

SEA OTTER BIOLOGIST



ACTIVITY BOOK



Sea Otter Biologist Activity Book

This book features five hands-on activities designed for 8- to 12-year-olds. Each activity includes one 30- to 45-minute project and extensions. Activities can be used in any order. Also included are objectives and learning outcomes, assessment questions, ideas for a presentation or exhibit and topics for further investigation. Wonderwise learning outcomes are based on national science education standards identified by McREL (Mid-continent Research for Education and Learning), the Nebraska Educational Standards, and the National Science Education Standards developed under the direction of the National Research Council. This book incorporates concepts of inquiry-based learning and the 4-H Youth Development experiential learning model.

Each youth participant should receive a copy of the activities. Copies of this book can be downloaded from the Sea Otter Biologist CD-ROM.

WONDERWISE
Women in Science Learning Series

Wonderwise introduces you to women who have made science their career. Each kit is a comprehensive instructional package that includes a video, CD-ROM, and activity book. With these materials, leaders and youth explore the world of women scientists and discover together the fun of learning about science. For more information about Wonderwise, including free samples, Web activities, resources, science education standards and ordering information, visit our Web site:

wonderwise.unl.edu



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TABLE OF CONTENTS

OTTERS IN ACTION /ACTIVITY ONE 2

Watch a video about biologist Brenda Ballachey, then observe sea otters and record their behavior.
Learning Outcomes: Youth develop an understanding of animal behavior and learn to collect, analyze, interpret and display data.

KELP CRITTERS /ACTIVITY TWO 11

Make a kelp forest community in your classroom.
Learning Outcomes: Youth develop an understanding of the characteristics of living things and ecosystems.

FRAGILE WATERS /ACTIVITY THREE 18

Learn about the Exxon Valdez oil spill and conduct three oil investigations.
Learning Outcomes: Youth develop an understanding of natural hazards and environmental changes, and learn to collect and organize data and interpret their findings.

OTTER SMORGASBORD /ACTIVITY FOUR 30

Investigate how much food a sea otter pup needs to eat during the first year of life.
Learning Outcomes: Youth learn to collect data, calculate, and solve mathematical problems using the data, and interpret and communicate their findings.

TRACKING OTTERS /ACTIVITY FIVE 38

Discover how scientists track sea otters, and then try it yourself.
Learning Outcomes: Youth learn to use simple tools to gather scientific data and extend the senses.

PULLING IT ALL TOGETHER 44

Create a story about a scientist who works with sea otters.
Learning Outcomes: Youth draw on what they have learned in the activities to construct their own understanding of what it means to be a scientist.

NEW WONDERS 45

Here are some ideas you might like to use for projects or exhibits.
Learning Outcomes: Youth develop an understanding of science and technology in society and of science as a human endeavor.

INFORMATION FOR LEADERS

What You Will Need for Each Activity

Listed below are the materials and preparations you will need for each activity. Most of the materials can be purchased locally. The more difficult-to-find items can be purchased from Wonderwise. The symbol © indicates that an item can be ordered from the Wonderwise Web site or GPN, the Wonderwise distributor. To purchase supplies, kits, videos, or CD-ROMs contact:

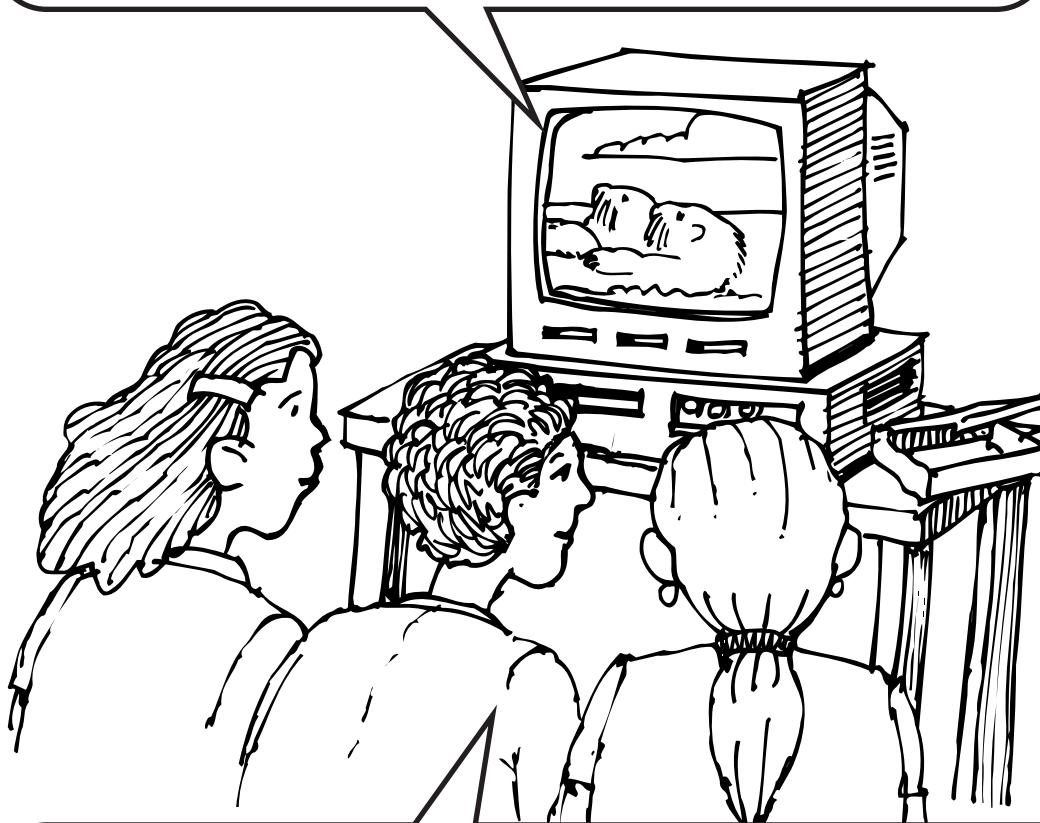
GPN (Great Plains National)
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 e-mail: gpn@unl.edu ▪ Web site: gpn.unl.edu

Activity 1 Otters In Action	Activity 2 Kelp Critters	Activity 3 Fragile Waters	Activity 4 Otter Smorgasbord	Activity 5 Tracking Otters
<p>For the entire group: © 14-min. video <i>Brenda Ballachey, Sea Otter Biologist;</i> 12-min. video of <i>Sea Otters in Action</i></p> <p>For each participant:</p> <ul style="list-style-type: none"> ▪ pencil ▪ colored pencils or crayons 	<p>For each team of 2-3:</p> <p>© Beachcomber's Guide or pictures of kelp forest animals downloaded from the Web</p> <ul style="list-style-type: none"> ▪ space for the kelp forest: a corner of the room or floor-to-ceiling wall space with a 1-meter area in front of it ▪ 1 package of different shades of green crepe paper (flat sheets) ▪ white construction paper ▪ markers or colored pencils and crayons ▪ tape ▪ stapler ▪ scissors ▪ rocks (10-12 cm. in diameter, 2 for each participant) 	<p>For the entire group: © Exxon Valdez Oil Spill Map (optional)</p> <ul style="list-style-type: none"> ▪ 1 newspaper to cover work area <p>For each team of 4:</p> <p>Part 1</p> <ul style="list-style-type: none"> ▪ Scale -- gram wts. ▪ 3 baby food jars ▪ 1 quart motor oil ▪ water <p>Part 3</p> <p>© plastic pipet or dropper</p> <ul style="list-style-type: none"> ▪ 2 paper towels ▪ plastic spoons ▪ cup of motor oil <p>Part 4</p> <p>© feathers, fur fabric</p> <ul style="list-style-type: none"> ▪ small rocks, sea shells ▪ parsley or carrot tops ▪ oil from Part 2 ▪ small brush ▪ cotton balls ▪ shallow pan ▪ paper towel ▪ hot water ▪ Liquid Dawn detergent <p>To prepare jars:</p> <p><i>Jar #1: fill with ¼ oil and ¼ water</i></p> <p><i>Jar #2: fill half full with water</i></p> <p><i>Jar #3: fill half full with oil</i></p>	<p>For the entire group: © Beachcomber's Guide or pictures of kelp forest animals downloaded from the Web or other sources - photocopy for each participant</p> <ul style="list-style-type: none"> ▪ 1 calculator ▪ colored pencils ▪ 1 sheet 12 x 18 inch white construction paper 	<p>For the entire group: © 1 clicker</p> <ul style="list-style-type: none"> ▪ Map of North America, including Alaska ▪ 11 sheets of 8½ x 11-inch white paper to make signs (see directions below) <p>For each team of 2:</p> <ul style="list-style-type: none"> ▪ 1 empty paper towel tube ▪ 1 blindfold <p>To prepare signs:</p> <p><i>Use 8 sheets of paper to make signs for North, South, East, West, NE, NW, SE, SW.</i></p> <p><i>Use 3 sheets of paper to make signs for Hawkins Island, Mummy Island, and Hinchinbrook Island.</i></p> <p><i>The leader should tape the signs on chairs at the approximate locations shown on the map, page 39.</i></p>

OTTERS IN ACTION

ACTIVITY
ONE

Watch the 14-minute video on Brenda Ballachey, a wildlife scientist working in Alaska. Take a look at human behavior, then watch the Otters in Action part of the video and observe and record the otters' behaviors.



Before You Begin

Work as individuals

Length:
Part I - 45-60 mins.
including 14-min. video
Part II - 45 mins.
Part III - 15 mins.

What You Need

For the entire group:

© 14-min. video *Brenda Ballachey, Sea Otter Biologist*; 12-min. video *Sea Otters in Action*

For each participant:

- pencil
- colored pencils or crayons

What We Know. It is no surprise that people come from all around the world to observe the sea otters that live along the Pacific Coast of North America. One can observe these sleek-looking marine mammals swimming, somersaulting, diving, rolling, shaking, twisting and turning as they interact with each other and their environment. The behaviors you see, such as feeding, grooming and resting, are behaviors that sea otters use to establish social relationships, raise their young and survive in their environment.

