E.T. - A LOCAL WAY OF LEARNING

Title: ROCKY SHORE ECOSYSTEM

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Grade Level: 4-12

Concepts:
1. Energy
2. Ecosystem
3. Carrying Capacity
4. Clean Water
7. Land Use
8. Values and Attitudes

Disciplines:
1. Social Studies
2. Science
3. Language Arts
4. Art

Objective:
Student shall identify the zonation of the beach and tell which animals and plants are found where and why. Student shall explain the adaptations that have taken place to enable the organism to live where it does. Student shall become familiar with the "transect" technique.

Rationale:
The carbonate beach rock exposed in the intertidal zone may either be abrupt or be interspersed with sandy mini beaches, providing nooks in which plants and animals are found. This is also the place where tide pools are common. There is a zonation where you may expect to find particular animals and plants. Microscopic algae serves as food for many animals whose "mouth" is on the bottom. For others the ever renewing splash of water brings new source of food with each wave: they have "mouths" on the top. Most are anchored securely against the wave action. Most have great tolerance for extremes of salinity and temperature--if it rains-a tide pool is almost fresh water--if the wave action is low the pool dries up and salinity and temperature go way up. Butwatch your step, those black tar balls are still soft. . .

Materials Needed:
Sneakers to walk in water for foot protection, sketch pad and pencil.

Directions/Activity:
In class preparation:

Introduce as many casts of crabs and dead shells of other animals you expect to find. See movies, look at books of rocky shore and intertidal plants and animals. Note that some "exoskeleton" animals (crab, lobster) must cast their hard outer covering to grow, whereas other shells (snail, conch, clam) grow an additional section of their shell when they become crowded in the present one. Note the hermit crab, who has no shell on his own posterior and must drag around the dead shell of another, usually a West Indian top shell, to protect his soft “tail". This requires a regular search for a slightly larger shell as the hermit grows.

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Activities at the site:

Note the color change from black, at the top of the rock (blue-green algae) to pink at the water's edge. On the high rocks and on grass and weeds are the beaded periwinkles (*Tectarius muricatus*). This is a marine snail which shows extreme adaptation. On the high beach during a dry season the animal pulls himself deep in his shell to preserve moisture, seals off his door (operculum) and also seals his shell rim to the rocky substrate. It has been shown to be able to live for 18 months in this dried up state and still revive when put into water.

1. Mark a shell with a dot of red finger nail polish, draw a ring on the rock around the snail with the same polish. Come back, days, weeks, later and see how much the snail moved. (Check him out a year later). The snail stays within a radius of a few feet. Pour some water on a patch of snails and watch for a while. (Almost immediately they begin to move a little).

2. What does the periwinkle eat? Scrape some of the "black" (blue-green algae) off the rock, wet it, and look at it under a microscope. (Looks like a golf green).

3. How does the snail reproduce? (Lays eggs at the water's edge so the surge can take the hatchlinqs (Veligers) into the sea (plankton). This is probably the longest trip *Tectarius* makes from the high beach.

4. Make an estimate of the number of snails (probably the greatest resident of the rocky shore in numbers). This is done by making a transect. Pull a line, as perpendicular to the shore as you can, from the high beach to the water's edge. Using a square measure (a stiff wire bent to close a square) of known size--foot, quarter meter--flip it over and over down the beach and count the snails in every fifth (or another interval, depending upon the width of the beach) square. Multiply the total by the number of squares in all.
Example: If you counted five squares and there were 25 in all, you will multiply the total number of snails counted by five to estimate the whole strip. Don't overlook all the immature snails stuck tightly underneath the rocky outcrops.

5. Closer to the water line you find a pointed shell with zigzag lines (*Littorina ziczac*). At the splash line another snail, the nerite or tooth shell is found. *N. peloronta* has a red mark (bleeding tooth) the other two do not. These snails are edible if you have the patience.

6. Just below the water line is the West Indian top shell of "wilk" (*Cittarium pica*) and is of a size such that a few make a worthwhile meal. The above are all herbivores.

