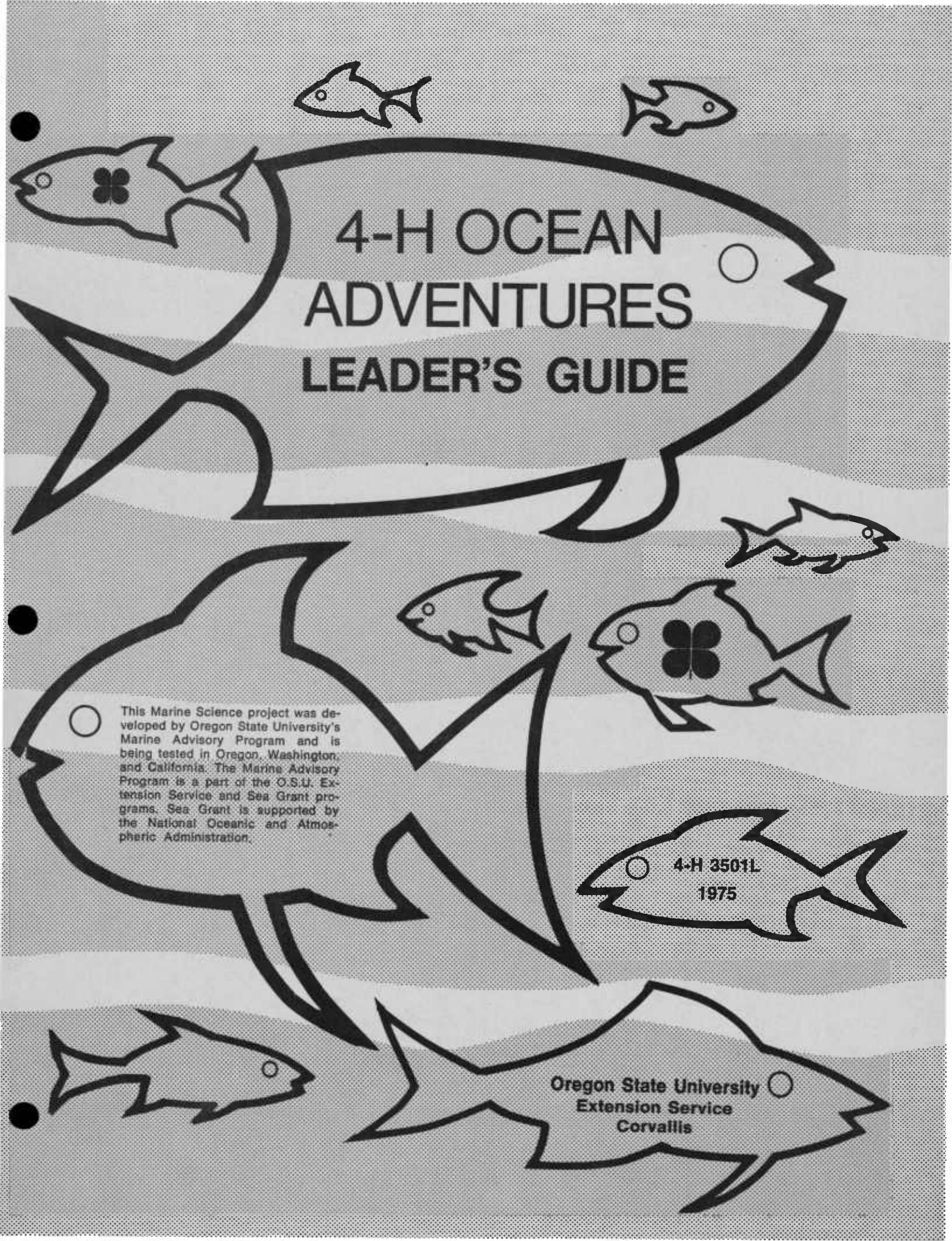

# 4-H OCEAN ADVENTURES

## LEADER'S GUIDE

This 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 Grant programs. Sea Grant is supported by the National Oceanic and Atmospheric Administration.

4-H 3501L
1975

Oregon State University
Extension Service
Corvallis

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# 4-H OCEAN ADVENTURES LEADER'S GUIDE

## INTRODUCTION

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 the oceans 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

4-H 3501 4-H Ocean Adventures Member's Guide
4-H 3001 Pocket Guide for 4-H Hikes

Materials for Leaders

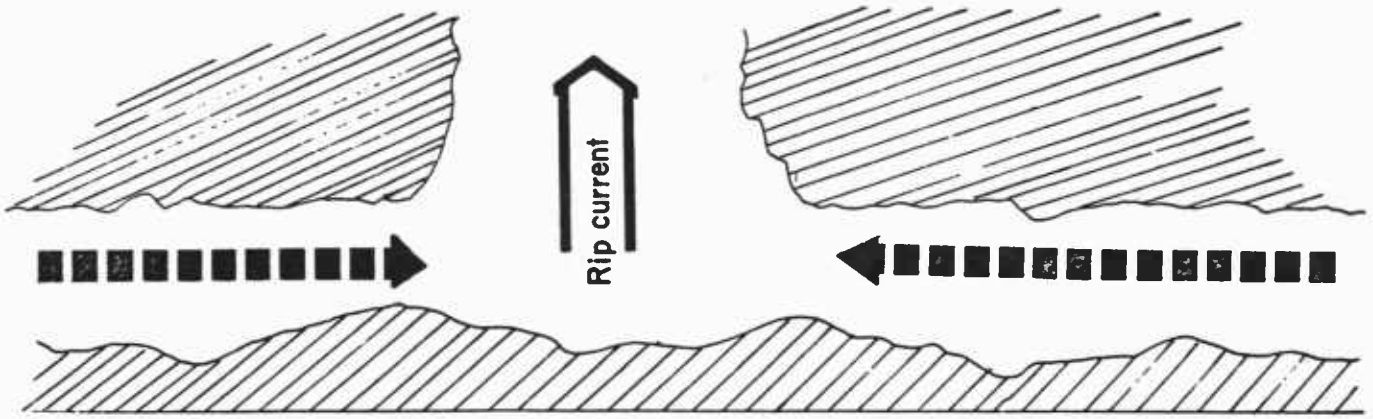
4-H 3501L 4-H Ocean Adventures Leader's Guide

# BEACH SAFETY

Safety is a primary objective of this project. Various types of accidents occur along the Oregon coast with such recurring frequency; these accidents could be reduced if everyone were informed of the hazards of the beach.

Drownings occur every year on our beaches when swimmers are caught in rip currents or are swept away by large waves. RIP CURRENTS, erroneously called undertows, are caused by offshore sand bars. Breaking waves carry large amounts of water over the sand bar. The force of many waves breaking over the bar keeps water trapped between the bar and the beach. If the bar is broken anywhere along its length, water will go back to the ocean through the hole. This water comes from both directions inside the bar and a current going straight away from the beach results. This is the rip current.

Rip currents are responsible for carrying many bathers "over their head" at the beach. Rips are strong and should be avoided. However, when necessary, surfers and lifeguards can use rips to get through the surf rapidly. Coming back through a rip is very difficult and should be attempted only if you are an excellent swimmer. If you are ever caught in a rip, swim parallel to shore. When you get out of the current, swim to shore. With just a little practice you can learn to spot rip currents. They usually hold back waves and are sometimes discolored by sand and other debris picked up from the bottom.




Water getting trapped between a sand bar and the beach can escape through a hole in the bar. This may produce a strong current running away from the beach. This current is called a rip current.

Another type of accident which occurs frequently on the coast is when tidepoolers or fishermen become stranded on nearshore rocks. They become so engrossed with their activities that the tide returns and cuts off the path to shore. Also, extra large waves can sweep them from the rocks.

Beachcombing or playing among the drift logs at high tide is also dangerous. High waves and tides can raise the water level to the logs and roll them about. This is particularly a problem during the winter when high tides coupled with storms normally occur.

The cliffs above the beaches are unstable and often undercut. Approaching too close to the edge can cause it to give way resulting in a bad fall.

