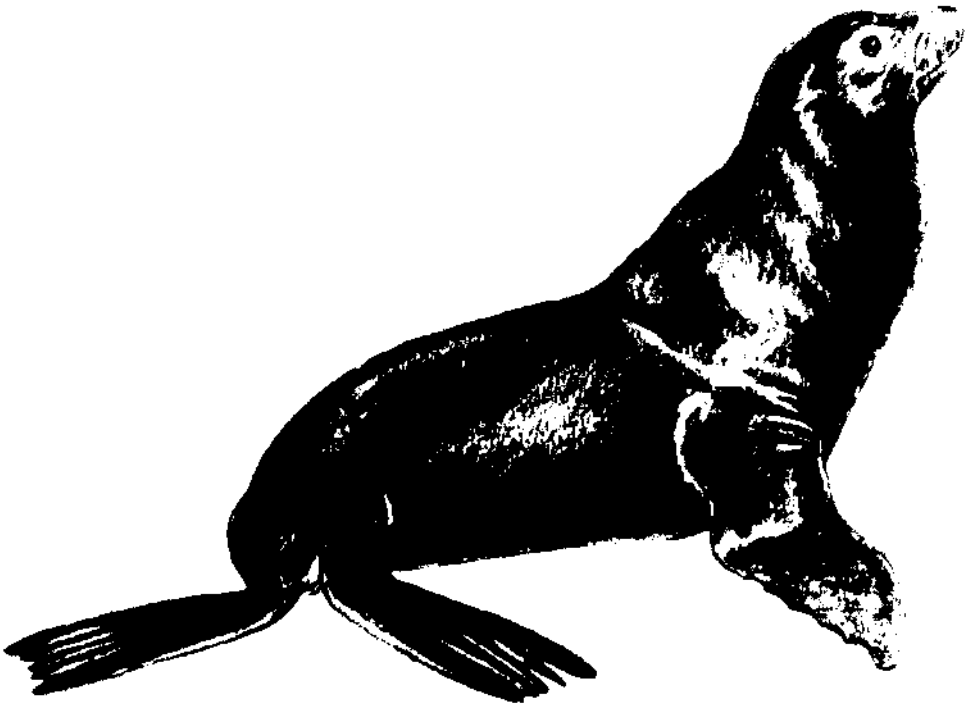
One of the best places to see these sea lions is on Seal Rocks opposite the Cliff House in San Francisco, where they occur with California sea lions.

Steller sea lions feed on fish and squid. While valuable fish such as salmon and halibut are occasionally taken, most of the fish they eat are commercially unimportant. Two killed near the mouth of the Columbia River during a salmon run had their stomachs filled with lampreys only.

While sea lions of both species usually seem friendly to swimmers, they sometimes may be aggressive. There is an instance of a sea lion seizing a skin diver off Monterey and holding him under water for a short time before releasing him.

## CALIFORNIA SEA LION

*Zalophus californianus*



This is the trained seal of circuses and other shows all over the world, and as such has become familiar to many thousands of people. Only rarely have others of this family been trained. Both males and females are used, though trainers are said to prefer males. The males are said to be more dependable because they are not so high-strung and do not get nervous or excited. The females are said to be more aggressive, to learn faster and be less stubborn, to have better dispositions, and to get along better with the other animals; they have the disadvantage of going through the oestrus cycle with a resulting lack of food drive, and also are more difficult to tame.

The California sea lion is found from Vancouver Island, British Columbia, south to the Tres Marias Islands off Mexico. Few are found north of San Francisco, and few south of Baja California. Counts made in 1927 and 1930 showed about 1,000 Californias in the state. These counts were made by observers from boats and on foot. It was possible to get an accurate breakdown into the two species (California and Steller) and to eliminate the pups (the natural mortality is so high on these, over 50% that it is not desirable to count them). In 1946 a combination method was used involving foot counts, boats, a blimp, and planes.

In 1947 a blimp was used for all except three places, which were covered by plane. Since then, planes have been used entirely, with most counts made from aerial photographs. These counts are made at the time the animals are on the breeding rookeries. Those north of Point Conception have been assumed to be Stellers, those south of there Californias, in some counts. Pups are of necessity included.

As pointed out earlier, Department of Fish and Game census figures admittedly have been low, and recent critical censuses have shown the error of assuming that all breeding animals north of Point Conception are Stellers. Population estimates recently released by the National Marine Fisheries Service suggest there are 32,000 to 40,000 California sea lions in our waters, and 20,000 to 43,000 in Mexican waters. The total world population is estimated at 60,000 to 85,000. A unique race of California sea lions in the Sea of Japan is thought to have been exterminated by man during, or shortly after, World War II.

Breeding grounds are mainly on the offshore islands from San Miguel Island south into Mexico, on either rocky or sandy spots. A few breed as far north as Pt. Piedras Blancas, in northern San Luis Obispo County, and some as far south as the San Benito Islands off Baja California. The greatest number counted at one place in California has been at San Miguel Island (9,500, or half the total in 1961). San Nicolas Island was second highest in the 1961 count (4,600).

The seals breed in June and early July, within a few days after the females give birth to their pups.

The males reach a size variously described as 500 pounds and up to 1,000 pounds, the latter probably represents an extreme figure. The females reach 200 pounds or up to 600. The males reach 7-8 feet in length, the females 6 feet.

The food of the California sea lion consists largely of squid, octopus, and a variety of fishes (chiefly non-commercial). Out of over 300 sea lion stomachs examined in a recent study, 24 contained fish remains in the form of otoliths. There were 424 otoliths, from over 24 kinds of fish. Hake (204 otoliths) were found in 17 of the 24 stomachs; this is a very abundant fish of almost no sport or commercial value. Only 8 of the species taken were of real commercial value. The amount of food taken by seals in the wild is not known. Captive seals may consume 15 to 20 pounds of fish a day.

