Grade Level: 3-5
Time Estimate: 1 day

OCEAN ZONES / INSTRUCTOR INFO

Summary

This lesson includes vocabulary, content, and a creative activity all about ocean zones. Students will learn about the five major ocean zones along with the adaptations that the animals have in order to survive in their environment.

Part 1. The First 1,000 Meters
Part 2. To the Deepest of Deeps
Part 3. Sharks and Their Zones
Activity 1. Comparing Zones

Goals & Objectives

The students will:
• Identify the five different ocean zones;
• Learn the unique characteristics of each ocean zone;
• Learn about animals that live there;
• Learn about the adaptations that help animals survive in specific ocean zones,
• Learn how animals are identified by what they eat.

Helpful Tips

1. The content in this lesson is related to 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 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.

// STANDARDS

This lesson aligns with the following TEKS:
Grade 3 Science: 2C, 2F, 3A, 9A, 9B, 10A, 10B
Grade 4 Science: 2C, 2F, 3A, 9A, 9B, 10A
Grade 5 Science: 2D, 2F, 2G, 3A, 9A, 9B, 10A

This lesson aligns with the following Next Generation Science Standards:

4-LS1 From Molecules to Organisms: Structures and Processes (4-LS1-1)

Science and Engineering Practice
Engaging in Argument from Evidence
• Engaging in argument from evidence in 3–5 builds on K–2 experiences and progresses to critiquing the scientific explanations or solutions proposed by peers by citing relevant evidence about the natural and designed world(s). (4-LS1-1)

Disciplinary Core Ideas
4-LS1 Structure and Function
• Plants and animals have both internal and external structures that serve various functions in growth, survival, behavior, and reproduction. (4-LS1-1)

Crosscutting Concepts
Systems and System Models
• A system can be described in terms of its components and their interactions. (4-LS1-1)

STEM
This lesson plan aims to assist teachers in implementing a STEM-based program into their classroom while inspiring the next generation of explorers, scientists, and stewards of the ocean. Based on real science and the Global Shark Tracker™, this lesson is intended to promote environmental awareness and to prepare students for STEM careers.

OCEAN ZONES / VOCABULARY

Adaptation - A characteristic that an organism has that helps them survive in their environment.

Bioluminescence - The ability of an organism to produce its own light through chemical reactions.

Buoyancy - The ability to float in liquid.

Carnivore - An animal that eats other animals.

Chemosynthetic Bacteria - Organisms that use inorganic molecules as a source of energy by converting them into organic substances.

Detritivore - An organism that eats dead or decaying plant and animal matter.

Inhabit - To live in or occupy.

Organism - A single plant, animal, or single-celled life form.

Photosynthesis - The process by which plants and other organisms, like bacteria use the energy from sunlight to produce sugar as a food source.

Phytoplankton - Plankton consisting of microscopic plants.

Pressure - The continuous physical force exerted on or against an object by something in contact with it.

Primary Producer - An organism that produces its own food and provides food for other animals.

Plateau - An area of relatively level high ground.

Scavenger - An animal that feed on dead animals rather than or in addition to hunting live prey.

Species – a group of living organisms consisting of similar individuals capable of exchanging genes or interbreeding.

Translucent - When something lacks vibrant color and allows light to pass through it.

Zooplankton - Plankton consisting of small animals and the immature stages of larger animals.

OCEAN ZONES / PRE-LESSON ASSESSMENT

Use the following true/false and multiple-choice questions as an introduction/warm-up to the lesson topics. You can do this in a verbal or written format, as a game, individually, or as a whole class! A handout is provided if you wish to hand the questions out in a quiz format.

The questions do not need to be graded. They are intended to give the students an idea of what they will be learning and to see what they already know.

1. True or False
There are only five major oceans.
Answer: True

2. True or False
Sharks do not live on the ocean floor.
Answer: False

3. How many major zones are there in the ocean?
- **a.** 5
- **b.** 2
- **c.** 8

Answer: a

4. Which of the following animal(s) can be found in the sunlight zone?
- **a.** Sea turtles
- **b.** Jellyfish
- **c.** Whales
- **d.** All of the above

Answer: d

5. What is a detrivore?
- ***a.*** An animal that only eats meat.
- **b.** An animal that only eat dead or decaying matter.
- **c.** An animal that only eats plants.
- **d.** None of the above.