If you are planning a trip to the beach, use the buddy system (pair members to look out for each other) and post someone to watch for large waves, and incoming tides. An assistant leader or parent is very helpful on field trips.

Activities:

Discuss safety precautions before taking a trip to the beach. Collect newspaper clippings and keep record of new reports of coastal accidents. Discuss these at one of your meetings.

# PHYSICAL OCEANOGRAPHY

## TIDES

The rise and fall of the tides is very important to people who live on the coast. Those who make a living from the sea find their lives regulated by the tides. Coastal dwellers also keep an eye on the tides for recreational activities such as clamming and crossing harbor mouths in boats. Knowledge of the tide cycle and ability to read a tide table is essential for people who live on the coast or those who plan to visit the beach.

A typical tide cycle has two high tides and two low tides in a 24 hour period. The tides on the west coast of the United States have two highs and two lows of unequal height. These are called MIXED TIDES and is the general pattern for tides the world over. Some places experience different patterns; for example, the east coast of the United States has SEMIDIURNAL TIDES. That is two high and two lows which are almost equal in height. DIURNAL TIDES occur in a few areas of the world such as the western shores of the Gulf of Mexico and consist of only one high and one low each day.

Activities:

For practical experience in reading a tide table, obtain tables from Chambers of Commerce from coastal cities or marine suppliers. Many newspapers also print tide tables. Use the discussion guide in the members project book to learn to use tide tables.

Graph the tide for a 4 day period on the graph in the member's book.

Answers to the Tide Table Discussion Guide in Project book on page 3.

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

If you have ever been surfing, you know that there is more to it than just standing on a board. In fact, the first thing a beginner must learn is how to get out through the surf. The next thing he must learn is to judge when the next wave will get to him so that he can catch a ride. With a little practice at this, he will see that the waves seem to follow each other in a pattern. In fact, they seem to break at about the same spot each time. Each one breaking at this spot will seem to be about the same size. Only after acquiring this bit of knowledge is the surfer ready to concentrate on riding the board.

Most of us may never go surfing, but waves are still important to us. Not only can waves cause serious damage, but they can benefit us when we harness their energy. Let's begin a study of waves by looking at their anatomy.

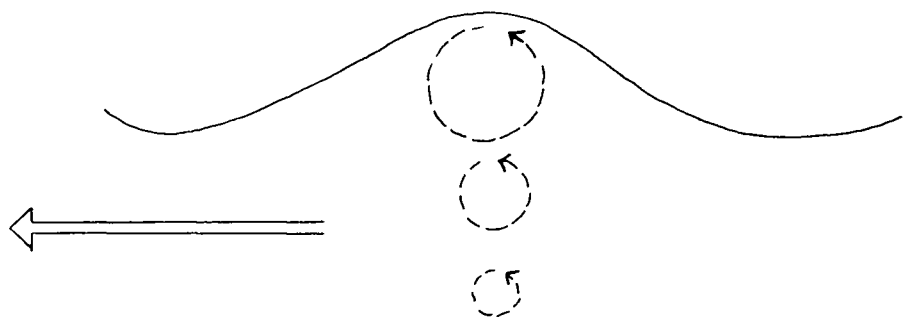
Waves are made up of the CREST AND TROUGH. The crest is the highest part, and the trough is the lowest part. Waves can be measured for length and height. The horizontal distance between wave crests is called the WAVE LENGTH. The vertical distance between the crest and the trough is called the WAVE HEIGHT.

Waves are timed by measuring the time it takes for two wave crests to pass the same spot. This time is called the WAVE PERIOD.

We know that waves move from place to place as SWELLS. We also know that those same swells will end their journey on some beach as BREAKERS, but do these waves carry water from one place to another? In order to find this out, scientists build wave tanks. The wave tank is a long rectangular structure with glass sides. Waves are generated at one end and can be observed as they move to the other end. Neutrally buoyant particles are introduced in the tank and their movement observed as swells pass. Interestingly, the particles do not appear to move forward. To see exactly what is happening the observers can trace the movement of the particles on the side of the glass. They find that the particles make a complete circle as a swell passes. This can be observed on a windless day on the ocean when there are swells present. Throw a floating object into the water and watch its movements.

How far below the surface of the water does this circular movement occur? The wave tank again becomes useful as a scientist's tool. Neutrally buoyant particles are placed from the surface of the water to the bottom. When waves pass they disturb the water to a depth of <u>one-half the wave length</u>. Below this, there is no disturbance caused by the wave.

When waves encounter water shallower than one-half their wave length, such as at a beach, they are said to "feel bottom." As the water becomes shallower, the circular motion at the bottom is altered. The water there is slowed down. At the surface the circular motion is still moving very rapidly. In fact, it moves so much faster than the bottom of the wave that the top will spill over in front. Then the wave is known as a BREAKER.

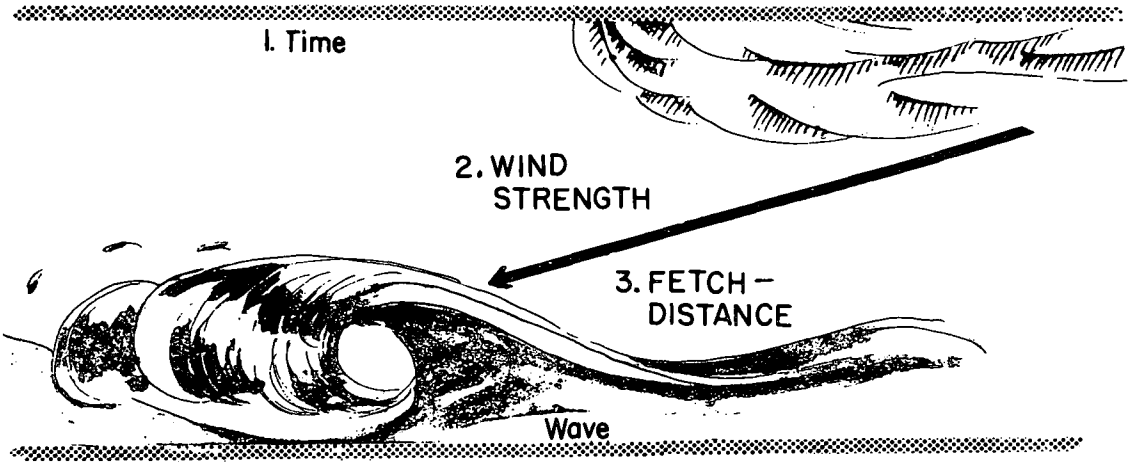


Motion of a particle of water in a wave. Notice the path forms a circle. There is slight movement forward, but not very noticeable. When many waves pass however, a large mass of water is moved very slowly. We call this mass movement.

Breakers do carry water along with them. Waves that transport water are called TRANSLATION WAVES. If the wave breaks very quickly, the crest will be thrown into the trough in front. This leaves, for a short time, a tunnel of water (surfers call this the Banzai Tunnel) and the wave is known as a PLUNGING WAVE. If the process is slow, the crest simply tumbles down the front of the wave into the trough. This kind of breaker is known as a SPILLING WAVE. Surfers prefer spilling waves because they last much longer than plunging waves.


Two Types of Breakers

What generates waves and where do they come from? The waves we commonly see at the seashore are WIND WAVES. These are generated by the friction of wind blowing across water. Usually wind waves are rather small, but storms can produce large waves. The size of wind waves is dependent on three factors, the fetch (distance over which the wind blows), and the strength of the wind and the length of time the wind blows. If all three factors are large, the waves will be large.




The size of wind waves is dependent on 3 factors: the length of time the wind blows, the strength of the wind, and the distance over which the wind blows (fetch).

Large storm waves can cause great damage. We must remember that even normal waves can erode vast areas of shoreline.

The most spectacular kind of wave is the SEISMIC WAVE. These are commonly called "tidal waves," but that name is unfortunate. Seismic waves are the results of movements of the sea bottom or undersea landslides. In fact, the work "seism" means earthquake in Greek. Since seismic waves have nothing what-so-ever to do with the tides, scientists have names seismic waves TSUNAMI (pronounced su-nah'-mee). Tsunami is the Japanese word for seismic waves.

