4-H MARINE SCIENCE

LEADER'S GUIDE

This pilot Marine Science project was developed by Oregon State University's Marine Advisory Program and is being tested in Oregon, Washington, and California. The Marine Advisory Program is a part of the O.S.U. Extension Service and Sea Grants programs. Sea Grant is supported by the National Oceanic and Atmospheric Administration.

4-H 3501L
1972

Extension Service
Oregon State University
Corvallis

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Prepared by Mrs. Vicki Osis, Marine Science Education Specialist, assisted by Don Giles and others of the Oregon State University Marine Science Center staff, Newport, Oregon 97365. Questions about the project and the evaluation sheets should be sent to Vicki Osis. Requests for extra copies of these materials should be directed to county Extension offices in Oregon, Washington, and California. Requests from other states should be sent to the State 4-H--Youth Office, Oregon State University, Corvallis, Oregon 97331.

Cooperative Extension work in Agriculture and Home Economics, Lee Kolmer, director. Oregon State University and the United States Department of Agriculture cooperating. Printed and distributed in furtherance of the Acts of Congress of May 8 and June 30, 1914.

4-H MARINE SCIENCE LEADER'S GUIDE

Marine science is the study of the ocean and its related environments. As the world's population grows, the ocean will become increasingly important to us as a source of raw materials, food, fresh water, a power source, and for recreation. The importance of the ocean to mankind, the influence that the ocean has for the people of coastal states, and the current interest in marine science, has prompted the writing of the 4-H project.

This beginning project is written for sixth to eighth graders, but is also suitable for older youth. An advanced project is available for those who have completed this unit. Each unit may be continued for two or more years by developing additional activities.

Each Marine Science Club will plan its own program by selecting activities from those listed for this project and by developing other similar activities. Ten or more meetings with at least two trips to the coast will be needed.

Materials for Members and Leaders

4-H 3501	4-H Marine Science Project, Members Book
4-H 3001	Pocket Guide for 4-H Hikes
EC 721	Enjoy the Beaches in Safety
	Synopsis of Regulations

Materials for Leaders

4-H 3501L	4-H Marine Science Leaders Guide
SG-4	Crisis in Oregon Estuaries

Supplemental Materials for Leaders available from the Fish Commission of Oregon, 1400 S.W. 5th St., Portland, Or. 97204

Bay Clams of Oregon
Food Fish for the Future

Club leaders from other states should check with your state agencies to see what publications are available. Pamphlets similar to the ones sited here are probably available from your Fish and Game Commission.

Oregon State University Extension Service and Sea Grant publications may be purchased by other state Extension officers.

BEACH SAFETY

Safety is a primary objective of this project. Too many beach-related deaths occur each year on the Pacific Coast. Have your numbers read and discuss the section on safety in their project books. Have them collect newspaper clippings and reports of coastal accidents. Discuss how they were caused and how they could have been prevented. Review safety precautions each time you go on a field trip.

Use the buddy system (pair members to look out for each other) on beach excursions and post someone to watch for large waves and incoming tide when exploring hazardous areas. As assistant leader or parent can be very helpful on field trips.

PHYSICAL OCEANOGRAPHY

TIDES

Have your 4-Hers read then discuss the section in their project book on tides. Have them get Tide Tables which are usually available from Chambers of Commerce, newspapers and other sources in coastal towns. An all day or overnight visit to the beach to learn about tides will be most helpful. When they have learned how to use their Tide Tables, have them graph the tide levels for four days using the graph on page 11. Have your members take different days so their graphs will not be identical. Then have them fill in the answers to the questions on the Discussion Guide on Tides as you discuss them. Be sure that all of your members understand each question and can answer it correctly.

Answers to the Tide Table Discussion Guide in Project book.

TIDE TABLES

1. Left side of page
2. A.M. - light type, P.M. - bold type
3. Height of the water.
4. Two highs and two lows.
5. ----------
6. No.
7. -1.1
8. It will cause the water level to be higher.
9. ----------
10. Fishing information, boating information.

WAVES

Discuss how waves are formed, and the terms associated with waves, such as fetch, crest, trough, wave period, breaker,etc. Discuss the material on waves in the project book. A 10 foot rope can be used to illustrate waves. Tie one end to a door knob or post or have someone hold it. Shake the rope up then down until it moves in an undulating pattern like waves on the surface of the ocean. The water particles in the waves move up and down but not horizontally. Illustrate this by tying a flag to the rope. As the rope undulates the flag moves up and down but does not move down the rope, just as the water does not move with the waves. Let each member practice making waves.

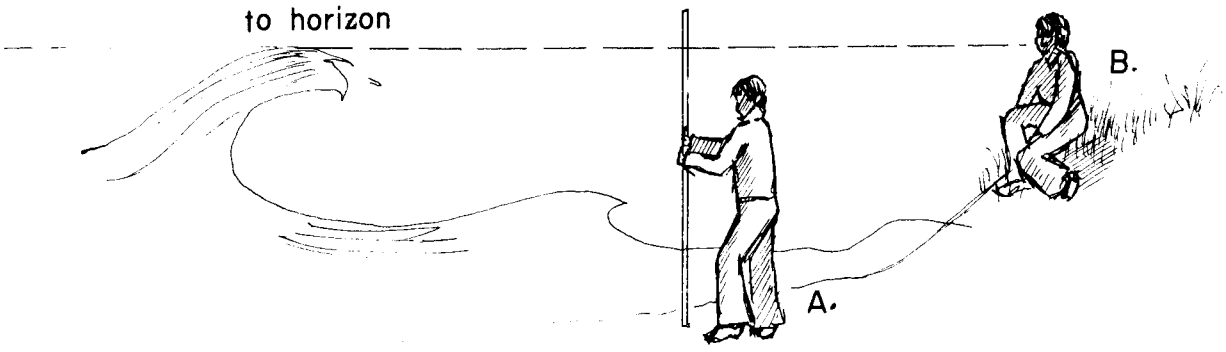
References: Encyclopedia
The Sea, Time Life Library
Waves and Beaches, by Willard Bascom

