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Mountains in the Sea Exploration

Head to Foot

Focus
Deep-sea squids

Grade Level
5-6 (Life Science)

Focus Question
What are the common characteristics of squids, and how do deep-sea squids differ from squids found in shallower waters?

Learning Objectives
Students will be able to describe the body form and major anatomical structures of squids.

Students will be able to describe some unusual or unique features of newly-discovered deep water squid species.

Students will be able to infer what types of food squids probably use from the major anatomical features and body form of squids.

Materials
- ❒ Copies of background materials on squids from the Project Oceanography unit on squid (see Resources)
- ❒ (Optional) frozen squid, materials for "Squid Gyotaku", "Squid Races!", and/or "Cool Communication of Cephalopods" (see Learning Procedure, Step #4)

Audio/Visual Materials
None

Teaching Time
One to three 45-minute class periods, depending upon the number of activities chosen

Seating Arrangement
Groups of four students

Maximum Number of Students
32

Key Words
Seamount
Cephalopod
Radula
Mantle
Tentacle
Chromatophore
Camouflage
Zooplankton

Background Information
Seamounts (also called "guyots") are undersea mountains that rise from the ocean floor, often with heights of 3,000 m (10,000 ft) or more. Compared to the surrounding ocean waters, seamounts have high biological productivity, and provide habitats for a variety of plant, animal, and microbial species. Seamounts are formed by volcanic processes, either as isolated peaks or as chains that may be thousands of miles long. In the Atlantic Ocean, the New England Seamounts form a chain of more than 30 peaks that begins near the coast of New England and extends 1,600 km to the southeast. Some of the peaks are more than 4,000 m above the deep-sea floor, similar to the heights of major peaks in the Alps.

Bear Seamount is the closest of the New England Seamounts to the coast of the United States, and

rises from a depth of 2,000 - 3,000 m to a summit that is 1,100 m below the sea surface. Previous investigations have found numerous invertebrates, including cephalopods, crustaceans, and more than a hundred other species in 10 different phyla. These investigations also found more than 100 species of fishes, some of which are commercially important. Several species discovered at Bear Seamount were previously unknown to science.

Deepwater squid are among the more intriguing new species that have recently been discovered by scientists exploring the deep ocean. Some of these species are found throughout the world's oceans, indicating that they are widely distributed and may be fairly common; but the fact that they have been rarely seen reminds us that although 90 percent of Earth's living space is in the ocean, less than five percent of the deep ocean has been explored. In this lesson, students will learn about some basic squid biology, then gather research on some of the new squid species being discovered by deep-sea explorers.

There are numerous internet web sites that provide information on squid and other cephalopods. The links described below are good starting points, but there are many others that can be used to extend the described activities.

Learning Procedure

1. Visit the following web sites to obtain background information on squids:
   http://is.del.ca/-ceph/TCP/index.html
   [Project Oceanography site]

2. Explain that seamounts are the remains of underwater volcanoes, and that they are islands of productivity compared to the surrounding environment.

   Although seamounts have not been extensively explored, expeditions to seamounts often report many species that are new to science and many that appear to be endemic to a particular group of seamounts. Tell students that these species may live on the surface of the seamounts (benthic species), or in the water column above (pelagic species). Ask students to brainstorm some examples of pelagic species. Tell students that they will be studying a group of animals that contains some of the largest known invertebrates, and ask them to infer the identity of this group. If they name cephalopods, remind them of the giant squid in "20,000 Leagues Under the Sea," and say that many scientists believe that cephalopods this size (or even larger) probably exist in the deep ocean.

   Remind students that cephalopods are mollusks, and have them name some characteristics that cephalopods share with other mollusks, such as snails or bivalves (for example, having a radula and a mantle, and the absence of a rigid internal skeleton).

3. Provide students with copies of handouts from the web sites listed above, or have students visit these sites themselves. Have each student (or student group) prepare a one- to two-page report on squids, including their overall body form, feeding habits, methods of locomotion, and at least three facts about squids that they find interesting.

4. You may want to have students do the "Squid Races!" and/or the "Squid Gyotaku" activity from the Project Oceanography unit on squid (see Resources) and/or the "Cool Communication of Cephalopods" activity (see "Resources," below). You may also want to let your students try one of the "Squid Recipes" from the Project Oceanography unit on squid (see Resources).

5. Have students research information on newly-discovered squid species from the deep ocean. A keyword search using "Vecchione" (a squid expert and scientist on the Ocean Exploration Bear Seamount Expedition) and

"Magnapinnidae" (a family of squid with large fins, which is believed to include some of the newly-discovered species) will return several news articles about a weird new deep-sea squid species. Each group should prepare a written report on one or more unusual squid species from the deep ocean and present their findings as a group to the class.

The BRIDGE Connection

www.vims.edu/bridge/ - On the home page, type "squid" into the "Search" box and press "return."

The "Me" Connection

Have students write a short essay on how newly-discovered deep-sea species might be important or useful to them personally.

Connections to Other Subjects

Earth Science, Physical Science (if the "Squid Races!" activity is used).

Evaluation

Reports prepared in Steps #3 and #5 provide an opportunity to assess students' thoroughness and understanding of the subject matter. Optional activities (Step #4) provide additional opportunities to evaluate hands-on work by student groups, as well as individual student reports if the latter are assigned as part of the activities.

Extensions

Have students visit http://oceanexplorer.noaa.gov to learn more about the New England Seamount Expedition and new species that have been discovered through NOAA's ocean exploration efforts.

Visit "The Cephalopod Page" for information and links to other sites and activities about cephalopods.

Resources

http://is.del.ca/-ceph/TCP/index.html - The Cephalopod Page

www.marine.usf.edu/pjocean/packets/sp01/unit7.pdf - Project Oceanography unit on squid

http://school.discovery.com/lessonplans/programs/octopus/ - "Cool Communication of Cephalopods," a lesson plan on how cephalopods use chromatophores in their skin to camouflage themselves, by Don DeMember

http://marinediscovery.arizona.edu/lessonsF00.blennies/2.html - An adaptation of the above lesson plan by Julie Pearson, Jared bond, and Madeleine Thompson.

National Science Education Standards

Content Standard A: Science As Inquiry

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

Content Standard B: Physical Science

- Transfer of energy

Content Standard C: Life Science

- Structure and function in living systems
- Diversity and adaptations of organisms

Content Standard D: Earth and Space Science

- Structure of the Earth system

For More Information

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