Scientists who study the behavior of animals watch them with trained and experienced eyes. Behaviors aren't always what they seem. For example, while sea otters appear to somersault for fun, scientists know that the somersaults help the otter clean its fur and trap air bubbles within each of the tiny fur fibers in its pelt. The fur bubbles help the otter stay afloat, and keep its skin warm and dry. Understanding the meaning of an animal's behavior requires careful observation and analysis.

OTTERS IN ACTION

Part One: Human Behavior

1 Watch the video about Brenda Ballachey. Then let's think about our own behaviors. What do you do when you are hungry? What do you do when you are tired? What do you do when your skin feels itchy? How do you know when someone feels happy? Sad? Tired? Bored? Upset? Excited?

2 Write down the behaviors that go with the feelings on the table below.

BEHAVIORS (What you do, your body language)	
Hungry	
Tired	
Happy	
Sad	
Bored	
Excited	
Hot	
Itchy	

3 Find a partner. Using one of the behaviors you recorded above, but no words, send a message to your partner. See if your partner can guess what you are feeling by watching your behavior.

4 Ask your partner what she thought you were feeling. Take turns sending behavior messages to each other until time is up.



OTTERS IN ACTION

ACTIVITY
ONE

Think It Over



What behaviors do you imagine you might have in common with sea otters?

Part Two: Studying Sea Otter Behavior

- 1** Watch the first 2-3 minutes of the *Otters in Action* video.
- 2** Look carefully at what the sea otters are doing. As you watch, make a list here of everything you see the sea otters doing.






- 3** Rewind the tape to the beginning of *Otters in Action*.





OTTERS IN ACTION

Part Two: Studying Sea Otter Behavior (cont'd)

Recording Behavior

- 1 Look at the pictures below. They show behaviors that belong to the categories GROOM and INTERACT. Read the description of each behavior.
- 2 Watch 5-7 minutes of the *Otters in Action* video, but this time look only for the behaviors included in the categories GROOM and INTERACT. Ignore all of the other behaviors for now. As you watch, place a tally mark in the box next to the name of each behavior, each time you see it. At the end of the video, add your tally marks to find a total for each group of behaviors.







GROOM			
 <p>LOGROLL From belly-up position the otter rotates to the side like a rolling log. Feet and flippers are submerged.</p>  <p>SOMERSAULT A full 360° forward roll with the head tucked close to the belly.</p>	 <p>NIBBLE Mouth contact is made with some part of the otter's own body, in nibbling or licking movement.</p>  <p>RUB Flippers rub some area of the otter's own body.</p>  <p>SHAKE The head is rotated side to side in a shaking movement.</p>	Nibble	
		Rub	
		Logroll	
		Somersault	
		Shake	
Total			

INTERACT			
 <p>RIDE The otter places his body on the belly of another otter by swimming up slowly or by rolling sideways onto its partner.</p>  <p>NOSE Muzzle contact made with another otter.</p>	 <p>TUMBLE Two otters roll over and over each other; the arched backs are usually visible.</p>  <p>WRESTLE In an upright position, two otters grasp each other with forearms around the head and shoulders, then twist to break the hold.</p>	Ride	
		Tumble	
		Nose	
		Wrestle	
		Total	

OTTERS IN ACTION

Part Two: Studying Sea Otter Behavior (cont'd)

- 3** Look at the pictures below that show behaviors belonging to the categories REST, FEED and LOCOMOTION. Read the descriptions carefully.
- 4** Watch the next 5-7 minutes of the *Otters in Action* video. Look only for the behaviors included below. Just as you did before, make a tally mark in the box next to each of these behaviors, each time you see it. Add all of your tally marks up to find a total for each category of behaviors.

<p>REST</p>  <p>ROCK From a head-up position, the otter rocks its body from side to side.</p>  <p>FLOAT Otter floats belly-up on the surface, rear flippers up and quiet.</p>		Rock	
		Float	
		Total	
<p>FEED</p> <p>SUBMERGE Body is totally under water.</p>  <p>PERISCOPE Only the shoulders and head are visible above the water as the otter takes a look around.</p>  <p>EAT While floating on back, otter repeatedly brings forepaws to mouth; food may be shoved into mouth or pieces bitten off.</p>		Submerge	
		Periscope	
		Eat	
		Total	
<p>LOCOMOTION</p>  <p>SWIM Belly-down, the head and back are visible moving along the surface.</p>  <p>DIVE From a belly-down position, the otter submerges head then feet.</p>		Swim	
		Dive	
		Total	

Otter illustrations courtesy of Dr. Jane Packard.

OTTERS IN ACTION

ACTIVITY
ONE

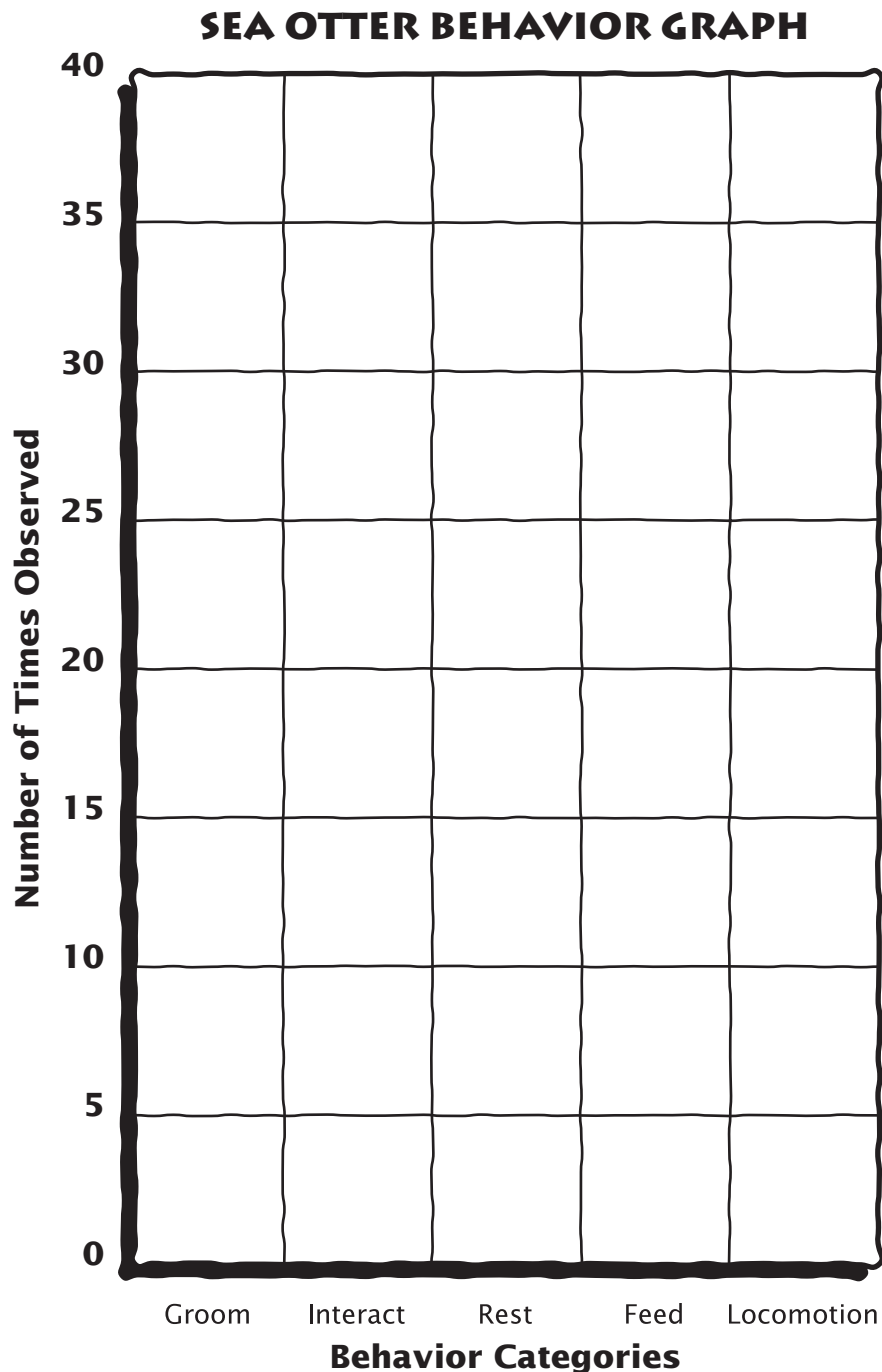
Think It Over

What behaviors do sea otters use
most frequently?

OTTERS IN ACTION

Part Three: Graphing the Data

Use the space below to make a bar graph that shows the total number of times you observed the otters displaying each behavior category.



OTTERS IN ACTION

ACTIVITY
ONE

Think It Over

In the event of an oil spill, an otter's fur becomes coated with oil. The oil causes the fur to become matted, destroying the layer of air bubbles within the fur fibers. How do you think this might affect the otter's behavior?

Excellent job studying sea otter behavior.

KELP CRITTERS

ACTIVITY
TWO

Create a kelp forest and learn about the animals that live among the kelp. Then, draw the animals and create a kelp forest community.



Before You Begin

Teams of 2 or 3

Length:
Part I — 45 mins.
Part II — 30 mins.

What You Need

For each team of 2-3:

© Beachcomber's Guide or pictures of kelp forest animals downloaded from the Web

- space for the kelp forest: a corner of the room or floor-to-ceiling wall space with a 1-meter area in front of it
- 1 package of different shades of green crepe paper (flat sheets)
- white construction paper
- markers or colored pencils and crayons
- tape
- stapler
- scissors
- rocks (10-12 cm. in diameter, 2 for each participant)

What We Know. Imagine yourself taking an underwater walk along the coast of California or Alaska. You would find yourself surrounded by a vast underwater forest made up of a plant called kelp. Kelp is a kind of seaweed. It has a thick stem from which leaflike blades grow. Kelp attaches itself to the ocean floor by rootlike structures called holdfasts. These hold the kelp in place. From there, the kelp grows up toward the sunlight. Giant kelp, such as the kind that grows along the coast of North America, is the largest

seaweed in the world. It grows more than 100 meters long—the height of a full-grown redwood tree.

