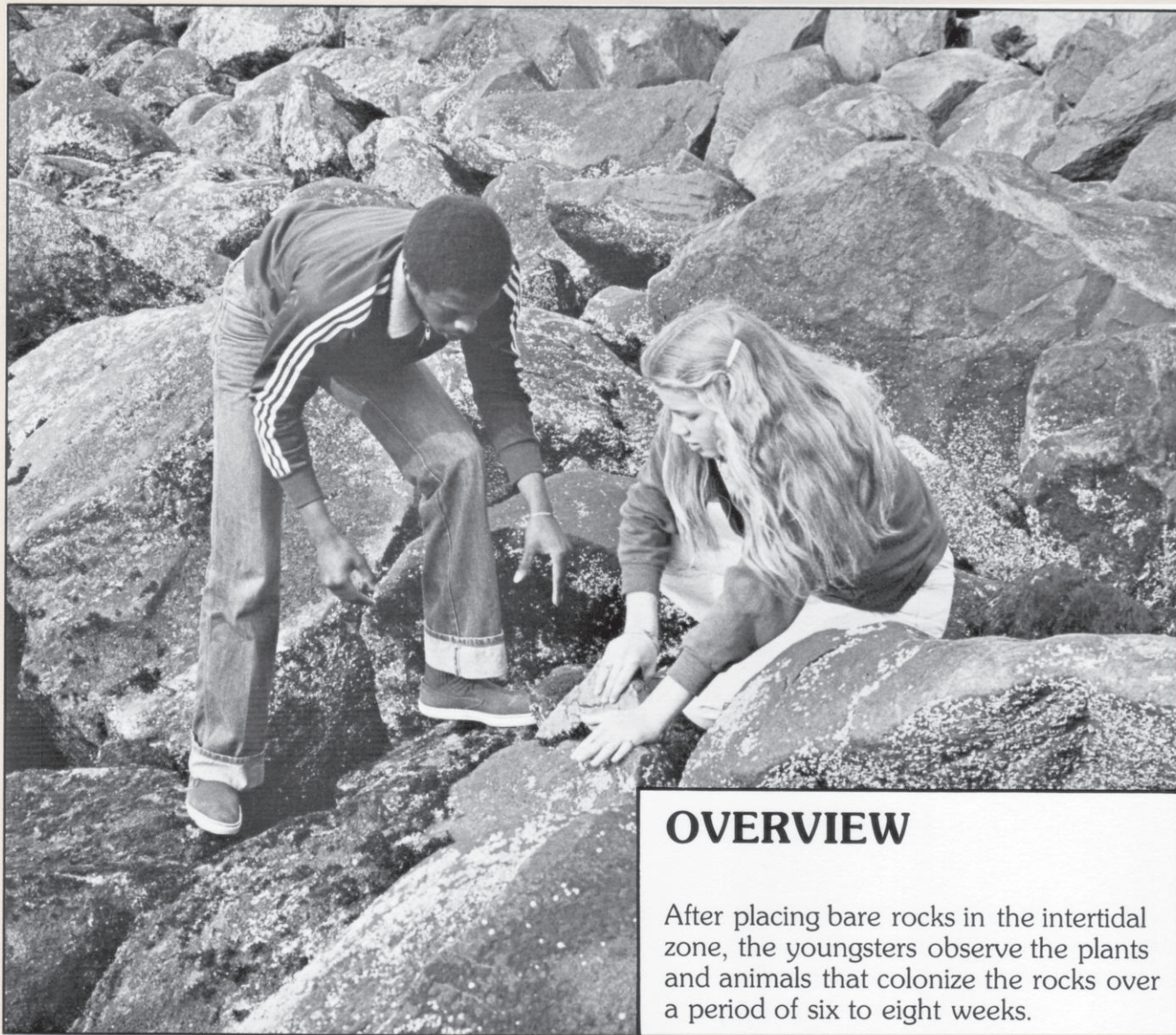


ROCK PIONEERS



OVERVIEW

After placing bare rocks in the intertidal zone, the youngsters observe the plants and animals that colonize the rocks over a period of six to eight weeks.

BACKGROUND



Rocks, pilings, and other solid surfaces in the intertidal zone are usually densely covered with marine organisms such as seaweeds, mussels, barnacles, snails, limpets, anemones, and starfish. Gaining a “foothold” on a solid surface is the key to survival for organisms in the intertidal zone. The competition for living space is so intense that every square centimeter of available surface, including the surfaces of some organisms, is likely to be occupied by organisms. The struggle for space is

continual because the intertidal waters are teeming with the larvae, eggs, spores, and young of marine organisms seeking a solid surface on which to settle and grow.