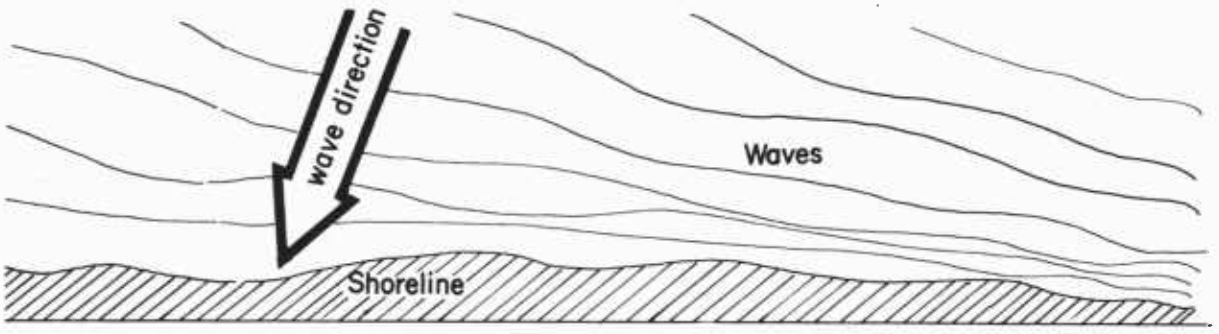
Although tsunamis are large at the coast, a ship at sea would hardly notice one passing. This is because their crests and troughs are so far apart. In shallower water the situation is completely different. The waves may become breakers as much as 100 feet high. On April 1, 1946, at Scotch Gap, Alaska, a tsunami completely demolished a radio tower that was placed on a rock 103 feet above the sea.

On the same day, the results of the same disturbance were observed in Hawaii. The wave took many lives and wrecked much property. Today there is a tsunami warning system around the Pacific Ocean. When a seismograph station detects an earthquake, a warning is sent to all areas that could be hit by a tsunami.

# BEACHES AND WAVES

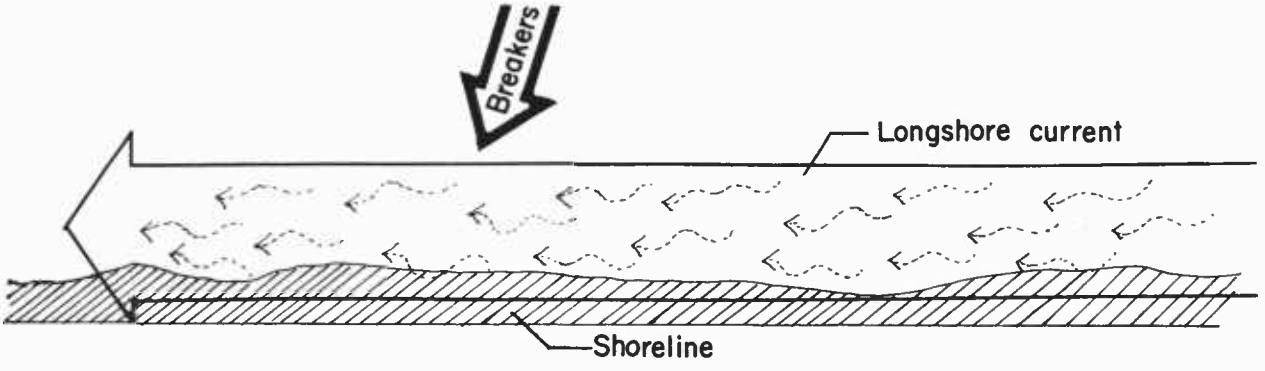
If you live inland, you probably think the ocean beach is a never-changing spread of sand. But, this is far from what a beach is really like. The beach bordering an ocean is constantly changing. This is due to the force of the wind and waves. As we have already said, the energy of the wind is picked up by the waves far at sea. When these waves travel to a beach all this energy is released on the beach. The larger the wave, the more energy it releases.

Although waves appear to hit the beach straight on, they seldom hit exactly parallel. Instead, they come from an angle. When a wave comes to a beach at an angle, the part closest to the beach feels bottom first. This part is then slowed down by friction with the bottom. This allows the rest of the wave to "catch up." From the air, the wave would appear to be bent so that it would be parallel to the beach. This bending is referred to as REFRACTION. Refraction takes most of the angle with the shoreline out of a wave, but there is usually a slight angle remaining.




Waves approaching a beach at an angle will be refracted. As they approach the beach, the part of the wave near shore will feel bottom and slow down. The other part will continue to move as fast as always and will seem to catch up with the other part.

Since breakers are waves that carry water, many breakers hitting the beach at the same angle can transport large amounts of water along the beach. This movement of water along the beach is called the LONGSHORE CURRENT. The longshore current is only found in the breaker zone.




Waves hitting the shore at a slight angle cause a water current in the surf zone (wave zone) in the direction of the wave.

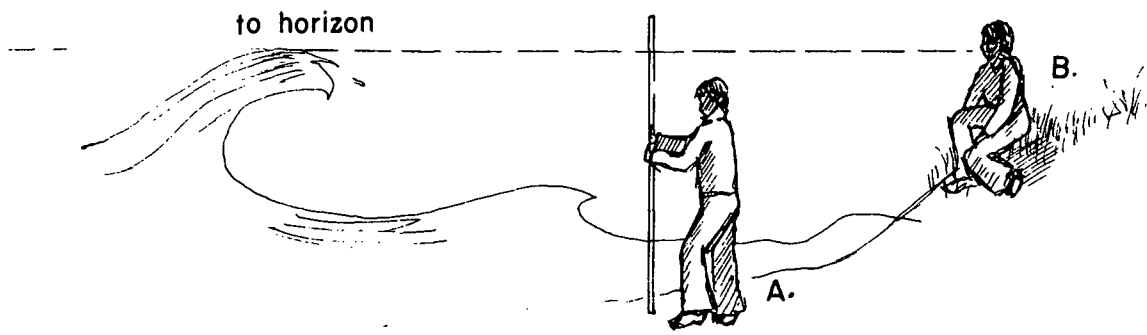
Activities:

Measuring Breaker Height

The approximate height of breakers (waves) can be easily measured by the following method.

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

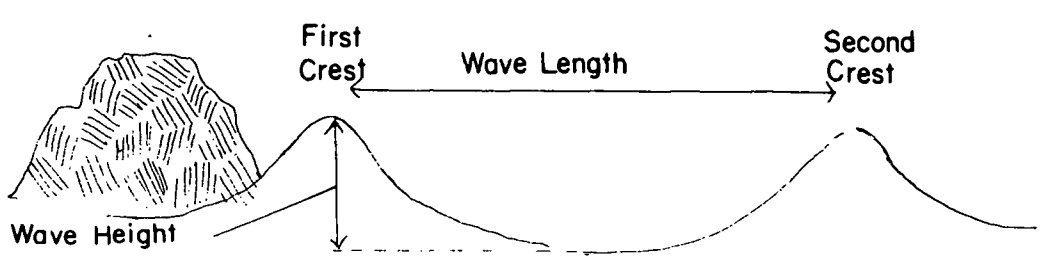
Divide members into pairs.
"A" stands at the waters edge and holds the pole.
"B" faces "A" about three paces up on the beach.
"B" sites past the pole to the horizon, then moves up or down till in his line of site the crest of the wave is in line with the horizon. The point where this line of site intersects 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, such as the end of a jetty or moored buoy 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.

("Count 1-1000, 2-1000, 3-1000, etc.") if a watch with a second hand is not available.



## THE OCEAN FLOOR

Ocean basins lie at an average depth of 2 1/2 miles below the surface of the water but have a rough and rugged terrain much like that on land. Plains, mountains, hills, valleys, and gorges lie hidden beneath the water masses. Mountain ranges (ridges) on each ocean floor are connected to create the most massive feature on our globe. Isolated mountain peaks dot the oceans and where they break the surface are islands. Deep trenches cut the crust surface to its lowest points, 7 miles below the surface of the sea.

