Unit Six
The Seashell Field Trip

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Objectives:

To give students opportunities to:

- Experience the magic of the water environment. Demonstrate respect and appreciation for water animals and their homes by designing beach rules (Activity 1).
- Make a plankton net (Activity 2).
- Help design field investigations of interest (Activity 3).
- Explore the beach (Activity 4).
- Watch the feeding habits of bivalves (Activities 5, 6).
- Observe mollusks in their natural environments (Activities 4, 7, 11).
- Record field data on mollusk observations (Activities 3, 8, 11).
- Collect field information and materials for follow-up work in the classroom (Activities 10, 13).
- Discover the life in a drop of water (Activity 10).
- Show their understanding of mollusk habits through pantomime (Activity 12).
- Review their mollusk learnings and share special moments (Activity 13).
Unit Six: The Seashell Field Trip.
Students explore and study diverse beach habitats to find a variety of mollusks and other coastal denizens.
"If there is magic on this planet, it is contained in water," writes author Loren Eisely. Children can share in this magic through field trips to local beaches, ponds and streams, especially when complemented by adequate classroom preparation and follow-up.

Field trips provide hands-on learning. In addition to stimulating both scientific observation and accurate recording skills, they also facilitate group interaction and cooperation. Field trips are therefore the fulcrum of Sea Week lessons.

Whereas the introductory activities prepare students to take better advantage of field-site learning, the review activities reinforce the field trip for better learning retention.

For logistics and organizational tips for field trips, see "Tips for Teachers" at the beginning of this volume.

Adequate preparation cannot be understated, so be sure to cover planning activities in units One through Five. Additionally, you may find it useful to:

- Set learning objectives for the field trip and develop a lesson plan (as for any other curriculum unit).
- Agree on specific tasks and investigations that are of interest to all, and review them for procedure before the actual trip.
- Have students bring raincoats, boots and additional items from home the day before the field trip.
- The day before your field trip, have a "fully dressed" practice run. Split the class into groups, assigning responsibilities and equipment to each group. Have each student choose a "buddy" for the following day.

As with any learning experience, students respond best to diverse learning modes. So, while on the beach, plan for periods of "exploration" as well as structured time. Lead students in discussions covering your learning objectives. Provide time for individual, small-group, and large-group activities.

Be sure to repeat visits later to the same area, bringing to each investigation a different focus. Overall, try to foster a familiarity that will lead to a sense of stewardship.

Making a "beach book," designed to record beach observations and artwork developed over the seasons, will give students a tangible memory of their beach. If the site is close by, students can be encouraged to visit on their own and bring reports back to class.
Activities 1 to 3 are designed to prepare for the trip. The remaining activities are for the trip itself. They fall into four categories:

I. *Initial Exploration and Discovery.* Individual free time to satisfy the natural exploration impulse (Activity 4).

II. *Structured Learning Activities.* Of two types: 1) group observation and experiments, which require limited supplies or teacher supervision (Activity 5-10); and 2) individual and small-group tasks and data collection, under the guidance of volunteer chaperones.

III. Games. Group amusement--a chance to bring students together to socialize and burn off excess energy (Activity 12).

IV. Review. Group synthesis--to review the day's learnings and to share feelings and experiences (Activity 13).

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**Activity 1**

**Beach Etiquette**

**Background:**

Students will be better stewards of their environment if they put some thought into stewardship, and will be more likely to pay attention to rules if they play a role in formulating them. Use the conservation and beach etiquette sections of the Sea Week Source Book as background.

The primary motivations for beach etiquette and conservation are to promote care and respect for living things and their homes.

Remind students that the beach is the home of the mollusks they have been studying.

**Materials:**

- paper
- pencil
- chalkboard or newsprint
- worksheet:
  ...Ounce of Prevention (6A)

**Vocabulary:**

- conservation
- safety
- natural resource
- respect
Procedure:

1. Write "conservation" on the board. Define it as "wise use of our natural resources." Also introduce and define "safety."

