Unit Three
Fish in the Field

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Objectives:

To help students:

- Map their own watershed (Activity 1).
- Diagram the hydrologic cycle (what happens when it rains!) (Activity 1).
- Explore the fish, wildlife and vegetation of a local stream (Activity 2).
- Measure stream flow and temperatures (Activity 2).
- Observe aquatic insects (Activity 3).
- Describe a stream bottom (Activity 2).
- Map pools and riffles and stream direction (Activity 2).
- Explore the fish, wildlife, and vegetation of a local lake (Activity 3).
- Measure lake density and temperature (Activity 3).
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Unit Three: The spawning of salmon into freshwater streams sometimes involves a migration of hundreds of miles from the ocean.
Activity 1
Mapping Your Watershed

Background:

Fish live in watersheds. A watershed is the region from which a stream or lake receives its supply of water; all the land that carries rainfall to the same river system.

Biologists are beginning to realize that 95 percent of what happens to a stream occurs outside its banks. To study fish habitat, it's necessary to look at everything happening in the watershed. The concept of watershed is particularly hard to understand, because so much is underground and out-of-sight in a series of underground rivers, streams, and reservoirs.

Vocabulary:

- watershed
- evaporation
- contour
- saturation
- hydrologic water cycle
- topography
- headwaters
- drainage
- tributary

Materials:

- large sheet of butcher paper
- felt-tip markers
- sponges
- water
- measuring cups
- flat pens with edges to hold water
- small and large pieces of plastic or plastic bags
- heat lamp or hot room
- tape or string
- local topographic maps
- paper
- pencils

Procedure:

1. Introduce the term watershed as the area drained by a river or stream. Draw a picture on the board. Rain falling on the stream's side of the mountain goes down and is drained off by the stream. Drainage is a term used to describe the course the stream follows. The watersheds of several streams join to make up the watershed of a river.

2. Show students a topographic map that shows the area surrounding one of your local rivers or streams. Any large-scale map will suffice, but it's better to have one that shows the contours. Have students trace all the streams that go into the river. Each contour line is drawn at a specific elevation. For instance, the 100-foot contour line means that everywhere along that line the elevation is 100 feet. The area where the stream or river begins is called the headwaters. Streams that form the river are called tributaries.
3. Have students draw their local watershed on a large sheet of butcher paper with felt-tip markers. Add features such as the site of your town or village, cabins, fish camps, roads, dams.

4. Show students how a watershed works by pouring measured amounts of water (rain) on sponges (the land) in a pan (bedrock or permafrost). Tilt the pan on its side and poke a hole (the stream) in the bottom of the lower edge, so students will get an even more realistic picture of a watershed. Now try several experiments:

a. What happens if it rains just a little? (Pour a little measured amount of water on the "land." The sponges soak it up. This is a very good analogy for Alaska—as most of Alaska is wetland—soggy, spongy ground that just soaks up the water when it rains or snows and slowly releases it later.)

b. What happens when it rains a little more? (The watershed continues to soak up the water. Now cover your whole pan with a large piece of plastic bag. Tape or tie it strongly around the pan. The bag represents the earth's atmosphere.)

c. What happens when the sun comes out? (Use a heat lamp or leave the pan overnight in a hot room. You should see droplets of water forming on the underside of the plastic. The water slowly evaporates from the "land." Eventually the droplets form clouds and under the right conditions rain again. This is called the hydrologic cycle which means that water is never lost, but it just keeps changing form.

d. What happens when it rains a lot? (Better do this part over the sink! Take off the plastic bag and slowly pour a greater measured amount of water on the "land." At first the land soaks up the water but eventually it floods. Note the measurement at which it first starts to flood.)

e. What happens when people disturb the watershed by building on top of it? (Cover some of the sponges with a piece of plastic or plastic bag to illustrate that when you build a house or pave a parking lot, the water doesn't have a chance to soak in. Pour
water on the watershed and see how much water it takes to flood it this time.

5. Have students draw pictures of what's happening on the watershed. They should show the hydrologic cycle, plus local events that are affecting the watershed. What happens in the headwaters is important downstream. Undisturbed headwaters mean a steady, constant supply of water instead of floods and dry spells. Wetlands along the banks of streams and rivers help assure this steady, constant supply of water for drinking, cooking, washing, transportation and fish habitat.
Activity 2
Stream Field Trip

Background:

Streams and rivers are places to explore. The moving water and streamside vegetation provide habitat for an array of fish and wildlife.

Vocabulary:
- riffle
- pool
- current
- meander
- velocity
- flow
- aquatic
- transect

Materials:
- maps, charts, aerial photos of your area
- flagging tape or colored streamers
- pencils
- magnifying lenses
- binoculars
- stop watch or watch that marks seconds
- thermometers
- yardsticks
- 100-foot measuring tape
- sampling screens
- white enamel pan or pie pan painted white
- litterbag
- local resource person
- field guides
- snack or lunch
- worksheets:
  - Stream Checklist (3A)
  - Stream Transect (3B)

Procedure:

1. Select a local stream (or river) for your field trip. Look at maps, charts, and aerial photos of your area. Pick one that has fish plus easy access. Local resource people (fisheries biologists, village elders, fishermen) may be able to help, or even offer to go along.

2. Plan your stream visit to include:
   a. structured learning
   b. summary or review
   c. litter pickup and snack or lunch

The Stream Checklist worksheet can be used initially or in conjunction with the Stream Transect worksheet. You may also want students to work on language arts or art projects. The summary can take the form of every student (and adult) telling what they liked or learned that day. Litter pickup can be slightly modified to take on a stream or fish theme, i.e., pile filled litter bags in fish shapes.

3. Send home transportation and permission slips and invite parents to participate as group leaders. High school students can be group leaders.
if they are well prepared. If possible, meet in advance with your group leaders. Visit the site and designate 100-foot sections of stream for each group to investigate. Mark the sections with flagging tape or colored streamers.

4. Get equipment together for the trip. Each group should have a thermometer, watch, yardstick, litterbag, magnifying lenses, pencils and copies of the two worksheets. Students may also want to make sampling screens and paint pie pans white for aquatic insect investigations. Go over the checklist, eliminating or adding animals to typify your area.

5. Prepare your students. You might want to do a "dry run" in which students wear rubber boots and bring rain gear and warm clothes. Show students the aerial photos, maps and charts. Lay out a model stream on the classroom floor. Explain to students that they will be doing a scientific study of the stream and later writing a scientific report about their findings. Divide students into teams of four to six, and have each team survey a 10-foot section of the stream with the Stream Transect worksheet. Explain to students that is a transect a section of a particular habitat. They will be looking closely at one part of a stream; and by doing so, they will have a better idea of what the entire stream is like. Then preview the rest of the worksheet.

Temperature: Have students practice using the thermometers. Can they predict the temperatures of their streambank, water, and air?

Stream bottom type: Ask students why the bottom is important. (Because that's where fish often feed and usually spawn. Some types of fish will spawn only where the gravel is a certain size. Other fish like a muddier bottom. Some aquatic insects will live only on certain types of stream bottoms. Students should write down what the bottom is like--sandy, muddy, small gravel, rock.)

Average stream depth and width: Students can use their yard sticks or meter sticks.

Fish species, size, and numbers: Because fish are under water, it's sometimes difficult to tell what kind they are; but students should do the best they can. Quietness at the bank of the stream is important to keep from frightening the fish. If a fisheries biologist or someone with a fish collecting permit is along, your class may be able to use seines, dipnets, or minnow traps to show the students what is in the stream. Students might also try dropping salmon eggs or bread crumbs quietly on the surface of a stream pool and see if any fish arrive to feed. Another possibility is sport fishing. How long does it take your students to catch a fish? What lures or baits work best? (Be sure to comply with sport fishing regulations.)
Aquatic insects: By drawing pictures of what they find, students may be able to identify the insects later. There is a good section on aquatic insects in Volume 2 of the Sea Week Curriculum Guide series. Look under rocks and sticks for the insects but be sure to put them back so their homes are disturbed as little as possible. Students may also want to make a sampling screen to check for aquatic insects. Have students kick up rocks and debris upstream from the screen so insects are dislodged onto the screen. Place the insects in water in a white enamel pan or pie pan painted white for observation and identification before releasing them.

Birds and mammals: List any birds and mammals that students find on their transects. Any observed elsewhere may be checked off on the checklist. Several bird identification guides are listed in the bibliography.

Animal tracks: Again, if students draw careful pictures they may be able to identify the tracks later. Local people who spend a lot of time outdoors plus Olaus Murie's A Field Guide to Animal Tracks should be very helpful. Have students be sure and measure not only the size of the tracks, but the distance between them. Another option is to give each group a package of plaster-of-Paris with which to make casts of bird and animal tracks.

