

Sharks

Class: Chondrichthyes

Misunderstood Predators



Great White Shark (*Carcharodon carcharias*)
<http://www.top-adventure-tours.com>



INSTITUTE FOR MARINE MAMMAL STUDIES

www.imms.org

Quick Facts

- Sharks, skate, rays, and chimeras have a skeleton made of cartilage.
- Modern sharks first appeared on Earth 140 million years ago.
- The shortfin mako is the fastest shark in the ocean reaching speeds of “up to” 20 miles per hour.
- The largest fish in the ocean is the whale shark, which can grow as large as 50 feet and weigh as much as 45,000 pounds.
- At six inches, the dwarf lanternfish shark is one of the smallest sharks.
- The extinct megalodon shark grew up to 60 feet long and weighed as much as 77 tons.
- The cookie cutter shark is so named from the small round bites it takes “out of” prey much larger than itself.

REMEMBER

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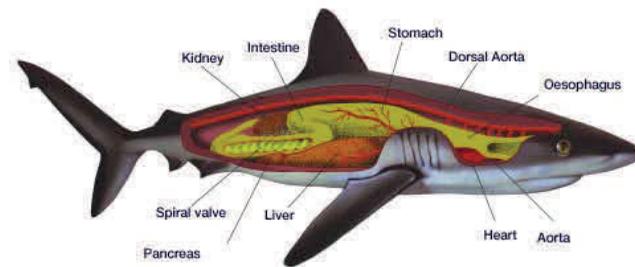
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Internal Anatomy

Unlike bony fish, sharks do not possess a swim bladder. Instead, sharks have a large, oily liver that lends buoyancy to the animal by decreasing overall body density. In some sharks, the liver can comprise as much as 25% of the total body weight. Inside the stomach of sharks are rough ridges called rugae. These rugae allow for stomach expansion so the shark can take large prey if the opportunity arises.



<http://aquariaklcc.com>

The intestines of a shark are shorter than in most other animals. To compensate for this characteristic, a shark's digestive system includes a spiral valve. This spiral increases the overall surface area of the intestine and allows digestion to take place more efficiently. To tolerate excess salt in the bloodstream, sharks have a rectal gland that secretes salty waste directly into the rectum.



Great Hammerhead (*Sphyrna mokarran*)
<http://forums.penny-arcade.com>

References:
www.sharksavers.org
www.flmnh.ufl.edu
www.marinebiodiversity.ca
www.elasmodiver.com

Sharks have highly evolved eyes similar to humans. Unlike most fish, sharks have the ability to dilate the pupil in response to different lighting situations. A shark's eye contains a cornea, an iris, a retina, and a lens. Because of the structure of the eye, most sharks have excellent vision. The eyes of sharks contain an extra eyelid called a nictitating membrane. This translucent covering protects the eye from injury during feeding.



Nictitating Membrane
<http://www.corbisimages.com>

Most bottom-dwelling sharks have structures located just behind the eyes known as spiracles. Spiracles allow sharks, skates, and rays to receive oxygenated water while sitting on the sea floor. This prevents sediment from entering the gills of the shark even when the animal is buried in the sand.



Gummy Shark (*Mustelus antarcticus*)
 Note: spiracle behind the eye
 © Ken Hoppen, oceannotions@primus.com.au

Reproduction

Sharks are sexually dimorphic, meaning there is a noticeable difference between males and females. They reproduce through internal fertilization. The males deliver sperms into the cloacal opening between the pelvic fins of the female via claspers. Some sharks give birth to live young (ovoviviparous) and some lay eggs (oviparous). The most common form of development is ovoviviparous. This form of development is similar to live birth in that the eggs mature inside of the mother. These eggs, however, do not receive direct nourishment from the mother, but from a



Pup and Yolk Sac
<http://maniiia.tumblr.com>



Shark Egg Case
 © Rik Kiekens
<http://www.trekearth.com>

Scientific Classification

Kingdom: Animalia

Phylum: Chordata

Subphylum: Vertebrata

Class: Chondrichthyes

Subclass: Elasmobranchii

Although still a topic for debate, it is believed that modern sharks first appeared approximately 200 mya. By 100 mya, most sharks had developed into fast-swimming, offshore predators.

