Well, Who Is Living Here?

Key Concepts

1. Species diversity is a measure of the complexity and health of an ecosystem.
2. The beach at Seal Rock Campground contains a diverse assemblage of animals and plants.
3. Careful observation provides information useful in establishing food web relationships
4. Sampling techniques are useful tools for studying the beach ecosystem

Background

In the activity "Who's Living Here?", students observed the variety of beach species and gathered data to calculate a species diversity index at Seal Rock Campground.

Diversity is an important concept in biology. It is used as an indicator of the richness and stability of communities and ecosystems. Biologists have developed well-defined procedures to measure and compare diversity. The "diversity index" is one such procedure and yields a number which is a useful tool for comparing different ecosystems or different areas within an ecosystem. The index is calculated with the following formula:

$$\text{Diversity} = \frac{\text{Number of species}}{\text{Square root of the total number of individuals}}$$

Additional information regarding diversity is found in the Teacher Background for the activity "Who's Living Here?"

Materials

- student notebooks from Seal Rock Campground site visit
- "Who's Living Here?" student activity pages
- calculators capable of determining square roots

Teaching Hints

Note: Since "Well, Who Is Living Here?" utilizes data collected during the class trip to Seal Rock Campground, it is imperative that students bring their notebooks from the trip to class.

In "Part I - Neighbors", students use the data collected at Seal Rock beach to calculate a species diversity index. Since index numbers are abstract and often confusing to students, an example is provided in the student text. You may wish to spend some time in discussing the example prior to having students embark on their calculations.

In "Part II - The Underground", students conducted a hunt for additional animals and animal signs under the shells and rocks of their study area. The culminating activity for this part was to create a beach food chain for their study area. You may wish to have students share their chains.

In "Part III - Get Off My Back", students examined a clump of oysters looking for the niches it provides for other animals. You may wish to review their discoveries, using the drawing in the student text of "Who's Living Here?" as a springboard for discussion.

In "Part IV - Dead But Not Gone", students determined the ratio of living oysters to oyster shells and searched for oyster spat and young oysters on the shells within their study area. The final question asks students to list two activities that happen on upland areas of Seal Rock Campground that affect the ability of oysters t thrive on Seal Rock beach. This question provides many avenues for further discussion.

"Part V - Oysters in the Rough" included a demonstration tour of oyster anatomy. If you wish to pursue this topic further, several activities are available in the Grades 9-12 Puget Sound Project curriculum guide, The Changing Sound, available from the FOR SEA Institute of Marine Science (forsea.org).

Essential Academic Learning Requirements in Science

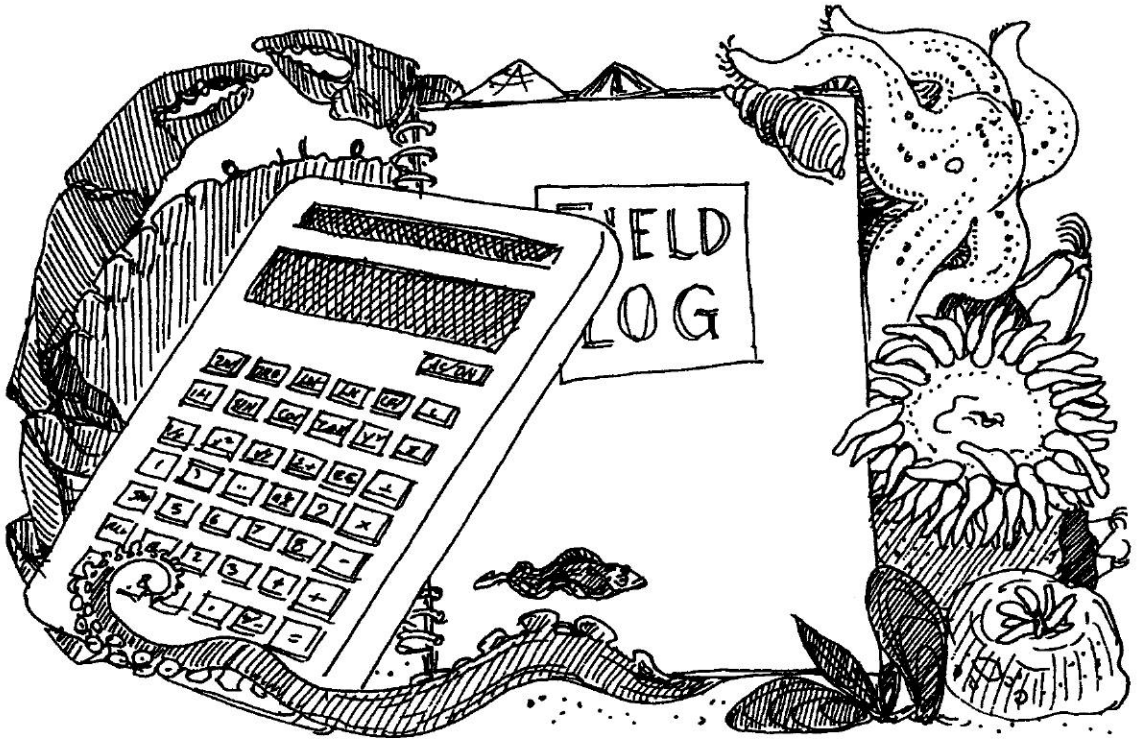
1. The student understands and uses scientific concepts and principles. (1.1, 1.2,1.3)
2. The student knows and applies the skills and processes of science and technology (2.1, 2.2)
3. The student understands the nature and contexts of science and technology. (3.1, 3.2)

