$1.00

# Our Water World

## 4-H Marine Science Discovery Project

***Leader Guide***

OREGON STATE UNIVERSITY
EXTENSION SERVICE

4-H 350L
Reprinted July 2001

# Contents

# Introduction

This book is offered to youth leaders and teachers as a tool to help young learners discover some of the wonders that the sea has to offer. It is also a tool for youth development.

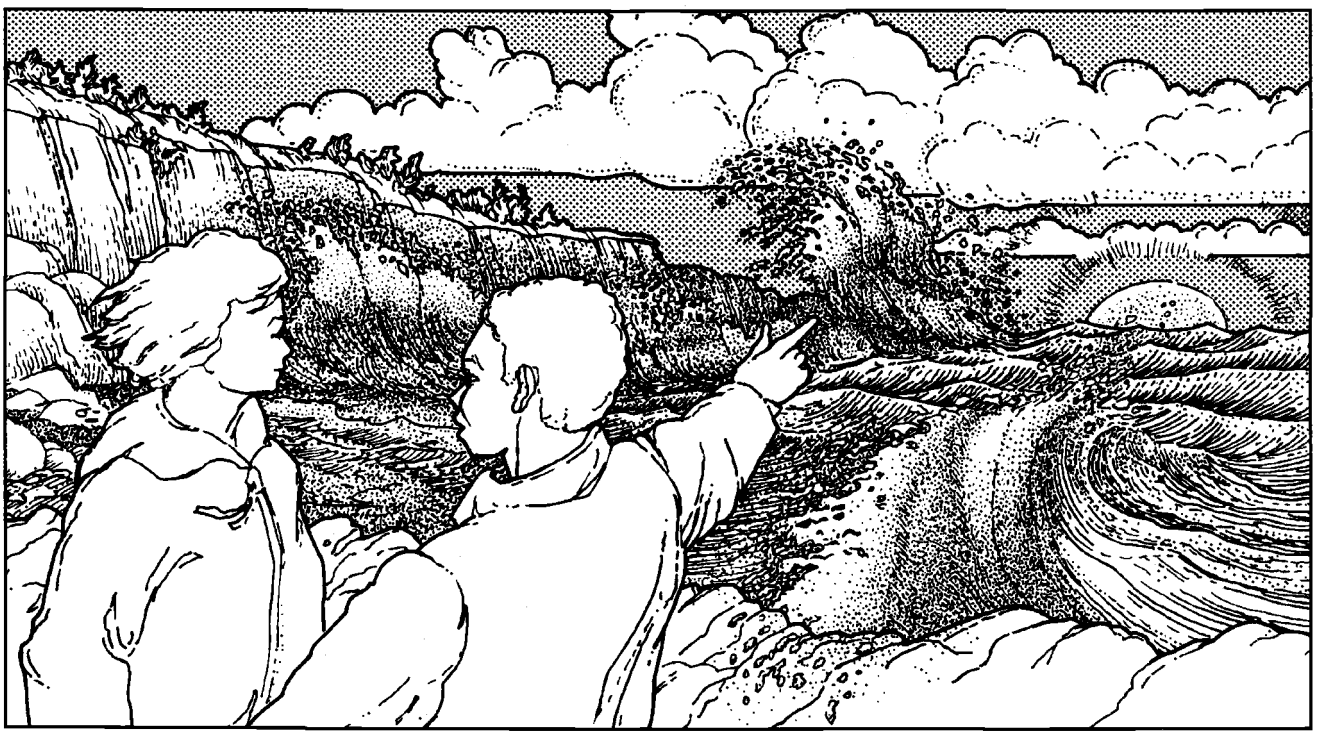
The goal of youth programming is to provide developmentally appropriate opportunities for young people to experience life skills, to practice them until they are learned, and be able to use them as necessary throughout a lifetime.

In each lesson in this curriculum, youth will have the opportunity to practice one or more life skills. In addition, they will understand the importance of the ocean's various roles in the lives of Oregonians. Combining life skills with science literacy will create a solid foundation for a life-long learner.

It is not necessary for the leader to have a science background to use this manual. It is good for children to see adults as learners too. In each activity, supporting information is provided in a background section or as part of the procedures section. Follow-up activities are suggested after some lessons. Member's Record Book pages accompany most of the activities. Leaders should duplicate as many copies of the Record Book pages as needed for the learners. Ask learners to purchase a three-ring notebook in which to keep their Record Book pages.

Different groups have different interests. Leaders can pick those lessons of greatest interest to their learners. It is not necessary to complete the activities in any particular order, although they are placed in the book in a suggested sequence. It is hoped that teachers/leaders will explore and discover with their learners the many fascinating aspects of "Our Water World."

Schoolteachers will find that students will be able to demonstrate capabilities in specific Oregon Department of Education Grade 5 Benchmarks through participation in these lessons. At the time these lessons were under development, the benchmarks listed on the following page were targeted.



# Oregon Department of Education Content Standards—Grade 5 Benchmarks

## *Unifying Concepts and Processes of Science*

- Identify interactions among parts of a system.
- Use models to explain how objects, events, and/or processes work in the real world.
- Describe actions that can cause or prevent changes.

## *Physical Science*

- Identify examples of gravity exerting force on an object.

## *Life Science*

- Describe the basic needs of living things.
- Describe the relationship between characteristics of specific habitats and the organisms that live there.
- Describe how adaptations help an organism survive in its environment.

## *Earth and Space Science*

- Describe the earth's place in the solar system and the patterns of movement of objects within the solar system.

## *Scientific Inquiry*

- Ask questions and make predictions that are based on observations and can be explored through simple investigations.
- Design an investigation to check predictions.
- Collect, organize, and summarize data from investigations.
- Analyze, interpret, and summarize data from investigations.

## *Science in the Personal and Social Perspectives*

- Describe how daily choices of individuals, taken together, affect global resource cycles, ecosystems, and natural resource supply.

## *Geography*

- Examine maps to locate places and interpret geographic information.
- Explain how physical environments are affected by human activities and present opportunities, constraints, and hazards.

## *Social Science Analysis*

- Identify and study two or more points of view on an event, issue, or problem.
- Explain characteristics of an event, issue, or problem, suggesting possible causes and results.
- Identify a response or solution and explain why it makes sense, using support from research.

# Planning Field Trips

A field trip is an exciting way to expand on the activities you will be doing in your regular meetings. A trip to the seashore may allow some members to see and do things they have never experienced before. Along with new discoveries, a field trip enables members to see first hand the principles and processes discussed at meetings and in books. A good field trip is planned well in advance. Poor planning may result in wasted time and missed opportunities.

Planning a field trip begins with the objective or purpose for making the trip. Clear understanding and communication of these goals and objectives will earn you the support of parents and help your group members know what to expect from the trip.

## *Safety at the Coast*

When working with any group, safety is always a concern. Accidents do occur on the beach, yet many could have been avoided. Some simple precautions and guidelines can help ensure a safe and enjoyable trip to the beach.

### Rocky Tidepools

- Visit the beach an hour before low tide so that you are exploring the beach on an out-going tide.
- Do not wander to the outermost rocks. There is the danger that variable waves will splash onto the rocks.
- Algae-covered rocks are slippery. Require good foot wear and move with caution.
- Many beach cliffs are old sand dunes. They are eroded and often unstable, posing a danger to those who come too close to the edge.

### Sandy Beaches

- Swimming in Oregon's ocean waters should be approached with caution. The water is very cold and hypothermia is a potential risk.
- Variable waves of unexpected size, called "sneaker waves," can swamp the unwary swimmer.
- Rip currents or undertows occur along sandy beaches. These currents are created by a narrow band of water flowing from the beach into the sea. Swimmers caught in these currents can panic and tire out fighting to swim back to shore. By swimming parallel to the beach instead, the swimmer will move out of the current and be able to return to shore.
- Beach combers should stay away from drift logs, especially at high tide. Even a small wave washing under a log can cause it to float and roll. There is usually at least one death a year from such accidents on the Oregon Coast.

### Boating in Oregon Bays

- Every person in the boat should wear a lifejacket. Oregon law requires children age 12 and under to wear fastened, appropriately sized lifejackets on both motorized and nonmotorized craft.
- Be aware of the tidal action, especially if boating near the

mouth of an estuary. Strong tidal currents can carry small craft out to sea and into rough ocean swells.

- Take precautions against hypothermia. Exposure to cold Oregon waters can bring about hypothermic conditions quickly. Hypothermia can be fatal.

### Before the Trip

- Set your goals—What is it that you and the learner want to accomplish on this trip? What experiences do you want the learners to have? Do they need any prerequisite skills or knowledge in order to get the most benefit from these experiences?
- Consider your local resources. Is there a way that you can accomplish your goal without travelling?
- If at all possible, visit the field site before taking the group. Find out necessary details about expenses, facilities, hours, tides, etc. If you are going to collect specimens, be sure that you have the proper permit and location.
- Compile an equipment list for the members that takes the season into account. Cold, wet children have little learning potential. If they are properly dressed, however, the weather will be less likely to disrupt your plans.
- Compile a trip equipment list that includes first aid kit, garbage sacks, whistle, clipboard, collecting equipment, and anything else you need to accomplish your trip goals. Take extra pencils, coats, hats, and lunches in case someone forgets theirs.
- Distribute and collect permission slips from youth. Recruit parents or other adults to go along. Expectations of adult leaders need to be clearly defined.
- Prepare a list of the names of the participants. Give one to every chaperon and leave one with a responsible adult at home. If the adults accompanying your group do not know all the members, make name tags for everyone.
- Be sure that you know the best route to take to the field site. Discuss this with the driver(s) prior to leaving. Remember to consider parking and turning needs for buses.
- Discuss with the leaders appropriate conduct for the trip. Make certain that they understand the consequences for inappropriate behavior, and follow through if necessary. Explain the need for adequate clothing and footwear.
- Actively involve club members in planning the activities. Get them involved in gathering materials, constructing equipment, researching the physical characteristics of the area, writing to the Chamber of Commerce, etc.

### On the Trip

- Appoint one member in each group to be responsible for equipment.
- Remind the learners before departing of the purpose of the trip, the appropriate conduct, and the schedule.
- Remind the parents of the time and place that they are to meet you on your return.
- Distribute materials the learners will need.
- Allow learners to work at their own speed. Listen, observe, and ask pertinent questions to encourage progress.
- Jot down ideas for additional projects and activities as they occur to you or the learners.
- If you turn over rocks, be sure to return them to their original position. Any animals collected for observation should be returned quickly to their pool or rock.
- Leave the area better than you found it.
- Be calm and flexible when plans must be changed. Model good problem-solving behavior for the children.

### After the Trip

- Discuss with the learners the investigations and how they apply to their project work.
- Help the learners compile information gained on the trip and relate it to the concepts in the area of study. This is a process that will be helpful throughout their 4-H project work experience.
- Enlist members' help in writing thank-yous to adult chaperons, guest instructors, and institutions that supported or hosted your visit.

# The Water Cycle—From Ocean to Land and Back Again

## Concept

The water on our planet is a finite resource that is naturally recycled. Its movement from clouds to precipitation to stream to river to ocean and then, by evaporation, back to clouds again is called the water cycle. The energy that powers the water cycle comes from sunlight and gravity.

## Life Skills

Learners will practice:

- Critical thinking

## Time

20 minutes

## Materials

- Clear glass
- Ice
- Round flask
- Water
- Dictionary

## Procedure

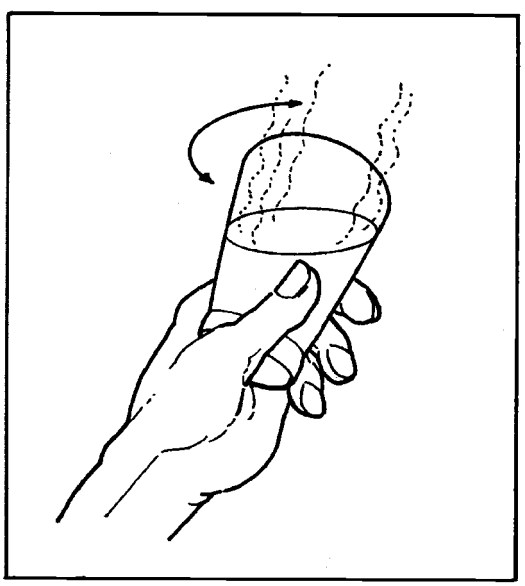
*Where does water come from? How does it get there?* Continue this line of questioning until the children come full circle back to the original source that they named. *It's kind of like a circle, isn't it? Does anyone know what that circle is called?* Chances are, the children already will have learned about the water cycle.

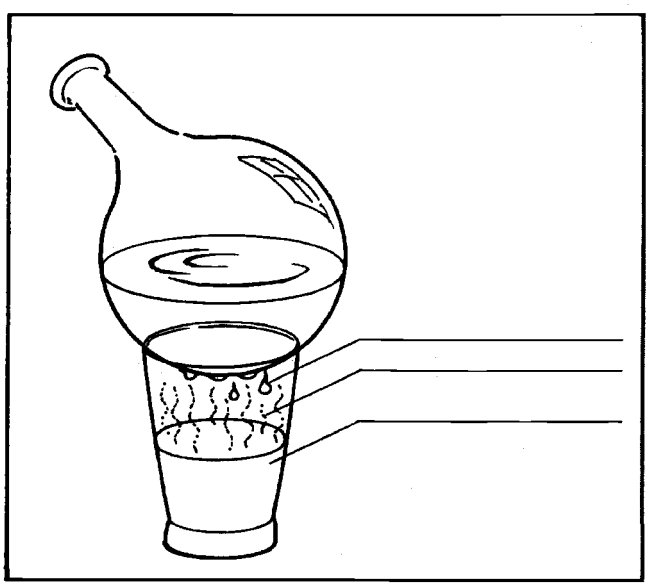
*Today we are going to make a miniature water cycle.* Heat some water until it is near the boiling point. Place it in a drinking glass and rotate the glass so as to moisten the sides clear to the top edges. Place some ice water in a round flask and set it on the top of the glass as shown.

Have the children label the parts of the illustration in their record books. Look up the words *evaporation*, *condensation*, and *precipitation* in the dictionary. Describe which process is happening in each part of the experiment.

## Follow-up Activities

1. Make or look at a terrarium. Why don't you have to water the plants inside? How is this like the water cycle?
2. Watch the evening weather report. Find out where most of the rain clouds in your area come from and where they are going after they pass over you.
3. Go to your local library. Look up information on rainfall for cities across Oregon. Make a map of the annual rainfall of Oregon. Why does the western part of the state get more rainfall than the eastern part?



