BEACH ZONATION

BIO KEY

Organism Search
Range
Zonation

OVERVIEW

The youngsters investigate the distribution of organisms in the upper region of the intertidal zone.

BACKGROUND

The seas do not lie motionless in their basins like water in a bathtub, but are drawn back and forth by the gravitational pull of the moon and sun. The resulting rise and fall of water along the coast is called the *tide*. In most parts of the world, the tide comes in and goes out twice a day. The region of the seashore that is alternately covered by water during high tide and exposed to air during low tide is called the ***intertidal zone***.

Three factors affect the distribution of organisms in the intertidal zone: wave action, tidal exposure, and the composition of the bottom materials (sand, rock, mud, or a combination). Organisms that can survive long exposures to air, high temperatures, and wave shocks ranging from light spray to heavy storm surf are adapted for life in the upper region of the intertidal zone. Organisms that can withstand exposure to air for up to twelve hours a day and light to heavy wave shock live in the middle intertidal region. The low intertidal region

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is inhabited by organisms that can tolerate only infrequent, brief exposures to air. The clustering of organisms in the intertidal regions where they are best adapted to survive results in the characteristic horizontal bands or zones referred to as ***intertidal zonation***. These zones can be easily observed at rocky intertidal areas during a low tide.

Note: This activity uses the *foot* rather than the *meter* because tide tables in the United States still list measurements in feet.

CHALLENGE: FIND THE RANGE OF ORGANISMS THAT LIVE IN THE UPPER REGION OF THE INTERTIDAL ZONE.

MATERIALS

For each team:

2 small flags (brightly colored yarn* or contact paper* attached to popsicle sticks* or straws)
2 lumps of clay* (about the size of ping-pong balls)

For the group:

1 tide table
1 watch
3 large flags*
2 meter sticks*
2 poles, 4 to 6 feet long
2 balls of heavy twine*
2 line levels*
1 "Use of the Tide Table" Technique Card*
1 "Determining the Highest Tide Level" Technique Card*

* Available from Delta Education.

PREPARATION

Group Size. This activity is suitable for groups of up to 16 youngsters. For this activity, we recommend one adult for every eight to twelve youngsters.

Time. Plan on forty to fifty minutes for this activity. Use a tide table to schedule the activity for a low tide of +1.0 foot or less. (See the "Use of the Tide Table" Technique Card.)

Site. Select a steep rocky shoreline, breakwater, or fill area for the activity site.

Safety

1. When working around the water, use the buddy system. (See the "Safety" section of the *Leader's Survival Kit* folio.)

2. Intertidal rocks can be very slippery. Caution the youngsters to avoid stepping on "mossy" or kelp-covered rocks and to be careful when walking in the intertidal zone.

ACTION

1. Use two of your large flags to mark boundaries for your activity site: forty to fifty yards of shoreline is sufficient.

2. Define and describe the intertidal zone for the group. (See the "Background" section.) Divide the group into buddy teams.

BEACH ZONATION

3. Give each team one small flag and one lump of clay. Challenge half the teams to find and flag the *plant* living the highest in the intertidal zone. Challenge the rest of the teams to find and flag the *animal* living highest in the intertidal zone.

4. After the teams have placed their flags, call the youngsters together. Ask:

- Did all of the plant teams flag the same kind of plant?
- Did all of the animal teams flag the same kind of animal?

If not, as a group decide which plant and which animal can be found living highest in the intertidal zone. Ask the kids to compare the highest plant and animal. Which lives higher?

