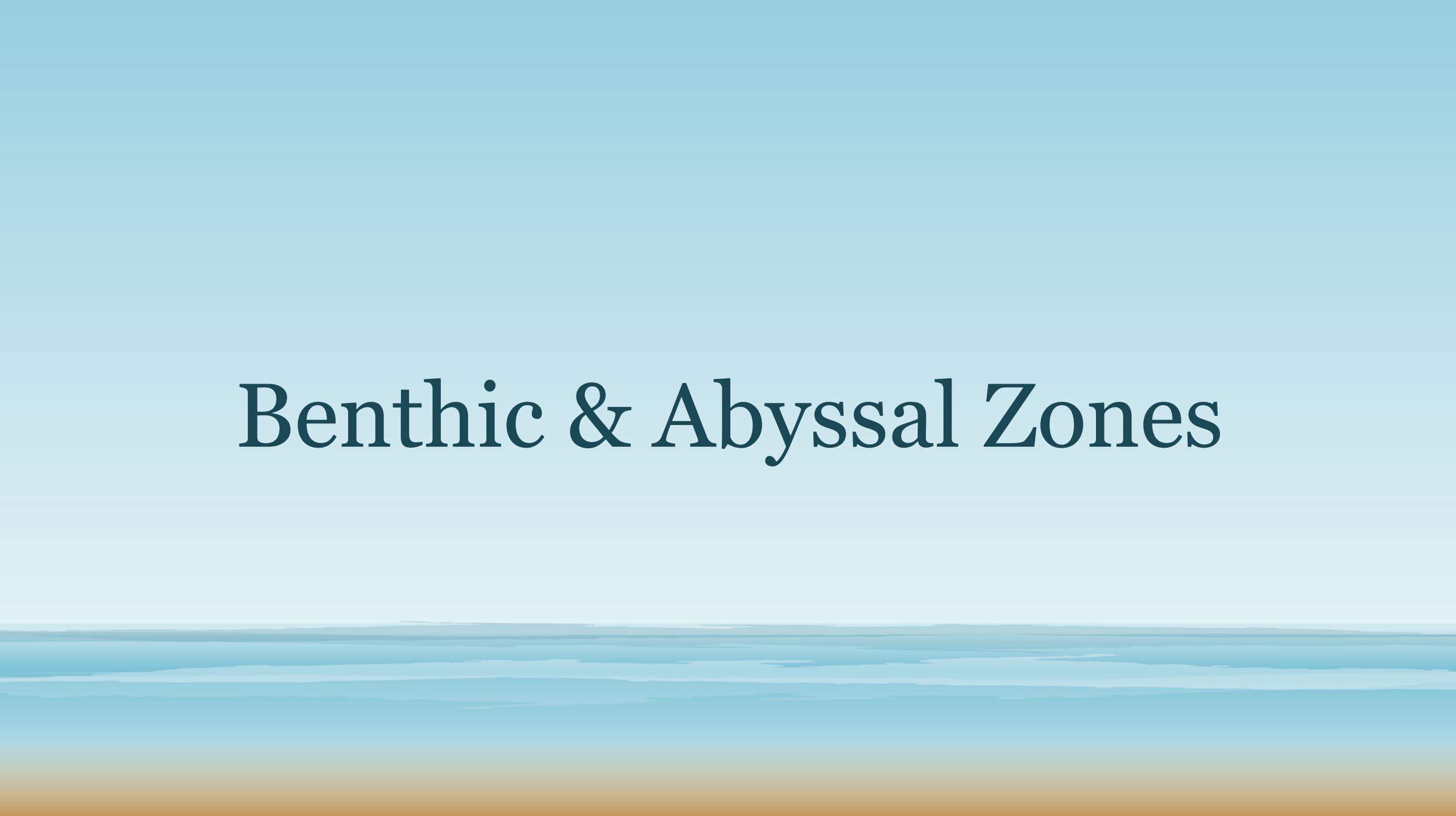
