

Marine mammals

Introduction

- One type of animal that made a successful and complete transition from land to water in the course of its evolution is the whale.
- According to the fossil record, about 50 million years ago some terrestrial mammals began to make the transition from a life on land to a life in the sea.
- whale is an air-breathing animal that spends its entire life in the ocean.
- The humpback whale (*Megaptera novaeangliae*), for example, feeds her offspring milk from her mammary glands, a distinguishing characteristic of all mammals.
- Another characteristic shared by mammals is the four-chambered heart.

CETACEANS: WHALES AND DOLPHINS

- Whales and dolphins belong to the order of mammals called Cetacea. There are about 80 different species of **cetaceans**.
- The largest cetaceans are the whales and the smallest cetaceans are the dolphins and porpoises.
- In general, the difference between dolphins and porpoises is that dolphins have an elongated snout and can swim faster.
- Dolphins and porpoises display a variety of acrobatic leaps, spins, and somersaults that take them out of the water and high into the air.

BALEEN WHALES

- The whales are classified into two main groups—the baleen whales and the toothed whales. The **baleen whales**, which belong to suborder Mysticeti, are filter feeders that eat plankton and small fish.
- They include such species as the blue, finback, humpback, right, and gray whales.
- There are three types of feeding methods in the baleen whales.
- These different methods are reflected in differing shapes and sizes of the baleen plates.

- While swimming through the water, a baleen whale opens its mouth to take in enormous quantities of water that contains zooplankton.
- The throat of some baleen whales—the rorquals—is pleated like an accordion to expand and hold the large volume of water.
- As the water is forced from the whale's mouth, it passes through overlapping plates of a fibrous protein material called **baleen**.
- The baleen plates, which look like giant combs, hang from the roof of the whale's mouth.
- They are strainers that filter small organisms from the water.

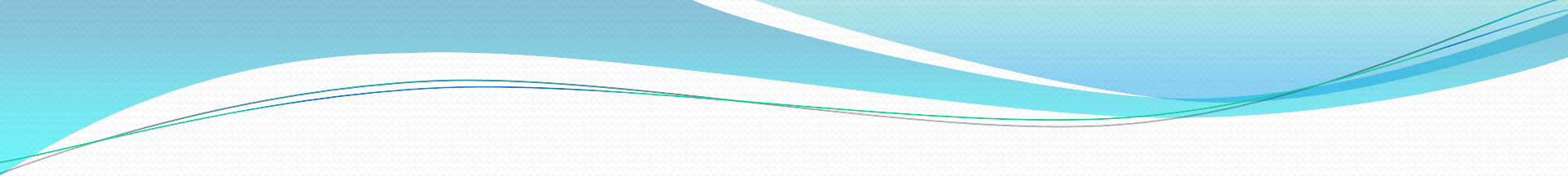
TOOTHED WHALES

- The **toothed whales**, which belong to suborder Odontoceti, include all other whales (such as the sperm, killer, pilot, and beluga), dolphins, and porpoises.
- These whales have peglike teeth on their jaws, with which they catch prey such as fish, seals, penguins, and squid.
- After seizing its prey, a toothed whale usually swallows it whole. Compartments in the stomach “chew” the food.
- The sperm whale (*Physeter macrocephalus*) is the largest of the toothed whales; it grows to about 15 meters in length.

- The smallest whale (not counting dolphins and porpoises) is the narwhal (*Monodon monoceros*), which grows to about 5 meters in length.
- Each of these whales has unique teeth. The sperm whale has large cone-shaped teeth, but only on its long, narrow lower jaw.
- The male narwhal has an elongated front tooth that grows out of the left side of its upper jaw.

REPRODUCTION IN WHALES

- Cetaceans are fully aquatic animals; they do not return to the land to breed.
- Fertilization and development are internal. The period of embryonic development, or gestation period, may last from about 11 months in some species to as long as 18 months in the largest whales.
- Whales breed about once every 3 years and usually give birth to one calf at a time.
- Mother whales invest a great deal of parental care in their offspring.

- 
- Whales are born tail-first. So that it will not drown, the newborn whale is pushed by its mother to the surface to get its first breath.
 - The whale nurses her calf for about 6 to 10 months.
 - The milk of whales is rich in protein and fat; this helps the newborn grow fast and add on layers of insulating fat.

Breathing in Whales

- The whale breathes through an opening on the top of its head called the **blowhole**, which is its nose or nostrils.
- As early whales evolved and became more fully aquatic, their nostrils moved from the front (snout) to the top of the head.
- This position is more adaptive for an animal that lives in the water but must surface to breathe
- Toothed whales have one nostril; baleen whales have two nostrils. A whale breathes in air at the surface through its blowhole; the air is then carried to the lungs.

