girl scouts of the chesapeake bay

H2O River

Resource Book

Pollution Patrol

Go on a scavenger hunt and search for signs of pollution.

Objectives: Define pollution and describe several examples of pollutions.

Materials

Chalkboard or easel paper

Copies of clues

Magazines (optional)

Scissors (optional)

Construction paper (optional)

Your girls can go on a "pollution patrol" scavenger hunt to look for different types of pollution and signs of potential pollution in their community.

Begin the activity by asking the kids what kinds of things come from the mind when they think of pollution. List their ideas on a chalkboard or sheet of easel paper.

Next tell the troop that they will be going outside to look for the kinds of pollution you talked about. Tell the girls to be on the lookout for pollution on the air, in water, and on land.

For younger girls

Before taking the troop outside, show the girls examples of pollution "evidence" they might find on the scavenger hunt. You might bring in things such as an empty beverage cans, some liter from a fast food restaurant, an empty container of household cleaner, and other trash. Or you could show pictures of cars, smokestacks, and outdoor grills, and so on to give the kids ideas about what to look for.

Once you're outside, tell the girls that they should rely on their senses to help them locate and identify pollution. For example they might smell exhaust from nearby cars, see oil spot on the road, or hear noise from a plan taking off or flying overhead. You may want the girls work in teams, with each team focusing on one form of pollution. For example, different teams could search for pollution they can see hear, or smell. Or the can search for pollution on land, in water, or in the air. Each time someone comes across a different kind of pollution, stop to discuss where it might have come from and what effect does it has on wildlife and the environment. (See "What makes It Pollution?" on the next page for some ideas.)

For older girls

Before going outside, use the pollution examples in bold type under "What makes it pollution?" On the next page make up a scavenger hunt clue sheet. Then pass a copy of the clue sheet to each person. Explain to the kids how they can work in pairs to try to look for the signs of pollution listed on their clue sheets. They also can add signs they find that are not included in the scavenger hunt list.

Now take the girls outside. Tell them to think about whether each type of pollution they find affects air, land, water, or combination of all three. Also tell them to think about whether each type of pollution affects people or wildlife in some way.

When the kids have finished their walk, go over the list. Have the girls take turns describing where they found various signs, and then discuss the likely sources of pollution and possible consequences. Use the information under "What makes it pollution?" to help with the discussion.

If there aren't many signs of pollution in your immediate area, have the kids look for them around their neighborhood or on their way to and from your meeting area. Or have them do their scavenger hunt inside by

searching for the clues in magazines. They can work in small teams to cut out pictures and make pollution collages. Tell them that they can use examples of things that can contribute to pollution even though the pictures may not show the pollution itself. For an example a picture of laundry detergent or even an washing machine could be symbolize the fact that many kinds of detergent contain phosphates-chemicals that can pollute surface water and ground water. Or the kids might include a cigarette ad and describe how cigarettes can contribute to the problem of indoor air pollution.

When they have finished, have the teams present their collages to the rest of the troop.

What Makes It Pollution?

(Note: This list does not include all the problems related to each entry. For example, there are a number of pollution problems related to plastic foam, but we've included only those related directly to plastic foam litter.)

Oil stains on the pavement: rain can wash oil into water supplies

Aluminum beverage can: unsightly; doesn't biodegrade; sharp edges may injure wildlife or people; small creatures may get trapped inside.

Paper litter: unsightly; inks and bleaching chemicals can contaminate soil and water.

Plastic six-pack ring: unsightly; doesn't biodegrade; may strangle wildlife.

Litter in a pond, lake, stream, or other body of water: unsightly; may injure aquatic animals that get stuck in it or try to eat it.

Lawn-care truck: lawn-care products contain chemicals that may harm wildlife, pets, and people; rain can wash chemicals into water supplies.

Construction sites: noise may be annoying and may damage the hearing of a construction worker; construction dust may pollute the air; rain can wash uncovered soil into surface water; creates solid and hazardous waste.

Car, truck, or bus exhaust: pollutes the air; harms human health; may contribute to global climate change.

Storm drain: rain washes litter, soil, chemicals, and other pollutants into surface water.

Animal waste: rain can wash waste into water supply; can harm human health.

Household chemical container: unsightly; can leak harmful chemicals into soil, water, or air.

Jet or airplane noise: annoying; may damage age hearing of people who live near or work at airports.

Smog: harms human life.

Overflowing trash containers: unsightly; litter may trap or choke wildlife.

Traffic noise: annoying

Glass litter: unsightly; broken glass may injury people or wildlife; small creatures may get trapped inside jars or bottles.

Smokestack: releases pollutants into the air.

Aerosol spray can: may contain air-polluting propellants or chemicals that can harm people of wildlife.

Plastic foam litter: unsightly; doesn't biodegrade; may injury animals that mistake it for food.

Discarded tires: unsightly; may catch on fire and release harmful pollutants into soil, water, or air.

Roadside dump: unsightly; may contain hazardous material that can leak into soil, water, or air; different type of materials may harm wildlife in different ways (poisonings, choking, trapping, and so on).

Smoke from the chimney: pollutes air; may contribute to global climate change.

Gasoline pump: nozzle releases toxic fumes; underground storage tank may leak gasoline into water supplies;

Person spraying garden pesticide: chemicals may harm people or pets; may kill species other than the other pests; rain can wash it into the water supplies.

Candy or gum wrapper: unsightly; foil and plastic doesn't biodegrade.

Bare soil on a slope: rain can wash soil into surface water.

Natures Recyclers

Summary

Centipedes, earthworms and copepods, oh my!

Girls investigate the connections between soil and a decomposing log or leaf litter.

Objectives

Girls will:

Describe the process of decomposition.

Explain the role of decomposers in soil formation.

Analyze a variety of interactions that occur in nature and at home.

Materials

A few flashlights

Humus, decomposed acorn, or moldy bread

Field guilds to insects, spiders, reptiles, amphibians, etc.

For each student or small group of students

Hand lenses

Bug boxes or clear jars with air holes punched in the lids

Index cards

Small cups and spoons

Pencils

Copies of the appropriate student page Brownies 8; Juniors 9

Clipboard or thick cardboard with the paper taped to it

Extra paper (optional)

Making Connections

Girls may have sifted through leaf litter and noticed a variety of insects and worms. They may not, however, appreciate the importance of these critters to healthy soil. The study of soil formation leads to an understanding of related natural processes as well as relationships between organisms in an ecosystem.

Background

Soil is the loose material on Earth's surface in which plants can grow. The top layer of soil, topsoil, is a dark color in some areas because it contains humus. Humus is formed when decomposers break down organic material (the remains of living organisms such as plants and animals). Because it is rich in nutrients and well-aerated (contains lots of spaces filled with oxygen), humus provides some of the plants need for growth. It is a very important part of the food web. Without it, we would not have many of the food we eat.

There are several different types of decomposers. Fungi (mushroom or bread molds) cannot make their own food, as plants do, so they must absorb nutrients from either dead or alive organisms. Bacteria are microscopic, single-celled organisms that also absorb nutrients from other organisms. Tiny sow bugs, like some insects and other animals, digest organic matter and deposit the decomposed material as a waste product.

Earthworms also contribute to the soil in this manner, and their movement in the ground helps aerate the soil. Cows contribute to the recycling process in a similar way. Their digestive tracts contain decomposers (bacteria) that turn ingested grasses and grains into a nutrient-rich waste product (manure).

Decomposers (or detritivores) consume organic matter, digest it, and leave it behind (excrete) other forms of nutrients. During digestion and excretion, detritus is changed both physically (in size) and chemically (in molecular structure). The decomposition process releases nutrients such as phosphorus and nitrogen, which can then be used by plants for growth. This form of natural recycling–discarded (and dead) materials made into different forms that can be reused-is a slow continual process. It takes 250 to 2,000 years to produce one inch of topsoil!

A fallen log or layers of leaf litter can be used to study nature's recycler's work. Observe material that is lying or just under the soil layer-this is the most decomposed. A great deal of activity centers around these areas.

Wood-eating insects such as termites and some beetles feed on logs, softening the wood; their tunnels provide access for other creatures. Such insects lay their eggs in decaying wood or leaf litter, and when the larvae hatch, they feed on the dead plant material.