The animals that live among the kelp make it colorful and keep it healthy. They are a part of the kelp forest community. The forest is home to octopuses, sea urchins, abalone, crabs, sea stars and fish. Sea otters and harbor seals live in the kelp forest because some of their favorite foods are found there, and the kelp provides protection.

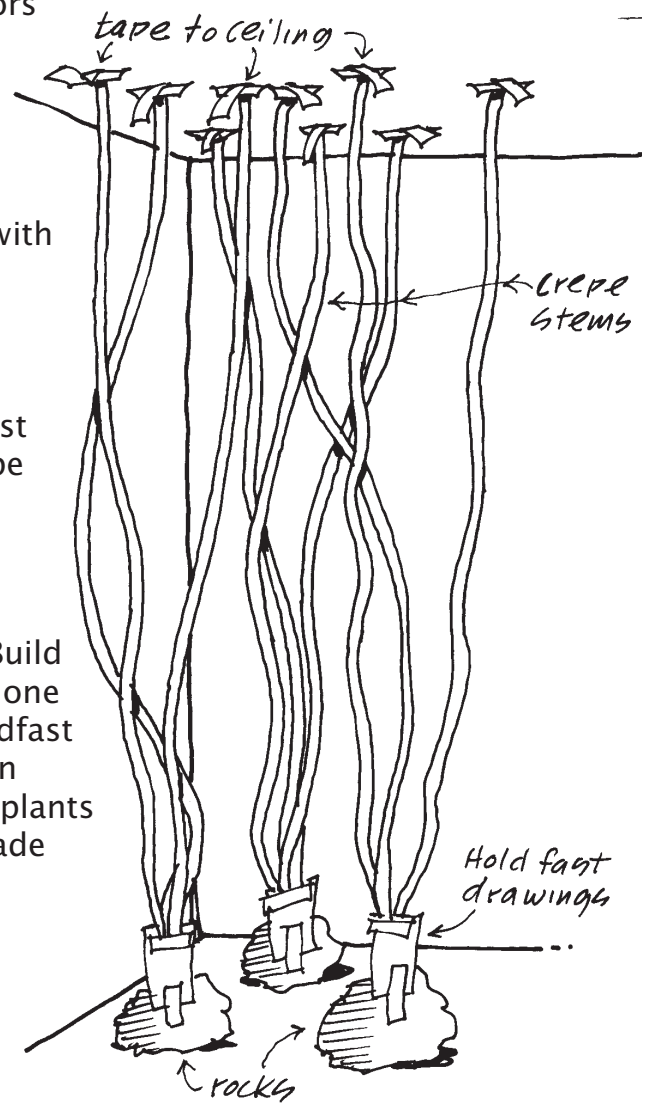
Part One: Creating the Kelp Forest

Take a look at the drawing of kelp on this page. Study the way it looks. Would you say it grows from the bottom up or from the top down? If you have trouble deciding, look for roots called holdfasts. Now which way do you think the kelp grows?

Find a space to set up your kelp forest and gather your materials: crepe paper (1 package), scissors, tape and Holdfast Worksheet (p.13). Follow the steps below to make the kelp stems:

Making the Kelp

- 1** Do not unfold crepe paper but use scissors to cut wavy strips about 3 to 5 cm wide.
- 2** Separate the “kelp” into individual strands. Use tape to join 4-5 strands together at one end to form a kelp plant.
- 3** Make as many “kelp plants” as you can with your crepe paper and tape.
- 4** Color the 2 holdfasts on the Holdfast Worksheet green and brown.
- 5** Cut out each holdfast. Attach one holdfast to each kelp plant at the base (where tape fastens it together).



Building the kelp forest

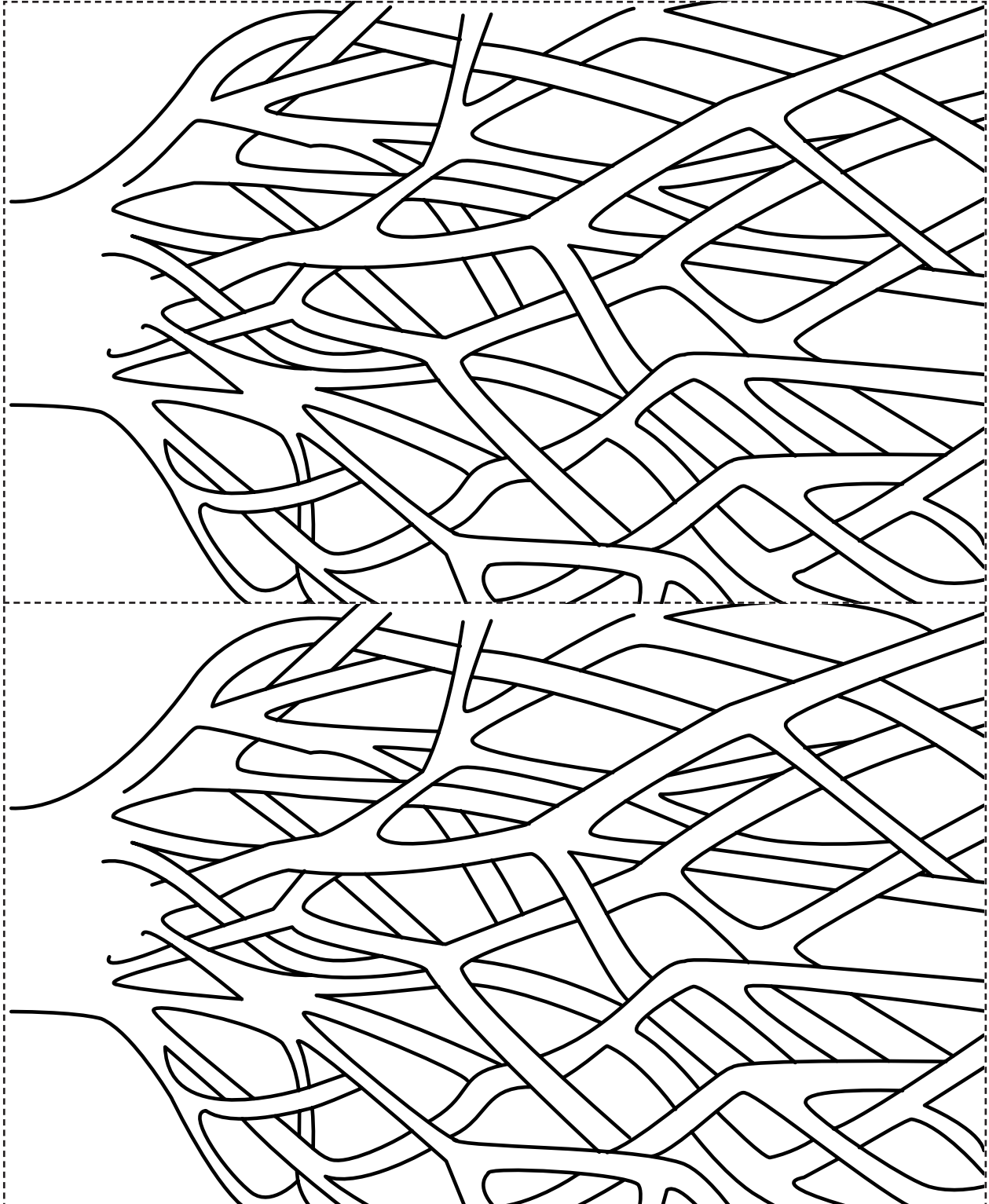
Go to an area set aside for the kelp forest. Build a small rock pile for each kelp plant (or use one large rock for each kelp plant). Tape the holdfast to the rock(s). This will help create the ocean floor. Use tape to attach the top of the kelp plants to the ceiling directly above. Add leaves made from scrap crepe paper.

KELP CRITTERS

ACTIVITY
TWO

HOLDFAST WORKSHEET


Cut along dotted line.



KELP CRITTERS

ACTIVITY
TWO

Think It Over



1. How many meters high is the kelp in your forest? Measure it to find out. Write the height of the tallest stem here:

2. If this were a real kelp forest, the plants would be much taller. Let's say that every meter of your kelp equals 5 meters. How many meters tall would your kelp be if it were growing in the ocean?

Part Two: Kelp Critter Art

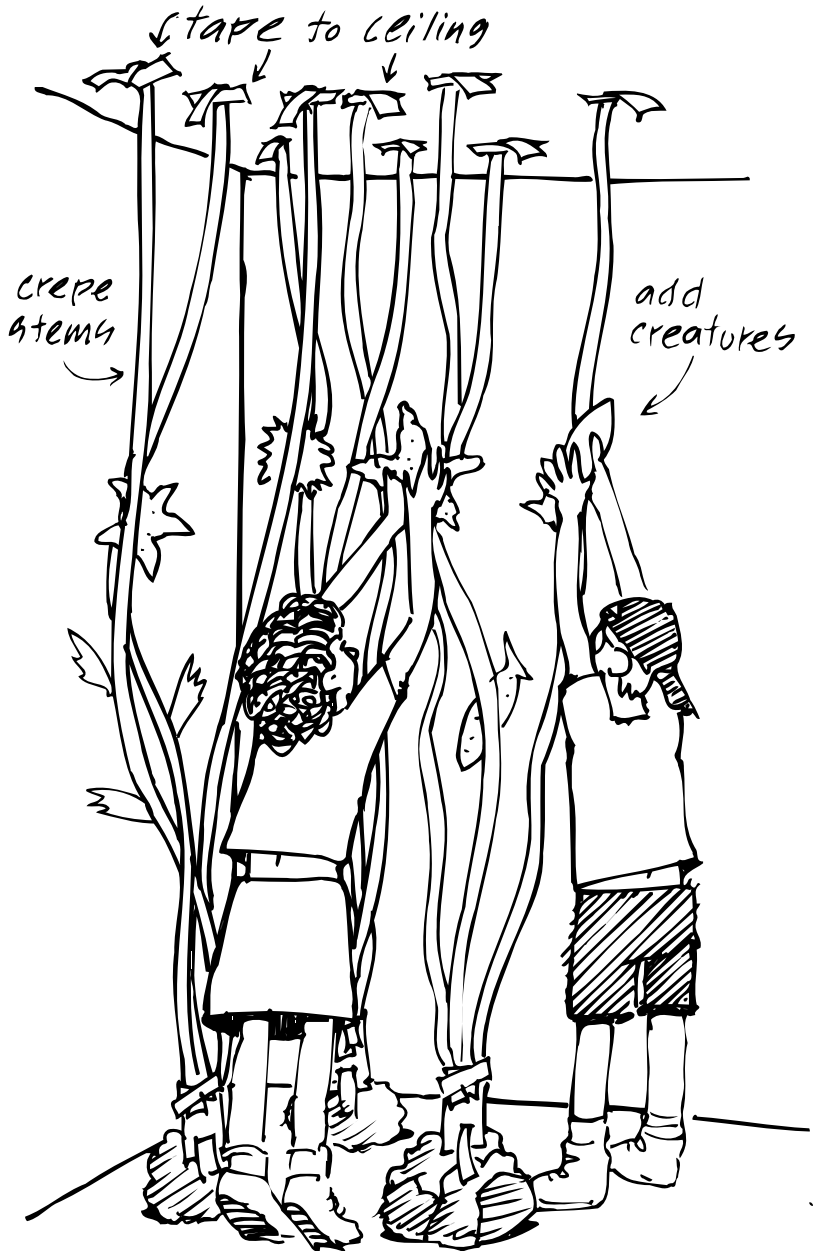
What animals make up the kelp community? It is made up of critters like crabs, sea urchins, abalone, fish, snails, lobsters, octopuses, clams, chitons, mussels and, of course, sea otters.

