

SHARK ANATOMY /INSTRUCTOR INFO

Summary

Sharks are amazing apex predators. Different parts of their body are designed to have different functions, just like humans and all other animals. From their gills to their caudal fin, each part has an important role to play that will ensure the survival of the species. When students study the anatomy of a shark, they are one step closer to understanding shark behavior, their habitat, and gaining understanding of the role sharks play in the health of the ocean.

Introduction

Part 1. What is a Shark?

Part 2. External Shark Anatomy

Part 3. Internal Shark Anatomy

Part 4. Marine Biologists

Activity 1. Anatomy of a Shark

Goals & Objectives

The students will:

- Identify basic external and internal shark anatomy;
- Explore how the anatomy of sharks allows them to survive in the ocean;
- Develop research skills using the OCEARCH Global Shark Tracker™;
- Describe the job of a marine biologist.

Helpful Tips

1. The content in this lesson is based on the conservation work of OCEARCH™ and the Global Shark Tracker™. Spend a few minutes getting familiar with the website and the tracker if you have not done so already. The Global Shark Tracker™ is also available as an app for iPhone and Android
2. This lesson plan is designed to be adaptable to suit your specific needs. Use the entire lesson plan or just parts of it. This material can be expanded to be an entire unit or condensed for just one day in the classroom.
3. Vocabulary words will be underlined as they first appear in the lesson plan. A complete list of vocabulary words is included as well.
4. Answers to questions and prompts for discussions will appear in italics.
5. Optional activities and content (side notes) will appear in a box. Use these to enhance your lesson and adapt it to suit your needs!
6. Have questions for OCEARCH Expedition Leader, Chris Fischer? Email info@OCEARCH.org to schedule a Skype session and let your students/child talk directly to Chris and the OCEARCH crew!
7. Email all questions about this lesson to info@OCEARCH.org.

OCEAN POLLUTION / VOCABULARY

Ampullae of Lorenzini – Small electroreceptors used to detect electrical impulses in the water; helps the shark swim in dark, murky water.

Anal Fin – Located on underside of shark; provides balance while swimming.

Anatomy – The branch of science that studies the bodily structure of living organisms.

Caudal Fin – The fin at the end of the shark's tail; propels the shark through water.

Dermal Denticles – Teeth-like structures on a shark's skin; literally translates to "skin teeth".

Eye – The external part of the shark that allows it to see.

Gills – The organ sharks use for breathing in the water.

Lateral Line – A series of specialized pores used in the detection of pressure changes and vibrations in the water.

Nares – The openings on a shark's snout that enable it to smell.

Pectoral Fin – The fins located on both sides of shark; provides steering, lift, and brakes while swimming.

Pelvic Fin – Fin located on the underside of shark, near the tail; assists with balance.

Snout – The nose of the shark.

Teeth – Helps a shark bite and tear its food.

SHARK ANATOMY / LESSON PLAN

INTRODUCTION 3-5 mins

Just like humans and other animals, sharks depend on their bodies to help them survive in their habitat.

What characteristics of a shark's environment is a shark adapted to? *Answer: A shark is perfectly adapted to surviving underwater.*

What adaptations do sharks have that help them survive underwater? *Write the students' answers on the board. Answers: Fins, gills, teeth, eyes, etc.*

Today we are going to explore basic shark anatomy. Anatomy is a branch of science that studies the bodily structure of living organisms. But first, what exactly is a shark?

PART 1. WHAT IS A SHARK? 5-10 MINS

There are nearly 400 species of sharks known worldwide. All sharks are fish, but not all fish are sharks.

So what makes a shark different from other fish? The first and main difference is their skeleton. Sharks are commonly referred to as "cartilaginous fish" because their skeletons are made of cartilage – more on that later! Other fish are referred to as "bony fish" because their skeletons are made of both bone and cartilage.

Another difference between sharks and other fish is how they stay buoyant. Bony fish have an air-filled swim bladder that helps them stay buoyant. Sharks on the other hand, do not have a swim bladder. They have another method for buoyancy, which we will also discuss later on.

And lastly, there are other differences such as their gills (bony fish have a gill cover while sharks do not), their skin (bony fish are covered in slippery scales while sharks have rough, dermal denticles), and how they reproduce (bony fish lay eggs while some sharks hatch from eggs inside their mother and then are birthed live).

PART 2. EXTERNAL SHARK ANATOMY 15-20 mins

First, let's explore the external anatomy of a shark. *Use a picture, photo, or drawing on the board to label the parts of the shark as the lesson progresses.*