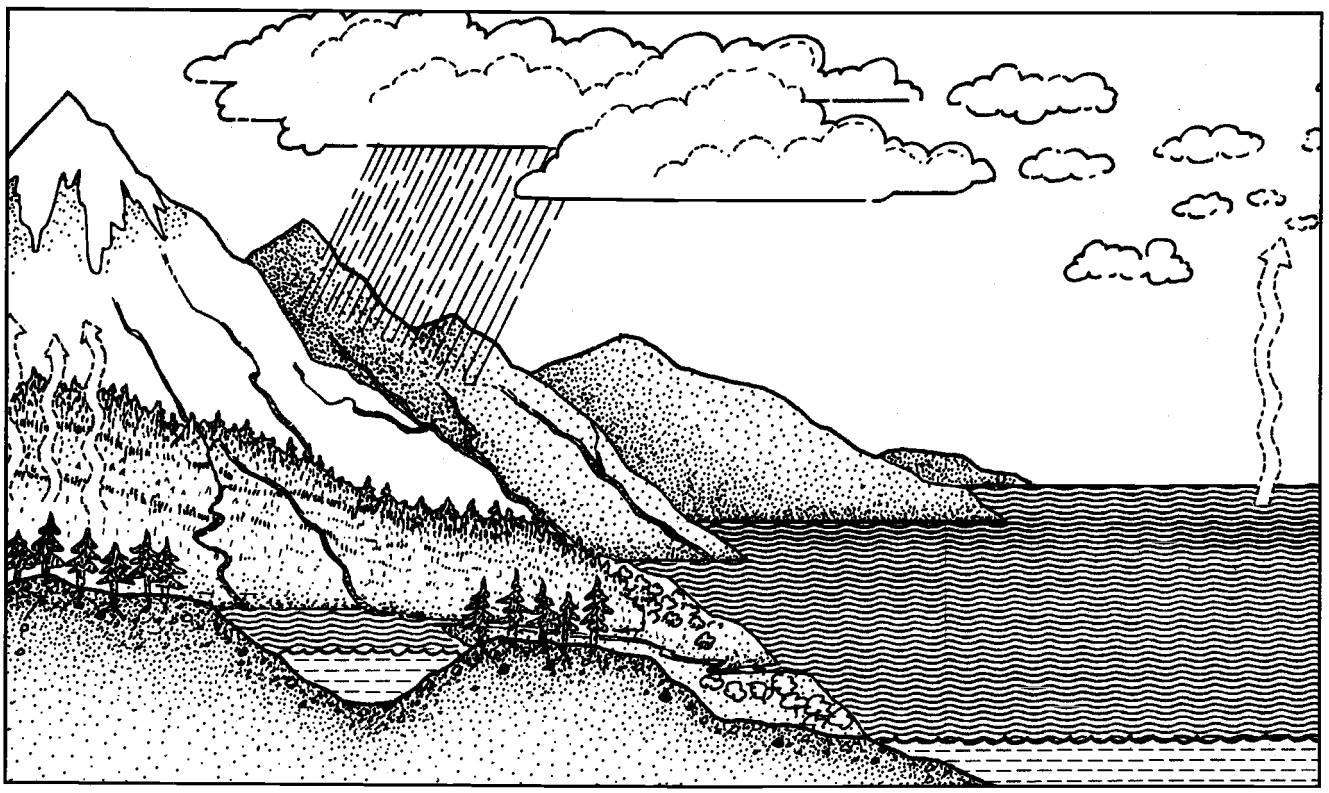


# Member's Record Book

## The Water Cycle

Date _____

Place each of the following words in the right space to illustrate water as found in nature: lake, cloud, rain.



Write the definitions of these words:

Evaporation _____

_____

Condensation _____

_____

Precipitation _____

_____

Describe any follow-up activities you did: _____

_____

_____

_____

_____

# The Ocean's Tides

## Concepts

Tides are the response of the ocean's waters to many interrelating forces. The primary forces are the pull of the moon's gravity and, to a lesser degree, the sun's gravity. The sun, even though it is much larger than the moon, has a smaller effect because of its greater distance from the earth.

## Life Skills

Learners will practice:

- Critical thinking
- Learning to learn

## Time

1 hour

## Materials

### Activity 1

- Hula-hoop
- String: 4-foot segment and 15-foot segment
- Sample tide table
- Globe or world map

### Activity 2

- A copy of the Earth, Sun, Moon, and tidal bulge model page for each learner

*A supply of*

- Crayons
- Scissors
- Glue
- Two brass brads (paper fasteners)/ model
- Rulers
- Pencils
- Sheets of tagboard or stiff paper

## Procedure

Lead the learners in a discussion of their experiences with tides. Ask them what they know about the forces that cause tides to change. Some children may have gone clamming and will know that the clam beds are exposed at low tide. Others may have noticed the change in tide level as they played on the beach. Large ships must wait for a high tide to move safely in and out of some harbors.

The causes of tides is a complex topic. To assist in visualizing the effect of the forces that create tides, ask students to imagine they are looking at the earth's North Pole from space. Imagine that the earth is completely covered with a layer of water—there are no continents visible.

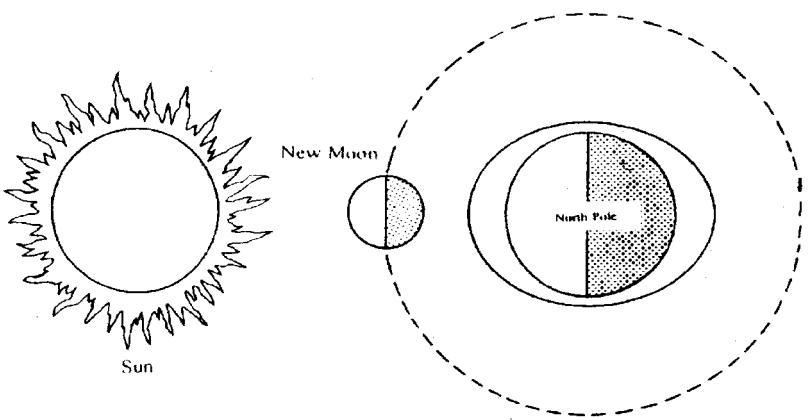
The layer of water covering the earth responds to the gravitational pull exerted by the moon and the sun. The sun, even though it is much larger than the moon, has a smaller effect because of its greater distance from the earth. The water also responds to the centrifugal force caused by the rotation of the earth. Remember that the tide has a high point and a low point. In the diagram below, the moon and the sun are on the same side of the earth. Two tidal "bulges" are present on opposite sides of the earth. Because there are two bulges, there generally are two tides per lunar day. A lunar day is 24 hours and 50 minutes. The earth makes one complete rotation relative to the moon each lunar day. Because the earth is turning in relation to the tidal bulge, any particular location on the Oregon Coast will move through both of the tidal bulges in a lunar day.

The earth, the moon, and the sun are moving constantly in relation to each other. The moon orbits the rotating earth. Both the moon and the earth orbit the sun. The path of the orbits is an ellipse, not a circle. In addition, the earth's axis is tilted with respect to its orbit about the sun. The moon's orbit is also at an angle to the earth's orbit. The relationships of the earth, the sun, and the moon are constantly changing in a predictable pattern.

### Activity 1: Hula-Hoop Tides

Select three learners to help enact the formation of tides. One will be the earth, one the moon, and one the sun. The layer of water covering the earth will be represented by a hula-hoop. Have earth stand in the center of the hula-hoop.

Cut the string into a 4-foot segment and a 15-foot segment. Tie the shorter segment to the



hula-hoop and have the learner who will be the moon hold the other end. Since the moon is closer to the earth than the sun, it exerts a much stronger gravitational pull. Water on the earth responds to the pull and forms a bulge. This is high tide.

The earth's water also is affected by the gravitational pull of the sun. Tie the 15-foot segment of string to the hula-hoop. The learner who is the sun holds the other end. Initially, have both sun and moon stand on the same side of earth (see diagram on previous page). Earth, meanwhile, should hold the hula-hoop with one hand near the strings and the other hand on the opposite side. Have the sun and moon pull the strings gently while earth counteracts the pull by pushing out on the opposite side of the hula-hoop. This will elongate the hula-hoop, creating an oval. The two sides of the hula-hoop farthest from earth are the two high tide bulges. The narrower part of the hula hoop oval represents the low tides. The high tide on the side away from the moon and the sun is caused by centrifugal force. The range between the high and low tides is extreme. This is called a Spring Tide (see diagram on page 12).

For some learners, this may be a good place to stop the lesson or to go on to the **Model Building** activity. The next demonstration concerns the movement of the moon and the sun in relation to the earth. This may be difficult for learners to visualize.

Have the sun and the moon move so that they are at right angles to the earth. Both the sun and the moon should pull gently on their strings. The sun and the moon are both exerting a gravitational pull on the earth's oceans, but they are working against each other. The high tide bulges are not as high and the low tides are not as low as in the Spring Tide. This is called a Neap Tide (see diagram on page 12).

Refer to the tide table and note that every other week there are extreme tides, the Spring Tides, followed by a week of not so extreme tides, the Neap Tides.

Place the hula-hoop on the floor, but have the earth, sun, and moon continue to stand. Ask questions about the movement of these bodies. *How often does the earth rotate?* (Once every 24 hours.) *How long does it take the moon to go around the earth?* (28 days.) *How long does it take for the earth to go around the sun?* (365 days.) *In the course of 1 day, will the moon move much?* (No.)

Have the *earth* turn around once while the moon moves one step in the same direction around the hoop. Now imagine that the tidal bulge stays pointed toward the moon. *Count how many high tides and how many low tides the earth-learner's right shoulder goes through as it rotates once more.* (Two of each.) It might help for you to pin a sign that says, "Oregon" on the earth's right shoulder. *Will the tides be at exactly the same time every day?* (No.) *Why not?* (Because the moon is moving a little bit each day.)

Continue the demonstration until the group can describe how the movement of the earth and moon dictate the height of the tide at any given time and place. Some learners may be able to figure out approximately how long each tide lasts, and whether the tide will be earlier or later each day. Have the learners consult a tide table to confirm their predictions.

### Activity 2: Model Building

This model will show how the earth rotates through the tides, and the orientation of the tidal bulge toward the moon. It will not show fluctuation in the height of the tide. The leader should construct a model before the lesson for learners to see a finished model.

Distribute the supplies for Activity 2 to the members. Have them color the earth, sun, moon, and tide figures and then cut them out. The earth figure is shown as it would look from space over the North Pole. Using a ruler, cut a strip from the long side of the tag board that is 15 inches long and ½ inch wide. Cut another strip the same width, 4 inches long. Glue the cutout figures on to tagboard and cut them out again.

Glue the tidal bulge to one end of the 4-inch strip with the long sides of the oval along the length of the strip. Pierce the center of the moon and the end of the 4-inch strip opposite the tidal bulge. Using a brad (paper fastener), fasten the moon to the 4-inch strip.

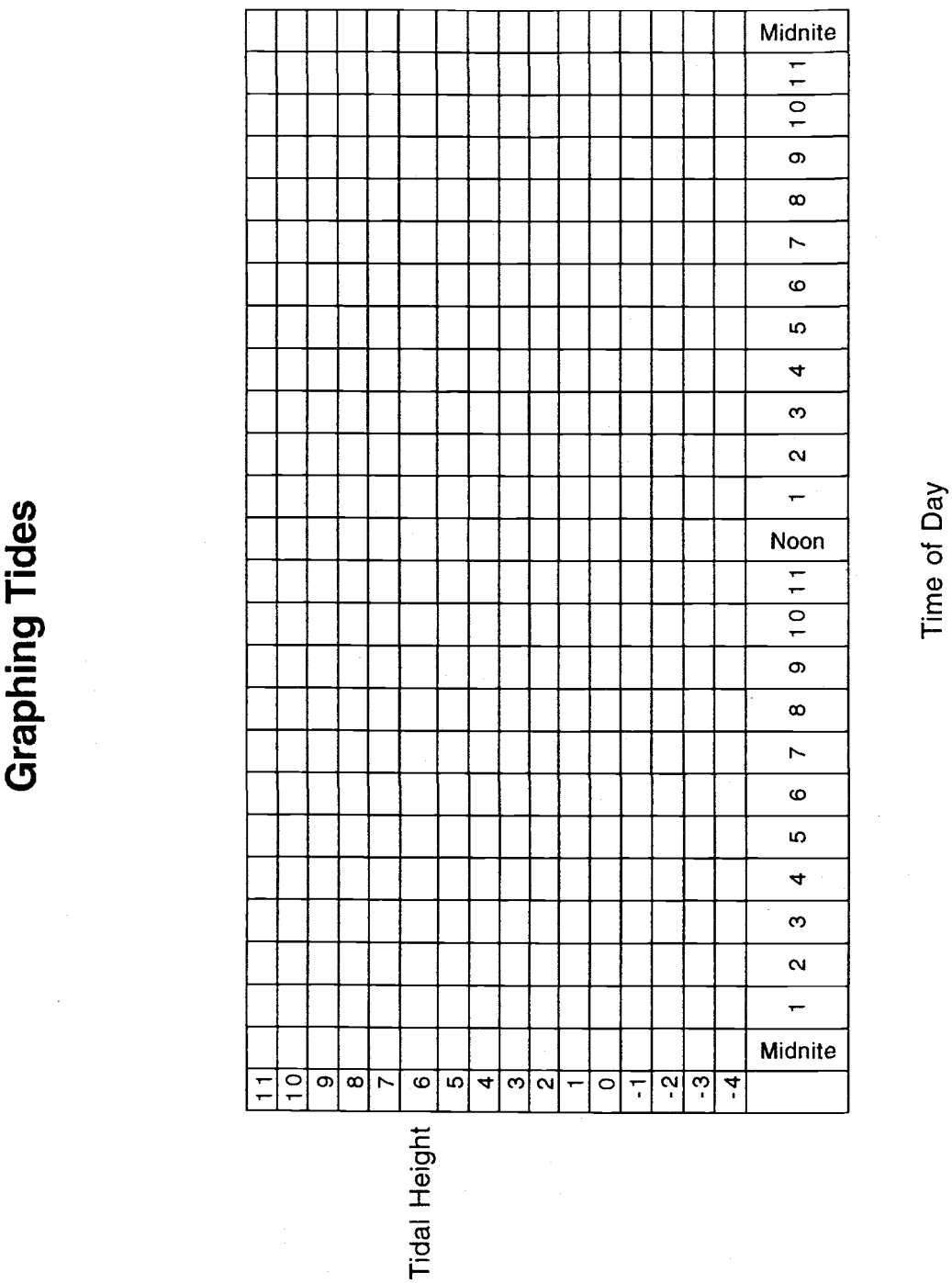
Glue the sun to the end of the 15-inch strip.