These tiny creatures attract hungry birds and other insect-eaters. Look at small holes tapped into wood by a woodpecker.

Many creatures use fallen logs for home sites or hiding places. Moisture trapped under logs is favored by animals such as the salamanders, who must be moist to breathe through their skin.

Logs often have a narrow tunnel used by a chipmunk, or a larger hole that was home to a woodpecker, wood duck, raccoon, or flying squirrel. These "cavity nesters" find that standing dead trees and fallen logs are softer and therefore easier to burrow through nesting. In some cases, animal activities may have caused the death of the trees in the first placed.

Procedure

Warm-up

Note: Before the lesson look for a place on or very near the meeting place that has at least on fallen, rotten log. If you cannot find a log, part of this activity can be done with leaf litter, or a pile of leave that has been there for a good while. As a last resort a woodpile in someone's yard would do.

Introduce the concept of decomposition to your girls before going outside. Bring in some humus and some partly decomposed acorns for the class to poke through and look at with hand lenses. You may want to bring to troop some moldy bread or rotten vegetables that have been your kitchen for to long. Discuss what is happening to these items.

Ask the girls what would happen if we allowed this process to continue? Explain that the food would continue to broken down. If we left it long enough, we would not be able to recognize the vegetable or bread.

How long do the girls think it would take for these food items to become unrecognizable? It would take a long time. Perhaps the students could conduct a controlled experiment in the classroom, to find out how long it takes.

Keep these things for a few days and let the process continue; have the girls periodically check them for changes. Explain that decomposition adds nutrients to the soil. Introduce the word humus. Discuss why plants need soil. Help the students indentify minerals and other nutrients plants need. By checking a vitamin or cereal package, girls can see that we use some of these nutrients as well.

The activity

Prepare the troop for a short trip outdoors. Review safety precautions and rules given below. Stress that you are only going outside to observe, and that everything should look the same as it did when you came. Explain that the class will be observing the many interactions that contribute to decomposition.

Guideline for outdoor manners and safety

Do not stick bare hands into dark holes, since they may contain sharp objects or even biting insects. Instead, use a flashlight to look into holes.

Do not break logs apart. Leave nature to its own course. If there has not been enough opportunity to see inside a log by the end of the lesson, the leader may break open one portion for all to observe.

Respect living organisms and their homes. Try to disturb them as little as possible. If you would like to observe a lively critter more closely, gently scoop it into a bug box or jar with an index card. Keep it only long enough to study and share it with others. Release all living things after observing.

Be sure to "put the roof back on the house" (roll logs back into the exact position in which they where found).

Do not pick live plants. Hitting tree trunks and picking off bark harms the trees (bark is the outer layer that protects the trees). It is okay to collect a few fallen leaves, twigs, and other discarded objects, if you wish.

Outside divide the class into two groups; hand out supplies. Explain the use of the equipment and let the students practice a bit with each item. The cup and spoon is for collecting a small soil sample.

Give the group a copy of the appropriate troop page and a clipboard. Choose a "recorder" for each group.

Review the instructions and questions on page 7 and have girls or the troop fill in the answers.

Wrap up

Either in the field or back in the meeting placer reviews the girls pages and discuss the findings.

Note: Some books refer to fungi (mushrooms, bread mold, and shelf fungus) as plants, though fungi are now classified in their own kingdom. To avoid confusing younger students, Fungi are referred to as plants in this activity. Please make the distinction with more advanced students.

Assessments

Have girls :

Outline the process of decomposition.

Identify the animals that aid in the process of decomposition.

Write a story (from the perspective of an insect or an earthworm) describing the process of decomposition, and why it is important.

Envision what the ground would look like without detritivores.

Nature in Your Neighborhood

The fallen log activity introduces interactions among living and nonliving things. Search for other interactions at home and in your neighborhood. Here are some examples. See how many you can find.

Plants and animals

Insects on a plant (bee on a flower)

Birds eating berries

Dog, cat, or other animal eating grass

People eating fruit or vegetables

Plants and the environment

Plant roots growing into soil

Lichen growing on a rock

Ivy growing on a house

Flower bending toward the sun

Plants and plants

Algae or moss growing on a tree

Mushrooms growing on a dead log

Mold growing on old bread

Animals and animals

Spider with an in sect in its web

Bird eating an insect

People eating meat

People and their pets

Animals in the environment

Bird nesting in the crevice of a building

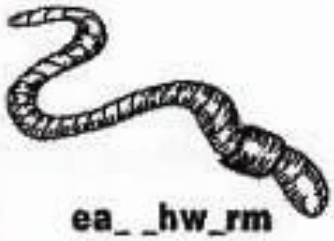
Insect living under a rock

Bird bathing or drinking from a puddle

People breathing

Nature's Recyclers: What's in a log?

These are some of the things that help make logs decay. How many can you find? Finish the name below each picture, then write the answers to the questions below.

Draw this one yourself **ant**	 **cen_ _ped_**	 **_ow b_g**	 **ea_ _hw_rm**
 **m_s_ro_m**	 **te_m_ _e**	 **s_ _g**	 **_os_**

How many creatures can you find on the log?_____

How many plants can you see on the log?_____

What colors are most of the things on or under the log?_____

Do you see any bright colors?_____

What is happening to the log?_____

Look at the soil under the log. Use a magnifying glass. What is soil made of? _____

Now feel the soil under the log. How does it feel?_____

Nature's Recycler's: A Log's Log

Approach the log quietly and observe it before touching it.

Describe what you see (creatures, what they are doing, etc.).

Are there parts that can be easily broken apart?

Are there other plants growing on the log? Describe or name them. Look for mushrooms, shelf-shaped fungi, lichens, mosses, algae, ferns and other plants.

Can you tell how these plants are changing the log? Look for roots growing through the log. Describe them.

Now you may touch the log. Carefully roll it back, just enough to see under it.

Draw and label the three decomposers that you see. Field guides will help you identify them.

How are these animals changing the log? .

Can you find insect holes, tunnels or other signs that creatures have been moving through the log? Describe them.

Describe any evidence (signs) that creatures have made their homes in this log (leaf litter in a cavity, animal droppings, a nest or nesting material, etc.).

Dig up a small sample of soil underneath or next to the los and study its contents. Describe the soil.

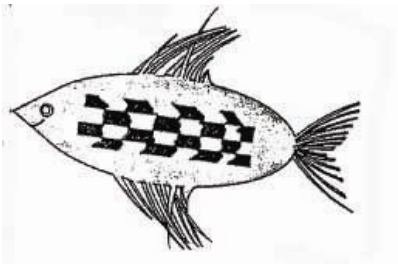
What role does the log play in this natural community?

When you are through, make sure the log is in exactly the same place as it was when you found it, and nothing else has been disturbed. Release all living things that you caught to study.

Weave a Fish

Make a patterned fish by weaving paper “scales” across its body.

Materials



Construction paper

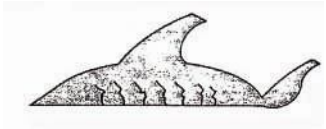
Scissors

Glue or tape

Ruler

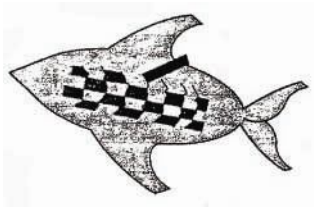
Ribbon (optional)

Directions



Draw a fish shape on a piece of paper and cut it out.

Fold the fish shape in half lengthwise and cut straight or wavy slits across the body. The slits should be about ½ to and inch apart, depending on the size of the fish. (Be careful not to cut to close to the edges.) Unfold the fish and set it aside.



3. Cut strips from different colored sheet of construction paper or from ribbon. The strips should be about ½ to an inch wide and long enough to weave through the slits you cut.

Weave “scales” into your fish with strips, forming a checkerboard pattern in the fish’s body. Once the strips are in place, trim off any excess paper or ribbon and glue or tape the ends down

Cut out construction paper eyes and glue them onto both sides of the fish. Cut fringes in the fishes fins and tail.