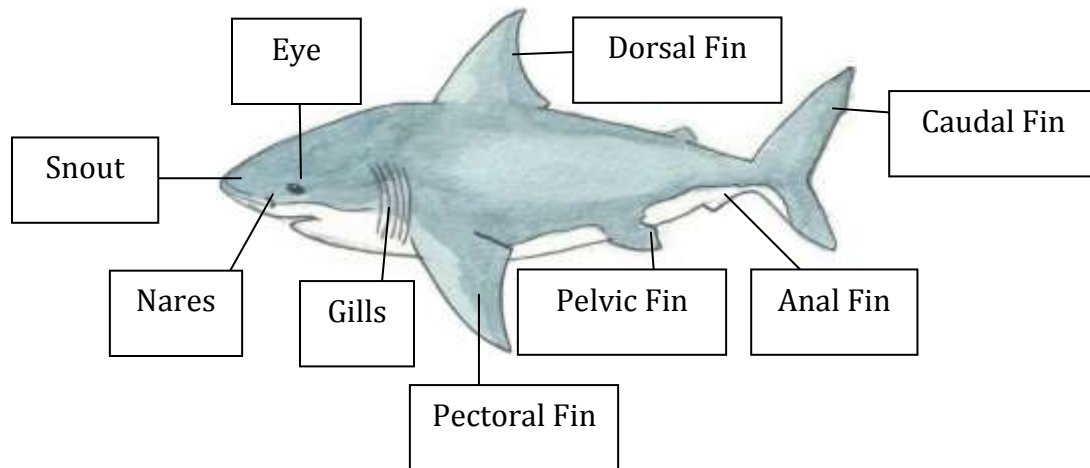


Figure 1. External Anatomy of a Shark

Illustration Credit: Sarah Rich – Landry's Downtown Aquarium

Fins

Sharks have many fins, each with a special purpose to help a shark swim! The caudal fin is located on the tail of the shark. Using powerful muscles, the shark moves its caudal fin side to side to push itself through the water.

The pectoral fins of a shark stick out like the wings on an airplane. They use these fins for steering and slowing down while swimming.

The dorsal fin, pelvic fin, and anal fin are important for helping the shark to stay upright and balanced in the water. Without these fins, the shark could lose balance and wobble or spin instead of swimming straight through the water.

Organs

Along with fins to help them move, sharks have special organs to help them live and hunt in the ocean. Without gills, sharks would be unable to breathe underwater! On the nose, or snout of a shark, there are two nares which allow the shark to smell. Sharks also have two eyes that allow them to see.

Skin and Teeth

Shark skin is very different from human skin. Their skin is actually covered in tiny teeth called dermal denticles! These dermal denticles all point towards the tail end of the shark and act like armor (Figure 2). Feeling shark skin from head to tail would feel very smooth but going from tail to head would feel extremely rough like sandpaper!



Figure 2. Close up view of dermal denticles.

Illustration Credit: Sarah Rich – Landry's Downtown Aquarium

Not only do sharks have skin that is covered in teeth, but they also have many rows of sharp teeth in their mouths. Sharks constantly grow new teeth to replace any that are lost. One shark can go through over 10,000 teeth in their lifetime!

Different types of sharks will have different shaped teeth depending on what they eat. The whale shark eats only plankton, so its teeth are very small and short. By contrast, a white shark has large triangular teeth with ridges called serrations for tearing through their food.

PART 3. INTERNAL SHARK ANATOMY 5-10 mins

Not all of a shark's amazing adaptations are located externally. Let's look at a shark's internal anatomy to learn other ways sharks survive so well in the ocean.

Cartilage

Sharks have very special bones made of cartilage. Cartilage is the soft rubbery tissue that your ears and nose are made of. *Have the students feel their ears and nose.* Since a shark's entire skeleton is made of this soft cartilage, their bodies are very flexible. This helps them to swim and turn quickly.

Oily Liver

Sharks have a large, oily liver unlike any other animal on the planet. This special organ serves two purposes. Just like other animals, its liver helps with digestion. But that's where the similarities end. A shark's liver is filled with an oily substance, called squalene that helps with buoyancy – or floating. How does this work?

A shark's body is naturally denser than water, so it should sink. Sharks do not have an air bladder like other fish to keep them buoyant. Instead the oil in the liver, which is less dense than water, keeps the shark from sinking to the ocean floor. Have you ever tried pouring cooking oil in water? What does it do? *Answer: It floats!*

Ampullae of Lorenzini

To help sharks hunt and navigate, they have special organs that give them senses humans don't even have! Sharks have the incredible ability detect the electrical impulses that are emitted by every living animal. Sharks have specialized pores located on their head and snout called ampullae of Lorenzini. These pores receive the electrical impulses emitted by other animals and then send a signal to the brain.

The brain is able to process where the impulses are coming from, allowing the shark to hunt its prey without even seeing it.

Biologists also believe that sharks use their ampullae of Lorenzini to detect Earth's magnetic fields which can be used for navigation. How else can sharks navigate the vast ocean so effortlessly?

Have you begun to wonder how we know so much about sharks? Believe it or not, there are people in the world whose job is to learn as much as they can about sharks and the ocean! These people are called marine biologists. Let's learn what a job in marine biology is all about.

PART 4. MARINE BIOLOGISTS 5-10 mins

Those who have a love for the ocean have made it their job to learn as much as they can about the ocean and then share their knowledge with the world. A marine biologist is a scientist who studies plants and animals that live in the ocean. They are interested in how animals survive in their environment, what they eat, how they protect themselves, how they reproduce, and how they are affected by changes to their environment such as pollution, temperature, and disease.

