ACTIVITY 2-4: **PREDATOR-PREY TUBES**

SCIENCE CONCEPTS/PROCESSES: Cause and Effect, Force, Observe

OBJECTIVE(s): After completing the activity, students will be able to:

- identify some of the fish predators that prey on young salmon.
- explore the process that creates a vortex (water spout).

MATERIALS:	
80-1 liter, clear plastic pop bottles	40 tornado tubes
2 packets of green confetti	2 packets of small confetti (fish)
40 fish predator patterns	blue food coloring
20 packs of clear tape	40 scissors

BACKGROUND INFORMATION:

THE VORTEX

In order for a fluid like air or water to flow from one place to another, a force must act on it. In open systems like a riverbed, this force is provided by gravity. In a closed system like your pop bottle predator-prey tube or a drain pipe, other factors, in addition to gravity, come into play. For a fluid to flow in a closed system, it must always go from a region of high pressure (greater concentration of molecules per unit volume) to an area of low pressure (lower concentration of molecules per unit volume).

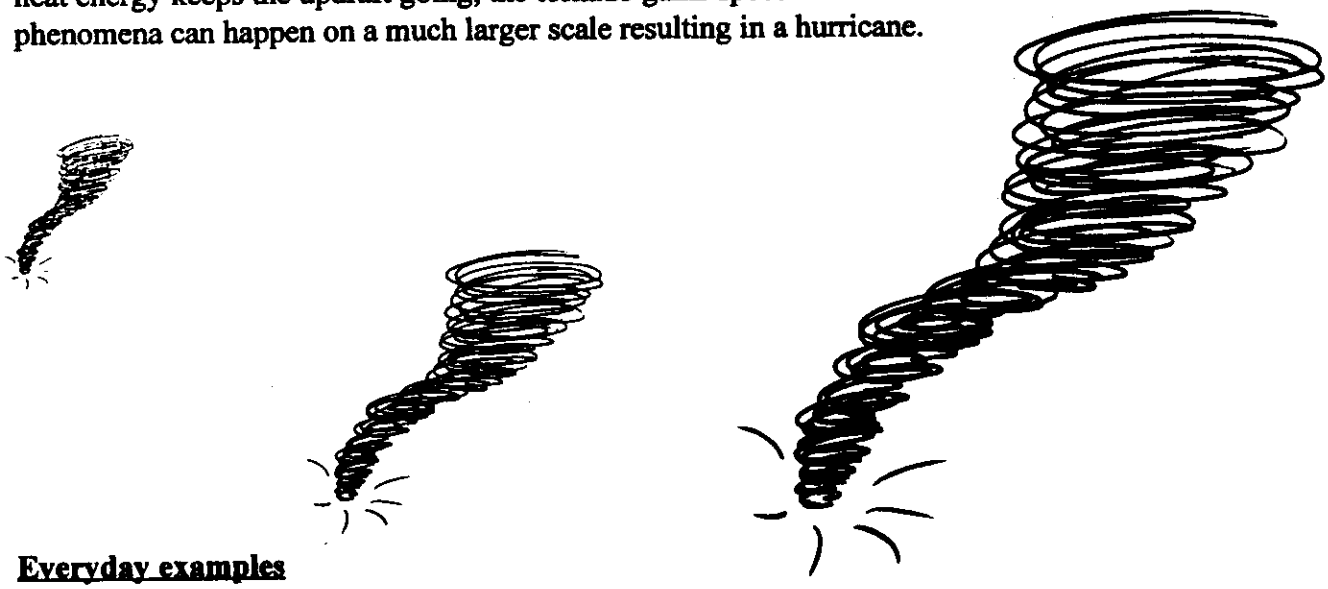
When you turn the predator-prey tube so that the full bottle is on top, the force of gravity pulls the water into the lower bottle. As the water flows, some of the air in the lower bottle is pushed out and bubbles up to the top. As long as the air can make it out of the lower bottle, gravity alone provides the pull or pressure to keep the water flowing down. Because the opening between the two bottles is made narrow by the tornado tube, the air and the water have a difficult time getting past each other. Eventually, the pressure of the air inside the lower bottle exactly equals the pressure of the water in the upper bottle, which stops the exchange of water and air.

To get the water moving again, another force is needed. That new force comes from the spin you create as you rotate the predator-prey tube. The force of the spin pushes the water toward the walls of the bottle. This force increases the pressure on the water near the walls of the bottle and lessens the pressure on the water in the center of the bottle. The higher pressure near the walls forces the water upwards, forming a depression in the top surface of the water. As the spin increases, the depression increases and eventually

reaches the opening of the bottles. The reduced pressure at the center, and the opening of the depression, "unclogs" the drain allowing air to move freely from the bottom bottle to the top bottle. Once this occurs, gravity quickly drains the water in the top bottle into the lower bottle.

Tornadoes and Water Spouts

Everyday common experiences such as water running out of your bathtub and water running down your toilet, usually get started because of differences in pressure. Tornadoes and water spouts get their energy from differences in air pressure. In tornadoes, this pressure difference is caused by unequal heating and cooling of air by the ground below. As air gets warm, it expands, becomes less dense (less molecules per unit volume), which causes a drop in pressure. A tornado begins when a narrow band of air expands so rapidly that it forms an area of extremely low pressure and suddenly rises, causing an updraft. Air from outside the updraft rushes into the low pressure zone to try and fill empty space. As air rushes in from all directions, it begins to spin. As long as heat energy keeps the updraft going, the tornado gains speed and moves. This phenomena can happen on a much larger scale resulting in a hurricane.



Everyday examples

The direction of the water's flow inside your bathtub drain or toilet bowl creates a vortex. If you feel the drain area of the bathtub, you'll notice that it is not flat. This uneven surface is specifically designed to direct the water into the drain and get it spinning. The water flowing in the vortex may swirl in either a clockwise or counterclockwise direction. You have probably heard the statement or read it in some books that water will swirl in one direction above the equator and the opposite direction below the equator because of the Earth's rotation. Unfortunately, this is not true. The Coriolis force, which explains why wind patterns on Earth change direction north and south of the equator, has little if anything to do with how water travels down bathtubs or toilets.