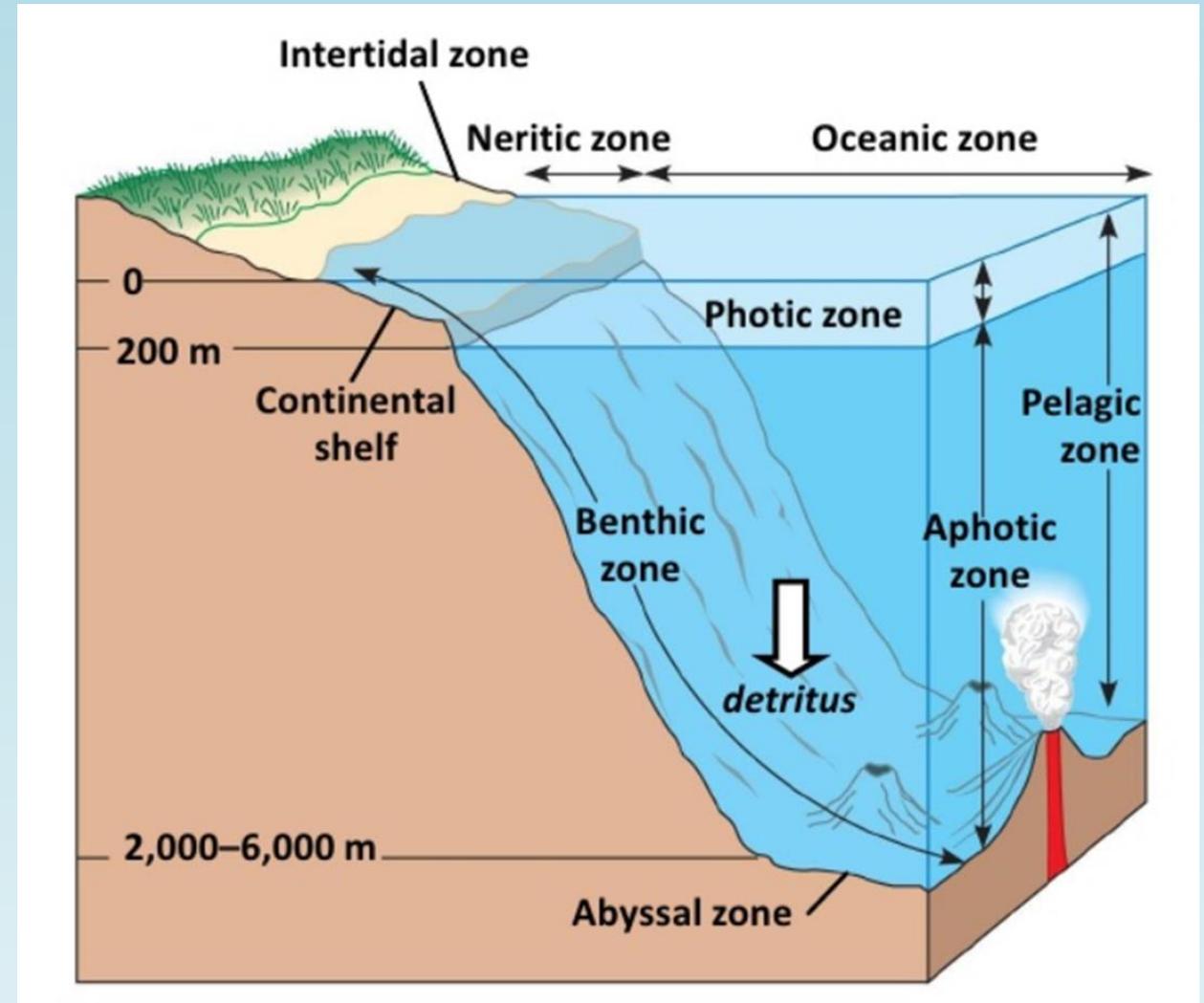