Streamside vegetation is important to fish. It provides shade to keep the water cool, insects falling from the vegetation are eaten by fish. Leaves also fall into the water, providing food and nutrients for aquatic insects, which are in turn eaten by fish. Logs and branches which naturally fall into the stream make good hiding places for fish.

Velocity is the speed of flow, measured in feet per second. To figure the average velocity of a stream, measure off a set length such as 20 feet. Then drop in a stick or an orange—anything that floats. Use the second hand on your watch to see how long it takes to go 20 feet. If it took 5 seconds, the velocity would be 4 feet per second. Experiment several times to check the accuracy of your measurement.

Pools and riffles: Pools are deep areas in streams or rivers where the current is slow. Riffles are shallow portions of streams or rivers where the current is fast. The ratio of pools and riffles in a stream helps determine how many fish can live there because fish need both types of habitats. Pools are good resting spots. Riffles add oxygen by mixing water with the air as little waves form. Also, different kinds of aquatic insects are found in each area. The more a stream or river meanders or curves back and forth, the less steep it is and the easier for fish to go up and down, and the more fish habitat is present because the distance covered is longer than would be covered by a straight line.

Additional observations: Sometimes it's the small things you notice that later turn out to be the most important, so encourage your students to take careful notes.

6. Ask students to make up some rules for the trip to protect the animals and plants of the stream (step softly and carefully, turn rocks or logs back over so the animals who like the moist environment
underneath can survive, leave everything just as found, pick up litter). Discourage collecting unless for a specific purpose such as an art project or freshwater aquarium.

7. Review safety procedures:

- Stay together. Have a buddy. If you become lost, stay where you are and call out periodically.

- Dress warmly and keep dry.

- Stay a safe distance from the water (If you will be visiting a river, you may want to bring several life rings with lines attached and have the students practice throwing them).

- Be careful of slippery mud, rocks, and logs.

- Help each other.

- Carry a first aid kit.

8. Plan follow-up activities. (See Activity 4 in this unit.)

9. Enjoy the trip!

Activity 3
Lake Field Trip

Background:

Lakes generally are large, deep bodies of water with rotted plants growing on their edges, in comparison to ponds which are small and usually shallow. Lake Iliamna is Alaska's largest, but other lakes of considerable size are located throughout the state. Most lakes were formed by the scouring and erosion of glaciers in the distant past. If large enough, lakes can alter local climate by moderating temperatures. They may also produce foggy conditions and cause snowfall on their lee sides. Lakes are constantly changing, and geologically are a comparatively short-lived phenomena. Lakes are continually filling in and have a life span of a few thousand to tens of thousands of years. Limnologists study lakes. Limnology is the formal, scientific study of lakes, ponds, rivers, and streams. The study also is called freshwater ecology or "inland oceanography."

Vocabulary:

- transparency
• secchi disk
• vegetation
• emergent
• plankton (review)
• aquatic (review)
• transect (review)

Materials:
• plankton nets
• secchi disk
• thermometers
• pencils
• magnifying lenses
• flagging tape or colored streamers
• 100-foot measuring tape
• rulers
• maps, charts aerial photos of the lake
• local resource persons
• binoculars/spotting scope
• litter bags
• large cans
• field guides
• white enamel pans or pie pans painted white
• life rings with ropes attached
• worksheets:
  • Lake Checklist (3C)
  • Lake Transect (3D)

Procedure:

1. Select a local lake (or pond) for your field trip. Look at maps, charts, and aerial photos of your lake. Pick a part of the lake to explore that has a variety of habitats (wetlands, river or stream inlet or outlet, heavy fish or bird concentrations, etc.). Local resource people (fisheries biologists, village elders, fishermen, birdwatchers) may be able to help.

2. Plan your lake visit to include:
   a. structured learning
   b. summary or review
   c. litter pickup, snack or lunch

The magnifying lenses and worksheet Lake Checklist can be used initially or in conjunction with the worksheet Lake Transect. You may also want students to work on language arts or art projects. The review can take the form of every student (and adult) telling what they liked best, or their favorite learning experience that day or each team can come up with a summary statement. Litter pickup can be a separate activity or just a continual part of the field study. If you have extra time at the end while waiting for transportation, play fish tag where a few "bears," "gulls," and "eagles" try to catch the "fish" (the rest of the students).

3. Arrange transportation and send home permission slips. Invite parents to participate as small group leaders. High school students can also be small group leaders if they are well-prepared ahead of time. If at all possible, meet with your group leaders ahead of time and go over what you'll be doing. Visit the site and lay out 100-foot sections along the lake shore for each team of four to six students to investigate. Mark the sections with flagging tape or colored streamers.

4. Gather equipment. Each team of four to six students should have a thermometer, plankton net, secchi disk, ruler, a large can, litterbag, magnifying lenses, white enamel pans or pans painted white, pencils
and copies of the two worksheets. Try to locate a spotting scope and tripod in case there are birds on the lake. Go over the checklist, eliminating or adding animal and plants typify your area. Have the students assist in making plankton nets and screech disks if you don't have any on hand.

5. Prepare your students. Try a "dry run" several days before the field trip. Have students wear short rubber boots or hip boots and bring rain gear, binoculars, and warm clothes. Show students the aerial photos, maps, and charts. Lay out a model lake on the classroom floor. Divide the class into teams of four to six students, and have each team survey a 10-foot section of the lakeshore. The teams should be numbered consecutively along the shore. Remind the students that a transect means a section. By looking closely at one section of the lake, they'll have a better idea of what the whole lake is like. Then go through the different parts of the worksheet.

Location of transect: When biologists do studies like this one, it's very important that they know where they are so that they can go back another time to see if any changes have occurred.

Temperature: Have students practice using the thermometers. Can they predict the temperatures of their lakeshore, water, and air?

Lake bottom type: Ask students why the bottom is important. (Because that's the home of aquatic insects on which the fish feed. Some types of insects will live only on a certain type of bottom. Red salmon and some other fish do spawn in lakes and they like bottoms of certain types. Students should write down what the bottom is like: sandy, muddy, gravelly, rocky.)

Estimated lake size: This information probably would be easiest to collect before the field trip from maps, charts, and aerial photos. Size can be estimated in acres or length and width in miles.

Fish species, size, and numbers: Because fish are under water, it's sometimes difficult to tell what kind they are; but students should do the best they can. Quietness at the lakeshore is important to keep from frightening the fish. On their transects, each team should count in the same direction so that fish aren't counted twice as they move around the lake. If a fisheries biologist or someone with a fish collecting permit is along, students may be able to use seines, dip nets, or minnow traps to see what's in the lake. Students also might try dropping salmon eggs or bread crumbs quietly on the surface and see if any fish arrive to feed. Another way to check for fish is by sport fishing! How long does it take your students to catch each fish and what type of baits or lures work best?

Aquatic insects: By drawing pictures of what they find, students may be able to identify the insects later. There is a good section on aquatic insects in Volume 2 of the Sea Week Curriculum Guide Series. Look under rocks and sticks for the insects, but be sure to put them back so their homes are disturbed as little as possible.
as possible. Also collect a sample of the lake bottom with your can. Dump the contents into the white pan and carefully sort through the mud or gravel looking for aquatic insects. Return the insects to the lake after each student has observed, drawn, and taken notes on the "finds."

Birds and mammals: List any that students find on their transects. Any observed elsewhere may be checked off on the checklist. Spotting scopes and binoculars could be helpful. Take along bird field guides to help with identification. Several suggested guides are listed in the bibliography.

Animal tracks: Again, if students draw careful pictures, they may be able to identify the tracks later. Local people who spend a lot of time outdoors plus Olaus Murie's A Field Guide to Animal Tracks should be very helpful. Have students be sure and measure not only the size of the tracks, but the distance between them. Another option is to give each group a package of plaster-of-Paris with which to make casts of bird and animal tracks.

Lakeshore vegetation is important to fish. They provide shade to keep the water cold, and insects falling from the vegetation are eaten by fish. Leaves also fall into the water, providing food and nutrients for aquatic insects, which are in turn eaten by fish. Logs and branches which naturally fall into the lake make good hiding places for fish.

Lakes may have pondweeds and water lilies growing in the water, shore vegetation on the land, and emergent vegetation (plants that grow half in and half out of the water). Emergent vegetation and the deeper pondweeds are excellent hiding places and feeding places for young fish. Larger fish come into the shallows to try to find and feed on the little ones.