The males of this species are dark brown, the females often light brown or tan; both, of course, look lighter when dry than when wet. The adult male has a pronounced sagittal crest—that is, a ridge down the midline of the skull, extending from the forehead to the rear of the skull. This helps distinguish this species from the Steller sea lion.

Another characteristic that helps distinguish this species is its almost incessant barking. The Steller is said to be fairly quiet except when disturbed on hauling-out grounds, though it roars constantly on the breeding grounds.

## RIBBON SEAL

*Phoca fasciata*

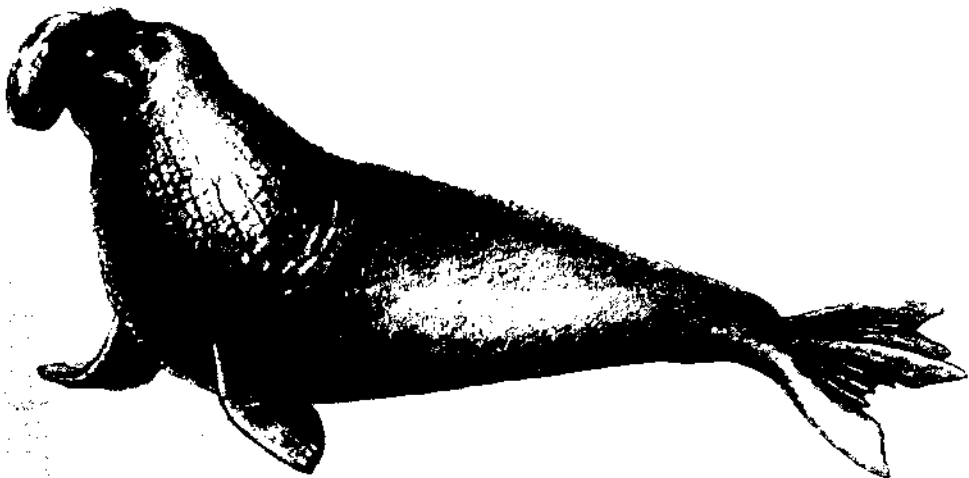


The normal range of this seal is from Pt. Barrow south to probably near the tip of the Alaskan Peninsula (55°N), and along the Asiatic coast in the western Pacific. However, in November 1962, a diseased and weakened male weighing about 200 pounds was found stranded on a beach just south of Morro Bay. This is the only California record. The animal was taken to the Morro Bay Aquarium, but it died a month later.

When in full pelage, this is a strikingly marked animal. It is dark-brown, grayish-brown, or grayish-yellow, with encircling yellowish bands, stronger in the male than in the female. One ring encircles the neck, one the flipper and shoulder region on each side, and one the rump.

## NORTHERN ELEPHANT SEAL

*Mirounga angustirostris*



This is the largest of all the seals, the males reaching lengths of 15-16 feet (an unverified report gives 22 feet) and weights of about 4,000 to 5,000 pounds, and females 11 feet and about 1,700 pounds. The color is brownish in old pelage, silver-gray in new. It is not a handsome animal: there are often patches of skin peeling off, and the male develops a bulbous enlargement of the snout, from which, along with its size, it gets its common name.

Those who have been fortunate enough to see elephant seals on their rookeries or hauling-out grounds have found them quite fascinating. They can be approached closely, usually neither fleeing nor attacking unless unduly disturbed.

The range of the species is from Alaska (Prince of Wales Island) to Baja California, Mexico (Cape San Lazaro). Elephant seals were formerly abundant as far north as Point Reyes, above San Francisco, but were hunted so extensively for their fine quality oil that they were nearly exterminated. Their last refuge was Guadalupe Island, off northern Baja California. In 1892 scientists found only nine on the island, and took seven of these for specimens. Fortunately, there must have been others which they did not see. In 1911 the Mexican government prohibited killing them, and the herd began building up until by 1930 there were about 500 on Guadalupe, and there were believed to be over 1,500 altogether. In 1938, 13 were counted on San Miguel, one of the southern California Channel Islands. In 1950 there were estimated to be 4,500-5,000 on Guadalupe Island and smaller colonies on other Mexican islands and on the Channel Islands; a count was made in that year of 168 on San Nicolas Island. By 1978 there were breeding colonies on San Nicolas, San Miguel, Santa Barbara, Ano Nuevo, and Southeast Farallon Islands, and a small breeding colony had started up on the mainland at Ano Nuevo Point. Individual animals have been seen as far north as Alaska on several occasions. A Department of Fish and Game census in 1978 revealed 5,600 elephant seals on San Miguel Island alone; however, this is at odds with National Marine Fisheries Service estimates of 10,000 for this island. In any event, the species has reoccupied all of its historic rookeries and hauling-out grounds, and recent estimates place the total population of northern elephant seals at 50,000 animals.



**Elephant seals on Guadalupe Island. Photo by John E. Fitch.**



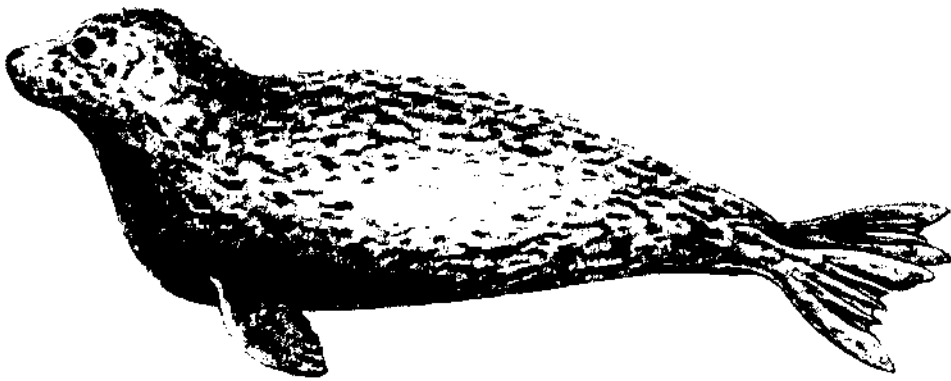
Elephant seals congregate on rookeries during the breeding season, which is from December through March. The harems consist of one male to 8 to 40 females. The gestation period is about 11-1/2 months. The principal breeding rookeries are Guadalupe and San Benito Islands, in Mexico.