Introducing new surfaces (“Pioneer Rocks”) into the intertidal zone and observing them over a period of time is one way to investigate the process of colonization. **Colonization** is the occupation of an area by a group of organisms that did not previously live there. If your group observes their Pioneer Rocks over a long enough period of time, they should see some of the

pioneer organisms (first colonizers) replaced by other organisms.

Succession occurs when one population of organisms replaces another population of organisms. A **population** is a group of organisms of one kind that lives in the same area. The process of succession will continue until the colonies of organisms on your group's Pioneer Rocks look just like the clusters of organisms on the surrounding rocks.

CHALLENGE: PLACE A BARE ROCK IN THE INTERTIDAL ZONE AND, EVERY WEEK OR TWO FOR SIX TO EIGHT WEEKS, RETURN TO SEE WHAT ORGANISMS LIVE THERE.

MATERIALS



For each team of two:

- 1 wide-tip, permanent-ink marking pen* (bright color)
- 1 large index card* and a pencil
- 2 pairs of work gloves* (optional)

For the group:

- 1 tide table (available at bait shops and sporting goods stores)
- 1 data board* and marking pen*
- 1 "Use of the Tide Table" Technique Card*

Optional:

- twine*
- guidebook for local intertidal organisms

* Available from Delta Education.

PREPARATION



Group Size. This activity works best with groups of up to sixteen youngsters, but can be conducted with larger groups if you have enough adult supervision. We recommend one adult for every twelve youngsters.

Time. Plan on thirty minutes for the first visit, and twenty minutes for each subsequent visit. This activity requires three to six visits spaced over six to eight weeks. All visits should be made during low tide so that the Pioneer Rocks are exposed. Use a tide table to plan the visits to coincide with low tides. (See the "Use of the Tide Table" Technique Card.)

Site. Select a rocky intertidal area that is safe and easy to reach. Avoid unprotected, outer coast sites during periods of heavy wave action. The site should contain bare, loose rocks, weighing between 5 and 10 kilograms, that can be moved into the intertidal zone.

Safety. Rocks in the intertidal zone are notoriously slippery. Caution your youngsters to use care when moving over kelp-covered and "mossy" rocks. The youngsters should also be very careful when placing new rocks in the intertidal zone to avoid falls and crushed fingers and toes. Gloves will help to protect the hands. When working around the water, use the buddy system. (See the "Safety" section of the *Leader's Survival Kit* folio.)

ACTION



Setting Up the Pioneer Rocks

1. Explain the buddy system and divide the group into buddy teams. Caution the



youngsters about the slippery rocks, and then take the group into the intertidal zone.

2. Explain that **intertidal zone** refers to the area that is covered by water during high tides and exposed to air during low tides. Gather next to an intertidal rock that is densely covered with organisms. Ask the participants how they think the organisms got there. Ask the youngsters if they think the organisms all arrived at one time or if certain organisms appeared first, followed by others. Allow time for your group to observe and comment. Tell the group that they are going to place *bare rocks* into the intertidal zone and observe them over a period of several weeks to determine when and which intertidal organisms “move into” the rocks.

3. Ask each team to select a bare rock or other substrate (see the “Variations” section) from the area above the intertidal zone to place in the intertidal zone. Large rocks of five to ten kilograms are best. If anyone is struggling with a rock that is too large, step in and suggest something more reasonable in size. Make sure the teams select rocks that are bare (that is, have no attached intertidal organisms).

4. After the teams position their rocks in the intertidal zone, gather the teams and distribute the marking pens. Ask each team to put a unique mark on its rock and to make the same mark higher up on the shore in such a way that the teams can find their rocks during subsequent

visits. The “permanent” marks last only two to four weeks in the ocean environment, so the youngsters will need to re-mark their rocks occasionally.

5. Give each team a large index card and pencil. Ask them to record their names and the date the Pioneer Rock experiment starts. Have them describe the appearance of their rock and how it is marked. Having the kids name their rocks (Pioneer Rock, Wanderer’s Roost, Rocky Haven) is fun and should be encouraged. Collect and keep the teams’ index cards for subsequent visits.

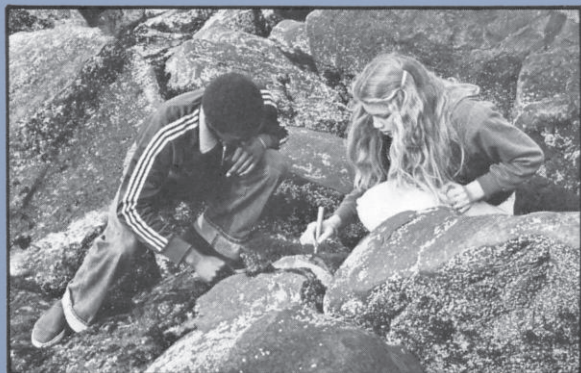
<i>Rock Pioneer Experiments</i>	<i>Team #1</i>	<i>STAN LIZ</i>
<i>April 14 - Placed rock in intertidal zone. Rock is smooth and flat and about 30cm across.</i>		
<i>April 21 - Rock feels slippery. Two black snails were found on one side.</i>		
<i>April 28 - Light areas of rock look greenish. 5 black snails and one limpet on one side and two snails on another side.</i>		
<i>May 5 - Total of 9 snails, 2 limpets. There are some white bumps that may be barnacles on the side of the rock facing the sea. The rock's surface is</i>		