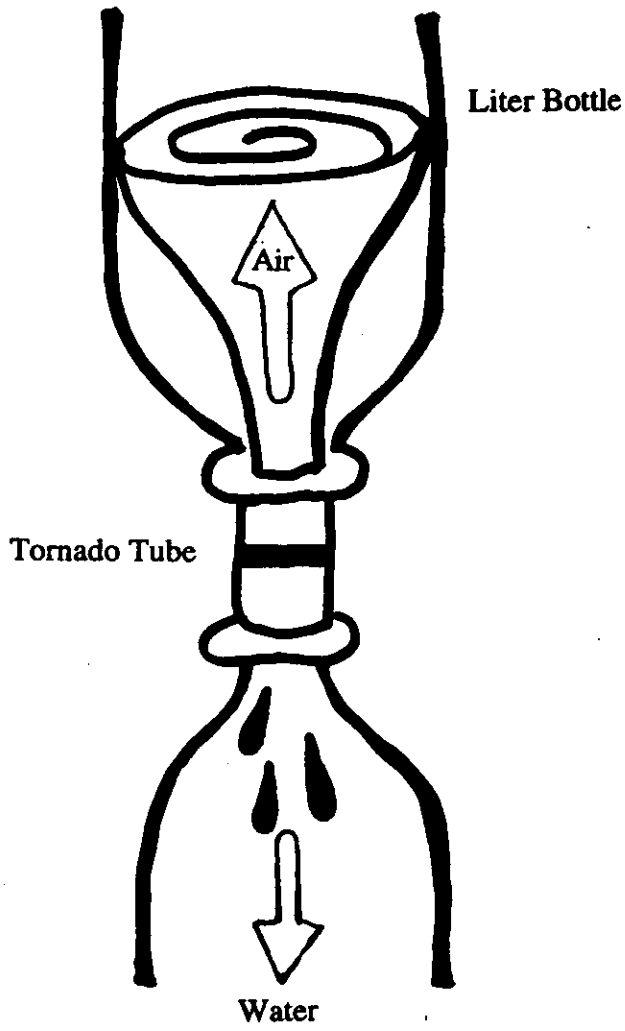
NATURAL PREDATORS

Young salmon are preyed on by sculpins, mink, raccoons, mergansers, and kingfishers, among others. When salmon reach the smolt stage they are preyed upon by larger fish, generally, walleye, largemouth bass, smallmouth bass and bigmouth minnow. The bigmouth minnow eats millions of young salmon smolt each year. Reducing the number of native bigmouth minnow may increase dramatically the number of salmon in the Columbia River Basin. A program sponsored by the Bonneville Power Administration, Oregon Department of Fish and Wildlife and the Washington Department of Wildlife, pays anglers to catch the native bigmouth minnow. The program removes these predators that feed on young salmon and other fish. Researchers are developing practical uses for bigmouth minnow, including fertilizers, fish meal, and food. This program aims to restore a more natural balance between the bigmouth minnow and its prey. Anglers earn $3 for each bigmouth minnow measuring 11 inches or longer. Generally, fishing techniques used for walleye or bass work well for bigmouth minnow (The Bigmouth Minnow is more commonly called the Northern Squawfish).

PROCEDURE:

1. In this activity, students will make a predator-prey tube using a tornado tube, two one-liter clear plastic pop bottles and water. The predator-prey tube will provide the students with a model of a vortex. By adding a fish predator pattern and fish-shaped confetti, it will also be used to symbolize the relationship between certain fish predators (walleye, largemouth bass, smallmouth bass, bigmouth minnow) and their prey (smolt).
2. Instructors should assist students in building their predator-prey tubes. Pour light blue water (one drop of blue food coloring per bottle-do not over color) into one of the liter bottles until it is approximately 3/4 full.
3. Before connecting the two one-liter pop bottles together, add a pinch of green glitter confetti to represent algae and five to ten fish-shaped confetti to represent the young salmon (smolt).
4. After connecting the two bottles together with the tornado tube, it is important to dry the outside of the bottles before attaching the predator pattern. Instructors should assist students with the cutting and taping of the patterns. The stomach of each of the predators should be cut out so that students can see the young salmon (smolt) after they are eaten. The patterns should be taped to one of the liter pop bottles.
5. Twirl the water in the predator-prey tube apparatus to form a vortex. The spin of the water will flush the young salmon into the waiting mouths of the four fish predators.

Predator-Prey Tube



CONCLUSION

Instructors should ask the following questions to bring closure to this activity:

1. What is a vortex?
2. Give common examples of a vortex
3. Define the terms paredator and prey.
4. Name a predator of the salmon smolt.

Journey of the *Oncorhynchus*
A Story of the Pacific Northwest Salmon

Teacher's Guide to Storybook

DAY TWO

It's April. Hydroid's young friends still hide in the pools and slower water. Their sides now have dark bands or *parr* marks to *camouflage* them and to hide them from *predators.* They are not strong swimmers, but they are bolder and a little more adventurous. They dart into the stream to grab small insects that live among the stream's rocks. Not all the young fish make it back to the safety of the stream bank. As they move into the stream, they are wide open for attack. Fry and parr are the favorite food of trout and other large fish. Not everything that looks like a branch is a safe hiding place. Some branches turn out to be the legs of great blue herons. Hydroid also warns the young chinook to beware of shapes darting out from trees. The shapes could be kingfishers. The bright blue birds are looking for young fish to feed their own young this time of year.

Not all the young chinook survive the first few weeks of life. But those that do live learn quickly how to find food and avoid danger.

