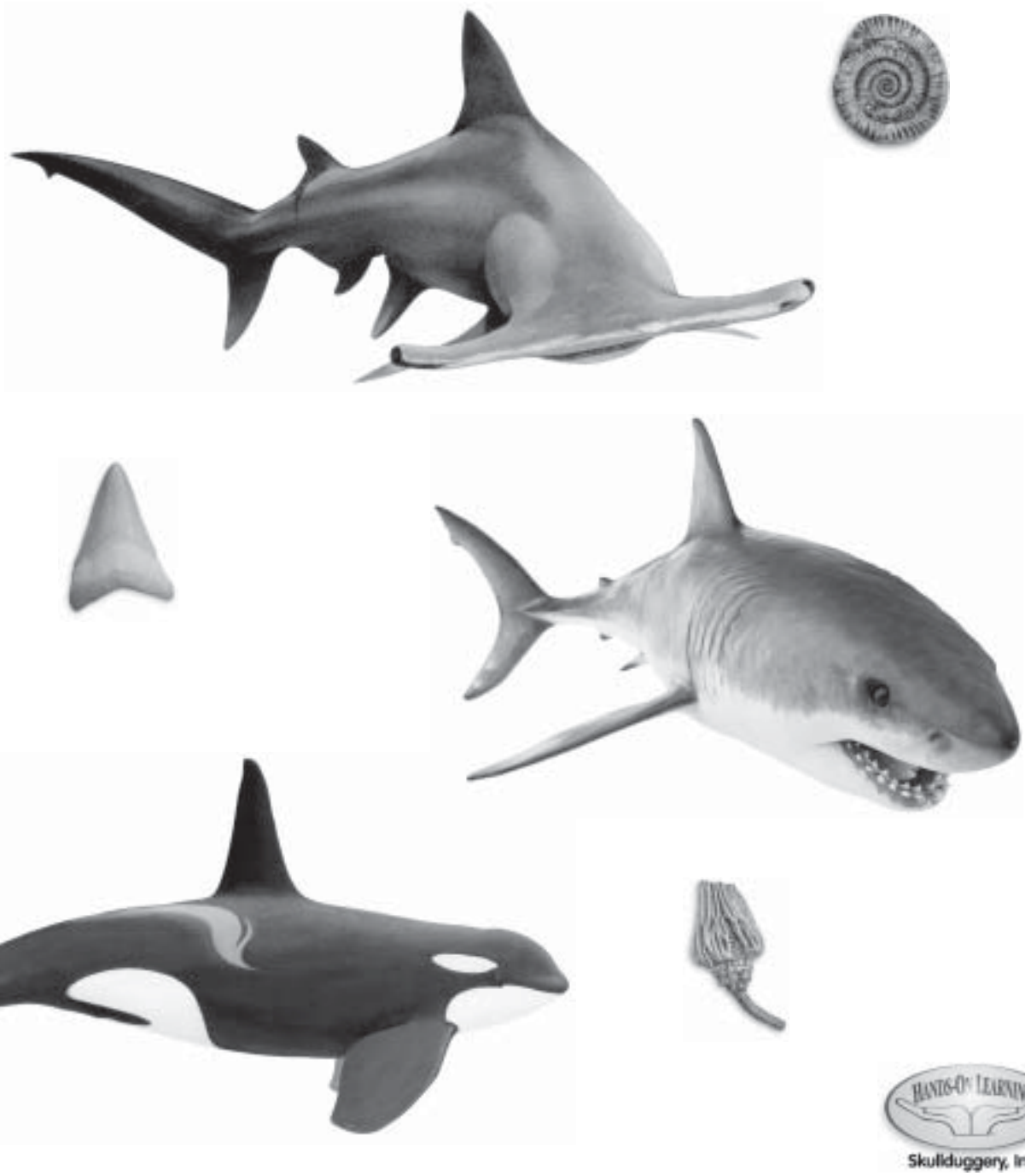
OCEAN LIFE

Lesson Plan



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OCEAN LIFE

OBJECTIVE

Ocean Life takes students on an interactive journey into the fascinating world of underwater creatures - **past and present**. Students will be able to cast marine fossil replicas, the bodies of three sharks and three shark teeth, and the bodies of three whales and one whale tooth. After casting and finishing, magnets can be attached for the purpose of display.

PAST

The kit provides students the opportunity to create casts of four marine fossils. Students will learn about fossil exploration and identification. They will learn how sea creatures become fossilized. The fossil replica casts will be used to give students a close look at the beauty and importance of fossils. The exciting activities in this kit will help foster awareness and appreciation of the Earth's history.

Upon completion of this activity, students should be able to (1) understand the basics of fossil formation; (2) grasp the importance of fossils to scientists; and (3) identify four important fossils and understand some of their basic anatomy.

PRESENT

Students will learn many fascinating facts about sharks, whales and the ocean in which these amazing creatures live. They will cast and paint the bodies and teeth of three different species of sharks and three species of whales. They will learn about ocean life as well as the biology and behavior that is known about sharks and whales. Not only will students learn about sharks and whales in general, but they will learn specifically about Great White, Thresher, and Hammerhead sharks, as well as Blue, Orca and Sperm whales!

Upon completion of this activity, students should be able to (1) begin to understand the underwater world of sharks and whales; (2) identify three very unique sharks and three whales; and (3) identify the teeth from three sharks and one whale.

For further information about ocean life, past and present, read Eyewitness *FOSSIL*, *SHARK*, and *WHALE*. These books with their colorful and detailed photographs give the reader many interesting facts on a wide variety of marine fossils and ocean life.