Measuring Breaker Height

The height of breakers (waves) can be measured accurately. This is easily done even if the line of breakers is well off-shore.

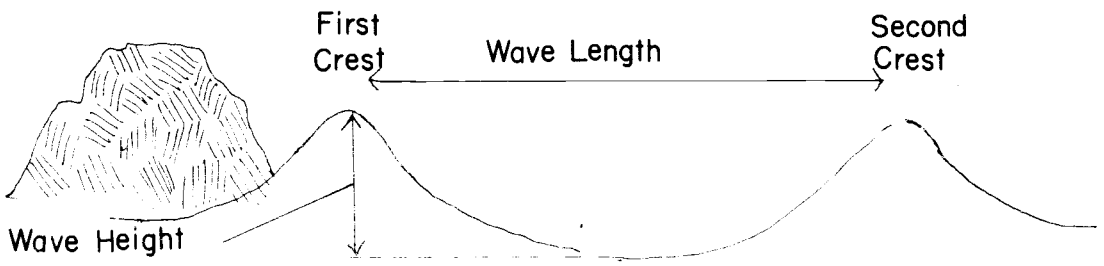
Material needed: A 5 to 7 foot pole, marked off in one foot increments.

Divide members into pairs.
"A" stands at the waters edge and holds the pole.
"B" faces "A" about three paces up on the beach.
"B" sites past the pole to the horizon, then moves up or down till in his line of site the crest of the wave is in line with the horizon. The point when this line of site intersects the pole indicates the height of the wave. The level of the ocean at the horizon and at the waters edge is approximately the same.



Measuring Wave Periods

A. Choose an off-shore rock as a reference point.
B. With the second hand of your watch, start timing when the crest of a wave passes the rock and stop timing when the crest of the next wave passes. The time interval is the wave period.



OCEAN FLOOR

To learn about the structure of the ocean floor, have your 4-H'rs make a model of it. Modeling clay can be made from 2 cups flour, 2 cups salt, and 1 cup water. Plywood can be used as a base. (See chart of ocean floor and definitions of the various structures on pages 19 & 20 of the project book).

THE EARTH

Have the 4-H members construct a display showing the earth's layers. Show the earth sliced in half or a pie wedge taken from it. The layers of the earth should be labeled.

References: The Earth, Time Life Library

Oceanography, by Yasso

OCEAN CURRENTS

To learn about ocean currents, each member should sketch and label the ocean currents on the map in his project book and indicate if it is a cold or warm current. Let them use the map on pages 8 & 9 of this book as a guide. Each should indicate areas of upwelling and should read and discuss the material on upwelling in the project book. Have your members answer the questions on the Discussion Guide, page 21.

Reference: The Sea, by Robert Miller

Charting Local Currents

While studying currents, the club member should prepare drift bottles to be placed in the ocean on a trip to the coast. A drift bottle can be made from soft-drink bottles filled 1/4 full of sand and sealed with a rubber stopper or cork. Place a self-addressed postcard in the bottle so that the finder can complete the card as to location of the washed up bottle and the date found and returned to the 4-H member, who should inform the finder when and where the bottle was put in to the sea.

Davidson's Current

This current flows only during the winter from October to May, from Southern California northward to British Columbia. It flows close to the shore. (See map page 8). Drift bottles can be placed in Davidson's current from the beach, but better success is insured if dropped from a boat one to five miles out. For assistance, contact your nearest marine extension agent.