1 Choose 2 or 3 of the animals listed above to draw. Use your Beachcomber's Guide or pictures from the Web. Make a plan with your group so that everyone is drawing a different animal.

2 Read the information below each picture that tells the size (in centimeters). Try to draw your animals to scale. Use the centimeter scale on the Beachcomber's Guide or a centimeter ruler to determine the correct size. If you choose to draw a sea otter, look at the pictures of otters in this book to help you. (Adult males are about 1¼ meters long while the adult females are about 1 meter long.)

3 Draw your animals on white construction paper. Use crayons or colored pencils to add color to your drawings.

4 Cut out your drawings.



KELP CRITTERS

Part Two: Kelp Critter Art

5 Where in the kelp do the animals live? They live at different depths. To help you decide where to place your animals in the kelp forest, read the chart below.

AREAS OF KELP	ANIMALS
Attached to kelp plants	crabs, limpets, chitons, sea stars
Moving in and around the kelp	sea otters, harbor seals, water birds, fish, mussels
The water column (middle section)	fish, plankton
Benthic (bottom section) of kelp	octopuses, sea urchins, abalone, fish, crabs and lobsters

6 Place your animals in the kelp forest according to the information above. Use tape or a stapler to hold the animals in place.

Great job making your kelp forest!

KELP CRITTERS

ACTIVITY
TWO

Think It Over



Can you think of a way the kelp helps the animals that live in the forest?

Explain your answer here.

FRAGILE WATERS

ACTIVITY
THREE

Study a map of the Gulf of Alaska and track the movement of an oil spill. Then conduct three oil investigations.



What We Know. In the icy, clear waters of Alaska's Prince William Sound live 10,000 to 15,000 sea otters. The rocky coast and plentiful shellfish make this an ideal habitat for otters. Thousands of birds, fish, whales, and other marine life also make their home here. Unfortunately, on March 24, 1989, shortly after midnight, an environmental catastrophe occurred. A 306-meter oil tanker, the Exxon Valdez, slammed into a rock reef which ripped open the ship's steel hull. The crash released nearly 42 million liters of crude oil into Prince William Sound in less than 5 hours. The oil poured out so fast and with such force that a wave of oil 1 meter high formed on

the surface of the water. In less than two days the spill had spread 50 kilometers on calm water. On the 4th day, a storm moved in with winds up to 100 kilometers an hour. The oil continued to spread, and by the 19th day it was 400 kilometers down the coast. By the 56th day the oil had traveled 750 kilometers southward.

One month later, oil was found all along the beautiful and fragile coastline, at distances of more than 1900 kilometers from the original spill. Because sea otters rely on clean and dry fur to keep warm, the oil coating their fur was life-threatening. Scientists estimate 3,000 sea otters died.

Before You Begin

Teams of 4

Length:
Part I - 15 mins.
Part II - 15 mins.
Part III - 30 mins.
Part IV - 45 mins.

What You Need

For the entire group:

© Exxon Valdez Oil Spill Map (optional)

- 1 newspaper to cover work area

For each team of 4:

Part 1

- Scale -- gram wts.
- 3 baby food jars
- 1 quart motor oil
- water

Part 3

© plastic pipet or dropper

- 2 paper towels
- plastic spoons
- cup of motor oil

Part 4

- © feathers, fur fabric
- small rocks, sea shells
- parsley or carrot tops
- oil from Part 2
- small brush
- cotton balls
- shallow pan
- paper towel
- hot water
- Liquid Dawn detergent

To prepare jars:

Jar #1: fill with $\frac{1}{4}$ oil and $\frac{1}{4}$ water

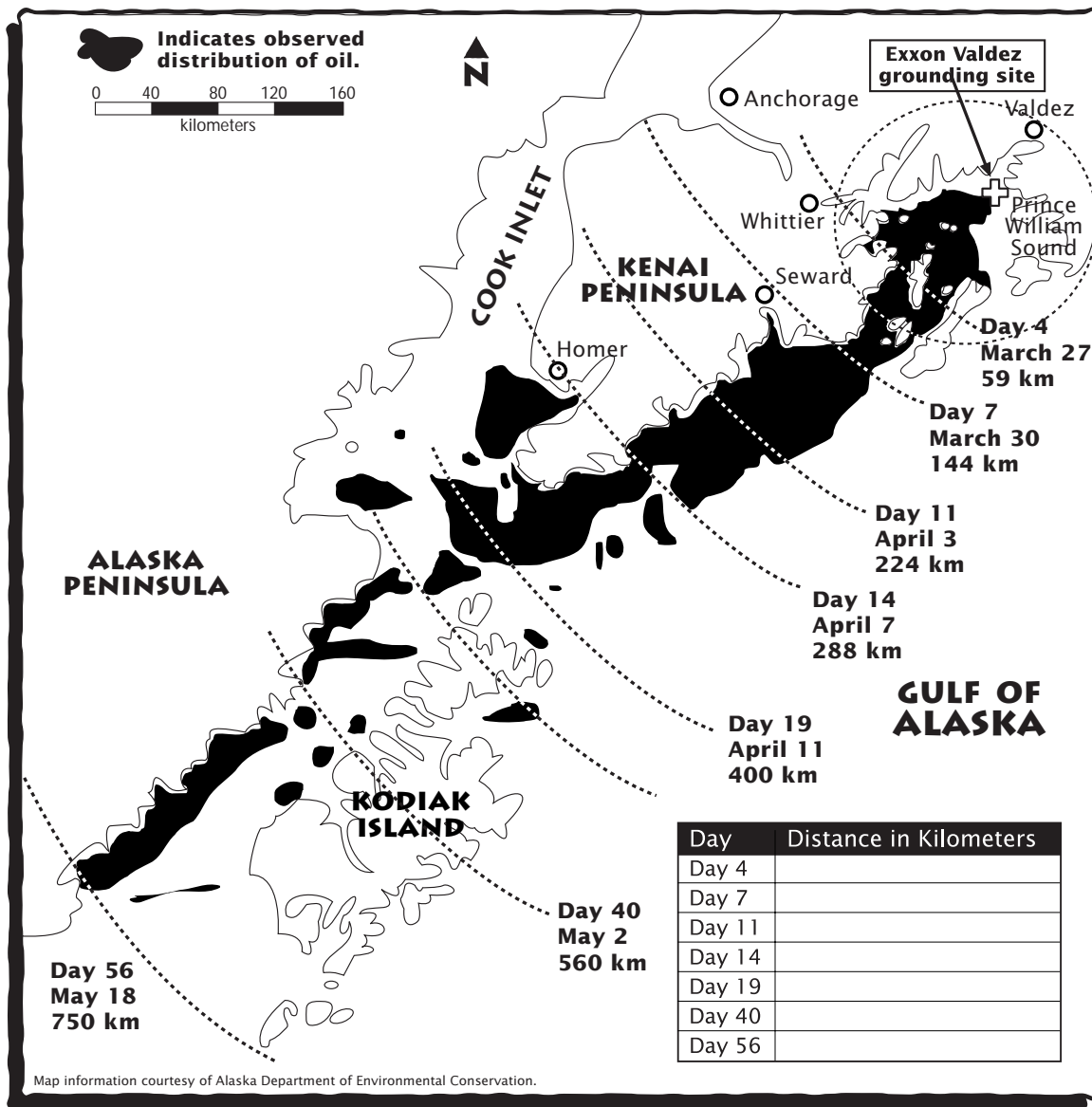
Jar #2: fill half full with water

Jar #3: fill half full with oil

FRAGILE WATERS

Part One: Map Study of the Gulf of Alaska

- 1 Locate Prince William Sound on your large map of the United States.
- 2 Look carefully at the map of the Gulf of Alaska below. Locate the Exxon Valdez grounding site. This is the area where the ship spilled the oil. Color in the grounding site symbol.
- 3 Note how far the oil spread over the 56-day period as indicated on the map. To track the distance, use the information on the map. Fill out the table below to track the distance of the flow.



FRAGILE WATERS

ACTIVITY
THREE

Think It Over



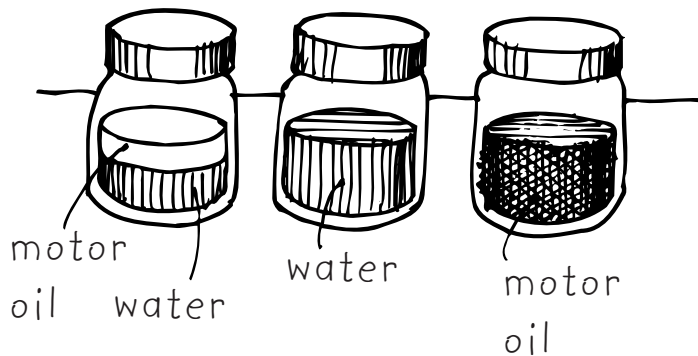
What do you think should be done to avoid
oil spills?