Journey of the *Oncorhynchus*
A Story of the Pacific Northwest Salmon

Teacher's Guide to Storybook

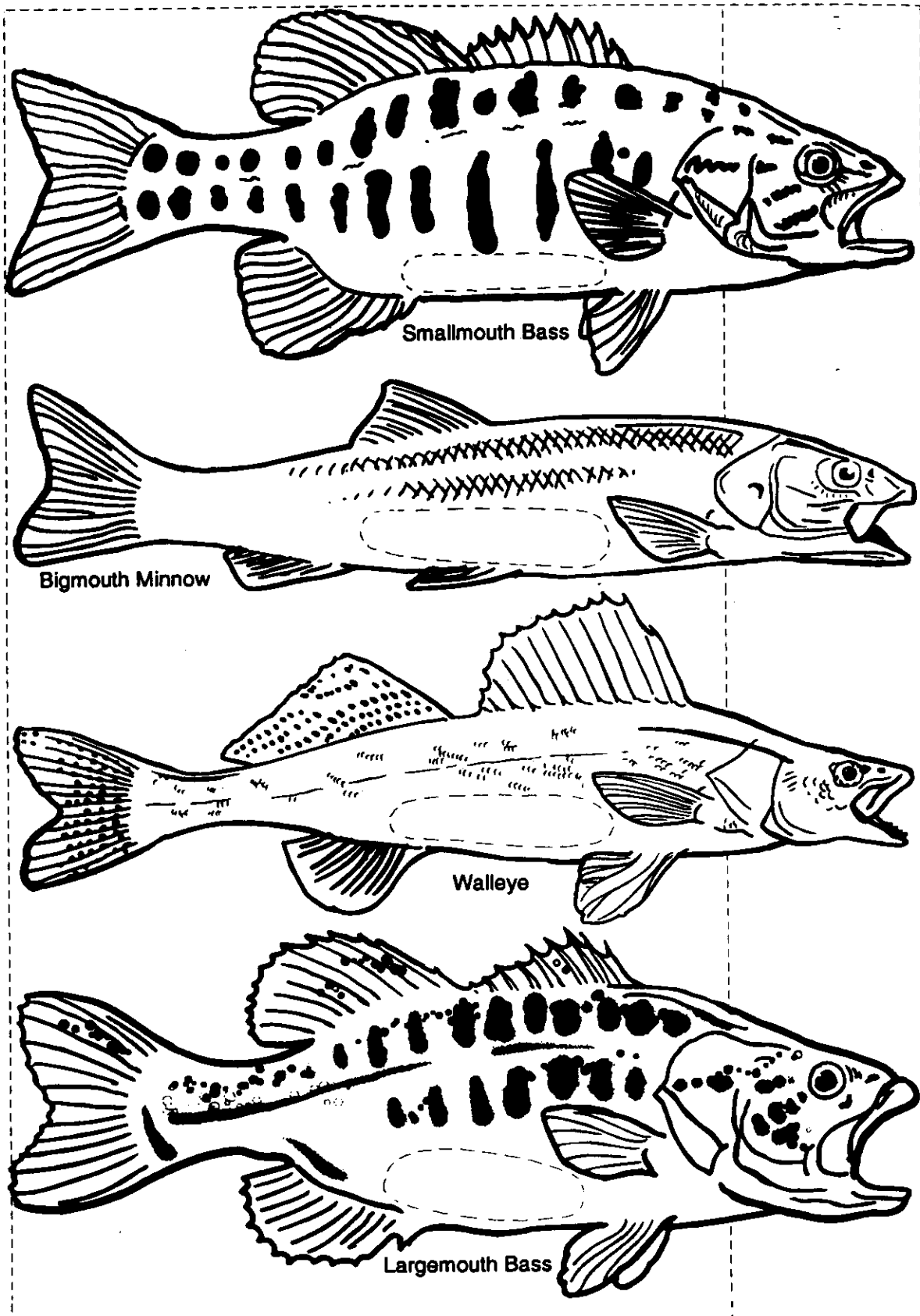
DAY THREE

It's April, one year later. Each fish is now about the length of a human finger. That's why they are called *fingerlings*. Their parr marks are fading to faint vertical stripes along their silvery sides. The young fish are restless. They are ready to move. As the snow from the mountain begins melting, the stream rises, the fish move into the swift current and let it pull them downstream. The fish do not swim, they float with their heads pointed upstream. Hydroid flips into the water and travels along with his friends. Their small stream joins Hood River. Not too far from the stream, they slip down the face of a four-foot waterfall. A kingfisher swoops in and snaps up one of the fish. They are far from the shelter of the stream bank now. The fish move down into the water and travel mostly at night to avoid predators. Along the way, they eat worms, flies and larger insects. The fish are growing quickly. They are changing inside as well. Hydroid notices that, as the days pass, the current becomes stronger and the fish seem more eager to move downstream. They are heading for the ocean.

The river angles north, then west and suddenly becomes wide, brown and slow. Hood River has joined the Columbia River. Hydroid and the fish are in the *reservoir* created by Bonneville Dam. The dam makes enough electricity to heat all the homes and turn on all the lights in Portland. It does this without polluting the air. But the fish are not all that happy with the reservoir. The reservoir is like a big lake. There is no current to tell the fish which way is upstream and which way is downstream. They are lost. They swim around looking until they find the flow. They need to get to the ocean and the reservoir is slowing them down. The slow water is warm. Chinook and other salmon like cold water. Bass, walleye and bigmouth minnows like warm water. These fish love to eat young chinook. Bigmouth minnows can eat as many as 25 young salmon a day. The salmon stay low in the water and move at night to try to avoid danger. But Hydroid knows the greatest danger lies ahead. Dams produce power by sending water past *turbines*.

Within the 2,000-foot long concrete wall of Bonneville Dam, there are 18 whirling turbine blades. The blades are not likely to cut the salmon. What hurts the fish is the sudden change in pressure in going from the top to the bottom of the dam. The young fish could drop 90 feet in less than one second.

The water speeds up as Hydroid and the fish get closer to the dam. The current draws the fish to the mouth of a turbine when Hydroid spots a screen wall ahead. Hydroid flattens itself against the screen and cushions the young fish as they ride the screen up, past the turbine into a tunnel within the dam. The tunnel guides the fish around the turbines and into a tube on the other side. The fish are safe from the turbines. But the danger is not over. The ride makes some fish dizzy. Gulls and other birds know this. They lurk overhead on the lower side of the dam, waiting to pick off the stunned fish. Hydroid quickly moves the Hood River chinook low in the river. They find the current and continue their journey downstream.