2. Explain that one natural resource is the beach. Have students help you list ways in which the beach is a resource. (by providing food, animal homes, human recreation, and a buffer zone that protects coastline communities)

3. Ask students to list creatures that live on the beach. Discuss manners, and ask the class what constitutes appropriate behavior for visiting someone else's home. Is it polite to break things at a friend's house, or step on things without looking?

4. Divide students into groups of four. Remind students that studying the beach beforehand shows respect for the things living there. Explain that this will also make the class visit there a safer one. Have each group then come up with two rules that will keep the beach a good place to visit. Request that the students word these rules in ways that will make everyone want to follow them.

5. Ask each group to write their rules on the board, or have the groups read them orally while you write them on the board.

6. Go over the rules, adding any you think necessary. Have the class agree on a list of major rules.

7. Read and study the following poem:

"Hurt No Living Thing"

Hurt no living thing;
Ladybird, no butterfly,
Nor moth with dusty wing,
No cricket chirping cheerily,
Nor grasshopper so light of leap,
Nor dancing gnat, no beetle fat,
Nor harmless worms that creep.

—Christina Rosetti

(The following additions are provided by Sue Baxter's class, Juneau)

Nor shellfish hard, no starfish scratchy,
Nor fish that swim happily,
Nor limpet small, nor hermit crab pinching.
Hurt no living thing!

10. Play the Ounce of Prevention game located with the worksheets.
Activity 2
Make a Plankton Net

Background:

Plankton are living organisms—tiny plants and animals—that drift or swim weakly in open waters. The word "plankton" is plural. An individual planktonic organism is called a "plankter."

Plankton are not microscopic by definition. In fact, jellyfish, which drift with the ocean currents, are among the larger planktonic organisms. The plankton your net will capture are the small microplankton, which constitute the "sea soup" that is the basis of the ocean food web.

By learning that microscopic plants and animals do exist, students can start to understand the basis for food webs in marine and freshwater systems. For example, microscopic plant plankton serve as food for tiny, swimming, animal plankton, which in turn serve as food for larger marine animals. This, of course, is the basic idea of the food chain. Humpback whales, for example, eat shrimp-like euphausiids that eat tiny animal plankton which eat microscopic plant plankton.

Materials:

- string
- needle and thread
- nylon hose or parachute nylon
- clothes hanger
- scissors
- wire cutter
- baby food jar and lid
- rubber band
- tape

Vocabulary:

- plankton
- net
- web
- chain
- organism
- microscopic
- bridle
- towline

Procedure:

1. Write "plankton" on the board. Explain that plankton consist of organisms, both plant and animal, that float in water.

2. Talk about which animals eat plankton. Students should recall from earlier exercises what bivalves do (and usually, they also remember from Book One that some whales eat plankton, too).

3. Cultivate anticipation by telling students they can catch plankton on this field trip and raise it in the classroom when they return.

4. Make one or two plankton nets, with student help. First, cut and bend a piece of clothes hanger to form a circle six inches in diameter. Wrap the ends around the wire forming the circle, and then cover all sharp points with heavy tape.
5. Sew the upper, large end of a nylon stocking over the wire frame to form what looks like a wind sock. Cut off the foot, leaving about one foot of hose. Fasten the small end onto an open baby-food jar with a rubber band. (Save the lid for transporting specimen.)

6. Use three pieces of string to fashion a bridle as shown, and to the bridle attach a long length of heavy string or cord as a towline. You're now ready to go plankton fishing!

7. Explain the use of the net. Ask what will happen to the water when you pull the net. (It will flow through the nylon.) What will happen to animals too big to flow through the nylon? (They will get stuck on the nylon and then get washed into the jar.)

Activity 3
Beach Books

Materials:

- paper
- yarn
- scissors
- task cards copied on heavy paper
- plastic sandwich bags
- worksheet:
  ...Beach Book (6B) (copied onto heavy paper)

Procedure:

1. Ask students what they expect to find on the beach. Make a list. Pass out the Beach Book worksheet, and ask for suggestions on additions or deletions that would adjust the list to apply more specifically to your local beach.

