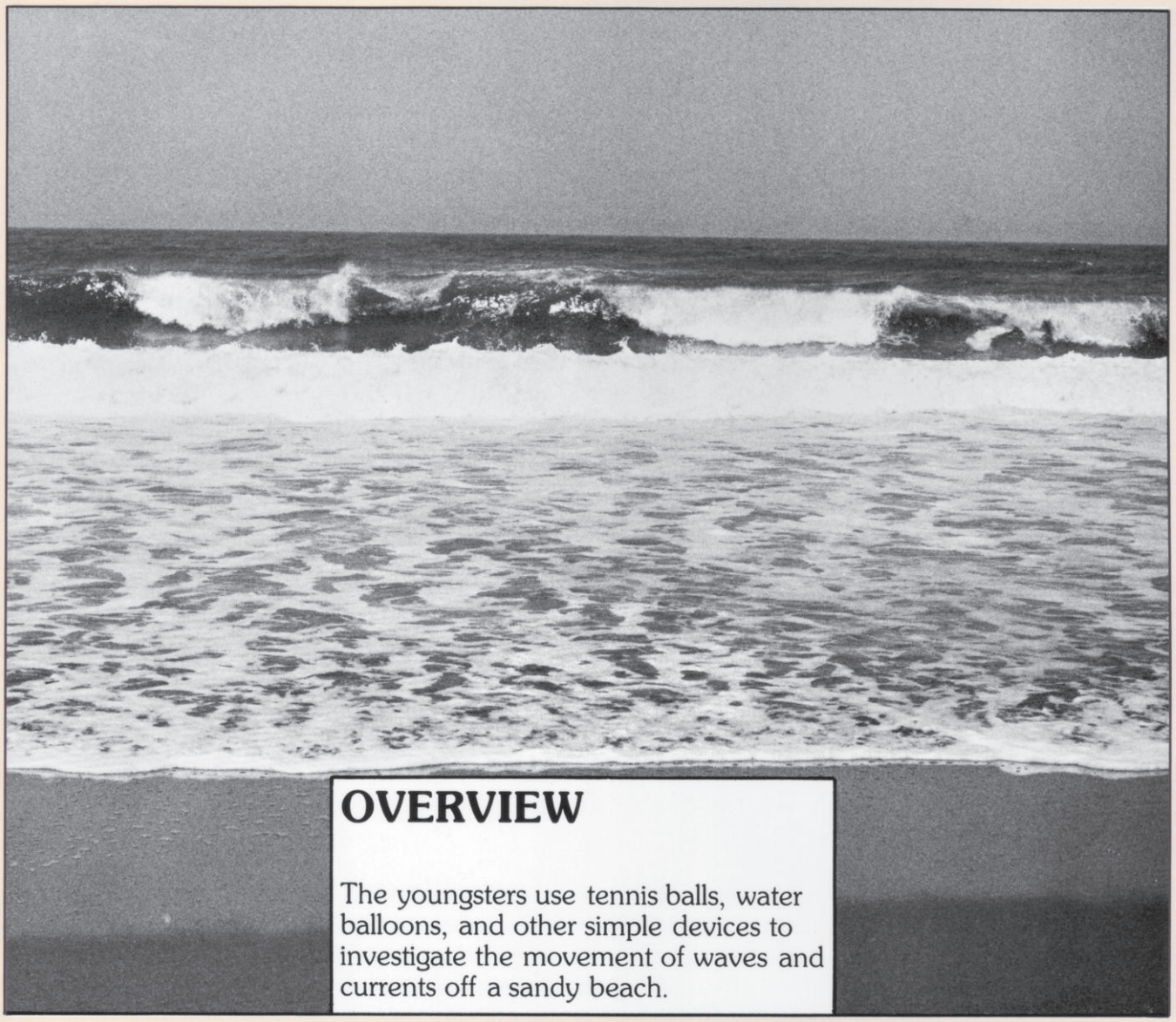
SEAS IN MOTION

BIO KEY
Exploration
Water Movement
Organism Transport



OVERVIEW

The youngsters use tennis balls, water balloons, and other simple devices to investigate the movement of waves and currents off a sandy beach.