Smallmouth Bass
Bigmouth Minnow
Walleye
Largemouth Bass

Draw (or write) everything you know about the Pacific Salmon.

(dam, life cycle, environment, saltwater, freshwater, food chain, predators, prey, body parts, and electricity are examples of things to write about)

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Name _____ **Camp** _____ **Date** _____

DAY 3 **TEACHER NOTES**

OXBOW PARK FIELD TRIP

EMERGENCIES
Oxbow Park Office phone number (503) 663-4708 or 797-1850 (METRO Park Office)
Pay phone located on Park Office porch.
Sheriff's Office (255-3600) or the Fire District #10 (232-2111).

Estimation Game: Challenge students to estimate the length of a piece of string in centimeters. (Winners will be announced at the beginning of lunch.)

Bus Activities: Students can complete games and/or activities in their student workbook during the bus ride to Oxbow Park.

OBJECTIVE(s): After completing the activities on this field trip, students will be able to:

- apply what they have learned in the classroom to their local and regional communities.

MATERIALS:

35 student workbooks	20 thermometers
Dissolved Oxygen meter	5 pH paper rolls/color charts
10 Streamwalk Games	35 bug boxes
2 ropes (each ~20 meters long)	20 watercolor sets
20 paint brushes	45 sheets of white paper
20-8 oz plastic cups	2 gallons of water
50 white (3" x 5") index cards	500 feet of string
50 pink (3" x 5") index cards	2 cardboard boxes
1 jump rope (10-15 feet long)	35 adhesive name tags
10-8 oz plastic cups	First Aid Kit
15 clip boards	4 traffic cones

BACKGROUND INFORMATION:

Oxbow Park, located 20 miles east of Portland, is a 1,000 acre natural area with recreational facilities. The Sandy River flows through the Park for three miles. The Sandy River supports spawning populations of coho, fall chinook, winter steelhead, spring chinook and summer steelhead.

The diverse topography and vegetation make Oxbow a haven for wildlife and provides an ideal setting for environmental education activities. The Park supports old growth and second growth forests. Some 220 varieties of native plants, 99 species of birds, 38 species of mammals, and 15 species of reptiles and amphibians make their home in the Park. Some commonly seen residents include, deer, osprey, pileated woodpecker, beaver, and great blue heron.

PROCEDURE:

1. Each group of students (A, B, etc.) will include one team from each of the two camps. Each group of students will experience five activity stations. The order in which each group will go through the stations is listed below.

Group	Morning Stations	Afternoon Stations
A	1, 2,	3, 4, 5
B	2, 3,	4, 5, 1
C	3, 4,	5, 1, 2
D	4, 5,	1, 2, 3
E	5, 1,	2, 3, 4

