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Mountains in the Sea Exploration

Deep Sea Coral Biodiversity

Biodiversity of deep sea corals

Grade Level:
7-8

Focus Question
How might biodiversity vary between tropical reefs and deep sea coral ecosystems?

Learning Objectives
Students will research life forms found on tropical coral reefs to develop and understanding of the biodiversity of the ecosystem.

Students will research life forms found on deep-sea coral reefs to develop an understanding of the biodiversity of the ecosystem.

Students will compare the diversity and adaptations of tropical corals to deep-sea corals

Adaptations for Deaf Students
None required

Materials:
Per group of 4 students:
- ❒ Colored pencils
- ❒ Colored markers
- ❒ Art paper - 2 sheets
- ❒ Books, magazines, and/or posters with pictures of tropical coral reefs

Teaching Time
Two 45-minute sessions

Seating Arrangement
Small groups of 3-4 students, according to the number of students in the class

Key Words:
Biodiversity
Ecosystem
Tropical coral reef
Deep-sea corals

Background Information
Coral reefs are the most luxuriant and complex of all benthic communities. The largest coral reef in the world, the Great Barrier Reef, stretches more than 2,000 km, from New Guinea southward along the east coast of Australia. Corals are colonial animals, and individual coral animals are called polyps. A coral polyp is very similar to a tiny sea anemone, but extracts calcium carbonate from the water and forms a calcareous skeletal cup. Large numbers of these polyps grow together in colonies of delicately branched forms or rounded masses. Most shallow-water coral colonies also have symbiotic algae living in their skeletons. The algae get protection from the coral and, in turn, provide nutrients for the coral polyps. These shallow reef-building corals require warm, clear, shallow, clean water and a firm substrate to which they can attach. Because the water temperature must not go below 18 degrees C and the optimum temperature is 23 degrees C to 25 degrees C, their growth is restricted to tropical waters between 30 N lati-

tude and 30 S latitude and away from cold water currents. Waters at depths greater than 50-100m are too cold for significant secretion of calcium carbonate. Also, reefs usually are not found where sediments limit water transparency. (from A. C. Duxbury and A .B. Duxbury, 1997, Introduction to the World" Oceans, 5th edition, William C. Brown Publishing Co., Tropical Coral Reefs, p. 460-477).

Until recent legislation banned trawling in deep sea coral beds off the coast of Norway, the existence of deep sea corals was known only to a handful of scientists and a large number of fishermen. Along the American east coast several deep-water corals, such as the octocoral *Primnoa resedaeformis* and gorgonian *Paragorgia arborea*, are common inhabitants of the upper and middle slope faunas in the canyons south of Georges Bank. Deep-water coral colonies can be found in a variety of shapes and forms, from branched trees to conical mounds. Like shallow corals, they require a hard surface to settle on and grow.

Given that the existence of these remarkable species has been known for more than a century, it is striking that almost nothing is known about their biology, population status, the role they play in enhancing local species diversity, and their role as habitat for deep water fishes, including those recently targeted by fishermen. The rarity of encounters with octocorals during recent submersible dives across the shelf of the northeast U.S. suggests that distribution of these species has significantly declined in the past three decades. These slow-growing species may live for centuries, yet be destroyed in seconds by human activities such as trawling and dredging. Trawling with rolling gear has allowed even larger and heavier gear into their rugged canyon homes.

Learning Procedure

Deep sea corals appear to be the primary factor that forms the physical structure of habitats in the New England Seamount Chain and in many other deep sea communities. Photographs from previous submersibe dives on these seamounts show that the habitat is mostly bare rock except in areas where corals are present. Most of these corals are octocorals (soft corals), rather than the scleractinian corals (hard corals) that are familiar habitat formers in shallow water environments. Because of the importance of octocorals, the Ocean Exploration 2003 Mountains in the Sea Expedition will focus on investigating the octocoral communities of the New England Seamount Chain. The following two activities ("Tropical Coral Reefs – Research and Drawings" and "Deep Sea Coral Reef – Research and Drawings") will give the students an opportunity to explore the biodiversity of both tropical coral reefs and deep-sea corals.

Activity 1. Tropical Coral Reefs – Research and Drawings

1. After the class is seated (small groups of 4 students), the teacher should ask students to name sea life found on a coral reef. The teacher should write each response on the board. Next, students should be directed to use their research skills to locate photographs and drawings of coral reefs. In addition to marine science texts, encyclopedias, and magazines, the Internet should be used as a valuable tool for this research. The following site should prove useful: www.deepseagallery.com
2. After an appropriate amount of time (teacher discretion), the teacher should redirect the class to their original list of coral reef life forms and ask students for additional life forms to be added. Again, the teacher should write these additions on the board.
3. Next, each group of 4 students should be directed to draw a picture of a coral reef. (Supplies: art paper, crayons, colored pencils, and markers)
4. Share group drawings with the class. Typically students will draw pictures of a tropical coral reef. Use this opportunity to discuss key terms: ecosystem and biodiversity.

Activity 2. Deep Sea Coral Reef - Research and Drawings

1. The teacher should describe for the class the overall goal of the Mountains in the Sea Expedition, which is the investigation of deepwater octocoral communities of the New

England Seamount Chain. The teacher should point out the location of this site on a World Map. Next, the teacher should ask the class, "Do you think the same life forms you drew on your tropical coral reefs will be found on these deep sea coral reefs?" Use their responses to guide a discussion of the demands of living in a deepwater ecosystem (no light, cold temperatures).

2. The teacher should direct the students to research deep sea coral reefs at the following websites:
   www.publicaffairs.noaa.gov/deepseacoral.html
   www.gulfofmaine.org/times/winter99/deep_corals.html
   www.cnn.com/2000/NATURE/08/10/coral.enn/
3. After an appropriate amount of time (teacher discretion), the teacher should ask the students for names of life forms they have found in their research which live in these deep-sea coral ecosystems. Students may want to share the descriptions of the deep-sea coral reefs dwellers. Next, with the second piece of art paper, the groups should be directed to draw a picture of a deep-sea coral reef using their knowledge of this ecosystem.
4. Share group drawings with the class. The teacher should ask the students to compare the two coral reef ecosystems. How are they alike? How are they different?

The BRIDGE Connection

www.marine-ed.org

Internet websites as noted throughout the activity.

The "Me" Connection

Students should understand the importance of coral reefs as highly productive ecosystems which play a vital role in the productivity of the ocean.

Connection to Other Subjects

Art

Evaluation

Several opportunities to assess student understanding are included with these activities:

- group participation:
- research findings
- drawings (for accuracy or completion)
- compare/contrast a tropical coral reef ecosystem to a deep-sea coral reef ecosystem using a Venn diagram.

Extensions

Learn more about the scientists who will be conducting the research during the Voyage of Discovery – Leg One:

- Les Watling, University of Maine
  www.ume.maine.edu/%7Emarine/watling.htm
- Kevin Eckelbarger, Univ. of Maine
  www.ume.maine.edu/%Emarine/eckelbarger.htm
- Peter Auster, University of Connecticut
  www.advance.uconn.edu/00092509.htm
- Barbara Hecker, Hecker Associates
  www.bu.edu/bump/bios/hecker.html

National Science Education Standards:

Life Science – Content Standard C:
Diversity and adaptations of organisms

For More Information

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