California Current

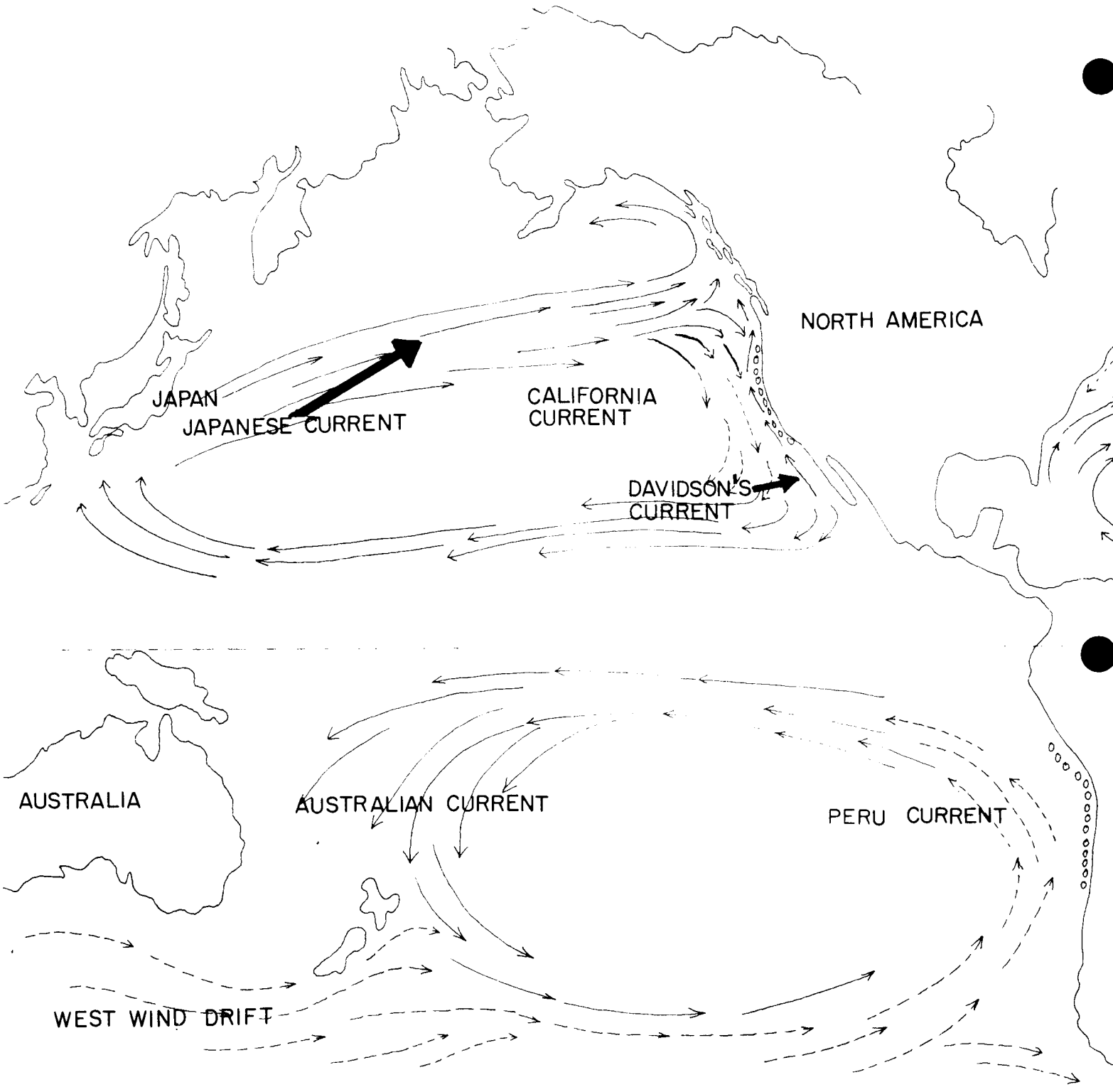
This current flows past the Oregon coast in a southerly direction all 12 months of the year as indicated on the map of the ocean currents, page 8. A drift bottle, to be placed in this current must be placed in the water from a boat 60 to 100 miles out during the winter and closer to shore during the summer.

Longshore Currents

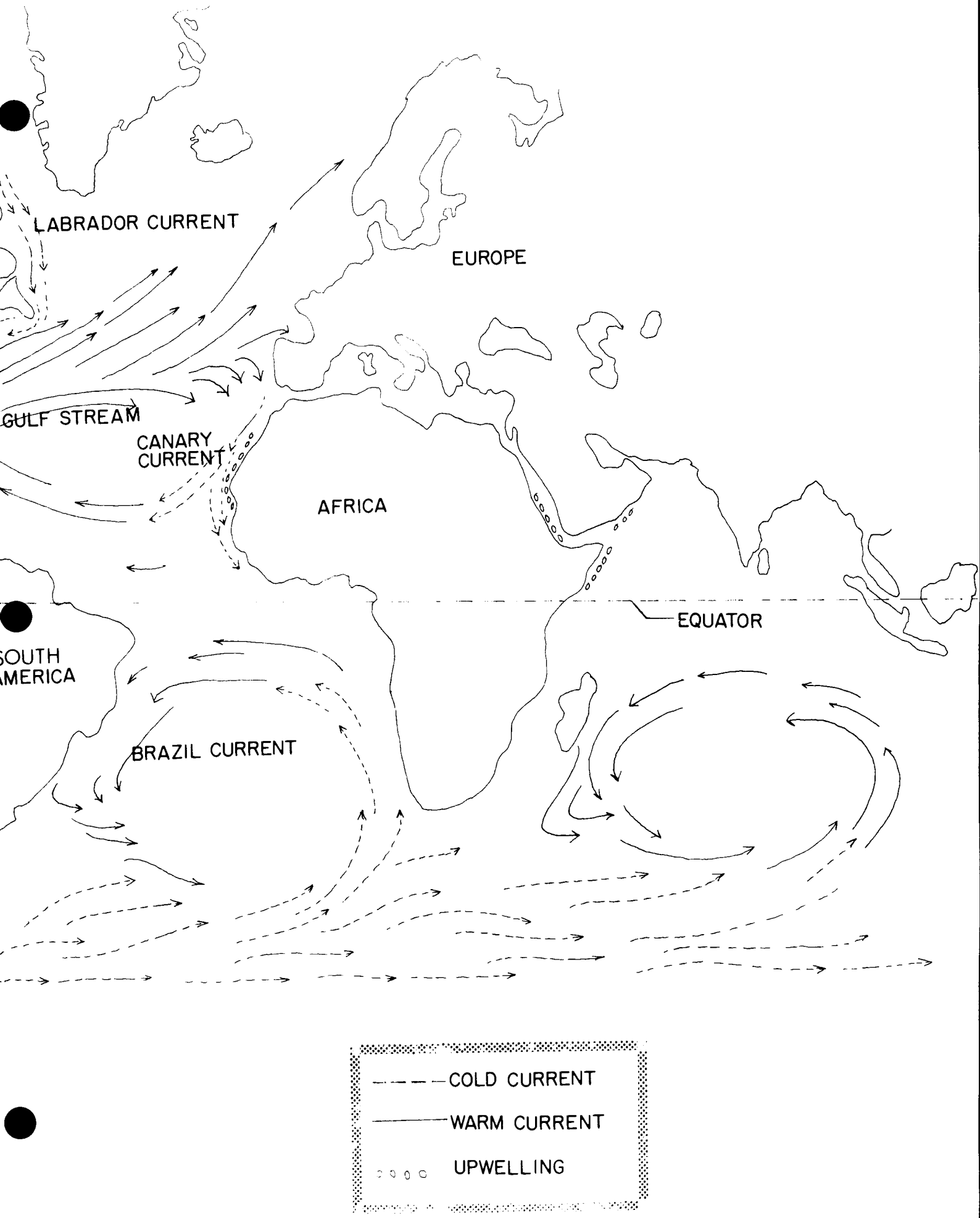
Waves, striking the beach at an angle, create a movement of water called the longshore current. This movement of water transports sand along the beach which results in a build-up of sand behind projections into the surf. Low tide exposes sand piled against jetties and other obstructions projecting into the water. To observe the longshore current, place plastic markers in the surf when the waves are coming in at an angle, and note how they are carried by the water movement along the beach. Rip currents may carry them out through the breakers. Plastic bleach bottles work well for markers.

