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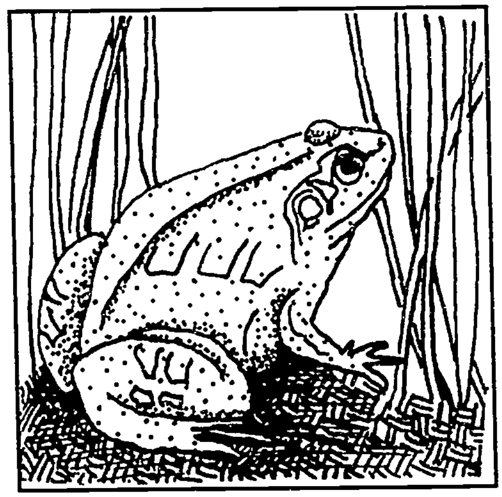
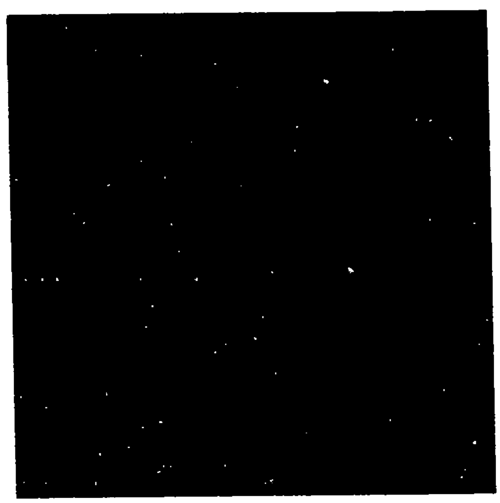
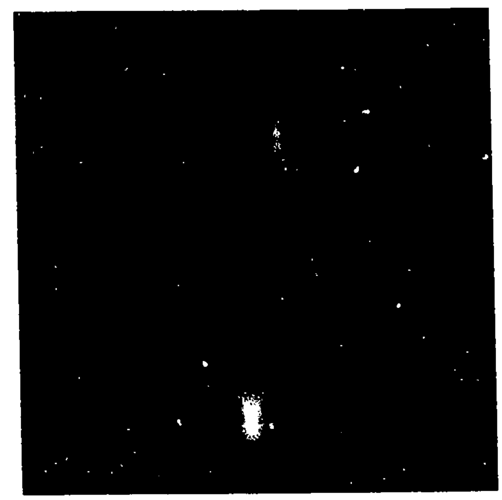
ABSTRACT

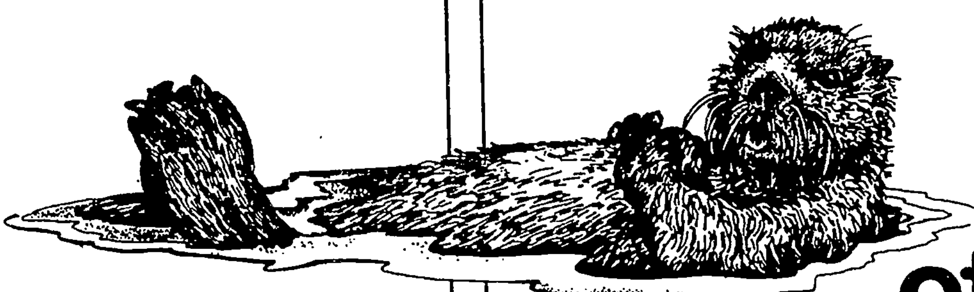
This curriculum guide is the second (Series II) in a six-volume set that comprises the Sea Week Curriculum Series developed in Alaska. This second book in the series lends itself to the first-grade level but can be adapted to preschool, secondary, and adult education. Nine units contain 30 activities with worksheets that cover the following topics: (1) introduction to marine invertebrates; (2) marine invertebrate species; (3) beach field studies; (4) freshwater invertebrates; (5) fish; (6) amphibians; (7) marine mammals; (8) freshwater mammals; and (9) aquatic habitats. An introduction provides information designed to help teachers become familiar with the contents of the curriculum guide and to assist in planning. Each unit contains information on student objectives, and activity background, vocabulary, materials, and procedure. Activities engage students in interdisciplinary projects that involve the skills of observing, identifying, reading, writing, coloring, numbering, counting, comparing, investigating, composing songs, role playing, and game playing. An annotated bibliography contains 239 resources divided according to unit. A packet of teacher reproducible worksheet masters accompanies the curriculum guide. (LZ)



alaska sea week
Curriculum Series: II







Animals of the Seas and Wetlands

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University of Alaska Fairbanks

Alaska Sea Grant College Program
University of Alaska
Fairbanks, Alaska

Alaska Sea Week Curriculum Series: II

Animals of the Seas and Wetlands

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Acknowledgements

The seven-volume set that comprises the new Sea Week Curriculum Series is an expansion and revision of a curriculum project begun by Juneau parents more than 15 years ago. Publication of this volume is the result of work sponsored by the Alaska Sea Grant College Program, cooperatively supported by the National Oceanic and Atmospheric Administration's Office of Sea Grant and Extramural Programs under grant number NA82AA-D-00044, projects E-70-08 and A-75-01, and by the University of Alaska with funds appropriated by the State of Alaska. The University of Alaska's College of Human and Rural Development supplied additional printing funds. The Sea Week project receives further support from the Alaska Department of Environmental Conservation, National Marine Fisheries Service, University of Alaska Cooperative Extension Service, Alaska Department of Fish and Game, and Alaska Department of Education.

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Table of Contents

Introduction

Sea Week is a celebration. It's one of those rare school programs that can saturate a class with learning opportunities without intimidating a single child. The hundreds of teachers now participating in Sea Week throughout Alaska have found it to be a highlight of the year--a week of delight and awe, intrigue and excitement. It's a week that translates classroom science, mathematics, language, history, social studies, art and music into the crash of a wave, the scuttle of a crab, the drift of a kayak, the bark of a sea lion, the taste of smoked salmon, the scent of a pier. The only frustration we've found is among educators who discover that a week isn't enough. Many teachers have expanded their programs to a month. Several have simply given up on trying to confine Sea Week to a time, and now make use of the curriculum throughout the year. However you design your own program, we're confident that its primary ingredients--Alaska's kids, rivers and coastlines--come to you satisfaction guaranteed!

Animals of the Seas and Wetlands is the second of seven Sea Week curriculum guides. This book lends itself well to a first grade curriculum; but is not "locked" into that grade level. It has been adapted effectively to preschool, secondary and adult education. Several factors are responsible for the versatility. One is that while student activities in each book are at grade level, the teacher background materials are written at university level, and can be transferred to the classroom at any level the teacher desires. Another is that the curriculum encourages the use of community resource experts, who can gear their talks and tours to anyone from preschoolers to retirees. A third reason for the flexibility is that many of the student activities have latitude. When in Volume VI the guide suggests building model boats, for instance, it includes the pattern for a paper cutout. But the same activity can be used by high schoolers constructing complicated models, or by adult students trying their hands at building an actual kayak!

The lives of all Alaskans are touched often by the sea--literally, aesthetically, productively. To begin with is the sheer immensity of the Alaska coastline. It stretches and twists, pounds and lies placid along two oceans and three seas for 6,640 miles--more than half that of all the contiguous United States. Islands, inlets, bays, fjords and delta regions add another 28,000 miles of saltwater shoreline for a total of 34,640 miles--a distance almost equal to twice the circumference of the earth. Alaska's continental shelf covers more than 830,000 square miles, more than 75 percent of the U.S. A large percentage of the fish caught in the U.S. come from Alaskan waters. And Alaska's coastal zones, both onshore and off shore, contain an estimated 75 billion barrels of petroleum and 380 trillion cubic feet of natural gas--amounts that would equal 50 percent of the nation's remaining petroleum reserves.

More than three-quarters of Alaska's almost half-million people live along its coastline. Their careers are generally sea-related. Grocers sell to the fishing fleet, lumbermen float their log rafts overseas to the mill, real estate salesmen get more money for property with an ocean view, and school teachers find that one of the most effective ways to spark interest in a child's eyes is to turn those eyes seaward.

The bulk of Alaska's culture is so closely interlaced with the sea that in many cases the sea is Alaska culture. The seven volumes of the Sea Week Curriculum series escort youngsters through the crafts, arts, music and oral and written literature of the coastal Haida, Tlingit, Chugach, Koniag, Aleut, Yupik and Inupiat to the poetry, literature and artwork of Alaska today.

And even the lives of that one-quarter of Alaska's folk who don't live along the coastline are linked to the sea. They are consumers of sea products, of course; and beneficiaries of seacoast oil wealth, and even occasional visitors to the sea. But more importantly they are linked to the sea by Alaska's myriad rivers and wetlands: Alaska's vast interior, which its inhabitants call "The Golden Heart" of the state, includes hundreds of thousands of miles of rivers and streams, and 390,941 square miles of wetlands. That's two-thirds of the state, all linked to the coastline by freshwater systems that serve as nurseries for Alaska's salmon and waterfowl, as transportation arteries to and from the coast, and as the nutrient-rich replenishers of the ocean currents.

Because of such interconnections between wetlands and the sea, with this edition the Sea Week Curriculum series has been expanded to include units on Alaska's wetlands and the traditional Athabascan and contemporary peoples who inhabit them.

The resulting series is the foundation of the most comprehensive marine education program ever developed in the Northland. We hope that you will find it as valuable and motivating as it is intended. We hope, too, that through Sea Week, the youngsters of your classrooms will come to more deeply respect and appreciate the environments for which they will soon be responsible. The insights they gain in your classrooms will become the votes and legislation, the lifestyles and attitudes, the wisdom and understanding--the sea harvest--of tomorrow.

Tips for Teachers

Welcome to Sea Week! Here's a checklist of tips designed to help familiarize you with the contents of Animals of the Sea and Wetlands, and to assist your Sea Week planning.

- If you haven't scanned the book already, we suggest you get a sense of its format by glancing through the Table of Contents, the different units containing teacher background and student activities, the student worksheets, and the bibliography. Note that each unit begins with a list of objectives that specify which activities are designed to accomplish those objectives, as well as a key picture that can be used to introduce, review or evaluate the unit.

- Student worksheets have been placed together at the end of the book, numbered to correlate to the units they complement. Thus, Worksheet 1-A is the first worksheet (A) listed among the activities in Unit 1; Worksheet 2-C is the third worksheet (C) assigned in Unit 2, and so on.

- Many more ideas are included than can be used in a week, but we wanted to give you a selection so you can potentially expand to Sea Fortnight, or "Sea Year"!

- Make lesson plans, selecting those activities most appropriate for your students, with consideration for local history and culture. Note that we've included activities to sharpen skills in language arts, science, social studies, math, music, art and physical education, so that all aspects of education during Sea Week can focus on Alaska's ocean, river and wetland environments.

- Plan your field trips. Arrange to take parents or interested community members as helpers. Older students make great assistants.

- Check through the "materials" list of each unit; then make, buy, scrounge or order any equipment you might need.

- Order films early!

- Talk to your librarian about books to back up your studies. Suggestions are included in the general bibliography at the end of this book.

In the Field

- Plan at least one field trip. Decide on a place, time and means of transportation. Biologists, long-time residents, parents or bilingual staff may have field trip suggestions. Invite one or more of these people to go along on your field trip.

. Develop an outline for your field trip. Suggested inclusions:

A. Discovery and exploration time.

B. Structured learning activities.

C. Snacktime.

D. Organized games, treasure hunts, litter pickup.

E. Review of the day's events (which can be as simple as having each student and parent telling what he or she enjoyed most).

If you're taking a bus, make up a game or a checklist of things to watch for so as to develop a learning atmosphere for the trip.

. Write a letter to parents. Include requests for field trip assistants, materials, ideas, and permission slips.

Dear Parents:

We are celebrating Sea Week May 6-11. All our classes that week will focus on the sea. We'll be emphasizing sea and wetland animals as we solve sea-related arithmetic problems, write sea themes, read sea stories, have a seafood snack and take a trip to Eagle River Beach. Can you help with any of the following items?:

[] provide a seafood snack

[] assist with a Sea Week art project

[] talk to the class on the following sea themes: _____
_____.

[] show the class your collection of _____

[] help with Sea Week planning and preparations

[] go on the trip to Eagle River Beach

Thanks so much! And happy Sea Week!

I give my permission for _____ to go to Eagle River Beach on Monday, May 7.

_____
signature of parent or guardian

. If possible, visit the field-trip site ahead of time with your assistants. Explain what you'll be doing and answer questions. Field trips generally work best if you can break your students into groups of five to six.

. Promote conservation by emphasizing the protection and wise use of natural resources. Ask children how they can help take care of animals and plants they encounter in their field and classroom studies. Draw up some rules:

1) Step softly and quitely while observing animals
2) Replace rocks or logs after looking underneath (to keep the roofs on animal homes)
3) Handle animals gently
4) Fill in holes after looking for clams (to prevent suffocation of the animals next door)
5) Don't take live animals or plants away from their homes.

. So that future children can enjoy the area, too, it is a good idea to discourage personal collections of any natural items, living or nonliving. Limit collections to educational purposes such as art projects or aquarium study. Be sure to return any living animals to their natural habitats as soon as possible. Preserve for classroom specimens only those animals that are already dead.

. Encourage students to leave the beach, river or pond cleaner than when they arrived.

. Remember safety. For field trips:

1) Have a plan for keeping students in groups through a buddy system or adult supervision.
2) Take a first aid kit.
3) Discuss hypothermia.
4) Take matches and tinder for starting a warm-up fire if one is necessary.
5) Make sure all participants dress warmly and take extra clothes and rain gear (plastic trash bags will do in a pinch, but remind students about the danger of suffociation from plastic).
6) Wear life jackets on boat trips.
7) Keep an eye on the stage of the tide--so that no one is stranded as the tide comes in.

In Your School and Community

. One of the best aspects of Sea Week is involving all the students, teachers and community residents so that everyone works together. The whole school is decorated; one class inspires another; older students do programs for younger ones and vice versa; community members help with field trips and speakers. An air of excitement pervades halls and classrooms! But don't hesitate to try Sea Week on your own or with just a few other teachers. By the following year, when they've had a chance to see what you've done, others will be ready to try Sea Week, too!

. Plan your school's Sea Week at a time best suited to your location. Teachers in southwestern, southcentral and southeastern Alaska are finding it best to consult tide tables and plan beach trips at low tide. In northern, central and western Alaska, Sea Week activities are proving most successful when there's open water, or when they are planned to coincide with longstanding seasonal activity, such as fishing or whaling.

. Brainstorm Sea Week ideas with other teachers and parents. Use the Sea Week Planning Sheet beginning on Page __ to list the names of parents and local resource people who can help make your Sea Week a success. You'll find most people pleased to be asked and more than happy to help.

. Involve your bilingual staff as you identify such community resources as speakers (fishermen, net menders, Coast Guard personnel, boat captains, community elders, artists, musicians) and field trip sites (beaches, harbors, canneries, seafood markets, salmon spawning streams, marshes, hatcheries, museums).

. One or more parents or teachers can be appointed to coordinate speaker schedules, movies and field-trip transportation, and to present your Sea Week plan to school district officials for approval.

. Contact your chamber of commerce, village council/borough government, and other community groups, inviting them to sponsor complementary Sea Week events such as festivals, seafood dinners, slide shows, speakers.

. If your school is inland, consider exchanges with a coastal school. Send it a selection of items found on your field trips, a class story, or perhaps photos. Maybe they can send you fish stories, pieces of net, floats, seaweed, beach sand. Most activities in this book easily can be adapted for inland schools. Try to acquire a saltwater aquarium for your school.

. Field trips and other Sea Week activities make good news features. Consider contacting your local newspaper, television or radio station. Reporters often enjoy going to the beach as much as students do! Provide as much information as possible to <u>all</u> community media.

<u>Follow-up</u>

. Write thank you notes to speakers.

. Ask students, teachers, parents and community participants to evaluate Sea Week.

The sea is important to me because...

To me, the best part of Sea Week was...

The part of Sea Week I didn't like was...

My suggestions for making Sea Week better are...

Overall, Sea Week was:

 poor  ok  great

x

- Write a brief report--including sample student work, evaluation forms, and news articles--for your administrators. Send a copy to the Sea Week Program Coordinator, College of Human and Rural Development, University of Alaska, Fairbanks, Alaska 99701. We like to keep informed of what you are doing. And we'll share your good ideas with other students, teachers, and administrators.

- Photocopy your lesson plans and stick them in this guide, so you'll be ready for next year!

- If you'd like to learn more, consider requesting a Sea Week inservice or 1-credit course for your school. Contact Alaska Sea Week, College of Human and Rural Development, University of Alaska, Fairbanks, Alaska 99701; or the School of Extended and Graduate Studies, Outreach Division, University of Alaska, Juneau, Alaska 99802; or Talent Bank, Department of Education, Pouch F, Juneau, Alaska 99811.

Sea Week Planning Sheet

Resource People: Speakers, craftsmen, field trip leaders.

Name	Expertise	Phone

Field Trip Possibilities:

Location	Habitat (Beach, river, pond)	Transportation Arrangements

Volunteers: To help with field trips, seafood meals, classroom activities.

Name	To Help With:	Phone

Films:

Call Number	Title	Source	Rating

Books:

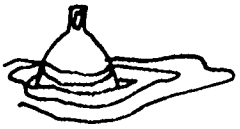
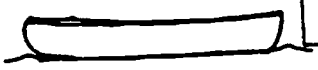
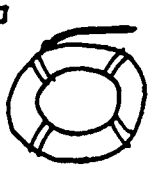
Call Number	Title	Source	Rating

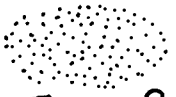
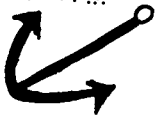
Equipment:

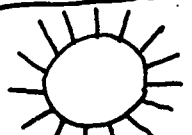
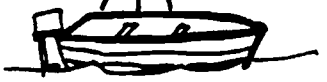
Type	Purpose	Source

BUS CHECKLIST:

Check off these items as you see them. Circle the ones you might <u>sea</u> at the beach. Happy hunting.

- ☐ gull 
- ☐ river 
- ☐ rain 
- ☐ mud puddle 
- ☐ buoy 
- ☐ canoe 
- ☐ trash 
- ☐ life ring 
- ☐ beaver lodge 

- ☐ raven 
- ☐ sand 
- ☐ anchor 
- ☐ stop sign 

- ☐ spruce tree 
- ☐ flower
- ☐ rock 
- ☐ sun 
- ☐ boat 

Unit One
Introduction to
Marine Invertebrates

Objectives:

To help students:

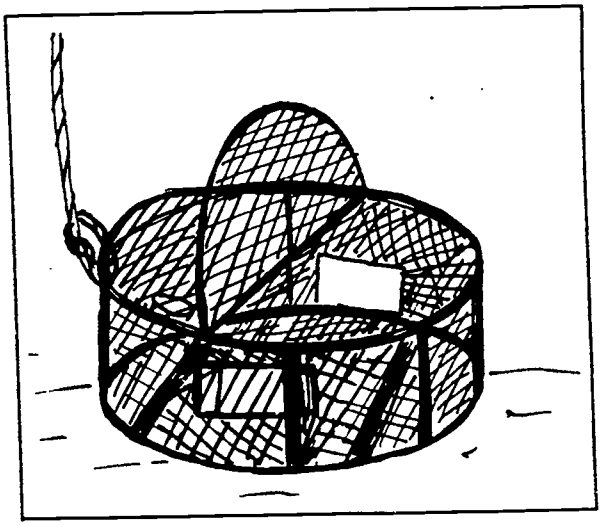
- Touch and identify common beach creatures such as sponges, jellyfishes, anemones, worms, crabs, barnacles, shrimps, amphipods, mollusks, sea stars, sea urchins and sea cucumbers (Activity 1).
- Understand the meaning of "invertebrate": a soft-bodied animal without bones (Activity 1).
- Talk to a diver and/or marine biologist and observe their equipment (Activity 2).
- Decorate the classroom like an undersea world (Activity 2).
- Train "animals" (paper bag puppets) for an underwater circus (Activity 2).

UNIT ONE: Introduction to Marine Invertebrates. The ideal way to approach the study of invertebrates in all their diversity is through observation of live animals.

All living things can be classified as belonging to either the plant kingdom or the animal kingdom. Vertebrates and invertebrates are the two major subdivisions of the animal kingdom. Vertebrates are animals with backbones: humans, horses, elephants, mice, fishes, etc. Invertebrates are animals without backbones: sponges, sea stars, insects, worms, jellyfishes. Ninety-five percent of all animal species are invertebrates.

There is a great assortment of colors, shapes and sizes among invertebrates found in Alaskan waters. Lacking backbones, they have various ways of supporting their bodies. Some, such as anemones, rely on the water itself to give them shape and support. Sponges have a support system of needlelike structures, which form an entwining mesh. Crabs, shrimps, and beach hoppers have external skeletons, or "exoskeletons," that must be shed as they grow. The skeletons of sea stars are composed of small plates; the plates of sea urchins and sand dollars are fused together to form a test. The soft bodies of snails and clams are encased in protective shells that increase in size as the animals grow.

Activity 1
Live Sea Animals



Background:

In teaching children about marine biology, nothing compares in excitement and value to the observation of living creatures. On the coast, live sea animals can be collected from the shore at low tide (rocky beaches have the most diversity), under floating docks or pier pilings, or from divers or fishermen. A crab pot, old tire or rope, set offshore or hung from a dock, will often attract creatures. An animal skull works extremely well for bait. Use the information in Unit 2 to help with identification of your finds.

Inland schools can obtain live animals from friends on the coast or parents visiting the ocean, or can order them sent air freight from biological supply companies.

Plan to return the creatures alive to their homes on the shore after this activity. That way, there will always be animals for future Sea Weeks!

Vocabulary:

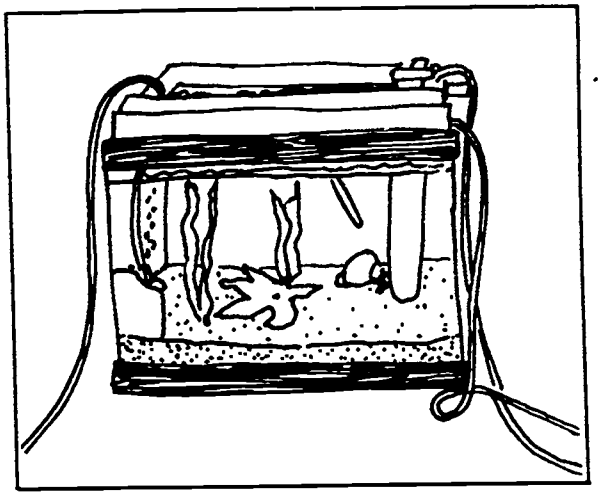
- invertebrate
- exoskeleton
- sponge
- jellyfish
- anemone
- worm
- crab
- barnacle
- shrimp
- amphipod
- mollusk
- univalve
- bivalve
- snail
- sea slug
- nudibranch
- clam
- mussel
- sea star
- octopus
- chiton
- sea urchin
- sand dollar
- sea cucumber
- sea squirt
- habitat

Materials:

- live sea creatures
- magnifying lenses or binocular microscopes with lights
- finger bowls

Procedure:

1. Obtain the sea animals. Remember conservation! It is important that live animals be treated well and returned to their proper habitats. Salt-water aquariums are ideal (use natural salt, sea water or marine salt, available at pet shops); but if none is available, animals can be kept for several days covered with paper towels dampened with salt water, in wet seaweed, or in a pan of salt water in the refrigerator. The most important rule is to keep the water cool at all times, which is necessary to maintain a sufficient oxygen level. As soon as the water begins to lose its chill, return the pan to the refrigerator. Don't use a metal pan, which can corrode and poison the animals. Most intertidal animals are hardy, but if one of yours becomes sluggish, return it to the sea. It is best not to collect sponges, which decay quickly.



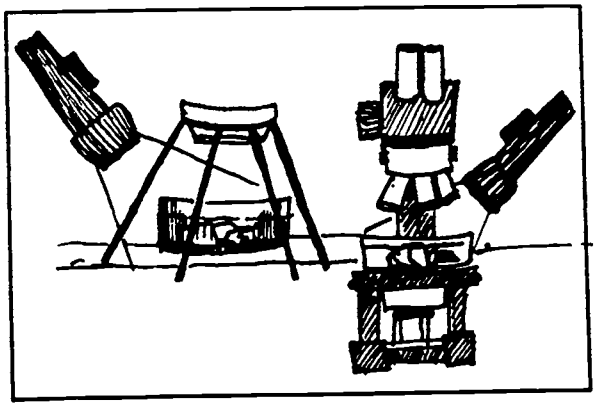
2. Build excitement about Sea Week by encouraging students to inspect and touch the animals. It is safe to gently handle them. Jellyfishes may be touched on the bell but should not be picked up, as their tentacles, located on the underside, may sting.

3. Write student questions about these animals on the board as starting points for future studies.

4. Introduce the word "invertebrate" as meaning "soft-bodied animal with no bones." Have the children find and feel their own backbones.

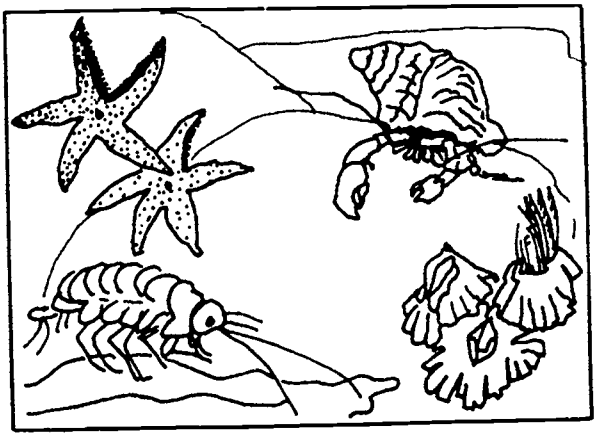
5. Discuss the habits of invertebrates. Where are invertebrates found? What are their needs? How can we help take care of them? (by being careful of them when we go to the beach, by not stepping on them, by filling in any clam holes we dig, by turning rocks back over after we look under them).

6. Set up the magnifying lenses or binocular microscopes. Explain the purpose of the instruments and how to operate them. Place an animal in the finger bowl in salt water, turn on the light and focus. Use flashlights with the magnifying lenses. The beauty and strangeness under magnification are impressive. (Remember, however, that the light produces heat that can warm the water and the animals, so turn the light off when you're not using it.)



7. Have students watch the way a jellyfish moves in an aquarium or plastic bag of salt water. Let students touch the tentacles of an anemone and feel their stickiness (due to the discharge of stinging cells, or nematocysts). Count the legs of crabs and shrimps and feel their hard shells.

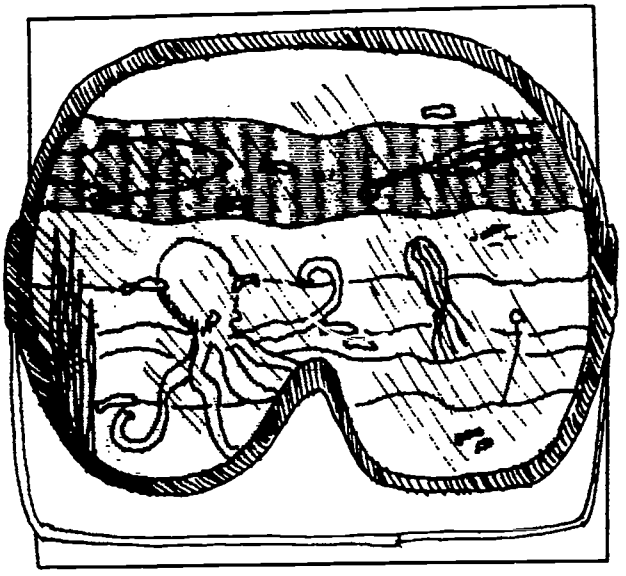
Under duress, a hermit crab will sometimes jump out of its shell. If this happens, put it quickly back in its saltwater home so that its soft abdomen will be protected. Notice how the fleshy abdomen is adapted at its tip to hang on to a shell, and observe the loss of appendages on the abdomen. Then place the empty shell next to the hermit crab, and watch how it examines the shell and inserts its abdomen.



Watch barnacles feeding with their feet. How does an amphipod move? Is the clam's shell open just a crack to let it feed? Can you tell where a snail or limpet has been? (They will leave trails on the rocks sometimes.) Watch the tube feet of a sea star waving about. Place the sea cucumber in a pan of salt water when observing it and be careful to disturb the cucumber as little as possible because, as a protective measure, it may extrude its internal organs. The sea cucumber will grow its insides back, but that takes time and energy.

8. Conclude the session by having students tell what their favorite animals are, and why.

Activity 2
Making an Undersea World



Background:

Children invariably are fascinated by the undersea world. By decorating your classroom, students will have a chance to use their imaginations and artistic skills, while learning more about the sea and its inhabitants.

Materials:

- masking tape
- plastic sponge
- coarse sandpaper
- crayons
- paper
- clothes iron
- red finger paint
- black marker
- newsprint
- dried sea star
- sand
- glue
- construction paper
- scissors
- yarn or string
- paper bags
- paintbrush
- powdered tempera paint

Procedure:

1. Invite a diver or marine biologist to demonstrate his or her equipment and show underwater slides.

2. Ask the students about their own ocean adventures. Have them make construction paper cutouts of the animals and label with names based on their own: Susannah Sea Squirt, Joe Jellyfish, Annie Anemone, Kathy Clam. Attach yarn or string, and hang the cutouts decoratively. The nicknames can be used later on field trip name tags.

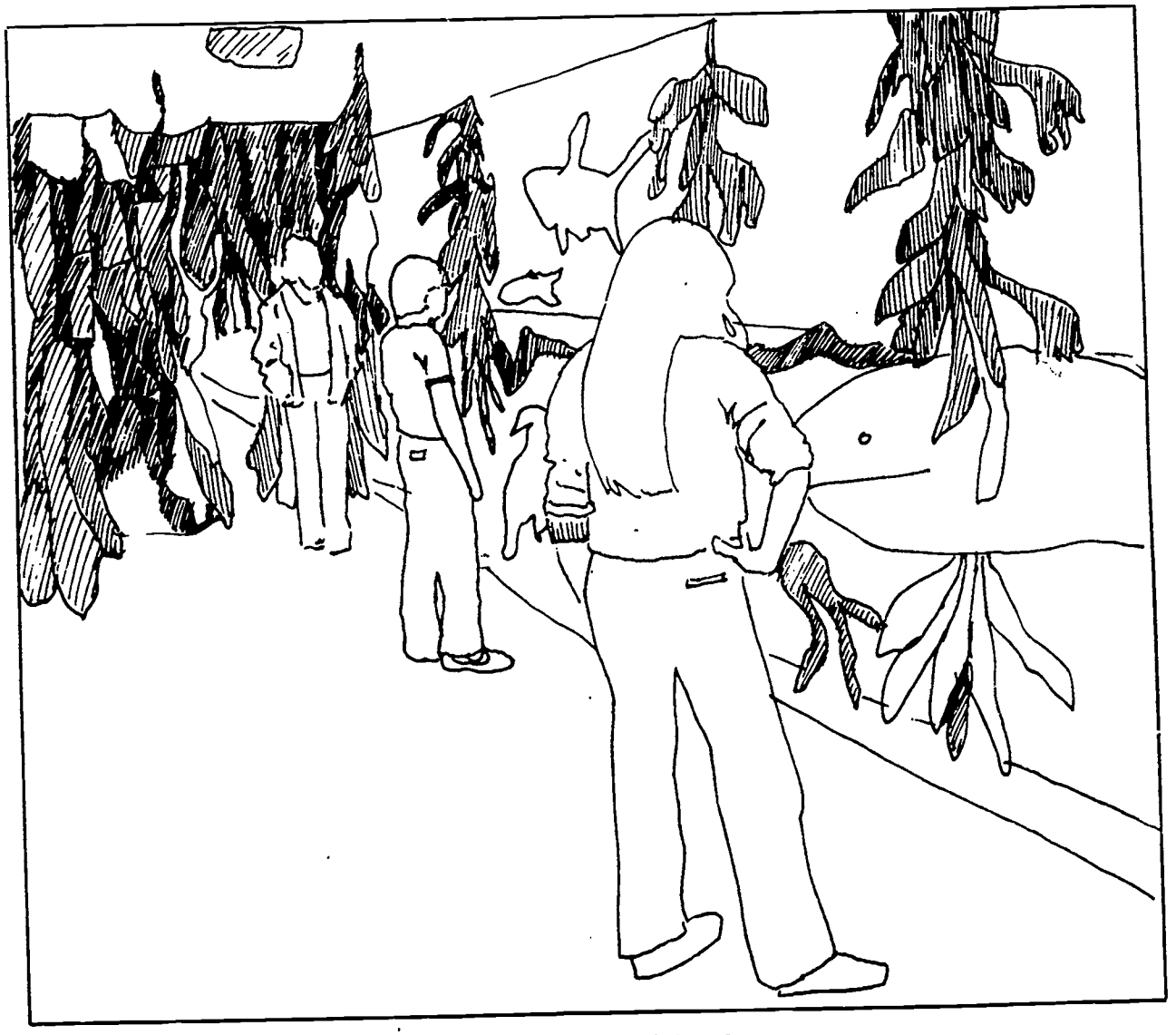
3. Select a variety of art activities that will turn your classroom and hallways into an undersea world: hang colored tissue paper beneath fluorescent lights to act as a filter; hang art projects and seaweed streamers from the ceiling; make murals; ask students to bring sea treasures from home such as nets, floats, shells and driftwood. Additionally, you can:

   a. Make paper waves from construction paper and tape to window shades. Tape sea birds, boats and planes above the waves, and sea animals below them. When the shades are drawn, it's low tide! (Suggested by the teachers at Badger Road Elementary, Fairbanks.)

b. Have the class cut jellyfish shapes from coarse sandpaper. Color the sandpaper heavily. Place a sheet of white paper over each sandpaper jellyfish and iron over it to make a jellyfish impression.

c. Cover a piece of paper with red finger paint. When the paint has dried, draw and cut out the outline of a sea star. Using a sponge and orange tempera paint, give the sea star a mottled look.

d. Brush tempera on a dried sea star. Sometimes one can be found freshly dead at the beach (but don't kill any just for an art project!) Cover it with a sheet of newsprint. Holding the paper in place, gently rub over the sea star to transfer its image.



Sea Week at Denali Elementary School in Fairbanks.

e. Make sea paintings, using powdered tempera paint, sand and diluted glue. Clean the sand and mix with paint powder (not too much). Keep the colored sand in baby-food jars. Spread glue on paper with a paintbrush and sprinkle sand over the wet glue. Students can make original designs or use ones that have been mimeographed. Frame and hang these. (Suggested by Kathy Amerman, Maureen Coon, Kathy Dill and Larry Trani, Baranof Elementary, Sitka.)

f. Make a "sea letter mural." Attach a long piece of paper to the wall. Have students use a black marker or crayon to outline a sea plant or animal; then color the drawings and label with the first letter of their creatures' names. When finished, students should notify the teacher so that the animals' full names can be added.

g. Make crabs out of construction paper circles folded in half. (Suggested by Joanne Rogers, Paul Banks Elementary, Homer.)

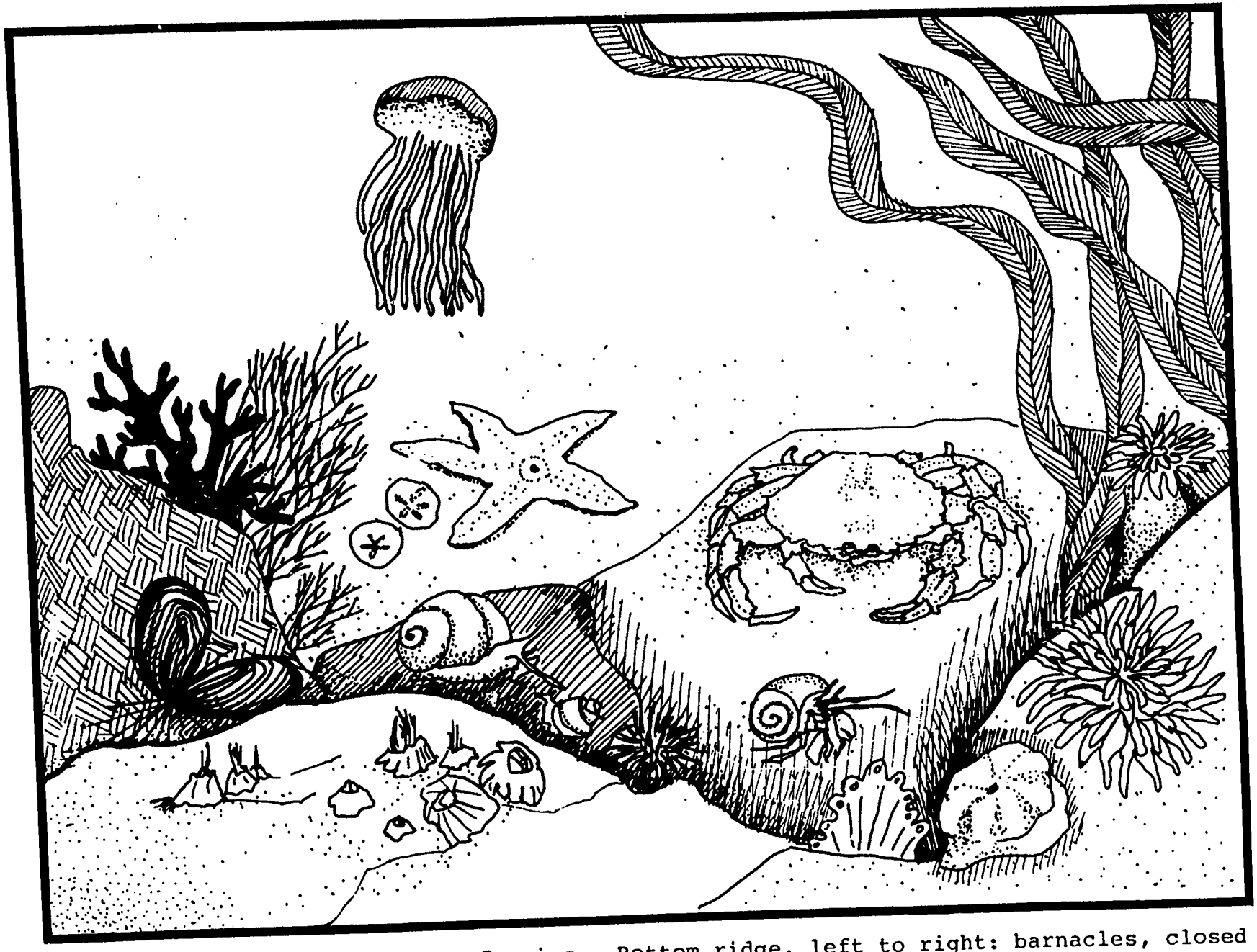
4. As a finale, have an underwater circus. Ask students to each pick an animal to train and show off. Make sea animal hand puppets out of paper bags, with features cut out of construction paper and glued on. Have students plan appropriate puppet acts. Practice and then do a program for parents and other classes. (Suggested by Joanne Rogers, Paul Banks Elementary, Homer.)

Unit Two
Marine Invertebrate Species

Objectives:

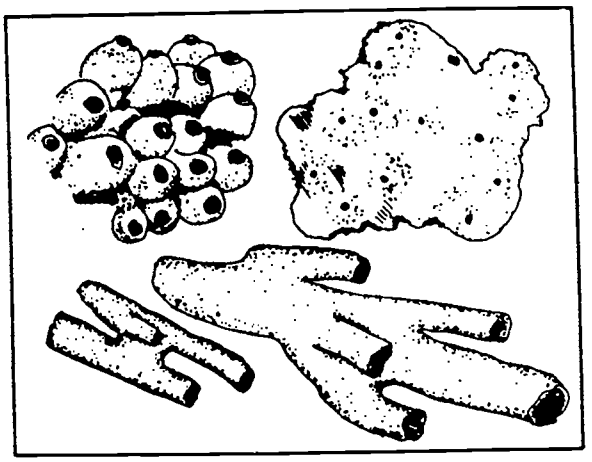
To help students:

- Practice reading, writing, coloring and numbering skills with marine invertebrate worksheets (Activities 1-8).
- Compare natural and synthetic sponges (Activity 1).
- Make sponge prints (Activity 1).
- Design, make, and wear jellyfish or anemone costumes for a class play (Activity 2).
- Write a class poem or story about worms (Activity 3).
- Sing a song with hand motions about crabs, shrimps, barnacles and amphipods (Activity 4).
- Listen to Pagoo, a story about a hermit crab (Activity 5).
- Investigate and taste crab (Activity 6).
- Construct a mollusk puzzle using two-dimensional shapes (Activity 7).
- Make three-dimensional sea stars, brittle stars, sea cucumbers, sea urchins and sand dollars out of clay or dough (Activity 8).
- Compare sea squirts to marine invertebrates (Activity 9).



UNIT TWO: Marine Invertebrate Species. Bottom ridge, left to right: barnacles, closed sea anenome, open sea anemones. Middle ridge, left to right: mussels, snails, sea urchin, hermit crab, Dungeness crab. Background: sand dollars, sea star, jellyfish.

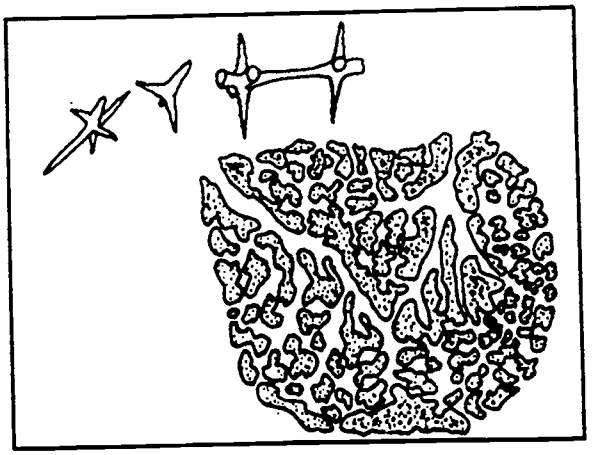
Activity 1
Sponges



Background:

In Alaskan waters, sponges are primarily subtidal, but some may be found in the intertidal zone. Intertidal sponges usually are inconspicuous, encrusting species growing under ledges, in crevasses, on rocks and boulders. Shades of green, yellow, orange and purple predominate, but other colorations may be found.

Sponges have been largely unchanged for 500 million years. Because they taste bad, they have few natural enemies. Some sponges shelter other organisms in their internal cavities.



If an intertidal sponge is examined with a magnifying glass, its scattered incurrent and excurrent openings can be seen. Flagellated cells draw sea water into the sponge mass through small incurrent openings. The sea water passes along internal passages and exits the sponge through the larger excurrent openings, which resemble volcanic craters. Inside the sponge mass, the flagellated cells along the passages capture microscopic bits of food from the passing water.

Sponges are given shape and texture by fibers and tiny, often elaborate siliceous or calcareous structures called "spicules." Biologists use the size and shape of these spicules to identify sponge species.

Some sponges have a distinctive form, which may resemble vases, fingers or balls; but others are amorphous. Sponges produce larvae that drift for a time in the water, then settle to the bottom and stay in the same place to grow and mature. They have no head, eyes, legs or heart.

Materials:

- Natural sponge (old-fashioned bathtub type)
- Synthetic sponge pieces (one per student)
- Tempera paint
- Paper cut in sea animal shapes
- Construction paper
- Scissors
- Glue
- Worksheets
  - ... Sea and Wetland Activity Book (cover)
  - ... Guess What I Am? (2-A)
  - ... The Cut and Paste Sponge Story (2-B)

Procedure:

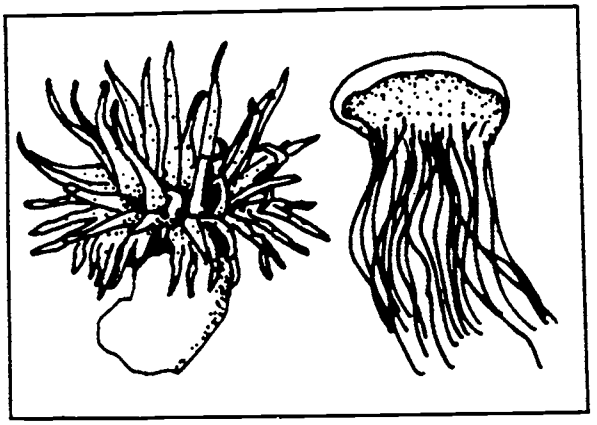
1. Have students compare a real sponge with the synthetic type. What differences can they see, smell, feel? Explain that real sponges are live animals gathered by undersea divers. Synthetic sponges are put together in a factory. Show the class the properties of sponges that make them valuable to people and useful to other sea creatures. They soak up liquids! Their central cavities provide places for smaller animals to hide or feed. And sponges taste terrible--so few animals eat them.
2. Have the class make sponge prints. Dip pieces of synthetic sponge into tempera paint, then press them lightly on paper cut in sea animal shapes. Glue the animal shapes to a construction paper background.
3. Talk about sponge colors and shapes. Show the class pictures of sponges from magazines or books. Have them complete the sponge worksheets. (The Cut and Paste Sponge Story was designed by Chris Normandin, Nikolaevsk Elementary, Nikolaevsk.)

Additional activities:

1. Art, Science: Have students cut out construction paper sponges of different shapes and colors, then draw pores, attachments and other details. Use for a corner room display.
2. Science. Show students sponge skeletons! Add a few drops of laundry bleach to a small piece of real sponge. Swirl or stir with a glass rod until the sponge material starts to visibly disintegrate.

   With an eye-dropper, carefully draw up some of the liquid, put a drop of it on a slide and add a cover slip. Place the slide under the microscope and see how many types of spicules you can find. Different species of sponges depend for structural support on different types and combinations of spicules.

Activity 2
Jellyfishes and Anemones



Jellyfishes and anemones belong to the same phylum, "Cnidaria," also known as "Coelenterata." In some species, the life cycle of the animal actually includes an alternation of generations: the jellyfishes reproduce sexually, producing larvae that settle to the sea floor and become anemone-like animals. These in turn reproduce, asexually, to produce jellyfishes.

Drifting and weakly swimming through the water, the soft-bodied jellyfish is shaped like an umbrella or bell. Its mouth is in the center of its undersurface, and its tentacles dangle like a fringe from the edge of the bell. In its tentacles are cells called "nematocysts" that rapidly emit tiny poisonous and sticky threads after contact by prey organisms. The animal is stunned, and the tentacles then entwine and convey it to the jellyfish's mouth. The nematocysts of some species, such as the large lion's mane jellyfish, can sting painfully; children should be cautioned not to touch any jellyfish they find either stranded on shore or drifting in the water.

An anemone is somewhat like a jellyfish turned upside down. The main part of the animal is an upright column. At the top of the column are its tentacles, and in the center of the ring of tentacles is the animal's mouth. Like jellyfishes, most anemones have nematocysts in their tentacles that they use to stun and capture prey. Students may touch the anemone's tentacles with their fingers without fear of being hurt. Do not touch the sensitive skin of the face, arms, legs, body or tongue to the anemone, however.

Anemones, like jellyfishes, have no bones and need water both inside and out for support. Out of water, they look like masses of gelatin. If children find such a specimen ashore, urge them to look into the water nearby. There they are likely to spot an anemone upright, expanded and beautiful.

Most anemones attach themselves to hard surfaces and move so slowly along the sea floor that their movement goes unnoticed. Some, however, look, live and behave in unusual ways:

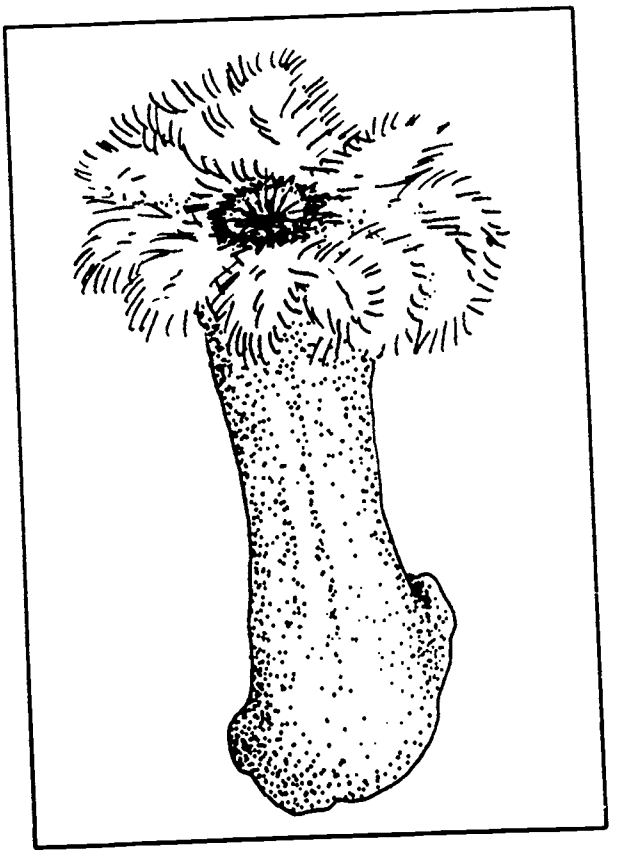
1. Some subtidal anemones construct and live in tubes that extend downward into the substrate. These creatures protrude from their tubes to feed, but may withdraw into them if threatened.

2. Some other, uncommon types of anemones are relatively mobile and can flop slowly over and over as if doing cartwheels.

3. Responding to the presence of predatory sea stars, members of at least two species actual-

ly let go of the bottom and swim feebly, with writhing motions.

Anemones reproduce in several ways. Like almost all animals, they can reproduce sexually. Eggs and sperm are released through the anemones' mouths. Fertilized eggs grow into tiny larvae that drift for a time, then settle to the sea floor to grow into adults. In one species, the fertilized eggs develop within the female and move out through the mouth to attach as small individuals at the anemone's base; when they are large enough they move away to the surrounding rocky area. An anemone may also reproduce by splitting in two, dividing itself top to bottom through the center of its column and oral disc.



Several species of anemones may be found intertidally in Alaska. These are three of the most conspicuous:

1. Anthopleura artemesia is small, about two inches in diameter, and is found in a range of colors, including pink, copper and green, always with bands of lighter and darker shades of the main color along the tentacles. The green color of Anthropleura is caused by symbiotic (mutualistic) algae. Anthropleura can often be observed in tidepools with its tentacles fully extended. This anemone may anchor itself to a rock covered with sand or mud; when the tide is low, it appears as a small, raised, sandy ring that retracts when touched.

2. Tealia crassicornis is sometimes called the "Christmas tree anemone." It has a pattern of irregular streaking of red, green and tan. A large anemone, it is often left exposed at low tide on Alaska shores.

3. Metridium senile is usually white and differs from the other two species in that its tentacles are finer and appear almost feather-like. Sometimes called the "cauliflower" or "plumose" anemone, this species is often spectacularly abundant on pilings and under docks. It feeds mostly on zooplankton--the characteristically tiny animals that float in great numbers in the ocean.

Vocabulary:

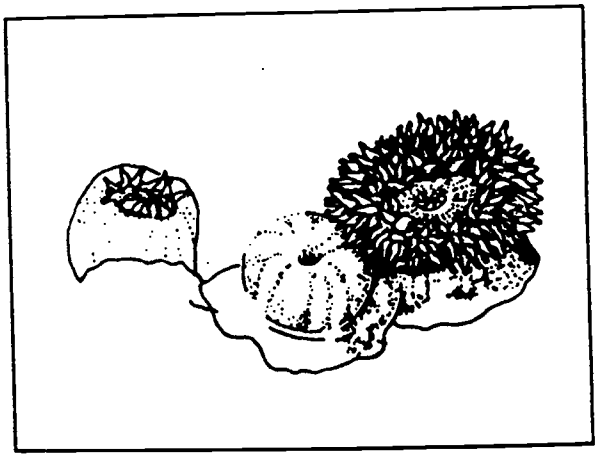
- tentacle

Materials:

- pictures of anemones and jellyfishes in books and magazines
- long, narrow balloons
- paper streamers
- old sheets or bedspreads
- scissors
- tape
- stapler
- worksheets
  - ... Sea Anemones (2-C)
  - ... Anemone Poem (2-D)
  - ... Sea Anemone Sentences (2-E)
  - ... Dot-to-Dot Mystery (2-F)
  - ... Jellyfish (2-G)

Procedure:

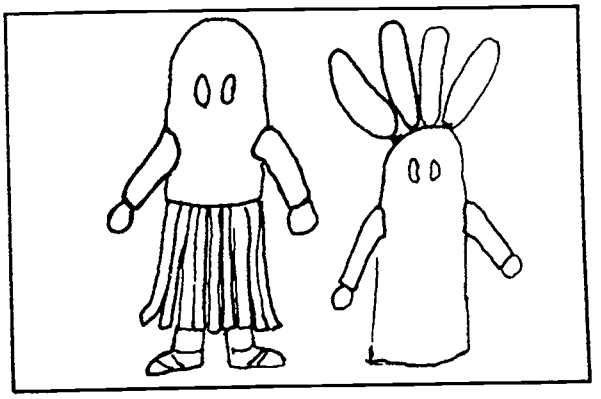
1. Show the class pictures of jellyfishes and anemones from books and magazines (or from the worksheets). Talk about how the animals live. Explain that anemones at low tide pull in their tentacles to keep from drying out.



Jellyfishes are often stranded on the shore, and depend on the tide to wash them back to the water. Once they land on the beach, many dry out in the sun and die.

2. Have students complete the sea anemone and jellyfish worksheets. (Sea Anemone Sentences was designed by Joanne Rogers, Paul Banks Elementary, Homer.)

3. Have students make up a class play about anemones and jellyfishes--how they eat and survive. Make costumes out of old sheets or bedspreads, paper streamers and balloons. Use scissors, tape, and staplers to put everything together. Children might want to save their costumes for Halloween.



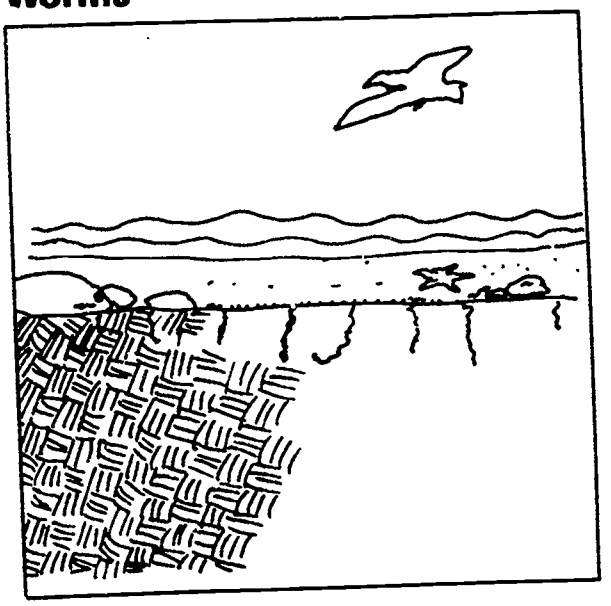
Additional activities:

1. Art, Science: Make jellyfishes and anemones from construction paper. Curl strips of paper for tentacles.

2. Science: Jellyfishes and anemones are difficult to keep alive in the classroom--so try to limit your observations to beach trips. If you do have live jellyfishes or anemones, ask students to watch their behavior. Place the jellyfishes in a plastic bag of salt water so that students can see their undulating movements and their tentacles. Caution students not to touch stranded jellyfish at the beach; they might get stung!

Students can touch the tentacles of anemones, and can try to feed them bits of food (pieces of fish, meat, shellfish). What happens? Have students watch anemones in and out of the salt water. Notice how they attach themselves firmly to a surface. Try not to disturb them. Scientists think anemones may live 100 years or more, as long as food is available, so don't let them die by human hand. Keep them cool, and return them to the ocean as soon as possible.

Activity 3
Worms



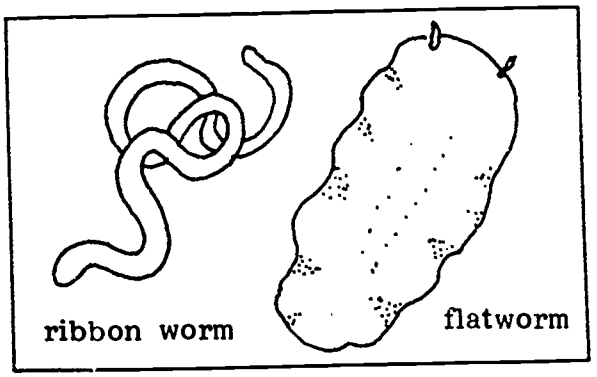
Worms of many kinds are an inconspicuous but important part of any beach. Many species have adapted to their habitats in specialized ways. There are species of worms living naked in sand or mud substrates, some that live commensally with larger animals, and others that reside in parchment-like or calcareous tubes.

Worms serve a vital function in their environment by loosening the substrate and processing nutritive material into the food chain. They are themselves on the menu of birds, fishes, and other animals.

Although the term "worm" as it is commonly used refers to slender, wiggly animals with no legs, there are actually a vast number of worm species--some slender, some fat, some with appendages and some without. Five main groups, or phyla, of worms may be found on Alaskan beaches:

1. Platyhelminthes (flatworms) These may be as long as four

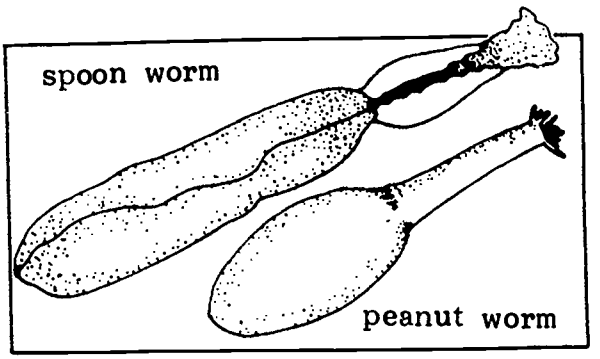
inches, but most measure only a fraction of an inch. They are flat and seem to flow over a surface, often looking like a moving spot on a rock or shell. They may be found on moist surfaces and are interesting to watch through a magnifying glass.



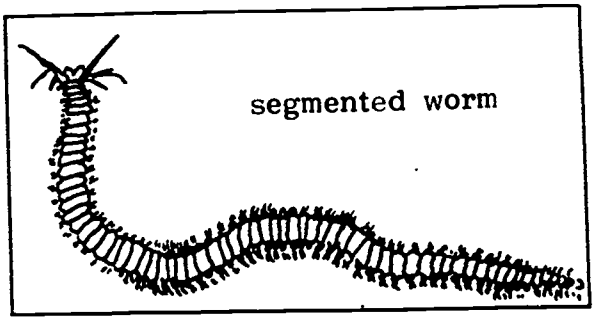
2. Nemertea (ribbon or proboscis worms)
Ribbon worms are round, sometimes highly colored, and quite elastic. A specimen that is a foot long when contracted may be capable of stretching to 10 feet. Ribbon worms break apart easily, and each severed part is capable of producing a new individual. They feed by everting a mouth apparatus called the "proboscis."

Some ribbon worms burrow into the sand or mud, while others live among clusters of barnacles, mussel shells or other marine organisms.

3. Echiura (spoon worms)
These take their common name from the shape of the proboscis, which when contracted looks like a spoon. They live in burrows and may be found under intertidal rocks in muddy areas with their proboscus projecting from the burrow. They are two to three inches long.



4. Sipuncula (peanut worm)
Taking their common name from their bulbous shape, peanut worms are burrowers in sand or mud and are often found in low intertidal areas. They may be several inches long.



5. Annelida (segmented worms)
The annelids are a large group of worms (including the common earthworm) with segmented bodies. The motile surface dwellers have well-developed heads with sensory organs including eyes, taste buds and tentacles. Others have reduced sensory structures on the head and may have tentacles or other structures used for feeding on the organic material associated with sediment. Many annelids have appendages called parapodia that are used for crawling, digging or swimming.

Annelids are greatly varied in size and appearance. The backs of some are covered

with scales (scale worms); some live in calcareous or parchment-like tubes (tube worms); and others live in cones made of cemented sand grains. Annelids can be found in vertually every type of marine habitat (as well as in fresh water and on land). Some form part of the zooplankton, some burrow in mud, others live under rocks or shells, and there are even some living in sediments of the deep sea.

Vocabulary:

- flatworm
- ribbon worm
- spoon worm
- peanut worm
- segmented worm

Materials:

- pictures of worms from books or magazines
- chalkboard or butcher paper
- chalk or magic markers
- worksheets
  - ... Worms (2-H)
  - ... Worm by Letter (2-I)
  - ... Tube Worms (2-J)

Procedure:

1. Show students pictures of worms from books and magazines, or from the worksheets. Discuss the way that worms eat and are eaten, and the role they play in loosening beach sands and muds. Distribute the worksheets Worms, Worm by Letter, and Tube Worms.

Additional activities:

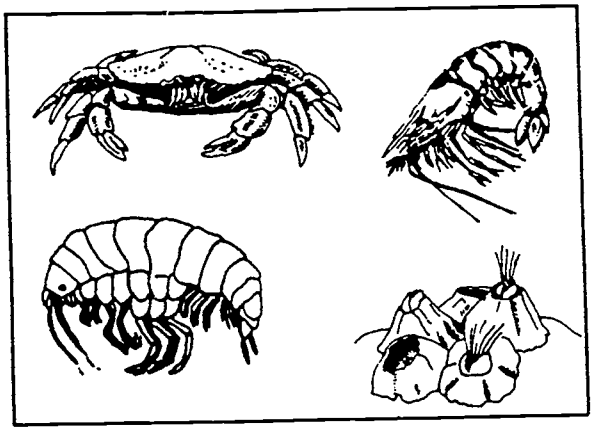
1. Art, Math: Have students cut worm shapes out of construction paper. Write math problems on one side of the cutouts and the answers on the other side.

2. Science: To help students get over any squeamishness about worms, bring some live ones into the classroom in a container of sand or mud. Ask students some of the following questions:

   - How long is the worm?
   - What color is it?
   - Does its body have segments (rings)?
   - How fancy or plain is its head? (Use a magnifying glass. Worms that crawl over the surface and hunt actively usually have well-developed sensory apparatus on their heads. Look at the tentacles on the heads of the tube worms.)
   - How many legs does it have?
   - Does it move fast or slow?
   - Will it stay in your hand when you hold it?
   - How quickly can the worm bury itself?

   Return the worms to the beach when you are finished watching them.

Activity 4
The Crustaceans: Crabs, Shrimps, Barnacles and Amphipods



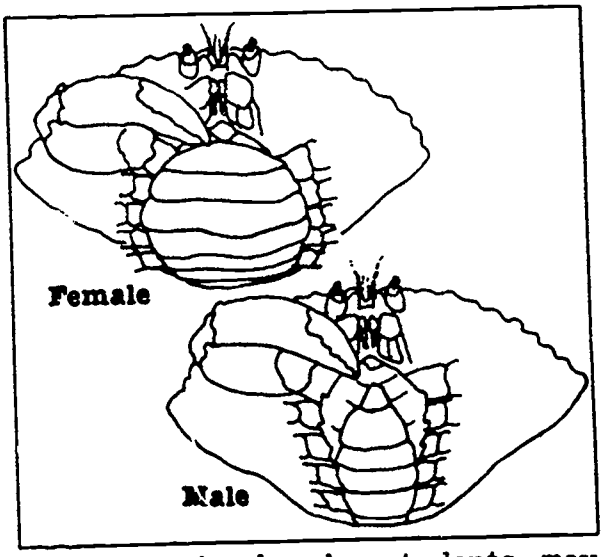
Background:

Crabs, shrimps, barnacles and amphipods belong to the class Crustacea, a large group related to insects. Like ants and beetles, crustaceans have a hard external skeleton and jointed legs.

Numerous kinds of CRABS may be found in Alaska. Small shore crabs are sometimes abundant in tidepools or other moist, protected places. Small, spiny juvenile king crabs can sometimes be found stranded by a receding tide. Hermit crabs--unique animals that protect their soft abdomens by living in empty snail shells--may be numerous on rocky shores, typically in tidepools.

Crabs are non-swimming, bottom-dwelling animals usually protected by a hard outer covering, or "exoskeleton." Although each of the many Alaskan crab species has its own distinguishing features, all crabs share certain characteristics:

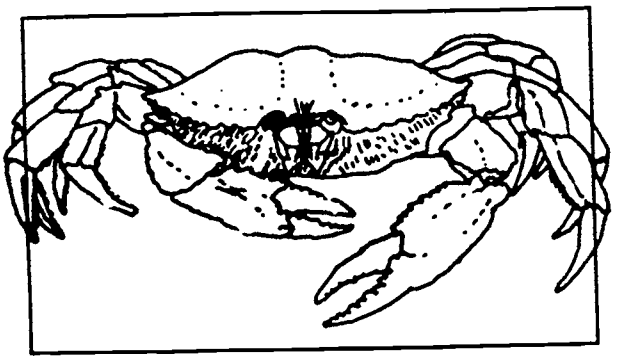
Growth: When we grow, our bones lengthen and get larger, and the soft muscle and other tissue making up our bodies grows too. Crabs grow in a different way. Instead of an internal skeleton, they have a hard outer shell that cannot expand. In order for a crab to grow, that shell must be shed, or "molted." In this molting process, a new, larger soft shell forms between the animal's muscles and the older hard-shell covering. This is visible as a red or brown covering over crab meat. When the old shell has been shed, the new one expands and hardens to protect the soft animal inside.



On the beach, students may find empty crab shells. If a shell is whole, it will have a narrow opening on its rear edge--the exit used by the crab when it backed out of its outgrown shell.

