Activity: Every Square Inch Counts: Abundance of the Rocky Intertidal Zone/Subtidal Zone with Life-sized Photos

FOCUS
Environmental monitoring of rocky intertidal/subtidal organisms

GRADE LEVEL
9-12

FOCUS QUESTION
How do scientists measure the abundance of rocky intertidal organisms?
How does the subtidal zone differ from the rocky intertidal zone in organisms and abundance?

LEARNING OBJECTIVES
- Students will visually identify the following rocky intertidal organisms: giant green anemones, chitons, whelks, turban snails, green pin-cushion alga, sea lettuce, rockweeds, coralline algae, red algal turf, turkish towel, iridescent algae, aggregating anemones, limpets, mussels, and acorn barnacles and Subtidal organisms: hydrocoral, orange cup coral, sponge, strawberry anemones, crinoids, seastars
- Students will learn to monitor the relative abundance of rocky intertidal organisms through sampling techniques used by LiMPETS (Long-term Monitoring Program and Experiential Training for Students) by practicing with life-sized photo quadrats.
- Students will complete data sheets recording the abundance of organisms in rocky intertidal and subtidal zones and compare abundance and organisms.

MATERIALS

- Intertidal and Subtidal Photo Quadrats printed on 8.5" x 14" paper
- Photo Quadrat Data Sheets
- Photo Quadrat Answer Sheet
- Animal and Algae ID Cards

There are 6 intertidal photos to be printed on 8.5" x 14" paper. The images were taken at Duxbury Reef in Bolinas, California. The identification cards are 8.5" x 11". To print photo quadrats, drag image to desktop, open file, under page setup select legal-sized paper and landscape, then print. There are 4 subtidal photos that were taken through the porthole of a submersible on Cordell Bank in California.

TEACHING TIME
45-minute classroom period

SEATING ARRANGEMENT
Groups of 3-4 students

KEY WORDS
Rocky intertidal/subtidal zone
Quadrat
Transect line
Invertebrates
Algae

BACKGROUND

The five West Coast National Marine Sanctuaries (Olympic Coast, Cordell Bank, Gulf of the Farallones, Monterey Bay, and Channel Islands) are working together to use field-based workshops and emerging technologies to engage middle and high school students in environmental monitoring efforts. The LiMPETS program was developed to standardize environmental monitoring protocols for sandy beach and rocky intertidal zones in the West Coast National Marine Sanctuaries. Students involved in the monitoring projects are able to compare and contrast their information with data collected at other sites. This activity allows students to practice the sampling techniques in the classroom before going into the field.

Measuring the relative abundance is a way to determine the health of an area. Large numbers of people frequently visit rocky intertidal areas, which can adversely affect the health of the environment. The baseline data collected by the LiMPETS network is part of an online database that allows the sanctuary to track changes in the environment over time.

Intertidal monitoring in the field is done along a transect line, that runs from the low tide zone to the high tide zone. Students collect data along this line and observe differences between the different tidal zones. Every five meters, the students place a 0.25m2 quadrat and monitor the organisms in the area. The students use the same sampling techniques in the field as described in this activity. For larger invertebrates, they count individuals found within the quadrat. In addition, they count the relative abundance of algae and invertebrates that are more common. This activity helps students become more familiar with the sampling techniques used by scientists and makes them more comfortable identifying the organisms in the field. Practicing in the classroom before a field experience also helps to assure that the data will be more accurate.

The subtidal environment of Cordell Bank in California is too deep to study by SCUBA and to use quadrats to estimate relative abundance with. The Sanctuary uses video cameras and an observer in a deep sea submersible to learn about the invertebrate cover on this deep rocky reef. This activity is intended to provide a comparison between the subtidal environment of Cordell Bank and the intertidal habitats in Gulf of the Farallones through photos. Students can assess their abundance and compare the depths (zones) from which the photos were taken.

LEARNING PROCEDURES

1. Begin the discussion by showing students pictures of a rocky intertidal and subtidal zones and defining characteristics of these environments. Ask students why monitoring the abundance of organisms in these zones is important and how this sort of information can be used. Explain to students that they will learn the exact same procedure that biological oceanographers use to monitor the population of target species in the intertidal zone. This lesson should precede the actual field experience, so explain to students that this lesson will provide them with the skills needed for their field experience during which they will monitor the abundance of species and collect real data which will be used by experts to make resource decisions. Stress to students that they will learn some of the same procedures that real scientists use to gather population data.

2. Students should work in small groups and monitor at least 2 photo quadrats. Each group should have one or two ID cards from both subtidal and rocky intertidal.

3. On each photo quadrat, students will draw 6 equal sized boxes. Each photo quadrat is 8.5” x 14”and each box should measure 4” x 4.5”. The photo quadrat has 1/4” border.

4. For each photo, students will monitor the abundance of algae and animals in each quadrat using two methods. For the larger invertebrates, a total count of the number of individuals is recorded (under “individuals” on the data sheet). For algae and the more abundant animals, the number of squares out of 6 with any portion of the algae or animal is recorded under “count and record” on the datasheet. The organism is counted if it is attached in that square. This is a very challenging method to use with photographs, yet it provides a relative abundance measurement and good practice for doing it for real outside.

5. Students should fill out the photo quadrat data sheet by looking to see if each species listed on the data sheet is present in the quadrat.
6. Discuss with entire class which organisms were hard to identify and how this would be different in the field. Ask students to explain some of the limitations in measuring abundance of species using this technique. Ask students to explain the benefits of measuring abundance using this technique. Ask students how they might design a technique to measure abundance that still gains the advantages that they have identified, but solve some of the limitations that they have identified. How can scientists measure abundance in the subtidal from a submersible? Ask students what sort of decisions might resource managers make using data collected by this method? Ask students to compare the rocky intertidal organisms to the subtidal organisms.? Why types of feeding strategies do each have? Why are some more abundant at one depth rather than another?

THE BRIDGE CONNECTION

www.vims.edu/bridge/ - Click on "Ocean Science Topics" in the navigation menu to the left, then "Biology," then "Invertebrates" or "Habitats," then "Rocky Shores."

THE "Me" CONNECTION

Have students write short essays on how the abundance of marine invertebrates directly affect their own lives or how they directly affect marine invertebrates when visiting tidepools.

RESOURCES

http://limpets.noaa.gov

NATIONAL SCIENCE EDUCATION STANDARDS

Content Standard A: Science as Inquiry
· Ability necessary to do scientific inquiry
Content Standard C: Life Science
· Biological evolution
· Interdependence of organisms
· Matter, energy, and organization in living systems

Georgia Biology Standards 9-12
Science 9-12 SCSH4. Students use tools and instruments for observnig, measuring, and manipulation scientific equipment and materials.
SB4. Students will assess the dependence of all organisms on one another and the flow of energy and matter within their ecosystems.
SCSH5. Students wil demonstrate the computation and estimation skills necessary for analyzing data and developing reasonable scientific explanations.
SCSh3. Students will identify and investigate problems scientifically.

Georgia Science Standards Grade 6
S6E3. Students will recognize the significant role of water in earth processes: Describe the composition, location, and subsurface topography of the world's oceans.

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