Benthic & Abyssal Zones

The background features a horizontal horizon line. Above the horizon, the sky is a uniform light blue. Below the horizon, the water is depicted with horizontal bands of varying shades of blue, creating a sense of depth and movement. At the very bottom of the image, there is a gradient that transitions from the light blue of the water to a warm, golden-brown color, suggesting a sandy or silty seabed.

Benthic Zone

- The term 'benthic zone' stands for the lowest ecological region in a body of water. It is defined as the region encompassing the floor and the water layer immediately above it.
- This terminology is independent of the depth of the water body, i.e., the benthic zone is not determined by the depth at which the bottom lies, but rather by the state of being the bottom-most region.



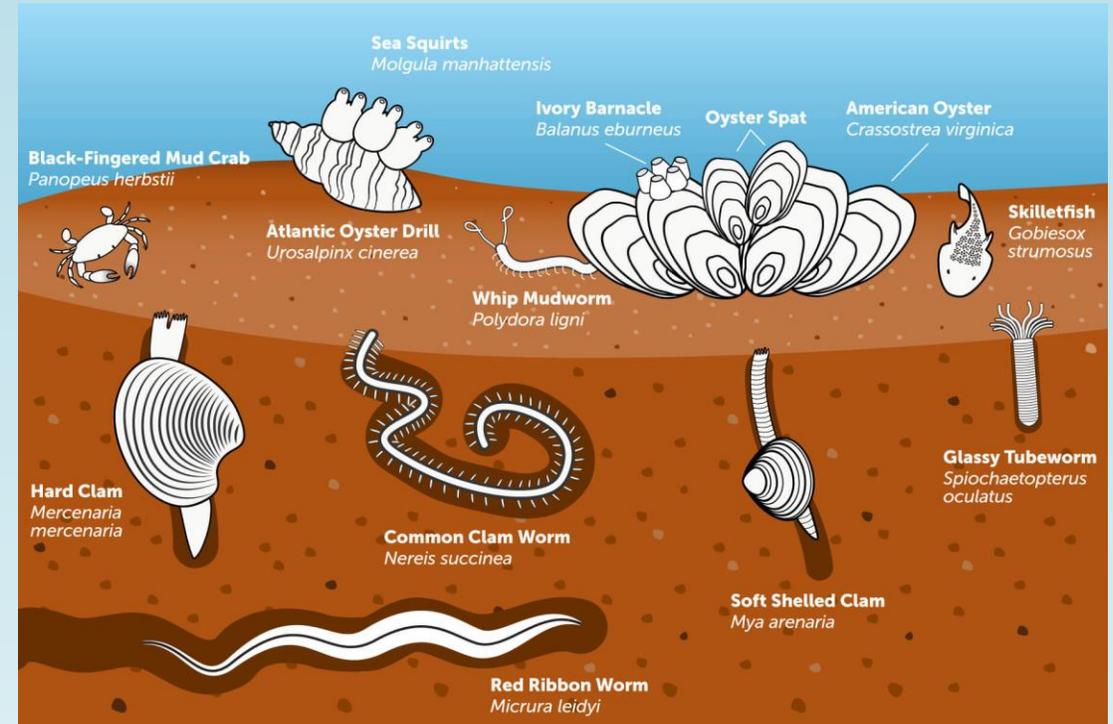
Benthic Zone

- Since the benthic zone is the zone at the bottom, it starts right at the coastline, and carries on along the continental shelf into the deep ocean. The benthic zone in deep waters is equated with **abyssal plains**.



Organisms in the Benthic Zone

- Organisms living in the benthic zone, particularly on the surface of oceans, are known as **benthos**.
- These are divided into two categories:
 - Epifauna, which live on the surface
 - Infauna, which burrow into it
- https://www.youtube.com/watch?v=K_7ByiYbCYM



Organisms in the Benthic Zone

- Due to the differing depth, a single particular biome is hard to describe with regard to the benthic zone.
- In general, **molluscs, crustaceans, bivalves, sponges, echinoderms, flatfish, eels, and even some species of sharks** are found in the benthic zone. The abyssal plains can also be home to various microorganisms, particularly those with flagella, as well as large organisms, such as anglerfish, which lure other fish with bioluminescence.

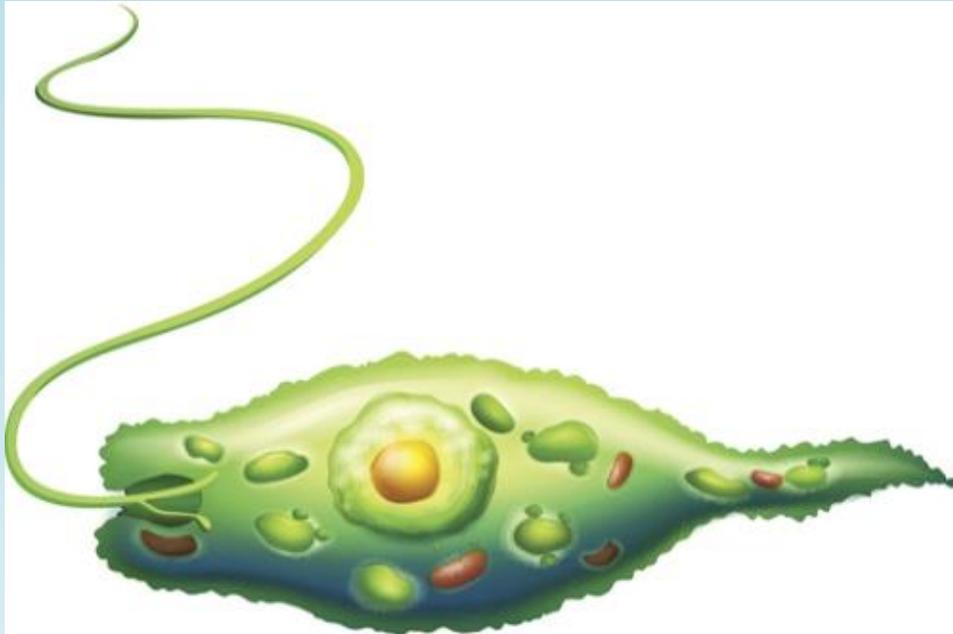


Plants in the upper Benthic Zone

- Many plants live in the higher levels of the benthic zone where they get sunlight to carry out photosynthesis.
- These bottom-dwelling plants live in water that's shallow enough for light to reach them.
- Examples: Water Lily, Mangroves, Cattails