Marine biologists study the ocean and its inhabitants in many different ways. They can SCUBA dive, snorkel, observe animals from a boat, conduct experiments, operate small submersible vessels, collect specimens, and much more! OCEARCH researchers tag sharks and then track their swimming patterns in order to better understand the sharks' life histories. Let's meet some well-known marine biologists!

Sylvia Earle

Sylvia Earle is a marine biologist who specializes in the study of plants. During 50 underwater expeditions and over 6,000 hours underwater, Earle has discovered many new marine species and set many diving records. In 1970, Earle led a team of five other explorers who lived for two weeks in an underwater laboratory!

Jacques Cousteau

Jacques Cousteau was a French ocean explorer. Cousteau traveled the world's oceans in his research vessel "Calypso," studying the sea and inspiring people around the globe to be environmental stewards of the ocean. In 1943, he invented the aqualung, a breathing apparatus that supplied oxygen to divers and allowed them to stay underwater for several hours.

Eugenie Clark

Eugenie Clark, sometimes referred to as The Shark Lady, was an American marine biologist known for her research on poisonous fish and on the behavior of sharks. Clark discovered the first effective shark repellent in secretions from a flatfish called Moses sole that lives in the Red Sea. She ventured into undersea caverns off Mexico's Yucatán Peninsula to find "sleeping sharks" suspended in the water, a discovery that upended scientists' belief that sharks had to keep moving to breathe. She was also a pioneer in the field of SCUBA diving for research purposes. Did you know, one of OCEARCH's sharks is named "Genie" in honor of Eugenie Clark?

If time allows, instruct students to research other famous marine biologists and explorers. Students should select one and research that biologist's life, including their major contributions to the field of marine biology. How has this person changed the world? Students should present their research to the class using props, costumes, posters, pictures, etc. The possibilities are endless!

SHARK ANATOMY

/ACTIVITY 1. ANATOMY OF A SHARK

INTRODUCTION

This activity provides an excellent opportunity for students to learn shark anatomy by incorporating real-life shark research. This activity is meant to be taken home but can be a classroom project if preferred.

The students will use the OCEARCH Global Shark Tracker™ to obtain information and pictures of a tagged shark of their choosing. Students will use the information and pictures to create a labeled diagram of their shark.

MATERIALS

- Computer(s) with Internet access
- Printer
- Poster board or white art paper
- Markers, pens, pencils
- Journal or paper to record observations
- "Anatomy of a Shark" handout (provided)

INSTRUCTIONS

1. The students should begin by going over basic shark anatomy and filling in the information on the supplemental handout.
2. Students should be familiarized with the OCEARCH Global Shark Tracker™ in class and able to navigate the website to find information on individual sharks.
3. Once familiar, students will choose a tagged shark from the tracker and write down information about the shark in their journals or notebooks.
 - a. What is the name of the shark?
 - b. Is it male or female?
 - c. What date was it tagged?
 - d. What is the species of the shark? (great white shark, tiger shark, etc.)
4. Students will draw or print a picture of their shark (or that species of shark if a clear picture is not available on the shark tracker) and glue to a poster board or white art paper.
5. The basic anatomy of the shark should be labeled and the information (name, gender, species, and tag date) should be clearly presented on the poster as well.
6. After completion, students can present their shark to the class.

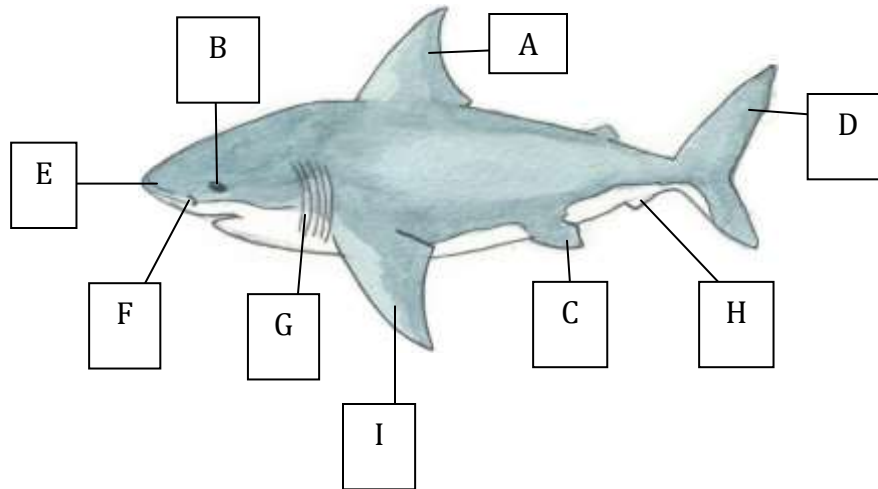
Student handout provided on next page.

Name: _____

Date: _____

ACTIVITY 1. ANATOMY OF A SHARK

Match the letter to the body parts listed below.



- | | |
|-----------|---------------------|
| A. | Pectoral Fin |
| B. | Dorsal Fin |
| C. | Eye |
| D. | Anal Fin |
| E. | Pelvic Fin |
| F. | Gills |
| G. | Caudal Fin |
| H. | Snout |
| I. | Nares |