A large sheet of lined paper with a vertical margin line on the left side. There are two circular binder holes on the left edge. The paper is held up by the girl's hand at the top right corner. The lines are horizontal and evenly spaced.

FRAGILE WATERS

ACTIVITY
THREE

Part Two: How Does Oil Behave in Water?



1 Set out your baby food jars on a table. Look carefully at Jar #1. The contents are $\frac{1}{2}$ oil and $\frac{1}{2}$ water. Where is the oil in relation to the water?

2 Make sure the top on the jar is tightened. Try to mix the contents by shaking the jar vigorously. Put the jar back on the table and observe. Now describe the position of the oil in the water.

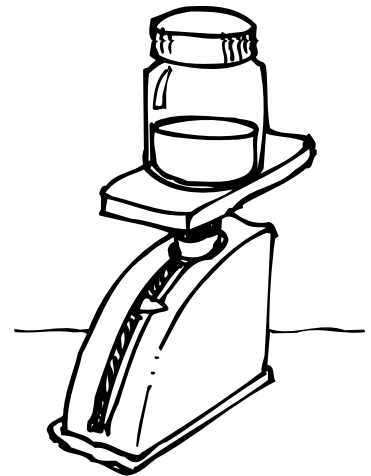
3 Why do you think the oil is sitting on top of the water?

4 Look at Jars #2 and #3. Which one do you think is heavier?

5 Use a the scale to weigh Jar #2 and then Jar #3. Record their weights in the table below.

6 Which one is heavier?

7 Does this explain why the oil is on top of the water in Jar #1? Explain your answer here:

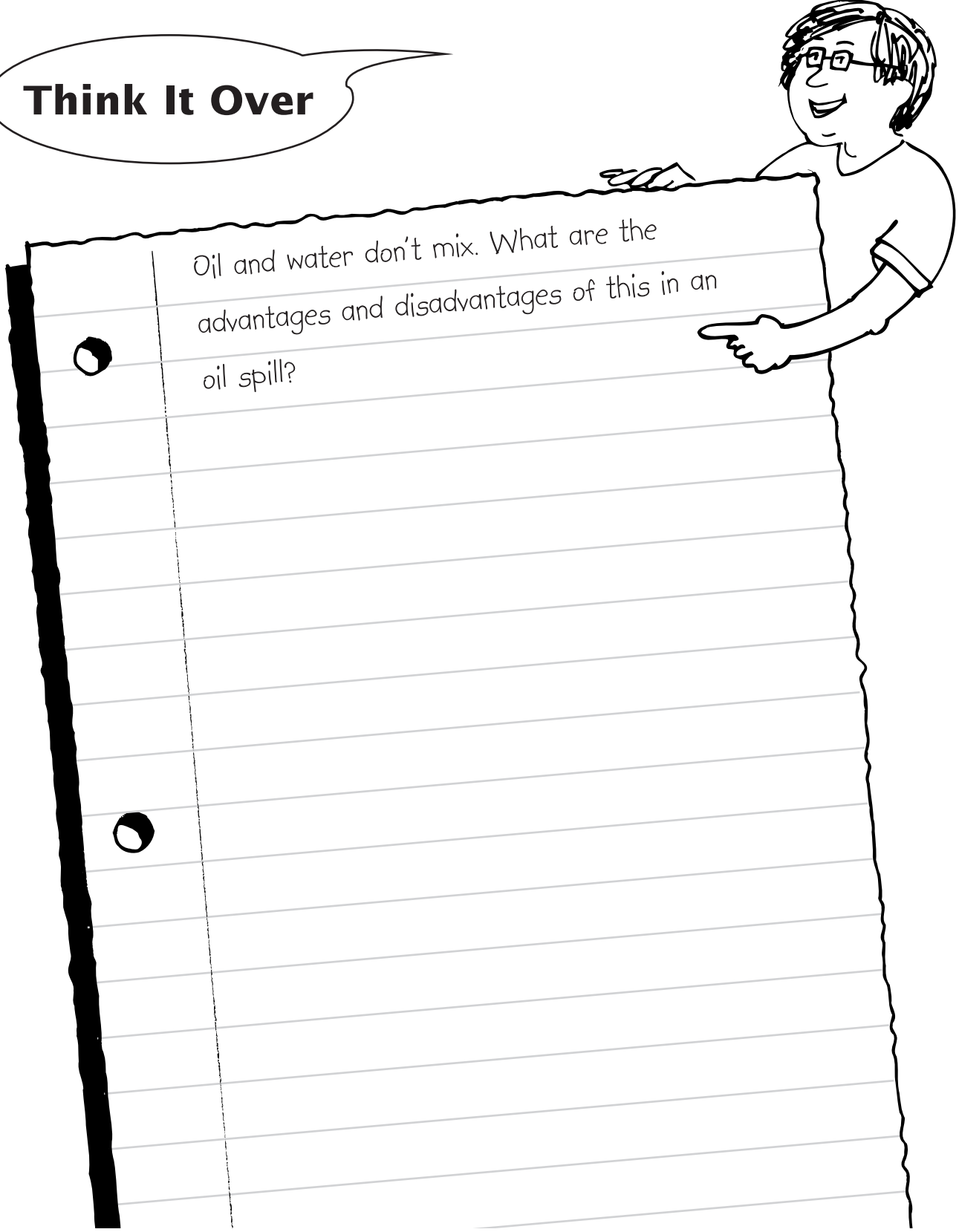


JAR	WEIGHT
Jar #2	(grams)
Jar #3	(grams)

FRAGILE WATERS

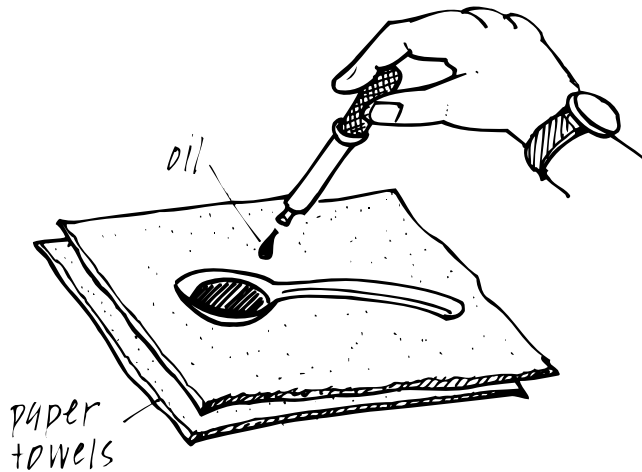
ACTIVITY
THREE

Think It Over



Oil and water don't mix. What are the advantages and disadvantages of this in an oil spill?

Part Three: What Are the Properties of Oil?



1 Stack two paper towels in front of you. Hold the empty plastic spoon so it rests on the paper towels. Remember to keep track of your oil so that it can be properly disposed of.

Pour oil into the spoon until it is very full. Next, have a partner use the plastic pipet to add more oil one drop at a time to your already full spoon.

How many drops can you add before the oil spills over? Record below:

Number of drops _____

- 2** What do you notice about how the oil looks on the spoon?
- 3** What do you think keeps the oil from spilling over while it piles up on the spoon?
- 4** Place the cup of oil in front of you. Begin pouring the oil from the spoon back into the cup. Try to get the oil to leave the spoon one drop at a time. Were you successful? Why or why not?

5 Remember that a real oil slick probably acts similarly to the oil in your spoon. Not only does it float on the surface of water, but it also hangs together. This is due to surface tension.



Good work! Carefully put the oil back into the cup. Place any oily paper towels in the garbage.

FRAGILE WATERS

ACTIVITY
THREE

Think It Over

Think of as many words as you can to describe the properties of the oil you tested.



Part Four: Does Oil Damage Natural Materials?

- 1** Gather your materials: a rock, a sea shell, two feathers, some furlike fabric and some plant material (carrot tops or parsley).
- 2** Use the shallow pan of water to test each item to see which ones will float. Float only one feather (keep one dry for later). Record your results below:

<i>Items that float in water</i>	<i>Items that don't float in water</i>

- 3** Remove all objects from water and dry with a paper towel.
- 4** Which of these items do you think would be the most damaged by oil in the event of an oil spill?

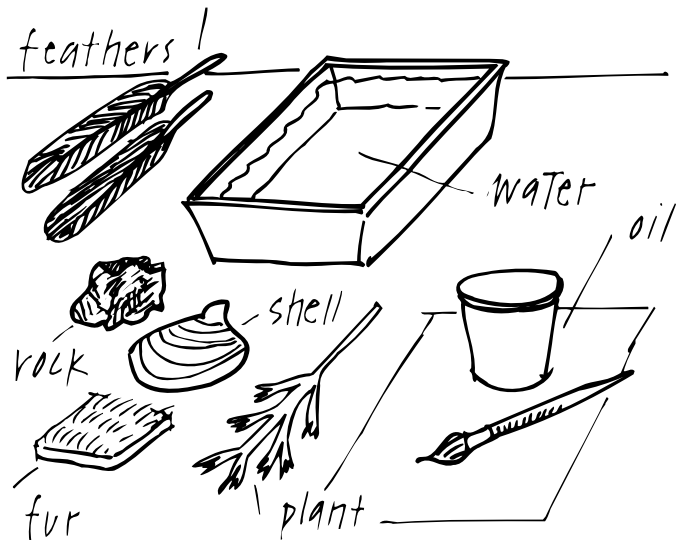
Record here:

Part Four: Does Oil Damage Natural Materials? (cont'd)

5 Place items on a thick pile of several paper towels. Use a brush to apply motor oil from the cup to all items except the dry feather.

6 Did the oil soak into the samples?

If so, which ones?



7 Place one oiled feather and one dry feather in the pan of water. Compare how they float.

8 How do you think an oil spill affects birds?

Part Four: Does Oil Damage Natural Materials? (cont'd)

Which method will clean oil from the items you tested?