Answers to Discussion Guide on Ocean Currents - page 21 in Project Book.

1. California - the Davidson current during the winter.
2. A cold current flows past Chili and upwelling of cold water near the shore.
3. By following the currents, their journeys could be made quicker.
4. Japanese floats are carried to the Oregon coast by the Japanese, North Pacific and California currents.
5. California - if off-shore.
6. Climate and navigation.
7. Cold currents originate from cold waters. For instance: The Peru current comes from Antartic waters.
8. Davidson current flows only during the winter (Oct. - March). It is a warm current.
9. Yes.
10. The winds.



MAJOR OCEAN CURRENTS


LABRADOR CURRENT
EUROPE
GULF STREAM
CANARY CURRENT
AFRICA
EQUATOR
SOUTH AMERICA
BRAZIL CURRENT
COLD CURRENT
WARM CURRENT
UPWELLING

LIFE IN THE OCEAN AND ESTUARIES

LIFE IN THE OCEAN

To learn about different forms of life in the sea, each 4-H member should make a scrapbook showing different animals of the sea. They should also include information about the animals they selected. Members may cut pictures from magazines or take their own and make a collection of photographs, or trace or draw the animals themselves.

Have each member learn about on ocean mammal, and one fish or bird and report on them at a club meeting.

References: Marine Life of British Columbia, by G. C. Carl.

The Sea, Time Life Nature Library

In the Wake of the Whale, by John Barbour. (This presents a good discussion of whales, whaling, and the effect it has had on whale population.)

Between Pacific Tides, by Ricketts, Calvin, and Hedgpeth.

FOOD PYRAMID OF THE SEA

Have members display a poster or model showing the food pyramid or food chain of the sea. Have each member write a discussion of the food pyramid

Reference: The Life of the Ocean, by N.J. Berrill

COMMERCIAL FISHING

Have your members visit a local market and list the sea foods that are offered for sale - fresh, frozen, dried, smoked, canned or pickled. Have them check to see which are processed in your state.

Visit a waterfront in a port city or town to observe the commercial fishing fleet or a sea food processing plant or an oyster farm.

FIELD TRIP TO A ROCKY BEACH AT LOW TIDE

Preliminary Preparation:

Before going to the coast, the beach safety material should be covered very thoroughly. Every year people are rescued off rocks, washed away by rip currents or waves, fall off cliffs, or are crushed by drift logs. Much of this could be avoided by thorough preparation before going to the beach. Know what the dangers are and how to avoid them. Each group on the beach should have a wave and tide watcher. One adult to each four to six youth is a good ratio.

Proper attire for the beach should be stressed. No matter how warm it is inland, usually it is cool on the Pacific coast. Rubber boots or tennis shoes with socks to protect ankles, and long pants are a necessity. Good preparation before the trip cannot be over emphasized. Review "Enjoy the Beaches in Safety".

The Rocky Beach Field Guide sheets that are in the project books should be discussed so that the members understand what they will be looking for. They are to find the animals pictured, and observe how they live. The guide sheets can be filled out later.

Explanation of Terms:

Wave Survival---

Observe the animal to see how it holds onto the rocks or keeps from being washed away by waves.

Protection from Drying---

During low tides, the rocks are exposed and the animals are subject to drying. Does animal close shell, crawl under seaweed, or what?

Level---

Observe which animals occur high on the rocks or lower down, close to the water. Different animals can withstand different amounts of exposure and as a result will be found at different heights. Indicate if the animal occurs at a high, medium, or low level.