2. Make "beach books." Have each student color a book cover and cut the pages apart (or cut them yourself ahead of time with a paper cutter). String the pages together with yarn and tie a crayon to the yarn. Put the book in a plastic bag.

3. Review the creatures in the book.
4. Instruct students to check appropriate boxes when they find the creatures, and perhaps write the number of creatures found in the space beside the box. Emphasize that all students are responsible for their own book, writing implement and plastic bag. Remind them not to litter the beach (as per one of the rules on the list they made earlier?).

Activity 4
Arrival Fun

After all this preparation, class work, organization and travel, you have finally arrived at the site! The students' first urge will be to get out and explore. Allowing them to act on this impulse might turn up some exciting finds and will make them more receptive to focusing later.

Materials:

- beach books
- litter bags

Procedure:

1. Before exploring, ask students to volunteer one beach rule until you have reviewed the complete list.

2. Allow students a specified period in which to explore. Be clear on the constraints: boundaries, time, group size. Suggest that they start on their beach books. Urge them to share their finds with the rest of the group, as well as to call them to your attention. Be sure to designate a rendezvous at the end of the exploration period. You may want to prearrange a signal to pull the group together.
(such as a ship's bell, bosun's whistle, conch horn or raised flag). From 20 to 30 minutes is a good initial exploratory period, with the half-hour generally stretching to 45 minutes during regrouping.

2. Remind students of the importance of respectfully caring for the area. Pass out litter bags and encourage students to collect litter. Encourage students to share finds by calling others over to them, rather than their collecting everything they come across. This would also be a good time to remind students that this place is where many things and creatures call "home."

3. When you have regrouped, share your finds briefly. Use this time to go over behavior rules and expectations, and to outline the rest of the day.

Activity 5
The Life of a Mussel

Background:

This activity should be done as a group, in order to disturb as few mussels as possible.

Materials:
- live mussels
- bucket, plastic bowl or milk carton with seawater
- chalk or food coloring

Vocabulary:
- habitat
- plankton
- filter feeding
- byssal threads

Procedure:

1. Remind students of classroom discussions and worksheets on mussels. Ask them to now observe and report on the mussel's habitat. Ask where it is. (low tide? high tide? close to the water? far from the water? among sand? among rocks?)

2. Explore a mussel habitat together. Ask what else they can find. (periwinkles? limpets? hermit crabs?)
3. Ask students what the mussels eat and how. (plankton, by filtering it from the water)

4. Place some mussels in the sea water container for observation. Let students help you demonstrate the movement of water into and out of the mussel, by dropping a few chalk particles, or a few drops of food coloring, near the gaping shell. Ask what happens. Experiment with different colored food coloring--do your mussels prefer one color over another?

5. Locate some byssal threads, explaining how entire mussel colonies are anchored by these threads. Have children pull some threads to see how strong they are. If left undisturbed for a while in the aquarium or bucket, the mussel may attach byssal threads. Periodically "post a guard" at the container, to watch for the mussel's slender, specialized foot, reaching out with a byssal thread, and then reaching in and out again with self-made glue with which to anchor the thread.

Activity 6
Find a Clam, Feed a Clam

Background:

Remind students that people eat clams. This is a good introduction to studying the clam's eating habits. Again, conducting this activity as a group will keep from disturbing more shellfish than necessary. What else are we eating when we eat a clam? The concept of the "food chain" applies here, as does a review of the habitat and food requirements introduced in the mussel unit.

Bivalves such as clams, which burrow into sand or mud, must extend their siphons to the surface to feed. The pressure of a human foot near the hole will cause the animal to retract its siphon. As it does so, water in the siphon will squirt upward, sometimes like a fountain.

