

## SHARK FACT SHEET

Created by the Center for Aquatic Sciences at Adventure Aquarium

### What are Sharks?

- Sharks are fish! Not ordinary fish however. Sharks, along with their close relatives the rays, skates, guitarfish, and sawfish are referred to as cartilaginous fishes.
- These fish all share a significant characteristic: a skeleton made of cartilage instead of bone. They are cold-blooded (Ectothermic) vertebrates that have been swimming in Earth's oceans for 350 million years.
- The majority of cartilaginous fish are limited to life in salt water. Only a few species of stingrays can be found in fresh water and only the bull shark can occasionally be found in large rivers.

### How long to long do sharks live?

- Sharks are relatively long lived animals that mature very slowly. Research suggests that some species can live to be over 100 years old.
- Currently, science does not know how long the largest species of sharks can live; however, it usually takes many years for any animal to reach a length of 20, 30, or 40 feet.

### Why is a shark's skeleton so special?

- Sharks have a skeleton, but it is not made of bone, like most other vertebrates. Instead, their skeleton is made of a softer, more flexible material called cartilage, the same material found in our ears and nose.
- Sharks are more flexible and more resistant to getting fractures in their skeleton. However, a cartilaginous skeleton lacks the stability and protection that a hard bony skeleton provides. Sharks are much more delicate than most people imagine.

- The fossil record rarely includes shark skeletons. This is because cartilage does not fossilize well; only a shark's enamel plated teeth are represented as fossils from ancient sharks.

### Are sharks covered with scales like other fish?

- All sharks are covered with scales, known as dermal denticles or "skin teeth". Dermal denticles are heavy scales in comparison to most other fish scales. These scales act as a suit of armor and add stability and strength. They compensate for the fact that a cartilaginous skeleton is not as protective as a skeleton made of bone.
- Dermal denticles resemble tiny pointed teeth with all of the tips pointing toward the tail. Due to the orientation and shape of the scales, shark skin is often abrasive when stroked against the grain (tail to head). In fact, some species of sharks have scales that are so abrasive that they can cause cuts in people's skin.
- Early civilizations used shark skin as a form of sandpaper.

### Why do sharks have so many teeth?

- A shark's jaws are unique for several reasons. First, shark jaws are not fused to the rest of the skull, which is why it is possible to buy a full set of shark jaws at a souvenir shop.
- Other vertebrates have their lower jaw separated from the skull so that the mouth can open and close, while the bones holding the upper teeth are fused to the rest of the skull and are immovable. Sharks and rays have their entire set of jaws, top and bottom, suspended from the rest of the skull by ligaments and muscles. This design

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allows the shark to protrude its jaws further from its body so that it has a better chance of biting or grabbing prey.

- Sharks do not have to roll onto their side in order to attack because they can protrude their jaws instead.
- Sharks are carnivores, and as such, their teeth are specifically designed to catch prey. Sharks' teeth are not housed in the jaw like our teeth are. In contrast, shark's teeth are loosely attached to the jaw and are designed to be disposable.
- Sharks can have as many as 7 or more complete rows of teeth in their mouth at any one time, although only one or two rows are functional. As each tooth becomes broken or dull, it eventually falls out of the mouth and is slowly replaced by a new tooth located behind the original.
- It is estimated that certain species of adult sharks can go through 30,000 teeth in a lifetime. This explains why fossilized shark teeth are so common.

### Do sharks ever stop swimming?

- You may have heard that sharks need to keep swimming or they will die. For many species of sharks, this is true.
- Free swimming sharks move through the water with their mouths slightly open. Water goes into the shark's mouth, over the gills, and back out through the gill slits located right behind the shark's head.
- Sharks use gills to extract oxygen from the water in order to breathe. Multiple gill slits are unique to sharks, skates and rays.
- All sharks have at least 5 gill slits on either side of their head, with a very few species having 6 or 7 slits.
- Unfortunately, gill slits are not designed to pump water over the gills, but rather to supply an exit point for water flowing out of the shark's mouth and gill chamber. For this reason, free swimming sharks need to constantly move forward in order for new, oxygenated water to flow over their gills.

Free swimming sharks of this type will drown if they cannot swim forward. This is why most sharks die so quickly when they are caught in fishing nets.

