Unit One
Introduction to Mollusks

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Objectives:

To help students:

- Classify mollusks by major categories (Activity 1).
- List common mollusk characteristics (Activity 1).
- Make a print of a shell (Activity 2).
- Use their lucky shell as a basis of a coat of arms (Activity 3).
A mollusk has a soft body, usually with a prominent muscular foot used for locomotion.

The mollusk body is in most cases protected by a limy shell produced by the mollusk itself. In a few cases, the shell is internal, or small, or lacking—as with nudibranchs (sea slugs). However, these are not the ones you will have in your "shell" collections.

Phylum Molluska includes these classes:

- **Bivalvia** - bivalve shells such as clams, mussels and scallops.

- **Gastropoda** - univalves with conical or spiral shells and a distinct head with tentacles—such as snails and limpets.

- **Polyplacophora** - animals with a shell of eight plates or valves, such as chitons.

- **Scaphopoda** - tooth shells such as tusk shells, **Dentalium**.
Cephalopoda - animals with a head and long arms, and bearing suction discs, such as octopus and squid.

Aplacophora - animals without a shell; worm-like marine organisms.

We will be considering the bivalves and univalves (Gastropoda), chitons, and Cephalopoda.
Activity 1
Introduction to Mollusks

Materials:
- a variety of shells
- photographs or illustrations of different mollusks
- worksheets:
  - Mollusks (1A)
  - Mollusk Groups (1B)

Vocabulary:
- mollusk
- foot
- shell
- locomotion

Procedure:
1. Pass out shells and begin by asking students what they are, if they are living or dead, where they come from, if they've seen them before. Ask students what they know about shells.

2. Using pictures and worksheets, discuss the idea that some marine animals live inside very hard shells and travel about—or dig—with a large muscular foot. These animals come in a wide range of shapes and sizes, but are all called mollusks.

3. Note that some mollusks, such as octopuses, squids and nudibranchs (sea slugs) can fool observers by not having a hard shell covering.

4. Ask students how the shells are similar, and then different.

5. Make a list on the board of what students would like to find out about shells.

6. Write bivalve, univalve, chiton and Cephalopoda on the board, and group the pictures and shells by these categories. Use the mollusk worksheets, plus photographs and examples, to introduce students to mollusks and the mollusk groups.
Activity 2
Shell Prints

Materials:
- a variety of shells
- newsprint
- paintbrushes
- prints or block print ink diluted with water
- newspaper

Procedure:
1. Cover the work area with newspaper.
2. Have students choose several interesting shells they wish to print, and then have them plan a print design.
3. Using a paintbrush, demonstrate printmaking by covering a shell evenly with paint. Make sure the paint is not too thin. Place the shell on the newspaper and have students gently press the newsprint down on the shell, rubbing back and forth gently until the impression of the shell is on the paper. Repeat these steps with other shells, then let the finished print dry.

Variations:
- Cut out the prints and mount them on contrasting paper.
- Combine shell printing with painting, or include shell prints as part of a collage.
Activity 3
Shell Coat of Arms

Background:

Romantic traditions are associated with shells through history, art and legend. Shells were used as good luck charms, as mediums of trade, and as money. Cowrie shells were used as money in China from 2000-600 BC, until they were replaced by metal coins shaped like small cowrie shells. Cowrie shells also were found in graves in Egypt, Germany and Lithuania. Indians of the American Northwest used the tusk shell, Dentalium, as money in pre-Russian periods; while on the East Coast, wampum money consisted of beads made from the hard-shelled clam. The Athabascans of Alaska's Interior used Dentalium necklaces as mediums of trade. Tlingits of Southeast Alaska traded ornamental shells with other Native groups and early Russian and American explorers. Have you or any of your students ever traded shells for other items or used them as good luck charms?