MATERIALS PROVIDED

- Information about crinoids, ammonites, trilobites, an ancient shark tooth and the process by which they became fossilized.
- Information about the underwater world of whales and sharks.
- Reference diagram for identifying the parts of the whale's anatomy.
- Reference diagram for identifying the parts of the shark's anatomy.
- Casting (PerfectCast) material to make at least 24 items.
- 5 mold trays - 1 tray with four fossils; 2 trays with three sharks and three teeth; 2 trays for three whales and one whale tooth.

- Instructions explaining how to use the mold trays.
- Paints and paint brushs to finish fossils, whales and sharks.
- Glue to attach castings to a surface of your choice.
- Bibliography.

PerfectCast is available from your local retailer to make additional castings.

MATERIALS NEEDED

- Disposable containers to mix PerfectCast. A can or paper cup will work nicely.
- Mixing utensils.
- Background.

SUGGESTIONS FOR CLASSROOM USE

1. Divide the class into two groups. One group will be paleontologists and the other group will be marine biologists.
2. Make copies of the information about fossils, whales and sharks; distribute to the respective groups.

GROUP I - PALEONTOLOGISTS

A. Hand out copies of the "Casting Instructions".

B. To make the fossil replicas, students should divide into three groups. The first group will cast the fossils, the second group will finish the fossils and the third group will cut and attach the magnets for display. Copies of instruction should be distributed accordingly.

C. Upon completion of the replicas, the students should read the information about marine fossils in general and the individual fossils. As a group they can prepare an oral report to give to the "marine biologist" about fossils and in particular marine fossils. They can divide into a group to organize and present the general fossil material, and four groups to organize and present the information about the individual fossils. In addition to the finished replicas, the students could draw pictures of what the creature looked like when it was living.

GROUP II - MARINE BIOLOGISTS

A. Hand out copies of the "Casting Instructions".

B. To make sharks, whales and teeth, students should divide into three groups. The first group will cast, the second group will finish, and the third group will cut and attach the magnets for display. Copies of instruction should be distributed accordingly.

C. Upon completion of the sharks, whales and teeth, the students should read the information about sharks and whales in general, and the individual species. As a group they can prepare an oral report to give to the "paleontologists" about sharks and whales. They can divide into a group to organize and present the general shark and whale material, and six groups to organize and present the information about the individual species and their teeth.

Adult supervision suggested

CASTING INSTRUCTIONS

Some mold trays hold more casting material than others, but on average, there is enough casting material to cast 12 trays (at least 24 items depending on which trays are used). Mix at least 1/12 of the casting material for each tray.

Find an area with a flat, level, stable working surface, such as a counter-top, desktop or table. Make sure the surface is waterproof; some excess water may spill out of your container. Use a disposable container to mix the PerfectCast and water.

1. Place the mold tray on a flat, stable surface.
2. In a disposable container, mix PerfectCast using a ratio (by volume) of 1 part cold water to 3 parts PerfectCast. *See tip below for suggestion on estimating the amount of PerfectCast to use for your cast. **
3. Stir the PerfectCast/water mixture with a spoon or mixing stick until it is evenly mixed (about 1½ minutes). Tap the container on the table several times to remove air bubbles. There should be no lumps.
4. Pour the PerfectCast mixture into the mold.

WARNING: Do not pour excess material into the drain or toilet bowl. Dispose of excess materials in the garbage.

5. Let PerfectCast set for 30 to 40 minutes. If the object is delicate, allow at least one hour before demolding.
6. After the mixture hardens, carefully press each part out of the mold. If a section should break, use glue to repair it or cast additional sections.
7. Let casts dry for 2 hours before painting. Consult color suggestions listed later in this brochure for painting the casts. Separate the paint pots from each other with scissors before painting. Experiment with mixing paints on a palette or other surface to create the desirable colors. Adding a small amount of water to the paint will thin it for easier application as well as insure enough volume to cover the complete item.
8. Glue the fossils, sharks and whales on the surface of your choice.

* Tip: How to measure the volume of the objects to be cast.

If you have purchased additional PerfectCast or don't want to mix all the PerfectCast included in your kit, follow the instructions below to determine how much PerfectCast to mix.

Fill all the cavities you intend to cast with water and pour into a measuring cup. This is the total volume of the finished casts.

For each fluid ounce needed, mix 1½ fluid ounces of PerfectCast and ½ fluid ounce of water. The mixture should have a consistency like a milkshake.

WARNING: Don't place hand in casting material while it is hardening. Don't pour excess material into drain or toilet bowl. Dispose of excess material in garbage.

INFORMATION ABOUT FOSSILS

What is a fossil? A fossil is any trace of a once-living organism preserved in rock; a relic of the Earth's past. Much of what we know of our planet's history comes from fossilized plants and animals, some of which may be 600 million years old or even older. The tooth of an extinct bear, the claw of a dinosaur, and a flower from a prehistoric plant preserved in amber are all fossils.

When living things die, their bodies usually decompose in a short time. But sometimes a plant or animal's body parts become buried out of reach of the factors that cause disintegration. Then they are transformed into a durable, rocklike substance that survives for millions of years. This is how fossils form. Generally, a living creature's soft parts do not fossilize; only the harder, more durable parts are preserved. So you are more likely to see the skeleton or teeth of an animal in fossil form rather than the muscles, internal organs, or skin.

