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Charleston Bump Expedition

A Piece of Cake

Focus
Spatial heterogeneity in deep-water coral communities

Grade Level
5-6 (Life Science)

Focus Question
What types of habitats are likely to be found on the Charleston Bump?

Learning Objectives
Students will be able to explain what a habitat is, and describe at least three functions or benefits that habitats provide.

Students will be able to describe some habitats that are typical of deep-water hard bottom communities.

Students will be able to explain how organisms such as deep-water corals and sponges add to the variety of habitats in areas such as the Charleston Bump.

Materials
- ❒ One half or whole sheet cake
- ❒ Icing in various colors
- ❒ Candies or other edible materials for modeling habitat features

Audio/Visual Materials
- ❒ Chalkboard, marker board, or overhead projector with transparencies for brainstorming sessions.

Teaching Time
One or two 45-minute class periods, plus time for group research

Seating Arrangement
Groups of 4-6 students

Maximum Number of Students
30

Key Words
Charleston Bump
Habitat
Deep-water coral
Sponge
Microhabitat

Background Information
The Blake Ridge is a large sediment deposit located approximately 400 km east of Charleston, South Carolina on the continental slope and rise of the United States. The crest of the ridge extends in a direction that is roughly perpendicular to the continental rise for more than 500 km to the southwest from water depths of 2,000 to 4,800 m. About 130 km east of the Georgia-South Carolina coast, a series of rocky scarps, mounds, overhangs, and flat pavements rise from the surface of the Blake Plateau to within 400 m of the sea surface. This hard-bottom feature is known as the Charleston Bump. While the Blake Ridge has been extensively studied over the past 30 years because of the large deposits of methane hydrate found in the area, benthic communities on the continental shelf of the United States are virtually unexplored (visit http://198.99.247.24/scng/hydrate/about-hydrates/about_hydrates.htm

for more information about methane hydrates and why they are important). Although this area has been important to commercial fishing for many years, until recently it was generally assumed that benthic communities of the continental shelf were scattered and relatively unproductive, and that useful fisheries were the result of migrations from other areas and/or nutrients carried in from deeper or coastal waters. But once scientists actually began exploring the area more thoroughly, they found many diverse and thriving benthic communities.

As the Gulf Stream flows around and over the Charleston Bump it is deflected, producing eddies, gyres, and upwellings downstream (to the north). These kinds of water circulation patterns are associated with increased concentrations of nutrients and marine organisms in many other areas of the Earth's oceans, and may be an important factor to the productivity of the southern U.S. continental shelf.

The 2001 Islands in the Stream Expedition to the Charleston Bump found a series of very complex habitats, and numerous fishes and invertebrate species involved in communities that we are just beginning to understand. (Visit http://oceanexplorer.noaa.gov/explorations/islands01/log/sab_summary/sab_summary.html, and click on logs from September 27, 28, and 29 for more information). One of the most conspicuous features of biological habitats on the Charleston Bump is spatial variety. Rock formations include flat pavements, boulders, caves, and overhangs. On top of this foundation, branching corals, sponges, and other animals add to the variety, creating countless "microhabitats" in many sizes. In this activity, student will create an edible model to simulate this spatial variety, and will develop inferences about the relationships between sessile (non-motile) organisms and other inhabitants of deep reef habitats.

Learning Procedure

[NOTE: Portions of this activity were adapted from "Edible Devonian Marine Ecosystem" by Naturalists at Falls of the Ohio State Park, Clarksville, Indiana, on the Geologic and Paleontologic Cook Book website. Visit http://www/uky/edu/KGS/education/cookbook.html for more edible education ideas!]

1. Review the concept of habitats. Have students brainstorm what functions or benefits an organism receives from its habitat. The students, list should include food, shelter (protection), and appropriate nursery areas. Lead an introductory discussion of the Charleston Bump and the 2001 and 2003 Ocean Exploration expeditions to the area. The website for the 2001 Islands in the Stream expedition is: http://oceanexplorer.noaa.gov/explorations/islands01/log/sab_summary/sab_summary.html; click on logs from September 27, 28, and 29. The website for the 2003 Charleston Bump expedition is: http://oceanexplorer.noaa.gov/explorations/explorations.html; click on "Charleston Bump." You may want to show students some images from the Ocean Explorer website and/or http://pubs.usgs.gov/of/of01-154/index.htm.