BACKGROUND

Sandy beaches are constantly being reshaped by waves, near-shore currents, tides, and winds. Unprotected beaches on the outer coast are particularly vulnerable to sudden lashings by storm-generated winds and surf. A single storm can wash away several feet of sand and dramatically reduce the width of a sandy beach. When seas and winds are calm, there is a net movement of sand from near-shore areas back onto the beaches. Sandy beaches tend to be whittled away during the winter and early spring when storms are prevalent, and built back up during the summer and early fall when water and wind conditions are calm.

Intertidal organisms are scarce on sandy beaches because of the lack of stationary objects on which to anchor. However, bits and pieces of organisms from more hospitible environments often litter sandy beaches, particularly after a storm.

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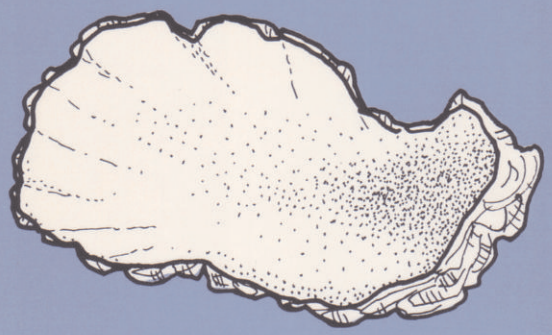
Where do these remnants of organisms come from and how do they end up on sandy beaches? This activity invites the youngsters to discover if the motions of the sea are responsible for transporting this organism debris.

CHALLENGE: INVESTIGATE THE MOTIONS OF THE SEA.



MATERIALS

For a group of sixteen:
2 tide tables
4 meter sticks* or tapes*
2 25-meter lengths of rope* or twine* (for measuring large distances)
4 waterproof permanent-ink marking pens*
12 small, round balloons*
4 old tennis balls*
4 dye markers †
2 sand stakes †
4 tide stakes †
4 watches with a second hand
2 copies of each Action Card
2 sheets of Action Cards*
1 copy of each "Seas in Motion" Equipment Card*
1 copy of the "Use of the Tide Table" Technique Card*
pencils

Optional:
1 or 2 fishing rods and reels (spinning outfits are easiest to use)
tossing cups †
1 life vest for each youngster

* Available from Delta Education.
† See the equipment cards.

PREPARATION

Group Size. This activity works best with groups of up to sixteen youngsters, but can be conducted with larger groups with additional materials and adult supervision.

Time. Plan on sixty to ninety minutes for this activity. Try to choose a day when the waves are one to two meters high.

Site. Choose a gently sloping, unprotected, sandy beach on the outer coast. This activity can also be conducted at large lakes with debris-littered shores when there is enough wave action. Select a central location for distributing materials and sharing results.

Safety. When working around the water, use the buddy system. (See the "Safety" section of the *Leader's Survival Kit* folio.) OBIS does not suggest going into the water, but surf-swept beaches can be dangerous. If possible, have the youngsters wear life vests.

Equipment. See the equipment cards in this folio for instructions on preparing and using the materials required by the Action Cards. If possible, let the group prepare their own materials beforehand. This will allow more time for investigating at the beach.

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ACTION

1. Point out limits for the activity site—100 meters of unobstructed beach should be ample. (Always keep the kids in plain view.)

2. ***Important: No one should go into the water!*** Warn the youngsters that when they are working near the water, they should *always* keep their eyes on the surf so they will not be surprised by an extra-large wave. Explain the buddy system, and divide the group into buddy teams.

3. Challenge the teams to find shells, seaweed, feathers, crab and fish skeletons, and other bits and pieces of organisms that are scattered along the beach. Allow about five minutes for this.

4. Call the group together and ask the kids how the organism remnants they found might have reached the activity site.

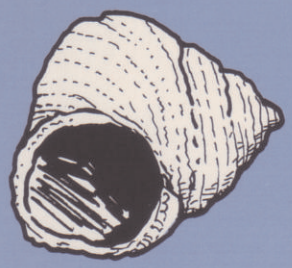
5. Tell the participants that they are going to find out if the motions of the sea carried the organism remnants ashore. The investigations involve tossing objects into the water off the beach and observing how they move. (Save the organism remnants for later use.)