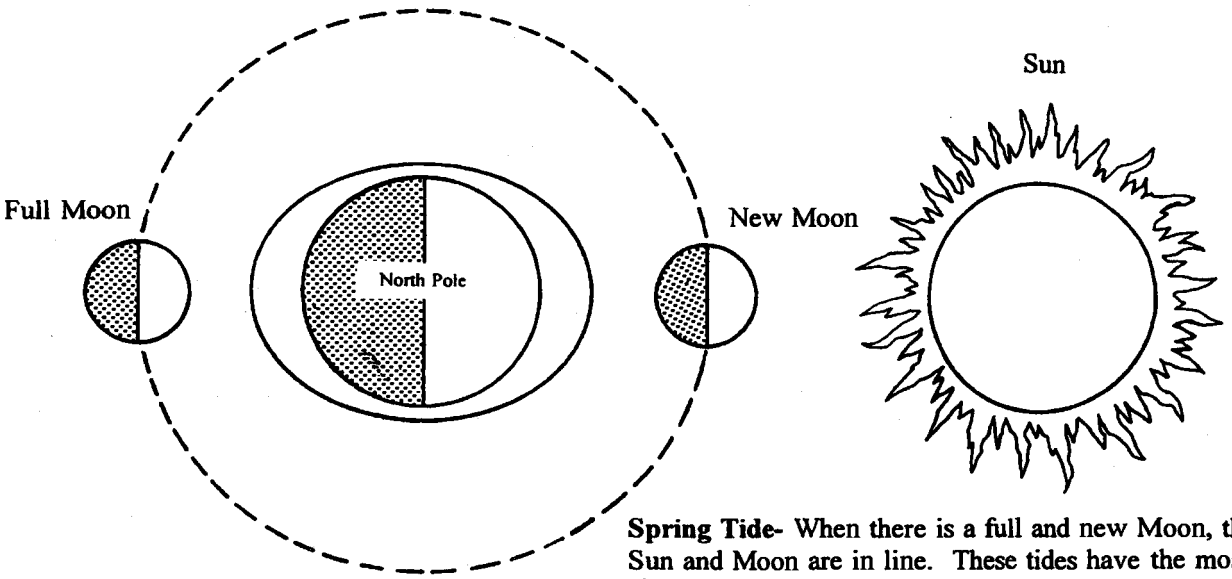
Stack the figures so that the earth is on the top, the tidal bulge with the moon attached is in the middle, and the 15-inch strip with the sun on the end is on the bottom. Pierce a hole through the three layers at the center of the earth and insert a brad (paper fastener).

The earth figure can now be rotated through the tidal bulge. Ask learners to arrange the figures to show a Spring Tide and then a Neap Tide. Remember to rotate the light side of the moon toward the sun.

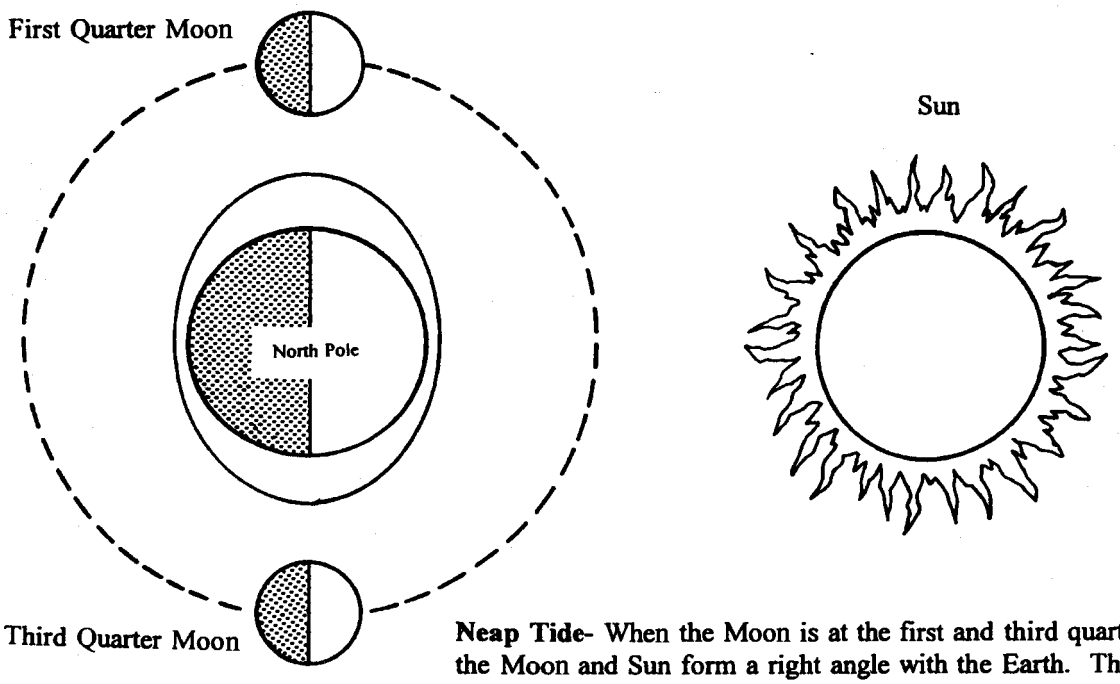
## *Follow-up Activity*

Graph the tides for one month. Make copies of the **Graphing Tides** chart for each group member. Divide the days of the selected month up amongst the group members and ask each of them to record the tide information on a graph page. When all the graphs have been completed, tape them together in sequence of the calendar dates. On the top of each graph page add the phases of the moon. Can you see how the tidal height change as the moon goes through its phases?

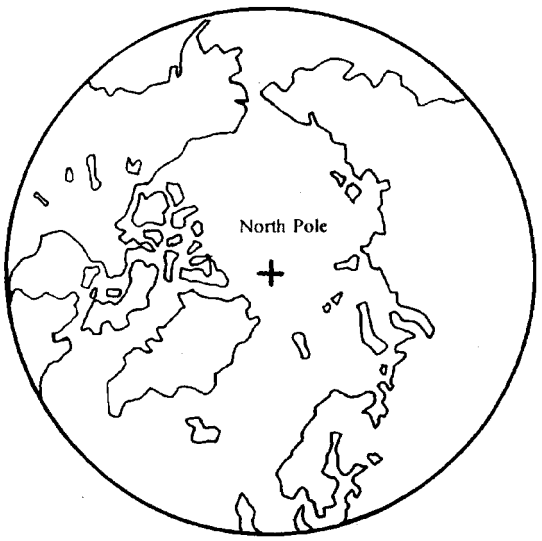




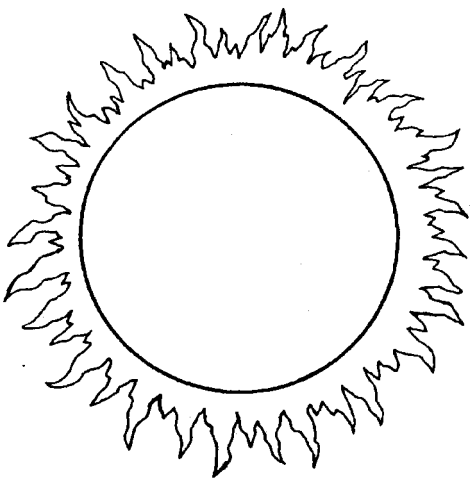

**Spring Tide-** When there is a full and new Moon, the Earth, Sun and Moon are in line. These tides have the most extreme range between the high and low tides.



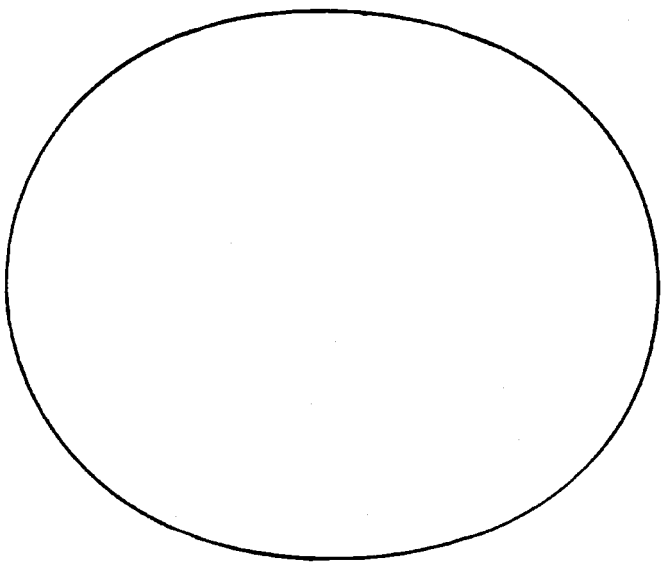

**Neap Tide-** When the Moon is at the first and third quarter, the Moon and Sun form a right angle with the Earth. These tides have the least range between the high and low tide.



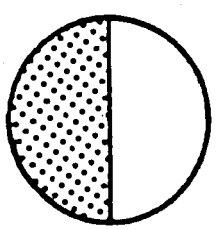

Earth



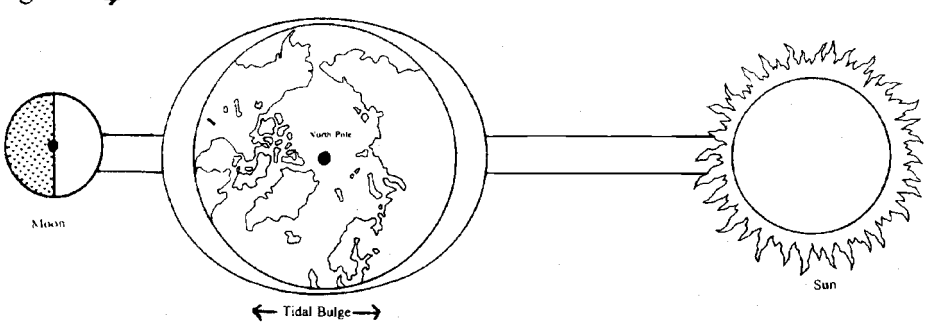
Sun



← Tidal Bulge →



Moon



# Reading a Tide Table

## Concept

1. Tide levels are predictable and are published in tide tables. For safety's sake, a tide table should be used when planning activities at the coast.
2. Winds and pressure, as well as the shape of the bottom and shoreline, affect the time and height of the tide.

## Life Skills

Learners will practice:

- Personal safety
- Critical thinking
- Learning to learn

## Time

40 minutes

## Materials

- Tide tables for the current year and upcoming months

## Procedure

Using the Member's Record Book questions as a guide, introduce learners to a tide table. Remind learners that wherever they may be visiting a coastal area they should consult the local tide table before planning their activities.

## Answers

1. Local sporting goods stores are a good source of tide tables. If you were traveling to another state you could write to a city's chamber of commerce or tourism for assistance.
2. The date for the month listed on the table.
3. The left side of the page.
4. A.M. is in light type; P.M. is in bold type.
5. These are the morning (A.M.) and afternoon or evening (P.M.) high tides.
6. Generally, there are two high tides and two low tides each day.
7. March 6 and 21.
8. March 6, at 5:33 P.M. the tide will be -1.0.
9. This is 6:50 P.M. It will be too dark to tide pool.
10. There are several correct answers to this question. March 9–17 have good low tides during daylight hours.
11. A storm will cause the water level to be higher than indicated on the tide table.
12. Fishing or boating information. Safer swimming times.

# Member's Record Book

## Reading a Tide Table

Date _____

1. Where can you find a tide table for a specific coastal area?

**Answer these questions using an actual tide table for the current month and year.**

2. What do the numbers in the first left-hand column indicate?

3. Where are the high tides listed in your tide book?

4. How is A.M. written differently from P.M. in your book?

5. Under the heading HIGH WATER, Time and Feet is written twice. What do these two entries mean?

6. How many high tides, and how many low tides does the Oregon coast have each day?

**Answer these questions using the sample tide table for March, provided at the right.**

7. What date(s) have only one high tide?

8. On which date and time is the lowest tide of the month?

9. On March 8, there is a -0.4 low tide at 6:50. Will that be a good time to go pooling? _____ Why or why not?

10. Give a date, the tide level, and the time that would be good for clamming.

11. If a bad storm is blowing on the day you want to go clamming, how will the storm affect the tide level?

12. What other types of information can be obtain from a tide table?

**TIDE TABLE FOR MAR**
Pacific Standard Time
OSU Marine Science Center Dock

| | HIGH WATER | | | | LOW WATER | | | |
|---|---|---|---|---|---|---|---|---|
| | Time | Feet | Time | Feet | Time | Feet | Time | Feet |
| 1 | 5:15 | 7.7 | 8:17 | 5.3 | 1:03 | 1.1 | | |
| 2 | 6:31 | 7.7 | 9:28 | 5.8 | 12:01 | 4.5 | 2:14 | 0.6 |
| 3 | 7:50 | 7.9 | 10:15 | 6.4 | 1:34 | 4.5 | 3:17 | 0.1 |
| 4 | 8:59 | 8.4 | 10:52 | 7.1 | 2:56 | 4.1 | 4:07 | -0.5 |
| 5 | 9:59 | 8.8 | 11:27 | 7.7 | 3:59 | 3.4 | 4:51 | -0.9 |
| 6 | 10:53 | 9.2 | | | 4:55 | 2.5 | 5:33 | -1.0 |
| 7 | 12:01 | 8.4 | 11:46 | 9.3 | 5:45 | 1.5 | 6:11 | -0.8 |
| 8 | 12:35 | 9.0 | 12:38 | 9.0 | 6:31 | 0.6 | 6:50 | -0.4 |
| 9 | 1:08 | 9.4 | 1:30 | 8.6 | 7:20 | -0.1 | 7:27 | 0.3 |
| 10 | 1:45 | 9.6 | 2:23 | 7.9 | 8:09 | -0.5 | 8:07 | 1.1 |
| 11 | 2:23 | 9.5 | 3:22 | 7.1 | 9:01 | -0.7 | 8:46 | 2.0 |
| 12 | 3:03 | 9.2 | 4:28 | 6.3 | 9:57 | -0.6 | 9:32 | 2.8 |
| 13 | 3:50 | 8.7 | 5:44 | 5.8 | 10:59 | -0.3 | 10:27 | 3.5 |
| 14 | 4:47 | 8.1 | 7:15 | 5.8 | 12:12 | 0.1 | 11:39 | 4.1 |
| 15 | 5:59 | 7.6 | 8:37 | 5.8 | 1:30 | 0.3 | | |
| 16 | 7:21 | 7.3 | 9:38 | 6.2 | 1:16 | 4.2 | 2:41 | 0.3 |
| 17 | 8:37 | 7.4 | 10:21 | 6.7 | 2:43 | 3.9 | 3:38 | 0.2 |
| 18 | 9:39 | 7.6 | 10:56 | 7.1 | 3:46 | 3.3 | 4:22 | 0.2 |
| 19 | 10:29 | 7.8 | 11:27 | 7.5 | 4:35 | 2.8 | 5:03 | 0.4 |
| 20 | 11:11 | 8.0 | 11:54 | 7.9 | 5:11 | 2.2 | 5:33 | 0.6 |
| 21 | 11:52 | 7.9 | | | 5:49 | 1.7 | 6:01 | 0.9 |
| 22 | 12:17 | 8.1 | 12:31 | 7.8 | 6:21 | 1.2 | 6:27 | 1.3 |
| 23 | 12:41 | 8.3 | 1:07 | 7.6 | 6:53 | 0.8 | 6:55 | 1.7 |
| 24 | 1:04 | 8.3 | 1:43 | 7.2 | 7:28 | 0.5 | 7:20 | 2.1 |
| 25 | 1:28 | 8.3 | 2:22 | 6.8 | 8:02 | 0.4 | 7:45 | 2.6 |
| 26 | 1:54 | 8.2 | 3:03 | 6.3 | 8:36 | 0.3 | 8:17 | 3.0 |
| 27 | 2:20 | 8.0 | 3:53 | 5.9 | 9:18 | 0.3 | 8:49 | 3.4 |
| 28 | 2:55 | 7.8 | 4:56 | 5.5 | 10:09 | 0.5 | 9:31 | 3.8 |
| 29 | 3:40 | 7.6 | 6:15 | 5.3 | 11:09 | 0.6 | 10:30 | 4.1 |
| 30 | 4:41 | 7.3 | 7:38 | 5.5 | 12:20 | 0.5 | 11:54 | 4.2 |
| 31 | 6:01 | 7.2 | 8:37 | 5.9 | 1:31 | 0.3 | | |

A.M. - Light Face P.M. - Bold Face

# Waves

## Concepts

1. Waves are a disturbance of the water's surface.
2. Breakers occur as waves enter shallower water. The wave begins to "drag" on the ocean's bottom, decreasing the energy available for forward motion. The bottom of the wave is slowed more than the top.
3. Except for near-shore breakers, there is little forward movement of water in waves. What we see is the movement of energy through the water. The energy from the initial disturbance is being passed on.