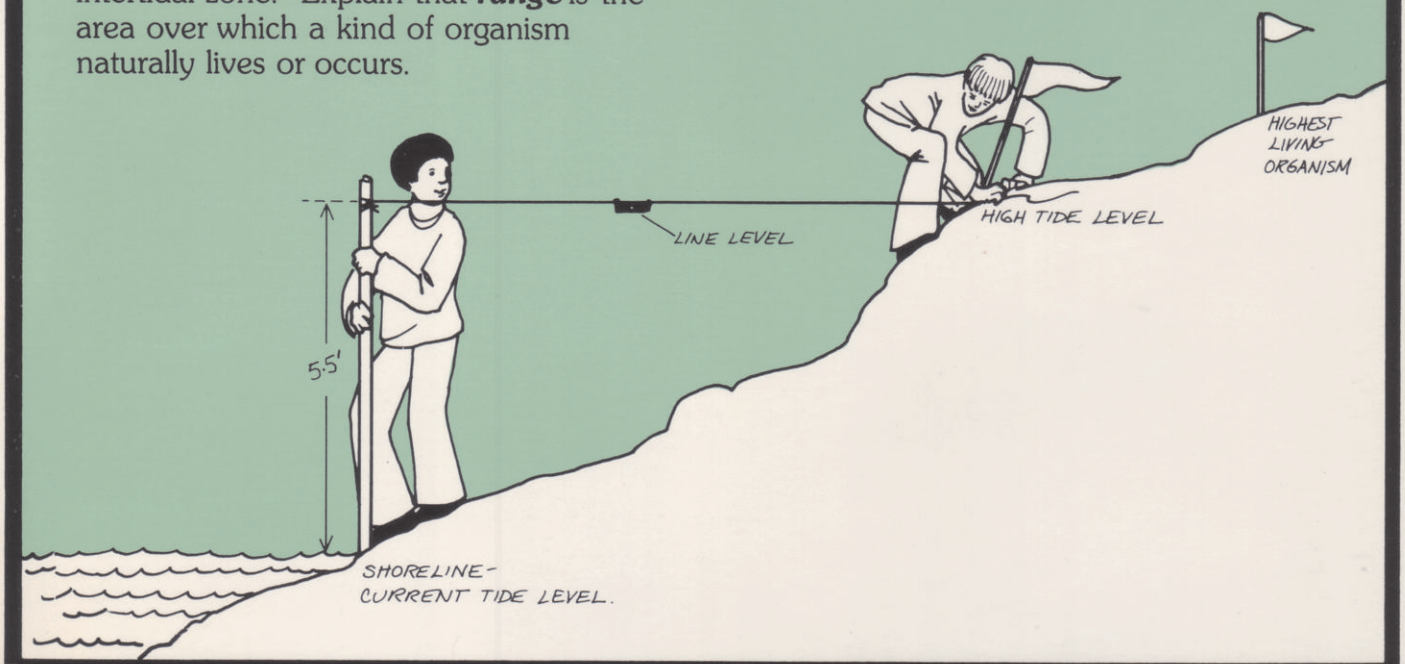
5. Now give each team another small flag and lump of clay. Challenge the teams to find the lowest places in the intertidal zone where they can find the same kind of plant and animal that they determined live highest.

6. After the teams have flagged the low spots, decide as a group which two flags mark the lowest places where the study plant and animal can be found. Point out that the distance between the high and low flags is the ***vertical range*** of the highest living plant and animal in the intertidal zone. Explain that ***range*** is the area over which a kind of organism naturally lives or occurs.

7. Demonstrate the use of the line-level rig. (See the "Determining the Highest Tide Level" Technique Card.) Combine the teams into two groups, and give each group a line-level rig.

8. Give one group the "Determining the Highest Tide Level" Technique Card, a tide table, and a large flag. Ask the group to find the high tide mark on the shore using the line-level rig. You will probably have to assist the group with this task after getting the second group started.

9. Ask the second group to find out how many vertical feet are between the lowest and highest plant or animal flags. One of the youngsters should hold the long pole next to the lowest flag. A second youngster should hold the other end of the string on the ground next to the highest flag. Someone should then move the string up and down the pole until the string is level as shown by the line level. By measuring the distance from the ground at the base of the pole to the string, the group can determine the vertical range of the study organism. This range represents the "upper zone" of the intertidal zone.



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THINKING ABOUT ZONATION

Let the two groups share their findings. Use the following questions for discussion:

1. Did the upper range of the study organisms extend above the high tide mark? How far? If so, how do you suppose the organisms in the top of the upper zone keep moist?

2. ***Adaptations*** are features of an organism that help it to survive and reproduce. What adaptations do you think organisms need in order to survive in the upper zone?

3. Where do you think upper-zone intertidal organisms could live higher: on a rocky shore that is exposed to heavy wave action, or on the back side of a breakwater that waves never reach? Why?

BRANCHING OUT

1. During a very low tide, locate an organism whose range defines a middle intertidal zone. Does this zone overlap with the upper zone?

2. During a low tide, stand and look at the intertidal zone. Can you see bands of similar organisms (brown seaweed, mussels, green seaweed, starfish)?

DETERMINING THE HIGHEST TIDE LEVEL

MATERIALS

1 tide table
1 large flag
1 line-level rig

1. To find the highest tide level, you first need to determine the present level of the tide. Check your tide table. You will have to estimate the present level if the tide is not at a high or low point at this moment.

Example: The time is now 2:20 p.m.

The tide table reads:

LOW TIDE				HIGH TIDE			
AM	**Ht.***	**PM**	**Ht.***	**AM**	**Ht.***	**PM**	**Ht.***
2:29	0.2	3:19	0.7	9:13	5.9	9:50	5.0

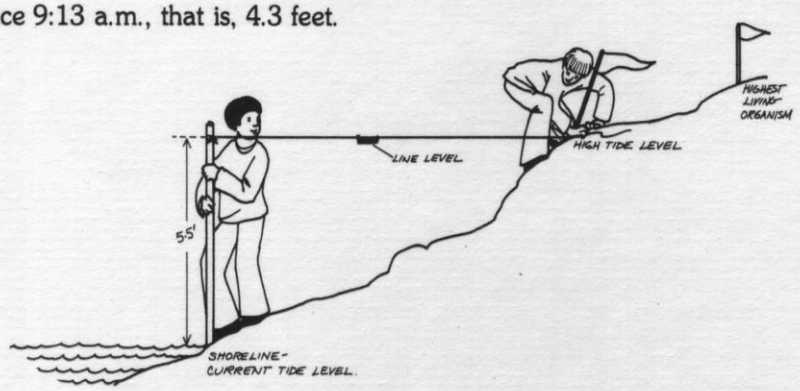
* Ht = Height of tide in feet.