9 When an oil spill occurs, scientists and other people must work quickly to try to clean it up. But what is the best way for cleaning the oil-coated animals and other natural objects? Listed in the table on page 28 are four suggested methods for cleaning the oiled materials. Look at the table and predict which method you think will work best. Write your prediction here:

FRAGILE WATERS

Part Four: Does Oil Damage Natural Materials? (cont'd)

10 Use cotton balls with each of the four methods to try to clean the oil off your materials. Use the numbers below to rate how well each cleaning method worked. Record the rating in the table below.

1 very good **2** good **3** marginal **4** poor **5** very poor

	1 very good	2 good	3 marginal	4 poor	5 very poor
	carrot tops	fur	sea shell	rock	feather
cold water					
hot water					
cold water with Dawn detergent					
hot water with Dawn detergent					

11 Which cleaning methods used above worked best? Explain why.

**Great job investigating the properties of oil.
Clean up your area carefully.**

FRAGILE WATERS

ACTIVITY
THREE

Think It Over

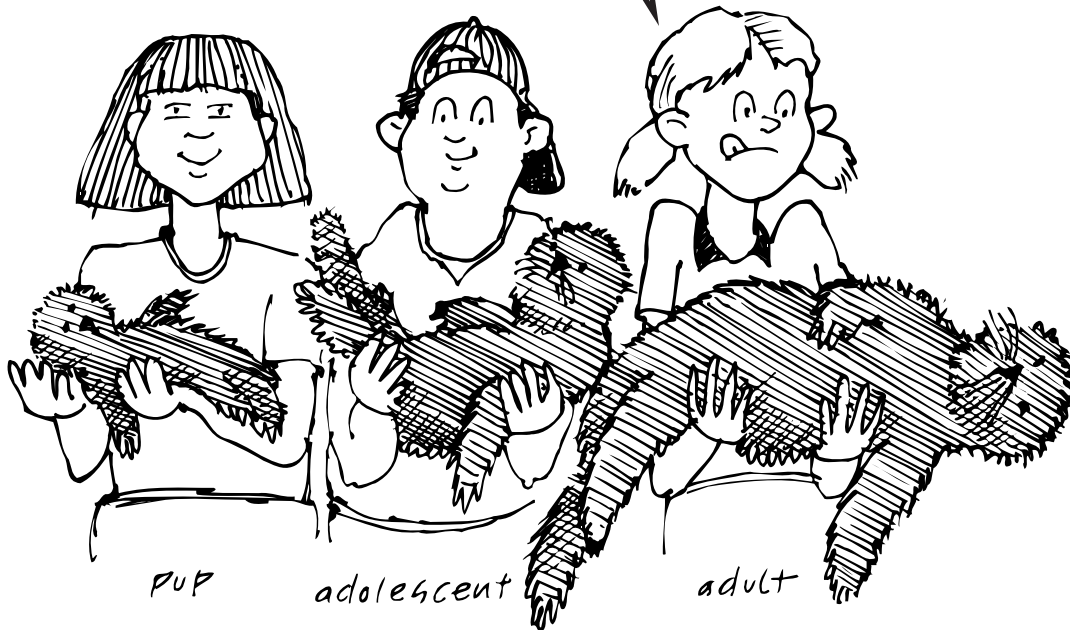
What properties of oil make it hard to clean up?



OTTER SMORGASBORD

ACTIVITY
FOUR

Investigate how much and what kinds of food sea otter pups eat during their first year of life.



Before You Begin

Work as individuals

Length:
Part I - 30 mins.
Part II - 30 mins.
Part III - 30 mins.

What You Need For the entire group:

© Beachcomber's Guide or pictures of kelp forest animals downloaded from the Web or other sources - photocopy for each participant

- 1 calculator
- colored pencils
- 1 sheet 12 x 18 inch white construction paper

What We Know. At birth, sea otters weigh between 1 and 1 ½ kilos. Much like a human baby, they are helpless and depend on their mother's fat-rich milk for survival. By the age of 2 ½ months, otters learn how to dive for prey and begin to eat solid food like fish, squid, clams, sea urchins and crab. At first the pup plays with the food, but eventually starts to take small bites.

By the age of six months, pups are able to capture their own prey. Depending on where they live and what food is available, sea otters learn to eat many different kinds of fish and shellfish. For example, otters who live in the Aleutian Islands of Alaska eat fish. But sea otters who live in the Prince William Sound

area choose invertebrates like sea urchins, clams, mussels and crab. Like humans, sea otters eat a large variety of foods. Their choice of food depends both on what is available and on individual likes and dislikes.

If you were a sea otter how much food would you eat? You would eat a great deal! In fact, sea otters eat at least ¼ of their body weight in food each day. For example, a 20-kilo, full-grown sea otter would eat more than 5 kilos of food a day or about 2,000 kilos of food a year. That is more than two times the amount of food needed for a boy or girl of the same weight. For a human adult that would be equal to eating 100 hamburgers a day! Can you imagine that?

OTTER SMORGASBORD

Part One: How Much Do Sea Otter Pups Eat?

1 How much food do sea otter pups need to eat as they grow? Scientists have determined that the amount of food a pup needs is related to how much it weighs. And, as you learned in the beginning of this activity, sea otters eat more than $\frac{1}{4}$ of their body weight in food each day.

Let's look at an example of how to figure this out:

If a pup weighs 2 kilograms, how much food would it need to eat each day? To find out what $\frac{1}{4}$ of 2 is, divide the body weight of 2 kilos by 4.

Write your answer here: _____ kilograms (kg) of food a day.

2 Record the answer you found above in the table below to show how many kilos of food are needed by the otter at the age of one month. (You should have found that a 2-kilo sea otter requires $\frac{1}{2}$ kilogram of food each day.)

3 Use a calculator to figure the amount of food (to the nearest whole number) needed each day for the next 11 months as the otter continues to grow.

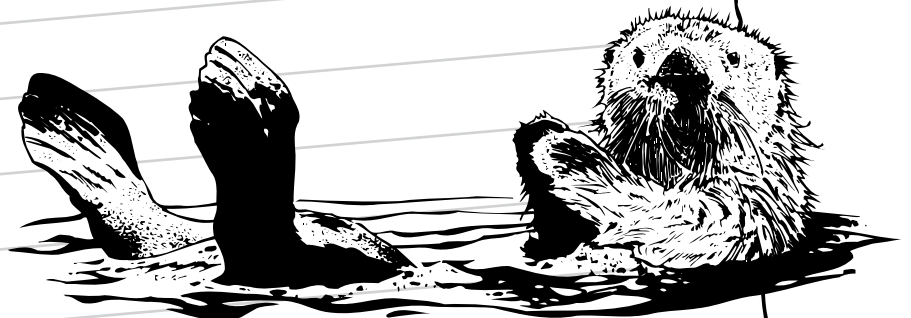
OTTER AGE	OTTER WEIGHT EACH MONTH	KILOS OF FOOD NEEDED EACH DAY
1 Month	2 kgs.	
2 Months	3 kgs.	
3 Months	4 kgs.	
4 Months	5 kgs.	
5 Months	6 kgs.	
6 Months	9 kgs.	
7 Months	11 kgs.	
8 Months	13 kgs.	
9 Months	14 kgs.	
10 Months	16 kgs.	
11 Months	18 kgs.	
12 Months	20 kgs.	

OTTER SMORGASBORD

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FOUR

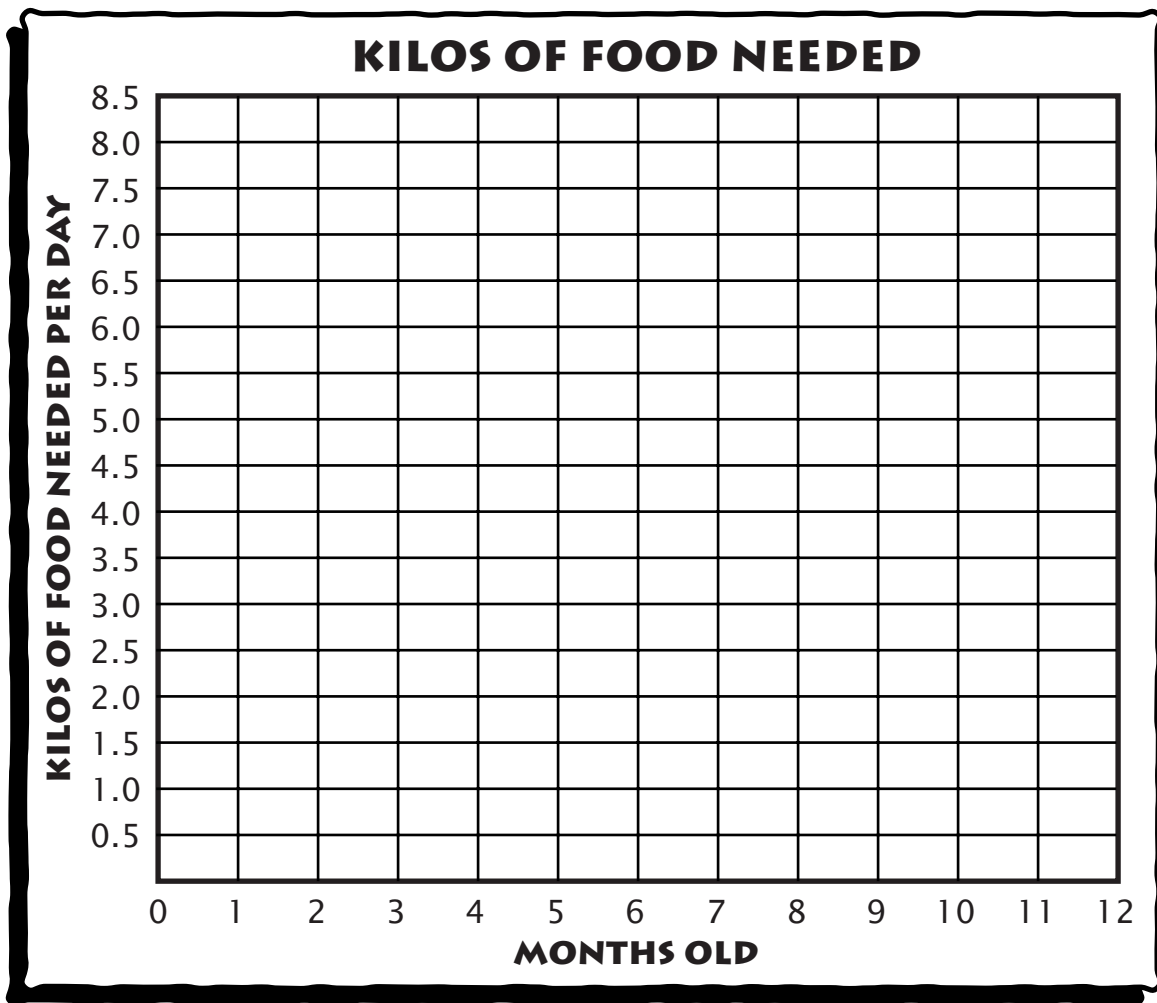
Think It Over

At six months, otter pups are able to capture their own prey. How much food do they need to find each week?