- Bottom dwelling sharks have a breathing system that is designed to allow them to stay motionless on the sea floor. They usually have a much slower metabolism, which means that they require a lot less oxygen. They also tend to have a larger head with more muscles associated with their gill slits. This allows them to pump water over their gills, something that most larger sharks cannot do.

### What senses do sharks have?

- People have five senses that allow us to accomplish a variety of things in our everyday lives. Our senses can help us find our way home, communicate with others, or even remind us to stay away from the fireplace. Sharks however, are apex predators and all of their senses are designed to help them locate food. Like lions and wolves, sharks are designed to locate and eat those animals that are slower or weaker than all of the others. By eliminating these "less fit" animals, apex predators ensure that other animal populations remain healthy.

### How do sharks hear?

- Sharks do not have external ear openings, however sound detection is one of their most sensitive senses. The shark's inner ear is sensitive to irregular, low- frequency sounds that are often indicative of a struggling or wounded animal.
- Sound travels faster and farther through water than it does through air, so a shark can detect sound from over a mile away.

### Can sharks smell?

- Probably the shark's most famous and important sense is its sense of smell. Sharks are well equipped to detect small

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amounts of blood and other body fluids in the water. An animal that is bleeding is usually weak or injured or already dead, making it a perfect prey item for an apex predator.

- In water, scents dissipate quickly and are often carried away by currents and tides. Research has shown that a shark can detect a concentration of blood in the water as small as one part per million.
- Once a scent has been detected, the shark can follow the trail until it finds the source, sometimes up to a mile away.

### Do sharks have any extra senses?

- The lateral line is a special and very important sensing system for most fish, including sharks. The lateral line consists of a long series of fluid-filled sensory canals containing tiny hair-like receptors that are sensitive to vibrations, pressure changes, waves, and other movements of water.
- Water movement occurs whenever any object travels through a water column. These tiny water vibrations go mostly unnoticed by people; however, a fish's lateral line detects the vibrations and gives the fish important information about its surroundings. This is how fish orient properly to currents, avoid obstacles, and remain in schools without bumping into one another.
- Sharks have adapted this sense to detect the erratic swimming patterns of struggling fish. An animal in distress moves through the water differently than a healthy animal. Sharks can detect the difference and pinpoint the direction of the motion.
- Under certain conditions, the lateral line can detect water vibrations from hundreds of yards away.

### Can sharks feel?

- Sharks, like all vertebrates, have a sense of touch. They can feel with their

entire body, similar to humans. Sharks do not rely on this sense to find food other than to test an object.

- Sharks obviously do not have hands to touch things; however, research has shown that many sharks, including the great white, will carefully "mouth" an item to find out more about it.

### How do sharks see?

- Many sharks are most active during dawn and dusk. They take advantage of nocturnal (active at night) animals adjusting to more light at the beginning of the day and diurnal (active during the day) animals adjusting to lower light levels at the end of the day.
- Sharks do not have eyelids like we do. Instead, sharks protect their eyes in one of two ways. Some sharks, such as sandbar sharks, have a protective layer that can cover their eyes when needed. This "eyelid" is called a nictitating membrane, and it is often used to protect the eye just as the shark is about to bite something. Other sharks, such as sand tiger sharks and white sharks will roll their eyes back into their head in order to protect them. Consequently, they are virtually blind when they bite something.

### Can sharks taste?

- There are taste receptors inside the mouths of sharks, just as there are in people. Sharks are not indiscriminate eaters, but rather often have specific likes and dislikes.
- The sense of taste acts as the final system to accept or reject a food source. Certain animals are distasteful as a way of protecting themselves, while others have distinct flavors that may or may not be attractive to sharks.
- Sharks will spit out food that they do not like once they have tasted it.

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## Do sharks really detect electricity?

- Surrounding a shark's mouth and snout are hundreds of small sensory pits called Ampullae of Lorenzini. These ampullae detect very minute amounts of electricity that come from most living animals.
- Muscle contractions and nerve impulses produce small amounts of electricity called bio-electricity. When the shark is within a foot or two of the source, the ampullae can detect the bio-electricity.
- This sense is also used to locate animals that are otherwise undetectable by the shark's other senses. Hammerhead sharks, for example, often rely on their electro-reception sense to detect small fish and rays that have attempted to escape by hiding under the sand. Although the animal is hidden, its constantly beating heart produces enough electricity to be detected by the ampullae.