Answer Key

Part I - Neighbors

1. - 3.b Answers depend upon experimental results.
3. c. While answers will vary students will hopefully recognize that increasing the number of study areas and/or size of the sample plots will allow one to have increased confidence in the diversity index calculation. Other answers might include, better observation, better field guides and more than one observer counting each area.
3. d. Many environmental factors might cause a difference in the diversity index from sampling area to sampling area including; exposure to tidal action, exposure to sun, slope of beach, size of substrate material, and type of substrate material.
4. Diversity is more important that the sheer number of animals because diversity is a measure of stability of an ecosystem or community.
5. Answers will vary. Use this question as a vehicle for a discussion of human impact on and responsibility for Seal Rock beach and other beaches, as well.

Well, Who Is Living Here?



How could you forget the Oopa-Hoopa? In the activity "'Who's Living Here?'", you had a chance to sample the intertidal beach ecosystem at Seal Rock Campground. In the following activity, you'll use the data you collected to help give you a better picture of the beach.

Part I - Neighbors

Picture yourself counting all the animals inside the Oopa-Hoopa. All of your counting gave you some information about what kinds of animals were on the beach and how many of them.

Scientists use diversity as a measure of the richness of an ecosystem. When we think about the beach, diversity means the variety of animal species present. Diversity is a useful tool for comparing different ecosystems or different areas within an ecosystem. To help make these comparisons, scientists have developed a diversity index. The index is calculated with this formula:

$$\text{Diversity} = \frac{\text{Number of species}}{\text{Square root of the total number of individuals}}$$

This formula gives more importance to the number of species and less importance to the total number of individuals. Let's look at an example:

Forest service biologists collected flying insects from the Dosewallips Estuary and from the lawn in front of their ranger station. They collected the insects with nets, using the same procedure at each site. Here's what they found:

Dosewallips Estuary	**Ranger Station Lawn**
28 species of flying insects	3 species of flying insects
1895 total individuals	2931 total individuals

So...

$$\text{Diversity} = \frac{\text{Number of species}}{\text{Square root of the total number of individuals}}$$

$$\text{Destuary} = \frac{28 \text{ sps}}{\sqrt{1895 \text{ individuals}}} \qquad \text{Dlawn} = \frac{3 \text{ sps}}{\sqrt{2931 \text{ individuals}}}$$

$$\text{Destuary} = \frac{28 \text{ sps}}{43.5} \qquad \text{Dlawn} = \frac{3 \text{ sps}}{54.1}$$

$$\text{Destuary} = .64 \qquad \text{Dlawn} = .06$$

The larger the diversity index, the richer the area. The estuary is more rich than the lawn. This richness means that the area is more likely to maintain itself in a steady state over long periods of time. If you've ever pulled weeds from a lawn, this makes sense. The lawn is unstable and has a tendency to become more complex through the addition of "weeds."

1. Now let's calculate the diversity index for your beach area. You'll need your data table where you recorded the total number of individuals of each species you found. It's probably somewhere around the middle of your notebook. Use the space below for your calculations:

$$\text{Diversity} = \frac{\text{Number of species}}{\text{Square root of the total number of individuals}}$$

The diversity index for our beach area is: _____

2. How does this diversity index compare with those for the estuary and lawn in the example above?

3. Compare your diversity index with those of the other teams and calculate an average diversity index for the Seal Rock beach.

Average Diversity Index

our index + indices from other sites = total/number of sites = average

___ + ___ + ___ + ___ + ___ + ___ + ... = _____ = _____

Use this data to answer the following questions:

a. How does your diversity index compare with average diversity index?

b. Look at your index, the indices of the other teams, and the class average diversity index and write a sentence stating which index you have the most confidence in and why.

c. What could you do to increase your confidence in your diversity index?

d. What is one environmental factor that might cause a difference in the diversity index from sampling area to sampling area?

4. Why is diversity or variety of the animals at Seal Rock beach more important than the sheer number of animals?

5. What can be done to ensure that the diverse collection of animals found on the beach continues to thrive?