These animals do a good deal of feeding at night, and probably in deep water. Small sharks, rays, rattfish, rockfish, and squid have been found in their stomachs.

A large seal, seen floating upright in the water with head and shoulders projecting, then sinking vertically out of sight, is probably of this species. On foggy days such happenings have been mistaken for mermaid sightings by wide-eyed fishermen.

## HARBOR SEAL

*Phoca vitulina*



The smaller size, chunky shape, lack of external ears, small front flippers, backward-pointing hind flippers which are used in swimming, and spotted coat make it easy to distinguish harbor seals from sea lions. Also, the squarer muzzle with more dorsally placed nostrils, and the large eyes, are characteristic of this species.

A male may be 5 or 6 feet long and weigh 250 to 300 pounds. Females are slightly smaller. These are rather chunky-built seals throughout, and lack the enlargement in the shoulder region of the male eared seals. The coat is mottled and spotted. There have been two subspecies described: *P.v. richardi*, which ranges from Herschel Island in the Arctic, and the Bering Sea, south to Monterey Co.; and *P.v. geronimensis*, which ranges from Santa Barbara south to San Geronimo Island, Baja California. The northern subspecies is typically a beautiful silvery-gray with black spots; the southern one is black (or brown) with silvery or white or yellowish spots. However, there is considerable variation, and the validity of these subspecies has been questioned. Their markings have caused them to be sometimes given the name "leopard" seal.

They are not as numerous nor as often seen as sea lions. The entire population of the two subspecies has been estimated at 50 to 200 thousand, with only about 2,000 individuals in California. They most often occur in bays and harbors or at the mouths of rivers, or may even go up rivers. San Francisco Bay is one of the places where they are most apt to be seen, or were at least in the days of the ferries. In 1944 a group of 10 to 70 hauled out on a sand bar 200 yards north of the east approach to the Bay Bridge, where they were observed and counted day after day by a biologist. In 1964 a group of about 30 hauled out regularly on some rocks directly below the east end of the Richmond-San Rafael Bridge. They frequently haul out on sand bars, as well as on rocky places. Surprisingly, they may go well-offshore at times: they have been seen on San Nicolas Island, the outermost of the southern California Channel Islands.



**Harbor seal under water. Photo from Marineland of the Pacific.**

Harbor seals were not included in the Department of Fish and Game census until recent years. The 1970 count was 1,675 which was a drop from the preceding year, but higher than in 1965.

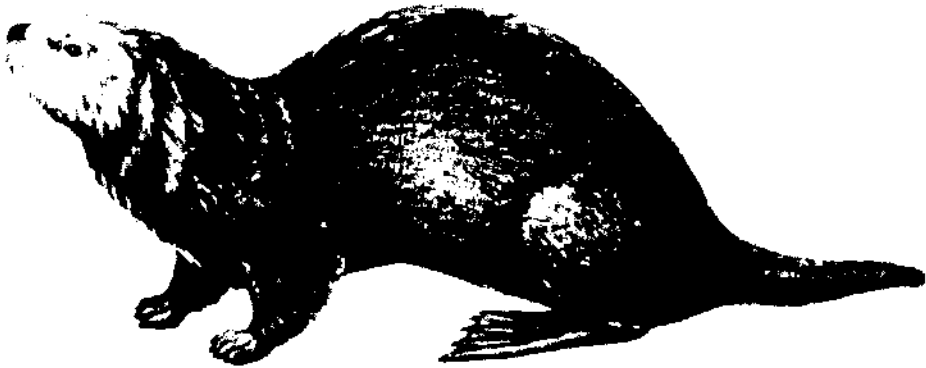
The harbor seal has been described as polygamous or promiscuous, but does not form organized harems for breeding purposes. The pups are born mainly from the end of May through July. They are usually born on land, but may be born in the water. Of several pups born at Steinhart Aquarium, in San Francisco (up to 1928), all were born in the water and were able to swim at once. The pups nurse for 4 to 6 weeks.

The food of the harbor seal consists of fish, squid, and octopus, also some shellfish.

It shares with the elephant seal the trait of floating in the water with just the head projecting, then sinking straight down out of sight. The sea lion dives forward.

## SEA OTTER

*Enhydra lutris*



Although California sea otters are very rarely seen out of the water, this one is shown in a standing position, to depict its body configuration better.

Biologists and others interested in animals were excited by the news in 1938 that a large herd of sea otters, variously reported at from 50 to about 90, had been discovered off Bixby Creek, 15 miles south of Monterey. But their existence along the Monterey County coast was not news to everyone. From about 1911, when the population reached a low point and they were feared nearly extinct, there had been occasional sightings, and several reports had been published in *California Fish and Game*. Ranchers and lighthouse keepers, park rangers, local wardens and other Fish and Game personnel knew of their existence and took an interest in them. However, because of the danger from poachers, their presence was not given much publicity.

In the summer of 1937, Highway 1, otherwise known as the Carmel-San Simeon Highway, was opened, making available to the general public a long stretch of rugged coastline hitherto almost inaccessible. It was inevitable that sooner or later the public would spot the sea otters. The opening of the highway also made it possible to study their habits and make more accurate counts of numbers and distribution.

