



## Discovery General Information

Sharks are an ancient kind of fish that evolved more than 400 million years ago, more than 100 million years before the first dinosaurs. Surprisingly, fossil evidence shows that during this immense span of time they have retained the same basic form and adaptations of their earliest ancestors. Today there are more than 400 species of sharks found in every ocean of the world, with 5 represented in San Francisco Bay: the leopard shark, spiny dogfish, brown smoothhound, sevengill and soupfin shark.

Although sharks are true fish, here are some of the adaptations that make them unique:

- The vast majority of fish have bony skeletons; sharks have skeletons made of cartilage.
- Many bony fish can propel themselves forward and backward with their pectoral fins. Sharks cannot swim with their pectoral fins, so they can only swim forward with tail motion.
- Bony fish gills are covered by a muscular layer of tissue called an operculum, while shark gills are exposed and appear in rows of slits.
- Centoid scales protect the bodies of most bony fish. Sharks have placoid scales made of enamel and dentin, just like teeth! These are called *dermal denticles*, or 'skin teeth.'
- Bony fish never replace their single set of teeth, but many sharks lose 20 thousand teeth during their lifetimes. Sharks' cartilage jaws make a poor anchor for teeth.

Part of the mythology of sharks is about their sensory abilities, especially their excitability to the smell of blood in the water; but sharks also have a keen sense of hearing, sight, taste and touch. In addition, sharks have a sixth sense called electroreception, which detects the electrical signals in the nervous system of their prey. Electroreception originates from a network of jelly filled pores that surround a shark's nose, called *Ampullae of Lorenzini* (named for the Italian anatomist who discovered them). Like a metal detector, sharks use electroreception to find prey buried in the sand, like worms, crustaceans and mollusks. Scientists speculate that electroreception detects the Earth's magnetic fields, and helps sharks navigate long migrations across open ocean.

In some ways, sharks are more comparable to marine mammals than fish. Some sharks lay eggs (oviparity), but many sharks give live birth: in some species pups hatch from an egg inside the mother (ovoviviparity), and others give truly live birth (viviparity). Sharks are also slow-growing and late to mature. For example, the 3 foot spiny dogfish shark does not reach sexual maturity until 20 years old and can live to 70. And though most think of baleen whales as the filter feeders of the sea, the 50 foot whale shark filter feeds on plankton with gill rakers.

Humans have had opposite relationships with sharks in different parts of the world. The Hawaiians regarded sharks as protectors, while Europeans saw them as dangerous animals to be killed. Meanwhile, the consumption of sharks as food in shark-fin-soup has spread globally from Asia, even though sharks contain dangerously elevated levels of mercury. Populations of nearly all shark species are in decline, with an estimated 100 million annual human caused deaths. Many are victims of bycatch and habitat destruction, but half are killed for their fins alone. Fortunately, attitudes are changing: California state law protects the great white shark; and some pacific island nations now protect sharks because of their contribution to the health of coral reefs and eco-tourism scuba diving. Still, more needs to be done to protect sharks if they are to retain their important role in the marine food web.



## Shark Discovery Vocabulary

**Adaptation:** A structure or behavior of an organism that has developed over time to allow the organism to survive in a given environment.

**Ampullae of Lorenzini:** Sensory cells in microscopic jelly-filled pits, located around the snout, allow them to detect weak electric currents and magnetic lines. Sharks use this sense to find prey under the sand.

**Brackish:** A mixture of salt and fresh water. (i.e. water in the San Francisco Bay).

**Benthic:** Organisms that live on or near the bottom of the ocean.

**Camouflage:** An adaptation that allows an organism to blend in with its environment through shape, color or behavior.

**Carnivore:** A meat-eating animal.

**Cartilage:** A firm but flexible skeletal material. Cartilage is found in human noses and ears as well as the entire skeleton of sharks, skates, and rays.

**Counter Shading:** A coloration pattern in aquatic animals where the upper part of the body is dark and the lower part is light.

**Dermal Denticles:** Sharp, tooth-like scales.

**Ecosystem:** A community of organisms interacting with each other and the physical environment in which they live.

**Endangered Species:** An organism whose population is in decline and in danger of becoming extinct within the foreseeable future.

**Estuary:** A place where rivers meet ocean, causing fresh water and salt water to mix. The resulting mixture of fresh and salt water is called *brackish* water. San Francisco Bay is an Estuary.

**Extinction:** The death of the last individual of a species or isolated population.

**Filter Feeders:** An animal who feeds by filtering food out of the water using its body, tentacles, or legs.

**Food Chain:** A grouping of living things that feed on the member below it.

**Food Web:** All the food chains in a community.

**Gills:** Breathing organs used by many aquatic animals. Gills remove oxygen from the water and release carbon dioxide from the body.

**Habitat:** The specific environment in which a species or community lives.

**Herbivore:** An animal that feeds only on plants.

**Lateral Line:** Canals under the fish skin which pick up vibrations in the water. This is one of the ways sharks sense prey and can navigate.

**Nutrients:** Substances that are essential for metabolism and growth. Nutrients come in many forms: plants, detritus, minerals and meat.

**Oviparous:** Describes animals that produce eggs that develop outside the Mother's body. (Birds and most reptiles, amphibians, and fish)

**Ovoviviparous:** Describes animals that the young develop within eggs that remain in the mother's body until they hatch or are about to hatch.

**Plankton:** Plants or animals that drift with the ocean currents. They are usually, but not always microscopic. The drifting plants are called Phytoplankton and the drifting animals are called Zooplankton.

**Predator:** An organism that lives by preying upon other animals.

**Prey:** Any creature that is hunted or caught for food.

**Scavenger:** An animal that feeds on dead plants or animals.

**Vertebrates:** Animals that have a spinal column.

**Viviparous:** Describes animals that bear live young. (Humans and most mammals)



# Shark Quiz

1. The largest shark on Earth is a \_\_\_\_\_ shark.  
A. White                      B. Whale                      C. Horn
2. All sharks' skeletons are made of:  
A. Bone                      B. Wood                      C. Cartilage
3. Sharks are:  
A. Mammals                      B. Fish                      C. Amphibians
4. Worldwide, if you include all species of shark, the average size is:  
A. 3 feet                      B. 8 feet                      C. 16 feet
5. In the year 2000, sharks killed \_\_\_\_\_ people.  
A. 11                      B. 111                      C. 10,011
6. In 2000, people killed \_\_\_\_\_ sharks.  
A. 100                      B. 1,000                      C. 110,000,000
7. There are about \_\_\_\_\_ species of sharks.  
A. 25                      B. 150                      C. 375
8. A close relative to sharks are:  
A. Elephants                      B. Whales                      C. Sting Rays
9. The most common shark in the San Francisco Bay is:  
A. Whale                      B. Great White                      C. Leopard
10. Sharks use \_\_\_\_\_ to breathe.  
A. Lungs                      B. Gills                      C. Scuba Gear



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