Materials:

- shovel, clam rake
- live clam
- bucket, plastic bowl or milk carton
- cold sea water
- food coloring or India ink
Vocabulary:
- clam
- siphon
- foot
- habitat

Procedure:
1. Ask who among the students has eaten clams. Discuss what else they might be eating as they eat a clam. Ask what the clam had eaten.

2. Encourage students to walk over sandy or muddy areas of the beach carefully, looking for siphon tips and holes left by retracted siphons. Have them watch for water squirts as the clams retreat. When they find evidence of a clam, help them dig carefully to uncover the one clam. Replace the mud in the hole to avoid suffocating neighboring clams.

3. Examine the clam, deciding what kind it is. First, place it in shallow water on the sand to see if it starts digging. Then place the live clam in a bucket of fresh, cold, sea water, watching to see if it extends its foot or siphon.

4. Introduce food coloring to the water and see if it is drawn into the clam through the incumbent siphon.

5. See how many different kinds of clams the class can find. Have students leave the clams where found. For each clam discovered, have students report on whether it was alive or dead, where it was found, and what the habitat requirements were for that particular clam.

Activity 7
Make ar. Abalone Run

Materials:
- abalone
- sunflower star
- tide pool or milk carton

Procedure:
1. Find an abalone and a many-armed sunflower star at the beach.

2. Put both animals in the same tide pool or in the same container of sea water.

3. Watch the behavior of the abalone. (Because sunflower stars eat abalone, the abalone may try to "run" from the star.) To encourage the retreat, touch one sea star arm to the abalone.

4. After you have watched the reaction of the abalone, put the animals back where you found them, so the star won't have an abalone "steak" for dinner today.
Activity 8
Beach Math
- Frequency Distribution

Materials:
- rulers
- pencils
- frequency distribution forms

Procedure:
1. Divide students into groups of two or three. Ask members of each group to collect as many of one kind of shell as they can in 10 minutes. Pick shells that are plentiful. You may want to assign all groups the same shell, but in different sections of the beach; or assign each group a different kind of shell.

2. Using a ruler, measure each shell from the hinge to the edge opposite the hinge.

3. Plot the number of shells found in each length category (round measurements to the nearest centimeter). Use the following form.

4. What does this tell about death in the local mollusk population? What size is the most plentiful? Is there one size at which only a few were found? At which size do most of the mollusks die?

5. Return your shells to the beach, so others can enjoy them, too.
Activity 9
Limpet Race

To have fun while illustrating how limpets can move surprisingly fast, try this experiment:

Materials:
- live limpets
- chalk

Vocabulary:
- limpet
- foot
- radula
- mouth

Procedure:
1. Catch a limpet. You'll have to sneak up on it because if you try to pull an alerted limpet from a rock, it can be difficult, and you might injure the animal. Examine the limpet, showing students the tiny, slit-like mouth on the underside of the soft animal. Explain how the limpet uses a radula to scrape algae from rocks.

2. Find an area in which limpets are common high in the intertidal zone. (One species lives on large rocks almost at the upper tide limit.) To hold the limpet race, divide the class into groups. Select a limpet for each group, and have students draw a circle around the limpet they have selected. Use a jar lid, tin can, paper plate or other guide to make all the circles the same size. Have the groups make a chalk mark on the limpet for later identification.

3. After an hour or so, return to the limpet area and check to see if the marked limpets have moved. You may want to calculate their rates of travel. Note the directions of travel, too. Many limpets feed at night and move to the undersides of rocks during the daytime, so some of the limpets may not have moved.
Activity 10
Plankton

Materials:
- plankton net
- baby food jars and lids
- binocular microscope - solid base on which to set the scope
- petri dishes (optional)
- eye dropper (optional)

Vocabulary:
- plankton

Procedure:
1. Find a site for plankton collection. Piers and docks are ideal. Drag your plankton net (see the field trip preparation section of this unit) horizontally through the water, back and forth the length of the dock. Or, walk it through the water, pull it behind a boat, or throw it out into the water from the beach and then pull it back in.