Plants in the lower Benthic Zone



- At the bottom of the ocean, it is constantly raining detritus. Bits of dead fish and the remains of microscopic organisms all move to the sea floor.
- Single-celled organisms like protozoa, fungi, and bacteria consume all this detritus. Thus, they form the base of the food chain for the bottom feeders, like the crabs and snails, and tunicates.
- Example: Euglena

Benthic Algae



- Benthic algae compose most of the ocean's plant life.
- They are 20 to 40 m deep from the seashore, and play a very important role in the food chain.
- Benthic algae can be categorized into Green algae (Chlorophyta), Brown algae (Phaeophyta) and Red algae (Rhodophyta), depending upon their pigment color.
- Turtle Grass (green algae)

Benthic Algae

- The Giant Kelp is the most prominent benthic plant that grows off the West Coast of the United States. It is a type of brown algae that grows in very deep layers and can extend upwards for more than 30m.
- Giant Kelp (brown algae)



Animals in the Benthic Zone



- These animals spend most of their time resting, feeding, and moving around at the bottom of the water.
- These include Aquatic invertebrates like:
 - Crabs
 - Sea stars
 - Sea cucumbers
 - Shellfish: clams
 - Snails
 - Worms

Sessile Creatures

- These creatures can be considered immobile. They attach to the bottom and do not move.

Examples:

- Corals
- Oysters
- Sea squirts
- <https://www.youtube.com/watch?v=zHIMPwJokBk>
- (last 1/3 only)



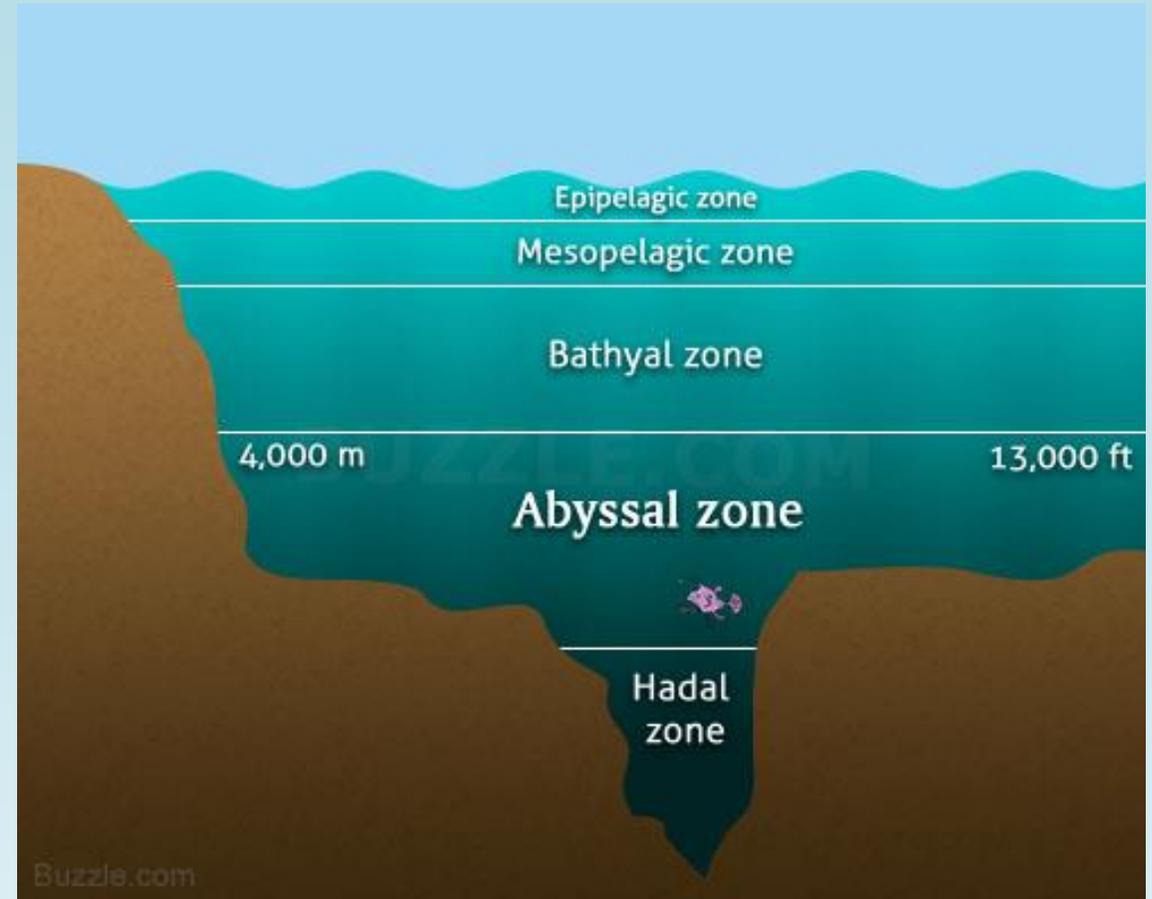
Benthic Fish



- Benthic fish are denser than water, so they can rest on the sea floor. They camouflage themselves, or lie and wait, covering themselves in sand.
- Examples:
 - Catfish
 - Dragonets
 - Flounder
 - Halibut
 - Turbot
- <https://www.youtube.com/watch?v=w1MAGs4RDDo>

Abyssal Zone

- Derived from the Greek word meaning “bottomless sea.”
- It refers to waters between 3000 m to 6000m deep. It is often defined as the area where the water hits 4 degrees Celsius.
- It is also marked by darkness and uniform environmental conditions. There are no seasons or day and night.