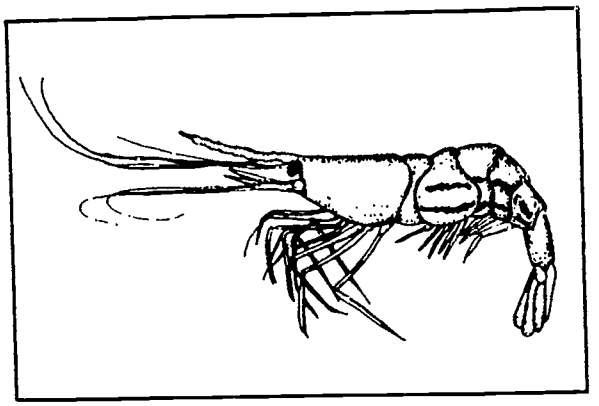
Movement: A crab's legs are jointed on different planes to allow complex maneuvering that probably helps it to escape a predator or capture prey. It can move sideways just as easily as it moves forward or backward.

Feeding: Most crabs feed on whatever they can find, including annelid worms, clams, snails, and sea stars, alive or freshly dead. (Crab fishermen report that crabs won't eat rotten bait.) Crabs are equipped with large claws specially adapted for digging in the sediment, tearing and pulling apart food, as well as for catching it. The claws also carry food to the crab's complex mouth.



Reproduction: Among crabs, the sexes are separate. The male crab typically attends the female as her molting time approaches, and mating usually occurs after molting. (Among tanner and other spider crabs, the females no longer molt after reaching maturity, but do continue mating.) The female then extrudes the eggs, which she carries attached to her abdomen until they hatch. The tiny swimming larvae are part of the ocean's plankton until they molt several times, change form, and settle to the sea floor to become adults.

The female crab's abdominal flap is broader and larger than that of the male, because it covers and protects the eggs she carries for much of the year.



SHRIMPS are not common intertidally in Alaska, but children occasionally may find some in tidepools; these are usually small and not likely to be of a commercially important species. Unlike crabs, which are compressed top to bottom, shrimps are flattened side to side. Five species of shrimps are fished commercially in Alaska: pink, humpy, sidestripe, coonstripe and spot shrimp. Of these, the spot shrimp are the largest, sometimes weighing as much as a quarter pound.

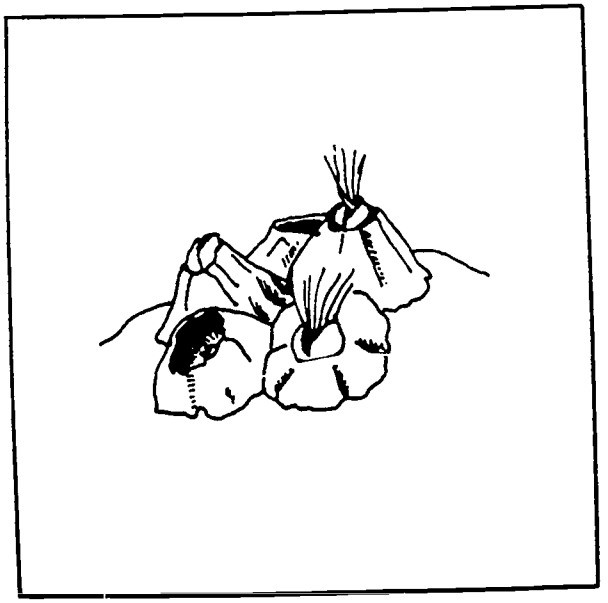
Shrimps are crustaceans, capable of swimming and walking. Their ten forward legs are used for traversing the ocean floor, and their abdominal appendages (called swimmerets) are used for swimming. Some species generally stay on the bottom during the day and swim upward in the water column to feed at night.

Like other crustaceans, shrimps must molt to grow. Like her crab cousins, the female shrimp carries her eggs among her abdominal appendages until they hatch. Some species of shrimps in Alaska have a curious life cycle in which all members of the species begin life as males, but are transformed after several years into females, remaining as such for the rest of their lives.

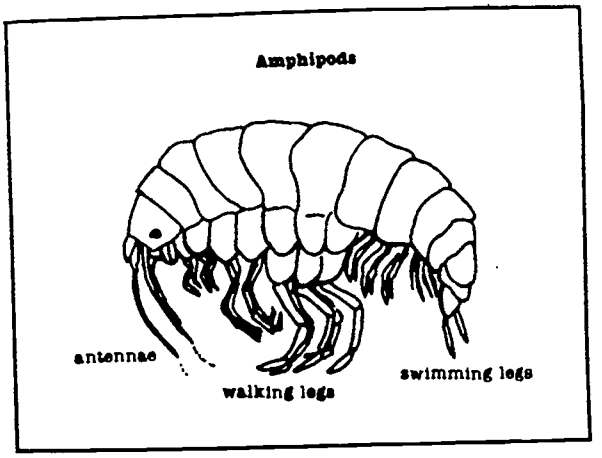
BARNACLES, very common on Alaska's shores, are encased in a hard, calcareous covering made of several overlapping plates. They use modified appendages to sweep the water. Acorn barnacles collect food particles, and gooseneck barnacles prey on tiny animals.

The young barnacle is free-swimming like other crustacean larvae. When it settles to the ocean floor, however, the barnacle attaches itself by its head to the substrate and starts to secrete a hard, calcareous sheath around itself. When the protective cover is complete, it usually is conical or columnar, and is topped by plates that open like a double-sliding door. Through the opening, the barnacle inside sticks out specially modified legs that wave rhythmically through the water to collect bits of food.

Different varieties of shore-dwelling barnacles live in different beach zones, and several species thrive on rocky Alaskan beaches. Drifting, open-water gooseneck barnacles may be washed ashore on outer coasts.



AMPHIPODS, also called beach or sand hoppers, are small, active, laterally compressed animals almost completely covered by an external skeleton. They have strong back muscles that they can flex in order to leap or hop. These animals are usually scavengers; they can be found under rocks and in nooks and crannies formed by the growth of other organisms. Amphipods are the street cleaners and garbage collectors of the marine environment. When food such as crab pot bait or a dead fish on the ocean floor is available, they may congregate in great numbers. In spite of their small size, they can quickly strip a food source to the bones.



Materials:

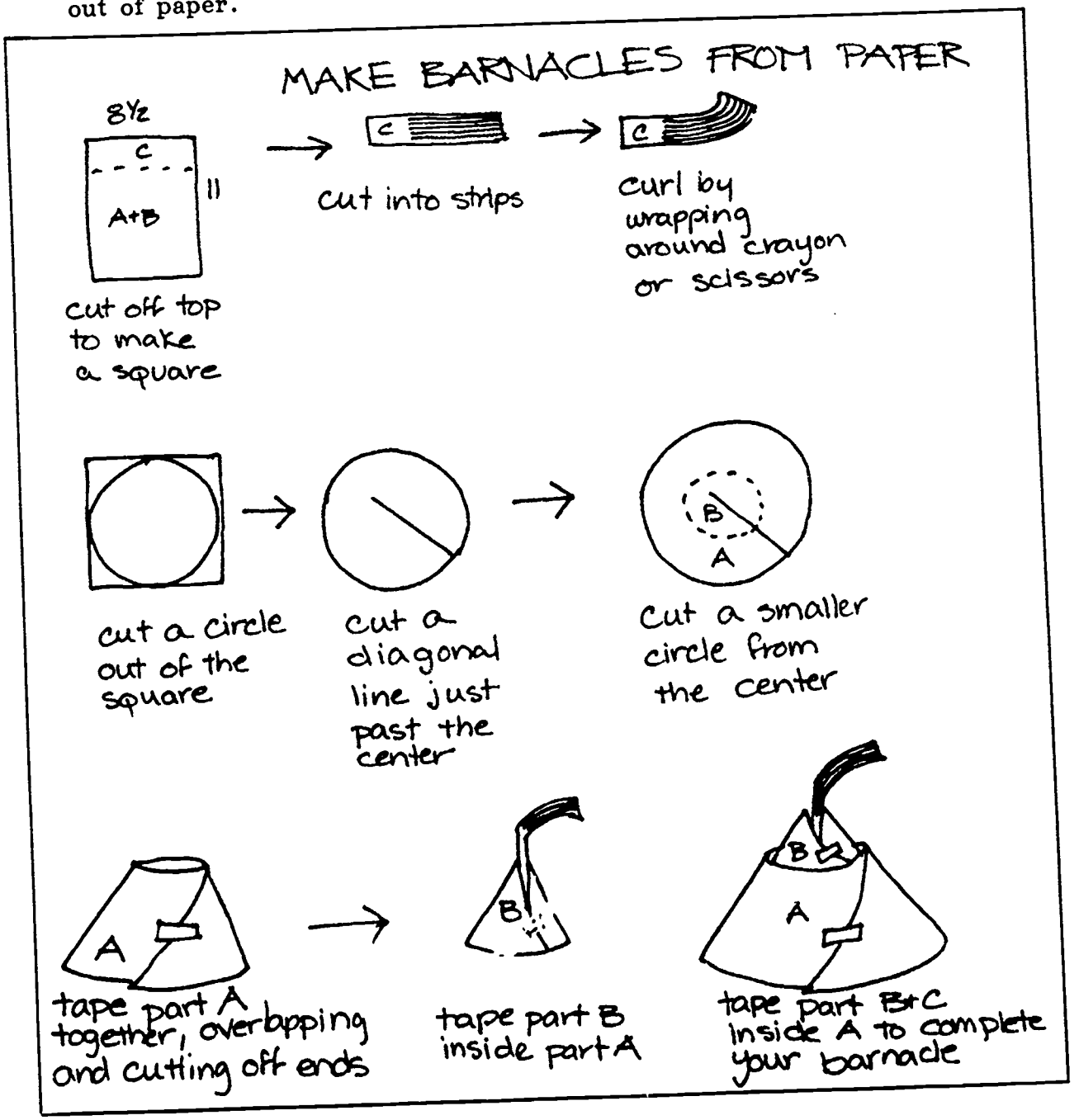
- pictures of crustaceans from books and magazines
- chalkboard or butcher paper
- chalk or felt-tip markers
- live crustaceans
- worksheets
  - ... Crab (2-K)
  - ... Crab Cutout (2-L)
  - ... Shrimp (2-M)
  - ... Shrimp Maze (2-N)
  - ... Barnacle (2-O)
  - ... Barnacle Math (2-P)
  - ... Amphipod (2-Q)
  - ... Sand Hopper (2-R)

Additional activities:

1. Language Arts: Write a class story or poem about what it is like to be a crab, shrimp, barnacle or amphipod.

2. Art, Science: Make barnacles out of paper.

3. Art: Make relief drawings of crabs. First sketch the crabs, then overlay with blue (for the ocean) and pink (for the crabs) tissue paper which has been dipped in liquid starch. Crumple extra tissue over the crabs for a relief effect. (Suggested by teachers at Badger Road Elementary, Fairbanks.)



Procedure:

1. Discuss the different kinds of crustaceans and how they live. Show the class pictures of crustaceans from books and magazines. Have students complete the worksheets: Crab; Crab Cutout; Shrimp; Shrimp Maze; Barnacle; Barnacle Math; Amphipod; Sand Hopper. (Barnacle Math was contributed by Larry Trani, Baranof Elementary, Sitka.)

2. Ask students if they know how different kinds of crustaceans move. If possible, obtain live ones for them to watch. Crabs should be kept cool (in the refrigerator); for short periods they keep best out of water. Try feeding them pieces of fish, meat or shellfish. Be sure to return them to the ocean as soon as the class has had a chance to watch them.

   Have the children imitate crustacean movements. They can try a "crab walk" on their backs on all fours, with faces and bellies facing up. They can also demonstrate how a crab walks by crossing their hands at the wrist and moving their fingers as if they were walking forward, backward and sideways. For sideways movement, the fingers of one hand pull as those of the other hand push.

3. Review with students the short finger play from the introductory Sea Week volume:

   Words

   I am a little hermit crab
   Looking for a shell

   I see one. . .
   Here I come!

   This one suits me very well.

   Actions

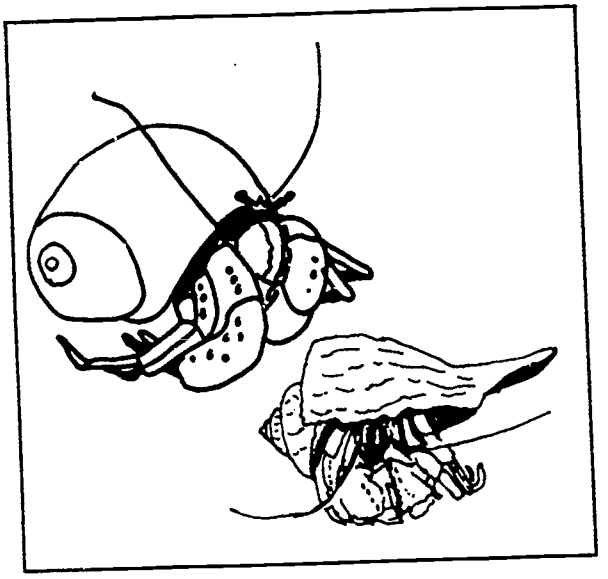
   Fingers of one hand creep across desk or table.

   Cup the opposite hand a short distance in front of the creeping fingers.

   The creeping fingers jump inside the cupped hand.

4. Now invite the class to make up its own song with verses and motions about the way the different crustaceans move and how they live. Have them use just their fingers, or their whole bodies. Change the words to a familiar song such as "Itsy, Bitsy, Spider," or "I'm a Little Teapot." Write the words on the chalkboard or on a sheet of butcher paper. Practice--then give a program for parents or another class.

Activity 5
Pagoo, The Hermit Crab



Background:

Hermit crabs are members of the same group of crabs as king crabs. Both have only three pairs of walking legs and one pair of chelipeds (pincers). True crabs, such as Dungeness and tanner crabs, have four pairs of walking legs plus a pair of chelipeds. Hermits, however, are a distinctive group of animals whose abdomens have been modified to take advantage of the protection afforded by abandoned snail shells and similar objects. The front of the hermit crab looks like that of other crabs, with antennae, stalked eyes, jointed legs and a body covered by an exoskeleton; but the animal's soft abdomen is long and usually curved. There are special hooks on the small appendages on the end of the abdomen. These are used to grasp the internal column of a snail shell.

Like other crustaceans, hermit crabs molt. When they grow, they often must move to larger snail shells. When the crab locates a new shell it likes, it releases the old shell and backs into the new one.

On the beach, the hermit crab may be found in tidepools, on sandy stretches or among cobbles. While examining snail shells, children may be startled to find one sheltering a retreating hermit crab, intent on withdrawing as far as possible inside to protect itself.

To introduce students to hermit crabs, use the book Pagoo, by Holling Clancy Holling. It is the story of one small hermit crab's trials, tribulations and encounters with other sea creatures. Accompanying the narrative are accurate, detailed drawings that present every kind of marine plant and animal life in the world of Pagoo, whose name comes from the genus Pagurus to which he belongs.

Vocabulary:

- hermit crab
- abdomen
- jointed legs
- antennae
- habitat

Materials:

- Pagoo, by Holling Clancy Holling. Houghton Mifflin Co.,
- Boston, 1957. 87 p.
- filmstrip or 16 mm film, "The
- Making of Pagoo"
- worksheet
  ... Pagoo (2-S)

Procedure:

1. Pagoo is 87 pages long and can be read over a five-day period or told to the class as the pictures are shared. Through Pagoo, students will learn not only about hermit crabs, but

also a great deal about the ways in which other marine plants and animals live and interact with each other.

2. Show the filmstrip or movie of Pagoo to the class if either is available in your library.

3. Follow up the reading of Pagoo and the viewing of the filmstrip or movie with discussion and with any of these related activities:

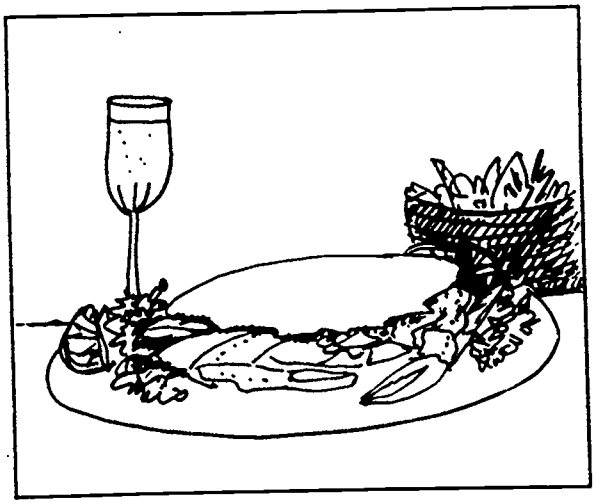
   a. Ask children to draw pictures of Pagoo in his world.

   b. Write a class story about a hermit crab living on your own beach.

   c. Write and illustrate a short story about another sea creature.

4. Use the worksheet on Pagoo to review hermit crab habitat. Hermit crabs need lots of shells, don't they? Remind the children that when they visit the beach they should leave a few shells for the hermit crabs!

Activity 6
Crab for Dinner



Background:

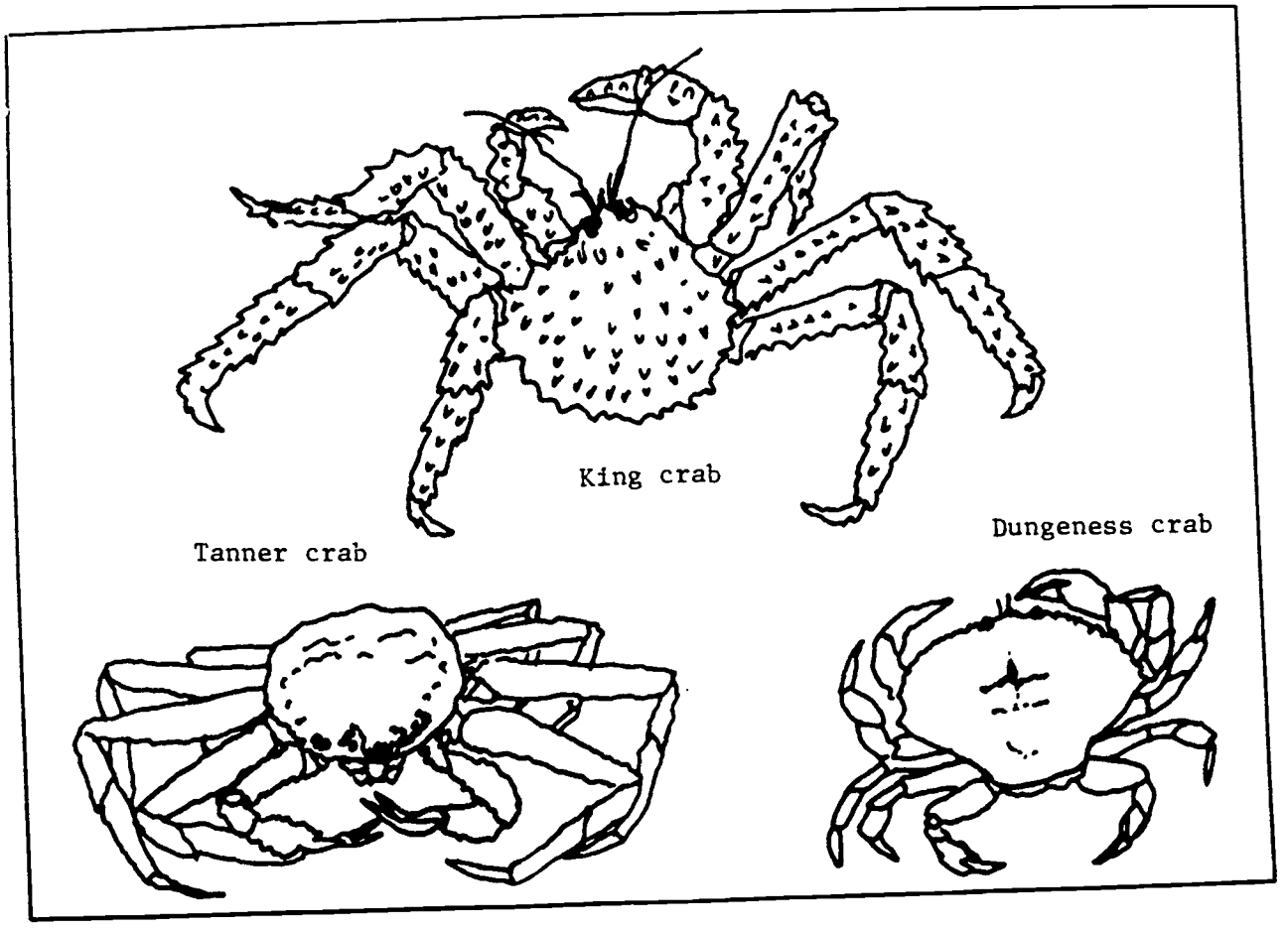
Eating crab in class can be a learning experience as well as a treat. Three kinds of crab--king, tanner and Dungeness--are caught commercially in Alaskan waters. All three usually live in subtidal waters, but sometimes large kings can be found intertidally (in spring larger ones may come into shallow water to mate), and Dungeness of edible size may be found covered with sand in the lower intertidal zone.

The KING CRAB is probably the best known of the Alaska commercial species. This is the largest of the Alaskan crabs and may reach a total width of more than four feet and a weight of more than 20 pounds. The best known is the red king (Paralithodes camtschatica), but blue (Paralithodes platypus) and golden king crab (Lithodes aequispina) are also caught and sold. As their common names imply, shell color separates the species; spination is also used to tell species apart.

The life history of the red king is well known. Eggs hatch in the spring, and the young drift in open water for about two months before settling to the sea floor. While drifting, they molt several times and begin to resemble adult crabs. When small, the young kings hide among rocks and algae to protect themselves. As they grow older, they join with other kings their own size, and often form large groups, or pods, that move over the sea floor like a living ball of red spines and tiny claws. At this stage, they have traded hiding for sticking together as a means of protection. As each crab continues to molt and grow, its size begins to afford it protection, and individuals move away from the pod.

With maturity, crabs follow another pattern. For part of the year they live in deep water, but each year in late winter or early spring they move into shallow water to mate. Beginning in late winter, males seek out females and carry them in their claws until the female molts. They then mate and separate. The female's eggs are deposited under a flap beneath her body and are carried there for almost a year. The following spring, the eggs hatch and the cycle begins again. Some adult males also molt while in shallow water, but these will not mate while their shells are soft.

Kings are easily identified by their size and by the spininess of their shells. No other commonly found crab has well-spaced conical spines over its back and legs. The king has six walking legs and two claws, the right claw larger than the left.



DUNGENESS CRAB spend a good deal of time buried in sand with only their eyes exposed, and sometimes they can be found still buried after the tide has gone out. Look for semicircular depressions in the sand, and dig carefully.

Dungeness are fast-moving, feisty animals that readily use their claws for defense if threatened. Because their grip can be painful, they should always be picked up by grasping the back of the body with one hand. Handled in this manner, the crab cannot reach the hand holding it.

Dungeness parts are easy to recognize. The shell covering the animal's back is almost semicircular along the front edge, and the back edge looks like three sides of a hexagon. The leg segments are relatively short and broad, and do not have spines. Dungeness have eight walking legs and a pair of claws.

TANNER CRAB, sometimes called "queen" or "snow" crab, are seldom found alive on a beach, but pieces of their shells may be common. Tanners are between Dungeness and king in size and shape. The tanner's eight legs are long and sprawling like a king's, but lack the latter's large spines. Its shell is brown when old, but pink when newly molted. The body is more or less oval, with a large spine extending forward on the outer side of each eye socket. Alaska has two species of tanner that are quite similar in appearance: Chionoecetes opilio and Chionoecetes bairdii.

Vocabulary:

- claw
- joints
- king
- Dungeness
- tanner

Materials:

- pictures of the three commercially important types of crabs
- collected shell parts from each type
- live or frozen whole crabs (or some canned crab)
- crackers
- crab-cracking implements
- pot of boiling, salted water
- worksheets
  - ... Crabs (2-T)
  - ... Dungeness Crab (2-U)

Procedure:

1. If at all possible, obtain a live or frozen whole crab. Check grocery stores, local fishermen, restaurants or friends in Kodiak or other coastal communities. Otherwise, use pictures, the worksheets and canned crab to discuss the three kinds of commercial crab and to give students a taste of crab meat. Try to obtain shell parts of the three species, perhaps on your beach field trip.

2. Have students sort the crab pieces by kind (king, tanner, Dungeness); by body part (leg, claw, body); by segment (long leg segment, short leg segment).

3. If you are lucky enough to get a live crab, keep it cool until you bring it out for the children to watch how it moves and how it uses its claws and eyes. Examine the mouth parts close up. Hold it by the back and turn it over. Point

out the stomach flap, or tail, which tucks up beneath the crab. Your specimen may be male, with a narrow flap, or female, with a broad flap covering the eggs when the animal is brooding them. Gently lift up the flap to see the brooding place.

4. Talk to the children about our dependence on the sea for food. Have a crab lunch. If the crab is whole and raw it may be cooked just as is, but many people find the taste better if it is first cleaned.

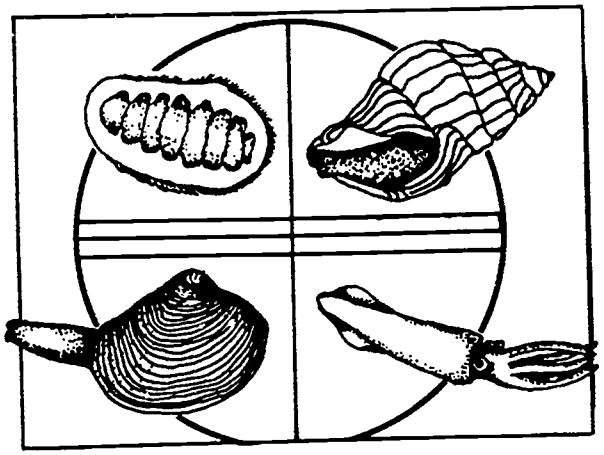
   To clean: cut with a knife on the softer underside and pull the appendages (as a unit) off one side, inward and away from the carapace (the shell covering the animal's back). Then do the same for the appendages on the other side. Shake each half of the crab well, and pull off the leaf-like gills. Cut off the crab's tail flap and save it to eat with the rest.

   To cook, get a pot of salty water (sea water is best). Cook for 12-15 minutes after the water has returned to a boil. Eat while the crab is still warm.

   While students are breaking the shell pieces and picking out the sweet crab meat, they can also be learning:

- Point out how hard the shell is. If you have more than one crab, see whether the shells on both are equally hard.
- Count the number of sections in each leg and each claw.
- Work the joints of the legs and claws to see how they move. Think about how the claws work.
- As the crab is cracked, look at the color of the skin on the meat (brown on Dungeness, red-orange on tanner and king). Explain to students that this is the new shell starting to form. If the crab is close to molting, the skin may be thick and rubbery and should be peeled off before the meat is eaten.
- If you are eating meat from more than one kind of crab, have students describe the differences in taste and texture.

Activity 7
The Mollusks— Bivalves, Univalves, Chitons, Octopi and Squid

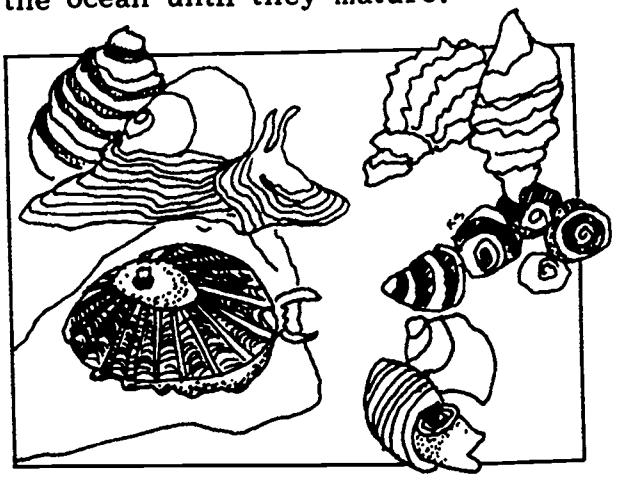


Mollusks are a large and diverse group of soft-bodied animals which usually have a prominent shell and a thick, muscular foot. The shell may be a spiral covering the whole animal; it may consist of one, two, or several parts; it may be internal, or altogether absent.

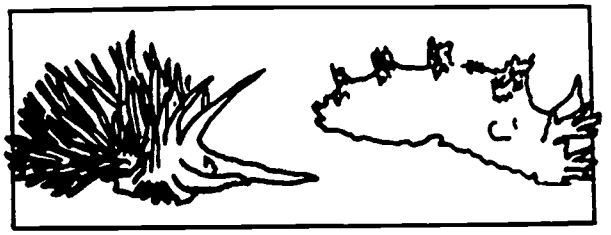
UNIVALVES are mollusks having one part, or valve, to their shells. They belong to the class Gastropoda, which is the largest class of mollusks. Snails, limpets (sometimes called Chinamen's hats because of their conical shape), and abalones are examples of univalves. The mantle, a part of the soft animal which enlarges as the animal grows, secretes the shell. In the case of snails, the shell spirals around a central column; its opening is always at the widest part of the shell and is the starting place for new growth.

Univalves generally have well-developed heads and sensory capacities because they must search for their food. Some, such as limpets, are grazers that scrape their food from rocks with a tooth-bearing, striplike structure in the mouth called a radula. Others, however, inject their prey with poison or feed in other specialized ways.

The eggs of many univalves may be found in clusters on beaches. Masses of eggs often are laid in different kinds of cases, some of which look like bent corncobs or oat grains, others like collars, tiny doughnuts, or groups of glassy beads. The larvae hatch as tiny swimming animals that will live in the ocean until they mature.

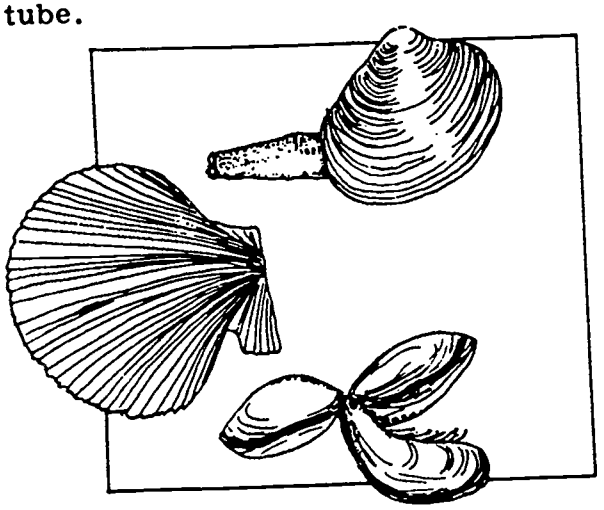


SEA SLUGS, or nudibranchs, are gastropods without shells. These soft animals may be mottled, dotted or striped in browns, yellows, reds, purples or combinations of colors. Often, elaborate branched or finger-like structures on their backs add to their striking appearance and serve as gills for gas exchange. They range in size from a fraction of an inch to more than a foot in length, but the animals found intertidally are generally small--sometimes small enough to be overlooked.



Sea slugs usually are specialized feeders and often may be found on their prey. Some eat barnacles. Others eat anemones and other cnidarians, and can store their prey's stinging cells in the structures on their backs for protection. One species of sea slug has a rounded hood that it uses to sweep the water for food.

Sea slug eggs usually are laid in gelatinous ribbons resembling the extrusions of a cake-decorating tube.



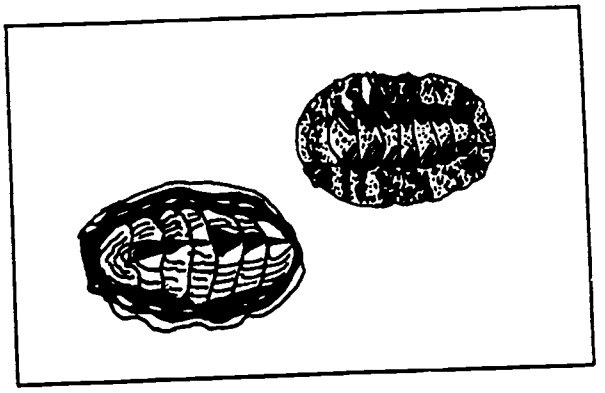
BIVALVES such as clams, cockles, mussels, oysters, and scallops are mollusks having two parts--or valves--to their shells. The shells are fastened together by a hinge. Muscles control their opening and closing, but the elastic fibers of the hinge ligament pull the shells apart. The soft animal inside the protective case usually has a much reduced head, but may have a well-developed foot for digging. Bivalves may live buried in sand or mud, or embedded in wood or sedimentary rocks (clams); or firmly attached to a hard surface (mussels); or unattached and unburied (scallops).

Unlike univalves, which actively seek food, bivalves are filter feeders. They pull water into their bodies (often with an incurrent siphon), strain microscopic food out of the water, then expel the water through an excurrent siphon. Some bivalves are deposit feeders, and utilize the organic material associated with sediment.

Among bivalves, sexes usually are separate. Eggs and sperm usually are released into the open water. Bivalves never produce egg cases as univalves do.

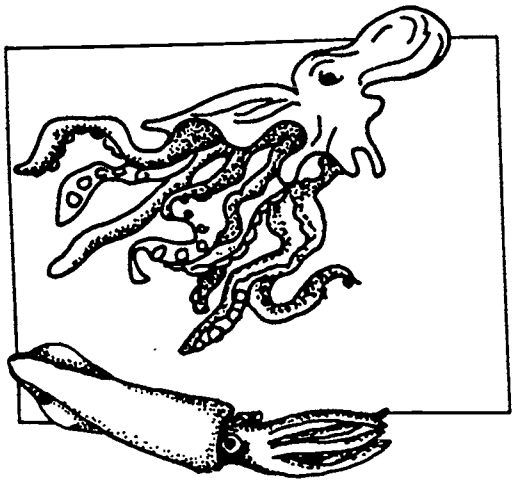
CHITONS are mollusks with eight overlapping valves to their shells. They are flat animals, usually found clinging tightly to rocks. Their ability to conform to a surface and fasten tightly makes them well-suited for intertidal areas where there is often strong wave action. Like limpets, they feed by scraping food from rocks.

Many kinds of chitons live in Alaskan waters, and they can be distinguished by the color patterns on their valves and on the girdle surrounding the valves. They range in size from species that never grow longer than an inch to a large red chiton that may be more than eight inches long.



Sexes are separate among the chitons. Eggs may be laid individually, in cases, in gelatinous masses, or may be carried by the female.

CEPHALOPODS, which include octopi and squid, are probably the most intelligent invertebrates. They have well-developed heads, relatively large brains, and are quick and active. Their eyes are similar to our own.



Octopi, with their suction ability, their eight disc-lined arms, and their sometimes awesome size of 100 pounds or more, have an undeservedly dangerous reputation. For the most part they are reclusive, hiding in dens that they leave only to forage for food such as clams and crabs. Although the octopus is capable of gliding silently and sinuously over the sea floor, it may jet away by using its siphon to expel water. If threatened, octopi and squid may expel ink to confuse predators. It was formerly believed that the ink formed a cephalopod-like shape that the predator would mistakenly chase, but more recent research indicates that the ink cloud may inhibit the predator's ability to locate the fleeing cephalopod by scent.

As is true of most cephalopods, one arm of the male octopus is modified for transferring sperm to the female (check for missing suction discs on one arm of the male octopus).

Females usually lay their eggs in protected places and tend them constantly as they develop. Females, who don't take time to eat while they are cleaning and aerating the eggs, usually die after the eggs hatch.

Squid vary in size, from the legendary giant squid to the tiny, bottom-dwelling squid found in Alaska, which is never more than a few inches long. Squid have 10 arms, two more than octopi, and they often have a flap-like projection on either side of the body covering or mantle. While octopi have no shell, squid have a thin, flexible, transparent or transluscent internal remnant of a shell. Unlike octopus eggs, which are usually tended by the female, squid eggs are left to develop on their own and have a chemical characteristic that discourages other sea animals from eating them.

Vocabulary:

- univalve
- bivalve
- mollusk
- limpet
- snail
- clam
- cockle
- mussel
- scallop
- chiton
- sea slug
- octopus
- squid
- cephalopod

Materials:

- pictures of mollusks in books and magazines
- shell samples
- construction paper or cardboard
- scissors

- butcher paper
- pencils, crayons, or felt-tip
- markers
- masking tape
- mollusk shapes
- worksheets
  - ... Snails (2-V)
  - ... Clams, Cockles, Mussels, and Scallops (2-W)
  - ... Mollusk Count (2-X)
  - ... Mollusk Math (2-Y)
  - ... Octopus Cutout (2-Z)
  - ... Mystery Mollusk (2-AA)

Procedure:

1. Put samples of the different mollusks on a table for the children to see and touch. Cut out the shapes of the mollusks for which you lack examples (e.g., octopus, squid, sea slug). Discuss the different types and show the children pictures of mollusks from books and magazines.

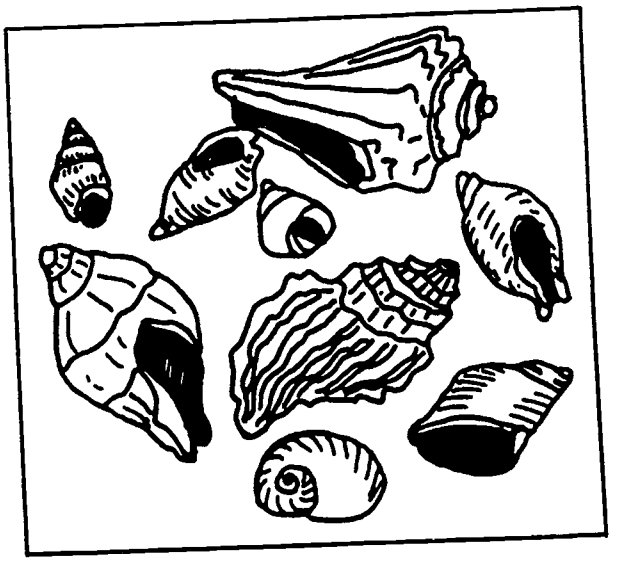
2. Have the class complete the worksheets: Snails; Clams, Cockles, Mussels, and Scallops; Mollusk Count; Mollusk Math; Octopus Cutout; and Mystery Mollusk. (Mollusk Math was contributed by Kathy Amerman, Maureen Coon, Kathy Dill, Mae Dunsing, and Larry Trani, Baranof Elementary, Sitka.)

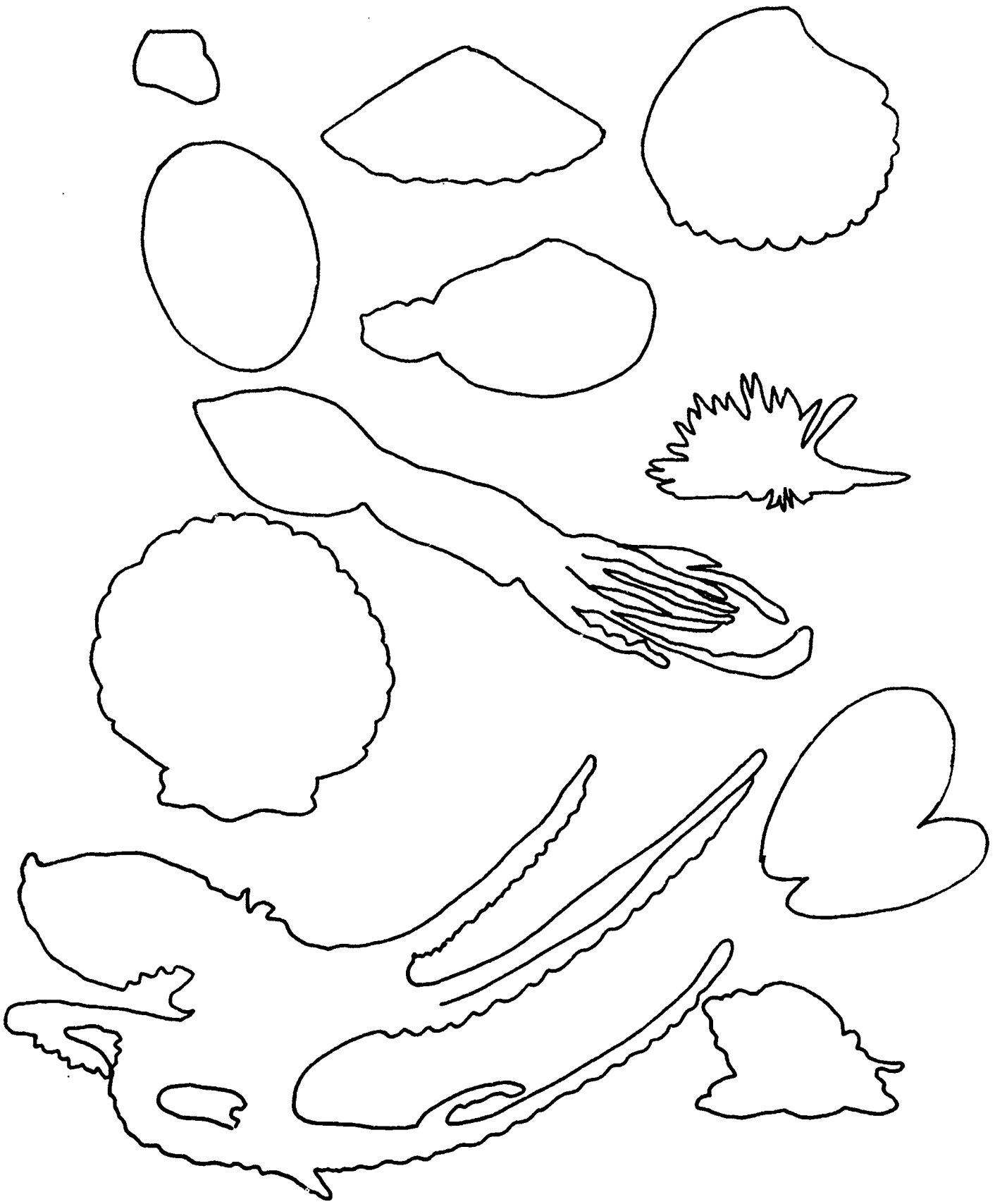
3. Make mollusk matching puzzles. Divide students into groups of two or three and give each group a piece of butcher paper; crayons, pencils or felt-tip markers; masking tape and 15 different mollusks--cardboard cutouts or shells. Have students trace the mollusk shapes and write arithmetic problems (e.g. 3+4, 5-2) on the butcher paper. Then have them write the answers on masking tape and stick these to the undersides of the mollusk cutouts. After the members of each group are finished, have them exchange their puzzle with another group--and see how fast they can match the tracings with the shells or cutouts. They can check their answers by doing the math problems!

Additional activities:

1. Math, Science: Have students measure their shells and cutouts and make bar graphs using these measurements.

2. Science, Language Arts: Bring live univalves or bivalves into the classroom for a brief showing. Have the class write a story about how fast they move, how they bury themselves, how they feed. Keep the animals cold (in the refrigerator) and take them back to their beach habitat as soon as possible, so that they can continue to fascinate future beach visitors.



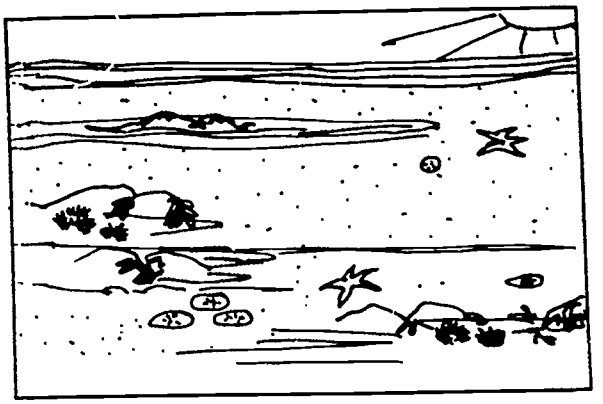


3. Language Arts: Obtain a worldwide variety of shells from students or local collectors. Let each child select one and develop an imaginative oral or written story about it. These questions may help them:

- Where did you find your shell?
- What were you doing when you found your shell?
- Why did you select this particular shell?
- What do you know about your shell and the animal that lived in it?
- Give your shell a name!
- Think carefully and find a name that fits.

(Suggested by Joanne Rogers, Paul Banks Elementary, Homer.)

Activity 8
The Echinoderms— Sea Stars, Sea Urchins, Brittle Stars, Sand Dollars, and Sea Cucumbers



Background:

Although it is not always obvious, the skeletons of the spiny echinoderms consist of tiny plates. Sometimes the plates form a recognizable "shell," as in the case of sea urchins; sometimes they are widely separated, as with sea cucumbers. Spines form part of the brittle armor of some animals, including sea stars, sea urchins, sand dollars and brittle stars.

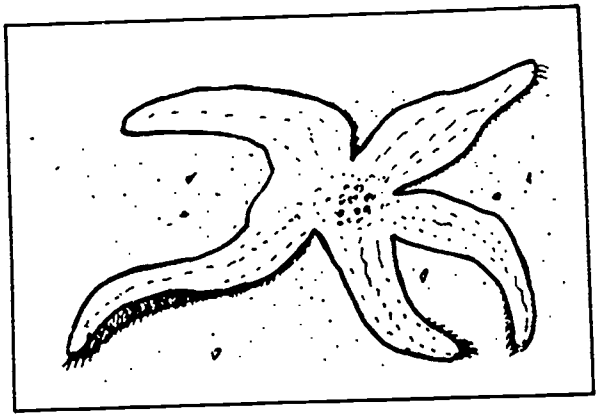
Radial symmetry is a distinguishing characteristic of this phylum. Like a pie, each echinoderm can be divided into similar wedges. Only among sea cucumbers is this difficult to see. To visualize a sea cucumber "pie," we must think of setting it on end before slicing.

In addition to their spiny appearance, skeletal plates and radial symmetry, all echinoderms have a water-vascular system that includes tube feet. These tiny, usually suction-cupped tube feet are linked to a system of canals that in most cases are in turn connected to a sieve plate through which water flows in and out of the

system. By muscular contractions and relaxation, each animal can attach or release the tube feet it uses for locomotion.

Most echinoderms release eggs and sperm into the open waters; the larvae swim freely until they mature and settle to the sea floor. Some sea stars brood their eggs under their arms, and small sea stars emerge from the fully developed eggs.

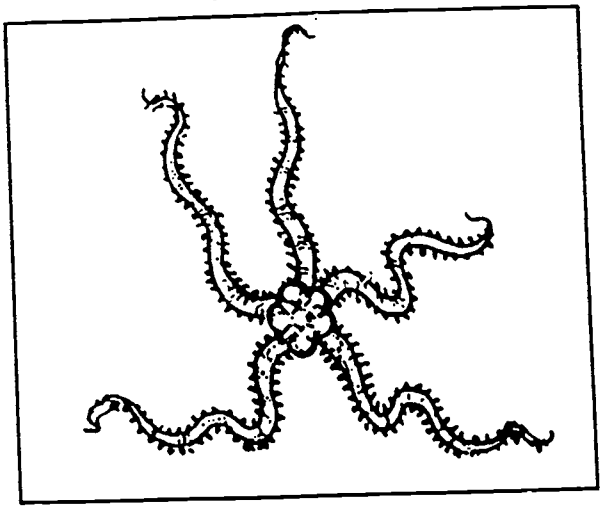
Sea stars and sea urchins often are abundant on Alaska shores. Sometimes sea cucumbers are plentiful too. Brittle stars are less often seen but may be found under clusters of other invertebrates. Sand dollars usually are subtidal, but sometimes their "shells" are washed ashore.



SEA STARS may be soft or stiff; many have five rays but several species have more. One species found in Alaska, the sunflower star (Pycnopodia helianthoides), develops new arms as it matures until it has 20 or more. Each of the many species found in Alaskan waters has distinct external characteristics separating it from other species. In general, however, major features of sea stars remain the same. All have an upper, or aboral, and lower, or oral, side. On the upper side there may be spines, tiny pincers, and microscopic, finger-like structures, used for gas exchange. In the center area of the upper side is the sieve plate or madreporite through which water enters the vascular system.

A groove runs the length of each ray on the underside of the sea star. There are dozens of tube feet in each groove; the animal's mouth is located where the grooves converge. Examination with a magnifying glass may reveal at the tip of each ray a tiny eye spot; a light receptor that can give the star limited information about its environment.

BRITTLE STARS are like sea stars in many ways. Both are radially symmetrical and have rays, a central mouth on the underside, and a system of tube feet. Brittle stars, however, have more snake-like rays than sea stars and move more sinuously.

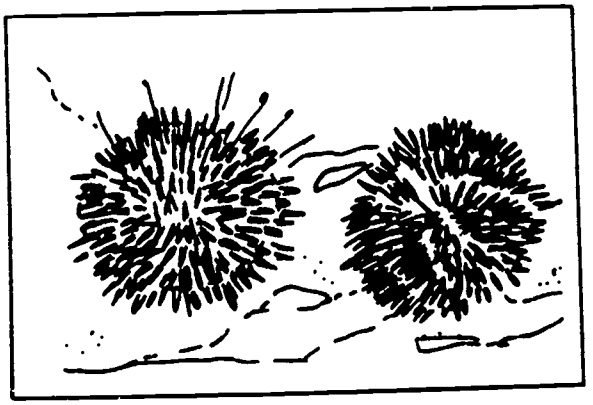


Brittle stars are so named because they readily shed pieces of their rays and even shed the central disc cap. Often these animals are found missing the terminal parts of one or more rays or with distinct areas of color change on rays, which mark the place where a ray has been regrown.

Many brittle star species are nocturnal, hiding under rocks, among kelp holdfasts, or in clusters of other invertebrates by day, and emerging to feed at night. Brittle stars are not often encountered intertidally but may be found tucked in some nook or cranny. Some brittle stars have pouches for carrying eggs at the bases of the rays. Others release their eggs and sperm into the water.

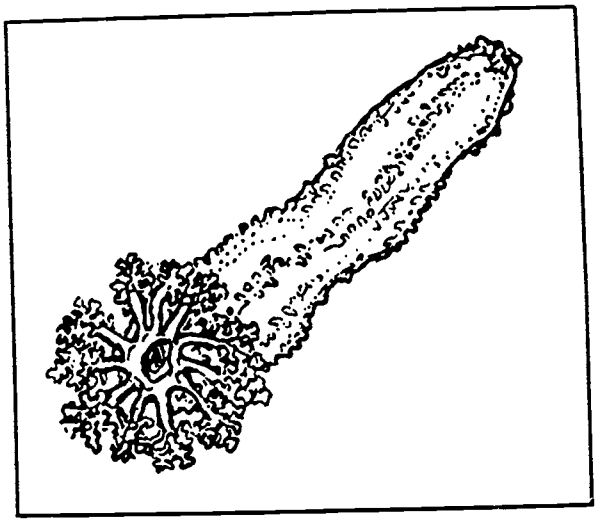
A number of species of brittle stars are found in Alaskan waters. One unique species, the basket star, Gorgonocephalus caryi, has dividing rays that form many tendrils to make it look like the mythical Gorgon's head with its writhing snakes for hair. The flesh-colored basket star lives subtidally and feeds by anchoring itself, then extending tendrils into the current to strain tiny drifting organisms or other food from the passing waters. Although they are not intertidal animals, basket stars are occasionally washed ashore.

Several species of SEA URCHINS live in Alaska's intertidal or shallow waters. Among them, the green urchin, Strongylocentrotus droebachiensis, is the most common. Red urchins, S. franciscanus, and purple urchins, S. purpuratus, may be found on rocky shores exposed to the open ocean.



Sea urchins look like living pin cushions. Externally they are covered with projecting spines, and among the spines are pincers and tube feet.

Like the other echinoderms, sea urchins are radially symmetrical and have a water-vascular system that includes tube feet, connecting canals and a sieve plate. To fully understand them, one must study both a living animal and the shell or "test" of an urchin. The test is a globular structure with a series of large and small knobs on which the spines articulate, and a series of pores through which the tube feet extend. The mouth of the urchin is a complex structure called "Aristotle's lantern." The sieve plate and the openings through which eggs or sperm are released into the open sea are on top of the urchin's test.

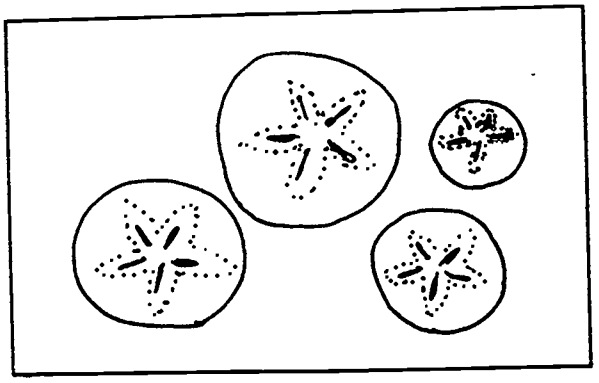


SEA CUCUMBERS, like other echinoderms, are radially symmetrical and have tube feet. Instead of being provided like urchins and sea stars with firm skeletal support, however, the cucumber has greatly reduced plates in the form of tiny "buttons" embedded in its skin. These give the animal its soft, "squishy" quality.

A number of species of sea cucumbers may be found on Alaskan shores. They range in size from the black, tar-spot cucumber (Cucumaria vegae) less than an inch long, to the large, edible Parastichopus californicus that may be more than 12 inches in length.

Some of the sea cucumbers live in crevices, some live under rocks, and some wander over the ocean floor, but most use a mop-like circle of oral tentacles to gather food. Typically, the tentacles extend to feed and are drawn one by one inside the animal and "licked clean" of food particles.

As a protective act when molested, some cucumbers have the peculiar habit of throwing all their internal organs out through the anal opening, or through a rupture in their body wall. Then, within 6-8 weeks, they regrow them.



The SAND DOLLAR is closely related taxonomically and by habits to the sea urchin. Like urchins, sand dollars have rounded, calcareous skeletons called tests. Tube feet are found on both surfaces of the test, and form a star-shaped pattern on the upper surface. Additional tube feet are found on both the upper and lower surfaces. Sand dollars are covered with soft spines, but these are absent from most specimens found on the beach--rubbed off by the surf.

Live sand dollars are usually found partially buried in the sand, where they search for their microscopic food. They use heavy particles (such as bits of gold) to help weigh themselves down, so many people have suggested mining them! If students find live sand dollars, tell them to replace them right side up, as some species can't turn themselves over without the help of the tides.

Vocabulary:

- spine
- tube feet
- sea star
- brittle star
- sea urchin
- sea cucumber
- sand dollar

Materials:

- live sea star
- flashlight
- suction cup
- magnifying lenses or a binocular microscope
- pictures of echinoderms from books or magazines
- clay or Baker's clay (dough)
- toothpicks
- popcorn
- sand
- pipe cleaners
- tempera paint or glaze
- brushes
- blue butcher paper
- felt-tip markers
- worksheets
  - ... Sea Stars (2-BB)
  - ... Sea Star Dot-to-Dot (2-CC)
  - ... Sea Star Cutout (2-DD)
  - ... Sea Urchin (2-EE)
  - ... Sand Dollars (2-FF)
  - ... Sea Cucumber Crossword (2-GG)

Procedure:

1. Sea Stars are the hardiest of the echinoderms and can survive short classroom visits. Obtain a live sea star and keep it cool in the refrigerator when you're not showing it to the children. Ask the children to:

   - count its rays
   - feel its texture (every species feels different)
   - see if they can find its mouth
   - feel the tube feet
   - look in the mouth area and adjacent grooves for the commensal worms that sometimes live there, (doing no harm to the star, but profiting by the easy food gathering)

   Demonstrate how tube feet work by using a suction cup. Mention that instead of having two feet like us, sea stars have hundreds that they must control. Some sea star species feed on clams and other bivalves, and with their tube feet they can apply a steady, pulling pressure on each half of the bivalve's shell, that eventually causes the mollusk's closer muscles to relax. Then the sea star extrudes its stomach between the halves of the shell, through openings as small as 1.0 mm. The star's digestive juices dissolve the bivalve's flesh, and the fluid food is taken in and absorbed by the sea star.

2. Have students look closely at the sea star with magnifying lenses or a binocular microscope. Place the sea star in salt water and shine a flashlight on it. Have students watch for:

   - the tiny eye spot at the end of each ray, which has limited sensory reception.
   - a hard smooth spot on the upper surface of the sea star. (This is the sieve plate--or madreporite--through which water enters and leaves the system so that pressure in the tube feet can be maintained.)
   - soft "fuzz" on the upper surface when the sea star is under water. (These are the "papillae," the respiratory structures that the sea star uses for breathing.)
   - small pinching or grasping structures on the sea star's upper surface. (These scissorlike organs are used to keep the upper surface free of debris and of attaching marine plants and animals like barnacles. They can best be demonstrated by carefully placing a sea star upside down on the back of your lower arm where hair is abundant. After a few minutes, gently pull the sea star upwards and you can feel its tiny pincers! They are too little to do any damage.)

   Be sure to return the sea star to the ocean as soon as possible.

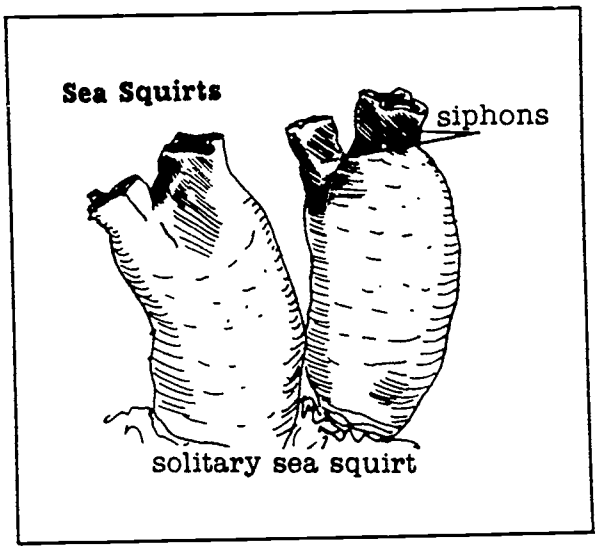
3. Show the students pictures of other echinoderms from books and magazines and discuss how they live and grow. Have students complete the work-

sheets: Sea Stars; Sea Star Dot-to-Dot; Sea Star Cutout; Sea Urchin; Sand Dollars and Sea Cucumber Crossword.

4. Have the children make three-dimensional models of echinoderms with clay or dough. To make:

   Use toothpicks for the sea urchin spines; pipe cleaners for the brittle star legs; sand to make the sea star skin a little rougher; and popcorn on toothpicks for the feeding tentacles of the sea cucumber. The echinoderms can be painted with tempera paint or glaze, depending on whether dough or clay is used. After being baked or fired, they can be displayed on an ocean of blue butcher paper. Use a felt-tip marker to write labels or students' comments beside their models.

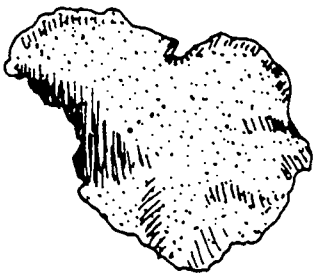
Activity 9
The Chordates



SEA SQUIRTS are primitive chordates. This means they have a notochord, a rod-like structure in the back, as the chief internal skeletal support at some stage of their development. Most chordates are vertebrates. In vertebrates, such as snakes, birds, and humans, a backbone of bone or cartilage segments develops around the notochord during the embryo's development; the notochord itself then generally disappears (it persists in some fishes). Sea squirts only have a notochord in their early, larval stage. In adults, all traces of a spine have disappeared; that is why they are discussed here with the true invertebrates--animals with backbones.

The sea squirts may be translucent or opaque. Tan and orange are common in Alaskan sea squirts, but many other colors are found. Some sea squirts live as solitary animals that may be several inches tall, but others form flat or rounded colonies comprising numerous individuals. Their gelatinous texture helps to distinguish them from sponges.

Each sea squirt has two openings or siphons. Water comes in one siphon and goes out the other. The animal strains out tiny bits of food as the water flows through it. The ability to shoot water out through the siphon gives this animal its common name.



colonial sea squirt

Both solitary and colonial sea squirts often are hosts to various animals such as sponges, mussels, amphipods and small tube worms.

Vocabulary:

- sea squirt
- notochord
- chordate
- vertebrate (review)
- invertebrate (review)

Materials:

- live sea squirt
- pictures of sea squirts from books and magazines
- chalkboard or butcher paper
- chalk or felt-tip marker
- worksheets:
  - ... Sea Squirts (2-HH)
  - ... Five Sea Animals (2-II)

Procedure:

1. Obtain a live sea squirt to show your students. Sea squirts are very common on some Alaskan beaches. Keep your specimen cold in the refrigerator. Let the students touch it and try to describe it.

2. Show students pictures of sea squirts from books and magazines.

3. Have the children complete the worksheet Sea Squirts.

4. Make a class chart on the chalkboard or on a sheet of butcher paper comparing sea squirts with the true invertebrates studied in this unit, using categories such as:

   is larger than

   is smaller than

   is softer than

   has more legs than

   is more colorful than

   is heavier than

   has more tube feet than

   moves faster than

   has a bigger mouth than

   has a smaller shell than

5. Have students complete the worksheet Five Sea Animals as a further review of the animals they have been studying.

Unit Three
Beach Field Studies

Objectives:

To help the student:

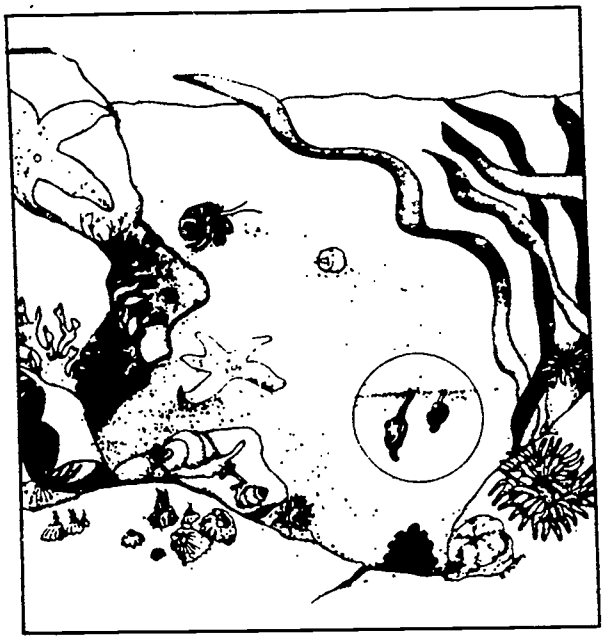
- Learn that tides go in and out (Activities 1 and 2).
- Practice safety procedures to avoid being caught by the tide (Activity 1).
- Dramatize the differences in beach creatures' behavior at high and low tide (Activities 1 and 2).
- Develop an awareness of proper care and respect for beach animals and their habitats (Activities 1 and 2).
- Take a trip to the beach to explore pebbles, rocks, sand, seaweed, beach animals, sea sounds, and the sea itself (Activity 2).
- Practice basic number concepts through counting barnacles, waves, pieces of driftwood, etc. (Activity 2).
- Go on a beach treasure hunt and play beach games (Activity 2).
- Create beach sculptures, a diorama and gifts from beach objects (Activities 2 and 3).
- Sort and graph beach treasures (Activities 2 and 3).
- Compose and sing sea songs; write and illustrate sea stories (Activity 3).

UNIT THREE: Beach Field studies. The excitement generated by a trip to the beach can be maintained with follow-up studies in the classroom.

Alaskan beaches are incredibly varied and fascinating. They range from jumbled boulders packed with invertebrates to mud flats or wind-swept sand, where only occasional invertebrates wash in with the tide.

Your students can be real explorers because very little is known about Alaska's coastline. Focus on the sea creatures (invertebrates, fishes, birds, marine mammals) and the roles they play in the total beach ecosystem. Include seaweed, plants, driftwood, sand, mud, pebbles, boulders, waves and currents in your studies. Follow-up activities are included here and in the fish and marine mammals units later in the book.

Activity 1
When the Tide Comes In



Background:

Tides, caused by the gravitational pull of the moon and sun on the oceans, are an intriguing and important factor of life along the coast.

The tide helps to shape the beach as it brings in waves and currents that move the sand, mud and rocks. It also has a tremendous effect on intertidal animals. Plankton comes drifting in with the tide to supply the many filter-feeding animals with nutrients. In order to survive in the intertidal zone, animals need to be extremely hardy: waves come crashing in; the hot sun dries the animals out; fresh water rain lowers the salinity level of the ocean; ice and freezing winter temperatures make life difficult; and pollutants often reach this area first because of waves and onshore currents.

Research by Gloria Snively at the University of British Columbia in Vancouver has shown that students, who generally see seashore animals stationary and closed up tight at low tide, often don't realize that they are alive and worthy of protection from rubber-booted feet. In order to help the children to realize that these are living animals and to better understand how they function in their habitats, have them act out the animals' behavior at high and low tide.

Another aspect of tides worth stressing is their inherent danger. Along with other elements of beach safety, students should be taught to take care not to get stranded by a high tide.

Vocabulary:

- tide
- tidepool
- conservation
- safety
- danger

Materials:

- local tide table
- yarn, string or streamers
- crayons
- worksheets:
- ... High Tide or Low Tide? (3-A)
- ... Tide (3-B)
- objects from the beach
- paper bags
- beach mural

Procedure:

1. Ask the students to tell you what they know about tides. Talk about the tides moving in. What happens to all the animals on the beach at low tide? (They pull in to try to keep moist--and to protect themselves from being eaten.) What happens at high tide? (They come out and feed and hang on tightly so that the waves won't wash them away.) Use the High Tide, Low Tide worksheet (adapted from Project Orca, Pacific Science Center, Seattle, Washington). Explain to the class that they may be able to see how these animals look at high tide by watching a tidepool. Fish, too, are frequently caught in tidepools, and birds often wait until the tide goes out for their daily feast.