6. Introduce and demonstrate the use of the various pieces of equipment: the tide and sand stakes, the water balloons, tennis balls, dye markers, marked shells, tossing cup, and fishing rod. (Refer to the equipment cards.)

7. Distribute an Action Card and pencil to each team. The youngsters should record their observations directly on the Action Cards. Let the teams select the materials needed for their investigation.

8. Start the investigations. Circulate among the teams to offer encouragement and assistance when it is needed.

9. If some teams complete the investigation on their Action Cards early, let them try other Action Cards. (This will require trading materials and Action Cards with another team.)



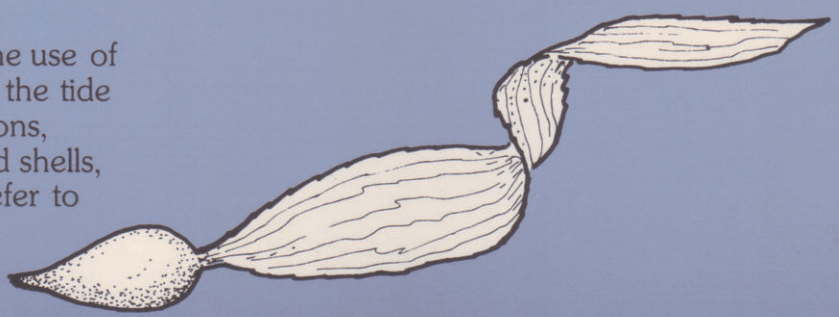
FATHOMING IT ALL

Call the participants back to share discoveries when each team has completed at least one Action Card investigation.

1. Was there a current running? Which way was the current running? Parallel to the beach? In what direction? How fast?

2. Was the tide coming in or going out? (Verify with the tide table.)

3. Was there any sand movement? In or out?



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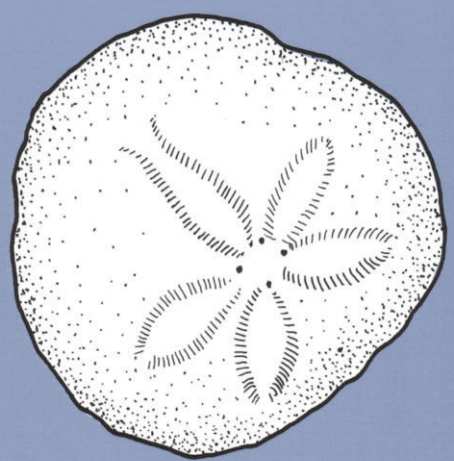
4. How did the movements of floating, sinking, and neutrally bouyant objects compare?

5. Did the marked shells reappear? If so, do you think they were moved by currents or waves? Was the wind a factor?

At the end of the discussion, ask the group if they think sea motions could transport shells, seaweed, and other organism debris onto the beach.



BRANCHING OUT

1. Repeat this activity when water conditions are different, e.g. a different tide, right after a severe storm, or when it is calm.

2. Try to determine the direction the bits and pieces of organisms your group found might have come from. If there is a rocky beach upcurrent from your beach, visit it and conduct an organism hunt to see if samples of the organism debris from the sandy beach can be matched with living organisms.

3. Return to the sandy beach during a minus tide to observe and, if possible, map the shape and profile of the beach. Come back during high tide and ask the group to relate the shape of the beach to the water movement off the beach (i.e. location of wave breaks, rip tides, and so forth).

TIDE AND SAND STAKES

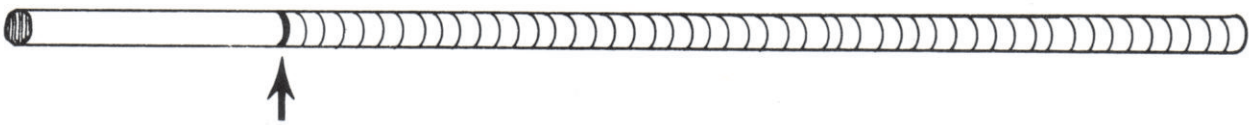
MATERIALS:

6 short fence stakes or wooden dowels* (about 80 centimeters long, and at least 1.5 centimeters in diameter)
2 meter sticks* or meter tapes*
2 waterproof marking pens*

* Available from Delta Education.