Swimming in Whales

- Whales are powerful swimmers.
- The killer whale, or orca (*Orcinus orca*), is the fastest of all the marine mammals, having been clocked at 55 km per hour.
- Vigorous contractions of its body muscles cause the up-and-down movements of the powerful hind flippers, or **tail flukes**, which propel the animal through the water.

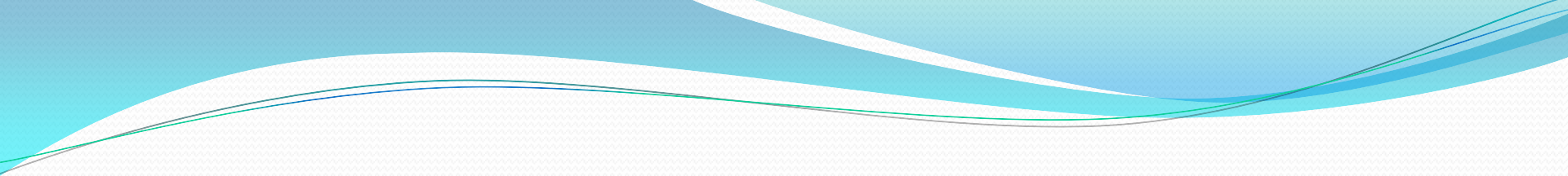
- The dorsal fin, which varies from 2 meters tall in the killer whale to very small in the baleen whales (and nonexistent in the narwhal), is used for staying on course.
- The pectoral fins, which range from the small, stubby flippers of the narwhal to the 5-meter-long winglike flippers of the humpback, are used for steering, braking, and balance.

Whale Migrations

- Whales are great long-distance swimmers.
- whales find their way by locating geological features along the seafloor and by sensing changes in ocean currents, water chemistry, Earth's magnetic field, and the position of the sun.
- Gray whales migrate in a north-south direction, from Alaska to Baja California, then back to Alaska again, a round-trip distance of more than 12,000 km.

COMMUNICATION AND ECHOLOCATION IN WHALES

- Cetaceans have relatively large, well-developed brains and are considered to be very intelligent.
- Dolphins are known to communicate through a series of clicks and other sounds. These sounds are produced in the dolphin's airway and then focused or directed by a fatty bump in its forehead, called the **melon**.
- Dolphins and whales (such as sperm whales) also use sound waves to sense objects

- 
- sound produced by the cetacean is bounced off an object, is called echolocation
 - The most interesting aspects of whale communication is their ability to produce songs.
 - Belugas are known to produce a great variety of sounds when they vocalize.
 - It appears that the singing is done primarily by the breeding males and is related to competition for mates.

SEALS AND OTHER MARINE MAMMALS

- Flesh eating animals, which usually have sharp teeth, are known as **carnivores**. The order of mammals called Carnivora includes both land and aquatic mammals.
- The seal, sea lion, walrus, sea otter, and polar bear are marine mammals that belong to this order.
-
- Animals that eat only vegetation are called **herbivores**. The manatees and dugongs are marine mammals that are herbivores.

SEALS AND SEA LIONS

- To move efficiently through water, another group of marine mammals has paddlelike appendages, or flippers, and a torpedo-shaped body.
- These fin-footed carnivorous marine mammals are classified in the suborder Pinnipedia (meaning “wing-foot” or “feather-foot”), which includes the seals, sea lions (and fur seals), and walruses.
- For pinnipeds’ main sources of food are fish and squid, although some will eat mollusks, crustaceans, or much larger prey.

REPRODUCTION IN PINNIPEDS

- Unlike whales and dolphins, which are fully aquatic and can breed in the water, pinnipeds have to return to land to mate and give birth.
- During the breeding season, pinnipeds swim onto the shore, where they often congregate by the thousands
- Interestingly, seals and sea lions have evolved the ability to delay the development of their embryos, so that the birth of their single offspring occurs exactly 12 months after mating—when they come ashore again to breed.

THE WALRUS

- The walrus (*Odobenus rosmarus*) inhabits the frigid Arctic and sub- Arctic waters.
- The tusks are overly developed canines that are used for digging up mollusks from the seafloor and for hauling the walrus up onto the ice.
- Tusks are found in both male and female walruses. In males, the tusks are longer and are used to establish dominance.
- They can dive more than 90 meters deep to find their food

Adaptations of Pinnipeds

- Recent research has shown that, like whales, pinnipeds communicate with one another by using a variety of sounds.
- It is possible that pinnipeds also use echolocation, since the sounds they produce are similar to those of the whales
- Pinnipeds also have the ability to dive to great depths in search of food
- All pinnipeds have a layer of blubber that insulates against the cold air and water

THE SEA OTTER

- Sea otters are closely related to the land-dwelling weasels and minks.
- They are the smallest of the marine mammals, growing to only about a meter in length.
- The three main populations live in the Pacific—along the coasts of California, Alaska and
- Sea otters are commonly found in the giant kelp forests along the rocky California coast.