Answer: b

Grade Level: 3-5

Name: _____

Date: _____

OCEAN ZONES

Select the correct answer(s) to each of the following questions.

1) True or False

There are only five major localized oceans.

2) True or False

Sharks do not live on the ocean floor.

3) How many major zones are there in the ocean?

a. 5

b. 2

c. 8

4) Which of the following animal(s) can be found in the sunlight zone?

a. Sea turtles

b. Jellyfish

c. Whales

d. All of the above

5) What is a detrivore?

a. An animal that only eats meat.

b. An animal that only eats dead or decaying matter.

c. An animal that only eats plants.

d. None of the above.

Grade Level: 3-5

OCEAN ZONES / LESSON PLAN

INTRODUCTION **3-5 mins**

Seventy percent of the Earth's surface is covered by ocean, which consists of about 97% of the Earth's entire water supply. In fact, 99% of the living space on Earth is in the oceans! There are five localized oceans that make up this living space: the Pacific Ocean, Atlantic Ocean, Indian Ocean, Antarctic Ocean, and Arctic Ocean.

Even with great advances in technology and research over time, there is still much ocean left unexplored. Scientists currently know of at least 1 million different species of plants and animals that inhabit the oceans, but because we have so much more ocean to explore, scientists believe that there may be around 9 million species yet to be discovered!

Oceanographers - scientists who study the ocean - have divided the ocean's water column into five ocean zones (Figure 1): the sunlight zone, the twilight zone, the midnight zone, the abyssal zone, and the hadal zone. Each zone has its own unique characteristics including different types of organisms that inhabit them.

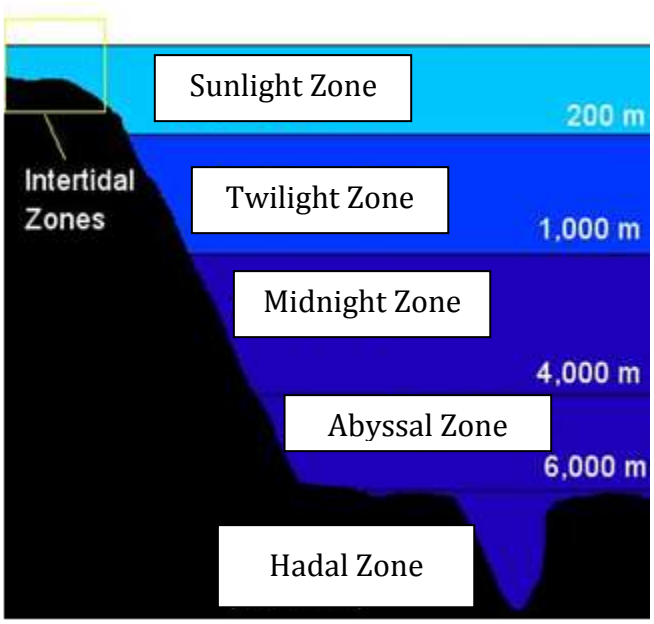


Figure 1. The Five Ocean Zones
Lori Timm, PhD. - Landry's Downtown Aquarium, Houston

PART 1. THE FIRST 1,000 METERS **10-15 mins**

The Sunlight Zone
The sunlight zone is the uppermost zone in the water column. This zone is also known as the epipelagic zone. It begins at the surface of the water and goes to a depth of around 200 m (656 ft.). This is the closest zone to the surface of the ocean and therefore receives a lot of sunlight.

Because this zone has plenty of sunlight, plants, such as algae, seagrasses, and mangroves as well as phytoplankton thrive here. The abundance of plants in this zone attracts herbivores to feed on the plants, which in turn attracts carnivores. Examples of animals in the sunlight zone include and astounding array of bony fish, sharks, sea jellies, sea turtles, corals, seals, whales, dolphins, and more!

The Twilight Zone
The twilight zone is just below the sunlight zone and has a depth range of 201 m - 1,000 m (657 ft. to 3,281 ft.). This zone is also known as the mesopelagic zone. Even though some sunlight reaches this zone, there is not enough of it for photosynthesis to occur. Therefore organisms that rely on photosynthesis to survive do not inhabit this zone. In fact, very few animals inhabit this zone due to lack of food.

The animals that do live in the twilight zone have learned to travel into the sunlight zone to feed on the more abundant prey found there. They do this under the cover of nightfall to avoid being eaten by the larger predators that live in the sunlight zone.