**Plankton.** Drag your plankton net under water for the length of your transect. Then put your lid on the sample. Hold the jar up to the light and see if you can see any tiny plants or animals. This plankton is what many of the smaller fish and some of the bigger fish eat.

**Secchi disk.** Try to find a good spot to lower your secchi disk in the water to measure the clarity or transparency of the water. Lower the disk slowly until you can't see it anymore. Mark down at what depth the disk disappeared. Then lower the disk even farther, and slowly bring it up. Mark down the depth at which the disk appeared. Now take the average of the two depths and that is the secchi disk reading.

Ask students: Do you think this reading would be the same year-round? (No, because plankton blooms in the spring and reduces
some of the clarity. Also, many Alaskan lakes are influenced by glaciers, so when the glaciers are melting in the summer, the lake transparency is reduced.)

Lake map. Students should draw a rough map of the lake and add features that they notice plus any additional observations.

If the class has access to a boat (and life jackets), additional measurements of plankton transparency, temperature, and depth can be recorded. Lake measurements also can be taken in the winter by drilling holes through the ice.

6. Ask students to make up some rules for the trip to protect the animals and plants of the lake. (Step softly and carefully, turn rocks or logs back over so the animals who like the moist environment underneath can survive, leave everything just as found, pick up litter.) Discourage collecting unless it's for a specific purpose such as an art project or freshwater aquarium.

7. Review safety procedures.

8. Plan follow-up activities. (See Activity 4 in this unit.)

9. Enjoy the trip!

Activity 4
Data Analysis and Report Writing

Background:

Field studies are fun; but if the data is not carefully analyzed and written up, it is of little use. Students can contribute to scientific knowledge, especially in Alaska where, due to the state's vastness and small population, comparatively little is known biologically. Especially helpful are long-term studies (in your class's case, perhaps yearly studies of the same stream or lake).

Vocabulary:

- abstract
- goals
- introduction
- method

Materials:

- data from lake and/or stream field studies
- paper
- pencils
- large sheet of newsprint or butcher paper
- felt-tip markers
- field guides
- graph paper
• worksheets:
  ...Stream Data (3E)
  ...Lake Data (3F)

Procedure:

1. Have each team go over its data, perhaps copying the information onto another sheet if the writing is illegible. Use field guides and other reference books to identify unknowns. Post completed data sheets where they can be studied and compared.

2. Make a class mural of the lake or stream with large sheets of butcher paper and felt-tip markers. Transfer information and observations into pictures and notes on the mural.

3. Pass out the worksheets Stream Data and/or Lake Data. Have each team copy information from the other teams' investigations.

4. Pass out graph paper and have each student graph the air, water and land temperatures.

5. As a class discuss, the information. You may want to ask a local biologist for help in the data analysis. Ask the students:

6. Have the students write reports of their findings. Include drawings and graphs. Begin with an abstract—a couple sentences about the purpose of your study and your findings. Next write an introduction (a few sentences introducing a stranger to your local stream or lake and to your class study including your goals (what you hoped to achieve by the study)); method (how you collected your data); results (what you found out, any trends you noticed, and your Stream Data or Lake Data worksheets) and finally, a summary of your study.

7. Ask the students:

• How would you rate this stream or lake as fish habitat?

• Is there anyone who would be interested in our reports? (Newspaper, community groups, village or town government, local planners, parents.)
• Are any developments planned for this stream or lake or the surrounding watershed?

• How might our reports have an effect on the future uses and resources in this area?

• Is there anything further we should do? (Write a story or take photos to give to the local newspaper; write letters to the editor; make a slide show or videotape about our stream or lake; make a presentation with maps, charts, our mural and reports to a community group; etc.)

Additional Activities:

1. **Art, Language Art, Science:** Have students fold an 11-inch by 18-inch paper into eight equal parts. On the top four spaces have them draw an event from the field trip. On the bottom four spaces have them write two facts related to each event. (Suggested by Ann Schultz, Mt. Eccles Elementary, Cordova)

2. **Language Arts, Science:** Have students pick one aspect of their field study that interests them, and research and prepare an oral and/or written report on that topic.

3. **Science:** Have students figure out what types of fish their stream is suitable for, based on the data they collected.
Unit Four
Fishing Then and Now

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Objectives:

To help the student:

- Read and listen to fishing legends (Activity 1).
- Research local fishing legends (Activity 1).
- Make a spear, hook, line, float, sinker, net, and/or fish trap (Activity 2).
- Learn about halibut hooks (Activity 2).
- Construct a model fish wheel (Activity 3).
- Read about fish wheels (Activity 3).
- Participate in a jigging derby (Activity 4).
- Practice gillnetting (Activity 5).
Fishing methods, clockwise from bottom left: 
1. Native Alaskan halibut hook, fishhook. 
2. Gillnetter. 
3. Troller. 
4. Seiner.
• Explain why undersize fish and shellfish incidentally caught in the net are the fishermen's future (Activity 5).

• Diagram purse seining techniques (Activity 6).

• Pantomime how a troller catches and takes care of his fish (Activity 7).

• Write a story or poem or draw cartoons about longlining for halibut (Activity 8).

• Read about gillnetting, seining, trolling, and longlining (Activity 5-9).

• Construct model shrimp trawls and crab pots (Activity 9).

• Match crab and shrimp descriptions with their pictures (Activity 9).

• Map a local harbor (Activity 10).

• Observe different types of fishing boats (Activity 10).

• Interview a local fishermen and harbor masters (Activity 10).

• Write a newspaper story about the local harbor or waterfront (Activity 10).
Rivers, lakes and the sea are traditional sources of food for Alaskans. Natives observed and studied the animals to learn where they lived and how their behaviors and appearances changed with the seasons. They knew when and how marine or freshwater animals were best to eat. They devised ways to catch fish and mammals with nets, hooks, harpoons and traps. They learned how to preserve their catch so there would be food throughout the year. Such ties to northern waters are reflected in the legends and traditional beliefs of Alaska's Native people.

As non-Native people began to settle in Alaska, they, too, turned to the waters for food. They learned from Alaska's Native people and brought and introduced new ideas and technologies.

With time, outside markets developed for Alaska's rich marine resources. With the markets came commercial fishing, whaling, canneries, salteries, imported labor and regulation and management of the resources.

The state of Alaska divides fishing into four categories: subsistence, personal use, commercial and sport. Subsistence fishing is for food on which one depends directly. Personal use is a category established recently by the Alaska Boards of Fisheries and Game. It is a non-priority designation, usually established on a temporary basis to allow extra harvests whenever there is a surplus of fish in a particular area. Commercial fishing is a term used to cover all fishing done by fishermen licensed by the state to take and sell a particular species. Commercial fishing began in Alaska during the late 1800s. Sport fishing is primarily for pleasure, although sport-caught fish may form a considerable part of the food supply for those who catch them.

Regulations for these fisheries are set by the Alaska Board of Fisheries. Local advisory committees and individual Alaskans can and do propose changes in these regulations. The Alaska Department of Fish and Game supplies management data and information to the Board and the fish and wildlife protection officers in the Department of Public Safety enforce the regulations.

Today, Alaska's fisheries and the many people dependent upon them are a complex mosaic. To begin to understand it, students will have to learn about many lifestyles, past and present. This and following units present information about how the lives of Alaskans are linked to seas and rivers. The materials here, however, are only a beginning. Exploration of fisheries resources is best individualized for each community.
Activity 1
Fishing Myths and Legends

Background:

Myths serve to explain some phenomenon of nature, the origin of man, or the customs, institutions and religious rites of a people. They can be defined generally as "sacred" stories.

Legends usually ascribe fanciful or fantastic deeds to a particular place or person.

The two terms have been used with such latitude that it's often difficult to label a story "myth" or "legend." If the question should arise among students, one way to judge the difference is to ask whether the story has a moral. Does it explain why the sun sets, or why the tide moves in and out, or what happens to parents who treat their children cruelly? If so—if it explains a phenomenon or belief, it can be called a myth. If it simply ascribes fantastic deeds to a person or place, without any particular moral, it can be called a legend.

By such a "morality criterion," the stories Raven and the Fog Woman and How the Fish Came Into the Sea in this activity are myths, while Raven Is Swallowed By Big Fish appears to be a legend.

Folklore is the whole body of oral tradition—myths, legends, music, games, dances, strengthening properties ascribed to certain foods and herbs—that is passed from generation to generation.