Niche---

This word refers to the specific habitat for an animal. Examples of niches are: crevices in rocks, under rocks, on the face of rocks facing the waves, surge channels, a flat rock shelf, in the holdfasts of algae, tide pools.

Keep Collecting to a Minimum.

Many beaches have been stripped of their animal life by collectors. Beaches are slow to recover and will stay barren and lifeless for a long time. What a pity to visit the beach and not be able to see a sea star.

If some members are confirmed trophy hunters, encourage them to collect their prizes on film. A colored slide of a nudibranch or sea anemone will last for years, while the specimen will die immediately if taken from the beach. Even if preserved in alcohol or formalin, the specimen little resembles the living creature

Always return overturned rocks to their original position.

Animals found underneath the rocks die from exposure very quickly if the rock is left overturned.

After the field trip, the leader may choose to discuss the relationships of the animals (scientifically) and by their tide levels (ecologically). This can be done with the use of the checkerboard (a sample of which is on page 14). Put a drawing of the checkerboard on a blackboard and have the club members try to fit the animals they observed onto the checkerboard: first, under the phylum in which the animal would occur, and secondly, as to the tide level at which they observed the animal. This latter information can be obtained from the "level" column on their guide sheets. (A phylum is a group of animals with similar characteristics.)

The short discussion of zonation which follows should be covered both before and after the field trip.

Seashore animals and plants on the Oregon coast seem to follow a vertical distribution pattern. The animals in the intertidal zone can withstand different amounts of exposure to drying and temperature changes; therefore, the less hardy animals live at lower levels on the rocks as they will be exposed the least by low tides. This vertical distribution has been divided into zones and a short explanation of each zone follows:

Spray Zone---

From the highest reach of the spray and storm waves to about the average of all high tides. This is mainly bare rock area and only the hardiest of the animals live here. They have adjusted to being out of water most of the time, and some will even drown if held under water for long periods of time.

High Tide Zone---

From the average high tide to about average sea level. Animals in this zone are accustomed to more air than water. In this zone will be found the dense mussel barnacle beds.

Mid-Tide Zone---

From the average of the high-low tides to the average of the lower-low tides--the zero mark on the tide tables. The animals found here have accustomed themselves to the rhythm of the tides. This zone begins approximately at the base of the mussel bed.

Low-Tide Zone---

From the lower-low tide to extreme minus tide. A wide variety of animals inhabit this zone, but the quantity of any species is low. Several deep water animals approach the beach in this zone and can stand only a minimum of exposure.

Subtidal Zone---

Beyond the lowest point of the tide are found animals and plants which seldom venture up to the exposed areas. At the lowest tides you may find different varieties of nudibranchs, sea cucumbers, and sea urchins, which seldom climb into our tide zones.

Answers to Discussion Guide on Personal Harvest Limit. Project Book page 24.

1. First 36 dug.
2. First 24 dug. No more than 12 Horseneck (Gapers).
3. Twelve at 5-3/4" across the back.
4. Only male Dungeness crabs can be taken.
5. To maintain populations large enough to replenish themselves. With no limits, populations of animals would be destroyed.
6. Ten.
7. No. There are closed beaches and beaches where you need a permit to collect. All beaches are regulated one way or another.
8. Sixteen inches.
9. Yes.
10. Two daily limits.

LIFE ZONE CHART

	Phylums							
	Molluscs	*Arthropods*	*Coelenterata*	*Echinodermata*	*Annelida Nemerteans Other worms*	*Porifera*	*Pisces*	*Red Brown Green algae*
Spray Zone or Uppermost Beach	Mussel Limpets Periwinkle Snails Littleneck crab	Isopod Barnacles Leaf Barnacle		Sea Stars	Worms			Green algae (Enteromorpha)
High Tide or Upper Beach	Mussel Thais Snail Limpet (keyhole)	Shore crab Rock crab Barnacles Hermit crabs	Anemones	Sea Stars	Segmented worms Ribbon worms			Rockweed (Fucus)
Mid-Tide or Middle Beach	Nudibranch Chiton Piddocks	Kelp crab Hermit crab Isopod	Anemones		Kelpworm	Sponges	Sculpin Blenny Tidepool Johnny	Sea-lettuce (Ulva) Coral algae
Low Tide or Lower Beach	Mussel Nudibranch Clams	Kelp crab Shrimp	Anemones & Cluster anemones		Kelpworm	Sponges		Kelp (Nereocystis)
Subtidal	Gum Boot Chiton			Sea Urchin				Giant kelps

ANSWERS TO ROCKY BEACH FIELD TRIP GUIDE

	Wave Survival	Protection From Drying	Level On Rocks	Niche	Method Of Feeding
Anemone *Anthopleura* sp.	Attached to the rocks	Closes up - withdraws tentacles and covers itself with shell fragments or lives in pools	Med. - Low	Tide pools and rocks	Catches food with tentacles
Tube worm *Serpula vermicularis*	Attached to rocks, usually in sheltered locations	Pulls plume into tube. Has "plug" for tube end.	Low	Surge channels and pools	Captures food with its plume
Common sea star *Pisaster ochraceous*	Tube feet act as suction cups to cling to the rocks	Crawls into moist crevices of the rock. Also forms clusters	Med.	Rocks, mussel bed	Pulls open mussel shells with its tube feet.
Limpets *Collisella* spp.	Holds onto the rocks with a muscular foot	Clamps down on the rock trapping water under its shell. Forms clusters in sheltered spots	High	Rocks	The mouth is located in front of the foot. They scrape tiny plants off the rocks for food.
Hermit crabs *Pagurus* spp.	Crawls under rocks or into crevices	Pulls into shell or crawls to a wetter area	Med. - Low	Tide pools and rocks	Uses claws to feed- a scavenger.
Porcelain crab *Petrolisthes cinctipes*	crawls under rocks	crawls to moist areas under rocks	High - Med.	Under rocks	Uses claws to feed - a scavenger.
Purple shore crab *Hemigraphsus nudus*	crawls under rocks	crawls to moist areas under rocks	High - Med.	Under rocks	Uses claws to feed. A scavenger