## Life Skills

Learners will practice:

- Contributing to group effort
- Critical thinking
- Learning to learn

## Time

30 minutes

## Materials

### Activity 1

For each member:

- Three wood blocks
- A sheet of sandpaper
- Masking tape
- A smooth surface on which to work

### Activity 2

- A clear plastic (soda or juice) bottle with a tight-fitting lid
- Mineral oil (cooking oil may be substituted, but results are not as good)
- Rubbing alcohol (may use water)
- Blue food coloring

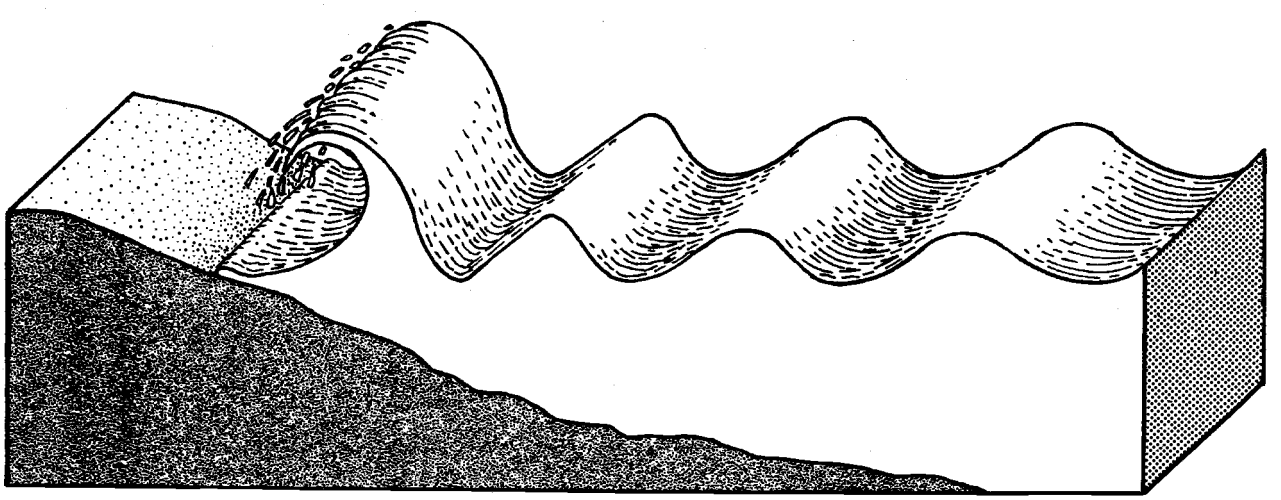
## Background

Waves are a churning or disturbance of the water's surface. The wind causes most wave action. A wave can be as small as a ripple or as large as a Tsunami wave.

Waves are made up of crests and troughs. The crest is the highest part of the wave; the trough is the lowest part. Waves can be measured for length and height. The horizontal distance between wave crests is called the wavelength. The vertical distance between the crest and the trough is called the wave height.

There is very little forward movement of water in waves. Waves appear to be coming in to shore but the water in the wave is actually moving in a circular motion. The larger the wave, the larger the circular movement of the water. The water moves forward, down, and then backward as the energy is passed through the water.

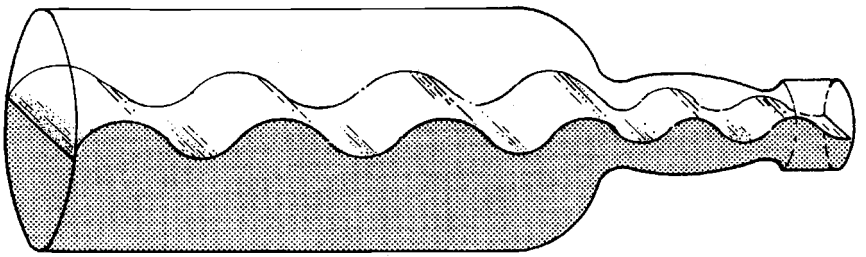
When waves encounter water shallower than one-half their wavelength, such as at the beach, they are said to "feel bottom." As the water becomes shallower, the circular motion at the bottom of the wave is altered. The water at the bottom of the wave slows down. At the surface, the circular motion is still moving rapidly. The upper portion of the wave moves faster than the bottom so that the top spills over, creating a breaker.



Breakers do carry water with them. Waves that transport water are called translation waves. If the wave breaks quickly, the crest will be thrown into the trough in front. This leaves a tunnel of water and the wave is known as a plunging wave. Surfers call this tunnel the Banzai Pipeline.

If the wave breaks more slowly, 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 longer than plunging waves.

These, and other breaker characteristics, are caused by a combination of the shape and composition of the ocean's bottom surface near shore and the type and origin of the swell.



## *Procedure*

Have learners recall watching waves. *Are they all the same? Where do you see waves that fall over?* (Near the shore.) *Those are called breakers. Today we are going to discover why breakers occur where they do. Think about a time when perhaps you were sliding on a smooth floor in your stockinged feet. As you slid, your feet came to a place on the floor that was not as smooth. Perhaps there was something sticky that had been spilled there; perhaps you came to some carpet or concrete. What happened?* (Tripped, fell, slowed down.)

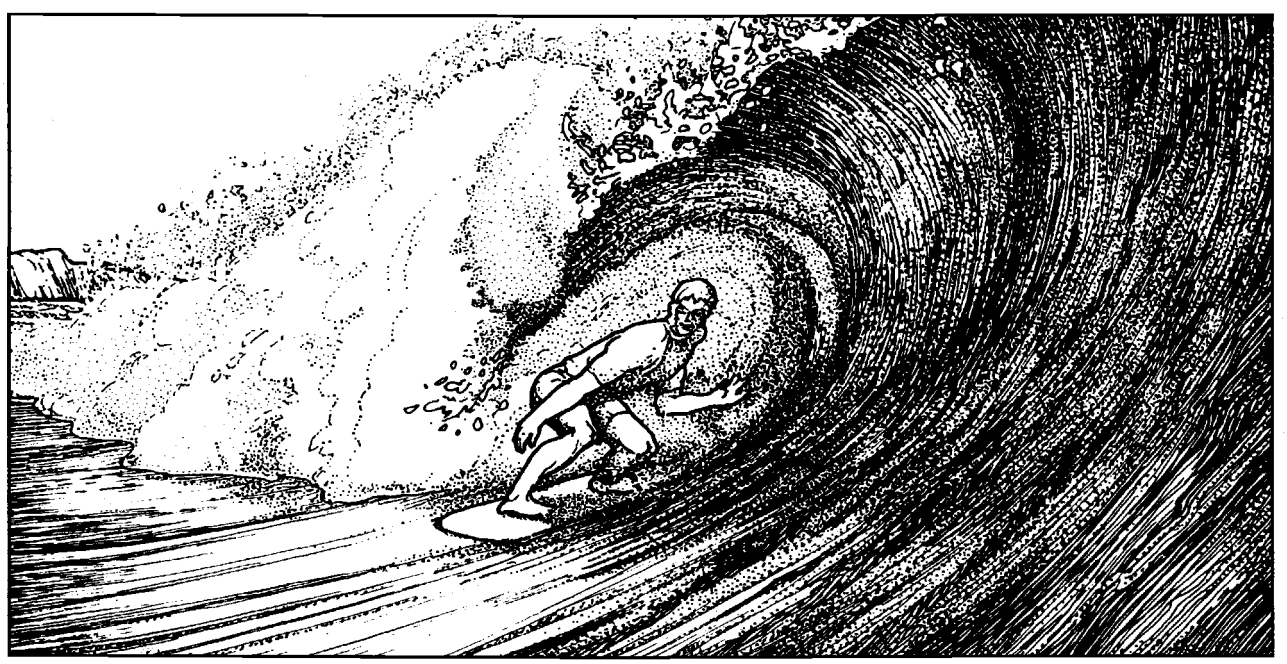
*The same thing happens with waves. Waves are really energy moving through the water. When the wave comes to shallower water near shore, the energy "drags" on the bottom and slows down, just like your feet did when you were sliding. The top of the wave keeps traveling, just like your head and upper body did, and falls over. Let's try to demonstrate with these blocks.*

### Activity 1: Wood Block Waves

Working with a partner, have learners tape the piece of sandpaper to the work surface. Stack the blocks one on top of another, and then push them along until they slide over the sandpaper. *What happens? How does this compare with the type of wave that we call a breaker?*

### Activity 2: Wave in a Bottle

Fill the bottle about half full of alcohol. Add a few drops of blue food coloring. Fill the jar to the top with mineral oil. Try to cap the bottle without trapping any air inside. Turn the bottle on its side and rock it gently back and forth to simulate the action of waves. A simple support can be constructed so that the bottle may be displayed on its side.



# Member's Record Book

## Waves

Date _____

Draw a picture of a breaker:

What makes breakers fall over?_____

_____

_____

How did you demonstrate this today in your meeting?_____

_____

_____

_____

_____

# Why are the Oceans Salty?

## Concept

Rivers transport dissolved salts and minerals from the land to the sea.

## Life Skills

Learners will practice:

- Critical thinking
- Learning to learn

## Time

30 minutes

## Materials

- A small salt lick block (mineral block), such as those sold at pet stores for guinea pigs
- Eyedroppers
- Cup and pan
- Permanent marker
- Salt (pickling salt works best; it will not make the water cloudy)
- Warm water
- Four jars
- Measuring cup and teaspoon
- A quart jar with 7½ teaspoons of salt in it (keep hidden)

## Procedure

Before the meeting, mix up the following solutions, in each of the four jars:

Jar A: 1 cup warm water with 1 teaspoon salt

Jar B: 1 cup warm water with 2 teaspoons salt

Jar C: 1 cup warm water

Jar D: 1 cup warm water with 3 teaspoons salt

Place the salt block on an overturned cup in a pan. Mark an "X" on the block with the permanent marker. While the rest of the meeting's activities are taking place, have learners take turns dripping water on the "X" on the block with an eyedropper. Let each learner drip the eyedropper for 1 or 2 minutes before passing it on to the next member.

Before continuing with the lesson, ask the learners to work individually to provide a hypothesis to answer the questions about saltwater on their record book page. An alternative method is to have members work in pairs or teams to create their hypotheses. Once each person has reviewed the questions and formed his or her hypothesis, call the group back together. Review the correct answers (provided below) and discuss how and why they are different, or the same as, the learner's answers.

## Answers to Member's Record Book Questions

1. Of the four jars presented for tasting, Jar B is the closest in salinity to actual seawater.
2. In 1 quart of seawater, there are approximately 7½ teaspoons of salt. (Show the jar prepared earlier.) Scientists measure the amount of salt in the ocean (called *salinity*) in parts per thousand. On average, in every thousand parts of seawater, there are 35 parts of salt. However, the amount varies with location.
3. If all of the salt in the sea were removed and spread evenly over the surface of the dry land, it would be over 500 feet thick! That is about the height of a 40-story building.

4. Most of the salt in the world's oceans came from the rocks of the earth's crust. Over millions of years, as the rocks are worn down by weathering, the salts are dissolved and carried to the sea. Some of the salts are contributed by underwater volcanoes, as well. When seawater evaporates in the continuous water cycle, the salts are left behind.

If you have not yet done so, take some time to examine the salt block. Notice how the water has dissolved part of it. The "X" may even be gone. This represents the way that water has dissolved salts out of the earth's crust.

5. Is the ocean getting saltier? This is a tricky question. Not everyone agrees on the answer. One difficulty lies in the length of time it would take to detect even the slightest change, and in the fact that the salinity of the ocean varies with location, season, and depth. It seems like the answer would be "yes," because wind and rain continue to break down rocks and release salts. Sea floor vents and volcanoes continue to form and contribute salts from under the sea floor. If you calculated how long it would take for the sea to reach its present level of salinity, given the amount of salt brought into the oceans by the rivers, however, you would get an answer of a little less than 100 million years. This is a short period of time geologically. The earth is thought to be about 4.5 billion years old. Although salts are continually entering the sea, some become bound into combinations with other minerals. Others are taken up and used by organisms. Still more are removed from the ocean by geologic processes, such as subducting sea floors. So what is the answer? The answer is probably "yes," but not as fast as you might expect.

## *Follow-up Activity*

Why does the salt stay in the ocean? When water evaporates and rises to form clouds, it is pure water. The evaporating water does not carry any salts or minerals with it. To demonstrate this, bring some saltwater to boil producing steam. Make sure the boiling water and steam don't splash onto the learners. Using a pair of tongs, carefully hold a cold plate over the steam. Moisture will collect on the plate. Remove the plate from the stream and tip it so the water drops run off the plate. Taste the water drops. Are they salty?

# Member's Record Book

## Why are the Oceans Salty?

Date _____

1. Using a clean spoon, taste the water in jars A, B, C, and D. In which jar is the salinity (saltiness) most like the ocean's?