Part Two: Graphing Results

Follow the directions below to create a line graph that shows how much food the sea otter needs as it continues to grow. Use the information from your table on p.31 to make the graph. First, find the age along the horizontal (→) axis. Then find the kilos of food needed for that age on the vertical axis (↑). Now, mark a dot on the graph that represents these two points. Finish by plotting the remaining information from the table on p.31. As you work, join the points you create with a line.



- 1 Find the difference between the amount of food that a 3-month-old and a 12-month-old otter eat.

Write your answer here: _____(kilograms of food/day needed).

OTTER SMORGASBORD

ACTIVITY
FOUR

Think It Over



What does your graph tell you about how much an otter pup eats as it grows older?

Part Three: Diet for a Day

At the age of 12 months, otters are eating about 5 kilograms of food each day. But what do they eat that would equal 5 kilos? In this part of the activity, you will create a Diet for a Day for a 12-month-old sea otter.

- 1** How many kilograms of food will a 12-month-old sea otter require each day? (Refer to the graph on page 33.)

Write your answer here: _____ (kilograms of food needed/day)

- 2** How many grams does this equal? (Multiply amount of kilograms by 1000 to get grams)

Write your answer here: _____ (grams of food needed/day)

- 3** What kinds of food will the sea otter eat during one day?

Use the list below to design a Diet for a Day. Keep in mind the total grams of food the 12-month-old sea otter requires. Use the worksheet below to help you plan your diet.

PREY ITEM	WEIGHT OF EACH PREY
Mussels	2 mussels = 30 grams of meat
Sea Stars	2 sea stars = 30 grams of meat
Scallops	1 scallop = 30 grams of meat
Crabs	1 crab = 30 grams of meat
Butter Clams	1 pound of clams = 30 grams of meat
Abalone	1 abalone = 120 grams of meat
Sea Urchins	4 sea urchins = 30 grams of meat
Kelp Greenling	1 greenling = 180 grams of meat

OTTER SMORGASBORD

ACTIVITY
FOUR

Part Three: Diet for a Day (cont'd)

DIET FOR A DAY			
PREY TYPE (animal)	WEIGHT OF EACH (in grams)	# OF PREY (how many)	TOTAL WEIGHT (in grams)
1			
2			
3			
4			
5			
6			

Add up total weight column to find total grams of food for one day: _____

4 Convert the total number of grams from your weight chart on p.35 to kilograms (divide by 1000; there are 1000 grams in 1 kilogram).

Write your answer here: _____ (kilograms of food needed/day)

5 Go back and look at the Kilograms of Food Needed graph, p.33. Compare the answer above to the amount of food needed for a 12-month-old otter. Do the numbers match? If not, go back and work on the diet again.

Great job completing Otter Smorgasbord!

OTTER SMORGASBORD

ACTIVITY
FOUR

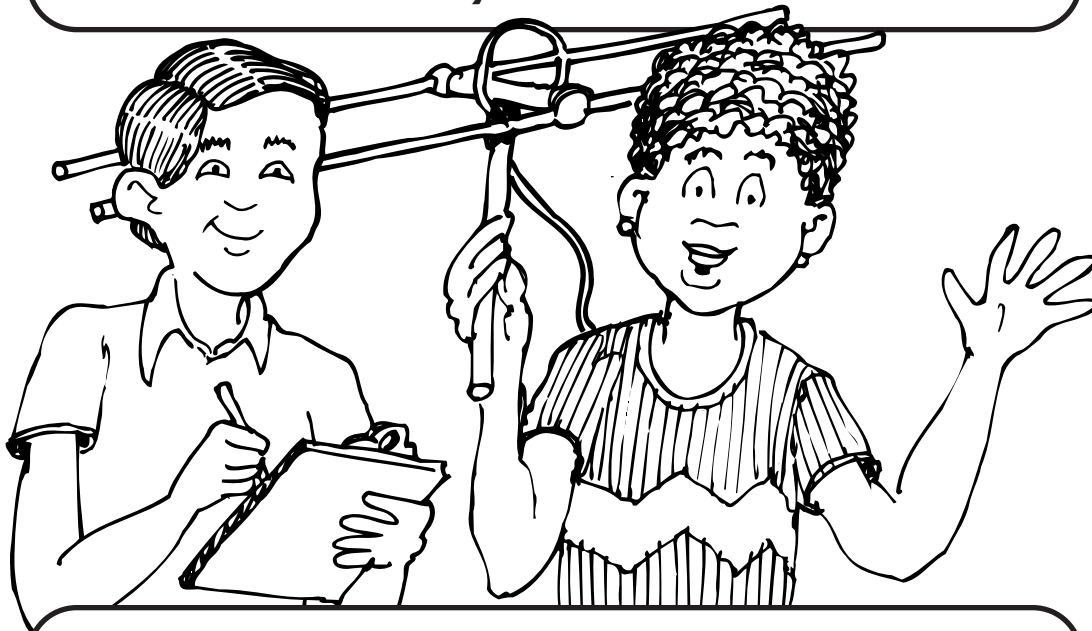
Think It Over

Otters find food on the water's surface and at the bottom of the ocean. How would an oil spill affect what they eat?

TRACKING OTTERS

ACTIVITY
FIVE

Biologists track sea otters using radios. Use a handmade “antenna” to listen for clicking sounds and try to determine where a “sea otter” is located in your room.



What We Know. When sea otters are born, they are completely dependent on their mother and stay in close contact with her. But by the age of six or seven months, they become more independent. Just like human kids, they venture farther away from their mother until eventually they grow up and leave home. After leaving their mother, some sea otters may travel several miles away to a new home while others may remain in the same general area.

Biologists like Brenda Ballachey use a method called radio tracking to learn more about otters. A small electronic transmitter is fastened to the sea otter. The transmitter works like a miniature radio station, but instead of

playing songs, it sends out beeps for 2-3 years or the lifetime of the battery. By tuning a radio receiver to the right frequency (like dialing your favorite radio station), Brenda can identify the beeps coming from an otter's transmitter. She then picks up the signal on a small hand-held antenna and records the location of the beeping. Biologists spend months or even years searching over large areas to locate and track otters.

Brenda Ballachey uses radio tracking to locate young otters and follow their movements in Prince William Sound, Alaska. The tracking method helps her determine how many of the pups will survive the first year of life.

Before You Begin

Teams of 2

Length: 60 mins.

What You Need

For the entire group:

- 1 clicker
- Map of North America, including Alaska
- 11 sheets of 8½ x 11-inch white paper to make signs (see directions below)

For each team of 2:

- 1 empty paper towel tube
- 1 blindfold

To prepare signs:

Use 8 sheets of paper to make signs for North, South, East, West, NE, NW, SE, SW.

Use 3 sheets of paper to make signs for Hawkins Island, Mummy Island, and Hinchinbrook Island.

The leader should tape the signs on chairs at the approximate locations shown on the map, page 39.

Part One: Map Making

Look at a map of North America and locate the state of Alaska. Find the location of Prince William Sound (located in southeastern Alaska). It is a large body of saltwater that lies between the mainland and several islands. This is the area where Brenda Ballachey does her radio tracking research.

Preparing for the activity as if you were at Prince William Sound

1 Choose at least four volunteers to place the eight direction signs (N, S, E, W, NE, NW, SE, SW) up around the room in the correct places. Discuss with the group where they should be placed.

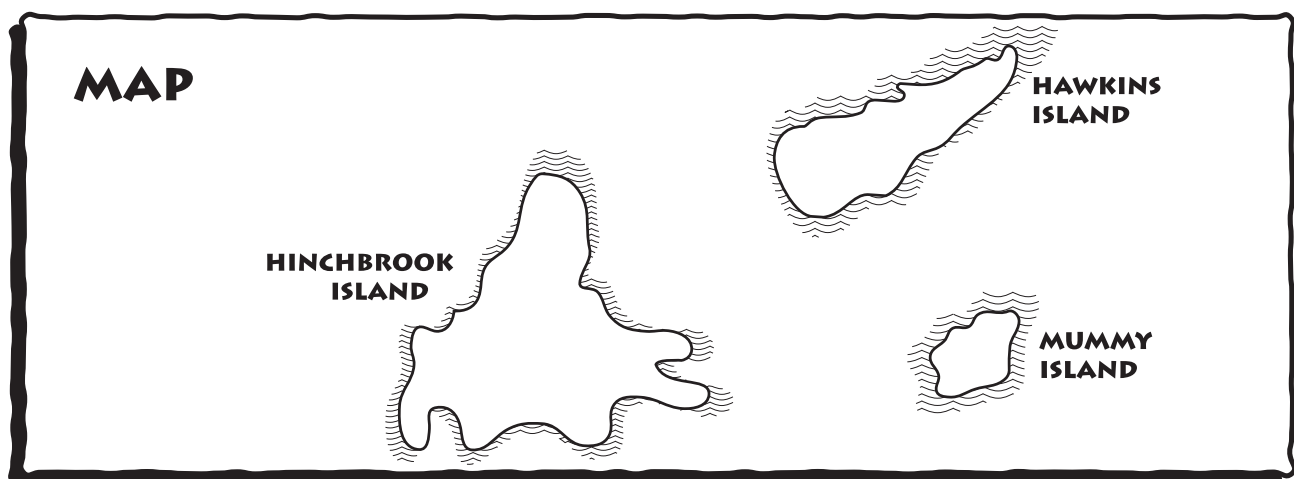
2 Look at the map below. It is a simplified version of the area in Prince William Sound where Brenda Ballachey radio tracks otters. You will use this map during the activity. Follow these directions to finish preparing the map:

Add four directions (North, South, East, West) to the map. Start by writing North at the top, then continue writing the other three directions in the correct places on your map.