ANSWERS TO ROCKY BEACH FIELD TRIP GUIDE

	Wave Survival	Protection From Drying	Level On Rocks	Niche	Method Of Feeding
Acorn barnacle *Balanus* spp.	Attached to rocks	Closes shell tightly.	High - Med.	Under rocks	Opens shell and a hand-like structure strains food from the water.
Leaf barnacle *Pollicipes polymerus*	Attached to rocks with a flexible stalk.	Closes shell tightly.	Med.	Exposed rocks.	Same as Acorn barnacles
California mussel *Mytilus californianus*	Attaches to rocks by tough threads called byssus threads	Closes shell tightly.	Med.	Rocks	Pumps water through shells to filter food particles from the water.
Sea Urchin *Strongylocentrotus* spp.	Tube feet act as suction cups to cling to the rock. Lives in depressions in the rock.	Cover themselves with bits of shell - lives in depressions in the rock.	Low - Med.	Rock ledge	Tube feet catch food. Move underneath to "mouth" note tiny teeth for eating seaweed.
Black chiton *Katharina tunicata*	Holds onto rock with muscular foot.	Clamps down onto rocks	Med.	Exposed faces of rock	Mouth is located in front of foot -scrapes tiny plants off rocks

ANSWERS TO ROCKY BEACH FIELD TRIP GUIDE

1. Turn over a rock and record what animals you find.

   Limpets, snails, crabs.

2. Why is it important that you return the rock to its original position:

   Animals will dry out or become too hot from the sun and die.
   If the animal is stationary, it will die from wave exposure.

3. What will this beach be like if everyone collects these animals to take home with them?

   There will be little animal life left.

4. Why do you think these animals are found here but not on a sandy beach?

   The rocks provide protection from the waves and a solid surface to attach to.

PREPARATION OF A MARINE AQUARIUM

One of the most exciting and rewarding experiences after a field trip to the ocean is the making and studying of a salt water aquarium. Some say it is easy to prepare and maintain--others state that it is difficult. The following suggestions come from experiences at East and South Prairie School, Tillamook, Oregon, during the past four years.

Materials needed:

1. Two 10-gallon glass aquariums and several gallon jars for observation of individual animals, if desired. (An excellent individual container is a gallon jar with the top off.)
2. An aerator, plastic tubing, joint connections, air regulators and air stones. (An inexpensive aerator may be purchased from OMSI or any scientific house for about $6.00. One aerator is enough for two aquariums.)
3. Glass covers for tops of aquariums.
4. Aquarium thermometers.

REMEMBER: THESE ARE TIDAL ANIMALS ACCUSTOMED TO THE EBB AND FLOW OF THE TIDE. AN AQUARIUM IS AT BEST A VERY ARTIFICIAL HABITAT.

Procedure:

Put an inch or more of clean sand in the bottom of each container. Pour in sea water (which you obtained on the field trip). Water level should be 3 or 4 inches below the top of the container. This is important so that space is available to accommodate the animals that come from the spray zone and are out of the water more than in it.

Limpets will usually stay just at or above the water line. Place them there when making the aquarium.

Plants and animals that have been collected may be carefully placed in the aquarium. DO NOT OVERLOAD THE AQUARIUM WITH ANIMAL LIFE. HAVE ONLY ONE OR TWO OF EACH SPECIES in an aquarium. It does not matter how many plants are in the water. Too many, however, will cut down on your observations because animals like to hide in them.

Temperature of the water should be kept between 65 and 70 degrees F. This may be hard to do unless you kept your normal room temperature around 70 degrees F. Keep a cover on the aquarium to prevent rapid evaporation.

Our aquariums were maintained with little care for over a month. After two weeks we added some fresh ocean water to replenish the food supply and maintain a more normal salt level in the water. Listed below are animals which will do well in your home aquarium.

Limpets	Barnacles	Chitons	Kelp crabs	Clams
Shore crabs	Mussels	Hermit crabs	Nudibranchs	

Anemones (difficult to collect as they are attached to the rocks)

Feed the anemones and crabs small pieces of liver or fish about every other day.

COLLECTING AND PRESSING ALGAE

Algae may be collected in plastic bags and transported back home. A plant press should be set up beforehand so the algae can be pressed upon returning home from the field trip. The algae won't keep long so should be pressed promptly. Directions for pressing and mounting algae are included in this booklet. Algae may also be collected to use in cooking. Seaweed pickles and seaweed bread recipes are included on page 27.

The algae you collect at the beach can be pressed and mounted.

Materials:

Shallow pan (cafeteria trays work well), blotter paper, newspaper, typing paper, 4-H Mounting Cards, cardboard, two pieces of plywood and two belts or rope.