Fun facts

Most fish are protected by tough, overlapping scales. But some fish such as lampreys and freshwater catfish have no scales at all.

Not all scaly fish have “regular” scales. For example, pinecone fish have spiny scales, and seahorses have armor like plates.

The “stinger” on a stingray’s tail is a modified scale.

Scientists can often estimate the age of a fish by counting growth rings on its scales

Clean Up Your Act

The Countdown

By starting an anti-polluting campaign in your meeting area, you can help your girls become aware of what they can do to fight pollution. After they have completed the 10-step countdown outline below, they can their pollution-fighting efforts by participating in an action project to help clean up pollution in their community.

You can do steps 9-3 of the countdown in any order. But before you start the countdown, read through each step to see what material you'll need.

10! Chart you course

Make a chart with three headings "Problems, Causes, Solutions" and put it where everyone can see. Explain to the girls that they will be taking part in a pollution countdown to help reduce pollution and that they'll be using this chart to record the steps they take. Tell the girls that as they proceed with the countdown, they'll learn about a variety of pollution problems and ways to help solve them. Have the girls take turn updating the chart as the take on each of the following steps in the countdown.

9! Anti-litter bug

Have the girls keep an eye out for litter, and tell them to be sure to clean up when paper, broken pencils and other litter collect in the area. (Point out that, when ever possible, the girls should recycle or use the things they pick up.) The girls can create colorful "litter patrol" buttons to wear or signs to put on their desks. (Encourage them to use recycled materials for their buttons and signs.)

8! Supply spies

Tell your troop that many products everyday that can cause pollution. For example, many cleaning products can contain toxic ingredients, such as ammonia, that can contaminate water supplies when washed down the drain. Have the girls find out if any of the materials used in the classroom or meeting area contain toxic ingredients. (The girls can check with the maintenance staff to see which products are used and whether these products contain toxic chemicals. Then have the girls come up with a list of recommended alternatives to the toxic products currently used.

7! Plant power

Explain to your troop that indoor air pollution can be a big problem in some buildings. That's because pollutants form glues, new carpeting, toxic cleaning products, and other sources can become concentrated inside poorly ventilated buildings.

Tell the girls that some kinds of houseplants absorb certain air pollutants help to improve indoor air quality. Some of the best pollution absorbers are Philodendrons, gerbera daises, golden phothos, and spider plants. You can ask a local garden center or nursery to donate plants or cuttings of these plants, and the have the girls take turns caring for them.

6! Light the way

Explain to the girls that every time they flick on a light switch or run hot water, they're using electricity. And this electricity use is probably contributing to pollution. That's because most electricity is supplied by coal- or oil burning power plants, which emit harmful materials into the air. Point out to the girls that by using less electricity, they can help reduce pollution. Have the girls create eye-catching mini-posters that they can put near light switches to remind people to turn off the lights when there not needed.

5! More energy alerts

There are probably a lot more of ways to save energy in your meeting area. One thing you can look for is drafty windows. The girls can block drafts by caulking the area around the window. You can also contact your local utility company to see if they'll send a representative to talk to your group about ways to save energy.

4! The lunch bunch

Talk to your girls about the amount of trash they generate at lunch and snack times. (To illustrate this point, you might want to collect all the garbage you group produces a day.) If the girls bring their lunches, they can avoid throwing away a paper bag each day by packing their lunches in a reusable lunch boxes or cloth bags. And instead of using disposable drink containers, they can bring drinks in a thermos or other reusable containers.

Another way to cut down on trash at meals and at parties is to keep a reusable plate handy. And if your cafeteria uses paper cups, plastic foam plates, or any other throwaway materials, encourage officials to switch to

reusable plates and utensils.

3! Waste watchers

To help cut down on the number of paper towels they throw away, the girls can bring in some rags from home. They can use these rags to clean up desks and tabletops, and then take turns washing them out in the sink or taking them home to be washed.

Other waste-watching tips include using both sides of a piece of paper before throwing it away or recycling it, setting up containers to collect pencil stubs that can be reused, and using construction paper scraps for bookmarks and for art projects. And you can help watch waste by using both sides of the paper when copying handouts.

2! Media mania

As your group nears the end of the countdown, have the kids publicize their achievements by writing articles for school or local newspapers, making posters, and organizing tours of their model meeting area. They may also want to write up an anti-pollution tip sheet for visitors to take home at the of their tour.

1! Check the chart

As the last step in the pollution countdown, have the girls look over the pollution chart to decide whether they solved all pollution problems listed. Discussed what worked and what didn't, and decide what project the kids would like to continue. Was it possible to completely eliminate all forms of pollution? The girls will find out that it's nearly impossible to completely eliminate all pollution, but that their pollution countdown did make a difference!

0! Blast off

When your troop has reached the end of the pollution countdown, celebrate with an anti-pollution party! Put up decorations made from recycled materials. Avoid using balloons, since they can some times harm wildlife after being discarded. And be sure to serve party snacks on reusable dishes!

Garbage Shuffle

Discuss trash disposal through history and perform a trash rap.

Objectives

Describe how people have disposed of solid waste through history. Describe several problem related to solid waste disposal.

Materials

Copies of Garbage Shuffle

Materials to make costumes and props

If you were an archaeologist, you could sift through the dusty remains of every human population since prehistoric times and discover something common in all of them: trash. By performing a trash rap, the kids in your group can learn about the history of how the people have dealt with trash.

Begin by asking the troop how people get rid of trash. (By dumping it, burying it, or burning it) Explain that the task of getting rid or garbage has been around for as long as people existed. Next past out copies of page 13 and have the girls read through the rap. Then use the information under "A history of trash" to discuss the disposal method command to the time period depicted in each of the verses. Use these questions during your discussion:

What kind of trash have people thrown out during different periods? How did they dispose of it?

Why could prehistoric hunters throw trash on the ground without any problems? How did trash cause problems in ancient Rome, medieval London and 19th-central U.S. cities?

What kind of pollution can trash create?

What are some of the problems with dumping trash at sea that aren't mentioned in the rap?

Some people think that we should launch our trash into outer space. What do you think about this idea?

Do the Trash Rap

Now tell the girls that they can perform the rap. Have a volunteer who can perform demonstrate the right rhythm read the first verse out loud so the troop can get an idea of how the rap will sound. Then assign each of the verses in the rap to a different child or small group of kids. Everybody can join in for the chorus.

Be sure to hive the girls plenty of time to study their verses. And have them coordinate some move to accompany the chorus, such as shuffling from side to side and clapping. Encourage them to make up appropriate actions for the verses too, such as pointing their fingers and shaking their heads. You can also have the group make costumes and props to fit the different rap roles. The girls may want to perform the rap in front of other troops to teach them how people have disposed of trash through time.

When the girls are ready to perform, Have them stand in a semi-circle. Start out with every doing the chorus, while the first "soloist" or small group moves out in front to do the first verse, at the end of the first verse, repeat the chorus while the second performer(s) steps up front. Continue alternating the verses with the chorus until the end of the rap.

Afterward you can have the girls create a trash time line, using drawing and short summaries to describe the various periods depicted in the rap. You might also want to have the group make up a new rap verse to describe the kinds of trash people might generate in the future and the ways they might dispose of it.

A History of Trash

1. Africa, 1.5 million years ago

Many prehistoric hunter-gatherers simply threw trash on the ground around their camps. Others sometimes had a special place to dump their refuse. Made mostly of biodegradable items, the trash generally decomposed. Even nonbiodegradable objects, such as old stone tools, never accumulated to any significant amount because people lived in small groups and moved from place to place.

2. Ancient Greece, 500bc

For a time, city residents in ancient Greece and Rome threw their trash out into the streets. Human scavengers regularly picked through the waste for reusable items, a practice which continues today in many parts of the world. Road levels grew higher and higher for the onslaught of trash. Old, torn-down homes were used as foundations to make newly built homes level with the roads. People in Greece finally organized a system of

municipal trash collection, carrying waste to dumps at least a mile outside of town.

3. Medieval London, ad 1350

People in the middle ages threw trash, food, and human waste out into the streets, where it caused a problem in densely populated cities such as London. The mess contributed to the spread of various diseases. (The bubonic Plague was one disease that became epidemic. It was spread by fleas from infected rats, which swarmed through crowded cities.)