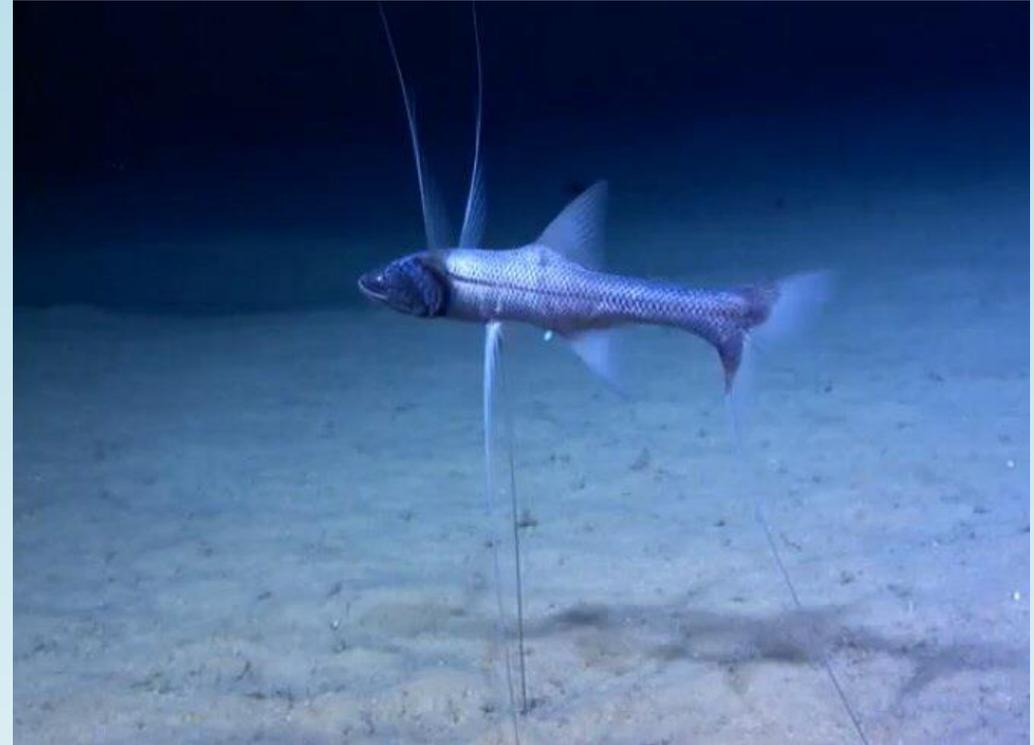
Abyssal Zone



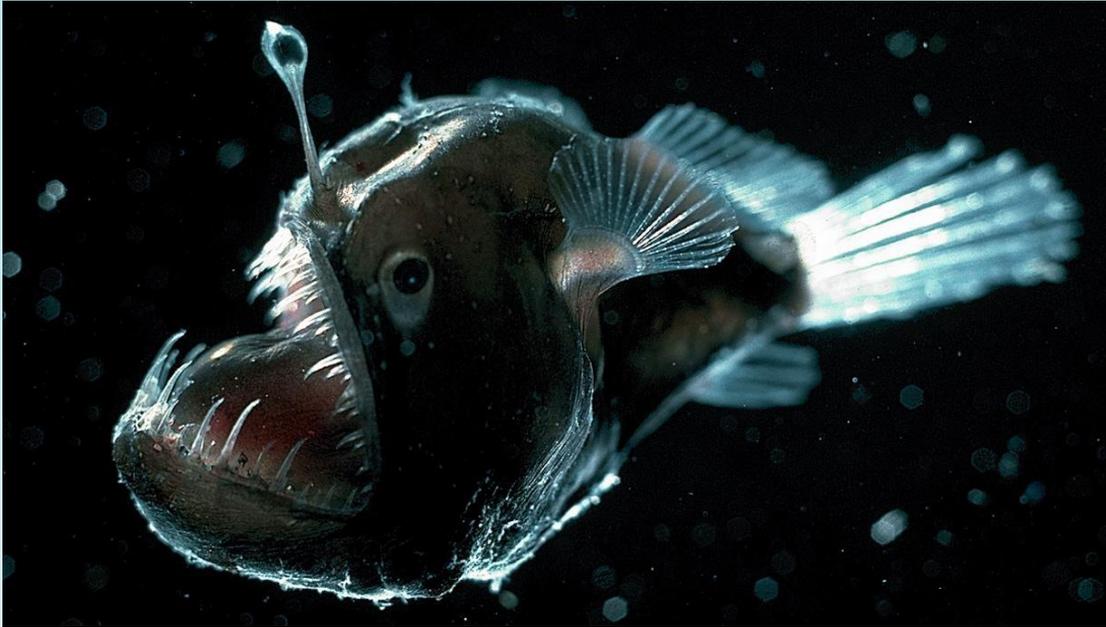
- The average depth of the ocean is 4000m, making the Abyssal Zone the largest living environment on Earth.
- It covers over 300,000,000 square km –about 83% of the ocean’s total area and 60% of Earth’s surface.
- <https://youtu.be/8101vCjM7nY>

