

Ocean Habitats – The Deep

Adapted from Project Wet
(MAKEUP VERSION)

Background: With their exceptionally varied underwater geography, the ocean basins support the life of almost 50 percent of all species on Earth and play a major role in weather and climate. Trenches and canyons deeper than the Grand Canyon, mountain ranges larger than the Himalayas, vast flat bottom valleys, active volcanoes and smoker chimneys belching gas and particles from the Earth's core are all part of the topography of the ocean. Of all of Earth's complex ecosystems, the marine environment is the least explored and understood. Scientists estimate that 95 percent of the ocean remains biologically uncharted.

The sun, a vital component of life for much of our planet, penetrates only the uppermost layers of the ocean. In deeper realms, scientists are studying ecosystems along the edges of continental plates. In the absence of sunlight, creatures live and grow using chemosynthesis, a process much like photosynthesis except that instead of sunlight, organisms are able to convert chemicals like methane and hydrogen sulfide, into life-supporting energy. Some thrive on gases spewing from hydrothermal vents along the plate boundaries of the ocean floor. The superheated water and gases are toxic for species above the surface of the ocean, yet crabs, tube worms and clams flourish in this extreme environment.

In the dark, open water of the ocean, bioluminescent creatures use light to capture prey and communicate with one another in the dark. Fish, crabs, octopuses and other animals have adapted to an environment that is not only without light but is also under the extreme pressure of the billions of gallons of water above them.

Scientists have classified ocean basins into different zones, each with its own characteristics. The five zones are:

The sunlit or **epipelagic zone** is the top layer of the ocean, extending from the surface to 200 m below the surface. As the name suggests, this zone has the most visible light. Heat from the light contributes to the wide swings of temperature that can occur in this zone.

The twilight or **mesopelagic zone** extends from 200 m to 1,000 m. Only faint light can penetrate to this depth – not enough for photosynthesis, but enough for some creatures to have countershading.

The dark or bathypelagic zone reaches from 1,000 m to 4,000 m. The only light visible in this zone is produced by the organisms that live there. Most of them are black or red in color because of the lack of light.

The abyssal or **abyssopelagic zone** extends from 4,000 m to 6,000 m and is sometimes called simply “the abyss”. The waters of the abyssal zone are near freezing, and there is no light at all. Very few creatures can make their homes in the extreme pressure of these depths, yet approximately three-quarters of the ocean floor is within this zone.

The trenches, or **hadalpelagic zone**, are below the deepest depths of the abyssal zone, starting at 6,000 m. The deepest place in the ocean is in the Pacific Ocean's Mariana Trench off the coast of Japan, at a depth of approximately 10,911 m. Despite the near-freezing temperatures and extreme pressure, life exists, even at the very bottom.

Depending on individual adaptations, marine species may move freely between zones. Each layer provides a different living environment influenced by sunlight, depth and hydrostatic pressure. The deeper an animal is, the more gallons of water are weighing down on it. Each gallon of water weighs 8.8 pounds. The pressure generated by the accumulated weight of water at a given depth is called the hydrostatic pressure.

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What We Did in Class: Students played a game racing to the bottom of the sea! They chose a submarine then drew cards that depicted a variety of marine organisms. Finding an organism from the next ocean layer led them deeper and the first to the ocean floor and back to the surface won the game.

Prelab Questions:

1. What percentage of the seafloor is still biologically uncharted? What does that mean?
2. How does the base of the food chain differ from the upper layers of the ocean to the deeper layers of the ocean?
3. Why do creatures use bioluminescence?
4. What is the deepest place on Earth? How deep is it?
5. How much hydrostatic pressure is generated by a gallon of water?

6-10. For each zone in the descent, research one organism and record the information below.

Ocean Zone	Species Discovered	Depth Found	Cool Fact
Epipelagic (0-200m)			
Mesopelagic (200-1000m)			
Bathypelagic (1000-4000m)			
Abyssopelagic (4000-6000m)			
Hadalpelagic (6000-11000m)			

Analysis:

11. Describe the changes you saw in animal characteristics as you descended into the deep sea.
12. Create an imaginary organism that could be found living in the deep sea (mesopelagic or below).
Draw the creature and describe at least three characteristics consistent with life in that zone.
13. Share the organism you created with your group. How is your organism similar to others?
How is your organism different?