Shells have also been used as decoration. Peruvian Indians used symbols of cockle, scallop and oyster shells in their art. In Mediterranean areas, a popular picture on vases and other pottery depicted Venus, the goddess of love and beauty, being born from a scallop shell. The stained glass windows of medieval churches also depict scallop shells. Scallops, associated with pilgrimages to St. James' grave were worn by crusaders, and appear on coats of arms of families whose ancestors fought in the holy wars. Some coats of arms were decorated with whelks, although more popular patterns included unicorns, lions, swords and castles.

Materials:

- crayons
- paper
- worksheet: "...Coat of Arms (1C)"

Vocabulary:

- luck
- coat of arms
- shield
- scallop

Procedure:

1. Have students draw a picture of a shell that they would like as a good luck charm. Discuss the use of shells in legends and history.

2. Explain that a coat of arms was a shield used to identify a family. Each coat of arms had pictures or symbols on it that told a story about the family. Point out the coat of arms on the worksheet and identify the shell as a scallop.
3. Have students design their own coats of arms using their lucky shells and other pictures.
# Unit Two
## The Bivalves

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**Objectives:**

To help students:

- Report that bivalve means "two shells" (Activity 1).
- Make a stuffed bivalve to learn local shell species and forms (Activity 2).
- Recognize local bivalves (Activities 1, 2, 3, 5, 6, 7).
- Label the external and internal features of bivalves (Activities 1, 2, 3, 5, 6, 7).
- Identify bivalve feeding habits (Activities 1, 5, 7).
- Make clam chowder (Activity 4).
- Learn that eating bivalves can cause paralytic shellfish poisoning (Activity 4).
- Count growth rings to age bivalve shells (Activity 6)
Unit Two: The Bivalves. Bivalve internal anatomy (upper left) and external anatomy (lower left). Bivalve groups: (clockwise from top right) mussel, clam, cockle, scallop.
Most bivalves have a soft body protected by two valves (shells). Clams and some other bivalves have:

- a stomach
- mouth
- heart, kidneys and liver
- intestines
- gills (for breathing)
- siphons (two: one called an incumbent siphon, for bringing in new water, air and food; the other called excurrent siphon, for sending out "used" water and wastes.)
- a mantle (a membranous flap that covers the mollusk's soft parts and secretes the material that forms the shell)
- a foot (for digging or moving through sand and mud)
- two powerful "adductor" muscles (that help hold and move the valves, and leave the scars visible on empty shells)
- hinge teeth and hinge ligaments, which help to hold the two valves of the bivalve shell together
- but no head.
Most bivalves live quietly, often either attached to the sea floor or burrowed into it. Clams are always buried anterior (head) end down. Because of this predominantly stationary existence, bivalves need no head or well-developed sense organs to aid them in hunting food. Instead, they rely on circulating sea water to supply them with both oxygen and food. Using an incumbent siphon, they move sea water into their bodies where a "gill" exchanges gasses and collects the tiny food particles on which the bivalve feeds. The water exits through an excurrent siphon.

Bivalves usually are either male or female. When conditions are right for spawning, the bivalve releases either eggs or sperm in a stream. Egg and sperm unite in open water, and the developing larvae are free-swimming for a time. Within a few weeks, however, they settle to the sea floor and change into their adult forms.

Few age studies have been done on Alaska's bivalves, but we do know that cockles live as long as 17 years, razor clams 19 years, the giant scallop 18 years, butter clams 24 years and red-neck clams to 32 years. Growth rings on a bivalve shell are similar to the growth rings on the cross-section of a tree trunk. Each "wide-open space" represents summer periods of abundant food and good growth, while the closely spaced rings (called "annuli") indicate winter periods of less food and slower growth.

Freshwater Bivalves: The two kinds of bivalves that students are likely to discover in Alaska ponds are in the families Sphaeridae or Unionidae.

Sphaeridae, small bivalves ranging from 2 to 25 mm, are often called fingernail clams. The shells are fragile and faintly polished. Children should find it easy to locate Sphaerids on pond bottoms.