Abyssal Conditions

- The conditions of the Abyssal Zone are almost constant. It is dark and cold at all times (averaging 2 degrees Celcius at 4000 meters).
- It is calm and unaffected by sunlight and turbulent seas, far above.
- The water is very still, and the oxygen in the water derives solely on the amount of dissolved oxygen it had when it left the polar regions, from which all Abyssal water originates.
- The nutrient salt concentration (nitrogen, phosphorus and silica) is uniform and higher than in the waters above because the Abyssal and Hadal Zones are the areas where dead biological materials settle to the floor.



Animals in the Abyssal Zone



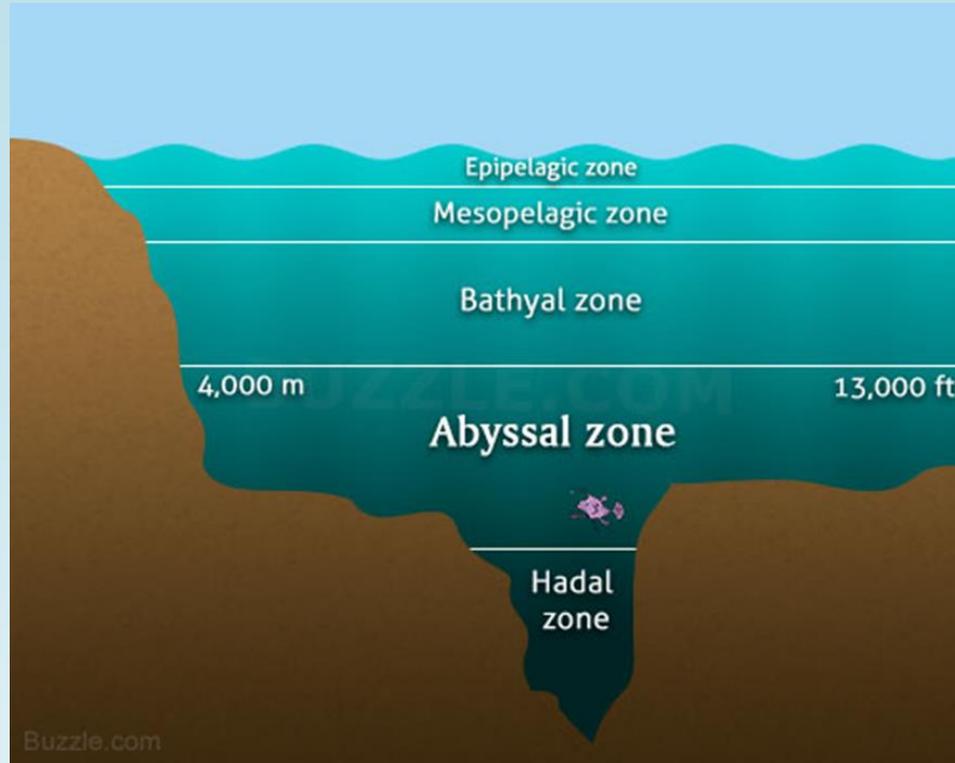
- In spite of the fact that water near the sea floor is devoid of oxygen, there is a spike in biomass here. This is because the collection of sediment gives a food source.
- There are few species and low numbers of each.
- Fish at these depths often have huge, gaping, underslung jaws to sift through the sand and catch food.
- <https://youtu.be/-qCgw6RgipQ>

Animals in the Abyssal Zone

- Animals here must withstand pressures of up to 11,000 psi.
- They tend to be grey or black (for camouflage) and unstreamlined (for energy conservation).
- Many are blind, and they are thought to reproduce very slowly.
- Some examples of deep sea life here are the tripod fish, anglerfish and giant squid.