2. Wash the organisms caught in the nylon mesh into the baby food jar. Hold the jar up to the light and watch for movement to see if you have collected any plankton. If necessary, pull the net again until you get a good concentration of animals.

3. Remove and cap the jar. If you are taking a number of samples, you may want to label each jar for later comparison.

4. Catch some plankton with an eyedropper and--either in the field or later in the classroom--put them in a petri dish or on a slide under the microscope. The smaller the drop of water, the less room the creatures will have to escape the microscope's field of view.

5. Demonstrate the microscope. Focus on the plankton and let students look. Encourage them to search for modes of locomotion, count legs, and look for other body parts. Let them wonder at the life in a drop of water.
Activity 11
Beach Task Cards

The following activities can be prepared on task cards and distributed during the field trip, either all at once or as a change of pace between group activities. Students can do them individually or chaperones can lead small groups. Select the cards most applicable to your area.

BEACH SOUNDS

Find a spot away from other students where you can sit quietly.

Listen to the sounds around you for three minutes, and remember them to tell the group later.

What did those sounds make you think about?

How did the sounds make you feel?

DANGER

Pick a favorite spot on the beach.

Think about your spot. What kinds of plants and animals live there? Name as many as you can.

Think of any dangers these plants and animals will face because you are visiting the beach. In your beach book, list four of the dangers you think they will face.

BEACH MYSTERY

Find clues to a beach mystery. Explain the clues and tell a story about what happened. (Example clue: tracks in sand, feather on beach.)
PERIWINKLE SEARCH

Turn over a rock and gather all the periwinkle shells into a milk carton or margarine bowl. Be sure to turn the rock back over after you have finished collecting.

Count all the shells.

Do any of the shells have hermit crabs inside? Count them.

What will the hermit crab do when he gets too large for a periwinkle shell?

Carefully replace the animals and the rock so the animals will have a safe, damp home.

ROCK HOME

Turn over a rock in an area designated by your teacher. Draw at least two animals you find there.

Why do you think the animals prefer to live under a rock?

Are there any animals attached to the rock? How do you think they are attached?

If you lived under a rock, what would you need to do to be able to live there?

Are there any advantages for these animals to live under rocks, while they are out of the water at low tide?

Carefully replace the rock in its original position to return the home to normal.

NOT LIVING

List in your beach book at least five non-living materials at the field trip site.

Put a star by those that occur naturally. (In other words, those not there because of humans.)

Put a second star by the materials necessary for life to survive here.
MOLLUSK HABITAT

Pick one type of mollusk. How far up the beach is the farthest it lives? How close to the water does it live?

In your beach book, draw a picture of a mollusk in its home.

What animal lives the farthest away from the water?

What mollusk lives as far into the water as you can see?

LITTER

Collect litter. Put all your litter in one spot. What clues does it tell you about who has been here? Make a story based on the litter you find. Put the litter in a bag to throw away.

CIRCLE UP

Hold hands with a friend and make a circle. Find a spot on the beach where there are three different kinds of invertebrates inside your circle. Write their names in your beach book. Count how many of each kind there are, and write that number in your beach book.

MUSSEL COUNT

How many mussels can you cover with one hand? How many can you and a friend cover with all four hands?

SHELL HUNT

Find the most colorful shell on the beach. Leave it where it is, but remember where it is. Find the littlest shell, the biggest shell and your favorite shell. Be careful not to step on them. Take your group on a tour to see them.

MOLLUSK MEAL

Find evidence of a mollusk meal. Who ate the mollusk? What kind of mollusk was eaten? What could eat the mollusk-eater?
Activity 12
Pantomime

Procedure:

1. Provide the following scenarios for students to mime:
   - You are a chiton hanging onto a rock.
   - You are a hermit crab in a periwinkle shell on the beach.
   - You are a snail under water, feeding on grass.
   - You are a hermit crab looking for a shell. Then you find it.
   - You are an abalone on a rock and a person is trying to pry you loose.
   - You are a clam under the sand, and you've been stepped on.
   - You are a mussel feeding.