Vocabulary:

- myth
- legend
- folklore

Materials:

- paper
- pencils
- tape recorder
- village elder
- Raven and the Fog Woman Legend
- Raven Is Swallowed by Big Fish Legend
- worksheet:
  ...How the Fish Came to the Sea (4A)

Procedure:

1. Discuss how traditions are passed from generation to generation. In the old days, the abilities to listen and remember were vitally important because there was no written language. Explain that students long ago were very skilled at listening. Mention that you will be reading them a Tlingit myth and an Athabascan legend. Afterwards, see how well they do at telling the stories back to you!

2. Explain to students that Raven is an important figure in Alaskan Native traditions.
Raven, who created the world, is wise and cunning and full of trickery. To set the mood, have the students sit around on the floor as if you were telling them the stories around the campfire on a summer evening.

RAVEN AND THE FOG WOMAN

Raven wanted to get married. He went to the chief called Fog-Over-the-Salmon, who had a daughter of marriageable age. The chief was glad that Raven wanted to marry his daughter but he said,

"You must promise to treat my daughter well. You must have respect for her, and look after her. If you behave badly, she will leave you and you won't get her back."

Raven agreed to what the chief demanded, and the couple were soon married. They lived contentedly in the village near the water all summer and fall. Then winter came and they were without food.

One bleak, rainy day, after they had been hungry for some time, Raven's wife started making a basket.

"What are you making a basket for?" asked Raven testily. "We have nothing to put in it."

His wife did not answer him, but continued making the basket until it was very big.

That night they went to sleep hungry again, and the next morning when the Raven woke up, he saw his wife sitting on the floor, washing her hands in the basket. He got up to look at what she was doing, and when she had finished, there were salmon in the basket! These were the first salmon ever created.

Raven and his wife were very glad, and they cooked and ate the salmon. Every day, she did the same thing: she washed her hands in the basket, and when she had finished, there were salmon in it. Soon, their house was full of drying salmon, and they had plenty to eat.

After awhile however, Raven forgot that he owed his good fortune to his wife. He quarreled with her. Every day they would exchange bad words with one another; and in the end, Raven got so angry he hit his wife on the shoulder with a piece of dried salmon! He had forgotten the words of his father-in-law, the chief.

Raven's wife ran away from him. He chased her, but when he tried to catch hold of her, his hands passed right through her as if through mist. She ran on, and every time Raven clutched her body, there was nothing to hold on to. He closed his hand on emptiness.

Then she ran into the water, and all the salmon she had dried followed her.

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Her figure became dim and she slowly disappeared into the mist. Raven could not catch her, because she was the fog.

Raven went to his father-in-law, Chief Fog-Over-the-Salmon, and begged to have his wife returned. But his father-in-law looked at him sternly, and said,

"You promised me that you would have respect for my daughter and take care of her. You did not keep your promise. Therefore you cannot have her back."

From Booklet IV, Alaska Multimedia Education Program, Alaska State Museum. Adapted from John R. Swanton's Tlingit Myths and Texts (1909).

RAVEN IS SWALLOWED BY BIG FISH

Raven was by the seashore. Along came Big Fish. Raven said, "We are cousins."

Big fish was doubtful but Raven said, "yes, we are. My father and your mother were brother and sister. Look in my mouth and you will see."

Raven opened his mouth and Big Fish looked in. Then Raven said, "Open your mouth so I can see."

And Big Fish opened his mouth. Raven said, "Open wider."

Then Raven ran right down Big Fish's throat into his stomach. He made camp there. He cut out strips of fat and made a fire. Big Fish dove deep into the water and swam all through the seas, but he could not get rid of raven. Finally he swam near shore.

Raven started up Big Fish's gullet. When he got near the heart he stopped. He took his knife and cut into Big Fish's heart and cooked and ate all. Some Indians saw the dead creature stranded on the shore. They thought, "Good, here is lots of meat."

They went to the body and began to cut it open. When they slit open the belly, a burst of air shot out, followed by some smoke and a little black thing that went shooting off into the trees. This was Raven. He changed into a man and came back to the Indians. He said, "You better not eat that meat for it is poison. Don't you see it smoking?"

The Indians all went off, and Raven had the fish for himself.

-told by Chisana Joe and recorded in The Upper Tanana Indians, by Robert A. McKennan

3. Discuss how the seas and rivers and their creatures are important to Alaskan Natives. Ask the students:

- What lessons can you learn from these stories?

- How are these stories similar to modern life?

Then have the students try to repeat the stories in the proper sequence.
4. Allow students time to read the worksheet How the Fish Came Into the Sea. This is a Tlingit myth that accurately defines, with the sequence in which the doors are opened, the order of Alaskan annual fish migrations. The fish that "stop," or stay, are those that do not migrate. This myth was taken from Hilary Stewart's Indian Fishing: Early Methods on the Northwest Coast (University of Washington Press, Seattle and London, 1977) and was told by Billy Wilson, a fisherman and silversmith, when he was 84--just the year before he died.

5. Collect local folklore. Ask students about village elders in their community who might know some oral traditions about fishing, and would like to share them in their homes or in the classroom. Have students practice interviewing each other and using a tape recorder. Discuss interview techniques (how to make the person you're interviewing feel at ease; how to be at ease yourself; remembering everything said in case the tape recorder doesn't work; going over the tape right away so if there are blank spots you can fill them in, etc.). The school bilingual staff should be of great help in executing this activity.

Activity 2
Traditional Fishing Methods

Background:
Successful sea and river harvests literally were matters of life or death to Alaskan Natives and early settlers. Fishing methods that evolved from long and careful observation, from trial and error, and from sudden inspirations have been perfected through long use by many generations. Today, some Eskimos and Indians still move to summer fish camps where salmon or other foods from the seas or rivers are gathered and preserved for winter use. In the wintertime, ice fishing remains a traditional harvest method.

Vocabulary:
- netting needle
- weir

Materials:
- stones
- twine
- string
- sticks
- chunks of wood
- sandstone or sandpaper
- bone
- netting needles
- knives
- traditional fisherman or woman
- worksheet:
  ...Halibut Hooks (4B)

**Procedure:**

1. Ask the students:

   - If you were lost in the woods (or tundra), or went down in a plane next to a lake or stream, would you know how to make something with which to catch fish? (That's when some old-time fishing techniques would come in handy!)

   - What do you know about these old-time fishing methods?

   - Do you know someone who could come and show our class some of these fishing strategies? (Well, let's invite them!)

2. Ask an old-time fisherman or woman to come to the class and demonstrate how to make hooks, sinkers, floats, nets, line, spears and/or traps. Contact the guest ahead of time to offer to round up the required materials. Here are some ideas adapted from Hilary Stewart's *Indian Fishing.*

   - Fishing line initially was made from cedar bark, nettle fibers, animal sinew, or bull kelp stems. Students can learn some of the principles of line (or rope) making by braiding twine. Tie an overhand knot at one end of three pieces of twine. Keep folding first the right, then the left piece over the centerpiece, in the same way as one braids hair.

   - Hooks can be made by lashing two sticks together, or a piece of bone and a stick. To use a bone, first splinter the bone by smashing it with a stone, then smooth one of the sharp shards with sandstone or sandpaper. Hooks also can be carved from wood. Students can make a variety of sizes and types to try out in one of the local fishing holes. For inspiration, read the worksheet *Halibut Hooks.* (Answers: 1: yew and yellow cedar; 2: bone or a nail; 3: cedar bark, nettle fibers, animal sinew, or bull kelp stems; 4: rock; 5: piece
of wood; 6: octopus, herring, etc.; 7: to encourage a spirit helper to aid in catching the halibut; 8: several hours or days)

c. Floats can be carved out of chunks of wood. They can be fancy ones as were used for catching halibut or plainer ones for gill nets.

d. Sinker can be made from stones or rocks for hook and line fishing, or for placement at the bottom of a gill net.

e. Spears or harpoons can be made from pieces of bone, metal, carved wood or stone lashed to a long stick.

f. Netmaking is a real art. Students can carve or buy netting needles and use string or fishline to make small sample nets. Modern fishing nets differ only in material, not in form, so it should be possible to find someone to practice netmaking with your students. Run the heavier cork line and heavier sinker line between two chairs then run a lighter weight line down the sides. Wrap your netting needle (not too full) with the fishing line. Begin in one of the upper corners with
primarily to the salmon's urge to run upstream. Salmon traps were used first by Natives, and later by commercial canneries. These traps were the scenes of many bitter battles; and in some cases, whole runs of salmon were wiped out by overharvesting. Salmon traps are now illegal (except for use in one area of Southeast Alaska). Alaska Department of Fish and Game biologists do use weirs in their biological work, but the fish are merely counted, not harvested. Weirs and traps can be made of sticks lashed together with string.