2. **OXBOW PARK ACTIVITY STATIONS**

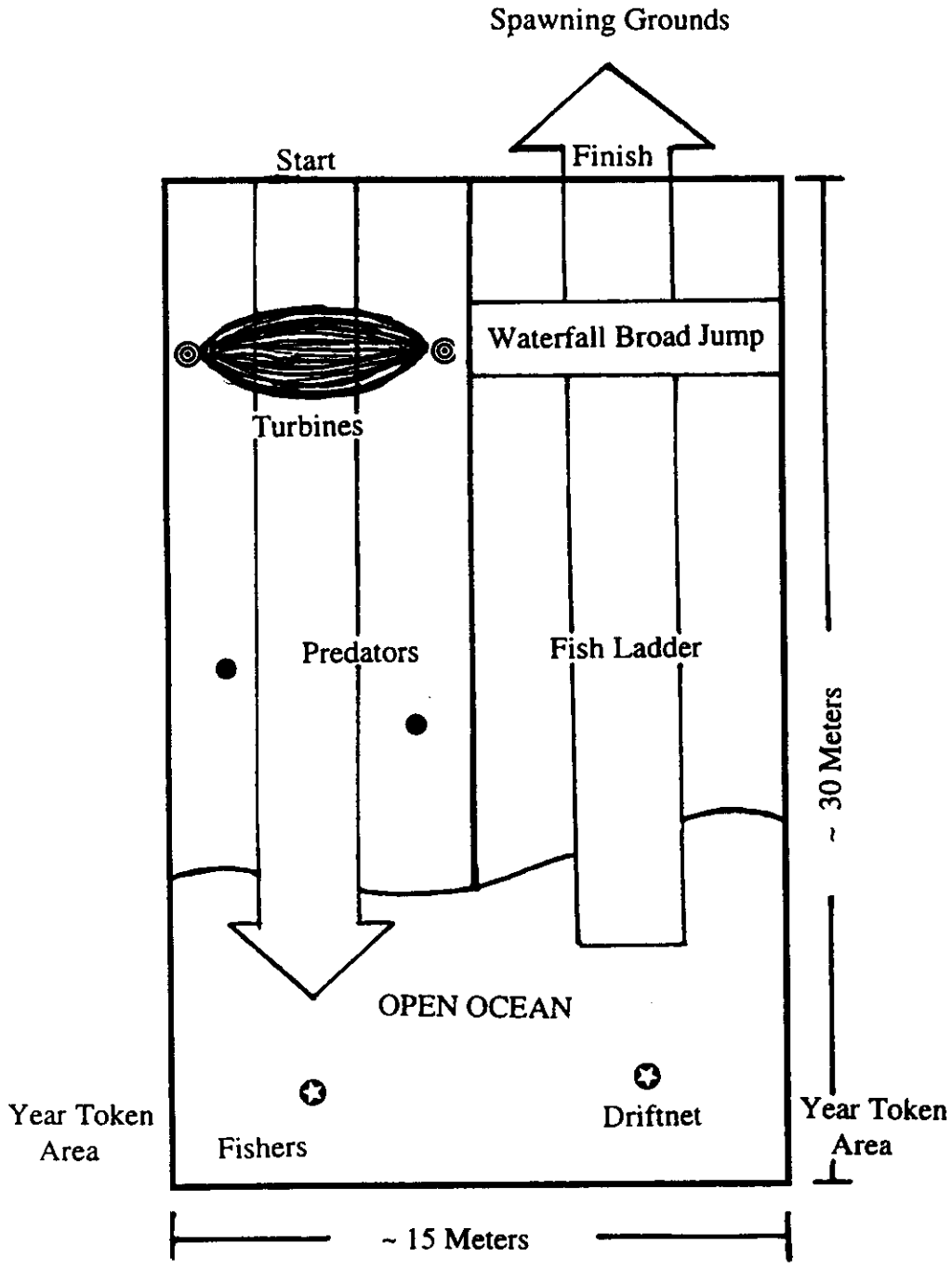
STATION 1: STREAM DETECTIVES

Pacific Salmon Life Cycle Review
- Stages of growth: fertilized egg, eyed egg, alevin, fry, parr, smolt, adult.

The Streamwalk Game
- The Murky Water Mystery
- Investigation Report
- The Clue Cards
- The Stream Detective Map

Stream Conditions
- Temperature
- pH
- Dissolved Oxygen

STATION 2: THE SALMON GAME
(Adapted by permissiion from Aquatic Project WILD,© 1992 Hooks and Ladders activity.)



1. Set up the playing field as shown in the diagram. The area should be about 30 meters by 15 meters. Use string/rope to mark the boundaries. (See diagram.) The waterfall broad jump should be approximately three to four meters in length.

2. Assign roles to each of the students in the recommended numbers listed below.

   - Choose **two** students (or adults) to be the **turbine team** (these recommended numbers are based on a class size of 30 students, if your group is larger or smaller, adjust the numbers accordingly). These two students will operate the jump rope which represents the turbines in hydroelectric dams. Later in the game, when all the salmon have passed the turbine going downstream, these two students should move to the upstream side to become the waterfall-broad jump monitors (this activity works best with 30 or more students).

   - Choose **one** student to be a **predator** (kingfisher, bigmouth minnow, great blue heron, etc.). At the start of the game the predator will be below the turbines where he/she will catch salmon headed downstream. Later in the activity when all the salmon are in the sea, the predator will patrol the area above the "broad jump" waterfall. There she/he will become a bear and feed on salmon just before the salmon enter the spawning ground.

   - Choose **one** student to be a **human** in a fishing boat catching salmon in the open ocean. This student in the fishing boat must keep one foot in a cardboard box to reduce his/her speed and maneuverability.

   - Choose **one** student to use a **drift net** to capture salmon. This student will have to capture the salmon by wrapping his/her arms around the shoulders of the student salmon.

   - All remaining students represent salmon.

3. The activity begins with all the salmon starting their journey downstream. The turbines (jump ropes) at the dam will be their first hazard. The student salmon cannot go around the jump rope swingers, but they can slip under the swingers' arms if they do not get touched while doing so. A salmon dies if it is hit by the jump rope (turbine). **Any salmon that "dies" during this activity must immediately become part of the fish ladder.** The students who make up the fish ladder should kneel on the ground with a body-wide space between them.

4. After successfully passing the turbines, the salmon encounter native predators. The predators must catch the salmon with **both hands**, tagging isn't enough. The salmon that are caught are escorted by the predator to become part of the fish ladder.

5. After reaching the open ocean, the salmon can be caught by fishing boats and drift nets. The salmon must move back and forth across the ocean area in order gathering four tokens (two white and two pink). The white year tokens will be located on one side of the ocean and the pink year tokens will be on the other side. Each token represents one year of growth. Once each salmon has four tokens, that fish can migrate upstream. The year tokens can only be picked up one token at a time on each crossing. Remember, the salmon must cross the entire open ocean area to get a token (two white and two pink).

6. When the student salmon has obtained four of the year tokens, the salmon can begin its upstream journey. The salmon must **walk** through the entire pattern of the fish ladder. In the fish ladder, predators may not harm the salmon.

7. Once through the fish ladder, the salmon faces the broad jump waterfall (~4 meters in length). The waterfall represents one of the natural barriers the salmon must face going upstream. If the salmon fails to make the jump, then it must return to the bottom of the fish ladder and come through again.

8. Above the falls, the person who started the game as the predator is now the last set of limiting factors faced by the salmon. This predator can represent a bear or dipnet fisherperson. Again, remember that the predator must catch the salmon with **both hands.** If he/she does catch a salmon, they must then take the student they caught to become part of the structure of the fish ladder.

9. The activity (cycle) ends when all the salmon are captured before the spawning ground is reached or when all surviving salmon reach the spawning ground.

10. Some discussion topics to talk about after the game is completed:

    A. The survival-mortality ratio of salmon
    B. The student's feelings throughout the game
    C. The role of the barriers
    D. The role of the predatory wildlife and the people fishing
    E. Where the losses were least.
    F. Where the losses were greatest
    G. The causes for variation of the salmon population.

STATION 3: OLD GROWTH FOREST

Introduction
- Wake up your senses!

Define Old Growth Forest
- Did you notice changes/differences in the forest while driving through?
- Four part definition (size/age of trees, standing and downed dead wood, diversity of species, layered canopy).

Overview of Site
- Identify four visible plant communities, introduce succession.
- Identify osprey nest, it's life cycle and eating habits.

How to Walk in the Woods
- Introduce or review first line of defense (freezing), splatter vision, focused listening, and fox walking.

Identify three tree species (Douglas Fir, Western Red Cedar, Western Hemlock, Indian legends, shade tolerance

How it all fits together - Story of what happened at this site.
- Volcanic flood in 1750
- Douglas Fir forest, now old growth
- Flood in 1964

Other activities along hike
- Deer chews
- Edible plants (*Oxalis*)
- Examine 800-year old stump, estimate age
- Look for fish bones under osprey tree.