2. Ask students for suggestions of additional pantomimes for the class to try.

3. Encourage students to enlist the help of their friends if they think a pantomime requires more than one actor or actress.

4. Let each student or group of students do a pantomime and have the rest of the class guess what they are.
Activity 13
On-site Review

Procedure:

1. Bring the group together to share the day's experiences and learnings.

2. Ask students to volunteer something they saw or did today that they had never done before, or to explain something they learned.

3. Review some of the card tasks. What did students hear during their quiet period? How many mussels did they cover with one hand? (Tailor other questions to the tasks you selected.)

4. Discuss what kind of impact your visit had on the beach. Did you leave it in better or worse shape? What could you do to leave it better?

5. Close with sharing your favorite things about the beach or the field trip.
Unit Seven
From Mollusks
to Insects:
Water Invertebrates

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Objectives:

To enable students to:

- Recognize that vertebrates are animals with backbones (Activity 1).
- Recognize that invertebrates are animals that lack backbones (Activity 1).
- Designate animals as vertebrates or invertebrates (Activities 1, 2).
- List ways to show respect for invertebrates as living things (Activity 1).
- List similarities and differences between invertebrates and vertebrates (Activity 2).
- Explain that the earth changes with time (Activity 3).
- Define a fossil as a preserved record of a living thing (Activity 3).
- List factors that lead to the extinction of organisms (Activity 3).
- Simulate the process of shell breakdown on the beach (Activity 4).
- List the processes of decay (Activity 4).
- Simulate the creation of a shell fossil (Activity 5).
Unit Seven: From Mollusks to Insects: Water Invertebrates. Insects and mollusks are easily studied representatives of invertebrates, which are the most numerous, as well as very ancient, group of animals.
People are "vertebrates," as are most of the animals with which people most often deal: dogs, cats, horses, birds, fish. But vertebrates make up only a very small part of the whole—about 5 percent. Ninety-five percent of the animals on earth are "invertebrates"—those often wiggly, squishy, squirming animals that lack backbones.

The mollusks and insects are two subgroups within the large invertebrate category. Mollusks (Mollusca) constitute a phylum of soft-bodied, usually shell-covered organisms found mainly in aquatic environments. The insects (Insecta) and crustaceans (Crustacea) are classes of the phylum Arthropoda, which also includes spiders. The insects make up a wide and successful class that is primarily terrestrial but has invaded many freshwater environments. The crustaceans include crabs and shrimp in the marine environment, crayfish and zooplankton in freshwater, and the homely pillbug on land.

Students can easily discover their own backbones and other bones. They also will recognize that vertebrates usually are familiar animals with heads, eyes and bodies. Invertebrates, on the other hand, not only lack bones, but many of them—headless and eyeless—don't look like "animals" at all.

Both insects and mollusks are abundant organisms. The insect class is the single largest group of animals, larger than all other groups combined, with more different kinds of individuals than any other group. Mollusk is the second largest phylum. (Arthropods is the largest, as it includes the insects. Both groups are ancient.) The mineral shell of the mollusks makes it particularly likely to show up in the fossil record.

The earliest mollusks lived in the Precambrian oceans more than 600 million years ago. Univalves and bivalves became abundant in Ordovician oceans about 420 million years ago. In the Devonian period a few hundred million
years later, some bivalves took up residence in fresh water. About 100 million years after that, univalves also entered fresh water. In recent times, the trend has been that freshwater mollusks are evolving and increasing, while saltwater species appear to be decreasing.

The first flying animals were insects. Huge cockroaches and dragonfly-like creatures with six-foot wing spans prowled the shores of oceans and ponds 200 million years ago. Aquatic insects were terrestrial before invading both salt and fresh water—though they did so in relatively small numbers. The main challenge of submergence for these otherwise omnipresent organisms is breathing, as their traditional spiracle method is not easily adaptable to water.