Students also can make belts, basketball goal nets, and other craft items. See teacher's reference bibliography entry for net-making by Charles Holdgate. Traps and weirs probably are the most productive of any fishing devices, due

One trap that students might especially enjoy making is a blackfish trap, which is legal.

3. Now have students put their
fishing gear together and try it out as an after-school project. Be sure to familiarize the class with local fish and game regulations ahead of time. Pick up a copy of the regulations at any place in your community where licenses are sold or write to the Alaska Department of Fish and Game, Box 3-2000, Juneau, Alaska 99801.

Activity 3
Constructing a Fish Wheel

Background:
The fish wheel was introduced to Alaska by white settlers about 1900. Its coming revolutionized Interior Alaskan life because salmon for people and dogs could be caught more easily. People could afford to have enough dogs to run teams and hunt, trap, and travel much greater distances in wintertime.

Vocabulary:
- axle
- basket
- bearing block
- chute
- debris
- fish wheel
- stanchions
- spar

Materials:
- sticks
- string
- glue
- small pieces of wood
- nylon window screening
- scissors
- knife
• map of Alaska
• worksheet:  
  ...Fish Wheels (4C)

Procedure:

1. Ask students to tell you what they already know about fish wheels. Then pass out the worksheet Fish Wheels and read it individually or as a class. You'll need a map of Alaska to answer the last question on the worksheet. A good reference for any additional questions is Kathleen Lynch's Fishwheels and How to Build Them (see Teacher's Reference bibliography) whence came the information for this activity. (Worksheet answers: 1: since 1900; 2: the river's current; 3: the fish are caught in the revolving baskets as they migrate upstream; 4: storage box; 5: commercial fish; 6: Yukon, Tanana, Kuskokwim, Copper)

2. Have the students make a model fish wheel from the drawing on the worksheet and a variety of materials (sticks, string, glue, small pieces of wood, nylon window screening, scissors, knives) stockpiled in the classroom. If there is anyone in the community familiar with fish wheels, ask them to help supervise the project. Visit any nearby fish wheels so students can see how closely their models match the real item.
Activity 4
Jigging Derby

Background:

Jigging has been used as a fishing technique both winter and summer for centuries. Today jigging machines are being used to catch ocean whitefish.

The idea for this fun activity comes from Jim Gall at Kotzebue Elementary in Kotzebue. These procedures can be used in other areas of the state with other fish species and other types of fishing gear. But be careful not to decimate your local fish population. Check with a fisheries biologist before beginning the contest. You may need to strictly limit student fishing time or methods to save some fish for next year.

Vocabulary:

- jigging lure

Materials:

- ice chisel, ax or auger
- jigging sticks and helping sticks
- lines
- lures and bait if needed
- ice skimmers or old cups or strainers
- sled (on which to sit and carry gear and fish)
- knife
- pliers
- spare line and lures
- weighing scale
- measuring stick

Procedure:

1. Discuss local fishing techniques. Invite a village elder to your class and discuss jigging for fish and ice safety tips on weather, breakup, ice chisels, axes, ice augers, lures, knots, bait, barbed and barbless hooks, fish cleaning and preservation and use.

2. Plan a school-wide one- or two-week jigging derby in which students hook fish before and after school. Make up contest rules. Some suggestions:

a. Hook a tomcod between Monday ___ and Sunday ___.

b. Bring it into room ___ for weighing and fin clipping any school day from ___ to ___ a.m. or from ___ to ___ p.m.

c. Sign an "official on-my-honor" form that says you actually caught the tomcod and caught it during derby week.

d. Last day for entries is ___, so you can hook during the weekend.

e. Winners announced on ____.
f. Prizes will be given to each boy and girl at each grade level who catches the most and largest tomcods.

3. Also plan a daylong derby day, in which each class spends an hour hooking fish as part of the physical education and science program. Send home permission slips and make sure each child dresses warmly, and has a hooking stick and bag with his or her name on it in which to carry the fish back to school. Plan hot drinks and snacks when each class returns to school. Invite parents to assist with the derby and alert them to alternative plans in case of bad weather. Arrange to donate leftover fish to a convalescence home or similar facility.

4. Discuss derby plans with other teachers and your principal.

5. Round up weighing scales, a measuring stick, sled, knife, pliers, spare lines and lures. Cut ice holes ahead of time and mark their locations.

6. Review ice safety procedures. Each student should have a buddy, dress warmly and return when the whistle blows. Head counts should be taken frequently.

7. Enjoy the day!

8. Follow up with demonstrations of fish cleaning, preservation, and tasting.
Activity 5
Gillnetting

Background:

Gillnetting, as the word implies, means catching fish by their gills in a net. This is the principle behind both set and drift gillnetting.

Gill net fisheries concentrate primarily on returning runs of salmon and herring as they near their spawning grounds. Because of this, they are closely managed by the Alaska Department of Fish and Game. Regulations are set by the Board of Fisheries to govern when, where and what kind of gear can be used.

Drift gillnetting means setting the gill net from a boat, then tending the net as it drifts and fishes. Boats used for gillnetting come in all sizes and shapes. Some are as short as 16 feet, others longer than 40 feet. The boats can be rigged to pick the net up over the bow or the stern and thus are termed bowpickers or sternpickers.

Gillnetting may be carried out as a one-person operation, but most often a gill-netter will have a partner. If a reel is used to pull the net, for example, it is efficient to have one person on each side of the net, using gloves or a short hooked tool to release salmon tangled in the net.

Setnetting operates on the same principles as drift gillnetting, except that the set net is stationary and set out from an anchor on shore rather than being left adrift. Set net sites are for the most part traditional, and many sites have been used by families for years.

In both kinds of gillnetting, a cork line keeps the upper edge of the net floating and a lead line keeps the net vertical by holding down the lower edge. How long a net is allowed to fish before it is checked and the catch removed
depends on the person fishing the net. One way of judging how well
the net is fishing is by noting whether the individual cords along
the top of the net are bobbing or being pulled under water. The
more fish caught in the net, the more changes can be seen in the
cork line. This gives the gill-netter a quick, visual check of
whether fish are being caught.

In addition to salmon or herring, various incidental fish and crabs
are pulled in with the gill net. These often are termed "trash,"
but actually these young fish and crabs are the fishermen's future.
Many will return later as larger fish or shellfish to be caught by
someone in the fishing community--or they will provide food for
growing salmon, herring, halibut. Gillnetters should toss these
incidental fish back as required by state law, being careful not to
mangle them in the rush to clean the net and return to fishing.

Vocabulary:

NOTE: The spellings of set net and gill net vary with context.
It's set net and gill net (the net itself); setnetting and gillnetting
(activity); set-netter and gill-
netter (the person); and gillnetter
(the boat; setnetting is not a
boating activity).

- reel
- drift gillnetting
- setnetting
- bowpicker
- sternpicker
- cork line
- lead line

Materials:

- old gill net or gill net drawn
  on butcher paper
- 2 floats
- 2 sets of rubber gloves, rain
gear and hip boots
- rulers
- bucket or water basket
- reel or roller on which to
  wrap net
- magic markers
- local person who gillnets
- construction paper
- scissors
- current prices of salmon or
  herring on the dock
- worksheet:
  ...Gillnetting (4D)

Procedure:

1. Encourage students to relate
their own gillnetting experi-
ences. Pass out the work-
sheet Gillnetting and have
students read and answer the
questions. (1: set and drift;
2: 200 fathoms; 3: 6 fathoms;
4: fish are striking the net;
5: drift; 6: because the fish
  stick their heads through the
  net and get caught behind
  the gills; 7: a bowpicker has
  the reel or roller in front,
  sternpicker has the reel or
  roller in back and picks the
  fish off the stern.)

2. Bring in a manageable piece
of an old gill net (or draw
one on a long sheet of butch-
er paper or newsprint); two
large floats for either end of
the net; a reel or roller (map
tube and broomstick); two
sets of rain gear, rubber
gloves and hip boots. All
this should provide great
room decorations in addition
to the instructional potential!

3. Roll out the net on one side
of the classroom. Hook up
the floats at either end and
you're "fishing!" Review the
terms "cork line" and "lead
line." Have students measure
the mesh size and see if they can tell you the species of fish they'll be catching. (Refer to the netmaking section of Activity 2 for information on mesh sizes.)

4. Pass out the construction paper and have students cut out a typical catch for your local area. Include salmon or herring and a variety of incidentals: jellyfish, crabs, young bottomfish, young halibut, shrimp, seaweed. Each salmon or herring should be labeled on the back with the amount it weighs.

5. Have the students stick the fish and shellfish in the net, gently bobbing the cork line as the fish strike.

6. Ask for volunteers: two to pick the net; two to manage the reel; two to pitch the fish; two to weigh the fish; one to run the tender; one to pump gas and sell groceries; one to pay the gillnetters.