   Tell students that detailed surveys of the Charleston Bump are just beginning, but we can have a general idea of what to expect based on explorations in other deep-water, hard-bottom habitats. Explain the concept of "microhabitat." Be sure students understand how the combination of various rock formations and organisms with complex physical forms (like branching corals and sponges) can offer many different types of habitat and as a result can provide food, shelter, and nursery space for many different kinds of organisms.

2. Tell student groups that they are to find out what sorts of habitats explorers on the 2003 Charleston Bump Expedition might find. Have students read relevant trip logs from the 2001 Islands in the Stream expedition, and visit http://www.wwf.org.uk/filelibrary/pdf/darwin_mounds.pdf for information about a recently discovered group of hard-bottom habitats in the United Kingdom's 200 nm offshore zone. Have

students pay particular attention to organisms that modify or create habitats (such as branching corals and sponges). Have students find pictures or illustrations of these organisms. In addition to printed reference books, the Ocean Explorer Gallery (http://oceanexplorer.noaa.gov/, click on "Gallery") and http://biodicac.bio.uottawa.ca have lots of images suitable for downloading.

3. Have each group present their research findings. Discuss and list the types of habitats that may be found on the Charleston Bump, and the kinds of organisms explorers are likely to see from a research submersible. Have students describe what functions or benefits organisms receive from each habitat type.

4. Tell students that the class is going to construct an edible model of the kinds of habitats they hypothesize will be found on the Charleston Bump. The base of the model will be a sheet cake (half or whole, depending upon how many students you have, how much space is needed to model the hypothetical habitats, and how hungry the students are).

   Have students brainstorm what kinds of edible features can be added to the cake to make the habitat model. Mounds of icing can be used for boulders, and when hardened can be sculpted to form caves and overhangs. Sponges might be modeled with small pieces of sponge cake (of course), and strings of rock candy (made by hanging pieces of string in a saturated sugar solution) could represent branching corals. Of course, there are many more possibilities, and your students will probably have a pretty good idea of potential model elements.

   Once the model is completed, you may want to have your students use it to explain about deep-water hard-bottom habitats to another group of students, perhaps a younger class. Their presentation can conclude with students assuming the role of top consumers, and having direct interaction with the model system (they can eat the cake).

The BRIDGE Connection

www.vims.edu/BRIDGE/ – Click on "Ocean Science" in the navigation menu to the left, then "Biology," then "Invertebrates," then "Other Inverts," for resources on corals and sponges. Click on "Ecology" then "Deep Sea" for resources on deep sea communities.

The "Me" Connection

Have students write a short essay describing their personal habitat, what benefits or functions it provides, and what other organisms are involved in creating this habitat.

Connections to Other Subjects

English/Language Arts, Earth Science

Evaluation

You may want to have students prepare written reports (either individually or in groups) prior to the group discussion in Step 3.

Extensions

Log on to http://oceanexplorer.noaa.gov to keep up to date with the latest Charleston Bump Expedition discoveries, and to find out what researchers are learning about deep-water hard-bottom communities.

Log onto http://www/uky/edu/KGS/education/cookbook.html for more edible education ideas.

Resources

http://oceanica.cofc.edu/activities.htm – Project Oceanica website, with a variety of resources on ocean exploration topics

http://pubs.usgs.gov/of/of01-154/index.htm – U.S. Geological Survey Open-File Report 01-154 "Sea-Floor Photography from the Continental Margin Program"

http://oceanexplorer.noaa.gov/explorations/islands01/log/sab_summary/sab_summary.html – Summary report of the 2001 Islands in the Stream Expedition

http://www.wwf.org.uk/filelibrary/pdf/darwin_mounds.pdf – Report on the Darwin Mounds, a recently discovered group of hard-bottom habitats in the United Kingdom's 200 nm offshore zone

http://www/uky/edu/KGS/education/cookbook.html – The Geologic and Paleontologic Cookbook

National Science Education Standards

Content Standard A: Science As Inquiry

- Abilities necessary to do scientific inquiry
- Understanding about scientific inquiry

Content Standard C: Life Science

- Populations and ecosystems

Content Standard D: Earth and Space Science

- Structure of the Earth system

Content Standard E: Science and Technology

- Abilities of technological design
- Understandings about science and technology

Content Standard F: Science in Personal and Social Perspectives

- Populations, resources, and environments

For More Information

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