The sea otter is one of the most interesting of all California mammals. It is a member of the weasel family, and is most closely related to the river otter. It is a large animal. In California the male reaches a length of about 4-1.2 feet and occasionally more (including a 10- to 12-inch tail) and a weight of up to 87 pounds. The female reaches a length of up to 4 feet and a weight up to 60 pounds. Otters have stubby, rounded forepaws, with not very well-developed fingers, and partially retractable claws. However, they are able to make considerable use of their paws for capturing food, for wielding rocks to puncture holes in abalones to remove them from the substrate and for hammering hard-shelled food items upon a rock positioned on their chests. The hind feet are large and webbed, with the fifth digit (comparable to man's little toe) the longest. The hind feet are used for propulsion, and the tail is used as an aid in swimming. When resting or swimming leisurely, the most common position is on the back, but when in a hurry, the otter will swim on its belly at speeds up to 5 miles per hour. Under extreme stress, the escape behavior is to swim underwater for long distances, coming to the surface briefly for air. The longest dive recorded was 4.5 minutes.

The most notable feature of the sea otter is its fur, which is unusually fine, soft and dense. In color it ranges from nearly black to reddish brown; the head and neck are paler on older animals. White-headedness is often associated with males and aging, but some females and young of both sexes may have white heads. It was the great value of its fur which almost led to its undoing. The original range of the species was from the northern islands of Japan north along the Kuril Islands and Kamchatka coastline, throughout the Aleutian and Pribilof Islands to the Alaskan mainland, thence south in a

continuous band into lower Baja California including all the offshore islands. The aboriginal inhabitants throughout the pristine range hunted the otter for its fur and for food. In many areas the fur was worn only by those of high social status. Aboriginal hunting methods in some areas were quite efficient, utilizing tangle nets, supported by wooden floats carved in the shape of a sea otter, and spears and arrows. The most proficient of the otter hunters were the Aleuts in Alaska, the Haida of the Queen Charlotte Islands and the Nootka and Kwakiutl of Vancouver Island and the Georgia Strait. In some areas hunting was so efficient the natives kept the otter populations at low levels enabling the Indians to gather quantities of large shellfish for consumption.

In 1741 Vitus Bering, from whom the Bering Sea took its name, discovered sea otters in the Commander Islands and eastward in the Aleutians. These explorers, accompanied by the German naturalist, Georg Wilhelm Steller, obtained about 800 pelts from the natives, thus starting the sea otter fur trade which eventually was to subject the north Pacific coastline and islands to exploration and occupation by several nations. In 1778 the English explorer James Cook explored the area from Vancouver Island to the Kamchatka Peninsula and revealed to the Western World the presence of a potentially vast source of profit in sea otter furs. The Russians hunted sea otters across the north, then, as they became scarce there, continued on south into central California, employing efficient Aleut hunters. In 1812 the Russians established Fort Ross in Sonoma County as a base, then hunting camps at Bodega Bay and the Farallon Islands. The Spanish passed legislation to keep nationals of other countries from hunting in their waters but were unable to enforce it except to refuse to supply hunting vessels. The Americans, and to a much lesser extent the British and French, began hunting otters after 1785. The hunt was exceptionally heavy from about 1830 to 1845, but by 1850 the trade in California was nearing an end, only a few scattered otters were taken from then until 1911. Near the end of the hunting (about 1850), the Russians, realizing the value of a controlled take, imposed restrictions in Alaska, then known as Russian America. However, the sea otter population in Alaskan waters was due for another slaughter when the Americans purchased Alaska in 1867. Within a 30-year period 100,343 pelts were taken despite a flood of letters and petitions urging protection of both the fur and seal and the sea otter. Finally, in 1911, an agreement known as the Fur Seal Treaty was reached by the United States, Russia, Japan, and Great Britain. This protected sea otters on the high seas (outside the three-mile limit) from citizens of the four signatory nations. In 1913 the territory of Alaska and the State of California enacted legislation for total protection of sea otters inside the 3-mile limit, where nearly all the otters are located. The remnant populations at that time were at Cedros Island, Baja California; at Big Sur and possibly Santa Catalina Island in California, at the Queen Charlotte Islands, British Columbia; at Prince William Sound, Kodiak Island and several places in the Aleutian Islands, Alaska, the Commander Islands, Russian, and the Kuril Islands, Japan. By 1920, however, the only remnant population south of Prince William Sound was at Pt. Sur.

An estimate of the number of sea otter pelts taken over the years is uncertain because of the illicit nature of much of the trade in California and Baja California, but there may have been 600,000 to 800,000 taken in the Pacific northwest and as many as 200,000 from California and Baja California waters during 170 years of hunting. That is not to say that the pre-hunting population in California and Baja California was anywhere near 200,000 sea otters. Much of the initial hunting probably consisted of cropping animals that otherwise would have died from natural causes, thus a viable stock was left for many years. It was the heavy take of otters by guns after 1830 that rapidly diminished the stocks leaving little recruitment to keep the population viable. Based upon present sea otter densities along part of the California coastline, the maximum population that may have been in California at the beginning of the fur trade is estimated at around 16,000 animals. The prices for pelts varied by fur quality and market conditions, with individual pelts occasionally selling for as little as \$8 and as much as \$1,703. The Alaskan government harvested around 2,000 sea otters in the late 1960s and received an average of \$80 per pelt. A color-matched set of four pelts brought \$2,300.

The 1978 range of the sea otter in California was from Santa Cruz, Santa Cruz County, south to Avila, San Luis Obispo County, a distance of about 200 miles. The population has been expanding about 2.5 miles per year since 1913 and has increased in numbers about 5% annually. At this time there are around 2,000 sea otters in California, from 105,000 to 140,000 in Alaskan waters, and about 10,000 in Russian waters. The latest thorough taxonomic work on the sea otter places the California and Alaskan populations in the same subspecies, *E. lutris lutris*, and considers the population in the Kurils as *E. l. gracilis*. Considering that sea otters have been along the north Pacific coast for at least 3 million years, there must have been considerable gene flow throughout their range for there to be so little difference between Californian and Alaskan animals in structure and behavior. Obviously there were long-distant wanderings then as are now observed in the California population, even though most individuals in an established population remain within a small home territory.