The twilight zone is home to many strange and bizarre looking creatures such as squid, octopus, cuttlefish, krill, and lantern fish. Due to the lack of sunlight, these animals have adaptations to help them survive in almost total darkness. For example, some of these animals can even produce their own light! This amazing adaptation is called bioluminescence. This type of light is not used to see better in the dark. Instead, it is used to lure prey, to avoid predators, and to attract mates.

PART 2. TO THE DEEPESTS OF DEEPS **10-15 MINS**

Midnight Zone
Just below the twilight zone is the midnight zone, which is also called the bathypelagic zone. This zone goes from 1,001 m - 4,000 m (3,282 ft. - 13,124 ft.). This zone completely lacks sunlight so it is very dark and very cold. Most of the animals found in the midnight zone are detritivores, carnivores, and scavengers. A detritivore is an organism that eats dead or decaying plant and animal matter. Detritivores in this zone feed on this type of matter as it sinks to the ocean floor.

Abyssal Zone
After the midnight zone comes the abyssal zone, which is also known as the abyssopelagic zone. This zone ranges from depths of 4,001 m - 6,000 m (13,125 ft. - 19,686 ft.). Just like the midnight zone, there is absolutely no sunlight here, the temperature of the water is close to freezing, and the water lacks nutrients. Only a few unique organisms are adapted to live here. Animals in this zone, such as shrimp, anglerfish, and bacteria, tend to be red in color or have no color at all. Animals with no color appear translucent and typically have bioluminescent capabilities.

Hadal Zone

The hadal zone, also known as the hadalpelagic zone, extends from 6,001 meters all the way to the bottom of the deepest parts of the ocean. The ocean floor is not completely flat. Instead there are mountains, canyons, flats, and deep trenches. Mariana Trench, location in the Pacific Ocean, is the deepest part of the entire world ocean with a depth of 10,911 meters (35,797 ft.). That's deeper that the height of Mount Everest, the tallest mountain in the world!

Another fascinating feature of the hadal zone is the hydrothermal vents. These areas are where tectonic plates are slowly shifting away from each other. Hydrothermal vents are inhabited by more organisms than any other areas on the ocean floor. These organisms include sea stars, tube worms, clams, and chemosynthetic bacteria. Chemosynthetic bacteria are able to produce their own energy just like phytoplankton! They use inorganic molecules as a source of energy by converting them into organic substances.

Only a few species of fish are able to withstand the harsh conditions of the hadal zone, like the deep-sea anglerfish and spook fish. The fish in this zone have to color to them at all and have wide eyes to detect bioluminescence from other organisms.

PART 3. SHARKS AND THEIR ZONES **10-15 mins**

Now that you know all about the different ocean zones, let's learn about what zones sharks are found in!

One of the most well-known sharks alive today is the great white shark (Figure 2). Great white sharks live primarily in the sunlight zone and spend most of their time at the surface of the water near coastlines. Why would a big shark stay near the surface along coastlines? Because that's where it finds its food! Adult great whites feed on a variety of large fish, marine mammals, birds, and even whale carcasses. Their bodies are large and streamlined and have large fins that make cruising through the ocean water seamless.

By tracking the movements of great whites, OCEARCH has learned that some individuals travel vast distances while others stay in small areas. They've also learned that some great whites occasionally dive down into the twilight zone, potentially for hunting or to avoid intense storms. The more information researchers collect, the more we can understand the great white shark and ultimately help protect it!

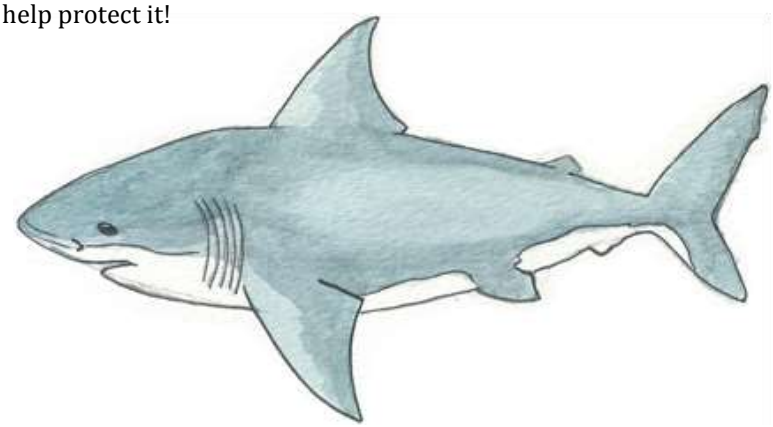


Figure 2. Great White Shark, *Carcharodon carcharias*
Illustration Credit: Sarah Rich – Landry's Downtown Aquarium, Houston

The cookiecutter shark (Figure 3) is an interesting shark that primarily lives in the twilight zone, but occasionally comes up to the sunlight zone at night to feed. They have very large eyes so that capture as much sunlight as possible to be able to see in the dark.