2. Now have the class dramatize these creatures by pretending to be sea anemones, hermit crabs, barnacles (stand on your head and kick your feet), sea stars, sea urchins and others at high and low tide. One child can be a fish dashing to and fro in a tidepool. Now a gull, flying about, spies the fish. Does he catch it?

3. This is a good time to ask the children how they can help take care of these animals when they go to the beach. Children will seem like giants to the small shore animals. With the students' help, make a list of rules. You might include: stepping softly; handling any animals carefully and gently; turning rocks back over (keeping the roof on); filling in mud holes (if you dig for clams) so as not to hurt the animals "next door"; and not taking live animals away from their beach homes. Talk about "conservation"--the wise use of the

beach--and about leaving the beach cleaner than you found it. It is likely that the students will be more responsible at the beach for having helped to make the rules.

4. Talk about the power of the tide. What might happen if someone walked far out on a mud flat and the tide started to come in? Use the Tide worksheet. Have the children color the picture at low tide "when the water is all the way out." Have them draw pictures of themselves on the beach looking at sea creatures. Then, using a blue crayon or pencil, lightly color in the water to where it would be at high tide. What would happen to their lunch? What would happen if the students had been playing at the base of a cliff?

5. Have students pretend that they are on the beach digging clams when the tide comes in, surrounding them with water. What should they do? (Call for help, blow a whistle, wave a scarf--use a stick or clam shovel to feel cautiously shoreward through the water.)

6. If you have a beach mural in your room, hang string or crepe paper across it. Use a tide table to move the string up and down your beach each day to aid the children in understanding tide movements.

7. Invite students to bring in treasures they found at the beach at low tide. Place the objects in brown paper bags and ask the children to take turns reaching inside, feeling and describing their finds.

Activity 2
Beach Field Trip

Background:

The most important part of Sea Week is giving children a chance to explore and discover sea creatures on their own. For areas with meager tidepool life, take a look at some outstanding features of the beach (waves, currents, sand, pebbles, beach formation) and at the birds, fish, marine mammals, seaweeds and shoreline plants. And watch out for that occasional jellyfish or sea star coming in with the tide.

An inland class can create its own beach on the classroom walls or in the hallways. Older students may want to prepare a beach for the younger ones, who can use animal cutouts and their imaginations to make the beach come alive.

To prepare for your field trip:

a. Select a time and place. Local people knowledgeable about the area can help you decide. (Low tide would be best in the southern and

southeastern portions of the state that are affected by tide. Northwestern and northern Alaska have a tide of only six inches, which is affected by the wind and currents so that it is barely noticeable.)

b. Invite one of these local experts to go with you. They'll be pleased to be asked, and will enjoy the day, too. But don't hesitate to go by yourself, if necessary. You don't need to be an authority on beach life to lead a field trip. Learn with the children!

c. Write a letter to parents asking for permission form signatures and for their assistance with the field trip. High school students and bilingual or special education staff may also be able to help. Small groups with a ratio of one adult to five students are ideal.

d. Plan your field trip time to include plenty of discovery time, structured learning activities, a snack or lunch, litter pickup, and a review of the day's activities. A beach book or checklist can be very useful (see My Beach Book, worksheet 3-C).

e. Discuss your field trip plans with the group leaders, ideally visiting the beach ahead of time. Stress the importance of disturbing the animals as little as possible.

f. Prepare the students for the field trip by discussing what they're likely to see and by developing observation skills and safety and conservation rules as a class. Limit collecting to material for art and science projects. Overly enthusiastic gathering could quickly strip our beaches of their more intriguing life forms!

g. Plan your beach follow-up (see Activity 3 in this unit.)

h. Enjoy the trip! It will probably be the highlight of the year for your students.

Materials:

- beach
- several clear plastic shoe boxes, other clear containers or heavy-duty plastic bags
- task cards for volunteer helpers
- hand lenses
- student name tags
- coat hangers
- snack
- paper bags for each group of students for the treasure hunt
- worksheet: ... My Beach Book (3-C)

1. Give students their Beach Book worksheets. Go over safety and beach rules.

2. When you first arrive, place a stick at the edge of the water as a marker. Ask students if the tide is moving in or out. How can they tell? (Check the marker after a few minutes. If the tide is coming in it will be starting to cover the marker. If the tide is going out, it will move away from the marker--and the beach will be soaked above the waterline.)

Ask them to find the highest point reached by the waves within the past day and night. Can they determine the highest spot the water has reached this spring (or fall)? Have the class guess where the water will be when you leave. Check your marker at lunch time and at the end of the day. See who guessed the closest.

3. After students have had some time for general exploration, have your volunteers help them with the task cards. The children can take turns choosing them. Pick out the cards most applicable to your area. You may want to use some of the task card ideas informally and to make up some tasks of your own. It's best to observe the animals in their natural surroundings, but if no tidepools are present, set them briefly in a clear plastic box or plastic bag of salt water so that the children can observe them closely under high tide conditions.

Task Cards

SEA CREATURE

Decide on a sea creature to make from sand or mud. Then make it!

BEACH CRIME

Look for evidence of a beach mystery. If you find a clamshell that's broken open--who dun it? If you find trash on the beach, or holes bored in a wooden dock--who dun it? Decide how the crime happened and how long ago, who the villain was and how it could have been prevented.

DIG, DIG, DIG

Dig a hole one foot deep. Collect everything you find in a pile. What living things did you find? What non-living things? Cover up your hole so as not to disturb the animals next door. (Limit this to one or two holes, so that you don't disturb the whole beach!)

SEA ANEMONE SPECIAL

Find a sea anemone and gently touch its tentacles. What happens? Feed it a bit of food (bread, mussel, clam) and watch what happens. How many anemones, of how many colors, can you find?

SHELL FIND

Have the children find as many kinds of shells as they can in three minutes. How many are univalves? How many are bivalves? Leave the shells on the beach for other children to find.

SEA STAR PINCH

Find a sea star and place it upside down on the lower arm of one of the students for several minutes. What happens when the sea star is drawn away? (If the sea star has pincers, children will feel its tiny pinches when it is drawn away. The pincers are used to clean debris off the star's top surface.)

BEAUTY CONTEST

Pretend you are judges at the International Tidepool Beauty Contest. Pick the first, second, and third place winners. Also pick the last place contestant - but don't hurt the critter's feelings by telling him or her the results!

1st _____
2nd _____
3rd _____
LAST _____

CLAM DIG

Dig up a clam and set it back down on the sand or mud. Watch it for a while. How long does it take to start burrowing back into the sand? How does it move? (Be sure to refill any clam holes you dig!)

EXPLORE A ROCK

Stand in front of a rock face. Close your eyes. Reach slowly up, down and sideways with your hands. Think about everything you feel, taking time to explore the area slowly and completely. Are there changes in texture, moisture, slope? Describe to others how the rocks felt and what you thought about as your hands explored them.

SAND SIFT

Sit in a sandy area and close your eyes. Run your fingers through the sand. Is it dry or wet? Are the particles all the same size or are they different sizes? Do you feel any larger objects? Are they living or non-living? Can you describe them with your eyes closed?

SEA SOUNDS

Sit by the shore with your eyes closed. What do you hear? Is the sea silent or noisy? Do sea sounds come and go or are they continuous? How would you describe the sound of the sea? Do birds add their sounds? Guess what kinds of birds you are hearing. Can you imitate them?

BAREFOOT

If the day is warm, walk barefoot in the sand or on the warm rocks. Describe how it feels.

TASTE TREATS

If your beach site is free from polluting influences, taste the sea. Is it really salty? With someone along who knows local marine life, taste sea lettuce, raw sea urchin eggs, or edible land plants that grow at the edge of the sea. Describe how each tastes.

BARNACLE FEED

Find barnacles in a tidepool and watch them eat. Can you stick your tongue out and back as fast they can?

WORM SQUIGGLE

Find a worm. What is it doing? Squiggle your body like the worm does!

MUSCLE UP

Find a blue mussel. Can you see the golden threads it makes so that it can hang on to rocks? Show your muscle. How do you hang on to rocks?

CRAB WALK

Practice a crab walk, using your hands and feet and facing upward. Now try making just your hands walk like a crab. Cross them at the wrists and move your fingers as if you were walking forward, backward, and sideways. See how the fingers of one hand pull and those of the other hand push--just the way a crab moves.

SHELL SOUNDS

Find a large shell. Hold it up to your ear. Can you hear the ocean?

SNAIL RACE

Find some snails and have a snail race. Now find a friend and have your own snail race. How fast can you crawl?

CRAB MOLT

Look for an empty crab shell. Did the crab die or did it merely shed its shell (molt) so that it could grow a bigger one? (If it shed its shell there will be a slit-like opening where it backed out. Save some crab shell parts for later studies in your classroom.)

WORM TOUCH

Touch a feather duster (tube) worm. What happens?

HERMIT CRAB WALK

Hold a hermit crab gently in your hand. See if you can hold it still enough for it to come out.

PEBBLE FIND

Find two beach pebbles exactly the same size. Find a flat pebble. Find a round one and a square one.

BARNACLE SOUNDS

Listen to the barnacles. Can you hear them?

SEAWEED SMELLS

Pick up some seaweed and smell it. What does your nose tell you?

SAND HOPPER SWIM

See if you can find a sand hopper in some seaweed. Put it in the water and watch it swim.

BEACH COUNT

Count the number of waves. How many clouds are in the sky? How many pieces of driftwood are on the beach? How many barnacles? How many grains of sand?

SEA STAR SEARCH

How many sea stars can you find? What colors are they? How many arms do they have? Touch their tube feet. (Don't force them if they're hanging on real tight!)

CUCUMBER TOUCH

Touch a sea cucumber. Run your fingers along its side. Can you find its five rows of tube feet?

URCHIN WATCH

Find a sea urchin. Put it in a tidepool and see if you can see its spines move. Can you see its tube feet sticking up and waving around?

SPONGE UP

Find a sponge. Touch it gently and leave it where it is. Can you find the little holes letting water in and out?

DRIFTWOOD DRIFT

Have everyone find a piece of driftwood. Toss the wood in the water as far as you can. Which way do your floats go? Why? (If you can get them out far enough, you might be able to see the effects of the longshore current.)

MARINE MAMMAL SIGNS

Do you see any signs that whales, walrus, seals, sea lions, sea otters or polar bears live in the ocean by your beach? Which kind of marine mammal do you think came by your beach most recently? What was it doing?

ROCK MYSTERY

Find a rock on the beach. Turn it over carefully. What's underneath? Put your hand there. How does it feel? Now put your hand on the sand next to the rock. How does that feel? Do you know why some animals live under rocks? Now put the rock back carefully.

WIND WATCH

Which way is the wind blowing? Wet your finger and hold it up in the wind to help you decide. What other signs can you use to tell which way the wind is blowing?

DRIFTWOOD STORY

Find a piece of driftwood. Look closely at it and try to figure out where it came from. How many sea creatures have watched this piece of wood going by? Tell us a story about your piece of driftwood.

FISH FIND

Can you catch a little fish? If you can, tell what shape it is. Why is it that particular shape? Put it in a container and watch it swim. How many fins does it have? Does it open and close its mouth? How does it breathe? (through its gills). Give a name to your fish. Then say goodbye and put it back in its home.

SAND TRACKS

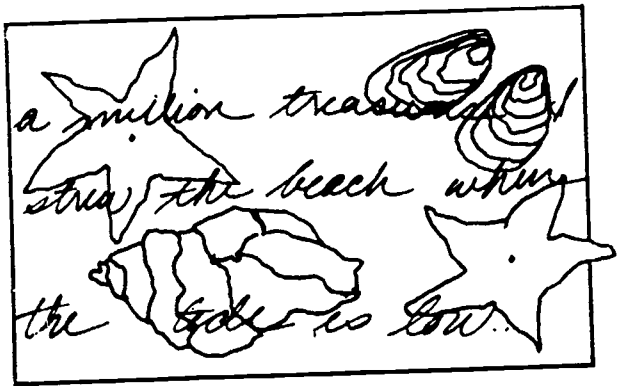
Find some tracks in the sand. Who made them? What was the animal doing when it made the tracks? Make some tracks of your own and see if your friends can tell what you were doing from looking at your tracks.

4. Collect a sand sample for the class to look at later under magnifying glasses or the binocular scope.

5. Do an "initial find." Have each student trace the outline of her first initial on the beach with a stick or pencil. With a flat stick or spoon scoop out everything within the boundaries of the initial to a depth of ½ inch. Have the children record their finds--and then replace any tiny creatures found. (Contributed by Gerry Young, University Park Elementary, Fairbanks.)

6. Snack time. Children may need to build up energy or stand by a beach fire if it is cold or rainy.

7. Have a treasure hunt. The group leaders can check off items as the students find them so that they don't have to remove living things from their habitats. Sample items:
   - black snail shell
   - all the litter you can find
   - dry sand
   - something brown
   - something red
   - something with spines
   - green plant
   - dried up plant
   - clam shell
   - feather
   - driftwood



Give each group of students a paper bag with the list taped onto it. Keep the litter to discard afterwards!

8. Have the class dramatize beach life. Practice being:
   - crabs scurrying across the sand
   - eagles soaring
   - gulls swooping over the ocean
   - waves coming in
   - anemones at low and high tide
   - sea stars eating blue mussels
   - hermit crabs moving to a new shell
   - seaweed waving in the ocean

   Then put it all together as a dramatic scene and create a sea symphony with all the beach sounds!

9. Play a game of Clam, Clam, Chowder or Fish, Fish, Gull along the lines of Duck, Duck, Goose: The students sit in a circle and one walks around, tapping each child's head and saying, "Clam, Clam, Clam... Chowder!" At the call of "Chowder," the child caller and the student tapped as "Chowder" race around the circle back to "Chowder's" seat. The loser sits in the center of the circle until replaced by another child, and the winner becomes "It" for the next round.

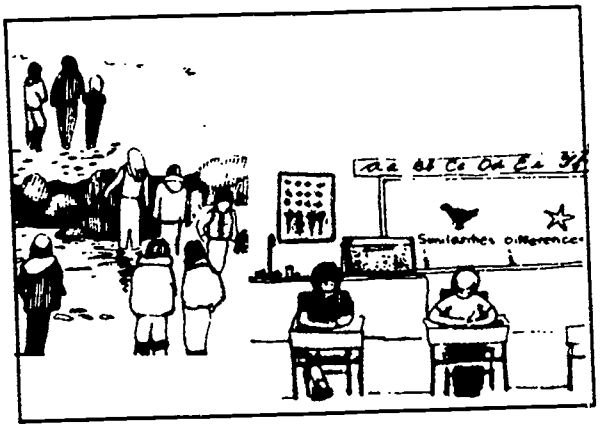
10. Have races in which students mimic different seashore animals: clams, crabs, octopi, anemones, limpets, hermit crabs, sea urchins, jellyfish, worms, beach hoppers, gulls, fish.

11. Limit each child to one treasure (non-living) as a remembrance of the day (save a few for absent children). Plan follow-up art activities before you go to the beach, and collect as a class any materials you will need. Try not to take scarce items.

12. End the day with a review of what the class has seen and learned. Stand in a circle and have the children take turns saying what they liked best about the beach.

13. Sing a few sea songs on the way home.

Activity 3
Home from the Beach



Background:

The beach visit works as a tremendous motivator, and after the field trip is an ideal time to capture the enthusiasm so that the students can work on their reading, writing, mathematics, social studies and artistic skills. Activities should depend on what you found at the beach and what the children are most excited about.

Materials:

- paper
- pencils
- crayons
- magnifying lens or binocular microscope and light
- glue
- beach treasures (one each)

Procedure:

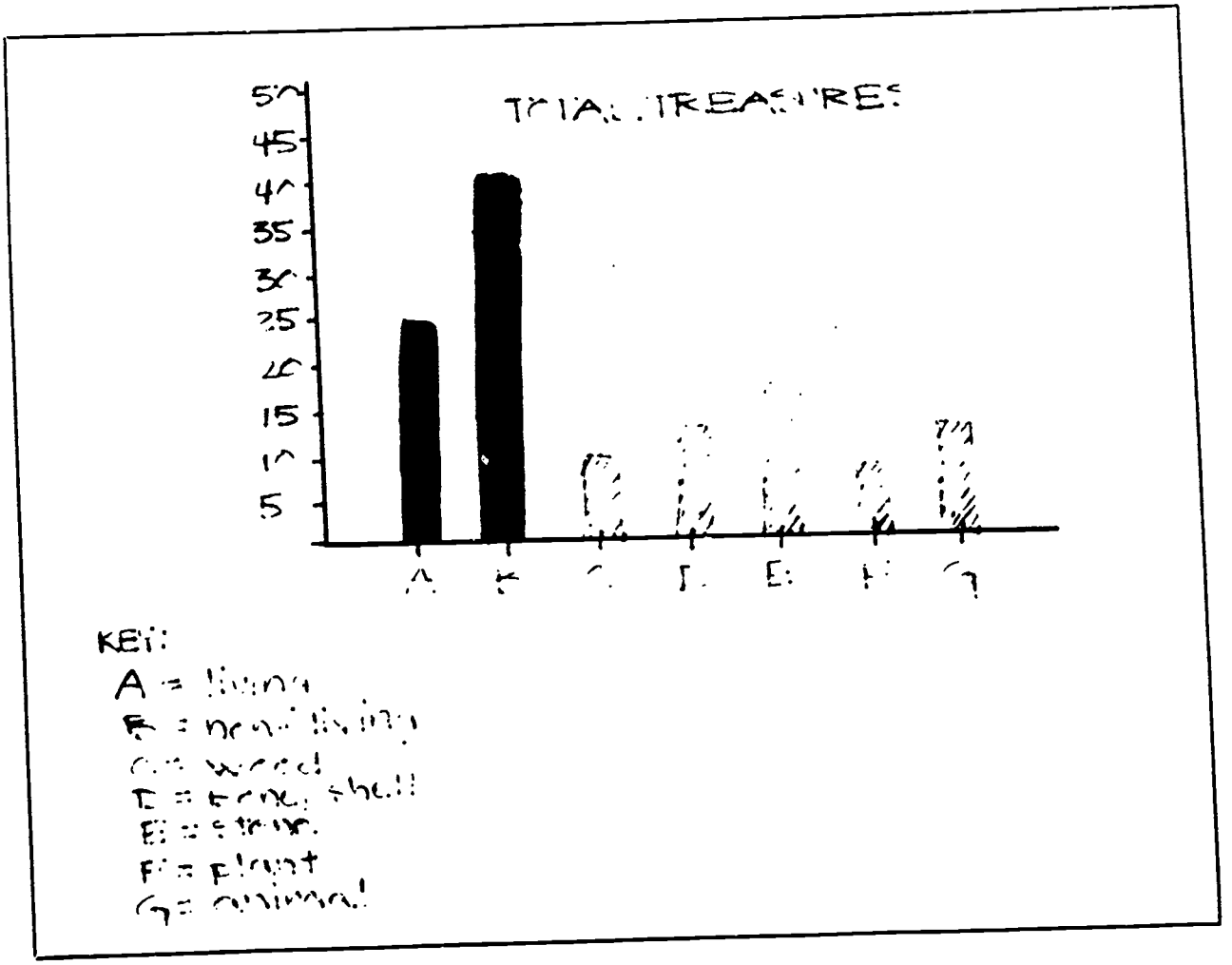
1. Ask the children to remember their day at the beach. What did they see, feel, taste, smell, hear? Have them draw pictures and write words or sentences to tell what they liked best. What did they like least? Would they like to go again?

2. Examine your beach treasures. Have students empty their finds onto a large piece of paper. Tell them to sort the items into groups for a few minutes, then talk with them about these groups for about five minutes.

   Return to sorting for another 10 minutes. The students may set groups up by size, color, composition (stone, stick, bone), shape, whether living or non-living, whether animal or plant, and other categories.

3. Make a bar graph of the beach treasures.

4. Have the students further evaluate the treasures by telling why a particular item should be on the beach, how it affects others around it (does it offer shelter or create a sand dune?) or how it might be used by humans, birds or sea creatures. Use magnifying lenses or a binocular microscope to look at colors and textures. Look at beach sand under magnification. If you have any sand samples from other beaches, let the students compare them. Explain that the combination of rocks ground down to form sand is different everywhere. (Contributed by Gerry Young, University Park Elementary, Fairbanks.)



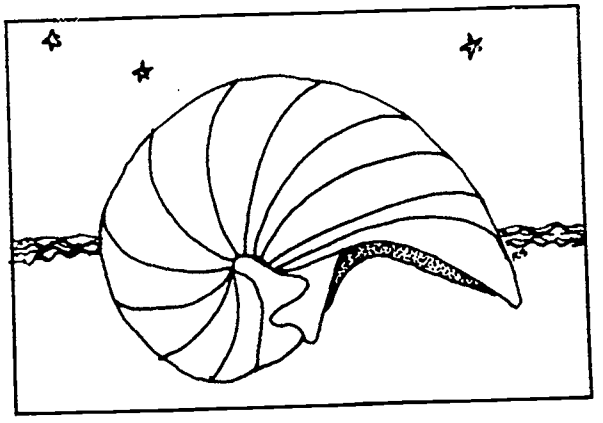
5. Discuss the tidepool beauty contest (on one of the task cards). Tally the first place contestants in the various groups, then the last place contestants. Ask the students how they made their last place choices. If the first and last place contestants ran off and got married, they would probably have some strange-looking offspring. Draw a picture of one of their children.

6. Out of shoe boxes or heavy construction paper make sea life dioramas of your day at the beach. (Contributed by Carol Deitz, Paul Banks Elementary, Homer.)

7. Make a present for someone in your family. Use driftwood, bark or cardboard for a base. Place some of your beach finds (shells, crab shells, pebbles, dried seaweed, driftwood) on the base until you have an arrangement you like; then glue the objects into place.

8. Make up an ocean song. Using the poem "Over in the Meadow" by Olie A. Wadsworth, write verses using the names of sea animals for "Over in the Ocean" or "Over by the Seashore." Each student can make a page to illustrate one of the verses. Then combine the pages into a class book. See example on next page.

9. For another kind of class book: Ask students to draw and color pictures of their favorite sea animals. These pictures can be incorporated into a book along with a map of the beach and a description of the shore, of your trip, and of the treasures you found.



Over in the Ocean

by Baranof Elementary School Students,
Sarah Jordan, Music Teacher

Over in the ocean, where the dolphins have fun,
Lived an old mother whale and her little calf one.
"Blow," said the mother, "We blow," said the one.
So they blew and were glad where the dolphins have fun.

Over in the ocean where the eelgrass grew,
Lived an old mother limpet and her little limpets two.
Crawl," said the mother. "We crawl," said the two.
So they crawled and were glad where the eelgrass grew.

Over in the ocean where the tide runs free,
Lived an old mother mussel and her little mussels three.
"Stick," said the mother. "We stick," said the three.
So they stuck and were glad where the tide runs free.

Over in the ocean on the ocean floor,
Lived an old mother hermit crab, and her little crabs four.
"Pinch," said the mother. "We pinch," said the four.
So they pinched and were glad on the ocean floor.

Over by the shore where the wild grasses thrive
Lived an old mother goose and her little goslings five.
"Honk," said the mother. "We honk," said the five.
So they honked and were glad where the wild grasses thrive.

Over by the shore where the children throw sticks
Lived an old mother halibut and her little halibut six.
"Hide," said the mother. "we hide," said the six.
So they hid and were glad where the children throw sticks.

Over in the ocean as high as heaven,
Lived an old mother seagull and her little gulls seven.
"Glide," said the mother. "We glide," said the seven.
So they glided and were glad as high as heaven.

Over in the ocean where the king salmon ate,
Lived an old mother sea urchin and her little urchins eight.
"Poke," said the mother. "We poke," said the eight.
So they poked and were glad where the king salmon ate.

Over in the ocean where the water and rocks shine,
Lived an old mother shrimp and her little shrimp nine.
"Paddle," said the mother. "We paddle," said the nine.
They paddled and were glad where the water and rocks shine.

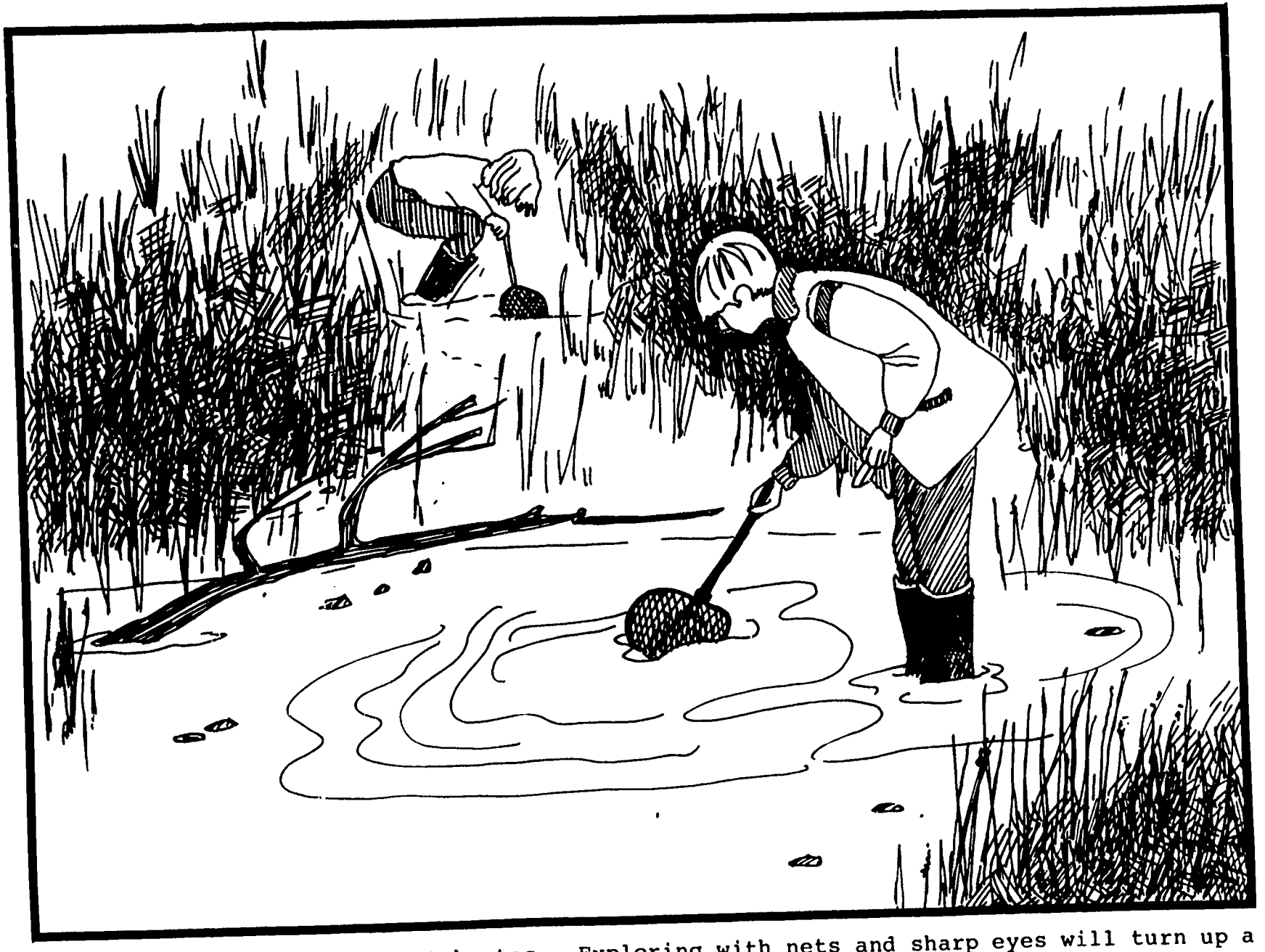
Over in the ocean with some diving men
Lived an old mother duck and her little ducklings ten.
"Quack," said the mother. "We quack", said the ten.
So they quacked and were glad with the diving men.

Unit Four
Freshwater Invertebrates

Objectives:

To enable students to:

- Make a mural of pond or stream life (Activity 1).
- Use the invertebrate worksheets to improve counting and coloring skills (Activity 1).
- List basic needs for living things (Activity 1).
- Explain how organisms change with the seasons (Activity 1 and 2).
- Recognize and investigate freshwater invertebrates including worms, leeches, clams, snails, amphipods and insects (Activities 1 and 2).
- Practice wetland safety procedures (Activity 2).
- Go on a wetland treasure hunt (Activity 2).
- Sing songs, play games, and have wetland animal races (Activity 2).
- Search for wetland pollution and discuss solutions (Activities 2 and 3).
- Assist in making a model freshwater wetland (Activity 3).
- Compare freshwater and saltwater environments (Activity 3).



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UNIT FOUR: Freshwater Invertebrates. Exploring with nets and sharp eyes will turn up a variety of invertebrate species in any healthy pond or stream and will afford an opportunity to learn about the interdependence of life forms in wetland habitat.

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Children are fascinated by water, and a pond teeming with life is ideal for exploring. Ponds are an important component of wetland habitat, supporting a diverse animal and plant population--everything from moose to waterlilies, from ducks to dragonflies. Wetlands are areas where the ground is wet at least part of the year. They support plants and animals that prefer wet soil. Marshes, rivers, lakes, ponds, streams, wet tundra, barrier islands, river deltas, tidelands, muskegs and bogs are all types of wetlands.

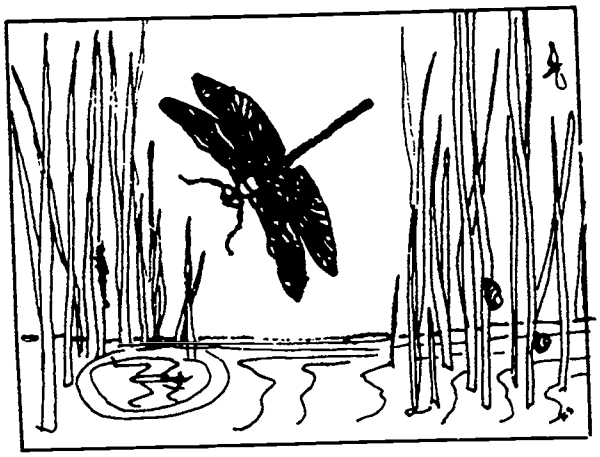
Critical for fish and wildlife survival, wetlands provide recreation as well as water and food for humankind. They act as natural storm buffers, helping to prevent flooding by soaking up heavy rains. Wetlands also filter out pollution (within limits!) and are abundant sources of such edibles as fish, birds, crabs, shrimp, clams, moose, caribou, berries, and other plants.

If ponds are not available in your area, substitute a nearby stream for your field studies. Stream animals are accustomed to a high level of oxygen because of the cool, moving water in which they live. Use an air pump if you keep them in an aquarium to ensure that they get enough oxygen.

The following activities will help your students to explore a local pond or stream. It may be enough for many of them to learn basic information such as the fact that "bugs live in water." But plenty of background on freshwater invertebrates has been included for you to refer to if your class wants additional information on a particular animal. This is an opportunity for them to use all their senses in the enjoyment of a still or running water environment.

Because their natural habitat is standing water, the smaller pond critters are particularly well suited for freshwater aquariums. With care, they can be kept for a long time.

Activity 1
What Lives in a Pond?



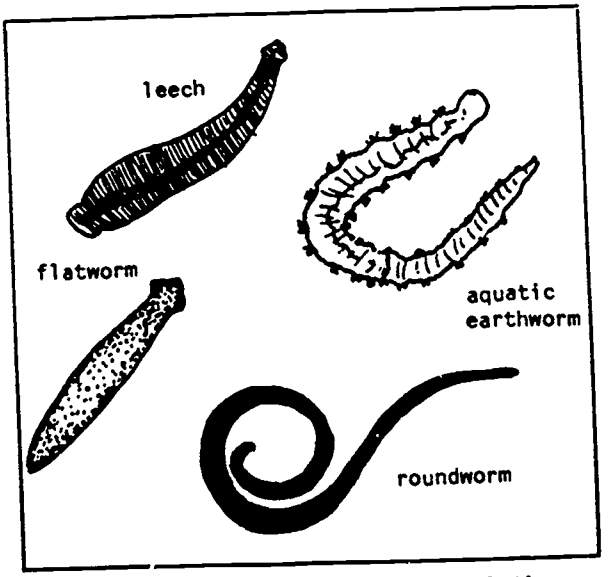
Background:

Many invertebrates live in freshwater ponds. Sometimes you can even find sponges and tiny jellyfish--but they're not very common. There are lots of worms, however. Most freshwater flatworms (Platyhelminthes) are parasitic. Tapeworms and flukes inhabit the food canals of fish and animals. The free-living freshwater forms that you are likely to find in ponds are planarians. Generally about one centimeter (½ inch) long, flatworms are grey or black and avoid light in the daytime. They can be found on the undersides of stones, leaves or other debris.

Roundworms (Nematoda) usually are abundant in bottom mud, sand or debris. Less than one-half inch long, they are noticeable because of their constant whip-like, S-shaped thrashing.

Aquatic earthworms and leeches are the two main groups of freshwater segmented worms (Annelida). These worms are common in the mud and debris of stagnant ponds, streams and lakes, and common as well in non-stagnant water. Aquatic earthworms look very similar to the land varieties. They digest bottom muds and organic material. Some varieties build little tubes and bury their heads in the mud while their tails wave above, creating a current that draws oxygen or food into the tubes.

Leeches often are abundant in calm, shallow, warm bodies of water whose bottoms are cluttered with debris. Most are predators and scavengers, although only a few species suck blood from warm-blooded animals. Leeches have head and tail suckers, are often brightly colored, and change shape rapidly by stretching or shortening their muscles. Historically, leeches were used by doctors to heal the sick by removing "bad blood."

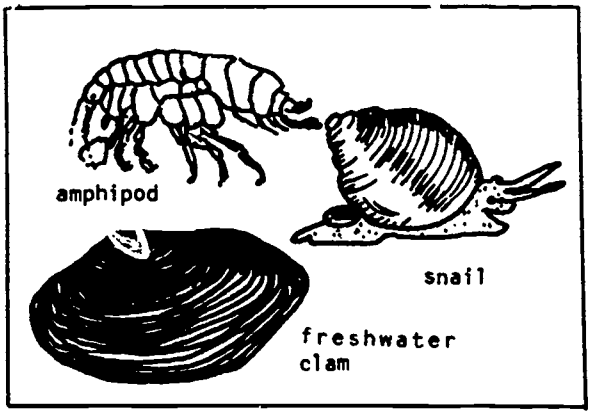


Like their saltwater relatives, freshwater mollusks are soft-bodied invertebrates covered by a hard shell including univalves, such as snails, and bivalves, such as mussels. (Further information is available on mollusks in Unit One: saltwater invertebrates. Their life history and general information sections apply to this unit as well.)

Snails are most frequently found in ponds and streams, but are also present in lakes and rivers. Freshwater snails are herbaceous, grazing on plant stems to scrape off the algae. Some snails have gills, which are protected by a lidlike structure called the "operculum"; others breathe with a lung sac.

Although they are sometimes referred to as "clams," all freshwater bivalves are true mussels. In Alaska, you may find tiny fingernail "clams" as well as larger ones up to six inches long.

Alaska's ponds and streams are rich in freshwater crustaceans. Members of the crustacean group have many legs and a hardened outer shell. Small tundra ponds or spring breakup puddles are often packed with tiny fairy shrimp or tadpole shrimp. Amphipods like the sand flea, which have one set of feet for walking or jumping and one set for swimming, are quite common.

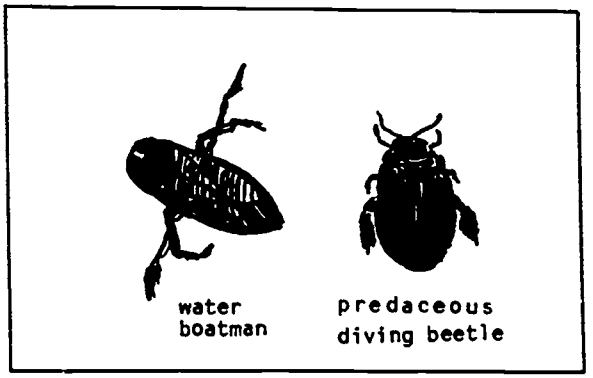


Insects inhabit fresh water both as adults and as young nymphs or larvae. Among the most successful life forms on earth, insects live even in arctic snow and ice. They are extremely rare in the oceans, however; so we have no saltwater examples with which we can compare our freshwater species.

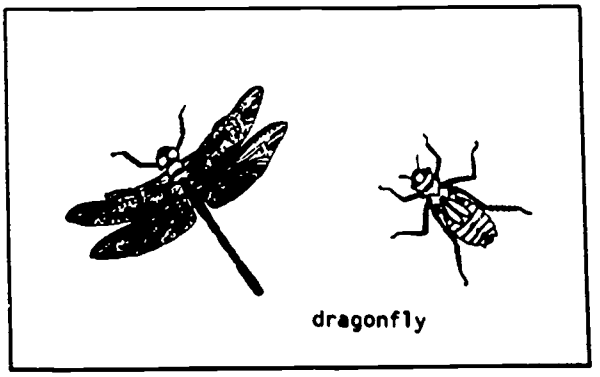
Each adult insect has a body segmented in three parts, six legs, a hard outer covering and (as adults) wings. Immature insects are more variable. Some resemble worms; others look much like adult insects.

The topic of insects is covered in detail in Volume Three of the Sea Week Curriculum Series, with pictures and brief description of some of the common insects that your students might find in ponds.

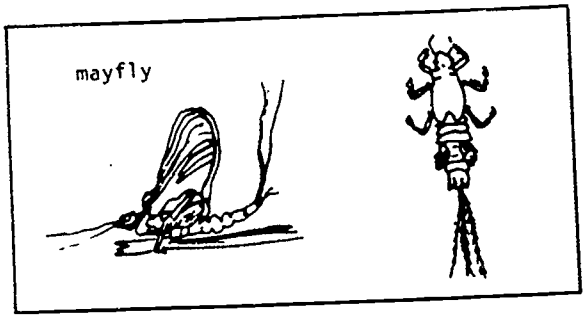
The water boatman is a great swimmer. It dives down, its body wrapped in a blanket of air, and anchors one claw of its middle leg onto a plant stem. There it can feed upon diatoms and algae.



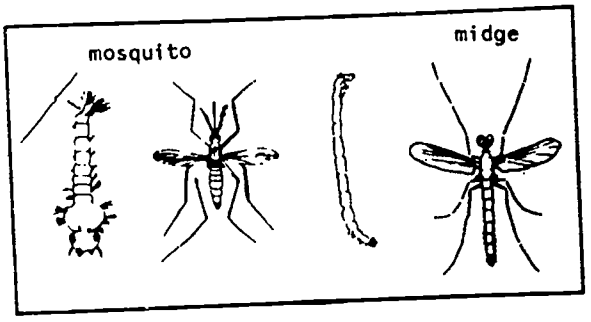
Dragonflies and predaceous diving beetles, both adults and young, are ferocious predators, eating anything they can catch!



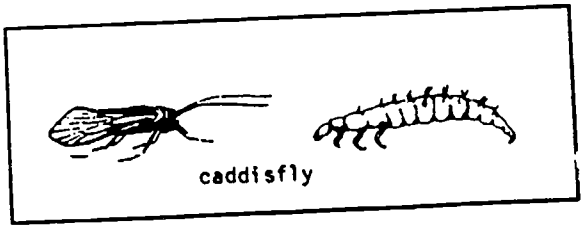
Mayflies are excellent fish food both as nymphs and as adults. They spend most of their lives as nymphs and only a few hours or, at most, a few days, as adults. The ephemeral adults don't eat. They mate and lay their eggs, then die on the water's surface becoming food for eager fishes.



Mosquitoes are all too well known to Alaskans. Adult midges are similar in appearance to mosquito adults, but most of them don't bite. Mosquito larvae (wrigglers) float on the water's surface; and midge larvae (bright red worms) are found in bottom muds.



Caddis fly larvae are interesting because most build homes out of sand grains, bark or vegetation. Caddis fly adults look like moths because their wings are folded similarly--like a tent over their backs.



Vocabulary:

- wetland
- flatworm
- roundworm
- segmented worm
- mollusk
- crustacean
- insect
- boatman
- dragonfly
- predaceous diving beetle
- mayfly
- mosquito
- midge
- caddis fly larvae

Materials:

- pictures of Alaskan wetlands (marshes, muskegs, tidelands and tundra with their ponds and streams, animals and plants) from magazines,
- postcards, books, slides
- chalkboard or butcher paper
- chalk or felt-tip markers
- scissors
- paste
- crayons
- paper
- worksheets:
  - ... Make Your Own Wetland (4-A)
  - ... Leeches (4-B)
  - ... Snails (4-C)
  - ... Insects (4-D)
  - ... Invertebrate Cut Out (4-E)
  - ... Freshwater Life (4-F)

Procedure:

1. Introduce the idea of wetlands. Ask the students about places nearby where they can get their feet wet. Where are local ponds and streams? What animals and plants would they find in them? Show the students pictures of Alaskan wetlands.

How do they change with the seasons?

2. Review the needs of all living things (food, water, shelter) and discuss:

   a. How living things grow and change.
   b. The different elements of nature (plants, animals, soil, water, air, and energy) and why all are necessary.
   c. What "habitat" is: an animal or plant's home.

3. Make a large class mural of one of your nearby wetlands with its accompanying ponds and streams on butcher paper or chalkboard. Include appropriate plants and animals.

4. Do worksheets: Make Your Own Wetlands; Leeches; Snails; Insects; Invertebrate Color, Cut Out and Paste; and Freshwater Life. The students will need scissors, paste, crayons, and extra paper.

5. Share this poem with your students, and invite them to write poems of their own.

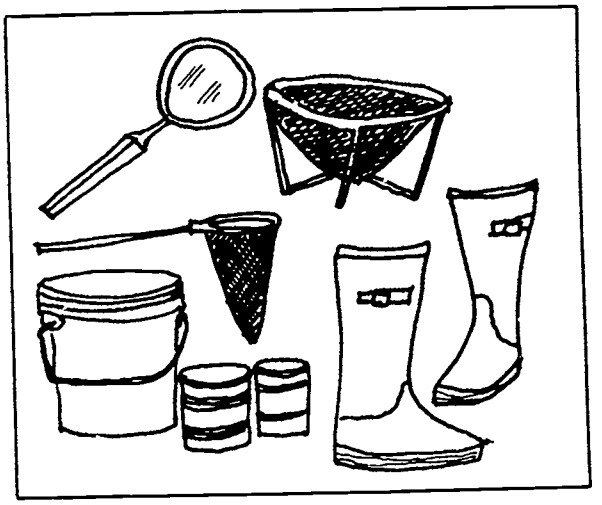
SNAIL

Snail upon the wall,
Have you got at all
Anything to tell
About your shell?

Only this, my child--
When the wind is wild,
Or when the sun is hot
It's all I've got.

John Drinkwater

Activity 2
Visiting a Pond or Stream



Background:

Ponds can be described simply as shallow, quiet bodies of water with aquatic plants growing across them. There are millions of ponds in Alaska. If you're lucky enough to have a pond near your school, you may want to visit it several times during the year. Go to a stream if a pond is not available. If you can arrange only one trip, be sure to check the later units on amphibians and freshwater mammals beforehand.

To help plan your field trip, read over the suggestions for the beach trip in the teacher background for Unit 3, Activity 2.

Vocabulary:

- pollution
- mayfly
- minnow

Materials:

- large kitchen strainers
- magnifying lenses

- buckets, big cans
- clear plastic boxes, containers or plastic bags
- minnow traps
- sweep nets
- rubber boots, hip boots
- task cards for volunteer teachers
- snack
- paper bag for each group of students

Procedure:

1. Ask your students what they think they will find when they visit the wetlands. Have students draw pictures of their predictions. Will they see moose, an eagle, bear, salmon?

2. Discuss safety; have students decide how to keep warm and dry; how to avoid falling in ponds, streams, or bogs; how to keep from getting lost. Invent some risky situations and have the students tell you how they would act to get through safely.

3. If the area is close enough to visit regularly, make your first visit a short exploratory one. Encourage students to use all their senses to understand the pond or stream.

   - What animals live there?
   - What plants can you find?
   - What can you discover about the water?
   - What do you notice about the area around the pond?

   Remind students about the differences between invertebrates and vertebrates. What animals can they find that have backbones? (birds, frogs, muskrats, beavers, fish, people, etc.). What animals don't have backbones? (insects, univalves, bivalves --most animals in the world are invertebrates). Students can return to the classroom with questions that will be good incentives for finding out more about wetlands.

4. Use various kinds of sampling equipment for your next venture. Set a minnow or blackfish trap the day before your trip (first get the permission of the Alaska Department of Fish and Game). Put on hip boots and use a sweep net to sample the water column. Have the students use kitchen strainers, large tin cans, and sweep nets to capture what they can along the pond's edge. Collect a bucket of pond water, a bit of pond bottom, pondweed and a few critters (not big fish--they take too much oxygen) to take back for a classroom aquarium.

5. Select task cards, each of which contains instructions for a student activity. Have your volunteer assistants present these to the students one at a time.

Task Cards

Hot or Cold

Put your hand in the water and keep it there for several seconds. Then hold your hand on the pond shore for the same amount of time. Finally, hold it in the air. What did you notice? Which was the coldest place? The warmest?

The Adventures of a Water Bug

Find a water insect. Sit quietly and watch it for a few minutes. What is it doing? Tell us a story about its adventure.

Pondweed

Touch some pondweed (without tearing it out of the bottom). How does it feel? How much of the plant is covered by water?

The Beach at _____

Go beachcombing. Tell us about your beach. What is it made of? What have you found there?

Bug Moves

Find an insect in the pond and put it in a "field aquarium." Watch it and see if you can figure out how it breathes, how and what it eats, how it moves, and what part of the pond it lives in. Do you think it sleeps? Then put it back in its own habitat (the pond!)

Pond or Stream Bottom

Pick up a handful of pond or stream bottom material. What does it feel like? What is it made of? Walk around the pond or along the stream. Is the bottom the same everywhere?

Wind

Is the wind blowing? How can you tell? Use your breath as a "wind" to move things around you.

Tracks

Find some tracks in soft mud. Who made them? What happened?

Pebbles

Are there any pebbles around your pond or in your stream? Find as many different-colored stones as you can.

Driftwood

Find some driftwood...
...with no bark...
...with one branch...
...with two branches...
...with three branches...

Water Color

What color is the water? How deep is the pond or stream? Is it over your head? How big is the pond or stream? Is it bigger than your classroom? Bigger than your school?

Under a Log

Find a log on the edge of the pond or stream. Carefully turn it over. What do you see? Return the log to its original place afterwards so that you don't disturb any animals underneath.

Snailing

Find a snail by looking closely at pond vegetation or bottom debris. Place the snail in your field aquarium and watch it closely. Are you ready for some snail races? Find another snail and try a race between the two. But you'll have to be patient!

Bird Watching

How many birds can you see? What are they doing? Why do they like this pond? Pretend you are a bird. Fly around. What are your needs? Where will you find shelter? Food? Water?

6. Try a treasure hunt. Have group leaders check off each item as found, so students don't have to take live animals away from their habitats. Some ideas: something brown, green, red, blue or black, snail, bug, worm, dried-up plant, feather, driftwood, pebble, green plant, pondweed and litter (which they can collect and dispose of!)

7. Introduce the word "pollution." Is this pond polluted? What kinds of things can harm the animals and plants in this habitat? Tell us about any places you know of that are polluted. Is there any way we can help?

8. Review the seasons. Which season is this? What will the pond look like in winter, summer, fall, spring? How does it change? How do we change?

9. Have a leech race! Students can't move their hands until their feet are touching the ground. They can't move their feet until their hands are on the ground! Then try an amphipod race. Students slump over and run forward and backward with their hands trailing on the ground.

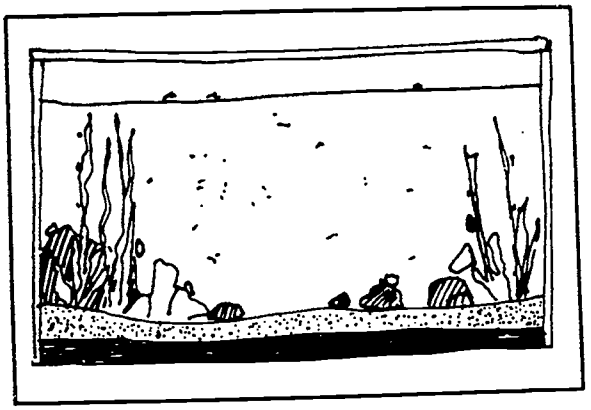
10. Try a pond version of "Duck, Duck, Goose." Introduce it with the following jingle sung to the tune of "Round and Round the Mulberry Bush":

"Round and round the
little pond
The minnow chased the
mayfly.
All at once the minnow
went "gulp,"
"Pop" goes the mayfly!"

Substitute the names of animals you have found and make up several verses. Then stop the song long enough to seat the children in a circle. Designate one as "mayfly." As the children start singing the minnow-and-mayfly verse again, have the "mayfly" walk around the outside of the circle tapping each child on the head and repeating "mayfly" at each tap. The student tapped as the word "pop" is sung becomes the "minnow" and chases the "mayfly" around the circle and back to the minnow's slot. Whoever gets there first is now "It." The loser takes a seat in the center of the circle until replaced by the next loser.

11. End the field trip by recalling what has been learned. As the children get more expert at this exercise, ask each one to say something different. Let the other children help if anyone has trouble, so that the day ends on a positive note.

Activity 3
Bringing Wetlands to the Class



Background:

By making a freshwater aquarium, students will have a chance to closely observe the inner workings of a pond and nearby wetlands in miniature. Aquariums can be constructed even in the winter using a hole drilled in the ice, a grappling hook to bring up pondweeds and a bucket to haul up water. A minnow trap baited with sardine pieces will catch insects overnight. If the aquarium is well balanced with the proper proportion of plants, animals and sunlight, it can be sealed. We've heard of sealed ones lasting a year.

Vocabulary:

- aquarium

Materials:

- construction paper
- twigs, grass, moss, pebbles
- an aquarium or gallon glass jar
- pond or stream water, vegetation, animals, soil
- air pump (optional)
- magnifying lens or binocular scope and light
- finger bowls

Procedure:

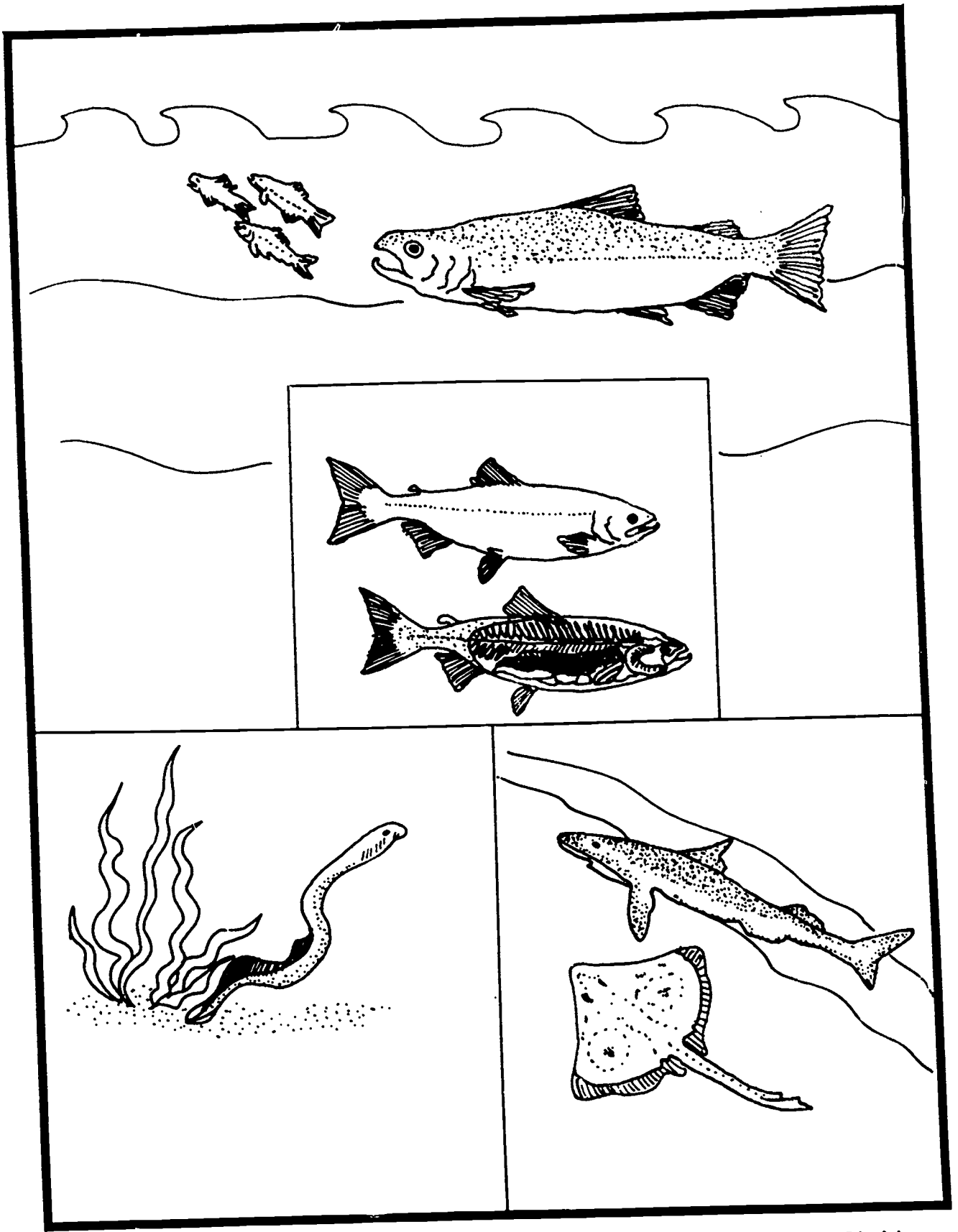
1. Review what happened on the field trip. Ask students whether they would like to have their own wetland. Have them help you set up the aquarium. Talk about each component--soil, water, animals, plants, air--as it goes in. Use soil, twigs, moss, grass and pebbles to build the shore around your pond. Set up a "wetland watch" so that whenever students have free time they can go over and watch what's happening. Make a log book to record important events. Use an air pump if one is available. Stream organisms are accustomed to higher oxygen levels.
2. Set up the magnifying lenses or binocular scope and take a close look at any critters you captured. By using the water-filled finger bowls, students will have a chance to see moving critters. (For more information on your finds, consult Sea Week Volume 3.)
3. Have students look at the wetland pictures that they drew earlier. What do they need to add? How have their ideas changed?
4. What pollution sources did your students find? Is there anything your class can do to help reduce them? What are the future plans for your wetlands?
5. If your students have also visited salt water, compare it to fresh water according to types of animals, plants, sediment, water, wind, weather, human uses.

Unit Five
Fish

Objectives:

To enable students to:

- Discover and explain how a fish breathes (Activity 1).
- Demonstrate how a fish moves (Activity 1).
- Describe what a fish eats and how it protects itself (Activity 1).
- Write a big fish story (Activity 1).
- Taste a fish (Activity 1).
- Illustrate a poem about fishing (Activity 1).
- Create a three-dimensional fish (Activity 2).
- Act out the salmon life cycle (Activity 3).



UNIT FIVE: Discovering Fish. Top: salmon and fry (bony fish). Center inset: cutaway of salmon. Bottom left: lamprey. Bottom right: skate and shark.

Sea anemones, sea stars, crabs, leeches, aquatic insects, and sponges are classified as invertebrates, or animals without backbones. Fish, amphibians, reptiles, birds and mammals all have backbones and are classified as vertebrates. Fish can be further subdivided into three groups:

1. Hagfish and lampreys: fish without jaws, scales, or paired fins; cylindrical bodies; gill openings are small and round; skeletons made of cartilage, which is softer than bone.

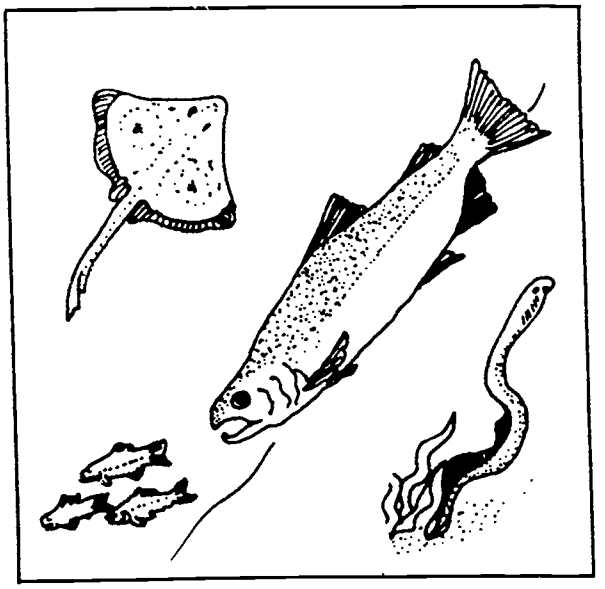
2. Sharks, skates and rays: fish with jaws, paired fins, and five to seven gill slits on either side of body; scales present but do not overlap; skeletons made of cartilage.

3. Bony fishes: most common types of fishes; have jaws, paired fins and overlapping scales; one gill opening on either side of the head; skeletons made of bone rather than cartilage.

In the intertidal zone, students may find small fish such as gunnels, pricklebacks and sculpins. On ocean fishing trips they may have seen salmon, cod, herring, or other fish. Blackfish, grayling, pike, whitefish, and lampreys are abundant in various Interior and coastal freshwater habitats.

Although fish will be more thoroughly studied in volume 6, younger students can begin studying fish anatomy and thinking about the ways in which fish are uniquely suited to their environment.

Activity 1
Discovering Fish



Vocabulary:

- fish
- gills
- scale
- skeleton
- fin

Materials:

- live fish in a jar or aquarium
- fish food
- paste
- scissors
- paper (lined and blank)
- pencil
- paints
- whole fish (fresh, frozen or canned)
- frying pan, stove, eating utensils, napkins, plates
- worksheets:

  ... Make a Fish (5-A)
  ... Fish (5-B)
  ... Fish Story (5-C)
  ... Fish Find (5-D)

1. Obtain a live fish for students to watch in an aquarium or jar, and a dead fish specimen for classroom examination.

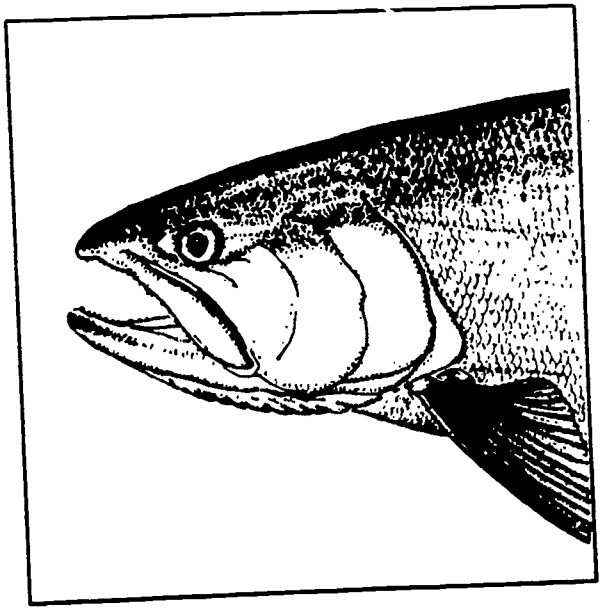
2. Methodically begin your observations:

How does a fish breathe?

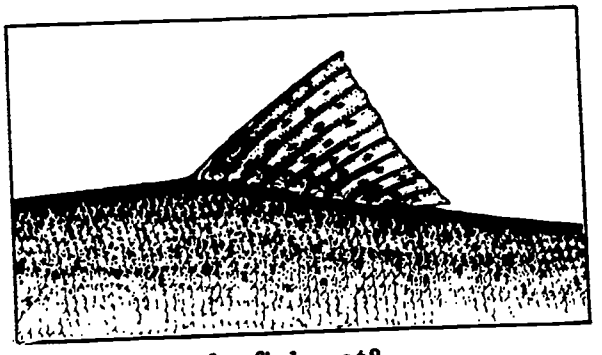
Observe the fish as its mouth and gill covers open. Gills are to a fish what lungs are to humans. As the fish draws in water through its mouth and expels it through the gill slits, oxygen is removed and transferred to the fish's blood.

How does a fish move?

Have children feel their own backbones and discuss how and why those bones are important in giving their bodies shape and in holding them erect. Explain that the spine is flexible because it is made of many separate bones called vertebrae. Cut the fish specimen along its back to expose the spine.



Watch fish swim in an aquarium or watch a film about fish and ask the children to describe the movements. Does a fish's body bend? How much and in what directions? Watch how the scales curve to accommodate every movement the fish makes. What do the fins do: help the fish swim, stop, or stay still? Do different fins seem to help the fish in different ways? How might its scales and the slime covering protect the fish and help it slide more easily through the water?



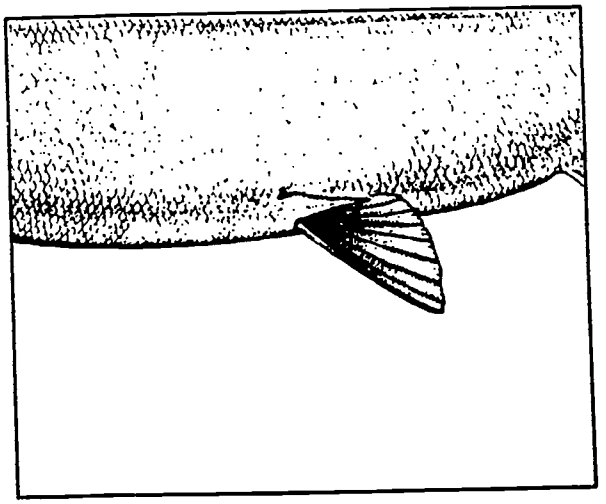
What do fish eat?

Feed the live fish. Ask the children to open the mouth of the dead fish and to feel its teeth. Decide whether they are sharp or dull, large or small. What kinds of food might be best suited for these teeth--can they chew? Different species of fish prefer different kinds of food. Many fish eat smaller fish. Other fish food includes the drifting, planktonic young of many bottom-dwelling invertebrates; adult crabs, clams, sea squirts, etc.; seaweeds and other aquatic plants. Some sharks, with their numerous razor-sharp teeth, may attack and eat marine mammals, but other species of sharks are content to feed on fish or plankton.

How does a fish protect itself?

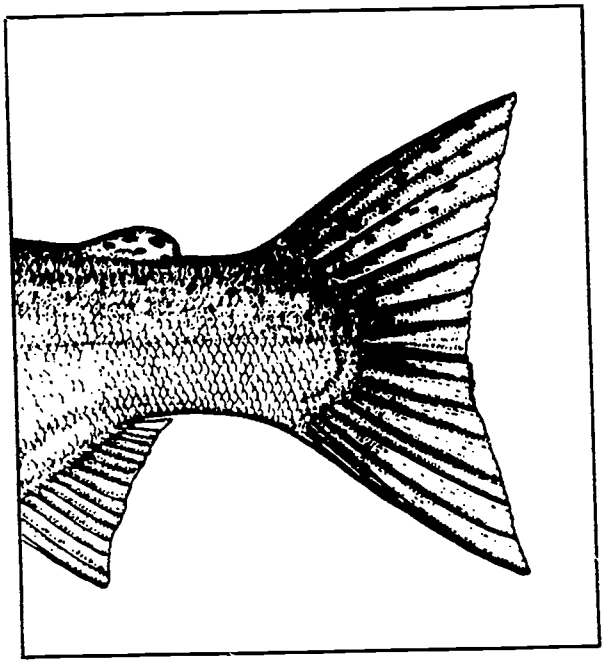
Ask children to think about how a fish can protect itself from predators. Encourage them to role play and discuss various defense mechanisms such as:

a. growing spines (sculpins, sticklebacks)
b. swimming away from more slowly moving predators (salmon, trout)
c. using protective coloration to hide (sculpins, flatfish)
d. hiding in crevices (rockfish)
e. lying still on the ocean floor and covering themselves with silt (flatfish)
f. being able to survive low oxygen and low temperature conditions (blackfish)



How do people protect fish?

Mention: fishing regulations protecting spawning and rearing grounds (habitat); trying to reduce water pollution; not taking more fish than can be eaten, etc.



3. Do the worksheets: Make a Fish; Fish; Fish Story; and Fish Find. You'll need scissors and paste and blank paper for Make a Fish. Fish Story requires lined paper, blank paper, pencils and paints. (It was designed by Joanne Rogers, Paul Banks Elementary, Homer.)

4. Ask children to think about where in the water they would be most apt to find fish (in tidepools, at the sea surface, in the water column, under rocks, around pilings and docks, in ponds and sloughs). Maybe your class can catch a fish to cook. If you are lucky enough to do so, pick your favorite recipe and enjoy a delectable meal!

5. Read aloud this poem about an amazing fishing venture. Ask the students to draw pictures illustrating the poem.

WYNKEN, BLYNKEN, AND NOD

Wynken, Blynken, and Nod one night
Sailed off in a wooden shoe--
Sailed on a river of crystal light,
Into a sea of dew.
'Where are you going, and what do you wish?'
The old moon asked the three.
'We have come to fish for the herring-fish
That live in this beautiful sea;
Nets of silver and gold have we!'
Said Wynken, Blynken, and Nod.