Shallow ledges extend from the continents below the surface of the seas. These continental shelves vary in width from 20-30 miles to over 100 miles. They slope to a depth of about 100 fathoms before plunging down the steep slopes of the continents.

The continental shelves are the most productive areas of the sea. The sun penetrates through the shallow waters and nutrients from the ocean floor are stirred to the surface. These conditions provide optimal conditions for plant growth forming rich ocean pastures. The shelf areas are therefore the sites of most of the world fisheries.

Activities:

Construct a model of the ocean floor. Modeling clay can be made from 2 cups flour, 2 cups salt and 1 cup water. A plywood square 1 foot by 1 foot can be used as a base. (See chart of ocean floor and definition of various structures on pages 5 & 6 of members book).

## OCEAN CURRENTS

Ocean circulation takes many forms, from water movements which oceanographers call surface currents to deep water currents and vertical movements of water called upwellings. Surface currents are driven by prevailing winds, temperature and salinity differences, and the rotation of the earth. The surface currents form large bodies of water moving in a circular pattern in the oceans. The movement is clockwise in the northern hemisphere and counterclockwise in the southern hemisphere. Surface currents play an important role in regulating world climates by transporting heat absorbed in the tropics to the northern reaches of the world.

The surface current flowing from north to south along our shores is the California Current. It is a portion of the circulation system of the North Pacific Ocean. During the winter, (October - March), strong southwest winds along our coast create a secondary surface nearshore current which flows from south to north and is called Davidson's Current.

In summer, our prevailing winds from the northwest coupled with the turning of the earth from west to east cause warmer surface waters to move offshore. Cold waters from the deep rise to the surface nearshore to replace the displaced surface-water. This action is called UPWELLING and carries cold water and nutrients from the floor of the sea to the surface.

The various water movements along the Oregon coast greatly affect our climate. The cold, upwelled water cools the warm summer air and condensation-fog occurs which often shrouds our coast in summer. During the winter, the warm Davidson's Current moderates our climate. Because of prevailing wind patterns and characteristics of surface currents near the shore, some of the most pleasant weather on the coast occurs in September, October, and in February.

Activities:

Charting Local Currents

You can prepare drift bottles to be placed in the ocean to trace local ocean currents. A drift bottle can be made from soft-drink bottles filled 1/4 full of sand and sealed with a rubber stopper or cork. Drop the bottle into a bucket of water to test its buoyancy. The sand should cause the bottle to ride low in the water but not sink. This insures that water movement and not air movement will be measured. Place a self-addressed postcard in the bottle and seal the cork with paraffin. A local fisherman or perphaps the Coast Guard can place the bottles at sea. Be sure you find out when the bottles were placed in the water. For assistance, contact your nearest marine extension agent

Sample of a Self-addressed, Stamped Drift Bottle Data Card

(post card)

Card Number: 14

Finder's name _____

Address _____

Exact location drift bottle was found _____

_____

_____

Date and hour drift bottle was found _____

_____

_____

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 13.) 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.

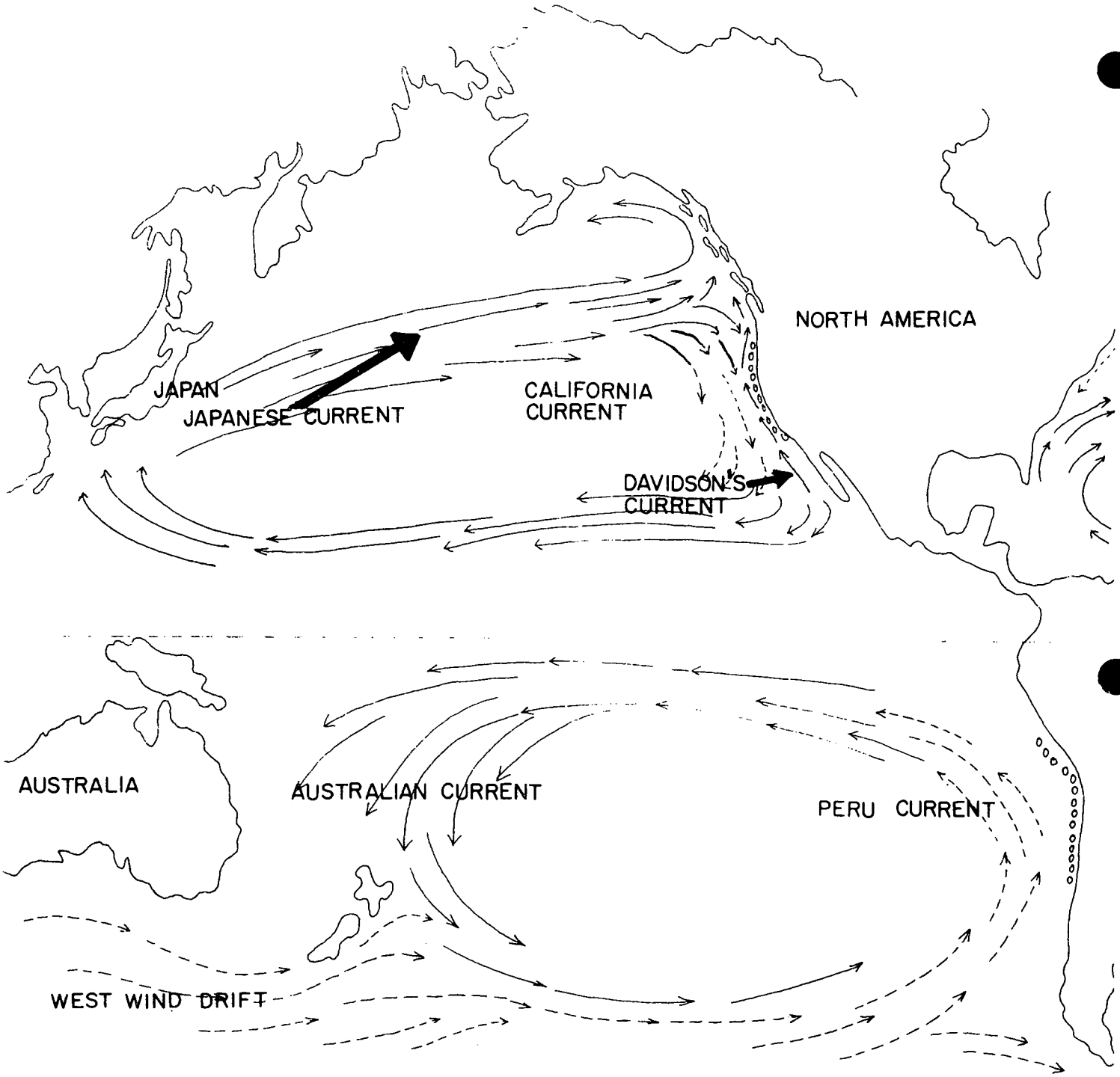
California Current

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 13. 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.