7. At the high water mark you will find a meat eater, *Purpera patula*. If prodded the animal will excrete a smelly white substance which stains skin purple. Put the *Purpera* in a pool with other snails and watch them leave.

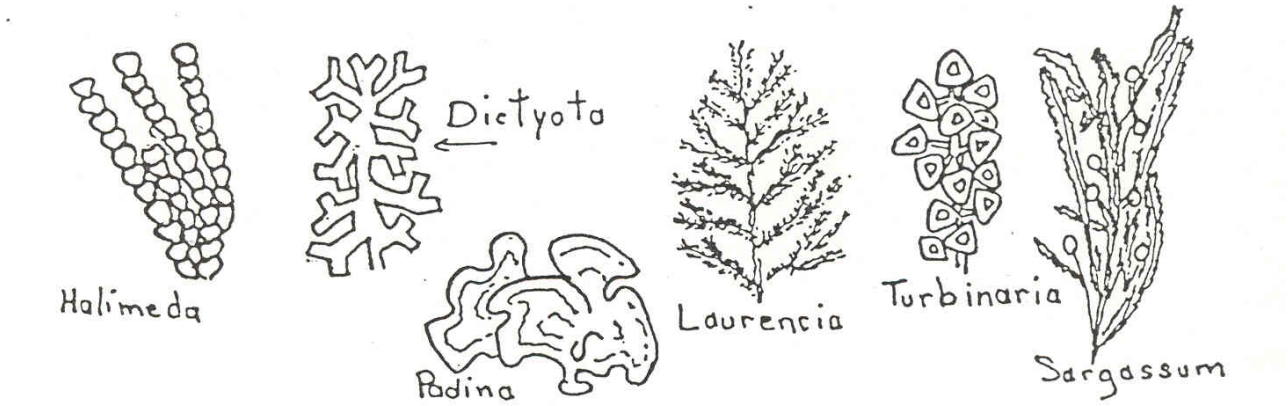
8. Find some limpets and some keyhole limpets--why do you think they are so named? Also at the splash zone you will see an animal not changed since the beginning of time. It is the chiton and there are three, depending upon the kind of girdle it has. The animal looks like it's stuck in a rock hollow

forever. It has eight separate plates in its shell. Don't paint it with polish--it has pores on the top of its shell.

9. Look for casts of crabs (*Grapsus grapsus*) with their claws still gripped to the rock to pull themselves out. Those short-spined sea eggs are rock boring, red or black, urchins (*Echinometra lucunter)* and they dig the hole they are sitting in. Barnacles may be feeding if the water is surging over them. They whip out their feeding "plumes" to catch whatever is in the water.

10. Slightly lower on the beach you will find two other urchins, the white one you can safely pick up (*Tripneustes*) and the long spined black one (*Diadema*). Note the weed and shell bits the white one has stuck on his shell: how does it do this? (Has tube feet between the spines). Pick it up and hold it at the water level. Feel the tube feet with the suction cups hold on to you-in this way the animal avoids being swept by the surf.

The five zones are the surf zone, pink zone, green zone, yellow zone and the black zone, according to Lewis. From land to sea, below the black zone and still above the high water mark is the yellow zone which has a thick film of algae. It is here that the nerites are found. The green zone is covered by coralline algae and is smooth--here you will find Purpera. The pink zone extends between the mean low water mark and the mean high water mark (area of the wilks). The pink is also an encrustation of coralline algae. In the surf zone are the algae *Halimeda*, *Dictyota*, *Padina*, *Laurencia*, *Turbinaria* and *Sargassum*.



Tide pools have a changing community as the big waves bring new fish or give access for others to return to the sea. Tiny hermits scurry around. Frequently an octopus gets carried into the pool by a big surge of water. Observina his color change (chromatophores) you can see how good they are at camouflaging themselves. Also observe the use of appendages curled up to 'walk' and the precise timing to catch the next big wave to get back into the sea.

Literature:

Guidebook to the Geology and Ecology of St. Croix
H. Gray Multer and-Lee C. Gerhard
West Indies Laboratory
1974