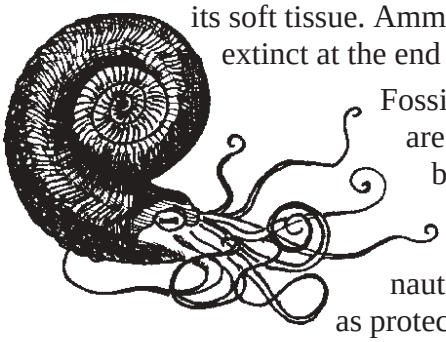
Animal fossils are divided into two basic groups: invertebrates and vertebrates. The invertebrate category consists of animals with no internal spinal column or backbone. Some animals from this category are worms, snails, coral, insects, and shellfish. The vertebrate category, on the other hand, consists of animals with an internal spinal column. These are considered to be more advanced than the invertebrates. Fish, reptiles, birds, and mammals are considered to be vertebrates. Because vertebrates have a rigid internal skeleton, fossilized remains have been found for many specimens.

Scientists who study fossils are known as paleontologists. Over the past two or three centuries, they have learned much about the Earth's past by studying fossils. For example, they often find fossils of sea creatures in rocks that today are on dry land, far from any bodies of water. Sometimes such fossils occur high up on mountain slopes. This tells paleontologists that millions of years ago, what is now dry land and mountains was once water—perhaps beneath a river delta, or the bottom of a lake or sea.

Studying fossils from different places around the world, paleontologists have also helped to confirm that the Earth's continents slowly change their positions over millions of years. Fossils also teach us that the plants and animals of Earth's past were different from those we see around us today. We have learned from fossils that there were once dinosaurs alive on Earth, how long ago sabertooth cats lived, and when humans first appeared on Earth. There are no written words or photographs to record these things; we know about them from studying fossils. It is amazing what fossils can teach us!

AMMONITE

Ammonites were ancient marine mollusks belonging to the cephalopod class. They were related to today's squid and octopus. Each ammonite produced a hard, multichambered shell to protect its soft tissue. Ammonites existed on Earth for about 330 million years, becoming extinct at the end of the Cretaceous Period, 65 million years ago.

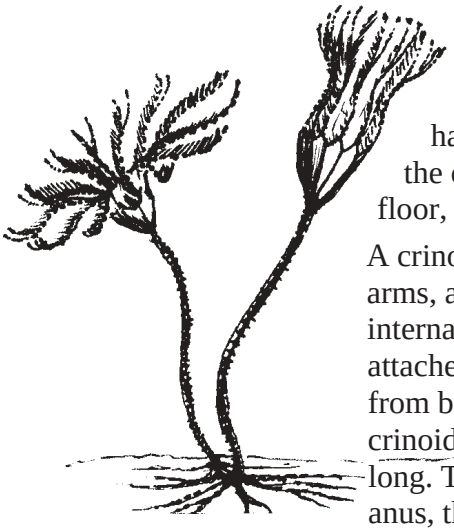


Fossil ammonite shells are common in North America. Such shells are virtually the only ammonite remains available for study; soft body parts are very rarely preserved. Scientists study how an ammonite might have lived by examining its closest living relative, the hard-shelled chambered nautilus. Like the nautilus, ammonites probably used their shell for flotation as well as protection, becoming buoyant by replacing fluid inside the shell's chambers with gas. This enabled them to maneuver through ocean waters.

Because they are plentiful and occur in great variety, ammonites help paleontologists to date the Earth's rocks. When the same kinds of ammonites are found in rocks at different places, we know that those rocks were created at about the same time, millions of years ago, regardless of how far apart the places might be.

CRINOID

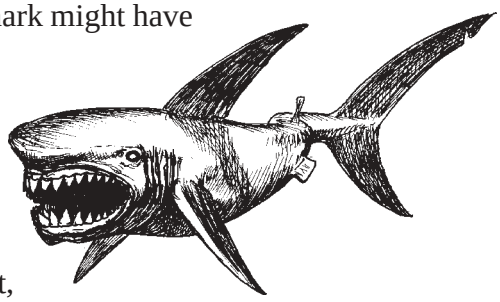
Crinoids are flowerlike marine animals belonging to the Echinodermata phylum (primary division of classification). Fossil crinoids are abundant at various sites around North America . Crinoids lived from the late Paleozoic Era (345 million years ago) to the present. Crinoids varied greatly in size and shape and may have been beautifully colored. Although most species lived on the ocean bottom, attaching themselves to material on the sea floor, some ancient forms were able to crawl or swim.



A crinoid, or "sea lily," is made up of a root, a stem, a body, and arms, and looks very much like an ocean flower. It possesses no internal spinal cord and is considered an invertebrate. The root attaches to an object on the sea floor and helps to keep the crinoid from being moved. The stem is generally the longest part of the crinoid; fossil crinoids have been found with stems up to 50 feet long. The body contains the vital organs, including the mouth, the anus, the gonads, the podia, and the water inlet. The arms, or tentacles, spread like an opening flower to catch passing food. . Crinoids resisted extinction since their appearance more than 500 million years ago

SHARK

Shark skeletons are made of cartilage, not bone, so they usually decompose before burial and leave nothing behind for fossilization. But shark teeth are bone, not cartilage, and great numbers of these litter the fossil record. Sharks generally have triangular, serrated (saw-like) teeth set in numerous rows. As they wear out, the teeth in the front row fall out and another row of new, razor-sharp teeth takes their place from behind. A single shark might have generated many fossil teeth.