Activity 1
'Spineless' the Octopus

Materials:
- yarn
- glue
- scissors
- nylon stockings or styrofoam ball
- buttons
- 12-inch stick
- worksheet:
  ...Invertebrates (7A)

Vocabulary:
- vertebrate
- invertebrate
- backbone
- "in" (meaning "not")

Procedure:
1. Make a "Spineless the Octopus" puppet: Cut a skein of yarn into two-foot pieces. Tie these strips together and drape them around a styrofoam ball or a ball of nylon hose the size of your fist, covering all sides evenly. Tie the yarn into eight even sections and braid each of these to form the eight legs of the octopus. Insert the stick to provide a handle. Glue on buttons for eyes.
2. Introduce "Spineless" to your class. See who recognizes what she is. What do they know about Spineless?

3. Ask the class to tell you some similarities and differences between themselves and Spineless (leading up to the major difference: kids have backbones and Spineless does not).

4. Have students locate their own backbones. Explain that the presence of their backbones and other bones includes them in a group of animals called vertebrates.

5. Write "vertebrate" on the blackboard. Ask students to give examples of other animals they know that have bones. Try to elicit a diverse array of groups. If they have not listed fish, remind them of the bones found in fish when they are eaten or cleaned. Chicken or duck bones can provide similar links with the bird world.

6. Now ask the class for examples of animals that lack backbones. Draw on student experiences with aquatic animals in the Sea Week Discovery volume, such as insects, sea stars, anemones, worms, and such mollusks as clams, snails and the octopus. Explain that these are called invertebrates.

7. Explore with students how these invertebrates are animals, even though they lack the bones of dogs, whales or birds. Invertebrates, like all living things, should be respected and cared for to preserve their lives. Ask the class to think of ways to act so as to be sure not to hurt invertebrates.

8. Write the word "invertebrate" on the board. Compare the words "vertebrate" and "invertebrate." Explain that the prefix "in" means "not." For example, inexpensive means "not expensive." Can the students think of any "in" words that mean "not"? Examples:

   inaccurate  independent
   inactive    indirect
   inadequate  inedible
   inattentive infrequent
   incapable   inhospitable
   inconvenient inhuman
   incomplete  insane
   incomparable insincere
   incorrect   invalid
   incredible  invisible

List some "in" words on the board. You could use these and other Sea Week words as spelling words.

9. Give students the Invertebrates worksheet and have them color and circle all of the invertebrates and place an "X" on all the vertebrates.
Activity 2
Similarities and Differences

Materials:
- octopus puppet
- pencils
- crayons
- invertebrate specimens or pictures
- worksheet:
  ...Similarities and Differences
  (YB)

Vocabulary:
- similarities
- differences
- invertebrate
- vertebrate

Procedure:
1. Have students select partners. Give the pairs a
   Similarities and Differences
   worksheet.

2. Have each pair choose an invertebrate specimen or
   picture. Have one youngster draw a picture of a person
   in the vertebrate box, while the partner draws the selected
   invertebrate.

3. Ask students to list vertebrate-invertebrate similarities
   in one column, and differences in another. Review the
   observations as a class.

4. Discuss with students the purposes of their own bones.
   Explain that without bones, each student would be a limp
   pile of flesh. Ask students: if the insects and crustaceans
   and mollusks don't have bones, then what offers them
   support and gives them something to which their muscles
   can attach? (Their hard outer coverings—or skins or
   shells; or, for shell-less invertebrates, the buoyancy
   of the water.)

5. Return to Spineless. Have Spineless explain to the class
   that there is a whole world of spineless invertebrates in
   oceans, ponds and streams—and that actually most animals
   are invertebrates. The students, as vertebrates, are
   rather unusual. Spineless also thinks that she and the
   rest of the invertebrates are rather important. And be-
   cause the teacher shares that opinion, the class is going to
   spend (Sea Week) learning about invertebrates of oceans,
   streams and ponds.
Activity 3
Change

Materials:
- fossil examples or pictures
- worksheet: ...Fossils (7C)

Vocabulary:
- change
- fossils
- extinct

Procedure:
1. Explain that, at one time, there were animals living here that are not here today. Discuss what could have caused the animals to disappear. (lack of food, lack of home)

2. Talk more about change through time, and explain that areas change, too. There are places even within students' lifetimes that used to have trees or plants, or buildings that have burned or have been demolished. Ask for other examples. Has a nearby river or stream changed course, or have ponds appeared or disappeared, beaches receded or advanced?