   (Hypothesis)_____ (Correct)_____

2. Approximately how many teaspoons of salt are there in 1 quart of seawater?

   (Hypothesis)_____ (Correct)_____

3. If all the salt in the sea were removed and spread evenly over the surface of the dry land, how deep would it be?

   (Hypothesis)_____ (Correct)_____

4. Where does the salt in the ocean come from?

   (Hypothesis)_____ (Correct)_____

5. Is the ocean getting saltier? State why or why not.

   (Hypothesis)_____ (Correct)_____

# The Density of Sea Water

## Concept

Saltwater is denser than freshwater.

## Life Skills

Learners will practice:

- Critical thinking
- Learning to learn

## Time

30 minutes

## Materials

### Solid Density Demonstration

- A rock and a block of wood about the same size

### Gas Density Demonstration

- A helium balloon and a regular balloon

### Liquid Density Demonstration

- Two eyedroppers
- Food coloring
- Salt (pickling salt works best; it will not make the water cloudy)
- Two large glass beakers or clear drinking glasses
- A dish pan of water
- Two small beakers for colored water, such as juice glasses

**Note:** the above materials are enough for the leader to perform a demonstration. If time and materials allow, provide each team of learners with a set of equipment for the liquid density part of the lessons.

## Procedure

Before the meeting, set up the following solutions:

*In the glass beakers or drinking glasses—*

- Glass A: water and 2 teaspoons of salt
- Glass B: freshwater

*In the small beakers or juice glasses—*

- Glass C: a small amount of the saltwater from glass A and food coloring. The solution should be dark.
- Glass D: a small amount of freshwater and food coloring

Let the glasses stand in a place where they will not be bumped or disturbed. It is important for the water in the glasses to be as still as possible for the demonstration to work.

When the learners are ready to begin, introduce the word *density*. Density is the amount of mass an object has per unit volume. This relationship is demonstrated by the old joke from physics class that asks, "Which weighs more, a pound of lead or a pound of feathers?" They both weigh the same, but the lead is much denser and will take up a smaller space than a pound of feathers. If two objects are the same size, but one weighs more, the heavier one is denser.

*Is it possible for solids to have different densities?* Pass around the rock and the block of wood. *Here are two solids. Is one more dense than the other?* Drop the wood and the rock into a pan of water. The wood floats because it is less dense than the water. The rock is denser than the water, so it sinks. When all the learners understand that solids can have different densities, ask, *Is it possible for gases to have different densities?* If the learners are not sure, show them the two balloons. The gas inside the helium balloon is less dense, so it floats in the air, just like the wood floats in water.

Finally, ask, *Is it possible for liquids to have different densities?* If anyone answers, "Yes," ask for an example. A good example is oil and vinegar in salad dressing. When oil and vinegar are combined, it is easy to see that one liquid is less dense than the other.

*What about seawater? Is it denser or less dense than freshwater? Could we design an experiment to find out?* Since the previous examples involved floating one substance in another, the learners might suggest doing this with freshwater and saltwater.

When the learners have completed the discussion, point out the four glasses of water solutions. Tell them which glasses contain fresh and which contain salty water. Using an eye dropper, take some of the colored freshwater from glass D and hold the dropper in glass A with the saltwater so that the tip is in the middle of the liquid. Make sure that all the learners can see.

*What do you think will happen when I squeeze the freshwater into the saltwater? Why do you think so?* Allow everyone who has a prediction to share their reasons with the group. The predictions also can be recorded in the space provided on the member's record book page. When all the predictions are recorded, gently squeeze the bulb of the eyedropper so that the colored water comes out in a thin stream. Because freshwater is less dense, the colored water will rise, making the stream go up before it dissipates.

Repeat the demonstration by using an eyedropper of the colored saltwater from glass C in glass B. Again, allow the children to make a prediction before you actually do the demonstration. You will know that they are understanding the concept if most of them predict that the colored saltwater will sink in the freshwater. If time and materials permit, allow the learners to do the demonstration themselves. They may want to experiment with different concentrations of salt to test different densities.

In closing, ask, *What difference does it make that saltwater is more dense than freshwater? How would the density of the water affect an animal trying to swim on the surface? Under the surface? Can you think of any place that freshwater and saltwater come together?* (In an estuary, where rivers meet the sea.) *If you could slice an estuary down the middle and look at a cross section, where do you think that the saltwater coming from the sea and freshwater of the stream would be in relation to one another?* (Accept any plausible answer.)

## Follow-up Activities

1. If you did not make the wave-in-a-bottle a part of your study of waves, you could do it now to demonstrate the different densities of liquids.
2. Make several water balloons of the same size and put salt in one of them. Challenge the children to discover which one contains saltwater without breaking it and tasting the water.
3. A raw egg will sink in freshwater, but float in saltwater. This is often included in books of magic tricks for children. (The audience will suspect something if the water is cloudy. Use pickling salt and warm water to avoid cloudy water.)
4. Ask learners to think about how the density difference between salt and freshwater might affect a ship traveling into the mouth of the Columbia River toward the Port of Portland. The captain knows that the mast of her ship is exactly 40 feet above the surface of the water when the ship is at sea. One of the bridges over the river on the trip to Portland is 39 feet above the surface of the water. Should the captain be worried about the ship's mast hitting the bridge? (Hint: Will the ship float higher or lower in the freshwater of the river compared to ocean water?)

# Member's Record Book

## The Density of Sea Water

Date _____

What is density?_____

_____

Is it possible for two solids to have different densities?_____

If you answered "yes," give an example: _____

How can you test this?_____

_____

_____

Is it possible for two gases to have different densities?_____

Is it possible for two liquids to have different densities?_____

How would you test this?_____

_____

_____

Draw a picture of your prediction of what will happen when the colored freshwater is squeezed into the saltwater glass. Draw a picture of what actually happened, if it was different from your prediction.

**My prediction**

**How it really looked (different from my prediction)**

Draw a picture of your prediction of what will happen when the colored saltwater is squeezed into the freshwater glass. Draw a picture of what actually happened, if it was different from your prediction.

**My prediction**

**How it really looked (different from my prediction)**

# Gallon Ocean

## Concept

As vast as the ocean is, it still can be negatively impacted by small amounts of contaminants.

## Life Skills

Learners will practice:

- Responsible citizenship
- Contributing to group effort
- Critical thinking
- Learning to learn

## Time

30 minutes, with a continuing experiment

## Materials

- A globe, world map, or atlas of earth
- Two gallon-size clear (glass) containers, 3/4 full of water
- Food coloring
- Eye dropper
- Two living aquatic plants, such as eloedia (available at pet or aquarium supply stores)
- Vinegar
- A measuring tablespoon
- pH paper (optional)

## Procedure

Display the globe, and point out how much of our planet is covered by oceans. (Greater than 70 percent.)

Place one of the glass containers where all learners can see it. Ask, *In what ways is this container like the ocean?* Help learners develop the idea that, even though the ocean is immense, it has edges and a finite size, just like the container. For the purpose of this experiment, learners are going to suppose that the two containers are two oceans. What name would the learners like to give to each ocean?

*How many drops of water do you suppose are in each ocean?* The amount isn't important; just the idea that it would take many, many hundreds of drops to fill the containers. *If I added one drop of something, would it make any difference?* Probably not. Try adding one drop of food coloring and stirring the water. It will be so diluted that learners probably won't be able to tell that anything has been added. If there is disagreement, set a glass of clean water next to a glass of water from the container and see whether the learners can tell the difference.

Explain that the experiment that will be started today is a test to see how many little bits of a pollutant (vinegar) can be added to one ocean before it will have an effect on the living things in that ocean. Both oceans will begin by containing clear water and an aquatic plant. Each day (week/meeting), 1 tablespoon of vinegar will be added to one ocean. Vinegar is a mild acid. If pH paper is available, have one learner test the pH of the pure vinegar and show the results to the group. The aquatic plant in each ocean will serve as a measure of the livability of the water for organisms.

Select individuals to be responsible for adding the vinegar to one ocean, testing the pH of both oceans, and agree on the types and frequency of observations that should be made (smell, color of the plant and water, condition of the plant, etc.). Observations made during the interval between meetings can be shared at the next meeting.

At the end of the experiment, how healthy did the aquatic plants look? Why was it important to compare one ocean with vinegar and one without vinegar? What are some other ways learners might design this experiment?

## Additional Activities

1. Have each learner establish a gallon ocean at home. Ask each of the learners to choose a different pollutant to add to their ocean over time. The pollutant selected should be added in the same amount and frequency by each learner. Compare results. Which of the pollutants are actually getting into our streams (rivers, oceans)?
2. Identify sources of contaminants in your neighborhood (motor oil, fertilizer, weed killer, antifreeze, soap from car washing). Many storm sewers in streets drain directly into local creeks and streams. What impact might this have on the ecology of that stream? of the ocean?
3. Storm drain stenciling—Get permission from local authorities to paint a fish next to the covering of the storm drain to remind people of the impact that dumping substances into the storm sewer has on animals. Create and circulate a flyer that explains your project to the neighborhood.
4. Tour your local water treatment facility. Find out which substances carried into the treatment facility break down into harmless components. What is your local authority doing to minimize the effects of water pollution in your area?
5. Read the local newspapers and magazines and clip and save any articles found pertaining to water issues. At a meeting compare articles. Do the articles tell the full story or do learners need more information about an issue or situation?

# Member's Record Book

## Gallon Ocean

Date _____

Draw a picture of the plant in each gallon ocean on the day the experiment began:

Record your observations of the "oceans" here:

| Date | Ocean Name | Observations | pH |
|---|---|---|---|

Draw a picture below of the plant in each gallon ocean at the end of the experiment.

# How the Oceans Affect Temperatures on Land

## *Concept*

The ocean moderates the temperatures on land. The nearer a community is to the ocean, the smaller the annual range of temperature.

## *Life Skills*

Learners will practice:

- Contributing to group effort
- Critical thinking
- Learning to learn

## *Time*

30 minutes

## *Materials*

- Several maps of Oregon showing city names
- A pad of sticky notes
- A supply of pencils

## *Procedure*

Divide the learners into small groups. Give each group an Oregon map. Ask the learners to locate cities on the maps that are listed in the Minimum and Maximum Temperatures chart on their record book page.

Ask each group to calculate the annual temperature range by subtracting the minimum temperatures from the maximum temperatures. Enter the calculated temperature ranges on the chart in the record book. Write the data on sticky notes and place it next to the city names on the map.

Help the learners analyze the data by comparing annual temperature ranges to the proximity of the community to the ocean.

## *Follow-up Activity*

- Try heating a cup of water and a cup of soil from above with a lamp. Investigate which one will heat up or cool off faster. Have the members predict what will happen before you begin the experiment.
- What is the Annual Average Rainfall in each of these cities? Go to the library to gather information on precipitation patterns. How does the ocean affect precipitation? Refer back to the Water Cycle lesson.

# Member's Record Book

## How the Ocean Affects Temperatures on Land

Date: _____

Fill in the blanks in the chart below by subtracting the minimum temperature from the maximum temperature for each city.

**Minimum and Maximum Temperatures for Some Cities in Oregon in July**

| City | Minimum Temp. | Maximum Temp. | Annual Range |
|---|---|---|---|
| Ontario | 58 | 95 | _____ |
| Burns | 54 | 88 | _____ |
| La Grande | 54 | 88 | _____ |
| Bend | 45 | 84 | _____ |
| Eugene | 52 | 84 | _____ |
| Medford | 55 | 89 | _____ |
| Salem | 52 | 82 | _____ |
| Portland | 58 | 80 | _____ |
| Astoria | 54 | 70 | _____ |
| North Bend | 54 | 68 | _____ |

* Temperature data from *Atlas of Oregon* by Loy, Allan, Patton and Plank, U. of O. Books, Eugene, OR, 1976.

Find the cities listed above on an Oregon map. Use sticky notes to post the temperature range data for each city next to the name of the city on the map.

Which two cities have the lowest annual temperature range?

_____ and _____

In what part of the state are they located? _____

_____

What can you conclude about how the ocean affects temperatures on land? _____

_____

_____

_____

_____

# Life in the Beach Zone

## Concepts

1. The beach can be divided into zones—microhabitats—that are differentiated by specific water, air, light, and temperature conditions.
2. Zones can be characterized by the plants and animals that live there.
3. Each of the organisms living on the beach has special physical features that are adaptations for the best use of the resources available in the zone in which they are found.

## Life Skills

Learners will practice:

- Contributing to group effort

## Time

2 hours

## Materials

- Butcher paper
- Marking pens
- Tape
- Stapler
- Scissors
- Glue
- Construction paper
- Beach zone information sheets

## Procedure

Tape a large piece of butcher paper to the wall. Draw the shape of a beach profile on it with a marking pen.

Divide the learners into four groups. Give each group a copy of one of the beach zone information sheets. Have beach reference books available.

Announce that the learners will be going on a guided tour of the beach. Each group will be the tour guides for their particular zone. They are to research the zone and color or glue appropriate plants and animals onto the mural.

Allow adequate time for the learners to plan and create their presentation. Help them find information in reference books to supplement the information sheet. Ask learners to identify the plants and animals that live in each zone. Which animals live in two or more zones? How are plants and animals adapted to live in a specific zone?

As each group makes its presentation, encourage members to ask questions, but do not allow criticism. Keep the presentations moving along so that all four groups make their presentation before the learners lose interest.

## Follow-up Activity Field Trip

Plan a trip to the beach to identify the zones learners have studied. How can you tell where one zone ends and another begins?

## Dune Zone

The dune zone is mostly sand. Beach sand may be pure sand or it may be mixed with small particles of broken shells or other minerals. Sand is mostly composed of the mineral quartz. The kinds of minerals and particles in sand determine its color.

The mounds of sand found on the beach are called *dunes* and are formed by the actions of wind on the sand. At the beach there is almost constant wind. Dunes are formed or change in shape when the wind picks up the sand a few particles at a time and blows it around. Plants on the beach trap and store blown sand and cause mounds to be formed. The dunes help to protect the land from the ocean and the action of the waves.

The environment of the dune area is dry, sandy, and windy. All of the plants and animals living in this area are specially equipped to survive under these conditions.

Examples of organisms living in this area include: dune grasses, insects, and rodents.

## Fore Dune Zone

This zone is the flat sandy area found after the dunes as you walk toward the ocean. It is the zone with the most difficult living conditions for plants and animals. This area is above the high tide line, so it is generally extremely dry. A natural fore dune is barren and provides no protection from the effects of wind and sun. In many areas, the fore dune has grown quite large due to the dune stabilization program that introduced European beach grass to trap and hold the sand.

Organisms found in this area include: beach hoppers, shore crabs, and insects. In this zone you also will find skate or whelk egg cases, shells, and other debris. Although the organisms related to these finds do not live in this zone, this area is where many materials gather.