From 9:13 a.m. to 3:19 p.m. (just over 6 hours), the tide level will drop (ebb) 5.2 feet. [5.9 feet - 0.7 feet = 5.2 feet] At 2:20 p.m., about 5 hours have elapsed since the 9:13 a.m. high tide. Assuming that the tide changes uniformly over the six hours, five-sixths of the tidal change has already occurred. Multiply 5.2 feet by 5 and divide the result by 6 to obtain the amount of tidal drop since 9:13 a.m., that is, 4.3 feet.

Subtract 4.3 feet from the 9:13 a.m. high tide of 5.9 feet to obtain the present tide level of 1.6 feet. The tide will continue to ebb until 3:19 p.m.

2. Now leaf through the high tide listings in your tide table and find the highest tide of the year. Let's say that 6.6 feet is the highest. The tide is now 1.6 feet. **Important:** Subtract the present tide (1.6 feet) from the highest tide (6.6 feet). Now you know that the highest tide level is 5.0 feet higher than the present tide.

3. Marking the Highest Tide Level on the Shore. From one end of the long pole of the line-level rig, measure off the difference you found for the highest tide level. Tie the string on the pole at this point. Then attach a line level to the string. Hold the stick straight up at the water's edge. Someone should take the other end of the string up the beach, pulling tight so the string doesn't sag, and find the spot on the shore at ground level where the bubble indicates the line is level. This point is the highest level that the tide reaches during the year. (If your pole is shorter than the tide difference, you will have to perform the measuring procedure twice. First, measure off 3 feet of height on the shore, move the long pole to that spot on the shore, and measure off the remaining distance.)



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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.

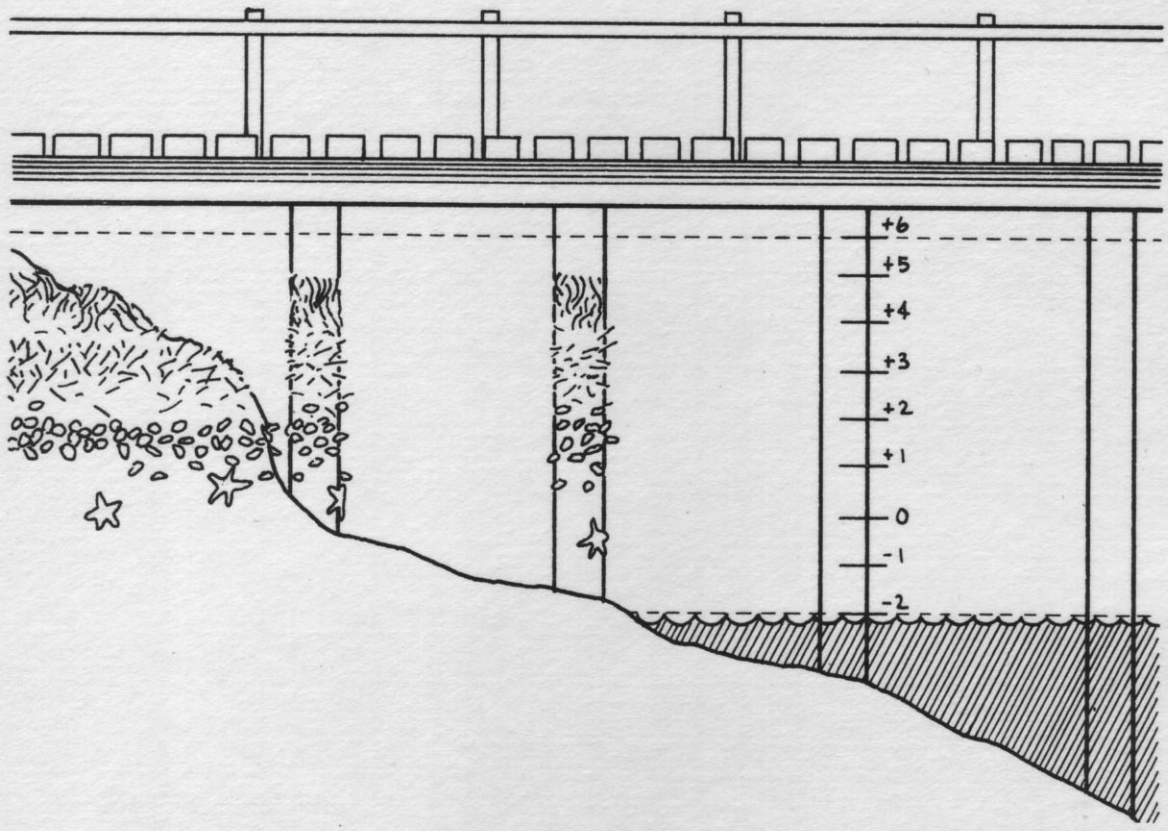
If it is not a high or low tide at the time you want to study your coastal community, you will have to estimate the height of the tide.

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).



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