4. Atlantic Ocean, ad 1500

People throughout most of history have considered the ocean limitless and have dumped trash in it without hesitation. The trash and food waste dumped during the age of ocean exploration usually disintegrated in the salt water. But today, the plastic, sewage, hazardous waste, and other material we dump are harming marine life and washing up onto beaches, where they can be dangerous to people and coastal wildlife. It's estimated that people around the world dump nearly 14 billion pounds of waste into the oceans each year.

5. New York City, 1860

During the Industrial Revolution, large industrial cities in the U.S. became filthier than other cities in previous periods. Dead horses, coal and wood ash from furnaces, and kitchen and animal waste filled streets and alleys. Pigs roamed the streets, eating much of the food waste. Rats and roaches also invaded the rotting mess, and they were epidemics of disease. For a time, people believed that the fuel fumes carried germs that could be transmitted to people. Although this theory was disproved in 1880, the concern about public health did lead to city street cleaning and better-regulated municipal collection and disposal.

6. United States, 1920

Open dumps have been around since prehistoric times and remained a common method of disposal in the U.S. until after World War 2, when landfills became the favored method. Long before that time, though, people complained about problems associated with open dumps, such as rodents, fires, and odors.

7. Los Angeles, 1930

The large-scale burning of trash in incineration plants has been used on and off as a waste disposal method since 1870's. Although incinerators significantly reduced the volume of trash, citizens complained about the smoke and odors from these plants. Many of the incinerators that was common in hundreds of U.S. cities during the 1930's were later closed down.

8. United States, 1960

The period after War World 2 marked the rise of a throwaway lifestyle and use of synthetic materials. Households no longer burned much wood or coal, but they generated more waste from disposal products and packaging materials, including a lot of paper and plastic trash. They also began to throw out more toxic substances that ended up in dumps and landfills. These hazardous materials leached through the soil into the water supplies. And when dumps caught on fire and smoldered, toxic fumes was released in the air. It later became clear that, as landfills filled up, sitting new, "safe" ones would become more and more difficult.

9. United States, 1973

A movement to control the increasing volume of garbage going into the landfills led to revival of interest in incineration. Incinerators became known as "resource recovery" plants, such as the one described in the rap. Not only do these plants reduce the volume of trash, they also produce usable energy. This was seen as added benefit after an oil crisis raised concern about the nations limited energy sources. But the plants emit noxious fumes are expensive to build and run, and produce a highly toxic ash. Because of these problems, these plants have yet to gain widespread acceptance.

10. United States, 1990

Citizens in the U.S. and throughout the world have begun to reduce, reuse, and recycle to cut down on the total amount of materials entering the solid waste stream and to save natural resources.

Garbage Shuffle

Chorus
Do the garbage shuffle; it's an age-old thrill
'Cause we all make garbage, and we always will!

1: Now I bet you're askin', bet your dyin' to see
What hip hippo hunter from prehistory
Does with garbage! (clap)... like old tools of stone
All that garbage! (clap)... like those animal bones.
Well, I throw 'em, toss 'em, I drop 'em at my feet.
Then I move my camp and hunt more meat.

2: I'm a wise orator, I'm an ancient Greek.
I was born to talk, and I love to speak
About garbage! (clap) ...it use to fill our roads
All that garbage! (clap)... now we take it in loads
'Bout a mile beyond our city limit.
Now our homes and streets aren't buried in it.

3: Now you might be askin' why a British maid
From the Middle Ages would be afraid
Of garbage! (clap) ... out the window we throw
All our garbage! (clap) ... to the street below.
Well, our city's so crowded that all of that trash is
Making us sick and giving us rashes.

4: I'm a Spanish explorer and here's what I love:
It's a sailing ship that isn't full of
Garbage! (clap) ... who wants a messy boat?
All that garbage! (clap) ... it's tough to stay afloat.
So I toss my trash out into the sea,
Where it disappears and never bothers me.

5: It's the 1860's. I'm a germ detector.
I'm a New York City health inspector.
I hate garbage! (clap) ... the alleys flow with trash
All that garbage! (clap) ... the water is full of ash.
Now those garbage fumes- they can make you ill,
So it's time to clean up what we spill.

6: In the roaring twenties you would be a grump
If you lived, like me, near an open dump.
It's all garbage! (clap) full of bugs and flies
In the garbage (clap) ... the rats are monster size.
The trash is so high that the people say
We'll have a garbage mountain 'round here someday.

7: Now we're in the depression some folks feel
That incinerators are the way to deal
With the garbage! (clap) ... it all goes up into smoke
All that garbage! (clap) ... but I cough and choke
On the cloudy fumes that fill the air.
I just wish I can move away somewhere.

8: It's the age of plastics; it's the age of ease.
I'm a '60's chemist, and I'm very pleased
With garbage! (clap) ... plastic cups, paper plates
All that garbage! (clap) ... disposable are great
We've got landfills now to store this waste.
What we throw away can just be replaced.

9: There's an oil crisis, and I have to brag,
'Cause I think I've fixed the biggest snag
With garbage! (clap) ... "cause the trach can burn
All that garbage! (clap) ... can make a turbine turn.
We'll make energy from our piles of trash.
The only problem will be the toxic ash.

10: I'm your average kid, and I have to say
That I've found an awesome, cleaner way
With garbage! (clap) ... I try to make much less -
All that garbage! (clap) ... I'm tired of all this mess.
Now I reuse, recycle, make a compost pile -
It's the garbage shuffle, 1990s style.

Go With The Flow

Study a watershed, and then map your local watershed.

Objectives

Define watershed. Explain how pollutants can affect water quality in a watershed.

Materials

Copies of page 16

Markers or colored pencils

State highway, regional or topographic maps

Tracing paper

Masking tape

No matter where you live, you live within a watershed. Conditions within that watershed greatly affect the quality of the rivers and streams flowing through it. After learning about watersheds, the kids in your group will have a better understanding of how water can become polluted. But before you do this activity, make sure the kids are familiar with some of the different kinds of water pollution.

Part 1: Upstream, Downstream

Begin by asking the girls if they've ever seen splotches of oil in a parking lot or driveway. Then tell them that by doing this activity they'll find out what eventually happens to this oil.

Next introduce the troop to the term watershed. Explain that a watershed is an area of land from which rainwater and snowmelt drain into a particular stream or river. Watersheds may be small areas of land that drain water into small streams or huge areas of land that drain water into large rivers. And within each large watershed there are many smaller watersheds. A watershed is usually named after the stream or river it drains into.

Point out that as rain and snowmelt flow across land and into waterways, they wash over everything in their path: golf courses, roads, fields, lawns, woodlands and so on. And they pick up and carry material along the way: trash, dirt, pesticides, oil and so on.

Next pass out copies of page 16 to the troop. Tell the girls to use the map at the top of the page to answer the question of the bottom of the sheet. (If the girls are having trouble determining the boundaries of the watershed, have them look at the streams on the map to see which way they flow. Those flowing into the Cedar River are in the Cedar River watershed.) Afterward, go over the page with the girls , using the answers on the next page.

Part 2: Local Waters

Now have the girls map the watershed they live in. Pass out highway, regional or topographic maps of your area that show a stream or river flowing through (or near) your community. Also pass out sheets of tracing paper, masking tape and colored pencils or markers and tell the kids to follow these directions:

Find your community and the nearest stream or river on the map. Then tape tracing paper over the section of the map. (Note: as we discussed in the answers to Part 1, slope is the factor that separates one watershed from another. Depending on the slope of the land in your area, the watershed of the nearest stream or river may or may not include your community. The only way to tell is to look at the slope on a contour map. For this activity, the girls can assume that your community is in the watershed of the nearest stream.)

Use a colored pencil or marker to trace the stream or river downstream until it joins a larger river. Use the same colored pencil or marker to trace the stream upstream as far as you can and to trace all the tributaries that dump into the river or stream all along its length.

Use a different colored pencil or marker to trace other streams and rivers in your area.