Now add the directions for each corner of the map as you did in the room.

3 Notice that your leader has already placed the three Prince William Sound locations, Hawkins Island, Mummy Island and Hinchinbrook Island, on chairs around the room. These are actual locations in Prince William Sound where Brenda Ballachey tracks sea otters. Find them below.

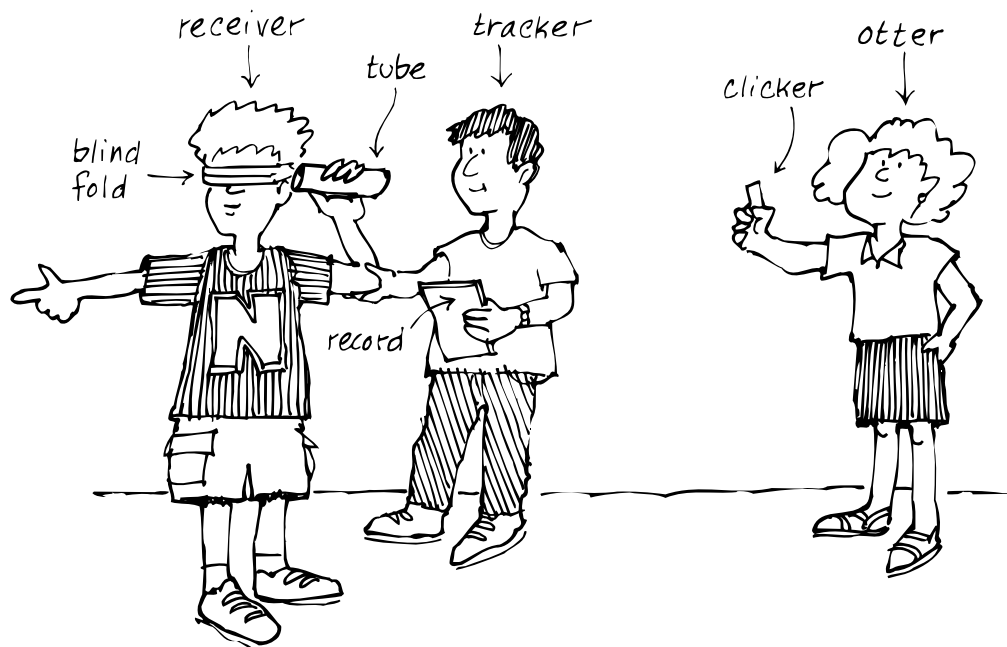
4 During the activity you will imagine that your room is Prince William Sound. Your job will be to track (or locate) an otter. What tools and equipment will you need? How will you find the otter? How will you record what you have found? All of these questions can be answered in the next part of this activity. Turn to Part II now, and have fun tracking otters!



Part Two: Tracking the Otter

Tracking Activity Demonstration

First try a practice run. Choose four people to demonstrate the activity for the rest of the group. Decide who will play each of the following roles: Speaker, Sea Otter, Tracker and Receiver. The Speaker will read the following descriptions slowly and loudly to guide the others through their parts.



Speaker reads:

Sea Otter's role: Get the clicker from your leader. When it is time for the demonstration, move to any location in the room, wait for the Receiver to put on the blindfold, and then press down to make a clicking sound. Click slowly for 30 seconds.

Receiver's role: Take a paper towel tube and a blindfold. Place the blindfold over your eyes and tie it on. Put the paper towel tube up to one ear. Slowly turn in a circle and listen for the Sea Otter's clicks. When you hear the clicking at its loudest, stop and point in that direction. Pull down your blindfold but continue pointing. Check to see how well you located the otter.

Tracker's role: When the blindfold is in place on the Receiver and the clicking begins, the Tracker will help turn the Receiver around in a circle. At the end of each 30-second trial, the Tracker will record a dot on the map that estimates where the Receiver was pointing.

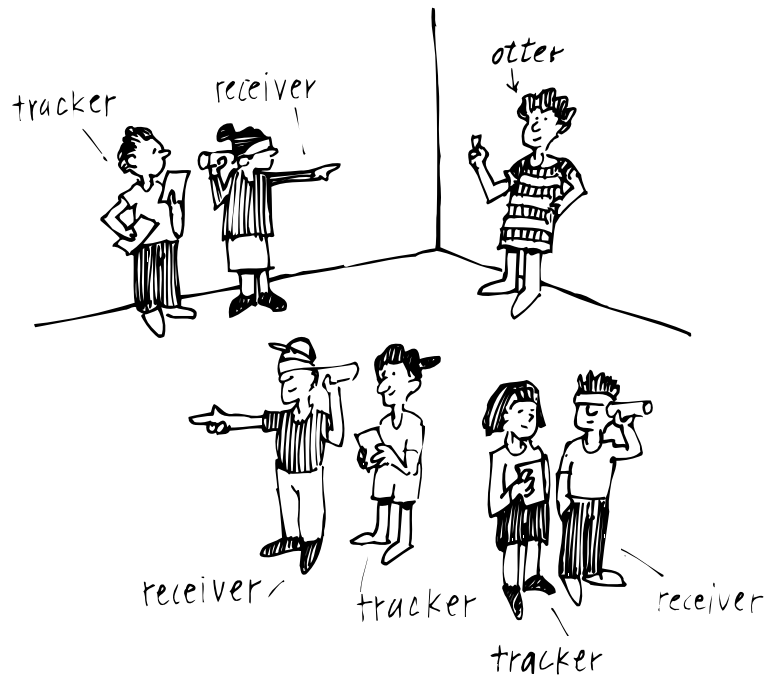
Part Two: Tracking the Otter (cont'd)

Now you are ready to try the activity for real.

1 Choose one person from the entire group to play the Sea Otter. Give the Sea Otter the page titled "Directions For Sea Otter Only," Have the Sea Otter carefully read the instructions.

2 The rest of the group should find a partner and decide who will be the Receiver and who will be the Tracker. Gather your materials: a paper towel tube, a blindfold, a pencil and the maps on page 39 that you prepared.

3 With your materials, go to a spot near one of the direction signs (such as NW, E, SW). As soon as everyone is quiet the Sea Otter will begin clicking.



Trial One - As soon as the clicking begins, the Receiver begins to track the otter. The Tracker records a dot on the map to show where the Receiver is pointing.

Trial Two - Gather your materials and go to a second spot near a direction sign of your choice. Play the same role. Repeat the same steps.

Trial Three - Go to a spot near a third direction sign of your choice. Repeat the same steps. Now, return to your desk with your partner. Use a pencil to connect the three points made by the Tracker.

Now have your team meet and discuss the map you made. Is it correct? Does it match the Sea Otter's movements?

If you have time, try this extension. Trackers and Receivers change roles. Repeat Trials 1-3 exactly as above, but use your partner's map.

Part Two: Tracking the Otter (cont'd)

For the Sea Otter Only: Give this page to the Sea Otter.

Your job as the “sea otter” is to go to each of the islands set up around the room and click slowly for 30 seconds. Time yourself at each location. You will go to a different island for each trial. There will be three trials. Take these written directions with you.

Trial One

- Wait on the sidelines until the Receivers have blindfolds on.
- Then go to the first location, Hawkins Island.
- As soon as everyone is quiet, face in one direction, hold your clicker out and click slowly for 30 seconds. Be sure you are not close enough for a Receiver to touch you. The Receivers will try to locate you. Stay put until the Trackers have marked their maps and the Receivers have pulled down their blindfolds.

Trial Two

- Wait until the Receivers have their blindfolds in place.
- Then go to your second location, Mummy Island.
- Face in a different direction and click slowly for 30 seconds.
- The Receivers will try to locate you. Stay put until the Trackers have marked their maps and the Receivers have pulled down their blindfolds.

Trial Three

- Wait until the Receivers have their blindfolds in place.
- Then go to your third location, Hinchinbrook Island.
- Face in a different direction and click slowly for 30 seconds.

Extension

Go to the same island for all three trials. You will repeat the clicking sequence as before. Be sure to move to the sidelines in between each trial and keep your clicking location secret.

TRACKING OTTERS

ACTIVITY
FIVE



Think It Over

1. What might the otter be doing when it needs to move around a lot? When it is not moving around?

2. Why is it important for scientists to know how much space animals need to live?

PULLING IT ALL TOGETHER

**Create a story
about a scientist
who studies
sea otters.**



NEW WONDERS

Here are some ideas you might like to use for projects or exhibits.



1. Go to your library and read about the fur trade of the 18th and 19th centuries. Find out why sea otters (or a furry animal of your choice) were hunted, how many there were before the fur trade, and what their numbers are today.



2. Learn about one of the animals you drew for the Kelp Critters activity. Go to the library and find books and computer software (multimedia encyclopedia) that have information about your animal. Write a one-page report telling where your animal lives, how big it gets, what it eats, and why it is important to sea otters.

3. Observe the behavior of one of your household pet mammals (dog, cat, hamster). Compare the animal's behavior to that of another animal by recording which behaviors are the same and which are different.

4. Create a poster to investigate the following questions:

Where is oil found? What is it made of?

Is oil a renewable or nonrenewable resource?

What are three renewable resources?

5. Follow these steps to track your own movements for a week: Make a map that shows your home in your neighborhood. Include the streets, your school and some of the stores, parks and other places you visit often. Use your map as a guide, but keep a journal that tells where you go each day for one week.

Can you see a pattern to your movements?

How do your movements compare to those of a sea otter?