Procedure:

1. Float the algae in the shallow pan to arrange the fronds. Slip a sheet of typing paper under the algae and carefully lift it out of the water. If this step proves too messy, place the algae on the typing paper and arrange the fronds as best you can.

2. Place a piece of waxed paper over the specimen to keep it from sticking to the other papers which are placed on it.

3. The following layers of papers are placed on each side of the specimen to absorb excess moisture from the plant.

   a. Blotter paper

   b. Newspaper

4. Place a sheet of cardboard on each side of the growing stack of papers. The cardboard should be the hollow type to allow circulation of air.

5. Repeat the above steps for each specimen to be pressed.

6. After all specimens have been prepared for pressing, place one piece of plywood on each side of the stack and secure it tightly with the belts or rope.

7. Set the plant press over a register or any other warm place with circulating air.

8. The layers of blotter paper should be changed once a day, so drying is thorough.

9. When the plants are thoroughly dry, glue the plant to the mounting paper and label. List the name of the plant, the collector, place of collection and the date.

Herbarium supplies are available from: Herbarium Departmant, Carpenter/Offutt Paper Inc., P.O. Box 3806, Rincon Annex, San Francisco, California 94119

SAMPLING PLANKTON

You can construct your own plankton net by using a piece of wire (a coat hanger works well) and a nylon stocking.

A. Bend the wire into a circle about the size of the top of the stocking and secure the loose ends.

B. Sew or otherwise attach the top of the stocking to the wire. You can leave the foot intact, but the plankton must be rinsed out after sampling. You may prefer to cut the foot out of the stocking and secure a small bottle in the end to catch the sample.

This net works best, if collecting in the surf, to pour several buckets of water through the net. Dragging it through the surf collects too much sand.

FILMS AVAILABLE FROM AUDIOVISUAL INSTRUCTION GILL COLISEUM 133, OSU, CORVALLIS, OREGON

(Oregon 4-H clubs may order through their County Extension officers)

Title	Lngth. in mins.	Group level	Related Exercise
Animal Life at Low Tide	11	Junior	Life in the sea
Beach and Sea Animals	11	Junior	Life in the sea
Seashore	10	Junior	Beaches
Seashore Life	11	Junior	Life in the sea
The Earth - Its Oceans	14	Junior	Ocean Floor and Currents
Beach, a River of Sand	20	Junior & Advanced	Longshore current, wave tank
Marine Animals of the Open Coast	22	Junior & Advanced	Animals of the sea
Seal Island	28	Junior & Advanced	Mammals, ocean
The Restless Sea	16	Junior & Advanced	Tides
Mysteries of the Deep	24	Advanced & Junior	Life in the sea
Ocean Currents	17	Advanced	Currents
Plankton & the Open Ocean	19	Advanced	Life in the sea
Salmon Story	54	Advanced	Waves, tides, currents & ocean floor
Sea Urchin	10	Advanced	Life in the sea
Secrets of the Underwater World	16	Advanced	Life in the sea

4-H MARINE SCIENCE LIBRARY

A Field Guide to Seashore Life on Rocky Beaches of the Central Oregon Coast, J. and L. Whitney, OSU Bookstores, Inc., 1966.

A Guide to Field Identification of Seashells of North America, R. T. Abbott, Golden Press, 1968

Beachcomber's Guide, John Hoyt, Houghton Mifflin, 1971.

Between Pacific Tides, E. Ricketts, J. Calvin and J. Hedgpeth, 4th ed., Stanford University Press, 1968.

Common Seaweeds of British Columbia, R. Scagel, B.C. Provincial Museum, 1967.

Exploring the Secrets of the Sea, W. J. Cromie, Prentice Hall, 1962.

Field Guide to Beaches, John Hoyt, Houghton Mifflin Company, 1971

Fishes, A Guide to Familiar American Species, H. Zim and H. Shoemaker, Golden Press, 1955.

Frontiers of the Sea, R. C. Cowen, Doubleday and Company, 1960.

In the Wake of the Whale, John A. Barbour, Cromwell-Collier Press, 1969.

Introduction to the Seashore Life of San Francisco Bay and the Coast of Northern California, E. Yale Dawson, Univ. of California Press, 1962.

Life on the Seashore, A. J. Southward, Harvard University Press, 1965.

Marine Shells of the Pacific Northwest, Tom Rice, Ellis Robinson Publishing Co. 1971.

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Places of Interest to Visit in Oregon

Astoria (city and surrounding area)

Bumble Bee Seafood Factory - conducts tours through their facilities
Maritime Museum
Big Creek Hatchery
Clatskanie Hatchery
Seafoods Laboratory, OSU Facility

Seaside

Seaside Aquarium

Tillamook

Pioneer Museum
Trask Hatchery
Nehalem Hatchery
Netarts Chum Salmon Hatchery
Tillamook Bay Oyster Growers
Commercial Fishing Fleet - Garibaldi
Shipping Docks

Newport

OSU Marine Science Center
Commercial Fishing Fleet
Yaquina Bay Light House Museum
Undersea Gardens

Yachats - Florence

Cape Perpetua Visitor Center - Naturalists conduct tours through nature trails and tide pools.
Sea Lion Caves

Coos Bay

Peterson Seafood Factories
Commercial Fishing Fleet
Shipping docks

Port Orford

Marine Station OSU Research Facility
Oregon Prehistoric Gardens
Elk River Salmon Hatchery (Fish Commission)

Places of interest to visit - cont.

