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Deep East 2001 Exploration

Design a Deep-Sea Vertebrate or Invertebrate

Focus
Blake Ridge - Structure and Function in Living Systems

Grade Level
7-8

Focus Question
What types of adaptations do invertebrates need to live in a methane hydrate habitat?

Learning Objectives
Students will design an invertebrate or vertebrate capable of living in a methane hydrate ecosystem.

Materials:
- ❒ Reference materials such as : encyclopedias , life science textbooks, Internet
- ❒ Colored pencils or markers (one pack per student group)
- ❒ Animal Adaptation Chart (one copy per pair of students)
- ❒ Chart paper
- ❒ Overhead projector, transparency and markers

Teaching Time
Two 45-minute sessions

Seating Arrangement
Students will work in pairs for research.

Key Words
Cold seep communities
Hydrates
Methane
Chemosynthetic
Symbiosis
Bacteria
Polychaete
Mussel
Gastropod
Echinoderm
Benthic
Adaptations

Background Information
Hydrates are a solid structure in which ice forms a cage around a gas molecule. This gas is usually methane. These hydrates can be found deep in the ocean where there is enough gas present and the pressure and temperature are at the right level.

Cold seep communities in the deep, dark ocean are inhabited by chemosynthetic organisms, capable of producing food without sunlight. Bacteria that live either alone or symbiotically within some deep-sea animals, such as tubeworms and mussels, manufacture food used by these organisms to live, grow, and reproduce. Each of these organisms is uniquely adapted to the specific environment in which they live.

Organisms adapt to their environment in the following ways:

1. They need to be a certain shape, or form, depending on where they live,
2. They may or may not need to move around. Some organisms are sessile, or immobile. They only move in their larval stage. Once

they reach their adult phase they stay in one place. They need some sort of adaptation to stay in that place. Other organisms move about. They need an adaptation to help them move.

3. All organisms need food. Some organisms filter food through gills, while others take in food through a mouth. They also need to get rid of wastes.
4. All organisms need protection from predators and environmental stress. This protection may be camouflage, special body parts, a heavy, protective outer layer, and/or some form of locomotion, or a metabolic process to handle stress.
5. All organisms need to reproduce. Reproduction may be sexual or asexual.

Learning Procedure:

1. Make one copy of the Animal Adaptation Chart for each pair of students.
2. Given polychaete, mussel, gastropod, echinoderm, or a fish, each student pair will choose one animal, research using available references (Internet, encyclopedias, and/or textbooks), and complete the Animal Adaptation Chart for adaptations.
3. Compile a class chart of adaptations of all groups.
4. As a class, brainstorm adaptations required for survival in a deep-sea oil and gas seep ecosystem. Students need to remember the parameters of the ecosystem, such as cold, no light, and the presence of chemosynthetic bacteria. Visit www.hydrate.org/about/biology.cfm for more background information on organisms that live in cold seep communities.
5. Each student will design and draw an invertebrate or vertebrate capable of living in this ecosystem. Each invertebrate/vertebrate must exhibit adaptations in body form, locomotion, feeding, protection, and reproduction.

The BRIDGE Connection:

www.hydrate.org

The "Me" Connection

Students will see the importance of adaptations in the survival of deep-sea organisms and relate these specializations to the demand of the deep-sea environment.

Connection to Other Subjects

Art

Evaluation

Adaptation charts from each student pair may be evaluated for completeness and student drawings may be evaluated for understanding adaptations.

Extensions

- Have students write a story about "A Day in the Life of…" for the animal they chose to design. They should explain the unique adaptations of the animal within the story.
- The student pairs could get together with other student pairs to form a food web that incorporates several of the animals they designed.
- Students should research the animals that actually live in the cold oil and gas seep communities.

National Science Education Standards:

Life Science Content Standard C:

- Structure and Function in Living Systems
- Reproduction and Heredity
- Regulation and Behavior
- Populations and Ecosystems
- Diversity and Adaptations of Organisms

For More Information

Paula Keener-Chavis, National Education Coordinator/Marine Biologist
NOAA Office of Exploration
Hollings Marine Laboratory
331 Fort Johnson Road, Charleston SC 29412
843.762.8818
843.762.8737 (fax)
paula.keener-chavis@noaa.gov

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Student Handout

Animal Adaptation Chart

Directions: Use provided references to complete the following chart for your invertebrate/vertebrate.

Animal: _____

Describe its body form.

Describe how it moves.

Describe how it feeds.

Describe how it protects itself.

Describe how it reproduces.