7. Have the gillnetters put on the hip boots, rain gear, and rubber gloves and place the rest of the students appropriately around the room.

8. As the gillnetters pull the net, discuss what they will do with the fish as they pick them out of the net. (Ideally they should be placed carefully in a fish bin—an iced bin if they are a long way from the tender, especially if the weather is warm. Fish should always be grasped by the head or body rather than the tail to retain their quality.)

9. What should they do with the other incidental fish and shellfish? (State law requires that they be pitched overboard. These fish are the fishers future—the ones that will come back later as large fish and crabs, or the ones that will provide food for growing salmon, herring, and halibut. So students should carefully untangle them from the net and gently drop them overboard. They are an important part of the ocean's food web.)

9. After the gillnetters have picked the net, they may want to set the net again or head for the tender. There they can deliver the fish, buy groceries and gas (remember no smoking while the gas is being pumped!). As the fish are being weighed, have a student record their weights on the board. Students should multiply the total weight times the price per pound and then subtract the prices of groceries and gas to determine the amount the gillnetter will be paid. They can either be given a fish ticket or cash, depending on the type of tender.

10. Invite a local gillnetter to visit the class, answer questions, and discuss gillnetting techniques and safety.
Activity 6
Purse Seining

Background:

Purse seining was first tried in the United States on the East Coast in the early 19th century. It is a method that has been used in the Pacific salmon fishery since its beginning and has probably been more economically valuable to the salmon fishery than any other method. In purse seining, a large net is issued to encircle a whole school of fish at one time. After the school is surrounded, the bottom of the net is pursed, or drawn shut, preventing the fish from diving to escape.

On the first seine boats the nets were pulled by hand, an effort requiring many men and much muscle. By the mid-20th century, hydraulic systems were developed to do much of the work previously done with muscle power. In the early 1950s, the power drum and the power block were first used on seiners. Both the drum and the block are hydraulically run and both help bring the net onto the boat. The power drum was quickly outlawed in Alaska because it was so effective and because fewer crew are needed. Alaska has so many fishermen and women that with the power drum, the catch would be harvested too quickly (or overharvested) and they would not be as many crew jobs. The power drum is still used in Washington, Oregon, and British Columbia—but Alaskans use the power block, a large unit that looks like a pulley and hangs from a boom angled upward above the boat's work deck.

As in all commercial fisheries, many state regulations apply to the seine fisheries. Seine boats operating in Alaska can be no more than 58 feet long, hence the term "limit seiners." The length of the seine net is also regulated, and the limit differs depending on the area to be fished. In Southeast Alaska, for example, the seine nets used for salmon must be between 150 and 250 fathoms long (six feet = one fathom). In Prince William Sound it must be between 125 and 150 fathoms long. The net depth and mesh size also are regulated. Where and when seining may occur is determined by the Alaska Board of Fisheries, and is based on a combination of two factors: the number of fish needed to enter the river system to reproduce, and the number of fish from the "run" already caught that year.

Vocabulary:

- seiner
- power block
- boom
- seine skiff
- jitney
- fathometer
- diagram

Materials:

- paper
- pencils
- seine captain or crew member
- worksheet:
  ...Purse Seining (4E)
Procedure:

1. Discuss information that students have heard about purse seineing. Pass out the worksheet Purse Seining and have students answer the questions. (1: to pull the seine around a school of fish; 2: by relying on past knowledge of where the fish have been, plus currents and tides and a recording fathometer; 3: the top of the net where the floats are; 4: the bottom of the net where the lead weights are; 5: pull in the net; 6: scoop them out with the brailer; 7: 4-6; 8a: $180.30; 8b: $19.83; 8c: $260.80; 8d: $29.24; 8e: $49.07.)

2. Have students get out papers and pencils. Ask the students how they explain something complicated to other people. (One of the best ways of passing on information is by pictures--by drawing a diagram.) Have the students individually diagram how a purse seiner works. They can draw everything on one picture or they might try a series of pictures or cartoons.

3. Have students exchange diagrams and see if the explanations and labels are clear.

4. Invite a seine captain or crew member to show slides or pictures and tell of some of their adventures and critique your diagrams.

Activity 7

Trolling

Background:
Trolling is a line fishery, which means fish are caught one by one, or a few at a time.

Because a troller catches just a few fish at a time, the fish are landed more carefully. After a fish is swung aboard with the gaff (a wooden club with a steel hook at the end), it is cleaned and rinsed. Then it is carefully bedded in ice, or placed in a slush tank filled with ice and sea water, or frozen. Troll-caught fish have a higher market value because of their quick, immediate and careful handling.

Trollers traditionally have been the most independent and the least restricted of salmon fishermen. Restrictions on them, however, are increasing annually. Until recently, both power and hand trollers could fish year-round anywhere from Ketchikan to Yakutat. Unlike gillnetters and seiners, they were not limited to brief "open" fishing periods.

Vocabulary:

- troller
- gurdies
• gaff
• pantomime

Materials:

• map of Alaska
• person who works on a troller
• worksheet:
  ...Trolling (4F)

Procedure:

1. Ask students what they know about trolling. Ask if anyone can imitate a troller. Explain that silent imitation is a form of acting called mime or pantomime. Mime players often paint their faces so that the audience can see their expressions more clearly. Charades is a common party game that similarly relies on silent imitation. To imitate trollers, so that anyone can tell what's happening, students will have to find out everything they can about trolling.

2. Distribute the worksheet Trolling and have students read and complete the questions. You'll need to have an Alaska map handy for question 6. (Answers: 1: by the two or more long poles sticking up in the air or out to the sides; 2: fish are individually caught, carefully cleaned and chilled; 3: kings and cohos; 4: gurdies; 5: Southeast Alaska from Ketchikan to Yakutat; 6: 430 miles; 7: to refer to the boat or to the person who fishes it; 8a: $698.20; 8b: $454; 8c: $506.10)

3. Have the students practice their pantomiming skills as a class. Perhaps start by having them silently bait hooks. Other suggestions:

   Ohh—did somebody hook their finger? Indicate that the boat is rolling a bit with the swells. Drop the baited hooks overboard and watch them slowly go out behind the boat. Ding, the bell on one of the poles rang indicating a hit. Better get busy pulling it in. Boy it's a big one—a 60 lb king! Use a gaff to haul it on board. Then bait the hook, drop it in again. Clean your fish and hold it up to admire! Isn't trolling great?

4. Divide the class into small groups and have each group invent a trolling adventure and practice pantomiming.

5. Have each group perform, and let the other guess what they were doing. Invite a troller to come and critique the mime performance and to tell stories, answer questions and demonstrate gear.
Activity 8
Longlining

Background:

Longlining is the primary method used in Alaska to catch halibut commercially. Incidentally caught halibut picked up by trolls can be sold, if caught when halibut season is open.

Halibut fishing in the northeastern Pacific is regulated by a joint U.S.-Canadian Commission called the International Pacific Halibut Commission (IPHC). The commission watches over the fishery, and decides when and where fishing can occur. Before the beginning of the fishing season, the IPHC announces the times and places halibut fishing will be allowed in the waters of the two countries. As the season goes on, the halibut catch is monitored. If it is high, some of the scheduled fishing times, or openings, are canceled or shortened.

The size of halibut that may be kept is regulated for commercial fishing. Fish shorter than 32 inches must be released and returned live to the sea.

Vocabulary:
- longlining
- skates
- gangions

Materials:
- paper
- pencils
- person who fishes halibut commercially
- worksheet:
  ...Longlining (4G)

Procedure:

1. Ask students if they have ever gone halibut fishing. Introduce longlining as the way halibut are caught commercially. Pass out the worksheet Longlining and have students read and answer the questions. (Answers: 1: halibut; 2: tuna, swordfish, and sharks; 3: a skate; 4: gangions; 5: anchor, buoy line, buoy, and 17-foot pole; 6: so the groundline and gangions will be held on the bottom and so the gear won't drift away; 7: they're so big; 8: by the bundles of tall poles with flags and lights on them and by the longline gear with hundreds of hooks.)

2. Discuss halibut life cycles and the halibut’s need for shallow nearshore waters and estuaries for rapid juveniles growth. Order the Sea Grant Life Cycle Poster (see bibliography) and read Alaska Tidelines "The Old Woman," Vol. IV, No. 6, March 1982.
THE LONGLINERS

Yes, give me a packet that's sound and tight.
And a skipper with guts to boom her
Up under the heel of the northern lights
Where the grey seas strive to doom her.
Through the grinding ice where the ground lines freeze,
Through the howling gale and the pounding seas--
Into such tranquil spots as these
You must drive with a halibut schooner.