STATION 4: WILDLIFE WATCHING AND TRACKING

How animals protect themselves ("freezing"). Camouflage.

Concepts of Awareness
- Splatter Vision
- Focused Listening
- Fox walking
- FREEZE GAME

Where and when to see animals.

Animal SIGNS
- lays, chews, scat, hair, feathers, dens, etc.

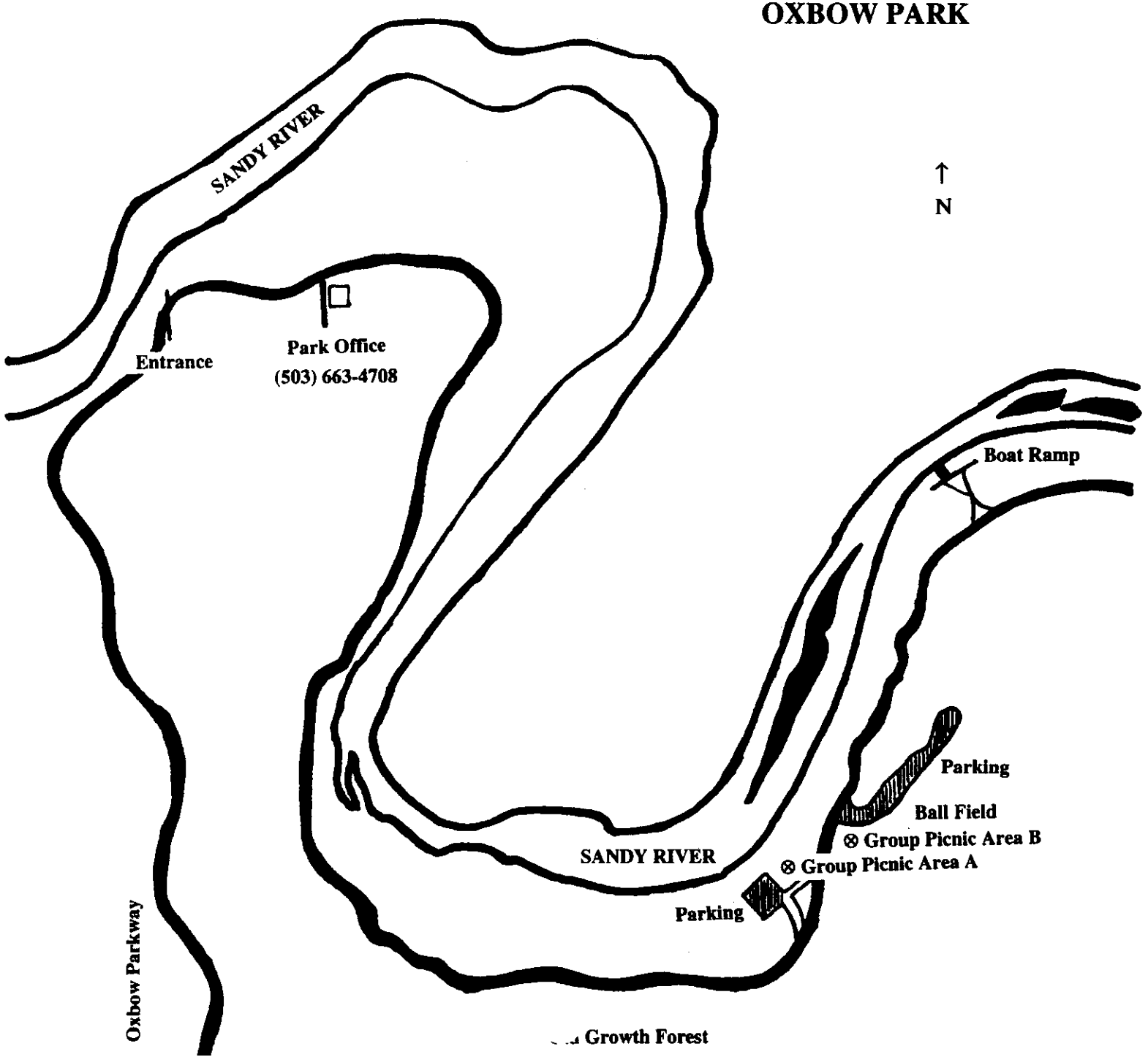
Animal TRACKS
- Clear print identification (go through formulas and families)
- Pattern Identification