## How can you tell a male shark from a female shark?

- One of the most common questions people have is whether a given animal is a male or a female. Luckily, it is very easy to tell shark, ray and skate sexes apart.
- Males have a long extension to each of their pelvic fins called claspers. The claspers are very easy to see in adult sharks but are often difficult to see in shark pups.

## Are sharks really dangerous?

- Sharks have been made famous because of their size and the fact that they have been involved in numerous attacks on people all over the world.
- While sharks have attacked and killed many people over the years, their fierce reputation has been greatly exaggerated.

- In 2011, the International Shark Attack Files recorded 75 unprovoked shark attacks, resulting in 12 deaths throughout the entire world. 29 of those attacks occurred off the waters of the United States, resulting in 0 deaths. In comparison, 26 people were killed in the United States by lightning in the same year.
- Most of the shark attacks that are recorded in the United States occur in Florida, with California a distant second.
- While many species of sharks have been implicated in shark attacks, the three most commonly involved are the great white shark, the tiger shark, and the bull shark. While these and many other sharks are large predatory animals and capable of hunting human size prey, it is important to remember that sharks do not commonly hunt people.
- They have been swimming in Earth's oceans for over 350 million years; in that time, they have adapted to hunt native marine life. People are not considered sea life, yet shark attacks occasionally happen. Why?

## Why do sharks attack people?

- Many shark attacks, especially involving great white sharks can be attributed to the shark mistaking a person for a seal or sea lion.
- Great white sharks are a large species that commonly eat large marine mammals. They often patrol sea lion rookeries looking for potential meals. Unfortunately, in areas such as northern California, South Africa and southern Australia, people frequently share the water with the sea lions; and a surfer may be mistaken for an injured marine mammal.
- The white shark may attack the person causing severe wounds, but the individual is then left alone once the shark "realizes" its mistake.

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- Victims of white shark attacks are not eaten by the shark; most survive, and those that die succumb to blood loss and shock.
  - Many shark attacks result from people antagonizing sharks. Attempts to handle sharks in the wild often result in shark bites.
  - Remaining in a shark's territory after the shark has given a warning with a threat display can result in a shark attack. Following or chasing a shark in the wild can also cause the shark to feel threatened and attack as a defense. None of these situations are examples of the shark hunting or trying to eat a human, but rather a shark's defensive response.
  - Shark attacks sometimes result when a person finds himself in an area where sharks are trying to hunt naturally. Spear fishermen have been inadvertently bitten by sharks when in the water close to a bleeding or struggling fish on a spear.
  - Survivors of maritime disasters have been attacked when a significant amount of blood is in the water and thrashing about has occurred.
  - Still others have intentionally entered waters where sharks are actively hunting or have been lured with bait. These situations are not examples of sharks' intentionally hunting people. Rather, individuals are bitten by being too close to a natural food source or being in an area where the sharks' senses have been overloaded.
- field of vision, making it easier for the hammerhead to hunt for food.
- Sand tigers are large, slow-moving sharks notable for their jagged, visibly menacing appearance. Despite its fearsome appearance and strong swimming ability, it is a relatively placid and slow-moving shark that has rarely been implicated in unprovoked attacks on people.
  - The sandbar shark, true to its nickname, is commonly found over muddy or sandy bottoms in shallow coastal waters such as bays, estuaries, harbors, or the mouths of rivers, but it also swims in deeper waters.
  - The silky shark is named for the smooth texture of its skin. It is one of the most abundant sharks and can be found around the world in tropical waters. Highly mobile and migratory, this shark is most often found over the edge of the continental shelf down to a depth of 164 feet.
  - Nurse sharks are common bottom-dwelling sharks that spends their day in large inactive groups of up to 40 individuals. During the day, they seem to prefer specific resting sites and will return to them each day after the a night of hunting.
  - Be sure to visit <http://www.adventureaquarium.com/What-to-do/Aquarium-animals.aspx> for more about the animals you will see when you visit Adventure Aquarium.

## Who is at Adventure Aquarium?

- Adventure Aquarium has the distinction of being the only aquarium in the United States with a great hammerhead shark on exhibit. The name is derived from the hammer shape of the shark's head. The eyes and nostrils are located on the far sides of the head. It is thought the wide separation of the eyes gives it a wider

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