TO MAKE THE SAND STAKE:

Mark your stake at 1-cm intervals, starting 25 cm from one end.



Push this end into the sand up to this mark.

TO USE THE SAND STAKE:

At a point inside the active wash zone (where the sand is wet), push the unmarked end of the stake into the sand until the first mark is flush with the top of the sand. When you recover the stake (near the end of the activity), slide your hand down to the sand level and pull out the stake. The space between the bottom of your hand and the first mark represents the net gain or loss of sand during the time the stake was planted.

TO MAKE THE TIDE STAKE:

The tide stake requires no special preparation.

TO USE THE TIDE STAKE:

Sink two stakes into the beach to mark the highest point currently reached by the incoming wave wash. By the end of the period, the tide stakes will either be standing above or below the incoming wave wash. Move one of the stakes to the new highest point, directly inshore or offshore from the remaining stake. The distance between the two stakes marks the horizontal tide change during the period.

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MARKED SHELLS

MATERIALS

shells*
2 waterproof marking pens*
2 watches with a second hand
2 meter sticks* or meter tapes*

* Available from Delta Education.

By marking some shells, you can investigate the way the sea moves them. Collect some shells from the beach and mark them on both sides with waterproof marking pens. Toss the shells into the surf either by hand or with a tossing cup attached to a fishing rod. Mark the spot with a piece of driftwood or a line marked in the sand above the wash zone. Clock the amount of time it takes for the marked shells to wash ashore. Measure the distance the shells travelled along the beach from the marked delivery point.

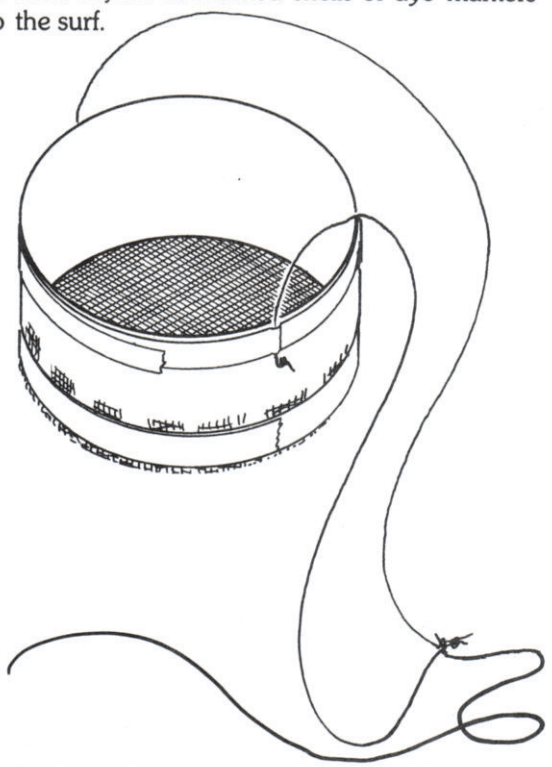
TOSSING CUP

MATERIALS

1 small can* or plastic cup*
1 piece of screen* or gauze*
filament or masking tape*
50 centimeters of fishing line* (at least 10 pound test)

* Available from Delta Education.

You can use a small cup or can to toss objects into the surf by hand or with a fishing rod. Remove the bottom of the cup or can and tape screen or gauze over the bottom. (This cuts down resistance and makes it easier to retrieve the cup.) Masking tape works, but filament tape is better. Cut two pieces of line approximately 25 cm long and tie knots at both ends of each string. Tape the strings to the top of the cup to form a harness. You can now use the cup to toss such objects as marked shells or dye markers into the surf.



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Equipment Card II

WATER BALLOONS

MATERIALS

12 to 24 medium-sized round balloons*
2 turkey basters* (giant dropper type)
1 bucket* for fresh water
1 bucket* for sea water
1 waterproof marking pen*

* Available from Delta Education.

In the ocean, the ever-popular water balloon is a neutrally buoyant object (when filled with sea water) or a floating object (when filled with fresh water). Blow the balloons up to loosen them and then use the turkey basters to fill the balloons with water, keeping them the size of tennis balls. Important: Remove all air bubbles. Carefully let all the air out, then tie the water balloons off.