## Intertidal Zone

The area of the beach between the high and low tide line is called the intertidal zone. The constant pounding of waves and alternating exposure to air and saltwater caused by the tides would seem to make this area a difficult environment for survival. At first glance, this zone may appear to be barren and lifeless. In reality, the intertidal zone is the habitat for many interesting organisms. Because of the changing environmental conditions, many intertidal organisms are not readily visible. This area also is an excellent place to find seashells washed in by the waves.

Organisms living in this zone include: hermit crabs, worms, mussels, sea stars, sea anemones, urchins, and snails. Many kinds of seaweed, or algae, grow on the rocks in this zone, making walking at low tide dangerous.

When looking at this area of the beach, you also will often see birds. Although birds do not nest in this zone, the organisms living here provide a source of food to birds. Birds along the shore include sandpipers, oystercatchers, turnstones, and gulls.

## Sub-tidal Zone

This zone is located beyond the lowest tide line and marks the beginning of the marine environment. This area may have some overlap with the intertidal zone. Organisms living in this area are constantly underwater and must have the capacity to breathe in this environment. Some of the organisms in this zone include: sea anemones, clams, snails, crabs, skate, jellyfish, and rockfish.

Adapted from *4-H Marine Science Project Leader's Guide,* by Betty J. Jesuncosky; Cook College-Rutgers University, 1987.

# Member's Record Book

## Life in the Beach Zone

Date_____

Label the parts of this beach profile:

As the different groups give their presentations, list or sketch at least two things found in each zone.

# Marine Debris

## Concept

Refuse from human activities is littering the oceans and creating hazards for wildlife.

## Life Skills

Learners will practice:

- Cooperation
- Community service/ Volunteering
- Responsible citizenship
- Use of resources

## Time

1 to 2 hours or more

## Materials

- Litter bags
- Rubber gloves
- *Trashing the Oceans* video (see reference at the end of the activity)

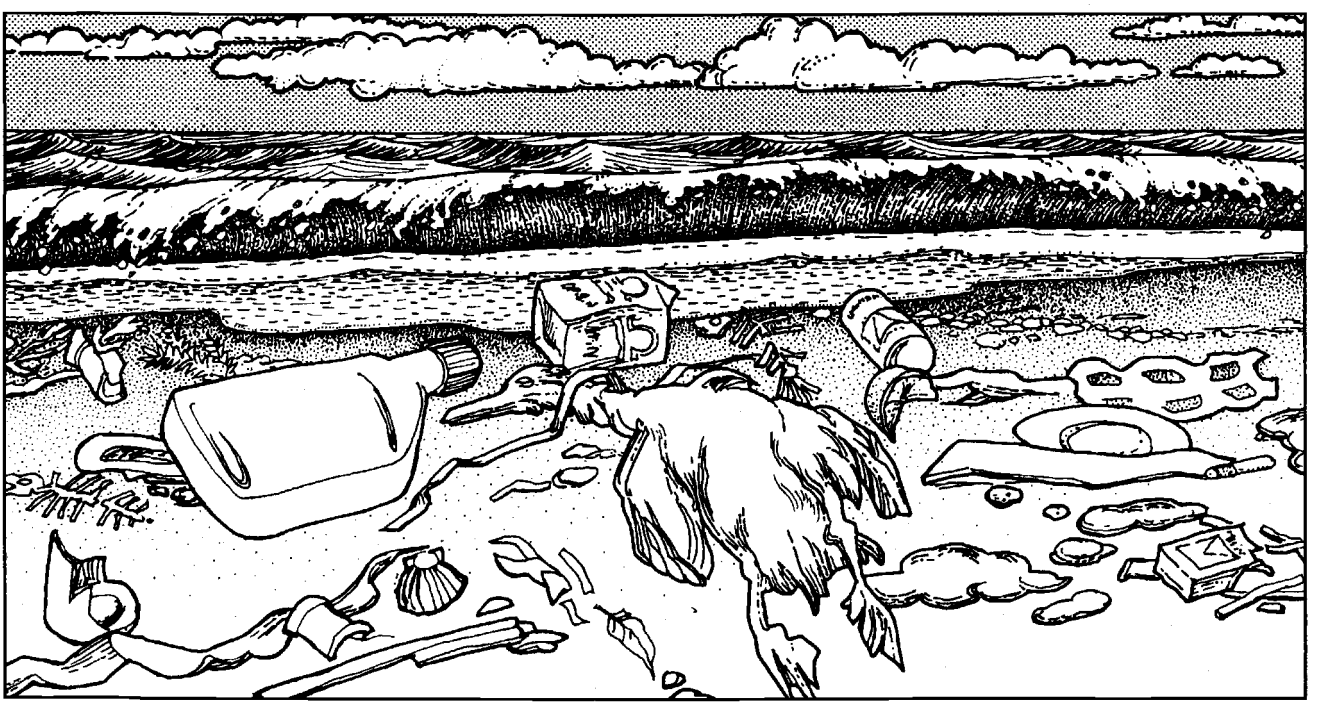
## Procedure

Begin the discussion of marine debris by showing the video *Trashing the Oceans* to your group. Ask the learners to restate in their record books reasons why marine debris is a problem. Two primary problems that learners should understand are entanglement and mistaking plastics for food. In the ocean, the main sources of litter are picnickers, ships, fishing boats, and debris floating down the rivers. Dumping of refuse at sea is now prohibited by international law. This law, although difficult to enforce, is an attempt to put an end to the practice of disposing garbage directly into the ocean.

The Cousteau Society estimates that 6 million tons of litter enters the oceans each year. The greatest hazard to animal life is posed by non-biodegradable plastic netting. Animals become entangled in discarded fishing gear and drown or starve to death.

Plastics may be killing up to a million seabirds and over 100,000 marine mammals a year. Plastics have been found in the stomachs of whales, dolphins, fish, birds, and manatees. Leatherback turtles mistake plastic bags floating in the sea for jellyfish and consume them. The plastic is not digested and accumulates in the intestines of the turtles. They slowly starve to death. Balloons released or lost can drift over ocean waters and have been found in the digestive tracts of marine animals.

If you are at the beach, have the group spend 20–30 minutes picking up all the human-generated litter they can find. If you are unable to do this at the beach, a similar pickup can be organized in a local park or neighborhood. Plastics can threaten terrestrial animals, as well. Collect all the litter in one large pile, and then sort it by kind and where it might have come from. Use rubber gloves to pick up and sort the litter. Record this information in the Record Book.



Once you have classified the garbage, pick it up again and dispose of it properly. Your group may want to make a plan to keep a specific section of beach or a neighborhood park cleaned up by performing regular cleanups. Another possibility is participating in the statewide beach cleanup days that are organized in the spring and fall. Contact the Portland office of Stop Oregon Litter and Vandalism (SOLV) or your local Oregon Department of Fish and Wildlife office for information about dates and plans for beach cleanup day.

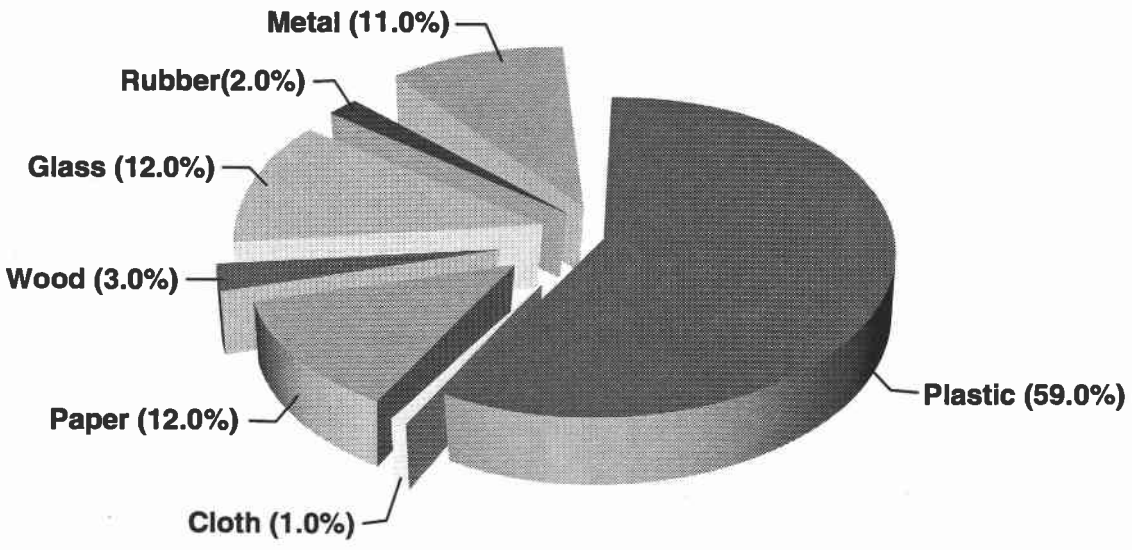
## Follow-up Activities

1. Have group members collect every bit of plastic trash that is thrown away in their house for 2 days. Wash it if necessary and bring it to the next meeting. Divide the accumulation into groups representing items that **would** be hazardous to wildlife and items that probably **would not** be hazardous to wildlife. Remember to consider both entanglement and confusion with natural foods.
2. Formulate a plan for reducing the amount of plastic trash generated in your home.
3. Develop and display an informational campaign about the dangers of plastic to wildlife. Try to get others involved in habitat cleanup.
4. Find out where your trash goes after it is picked up by the garbage truck. Is there any danger that the plastic will pose a threat to wildlife?

## References


- *Trashing the Oceans* videotape available for rent or purchase from Extension Sea Grant, Hatfield Marine Science Center, Newport, OR, 97365.
- Center for Marine Conservation Web site at http://www.cmc-ocean.org


## Results of 1994 U.S. Coastal Cleanup



# Member's Record Book

## Marine Debris

Date_____

Why is marine debris a problem?

A._____

_____

B._____

_____

Tally the numbers of different kinds of trash that you found on your pick-up on another piece of paper.

Divide the trash your group collected into piles according to where you think it originated. If you are doing a beach cleanup, what sources of marine debris did you identify?_____

_____

_____

_____

_____

Which pile had the most trash in it?_____

Did you see any evidence of wildlife whose health was endangered by debris? If so, describe it:

_____

_____

_____

_____

_____

Make a graph of your findings

# Future Catch

## Concepts

1. Some natural resources are renewable.
2. Resource management can assist in maintaining natural resources for human use for future generations.

## Life Skills

Learners will practice:

- Responsible citizenship
- Use of resources

## Materials

- A small fish bowl (for large groups, provide more than one bowl)
- Two to three bags of "goldfish" crackers (for large groups, provide more bags of fish and divide learners into several small groups)

## Time

30 minutes

## Procedure

In this activity, learners will investigate how a fish population may become over-fished and how the problem could be controlled through management.

Assign learners the following roles:

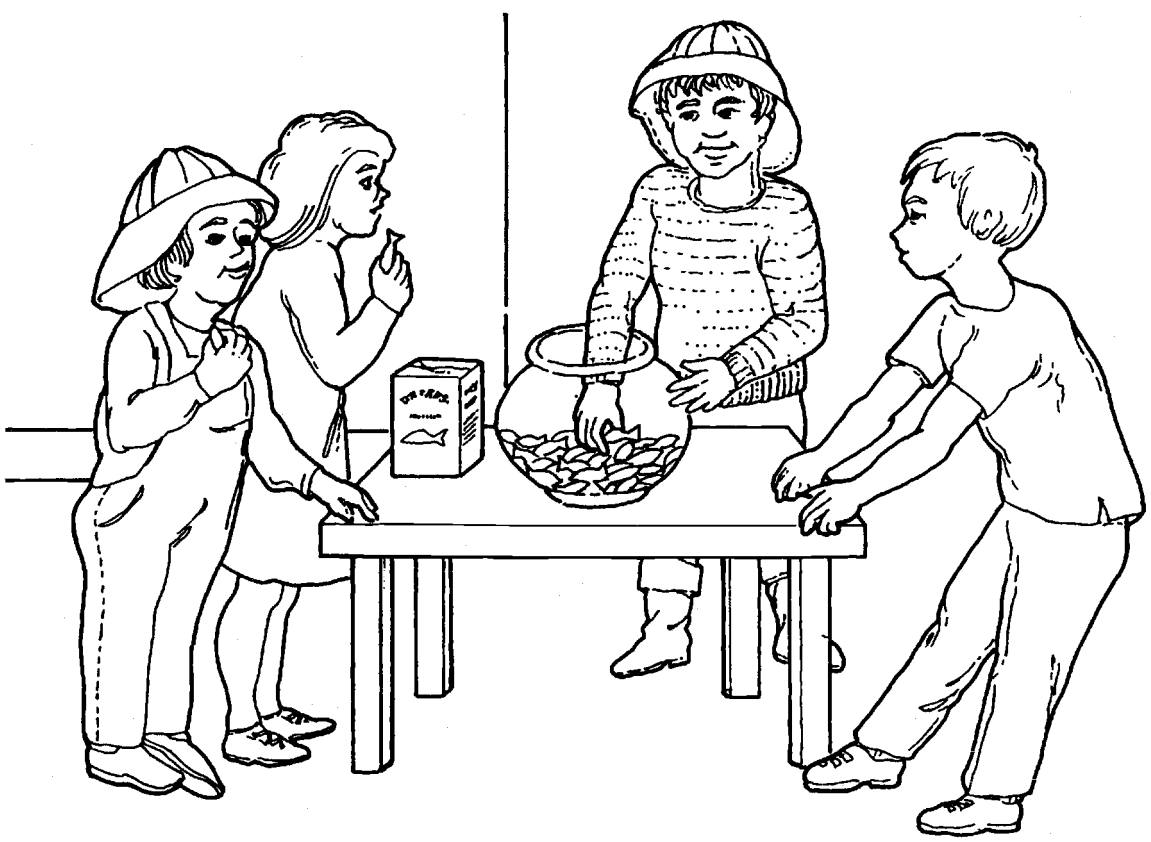
- **First generation:** grandma, grandpa
- **Second generation:** son #1, son #2, daughter #1, daughter #2
- **Third generation:** grandchildren 1–8

Tell the learners that each generation wants to make a living by fishing. Make sure everyone has washed their hands before beginning to "fish." Then begin the exercise:

1. Pour the contents of one bag of goldfish crackers into the fish bowl.
2. Let each grandparent fish from the bowl by scooping up a handful of fish. Let the grandparents decide whether this is enough fish for them.
3. Let the second generation fish in the same manner.
4. Let the third generation fish in the same manner. (Probably there will be no fish left for them.)

What have we forgotten? Fish reproduce. Repeat steps 1 through 4, but add two handfuls of fish after each generation fishes. You still should run out of goldfish.

Who did not get enough fish? Why? How could the fish be conserved for each generation? Would you change the fishing method to allow use of only the thumb and forefinger? Would you allow a shorter time to fish? Would you set a limit for the number of fish that could be caught? These are all techniques



that are used by fisheries managers to maintain adequate stocks of native fish for future generations to catch and enjoy.