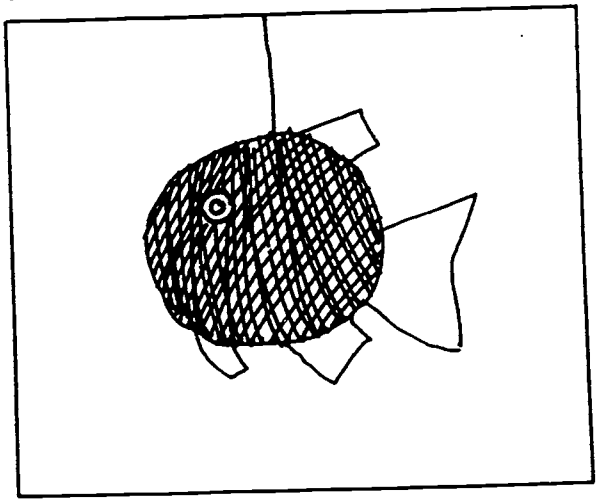
The old moon laughed and sang a song,
As they rocked in the wooden shoe,
And the wind that sped them all night long,
Ruffled the waves of dew.
The little stars were the herring-fish
That lived in that beautiful sea--
'Now cast your nets wherever you wish--
But never afeard are we';
So cried the stars to the fishermen three:
Wynken, Blynken, and Nod.

All night long their nets they threw
For the fish in the twinkling foam--
Then down from the sky came the wooden shoe,
Bringing the fishermen home;
'Twas all so pretty a sail, it seemed
As if it could not be;
And some folks thought 'twas a dream they'd dreamed
Of sailing that beautiful sea--
But I shall name you the fishermen three:
Wynken, Blynken, and Nod.

Wynken and Blynken are two little eyes,
And Nod is a little head,
And the wooden shoe that sailed the skies
Is a wee one's trundle-bed.
So shut your eyes while mother sings
Of wonderful sights that be,
And you shall see the beautiful things
As you rock in the misty sea,
Where the old shoe rocked the fishermen three:
Wynken, Blynken, and Nod.

-Eugene Field

Activity 2
Make Your Own Fish



Background:

Three different ways of making three-dimensional fish are described here. Students will have a chance to review the parts of a fish as they work, and the finished fish will make an attractive addition to the underwater world in your classroom.

Materials:

(numbers in parentheses indicate which of the three art projects apply):

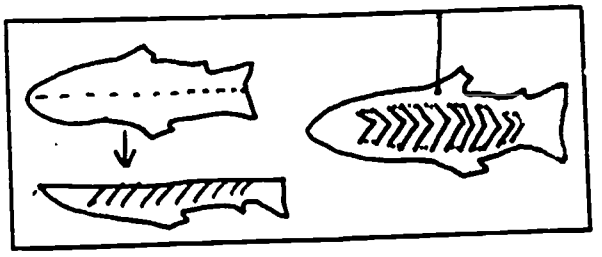
- balloons (1)
- colored tissue paper (1)
- white glue (1, 2)
- water (1)
- crochet thread (1)
- glitter (1)
- metallic foil (1)
- paper bags (2)
- magic marker (2)
- stapler (2)
- yarn or string (1, 2, 3)
- construction paper (2, 3)
- scissors (2, 3)

Procedure:

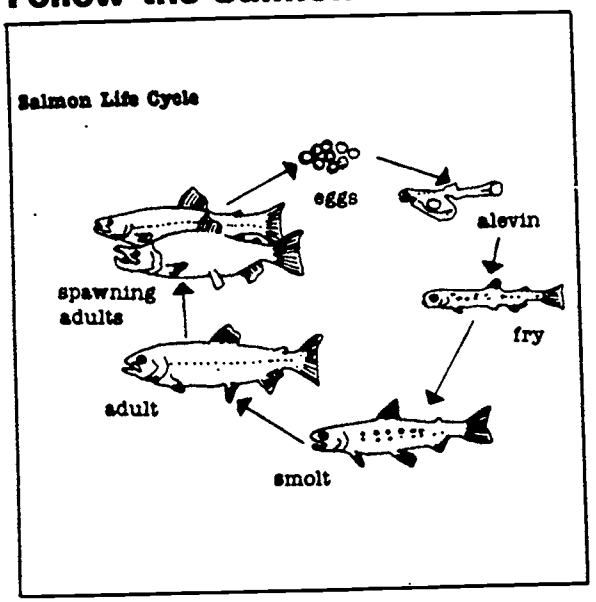
1 To make a balloon fish, mix two parts of white glue with one part water. Coat an inflated balloon with the glue and water mixture. Cover the balloon with tissue paper, overlapping the scraps so that the entire balloon is covered. Dip crochet thread in the glue/water mixture and wrap it around the balloon, criss-crossing many times. Sprinkle the fish with glitter. Cut a tail, eyes and fins out of the metallic foil and glue them to the balloon. Let the fish dry, and then hang it for decoration.

2. To make a paper bag fish, flatten a paper bag. Fold and staple the front edges so that the top is triangular. With a string, cinch the bag where the tail should begin. Cut eyes out of construction paper and glue them on. Draw a mouth with a magic marker. Staple the fish to an undersea background or hang it from the ceiling. (Suggested by Janet Renfrew, Denali Elementary, Fairbanks.)

3. To make a construction paper fish, first cut a fish shape out of construction paper. Glue on cutout eyes. Fold the fish lengthwise and cut slits diagonally along the body. Unfold and bend the center strips alternately to each side. Hang from the ceiling. (Suggested by Arlene Gordon, Paul Banks Elementary, Homer.)



Activity 3
Follow the Salmon



Background:

Five species of salmon live in Alaska. And one or more species reach nearly every community in the state as they follow the rivers upstream to spawn. Salmon depend on quality stream and wetland habitat in which to lay their eggs and rear their young which then migrate to the ocean, where they develop quickly into adults.

Vocabulary:

- egg
- alevin
- fry
- smolt
- adult
- spawning adult
- stream
- wetland

Materials:

- chalkboard
- large cutouts of the different parts of the salmon life cycle
- crayons
- scissors
- paste
- worksheets
  - ... Salmon Life Cycle (5-E)
  - ... Salmon Maze (5-F)

Procedure:

1. Ask the children to tell you what they know about salmon. Write their responses on the chalkboard. If the children haven't mentioned it already, explain that salmon lay their eggs in streams all over Alaska. Some types of young salmon grow up in the streams, while others head straight out to sea. The salmon live in the ocean for one to five years, but return to their home streams to lay their eggs.

   Wetland areas bordering the stream provide nutrients as plants decay and wash into the stream. Instream insects feed on this plant material, and the insects provide food for young salmon. Wetlands also act as sponges, soaking water up during wet periods and releasing it during dry periods, so the salmon always have enough water.

2. Make large cutouts of the different parts of the salmon life cycle using the worksheet Salmon Life Cycle as a model. Then go over the parts of the cycle with the class.

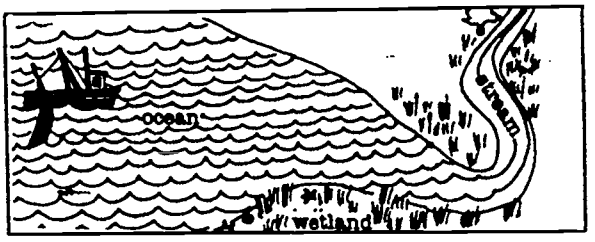
   First the eggs are laid in the stream bed (use a local example), usually in gravel. In five or six months, each

egg grows into an alevin (al'-i-vin) with a yolk sac attached that provides all its food. A few months later, alevin come out of the gravel as "fry," which are little salmon only a few inches long. Depending on the species, the fry may head downstream immediately or may spend a season or more growing in the stream before heading downstream as smolts, which are four to six inches long. Once in the ocean they rapidly put on weight, and after one to three years at sea the adults return to their home stream to spawn.

After they've laid eggs, they die and add nutrients to the stream--so plants (algae) and animals (insects) can grow more vigorously to feed the young salmon.

3. Have the children act out the parts of the salmon life cycle as you hold up the different cutouts. Have them be eggs (curl up in balls), then turn into alevins with a big yolk sac (stick out their bellies). Then the children can be fry trying to hide from bigger fish in stream pools and eddies. Tell them to start growing bigger into smolts and to head down to the ocean. The children should swim vigorously as adult salmon, then head upstream to lay eggs. Discuss the long journeys some salmon make and the hazards they may encounter--bears, gulls, pollution, people fishing, waterfalls, log jams, etc.

4. As a review, have the students do two worksheets: Salmon Life Cycle and Salmon Maze. For the Salmon Life Cycle worksheet, they will need additional sheets of plain paper (scrap is fine); also crayons, scissors and paste.



Additional activities:

1. Language Arts, Art: Ask the class to imagine how it feels to be a salmon smolt heading out to sea. Ask the children to each draw a face on a paper plate expressing these feelings and to write an accompanying sentence. Have them use the plates as masks, reading their sentences in voices that match the feelings expressed. (Contributed by Joanne Rogers, Paul Banks Elementary, Homer.)

2. Social Studies, Language Arts: The salmon fisheries play a major role in Alaska's economy. Invite a local fisherman to come to school and explain his (or her) occupation. Encourage the students to ask questions, and to think about what it would be like to be a fisherman. What would they need to know to be deckhands on a fishing boat? Write a class story using their ideas. (Contributed by Joanne Rogers, Paul Banks Elementary, Homer.)

Unit Six
Amphibians

Objectives:

To enable students to:

- Describe the life cycle of a frog or toad (Activity 1).
- Make their own pet frogs (Activity 1).
- Draw the wetland habitat of frogs and toads (Activity 1).
- Learn a legend telling about the importance of frogs in Native life (Activity 2).
- Place story events in sequential order (Activity 2).
- Draw an event from the "Legend of Six Frogs" (Activity 2).
- Act out the "Legend of Six Frogs" (Activity 2).

UNIT SIX: Amphibians. Because amphibians, like the frog and toad pictured, are cold-blooded, life in the north is hard for them. They need summer warmth for metamorphosis and suitable spots for winter hibernation.

Amphibians are vertebrate animals that are dependent upon water for survival for parts of their lives. They lay their eggs in water, and when the eggs hatch the young, or larval, stages live in the water, acquiring lungs only as adults. Some amphibians depend on moist skin for respiration. In Alaska, all amphibians hibernate during the winter. Salamanders, frogs and boreal toads inhabit Southeast Alaska. The toad and possibly one species of newt (a family of salamanders) are found in South-central Alaska. The wood frog, Rana sylvatica, is found in most parts of the state.

Reptiles are similar to amphibians, but they have no aquatic larval stage. Reptiles generally need more sunlight and warmth than amphibians.

A few garter snakes have been reported along the British Columbia border and a leatherback sea turtle was caught at the mouth of the Copper River Delta (and is now on display in the Cordova Historical Museum), but reptiles are extremely rare in Alaska.

Life in the north is difficult for amphibians. They are cold-blooded, which means that their body temperature is close to that of the environment around them. They need enough summer warmth to enable them to go through metamorphosis. They also need suitable spots for hibernation.

Wood frogs hibernate in shallow, bowl-shaped depressions that they excavate in the upper layer of the previous year's vegetation. The winter snow acts as an insulator. Light snow years result in high frog mortality. Frogs use their own body energy for fuel, losing weight during the cold winter months. Spring warmth finds frogs calling, mating, and laying eggs in ponds. The eggs hatch into gilled tadpoles. If all goes well, these metamorphose into lunged, air-breathing adults by the end of the summer.

Besides breathing through their lungs, amphibians can absorb oxygen through their moist skin. In the winter, when they hibernate in the bottom of ponds or in the ground, they take in enough oxygen through their skin to stay alive.

(For more information read R.P. Hodge's Amphibians and Reptiles in Alaska, the Yukon, and the Northwest Territories. Additional background information and activity ideas are available in the Frogs and Toads activity packet produced by the Dahlem Environmental Education Center, Jackson Community College, Jackson, Michigan.)

Activity 1
Frogs and Toads

Background:

Frogs and toads spend the first portion of their lives in ponds, as eggs and then as tadpoles. They absorb dissolved oxygen through fish-like gills. Then, as adults, they breathe air with lungs.

Each spring, after mating, female amphibians lay soft, jelly-like eggs in ponds. Frogs lay large masses of floating eggs; toads lay strings of eggs that stick to vegetation in the bottom of the pond. After a few days, the eggs hatch into tadpoles (polliwogs).

The fishlike tadpole eats small water plants, especially algae. It grows hind legs followed by front legs. Then it stops eating as its small body undergoes drastic changes: eyeballs move from the side to the top of the head; gills make way for legs and lungs; and the digestive system transforms to accommodate an insect diet. During this time, its body is supplied with nutrients from the storehouse in its shrinking tail.

Vocabulary:

- amphibian
- tadpole
- polliwog
- metamorphosis
- hibernate

Materials:

- green, smooth material
- brown, bumpy material
- construction paper
- crayons
- scissors
- brads
- butcher paper or chalkboard
- felt-tip markers or chalk
- dictionary
- worksheets:
  - ... How Does a Frog Grow? (6-A)
  - ... Frog or Toad? Which is Which? (6-B)

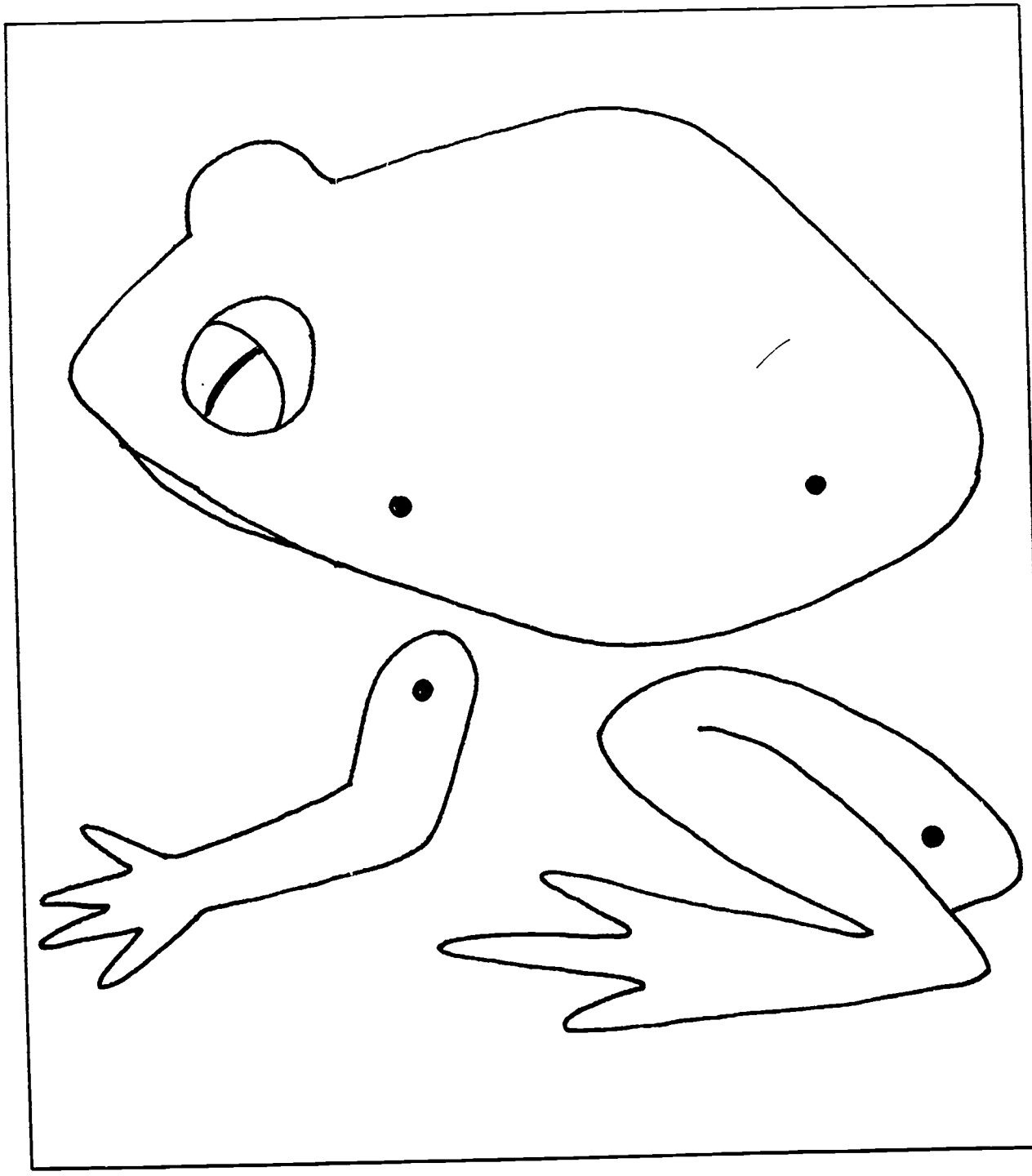
Procedure:

1. Explain to students that they are going to study one category of amphibians--frogs. Have them look up "amphibian" in the dictionary. Talk about the changes in the frog's life cycle and introduce the idea of metamorphosis. Use the worksheet and have students cut out pictures of the frog's life cycle and see if they can place them in the proper order.

2. Prepare frogs and toads before class using the pattern from the worksheet Frog or Toad? Which is Which? Cut the frogs out of smooth green material such as acetate, oil cloth or wrapping paper. Cut the toads out of bumpy brown material such as sandpaper, rough wood or cloth.

3. Toads and frogs can be safely handled by anyone, but handling frogs removes their protective mucous layer. Tell the children to be careful not to squeeze too hard when trying to keep hold of these jumpers.

Have students make pet frogs or toads by cutting out and coloring the following pattern. Use brads at the leg and arm joints for some movable, hoppy toads and frogs.



4. Distribute the worksheet Frog or Toad? Discuss the differences between frogs and toads. Pass around the frogs and toads you made, for the children to feel. Frogs are green or light brown, smooth and moist. Their color blends in with the plants that fringe ponds and streams. Because of their longer back legs, they are great jumpers.

   Toads are brown, bumpy and dry, blending in with mud and dead leaves. With their shorter rear legs, they are better than frogs at walking. Toads have kidney-shaped glands on their heads which exude a milky white poisonous fluid when predators try to eat them. They do not give people warts, and their poison will not bother people unless they try to eat the toads!

5. Discuss where frogs and toads live (their habitat). Frogs and toads breed in ponds and are usually found in or near fresh water. Marshes and the edges of ponds and streams provide them with water, food and cover. However, wood frogs, the most widely distributed amphibians in Alaska, live in grasslands and open forests and may often be found considerable distances from water. Polliwogs eat algae. Adult amphibians eat live worms and insects--thousands of them--which is a great help in Alaska in the summertime!

6. Draw a big mural on butcher paper or chalkboard of frogs and toads in their wetland habitat, showing every stage of their life cycles. Draw their food, water and cover. Show them eating lots of mosquitoes!

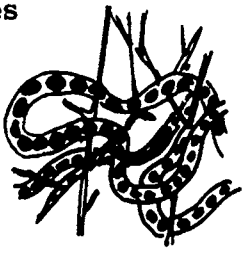
Additional activities:

1. Language Arts: One of the most famous Japanese haikus is about a frog. Use it as a model, and have the children write their own haikus.

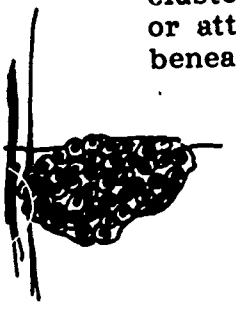
   Large pond.
   Frog jump in.
   Plop!
   -Basho

2. Science: Take a field trip to a nearby wetland area to look for frog and toad adults, polliwogs and jelly-like eggs. Listen for croaking. Evening is often the best time to hear frogs and toads, so encourage parents to take their children on flashlight expeditions.

Toad eggs--
long strings attached
to bottom vegetation
in ponds or puddles



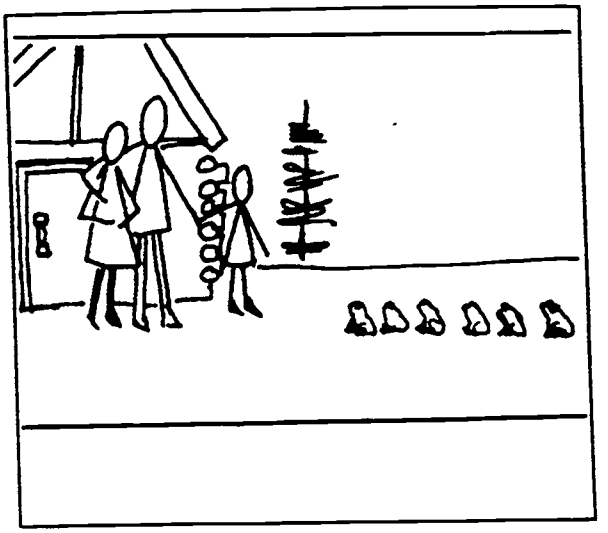
Frog eggs--
clusters floating on ponds
or attached to vegetation
beneath the surface



3. Science. Make a terrarium so that you can observe a live frog or toad for short periods. Place a layer of rocks and gravel in a large glass container or pan; add soil and plants. Set a pie pan full of water in one corner. Cover the top with plastic wrap to hold in moisture. Punch a few holes for air, and collect plenty of live insects to feed your frog or toad. Watch it move, eat and breathe. Then return your frog or toad to its wetland habitat.

Eggs or tadpoles can be kept briefly in an aquarium filled with pond water. Discard non-developing eggs and any that turn gray or white. Keep the water cool, out of direct sunlight. Feed the tadpoles cornmeal, cooked spinach, boiled lettuce, and hard-boiled egg bits. Remove leftover food. Captive tadpoles often won't complete the transition to an adult because the aquarium lacks the increasing concentration of nutrients found in an evaporating spring pond. So release the majority and give those remaining plenty of extra food.

Activity 2
The Legend of Six Frogs



Background:

This activity involves a legend from British Columbia. Alaskan Natives have similar legends and stories about frogs. Frogs are especially important in Southeast Alaskan mythology, and totem poles and gravestones often have carved images of frog-like or toad-like figures. In the stories, frog is a guardian spirit, a bringer of good fortune, the embodiment of wisdom, a guide through treacherous country and the symbol of secret societies. Also, in this tradition, a frog's owner is supposed to be endowed with singing power.

Vocabulary:

- legend

Materials:

- copy of "The Legend of Six Frogs"
- cloth or colored paper to
- make student costumes
  paper

- crayons
- scissors
- worksheet:
  ... Legend of Six Frogs (6-C)

Procedure:

1. Read students "The Legend of Six Frogs."

2. Have students cut out pictures of the specific story events on the worksheet Legend of Six Frogs. Ask them to recall the story, then to match the following captions with the pictures and place the pictures in proper sequence.

   a. seven children asking father permission to go hunting
   b. seven children in canoe waving farewell to father
   c. children eating lunch by pond and noticing wrapped food
   d. six children eating food and dried fish
   e. seven children--one normal size and six shrinking, part-frog children
   f. one child paddling home
   g. six frogs croaking outside the door

3. Discuss the legend. Ask, "What do you think happened to the six frogs during the winter months?" Lead into a discussion covering frog hibernation.

4. Have students draw favorite scenes from the legend.

5. Assign parts to the students and act out the "Legend of Six Frogs." Students can make costumes and invite parents or friends to see the play.

Additional activities:

1. Language Arts, Social Studies: Have the children try to discover and record local legends and carvings of frogs and toads. How does the "Legend of Six Frogs" differ from local legends? Show the children on a map where the "Legend of Six Frogs" originated (The Saanich Reserve is near Sidney, Vancouver Island, British Columbia, Canada).

2. Language Arts, Science: Have the children write a class story about frogs and toads, weaving in lots of facts and anecdotes about their experiences with amphibians.

LEGEND OF SIX FROGS

Joan Morris,
Told by her grandmother

Once upon a time there lived a family at the West Saanich Reserve, near a pond. There were seven children in this family from the ages of seven to fourteen years old.

One day they all decided to go hunting together, so they asked permission of their parents.

Just as they were leaving the father took them aside and told them if they stopped at the pond to eat their lunch, they were not to eat anything they found there. After this they bade farewell to their father and set out in their canoe.

As they were approaching the pond one of them asked if they should stop and eat, as he was very hungry. So they all stopped and ate some of their lunch.

As they were eating one of them noticed a piece of paper with something wrapped inside it. So, they all went to see what it was.

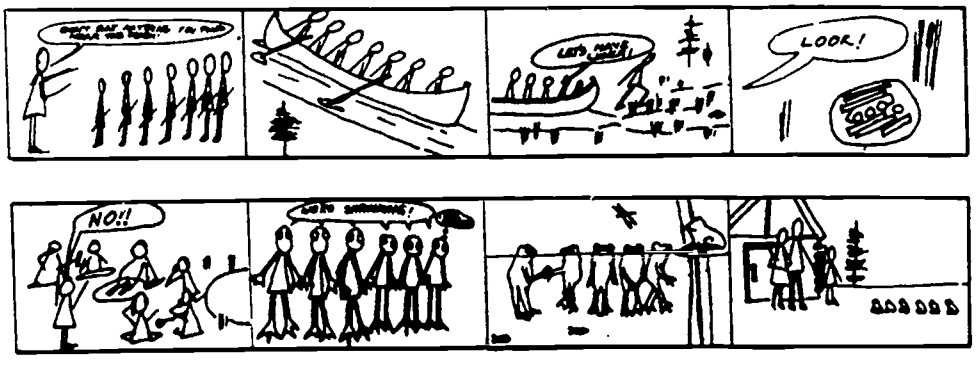
When one of the bigger boys opened it they found all sorts of food and dry fish. It looked so delicious that six of the boys started eating, but one of them remembered what his father had told them and he tried to stop his brothers. But they laughed at him and said that he was superstitious, like their father.

Not long after that they all felt strange. Then looking at one another they noticed that each one was getting smaller and smaller. Gradually all six of them changed into little green frogs.

The one that did not change got in the canoe and paddled home to tell his father what had happened.

After supper the father told the mother the sad news. Suddenly they heard the croaking of frogs outside and going out they noticed six little frogs. These little frogs stayed there until winter.

That is how the frogs came to the West Saanich Reserve.



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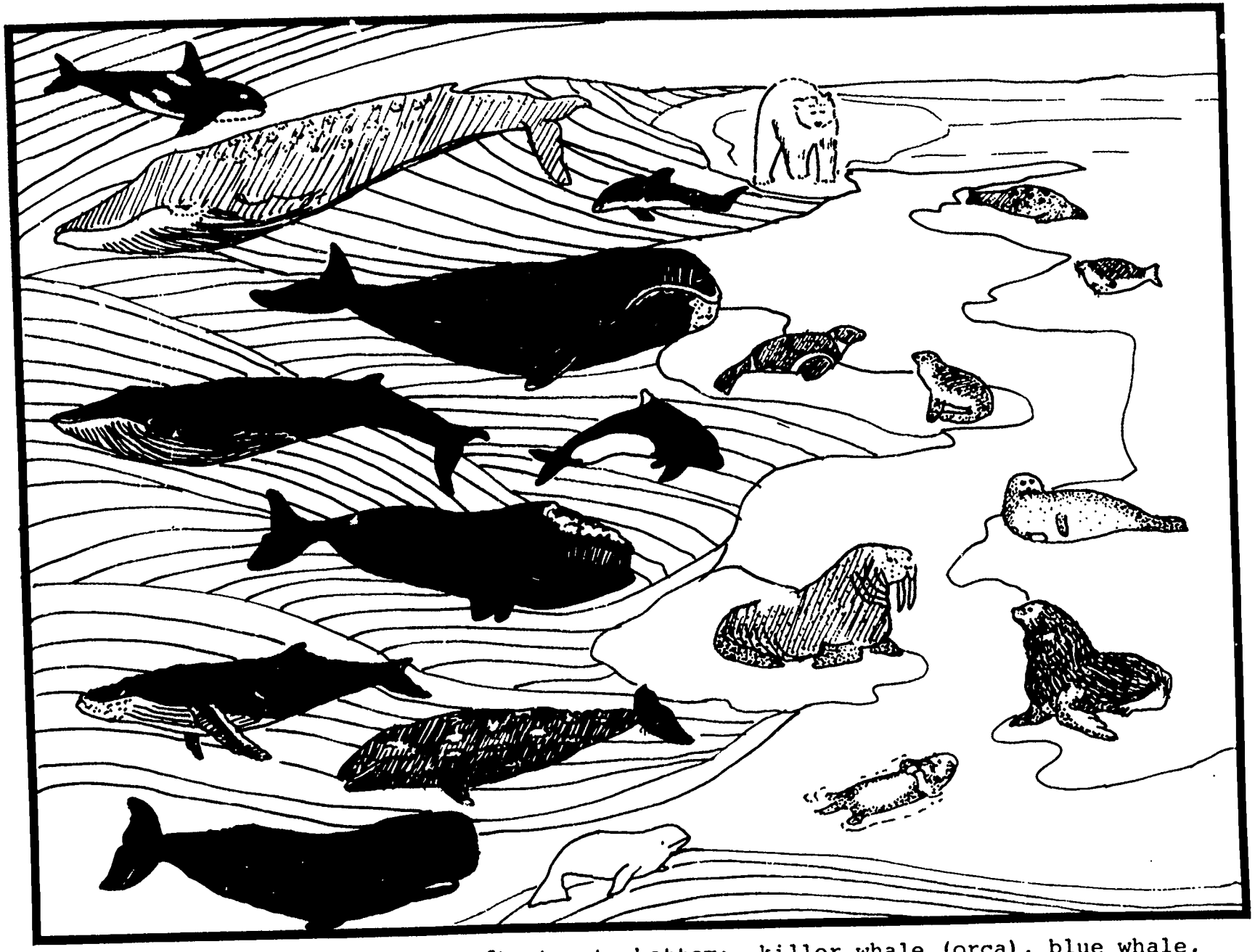
Unit Seven
Marine Mammals

Objectives:

To help the students:

- Develop a better awareness of marine mammals and their habitats (Activity 1).
- Select one marine mammal and learn its traits: size, color, special features, history, eating habits (Activity 1).
- Draw a life-size outline of that mammal for the hallway (Activity 1).
- Record daily sightings of marine mammals (Activity 1).
- Make walrus, seal or sea otter puppets (Activity 2).
- Listen to a marine mammal story (Activity 3).
- Illustrate the poem, "The Walrus and the Carpenter" (Activity 3).
- Sing the song, "A Whale of a Tale" (Activity 3).
- Listen to a whale record (Activity 3).
- Make up a whale dance (Activity 3).
- Create marine mammals out of clay or dough (Activity 3).
- Interview local residents about their experiences with marine mammals (Activity 3).
- Write, illustrate, and print a booklet about local marine mammal stories (Activity 3).
- Contribute to a community Whale Fair (Activity 3).



UNIT SEVEN: Marine Mammals. Left, top to bottom: killer whale (orca), blue whale, bowhead, fin whale, right whale, humpback, grey whale, sperm whale, beluka. Right, top to bottom: polar bear, ringed seal, harbor seal, ribbon seal, fur seal, Pacific bearded seal, walrus, sea lion, sea otter.

Marine mammals, from the playful sea otter to the giant, square-snouted sperm whale immortalized in Herman Melville's Moby Dick, are endlessly fascinating to us land-bound humans. The following is a brief survey of some of the marine mammals living in the waters off Alaska's shores. They are divided into two main groups: the cetacea (whales), and the carnivora (seals, sea lions, walrus, otters and polar bears.)

1. Cetacea

Like all other mammals, the warm-blooded whale breathes air through its lungs and bears live young that nurse. Unlike other mammals, it never leaves the water, breathes through a blowhole on top of its head, has a tail spreading horizontally into flukes and has forelimbs modified into flippers. Its hind limbs are reduced to non-functional remnants or are absent.

Cetaceans are divided into two groups: animals with teeth and animals that have horny plates called "baleen" in their mouths instead of teeth. The fringed edges of the baleen are used to strain out the small fish and crustaceans on which the animal feeds.

The BALEEN WHALES most commonly seen in Alaska waters are the fin, minke, gray, bowhead and humpback whales. The smallest of these, the minke, is about 25 feet long and is found along the Alaska coast as far north as the Chukchi Sea. Worldwide, it is the most heavily harvested baleen whale.

The blue whale, giant cousin to the minke, can grow to 100 feet long and weigh 200 tons--undoubtedly the largest animal that has ever lived. During the summer, it needs to eat four tons of krill a day just to keep going! The blue whale is very rare and is on the endangered species list.

The fin whale is probably the fastest of the large whales. It cruises at five to six knots (nautical miles per hour; one nautical mile is 15 percent longer than a standard mile) and can sustain a speed of 20 knots when alarmed.

Humpback and gray whales measure up to 50 feet. The humpbacks are noted for their acrobatics. They often jump out of the water (breach), slap the water with their flukes (lobtail), and wave their flippers in the air. Gray whales winter in Baja California and migrate north along the coast to spend their summers in the Bering and Chukchi Seas, then travel back south again in the fall: a 6,000-mile round trip!

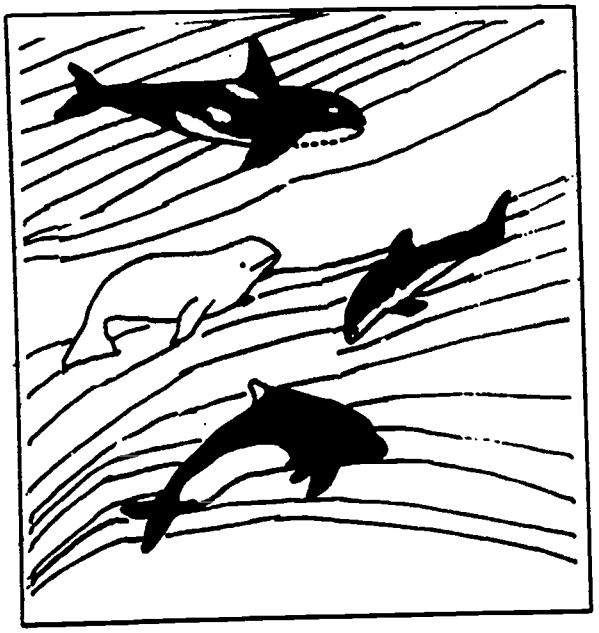
The bowhead, up to 60 feet long, is the only large whale that spends its entire life in far northern waters. The bowhead's baleen is sometimes over 15 feet long--the longest of any whale's.

The common TOOTHED WHALES of Alaska include the sperm, belukha, and killer whales, and dall and harbor porpoises. Narwhals are occasionally seen off northern Alaska, although they are uncommon there.

The largest of these toothed cetaceans, the 50-foot, square-snouted sperm whale, dives to the ocean depths to capture squid, cuttlefish and octopus.

Sometimes called the "sea canary" because of its noisy calls, the belukha is a 16-foot-long whale found in Arctic waters. Adults are white, but the young are black. Its name is often spelled "beluga," but "belukha" is a closer transliteration of the Russian name and that spelling serves to distinguish it from the beluga fish, which is a white sturgeon. In Canada, it is known as the white whale.

Closely related to the belukha, the narwhal is a truly northern species which is found only as far south as the southern Bering Sea and is most abundant in Canada's eastern Arctic. It has one tooth, elongated to a tusk, and it may be the original model for the unicorn legend.



The killer whale, or orca, may grow up to 30 feet long. A formidable predator that eats other marine mammals as well as sea birds and fish, it has not been known to threaten humans. Its white-on-black patterns give it a dramatic appearance.

The two porpoises can best be distinguished from each other by their habits and behavior. Dall porpoises are found in deep waters and run in groups, conspicuously casting up spray. They often jump and swim ahead of a ship's bow. Harbor porpoises are found in shallow inshore waters. Generally they are seen singly; sometimes just a dorsal fin is spotted jutting out of the water as the porpoise completes a slow roll.

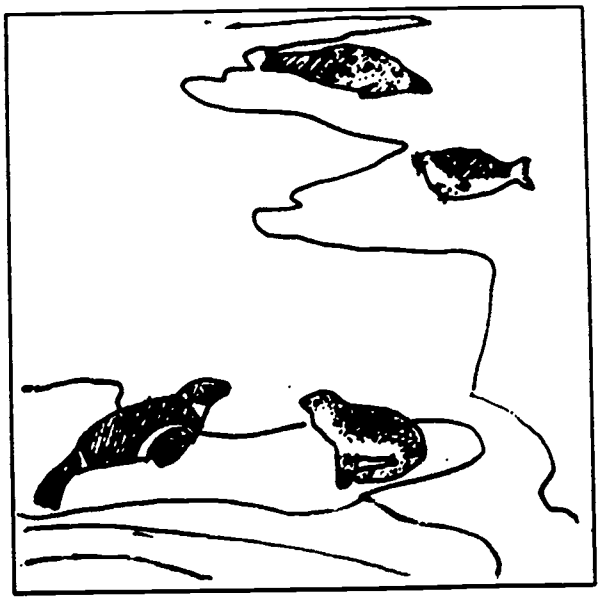
2. Carnivora

Seals, sea lions and walrus were formerly classified in a separate order called Pinnipedia. However, they are not all as closely related as was formerly believed, and now are included within Carnivora. This is a large order of flesh-eating animals that also includes many non-marine species such as dogs, cats and wolves.

The pinnipeds are animals with both fore and hind limbs modified into flippers and with tails almost or completely nonexistent. They are split into three groups: true seals, eared seals and walrus.

TRUE SEALS are unable to rotate their hind flippers forward. They walk on land by sliding or inchworming along on their bellies with the help of their fore-flippers. All flippers on true seals are covered with hair; the fore-flippers are small, and the animals have no visible external ears.

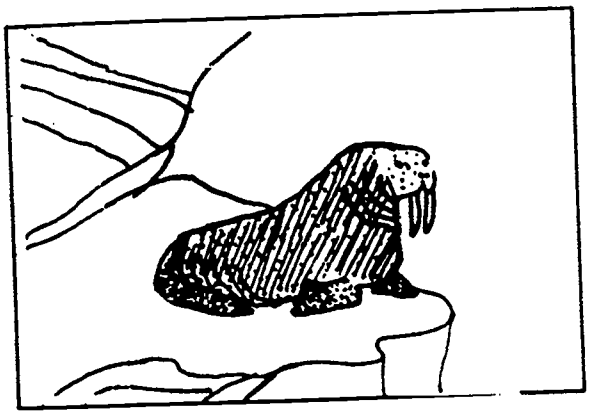
The true seals in Alaska include the bearded, ribbon, ringed, spotted and harbor seals. Harbor seals are the most common species of seal along the southern Alaskan coast. Their coloring is variable, but they usually are covered with irregular dark spots and blotches. Often found concentrated in bays or glacial fiords, they "haul out" on sand beaches, sandbars, rocky areas or ice floes. They usually can be spotted poking their heads above the water's surface. Bearded, ringed, spotted and ribbon seals follow the ice pack out in the Bering and Chukchi Seas.



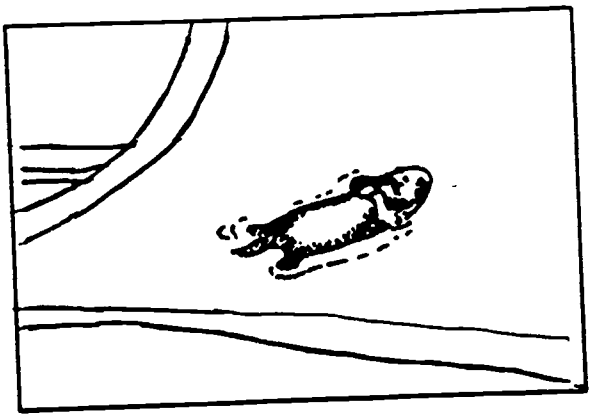
EARED SEALS include the seals that perform in circuses. They have easily visible ear flaps, or "pinnae." They are able to walk on land on all fours because they can rotate their hind flippers forward. The two types of eared seals in Alaska are the fur seal and the Steller sea lion. Fur seals travel north from their winter homes in a broad area of the North Pacific Ocean and may follow boats and play in their wakes.

Steller sea lions congregate at "haul-outs" and breeding areas on rocky shores. Their lusty roars may be heard in bays or wherever herring and other food is available. They may be seen in small groups, rolling at the surface with their backs out of the water, or upright with a fore-flipper extended and head raised well above the surface. Sometimes large groups of 20 or 30 can be observed, surfing and cavorting.

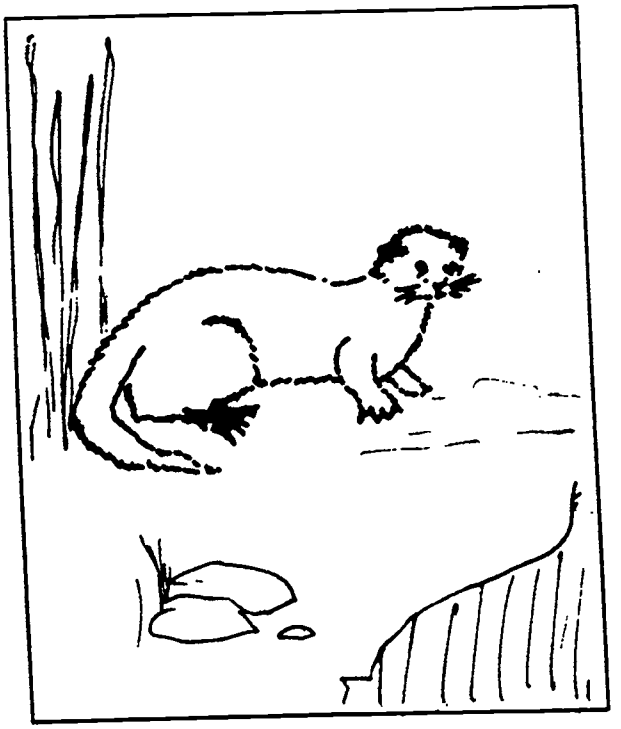
The large, wrinkled, tusked WALRUS looks even at birth like the grandparent of the sea. This 12-foot mammal follows the seasonal movement of the ice pack from the Bering Sea to north of Point Barrow, although some bulls remain in Bristol Bay throughout the summer.



Sea otters are found in shallow coastal waters mostly from Southeast Alaska to the Aleutian Islands; a few also live near the Pribilof Islands. They may often be seen swimming in shallow waters in or near kelp beds. The otters dive to the sea floor for sea urchins, abalone, crabs or clams, which they bring back to the water's surface to eat. Sea otters are tool-using animals, sometimes using a rock to crack open their food.



Once hunted extensively for their dark brown fur, sea otters, like all other marine animals, are now protected by federal law, which prohibits non-Natives from taking them except for special purposes. As of 1985, the state of Alaska is polling the population, asking whether or not it should apply to the federal government for return of jurisdiction over certain species (seals, sea lions, fur seals, walrus, polar bear) on which the Native population depends for subsistence.

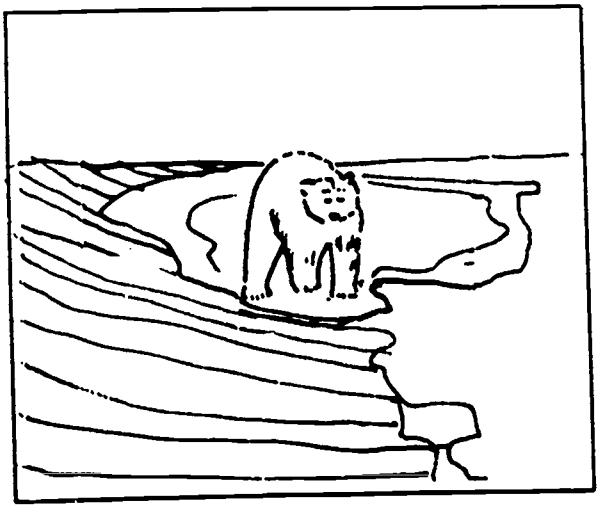


RIVER OTTERS (see also Unit Eight) may be seen near shore in some coastal waters. They are much smaller than sea otters, and do not float or swim on their backs as do their larger cousins. They spend much of their time in fresh water. To feed, river otters carry their catch (often flatfish) to shore.

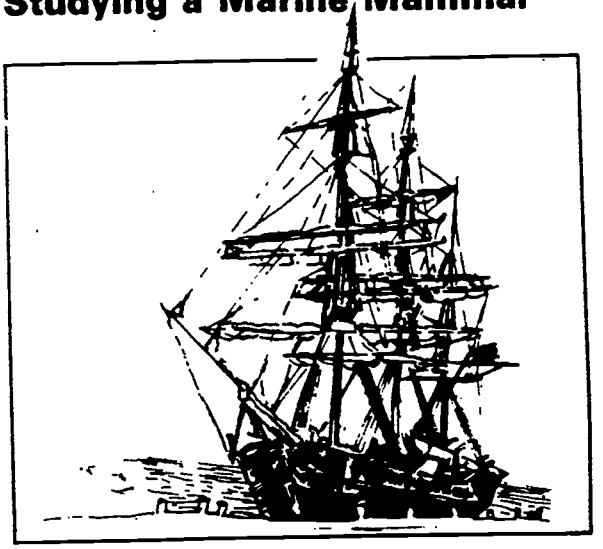
The POLAR BEAR, though not strictly an aquatic animal, is dependent on northern Alaska ocean waters, and is considered a marine mammal for the purposes of game management.

Most of Alaska's polar bears spend their lives in the Chukchi Sea, where they reside along the edge of the ice in summer and along leads and other places where the seals are during the rest of the year. The bears primarily eat ringed seals, which they catch either on the ice or when the seals surface at breathing holes in the ice. Polar bears are adapted for this life on the sea ice by their fur. The fur's white color camouflages them. The outer fur is waterproof and the underfur is dense and warm. It covers the bottoms of their paws, keeping them warm.

Polar bears sometimes leave the ice and wander inland. Pregnant females, in particular, build inland dens in the snow to serve as winter refuges for themselves and their young cubs.



Activity 1
Studying a Marine Mammal



Background:

One responsibility of our schools is to help students to develop lifelong learning habits by teaching them how to find out more about subjects that interest them. The following activity emphasizes library and oral history skills.

Vocabulary:

- mammal
- characteristics
- marine
- history
- endangered
- habitat
- flukes
- flipper
- warm-blooded

Materials:

- library resources (books, films, filmstrips)
- museum resources
- people within the school and community who are experts on mammals or on native use of mammals
- paper

- envelopes
- stamps
- worksheets:
  - ... What is a Marine Mammal? (7-A)
  - ... Color the Marine Mammals (7-B)
  - ... Marine Mammal Crossword (7-C)
  - ... Marine Mammal Match (7-D)
  - ... Whale Count (7-E)
  - ... Humpback Whale (7-F)

Procedure:

1. As a class or as groups within the class, select one or more marine mammals and learn as much as you can about them. Use the worksheets What is a Marine Mammal? and Color the Marine Mammals to introduce the concept of marine mammals. By reading, viewing films or listening to speakers, learn what the various marine mammals look like. How large is the particular mammal you're studying? What color is it? What is its habitat like? Was it, or is it, hunted? Why? Is the animal endangered?

2. Have the students write to some of the following organizations for information about whales and whaling. Discuss the pros and cons of whaling.

Alaska Dept. of Fish & Game
Capitol Office Park
1255 W. 8th St.
P.O. Box 3-2000
Juneau, AK 99802

Marine Mammal Commission
1625 "I" Street
Washington, D.C. 20006

International Whaling Commission
The Red House
Station Road, Histon
Cambridge, CB4-4NP
England

North Slope Borough
Barrow, AK 99723
(for information on subsistence whaling)

Cousteau Society
8150 Beverly Blvd.
Los Angeles, CA 90048

Greenpeace
2623 West 4th Avenue
Vancouver, British Columbia
Canada BCV 6P

American Cetacean Society
P.O. Box 2698
San Pedro, CA 90731

The Whale Museum
P.O. Box 1154
Friday Harbor, WA 98250

Project Jonah
240 Fort Mason
San Francisco, CA 94123

General Whale
9616 McArthur Boulevard
Oakland, CA 94605

Save the Dolphins
1945 20th Avenue
San Francisco, CA 94116

World Wildlife Fund
1319 18th Street NW
Washington, D.C. 20036

Whale Protection Fund
c/o Center for Environmental Education
624 9th Street NW
Washington, D.C. 20001

National Marine Fisheries
Service
Dept. of Commerce
Washington D.C. 20235

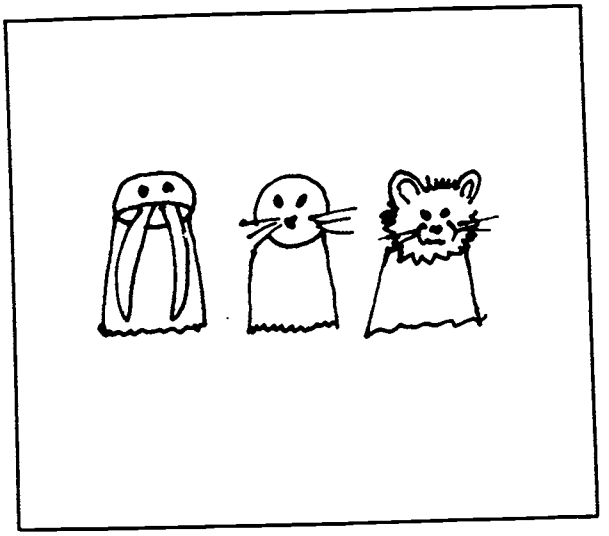
3. Put up a bulletin board about marine mammals, with class stories and pictures. Do worksheets: Marine Mammal Crossword, Marine Mammal Match, Whale Count, and Humpback Whale.

4. Make a life-size marine mammal cutout to put up in the hallway.

5. If marine mammals are frequently seen in your area, ask students to record sightings. Keep a class record giving date, time, weather and other circumstances of each sighting.

6. Encourage students to talk with their parents, the bilingual staff, or other community members about their experiences with marine mammals in your area, and then to share what they have learned with the class.

Activity 2
Making Walrus, Seal or Sea Otter Paper Bag Puppets



Vocabulary:

- haul out
- tusk
- flipper
- fur
- pod

Materials:

- brown, gray, tan and white construction paper
- paper straws
- rice
- black felt-tip markers
- paper bags (one per student)
- white glue
- scissors

Procedure:

1. Have students cut out marine mammal head shapes. If you're short on time, you may want to do this ahead of class. Use tan, yellow or light brown construction

paper for the otters, dark brown for the walrus and gray or brown for the seals.

2. Glue the heads to the folded over paper bag bottoms.

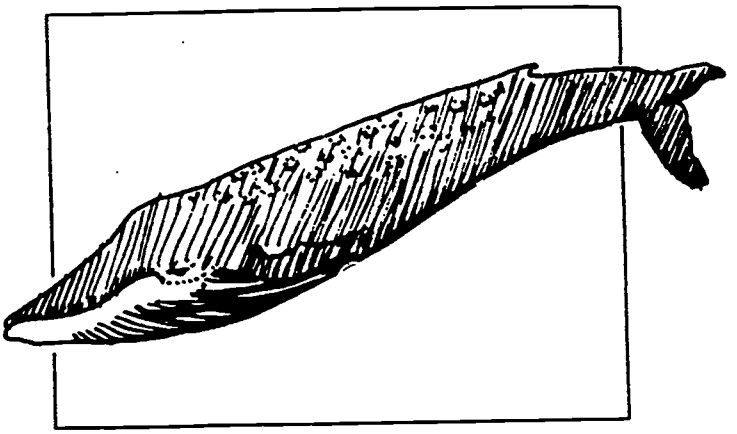
3. Use black felt-tip markers to draw faces on the animals. Glue on the whiskers: rice for the walrus, straws for the otters and seals (or use black markers). Glue tusks (white construction paper) to the walrus faces.

4. Let the puppets dry for a few minutes.

5. Then have them role play the different animals. Have the walrus, seals and sea otters "haul out" on the ice or shore. Have them hold their arms tight to their bodies with their hands out like flippers. Now swim. The sea otters can dive down to the bottom and get their meals (clams, crabs and sea urchins) and bring them back to the surface. They crack clams open with a rock and they lie on their backs to eat, using their stomachs as tables.

   Walrus are great clam eaters, too. They suck them out of the bottom mud with their large snouts. The tusks, used in breeding displays and in fighting, are also handy for helping walrus climb up on ice floes. Seals are fast swimmers and catch fish, crab and squid. Like walrus and sea otters, seals often travel in groups.

Activity 3
Marine Mammals in Arts, Music and Literature



Background:

Marine mammals have fascinated people all over the world for many centuries. Recently there has been an upsurge of artistic interest. Marine mammals have captured the imagination and concern of many people because of their high intelligence and, for some species, their dwindling numbers.

Materials:

- books on marine mammals (check bibliography)
- whale record (check bibliography)
- copy of the song "Whale's Tale"
- copy of the poem "The Walrus and the Carpenter"
- construction paper
- felt-tip markers
- paper streamers
- clay or dough
- crayons
- paper
- pencils
- copy machine
- whale-shaped cookies
- refreshments

Procedure:

1. Find a book about marine mammals to read aloud to your students (check the bibliography).

2. Read the poem "The Walrus and the Carpenter." Have the students draw pictures to illustrate the different parts of the story.

3. Sing the song "Whale's Tale," written and composed by Paul Banks of Homer, Alaska. Going around the room, have the students say one complete sentence each about what they think it would be like to ride on a whale.

4. Listen to a whale record. Ask the children what they think the whales are saying. Make up a dance to go with the recording; use paper streamers to simulate waves. (Suggested by Kathy Hanna, Auke Bay Elementary, Juneau.)

5. Make marine mammals out of clay or dough. Here's a recipe for the dough:
   1 c. flour
   1 c. salt
   1 rounded tsp. powdered alum
   Stir these ingredients and add water slowly until your mixture is the texture of clay. Store wrapped in wet cloth and plastic. Finished animals can be baked in 350° oven until hard.

6. Interview local residents about their experiences with marine mammals. Compile and illustrate these stories to make a little booklet. Also ask local residents about any marine mammal art objects they may have bought or made themselves.

7. Have a Whale Fair! Ask the children to gather all their marine mammal poems, stories and artwork, and prepare additional projects. Use a community gathering spot such as a grocery store, senior citizens or youth center, library, or town hall. Using construction paper and felt-tip markers, make posters inviting everyone to come. Bake and serve whale-shaped cookies. Ask members of the community for help in preparation and display.

Additional activities:

1. Language Arts, Art: Have the children make badges that describe how they feel about whales.

2. Language Arts: Write poems and make pattern books using this pattern:

   If you ever, ever, ever see a (whale), You must never, never, never (pull his tail!)
   (Suggested by Lynn Fry, Weller Elementary, Fairbanks.)

3. Social Studies, Language Arts: Develop creative thinking and communication skills. Make up a whale learning center in one corner of the classroom and tape record the questions and/or answers, or work on the questions as a class. Here are some suggestions:

. Whales have the largest brains of any animals, including humans. Although it is hard to compare the intelligence of different kinds of animals because they use their minds for different purposes, whales are certainly among the most intelligent creatures on earth. If you were given the whale's brain for one day, what are some things you would like to do? What would you would think about?

. What might happen if the sea was full of many, many whales?

. How would the world be different if there were no whales anywhere?

. Pretend that you have a pet whale. List all the things you would need to do to keep a pet like that.

. Pretend you are going on a voyage to observe whales. List everything you need to do to get ready.

. What do you think a whale would be trying to express by doing these things?

Spouting _____
Flapping its tail _____
Beaching itself _____
Leaping _____
Winking _____
Swimming in circles _____
Breaching _____
Diving _____

. You are an Eskimo. For many generations your family has hunted whales. You have used the whale for food and oil. You learn that whales are endangered, and that not hunting them may help save them. Will you decide to keep hunting for whales or stop hunting and take a chance your family may not have enough food? Tell what you would do and give reasons.

. You fish for a living. A whale gets tangled in your fishing net. An aquarium has offered to pay you $2000 for the whale. Will you sell it or let it go? Give reasons for your decision.

Put each of the following into the best column.

1. Dinosaurs never became extinct.
2. It rains for three days.
3. The ocean freezes.
4. The ocean gets very salty.
5. There is a big earthquake.
6. There are no more boats on the sea.
7. There is an oil spill.
8. Whales and people could talk with each other.
9. Everyone cared for whales.
10. People never got hungry or cold.
11. Whales were as small as humans.

Column 1
Harmful to whales

Column 2
Helpful to whales

Column 3
No effect on whales

(Contributed by Debbie Piper, Paul Banks Elementary, Homer.)

The Walrus and the Carpenter

The sun was shining on the sea,
Shining with all his might:
He did his very best to make
The billows smooth and bright--
And this was odd, because it was
The middle of the night.

The moon was shining sulkily,
Because she thought the sun
Had got no business to be there
After the day was done--
"It's very rude of him," she said,
"To come and spoil the fun!"

The sea was wet as wet could be,
The sands were dry as dry.
You could not see a cloud, because
No cloud was in the sky:
No birds were flying overhead--
There were no birds to fly.

The Walrus and the Carpenter
Were walking close at hand:
They wept like anything to see
Such quantities of sand:
"If this were only cleared away,"
They said, "it would be grand!"

"If seven maids with seven mops
Swept it for half a year,
Do you suppose," the Walrus said,
"That they could get it clear?"
"I doubt it," said the Carpenter,
And shed a bitter tear.

"O Oysters, come and walk with us!"
The Walrus did beseech.
"A pleasant walk, a pleasant talk,
Along the briny beach:
We cannot do with more than four,
To give a hand to each."

The eldest Oyster looked at him,
But never a word he said:
The eldest Oyster winked his eye,
And shook his heavy head--
Meaning to say he did not choose
To leave the oyster-bed.

But four young oysters hurried up,
All eager for the treat:
Their coats were brushed, their faces washed,
Their shoes were clean and neat--
And this was odd, because, you know,
They hadn't any feet.

Four other Oysters followed them,
And yet another four;
And thick and fast they came at last,
And more, and more, and more--
All hopping through the frothy waves,
And scrambling to the shore.

The Walrus and the Carpenter
Walked on a mile or so,
And then they rested on a rock
Conveniently low:
And all the little Oysters stood
And waited in a row.

"The time has come," the Walrus said,
"To talk of many things:
Of shoes--and ships--and sealing-wax--
Of cabbages--and kings--
And why the sea is boiling hot--
And whether pigs have wings."

"But wait a bit," the Oysters cried,
"Before we have our chat;
For some of us are out of breath,
And all of us are fat!"
"No hurry!" said the Carpenter.
They thanked him much for that.

"A loaf of bread," the Walrus said,
"Is what we chiefly need:
Pepper and vinegar besides
Are very good indeed--
Now, if you're ready, Oysters dear,
We can begin to feed."

"But not on us!" the Oysters cried,
Turning a little blue.
"After such kindness, that would be
A dismal thing to do!"
"The night is fine," the Walrus said
"Do you admire the view?

"It was so kind of you to come!
And you are very nice!"
The Carpenter said nothing but
"Cut us another slice.
I wish you were not quite so deaf--
I've had to ask you twice!"

"It seems a shame," the Walrus said,
"To play them such a trick
After we've brought them out so far,
And made them trot so quick!"
The Carpenter said nothing but
"The butter's spread too thick!"

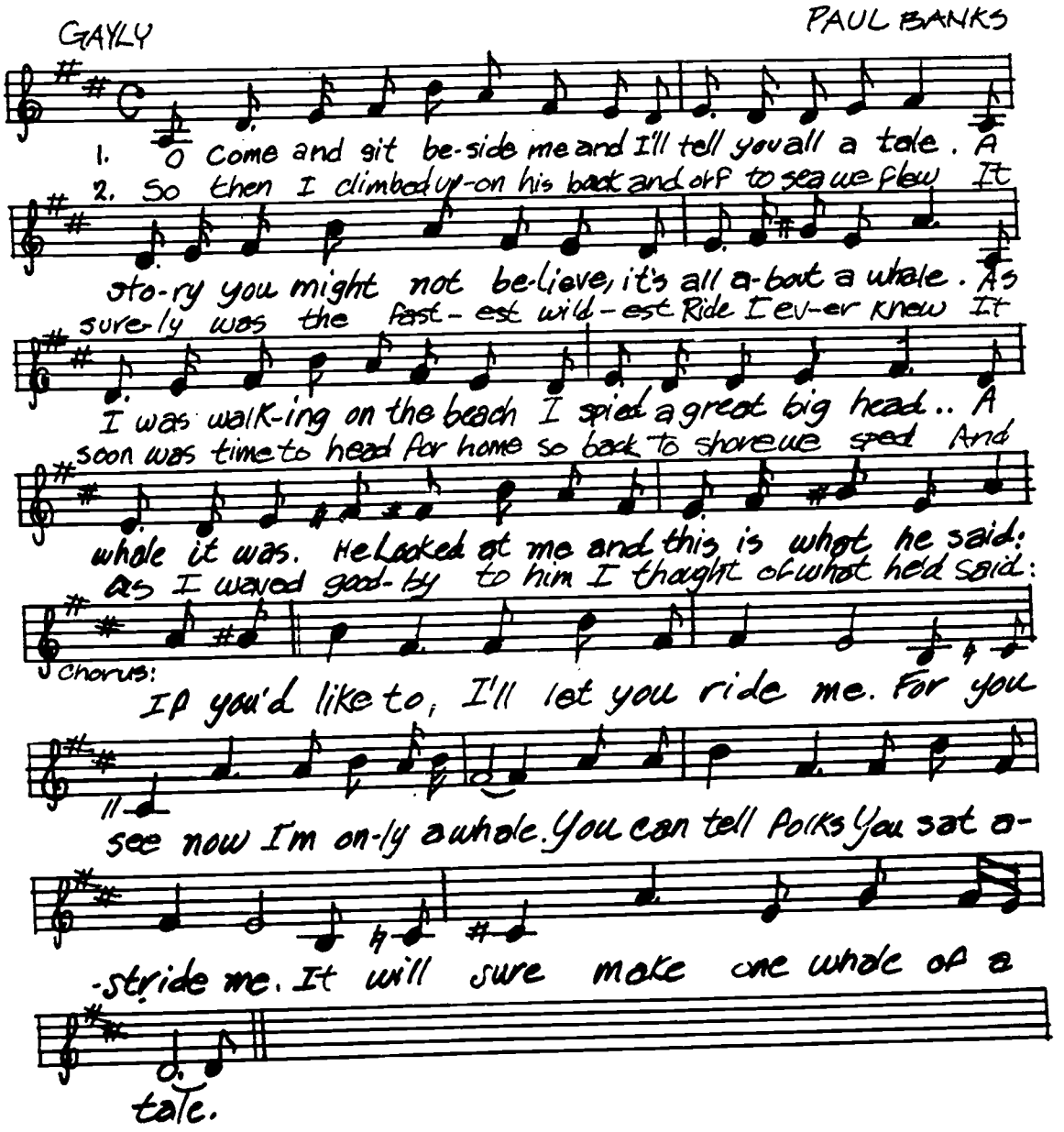
"I weep for you," the Walrus said:
"I deeply sympathize,"
With sobs and tears he sorted out
Those of the largest size,
Holding his pocket-handkerchief
Before his streaming eyes.

"O Oysters," said the Carpenter,
"You've had a pleasant run!
Shall we be trotting home again?"
But answer came there none--
And this was scarcely odd, because
They'd eaten every one.

--Lewis Carroll

THE END

A WHALE OF A TALE



Unit Eight
Freshwater Mammals

Objectives:

To help students:

. Compare and contrast the river otter, beaver, mink and muskrat with each other and with other animals (Activity 1).

. Count different and similar animal tracks found near a freshwater pond or stream (Activity 1).

. Find a stick cut by a beaver (Activity 2).

. Construct a miniature beaver lodge in the classroom (Activity 2).

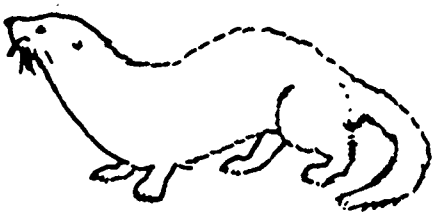
UNIT EIGHT: Freshwater Mammals. Clockwise from lower left: Two beavers, muskrat, river otter, mink.

The mammals making their homes in Alaska's freshwater environment are much like their saltwater relatives. They all breathe air, give birth to live young, which they nurse, have fur or hair and are supported by a backbone. However, freshwater mammals differ from their saltwater counterparts in that they are more amphibious (at home both in the water and on land).

The river otter has a long, slender body, short legs, and scent glands that it uses to mark a territory or to repel enemies. The otter may travel on land between bodies of water. By running and sliding on the snow in winter it can move as fast as 15 miles per hour. In water, it propels itself by flexing its body and using its webbed feet. The river otter eats snails, clams, mussels, sea urchins, insects, crab, octopus, frogs, fish and plants. It is found as far north as the Brooks Range and Point Hope.

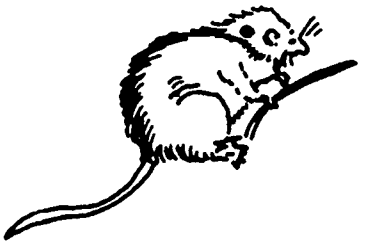
River Otter

Mink are smaller than otters and the hind feet are only slightly webbed. Their fur is dark chocolate brown and they have fuzzy tails. They eat many of the same foods as river otters and are found throughout the state except in the Arctic Slope, Kodiak, and the Aleutian and Bering Sea islands. Mink are equally at home on land or in the water when hunting for food. Their rapid movements contrast with the otter's easy lope.