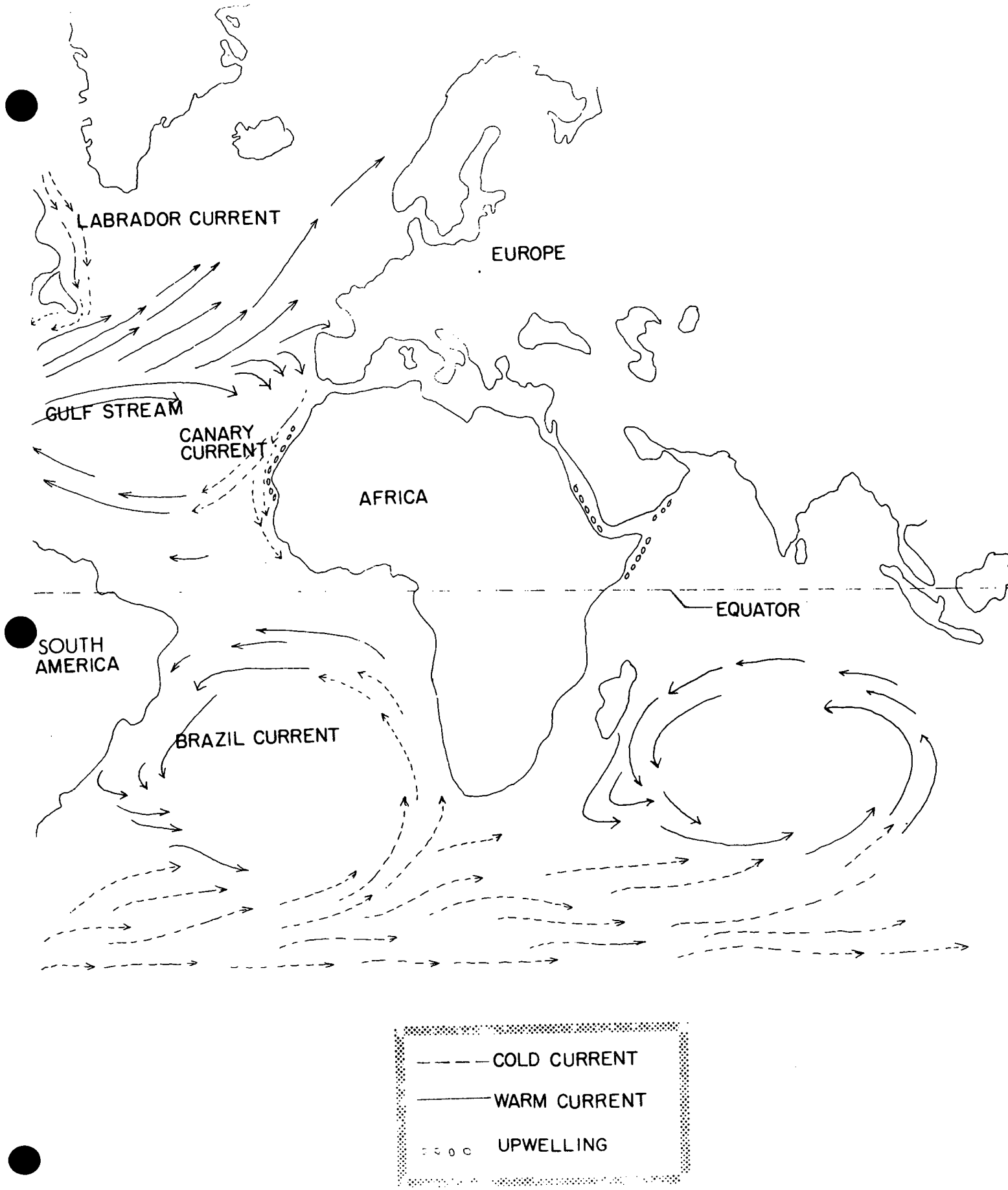
To learn about ocean currents, each member should sketch and label the ocean currents on the map in his project book and indicate if it is a cold or warm current. Let them use the map on pages 8 and 9 of this book as a guide. Each should indicate areas of upwelling. Have your members answer the questions on the Discussion Guide, page 7.

Answers to Discussion Guide on Ocean Currents - page 7 in Project Book.

1. California - the Davidson's 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's Current flows only during the winter (October - March). It is a warm current.
9. Yes.
10. The winds.

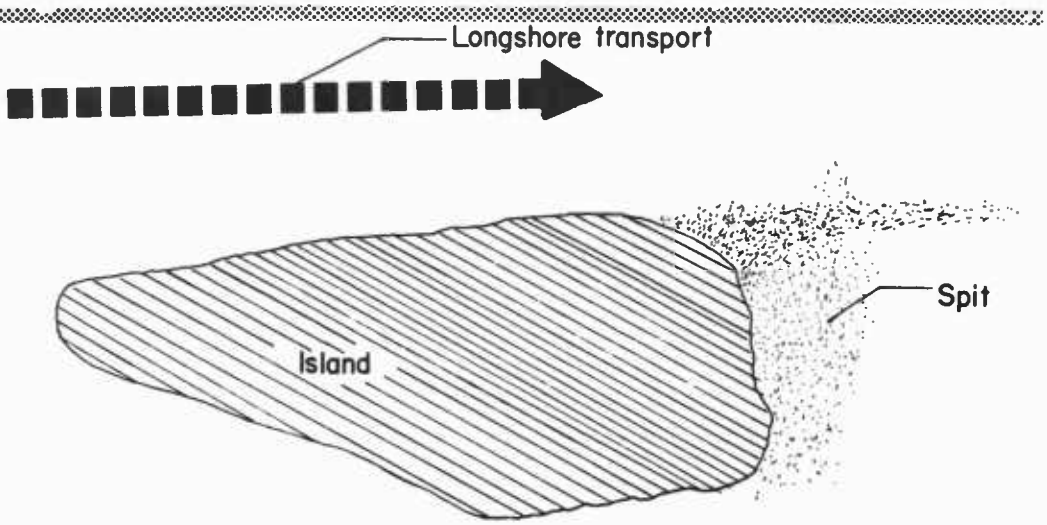



MAJOR OCEAN CURRENTS


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

Longshore Currents

The longshore current is responsible for many of the natural alterations taking place on beaches. It can and does move tons of sand from one spot on the beach to another. For instance, next time you go to the beach notice the sand kicked up by incoming breakers. This sand kicked up from the bottom is moved along by the longshore current. The movement of sand along the beach is called the LITTORAL DRIFT or LONGSHORE TRANSPORT. The effects of the littoral drift can be seen on the ends of island or peninsulas where the longshore current is operating. There, the waves no longer hit against the shoreline and the longshore current loses its energy. Sand is no longer carried along, but settles to the bottom. The results are long extensions of sand on the ends of these islands or peninsulas. We call these SPITS.




Island with a sand spit deposited on the end by the litoral drift.

Another common movement of sand at the beach is a movement offshore and onshore. The results of this movement are long mounds of sand parallel to the beach called SAND BARS. Sand bars are usually present offshore after a week or two of high breakers. When the waves are small for long periods, the sand bar is pushed toward shore and spread out by the waves.

Activities:

To demonstrate the longshore current take along empty bleach bottles, old tennis balls or orange painted pieces of 2 x 4's on a trip to the beach. Upon arrival at the beach, observe the waves to determine the angle at which they are striking the beach. From this observation, guess which direction the longshore current will be moving. To test your theory, throw the floats into the surf. Mark where they entered the water. Observe which direction the water carried the bottles. Mark the beach at 10 foot intervals. Time the bottles and record the speed of the current in feet per minute.

# LIFE IN THE SEA

Life in the sea is divided arbitrarily into two different communities. Plants and animals attached or crawling on the ocean floor make up the BENTHIC community. Those which swim or float in the ocean waters are the PELAGIC community. Members of both interact and some pass from one community to the other during different stages of its life. For example, starfish eggs and larvae drift about the ocean waters until metamorphosis occurs and the larvae sink to the floor to develop into young starfish.

Intertidal and commercial species are the most familiar marine animals but make up only a portion of animals living in Oregon's nearshore ocean.

Activities:

To learn about different forms of life in the sea, have each club member make a scrap book showing different animals of the sea including information about each of the animals they select. Those with cameras may wish to make a collection of photos instead of clipping pictures from magazines.

## PLANT PLANKTON AND THE FOOD PYRAMID

Plant plankton are one-celled plants which drift in the water near the surface. They take carbon dioxide, water and in the presence of sunlight, carry on a complicated chemical process called "photosynthesis". The photosynthetic process creates food which sustains life on this planet and releases vital oxygen into the atmosphere. Plants are the producers and form the base of the food pyramid. All animals (the consumers) must eat plants or animals which have fed on plants. A diagram of a food pyramid is on page 17. The small animals which drift about in the water (zooplankton) feed on plant plankton and convert plant material to animal material. It takes approximately 10,000 pounds of plant plankton to produce 1,000 pounds of animal plankton, which produces 100 pounds of small fish, which in turn produces 10 pounds of large fish, which will in turn produce 1 pound of seal, penguin or man at the top of the pyramid.

