

Endeavour Hydrothermal Vents: Canada's First MPA

Activity III

(adapted from Project Wild, Fashion a Fish Activity, Canadian Wildlife Federation.)

A Product of My Environment

Timeline

Two - 45 minute lessons.

One lesson is to discuss terminology and background, one lesson is to hear visualizations and create creatures.

Grades 4 – 8

Materials and resources

Art materials,

paper

modeling clay

colouring page

glossary of terms (pick out relevant words)

visualizations #1 and #2

Objectives

1. Students will be able to define biomes, the abyssal zone, and describe adaptations of marine life to their environments.
2. Students will be able to describe how adaptations can help marine life survive in their habitat
3. Students will interpret the importance of adaptations in living organisms.

Curriculum connections

Grade 4 - (Science) Biomes –The abyssal biome (or zone) is where the Endeavour hydrothermal vents exist.

Grade 5 - (Science) Humans use earth materials as natural resources – Sustainable practices – MPA's .

Chemosynthesis vs photosynthesis - Multicellular organisms have organ systems that enable them to survive and interact within their environment.

Grade 6 - (Science) Multicellular organisms rely on internal systems to survive, reproduce and interact with their environment.

Grade 7 - (Science) Theory of evolution by natural selection provides an explanation for the diversity and survival of living things. Unique adaptations of vent inhabitants.

Grade 8 - (Science) – Communication, creative and critical thinking.

- characteristics of life

- the theory of plate tectonics is the unifying theory that explains Earth's geological processes.
- the relationship of micro-organisms with living things
- photosynthesis (vs. chemosynthesis)

English Language Arts

- Create and communicate – presentation techniques

Natural selection, survival needs and interactions between organisms - Chemosynthesis/symbiotic relationships of hydrothermal tubeworms and bacteria, as well as other vent organisms.

Overview

In the first activity, a class discussion of biomes, the abyssal zone, and adaptation, students are asked for specific examples of adaptations for various biomes, and more specifically the abyssal zone where the Endeavour site is located.

In the second activity, through guided imagery, students are given traits of an imaginary marine environment and are asked to “design” marine creatures that will have the best chances for survival.

They are then given another guided imagery, where characteristics of the abyssal zone – then the Endeavour hydrothermal vents area are described, and students are asked to create a creature that is adapted to survive there.

Background

Our earth is divided into areas called **biomes**, areas of the earth with similar climatic conditions and species living there. **Biomes** are defined as "the world's major communities, classified according to the predominant vegetation and characterized by adaptations of organisms to that particular environment" (Campbell, 1996).

There are aquatic and terrestrial (land) biomes. Terrestrial biomes are – tundra, rainforest, savanna, taiga, temperate forest, temperate grassland, chaparral, alpine, and desert.

Each biome consists of many ecosystems whose communities have adapted to the small differences in climate and the environment inside the biome. All living things are closely related to their environment.

Aquatic biomes are freshwater and marine.

Within the marine biome there is the ocean, estuaries, and coral reefs.

The ocean is divided into layers according to depth and temperature, with the abyssal zone being the area where the Endeavour hydrothermal vents occur. This layer of the ocean ranges from approximately 2000 to 6000 meters deep, and is subject to extreme cold, intense pressure due to depth, and complete darkness.

The water in this region is very cold (around 3° C), highly pressured, high in oxygen content, but low in nutritional content. The abyssal zone supports many species of invertebrates and fishes. Mid-ocean ridges (spreading zones between tectonic plates), often with hydrothermal vents, are found in the abyssal zones along the ocean floors. Chemosynthetic bacteria thrive near these vents because of the large amounts of hydrogen sulfide and other minerals they emit. These bacteria are thus the start of the food web as they are eaten by invertebrates and fishes.

(Biomes Group of the Fall 96 Biology 1B class, section 115, at UC Berkeley
Editing by Stephanie Pullen, redesign by Kacey Ballard, April 2004.)