## Follow-up Activities

1. Invite a wildlife biologist to talk to your group about how policies for wildlife management are established.
2. Find out about regulations affecting collection or harvesting of non-commercial species of plants and animals.
3. Plan a tour of a local Oregon Department of Fish and Wildlife Fish Hatchery. Leaders should contact the hatchery to receive a copy of the 78-page Educator's Guide, *The Fish Hatchery Next Door—getting the most from your visit.*
4. Timber is an important industry in Oregon. Currently, there is a great deal of conflict between the timber industry and those who are concerned about preservation of habitats. Collect articles about both sides of the preservation/resource use issue. Attend a public hearing if possible. Present your findings to an audience of your peers.

From Project WILD, Aquatic version. Western Regional Environmental Council.

# Member's Record Book

## Future Catch

Date _____

What happened the first time all the generations of fishermen went fishing? _____

_____

_____

Why did this happen? _____

_____

_____

What was done differently the second time the generations went fishing? _____

_____

_____

What happened then? _____

_____

_____

Name three ways that people might help to ensure enough fish for every generation of fishermen.

_____

_____

_____

What did you learn by playing this game? _____

_____

What other resources are there that can be maintained by using management techniques?

_____

_____

_____

_____

_____

_____

# Amazing Marine Mammal Trivia

## Concept

Marine mammals are some of the most amazing animals on earth.

## Life Skills

Learners will practice:

- Teamwork

## Time

40 minutes

## Materials

- A scratch pad and pen for each team
- A large sheet of paper and a marker with which to keep score

## Procedure

People are fascinated by trivia, and everyone learns best when they are having fun, so this activity combines some amazing animal facts with light-hearted competition. Everyone who participates and has a good time is a winner.

Divide the learners into two teams of three or more. Have each team select the name of a marine mammal as their team name.

A series of multiple-choice questions will be read aloud. After each question, the teams confer amongst themselves and write down their selected answer. The leader calls on each team to reveal its answer. The team(s) with correct answers get one point per answer and remain seated. The team(s) with incorrect answers must stand during the next question and are awarded a letter from a selected animal (like the basketball game "horse"). If a standing team gives a correct response for the next question, they may be seated, but they keep their letter. The game is over if (1) the leader runs out of questions, (2) one team spells the name of the selected animal (p.e.n.g.u.i.n), or (3) the group runs out of time.

### Questions

(Correct answers are in bold type)

1. *Which whale was Moby Dick?*
   **A. Sperm whale**
   B. Humpback whale
   C. Gray whale

2. *Why are Humpback Whales called Humpback?*
   A. Because their back is odd shaped
   **B. Because they hump their backs when they dive**
   C. They were named for George Humphrey

3. *What products were made from the whales when they were killed in the 1880s?*
   A. Oil for lamps
   B. Ladies' corsets
   C. Meat to eat
   **D. All are correct**

4. *Can whales breathe through their mouths?*
   A. Yes
   **B. No**

5. *Which whale would you not likely see on the Oregon Coast?*
   A. Blue whales
   B. Sperm whales
   C. Gray whales
   **D. Beluga whales**

6. *Which whale is known for its singing?*
   A. Blue whales
   B. Killer whales
   **C. Humpback whales**
   D. Fin whales

7. *Which whale traps small fish in a "bubble net"?*
   A. Orca whales
   **B. Humpback whales**
   C. Minke whales

8. *Which is the most numerous of the great whales today?*
   A. Blue whales
   B. Right whales
   **C. Sperm whales**
   D. Fin whales

9. *Which mammal has the longest migration?*
   A. Lemmings
   **B. Gray whale**
   C. Caribou

10. *What is the migration route of the Gray whale?*
    **A. From Alaska to Mexico**
    B. From California to Guam
    C. From Hawaii to Alaska

11. *Blue whales give birth to one calf*
    A. Every year
    B. Every other year
    **C. Every 3–4 years**

12. *Finding one's prey and locating surroundings using sound waves instead of sight is called?*
    A. Singing
    **B. Echolocation**
    C. Sounding

13. *What is the best means of protecting whales today?*
    A. Killing predators
    **B. Protecting habitat**
    C. Stopping whaling

14. *Predators of Gray whales are*
    A. Hammerhead sharks
    B. Dolphins
    **C. Killer whales**

15. *Which whale has the longest baleen?*
    **A. Bowhead whale**
    B. Gray whale
    C. Blue whale

16. *The Sperm whale only has teeth in its lower jaw.*
    **A. Yes**
    B. No

17. *Sperm whales use their teeth to feed on*
    A. Plankton
    **B. Giant Squid**
    C. Sharks

18. *When a whale jumps out of the water it is called*
    **A. Breaching**
    B. Lobtailing
    C. Navigating

19. *Besides oil and baleen, Eskimos made use of almost every part of the whale. Which of the following is a use for whale parts?*
    A. Windows
    B. Toys
    C. Drums
    **D. All of the above**

20. *In the early- to mid-19th century, whalers went on long voyages to kill sperm whales and collect their oil. How long would the whalers be at sea on each voyage?*
    A. 3 months
    B. 1 year
    **C. 3–5 years**

21. *Ambergris is a product from whales that was used as a base for perfumes. What is Ambergris?*
    A. Hardened whale oil
    **B. Waxy substance formed in whale intestines**
    C. Whale poop

22. *The largest member of the dolphin family is the*
    **A. Killer whale**
    B. Bottle nose dolphin
    C. Common dolphin

23. *Killer whales hit seals and sea lions with their tail in order to stun them.*
    **A. Yes**
    B. No

24. *A group of whales is called a*
    A. Herd
    B. Pride
    **C. Pod**
    D. School

25. *Which cetacean has a tusk-like tooth up to 9 feet long that makes it look like a unicorn?*
    A. Unicorn whale
    **B. Narwhal**
    C. Beaked whale

26. *Innuit Eskimos remove the skin from Narwhals in strips. The skin is eaten raw or boiled. Besides the calorie-rich fat, what nutritional value does the "muktuk" have?*
    **A. Vitamin C**
    B. Niacin
    C. Iron

27. *What keeps whales warm in the cold northern waters?*
    **A. Blubber**
    B. Fur
    C. Thick skin

28. *What is used to divide the whales into different groups?*
    A. Teeth and baleen
    B. Number of blow holes
    **C. Both**

29. *Whales have resting periods that are similar to sleep.*
    **A. Yes**
    B. No

30. *How can we tell the age of Baleen whales?*
    **A. Counting rings on the waxing plugs from their ears**
    B. Counting the rings on their teeth
    C. Counting the rings on their scales

31. *The whales with the longest life spans are the*
    **A. Sperm and Fin whales**
    B. Killer whales
    C. Gray whales

32. *A baby seal is called a*
    A. Calf
    B. Darling
    C. Kit
    **D. Pup**

33. *What does the walrus use it tusks for:*
    A. Digging clams
    **B. Pulling itself up on ice shelves**
    C. Fighting

34. *Which animals are the pinnipeds?*
    A. Beaked whales
    B. Largest whales
    **C. Seals and Sea lions**

35. *Which is the largest pinniped?*
    A. Steller's sea lion
    B. California sea lion
    **C. Elephant seal**

36. *What is the smallest marine mammal?*
    **A. Sea otter**
    B. Harp seal
    C. Polar bear

37. *Killer whales are identified in the field by researchers by the shape of their fins and by their markings.*
    **A. Yes**
    B. No

38. *Sea otter fur conserves heat by the following:*
    A. Waxy covering on their fur
    B. Hollow fur fibers
    **C. Trapping air and with dense underfur**

39. *Which pinnipeds would you expect to see along the Oregon Coast?*
    A. Ringed seal, Elephant seal, and Harp seal
    **B. California sea lion, Steller's sea lion, and Harbor seal**
    C. River seal, Gray seal, and Monk seal

40. *The polar bear's main source of food is*
    A. Fish
    **B. Seals**
    C. Penguins

41. *Spinner dolphins can leap up to 20 feet in the air.*
    **A. Yes**
    B. No

42. *Sea otters do not have a layer of blubber to keep warm. They need to eat 25 percent of their body weight each day to survive. How many pounds of food does a 65-pound otter need daily?*
    A. 10 pounds
    **B. 16 pounds**
    C. 20 pounds

43. *Sea otters can be found*
    A. On the Oregon Coast
    **B. On the California and Alaskan coasts**
    C. Only around the Hawaiian Islands

44. *Sea otters use stones as anvils on which to break open the shells of their prey.*
    **A. Yes**
    B. No

45. *One predator of the sea otter is*
    A. Humans
    B. Octopus
    C. Mackerel
    **D. Sharks**

46. *Sea otters wrap themselves in kelp to keep from drifting while they sleep*
    **A. Yes**
    B. No

47. *The closest relative to dolphins are*
    A. Fish
    B. Deer
    **C. Polar bears**

48. *An adult Blue whale weighs as much as*
    A. 10 elephants
    **B. 18 elephants**
    C. 30 elephants

49. *Where would you find Narwhals?*
    **A. In the high Arctic region only**
    B. From Guam to the Marinas Islands
    C. In the southern hemisphere only

50. *The only great whale that is not listed as endangered is the*
    A. Blue whale
    B. Humpback whale
    **C. Gray whale**

51. *Are there any freshwater whales?*
    A. Yes
    **B. No**

52. *Are there any whales that have become extinct since the 1800s?*
    A. Yes
    **B. No**

53. *What is the deepest that a whale can dive?*
    **A. Sperm whales that can dive deeper than 1 mile**
    B. Blues that can dive down to 5 miles
    C. Humpbacks that can dive down to 3 miles

54. *Why do whales make seasonal migrations?*
    **A. They move to warmer waters during the winter and bear their calves**
    B. They run out of habitat in their summer feeding grounds
    C. They enjoy visiting tropical islands during the winter

55. *What is a female whale called?*
    A. Sow
    **B. Cow**
    C. Doe
    D. Girl

56. *What is the likely cause of standings?*
    A. The whale is ill from parasites or disease
    B. The lead animal becomes ill and disoriented and other members of the pod follow him/her
    C. Whales practice mass suicides
    **D. A and B**

57. *Whales have been protected for several decades and...*
    A. Their numbers are recovering rapidly
    **B. Some scientists think there may never be a full recovery of stocks to historic numbers**
    C. Most stocks have fully recovered

58. *You can tell a dolphin from a porpoise by*
    A. The shape of its tail
    B. The number of blow holes
    **C. The shape of their teeth**

59. *The bottle-nosed dolphin is found in*
    **A. Shallow coastal waters**
    B. Open ocean around islands
    C. Rivers and lakes as well as the ocean

60. *Are there species of dolphins that are found in rivers?*
    **A. Yes**
    B. No

61. *Most scientists believe that whales evolved from an ancient, now-extinct terrestrial mammal.*
    **A. Yes**
    B. No

62. *Seals, Sea lions, and Walruses are called pinnipeds. What does this term mean?*
    A. Four-footed
    B. Pin-footed
    **C. Feather-footed**

63. *The largest member of the dolphin family is the*
    A. Bottle-nosed dolphin
    **B. Killer whale**
    C. White-sided dolphin

64. *Baby whales gain weight quickly because*
    A. They immediately begin feeding on Krill
    **B. Their mother's milk is very rich in fat**
    C. They eat continuously from the moment they are born

65. *Mammals have hair, give birth to their calves, and feed their young milk. Do whales have these characteristics?*
    **A. Yes**
    B. No

66. *Most mammals have five senses—touch, hearing, sight, smell, and taste. Which of these senses have whales lost?*
    A. Hearing and touch
    B. Sight and taste
    **C. Smell and taste**

67. *Can whales have external parasites such as lice?*
    **A. Yes**
    B. No

68. *Which marine mammals are being trained to retrieve scientific equipment from the ocean floor?*
    **A. Sea lions**
    B. Sperm whales
    C. Killer whales

69. *The greatest threat to whales today is*
    **A. Rapid human population growth, which is changing the world's oceans**
    B. Marine debris
    C. Radioactive wastes dumped into the ocean

# Member's Record Book

## Amazing Marine Mammal Trivia

Date _____

List the three most amazing facts you learned today:

1.

2.

3.

Why do you think people are so interested in marine mammals?

Make up a new question for the game:

# Vanishing Habitat

## Concept

The primary threat to the survival of many animals is the disappearance of suitable habitat. Habitat is most important for the purposes of breeding and nursery grounds. In this activity, members will play the role of waterfowl migrating between nesting habitats and wintering grounds.

## Life Skills

Learners will practice:

- Responsible citizenship
- Wise use of resources

## Materials

- Large playing field, yard, or gymnasium
- Paper plates or plastic flying disks (two for each player)

## Time

45 minutes

## Background

Migratory waterfowl need wetlands for both breeding and wintering habitat. Since the northern breeding range and the southern wintering range are often thousands of miles apart, waterfowl also need wetlands between the two regions for feeding and resting during their migrations.

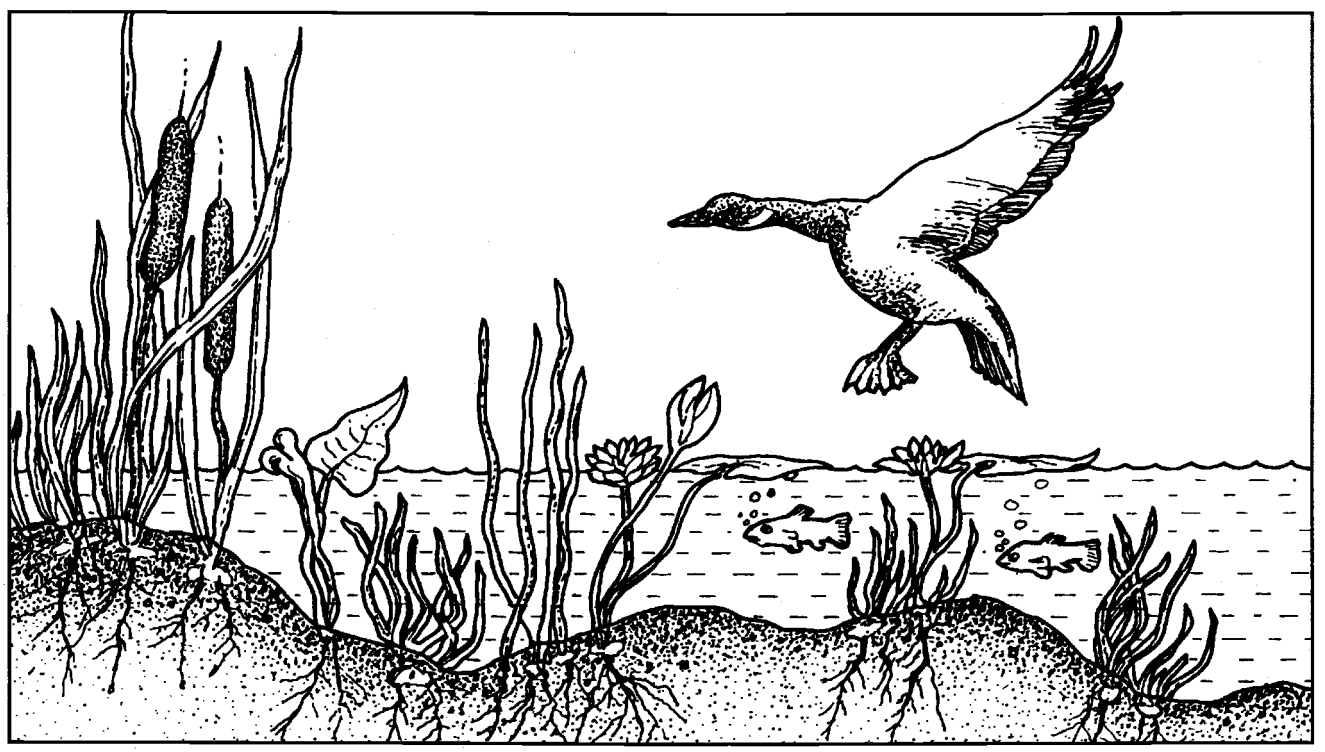
The primary threat to the welfare of waterfowl is the disappearance of wetlands. Dozens of species of ducks, geese, and swans face loss of the necessary habitat for survival.