--from "The Doryman" (author unknown)

3. Have students write stories and poems, or draw cartoons about halibut longlining. Invite someone who fishes halibut to tell some of their adventures as an incentive for accurate, creative big fish stories. Ask them to describe some of the current issues in the halibut fisheries.
Activity 9
Shrimping and Crabbing on the High Seas

Background:

Five types of shrimp are caught in Alaskan waters. Their names and maximum sizes are: the northern pink, 6 1/2"; humpie, 4 3/4"; sidestripe, 8 1/2"; coonstripe, 8"; and spot, 11". All five species may be found in the same areas, but at varying depths and over different bottom types.

Shrimp can be caught with pots but most commercial operations use huge otter trawls anywhere from 70 to 130 feet long. The net is held open by two huge doors. The Bureau of Commercial Fisheries is developing a trawl which separates bottom-dwelling creatures from shrimp while fishing. Otherwise, tremendous numbers of fish, invertebrates and debris are mixed with the shrimp. This not only costs the shrimp fishermen and women sorting time, but also disrupts the ocean food web as many of these small creatures are food for--or the young of--fish caught in other fisheries.

In Alaska, a large boat (70-80 feet long) may catch as much as 30-40,000 pounds of shrimp a day. They are rinsed and then shoveled into the hold where they are mixed with crushed ice. Because of the perishability of their catch, shrimp fishermen and women usually fish within 12 hours of their home port. Kodiak is the center of shrimp fishing on the Pacific coast, though the bulk of U.S.-caught shrimp comes from the Gulf of Mexico and the waters off the south Atlantic states.

Three types of crab are caught in Alaska: king, Dungeness and tanner or snow crab. Both shrimp and crab depend on shallow near-shore waters and estuaries for mating and rearing of their young. (See the Sea Week Curriculum Series Volume 1 for descriptions and further information on both crabs and shrimp and Tidelines "Wanted: Information on the whereabouts of _Pandalus borealis_, alias Pink Shrimp," Vol. 1, #5, Feb. 1979, for information on shrimp or get a set of the Sea Grant life cycle posters listed in the bibliography.)

Dungeness are fished in small round pots approximately 30 inches in diameter, 12 inches high, and covered with stainless steel mesh. The pots weigh about 80 pounds each. King and tanner crab are fished with rectangular seven-by-seven-by-four-foot steel pots with nylon or steel webbing. These pots weigh 500 to 700 pounds and more when they're filled with crab. In both types of pots, crabs enter through a webbed tunnel to get at such bait as dead herring, squid, or fish heads. The pots are attached by a line (rope) to a float at the water's surface. The lines may be 600 to 1,000 feet long for the king crab fishery.
Fishermen use large, stable boats for crabbing because of often foul weather and because they need storage room for all the pots and the huge seawater tanks used to keep the crabs alive. The profits in crab fishing can be tremendous but so can the risks. Alaska's crab seasons are open in the winter when ocean storms are at their worst. Boats can ice up, or go down and crew members can be washed overboard in heavy seas or hit by the heavy crab pots as they are swung aboard. King crab are caught in the eastern Bering Sea and in the waters around Kodiak, Adak, Dutch Harbor, Sand Point, Cook Inlet, Prince William Sound and Southeast Alaska. (See Tidelines "Alaska's Scariest Fishery," Vol. II, No. 5, February 1980 for more information on the crab fishery.)

Basic shrimp and crab biology are known but there are many gaps in this knowledge. Populations seem to rise and plummet mysteriously. Such unpredictability has both biologists and members of the fishing industry worried. Overfishing and poor handling methods may be reasons for recent major declines in both shrimp and crab populations. For instance, while undersized and female crabs are supposed to be released to help keep the crab populations up, often they are frozen, stepped on or otherwise injured before being returned to the sea.

Yet, while it is true that crab and shrimp populations have declined in heavily fished areas, the populations also are down in areas where there has been no fishing at all.

Weather may be one factor. Changes of only a few degrees in water temperature can affect the movements and developments of marine life. Shrimp, for instance, spawn earlier and carry their eggs longer when the water is cold. And if it's too cold, they have trouble keeping their eggs.

On the other hand, when the water is warm, shrimp grow faster and mature earlier. Speeding up the growth rate like this might throw off the balance of males and females needed for a healthy population, because most shrimp species begin life as males and then transform into females when they are three or four years old.

Water temperatures have been warmer lately in both the Bering Sea and the Gulf of Alaska. The increases might have resulted not only in changes in shellfish reproduction, but also the movements of pollock, cod, halibut and salmon, all of which eat young shellfish. Supporting this theory is the fact that the numbers of such fish have been much higher lately in traditional shellfish waters.

(Background information for this activity is from Alaska Tidelines, The North Pacific Deckhand's and
Vocabulary:

NOTE: The plural of crab is "crab" when referring to marine animals of the same species, but "crabs" when referring to more than one species.

- shrimper
- crabber
- trawler
- king
- tanner
- Dungeness
- coonstripe
- sidestripe
- humpie
- spot
- northern pink

Materials:

- scissors
- tape
- thin felt-tip markers
- small balloons
- small dowling
- knife
- thread
- needles
- copy of the WANTED poster (see background)
- person who fishes crab or shrimp
- worksheet:
  ...Trawl and Pots (4H)
  ...Shrimp and Crab Matching (4I)

Procedure:

1. Ask students what they know about shrimp and crab fishing. Mention that even though shrimp and crabs are not fish, they are part of the fishery. Familiarize students with the workings of a shrimp trawler (which hauls a big net through the water) and a crabber (which drops pots at set intervals). Small shrimp boats haul the net in over the side, while large boats bring it in over the stern. Crabbers have to be careful not to lose their pots in strong tides and currents. Distribute the worksheet Trawl and Pots. Explain that the trawl is 70 to 130 feet long; the king crab pot is seven-by-seven-by-four feet, and the Dungeness pot, one-by-two-and-a-half feet.

2. Have students sketch netting for the trawl and the two pots with dark felt tip markers. The doors of the otter trawl should be a solid dark color. The frames (all the edges and fold lines) of the crab pots should be a solid dark color.

3. Then have the students cut and tape their pots and tie on
lines (thread) and attach floats (small balloons for the king crab pots and short pieces of colored sticks for the Dungeness pots) to the crab pots. The students should write their initials on the crab pot floats to mark them as required by law. Plus, students need to punch holes in the bait cans so the crabs can smell what's in there.

4. Pass out the worksheet Shrimp and Crab Matching so the students can catch something to put in their traps! Have them match the pictures with the descriptions. They may need the WANTED poster on the next page to locate the parts of the shrimp that are mentioned. (Answers: 1: king crab; 2: northern pink shrimp; 3: spot shrimp; 4: Dungeness crab; 5: humpie shrimp; 6: tanner or snow crab; 7: coonstripe shrimp; 8: sidestripe shrimp.)

5. Have students color the shrimp and crab, cut them out, and write their names on the back. Then they can put them in the proper traps: shrimp in the otter trawl; tanner and king in the king crab pot; and Dungeness in the Dungeness pot. Explain that some commercial fishers use special tanner crab pots with openings just the right size for this smaller species to get into the pots. Others use king pots and put a board partially across the opening to keep kings out when king season is closed.

6. Discuss the difficulties that the shrimp and crab industry has had because of the mysteries of weather and biology. Show students the WANTED poster on the next page and explain some of the puzzles about crabs and shrimp mentioned in the teacher background. Students can do their part to help Alaska's future fisheries by always tossing back the young, females, and incidently caught fish when they are out fishing. Invite a local shrimp or crab fisherman or woman to discuss these and other aspects of the fishery and to answer questions.

7. Be sure students know the sportfishing regulations on these species. Shrimp are often sport-fished in pots. Small crabs and females should be tossed back to provide for the next generation of fishing and eating!! (The female crab has a wide tail under which she broods her eggs.)
WANTED

Information on the whereabouts of *Pandalus Borealis*, alias pink shrimp

**DESCRIPTION**

**Size:** About 3-5 inches  
**Color:** Pale Pink  
**Weight:** 60-160 per pound

- Very strong tail section. Used for quick getaway (swimming backward).
- Carapace or Shield (hard shell).
- Armed with spiny blade for protection.
- Small antenna warning system. Used for touch, smell, taste, and also balance.
- Five pairs of swimming limbs (also used for holding eggs).
- Eyes on stems. Swing around in all directions.
- Large antenna warning system. Used for touch, smell, taste.
- Five pairs of legs: 4 pairs pointed, used for walking. Second pair from front with tiny pincers, used for holding food.