3. Explain that, long before humans arrived, some places in Alaska were once covered by ocean water. When this ocean existed, animals with shells lived here.

A fossil is a record of a living thing preserved over time. Many fossils are animals that are now extinct. Change of habitat is one thing that causes animals to become extinct. Could the fossil mollusks in the Brooks Range survive as living animals now? Could the roose that used to wander the banks of the Chena River survive in downtown Fairbanks today?

5. What could make animals in our area go extinct? What can students do to help protect these animals?
Activity 4
Mollusk Fossils

Background:

Invertebrate fossils date back to the earliest traces of life on earth. Most fossils in Alaska are found in sedimentary rock. mollusks have the best chance of showing up in the fossil record because they are numerous, they have hard parts, and they live in a region of low oxidation where there is a chance of burial. Usually the hard parts of organisms are preserved; notable exceptions are mammoths frozen in Alaska's permafrost or organisms buried deep in peat bogs. Most organisms do not become fossilized because they disappear due to decay, scavenging animals, chemical action or physical wearing away (as of shells rolling in the surf).

Fossils are found throughout most of Alaska. Geologists in your area may be able to tell your class the local geologic history. Trips to fossil sites should be arranged with conservation of the fossil record as a primary objective.

Materials:

- shovel
- garbage
- sand
- shells
- microscope or hand lens
- hammer or mortar and pestle

Vocabulary:

- decay
- fossil
- sand
- wear

1. Visit your community dump or someone's compost heap. Talk about what is happening (or will happen) to the garbage. It rots, or decays, if the weather is warm enough. As an additional or alternate project, bury some lunch leftovers in the school grounds. Mark your spot and return weekly to keep a record of the decay process.

2. List what could happen to something dead. It could decay, be eaten by animals, wear away by wind or sand action, dissolve, or become a fossil.

3. As a class, discuss your mollusk shells. What happened to the animal once inside? Why are some of the shells broken? What could happen if they were left on the beach?

4. Carefully crush your shells with a hammer or a mortar and pestle, explaining to students that you are hurrying the process that might happen on the beach. Examine the crushed pieces with either hard lenses or a microscope.

5. Now magnify some sand to see if you can find shell pieces in the sand.

6. Explain to students that to become a fossil, a shell has to stay around long enough to be buried in mud or dirt that will later be made into rock by being compressed.
Activity 5
Make a Fossil

Materials:
- plaster of Paris (if unavailable, substitute building plaster, soft mud or modeling clay)
- bivalve shells (two valves)
- sticks
- water
- petroleum jelly (optional)

Vocabulary:
- bury
- burial
- time
- fossil
- mold
- internal
- external

Procedure:
1. Mix the plaster of Paris with water in a milk carton, using a stick to stir. At the right consistency, the plaster should flow slowly, but not be runny.

2. Explain to students that you are going to simulate one method of making a fossil. Review the concepts of burial on the ocean bottom, as well as preservation over time.

3. Fill the two shells with plaster of Paris. Allow to harden. Discuss with students what might have covered the shell or the ocean bottom.

4. When the plaster is hard, remove it from the shell. It should show all the markings of the inside of the shell, such as the muscle scars.

5. Fill the bottom of a halved milk carton with plaster of Paris. Press the concave sides of the shells into the
plaster and allow to harden. Remove the bivalve to reveal an external mold.

6. Use the internal and external molds to cast plaster shells. Coat them with petroleum jelly to prevent sticking.

Additional Activity:

Use plaster of Paris and shells to mold plaques for gifts.