Like plants on land, plants on the water must have fertilizer to grow and flourish. In the ocean, much of the fertilizer comes from plants and animals which die and decay. If too much fertilizer is added to the water, plankton grow so rapidly they become crowded, die, and extensive decay is started. This removes oxygen from the water. The fertilizer then becomes a form of pollution.

Activities:

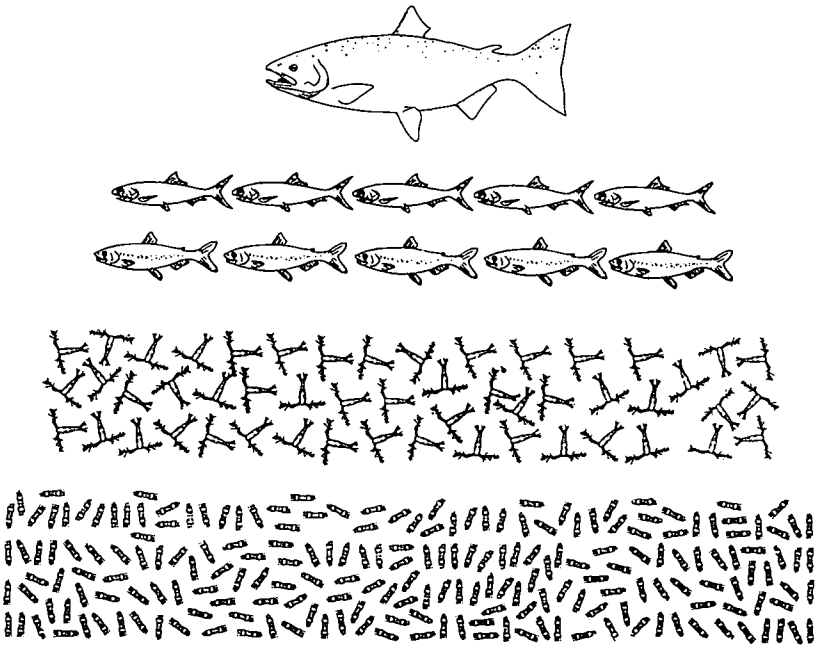
To demonstrate the food pyramid, cut out several models of members of the food chain. Give one to each child, making sure you hand out more producers than consumers. Connect one string from one member of the food pyramid to the next, to show the order of their consumption. When done, have the student hold the web over his head. Cut the string while proposing various problems, such as: a) this plant was killed by pollution, b) this one didn't receive enough sun, c) this consumer died from a disease, d) an oil spill polluted the water and killed both producers and consumers. Discuss what would happen if all the plants in the ocean and lakes were killed.

To demonstrate the effects of fertilizer on the growth of plankton, take two five gallon buckets of seawater or fresh lake-water. Label one bucket "control", and the other "experimental", and place them in a sunny place. Each day add one or two drops or a pinch of household phosphate detergent, or fertilizer, to the experimental bucket. Record water temperature, turbidity, and general appearance. Continue the experiment until water becomes very turbid and green, a plankton bloom. Answer the following questions: 1) Why is the water green? 2) Is there any difference between the two buckets? Explain the difference.

Taken from New England and the Sea; Marine Bulletin #11; University of Rhode Island.

***The Food Pyramid***

**This drawing is an extreme simplification. Actually, *millions* of phytoplankton (bottom layer, *Skeletonema* in this example) are needed to sustain *thousands* of zooplankton (next layer, copepod this time); these zooplankton in turn feed the ten fish in the next layer (anchovies on top, smelt below), which finally nourish one coho salmon. Looked at another way, there is an approximate *weight* ratio of 10 to 1 between levels of the pyramid: it takes about 1,000 pounds of phytoplankton to feed 100 pounds of zooplankton; these would be food enough for ten pounds of anchovies and smelt, which would sustain one pound of coho salmon. And one coho salmon can weigh 35 pounds!**



When at the beach of a lake, a sample of animal plankton (ZOOPLANKTON) can be taken. You can make a plankton net from an old nylon stocking or a pair of pantyhose and a gallon can. Remove both the top and bottom from the gallon can. Attach the stocking or pantyhose to the can by tying tightly to the can with string. Put a small jar in the toe of each leg and tie a string around the foot to fasten in place. Make a handle for the can by punching holes in the top of the can and securing string or twine to its top. You can dip this net in the water on the beach or from a boat dock. As the water is filtered through the fine mesh of the stocking, plankton organisms are collected in the bottle.

To determine the number of organisms per gallon, cubic foot or other measure of volume you need to know how much water is filtered through the net. The easiest way to do this is dip the water with a gallon can and pour through the net. You can then determine the number of organisms per gallon of water.

Empty the collecting jars into dishes and observe the plankton which has been collected. Most of the animals are transparent. Why do you think this would aid the animals? Perhaps their enemies cannot see them as well. Watch the animals weak swimming motions. Can you see why plankton are referred to as drifters of the sea? Many of the animal plankton feed on tiny one-celled plants in the water. Use a magnifying glass to look for feeding structures on the plankton.

# A MARINE AQUARIUM

A sea water aquarium may be set up in a meeting room or your home without the expense of an elaborate cooled water system. Many of the intertidal animals are hardy enough to live in sea water which is kept at cool room temperatures.

Activities:

Set up an aquarium for the display and study of intertidal marine life. A 10 gallon glass aquarium is adequate; however, the larger the volume of water the better the survival of the animals particularly if starfish are used.

Put an inch or more of clean sand or gravel in the bottom of each container. A few broken clam shells to help prevent acidity from developing can also be added. Pour in sea water which was collected on a field trip and let stand for a couple of days before adding the animals. This allows colonies of bacteria to be established which will help to control waste products produced by the animals. The water level should be 3-4 inches below the top of the container so spray zone animals will have a place to congregate in the tank.

Place the animals in the aquaria and mark the level of the sea water on the tank. Evaporation will occur but the proper salinity can be maintained if an equal amount of distilled water is used to replace the evaporated water. Change the water about once a month if possible. The temperature of the water should be kept as cool as possible, at least between 65 and 70 degrees F. This may be difficult unless you keep the room temperature around 70°.

Don't overload your aquarium with animal life. Have only one or two of each species. Sea weeds will dress up the aquarium but will not live long. Animals which will survive quite well in the tanks are some of the common tidepool creatures such as limpets, shore crabs, hermit crabs, anemones, barnacles, chitons, nudibranchs and even starfish (if there is large enough volume of water).

The rules for maintaining your aquarium are few and simple:

1. Don't overload the aquaria with animals and use only the ones listed as they survive best.

2. Feed small chunks of liver or fish every other day. Feed sparingly as uneaten food will foul the water.

3. Keep the water aerated, filtered and cool as possible. Change the water once a month if possible.

4. Let the water stand 1-2 days before adding the animals.

5. Don't use aquaria with metal frames exposed to the sea water.

# SEAWEEDS

Seaweeds (or ALGAE) are plants which occur in the nearshore waters of the ocean. They are attached to the ocean floor and must occur in shallow water in order to receive enough sunlight to grow. They are common in the intertidal region on rocky beaches where they are a hazard to tidepoolers and fishermen. They are extremely slippery and are the cause of painful falls on the rocks.

The algae are simple plants having no stems, leaves or roots, as does a typical land plant. Land plants must have an efficient mechanism for absorbing water and conducting it to all parts of the plant. The roots and stems are essential in this operation. The seaweeds are immersed in the seawater and absorb nutrients necessary for growth and reproduction directly from the water.

Reproduction of seaweeds is vastly different than that of the common land plant. They have no flowers or fruits; rather the reproductive organs are often microscopic and the reproductive stages quite complex. The green grass which occurs on rocky beaches and in bays is the only exception and bears flowers and seeds.