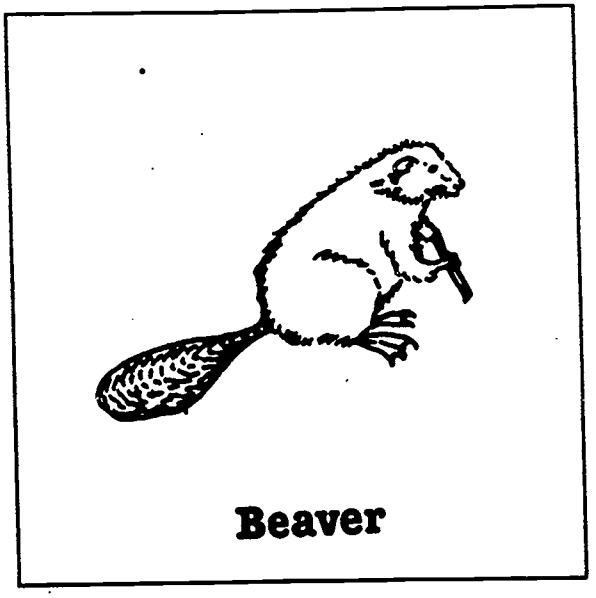
Mink

Muskrats and beavers are related; both are members of the rodent family. The muskrat looks something like a large, plump, furry common rat and is found throughout most of Alaska. Its tail is about 11 inches long and is adapted to an aquatic habitat by being flattened on each side. The muskrat eats lilies, sedges, roots, grasses and other vegetation.



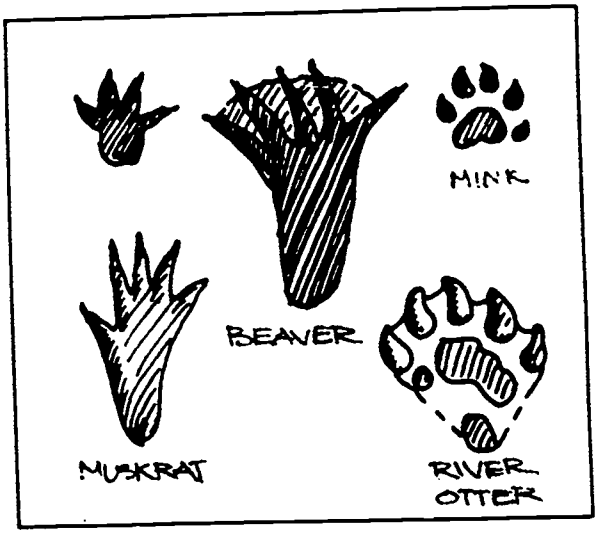
Muskrat

Beavers are the largest rodents in Alaska and range throughout the state's wooded areas. Animal engineers, they are known for their mud and stick dams, which create ponds in which the beavers build their lodges. Beavers eat small twigs and bark of trees and shrubs, and roots and stems of aquatic plants. They are well adapted to their watery environment with their thick, dark brown fur, large webbed feet, nose and ear valves to shut out water, and broad, flat tails.



Beaver

Activity 1
Counting Animal Tracks



Background:

Tracks are one of the most common signs that animals are around. By watching tracks, students can learn to be careful observers, and can figure out not only what kind of animal has visited an area, but what it was doing there. Olaus Murie's Field Guide to Animal Tracks is the classic treatise on tracks and other animal signs.

One of the best places to spot tracks is in the muddy areas around the edges of streams and ponds. The size and shape of tracks and the space length between them are all important for identification. Other clues to identification are habitat, scats (droppings), browse and scent. Burt and Grossenheider's Field Guide to the Mammals provides additional information on identification.

Vocabulary:

- webbed
- mammal (review)

Materials:

- resource materials from library (filmstrips, books, magazines)
- biologists, trappers, hunters, elders from the community who are familiar with freshwater mammals
- copies of track cards
- rulers
- worksheets:
  - ... River Otter (8-A)
  - ... Mink (8-B)
  - ... Muskrat (8-C)
  - ... Beaver (8-D)

Procedure:

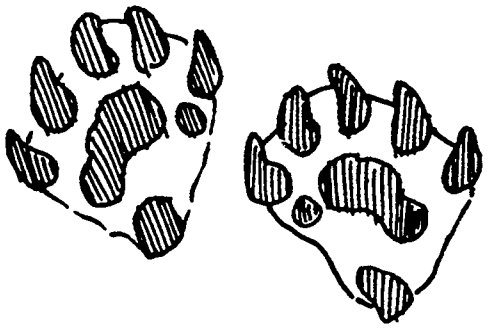
1. Discuss freshwater mammal characteristics and compare them with those of marine mammals.

2. Ask a local expert to help your class with its studies. Use the River Otter, Mink, Muskrat and Beaver worksheets. Both front and hind feet of the river otter are webbed. Beavers have webbed hind feet and muskrats feet are partly webbed, while mink have just a little bit of webbing in their hind feet. Discuss the purpose of webbed feet. Refer to the similarity between a scuba diver's flippers and webbed feet.

3. Take a trip to a freshwater pond or stream near your school to look for tracks. Count the kinds of tracks and measure and record their sizes. Include man-made tracks and bird tracks. If a pond or stream is not available, take a walk around the school, counting various tracks. Make copies of the track cards, first cutting off the labels. Place them around the classroom or school grounds. (Be sure students realize that these tracks are much smaller than normal.)

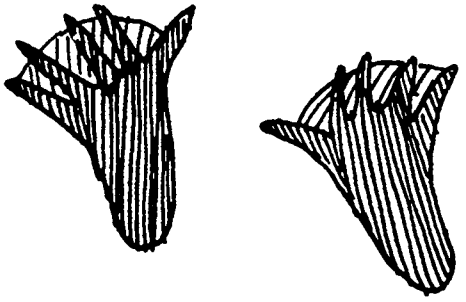
4. Discuss the importance of wetlands habitat (with its interspersion of ponds and streams) to otters, mink, muskrats and beavers. Wetlands are a source of food and shelter for all these animals.

TRACK CARDS



RIVER OTTER TRACKS

DOG TRACKS



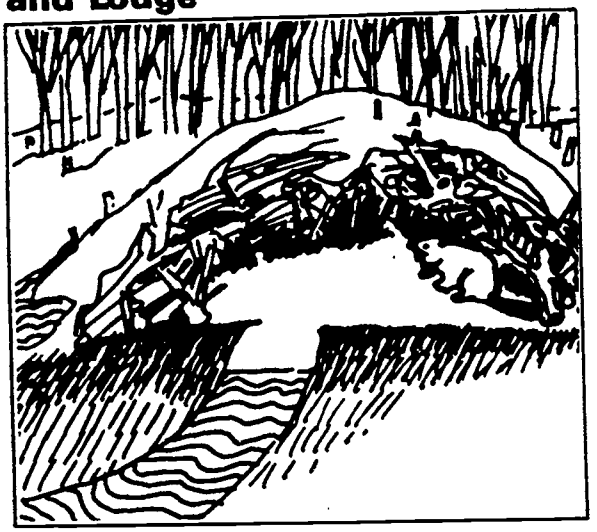
BEAVER TRACKS

PEOPLE TRACKS

MINK TRACKS

MUSKRAT TRACKS

Activity 2
Constructing a Beaver Dam and Lodge



Background:

Beavers have been important to the Alaskan economy for many years. Their pelts provide cash for subsistence hunters, who sell beaver furs to be made into hats and coats. Beaver meat is eaten by people, and is much prized as food for dog teams. Trappers along the Iditarod dog team race route save their beaver carcasses to sell to the racers. Beaver Roundup is a big celebration every year in Dillingham.

Most adult beavers weigh 40 to 70 pounds and live about 10 to 12 years. Their heavy, chestnut brown coats and soft underfur keep them warm. The beaver's nose and ear valves close automatically under water. Their lips are loose and can be drawn tightly behind the protruding teeth, so that the animal can cut and chew wood underwater without getting water in its mouth.

Young beavers (kits) are born from late April through June; they can swim immediately. They stay with their parents for two years, then leave to make their own homes. Life depends primarily on food supply. Beavers eat tree bark, aquatic plants, roots and grasses. When an area is cleared of food, the family migrates.

Abandoned, with no one to maintain its dam, the old beaver pond drains and turns into a meadow. Then trees begin to sprout, and the area eventually becomes a forest. But in the meantime, the pond has provided habitat for a variety of aquatic life and added many nutrients to the soil from feces and silt from upstream, built up behind the dam. (This background material was adapted from the Alaska Department of Fish and Game's Wildlife Notebook Series.)

Materials:

- aquatic plants
- sticks and mud
- water
- large baking sheets (with edges)
- worksheets:
  - ... Water Mysteries (8-E)
  - ... Freshwater Mammal Puzzle (8-F)

Procedure:

1. Take a trip to a local pond or stream to look for beaver signs and old or new lodges and dams. Collect small sticks cut by beavers and note their teeth marks. Collect mud and a few aquatic plants, too. If a pond or stream is not accessible, collect mud and twigs around the school grounds.

2. Back in the classroom, construct a beaver dam and lodge with the sticks, mud and aquatic plants. Use a

cookie sheet or baking pan with edges. Then see if your dam will hold water!

3. Discuss with students how beavers create wetland habitats with their buildings. Their dams flood an area and make more room for fish, water birds, pondweed and moose. Beavers are master engineers, as students will discover when they try to construct a mud dam that holds water. Beavers are fast builders; often, if a hole is knocked out of one of the dams, they can rebuild it overnight.

4. Use the worksheets Water Mysteries and Freshwater Mammal Puzzle as a review of this unit. Water Mysteries is based on actual relationships. Muskrats often use old beaver lodges for dens. Mink eat muskrats. And otters (although it is not mentioned on the worksheet) often tear holes in beaver dams, lowering the water and exposing beavers to predators. In the Freshwater Mammal Puzzle, have students color, cut out, and match the different names and characteristics.

Unit Nine
From Wetlands to the Sea

Objectives:

To help students:

. Define the term "habitat" (Activity 1).

. Understand that all animals need food, water and cover (Activity 1).

. Identify and compare animal and human habitats (Activity 1).

. Imitate different forms of underwater locomotion (Activity 2).

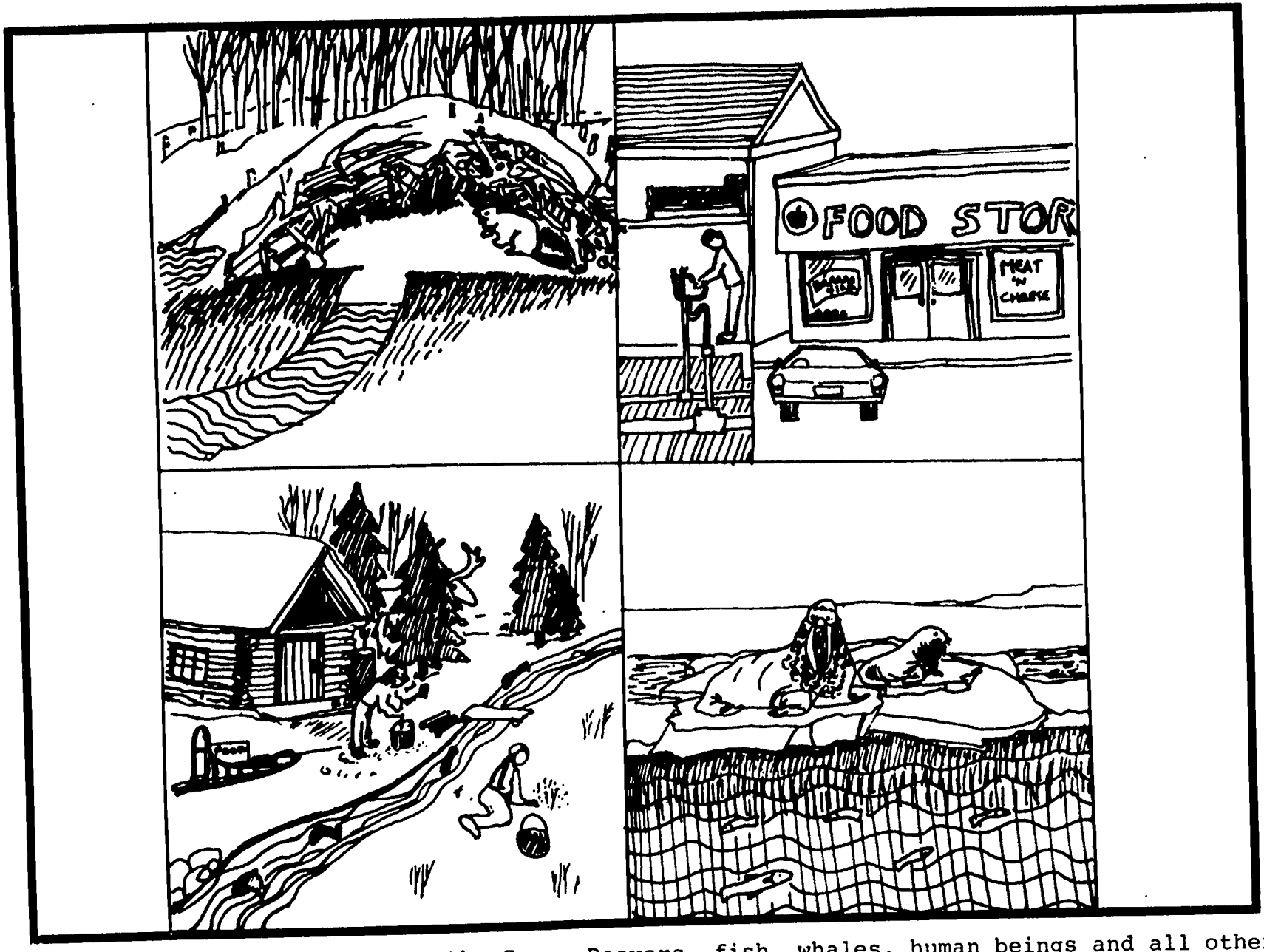
. Place Sea Week food signs on food from the seas, rivers, and wetlands in a local grocery store (Activity 2).

. Draw a mural of local habitats (Activity 3).

. Role play the animals living in a particular habitat (Activity 3).

. Compose and perform a song about local habitats (Activity 3).

. List potential changes and ways people can help care for these animals and their habitats (Activity 3).



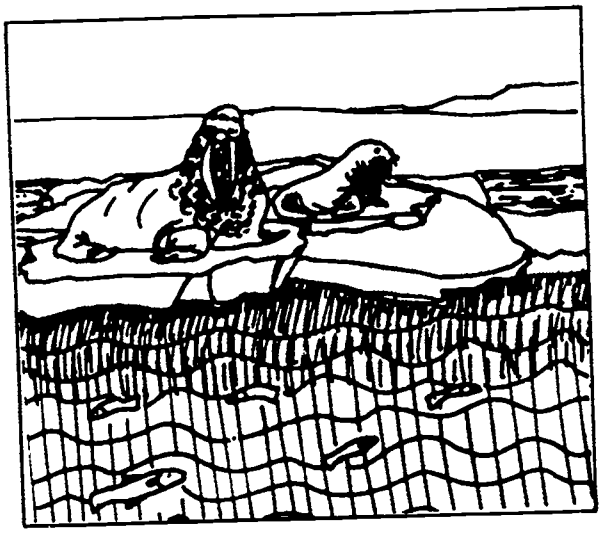
UNIT NINE: From Wetlands to the Sea: Beavers, fish, whales, human beings and all other animals must live in habitat that has the necessary ingredients for life: food, water and cover. Within each type of habitat are concentrations of plants and animals whose lives are closely woven together.

Alaska's water animals live in many different communities within our seas, rivers and wetlands. A community is a group of plant and animal species whose lives are closely woven together so that they are interdependent.

From the ocean to the tundra, each animal inhabits a certain place (called its habitat) that has all the necessary components for life: food, water and cover. The range may be very small, like that of a clam, or very large, like that of a bald eagle, which soars over an entire saltwater marsh, tideland, and adjacent forest to seek food, water and shelter.

Each animal is specifically adapted to its habitat. Water animals breathe oxygen taken from the water and move differently from their relatives on land, since water is denser than air and gives the animals more support.

Activity 1
Aquatic Habitat



Background:

Studying the walrus and beaver, two typical Alaskan aquatic animals, will help students to understand the term "habitat."

The walrus lives in the ocean, primarily along the coasts of the Bering and Chukchi Seas; its habitat is composed of ice floes, rocky islands and the surrounding salt water. Walrus eat clams, other bottom marine life and, occasionally, seals.

Beavers live in wetlands; in fact, they often add to wetland habitat by damming up small streams to form ponds. They live in lodges which they build of sticks, or they burrow into riverbanks. Beavers eat small twigs and bark of willow, alder and poplar trees and are found all over Alaska except for the far northern and western sections of the state.

Vocabulary:

- habitat
- needs

Materials:

- pictures: from Alaskan magazines, calendars or photos
- pencils
- crayons
- paper
- worksheet:
  ... Animal and Human Habitats (9-A)

Procedure:

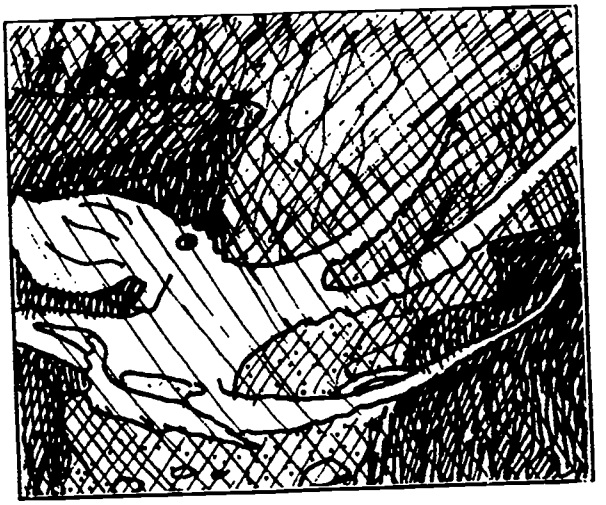
1. Ask students what they like best about the seas, rivers, or wetlands around them.

2. Show pictures of different Alaskan aquatic environments from magazines, calendars, or photos. Explain that these are called "habitats." What animals live in these places, and what do they need for life? (food, water, cover).

3. Use the worksheet Animal and Human Habitats to compare walrus, beaver, and human habitats. What does each species eat? Where does each live? Color water blue, food yellow, and cover (space or shelter) red in each of the three worksheets. Which animal needs the most water, the most food and the most cover? Which animal makes the most changes in its habitat? List the good things and the bad things that result from these changes.

5. Have the class choose another aquatic animal and draw its habitat.

Activity 2
Swimming in an Underwater World



Background:

Seals, sea lions, walrus, beavers, mink and muskrats breathe through mouths and noses as we do, and must come to the water's surface for air. Whales and porpoises breathe through a special blowhole on the top of their heads. The blowhole opens when the animal surfaces; old air is expelled and fresh breath is drawn in. Fish, however, use their gills to "breathe" oxygen out of the water that is constantly moving over their gills.

Movement in the water is quite varied:

- Fish move through the water by flexing their tails from side to side. Fins help them to keep their balance and sometimes to move in special ways.

- Whales and porpoises flex their bodies and move their flukes (tails) up and down when they swim.

- Sea lions, otters and seals flex their bodies or use their powerful forelimbs to propel themselves.

- Beavers, otters, muskrats, frogs and toads use webs between their feet to help them swim.

- Crabs walk over the sea floor as if on tiptoe. The pointed tips of their legs help keep them poised and yet ready to run and escape if the need arises.

- Sponges, anemones, mussels and barnacles anchor themselves firmly to the sea floor. Water currents cannot dislodge them, but instead bring the animals a steady supply of plankton and drifting organic debris for food.

- Clams and worms may burrow deep into the sea floor. This gives them protection and keeps them from being moved about by currents.

- Scallops, jellyfish, octopi and leeches use various techniques to move through the water:
  Scallops clap the valves of their shells together.
  Jellyfish cause their bells to pulsate.
  Octopi can spread the webs located between their arms for gliding, or they can jet away by expelling water from their siphons. Like sea stars or urchins, they also use suction discs to move over the sea floor. These discs let them hold on tight so that they won't be dislodged by strong currents.
  Leeches loop through the open water by alternately stretching and shortening their segmented bodies. They also have head suckers that they use to move along in inchworm style.

Vocabulary:

- breathe
- gill
- move
- blowhole
- fluke
- webbed feet

Materials:

Large space indoors or outdoors where students can move freely.

Procedure:

1. Prepare the children for an undersea voyage. Ask them to imagine water moving around them and to imagine what they would see underwater.

2. Pretend that you are various undersea animals. Pretend to breathe, move and eat like those animals. What are your needs? What is your habitat like?

   Use the teacher background material for ideas. This activity should be a good review of animals studied in previous units. If students have further questions about the animals, have them look up the answers in the library, or ask their parents.

3. Have each student pick a sea animal to imitate and see if the others can guess its identity.

Activity 3
Look at Your Habitat

Background:

Streams flow into rivers on their way to the sea. Lakes and ponds occasionally interrupt the faster current of the stream and river water. Along the banks of these water systems are wetlands of one kind or another: wet tundra, marshes, tidelands, river deltas, bogs, swamps, or muskegs. Practically all of Alaska is wetland except for the mountains and upland forests. Throughout this book, the students have been studying the animals that live in wetland habitats. Now is the chance to apply their knowledge to their own locality.

Materials:

- scissors
- butcher paper
- felt-tip markers
- paper
- crayons
- worksheet
  ... Invertebrate or Vertebrate? (9-B)

Procedure:

1. Review with the children the different animals that they have studied. Distribute the worksheet Invertebrate or Vertebrate?. Have the students color the animals, then cut out and separate them into two piles: invertebrates (anemones, insects, sea stars, crabs, leechs, clams, snails) and vertebrates (beavers, frogs, whales, birds, seals, fishes, otters).

2. Go over the different aquatic habitats in which these animals live (ocean, river, wetlands). Make a list of the different types of habitat found locally (mudflats, rocky intertidal, marsh, river, open ocean, lake, muskeg, tundra), and the different animals in each. Talk about the importance of each area. What kinds of habitat support human recreation, jobs, water for drinking or transportation, clothing? What food comes from each area?

3. Make Sea Week food signs. Take them to the grocery store and put them on all the food that comes from the sea, rivers, or wetlands. (Suggested by Jan Kecklove, Craig Elementary, Craig.)

4. Make a large class mural of different habitats and the animals in each. Divide the class into small groups, and have each work on a section of the mural.

5. Then make up a song to go with your mural. Use "Old MacDonald had a Farm" or a similar model.

"In Alaska we have a (name a habitat)

E-i-e-i-o

Or try "Row, Row Your Boat."
"Row, row, row your boat
Gently (across the ocean,)
Merrily, merrily, merrily, merrily,
(Don't forget the motion!)

(Songs suggested by Lynn Fry, Weller Elementary, Fairbanks.)

6. Ask students what would happen to them if there were changes in these habitats. Discuss earthquakes, floods, forest fires, roads, housing developments and gas stations. Some of these changes are natural (earthquakes, floods, forest fires), but others occur as Alaska grows and develops. Some animals such as gulls and ravens have adapted to living near humans. But others, such as bears and moose, have trouble adapting.

7. What can people do to help care for these animals and their habitats? (Some ideas: taking care when walking through areas populated by animals not to disturb their "living room"; not killing more than is needed for food or clothing; not polluting the animal's water, air or land; not using more of the animal's land than needed; picking up litter and keeping the wildlands clean.)

8. Later, have each group pick one kind of habitat and role play the animals living in it. Let the other students guess which kind of habitat they are imitating. The children can add drama by imagining a natural or human change occurring in their habitat and showing the animals' reaction.

9. As a finale, invite parents or another class to look at your mural and to watch your habitat plays. See if they can guess what animals you are imitating. Sing your song for them!

Bibliography

Compiled by Belle Mickelson, Peggy Cowan, Mary Lou King, Nancy Barr and Dr. Earl Clark, associate professor, University of Alaska, Juneau, and his students Joyce M. Roloff, Linda Edmondson, Patricia Muchnick, Dan Penrose, Chris Winter, and Tom Castagnola.

Selections from the following annotated bibliographies are included in this volume. Consult these excellent sources for additional suggestions for Sea Week books.

Bagnall, Norma. Sea Sources, Texas A&M Sea Grant College Program, Texas A&M University, College Station, TX 77843, 1981. 187 p.

Currier, Janice A. Skiff and Shore: A Teacher's Guide to Fisheries Education Materials. Alaska Native Foundation Fisheries Program, 411 West Fourth Avenue, Anchorage, AK 99501.

Florida 4-H Department Marine Library Book List, Florida Marine Program. 17 p.

Institute of Marine Science List of Technical Reports and Occasional Publications, IMS Publications Department, University of Alaska, Fairbanks, AK 99701.

Lee, Richard S. and F.F. Wright. Bibliography of Marine Teaching Materials. Marine Advisory Program, Cooperative Extension Service, University of Alaska, Anchorage, AK 99504. 1976. 40 p.

A List of Books on the Marine Environment for Children and for Young People. Project Coast, 310 Willard Hall Education Building, University of Delaware, Newark, Delaware. 1971.

Publications Directory, University of Alaska Sea Grant College Program, 590 University Avenue, Suite 102, Fairbanks, AK 99701. 1984.

UNITS 1, 2 and 3: INTRODUCTION TO MARINE INVERTEBRATES, MARINE INVERTEBRATE SPECIES AND BEACH FIELD STUDIES

Children's Literature

Angel, Heather. Life on the Sea Shore. Illustrated by Richard Hook and John Sibbeck. MacMillan Education, Morristown, N.J., 1976. 23 p.

Gorgeous illustrations of seashore animals in their varied seashore habitats.

Asimov, Isaac. ABC's of the Ocean. Walker and Co., New York, 1970. 48 p.

Alphabet book with marine subjects. Carefully and accurately done, with photographs and black-and-white drawings.

Beauregard, Sue and Jill Fairchild. Ocean Animals and Ocean Floor Animals. Sea Library Series. Cypress Press, Glendale, Calif., 1977. 32 p.

Simple, informative, large-print narrative with photographs.

Behrens, June. Look at the Sea Animals. Childrens Press, Chicago, 1975. 40 p.

Instructive, easy text provides the distinguishing characteristics of creatures including starfish, sponges, octopi and dolphins. Colorful, page-size photographs accompany text.

Bendick, Jeanne. Exploring an Ocean Tide Pool. Garrard Publishing Co., Champaign, Ill., 1976. 69 p.

Describes tidepool life and interrelationships. Includes line drawings, photographs and an index.

Buck, Margaret Waring. Along the Seashore. Abingdon Press, New York, 1964. 72 p.

A simple seashore encyclopedia, using line drawings for identification. Covers plants, invertebrates, fish and birds.

Carrick, Carol. Lost in the Storm. Illustrated by Donald Carrick. Seabury Press, New York, 1979. 32 p.

Description of two youngsters' day at the beach in a well-done text with pictures.

Cartwright, Sally. Sand. Illustrated by Don Madden. Coward, McCann and Geoghegan, New York, 1975. 31 p.

Picture book providing information on the characteristics of sand. Entertaining cartoon illustrations. Includes projects using sand.

Cartwright, Sally. The Tide. Illustrated by Marilyn Miller. Coward, McCann and Geoghegan, New York, 1970. 46 p.

Explains tides, spring tides, neap tides and their causes. Illustrated with diagrams.

D'Ahilo, Anthony. Seashore Life Coloring Book. Dover Publishing Co., 1973. 47 p.

Pictures of ocean creatures from around the world, including Alaska.

Dos Santos, Joyce Audy. Sand Dollar, Sand Dollar. J.B. Lippincott, Philadelphia, 1980. 32 p.

Peter and his dog Urchin spend a day at the beach building a castle, exploring the shoreline and contemplating the magic in the sand dollar.

Garlick, May. Down to the Beach. Illustrated by Barbara Cooney. Four Winds Press, New York, 1973. 42 p.

A gentle, lyrical book describing a day at the beach. Children discover waves, tides, tidepools, shells, crabs, boats, buoys and a foghorn. Beautiful watercolor illustrations.

Golding, Augusta. The Sunlit Sea. Illustrated by Paul Galdone. Thomas Y. Crowell Co., New York, 1968. 33 p.

Interdependence and the food chain are the themes. Presents sealife including vegetation and animals. Simple illustrations and vocabulary highlighted with capital letters.

Holling, Holling Clancy. Pagoo. Illustrated by the author and Lucille Webster Holling. Houghton Mifflin Co., Boston, 1957. 87 p.

Pagoo the hermit crab, with his life and adventures set off by beautiful illustrations. Accurate information about Pagoo and his marine neighbors. Engrossing narrative.

Huntington, Harriet E. Let's Go to the Seashore. Doubleday and Co., New York, 1941. 89 p.

Included in the American Library Association's list of 1,000 basic books for elementary school libraries. Photographs of marine animals and an informative text.

Hurd, Edith T. Starfish. Thomas Y. Crowell Co., New York, 1962. 40 p.

A Let's Read and Find Out book with brief, careful explanations of life cycles, feeding habits and regeneration. Fascinating two-color illustrations.

Kinney, Jean. What Does the Tide Do? Illustrated by Cle Kinney. Young Scott Books, New York, 1966. 36 p.

The tide rises and recedes as a boy fishes from a wharf, observing the exposed marine animals. Causes of tides are explained.

Komin, Marine W. The Beach Before Breakfast. Illustrated by Leonard Weisgard. G.P. Putnam's Sons, New York, 1964. 47 p.

Sensitive account of the relationship between father and son as they explore a beach, observing life there while digging for clams. Simple beach scene illustrations set the mood.

Lasky, Kathryn. My Island Grandma. Illustrated by Emily McCully. Frederick Warne and Co., New York, 1979. 32 p.

This account of a summer by the sea will charm readers of any age.

List, Ilka K. Grandma's Beach Surprise. Illustrated by Ruth Sanderson. G.P. Putnam's Sons, New York, 1975. 47 p.

Father and daughter explore a beach, looking for treasures for the child's grandmother, learning about their finds. Illustrations set a serene mood.

List, Ilka K. Questions and Answers About Seashore Life. Four Winds Press, New York, 1970. 123 p.

Answers to questions about common marine invertebrates, with attractive woodcuts.

MacDonald, Golden. The Little Island. Illustrated by Leonard Weisgard. Doubleday and Co., Garden City, New York, 1946. 40 p.

The seasonal cycle of life on and around a small ocean island, explained in simple text, with captivating illustrations. Weisgard won a Caldecott award for this book.

McClung, Robert M. Sea Star. William Morrow and Co., New York, 1975. 48 p.

Life cycle of the star fish is described through adventures. Large print and illustrations.

Morse, Doug. The Sea Book. Illustrated by Joel Snyder. Storyfold, Newbury, Mass., 1974.

Combination of a mural and foldout story. Colored pictures on one side with the text, black-and-white illustrations with facts and activity ideas on the reverse side.

Myers, Arthur. Sea Creatures Do Amazing Things. Illustrated by Jean Day Zallinger. Random House, New York, 1981. 70 p.

Descriptions of clams, anemones, octopi, crabs and sea urchins. Illustrated with blue line drawings. A "step-up" book.

Peet, Bill. Kermit the Hermit. Houghton Mifflin Co., Boston, 1965. 48 p.

Detailed drawings contribute to this rhyme about a hermit crab and the effects of a young boy's kindness.

Pittman, Al. Down by Jim Long's Stage -- Rhymes for Children and Young Fish. Illustrated by Dan Hall. Breakwater Books, Portugal Course, Newfoundland. 1976.

Creative, illustrated nonsense rhymes about sea creatures.

Rinkoff, Barbara. No Pushing, No Dunking: Safety in the Water. Lothrop, Lee and Shepard Books, New York, 1974. 40 p.

Two children swim, fish and go boating while learning about water safety and the dangers of water. Color illustrations.

Russ, Lavina. Alec's Sand Castle. Illustrated by James Stevenson. Harper and Row, New York, 1972. 30 p.

Picture book story of Alec's use of mind-over-matter when grown-ups take over his sand castle.

Schultz, Charles M. Snoopy's Facts and Fun Book about Seashores. Random House, New York, 1980. 33 p.

Combines humor and facts in portraying the seashore environment.

The Sea World Alphabet Book. Sea World Press, San Diego, Calif., 1979. 32 p.

Features one-page sea photos together with couplets like, "B is for Beluga, one kind of whale, that's all white as snow from its head to its tail."

Selsam, Millicent E. and Joyce Hunt. A First Look at Animals without Backbones. Illustrated by Harriet Springer. Walker and Co., New York, 1976. 32 p.

Delineates vertebrates and the major groups of invertebrates in clear and simple manner. Emphasis is placed on observation skills.

Selsam, Millicent E. Animals of the Sea. Illustrated by John Hamberger. Four Winds Press, New York, 1975. 40 p.

Clear explanations of the ocean food chain and different animals' part in it. Color illustrations integrated into the text.

Selsam, Millicent. Sea Along the Shore. Illustrated by Leonard Weisgart, Harper and Row, New York, 1961. 50 p.

Answers often-asked questions about the seashore, in text and with colorful illustrations. Explains the origin of sand and why the sea is salty; discusses tides, tracks, shells and insects.

Shepard, Elizabeth. Tracks Between the Tides. Lothrop, Lee and Shepard Books, New York, 1972. 95 p.

Discussion of tracks left on the sand and the animals that make them. Written for the East Coast, but also includes animal groups represented in Alaska.

Silverstein, Alvina and Virginia. A Star in the Sea. Illustrated by Symean Shomin. Frederick Warne and Co., New York, 1969. 40 p.

The life of a sea star from conception on. Explained accurately and enhanced with beautiful illustrations.

Smith, Boyd. The Seashore Book. Houghton Mifflin Co., Boston, 1912.

Classic children's text with outstanding illustrations.

Tresselt, Alvin. Hide and Seek Fog. Illustrated by Roger Duvosin, Lothrop, Lee and Shepard Books, New York, 1965. 32 p.

Lovely watercolor paintings lend a mystical, magical quality to this story.

Tyler, J. The Children's Book of the Seas. Usborne Publishing, London, 1976. 32 p.

Quality introduction to oceans, accompanied by attractive and interesting illustrations.

Vasiliu, Mirea. A Day at the Beach. Random House, New York, 1977. 30 p.

Show-and-tell format gives cursory information on plants and animals found on the beach.

Vevers, Gwynne. Life in the Sea. Illustrated by Barry Driscoll. McGraw-Hill Book Co., New York, 1965. 32 p.

Introduces sea life through an outline discussion of topics including tides, pools, shores, animals, food chains and aquariums.

Waters, John F. A Jelly Fish Is Not A Fish. Thomas Y. Crowell Co., New York, 1974. 34 p.

Careful description augmented by good illustrations describes a jelly-fish.

Teacher's Reference:

Abbott, R. Tucker. Seashells of North America. Golden Field Guide series. Golden Press, New York, 1968. 280 p.

Describes shell species for purposes of identification. Color drawings. Includes general background information on shells.

Abbott, R. and H.S. Zim. Seashells of the World. Golden Press, New York, 1962.

Well-illustrated guide to the most common shells of the world.

Amos, W.H. The Life of the Seashore. McGraw-Hill Book Co., New York, 1966. 231 p.

Stresses ecological relationships, includes color photos and line drawings of marine life. One of the Our Living World of Nature series developed in cooperation with The World Book Encyclopedia.

Ayres, J. and D. McLachlan. Field book of Pacific Northwest Sea Creatures. Naturegraph Publishers, Happy Camp, Calif., 1979. 208 p.

Explains similiarities and differences between classes and phyla of shallow-water sea creatures. Presents species in photos and text.

Barr, Lou and Nancy. Under Alaskan Seas: The Shallow Water Marine Invertebrates Alaska Northwest Publishing Co., Anchorage, 1983. 208 p.

Specific to Alaskan waters, this book is the perfect complement to the Sea Week Curriculum Series. Its excellent photos are supplemented by descriptive text that includes species descriptions, ranges and natural history.

Brown, Joseph E. Wonders of a Kelp Forest. Dodd, Mead and Co., New York, 1974. 80 p.

Discusses the classification of invertebrates by describing life in kelp beds.

Brown, Vinson. Exploring Pacific Coast Tide Pools. Photographs by Ernest Braum. Naturegraph Publishers, Happy Camp, Calif., 1966. 56 p.

Narrative text brings interest to marine life. Deals with rocky tidepools. Photos of specimens and illustrated list in back helpful for identification.

Brusca, Gary J. and Richard C. Brusca. Drawings by Sue Macias. A Naturalist's Seashore Guide: Common Marine Life of the Northern California Coast and Adjacent Shores. Mad River Press, Inc., Eureka, Calif., 1978. 205 p.

Excellent introductory section on intertidal ecology. Good glossary. Black-and-white line drawings. Many of the particular species, however, do not occur in Alaska.

Buchsbaum, R. Animals Without Backbones. University of Chicago Press, Chicago, 1948. 405 p.

Clearly written, well-illustrated, elementary college text on invertebrate animals.

Calvin, J. and H. Ricketts. Between Pacific Tides. (1948). 4th Ed. Stanford University Press, Stanford, 1968. 614 p.

In-depth descriptions of various shore types and their invertebrate inhabitants. Photographs and line drawings.

Campbell, A.C. The Wonderful World of Life in the Sea. The Hamlyn Publishing Group, New York, 1978. 96 p.

Large picture format covering seashore animals and plants, shallow seas, coral reefs, open seas, deep seas. Many color photographs.

Carefoot, T. Pacific Seashores. University of Washington Press, Seattle, 1977. 208 p.

Excellent introduction to intertidal ecology. Easy to read and profusely illustrated. Covers mariculture, marine pollution and sand dunes.

Carl, George C. Guide to Marine Life of British Columbia. British Columbia Provincial Museum, Victoria, Canada, 1978.

Includes a variety of information on seashore animals, including birds and fish. Line drawing illustrations.

Carson, Rachel. The Sea Around Us. Oxford University Press, New York, 1951. 230 p.

Clearly written and informative, enjoyable reading. Provides a comprehensive look at the sea.

Cornwall, Ira E. Barnacles of British Columbia. British Provincial Museum, Victoria, B.C., 1955. 69 p.

Everything you ever wanted to know about barnacles. One of the British Columbia Provincial Museum of Natural History handbooks.

Crowley, Walt. The Seattle Aquarium Guide to Life in the Sea. Seattle Aquarium, Seattle, 1981. 79 p.

Ecological relationships and scientific concepts explained, using color photos and drawings.

Duggins, David and James Quinn. The Intertidal Life of Bartlett Cove: Glacier Bay National Monument, Gustavus, Alaska. U.S. Dept. of the Interior, Washington, 1979. 38 p.

Guide to intertidal life. Easy to understand with good line drawings.

Ellis, Davud W. and L. Swan. Teaching of the Tides: Uses of Marine Invertebrates by the Manhousat People. Theytus Books (76A Bastion Street, Nanaimo, B.C., Canada V9R 3A1), 1981. 118 p.

Ethnozoology of Native Indians from the west coast of Vancouver Island.

Engel, Leonard and the Editors of Time-Life Books. The Sea. Time-Life Books, Alexandria, Va., 1979. 128 p.

Many color drawings and a few photographs complement the text, which overviews oceanography, invertebrates, sharks, marine mammals, and man and the sea's future.

Field, Edward, ed. and trans. Eskimo Songs and Stories. Illustrated by Kiakshuk and Pudlo. Delacorte, New York, 1973. 102 p.

Songs and stories portray daily life and beliefs of the Netsilik Eskimos. Collected by Knud Rasmussen on the fifth Thule expedition.

Flora, C.J. The Sound and the Sea: A Guide to Northwestern Neritic Invertebrate Zoology. Washington State Dept. of Printing, Olympia, 1977. 474 p.

Species-by-species description of seashore animals. Black-and-white photographs of nearly every species make this volume easy to use as a field guide.

Friese, J. Erich. Marine Invertebrates. TFH Publications, Neptune, N.J., 1967.

Beautifully illustrated book describing all types of marine invertebrates.

Furlong, Margorie and Virginia Pill. Starfish: Guide to Identification and Methods of Preserving. 2nd Ed. Ellison, Edmonds, Wash., 1973. 104 p.

Includes species from Alaska to Mexico; also includes Hawaii. Color illustrations of each species in dried condition.

Graham, Ada. Foxtails, Ferns and Fishscales: A Handbook of Art and Nature Projects. Illustrated by Dorothea Stoke. Four Winds Press, New York, 1976. 128 p.

Botanical information provided with suggestions for decorative crafts made from natural materials. Includes sand painting, driftwood mobiles, and leaf and fish prints.

Harbo, Rick M. Tidepool and Reef: Marine Life Guide to the Pacific Northwest Coast. Hancock, House Publishers, Vancouver, B.C., 1980. 55 p.

Descriptions and beautiful color photographs.

Hoyt, John H. Field Guide to Beaches. Houghton Mifflin Co., Boston, 1971. 46 p.

Discusses tides, currents, sand, and beach geology. Line drawings.

Kohns, Bernice. The Beachcomber's Book. Illustrated by Arabelle Wheatley. The Viking Press, New York, 1970. 96 p.

Filled with ideas on crafts, identification of collections, recipes, and identification of common shells and seaweeds.

Kozloff, Eugene N. Seashore Life of Puget Sound, the Strait of Georgia, and the San Juan Archipelago. University of Washington Press, Seattle, 1974. 282 p.

Delightful reading, excellent source of information. Clear color plates and line drawings.

Langstaff, Nancy and John. Jim Along, Josie: A Collection of Folk Songs and Singing Games for Young Children. Illustrated by Jon Pienkowski. Harcourt Brace Jovanovich, New York, 1970. 128 p.

Collection of folk songs includes sea chanties and ballads such as "Who Built the Ark," "Bobby Shaftoe," "The Jackfish," "The Allee-Allee-O," and "Floating Down the River."

MacGinitie, G.E. and N. MacGinitie. Natural History of Marine Animals. McGraw-Hill Book Co., 1949.

Engagingly written college text on West Coast invertebrates and their interrelationships. Full of interesting facts.

McDonald, Gary R. and James W. Nybakken. Guide to the Nudibranchs of California: Including Most Species Found From Alaska to Oregon. American Malacologists (P.O. Box 2255, Melbourne, FL 32401), 1980. 72 p.

Excellent color plates and thorough coverage.

Morris, Robert H., Donald P. Abbott, and Eugene Haderlic, eds. Intertidal Invertebrates of California. Stanford University Press, Stanford, 1980. 690 p.

Encyclopedic coverage of marine invertebrates of Pacific waters. Thirty-three scientists writing on their specialties. Nearly 1,000 photos of marine habitats, animals and anatomical details.

Morris, Percy A. A Field Guide to Shells. Houghton Mifflin Co., Boston, 1966. 297 p.

Identification of mollusks of the Atlantic and Pacific coasts and Hawaii.

Niesen, Thomas M. The Marine Biology Coloring Book. Illustrated by Wynn Kupit and Lauren Hanson. Barnes and Noble Books, Harper and Row, New York, 1982. 96 p.

Ninety-six detailed plates illustrate marine biology concepts and structure of marine life. In-depth coverage of marine biology presented in the text.

Ricketts, Edward F. and Jack Calvin. Between Pacific Tides; An Account of the Habits and Habitats of Some Five Hundred of the Common, Conspicuous Seashore Invertebrates of the Pacific Coast Betwen Sitka, Alaska and Northern Mexico., 4th Ed. Stanford University Press, Stanford, 1968. 614 p.

Weather information on species and ecology, organized according to habitat type.

Robinson, Gayle. Beach Animals. Erco (P.O. Box 91648, Tacoma, WA 98491), 1974. 27 p.

Handy pocket picture book of Pacific Northwest marine invertebrates, written especially for elementary school teachers.

Ross, Arnold. Wonders of Barnacles. Dodd, Mead and Co., New York, 1974. 78 p.

Informative and easily converted for student comprehension.

Selsam, Millicent E. Underwater Zoos. Illustrated by Kathleen Elgin. William Morrow and Co., 1961. 96 p.

Appropriate animals, plants and water conditions for building and maintaining fresh and saltwater aquariums. Simple drawings.

Smith, L.S. Living Shores of the Pacific Northwest. Pacific Search Press, Seattle, 1976. 149 p.

Description of marine shore habitats and their inhabitants. Illustrated with color and black-and-white photographs. Includes a simple picture key and tables showing intertidal distribution of the different species.

Snively, Gloria. Exploring the Seashore in British Columbia, Washington and Oregon: A Guide tc Shorebirds and Intertidal Plants and Animals. The Writing Works, Mercer Island, Wash., 1978. 240 p.

Lucidly describes a variety of seashore organisms. Organized by habitat. Illustrated with line drawings and color photographs.

Texas A and M University Sea Grant College Program. Fairy Tales of the Sea. College Station, Tex., 1981.

These Eskimo, Indian, African, Asian and European stories illustrate perceptions of the sea throughout the world. A separate teacher's guide suggests activities for incorporating the tales into the classroom.

Zim, Herbert S. and Lester Ingle. Seashores. Golden Pocket guide. Golden Press, New York, 1955. 160 p.

A handbook for exploring the ecology of any shore. Classification charts and color illustrations aid in identification.

Recordings:

Sounds of the Sea. No. 3 of Droll Yankees Seaport Series. 33 RPM, LP by Droll Yankees, 1962.

Sea sounds, from boats and ports to wind and waves.

UNIT 4: FRESHWATER INVERTEBRATES

Children's Literature:

Carrick, Donald and Carol. The Pond. MacMillan Co., New York, 1970. 33 p.

Watercolors portray pondlife in style of oriental silkscreens. Brief, poetic text.

Crosby, Alexander L. Pondlife. Illustrated by Jean Zallinger. Garrard Publishing Co., New York, 1964. 64 p.

Depicts the birth of a pond and its inhabitants. Separate chapters on insects, frogs, fish, herons, muskrats and others.

Faber, Norma. Small Wonders. Illustrated by Kazue Mizumura. Coward, McCann and Geoghegan, New York, 1979. 31 p.

Poems celebrating small things. Beautiful imagery. Includes freshwater and saltwater topics.

Robinson, Carmelia K., Gordon E. Burks and Irving Leitmar. Life in a Pond. Illustrated by Marjorie Hartwell. Golden Press, New York, 1967. 28 p.

Labels a pond's living things, from insects and snails to fish and birds. Simple text.

Seuss, Dr. McElligot's Pool. Random House, New York, 1947. 56 p.

Fanciful rhyme moves reader from a small meadow pond to a stream and finally into the sea.

Teacher's Reference:

Amos, William H. The Life of the Pond. McGraw-Hill Book Co., New York, 1967.

Stresses ecological relationships with many color photos and line drawings. One of the Our Living World of Nature series developed in cooperation with the World Book Encyclopedia.

The Audubon Nature Encyclopedia, Vol. 8. "Ponds." Curtis Publishing Co., New York, 1965. pp. 155-1563.

Describes the living community patterns of ponds. Clear, brief definitions and explanations.

Cooper, Elizabeth K. Science on the Shores and Banks. Harcourt, Brace and World, New York, 1960. 187 p.

Useful guide for observing, gathering and studying a variety of plants and animals in shallow, fresh and salt waters.

Furlong, Marjorie and Virginia Pill. Edible? Incredible! Pondlife. Nature-graph Publishers, Happy Camps, Calif., 1972. 95 p.

Photographs and text describes pondlife and how to prepare as food. Helpful hints on where to find species.

Klots, E.B. A New Field Book of Freshwater Life. G.P. Putnam and Sons, New York, 1966.

Excellent descriptions and line drawings of a wide variety of wetland plants and animals. Stresses invertebrates.

Reid, G.K. Pondlife. Golden Nature Guide series. Golden Press, New York, 1967. 160 p.

The best pocket guide to life in and around ponds and streams. Packed with color drawings.

Sisson, Edith A. Nature With Children of All Ages. Prentice-Hall, Englewood Cliffs, N.J., 1982. 195 p.

Teaching tips and activities on plants, seeds, trees, invertebrates, fish, amphibians, birds and mammals. Overall guidelines for taking children into the out-of-doors as well as step-by-step plans on specific topics.

Snow, John O. Secrets of Ponds and Lakes. Guy Garrett Publishing Co., Portland, Maine, 1982. 94 p.

Interesting facts and stories written for the East Coast but also applicable to Alaska. Author an avid naturalist and high school biology teacher. Illustrated with line drawings and black-and-white photographs.

UNIT 5: FISH

Children's Literature:

Beauregard, Sue and Jill Fairchild. Open Ocean Fish and Coral Reef Fish. Cypress Press, Mankato, Minn., 1977. 32 p.

Sea Library series. Photographs illustrate simple, informative, large-print narrative.

Figdor, George and Barbara Figdor. Salmon Fishing. State of Alaska Dept. of Education, Educational Program Support Section, Juneau, 1978. 48 p.

Excellent photographic illustrations and creative text explaining what is involved in commercial salmon fishing.

Goffstein, M.B. Fish for Supper. Dial Press, New York, 1976. 31 p.

Grandmother's day fishing from 5 a.m. breakfast to cooking the fish for dinner. Charming, simple text accompanied by Caldecott honor illustrations.

Lionni, Leo. Fish is Fish. Pantheon Books, New York, 1970. 32 p.

A fish imagines the world outside the pond as described by a frog. Engaging illustrations.

Lionni, Leo. Swimmy. Pantheon Books, New York, 1968. 28 p.

Swimmy, the sole survivor of a tuna's predation on his school, searches the ocean for another school. His search discovers many wonders of the ocean and the realities of predation. Interpreted in enchanting watercolors.

McGovern, Ann. Sharks. Illustrated by Murray Tinkelman. Four Winds Press, New York, 1976. 47 p.

Easy-to-read text explains basic information about sharks.

Phleger, Fred. Red Tag Comes Back. Illustrated by Arnold Lobel. Harper and Row, New York, 1961. 64 p.

Fictional life of a salmon tagged by a scientist. An Easy to Read book.

Selsam, Millicent E. A First Look at Fish. Illustrated by Harriet Springer. Walker and Co., New York, 1972. 32 p.

See-and-do book teaches similarities and differences between several kinds of fish.

Shaw, Evelyn. Fish Out of School. Illustrated by Ralph Carpentier. Harper and Row, New York, 1970. 60 p.

Behavior of fish schools and underwater life woven into story of a herring lost from its school. A nicely illustrated I Can Read book.

Spizzirri, Linda ed. An Educational Coloring Book of Fish, An Educational Coloring Book of Prehistoric Fish, An Educational Coloring Book of Sharks. Spizzirri Publishing Co., Medinah, Ill., 1981.

Full-page pictures of animals in underwater settings. Facing pages provide information in outline format.

Walcott, Patty. Tuna Fish Sandwiches. Addison-Wesley, Reading, Mass. 2 p.

Attractive illustrations. Ten words engagingly explain an ocean food chain, with humans as the ultimate users.

Waters, John F. Hungry Sharks. Illustrated by Ann Dalton. Thomas Y. Crowell Co., New York, 1973. 33 p.

Sharks' eating habits, sensory perceptions, and eating instincts simply explained. Mood-setting illustrations.

Waterton, Betty. A Salmon for Simon. Illustrated by Ann Blades. Antheneum, New York, 1980. 27 p.

Simon tries to return a salmon, dropped into a tidepool by an eagle, to the sea. His endeavors introduce the reader to various features of the ocean environment.

Wheeler, Alwyne. Fishes. Usborne Publishing, London, 1982. 24 p.

Superb descriptions of fish and their adaptations. Gorgeous color drawings, simple story line.

Teachers Reference:

Alaska Geographic Society (Box 4-EEE, Anchorage, AK 99509). Vol. 10, No. 3, 1983, Alaska's Salmon Fisheries. Jim Reardon, ed.

Excellent description of Alaska's salmon fisheries. Many photographs.

Alaska Sport Fish Identification Handbook. Alaska Dept. of Fish and Game (free from Public Communications Section, P.O. Box 3-2000, Juneau, AK 99801).

Explains basic fish anatomy and how to identify common fresh and salt-water sport fish. Includes line drawings and weight information.

Alaska Wildlife Notebook Series. Alaska Dept. of Fish and Game, Juneau. 1980. (free)

Portfolio of 60 one-page sheets on fish and other animal species. Excellent line drawings and range maps.

Browning, Robert J. Fisheries of the North Pacific: History, Species, Gear and Processes. Alaska Northwest Publishing Co., Anchorage, 1974. 408 p.

Good overview of all aspects of commercial fishing in the North Pacific. Covers Alaska commercial fishing species, vessels and gear, as well as fisheries management, processing and marketing.

Childerhose, R.J. and M. Trim. Pacific Salmon and Steelhead Trout. University of Washington Press, Seattle, 1979. 158 p.

Large picture-book format detailing salmon species, life cycles, hatchery techniques and pollution problems. Color photos.

Commercial Fish Species of the Pacific West Coast and Alaska. Alaska Fisheries Development Foundation, Anchorage. 1982. 56 p.

Fact-filled booklet with beautiful water colors of fish species, line drawings of fishing gear, and range maps. Written in English, French, German, Spanish and Japanese.

Cooperative Extension Service, University of Alaska, Fairbanks, AK 99701.

P-468	Easy Steps for Canning Salmon (12 p.)
P-24	Pickling Fish (4 p.)
P-25	Smelt (4 p.)
P-26	To Salt Fish (2 p.)
P-27	The Fisherman Returns (67 p.) (cookbook)
P-128	Pressure Canning Alaska Fish at Home
P-229	All About Alaskan Clams (2 p.)
P-040	Hypothermia - Cold Blooded Killer (26 p.)

Useful pamphlets on fish and fishing.

Davis, J. Charles. Fish Cookery. A.S. Barnes and Co., South Brunswick, N.J., 1967. 226 p.

A surprising collection that, in addition to good advice on standard fish cooking, gives many interesting and exotic recipes. If you bring anything home from fishing--from an octopus to a whale--this will tell you how to prepare it.

Dennon, Jerry. The Salmon Cookbook. Pacific Search Press, Seattle, 1978. 127 p.

In addition to giving many delicious recipes, this book discusses cooking and cleaning techniques, and goes into the history, spawning and migration patterns of salmon. Highlighted with pen and ink drawings.

Hart, John L. Pacific Fishes of Canada. Bulletin 180, Fisheries Research Board of Canada, Ottawa, 1973. 740 p.

Best reference available for Alaska saltwater fish. Detailed species descriptions and illustrations.

Hartman, Wilbur L. Alaska's Fishery Resources: The Sockeye Salmon. Fishery Leaflet 636, U.S. Dept. of Commerce, National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Seattle, 1971. 8 p.

Presents information on the life history and management of the sockeye salmon. Contains a good graphic of the salmon's life cycle.

Lynch, Kathleen. Fishwheels and How to Build Them. Illustrated by the author. Adult Literacy Lab, Anchorage Community College (2533 Providence Avenue, Anchorage, AK 99504), 1979. 45 p.

Excellent description of fishwheels. Large print with ample illustrations.

Meltzer, Michael. The World of the Small Commercial Fishermen: Their Lives and Their Boats. Dover Publications, New York, 1980. 88 p.

Describes the life histories and harvesting methods for Pacific salmon, New England lobster, cod, halibut, whitefish, tuna, menhaden, mollusks and crustaceans. Includes some first-person narratives. Chapters on fishing vessels, fishing gear, and ethnic fishing communities. Many good photographs, engravings and drawings.

Morrow, James E. Freshwater Fishes of Alaska. Alaska Northwest Publishing Co., Anchorage, 1980. 248 p.

Describes distinctive characteristics, range, abundance, and habits of freshwater species and their importance to humans. Includes line drawings and maps of the range of each species in Alaska, plus a selection of color photographs.

Morrow, James E. Illustrated Keys to the Freshwater Fishes of Alaska. Alaska Northwest Publishing Co., Anchorage, 1974. 78 p.

Handy field guide. Line drawings and brief descriptions.

Reid, Gerald M. Alaska's Fishery Resources: The Pacific Herring. U.S. Dept. of Commerce, National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Seattle (for sale by the Superintendent of Documents, U.S. Government Printing Office, Washington, DC 20402).

Good source of information on the life cycle, biological characteristics, and population dynamics of herring as well as on the commercial herring industry itself. Lacks information, however, on the Bering Sea herring fisheries.

Scott, William B. and E.J. Crossman. Freshwater Fishes of Canada. Bulletin 184, Fisheries Research Board of Canada, Ottawa, Canada, 1973. 966 p.

Detailed descriptions and line drawings of fish and their ranges (includes Alaska).

Stewart, Hilary. Indian Fishing: Early Methods on the Northwest Coast. University of Washington Press, Seattle, 1977. 188 p.

Numerous superb line drawings and photographs accompany text on the life of the people of the Northwest coast. Describes the use of hooks, lures, and floats, spears and harpoons, nets, traps and weirs; methods of cooking and preserving fish; songs, customs, and ceremonies.

Periodicals, Posters and Games:

Alaska Fish Tales and Game Trails, Alaska Dept. of Fish and Game (quarterly, free upon request to Public Communications Section, P.O. Box 3-2000, Juneau, AK 99801).

Game Fishes of Alaska. (Division of Sport Fish, P.O. Box 3-2000, Juneau, AK 99801.)

Colorful poster of many of the freshwater fishes of Alaska, including salmon.

Marine Fishes of the North Pacific (Stock no. 003-020-00051-7) and Mollusks and Crustaceans of the Coastal U.S. (Available from the Superintendent of Documents, U.S. Government Printing Office, Washington, DC 20402 - Stock No. 003-020-00087-8).

Large, beautiful color posters depicting these animals in their habitats.

Marine Life Posters. Alaska Sea Grant College Program, University of Alaska, Fairbanks, AK 99701.

Blue-and-white line drawings of the life cycles of king crab, ocean perch, Pacific halibut, pink shrimp, and scallop.

National Bilingual Materials Development Center, University of Alaska (2223 Spenard Road, Anchorage, AK 99503).

Sets of 11" x 17" posters on fish and crustaceans, and bilingual books on a variety of topics.

Salmon Game. Western Education Development Group, University of British Columbia, Vancouver, Canada V6T 1W5.

Board game based on the salmon life cycle.

Salmon Kit, Alaska State Museum (Pouch FM, Juneau, AK 99811).

Salmon Legends. Alaska State Museum, Juneau.

Legends include "Nakani Stealing Fish" from Ingalik Mental Culture by Cornelius Osgood; "Red Stone Shaman Brings Back the Salmon" from Ingalik Social Culture by Cornelius Osgood; "Moldy End," Haida legend adapted from The Wolf and Raven: Totem Poles of Southeastern Alaska, by Viola Garfield and Linn Forrest; "The Prince Who Was Taken Away by the Salmon People," from Once Upon a Totem by Christie Harris; and "Coyote Helped the People" from Indian Legends of the Pacific Northwest by Ella E. Clark.

Salmon Posters. B.C. Wildlife Federation (5659 176th St., Surrey, BC V3S 4C5).

Full-color 18" x 21" posters of the five Pacific salmon species and steelhead.

Sharks of the World. National Geographic Society (17th and M Streets NW, Washington, DC 20036).

Source of a shark chart and a shark filmstrip.

Splash! National Park Service (709 W. 9th Street, Juneau, AK 99801).

Game on folding sheet of heavy 17'x22" paper that focuses on the hazards to migrating salmon. (Also available is a coloring book, Life of the Salmon, on the same topic.)

UNIT 6: AMPHIBIANS

Children's Literature:

Blassingame, Wyatt. Wonders of Frogs and Toads. Dodd, Mead and Co., New York, 1975. 80 p.

Descriptions of frogs and toads. Life cycles and categories of frogs explained in text and photographs.

Chenery, Janet. The Toad Hunt. Illustrated by Ben Shecter, Harper and Row, New York, 1967. 64 p.

Easy-to-read narrative about two little boys in their garden discovering frogs, toads and salamanders.

Hawes, Judy. Why Frogs are Wet. Illustrated by Don Madden. Thomas Y. Crowell Co., New York, 1968. 35 p.

Topics include variations in kind, size, ancestry, reproduction, growth and hibernation. A Let's Read and Find Out book, illustrated with vitality and humor.

Kepes, Juliet. Frogs Merry. Pantheon Books, New York, 1961. 28 p.

Light-hearted story discusses the interactions of pond life. Lively illustrations recreate a pond atmosphere.

Potter, Beatrix. The Tale of Jeremy Fisher. Dover, New York, 1974. 60 p.

The adventures of Jeremy the frog are chronicled in this classic, finely illustrated story.

Selsam, Millicent E. and Joyce Hunt. A First Look at Frogs, Toads and Salamanders. Illustrated by Harriet Springer. Walker and Co., New York, 1976. 32 p.

Classification of amphibians and distinguishing characteristics portrayed in clear text and simple drawings. Puzzles and matching game included.

Zim, Herbert S. Frogs and Toads. Illustrated by Joy Buba. William Morrow and Co., New York, 1950. 65 p.

Engaging storybook narrative provides information on eating, mating, sleeping and protection. Simple drawings and easily understood text.

Teacher's Reference:

See Unit 3 - pond references

Hodge, Robert P. Amphibians and Reptiles in Alaska, the Yukon and Northwest Territories. Alaska NW Publishing Co., Anchorage, 1976. 89 p.

Natural history and guide to identification. Range maps, photos and drawings.

Recordings:

Voices of the Night: The Calls of 34 Frogs and Toads of the United States of America. Produced by Peter Paul Kellogs and Arthur Allen. Houghton Mifflin Co., Boston.

One croak after another.

UNIT 7: MARINE MAMMALS

Children's Literature:

Armor, Buris. Bully the Blue Whale. Illustrated by John Mack. Criterion Books, New York, 1964. 76 p.

Yearly cycle of blue whale. Information on size, food habits, predation by killer whale and humans.

Armour, Richard. Sea Full of Whales. Illustrated by Paul Galdone. McGraw-Hill Book Co., New York, 1974.

Humorous poems entertain and convey facts about blue, killer, humpback, finback, right, pilot and sperm whales, narwhals, dolphins and porpoises. Charming sketches.

Behrens, June. Whale Watch. Children's Press, Chicago, 1978. 32 p.

California schoolchildren on a whale watch learn about the habits and environment of the grey whales. National Geographic photos illustrate this easy reader picture book.

Benchley, Nathaniel. The Several Tricks of Edgar Dolphin. Harper and Row Publishers, New York, 1970. 63 p.

Edgar's curiosity and cleverness get him captured by men aboard a ship, and also leads to his escape. Funny, lively tale.

Bradey, Irene. Elephants on the Beach. Charles Scribner's Sons, New York, 1979.

Sketches and observations of a bull-elephant seal, his harem and calves. Done with warmth, humor and realistic details.

Bridge, Linda McCarter. The Playful Dolphins. Photos by Lowell George. National Geographic Society, 1976. 33 p.

Glorious color photographs and simple text.

Compere, Mickie. Dolphins. Illustrated by Irma Wilde. Viking Press, New York, 1967. 39 p.

Appealing and simple information on dolphin habits.

Conklin, Gladys. Journey of the Grey Whales. Illustrated by Leonard Fisher. Holiday House, New York, 1977. 39 p.

Follows the activities of a whale and her calf, from birth through migration, from Mexico to the Bering Sea.

Darling, Louis. Seals and Walruses. William Morrow and Co., New York, 1955. 63 p.

Describes the lifestyles and habits of seals and walruses, and explains measures to protect them.

Davidson, Margaret. Dolphins! Illustrated by Irene Wilde. Four Winds Press, New York, 1964. 48 p.

Text for beginning readers. Many monochrome illustrations depict the life of the dolphin.

Fisher, Ronald M. Namu. Books for Young Explorers. National Geographic Society, Washington, 1973. 32 p.

True story of a killer whale caught in a fishing net and of its subsequent life in an aquarium. Photographs and simple text.

Goudey, Alice. Here Come the Dolphins. Illustrated by Garry MacKenzie. Charles Scribner Sons, New York, 1961. 94 p.

Dramatic presentation of scientific information. Details the way dolphins are trained. Accurate and lively drawings.

Hoff, Sydney. Walpole. Harper and Row, New York, 1977. 32 p.

The biggest walrus in the herd would rather play with baby walruses than be a leader. An Early I Can Read book.

Hurd, Edith. The Mother Whale. Illustrated by Clement Hurd. Little Brown and Co., Boston, 1972. 32 p.

Simple and precise language describes the cycle of mating, birth, and raising offspring. Illustrated with charming block prints.

Johnson, William Weber. The Story of Sea Otters. Random House, New York, 1973. 89 p.

A history of the sea otter and the fur trade. Includes background on otter habits.

Kavaler, Lucy. Life Battles Cold. John Day Co., New York, 1973. 160 p.

This discussion of the adaptations of animals, man and microbes to cold climates includes survival information and hibernation research.

Kaufman, John. Animal Travelers. Greenwillow Books, New York, 1977. 55 p.

This read-aloud book describes the migration of grey whales, as well as caribou, barn swallows, painted lady butterflies, etc.

King, Patricia. Mabel the Whale. Follett Publishing Co., Chicago, 1958. 27 p.

Short, simple, true-life account of a whale's capture and its subsequent life at Marineland.

Kipling, Rudyard. How the Whale got his Throat. Illustrated by Don Madden. Addison-Wesley Reading, Mass., 1972. 30 p.

A wise and resourceful man keeps the whale from devouring all the fish in the sea. This is one of Kipling's classic Just So Stories, available in many different editions.

Lauber, Patricia. Sea Otters and Seaweed. Garrard Publishing Co., Champaign, Ill., 1976. 64 p.

Life history of the sea otter, and ecology of its kelp-bed home. Illustrated with photographs.

Marko, Katherine. Whales: Giants of the Sea. Abingdon, Nashville, 1980.

Simple, scientific information on whales.

McCloskey, Robert. Burt Dow, Deep-Water Ma[illegible]. Viking Press, New York, 1963. 63 p.

Old sea salt catches a whale by the tail and winds up in its stomach. Tale of boats, the ocean and marine life.

McDearmon, Kay. A Day in the Life of a Sea Otter. Dodd, Mead and Co., New York, 1973. 44 p.

A female sea otter's day nurturing of her offspring, searching for food, and escaping from a killer whale is followed. Illustrated with photographs.

McDearmon, Kay. Polar Bear. Dodd, Mead and Co., New York, 1976. 46 p.

Life cycle and habitat of the polar bear described in story form. Illustrated with black-and-white photographs.