The migration routes of North American wildfowl are well known. Their journeys take them over lands in which human use is ever increasing. Agriculture, development, and industry are all encroaching on natural wetlands. Pollution, through pesticides and herbicides, takes its toll. Natural conditions also affect the migratory birds. Predators, weather, disease, and fire influence both the birds and their habitat. While use of pesticides and herbicides is relatively controlled in the United States, this is not true of many countries where waterfowl may winter.

In this activity, the events of migration have been simplified to include only the reduction of habitat in the wintering and breeding grounds. In reality, many of the hazards faced by migrating waterfowl are hazards enroute. These hazards should be mentioned in discussion rather than during the simulation in order to keep the rules of the activity manageable. Each member represents tens of thousands of waterfowl. Thus the introduction of natural predators, hunters, and short-term contact events was avoided in favor of the long-term loss of habitat.

## Procedure

1. Paint or otherwise mark one side of the paper plates so that the members will be able to distinguish one side from another easily. Prepare two paper plates for every member.



(This activity works best with large groups of 15 or more.)

2. Select a large playing area about 70 feet in length. Place the paper plates in two patches at opposite ends of the playing field. To begin, there should be one plate for each player at each end of the field. Designate one of these areas the "southern wintering habitat" and the other the "northern nesting habitat." This means you have two sets of plates; one set at the nesting habitat and one set at the wintering habitat.
3. Explain to the learners that they are waterfowl. They will migrate between the southern wintering habitat and the northern nesting habitat at your signal. Have them understand that the paper plates represent wetlands that provide suitable habitat for them. At the end of each migration they will each have to have one foot on a paper plate in order to "survive." One person (bird) per plate. If they cannot find suitable habitat, they will have to move (temporarily) to the sidelines and watch.
4. Describe to the learners the many factors that may affect these two habitats, causing changes. (See the list on page 46.) There will be times of abundant food, water, shelter, and space suitably arranged to meet the habitat requirements of the birds. There will be times when the habitat is stressed, with many factors reducing the potential for waterfowl to survive. Sometimes the size of available habitat is reduced.
5. Begin the activity with all the players at the wintering habitat. Announce the beginning of the first migration. On the first try, all the waterfowl will successfully migrate to the nesting habitat.
6. Explain that there has been no loss in the available northern nesting habitat. Thus, a successful nesting season is at hand.
7. Before the players are sent back to the wintering habitat, the leader turns over a plate. This plate is no longer available to the waterfowl. Repeat the instruction to migrate and send the waterfowl to their southern wintering habitat. When the ducks arrive, explain that a large wetland area has been drained and used for agricultural purposes. Have any displaced players move to the sideline. Emphasize that the loss of habitat caused the waterfowl to die.

The players on the sidelines, will have a chance to get back in the game. They can come back only if there is enough available habitat in the summer nesting ground for them to represent new hatchlings. Instruct them to move to the sidelines of the nesting habitat and wait.

8. Before the next migration to the nesting region, turn over three plates in the nesting habitat. This represents a catastrophic loss. Tell the players that this is the result of an oil spill in the local river, severely damaging shoreline habitat. Instruct the players to migrate to the nesting grounds.
9. Repeat the process as many cycles as you think is necessary to illustrate habitat variables. Add and subtract wetlands with indication of causes. Be sure to allow opportunities for "dead" waterfowl to re-enter the game as hatchlings. Emphasize the variety of conditions that can affect habitat.

**Factors Limiting Survival of Populations of Migratory Birds**

- Wetland drainage
- Drought
- Pollution/contamination
- Urban expansion
- Conversion to farmland
- Converting waterways to canals
- Over hunting
- Lead shot in food supply
- Disease

**Factors Conducive to Survival of Populations of Migratory Birds**

- Preservation of wetlands
- High rainfall
- Restoration of habitat
- Regulation of hunting
- Dynamic balance with natural predators

Overall, habitat for migrating aquatic birds is diminishing — the activity should end with fewer areas of available habitat than can accommodate all the waterfowl. The greatest long-term threat to populations of migratory waterfowl is loss of habitat.

10. Ask the members to summarize what they have learned about some of the factors that affect the success of aquatic bird migration. Emphasize the differences between short-term (temporary) and long-term (permanent) impacts. Distinguish between catastrophic impacts and gradual changes; human-caused factors and natural factors.

## *Follow-up Activities*

1. Explore habitat loss or gain in your community.
2. Learn about how migratory birds navigate. What other types of birds, besides waterfowl, migrate over national boundaries?
3. Map the migratory pathways of a particular species of waterfowl. Include on your map major wetlands along the route and also centers of human population and development that might threaten those wetlands.

From *Project WILD, Aquatic version.* Western Regional Environmental Education Council.

# Member's Record Book

## Vanishing Habitat

Date _____

What is habitat? _____

_____

_____

Why is habitat so important to migrating birds? _____

_____

_____

List three things that might happen to make habitat "vanish." _____

_____

_____

_____

List three things that can be done to preserve or re-establish habitat. _____

_____

_____

_____

_____

# A Voyage Through Your Home and Supermarket

## Concepts

1. Oceans are the direct source of some products found at the grocery store.
2. Oceans provide a waterway for ships bringing products manufactured overseas to the United States.

## Life Skills

Learners will practice:

- Problem solving
- Critical thinking
- Teamwork
- Wise use of resources

## Materials

- World map or atlas that can be mounted on a cork board
- Cork board or cardboard surface
- Sewing pins with colored heads
- Self-sticking file drawer labels
- Colored pens or pencils

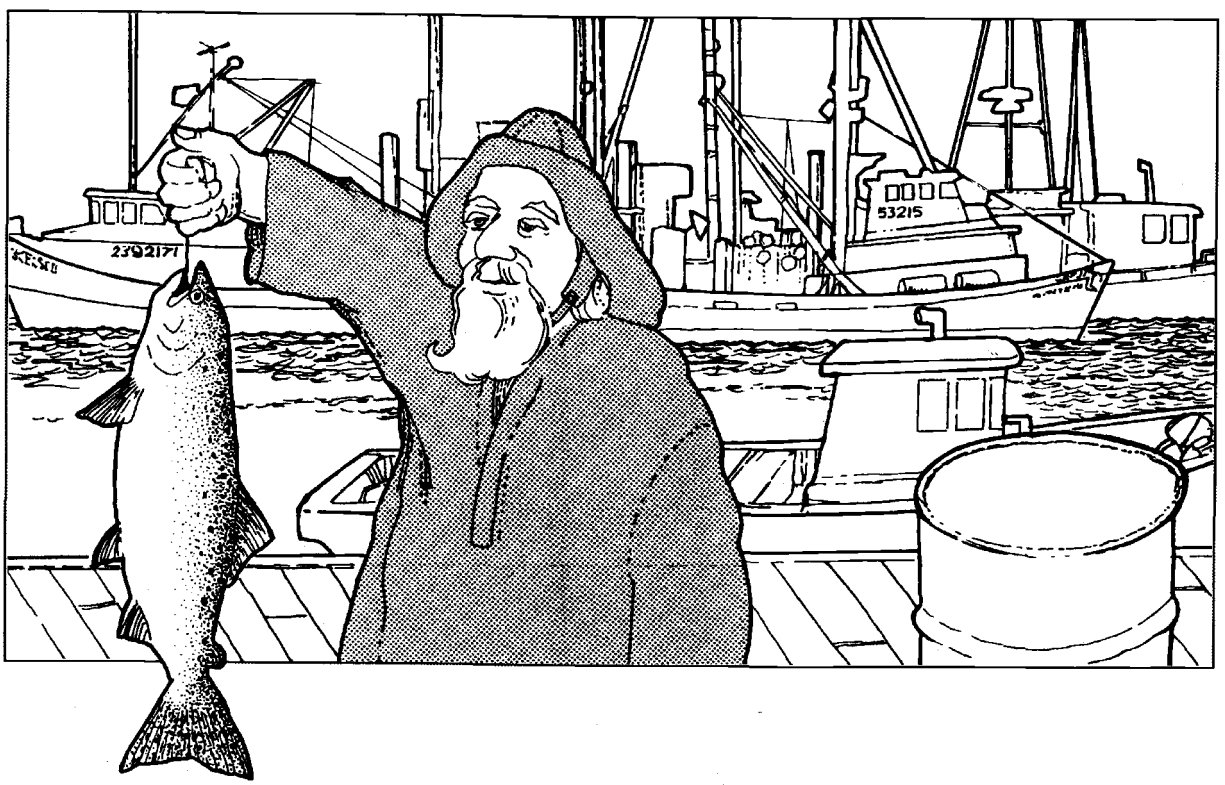
## Time

- 30 minutes, one meeting for introduction and discussion
- 1 hour, one meeting for review and sharing of research findings

## Procedure

Introduce members to the idea that many different products come from the ocean or travel over the ocean to get to our homes and supermarkets. Bring in several examples, such as clothing and seaweed (algae) food products. Ask learners to make some predictions in their Member's Record Book of which products they will find in their homes and stores that are from the sea or have traveled over the sea to reach them.

Algae (seaweed) extractions are used in many of the products that we use and enjoy every day. Gels are extracted from algae and used in products such as ice cream, chocolate milk, and milk shakes to improve smoothness and keep solids in suspension. Some kinds of algae are used for medicinal purposes. Seaweed extracts will probably be called carrageenan, vegetable gum, or alginin on the food labels.



The learners will need sufficient time to look through their homes and stores. Schedule the follow-up lesson for a specific date so that all the learners know what the deadline for completing their research is.

Reviewing the research—Ask each learner to share one item that they found at the store or in their home. Learners might start by sharing one of the items that surprised them. Attach the map to the cork or cardboard. Learners will make flags by folding the labels around the pins. Write each type of product on a flag and stick it into the world map in the country where the product originated. Make sure that each learner gets to put at least one flag on the map.

## *Follow-up Activities*

1. Eat at a Japanese restaurant that serves cessio (rice, fish, and vegetables wrapped in seaweed.)
2. Learn to prepare an algae dish.
3. Try some fish, shellfish, or another ocean product that is new to you. Many fish markets carry squid, shark, octopus, and other interesting foods from the sea.
4. Find out what items the United States exports. Make a map of the major shipping routes used by cargo ships.

# Member's Record Book

## A Voyage Through Your Home and Supermarket

Date _____

Before you go to the store, predict where in the supermarket products from the ocean will be found. List as many places as you can think of.

Predict which items in your home were manufactured overseas.

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**At the Supermarket**

List all the ocean products you find, along with the country where they were made.

Put a star next to the product that surprised you the most.

**********

**At Home**

List all the products you find that are manufactured overseas, along with the country where they were made.

Put a star next to the product that surprised you the most.
Below, list products that other learners found in addition to those that you located.

# A Conversation with Yourself

## *Concept*

The community's land-use ethic is a composite of the ideals of each person. Members are encouraged to think about what they believe in regards to the human impact on our water world, and to articulate their own personal land/water-use ethic.

## *Life Skills*

Learners will practice:

- Problem solving
- Critical thinking
- Wise use of resources
- Responsible citizenship

## *Time*

30–40 minutes

## *Procedure*

Ask learners how land- and water-use policies are established. Keep asking how and why questions until they begin to realize that in order for something to happen, it must start with a person or group of people that strongly believes something. For example, someone must be concerned about pollution before they are willing to do something about it.

Read the following piece to the group, then invite them to thoughtfully respond by writing in their record books. Do not pressure them to share their thoughts unless you are certain they feel comfortable doing so.

**I Am Only One**

I am only one. I am not affecting the oceans. Someone else is doing it. The chemical plants are doing the polluting. The oil refineries and industrial plants are doing it, not me!

Pollution problems usually are blamed on industries and the needs of large cities. We don't think about the fact that the industries are in business because some of us want their products. Most people don't think they personally pollute their own environment, at least not seriously.

Think about the materials that you probably add to the water or soil. For example, when you wash a car, fertilize the lawn, take a bath, or even brush your teeth, you add new substances to the environment.

Soaps, toothpastes, and chemicals, along with human wastes, go into a drain or a sewer. Some cities may have sewage plants to partially treat the wastes. But whether the wastes are treated or not, most of the substances you add to the water cannot be removed. The sewer finally empties into a river and the river into the ocean.

Some chemicals get into water in another way. Fertilizers and weed killers often sink down through the soil into underground water sources. This water eventually drains into streams and lakes and finally the ocean. Do you think these chemicals affect our waters and the living things in them? Do you think about how these substances affect food webs and material cycles? Do you think about pollution when you run soapy bath water down the drain? Should you? Do you think there are things you, your family, and friends can do to stop or lessen water pollution?

From *Investigating the Marine Environment and its Resources.* Sea Grant, Texas A&M University.

# Member's Record Book

## *A Conversation with Yourself*

Date: _____

Do you think about your part in pollution?

Should you?

YOU

YOU

All this talk about the destruction of our coastal environment is over-reacting. There isn't that big of a problem.

**WHAT DO YOU SAY?**

YOU

Our salt marshes are being destroyed! In 20 years there will be none left.

**WHAT DO YOU SAY?**

YOU

We need resources from the sea in order to survive!

**WHAT DO YOU SAY?**

YOU

Prepared by Virginia Bourdeau, Extension 4-H specialist, Oregon State University; from materials compiled by Susan Squires Smith; with technical review by Vicki Osis, Extension marine education specialist, Oregon State University. Illustrations by Lolita Designs. Funding provided by Oregon Sea Grant.





Published July 1999. Reprinted July 2001.