Seaweeds are divided into various groups according to the color pigment contained in their cells. Three major divisions exist, green, red, and brown. Often the apparent color of the plant is enough to classify it into one of the groups. However, some species may appear to be brown but are actually a red or green algae. The large brown algae are called kelp and form dense beds in shallow nearshore waters. In southern California, the beds of kelp are harvested and the plants processed into substances used in tomato sauce, ice cream, face powder, etc.

Activities:

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 to the mounting paper and label. List the name of the plant, the collector, place of collection and the date.

The pressed plants are often attractive and suitable for framing or making a display for a fair.

## FISHING LAWS AND REGULATIONS

Fishing laws and regulations are designed to maintain healthy fish populations while giving each citizen an equal opportunity to enjoy the sport of fishing or pursue the occupation of commercial fishing. Without these laws and regulations, our fish populations could soon be destroyed and everyone would lose the opportunity to fish.

Through flexible laws and regulations and hatchery programs, biologists are able to maintain a balance between the number of fish lost each year (due to fishing, starvation, disease, predation, and so on) and the number gained each year from natural reproduction. In a year of good reproduction, fishing seasons may be extended and limits increased. In a poor year, the season and limits may be reduced. Thus, laws and regulation are important management tools to assure that fish populations are neither depleted nor wasted.

Activity:

The purpose of this activity is to show how different fishing regulations affect the size of fish populations. We will set up three model fish populations (using beans or other small objects to represent fish) of 20 fish each and have different fishing regulations for each population. Each population will have the same yearly natural reproductive rate of 50% (the number of young born each year equals 50% or one half of the number of fish in the population.)

The idea is to follow the three populations through several years of fishing and natural reproduction to see whether the populations' sizes increase, decrease, or remain about the same (Note: in this model, we will not consider the effects of starvation, disease, and so on). For each year in our model, we will simulate fishing by removing fish (beans) from the population and natural reproduction by adding fish (beans) to the population.

For population #1, we will set the regulations so that no fishing is allowed (no fish (0%) will be removed each year). In Population #2, the regulations will permit 25% (one fourth) of the fish to be removed by fishing each year. In Population #3, the regulations will permit 50% (one half) of the fish to be removed by fishing each year.

EXAMPLE

As an example, let's look at Population #2 where regulations permit 25% (one fourth) of the population to be removed by fishing each year. We start with 20 fish (beans). First, we show the effect of fishing by removing 25% (one fourth) of the population (1/4 of 20=5), which leaves us with a population of 15 fish (20-5=15). Next, we add yearly reproduction which is 50% (one half) of the population (1/2 of 15=7 1/2 which rounds off to 8) giving us a new population size of 23 fish (15+8=23). We have now completed one year of fishing and reproduction:

Population #2 (25% of fish removed yearly by fishing)

```
 20 fish (population size at start)
- 5 fishing (25% of 20)
 15
+ 8
 23 fish (population size after one year)
```

Continue this process for several years for each of the three populations.

Answers to Fishing Laws and Regulations Discussion Guide:

1. Population #1 increased in size. Population #2 remained about the same. Population #3 decreased.

2. a. 25%
   b. 50%
   c. 0%
   d. 25%

3. 25%

4. They would increase to such number that they would starve.

5. The fish population would be depleted from over-fishing.

6. Strong conservationist views may be that no fish could be taken and a situation as occurred in example 1 might result. Also strong pressure to allow more fish to be taken can result in depletion of the resource due to over-fishing as shown in example 3.

# FIELD TRIPS

## CLAMMING

Take a field trip to the coast to go clamming. Materials needed: clam shovel, a bucket, boots and tide book. There are various clams found on the Oregon coast and various methods for digging and preparing them. For information, see OSU SG 28, "Oregon's Captivating Clams," available from Oregon County Extension Offices. For information about where to clam, ask at a local bait shop, check with Marine Extension Agents or simply follow a bay road and watch for other diggers.

## CATCHING AND COOKING CRABS

Two species of crabs are important in the Oregon sports catch. One is the Dungeness or market crab (Cancer magister). This crab is yellowish-brown in color. Another group of crabs, known as rock crabs, are more reddish in color and have black markings on the tips of their pinchers. Both can be caught in Oregon bays using crab rings.

Reproduction takes place in the spring when the male fertilizes a female who has just shed her shell (molted). When first hatched, crabs are free floating microscopic larvae. In 3 to 5 months they have grown and settle down to the bottom. Crabs grow only when they mold (shed their shell and form a new one). The average Dungeness, market crab, is estimated to mold 13 times before it reaches a legal commercial size after about four years of life. Crabs eat fish and shellfish, and contrary to popular belief, they prefer fresh material.

Activities:

As a club project, a crab ring can be built. You may want to improvise if some materials are not available. If all else fails, crab rings may be purchased at sporting goods stores or rented at boat shops. You will need:

1. Two rings - one approximately 30" in diameter of 5/8 inch steel rod or cable; one approximately 26" in diameter of 3/8 inch steel rod or cable.

2. Side Netting - the side netting should be approximately 16" in depth using 1/8" cotton, nylon or linen net twine. The net mesh should be three or four inches. Shuttles for weaving nets are available from sporting goods stores. Also tennis netting may be used.

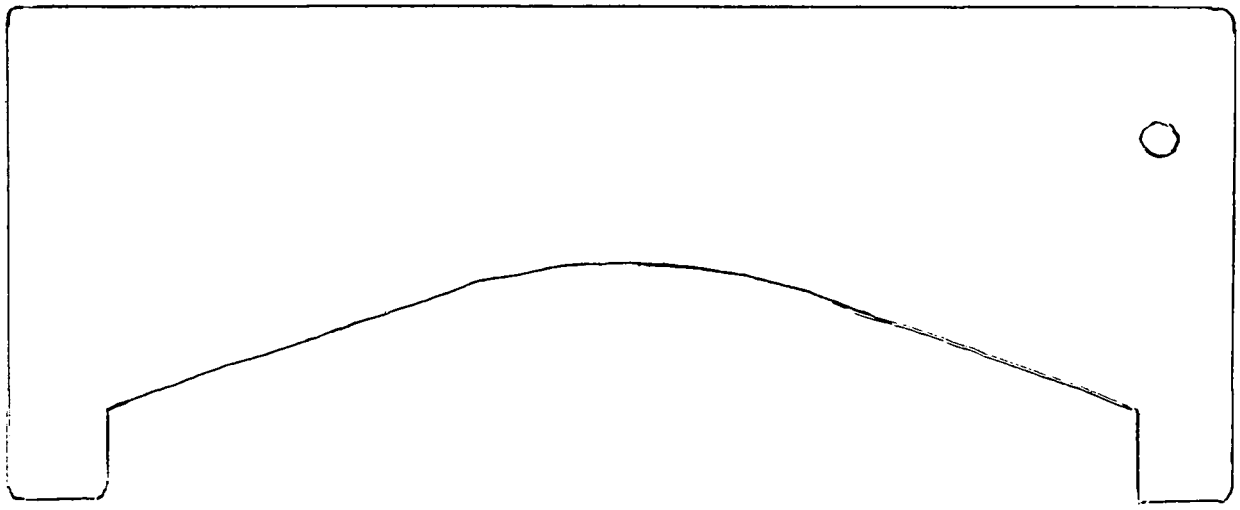
3. Bottom Netting - galvanized 2" mesh chicken wire is best.

4. Lines - a bridle is made by attaching three equal length, 1/4 to 3/8", lines to the top ring. A metal ring or a loop is needed to connect the pulling line. A length (25' to 50') of 3'8" line is needed for pulling the crab hoop net. If you are fishing from a boat a float will be needed (plastic jug). Plastic jugs work well and two floats per net are recommended as one is often lost.

5. Bait Holder - the type of bait holder depends on the bait. A fish carcass can be attached directly to the bottom netting. If squid, small fish, or clams are used, a small plastic jar (or baby food jar) with holes punched in it is very effective and protects the bait.

A crab measure can also be constructed by each member or as a club project. Materials needed are: 1/2 " plywood 7 inches by 5 inches rectangle, jigsaw, paint, string. Draw a carb measure on the piece of wood using the pattern given below. Cut it from the wood using a jig saw. Paint or seal with varnish.