Outline the watershed you live in. (Remind the girls that the watershed they live in is made up of all the land that drains into the nearest stream or river. So, to outline the watershed, they should be outlining the land surrounding the nearest waterway and all its tributaries.) Afterward discuss the following questions as a group.

- What types of things do rainwater and snowmelt flow over in your area? (rooftops, sidewalks, roads, agricultural land, lawns, golf courses and so on.)
- What kinds of pollutants might rainwater or snowmelt pick up as they flow through your area? (rainwater

and snowmelt that run over streets, parking lots, fertilized yards, construction sites and so on, often pick up toxic chemicals, silt and other pollutants. The water then flows into storm drains that empty into rivers. And water running off agricultural land often contains high amounts of animal waste, pesticides, fertilizers, dirt and other pollutants.)

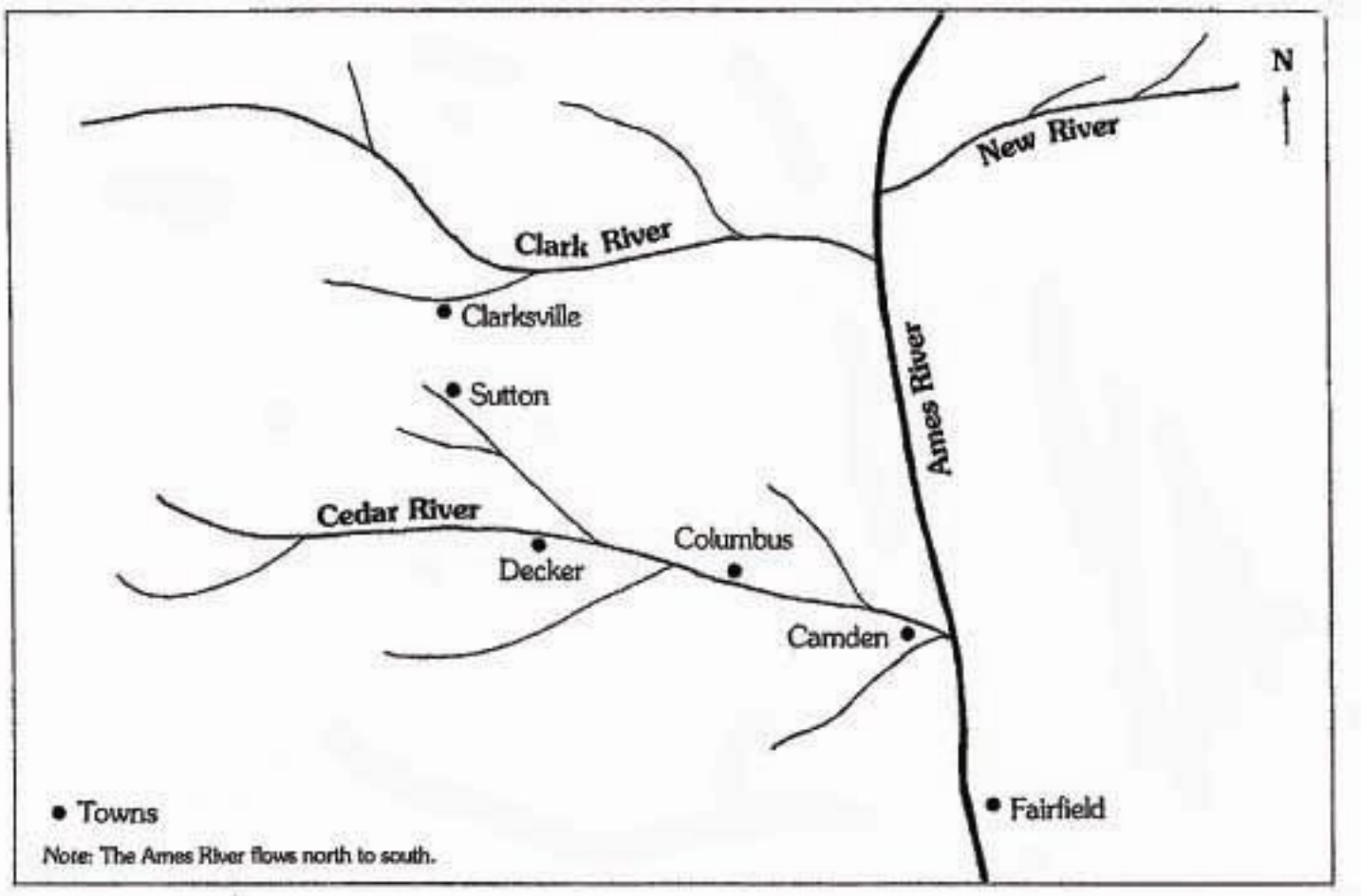
- In what other ways might your community affect water quality? (Some industries dump pollutants directly into rivers; pollutants from overflowing sewage treatment facilities may wash directly into waterways; pollutants from landfills or dumps may leach into water supplies; and so on.)
- Which nearby communities might be affected if your community dumped untreated sewage into the nearest stream or river? (those downstream) Which communities could affect water quality in your community? (those upstream)

Finally, ask the kids what happens to the oil splotches you talked about in the beginning of the activity. (The oil may wash into your local stream or river and be carried downstream.)

Answers to Go With the Flow Questions on next page
1 - see diagram
2 – Ames River watershed, Clark and New
3 – Columbus, Camden and Fairfield because they are downstream from Decker
4 – Cedar River, then into Ames River; Clark River, then into Ames River. Because Sutton is closest to the Cedar River and Clarksville is closest to the Clark River. However, they could be in the same watershed, depending on the slope of the land. For example, if a mountain or hill separated Clarksville from the nearby stream, wastewater from Clarksville could flow into the Cedar River watershed. It's more likely though, that Sutton is part of the Cedar River watershed. (Note: they are both in the same larger Ames River watershed.)
5 – Many of the pollutants carried by the Ames and the two other rivers – pollutants that were collected from large areas of land – would end up in Lake Churchill; as pollutants accumulate in Lake Churchill, water quality could decrease significantly and aquatic plants and animals could be affected.

Explain that as rivers empty into bays, lakes and other bodies of water, some of the waste they're carrying can accumulate in these areas. This accumulation can create big pollution problems. For example, the Chesapeake Bay and the Great Lakes are suffering from the accumulation of pollutants flowing into them.

Go with the Flow



1. Find the Cedar River and all the Cedar's tributaries – the smaller streams and rivers that flow into it. Then outline the Cedar River watershed.

2. What larger watershed is the Cedar River watershed a part of? What other rivers are part of this watershed?

3. There's a chemical manufacturing plant in Decker that dumps its waste into the Cedar River. What communities might be affected by this waste? Explain your answer.

4. Which river would animal waste and other pollutants from farms near Sutton wash into? What about from farms near Clarksville? Why would you think that Sutton and Clarksville are in two different watersheds? Is it possible for Sutton and Clarksville to be in the same watershed? Explain your answer.

5. Eventually the Ames River empties into Lake Churchill. Two other large rivers also empty into Lake Churchill. What effect might these three rivers have on conditions in the lake?

The Filtering of Polluted Water

Most cities have water treatment plants to clean or purify, their drinking water. The unclean water is first pumped to a large settling tank, where it stays for a while. Some of the dirt and other polluting particles in the water settle to the bottom. The cleaner water on top then goes into a filtering tank, which has thick layers of sand and gravel. Sometimes there is a layer of charcoal between these layers. As the water filters through, still more polluting materials are left behind. It's not easy to clean polluted water, even by filtering . You can find out more about his yourself by doing the following experiment.

Materials

Cut-off pint milk carton

Charcoal briquette

Small glass jar

Jar of soil water

Clean sand

Cotton

Nail

Small paper bag

Directions

Such some holes with a nail in the bottom of a cut-off milk carton.

Spread some cotton inside on the carton bottom. Add some clean sand.

Put crushed charcoal on top of the sand. (to crush charcoal, put briquette into a small bag and pond wit with a rock). The add another layer of sand.

Place the filter on top of a small glass jar.

Pour some clean tap water into your filter. (This will pack the material more tightly together)

Prepare a jar of soil water. Put a handful of soil into a jar of water and mix. Let the water settle for a half an hour

Pour some soil water from the top of the jar into the filter. Watch the filtered water trickle into the small jar.