Unionidae are the larger clams or mussels that students might dig from pond mud. Commonly called pearly mussels, or naalads, they take up in size where the Sphaerids leave off. They range from 25 mm to 250 mm. The shell varies in shape, is more rugged than its smaller cousin, and is usually dull in color. The clam Anodonta beringiana is the large freshwater clam found throughout most of Alaska. Normally found in the still parts of rivers, streams and lakes, they situate themselves with up to one-third of the shell exposed. They are quite active and often can be located by following their furrows on the bottom or by discovering the inch-long slit they make in the mud to allow water to their siptome.

Anodonta

Their shell also can be found around muskrat pushups, where the muskrats have eaten them. Human consumption of pond clams is slight, but the little mollusks could provide a good source of protein.
Activity 1
Introduction to Bivalves

Materials:
- bivalve shells
- pictures of beaches
- worksheets:
  ...Bivalve Vocabulary (2A)
  ...Bivalve Shells (2B)
  ...Bivalves Have No Head (2C)
  ...Bivalve Parts (2D)

Vocabulary:
- bivalve
- hinge teeth

Procedure:
1. Ask students which shells are bivalves. (The ones with two shells)

2. Explain that valve is another word for shell. Ask what students think the "bi" means. (Two)

3. Encourage students to think of as many words as they can that have the prefix bi-. Include such words as:

   biannual       bicycle
   biweekly       biennial
   bilingual      bimonthly
   bicameral      binoculars
   bicentennial   bilateral
   bipolar

4. Discuss the word meanings. Where is the "two" in each?

5. Discuss bivalve internal and external parts.
Activity 2
Making Stuffed Bivalves

Materials:
- construction or butcher paper
- staples
- scissors
- cardboard
- newspapers

Procedure:

1. Make cardboard patterns for different bivalves such as scallops, clams and mussels.

2. Have children trace two copies of one pattern of their choice.

3. Each child can then cut out his or her pattern and either staple it almost all the way around the outside, or punch holes around the outside and lace the halves together almost all the way around.

4. The patterns can then be colored or painted to look like shells.

5. Crumple newspaper or paper scraps to stuff inside the shells. Staple shut the opening.

6. Label the shells by name. Hang them from the ceiling to make your room an undersea world.
Activity 3
Introduction to Clams

Background:

Numerous clam species are represented on Alaska beaches. Among the more common are:

Gaper, horse clam or Pacific gaper (Tresus capax) found from Northern California to Aleutian Islands, reaching a length of 201 mm and weighing up to 4 1/2 pounds. Not all books will have the same Latin name for this clam.

The gaper is so-named because its shell gapes wider at the end where it grows over the clam's large siphons (often called the clam's "neck"). A gaper clam may have a pair of immature pea crabs or an adult female pea crab living in its mantle cavity. Because they live deep in the sand, you probably will see only the old, surf-worn shells of the gaper clam. If unburied, these slow-moving clams will take four months to re-bury themselves just below ground level. It is doubtful that they can ever dig back to their normal level.

The blunt soft-shell clam, northern softshell clam (Mya uzenensis), or truncated mya--length to 86 mm--is quite common on beaches from the Arctic to Northern California. The blunt soft-shell has valves and siphons covered with a paper-like skin, or periostracum. The long siphons look like a neck, but really are at the clam's posterior end.

The blunt soft-shell clam's body is too big for its shell, so the two valves have a wide gap and never do really fit together. The two valves are unequal--one valve is always slightly longer than the other. When you see the shells on the beach, they look a little like tiny "geoducks." (Geoduck--pronounced "gooey-duck"--is the Chinook word for Panope generosa, a very large, edible, burrowing clam also found on southeastern Alaska's intertidal beaches.)
Soft-shell clams (Mya arenaria) live in mixtures of sand and mud or gravel and mud where there may be a freshwater stream entering salt water. This clam reveals its presence by squirting water when alarmed by withdrawing its neck suddenly into the mud or sand. Such clams are found from California north to the Arctic and reach 111 mm in length. Mya arenaria is the "steamer" of the East Coast, where it is harvested in Chesapeake Bay from boats fitted with escalators that dig in the mud down to 40 feet below the water surface and then carry the shells up to the boat.