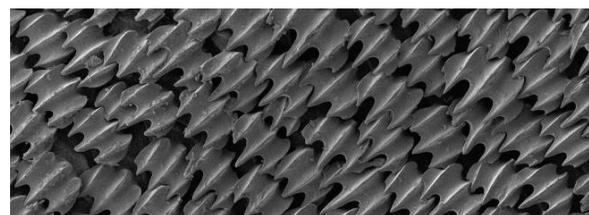


Blue Shark (*Prionace glauca*) <http://www.gooddive.com>

Anatomy

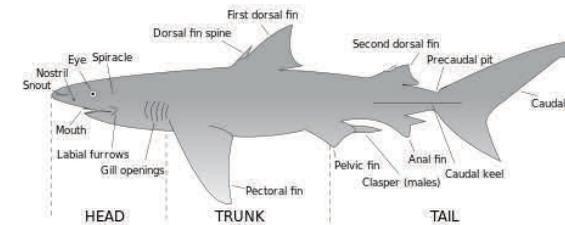
Sharks are fish with skeletons made entirely of cartilage. As members of the Class Chondrichthyes, sharks are related to skates, rays, and chimeras. Unlike bony fish, sharks do not have a gill covering. Instead, water flows over their gills through gill slits. Sharks have five to seven pairs of gill slits. The more primitive sharks have seven gill slits and the more modern sharks, like the hammerhead, have five pairs.

The bodies of sharks are usually fusiform or torpedo-shaped and are covered with tiny placoid scales known as dermal denticles. These “skin teeth” lay over the top of each other, giving the shark a hydrodynamic characteristic. When petting a shark from tail to head however, one will notice the dermal denticles are exceptionally rough. This characteristic of shark skin led it to be used as sandpaper in early fishing communities. Known today as Shagreen, shark skin is still used in many leather industries.



Placoid scales under electron microscope <http://images.cryhavok.org>

Sharks have a wide array of fins at their disposal. These fins serve a variety of purposes. On the back, or dorsal side of the shark, are the dorsal fins. Most sharks have two dorsal fins, but some have three and a few only have one. The dorsal fin acts like a rudder to keep the shark on a straight line while swimming across ocean currents.



<http://the-shark-side-of-life.com>

On the side of the shark are the pectoral fins. The pectoral fins help to steer the shark through the water, as well as provide lift to many species. Sharks, like most other fish, have two pectoral fins. On the ventral side, or belly of the shark, is another set of paired fins. These are the pelvic fins. The pelvic fins help to keep the shark steer and turn sharply in the water. On the males, two claspers, or reproductive organs, are attached to the interior side of each of the two pelvic fins.

Posterior to the pelvic fins lies the anal fin. The anal fin aids in stability while the shark is swimming. Most, but not all sharks possess anal fins. All shark do, however, possess a caudal fin. The caudal fin serves as the propulsion system for the shark. Caudal fins can be either homocercal, with the upper lobe of the caudal fin being relatively the same size of the lower lobe, or heterocercal, meaning the upper lobe is of a different size than the lower lobe, usually larger and extending more posteriorly. Most benthic or bottom-dwelling sharks have strong non-lunate (heterocercal) caudal fins to help them swim unimpaired across the seabed. Strong swimmers, like the mako, have strong lunate (homocercal) caudal fins.

Shark teeth are modified placoid scales which consist of a central pulp surrounded by dentine and covered with enamel. This enamel covering allows for fossilization of the teeth.



Tiger Shark Jaws
Galeocerdo cuvier
<http://www.sealifegifts.net>

Many prehistoric fish are known to science primarily through the study of fossilized teeth. Sharks constantly produce new teeth. Rows of teeth are produced on a “conveyor belt” which sends new teeth forward to replace the ones that have are lost. It is estimated that some sharks can loose as many as 30,000 teeth in their lifetimes. This replacement is possible



<http://commons.wikimedia.org>

because the teeth are loosely embedded in tissue over the cartilaginous jaw.

Sharks have the ability to minute magnetic fields, which are given off by all living animals, via small structures near the head region. The structures are called Ampullae of Lorenzini. These ampullae are small pores that form an extensive subcutaneous sensory system. This system is well developed in the hammerhead sharks and allows the predator to locate prey that is buried under the sand.

New research has concluded that these structures may also be able to detect changes in water temperature.



Ampullae of Lorenzini
<http://earthguide.ucsd.edu>



Bull Shark (*Carcharhinus leucas*) <http://flmnh.ufl.edu>

The Basics

There are approximately 400 described species of sharks in the world's ocean and more are being discovered all the time. These sharks are divided into eight orders according to physical characteristics and DNA modeling. Sharks are found throughout the world, mostly in marine ecosystems. Occasionally, however, some sharks can be found in freshwater environments.



<http://comons.wikimedia.org>

The first sharks appeared on Earth approximately 400 million years ago (mya). These creatures were quite different from the modern shark species, with mouths on the front of their heads and lacking tooth-like scales.