A water balloon can also be a sinking object (when filled with sea water and some sand or gravel). For "sinkers," put about a teaspoon of sand or gravel into the balloon before filling with salt water. Prepare equal numbers of floaters, sinkers, and neutrals and mark them "F," "S," or "N" respectively with the marking pen. You can hand toss the balloons into the water or use a fishing rod to cast them into the surf. Attaching a dye marker to a balloon or tennis ball will help you follow their movement.

If a rod and reel is used, keep the lines slack so they do not interfere with the movement of the balloon or tennis ball.

FLOATING DYE MARKERS

MATERIALS

powdered confectioners dye* or fluorescein dye*
string*
6 to 10 small cloth bags* (teabags, candy or tobacco pouches, or handmade cheesecloth bags)

* Available from Delta Education.

Confectioners dye and fluorescein dye are water soluble and extremely concentrated. Moisten a tablespoonful of dye with a few drops of water until the dye is gooey; let it dry. Break the resulting cake into pieces the size of a dime and put one piece into each empty tea or cloth bag. Adding a little sand to the bag will make it easier to throw or cast the bags. Dye markers can be tied with string to water balloons and other objects.

WATCH OUT!

Confectioners dye and fluorescein dye are ***extremely concentrated****. Avoid direct contact to prevent stains on hands and clothing!*

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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.

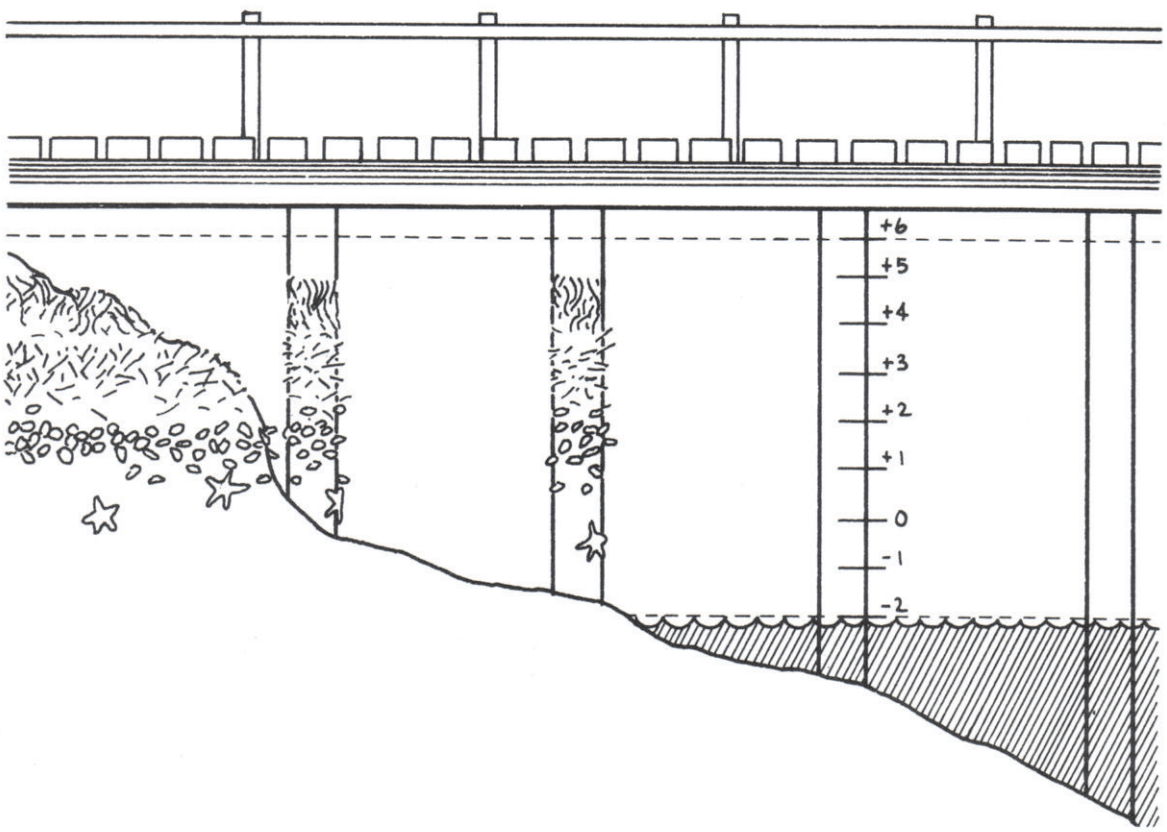
If it is not a high or low tide at the time you want to study your coastal community, you will have to estimate the height of the tide.