Activity

We will look at adaptation, and the adaptations the residents of the Endeavour Hydrothermal Vents have made to survive, and even flourish, in this harsh environment.

Introduction

Activity part 1 – 30 - 45 minutes

All life is the product of countless adaptations over long periods of time. What are the requirements for survival? (food, water, shelter) What are some adaptations to better survive? (body shape, mouth, colour - method of camouflage or hiding, reproduction or spawning, tolerance to temperature and temperature changes, tolerance to chemical compounds)

Have students draw or find a picture of a creature with specific adaptation. Have students think about an adaptation that an animal has – ie. long legs and sharp bill of blue heron for standing in water and catching prey, ears of owl offset in their head to enable them to hear in more directions.

Have a class discussion of the value of different kinds of adaptation to living things. Ask students if they can think of an adaptation to an extreme environment.

Activity part 2 – 1 hour, plus discussion time.

Discuss with the class the different adaptations marine creatures have that enable them to survive. Next, discuss the creatures of the hydrothermal vents and their adaptations to survive in the extremes of this environment. (extreme heat at vent sites, extreme cold away from vent sites, sulfur dioxide (rotten egg gas) and other metals, and complete dark)

Divide students into groups of 3 or 4, depending on class size. (this activity can also be done individually.)

Read students the “visualization story #1” and have them create a creature that would be best adapted to survive in the described environment. (This can be drawn, a modeling clay form, a written description)

Have groups present their creatures and tell what adaptations the creatures have (whether color, shape, reproduction, mouth, etc.) to best enable them to survive.

Students must be prepared to defend why their creature has the specific features they have given it.

Read students the “visualization story #2” (the characteristics of the abyss zone of the ocean) and have them create something that would be best adapted to survive this harsh environment. Make sure to stress that this does not have to be a creature like a fish – be creative!

Have students present these creatures and describe their adaptations and how they enable the creatures to survive.

Hand out colouring page on Endeavour Hydrothermal vents.

Have students look at the drawing page. Tell students to look for various adaptations that the various creatures have made to survive the high sulphur content of the water, the heat of the vents, the surrounding cold, the high pressure of the deep sea, and the complete lack of light.

How do these things feed, reproduce, avoid predation/predators?

End with discussion of unique adaptations of Endeavour HTV creatures and compare to adaptations of other creatures in various biomes on the earth.

Evaluation

Name two adaptations of creatures in hot areas - what is the advantage of these adaptations to the survival of the creature in the hot habitat?
What biome could a hot area be?

Name two adaptations of creatures in cold areas – what is the advantage of these adaptations to the survival of the creature in the cold?
What biome would this be?

Describe how deep sea (abyssal dwellers) have adapted to survive in the complete dark.

Name three adaptations of Endeavour hydrothermal vent dwellers – (chemosynthesis to deal with lack of light and maintain ability to produce food, symbiotic relationships to deal with extreme chemical environment, limited range of habitat to take advantage of warmth of smokers, adaptation to large temperature range – hot close to vents, cold as you go away.)

Define endemic and name three endemic species. (Found only in a specific habitat or biome - tubeworms, clams, bacteria.)

What have scientists done to be able to study these hard to access, dark, hostile environments?

Extensions

Have students draw their interpretations of what the visualizations #1 and #2 habitats looked like.

Look at the colouring page and choose a creature or feature to explore further. Colour this creature or feature according to what you have found in your research.

Explore all of the earth's biomes and look at the differences.

Pick one of the ocean biomes, research and present to class.

Class discussion of how different areas of the earth are divided into biomes. How does this assist science?

Find another area of the earth than hydrothermal vents that harbor endemic species.

Deep sea biome :<http://www.untamedscience.com/biology/biomes/deep-sea-biome/>

World biomes :<http://www.untamedscience.com/biology/biomes/>

Photosynthesis/chemosynthesis:

http://oceanexplorer.noaa.gov/edu/learning/5_chemosynthesis/activities/chemovsphoto.html