Observation Questions

How clean is the filtered water compared to the soil water?

How clean would the water get with fewer filtering materials?

Will your filter remove ink or food coloring?

Does the order in which you have your filter materials matter?

Would more or other materials work better? How else could you improve your filter?

Caution the girls not to drink their filtered water. They should know that a chemical is added to filtered water in city water plants to kill germs that survive filtering. Your troop may enjoy having a contest to determine the best filter. They may need to be reminded that everyone should filter samples of the same polluted water.

Generalization

Some water pollutants may be removed by filtering the water through layers of different permeable materials.

Sample Performance Objectives

The girls can experiment to find ways that improve the efficiency of simple water filter

They can also make a water filter with simple materials that removed larger particles from polluted water.

Salmon Boy

(Haida—Pacific Northwest)

Long ago, among the Haida people, there was a boy who showed no respect for salmon. Though the salmon meant life for the people, he was not respectful of the one his people called Swimmer. His parents told him to show gratitude and behave properly, but he did not listen. When fishing he would step on the bodies of the salmon that were caught and after eating he carelessly threw the bones of the fish into the bushes. Others warned him that the spirits of the salmon were not pleased by such behavior, but he did not listen.

One day, his mother served him a meal of salmon. He looked at it with disgust. "This is moldy," he said, though the meat was good. He threw it upon the ground. Then he went down to the river to swim with other children. However, as he was swimming, a current caught him and pulled him away from the others. It swept him into the deepest water and he could not swim strongly enough to escape from it. He sank into the river and drowned.

There, deep in the river, the Salmon People took him with them. They were returning back to the ocean without their bodies. They had left their bodies behind for the humans and the animal people to use as food. The boy went with them, for he now belonged to the salmon.

When they reached their home in the ocean, they looked just like human beings. Their village there in the ocean looked much like his own home and he could hear the sound of children playing in the stream which flowed behind the village. Now the Salmon People began to teach him. He was hungry and they told him to go to the stream and catch one of their children, who were salmon swimming in the stream. However, he was told, he must be respectful and after eating return all of the bones and everything he did not intend to eat to the water. Then, he was told, their child would be able to come back to life. But if the bones were not returned to the water, that salmon child could not come back.

He did as he was told, but one day after he had eaten, when it came time for the children to come up to the village from the stream, he heard on of them crying. He went to see what was wrong. The child was limping because one of its feet was gone. Then the boy realized he had not thrown all of the fins back into the stream. He quickly found the one fin he had missed, threw it in and the child was healed.

After he had spent the winter with the Salmon People, it again was spring and time for them to return to the rivers. The boy swam with them, for he belonged to the Salmon People now. When they swam past his village, his own mother caught him in her net. When she pulled him from the water, even though he was in the shape of a salmon, she saw the copper necklace he was wearing. It was the same necklace she had given her son. She carried Salmon Boy carefully back home. She spoke to him and held him and gradually he began to shed his salmon skin. First his head emerged. Then, after eight days, he shed all of the skin and was a human again.

Salmon Boy taught the people all of the things he had learned. He was a healer now and helped them when they were sick.

"I cannot stay with you long," he said, "you must remember what I teach you."

He remained with the people until the time came when the old salmon who had gone upstream and not been caught by the humans or the animal people came drifting back down toward him. It was so worn by its journey that he could see through its sides. He recognized it as his own soul and he thrust his spear into it. As soon as he did so, he died.

Then the people of the village did as he had told them to do. They placed his body into the river. It circled four times and then sank, going back to his home in the ocean, back to the Salmon People.

Discussion

"Salmon Boy" is an allegory of great importance, revealing a series of interlocking circles which, as the story proceeds, run progressively deeper into the life ways of the Haida. Even though the people catch and eat the salmon, they do so with respect and gratitude. When the people live in balance and treat the spirits well the salmon swim upstream and offer their bodies for food. By returning the bones and all they do not eat to the water the circle of giving and receiving remains intact—the gift keeps moving. There is an important, interdependent relationship here: The salmon give people food and the people show their appreciation through prayer and reverence.

The salmon take notice when the boy begins to live out of balance by being disrespectful and breaking the circle. Yet, the salmon do not react by getting angry and harming the boy. He is made one of them so that he may more fully understand who they are and how to care for and respect them. Even though he drowns and dies to his own people, Salmon Boy has a new life among the Salmon People at their home in the ocean. We see the great circle of life and death and the reality of the spirit world.

Then, in another circle, one of transformation, Salmon Boy returns to his people as a healer to teach them the ways of the Salmon People and to help them when they are sick. This even in the story reveals the Native American's deep sense of interconnectedness between this world and the spirit world, and between animals and people.

Finally, after drowning and finding a new life first among the salmon and then again with his own people, Salmon Boy spears his own salmon soul and his human self dies. When his body is placed into the river it circles four times—a sacred number—and returns again to life among the Salmon People.

Just as the salmon in this story represent a link between the ordinary world and the spirit world, they also connect us to their mysterious home under the sea. It is believed that salmon once lived only in fresh water, but at some point in their history began to migrate to the sea where food is plentiful.

Fish

For all of its great diversity of life forms, the ocean is the undisputable realm of fish. Fish, along with whales, squid and other strong swimmers of the open water, are called nekton. Science tells us that fish are the common ancestors of all land vertebrates, animals with a backbone, going back hundreds of millions of years. One survivor, the lungfish, has both gills and lungs and can even walk on its long fins. Some fish, like the Mississippi paddlefish, sea lamprey and sharks, have changed little over the millennia. There are over twenty thousand species of fish and over half of all vertebrate animals are bony fish!

Fish have adapted to every conceivable aquatic environment. Their home is found from the surface to the bottom, along with the open water in between, from frigid polar seas to tepid tropical waters, from ponds to coral reefs to rivers, and from bright waters to the darkest depths where some even create their own light. Water temperature largely determines the distribution of fish because they are cold-blooded. Most species live in temperate waters, though they can survive temperature changes of from 12 to 15°F (6.7 to 8.4°C). Some fish, however, life beneath the pack of ice in the Arctic and Antarctic, surviving in waters with temperatures below 32° F (0°C).

There are three major groups of fish. One group, the Agnatha, includes the jawless lampreys and hagfishes. Sharks, rays and skates comprise a second group, the Chondrichthyes, which have fully cartilaginous skeletons instead of bones. The bony fish or Osteichthyes, however, have from seven hundred to eight hundred bones in their bodies. Most well-known fish are bony fish. In fresh water these include trout, bass, catfish or horned pout, sunfish, perch, shiners, suckers, crappies, carp, dace, minnow and salmon. Some familiar saltwater species are the anchovy, bluefish, halibut, herring, goosefish, grunion, tuna, Pollack, haddock, founder, killifish, cod, swordfish and salmon.

An incredible array of rainbow colors are found among fish, unequalled by any other group of animals except, perhaps, insects and birds. Most fish follow a color pattern of being dark above and light below. This patterning, also common among many other kids of animals, allows fish to blend in with the dark bottom when seen from above and the bright sky when seen from below.

Adaptations for Survival

A fish's many adaptations for survival are a direct response to conditions for life beneath the waves. How deep is the water and how clear? What is the water temperature? How strong are the currents? Since water cannot be compressed it must be pushed aside when a fish swims through it. Streamlining allows fish to sue their pointed head and tapered tail to pass easily through the water with little disturbance and minimal resistance (Figure 9-2). Their fins help them to steer, maneuver and stay upright. Flying fish have evolved fantastic fins that allow them to actually fly along from wave crest to wave crest for up to one minute and to attain heights of up to 10 to 20 feet (3.0 to 6.1 meters) above the water.

Scales overlap to cover a fish from head to tail and are in turn coated with a slimy, antibiotic mucous. This light slippery armor lubricates a fish's body and protects it from being infected by bacteria and fungi. During the summer months, as a fish grows faster, annual rings are left on its scales. These can be counted to estimate age.