McDearmon, Kay. The Walrus: Giant of the Arctic Ice. Dodd, Mead and Co., New York, 1974. 45 p.

Follows the life of a female walrus and her calf. Good for sharing with the class.

McGovern, Ann. Little Whale. Illustrated by John Hamberger. Four Winds Press, New York, 1979. 43 p.

Describes the life of a humpback whale from birth to adulthood. Includes a glossary of whale words and a note about the danger of whale extinction. Attractive illustrations in earth tones.

Mites, Miska. Otter in the Cove. Illustrated by John Schoenberr. Little, Brown and Co., Boston, 1974. 47 p.

A fisherman wants to destroy otters because they eat fish and abalone. His daughter wants to save them.

Morris, Robert A. Dolphin. Illustrated by Mamoru Funai. Harper and Row, New York, 1975. 62 p.

Birth and growth of a dolphin focuses on nurturing by the mother and protection by the pod. Sensitive drawings illustrate this Science I Can Read book.

National Geographic Society. Amazing Animals of the Sea: Marine Mammals. Washington, D.C., 1981. 104 p.

Discusses the characteristics and habits of the whale, dolphin, manatee, sea otter, sea lion, seal and other marine mammals. Beautiful photographs illustrate text, which is accompanied by a classroom activities folder that includes puzzles, games, worksheets and related activities.

Overbeck, Cynthia. Splash the Dolphins. Carolrhoda Books, Minneapolis, Minn., 1976.

Brief facts about dolphins and their habits. Translated from French, illustrated with photographs.

Phleger, Fred. The Whales Go By. Random House, 1954. 62 p.

An I Can Read beginner book about the life history of the gray whale.

Pluckrose, Henry, ed. Whales. Gloucester Press, New York, 1974. 28 p.

Simple text describes whales and dolphins. Color illustrations.

Roy, Ronald. A Thousand Pails of Water. Illustrated by Vo-Dinh Mai. Alfred A. Knopf, New York, 1978.

The son of a Japanese fisherman does not understand why his father kills whales. He sets about trying to save a beached whale by keeping the whale wet until the tide returns. Pencil and wash illustrations.

Selsam, Millicent. A First Look at Whales. Illustrated by Harriett Springer. Walker and Co., New York, 1980. 32 p.

Classification, general attributes and distinguishing characteristics of whales and fish. Text and black-and-white drawings encourage observation.

Alaska Wildlife Notebook Series. Alaska Dept. of Fish and Game, Juneau.

Excellent descriptions of Alaskan animals, including marine mammals. Includes feeding habits, range, life histories. Illustrated with line drawings. Accompanied by teacher's activity units.

Daugherty, Amita E. Marine Mammals of California. California Dept. of Fish and Game, Sacramento, 1972. 91 p.

Excellent pocket-sized paperback that describes each species. Illustrated with line drawings and a few photographs.

Dozier, Thomas A. Whales and Other Sea Mammals. Time-Life Films, 1977. 128 p.

Picture-book format, with beautiful color photos. Text based on the television series "Wild, Wild World of Animals."

Ellis, Richard. The Book of Whales. Alfred A. Knopf, New York, 1980. 202 p.

Comprehensive coverage of whale species worldwide. Large format with line drawings and color paintings.

Haky, Delphine, ed. Marine Mammals of Eastern North Pacific and Arctic Waters. Pacific Search Press, Seattle, 1978. 256 p.

Written by 21 marine mammal authorities for general audiences. Includes photos, line drawings, and distribution maps.

Kelly, John. The Great Whale Book. The Center for Environmental Education, Acropolis Books, Wash., D.C., 1981. 116 p.

A good synopsis of the whale species and their status.

Laycock, George. Beyond the Arctic Circle. Four Winds Press, New York, 1978. 116 p.

Describes northern animals, Arctic regions, Alaska development, and Eskimo life.

Lewin, Ted. World Within a World - Pribilofs. Dodd, Mead and Co., New York, 1980. 76 p.

Describes animals of the Pribilof Islands with emphasis on seals.

McIntyre, Joan. Mind in the Waters: a Book to Celebrate the Consciousness of Whales and Dolphins. Charles Scribner's Sons, New York, 1974. 240 p.

Covers topics ranging from myths to brain anatomy to the International Whaling Commission.

Shaw, Evelyn. Sea Otters. Illustrations by Cherryl Pape. Harper and Row, New York, 1980. 64 p.

An I Can Read book on how a mother sea otter takes care of her baby pup and teaches him to be independent. Examines eating, sleeping and protection. Illustrations of animals and kelp-bed home in blue, gold and gray.

Spizzirri, Linda, ed. An Educational Coloring Book of Whales. Spizzirri Publishing Co., Medinah, Ill., 1981.

Full-page pictures of whales in their environments. Facing pages provide outline information.

Steig, William. Amos and Boris. Puffin Books, New York, 1977. 32 p.

Story of how two fellow mammals, a whale and a mouse, come to each other's rescue.

Strange, Florence. Rock-A-Bye Whale. Manzanita Press, Rafael, Calif., 1977. 32 p.

Baby humpback's birth and first few days of life. Learning stages and struggles detailed in text accompanied by monoprints.

Waters, John F. Seal Hunter. Frederick Warne and Co., New York, 1973. 47 p.

A boy in Maine observes and learns about harbor seals.

Waters, John F. Some Mammals Live in the Sea. Dodd, Mead and Co., New York, 1972. 96 p.

Clear, concise text and black-and-white photographs examine habits of sea mammals including seals, otters, and dolphins.

Winnick, Karen B. Sandra's Dolphin. William Morrow and Co., New York, 1980. 56 p.

An easy reader based on an old folk tale from the Mediterranean. A boy's life is saved by a young dolphin.

Teacher's Reference:

Alaska Whales and Whaling. Alaska Geographic Society, Anchorage, AK. Vol. 5, No. 4., 1978. 143 p.

Species-by-species accounts of Alaska whales and whaling history. Photographs, drawings and range maps complement the text.

Schad, Marsha C. A Field Guide to the Marine Mammals of Alaska. National Marine Fisheries Service (P.O. Box 1668, Juneau, AK 99802), July 1978.

Informative pamphlet with brief descriptions and simple line drawings.

Simon, Seymour, Life on Ice: How Animals Survive in the Arctic. F. Watts, New York, 1976. 65 p.

Survival of arctic animals despite extreme weather conditions and human threats.

Storehouse, Bernard. Animals of the Arctic; The Ecology of the Far North. Holt, Rinehart and Winston, New York, 1971. 172 p.

Story of northern ecology. More than 200 color plates of Arctic animals, past and present.

Charts and Records:

Buffy the Sea Otter and Baleena the Blue Whale. Whale Gifts, Center for Environmental Education (2100 M Street, N.W., Washington, DC 20037).

Tapes and accompanying 16-page children's book.

Callings. Produced by Paul Winter. Two records and booklet of photos, narrative, and background on each species.

Traces the mythic journey of a sea lion pup that encounters other marine mammals. The animal's voice mingles with Winter's music.

Deep Voices: The Second Whale Record.

Includes two entirely new humpback songs, plus right and blue whale sounds.

Marine Mammals of the Western Hemisphere. National Oceanic and Atmospheric Administration. (Available from the Superintendent of Documents, U.S. Government Printing Office, Washington, DC 20402 - Stock no. 003-020-00087-8).

Marine mammal chart with full-color scale drawings of whales, dolphins, and seals.

Ocean of Song: Whale Voices

Features a variety of unique songs, ocean waves, sea birds.

Songs of the Humpback Whales. Produced by Roger and Katy Payne. Capitol ST 620, 1970.

Classic recording of the great range and variety of humpback communications.

Whales and Nightingales, "Farewell to Tarwathie," by Judy Collins, Elektra, 1970.

Haunting musical combination of whale sounds and lyrics.

UNIT 8: FRESHWATER MAMMALS

Children's Literature:

Allen, Laura Jean. Ottie and the Star. Harper and Row, New York. 32 p.

An Early I Can Read book about a river otter and his search for a star.

Cork, Barbara. Wild Animals. Usborne First Nature Books, Hayes Books, Tulsa, Okla., 1982. 24 p.

Charming and scientifically accurate portrayal of mammals, their lives, and their distinguishing characteristics. Text interspersed with appealing drawings.

Freschet, Berniece. Year on Muskrat Marsh. Illustrated by Peter Parnall. Charles Scribner Sons, New York, 1974. 56 p.

A chronicle of the marshlands. The rhythm of the changing seasons and their effect on the marsh inhabitants.

Grahame, Kenneth. The Wind in the Willows. The Heritage Press, New York, 1966. 190 p.

Classic children's tale first published in 1908 describes the riverside adventures of Mole, Toad, Water Rat and friends.

Harris, Lorle. Biography of a River Otter. Illustrated by Ruth Kirschner. G.P. Putnam's Sons, New York, 1978. 62 p.

Easy-to-read book describes habits and behavior of a mother otter and her babies in their first year of life.

Kingsley, Charles. The Water Babies: A Fairy Tale for a Land-Baby. Henry Alterns Co., Philadelphia. 284 p.

Classic of children's literature tells story of Tom, an over-worked chimney sweep in England, who becomes a water baby in an enchanted undersea world.

McClung, Robert M. Animals that Build Their Homes. National Geographic Society, Washington, D.C., 1976.

Beavers are examined along with crabs, sticklebacks, flamingos and other home building animals. Basic text and color photographs.

Miles, Miska. Beaver Moon. Little, Brown and Co., Boston, 1978. 31 p.

Survival is the theme of this story of an old beaver's flight from his former lodge. Pond community including bobcat, bear and muskrat also introduced.

Schwartz, Elizabeth and Charles. When the Water Animals are Babies. Illustrated by Charles Schwartz, Holiday House, New York, 1970. 33 p.

Babies and their care described. Illustrations show natural habitats of animals that either live in water or depend on water for food--including muskrat, loon, octopus and manatee.

Tresselt, Alvin. The Beaver Pond. Illustration by Roger Duvosin. Lothrop, Lee and Shepard, New York, 1970. 32 p.

Simple, poetic description follows construction of beaver pond and interdependence of animals.

Teacher's Reference:

Alaska Wildlife Notebook Series. Alaska Dept. of Fish and Game, Juneau.

Descriptions of Alaska animals; includes games based on lives of freshwater-related animals such as as beaver, muskrat, river otter, moose. Provides feeding habits, range, life histories. Illustrated with line drawings. Accompanied by teacher's activity units.

Burt, W.H. A Field Guide to the Mammals. Peterson Field Guide series. Houghton Mifflin Co., Boston, 1964. 284 p.

Excellent descriptions, pictures, and range maps of mammal species found north of Mexico.

Murie, Olaus J. A Field Guide to Animal Tracks. Peterson Field Guide series. Houghton Mifflin Co., Boston, 1975. 375 p.

Describes tracks and other animal signs. Fascinating stories, many of which take place in Alaska. Illustrated by line drawings.

UNIT 9: FROM WETLANDS TO THE SEA

Teacher's Reference:

British Museum of Natural History. Nature at Work. British Museum, London, 1978. 84 p.

Exquisitely illustrated book explaining ecological concepts and habitats.

Headstrom, Richard. Adventures with Freshwater Animals. Illustrated by the author. Dover Publications, New York, 1964. 217 p.

An adult helps a child on 47 adventures to a nearby pond or stream. Written for the Lower 48, but includes many Alaska animals.

Horwitz, E.L. Our Nations Wetlands. An Interagency Task For Report, 1978. 70 p. (Available from the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402 - Stock No. 041-011-0045-9).

Describes various types of wetlands and their importance nationally. Many photos and drawings.

Iker, Sam. Look What We've Done to Our Wetlands. National Wildlife, June-July 1982. Vol. 20. 4 p.

Describes wetland importance and losses nationwide. Color photographs.

Niering, William A. The Life of the Marsh. McGraw-Hill Book Co., New York, 1966. 232 p.

Stresses ecological relationships. Color photos and fine-line drawings. One of our Living World of Nature Series developed in cooperation with The World Book Encyclopedia.

Updegraff, Imelda and Robert. Rivers and Lakes. Puffin Books, Penguin Books, New York, 1980. 24 p.

Explains basic concepts of rivers, lakes, glaciers, in large print on colorful pages. Gives worldwide examples and includes a few activity ideas. Lists only advantages of dams.

Updegraff, Imelda and Robert. Seas and Oceans. Puffin Books, Penguin Books, New York, 1980. 24 p.

Explains basic concepts of seas, oceans, and sea ice, in large print on colorful pages. Gives worldwide examples and includes a few activity ideas.

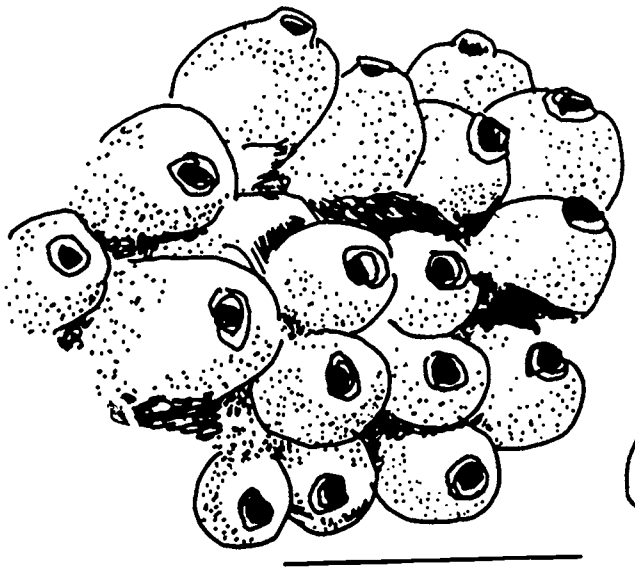
Usinger, Robert L. The Life of Rivers and Streams. McGraw-Hill Book Co., New York, 1967. 232 p.

Stresses ecological relationships. Color photos and fine-line drawings. One of our Living World of Nature Series developed in cooperation with The World Book Encyclopedia.

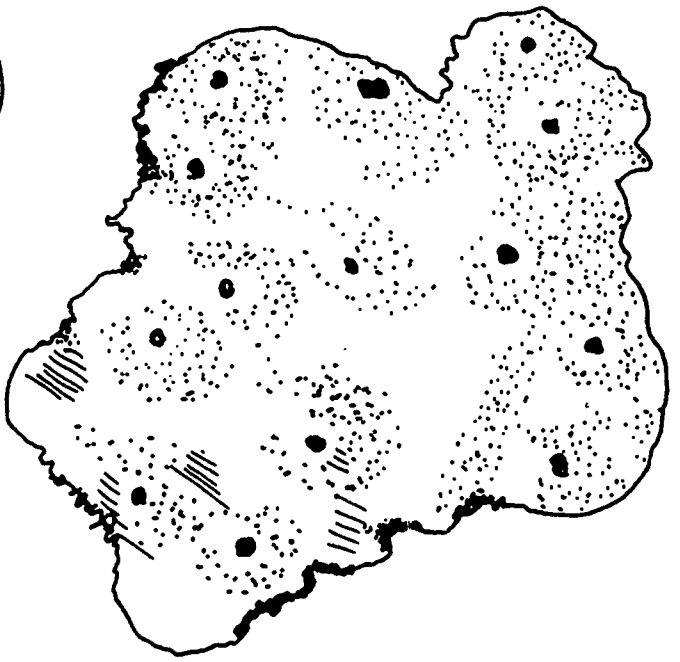
Name: _____ 2A

Guess what I am?

I am an animal.
I live in the ocean.
I cannot move.
I have no head or tail or legs.
I can be yellow or red or orange or purple.
When I am alive I am soft.
I feel gritty.
What am I?



Color this _____ purple.

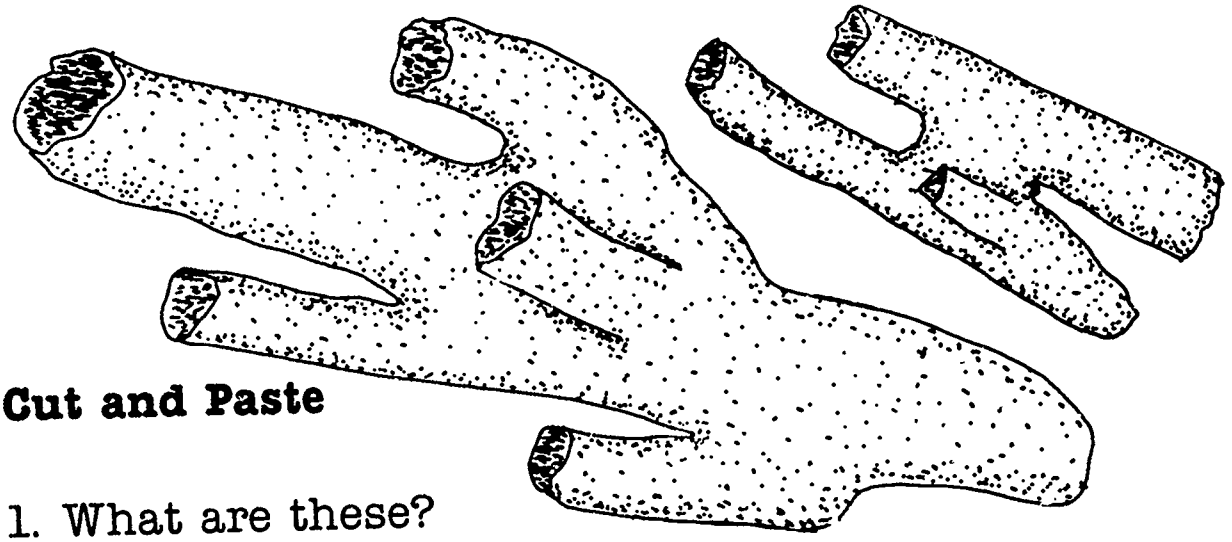


Color this _____ red.

2B _____

Name _____

The Cut and Paste Sponge Story



Cut and Paste

1. What are these?

_____

2. Are they animals?

_____

3. Where do they live?

_____

4. What moves through the tiny openings?

_____

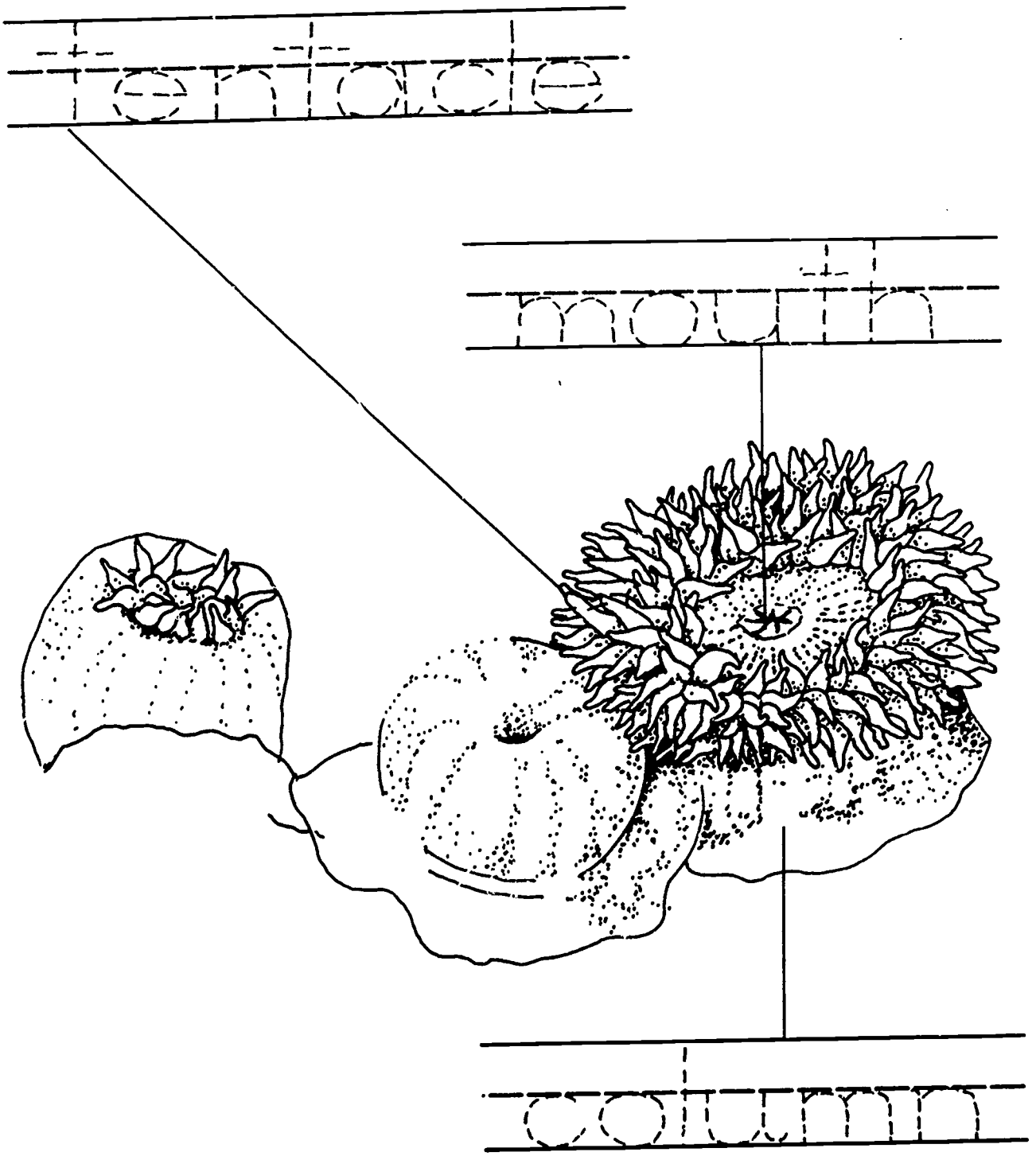
5. Do sponges move around?

_____

Water and food move through the tiny openings.
They cannot move.
They live on rocks in the sea.
They are animals.
These are sponges.

Name: 2C

Sea Anemones



2D

Name

Anemone Poem

The anemone's an animal
That looks like a flower,
Swaying in the seawater
Hour after hour.

Its tentacles wave
Like petals bright,
But just one touch
And it folds up tight.

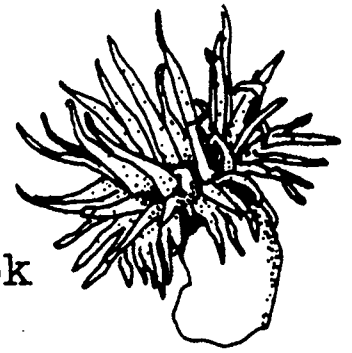
The anemone's tentacles
Catch and sting
Crabs and fish for supper
And other salty things.

Orange or yellow,
Green, red or pink,
It's a beautiful creature,
Don't you think?

Draw a sea anemone and color it.

Name: 2E

Sea Anemone Sentences



Sea anemones are animals but they look _____ like _____ growing in the sea.

The sea anemone uses its _____ to attract food.

The sea anemone will _____ itself to an object under the water.

The sea anemone has a _____ in the middle of its tentacles.

Sea anemones eat _____ and _____.

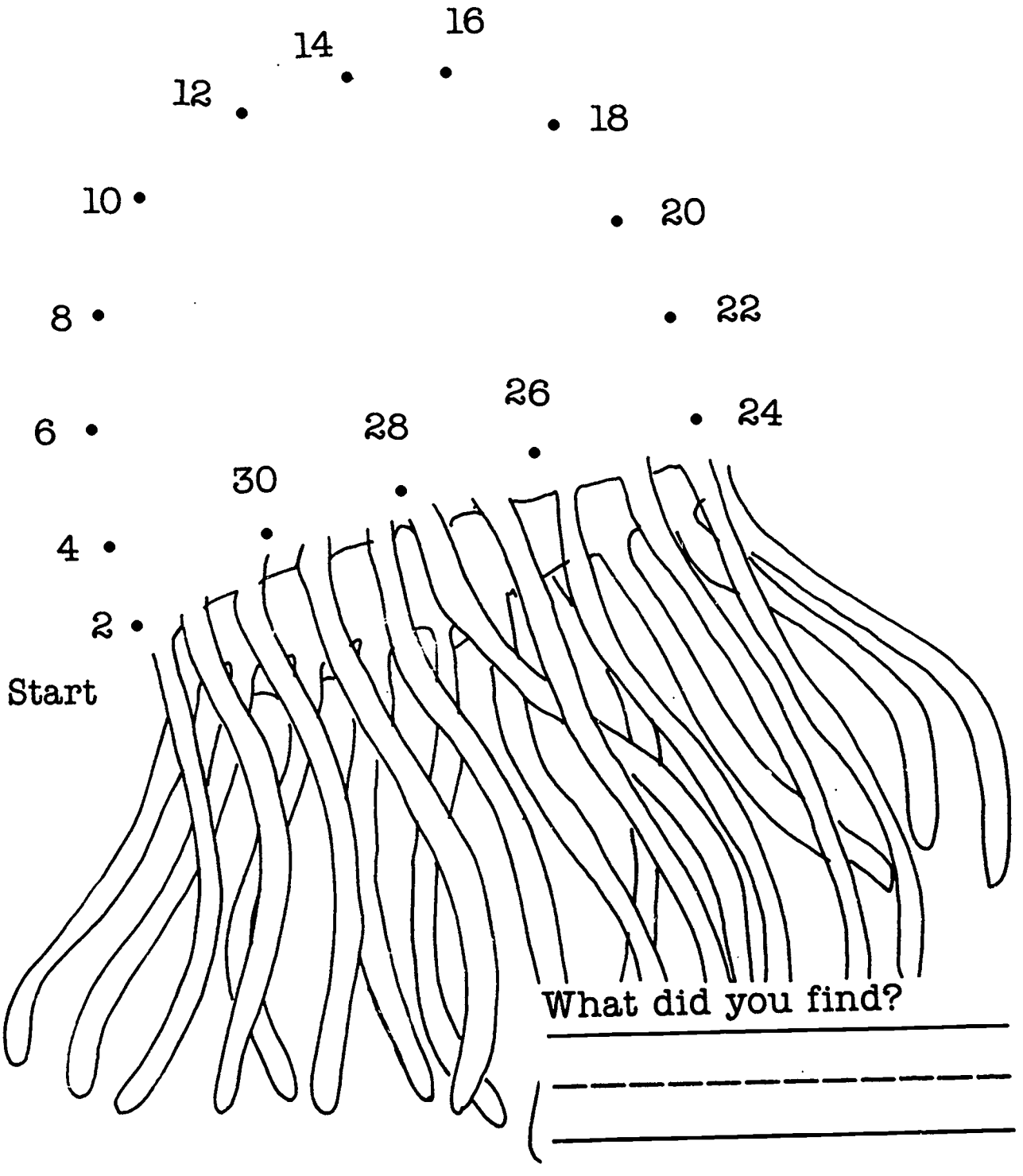
Directions: Use these words to fill in the blanks.					
tentacles	mouth	fish	attach	flowers	crabs

2F

Name: _____

Dot-to-Dot Mystery

Count by twos



What did you find?

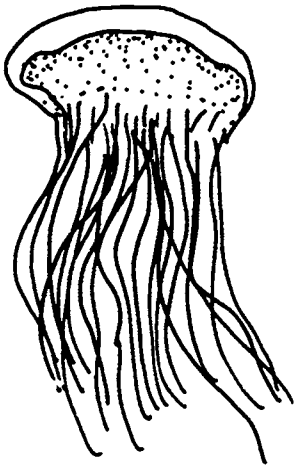
_____

_____

_____

Name: 2G

Jellyfish



A jellyfish is like an upside-down anemone floating on the sea.
Both animals are soft.
Both have tentacles that help them get food.
Both have a mouth in the middle of their tentacles.
The tentacles of a jellyfish can sting.
They can hurt people.

Circle the words that make the sentences true.

1. A jellyfish _____ in the sea.

boats floats coats

2. Tentacles help jellyfish get _____

room noon food

3. The jellyfish has a _____ in the middle of its tentacles.

mouth moon much

2H

Name:

Worms

Worms live at the beach, too.

They can be wiggly and long.
They can be short and flat.
They can be round and stretchy.

Some worms, called ribbon worms, can be stretched from 1 foot long to 10 feet long.

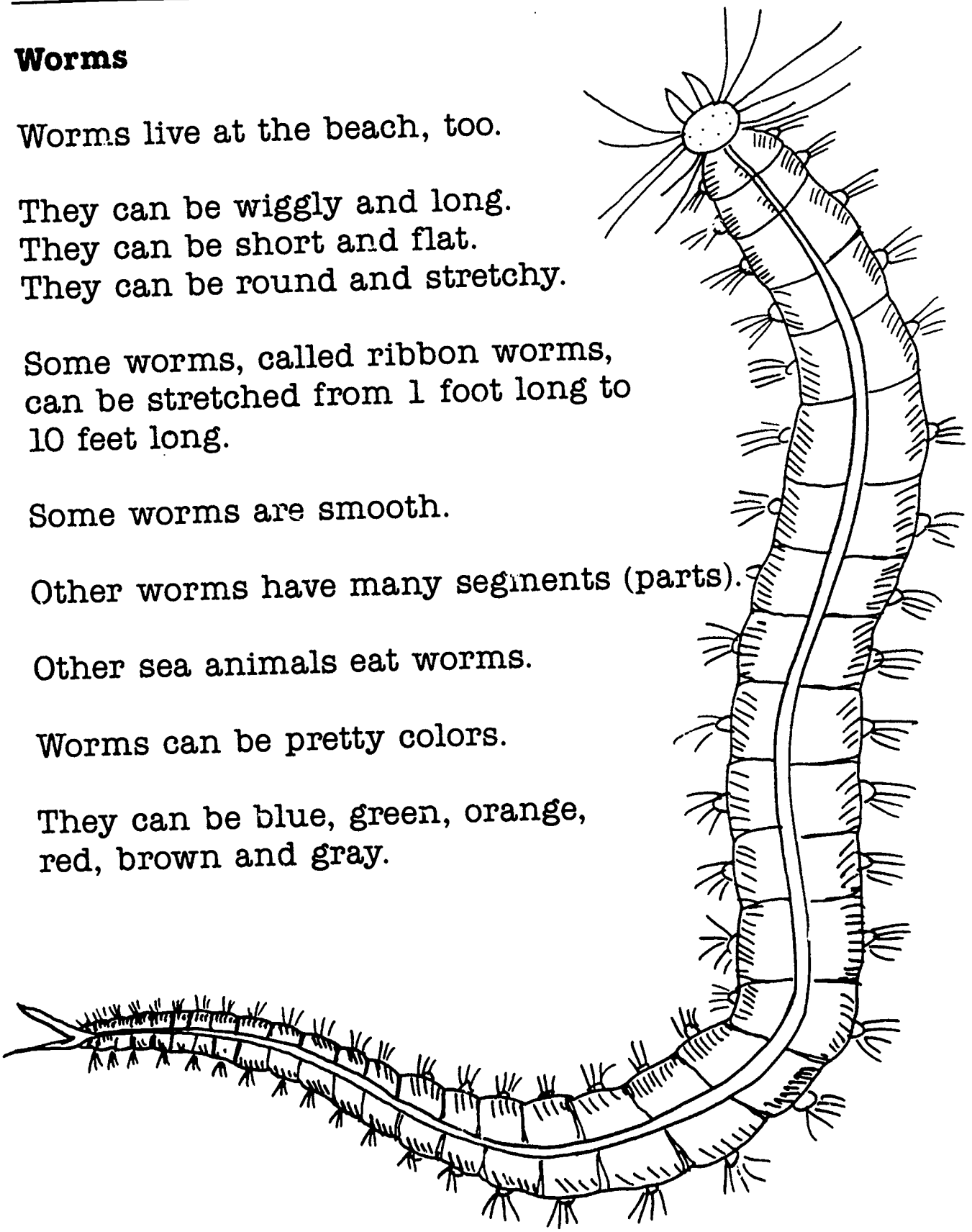
Some worms are smooth.

Other worms have many segments (parts).

Other sea animals eat worms.

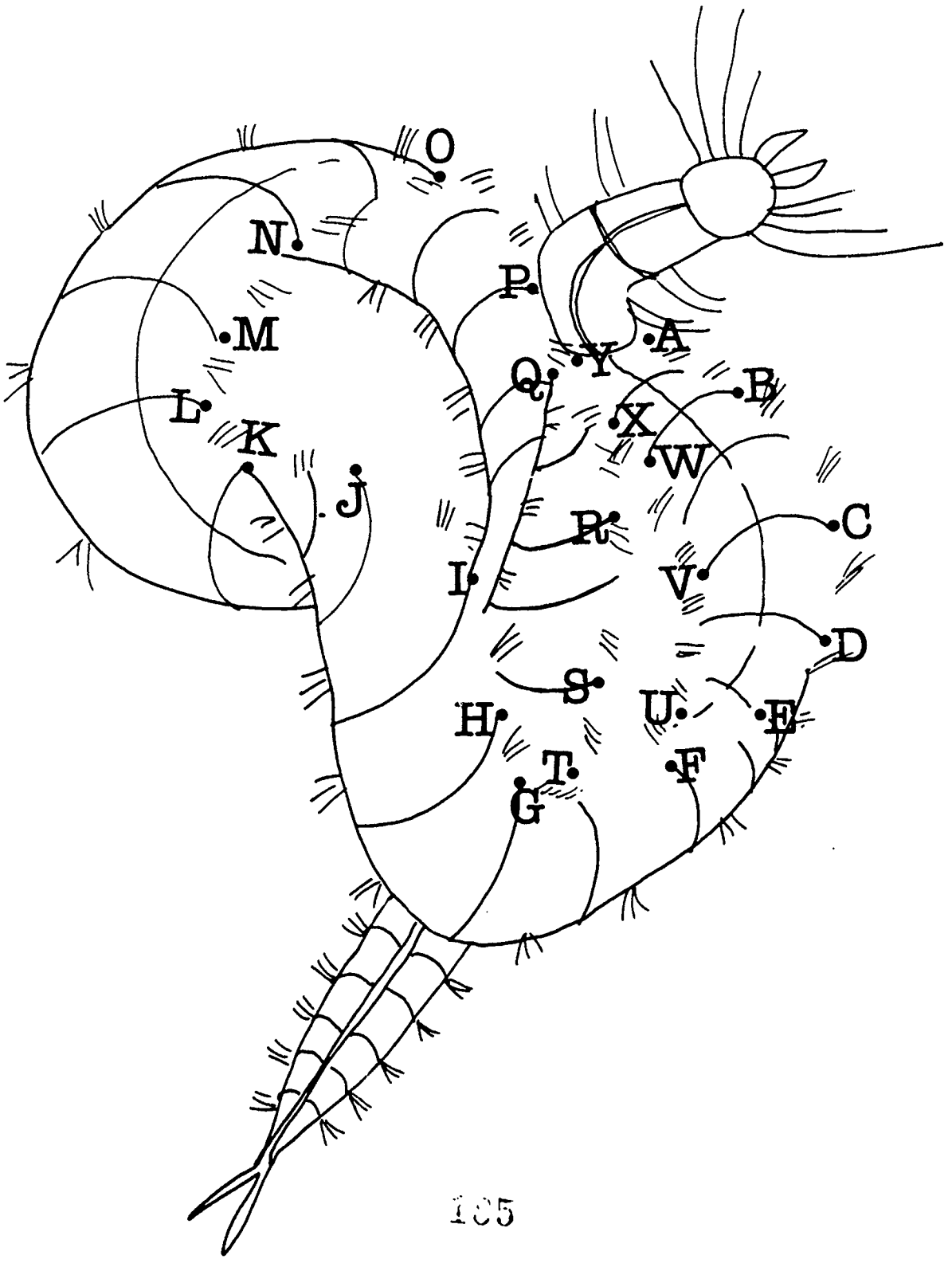
Worms can be pretty colors.

They can be blue, green, orange, red, brown and gray.



Name 21

Worm by Letter

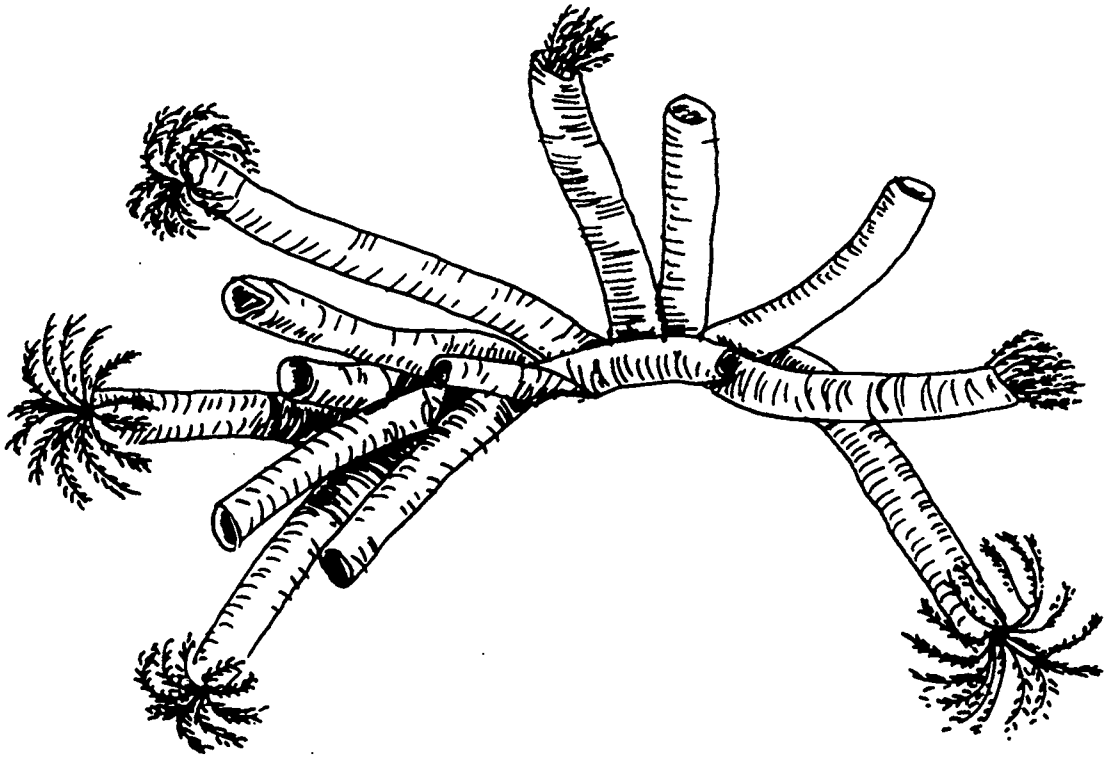


2J

Name:

Tube Worms

A tube worm cannot leave its tube. It uses a feathery mop to feed. If there is no danger, it pulls in the mop so it can hide.



find these words and circle them:
mop
feed
danger
hide
tube

m	o	e	t	c	b	a
o	n	r	u	t	f	h
p	s	w	b	e	x	i
z	f	e	e	d	h	d
v	r	l	m	j	k	e
y	d	a	n	g	e	r

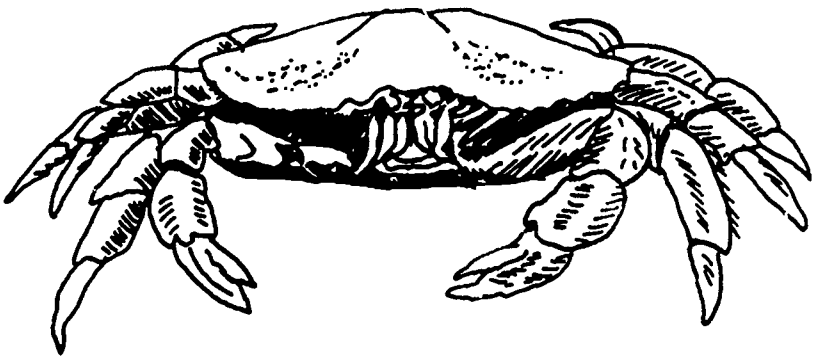
Name 2K

Crab

A crab has a hard outside shell.
Its shell protects its soft body.

A crab has legs with joints.
It has strong claws.

Some crabs can run fast.
Some crabs are good to eat.



Circle the words that are true about crabs.

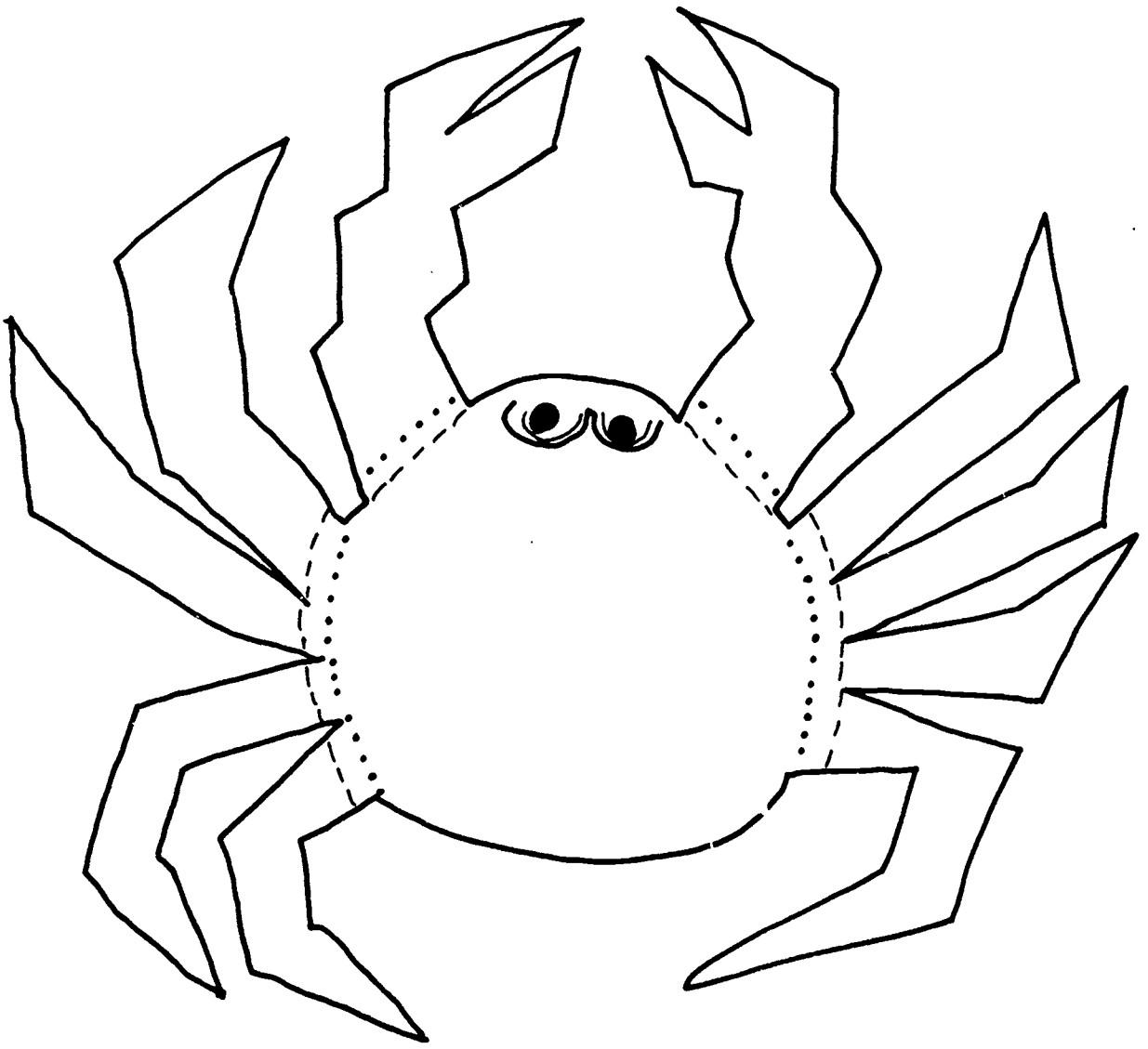
hard shell	soft body
legs with joints	good to eat
inside shell	all taste awful
outside shell	hard body
legs without joints	can run fast
strong claws	has five toes

2L

Name:

Crab Cutout

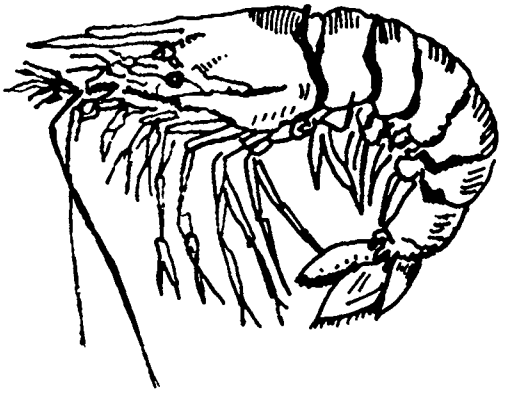
Fold down along dotted . . . . . .lines.



Fold up along broken——————————————lines.

Name 2M

Shrimp



The shrimp has a hard shell on the outside of its body.

As a shrimp grows, it wriggles out of its old shell.

The soft skin under the old shell turns into a new and bigger shell.

The shrimp has walking legs and swimming legs.

Shrimp can be 1/2-inch long to 6 inches long.

Draw a shrimp.

2N

Name: _____

Shrimp Maze

Make a line from Tom to the shrimp.
Do not cross any black lines.

Name 20

Barnacle

A barnacle is a crustacean like a crab or shrimp.

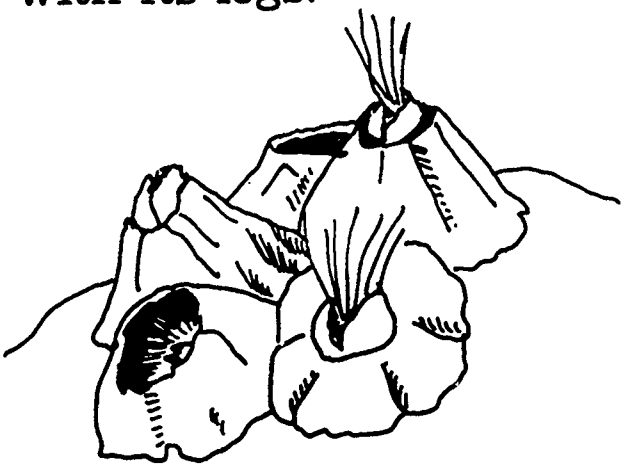
A barnacle has a shell.

A young barnacle glues its head to a rock.

It makes another harder shell around itself.

The hard shell has a door at the top.

The barnacle eats by pulling food through the door with its legs.

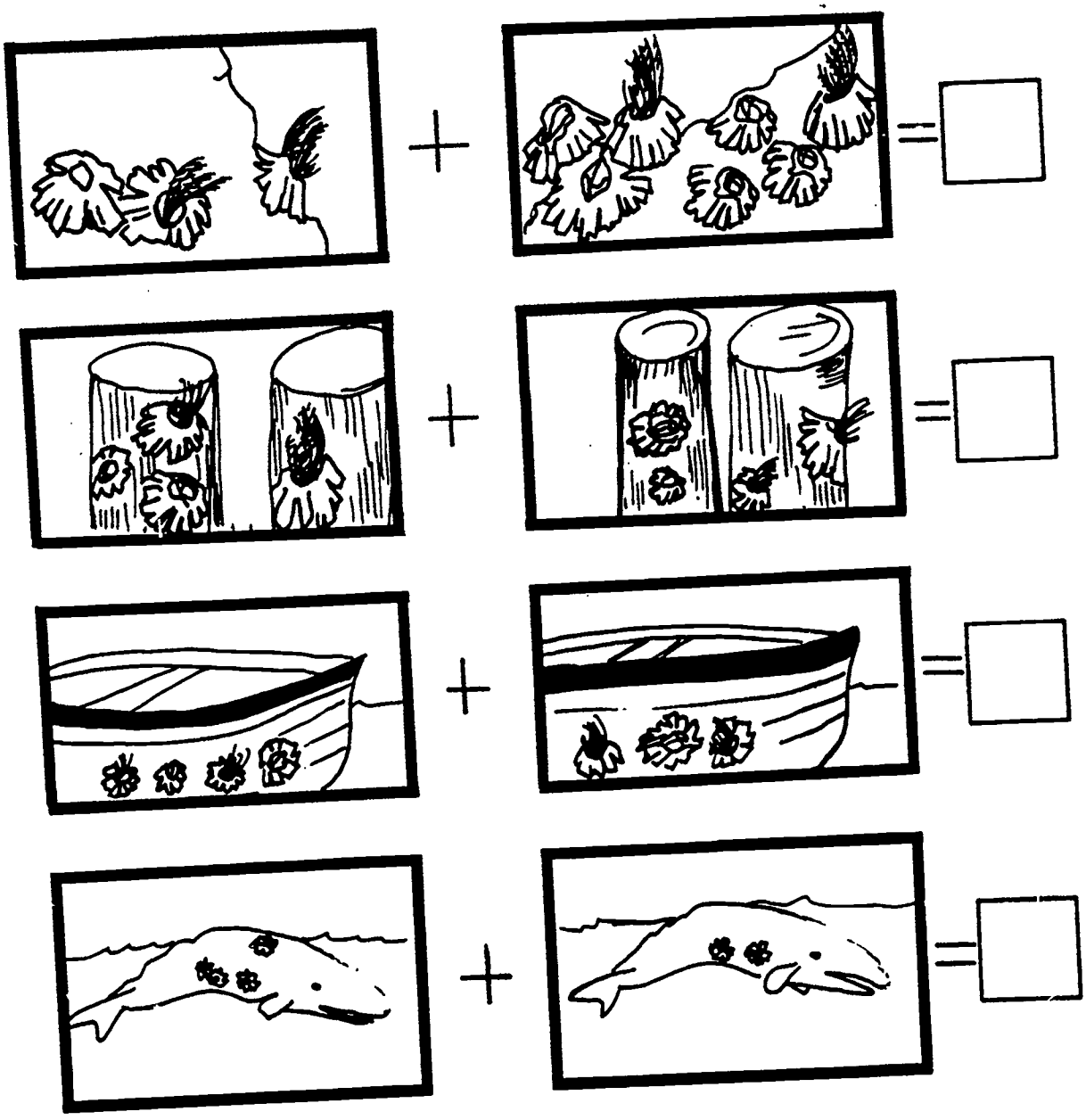


Circle the words that tell about barnacles.

Barnacles have shells have heads
have tails have doors
have legs

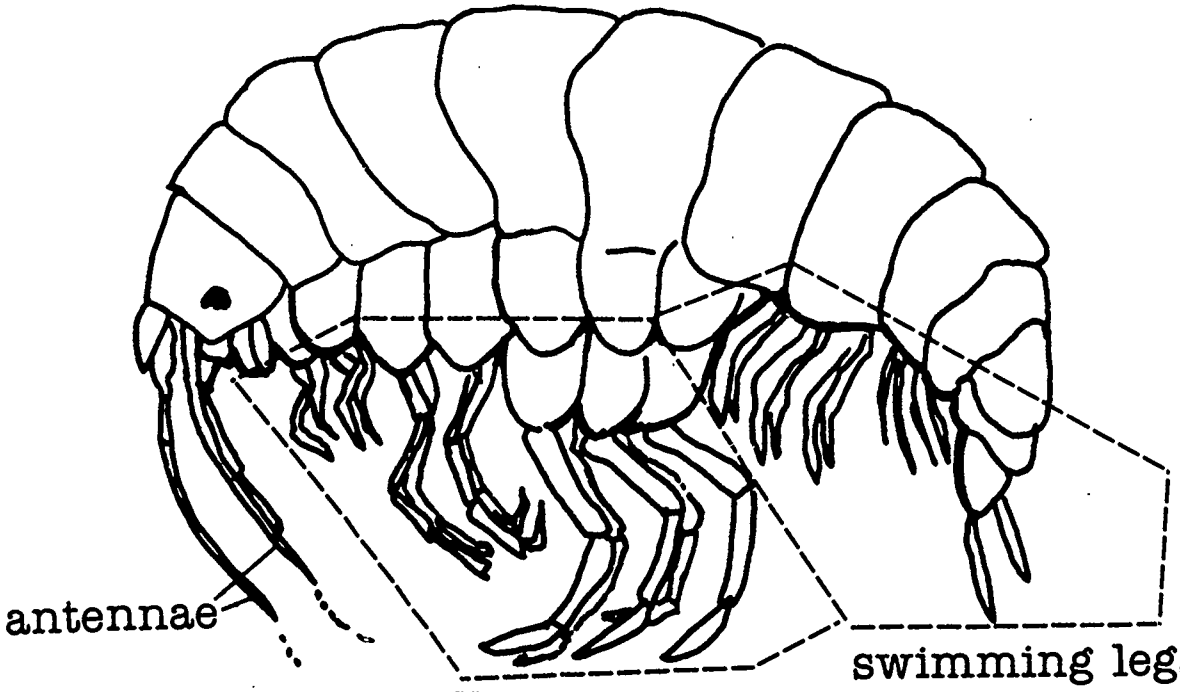
Name: 2P

Barnacle Math



Name: 2Q

Amphipod



Count the walking legs.
How many are there? _____

Count the swimming legs.
How many are there? _____

Name 2R

Sand Hopper

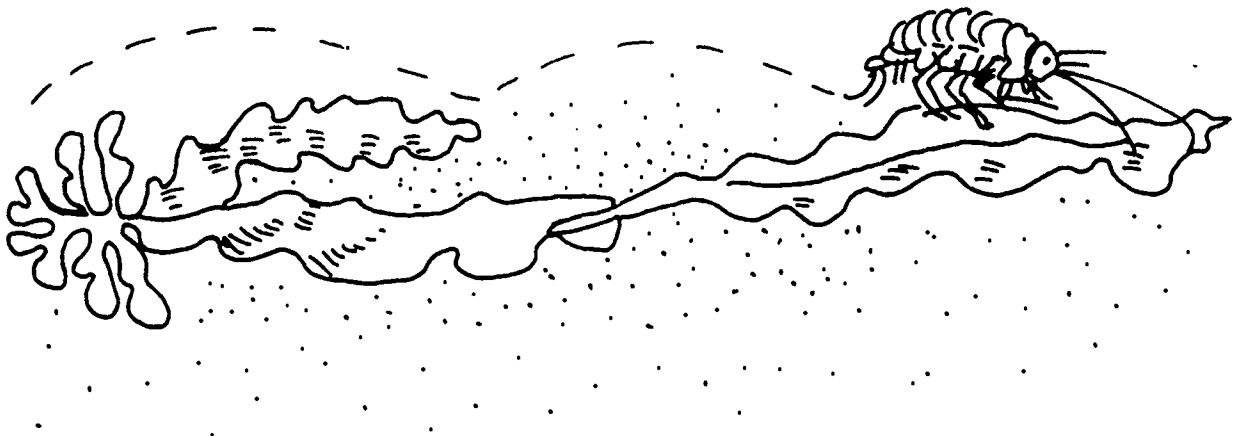
Sand hoppers, or beach fleas, are
a kind of amphipod.
They are fun to catch.
They wiggle.

Sand hoppers have
walking legs
swimming legs.
and jumping legs.

They are very small.

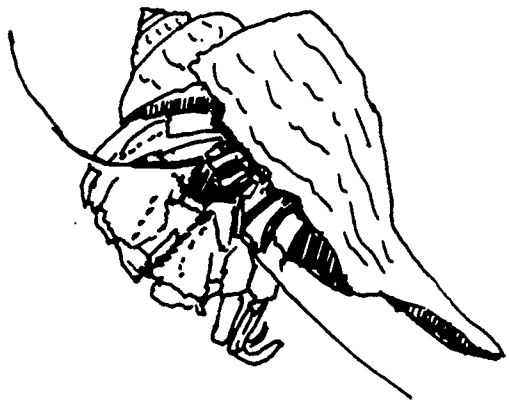
Sand hoppers hop on seaweeds at the beach.

They eat dead sea animals.



Name: 2S

Pagoo



The hermit crab is a sea animal.

It lives in a snail shell.

The snail shell is its house.

When the hermit crab grows bigger, it must find a bigger snail shell.

The hermit crab wears its house.

This hermit crab is called Pagoo.

Write the word that makes the sentence true.

1. A hermit crab is a _____ animal.

sea see

2. It lives in a _____ shell.

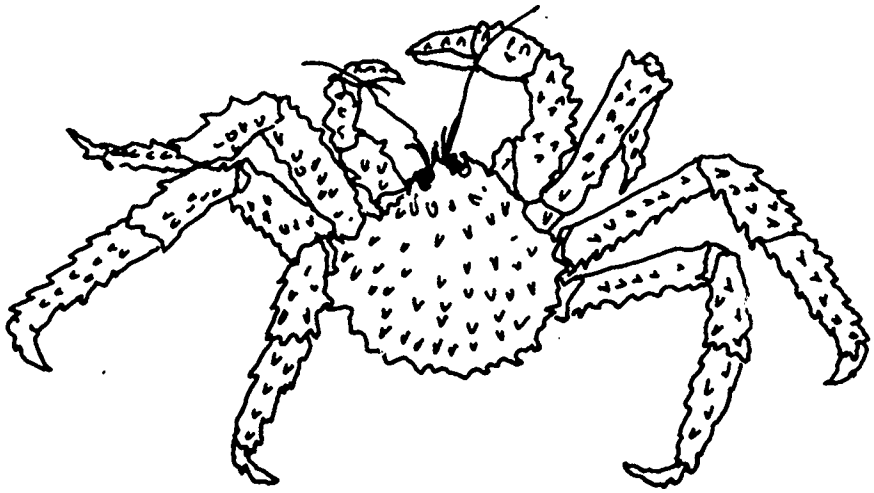
snail same

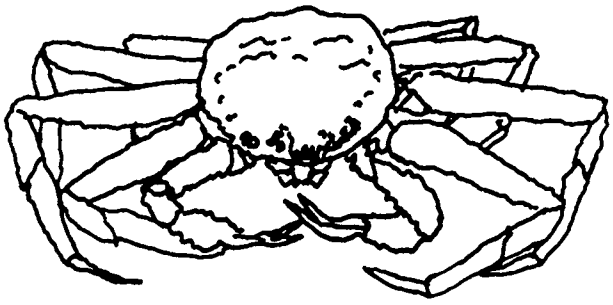
Name: 2T

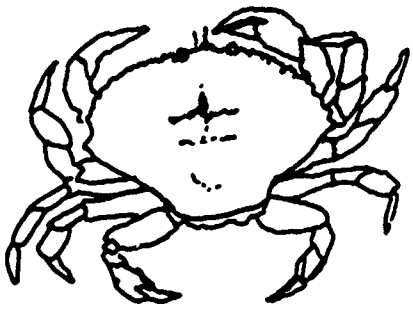
Crabs

Match the name to the crab.
Color each crab.

king Dungeness tanner hermit

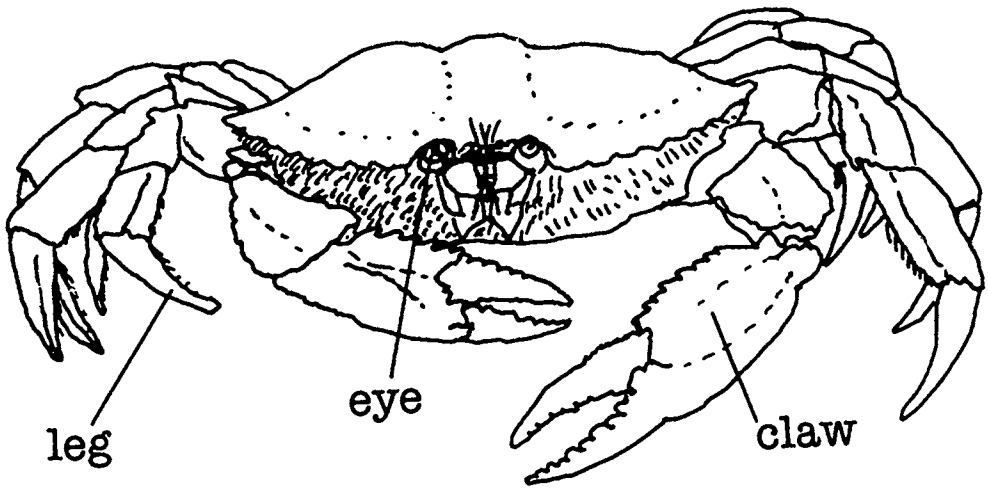


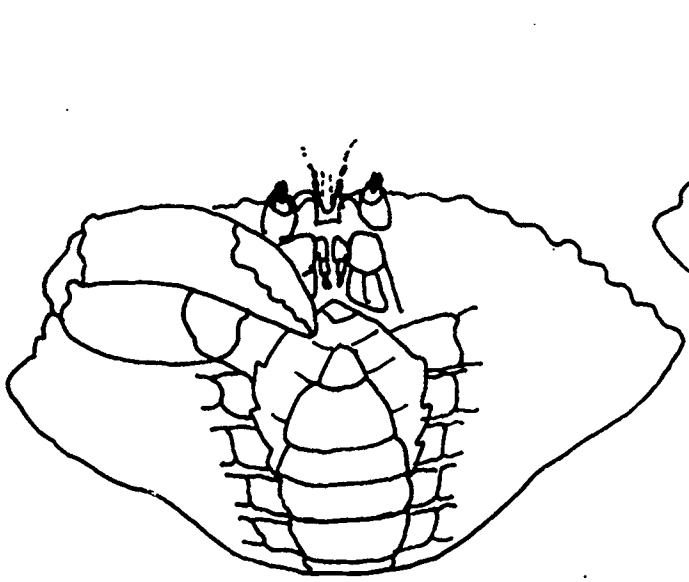




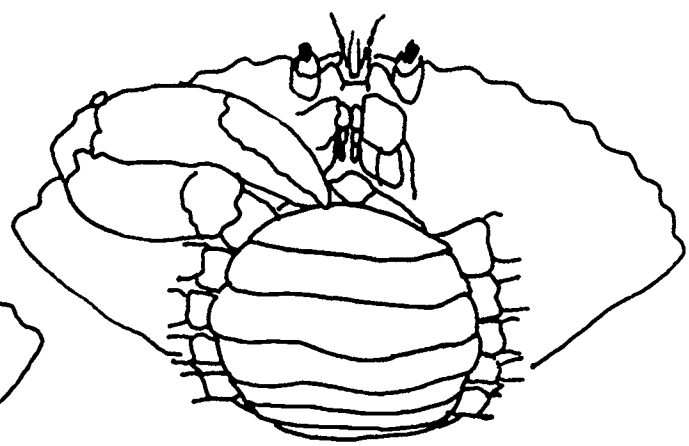
Name: 2U

Dungeness Crab





Male



Female

Can you tell a male crab from a female?

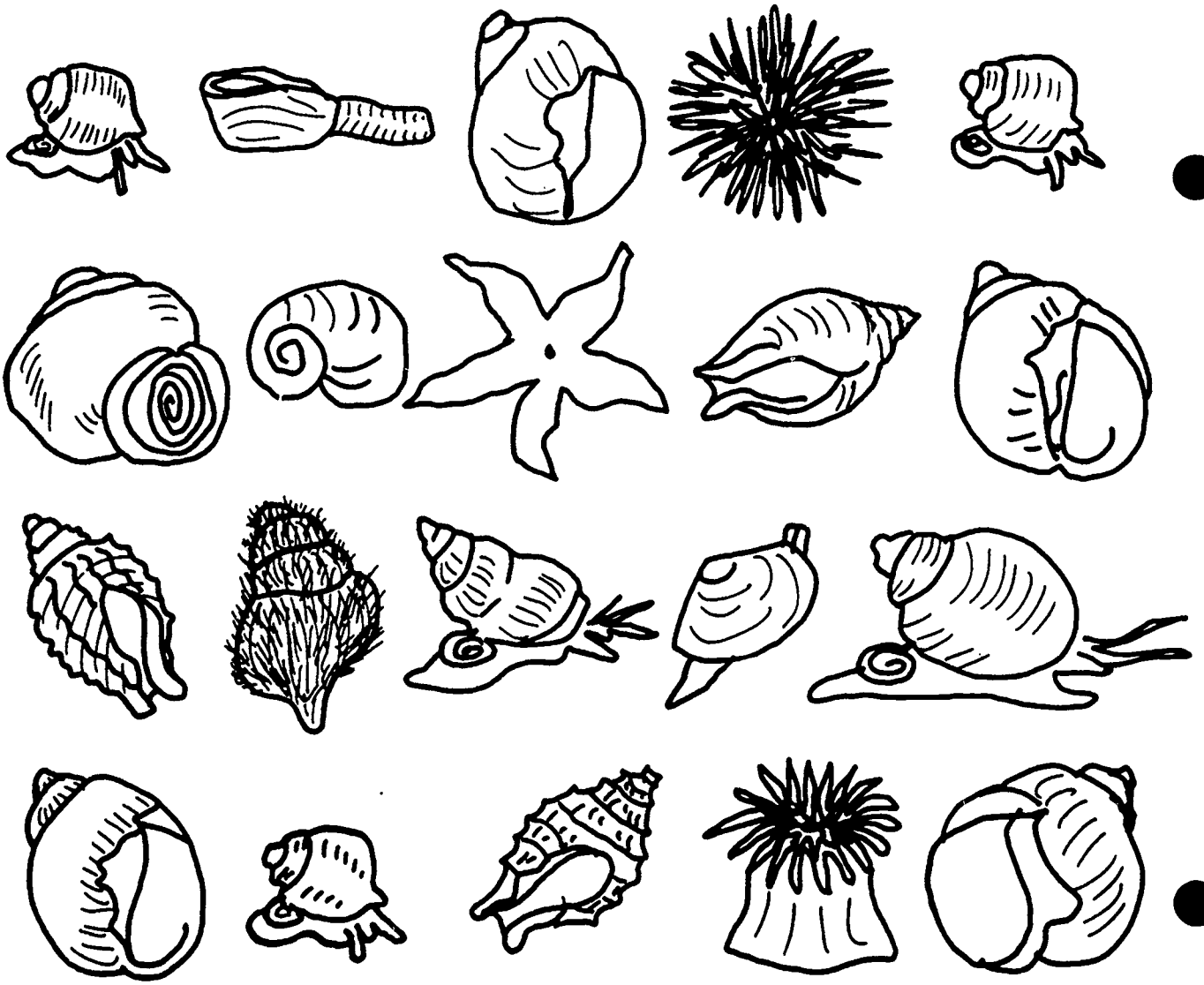
Name: 2V

Snails

Snails are univalves.