The butter clam, hardshell clam, Washington clam, or smooth Washington clam (Saxidomus giganteus) ranges from the Aleutians to Northern California and reaches 131 mm in length. Since its common names are used for a variety of other clams, it might be a good idea for the children to call this clam by its scientific name, Saxidomus (which means a rock house) giganteus (large). Saxidomus has a very heavy external hinge ligament, leather-like and rather rounded, which becomes brittle when old and dry.

It is one of the larger and more common shells to be seen—often old and weathered—on Alaska beaches. The shells, being heavy, survive the wearing action of rocks and tide better than do the more fragile ones. With matching valves, Saxidomus has good hinge teeth to fit together. The old shells are quite chalky, however, so the teeth might be worn off. As adults they are slow burrowers, almost unable to move.

The steamer clam or little neck [Protothaca staminea (Paphia staminea in older texts)] is fairly abundant in Japan, as well as from the Aleutians to California. It is said to take about ten years to reach full size. You will find "adult" animals as small as 20 mm, though they may reach 64 mm.

Young little neck clams sometimes have zigzag markings. The siphons (necks) are very short, so little necks are never very deep in the sand. The valves are thick and strong. The hinge ligament is external, and the hinge teeth are distinct, excellent for showing how hinge teeth interlock.
Little pink clams or navel clams (Macoma baltica) are found in the Atlantic to the Pacific from the Arctic to California. They reach a length of only 45 mm.

These are the lovely little pink shells so common to Alaska beaches. Farther south, they are sun-bleached to white, but in Alaska they usually are rose-pink, sometimes yellow or white. They do tend to fade when old and dry. Rubbing them lightly with a bit of baby oil or mineral oil will help keep the color bright, without making them unsuitable for a "scientific" collection (as lacquer or plastic finish would).

Because the little pink clam is not strong enough to dig very deeply into the mud or sand, the live ones are quite near the surface. Shore birds feed heavily on this tiny clam.

Razor clams (Siliqua patula) range from California to the Aleutians, with this species growing to 173 mm. Another species, Siliqua alta, ranges from Cook Inlet to the Arctic, growing to 133 mm. Razor clams are excellent eating. They are found on sand or sand/mud beaches. Cordova was formerly the razor clam capital of the world, until its clam beds shifted upward above sea level during the 1964 earthquake.

In Alaska, razor clams in Cordova and on the Kenai Peninsula grow the largest, to about 155 mm. Smaller razor clams are found along the coast of western Alaska. In Cordova a 100 mm razor clam is about nine years old. Razor clams up to 24 years old have been found in Alaska. The shells of all razor clams, large and small alike, are thin and slender. The outer covering or periostracum, is varnish-like and olive drab. On the inside of the shell is a distinct vertical or oblique rib.

To find "razors," clam diggers look for dimples in the sand, then dig quickly. A clam may be close to the surface, but it can rapidly retreat deeper and deeper, making digging a challenge. When surprised, it starts moving down at a rate of approximately one inch per second.
Surf clams or pink necks (Spisula polynyma) grow to 140 mm. Their shells are chalky white with a yellow-brown or gray outer covering, or periostracum.

These clams can be abundant on sandy beaches near low tide lines from the Arctic to Puget Sound. Clam diggers sometimes call them pink necks because of the color of the clam siphon.