Hadal Zone

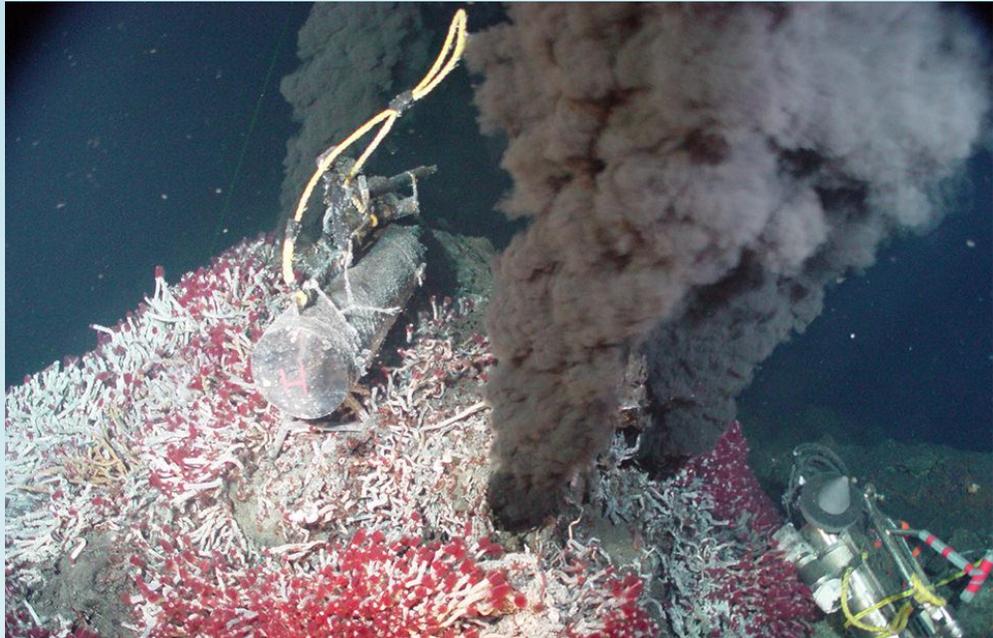


- The Hadal Zone is the layer of the deep sea below 6000 meters.
- Its found almost exclusively in deep ocean trenches.
- Here the pressures are tremendous, making it humanity's least explored place.
- More people have been to the moon than to the Marianas Trench – the deepest part of the ocean at approximately 11,021 m

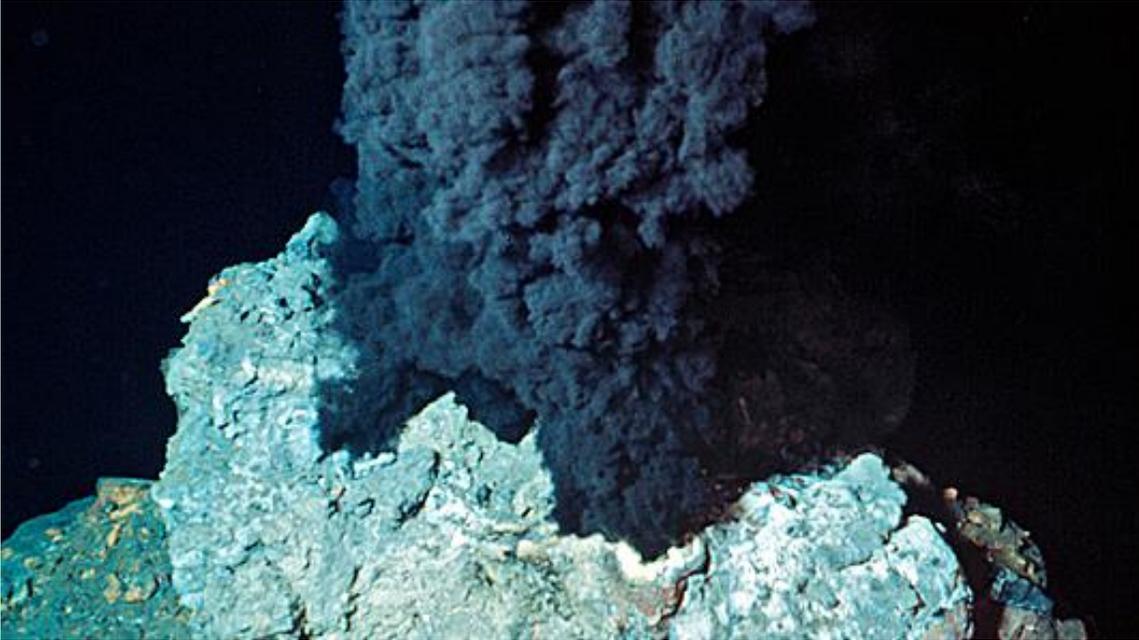
Thermal Vents

- Scientists first discovered hydrothermal vents in 1977 while exploring an oceanic spreading ridge near the Galapagos Islands. To their amazement, the scientists also found that the hydrothermal vents were surrounded by large numbers of organisms that had never been seen before. These biological communities depend upon chemical processes that result from the interaction of seawater and hot magma associated with underwater volcanoes.