A univalve has one part to its shell.

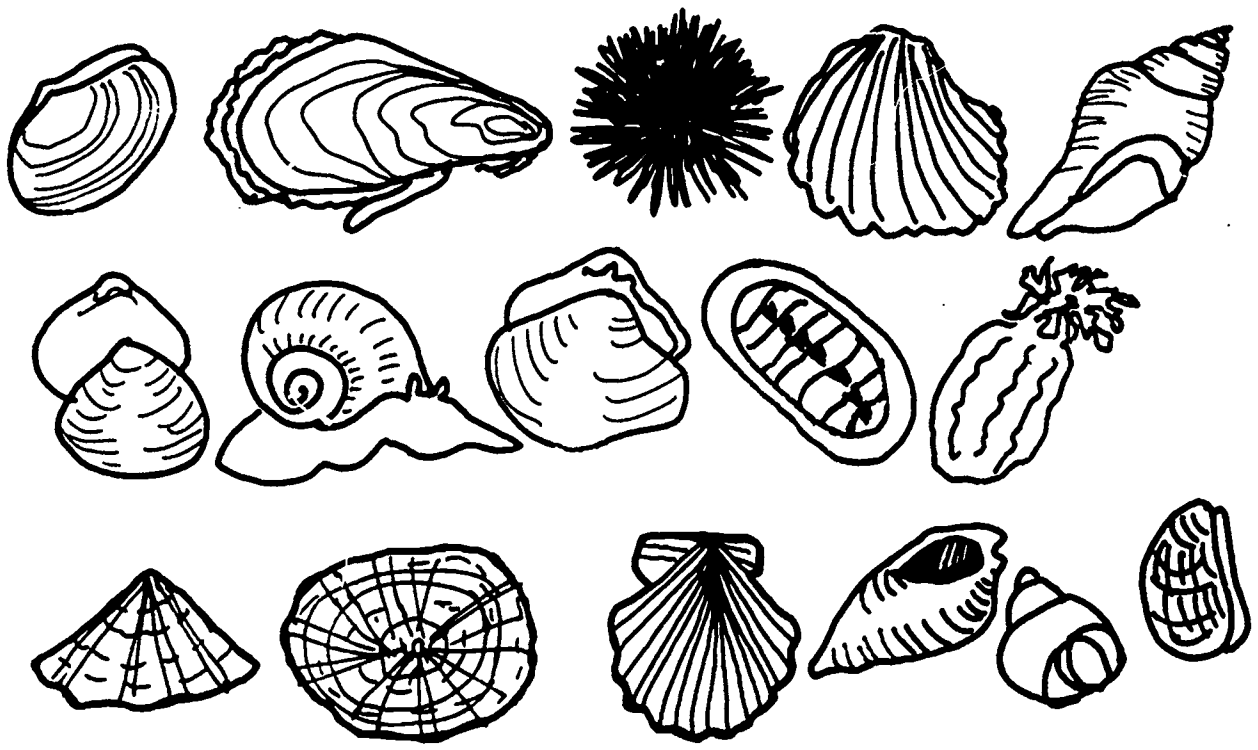
Color all the snails.



Name: 2W

Clams, Cockles, Mussels, and Scallops

Clams, cockles, mussels and scallops are bivalves.
Bivalves have two parts to their shells.
Color all the bivalves.



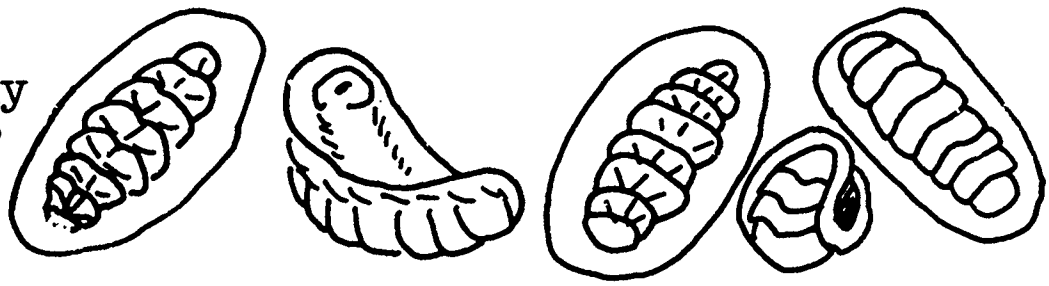
Name: 2X

Mollusk Count

How many chitons?

_____

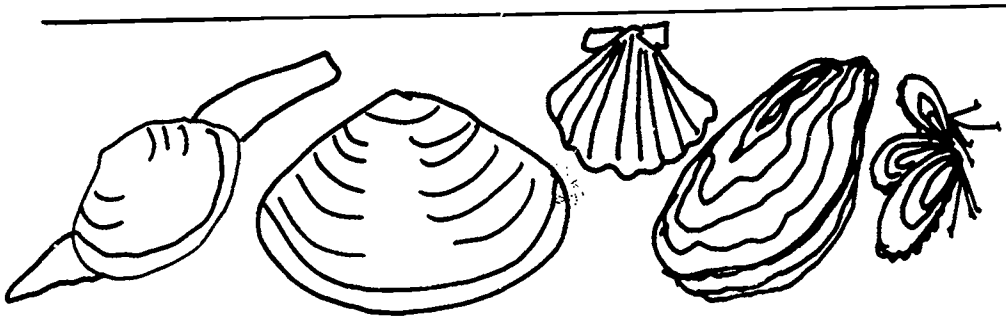
_____



How many bivalves?

_____

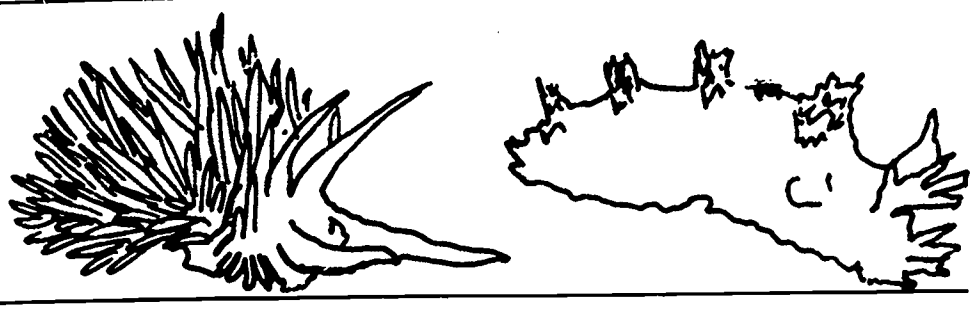
_____



How many sea slugs?

_____

_____



How many univalves?

_____

_____

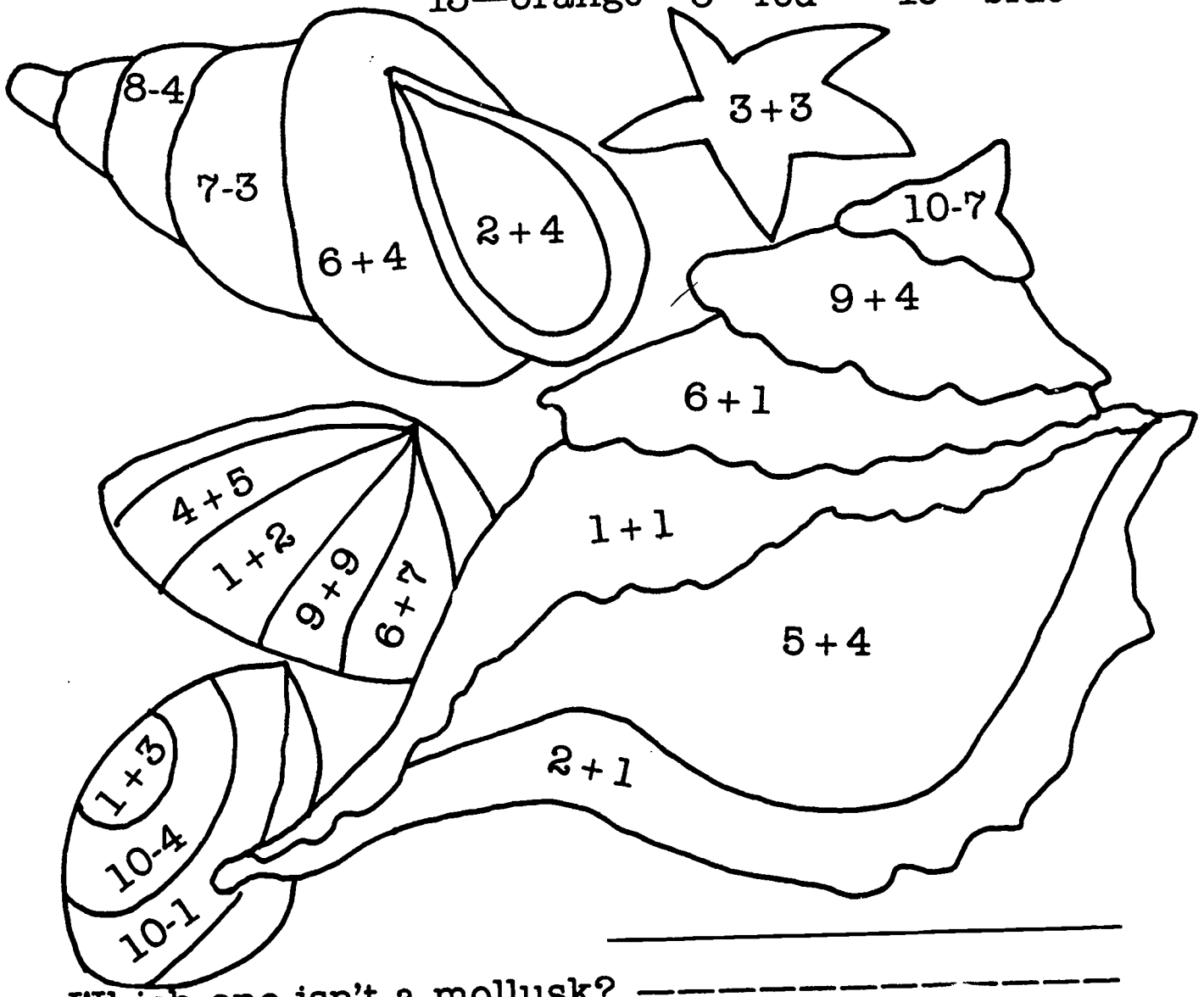
_____

Name: 2Y

Mollusk Math

Directions: Add or subtract and color that section the numbered color.

7—purple 18—brown 3—black
4—pink 2—yellow 9—green
13—orange 6—red 10—blue



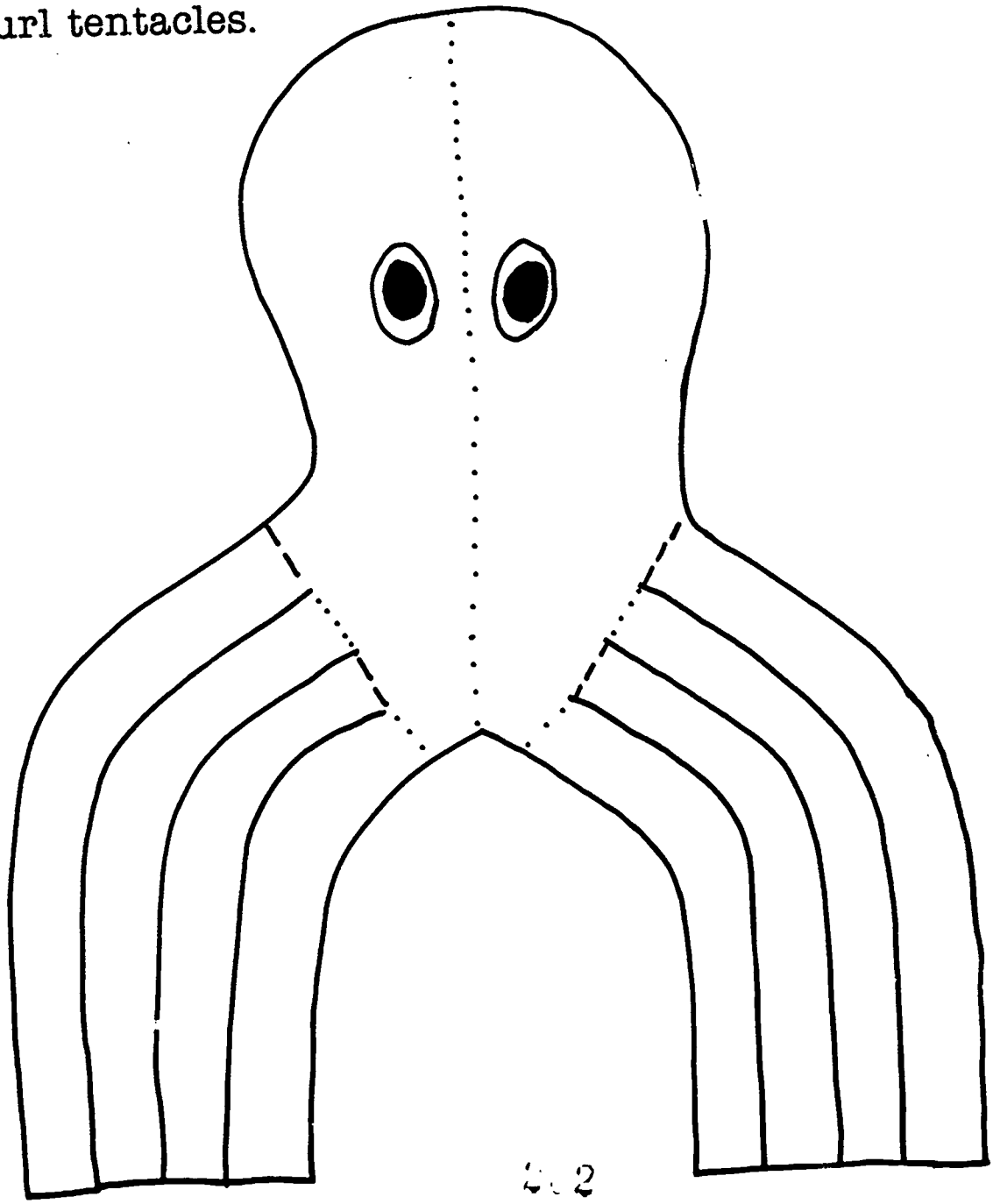
Which one isn't a mollusk? _____

_____

Name: 2Z

Octopus Cutout

Directions:
Cut carefully along solid lines
Bend tentacles forward and backward, alternating.
Curl tentacles.



Name: 2AA

Mystery Mollusk

8-7 = _____red
5-3 = _____orange
2+3 = _____brown
1+2 = _____black
7-3 = _____blue
9-3 = _____green

Find the mollusk. Add or subtract the numbers above then color the picture by the number.

Name: _____ 2BB

Sea Stars

Directions:
Fill in the blanks along with these words:

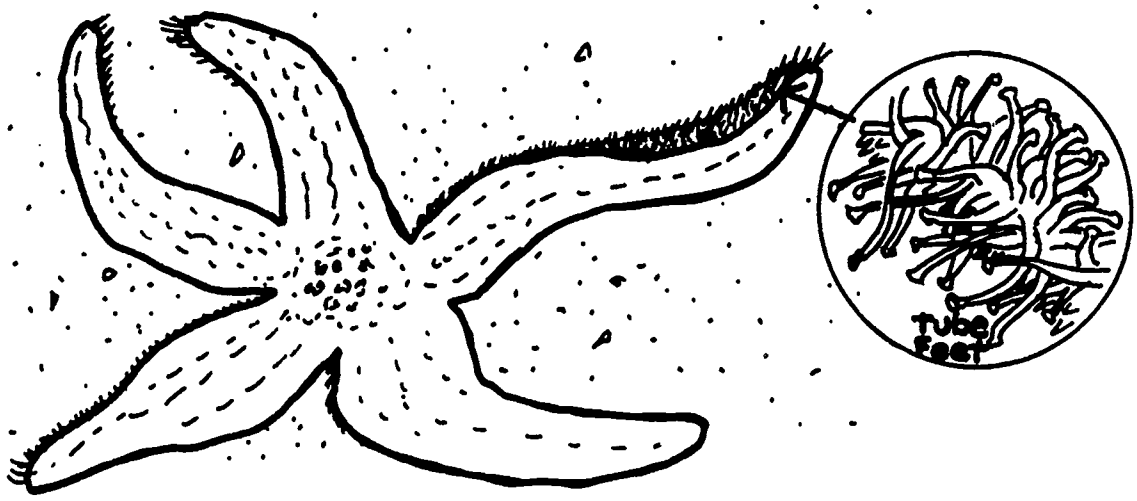
tube feet beach clams big

A sea star can be _____.

Some sea stars eat _____.

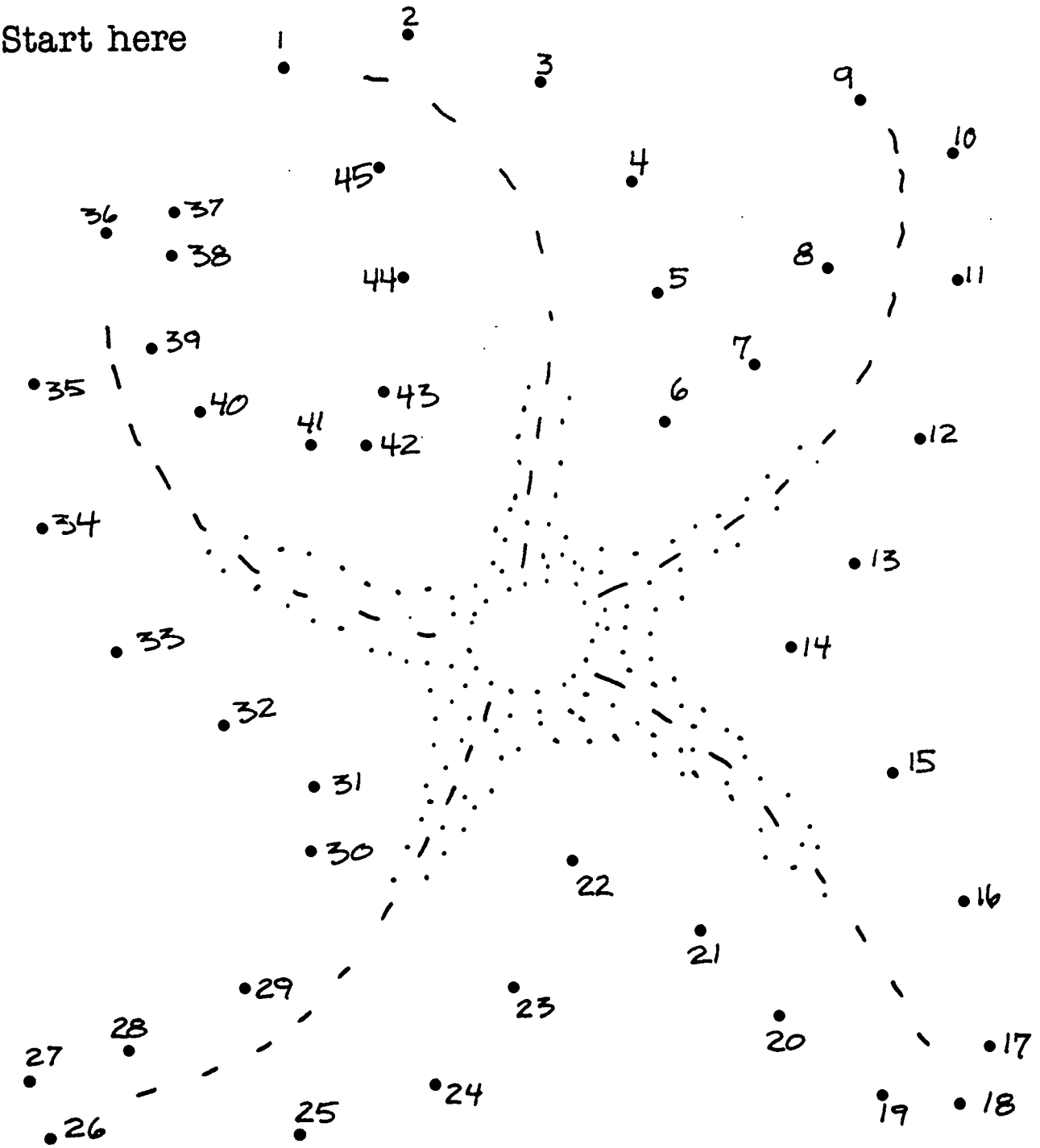
Sea stars use _____ to move.

Sea stars live at the _____.



Name: 2CC

Sea Star Dot-to-Dot



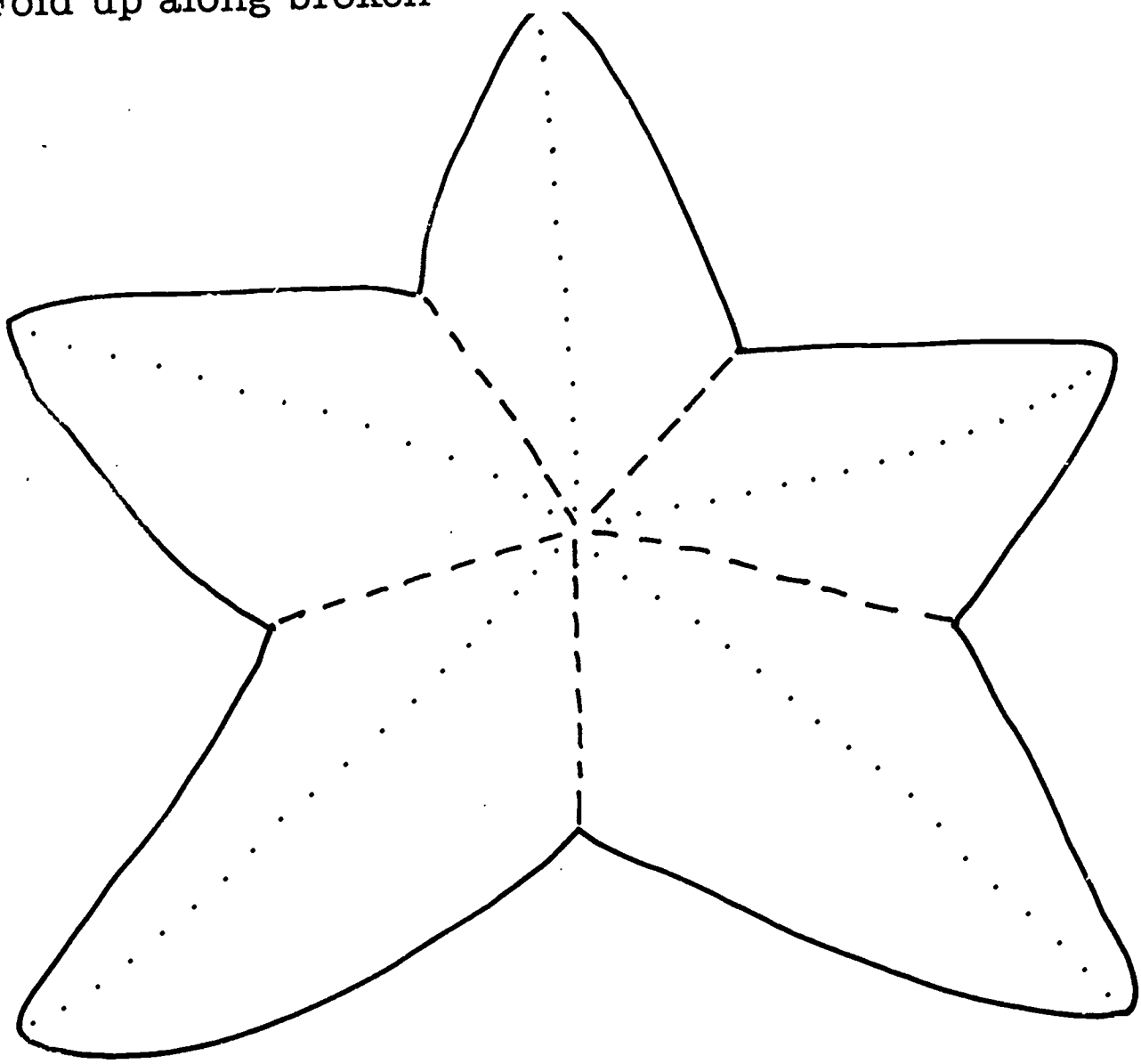
2DD

Name:

Sea Star Cutout

Directions: Fold down along dotted . . . . . .lines.
that the dots appear on top of the ridge.

Fold up along broken ——————————————lines.



Name: 2EE

Sea Urchin

Directions: Circle the correct word and write it on the line.

Sea urchins are _____

plants animals

Sea urchins have _____ feet.

tube tail

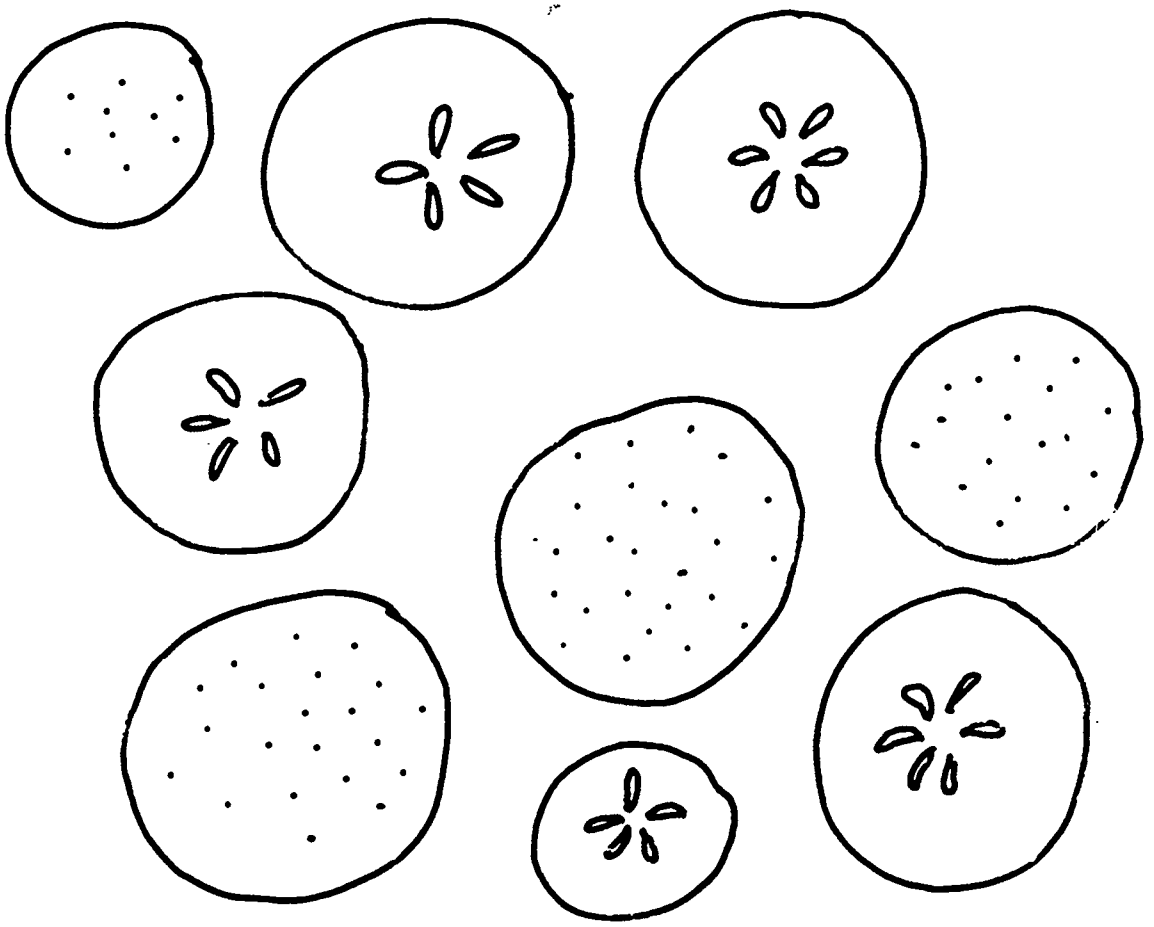
They live _____ the mud.

in on

Name: 2FF

Sand Dollars

Inside a broken sand dollar you will find five "doves" or "gulls". These are actually the sand dollar's teeth.



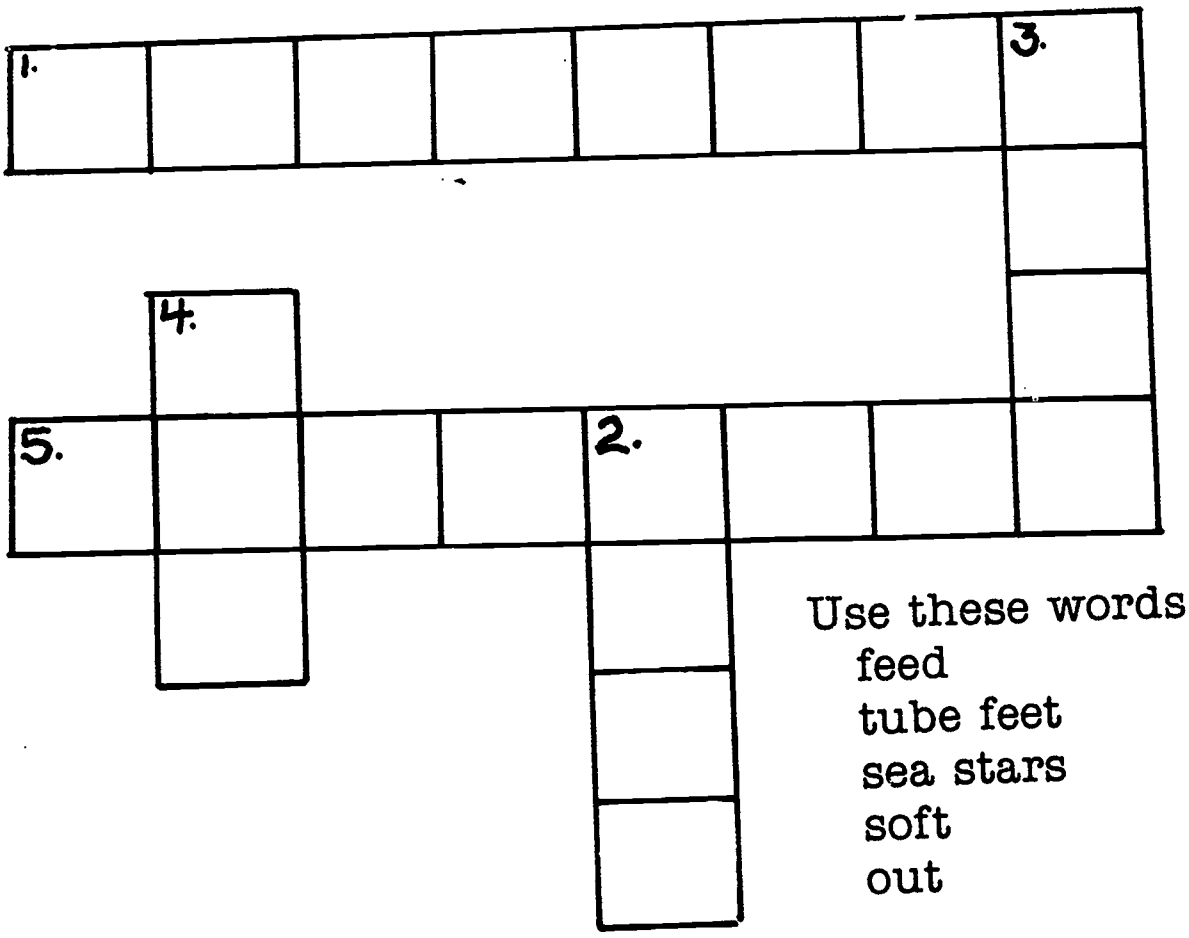
Some sand dollars cannot turn themselves right side up.

Color purple the sand dollars that need to be turned right side up.

Name: 2GG

Sea Cucumber Crossword

Directions:
Write the missing words



Use these words
feed
tube feet
sea stars
soft
out

Across

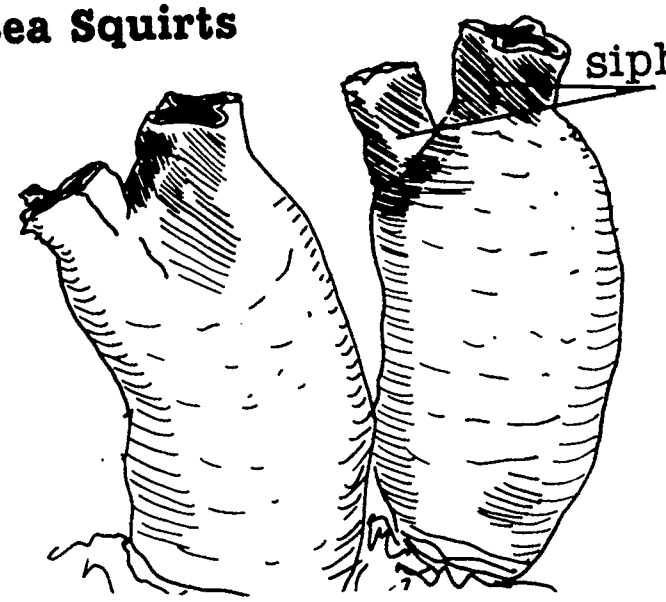
1. Sea cucumbers are like ———— ———————
   but they have no arms.
5. Sea cucumbers walk on these ———— ————

Down

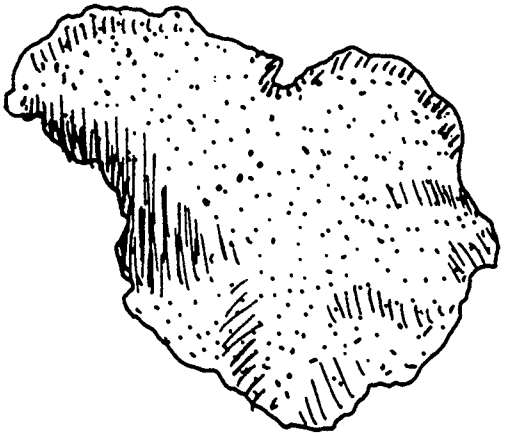
2. Sea cucumbers use tentacles to ————
3. Sea cucumbers are ————
4. Disturbed sea cucumbers throw their insides ————

Name: 2HH

Sea Squirts



solitary sea squirts

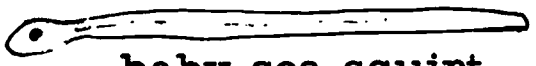


colonial sea squirt

Directions: Complete the sentences with the words below.

Adult sea squirts look like _____.

sponges sharks



baby sea squirt

Baby sea squirts look like _____

fish flatworms

Baby sea squirts have _____

no backbones backbones

Name:

Five Sea Animals

Draw five sea animals.
What are they doing?
Draw them clearly.

Write the names of your animals here.

How do they move?

Where are they going?

When is this happening?

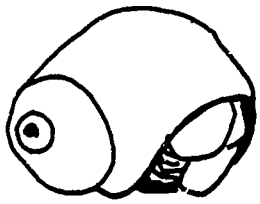
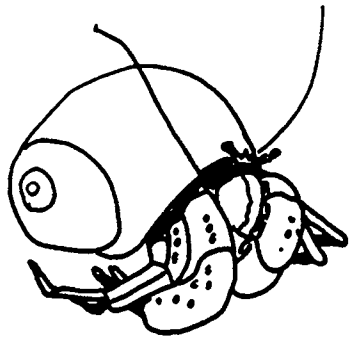
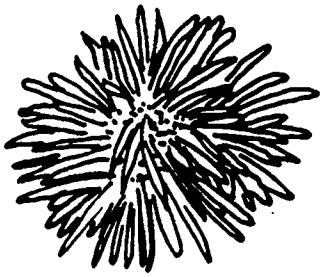
Name: 3A

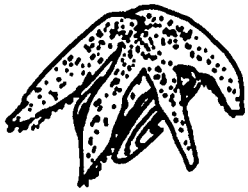
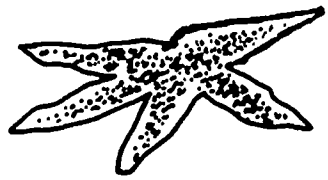
High Tide or Low Tide?

Circle how all the animals look at high tide.

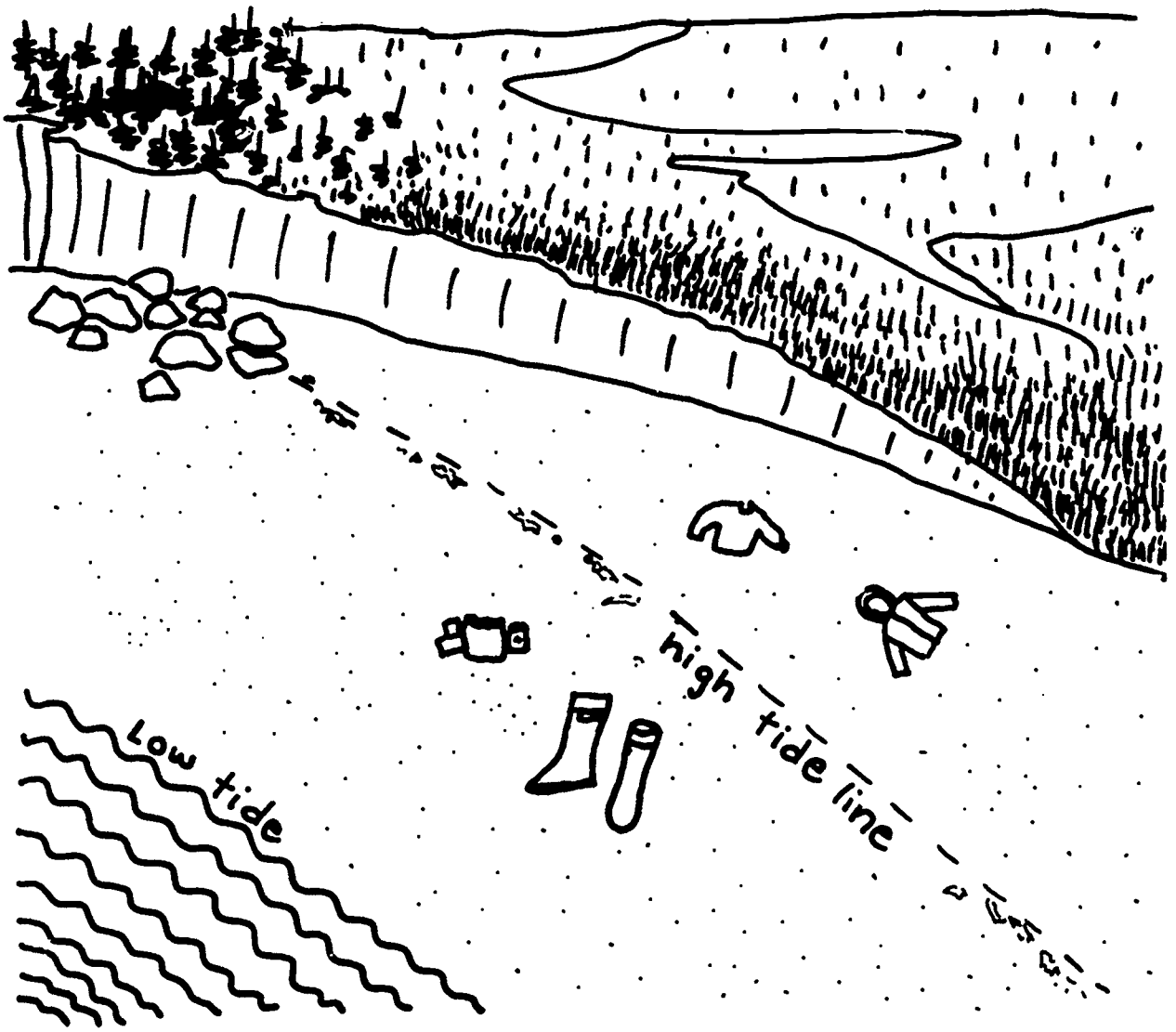




Name 3B



This is a picture of the beach at low tide. Color it! Now pretend the tide is changing and the water is coming up on the beach. Color the ocean up to the high tide mark. What happens to the rubber boots and the lunch?

barnacles

how many?

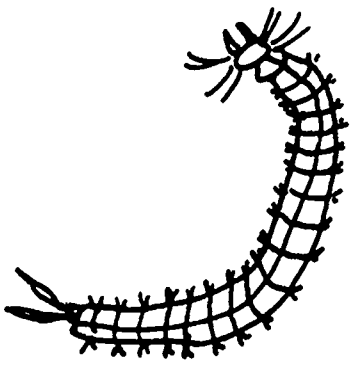
FOLD LINE

Name: _____

My Beach Book

CUT LINE

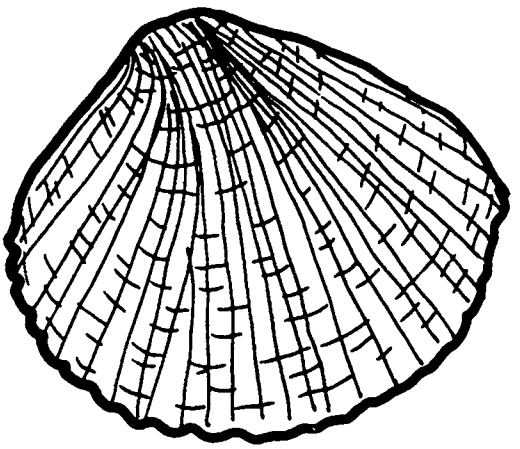
worm



how many?

FOLD LINE

cockle



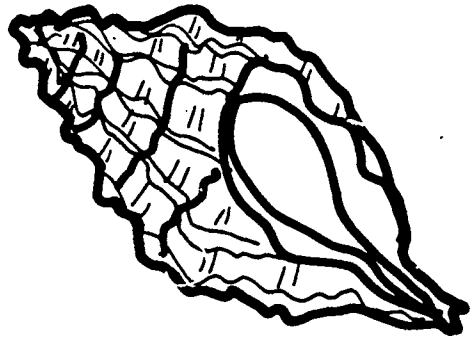
how many?

octopus

how many?

FOLD LINE

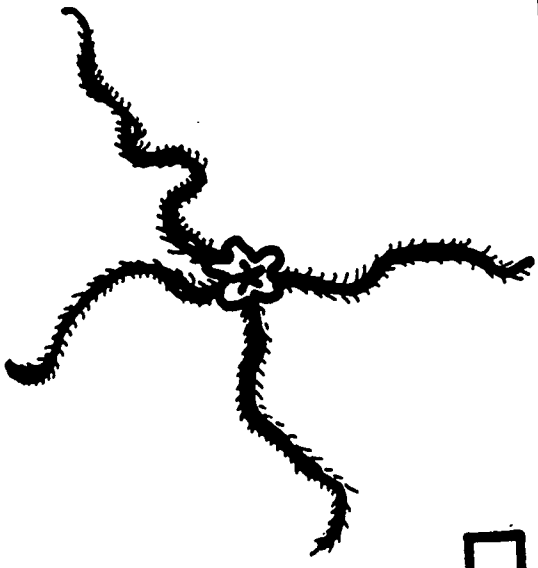
whelk



how many?

CUT LINE

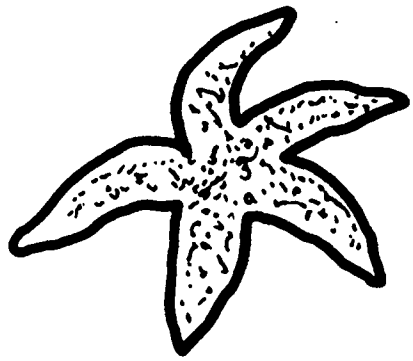
brittle star



how many?

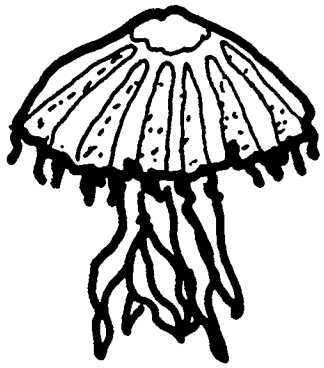
FOLD LINE

sea star



how many?

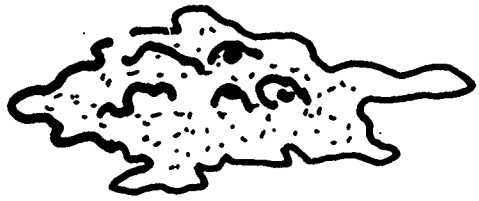
jellyfish



how many?

FOLD LINE

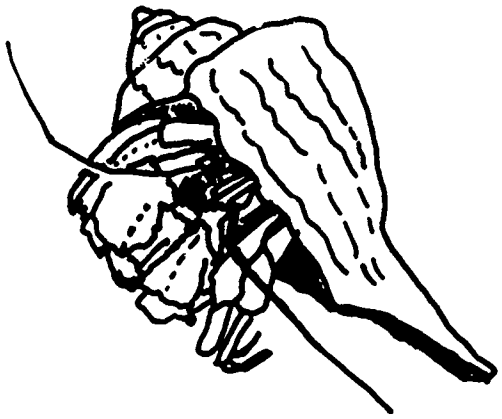
sponge



how many?

CUT LINE

hermit crab



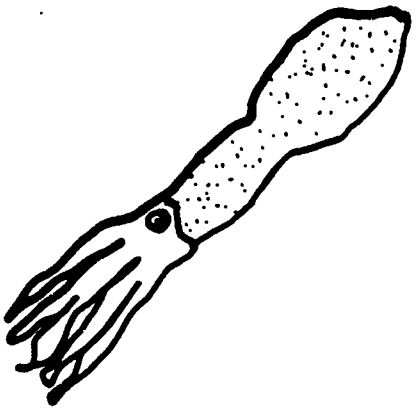
how many?

FOLD LINE

sea anemone

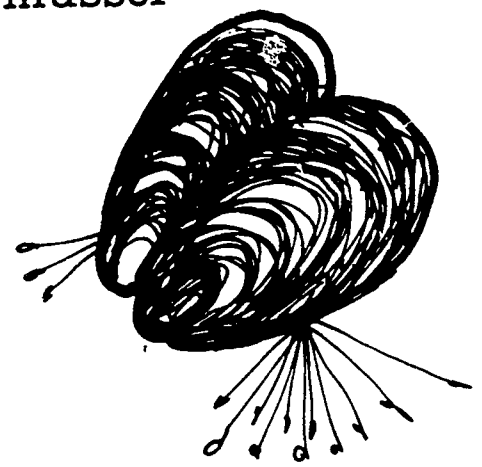
how many?

squid



how many?

mussel

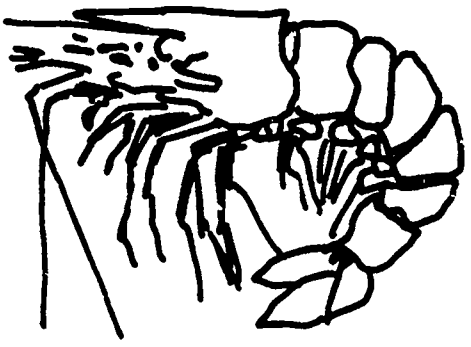


how many?

FOLD LINE

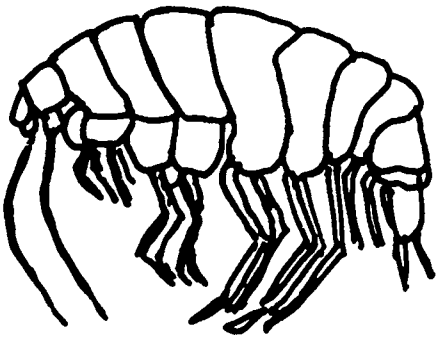
CUT LINE

shrimp



how many?

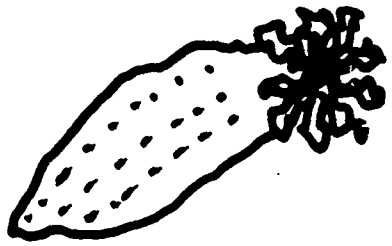
amphipod



how many?

FOLD LINE

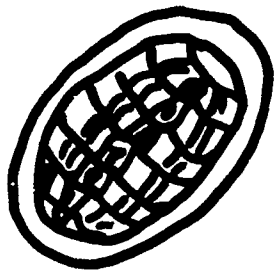
sea cucumber



how many?

FOLD LINE

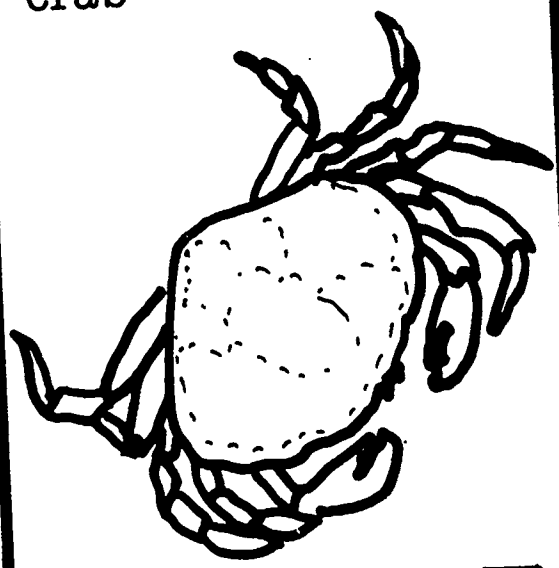
chiton



how many?

CUT LINE

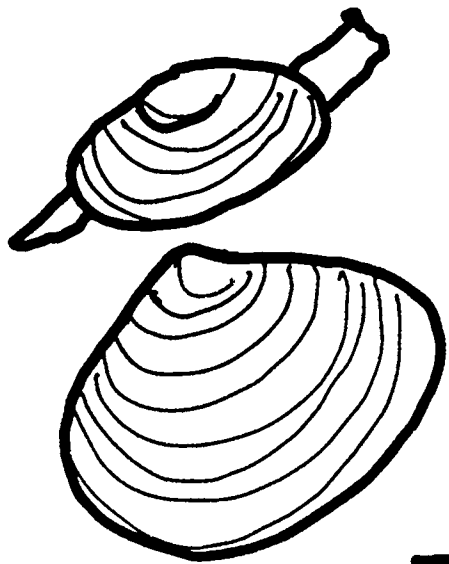
crab



how many?

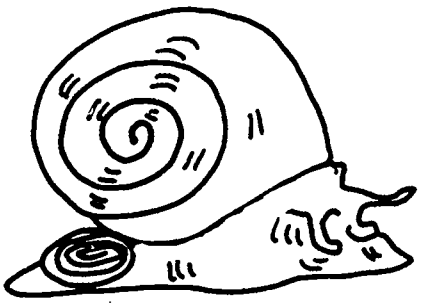
FOLD LINE

clam



how many?

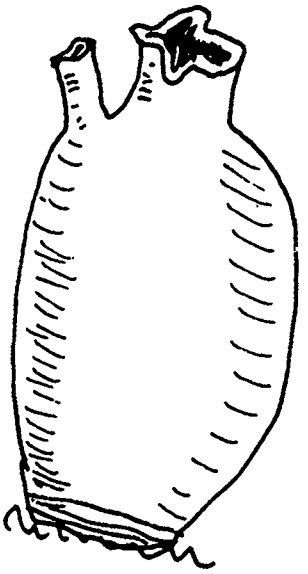
moon snail



how many?

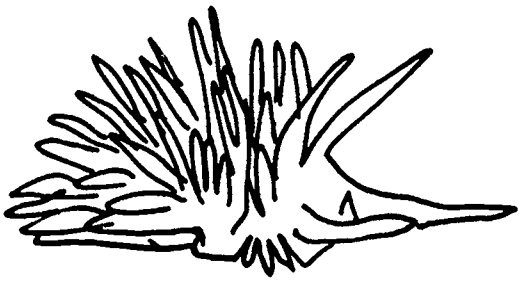
FOLD LINE

sea squirt



CUT LINE

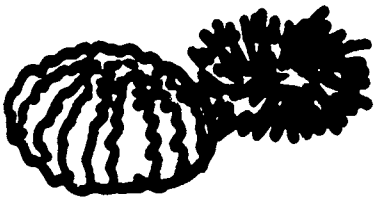
sea slug



how many?

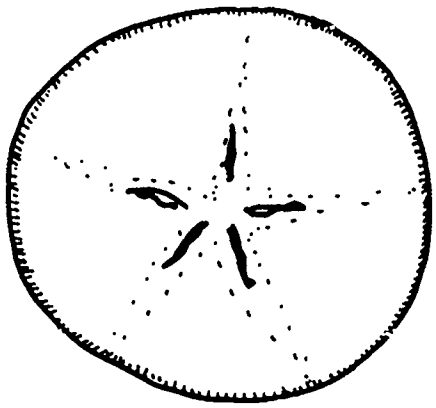
FOLD LINE

sea urchin



how many?

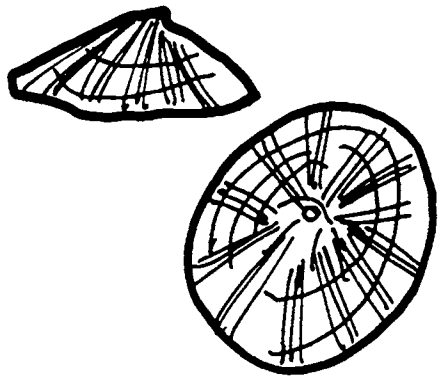
sand dollar



how many?

FOLD LINE

limpet



how many?

CUT LINE

I saw also

how many?

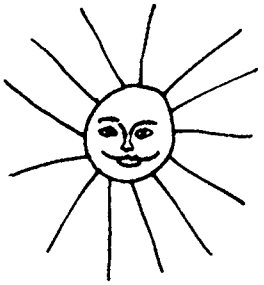
FOLD LINE

I saw also

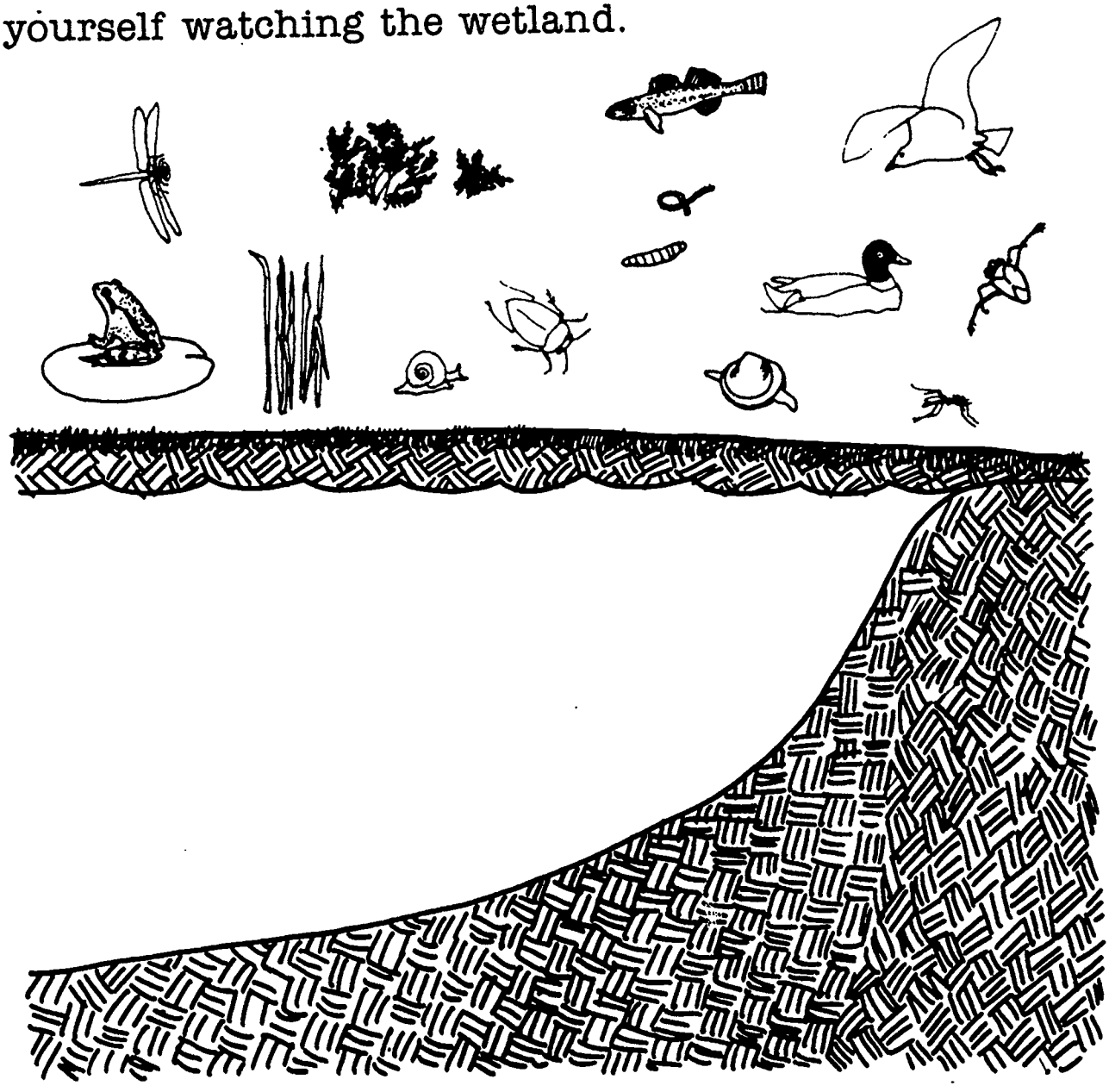
how many?

Name: 4A

Make Your Own Wetland



Cut out the wetland picture below and paste onto another piece of paper. Cut out the other pictures and paste them where they belong in the wetland. Then draw a picture of yourself watching the wetland.

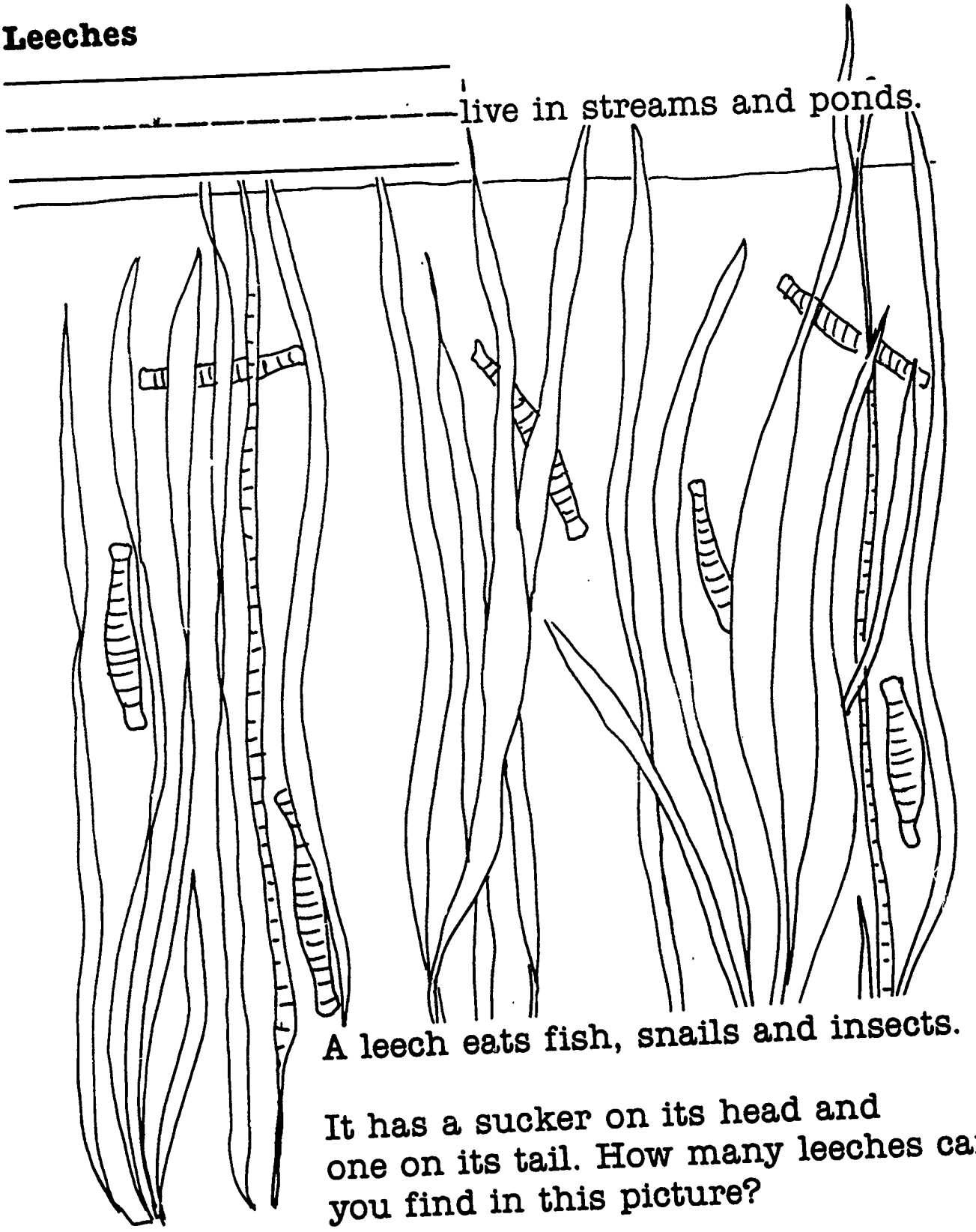


4B

Name

Leeches

live in streams and ponds.

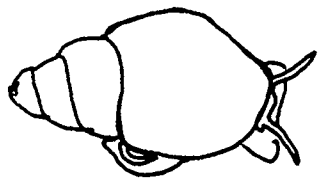


A leech eats fish, snails and insects.

It has a sucker on its head and one on its tail. How many leeches can you find in this picture?

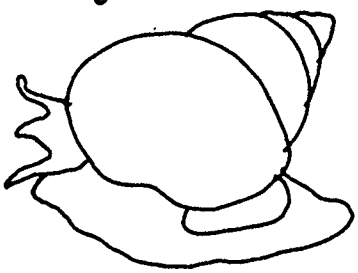
Name: 4C

Snails



Some snails live in ponds and streams.

They move around on their big ——————————



foot hand

Snails eat water ——————————————————

plates plants

Snails are eaten by fish and animals.

Find these words and circle them

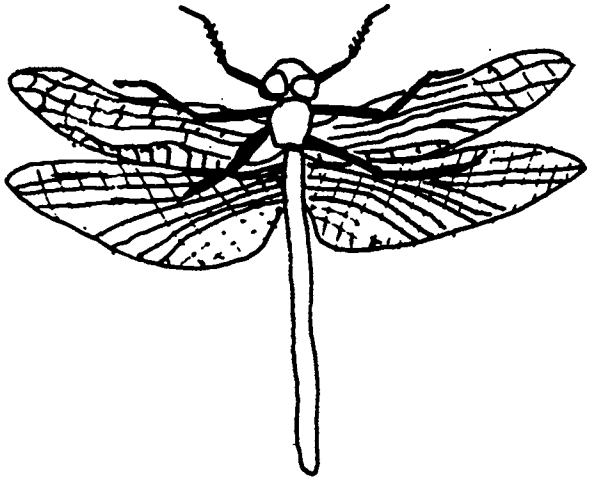
snail
pond
stream
foot
fish
sea
plant

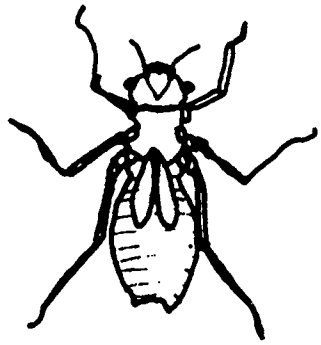
s	n	i	f	s	s
o	p	l	a	n	t
f	o	o	t	a	r
i	n	s	o	i	e
s	d	e	r	l	a
h	x	a	e	p	m

4D

Name: _____

Insects





An adult insect has _____ body parts

and _____ legs. Its body covering is hard and it has wings.

Young insects are very different. This dragonfly nymph has _____ body parts

and _____ legs, but its body is soft and its wings are not full grown.