The northwest shipworm, or Pacific shipworm (Bankia setacea), is called shipworm because of its long, worm-like body; but it is really a clam! It is the most common wood borer found from the eastern Bering Sea to Southern California. Bankia was named "shipworm" back in the days when big ships were built of wood. When young, the shipworm settles on wood, such as a submerged log or wooden boat hull, and starts boring a hole with its two small shells (valves). The rest of its life it keeps working at its burrow, which gets larger as the clam gets larger, and longer and more worm-like. The animal may grow to be a meter long. The biggest shell of this mollusk is only 10 mm long. Bankia lines its burrow with a shell-like lining as it goes. Shipworms, though a menace to wooden vessels and piers, serves an important function by breaking down logs and debris washed into the ocean and thus preventing huge log jams along our beaches.

This shipworm's food is plankton brought in by the water, though it may get some nutrition from the wood it eats as it cuts its burrow.

Look at an old log on the beach. You probably will find old tunnels made by shipworms. Some will still have the shell-like lining. Sometimes other small clams such as saxicave will use the old burrows as a "home."

Alaska has other borers that grind holes or tunnels in rock, but we are not apt to see their burrows.

The arctic saxicave (Hiatella arctica) reaches only 49 mm in length and is more or less oblong. Its shape is often twisted or gnarled by where it lives. It prefers nesting in kelp holdfasts and rock crevices from Southern California to the Arctic and also in Japan and the Atlantic. A very similar species, H. phcladis, lives in clay or soft stone.
Hiatella are common on Alaska beaches. They will survive in the classroom for short periods of observation. (Be sure to put some sand or mud in the pan along with the salt water.)

The jingle or rock oyster (Pododesmus macroschisma) is not an oyster at all— but it does fasten itself to a rocky surface and has a shell covering almost as rough and uneven as an oyster's. No true oysters inhabit Alaska waters except for a few in the state's extreme south near Ketchikan and some Pacific oysters from Japan planted in Southeast Alaska, Prince William Sound and Cook Inlet. Jingles range from the Chukchi Sea to Southern California.

The jingle grows to reach 92 mm in diameter. The inside of a jingle's shell is sea green. The flesh of the living animal is bright orange!

The upper valve of the jingle's shell is solid, but its lower valve has a hole through which the soft living animal puts a hard thread (byssus) that it uses to attach to a rock or other hard object.

The name "jingle" derives from the sound the loose shells make on the beaches as the waves move them around. The shells are so thin they may be translucent, and often will jingle if strung together.

Materials:
- clam shells
- worksheet: ...Clams (2E)

Vocabulary:
- hinge teeth
- muscle scars
- hinge ligaments
- growth rings

Procedure:
1. Give each child a clam shell. Discuss where the animal lives and how it uses the shell for protection and support.

2. Examine the shell for hinge teeth, muscle scars, hinge ligaments and growth rings. Ask the children to find the different features on their shells. Discuss what their uses are.

3. Have the children role-play a clam, with two children acting as shells and another as the animal inside.

4. Using the worksheet and clam specimens, identify the various kinds of local clams and discuss their similarities and differences.
Activity 4
Clam Chowder

Background:

Clams have been an important source of food in Alaska since humans first arrived. Piles of shells, which are refuse heaps called "middens," have been discovered covering areas up to 12 acres, and to depths of up to 17 feet. These middens mark the sites of ancient coastal villages.

Many Alaskans are both concerned and confused about "PSP," which stands for "Paralytic Shellfish Poisoning." Evidence of PSP resulted in statewide closure of commercial clam harvests in 1954. More recently, the National Shellfish Sanitation Program has approved specific areas in Alaska for commercial harvest, but the threat remains.

The following discussion briefly summarizes what PSP is, what its effects are, and what actions to take if poisoning is suspected. Research is currently underway, and more answers soon may be available.