**REWARD**

ABOUT $12 MILLION A YEAR FOR ALASKA FISHERMEN . . . MILLIONS MORE FOR ALASKA’S ECONOMY . . . AND MOUNTAINS OF FRESH SHRIMP SALAD FOR EVERYBODY.
Activity 10
Who Gets the Fish?

Background:

Sometimes there is complaint about fishing regulations without recognition of the background issues behind them, and without realization that regulations can be changed if they really aren't for the best. The Alaska Board of Fisheries makes the regulations, but there are opportunities for public input.

Regulations are, in effect, allocation decisions governing the private uses of common property resources. In other words, the Board of Fisheries makes decisions about who gets the fish. Subsistence fishermen need fish for survival. Sport fishermen support many businesses by purchasing gear for recreational fishing; and commercial fishermen need fish in order to make a living, to keep canneries open, and to provide fish for people to eat. The issue of who gets the fish can become extremely complex.

To make those decisions, the seven-member Alaska Board of Fisheries is appointed by the governor and confirmed by the legislature. In addition to the Board of Fisheries, there are local fisheries advisory boards (currently 68 of them), overlaid by six regional fishery councils. The Alaska Department of Fish and Game is charged with providing management data and information to the board. The Fish and Wildlife Protection Division of the Alaska Department of Public Safety (which also includes the State Troopers) enforces the regulations.

The increasing competition for limited fishery resources has resulted in frequent litigation, which also affects regulations. The Board of Fisheries also works with the North Pacific Fisheries Management Council which is a federally mandated advisory group responsible for fisheries between three and 200 miles offshore (outside state waters).

Individual citizens can make recommendations to the various boards and agencies, either privately or during regularly scheduled meetings and hearings.

The strength of the Alaska Board of Fisheries is in its being a public forum through which diverse input and scrutiny serve as crosschecks between competing viewpoints. The board is accessible to your students, along with all other Alaska residents. Many of the board's decisions rest not only on management data, but also on the quality of public participation.

Vocabulary:

- regulations
- Board of Fisheries
- advisory council
- litigation
- common property resource
Materials:

- copies of fishing regulations
- member of local Fish and Game Advisory Committee
- Fish and Wildlife Protection Officer

Procedure:

1. Ask students to name as many local fish regulations as they can. Then pass out copies of the fishing regulations (commercial, sport and/or subsistence). Add to the class list.

2. Invite a fish and wildlife protection officer to come to your class and talk about the challenges and rewards of enforcing regulations.

3. Invite a member of the local fish and game advisory committee to show to your class and share experiences or have students interview the committee member at home. Outline the procedure for changing a regulation.

   a. A proposal is submitted to the local fish and game advisory committee (Committee members or fish and game employees can assist with proper wording.)

   b. The advisory committee makes a recommendation on the proposal.

   c. The regional council makes a recommendation on the proposal.

   d. The Board of Fisheries acts on the proposal with input from the Alaska Department of Fish and Game, the Fish and Wildlife Protection Division, and other agencies.

   e. A regulation adopted by the board is drafted into the proper format for publication and, after lengthy legal review, goes to the lieutenant governor for signing into law. The regulations become effective 30 days after the signing.

Remind students that they are welcome to go to any of these meetings and add their verbal input before a decision is made. Students also can go directly to the Board of Fisheries with their proposals.

4. Ask the students if they can think of any regulations they would like to see changed. How would their proposal most likely be approved? The proposal should:

   a. be well researched (The students might want to do their own scientific study to be sure the fish would benefit too!). Discuss the proposal with a fish and game biologist and a protection officer as well as other fishers. (Is the proposal biologically sound, reasonable, and enforceable?)

   b. have local support (Generally but not always students should at least talk to someone with an opposing viewpoint to be sure they can respond to all the objections.).
c. be well-worded.

d. Have the support of the local advisory committee (generally but not always). Students should talk to each advisory committee member and attend a meeting ready to speak up in support of their proposal.

e. Write letters about their proposal to the regional advisory committee and the Board of Fisheries.

Now come up with a proposal and give it a try. Good luck!

Activity 11
Harbor Field Trip

Background:

The harbor is the focal point of just about every coastal community. Good harbor sites are extremely valuable, and are usually the first coastal sites to be inhabited. The comings and goings of local boats as well as those from other states and nations add excitement and color. In fishing communities, the boats in the harbor often are worth more than the houses in town. Harbors offer tremendous learning opportunities and are often within walking distance from local schools.

Even for interior communities, local waterfronts bustle with boats and motors, and serve as sources of hunting and fishing stories and outdoor adventures. This activity focuses on harbors, but easily can be adapted to general waterfront studies along Interior rivers.

Materials:

- notepads
- pencils
- binoculars
- life rings and ropes
• fisherman or woman
• harbor master or mistress
• worksheets:
  ...Fishing (4J)
  ...Harbor Investigation (4K)

Procedure:

1. Plan a field trip (preferably more than one) to your local harbor or waterfront.

2. Send home permission slips. Invite parents and local resource people to go with you or meet you at the harbor for a tour of their boat. Plan to divide your class into small groups, if possible, for part of the field trip. High school students involved in local fisheries could be good group leaders. All your assistants, in fact, will perform better with pre-trip preparation. Visit the harbor with your assistants ahead of time, if possible. Go over the two worksheets with them, reviewing the different types of fishing boats and ways to find invertebrates, birds, fish, mammals, and signs of environmental impact.

3. Pass out the worksheet Fishing Boats and have students label the pictures. (1: longlining; 2: halibut; 3: seining; 4: salmon (mainly pinks) or herring; 5: trolling; 6: salmon (kings and cohos); 7: trawling; 8: shrimp or whitefish (bottom-fish); 9: gillnetting; 10: salmon or herring; 11: crabbing; 12: king and Tanner crab.) Then go over the worksheet Harbor Investigation and talk about the answers you might expect. Binoculars might help in identifying birds and mammals. Tell students to look carefully for seaweeds and invertebrates under the dock, on the sides of pilings, inside old tires hanging down for bumpers, and on lines (ropes) hanging down in the water. For a sure way to find invertebrates, several days (or the day before) your field trip—put aged meat, entrails, or a baited crab pot (in season) into the water.

Typical environmental problems include oil and gas spills, litter, dog droppings, sewage, garbage seepage from a landfill, and fish gurry or crab wastes from a cannery. The class might want to interview a fisherman or woman and the harbor master or mistress as a group. Go over the questions students might ask about the harbor's past, present and future; fishing techniques; fishing boats and gear; problems of harbor management; fishing and harbor adventures. Have the students take notepads and pencils so they can jot down quick notes for writing a story later. Students may want to take cameras, plankton nets, and secchi disks, as well. (For more information on plankton nets and secchi disks, see Unit 3, Activity 3.)

4. Go over safety procedures and take a life ring and rope with you. Have each student practice throwing it beforehand.

• Use the buddy system.
• Stay together.
• If someone falls in, yell for help, toss a life ring or oar, launch a rowboat but don't go in the water yourself.

5. Plan follow-up activities. If you have only one chance to go to the harbor, you may want to do some of the activities in the next unit, Life on the Seas and Rivers, before you go.

6. Enjoy your trip to the harbor!

7. Follow up by having students write stories from their interviews for the school or community paper. Go over pointers for newspaper journalism:

• Have a strong lead-in (interesting but true statement).

• Tell what's happening (the "five Ws" are Who, What, When, Why, Where) in the first paragraph.

• Go over other story events in succeeding paragraphs.

• Remember, quotes make your story lively and interesting.

Additional Activities:

1. Art, Science: Have students make model fishing boats out of paper. Assemble soda straws, spools of thread (for reels), needles, old nylon stockings (for nets), felt-tip markers, scissors, construction paper. A sample hull cutout is enclosed. As the hull is folded down and the bow and stern are taped to the sides, the boat assumes an arched deck. (There is no bottom to the hull!) Students can create paper boxes for pilot houses and use the soda straws for masts, outriggers, cross-ties, stove pipes, or the center of reels and winches. Anything added to the pilot house should be done before the pilot house is taped to the deck. Felt-tip markers can be used to show port holes, scuppers, and other detail, plus to add the boat's name. (Activity developed by Bill Hastie, Marine Education Consultant, Oregon Department of Education)

2. Art, Science, Language Arts: Have students make charts comparing different types of sport, commercial and subsistence fishing boats. They can either draw the boats or cut pictures out of fishing magazines or catalogs.
Boat Hull

Directions: Cut on the solid lines, fold on the dotted lines.