The California population is limited in size by food supplies in the established portion of its range, but the otter can still increase in numbers and expand its range by chance wandering to the edges of the range where food is not the limiting factor. The concentrations of animals at the northern and southern boundaries of the range are mostly young males, but some older males and a few young females also are present. This aggregation of animals is called the migrant front. When the migrant front moves into new foraging grounds, the invertebrates on which the otters feed are soon reduced to low levels and the front must move onward. There appears to be a strong sense of territoriality among sea otters, and many will remain in either the established population area or in the front area until starvation presses them to find new food supplies. Since most migrant front animals are either immature or old males, it appears that these animals cannot compete with larger more dominant males in the center of the range and must find the edge where there is plenty of food or die. When a migrant front moves into the next food-rich foraging area, dominant males and females with pups, along with immature animals of both sexes, occupy the abandoned area, but at a much lower density. Tagging studies reveal that at least some of the animals in the migrant front return to the established range and settle down. Some sea otters have wandered more than 200 miles ahead of the migrant front, but these animals rarely remained in one place for more than a few weeks. The established range of the otter is considered to be the area between migrant fronts and does not include the wanderers ahead of the front.

One of the more interesting aspects of the California population has been the sighting of animals far from what is considered their established range. There are reliable reports of sea otters being sighted from northern California to the Mexican border in the past 20 years, and there have been many unconfirmed sightings from the Channel Islands and along the southern and northern California coastline. Some of these sightings have proved to be harbor seals which on occasions may rest in thick kelp with only their heads showing, thus resembling sea otters. On the north coast, river otters have been seen entering the ocean near river mouths and actually foraging on crabs near kelp beds.

For many years it was believed sea otters had to live in kelp beds where they drape kelp fronds over their bodies and rest. Wherever kelp, especially *Macrocystis*, is present, otters will rest and forage among the fronds for snails and crabs. However in 1973 both the southern and northern migrant fronts moved into sandy beach areas: Monterey Bay in the north and Estero Bay in the south. These animals remained along the beaches day and night foraging almost entirely on Pismo clams. They did not raft in kelp canopies.

When otters of the migrant front move into a new area, they forage primarily on abalones, sea urchins and large crabs if the area is rocky and on clams and crabs if the area is sandy. Once most of the abalones and urchins are removed from the rocky areas, the front moves on. The diet of the animals which settle down in rocky areas succeeding the migrant consists of only around 10% abalones and urchins. The bulk of the diet in an established area is made up of crabs, but more than 40 other invertebrates are also taken, including snails, mussels, squid, octopus, chitons, tubeworms, limpets, barnacles, scallops, and even starfish. In sandy areas, Pismo clams, gaper clams, razor clams, mole

crabs, Dungeness crabs and other *Cancer* crabs are the forage items. Fish rarely appear in the diet of California sea otters.

The sea otter has no blubber as do seals and sea lions, and since the fur is not exceptionally efficient in maintaining its body temperature of 100°F, it has a high metabolic rate and must consume large quantities of food daily. The daily consumption of food ranges from about 35% of body weight for a young animal to 15% for a large adult male. The average for a medium-sized adult is about 25% of body weight. This consumption of invertebrate biomass amounts to about 2.5 tons per animal per year, meaning that about 5,000 tons of food are consumed each year by the present California sea otter population.

Because of the efficiency of foraging (both daytime and nighttime) and the large volume of shellfish taken, the recovery of the sea otter is no longer endangered and it is now an enjoyable and entertaining part of the marine fauna. On the other hand, the shellfish resources that expanded after the otter virtually disappeared are now in danger of being greatly reduced should the otter be allowed to reoccupy the entire coastline of California. The otter, of course, does not eliminate shellfish populations, but it does forage on many species and reduces them to levels well below those exploitable by recreational and commercial users. Fisheries that likely will be greatly reduced should the otter be allowed to reoccupy its original range are the Pismo clam, recreational and commercial abalone fisheries, the sea urchin fishery and the shallow water red and rock crab fisheries. Fisheries that may be seriously jeopardized are the Dungeness crab, lobster, razor clam and all exposed mariculture projects.

Sea otters may live up to 20 years and have one young every two years or possibly sooner. Breeding and pupping occur throughout the year but pupping peaks from February to June. The mother cares for her young for at least six months and possibly a year. Births can take place either on land or at the sea's surface.

Sea otters usually dive in depths of 5 to 120 feet which are the depths they must go for most of their food. However, an Alaskan otter was taken from a king crab pot that was resting on the bottom 318 feet deep. Both Alaskan and California otters will haul out on land next to the water's edge, but they do so more often in Alaska where there is a greater need to conserve heat. The California otter regularly uses tools such as a rock positioned on its chest upon which to break hard shells. In Alaska, where most of the food selection is smaller and can be broken with its teeth, this practice is not as evident. Amchitka otters relocated to Oregon regularly used tools to break large shellfish in their new habitat. Their high metabolic rate requires from two to five forage bouts per day. The sea otter formula is  $1.3 \cdot 2, C 1.1, PM 3.3, M 1.2 = 8.8$ .

Sea otters are very adaptive. They can be extremely wary when harassed or quite tame and entertaining when treated kindly. They do well in captivity and can be seen at several oceanaria along the Pacific coast. They have no natural enemies in California except the white shark. There is an unverified report from the Kuril Islands of an otter being attacked by a killer whale. For a time it was thought that otters were being run over by boats near harbors, but it now appears that only one case of propeller damage can be documented. Nearly all of the trauma involving cutting of the fur and external damage has been caused by shark attacks. The teeth from white sharks have been taken from the bodies of 11 sea otters washed up on beaches. About 30 additional dead otters exhibited characteristic shark teeth patterns on the body. It is not known how many otters are being eaten by sharks, but the mortality can not be extreme because the California population is still increasing.