PSP is caused by one of a number of neurotoxins or poisons carried by all stages of small, planktonic organisms called dinoflagellates. Traditional association with a red tide is not an adequate indicator of PSP. The toxin carrying dinoflagellates may be present in a red tide, but also may occur in significant numbers without a red tide. Conversely, a red tide may occur that contains none of the guilty dinoflagellates. The dinoflagellate and its toxin are taken into a bivalve through the inhalant siphon and then filtered out of the water as food. The toxin is concentrated in the dark portion of the bivalve, which includes its siphon and stomach.

PSP does not harm the clam, but in humans—as its name suggests—it causes paralysis. The onset of paralysis can range from a few minutes to 10 hours. Symptoms include numbness in the mouth, tongue and lips, spreading to the face. The numbness will be followed by a prickly feeling in the fingers and toes, plus headaches, dizziness and nausea. Serious cases progress to loss of coordination of limbs and speech difficulties accompanied by pulse rate increases and muscular paralysis. Death occurs because the muscular paralysis causes cessation of breathing.

If poisoning is suspected, the victim should be rushed to a hospital or other source of artificial respiration. Vomiting should be induced and a laxative administered to get rid of any toxic material still in the stomach. Keep the victim calm, relaxed and lying flat. If breathing becomes difficult or ceases, give artificial respiration.
Materials

- big pot
- hot plate
- stirring spoon
- serving bowls/cups
- measuring spoons
- spoons
- cooking pot
- cutting knife
- potato peeler
- ladle

Ingredients: Quantities are estimates, which can be varied.

clams, 2-4 cans
bacon, 10 slices
potatoes, 6-8 large
celery, 6 stalks
onions, 2-3 medium
milk, 2 gallons
flour, 4 tablespoons
salt and pepper

Procedure:

1. Make clam chowder. You may want to use canned clams, to avoid paralytic shellfish poisoning. This will provide a cooking experience and a "taste treat."

2. Have the children bring the equipment and ingredients and have them help in the planning.

3. Write the recipe on chart paper to provide a reading experience.

4. Cut bacon into chunks, cook slowly in pot.

5. Chop onion and celery, saute in "bacon drippings" till tender.

6. Cook potatoes (as little as possible without burning dry--remaining water and vitamins will go into chowder). Dice after cooking.

7. In big pot, add 4 tablespoons flour to onion and celery mixture.

8. Add clams, milk, leftover potato water, cooked potatoes diced, and salt and pepper to taste.

Activity 5
Introducing Scallops

The beautiful scallops (Pecten and Chlamys) are the classic shell used in art and design (such as the Shell Oil Company insignia).

Alaska has 16 scallop species; but the shell you are most apt to find is the Hinds' scallop (Chlamys rubida), which ranges from the Arctic to California and reaches a maximum length of 67 mm, a rather small representative of the Chlamys genus. The Hinds' scallop's right valve usually is quite pink, and the left valve white or faintly pink. The color, however, is variable. Hinds' may be orange, yellow or rose.

Hinds' valves have wing-like "ears," one much wider than the other.

In the live animal, the "ruffly" mantle between the two valves has a row of tentacles. The edge of the mantle is bordered with tiny, shiny, blue-green eyes.

Scallops swim by clapping their shells together as a sort of "jet propulsion." The Chlamys attach themselves to the bottom with threads (byssus), similar to mussels, and only rarely move. They filter microscopic food from the water.

Pecten carinatus, called the "weather-vane scallop" or "giant Pacific scallop," ranges from the southern Bering Sea to Northern California and has a maximum length of 210 mm. It is found in deep water only; but if you have a shell exhibit, this is a big, "showy" shell that someone will surely bring.

Materials:

- scallop shells
- slides or other illustrations showing scallops
- worksheet:
  ...A Scallop is a Bivalve (2F)

Procedure:

1. Examine the scallop shells. Discuss scallop shape, characteristic "ears," and behavior.

2. Imitate scallop movement by clapping hands together. Wiggling fingers can imitate tentacles and eyes.

3. Discuss and share the scallop worksheet as a class.
Activity 6
Age a Cockle

Background:

"Cockle," "heart cockle," and "basket cockle" all are names for Clinocardium nuttali (most older books will use the name Cardium cordis).