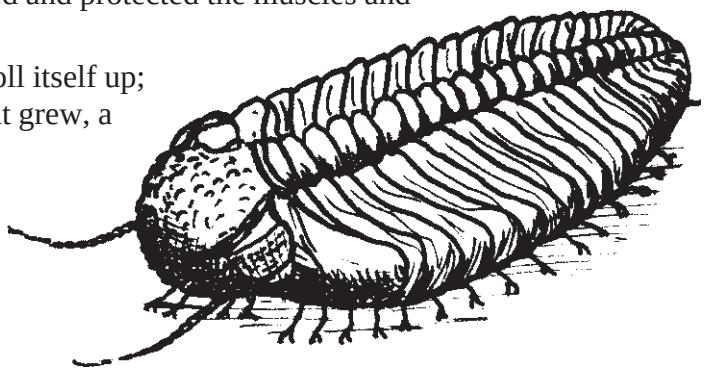
The largest shark teeth, up to 7 inches long, belong to the species *Carcharodon megalodon*. Almost everything we know about *Carcharodon megalodon* is derived from these huge fossilized teeth. This shark would have dwarfed its smaller relative, the dreaded great white shark of today. Once thought to have reached a length of more than 80 feet, this warm-water monster would have been 3 or 4 times the size of a great white. But more recent estimates make it only about half this size—still a very formidable marine predator. The shark is a member of the vertebrate family.

TRILOBITE

Trilobites were ancient sea creatures that roamed the ocean's depths from the beginning of the Cambrian Period (570 million years ago) to the end of the Permian Period (245 million years

ago). They belong to the most abundant and diverse phylum of all time, Arthropoda. Among the arthropods that exist today are insects, lobsters, crabs, spiders, and scorpions.

The word “trilobite” reminds us that the trilobite body was divided longitudinally into three lobes: the axial lobe down the middle and two pleural lobes on either side. The front of the trilobite is called the cephalon, or head; the rear is called the pygidium, or tail; and in between lies the thorax, or chest, to which its numerous legs were attached. An exoskeleton, or skeletal shell, covered the entire body and supported and protected the muscles and internal organs.



To protect its underside, a trilobite could roll itself up; many are found fossilized in this state. As it grew, a trilobite shed its exoskeleton many times. Thus, a single trilobite could have left many such exoskeletons behind for fossilization.

Trilobites were among the earliest life forms to possess vision. A trilobite usually had two crescent-shaped eyes that gave it a 360-degree visual field on the ocean floor. The amazing preservation of the eyes in some specimens has enabled scientists to dissect these ancient sensory organs and study their structure.

Trilobites existed for more than 300 million years, during which time they evolved into over 10,000 species. Their fossils come in a multitude of interesting shapes and sizes, from the tiny *Shumardia,* less than a quarter of an inch long, to the giant *Uralichas,* more than 28 inches long. Some were spiny and rough, while others were almost perfectly smooth.

AMMONITE COLOR SUGGESTION

Reddish brown with black in crevices.

CRINOID COLOR SUGGESTION

Green to gray with black in crevices.

SHARK TOOTH COLOR SUGGESTION

Beige to brown. The root of the tooth is generally darker in fossilized teeth.

TRILOBITE COLOR SUGGESTION

Black with gray matrix (stone base).

SHARK

The fossil record suggests that sharks are among the oldest of vertebrates (animals with backbones). Their ancestors can be traced back at least 300 million years. There were sharks on earth even before the dinosaurs!

Although there are many differences between the various species, sharks have many characteristics in common. Very often the first thing people think about when it comes to sharks is their teeth. Sharks shed thousands of teeth in their lifetime. When the teeth become worn or break off, new ones from the row behind replace them.

Sharks can see, hear, taste, smell and feel. They also have an additional sense that allows them to detect weak electrical voltages. Sharks have small sensory pores located in the snout called *ampullae of Lorenzini*. These pores help them navigate the oceans during long-distance migration. This sense also helps them locate nearby prey.

Sharks have a strong sense of smell. Although they don't breathe through their noses, they can detect odors in the water such as chemicals and blood. Sharks are able to obtain oxygen from the water with the use of gills. The water flows though the shark's mouth and passes over the gills, where oxygen is absorbed into the blood stream. The water, along with carbon dioxide, is expelled through the gill slits. Most sharks have five gill slits, but some species have six or seven.

The skin of a shark is rough, like the texture of sandpaper. It consists of tiny toothlike projections called dermal denticles. As the shark grows larger, the denticles are shed and are replaced by larger ones.

The typical shark has a streamlined body, a long snout, pectoral (side), and dorsal (top) fins, and a tail. Its cylindrical body, fins and tail are streamlined for swimming with ease. The tail propels the shark through the water by moving it from side to side. The pectoral fins, similar to an airplane's wing, provide lift to keep the shark from sinking and when tilted can also act as brakes. The dorsal fin keeps the shark from rolling.