The best places to observe otters are along Highway 1 where the road dips low to the water adjacent to kelp beds. Some of these areas are along the Monterey Peninsula, especially Point Lobos State Reserve south of Carmel, at Big Creek, Limekiln Creek, and Jade Cove. Binoculars are a must, and if a spotting scope is used, chances of observing grooming behavior, especially the mother's care for a pup, are much improved. When the pup is very young, up to two months of age, it possesses a long woolly coat of fine brownish hair. This thick fur prevents it from diving and it must remain at the surface while its mother dives and finds food for herself. The pup will reach for its mother as soon

as she surfaces, presenting a very touching mother-pup display. Often the pup will cry for its mother when the mother is foraging or if separated during stormy sea conditions. The cry can be heard for long distances.

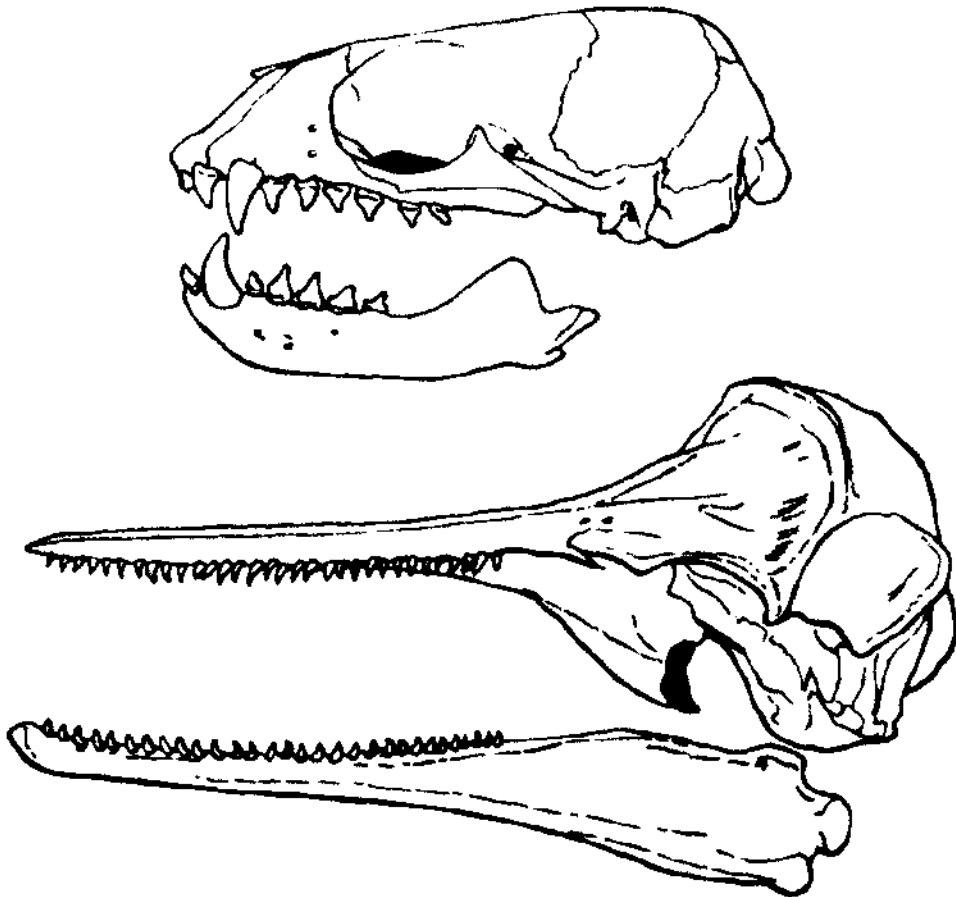
It is a little difficult to spot the animals at first, especially if the otters are in bull kelp, *Nereocystis*, beds. The round, dark brown kelp floats may resemble an otter's head or body, but one soon learns to recognize them. As the swells come in, the bull kelp attached to the bottom usually is covered temporarily while the floating otters remain. Look for gulls. One or two usually accompany each otter to grab what scraps they can while the otter is feeding. Otters often are spotted rolling over and over, a very characteristic trick which is part of the feeding and a grooming routine that keep fur in prime condition and able to trap air bubbles.

A representative of the Department of Fish and Game or local animal protection agency should be notified if a sick, wounded or dead sea otter is sighted, or if a pup appears to have been abandoned by its mother. The animals should not be touched. It is against both state and federal law to possess even momentarily a live or dead sea otter.

## CETACEAN TOOTH COUNTS

The accompanying chart will help you to identify beached specimens of the toothed whales or sun-bleached skulls which may be picked up on the beach. Even if the teeth are gone, a fairly good count can be made from the tooth sockets. It will be noticed that there is a good deal of variation in tooth numbers, unlike the situation in other mammals, where the number is usually fixed. Keep in mind, also, that the range may be greater than shown here; counts on several specimens obtained by me extended the range in two species, and as more specimens are obtained other extensions will undoubtedly be made. But, say you get a tooth count of 22. There are three definite possibilities here, with a good chance of at least two more. The size alone of the sperm whale would separate it from all the others. The bottlenose dolphin and the rough-toothed dolphin would be harder to separate, unless the teeth were present, in which case the fine vertical ridges of the teeth of the latter would distinguish it; also, the color pattern of the latter would be distinctive. The Dall and harbor porpoises would also have to be considered. These are both short-skulled, beakless forms, unlike the preceding two. The Dall porpoise has extremely distinctive markings, and the harbor porpoise has small, flattened, rounded teeth, sometimes described as spade-like, unlike those of any other kind. In some other cases, identification from skulls alone would be much more difficult.

All skulls should be saved and turned over to museums or other scientific institutions.