Bandon

Shipping docks
Bandon Fish Hatchery (Game Commission)

Gold Beach - Wedderburn

Boat building shops (4)
Rogue Bay Cannery

Brookings - Harbor

Commercial and sports fishing fleet
Seafood processing plants (3)

Evaluation Sheet for Pilot 4-H Marine Science Project

Number of members - boys_____, girls_____, Age range_____.

Assistant leaders?_____ County_____State_____

Which activities were least successful? How could they be improved?

Which activities were most successful? Could they be improved?

List other activities that you think should be added.

Was the material too simple or too difficult for the age level you worked with?

Any other comments you may wish to offer will be appreciated.

How many field trips did you have?_____How many other meetings?_____

Please return to:

Vicki Osis
Marine Science Education Specialist
OSU Marine Science Center
Newport, Oregon 97365

Cut along this line

SEAWEED SWEET PICKLE RECIPE

4 cups of rings or rectangles cut from fresh stems of kelp (Bull Kelp or Sea Palm are very good)
3/4 cup white vinegar
2½ cups sugar
1 teaspoon whole cloves
1 tablespoon mixed pickling spice

Remove the outer skin of kelp with vegetable peeler and slice into thin rings or cut into longitudinal strips and then into rectangles. Soak the cut kelp in fresh water for three days, changing the water several times a day to remove the bitter-tasting salts.

Enclose the spices in a cheesecloth bag and place in simmering vinegar and sugar for five minutes. Remove spices and pour the hot syrup over the sliced kelp. Let stand overnight.

Next day, drain off syrup, heat to boiling, and pour over kelp again; let stand overnight.

On the following day (sixth) remove syrup and heat to boiling. Place kelp slices in hot jars, cover with boiling syrup, and seal, or store the pickles in a covered crock.

For dill seaweed pickles, handle the kelp in the same manner, but substitute your favorite dilling process for the above syrup.

BREAD FROM THE SEA

Collect five to ten pounds of any kind of seaweed you can find. Wash seaweed thoroughly in fresh water and dry for several days, protecting it from being disturbed by animals. Grind dried seaweed in food blender to produce "flour." Use this "flour" in any standard bread recipe as a substitute for wheat flour.

Some observations made by those who have experimented with this:

- Water in place of milk seems to be better in most recipes.
- A tablespoon of butter added to the recipe seems to add flavor.
- If you have a shortage of seaweed, you can go half and half with wheat flour.
- Experiments with flavoring can be enjoyable; try a bit of almond extract or cinnamon, for example.

Have fun!

ARE YOU READY FOR THAT FIELD TRIP?

What are your objectives? To have fun? To bring everyone home safely? To help your members understand and respect the ocean? To learn about marine life? To observe the economic and recreational potential of the sea and the coast? To leave the places you visit as attractive and viable as you found them?

Have you visited the site? Does it have what you want to show your members? Will the tide be less than +1? Can you be at the site and ready to explore an hour before low tide? Do you have adequate transportation and supervision -- one adult to each four to six youth? Has acceptable behavior been agreed upon? Do you have a First Aid Kit? Do you know what to do and where to go if you need help? Will you have wave and tide watchers?

Will your members be adequately clothed and shod? Do you know what cold and wet do to one's interest and attention? No bare feet or thongs - tennis shoes that water won't hurt or overshoes or boots are best. (Salt water ruins leather.) "Smooth soles lead to departed souls." Warm, long pants, sweaters, windbreakers and heavy socks are usually welcome at the beach. Rain gear may be needed.

Food? How about a snack when you hit the beach for extra energy during your explorations? And plenty of food when you return - they'll be hungry.

Does everyone understand that the purpose of the trip is to explore and learn, not to kill and destroy? Why must rocks be returned to their original position? Have you scheduled a briefing session when you first hit the beach to observe the beach, rocks, birds, weather, surf and set boundaries for exploration?

Observing? Are there horizontal bands of organisms? How many? How many different kinds of creatures are found under rocks? Did you return rocks to original positions? How does a sea anemone feed: Harvest one mussel for feeding experiments. How does a crab eat? How does a limpet react to juice squeezed from a starfish? Is distribution of organisms different on wave side of rock compared to shore side?

Classifying? How many kinds of algea can be found? How do they hold onto rocks? How do snail shell structures differ in sculpturing, hole size? How many different species of crabs can be found? How do the various barnacles differ structurally: How do color patterns and sculpturing differ among limpet shells? How many different kinds of animals and plants can be found in one tide pool?

Measuring? What is the temperature of a high tidepool? A low tidepool? The ocean? The air? Among limpets of the higher rocks, what range is the shell lengths? How long does it take a sea anemone to swallow a bit of food? How long does it take various starfish to turn over when placed on their topside? How wide are the bands of organisms on rocks (if they are seen)? Using a squared wire coat hanger for area reference, what is the density of creatures at different levels of the tidal zone? If you find barnacles feeding in a tide-pool, how many times a minute do they rake their feathery feet through the water?

Follow Up? Has a time been set to review and record what has been seen at the close of the trip - before they forget?
Will there be opportunity for your members to tell what they saw and learned?
Will there be a parent's night to show them what you did?
Have you or the students written thank you letters to those who helped?
Do you have notes for your next field trip?