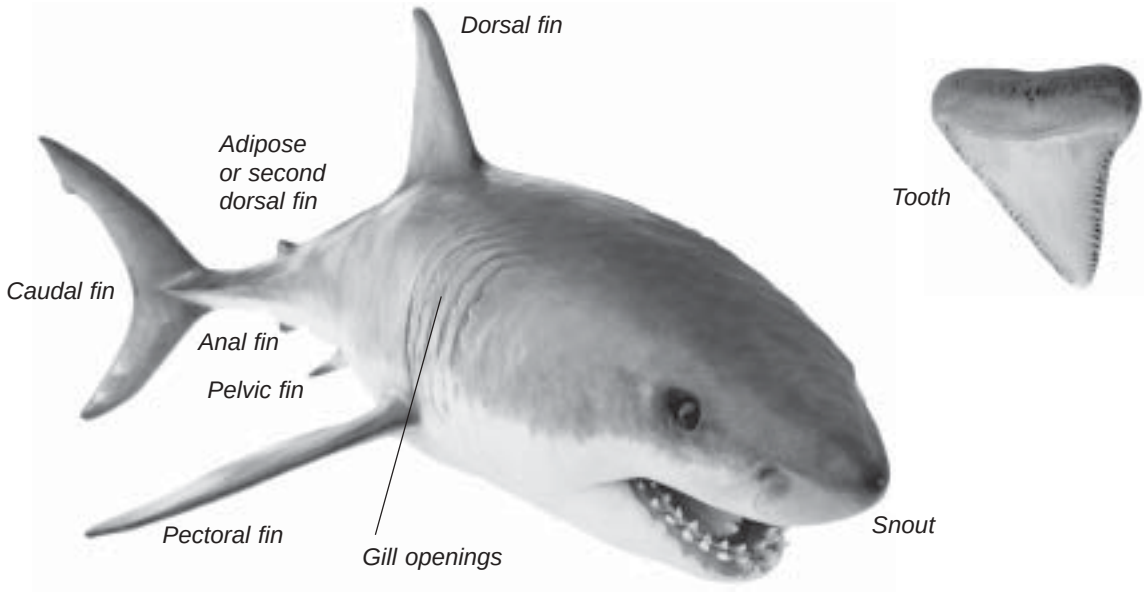
A shark's body is designed to be lighter in water to keep it from sinking to the bottom of the ocean. To maintain buoyancy and keep it from sinking, the shark has an oil-rich bladder that reduces its weight in water. It also has a lightweight skeletal system. Its skeleton is made up of cartilage, which is much lighter and more flexible than bone.

At present, there are over 375 species of sharks living in the oceans of the world. While all sharks have some characteristics in common, every species has its own unique physical and behavioral features. Some species of sharks grow to be only 8 inches (0.2 meters) long (lantern shark) while others are as large as 40 feet (12.1 meters) (whale shark). Approximately 40% of species have a different body form than the "typical" shark. Some sharks have long tail fins; while others have short fins. Some sharks have anal fins; others don't. Some sharks are flat and wide; others are long and narrow. Some sharks have two dorsal fins; others have only one. These species have

become specialized, their bodies have adapted to their individual ways of life.

Three interesting and diverse sharks are the great white, the hammerhead, and the thresher shark.

GREAT WHITE SHARK



The Great White Shark is probably the most notorious shark of all the species. The hit movie "Jaws" gave the general public the impression that the huge shark purposely stalked human beings. Tales of the monster from the deep have filled newspapers around the world describing the occasional shark attack with all its gruesome details. This giant creature may have been wrongly accused of being one of man's aquatic predators. It probably can't tell the difference between one of its regular meals (seals) and a person who might be in the water. If its hungry, it will try to eat anything that appears in front of it.

The Great White is a member of the *Lamnidae* family. Sharks in the *Lamnidae* family are also known as Mackerel sharks. These sharks are among the few species of warm-blooded sharks. Warm-blooded sharks are able to maintain a body temperature higher than the surrounding waters. Being warm blooded is important to a predator that has to rely on speed to catch its prey. It has a highly efficient predatory life-style. Its body design is almost perfectly hydrodynamic, built for speed and strength. It has a long conical snout and a large mouth with triangular shaped teeth. The teeth are serrated (edged like a saw) and are best suited to grab, cut, and tear prey that is too large to swallow whole.

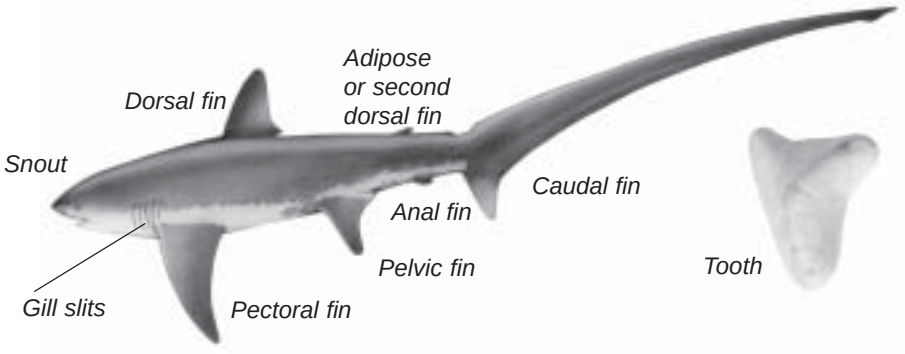
The great white has large gill slits located directly in front of the pectoral fins. It has very strong caudal keels. The Great White's tail or caudal fin is relatively short and nearly symmetrical. The shark relies on its tail for both low speed cruising and high-speed dashes after fast moving prey.

An adult Great White can grow as large as 23 feet (7 meters) long and can weigh as much as 3000 pounds. This gigantic shark needs a great deal of food to survive. It hunts in the open seas, primarily offshore, searching for anything and everything to eat. Its diet consists mainly of seals, sea lions, sea turtles, birds, and the occasional unfortunate human being who happens to be in the water. The shark's finely tuned sensors (*ampullae of Lorenzini*), located on his snout, lead him to

a potential meal. The Great White is one of the few sharks that can stick its head out of the water before and sometime during an attack on its prey. After taking a large tearing bite of flesh, the shark will wait while its prey bleeds to death nearby. Upon consuming an entire carcass, a great white can last two months before needing another one.

The Great White shark can be found in open ocean waters as well as near the coastline. It swims in both warm and cold water. This giant shark roams a large area from the surface, inter-tidal, surf line, and enclosed bays, to a depth of 4,000 ft.