- <https://www.youtube.com/watch?v=D69hGvCsWgA>



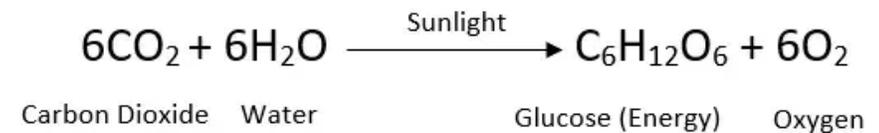
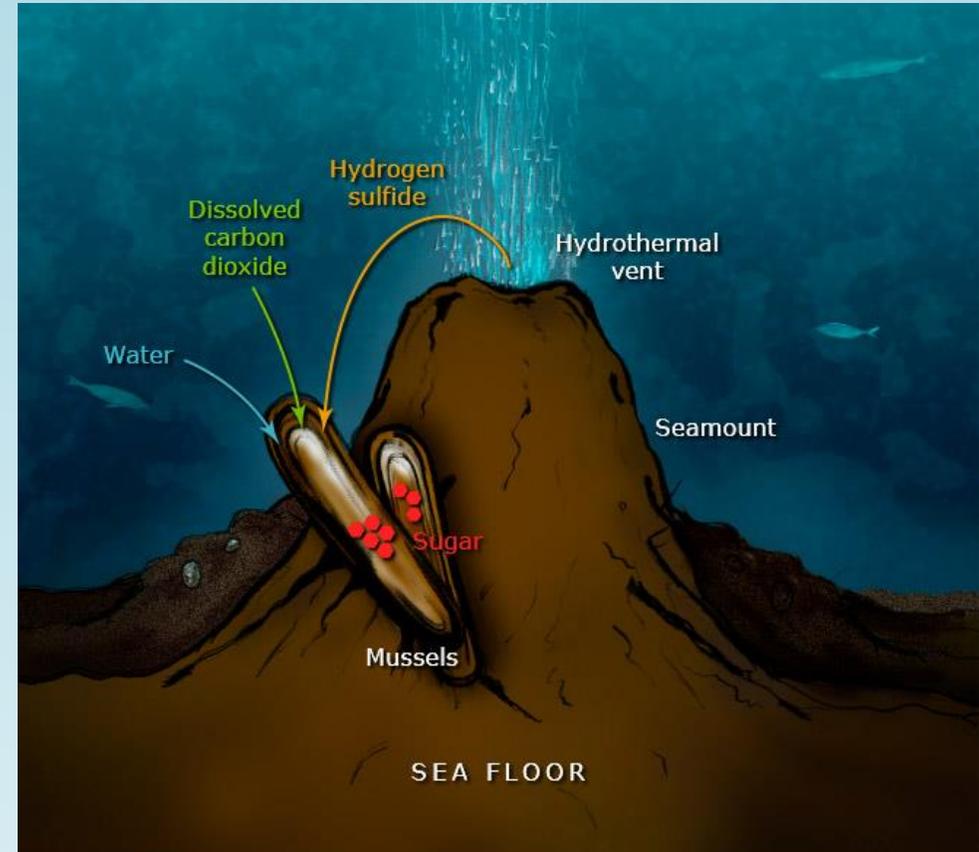
Thermal Vents



- Hydrothermal vents are the result of seawater percolating down through fissures in the ocean crust in places where two tectonic plates move away or towards one another.
- The cold seawater is heated by hot magma and reemerges to form the vents. Seawater in hydrothermal vents may reach temperatures of over 370° Celsius.
- Hot seawater in hydrothermal vents does not boil because of the extreme pressure at the depths where the vents are formed

Chemosynthesis

- Chemosynthesis is the process by which certain microbes create energy through chemical reactions.
- The animals that live around hydrothermal vents make their living from the chemicals coming out of the seafloor in the vent fluids.
- Hydrothermal vents typically have high biomass, in stark contrast to the very sparse distribution of animals outside of vent areas where animals are dependent on food dropping down from above.



Chemosynthesis



- Chemosynthetic microbes provide the foundation for biological colonization of vents.
- Where microbial mat covers the seafloor around vents, grazers such as snails, limpets, and scaleworms eat the mat, and predators come to eat the grazers.
- Tubeworms flourish in small clumps, waving in the warm fluids.

Exploration

- The first manned exploration to reach Challenger Deep, the deepest known part of the ocean located in the Mariana Trench, was accomplished in 1960 by Jacques Piccard and Don Walsh. They reached a maximum depth of 10,911 meters
- James Cameron also reached the bottom of Mariana Trench in March 2012 using the Deepsea Challenger. The descent of the Deepsea Challenger was unable to break the deepest dive record set by Piccard and Walsh by about 100 meters, however Cameron holds the record for the deepest solo dive.
- <https://www.youtube.com/watch?v=-DWPDsgTiaE>