Variations

A variation on this activity is to substitute wood, metal, plastic, or rubber for rocks. These substrates usually find their way into the sea through natural processes or man’s neglect. You can find most of these substrates at or near your study site. Small or lightweight objects will have to be tied and anchored with twine to prevent tides from carrying them off.

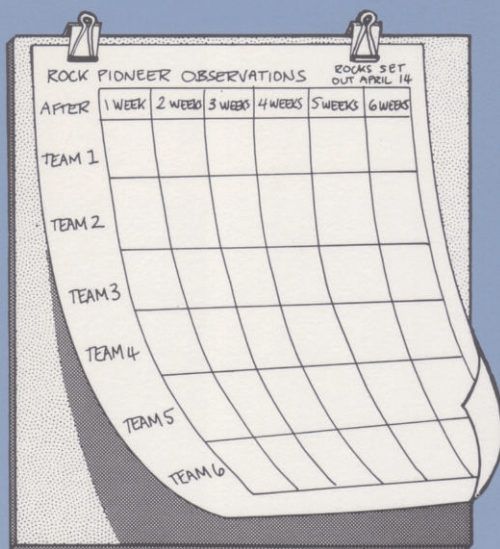
Return Visits

1. Now the real fun begins: finding out what happens! It may take several weeks for visible colonists to appear on the rocks. On the first return visit, encourage the teams to look for changes in how the rocks *feel* or *smell*. When visible



colonists do arrive, the teams should record on the index cards the names of the organisms and the date they were first observed. If the youngsters don't know the names of the organisms, they may use a seashore organism guide to identify the organisms or make up their own descriptive names (e.g. thread weed, polka dot snails).

2. Keep a group record of the appearance of organisms on the data board. See the illustration.



3. After the youngsters observe the appearance of the first organisms on their rocks, define the term **colonization** for the group. Suggest that each rock that was placed into the intertidal zone was an unpopulated territory and that the organisms that settle on the Pioneer Rocks are colonists.

4. Five to eight weeks into the experiment, the youngsters are likely to notice that some of the first colonizers have been replaced by new organisms. When this happens, introduce the term **succession** to the group.

PIONEER THOUGHTS



1. Compare Pioneer Rocks that were placed at different levels in the intertidal zone. Were they colonized at the same time and at the same rate? By the same organisms?
2. How does the size and stability of the Pioneer Rocks seem to affect the amount and rate of colonization?
3. Can you find all of the different organisms on your Pioneer Rocks on the surrounding rocks?
4. Which organisms on the surrounding rocks have not appeared on any of the Pioneer Rocks?
5. Are any organisms settling on top of other organisms?

BRANCHING OUT



1. Locate intertidal surfaces other than rocks that show signs of colonization.
2. Can you find any surfaces in the intertidal zone that are not colonized? Why do you think they have not been colonized?
3. Visit the site and try to locate the Pioneer Rocks six months to a year after the rocks were put in the intertidal zone. What do they look like now?
4. Visit a marina and try to find marine organisms living on boat hulls, docks, and pilings. Try to talk to some boat owners about their efforts to keep their boat hulls free of organisms.
5. Look for organisms that have been colonized by other organisms.



USE OF THE TIDE TABLE For Aquatic Activities

Technique Card



In a tide table (available from boating, fishing, and diving shops), you can find the height of the tide in your area for any time of day. Leaf through your table. You may see a range of tides from minus several feet to plus six to ten feet, depending on your area of the coast. Areas may differ, but the range will be consistent for your area month after month.

From the information in the table, you can determine the vertical height of the intertidal zone. (Subtract the lowest low from the highest high.) Let us say that in looking in the tide table for the day and time you wish to investigate, you find that the tide is two feet. This means that all but two feet of the intertidal zone is exposed.

If it is not a high or low tide at the time you want to study your coastal community, you will have to estimate the height of the tide.

Example: You meet your group at 10:00 a.m.

The tide table reports:

Low Tide:	6:53 a.m.	1.5'
High Tide:	1:10 p.m.	5.1'

10:00 a.m. is about half way between 6:53 a.m. and 1:10 p.m., so your tide will be about half way between 1.5' and 5.1', or about 3.2', and coming in (flood tide). After 1:10 p.m. the tide will be going out (ebb tide).