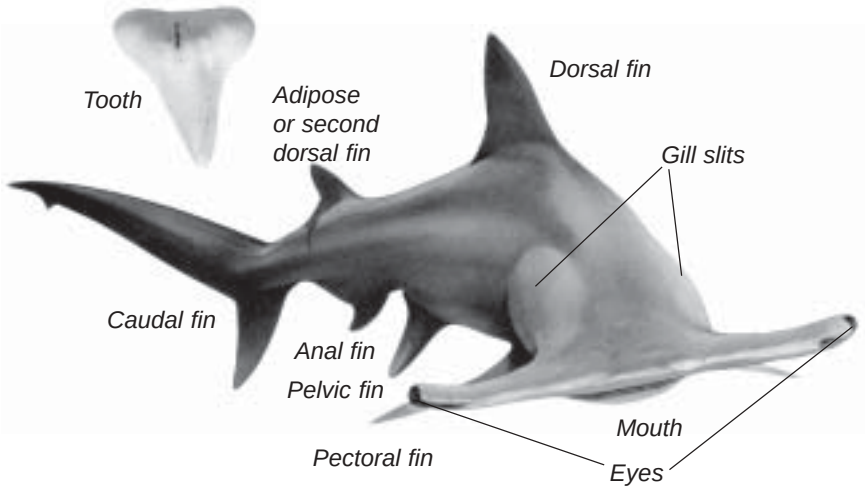
THRESHER SHARK



The Thresher shark is a member of the *Alopiidea* family. Like the Great White, it is warm-blooded. The thresher can grow to be 20 feet (8.7 meters) long. Its unique feature is its gigantic caudal, or tail fin. This caudal fin is as long as its body! The thresher's tail is its principal means of obtaining food. Its jaws and teeth are relatively weak, making it difficult for the shark to catch its prey. A thresher has been seen lashing a fish again and again with its tail to stun it so it could be swallowed. It is the only shark known to use its tail in this way. Threshers are powerful swimmers and can jump completely out of the water. Because of their power and jumping abilities, recreational fishermen consider thresher sharks prized catches.

The thresher has large eyes, a short conical snout, and a small mouth with small blade-like teeth. It lives in temperate and tropical waters. The thresher is considered an active swimmer, following the water currents as the temperature changes. In the winter it tends to be closer to the equator. It can be found swimming in open waters as well as near the coast. Thresher sharks swim near the bottom as deep as 1600 feet (484.4 meters). They feast on small fish, bottom-schooling fish and squid, octopuses, and crustaceans.

HAMMERHEAD SHARK



The hammerhead, one of the most unusual looking sharks is a member of the *Sphyrnidea* family. There are nine different species of hammerhead. They are easily identified when seen from above or below the surface of the water. By their expanded and flattened head which has the appearance of a hammer. Their eyes are located on the tips of either side of the head. It is thought that the shape of the head aids the sharks maneuverability and sensory capabilities. By moving the head it can quickly turn, dive, and ascend. As it swims, it moves its head from side to side to get a wide view of its surroundings. The hammerhead is always looking for a good meal and with the help of the many sensors on its snout (*ampullae of Lorenzini*) it finds its prey. Also located on the snout are the organs that detect scent. It is believed that hammerheads use the sensory organs on their head to navigate over long distances at sea. They may actually be able to detect the Earth's magnetic field to accomplish this.

Although there have been few reported attacks on humans, hammerheads are on a list of extremely dangerous sharks. Most attacks occurred in shallow water when the sharks are hunting for food. They swim in warm temperate and tropical waters. Hammerheads are very active swimmers and follow the warm water currents. They can be found in coastal and offshore and insular waters. Hammerhead sharks feed on bony fish, squid, crustaceans, and stingrays. They are apparently immune to the poison in the stingray's sting.

GREAT WHITE COLOR SUGGESTION

Slate brown to black on back. White to gray on bottom. Teeth are creamy white.

THRESHER COLOR SUGGESTION

Gray to dark gray on back. White to gray on bottom. Teeth are creamy white.

HAMMERHEAD COLOR SUGGESTION

Ash-gray on back. White to gray on bottom. Teeth are creamy white.

WHALE

Whales are among the world's largest mammals. These large marine mammals can be found in every ocean of the world. Whales are not easily studied. Because many whales live "over' the deepest, darkest parts of the ocean and occasionally dive into them, humans have had a difficult time gathering information about many aspects of their life at sea. Scientists have been able to study whales that are kept in aquariums. Studying whales in captivity has been invaluable to our understanding of them in the wild. We have learned much about whale physiology; gas absorption, heat exchange, vision and sonar, all of which could not have been obtained from the wild. This knowledge has been used hand in hand with wild studies and has allowed us to understand how whales accomplish the incredible things they do.

Whales can be divided into two groups: toothed whales and baleen whales. The toothed whales are comprised of 66 generally recognized species. Included in this group are dolphins, porpoises, giant sperm whales, and other whales of intermediate size. All toothed whales have teeth and a single external nostril, or blowhole. As the whales swim on the surface of the water they breathe in air through their blowholes. These whales use their teeth primarily to catch their prey. Most toothed whales swallow their prey whole, without chewing. Some scientists believe that many toothed whales "catch" their prey by making a sound that stuns them. Some whales are deep divers and feed on bottom-dwelling prey. Other whales living in open ocean waters feed on prey found living closer to the surface.