Name: 4E

Invertebrate Cutout

Directions: color the invertebrates below. Then cut out the pictures and paste each one in the square with the correct name.

snail	leech	dragonfly nymph	amphipod
worm	mayfly	mosquito	clam





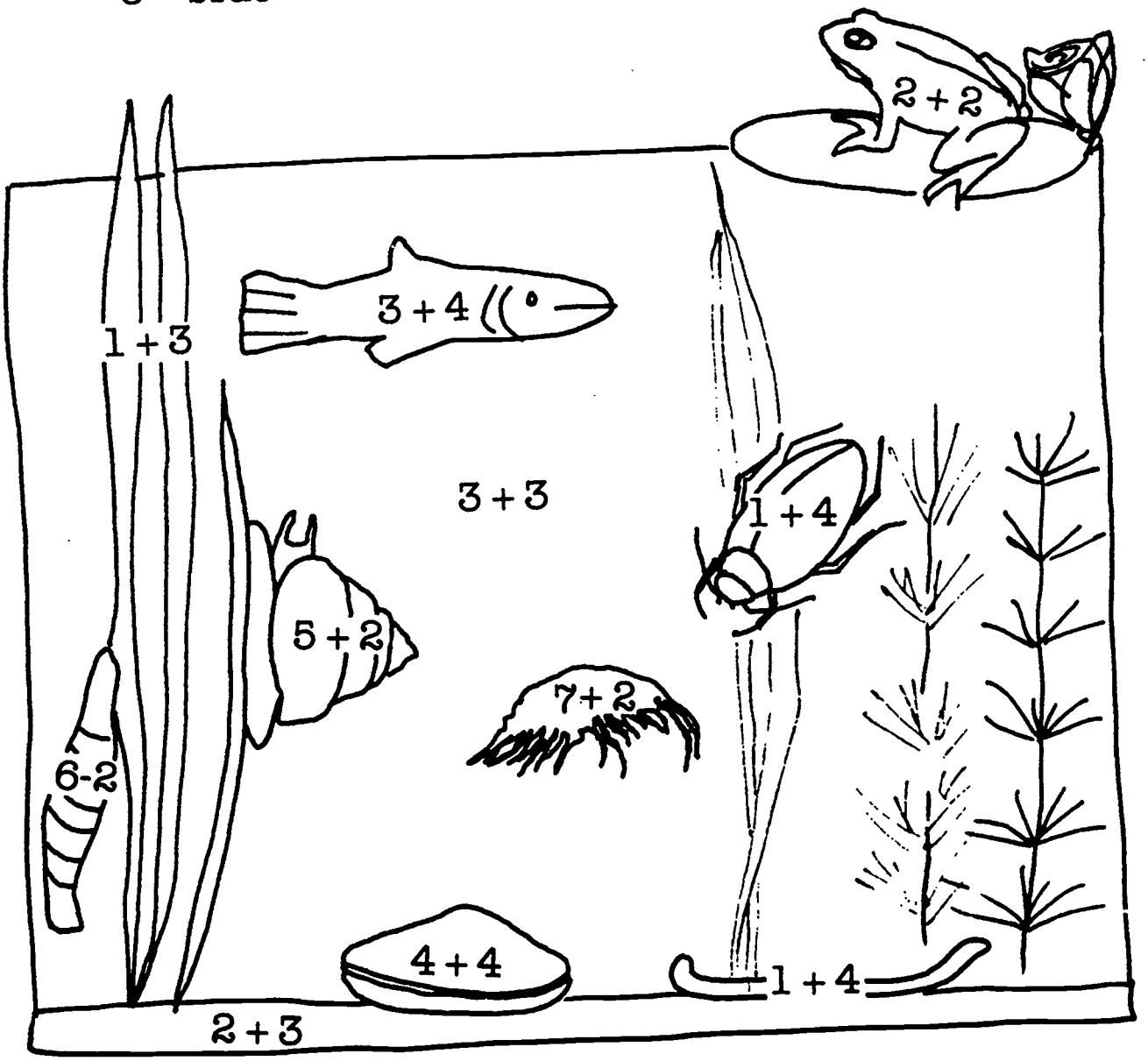



Name: 4F

Freshwater Life

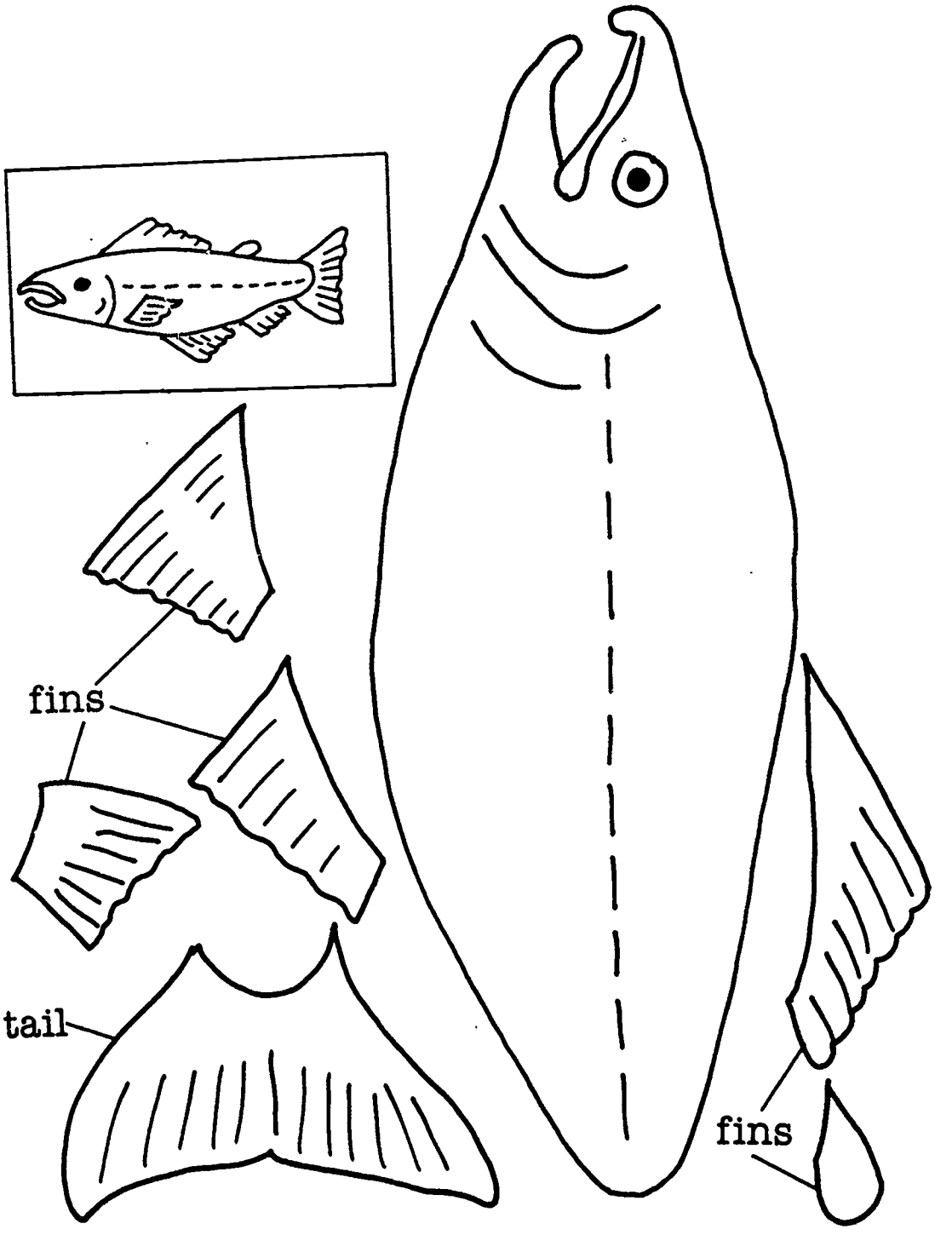
Directions: Add or subtract the numbers in each area. Color the drawing according to the numbers below.

4—green
5—brown
6—blue
7—black
8—red
9—yellow



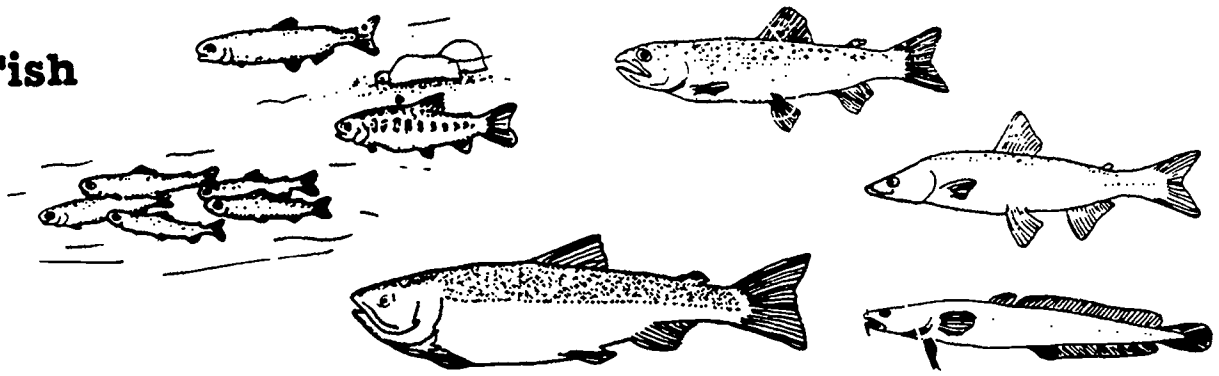
Name: 5A

Make a Fish



Name 5B

Fish



Fill in the blanks with one of these words:

water gills fins eat fresh

1. Fish breathe with ——————————.

2. Fish use their ——————————to swim.

3. Fish are good to ——————————.

4. Some fish live in salt ——————————.

5. Some fish live in ——————————water.

Name: 5C

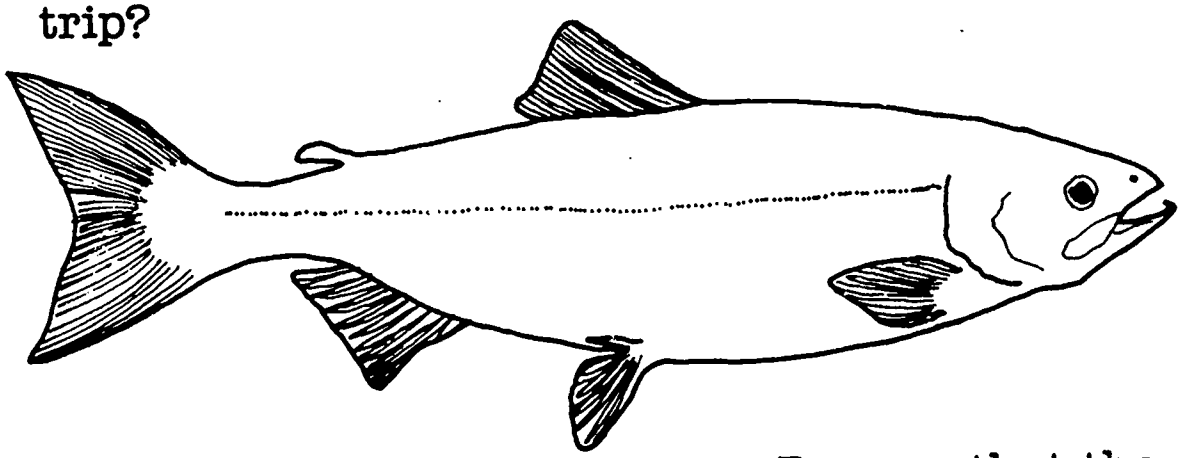
Fish Story

HAVE YOU EVER CAUGHT A FISH? I have.

I remember a fish that was fun to catch. Sometimes fishermen tell stories about fish they have caught, BIG STORIES!

Write a fish story, one you would have trouble getting your own mother to believe. Make it a good one. Think about these questions as you write.

1. Where did you go fishing?
2. Who did you go fishing with?
3. Were you in a boat?
4. Did your fish give you a good fight?
5. What size was your fish?
6. What was a funny thing that happened on your trip?



Now paint a picture of your trip. Be sure that the picture shows the best thing that happened in your story.

5D

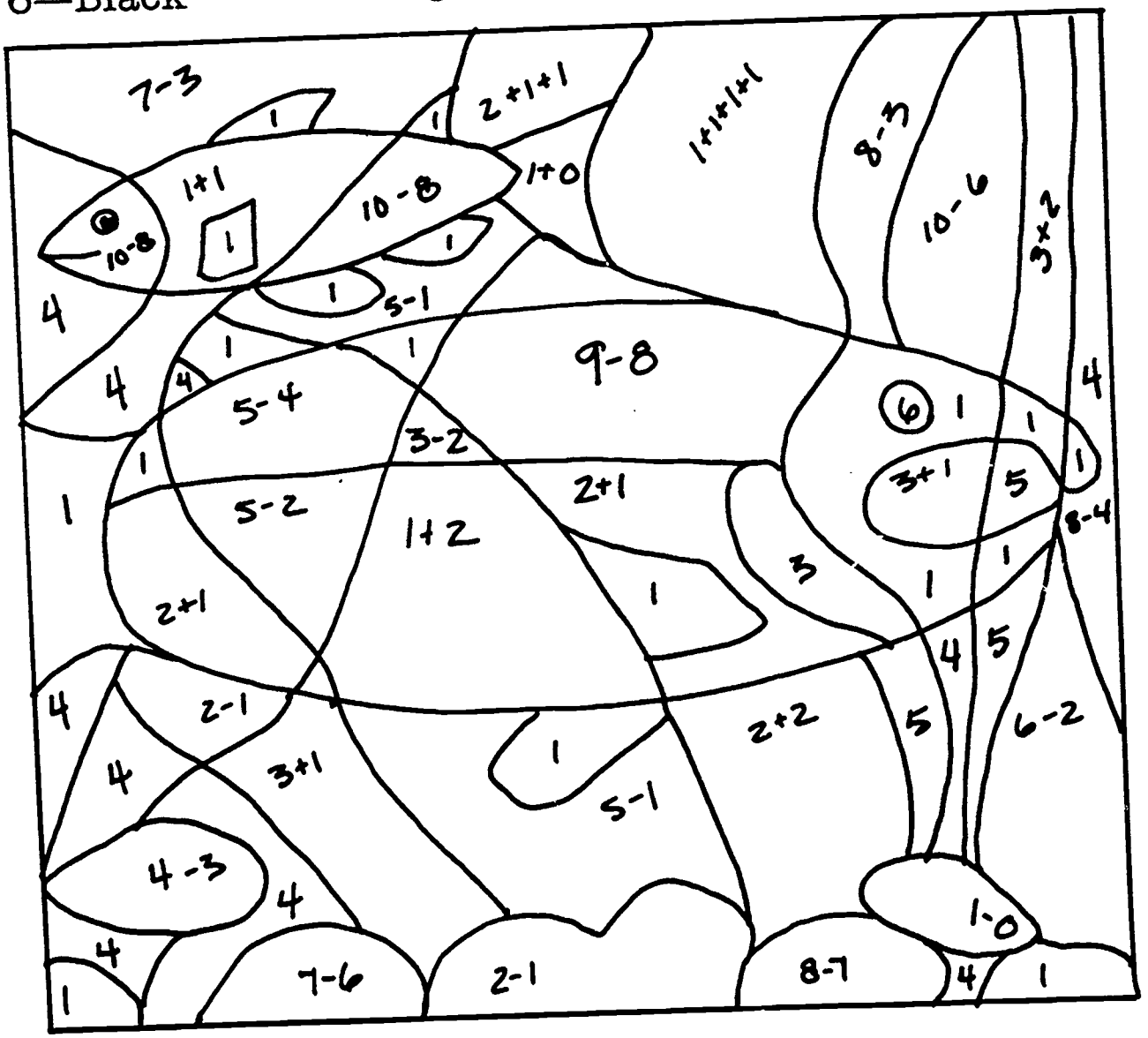
Name:

Fish Find

Directions: do addition or subtraction in each area. Color area according to the number of the answer, using the code.

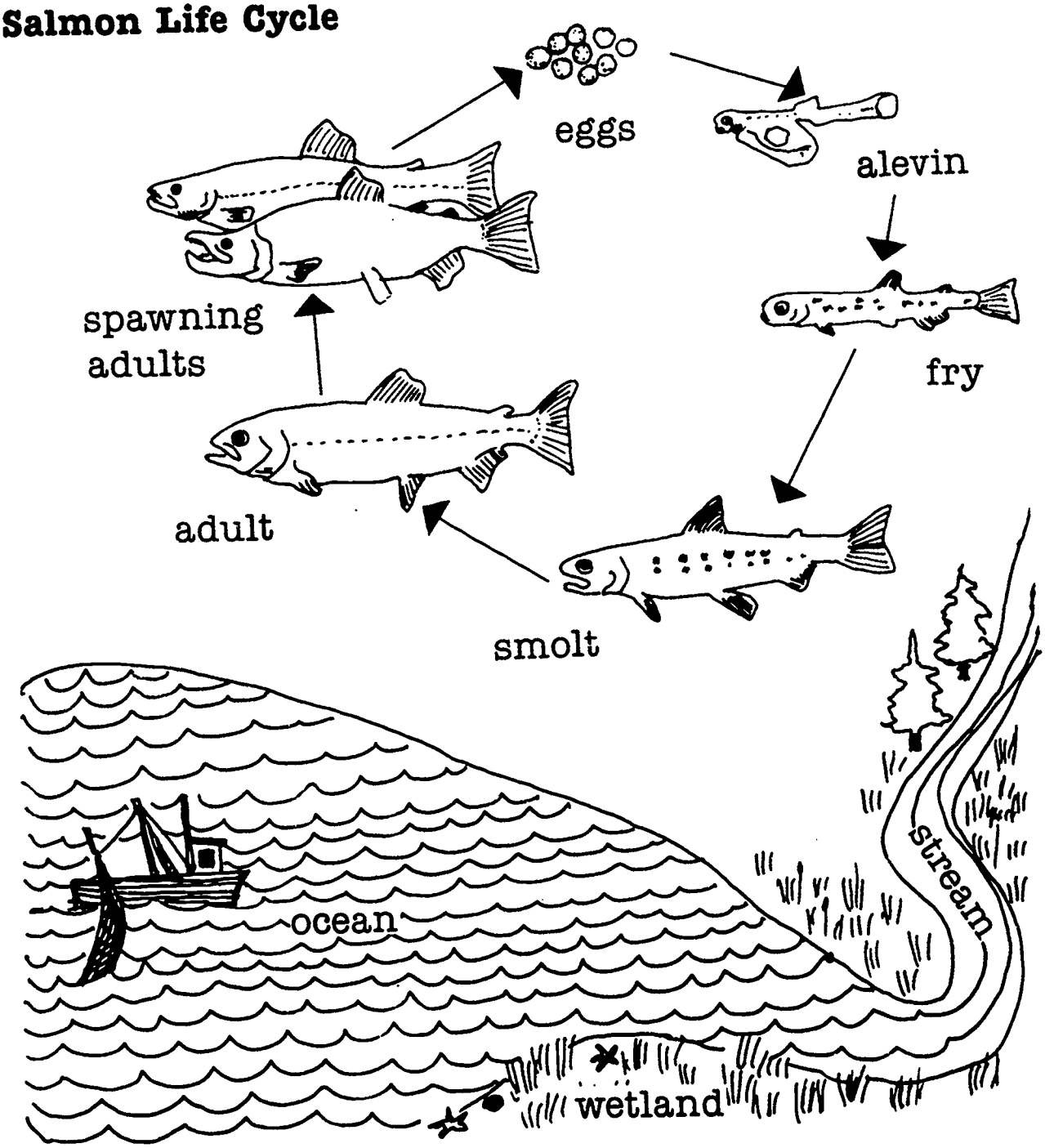
Fish Color Code

1—Brown	4—Blue	2—Red
6—Black	5—Green	3—Orange



Name: 5E

Salmon Life Cycle

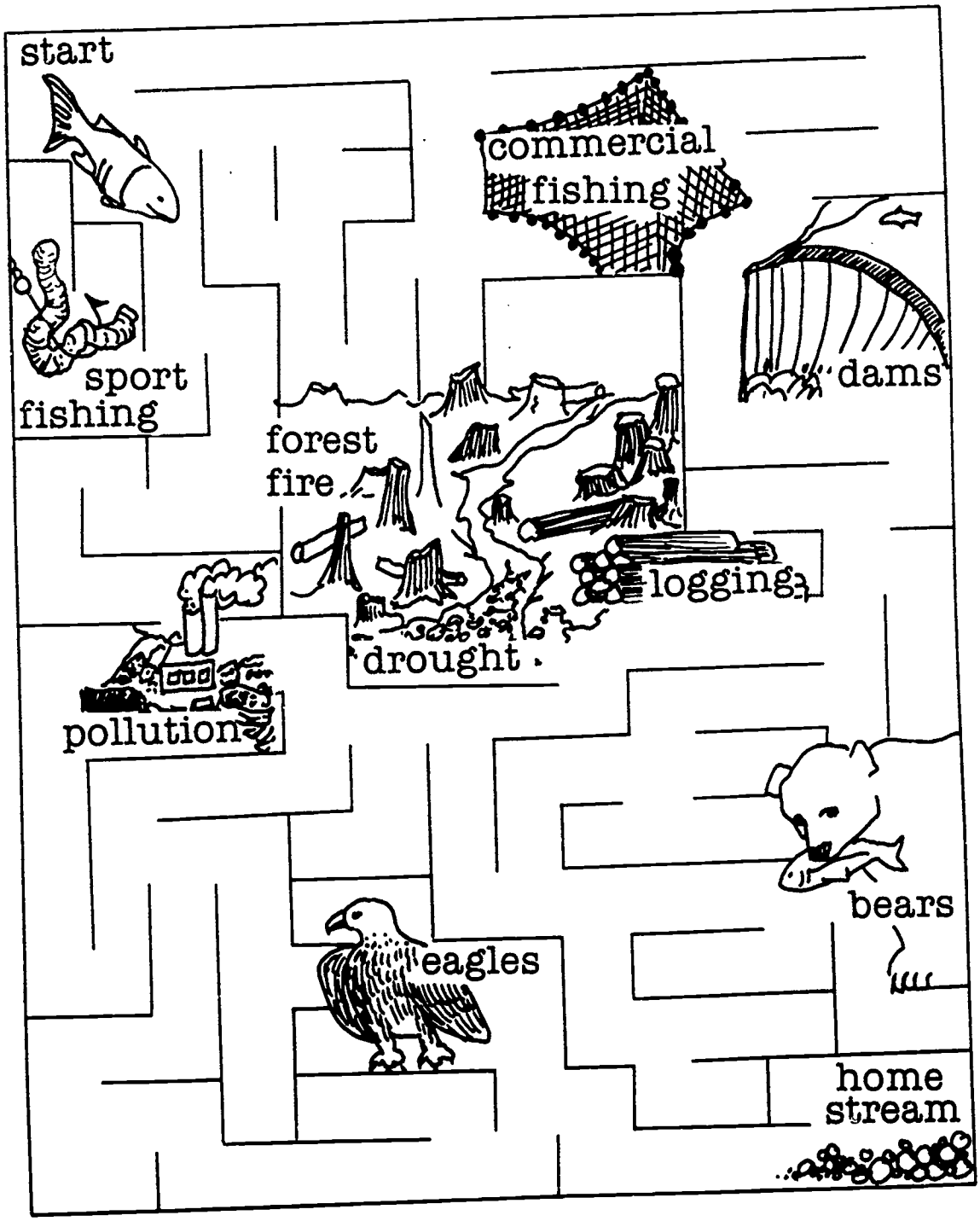


Color, cut and paste. Place the alevin, smolt, fry and eggs in the stream. Put the adult in the ocean.

Put the spawning adults in the stream.

Name: 5F

Salmon Maze



Used with permission of Seattle Sea Aquarium.

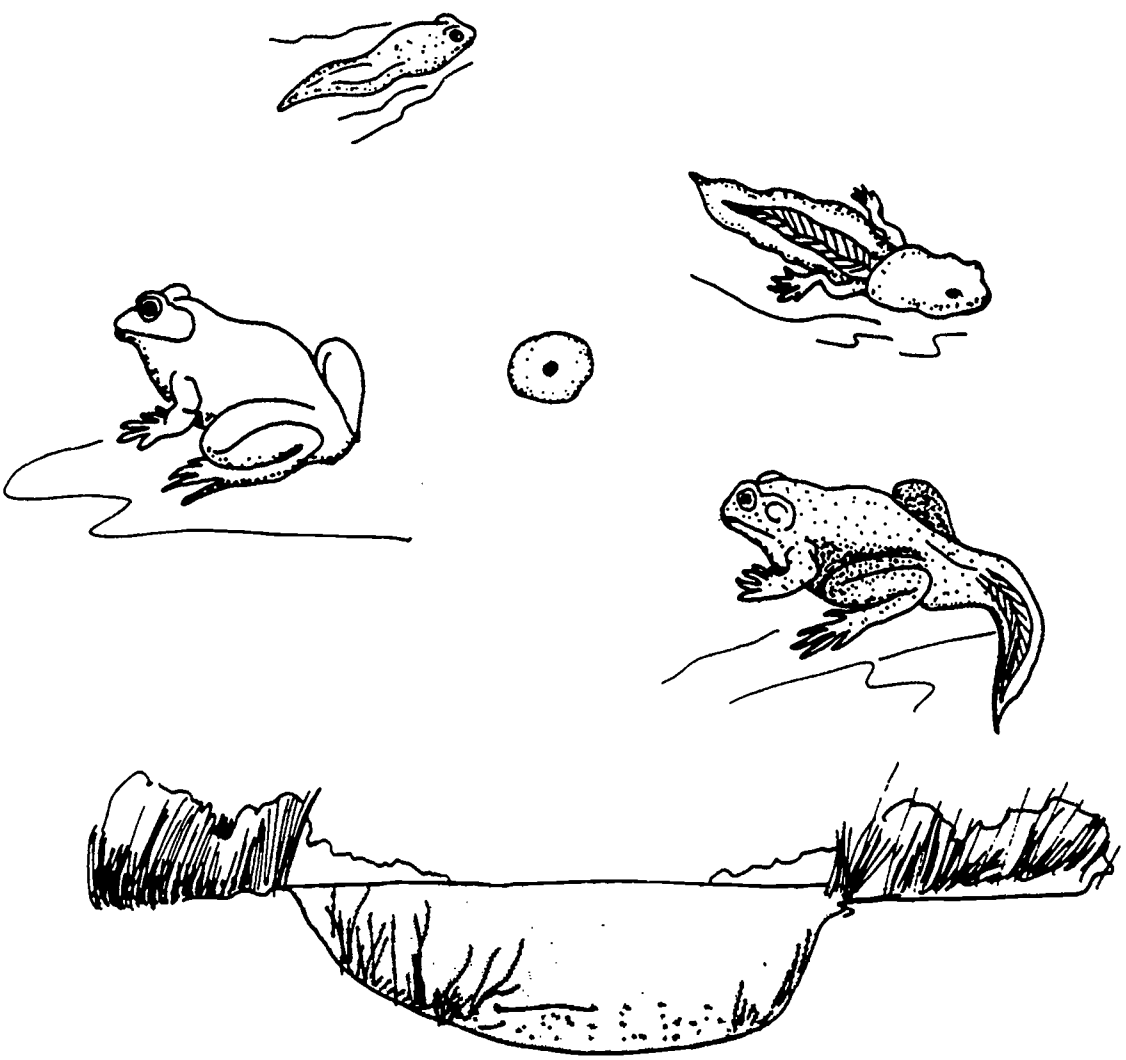
Name: 6A

How does a Frog Grow?

Salamanders, toads and frogs,
all begin as polliwogs.

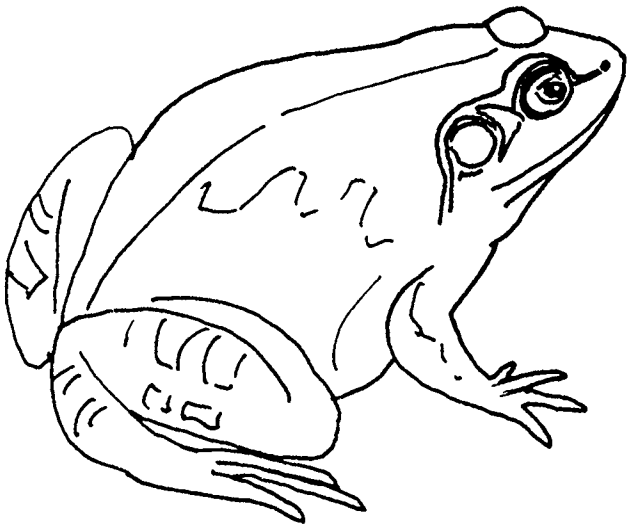
Polliwogs begin as eggs,
first sprout tail and later legs.

Eggs are laid by mother frogs
who began as polliwogs.

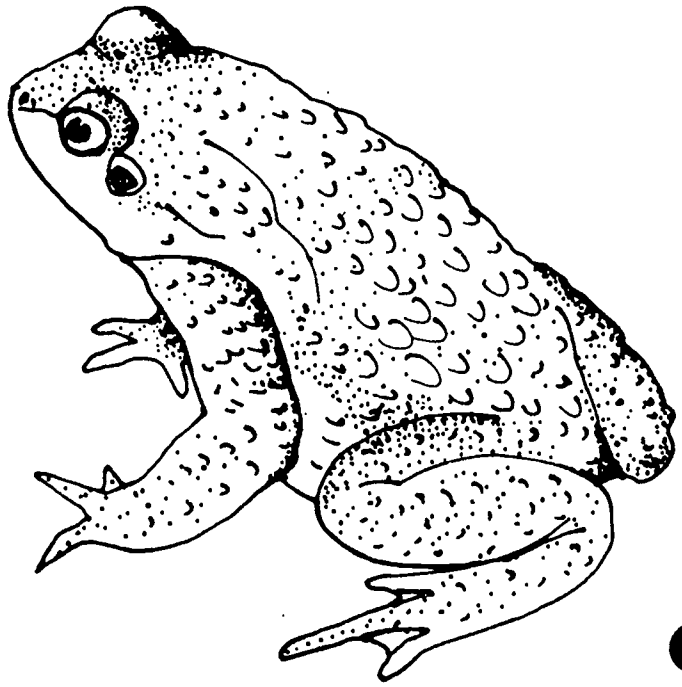


Name 6B

Frog or Toad? Which is Which?



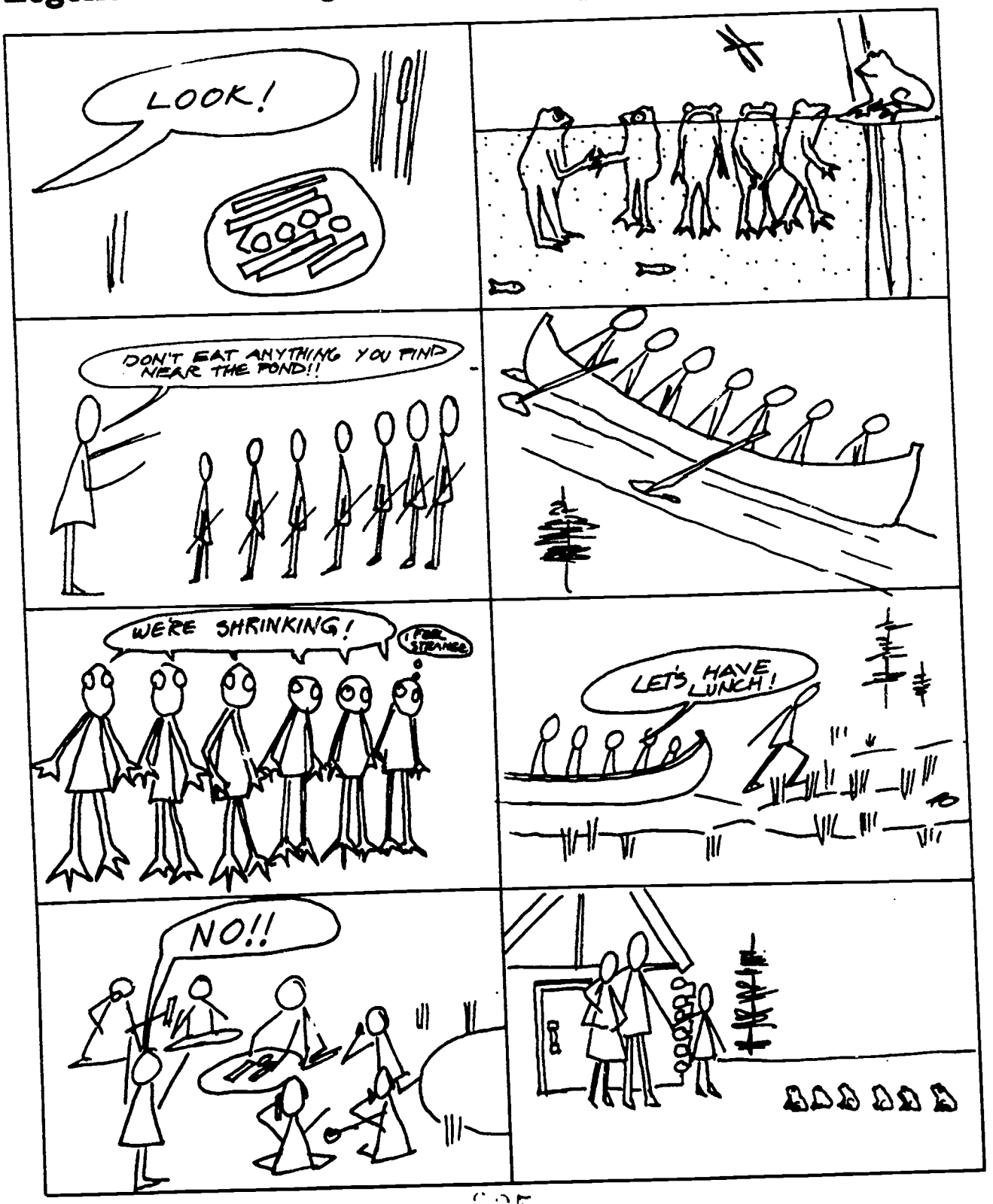
Color me smooth, green and wet.



Color me bumpy, brown and dry.

Name: 6C

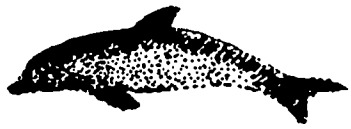
Legend of Six Frogs Cut and paste in story order.



7A

Name: _____

What is a Marine Mammal?



First, let's talk about what mammals are!

Mammals are _____.

cold-blooded
warm-blooded

Mammals breathe air through _____.

lungs gills

Mammals have _____ at some point in their life.

feathers
hair

Mammals have _____.

eggs
live young

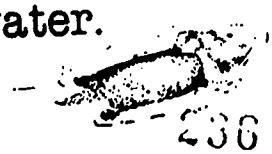
Mammals give their babies _____.

milk meat

Mammals have a 4-chambered _____.

head heart

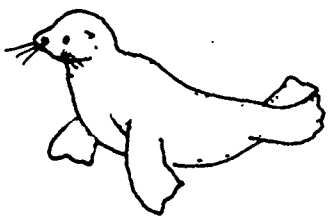
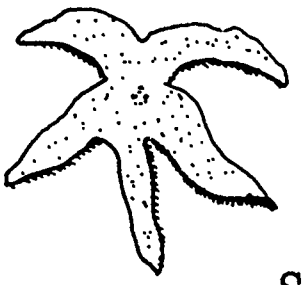
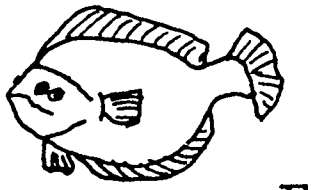
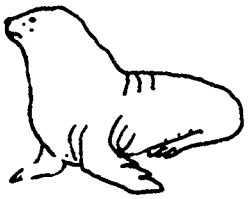
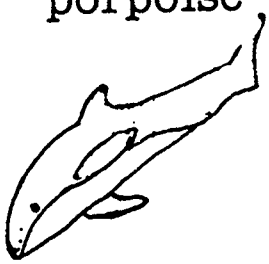
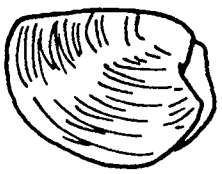
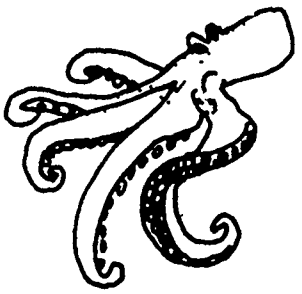
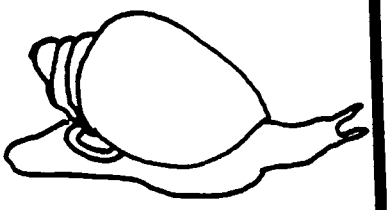
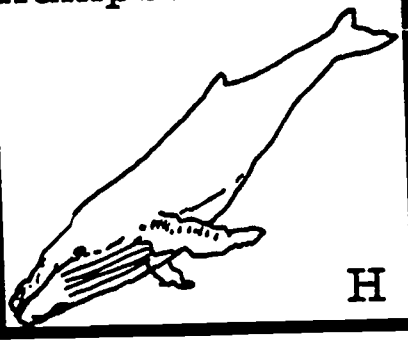
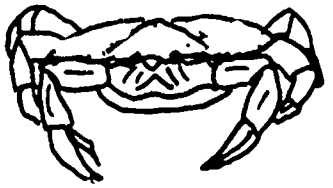
Marine mammals have all these characteristics and they live in salt water.



or around it!!

Name: 7B

Color The Marine Mammals

seal  S	sea stars  S	fish  F
sea lion  S	porpoise  P	killer whale  K
clam  C	octopus  O	sea horse  S
snail  S	humpback whale  H	crab  C

7C

Name _____

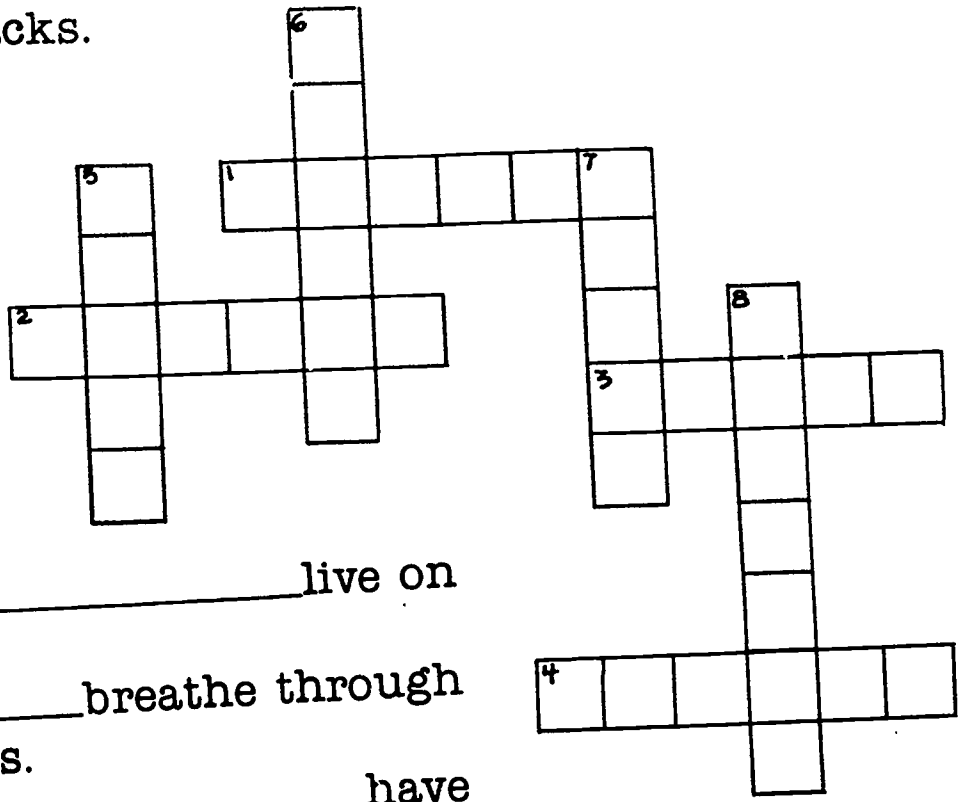
Marine Mammal Crossword

Use the words:

baleen	otters
toothed	seals
bears	whales
lions	walrus

Across

1. Large, wrinkled, tusked marine mammal
2. Gray bowhead and humpback whales strain their food through_____.
3. Sea _____can walk on land with their flippers.
4. Sea _____eat floating on their backs.



Down

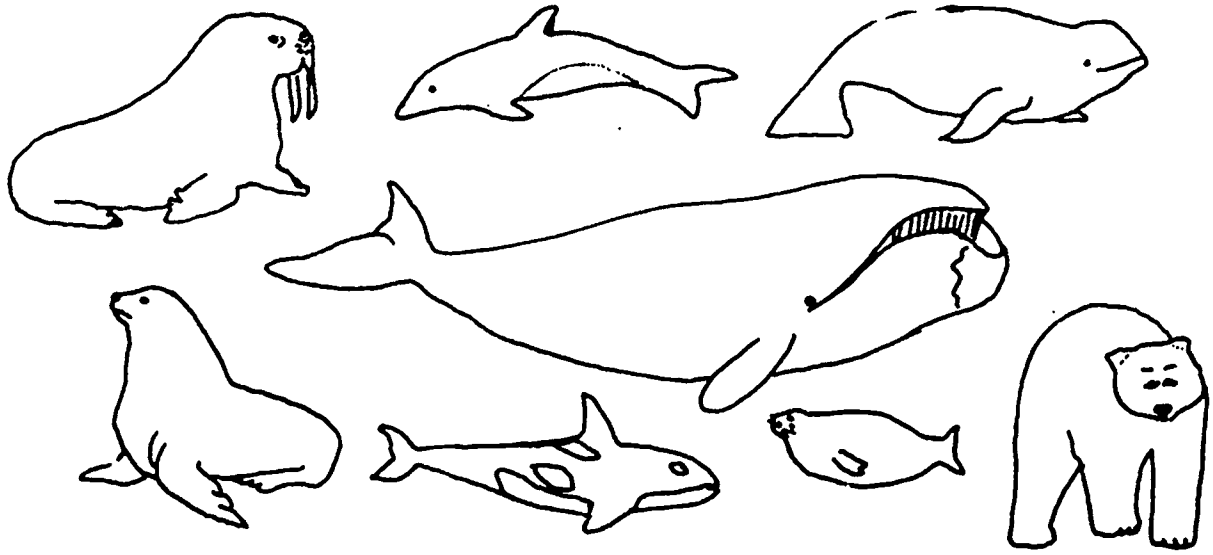
5. Polar _____live on sea ice.
6. _____breathe through blowholes.
7. True _____have flippers, fur and no visible ears.
8. Sperm whales, killer whales and porpoises are____whales.

Name: 7D

Marine Mammal Match

Directions: color, cut, match and paste

walrus	polar bear	dall porpoise
killer whale	sea lion	harbor seal
bowhead whale		belukha whale



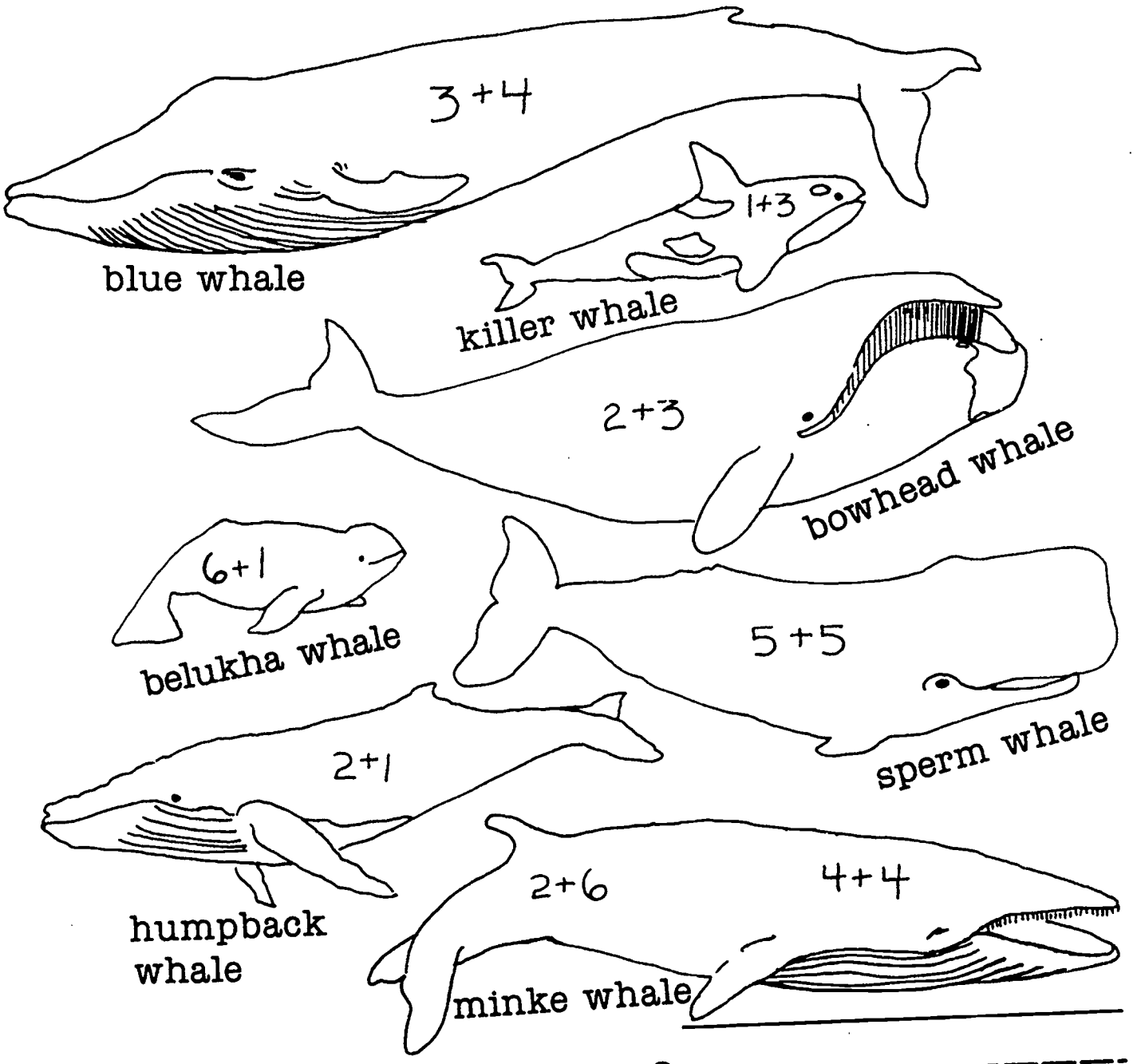
7E

Name:

Whale Count

Directions: Add and color.

3—Red
7—Green
4—Black
8—Yellow
5—Blue
10—Orange

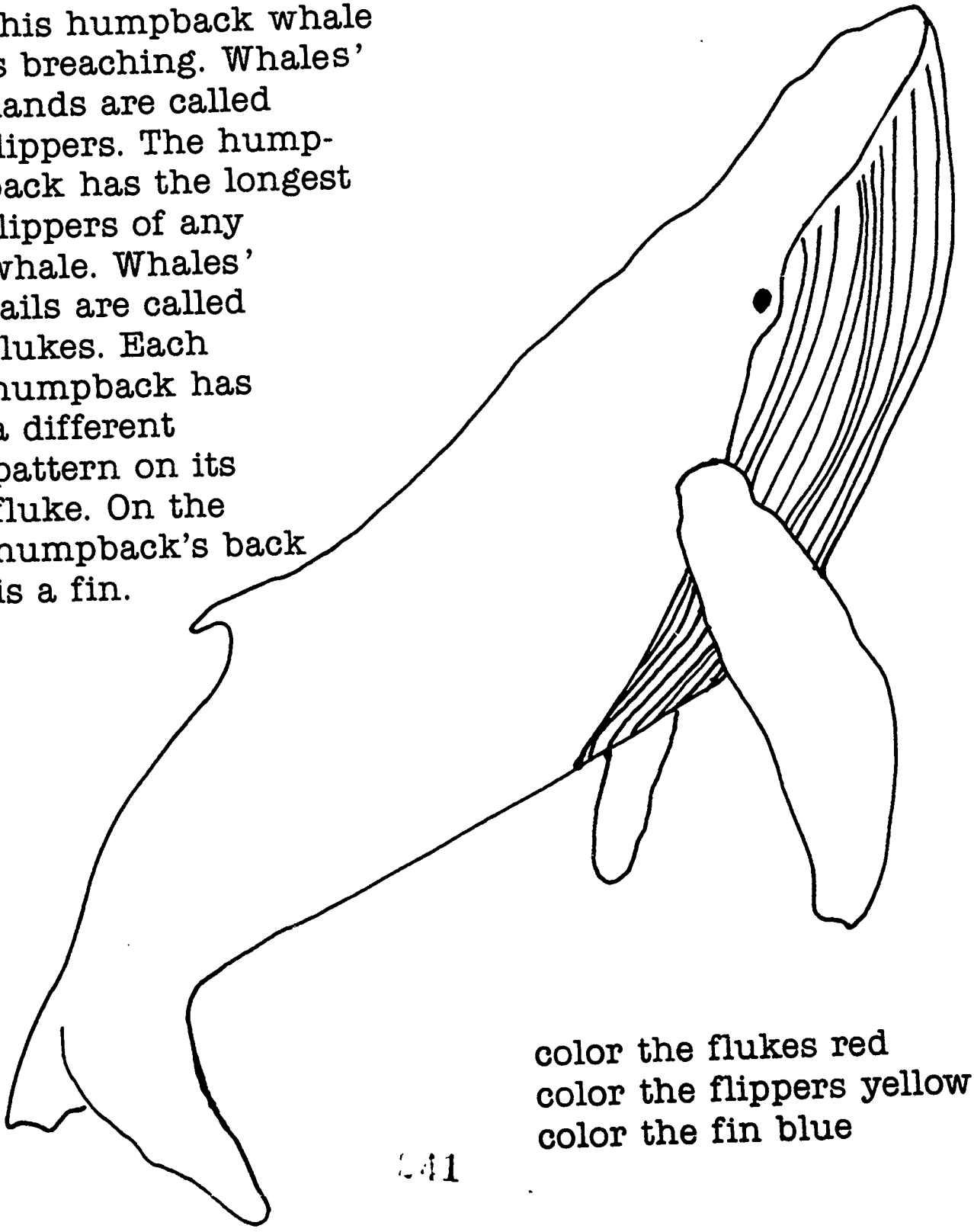


How many whales are there? _____

Name: 7F

Humpback Whale

This humpback whale is breaching. Whales' hands are called flippers. The humpback has the longest flippers of any whale. Whales' tails are called flukes. Each humpback has a different pattern on its fluke. On the humpback's back is a fin.



color the flukes red
color the flippers yellow
color the fin blue

Name 8A

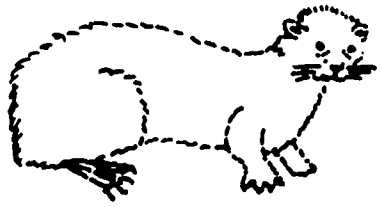
River Otter

Complete the sentences below, using these words:

fish fur slide webs

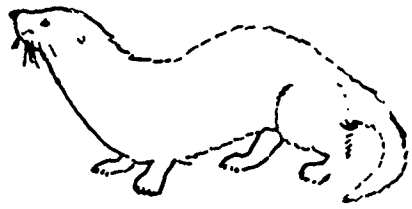
River otters eat _____. They have _____ between their toes. They have brown _____ which keeps them warm. River otters often _____ into the water.

Draw a tail on this river otter.



Name: 8B

Mink



Complete the sentences below, using these words:

dens night muskrats swimmers

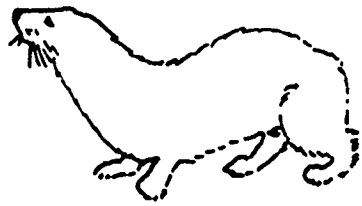
Mink eat _____ , other small mammals, birds and fish.

They feed and travel mostly at _____.

They dig _____ along stream and lake banks.

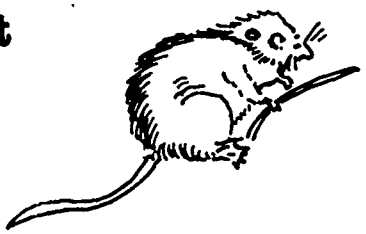
Mink are excellent _____.

Draw a tail on this mink



Name: 8C

Muskrat



Complete the sentences below, using these words:

tails plants houses scent

Muskrats eat _____ and sometimes clams _____ and fish.

They live in muskrat _____ or in burrows.

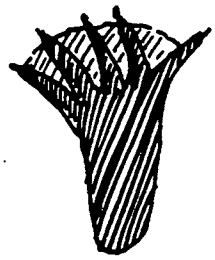
Muskrats have long, black, naked, scaly _____ _____

Sometimes muskrats make _____ posts to _____ tell other muskrats that they have been there.

Draw a tail on this muskrat.

Name: _____ 8D

Beaver



Complete the sentences below, using these words:

dams flat bark night

Beavers eat tree _____.

Their tails are _____.

Beavers build lodges and _____ out of branches

They work mostly at _____.

Draw a tail on this beaver.

Name _____ 8E

Water Mysteries

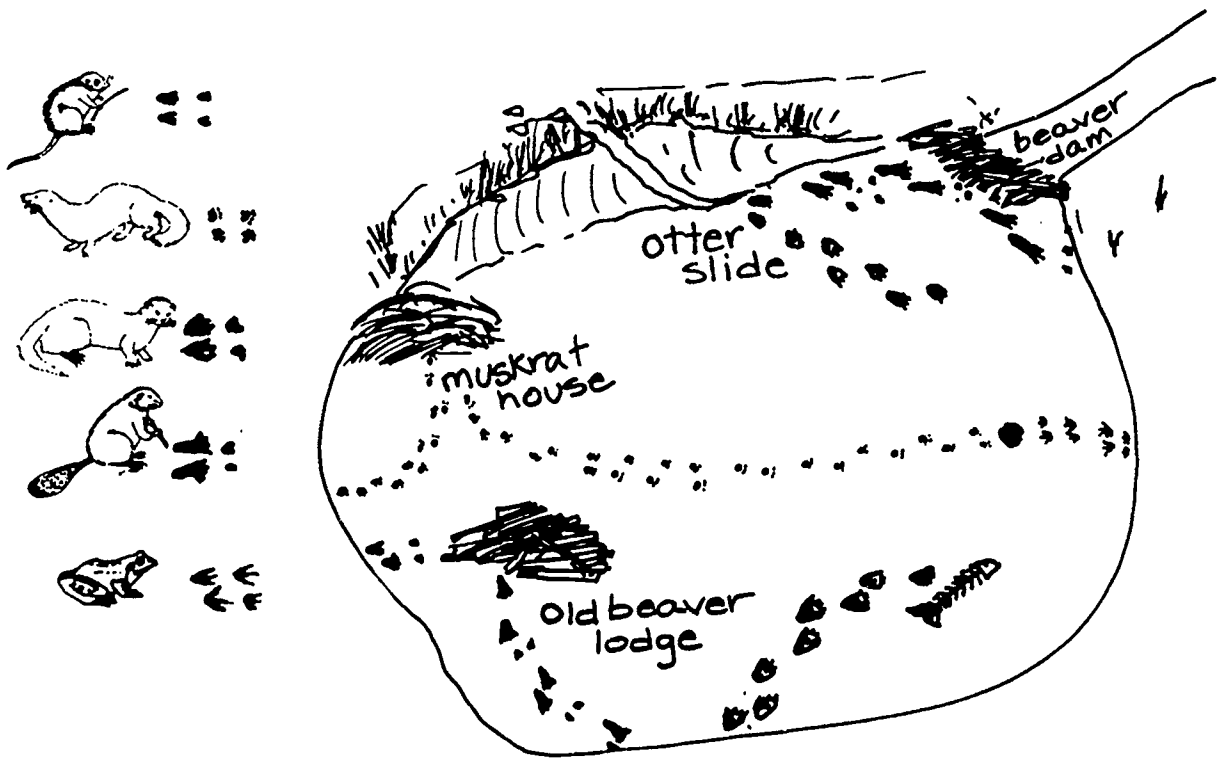
Read the tracks. Then color the animal red that built the dam.

Color the animal green that's living in the old beaver lodge.

Color the animal blue that slid down the bank.

Who ate the frog? _____

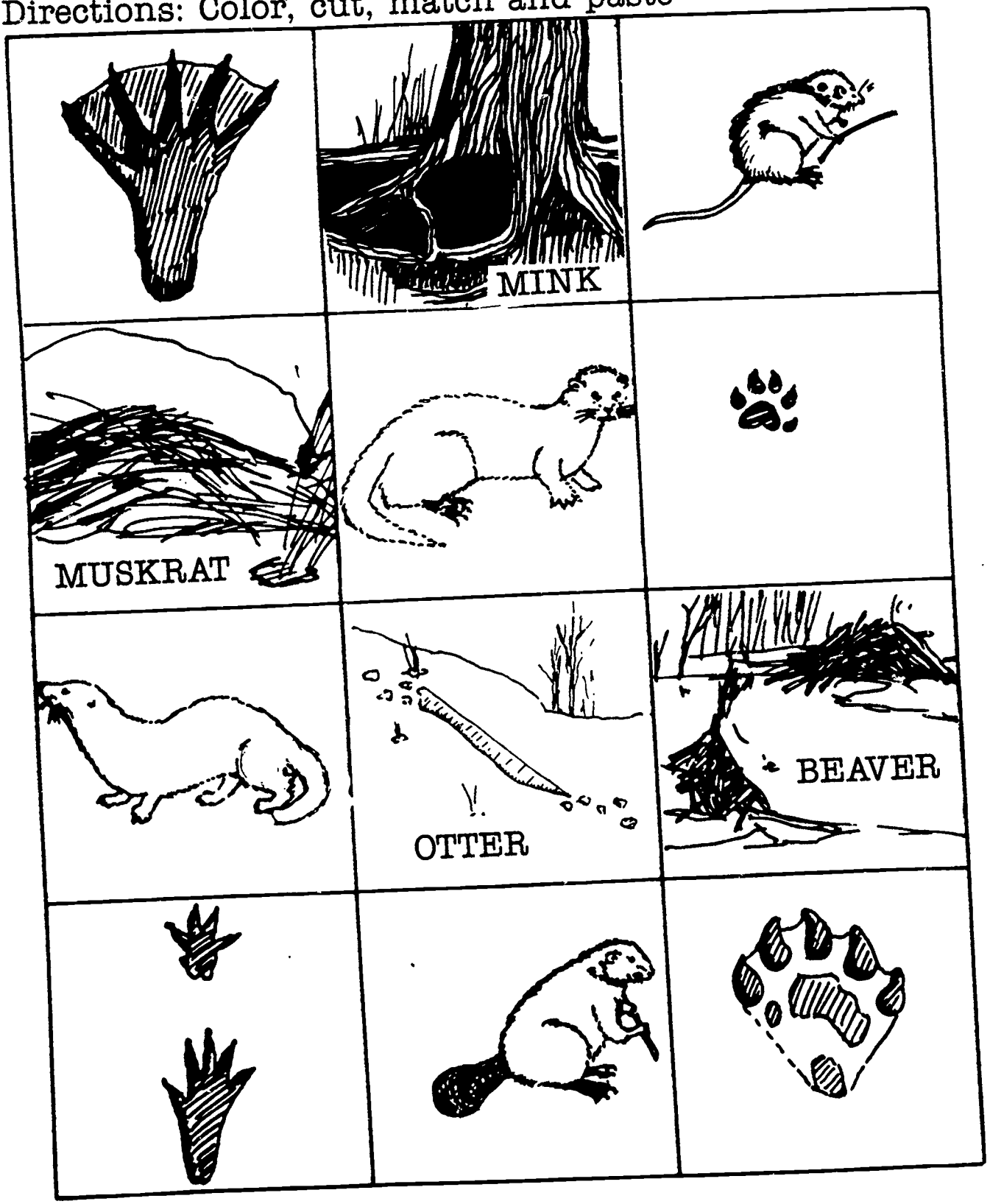
What did the otter eat? _____



Name:

Freshwater Mammal Puzzle

Directions: Color, cut, match and paste



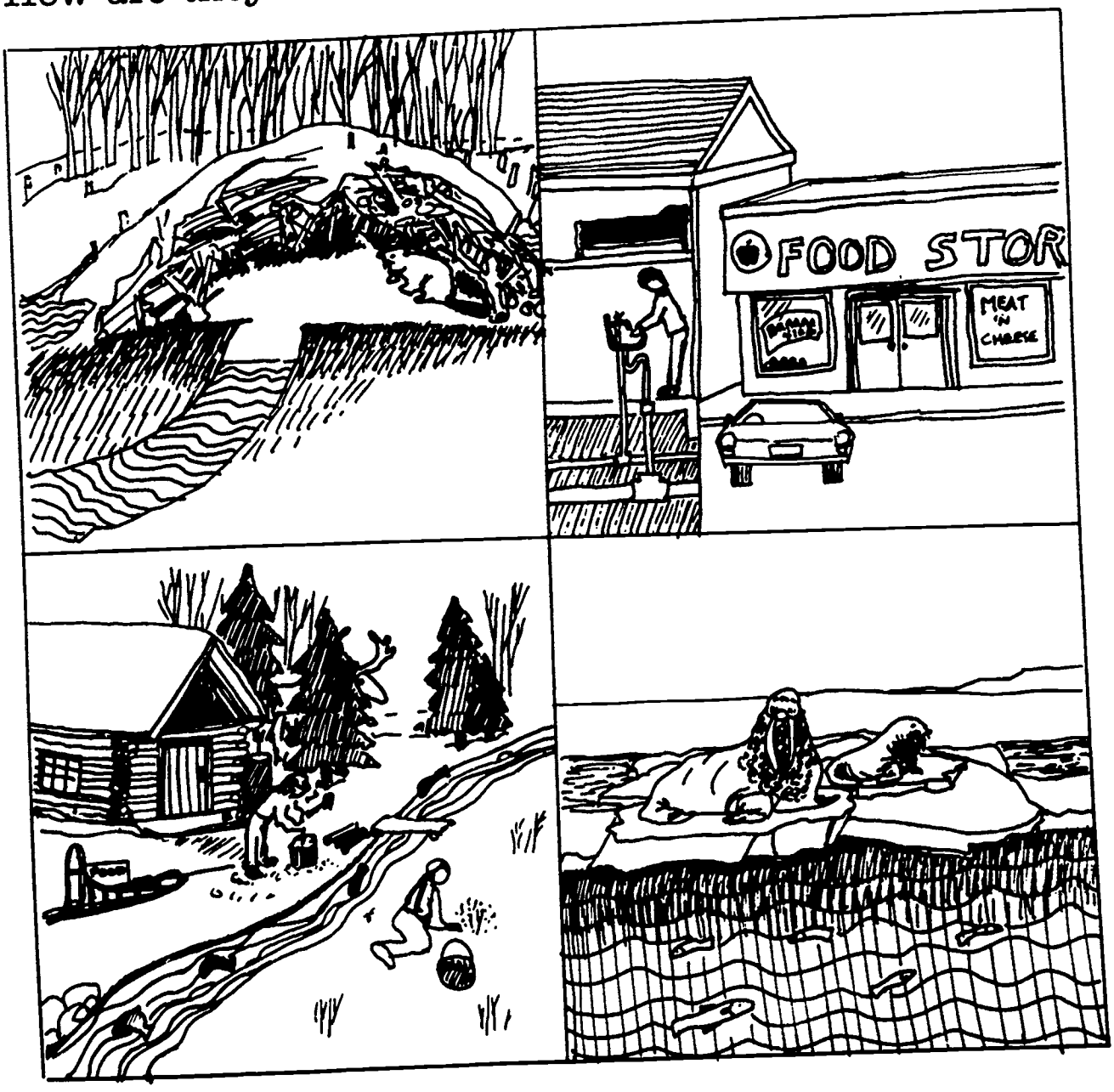
Name: 9A

Animal and Human Habitats

Animals—including people—need water, food and cover. Here are four habitats.

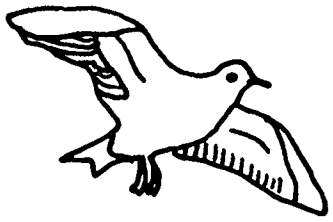
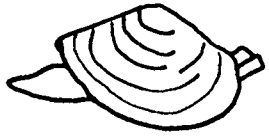
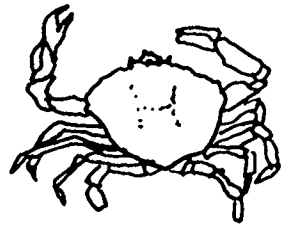
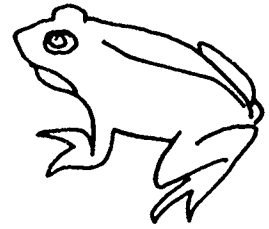
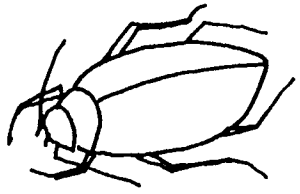
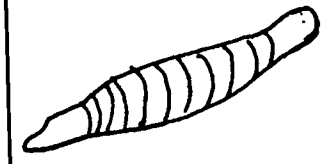
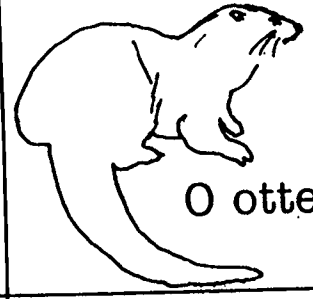
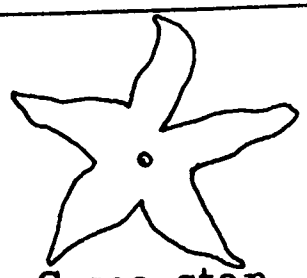
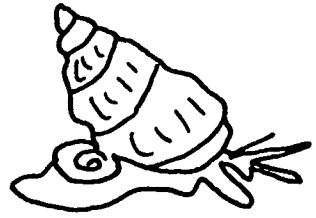
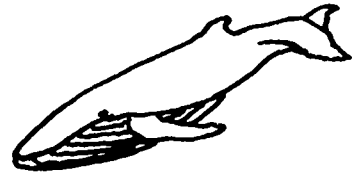
How are these habitats alike?
How are they different?

Color the water blue.
Color the food yellow.
Color the cover red.



Name: _____ 9B

Invertebrate or Vertebrate?

INVERTEBRATE animals without backbones	VERTEBRATE animals with backbones		
		 A anemone	 B beaver
 B bird	 C clam	 C crab	 F frog
 F fish	 I insect	 L leech	 O otter
 S sea star	 S seal	 S snail	 W whale

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