Cockles can be found from Japan to the Chukchi Sea and to California, and may be as large as 173 mm in length.

There are six other cockles in Alaska, but C. nuttali is the most common.

Cockles are members of the clam family, and have both "hinge teeth" and "hinge ligaments."

You will find cockle shells of all sizes (ages). The young specimens often are yellow, with brown mottling inside. The very tiny ones may have a blue umbo.

The umbo is the oldest part of the shell (valve). All shells have growth lines, but growth lines are most easily seen on cockles, on which each section looks like a complete shell.

If you look at the umbo, you will see the form of the tiny cockle where the shell began its growth.

If the shell is not too worn, the cockle is good for showing how hinge teeth fit together.

Clinocardium nuttali
heart cockle

Materials:

- cockle samples
- pictures of cockles
- worksheets:
  ...Cockles (2G)
  ...Umbo (2H)

Vocabulary:

- hinge teeth
- hinge ligaments
- umbo
- growth lines
Procedure:

1. Pass out shells and worksheets.

2. Examine the cockle and its shell with students.

3. Point out the umbo, growth ring ridges (just like the annual rings visible in tree cross-sections) and the shell's shape, texture and color.

4. Have students count the growth rings and age the cockle samples (or worksheet cockles).

5. Find out who has the oldest cockle, the youngest cockle.

6. Have equal groups of students add the ages of their cockles and see which group has the largest number.

Activity 7
The Life of a Mussel

Background:

Blue mussels (Mytilus edulis) live on many Alaska beaches. They grow in a variety of sizes, reaching 99.5 mm. Old, empty shells may accumulate in windrows on the beach.

The valves (shells) of the blue mussel generally are bluish black. Immature shells often are a light, almost translucent, brown, though they may be black at any size or age.

Since the mussel does not use its foot for digging or travel, the foot is not large. The mussel has only one siphon.

Mussels anchor themselves to rocks or pilings (or wood, or cans, or even other shells!) with strong "guy wires"--or threads--called byssus.

Clams and mussels obtain their food by straining microscopic plants and animals (plankton) from sea water. For this reason, bivalves often are called "filter feeders."
The mussel, so common in most of Alaska, is a good animal to use to introduce students to habitat and feeding. Like most bivalves, the mussel filters its plankton food from the water it siphons. The place or zone on the beach where the mussel lives is its habitat. The mussels themselves provide a habitat for other organisms that live among the shells and byssal threads.

Materials:

- mussel shells (live or preserved specimen optional)
- pictures or illustrations of mussels
- worksheets:
  ...Mussel Food (21)
  ...Who Am I? (2J)

Vocabulary:

- mussel
- muscle scar
- hinge
- byssal thread
- shell
- habitat

Procedure:

1. Give each child a mussel shell or picture. Review the term bivalve.

2. Ask the students to find the hinge and the muscle scars, and to describe the differences in the outer and inner layers of the shell. Use the Who Am I worksheet.

3. If some of the shells have a few byssus threads still attached to them, point these out and ask how they might be used and why they are important to the mussel.

4. Have students recall where they find mussels. Are they near the water's edge or far from it? In low or high tidal zones? Do mussels occur in bunches or singly?

5. Introduce the term "habitat" as the place where an animal lives. Write "habitat" on the board.

6. Ask what animals need to survive. Explain that each habitat must provide space for the organism to live, and food and water.

7. Use the food element of a habitat to introduce mussel and bivalve feeding habits. Review siphons and how bivalves pull water in and out, filtering or straining food from the water. Use the Mussel Food worksheet.

8. Review the idea of shellfish poisoning—what causes it, what it does, and so on. Emphasize the need for caution in eating mussels, because they absorb the toxin much more rapidly than do many other bivalves and thus can be especially poisonous.