Toothed whales make clicking sounds that are produced by a special organ in their head. Scientists believe that this clicking sound is a form of communication between whales and also acts as a sonar-type device to find food. In addition to the clicking sounds, some toothed whales make other noises, one of which is a whistling sound. Orca and dolphins whistle and make stereotypic "calls." These calls are believed to be used for communication, not echolocation. Clicks seem to be used to find and evaluate prey and the environment.

The second group of whales is the baleen whale. Instead of teeth, these whales have baleen plates. These plates are like huge fringed brushes that hang down from the upper jaw inside the mouth. These baleen plates act as sieve-like food-gathering structures. Baleen whales take huge amounts of water into their mouths, bringing with it many small fish and other backboneless organisms called krill. Large baleen whales have a series of folds on the undersides of the throat. These

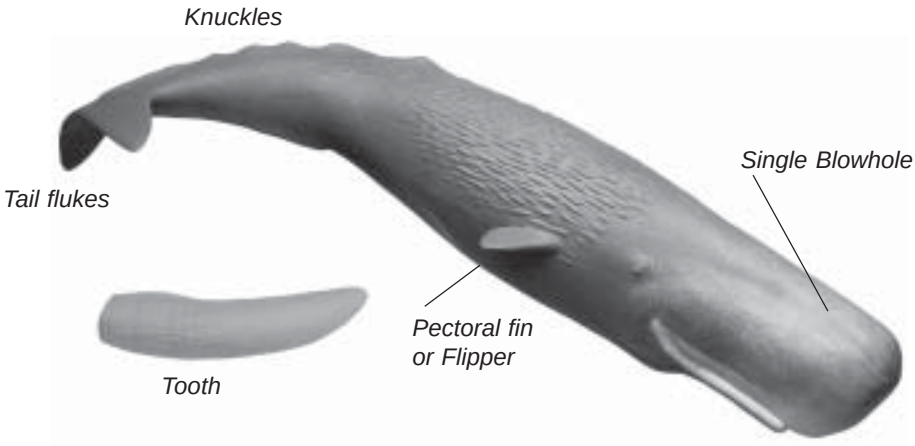
stretchable pleats of skin expand to hold this enormous amount of water. The whale then uses its tongue to forcefully expel the water. The baleen plates act as a filter, keeping the small fish from flowing out of the mouth with the water.

Baleens consume enormous amounts of small prey with every mouthful. They migrate to and from feeding grounds or areas where there are huge schools of small fish and invertebrate organisms. Because these small organisms are present in the upper layers of the ocean, baleen whales tend to travel mainly in the top 300 feet of the water. These whales have two blowholes and most of them have a dorsal fin (the fin on top of the whale).

Unlike fish, whales cannot breathe under water. They must surface to breathe through their blowholes.

Both groups of these giant marine mammals must maintain their warm body temperature in the frigid waters of the seas. The whales have developed an insulating layer of blubber. In some whales the blubber can be a foot or more thick. These enormous mammals have a surprisingly lightweight skeletal system. The bones are soft and filled with oil. Because the water supports much of the weight of the whale, its skeleton is not needed to support its weight. The skeleton acts more like a frame for the muscles.

SPERM WHALE



The Sperm whale is a magnificent whale! The first thing one notices about this gigantic whale is the huge boxlike head. This rectangular-shaped head is 1/3 the size of the body. This whale has one of the largest brains of any creature on earth. Its forehead contains an unusual organ called a spermaceti organ, a complex mass of oil-filled connective tissue and sacs. Scientists are not certain what purpose it serves. Some experts believe the sac in the head of sperm whales is used to control buoyancy and is therefore used in diving. Some think the sperm whale may also use the spermaceti organ to produce the clicking sound used to echolocate (process of determining location by echos of sonar waves) and communicate with other whales. No one has been able to devise a safe method of testing these whales to learn the purpose of this unusual organ.

The average sperm whale is about 50 feet (15 meters) long and can weigh up to 58 tons! The lower jaw of the sperm whale reaches 15 feet (4.5 meters) in length. The sperm whale is an *Odonticeti* or toothed whale. Its mouth contains about 25 conical teeth on each side of the lower jaw. These teeth fit into corresponding sockets in the upper jaw. There are no visible teeth in the upper jaw. A sperm whale's diet consists primarily of squid.

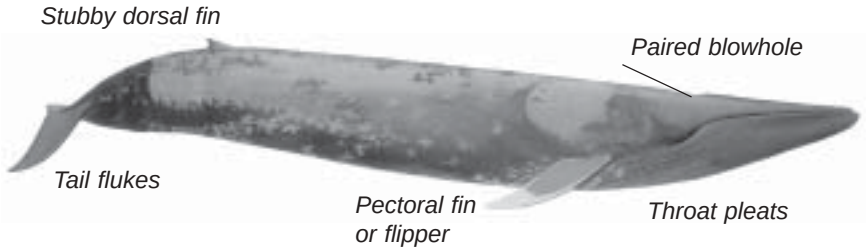
The sperm whale breathes through a single blowhole located near the left front of the head. These whales can be identified by the unique spout that shoots from the blowhole. The sperm whales spout blows forward into the air at a 45-degree angle.

The skin is dark brown to dark gray on the top portion of the Sperm whales body. The belly area and underside of the mouth is often light gray to white. The skin is rippled over much of its body. Sperm whales have no dorsal fin. They have an angular hump on the back, followed by a series of large, low knuckles extending down toward the tail. The flippers, located behind the head on both sides of the body, are oval shaped and relatively small compared to their gigantic body. The tail of the sperm whale is thick, broad and triangular in shape. It has a notch in the center. In a large sperm whale, the width of the two flukes, or tail fins, could measure as large as 13 feet (4 meters).