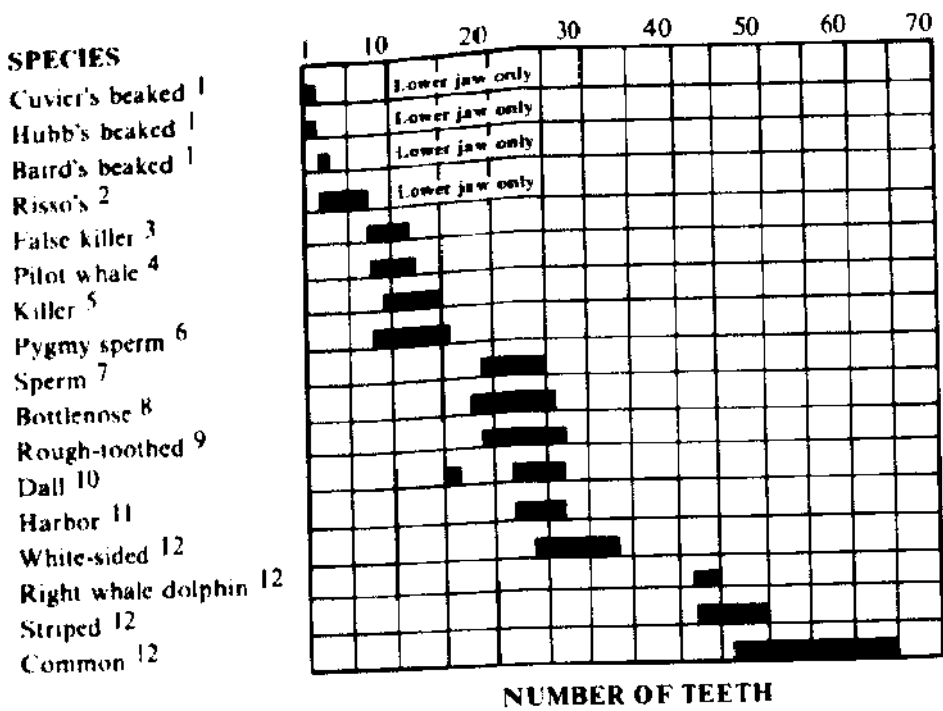


Top: Seal skull. Drawing by Phil Schuyler.

Bottom: Dolphin skull. Drawing by Phil Schuyler.



## CETACEAN TOOTH COUNTS FOR EACH SIDE OF JAW



- 1 Also has vestigial teeth in upper and lower jaw.
- 2 Teeth clustered toward anterior end; if present in upper jaw, small and confined to anterior half of rostrum.
- 3 Teeth prominent, conical.
- 4 Teeth confined to anterior half of rostrum; sharp, peglike.
- 5 Roots of teeth flattened; teeth strong, conical, set close together.
- 6 Teeth sharp and curved.
- 7 Also has vestigial teeth in upper jaw; teeth heavy, slightly flattened in cross-section, with rounded blunt tip.
- 8 Teeth large, smooth.
- 9 Teeth large, crowns with fine vertical ridges; set far apart.
- 10 Teeth small, frequently not projecting beyond gums, which are formed into "gum teeth."
- 11 Teeth small, compressed, rounded or spadelike on ends, some tricuspid.
- 12 Teeth small, sharp-pointed.

## MUSTELIDAE AND PINNIPEDIA—TOOTH COUNTS AND KEY

Check teeth with flat crown (for crushing)			$\begin{array}{r} 3-1-3-1 \\ \hline 2-1-3-2 \end{array}$	Sea otter
Check teeth peg-like, with single conical crowns	Upper incisors pointed	Check teeth (except first) large, double-rooted, 3-lobed	$\begin{array}{r} 3-1-4-1 \\ \hline 2-1-4-1 \end{array}$	Harbor seal
		Check teeth small, single-rooted, not lobed	$\begin{array}{r} 2-1-4-1 \\ \hline 1-1-4-1 \end{array}$	Elephant seal
	First and second upper incisors transversely notched across the ends	Pre-molars and molar not separated by a space as wide as a pre-molar width, occipital and sagittal crests very prominent, especially in males (30-50 mm high).	$\begin{array}{r} 3-1-4-1(2) \\ \hline 2-1-4-1 \end{array}$	California sea lion
		Pre-molars and molar separated by a space as wide as pre-molar; occipital and sagittal crests small (under 10 mm).	$\begin{array}{r} 3-1-4-1 \\ \hline 2-1-4-1 \end{array}$	Steller sea lion
		Pre-molars and molar not separated by a space as wide as a pre-molar, occipital and sagittal crests small (under 10 mm).	$\begin{array}{r} 3-1-4-(1)2 \\ \hline 2-1-4-1 \\ \hline 3-1-4-2 \\ \hline 2-1-4-1 \end{array}$	Northern fur seal Guadalupe fur seal

The above counts are for the teeth in the  $\frac{\text{upper}}{\text{lower}}$  jaw on one side. The first number is for the incisors, the flattened, sharp-edged cutting teeth in the front of the mouth; the second is the canine, a large, more rounded and pointed tearing tooth; the third and fourth are for the check teeth, the pre-molars and molars respectively, which are grinding or crushing teeth in many mammals. The last differ from one another in that the pre-molars usually appear as baby teeth and are replaced by a permanent set, the molars appear only as permanent teeth. Occasionally tooth numbers may vary slightly from those given above.

## MEANINGS OF SCIENTIFIC NAMES

Beginning with the catalogs of the Swedish naturalist Linnaeus, the tenth edition of whose *Systema Naturae* (1758) was taken as the official starting point, all kinds of animals and plants have been known by binomial scientific names. Each name consists of two parts, the name of the genus followed by the name of the species, which is a subdivision of the genus. This is sometimes followed by a second subdivision, the subspecies. The generic names of animals are always capitalized, the specific names never. These names are mostly derived from Latin or Greek roots describing the organisms, but sometimes from names of people or places. Since Latin was the universal language of scholars for many centuries, these names are in Latinized form. They are usually italicized (indicated by underlining in typescript). Scientific names have the advantage that they are uniform throughout the world, a sperm whale, for example, being known by the same name in India as it is in the United States. Also, they have the advantage of showing relationship among species in the same genus. Such differences as occur represent differences of opinion among biologists. As an example, the Atlantic harbor porpoises is *Phocoena phocoena*, while our Pacific form has been called *Phocoena vomerina*. But some scientists who have studied these animals think there is no real difference between them, and that all should be considered one species and be called by the earlier name, which is *Phocoena phocoena*. Things such as these may explain the differences you sometimes find in scientific names in different publications. The name of a man which you may see following a scientific name, either in parentheses or not, is that of the original describer of the species.