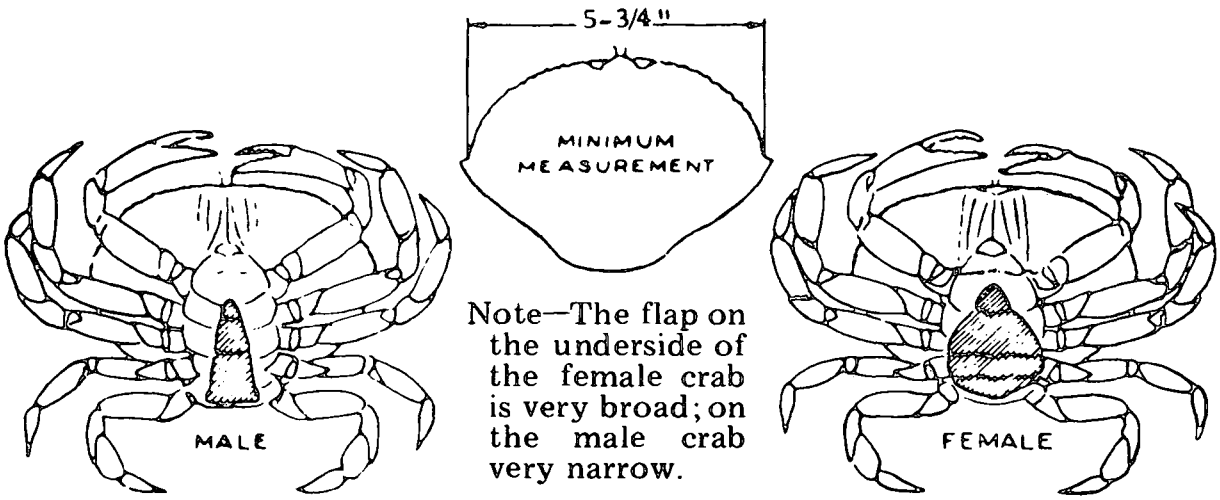
To use, place the ends of the crab measure over the top of the crab's back at its widest point, not the spine tips. If it touches both sides of your measure, 5 3/4 inches, the crab is large enough to take, provided it is a male crab.



Crab Fishing

Crabs are "opportunity feeders" and the best baits seem to be razor clams, herring, anchovies, squid and fresh fish carcasses. When fishing with squid, small fish or clams, a plastic container or baby food jar with holes will make your bait last longer. After baiting up your hoop net, let it down to the bottom. Check it every 15-20 minutes.

Only male Dungeness crabs over 5 3/4" may be taken. Daily limit is 12 male crabs per day. There are no restrictions on the size, sex or bag limit for the rock crabs. Be sure to check the Sportsfishing Regulations for changes in the laws as the regulations may change year to year. The drawing on the next page indicates how to sex the crabs.




Note—The flap on the underside of the female crab is very broad; on the male crab very narrow.

Cleaning and Cooking Crabs

Crabs may be cleaned before or after cooking. They have a better flavor if cleaned before cooking. The cleaning procedure is as follows:

1. Remove the carapace (back) of the crab by forcing the rear edge of shell against a solid object.
2. Break crab in two by folding it like a book--first up, then down.
3. Shake out viscera from each half.
4. Shake off gill filaments. Nothing remains except shell and edible meat.

Crabs should be cooked alive if uncleaned or as soon as possible after cleaning as they spoil quickly.

1. Add 1/4 pound of salt per gallon of fresh water, or use salt water.
2. Bring to a boil; add crabs, cook 12-15 minutes after the water begins to boil again (20-25 minutes for uncleaned crabs).
3. Remove crabs and immediately immerse or spray in cold water.
4. Then chill and crack crab and serve.

# 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. Food preparation before the trip cannot be over emphasized.

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.

Habitat---
Observe the specific habitats for each animal. Examples might be surge channels, tidepools, in holdfasts of algae, or under rocks.

## Rules to Follow While at the Beach:

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.

## ANSWERS TO ROCKY BEACH FIELD TRIP GUIDE

| | Wave Survival | Protection From Drying | Level On Rocks | Habitat | 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 |
| White 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 area 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 | Habitat | 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* sp. | 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 and cavities | 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.

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
Fort Clatsop National Memorial

Seaside

Seaside Aquarium

Tillamook

Pioneer Museum
Trask Hatchery
Nehalem Hatchery
Netarts Chum Salmon Hatchery, OSU Facility
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
Lincoln County Historical Museum

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

Oregon Prehistoric Gardens
Elk River Salmon Hatchery (Fish Commission)
Cape Blanco Coast Guard Station (Western most point in Oregon)

Places of interest to visit - cont.

Bandon

Shipping Docks
Bandon Fish Hatchery (Game Commission)
Cheese Factory

Gold Beach - Wedderburn

Boat building shops (4)
Rogue Bay Cannery

Brookings - Harbor

Commercial and sports fishing fleet
Seafood processing plants (3)

# ARTS AND CRAFTS

## JAPANESE FISH PRINTING

The technique of Japanese fish printing has been used in Japan for over 100 years to record catches of sports fish and to gain ichthyological (fish biology) information. These prints have even been used at the University of Washington to study how the physiology of a fish is related to its surface area.

The arts of fish printing is a good way to gain an understanding and appreciation of the beauty and great variety of fish. You can also use this technique for making prints of shells, rocks, flowers, and other items.

Before you make a print, identify the fish. What are the distinguishing characteristics of the fish? Study the life history of the fish. Where and how was it caught?

Materials:

Obtain a very fresh fish, flounder, bluegills, or rockfishes are good to start with. If you buy the fish at a market, select one that has bright red gills, clear eyes and a fresh smell. If the fish has been gutted, make sure that it has not been cut anywhere else on the body. You will also need: newspaper, plastic modeling clay, pins, water-base ink (linoleum block ink is best) a stiff 1/2 inch brush and rice paper or newsprint.

Method:

Use soap and water to clean the outside of the fish as completely as possible. The cleaner the fish, the better the print. Dry the fish well.

Place the fish on a table covered with newspapers. Spread the fins out over some clay and pin them in this position. Continue to dry the fish.

Brush on a thin even coat of ink. Leave the eye blank. It can be filled in after the print is made.

Place a piece of newsprint or rice paper over the top of the fish.

Carefully lay the paper over the entire fish. Use your fingers to gently press the paper over the surface area of the fish. Be careful not to move the paper too much since this results in double prints. Then remove the paper and you have a fish print. A small brush can be used to paint the eye.

A collection of fish print can be made displaying various types of fish. The prints can also be framed and displayed in the home or used as a project for fairs.

Adapted from California 4-H Marine Project, University of California.

## DRIFTWOOD MOBILE

Materials scavenged from the beaches can be used for various art projects. Driftwood and shells can be hung and arranged into attractive mobiles.

Materials:

Nylon fishing line or thread, driftwood, shells, screw eyes.

Method:

Select a long slender piece of driftwood to act as the main beam from which the other pieces of wood and shells are to be attached.

Hang wood pieces or shells from the main beam in a balanced pattern.

The screw eyes can be screwed into the wood to form an attachment for the line.

When completed, hang in an area with air currents.

## SAND PAINTING

Attractive textured paintings can be made from different colors of sand from our beaches.

Materials:

White glue, cardboard, pencil, brush, two types of sand: either different colors or different grain size.

Method:

Select a piece of cardboard the size the painting is to be.

Sketch a simple line drawing on the cardboard. The less complex the drawing the better. A sailboat, fish or tree are good subjects for sand painting.

Paint the interior of the outline with glue. Sprinkle one color of sand over the picture. Let dry. Dust off excess sand.

Paint the background of the painting with glue. Sprinkle other type of sand over the painting and let dry. Dust off remaining excess sand. Frame.

## 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

2 1/2 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.

## 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 seaand 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 explorations?

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 algae 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?

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