Sperm whales can dive to depths of over 3,000 ft. (909 meters) and remain under water for over an hour. Before a lengthy dive, a sperm whale will remain on the surface for about 10 minutes, blowing every 10 to 30 seconds, then raising its flukes high out of the water to begin another dive. Sperm whales attack, catch, and eat the largest of all deep-sea invertebrate creatures, the giant squid. Giant squid reach 58 feet (17.5 meters) in length.

Sperm whales are found in all oceans except the polar ice fields. It has been suggested that their migrations are determined by the water temperature and the abundance of squid.

BLUE WHALE



The blue whale is, as its name implies, blue-grey in color, with gray mottling. It is believed to be the largest animal to have ever lived. The average blue whale grows 70 to 85 feet (21.2 to 25.7 meters) long and can weigh from 90 to 125 tons! The body of a blue whale is long and cylindrical. For such a large whale, it has a small dorsal fin, about 13 inches high. The fin is located three-quarters of the way back from the head. The flippers are narrow, long and slender; they can be 10 feet (3 meters) long. The tail is relatively small for the huge body; it can be 15 feet (4.5 meters) from tip to tip.

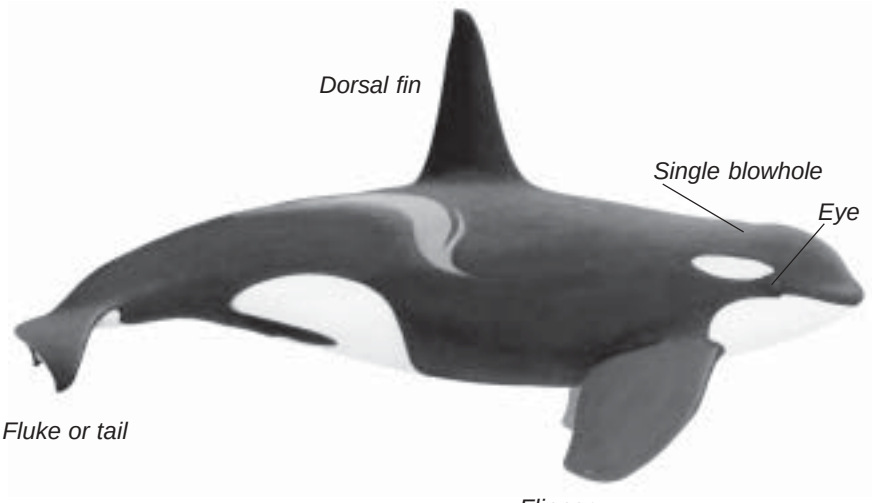
The blue whale has a giant heart about the size of a small car. Its stomach is large enough to hold over 2 tons of krill (shrimp-like crustaceans). A full-size blue whale must eat 2 tons of food a day to maintain its weight. Blue whales can dive to at least 350 feet (106 meters) to find food.

The blue whale is a baleen whale. It has 300 baleen plates on each side of the upper jaw. The plates are usually black. It has more than 40 pleats in the underside of its throat. Like all baleen whales, the blue whale has two blowholes.

Blue whales live in all oceans of the world. Blue whales living above the equator migrate north to feed in the summer, and south in the winter. Whales that live south of the equator migrate south in the summer and north in the winter.

Through complete protection over the last 22 years, the blue whale's population now appears to be increasing.

KILLER WHALE



Killer or orca whales are the largest of the dolphin-like whales and are probably the best known of all whales. There are quite a few orcas in captivity. They can be seen performing in aquatic theme parks around the country. They can be trained to do acrobatic tricks, but it is rare to see them do the things they are trained to do in captivity out in the wild.

Killer whales have large, powerful bodies. The average male can grow 25 to 29 feet (7.5 to 8.7 meters) long from snout to tail and can weigh up to 14 tons. Its head has a single blowhole and a broad, rounded snout and is relatively small for its body. It has an amazingly large dorsal fin for its body; about 6 feet (1.8 meters) high. Orcas have large, paddle-like flippers sometimes measuring 6 feet (1.8 meters) long and 4 feet (1.2 meters) wide. The tail is large and thick; notched at its center.

These unique whales are black with a large white area that extends along the lower side, from chin to tail. There is a distinctive white spot located behind and above the eyes. Killer whales also have a light gray to white “saddle patch” on their backs behind the dorsal fin. This saddle patch is often used in orca research to identify individual whales.

The orca is a toothed whale with 10 to 13 conical teeth on each side of each jaw. Its diet includes other large whales, dolphins, seals, sea lions, walruses, sea otters, sea birds, turtles, and a wide variety of fish. The killer whales have not been known to attack humans.

The orca travels in groups called pods which are permanent, close-knit families of males, females, and young. Orca scientists have discovered that orca tend to stay with the family or clan into which they were born. Often the oldest member of the clan is a female. Orca pods appear to be matrilineal - with old females as pod leaders. Long-term observation confirms a regularity of habits and feeding patterns. Killer whales have been known to hunt in packs in order to kill whales larger than themselves.

Killer whales can be found in all oceans. They appear to stay within 500 miles (833.3 kilometers) of the shoreline and will enter inland seas, bays, and estuaries.

SPERM WHALE COLOR SUGGESTION

Dark brown to dark gray. Belly and underside of mouth are often light gray to white.

BLUE WHALE COLOR SUGGESTION

Blue gray with gray mottling.

KILLER (ORCA) WHALE COLOR SUGGESTION

Black with large white areas that extend along the lower side from chin to tail. White spot located behind and above the eyes. Light gray to white saddle patch on back behind dorsal fin.

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