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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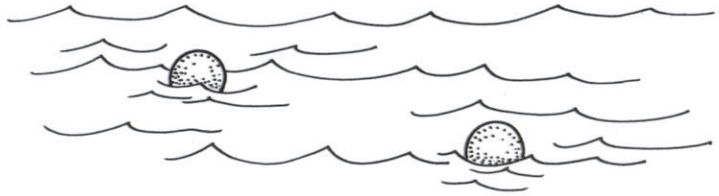
Seas in Motion
Action Card #1

Speed and Direction of Currents. Is there a current running parallel to the beach? Hand toss or use a fishing rod to cast tennis balls, water balloons,* or floating dye markers* into the surf. Use a watch and meter stick or tape to estimate their speed (meters per second) and main direction of movement. Fling objects into several different surf spots and compare the estimated speed and direction of movement in different areas.

* See Equipment Card II.

Seas in Motion
Action Card #2

Movement of Floating Objects. Are floating objects tossed back up on the beach or taken out to sea? Hand toss water balloons (filled with fresh water) or tennis balls into the surf and follow their movements.



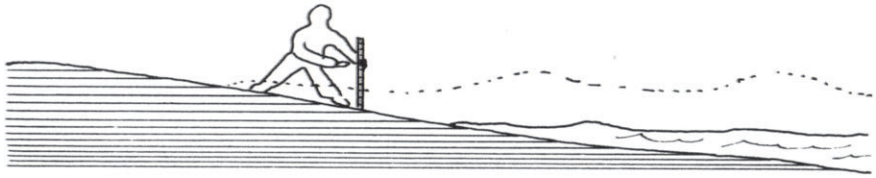
Seas in Motion
Action Card #3

Measuring Tidal Changes. Is the tide coming in or going out? To find out, use two tide stakes to mark the highest point currently reached by the incoming waves. At the end of the period, move one of the stakes to the highest point directly in or out from the remaining stake. The distance between the two stakes marks the horizontal tide change during the period.

The tide rose/fell _____ meters during the period. (Circle one.)

Seas in Motion
Action Card #4

Sand Movement. Is the water moving the sand onto or off the beach? To find out, put sand stakes in the area about halfway between the highest point the water reaches and the lowest point to which it recedes on each wave. Surf can be dangerous, so follow the returning water out and quickly put your stake into the sand up to the zero mark before the next wave comes in.



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Seas in Motion
Action Card #5

Shell Movement. What happens to shells when you toss them into the surf? How far up or down the beach do they move? Mark *both sides* of some shells with waterproof markers. Use your hand or the tossing cup* to toss the shells into the surf. See where they turn up.

How many shells did you mark and toss out?

How many shells did you recover?

How far did they travel?

* See Equipment Card I.

Seas in Motion
Action Card #6

Floaters and Non-Floaters. What happens to floating, sinking, and neutrally buoyant objects when you toss them into the water together? Use freshwater balloons* or tennis balls as floating objects, salt-water balloons* as neutrally bouyant objects, and bundles of shells as sinking objects. Hand toss the objects. Time their motions and measure the distances that they cover.

	DISTANCE	TIME
FLOATING		
NEUTRAL		
SINKING		

* See Equipment Card II.

Seas in Motion
Action Card #7

Movement of Materials. What happens to bits and pieces of organisms when they are tossed into the water? Measure the distances covered and speed of travel.

ITEM	DISTANCE	TIME

Seas in Motion
Action Card #8

Place a handful of shells, seaweed, and other fragments of organisms on the sand about halfway between the highest point the water reaches and the lowest point to which it recedes on each wave. Observe what the incoming waves do to the organism pieces. Record your observations below.

OBSERVATIONS:

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