Following are the meanings of the scientific names in this booklet.

### SCIENTIFIC NAMES

*acuto* L. sharp, pointed

*alba* L. white

*angusti* L. narrow, small

*arcto* Gr. a bear

*hairdi* after S.F. Baird, American zoologist and founder of the U.S. National Museum, 1823-1887

*balaena*-L. whale

*berardius* probably after a man's name

*borealis*-L. northern

*brevi*-L. short

*californianus* California, L. belonging to

*callo* Gr. beautiful

*carlhubbsi* after Carl Hubbs, American zoologist, 1894-

*cato* lower

*cavi*-a cave, hollow

*cephalus* Gr. a head

*ceps* L. head

*cetus* L. Gr. whale

*coeruleo*-L. blue

*crassi*-L. thick

*dalli* after W.H. Dall, American naturalist, 1845-1927

*delphinus* Gr. *delphis* = a dolphin + like

*dens, dent* L. tooth

*enhydra*-Gr. an otter living in water

*eschrichtius* after a Danish cetologist

*eu* true; good, nice

*eumetopias eu* + with a broad or high forehead

*euphrosyne* after a Greek goddess (lit., mirth or joy)

*fasciata*-L. banded

*gibbosus* humped  
*gilli* after T.N. Gill, American zoologist, 1837-1914  
*glaucus* Gr. silvery, gray  
*globi* L. globe  
*graffmanti* after a man's name  
*grampi*, *grampus*-Ital. L. a large fish (*gran. pes.*)  
*histrion*-L. actor  
*jubatus* L. having a mane  
*kogia*-?perhaps from an early observer of whales in the Mediterranean  
*logeno* L. Gr. flask  
*lisso*-Gr. smooth  
*lutris*-L. otter  
*mega* Gr. large  
*mirounga* from an Australian native name  
*musculus* L. muscular  
*novaeangliae*-New England  
*obliqui* L. slanting  
*odont* Gr. tooth  
*orca*-L. a kind of whale  
*philippii*-after a South American zoologist  
*phoca*-Gr. a seal  
*phocoena*-Gr. porpoise  
*phocoenoides* Gr. porpoise + like  
*pseud*-Gr. false  
*physalus*-Gr. porquial whale  
*physeter*-Gr. a blower, blowhole of whale  
*pinna*-L. wing (= fin)  
*ptera* Gr. wing (= fin)  
*recti*-L. straight  
*rhae* Gr. spine  
*rostris* L. beak, snout  
*rostrata* L. beaked  
*rhinus*-Gr. nose  
*rhynchus* Gr. beak, snout  
*sieboldi*-from Karl T.E. von Siebold, a German zoologist  
*simus*-L. with flat nose  
*sinus*-L. bay  
*scammoni*-after C.M. Scammon, whaling captain and author of a book on whales  
*stejnegeri*-after Leonhard Stejneger, American zoologist, 1851-1943  
*steno*-Gr. narrow, i.e. slender  
*stenella*-narrow + L. little  
*townsendi*-after Charles H. Townsend, American zoologist, 1859-?  
*truncatus* -cut off  
*tursiops* L. a porpoise  
*ursininus*-L. bear + like  
*virulina*-L. calf, also seal + little  
*vomerina*-L. plowshare + little  
*zalophus*-Gr. very + crest  
*ziphius* Gr. sword

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## MARINE MAMMALS OF CALIFORNIA

### ORDER CETACEA

#### Sub-order Mysticeti

- Balaenidae Northern right whale-*Eubalena glacialis*  
Balaenopteridae Minke whale-*Balaenoptera acutorostrata*  
Sei whale-*Balaenoptera borealis*  
Blue or sulphur-bottom whale-*Balaenoptera musculus*  
Fin or finback whale-*Balaenoptera physalus*  
Humpback whale-*Megaptera novaeangliae*  
Eschrichtidae Gray whale-*Eschrichtius robustus*

#### Sub-order Odontoceti

- Delphinidae Common dolphin-*Delphinus delphis*  
Pilot whale or blackfish-*Globicephala macrorhynchus*  
Risso's dolphin-*Grampus griseus*  
Pacific white-sided dolphin-*Lagenorhynchus obliquidens*  
Northern right whale dolphin-*Lissodelphis borealis*  
Killer whale-*Orcinus orca*  
Harbor porpoise-*Phocoena phocoena*  
Dall porpoise-*Phocoenoides dalli*  
False killer whale-*Pseudorca crassidens*  
Striped dolphin-*Stenella coeruleoalba*  
Rough-toothed dolphin-*Steno bredanensis*  
Pacific bottlenose dolphin-*Tursiops truncatus*  
*Physeteridae* Pygmy sperm whale-*Kogia breviceps*  
Dward sperm whale-*Kogia simus*  
Sperm whale-*Physeter catodon*  
*Ziphiidae* Baird's beaked whale-*Berardius bairdi*  
Hubbs's beaked whale-*Mesoplodon carlhubbsi*  
Cuvier's beaked whale-*Ziphius cavirostris*

### ORDER PINNIPEDIA

- Otariidae Guadalupe fur seal-*Arctocephalus townsendi*  
Northern (Alaska) fur seal-*Callorhinus ursinus*  
Steller sea lion-*Eumetopias jubatus*  
California sea lion-*Zalophus californianus*  
Phocidae Ribbon seal-*Phoca fasciata*  
Northern elephant seal-*Mirounga angustirostris*  
Harbor seal-*Phoca vitulina*

### ORDER CARNIVORA

- Mustelidae Sea otter-*Enhydra lutris*

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