A distinct line can be seen running along the side of a fish. This lateral line marks a system of canals in the skin which are extremely sensitive to water currents, movement and fine vibrations. This "sixth sense" helps a fish to orient in murky waters and dark places and to be keenly aware of any movements in its vicinity.

Breathing, as we know it, is impossible underwater. Fish get oxygen directly from the water. They take water in through the mouth, pass it over the gills and out the gill covers. Oxygen is absorbed into the bloodstream through the gill membranes.

Many modern fishes use a gas bladder to fine-tune their buoyancy to match that found at a particular depth.

This airtight sac expands and contracts to just the right flotation using gasses from their bloodstream. Since a fish's cellular fluid is about the same density as that of water it is better able to remain "weightless" in its home. Some fish, such as sharks, do not possess a gas bladder. Since they sink when at rest, sharks must remain in constant motion.

Salt water fish tend to lose water from their bodies into the concentrated salt of ocean water. They drink large amounts of water to compensate. The salt is then excreted and is also forced out through the gills. They do not usually urinate. Since freshwater fishes have body fluids that are more salty than their surroundings, they tend to absorb water over the surface of the skin and gills. As a result, they urinate often and do not drink at all!

Like many wild animals, fish spend much of their time searching for and catching or gathering their food. Fish exploit the entire range of available food, plant and animal, dead and alive, or a combination of several kinds. Plankton eaters, such as herring, mackerel, menhaden and the whale sharks, which stay near their food at the surface, use sieve-like gill rakers to filter out these tiny plants and animals. Predators, such as the bluefish, bass, shark and tuna, stalk their prey where they can be found. The masterful archerfish shoots its prey down with a jet of water, then devours it! This is even more amazing since water refracts light and the archerfish must compensate by aiming in front of its intended prey!

A fish's keen senses enable it to survive. They have good eyesight and no need for eyelids underwater where the eyes are always bathed. Fish can even see some color. The senses of hearing, touch and smell are all acute. Taste is unimportant since they gulp their food, though most possess taste buds located outside of the mouth.

Reproduction

Fish would not have survived millions of years without a number of successful means of reproducing. Many fish life on by dint of their great numbers. Cod produce from four to six million eggs in one mating cycle or spawn. An average-sized (22 pounds or 10.0 kilograms) king or Chinook salmon lays around eight thousand eggs. Most eggs are laid and fertilized in the water, while the eggs of some, such as sharks and guppies, are fertilized internally where they develop until the young are born live. Seasonal temperatures are an important factor in initiating spawning and in the successful development of the eggs. Spawning and growth usually occur during the spring and summer months. Most eggs are tiny, nearly transparent and they mature while afloat, especially among saltwater fish. Many freshwater fish lay eggs that sink to the bottom. In some species they young are cared for after hatching. The male bullhead (horned pout) guards the newly hatched young until they are up to 2 inches (5.1 centimeters) long.

Salmon

The salmon in the story "Salmon Boy" are anadromous species that live and grows in salt water, then return to ancestral freshwater spawning grounds when mature. The shad and the alewife are also anadromous. A few fish, such as the American eel, are catagromous, spending most of their lives in fresh water only to return to the sea to spawn.

Salmon travel immense distances on their life's migration to the sea and back. The king or chinook salmon of Idaho swim west to the central Aleutian islands where they mature. They then travel 2,500 miles (4,023.4 kilometers) back to spawn in the headwater of the Snake and Columbia Rivers. Pacific salmon, such as the king, chum and red or sockeye salmon, die once they spawn. Some Atlantic salmon survive to spawn again. There are even some landlocked salmon that live their entire lives in fresh water.

No one knows for sure how the salmon navigate to make their epic migrations. They may follow the sun, moon or star. Some hypothesize that they orient according to salinity, temperature, the unique odor and chemistry of water in their home streams or from some primal memory of how to reach these ancient sites of their origins. One theory surmises that enough salmon survive to assure that enough reach home to spawn just through random migration toward that general costal area.

Once in their home river systems salmon demonstrate an intense desire to move upstream—leaping up to 10 feet (3.0 meters) high over waterfalls and rapids. Spawning salmon do not eat along their journey.

Conservation of Fish

As in the story "Salmon Boy", people still fish for salmon as well as many other species. Those who remember the traditional ways still maintain a close, respectful relationship with the Fish People. Some traditional Oglala Lakota (Sioux), when fishing, offer the bait saying, "You who are down in the water with wings of red, I offer this to you; so come hither." When a fish is caught it is treated with respect, or else the others will hear of the catch and flee. When little fish are caught they are treated especially well and released to they will not tell the bigger fish and scare them away.

But fishhooks and spears have largely been supplanted by a high technology fishing industry that uses computers, planes and echo sounders to locate fish, and an array of nets and highly effective catching devices. A modern fishing fleet often consists of a mother ship, spotters, catchers and factory processing ships where the catch is gutted, cleaned and frozen, all while at sea. As a result of the pressures placed on fish populations by the technology and efficacy of modern fishing fleets, many species of fish that Native North Americans have hunted as food for thousands of years are now greatly depleted. Some species have been so over-fished that they have become scarce and can no longer be used as food.

Salmon and other fish face many other threats to their well-being besides extreme hunting pressures. Dams present obstacles that block migration upstream. Water pollution stresses and weakens the health of migrating fish and masks the natural odors by which salmon recognize their home streams on the return spawning runs. Severe water pollution along a stretch of river can create zones that are so deadly to fish that they cannot be traversed, and so act as barriers to migration. Polluted water can adversely affect the development of fish eggs and young. Acid rain has created numerous bodies of water that are devoid of fish life. Toxic elements in many aquatic ecosystems are causing severe and widespread disease among fish populations, such as birth defects, tumors and many other forms of cancer.

Fortunately, over time, some of the dams that once blocked the flow of many rivers are being fitted with fish passage facilities, such as fish ladders and elevators. And many polluted lakes, ponds and rivers have gradually been cleaned up over the past few decades. There is, however, a long way to go in North America before out waterways are restored to a level of cleanliness and ecological health benefiting the amazing fish that inhabit them.

Questions

What do the salmon do when the young boy treats them disrespectfully? What would you have done? Why do the salmon make the boy one of their own?

How is the young boy changed by his experience? What does he learn?

How can Salmon Boy die and come back to life so many times in this story? What finally happens to him in the end?

Identify some of the circles and cycles revealed in this story? Why are they important? Why is it important for our relationship with nature to be practiced with circles?

Salmon spend part of their lives in freshwater rivers and part of their lives in the ocean. What do they do in the rivers? Why do they swim down to the ocean? How do they find their way when traveling these great distances?

What do you think is the most important food for the ocean animals?

Would you want to live in the ocean? Why or why not? What would is be like to live in the deep sea?

What are you favorite animals of the ocean?

There are many kinds of fish living in the sea. Can you name some of them?

What kind of skin does a fish have? Why does it have scales?

How does a fish breathe?

How did Native North Americans fish using their traditional fishing methods? How do they fish today?

Do you eat fish? How do people catch the fish that your family buys? What is happening to the populations of fish as such great numbers of them are caught?

Salmon Survival

Activity

A—Listen to a fantasy journey and live out the life cycle of a salmon.

B—Calculate the number of salmon that would be produced if all of the offspring of one pair lived to reproduce.

Goals

Experience and understand the life cycle of the salmon. Realize that the cycle of life and death (mortality) plays an important role in maintaining a balance for life on Earth.

Age

Younger Children (A) Older Children (B)

Materials

Pencils (A and B)

Crayons or pastels (A)

Paper (A and B)

Calculator (B)

Chalkboard and chalk or newsprint (B)

Felt-tipped markers (B)

Procedure

The Life of a Salmon. Lead a question and answer session with the girls. Ask them to share what they know about salmon. Use the 'discussion' section to review the basics of fish migration and include examples of both catadromous and anaddromous fish.

Now prepare the girls for a guided imagery experience. Have them lie down and close their eyes to listen. Read the following story:

The Life of a Salmon

You have just hatched from an egg as a tiny salmon with a bit of yolk attached to your belly for food. Your new home is the cool, clear water at the top of a rock riverbed. There are millions of other young salmon swimming all around you.