The cookiecutter shark has a unique feeding method and its name might give you a clue! The cookiecutter shark's prey is attracted to the bioluminescent glow on its underside. The glow resembles a small fish, which lures larger predators towards the cookiecutter shark. But before this predator has a chance to take a bite, the cookiecutter shark quickly attaches itself to its prey with its sucking lips and sharp pointy upper teeth. Once it is attached, the small shark spins its body removing a cookie-shaped piece of flesh from its prey with its larger serrated bottom teeth. The prey is left with a perfectly round cookie cutter-shaped wound. Common prey items include large fishes such as marlin, wahoo, tuna, sharks, and stingrays as well as marine mammals including seals, whales, and dolphins.

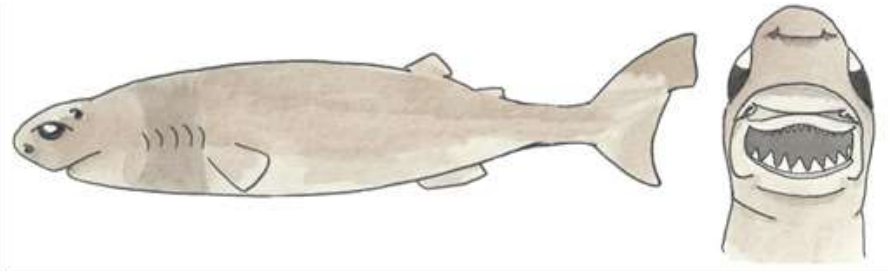


Figure 3. Cookiecutter Shark, *Isistius brasiliensis*
Illustration Credit: Sarah Rich – Landry's Downtown Aquarium, Houston

One of the most primitive sharks alive today is the frilled shark (Figure 4). These sharks can be found deep in the midnight zone and primarily feed on other sharks, bony fish, and squid! Because of the intense high pressure exerted this deep in the ocean, frilled sharks have exceptionally large livers that contain low density oil. This helps them to maintain that help them maintain buoyancy and their position in the water with little effort.

They are also one of the few species of sharks with an open lateral line (a visible line along the side of a fish consisting of a series of sense organs that detect pressure and vibration), which means theirs are directly exposed to the surrounding seawater. This is thought to enhance their sensitivity to movements of prey in their proximity.

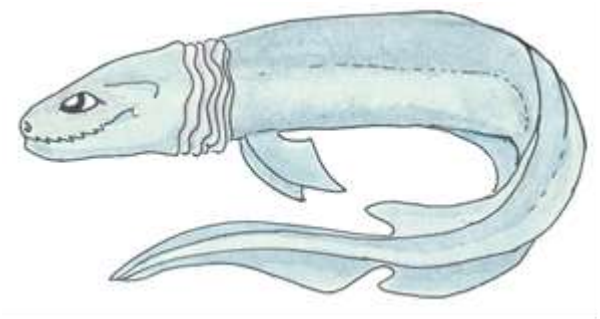


Figure 4. Frilled Shark, *Chlamydoselachus anguineus*
Illustration Credit: Sarah Rich –Landry's Downtown Aquarium, Houston

Grade Level: 3-5

OCEAN ZONES / ACTIVITY 1. COMPARING ZONES

INTRODUCTION

During this activity, students will use Venn diagrams to compare and contrast the five different ocean zones. One will compare and contrast the sunlight zone and the twilight zone and the second one will compare and contrast the midnight zone, abyssal zone, and the hadal zone.