- Kelp is the huge seaweed that grows from the seafloor to the ocean surface. As they float at the surface, sea otters hold onto the kelp, often wrapping it over their bodies to help anchor themselves in the choppy water.
- With their webbed hind feet, flattened tail, and streamlined body, sea otters are efficient swimmers and divers.
- On a typical dive, a sea otter swims to the bottom, locates a mussel, crab, abalone, or sea urchin, and returns to the surface where it rolls over to float on its back.

- The otters also eat fish and snails that live on the kelp
- By eating snails and sea urchins, which graze on the kelp, sea otters help to maintain and promote growth of the seaweed—a great benefit to the kelp harvesting industry.
- Sea otters spend most of their time in the ocean—they eat, sleep, mate, and rear their young in the water

Threats to Sea Otters

- Oil spills from tankers are particularly devastating to sea otters because the oil coats their fur, which the animals then cannot clean and groom.
- The otters quickly freeze due to the loss of insulation.
- Sea otters are also at risk of predation by great white sharks and killer whales
- River otters, which are closely related to sea otters, need protection too.
- Their numbers are dwindling due to loss of habitat, pollution, and the hunting of them for their fur.

Manatees and Dugongs

- A docile marine mammal, the **manatee** (*Trichechus manatus*) lives in the warm, shallow waters of Florida.
- The manatee lives underwater, feeding on vegetation that grows in the rivers and waters along Florida's Gulf
- About every 15 minutes, the manatee surfaces for a breath of air and then quickly submerges.
- The manatee moves slowly through the water, propelled by a gentle up-and-down movement of its wide, paddlelike tail

- Along with the **dugong** (*Dugong dugong*), which is its close relative, the manatee is classified in the order of mammals called Sirenia.
- The manatee uses its large upper lip, called a prehensile (meaning “handlike”) lip, to grasp vegetation .
- Dugongs are found in the tropical Pacific and off the east coast of Africa.
- Both manatees and dugongs have a cylindrical body shape similar to that of the pinnipeds.

Threats to Manatees

- Manatees and dugongs are endangered species, vulnerable to hunting, loss of habitat, and pollution.
- Unrestricted use of powerboats and continued development along Florida's coastal waterways are both responsible for a decline in the manatee population.
- The impact of the hulls can kill them; and propeller blades cause deep wounds in the backs of the animals, either killing them directly or causing them to die from infection.
- Certain areas have been designated as manatee sanctuaries to help ensure their survival.

THE POLAR BEAR

- The marine mammal that is the most terrestrial is the polar bear (*Ursus maritimus*), which lives on ice floes and along the shore in the North Polar region
- Its dense fur and thick layer of blubber keep out the Arctic cold and retain body heat.
- The polar bear uses its powerful forelimbs to paddle from one ice floe to another.
- Polar bears also wait at a hole in the ice to seize a seal when it comes up for a breath of air.
- Depending on the season, polar bears will also eat fish, birds, and plants.

THE DIVING RESPONSE

- Many marine mammals have adaptations for diving deeply in pursuit of food.
- Marine mammals that dive very deep, such as whales, may need to hold their breath for as long as one-and-a-half hours.
- Diving marine mammals, such as whales and seals, can dive to great depths on a single breath, because they have adaptations that increase the oxygen-carrying capacity of their bodies.
- These structures and behaviours make possible a group of responses that are collectively called the **diving response** (or diving reflex).

OTHER DIVING RESPONSE ADAPTATIONS

- Another part of the diving response is the ability of marine mammals to inhale and exhale quickly, and nearly completely, between dives.
- Elastic tissue in their lungs and chest permits greater expansion during inhalation.
- The recoil action of elastic tissue in the lungs (along with the push of powerful chest muscles) allows the lungs to empty more quickly during exhalation.
- Perhaps most important, diving mammals have a higher blood volume and a greater concentration of oxygen-binding red blood cells than nondiving mammals

- The protein molecule haemoglobin, which is present in red blood cells, holds onto the oxygen.
- Diving mammals also possess another oxygen-binding protein, called **myoglobin**, which is located in their muscles.
- Together, the haemoglobin and myoglobin increase the oxygen-carrying capacity of their bodies during a dive.
- Another important component of the diving response in marine mammals is **bradycardia**, the ability to slow the heart rate.