In a few weeks the yolk is used up and you begin to eat microscopic plants and animals. Your first summer passes, then fall, winter and spring as you grow larger and larger. Now you are eating other fish that are smaller than you. One day you swim past an old log underwater and you see the sinister outline of a fish lurking in the shadows. Quickly, a large trout shoots out to eat you. You swim as hard as you can. Your heart is racing. There is a small crevice in gravel up ahead and you dart in to safety just as the trout's jaws snap at you from behind. Whew! That was close.

Soon it is your second summer and you are a beautiful, two-year-old salmon. Now you feel an overwhelming urge to swim downstream. The river grows deeper, warmer and less shaded as you swim. Wheee! You shoot down some long rapids and high waterfalls. It is really fun! Then you hear a whirring sound and see a great cement dam across the river with a shoot for water to pass through. At first you hesitate and swim from side-to-side looking for another way down, but there is none. So you drop into the dark hole and are soon spun around wildly by the metal blades of a turbine. Then you shoot into the river below the dam. Since you are small you survive with only a minor cut, but you see other young salmon who are hurt badly in the water around you.

Finally you reach the salty sea and swim for several months and thousands of miles. Your new home is a vast, blue-green sea where you swim with many salmon in a great school. Here, where there are plenty of small ocean fish to eat, you live and grow for another two years. Once, when you are about three years old, a great net is dragged up from behind you and you are just able to outrun it to keep from getting caught. But many of your salmon friends are carried away and never seen again. Another time you narrowly escape the sharp teeth of a shark.

In time, your fourth summer arrives and the urge to go home to the stream where you were born drives you to begin a great journey. When you reach the shore you swim for a time before you smell the waters of your home river and head upstream. Someone is fishing from shore but you swim right by the baited hook. In fact, you

haven't eaten a thing since you began your journey. You are tired and hungry, but you press on.

Up ahead there is the high cement wall of a large dam. After exploring for a time you find a strong current leading up many small falls into little pools along the side of the dam. Up, rest…up, rest…up, rest you go until you reach the top.

Look! A great waterfall. How will you ever get up. You back up and swim very fast, then leap as high as you can. Now you're in the air! Through the cool mist of the falls you see the sunlight, green leaves and a small rainbow. It is beautiful. Plop! You land above the falls and push on.

You are weak and growing very thin. There is a fork up ahead and the smell of the river water entering from the left tells you the way home. Very sluggishly you near the place where you were born. Now you can recognize some of the large rocks in the riverbed.

This is your destiny. You summon all of your last strength to force a great mass of eggs out a hold beneath your body. There are hundreds of salmon all around you laying eggs and squirting milk sperm into the water. You feel light and relieved, but now you have nothing left to give.

There is a shallow pool up ahead. You flop over to it and feel your life begin to slip away. Your gills are working hard as you roll over on your left side. Your right eye can see the sun shining through the bright green leaves of a tree over hanging the stream. The image of the leaves slowly fads and you feel a deep sense of peace as the world turns dark and still.

Ask the girls to open their eyes and sit up. Allow them to share how they feel. What were their favorite parts of the story and which parts didn't they like? Ask them what happened to their fantasy salmon at the end of the story. Ask the girls what would happen on Earth if every animal and human being did not die eventually. Have them write and illustrate another story about the life of a young salmon that hatches from one of the eggs laid in this story just before the salmon dies.

Point out to the girls that not all Atlantic salmon die after spawning. Be sure to mention that the operators of many dams provide fish passage facilities, such as fish ladders and elevators, to help transport fish around the dams during spawning runs.

Further the experience by having them illustrate some of the scenes in 'the life of a salmon' that most caught their imaginations.

Salmon Calamity. Tell the girls that they are going to prove that, without natural death, life could not continue as it is on Earth. This will be done by calculating the approximate number of salmon eggs and all of their offspring for a total of five generations lived to reproduce.

A spawning female king or Chinook salmon lays an average of about eight thousand eggs. Assume, for the sake of this activity, that half of each generation of eggs produces females. Also assume that half of each successive generation of eggs will produce females. Although in reality each one of these females takes four years to grow to reproductive maturity, for this activity each living female will produce eight thousand eggs each year. The formula, then, looks like this:

1 female x 8,000 eggs=

8,000 eggs x .5 = 4,000 females x 8,000 eggs =

32,000,000 (32 million) eggs x .5 = 16,000,000 females x 8,000 eggs =

128,000,000,000 (128 billion) eggs x .5 =

64,000,000,000 females x 8,000 eggs =

512,000,000,000,000 (512 trillion) eggs x .5 =

256,000,000,000,000 x 8,000 eggs =

2,000,000,000,000,000 (2 quintillion) eggs after only 5 generations!

Now lead a question and answer/discussion session focusing on why it would not be a good thing for all of these salmon – or all of any animal – to survive. Stress that the circle of life and death allows room for new life to be born. This circle also prevents pollution, overcrowding and the depletion of resources, such as food, space, water and shelter. Also, if nothing ever died, nutrients would not be recycled back into the aquatic or terrestrial food chains.

Food Chain Game

Materials

Red flags

Popcorn

Blue flags

Tag board tally

Your troop will be simulating a simple aquatic food chain consisting of algae, minnows, trout and hawks.

Directions

Divide the troop into the below proportions. Give a red flag to all minnows and a blue flag to all trout.

Minnows – 50%

Trout – 30%

Hawks – 20%

Designate boundaries of stream. (The girls are representing aquatic organisms.) They will not be able to survive if they go beyond their boundaries. Minnows, etc, cannot live outside the stream.

Throw out several handfuls of popcorn into the 'stream bed'. The popcorn represents algae. The number thrown out does not matter, they will now be counted.

Send out the minnows to 'eat' the algae. Give them between ten and twenty seconds to gather food. All minnows who gather at least one kernel survive. If there should be any minnows who did not collect at least one kernel, they have dies and should leave the stream area.

Send out the trout to 'eat' the minnows. Give the students approximately ten to twenty seconds to chase minnows and grab their flag. If a trout grabs a minnow's flag, the minnow has been eaten and should leave the stream. At the end of the chase period, stop the game and remove all dead minnows and trout. A trout is dead if it does not have a flag. All of the surviving minnows should leave the stream bed and stay together as a group.

Send out the hawks to 'eat' trout. Give them approximately ten to twenty seconds to chase trout and grab their flag. At the end of the chase period, have all surviving minnows, trout and hawks divide up according to organism type (minnow/trout/hawk). Record results on class tag board.

Example:

Round 1	Minnow	Trout	Hawk
Starting Number			
Number Survived			
Round 2			
Starting Number			
Number Survived			

Play the game several times using different proportions of organisms. Have the students choose the proportions. Record results of each trial. At the end of the game, have students analyze the chart and determine which food chain is the best example of a stable community and why.

Electrical Plants

Be sure to call ahead to arrange for a troop visit. Be sure to wear tennis shoes and pants on your visit. Remember these are working sites and you may get dirty so be sure not to wear your best clothes.

Delmarva Power Delivery – available sites for Power Plant Tours

Hay Road Power Complex, 198 Hay Road, Wilmington, DE 19809.

Edgemoor Power Station – located at the end of Hay Road, Wilmington, DE 19899. Mailing address is PO Box 231, Wilmington, DE 19899

Children must be at least nine years old and one adult is needed for every four children. Be sure to wear tennis shoe and pants on your visit.

Indian River Power Station – PO Box 408, Millsboro, DE 19966.

Girls must be in sixth grade or older. Tour is two hours long. Wear pants and sturdy shoes and clothes that can get dirty. No dresses! All visitors will be required to wear hard hats and safety glasses. Also, only high school aged youth are admissible when plant's in overhaul status; during the months of March, April, May, September and October.

Vienna Power Station – PO Box 128 Vienna, MD 21869.

Sample Questions for Electric Plants

These questions may help you and your girls to think of your own questions.

What prevents fish from getting 'sucked' into the plant when water is drawn from the river?

What is the 'smoke' coming out of the stack?

Are any pollutants put into the air or water from the electric process?

What procedures are in place to protect the environment?

Do any women work at the plant? If so, how many? See if one of them can speak to your troop about their job.