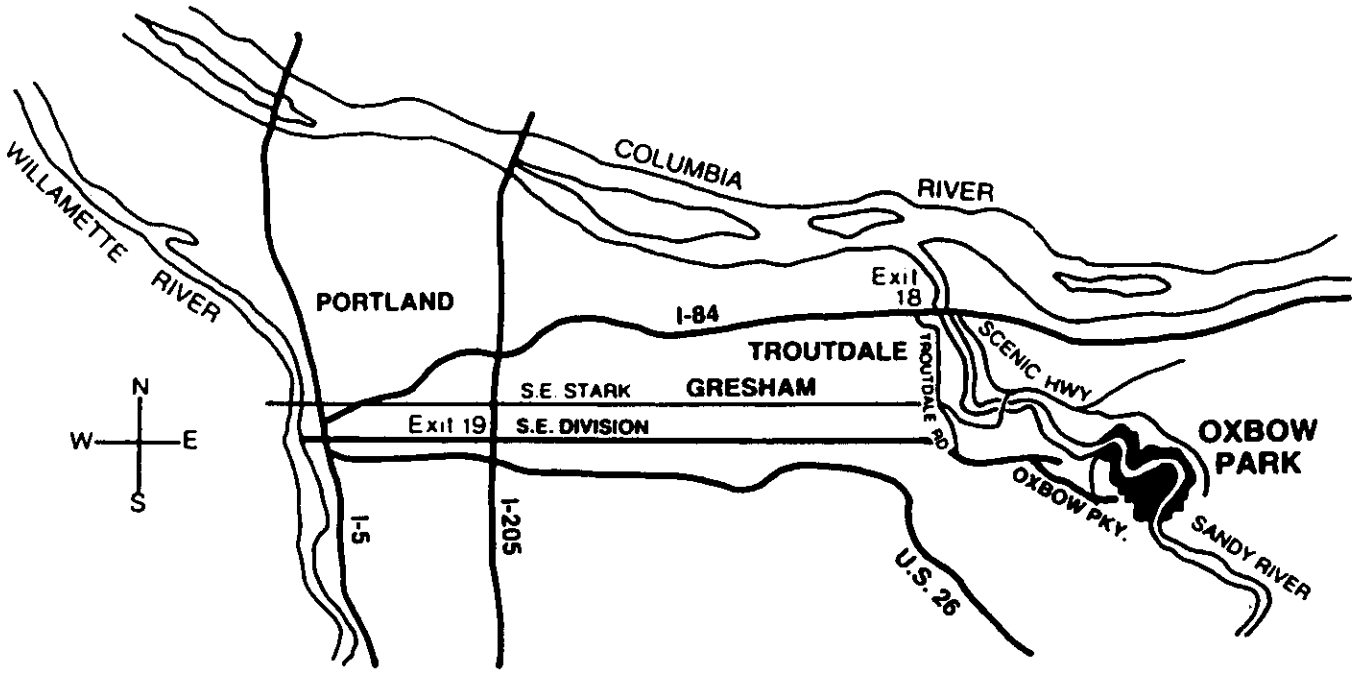
PRACTICE

STATION 5: ECOSYSTEM ART

Students are to use watercolors to paint a habitat scene.
Review food chains and food webs.
Identification of native plants and animals.
Insect collection and identification - insect boxes.

OXBOW PARK


SANDY RIVER
N
Entrance
Park Office
(503) 663-4708
Boat Ramp
Parking
Ball Field
⊗ Group Picnic Area B
SANDY RIVER
⊗ Group Picnic Area A
Parking
Oxbow Parkway
Growth Forest


COLUMBIA
RIVER
WILLAMETTE
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PORTLAND
I-84
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18
TROUTDALE
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SCENIC HWY
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S
S.E. STARK
GRESHAM
Exit 19
S.E. DIVISION
OXBOW
PARK
OXBOW PKY.
SANDY RIVER
I-5
I-205
U.S. 26

OXBOW PARK ATTENDANCE SHEET

GROUP A:
(Stations 1, 2, 3, 4, 5)

1._____
2._____
3._____
4._____
5._____
6._____
7._____

GROUP B:
(Stations 2, 3, 4, 5, 1)

1._____
2._____
3._____
4._____
5._____
6._____
7._____

GROUP C:
(Stations 3, 4, 5, 1, 2)

1._____
2._____
3._____
4._____
5._____
6._____
7._____

GROUP D:
(Stations 4, 5, 1, 2, 3)

1._____
2._____
3._____
4._____
5._____
6._____
7._____

GROUP E:
(Stations 5, 1, 2, 3, 4)

1._____
2._____
3._____
4._____
5._____
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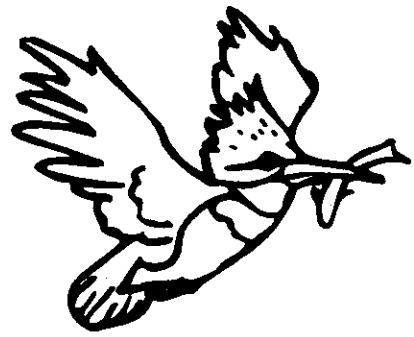
7._____

WILDLIFE
WORD SEARCH



R T W J T R A C K I N G U H L
Y G I S K I G J T U F O V U O
E K R E S O S P R E Y L P C E
C I K E R L H X I T K D U K V
O N S F A U W L S Y O G D L Q
S G L I M T T M R U E R F E M
Y F H L L A B A G R V O N B R
S I B D K T Z L R M Z W D E W
T S G L N J A Y U E N T G R H
E H C I G S H E D E P H E R B
M E A W F S O C K C H M A Y O
D R Q I Z N B P X I B E E J C
O P R E D A T O R L N X R T Q
P F Q F A G M P C H I N O O K
D I S S O L V E D O X Y G E N