MATERIALS

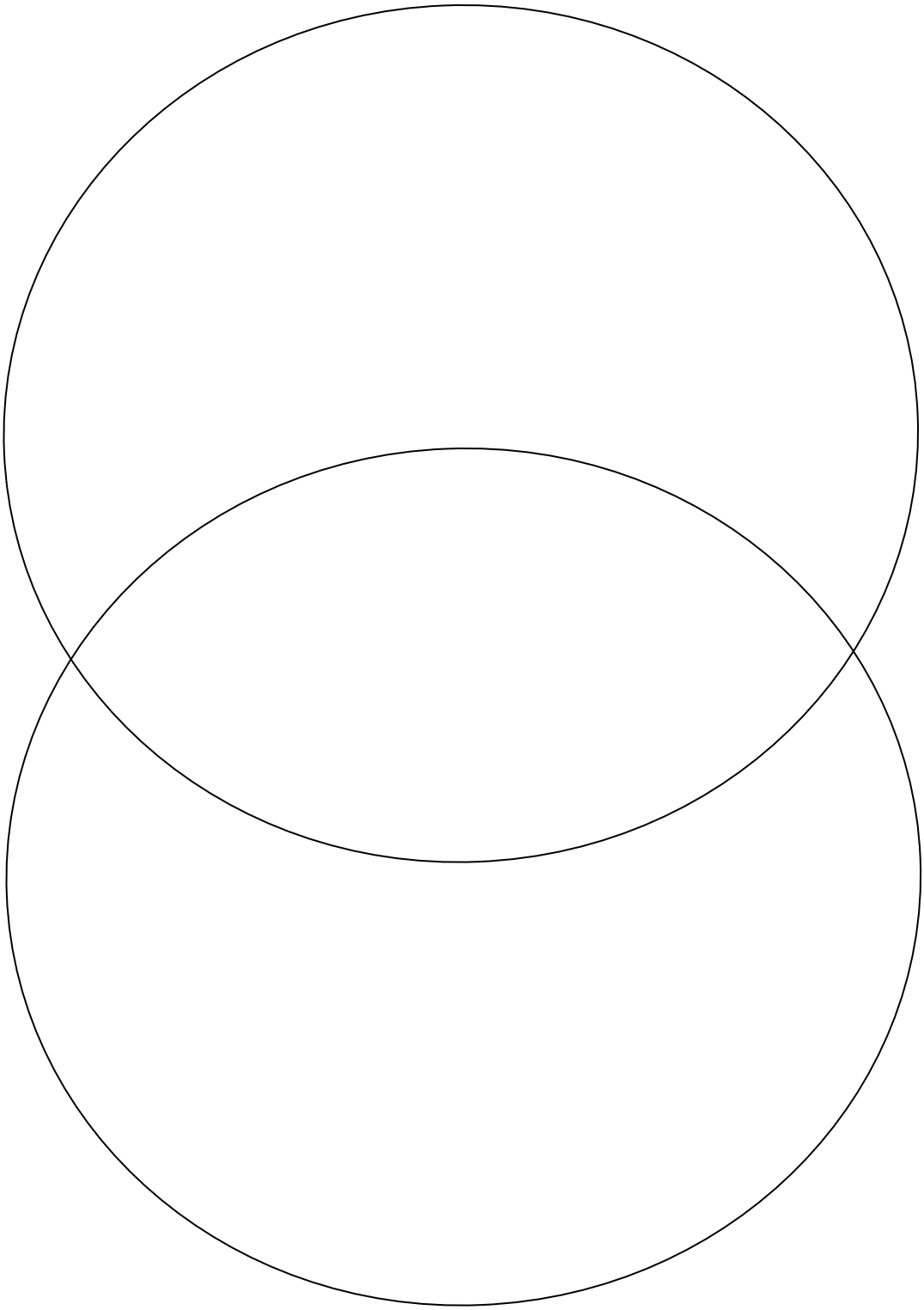
- Comparing Zones Handout
- Writing utensils, color pencils, crayons, markers
- Computer, tablet, or phone (optional)
- Internet access (optional)
- Library books (optional)

TIPS

To incorporate technology into this activity, you can have students use the computer to look up more facts about each zone and the different animals that live there. Make this activity colorful by using color pencils, crayons, or markers. This can also be done as a class discussion to summarize the material in this lesson.

COMPARING ZONES

Use the Venn diagram to compare and contrast the <u>sunlight zone</u> and the <u>twilight zone</u>.



Grade Level: 3-5

Use the Venn diagram to comparing and contrasting the <u>midnight zone</u>, <u>abyssal zone</u>, and the <u>hadal zone</u>.