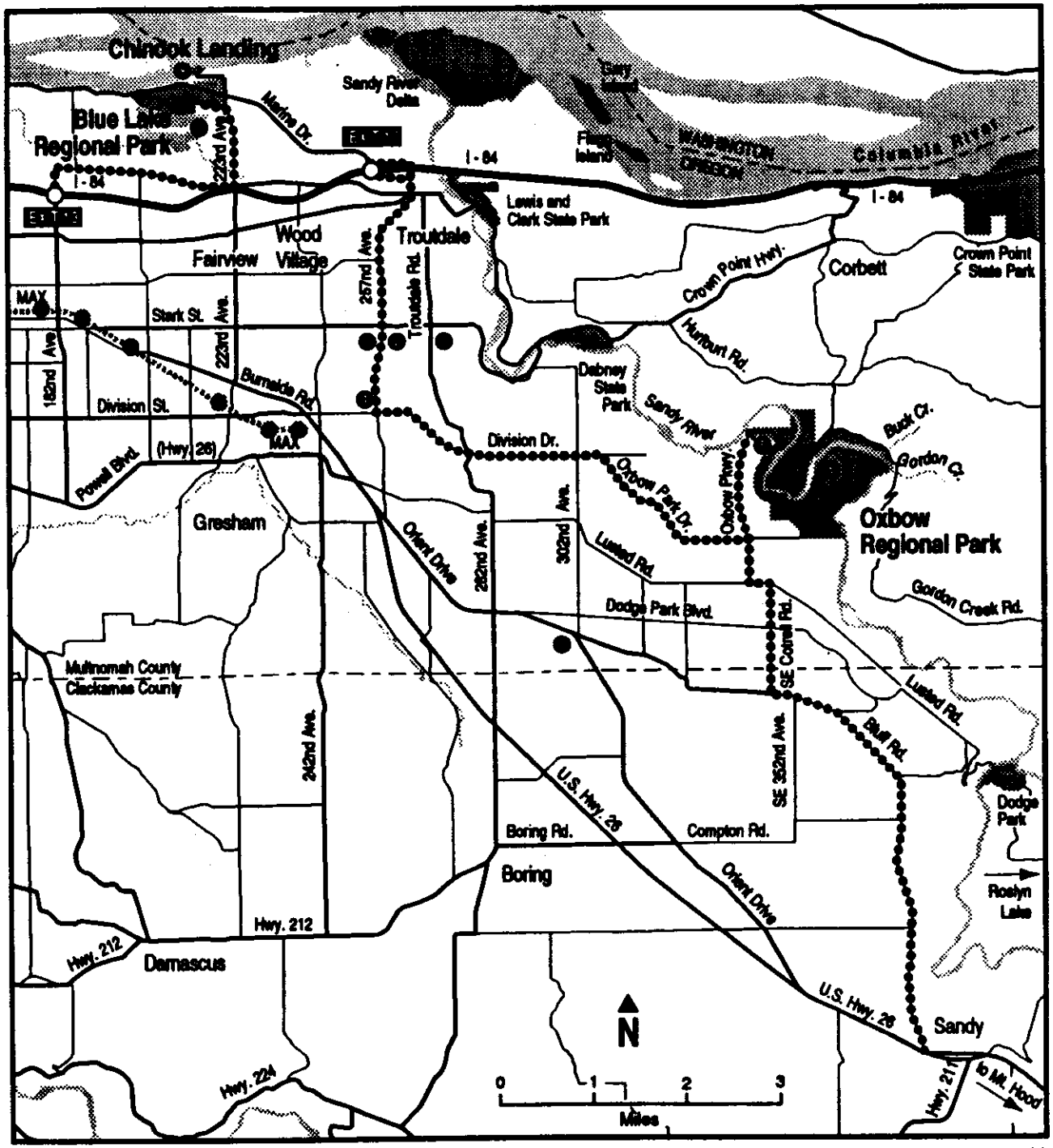
Predator
Douglas fir
Old Growth
Dissolved Oxygen
Tracking
Wildlife
Snag
Kingfisher
Great Blue Heron
Chinook
Temperature
Huckleberry
Osprey
Ecosystem
Silt

WILDLIFE
WORD SCRAMBLE

Directions: Unscramble the words below.

1. EWFIILDL	1._____
2. GSAN	2._____
3. TSLI	3._____
4. YOESRP	4._____
5. RPROETDA	5._____
6. KCHOION	6._____
7. MEECTOSSY	7._____
8. YHRURCEKBLE	8._____
9. SDAOLUG RFI	9._____
10. GTNRIAKC	10._____
11. RKEIHNSGIF	11._____
12. TGARE EBUL NHOER	12._____
13. ETREUMTPARE	13._____
14. DDEIVSLSO NOEXYG	14._____
15. RPYE	15._____

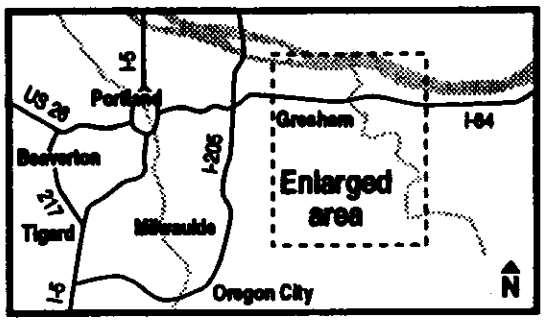
Oxbow Park & Blue Lake Park Vicinity Map



Legend

- Mt. Hood Medical Center
- Mt. Hood Community College
- Grocery
- Grocery/gas/bait (open 24 hours)
- Oxbow Park office
- Oxbow Park campground
- Blue Lake Park
- Chinook Landing

Preferred routes
MAX Light Rail
Park
River or lake



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Wildlife Watching

Stop **Stop talking** – become a tree, a rock, an animal . . .
Stop – when there is an alarm call.
Stop – when an animal looks at you.
Stop – learn to **freeze**.

Look Look – with **splatter vision** to see movement.
Look – for edges of fields and near water.
Look – for tracks and signs.
Look – at **dawn and dusk**.

Listen Listen – what are the birds saying?
Listen – for **alarms** or **concentric** rings.
Listen – for a rustle, snuffle, swish, crunch . . .
Listen – can you hear your breathing?

Move Move – with the **foxwalk**.
Move – in **slow motion**.
Move – when an animal looks away from you.
Move – with the wind.

METRO

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The Freeze Game

Would you like to know how it feels to be invisible?

At the word **freeze!** – stay perfectly still. You can breathe and you can blink – but that is all.

Stay "frozen" for a moment . . . Pretend that you have become a statue, a rock or a tree. If a rabbit or a deer is scared, this is what *they* do. Their colors blend in with the forest and allow them to disappear (camouflage).

If you are looking at a deer who has "frozen," you should try to stay still as long as the deer can. You may have to stay still for a long time! Finally, the deer will forget that you are there. It will look away from you. Now is your chance to move closer to it! Any time the deer looks at you – **freeze!**

Use the freeze game when you are watching wildlife and also when you hear an **alarm call**. This is a short, choppy call given by a bird or squirrel to let the other animals know there is danger nearby. Even a hummingbird has an alarm call! Is the alarm call nearby? Wait for it to stop before you move. Is it far away? Perhaps another animal or person is moving in the woods and the birds have spotted them. Soon you can learn to understand the birds.

Invent a hand signal for **freeze!** to use on your walks. You don't want to shout "freeze!" and scare everything away!

If you have an hour or two, try finding a nice spot in a park, forest or your backyard. Then sit down, get comfortable and **freeze!** After a while, the birds begin to sing and come closer to you. Soon you will be in a new world full of surprises – animals walking, eating, playing or hunting. That's the way the forest is when there are no people around!

You have become invisible!

For more information, see books and field guides by Tom Brown Jr.

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Splatter Vision

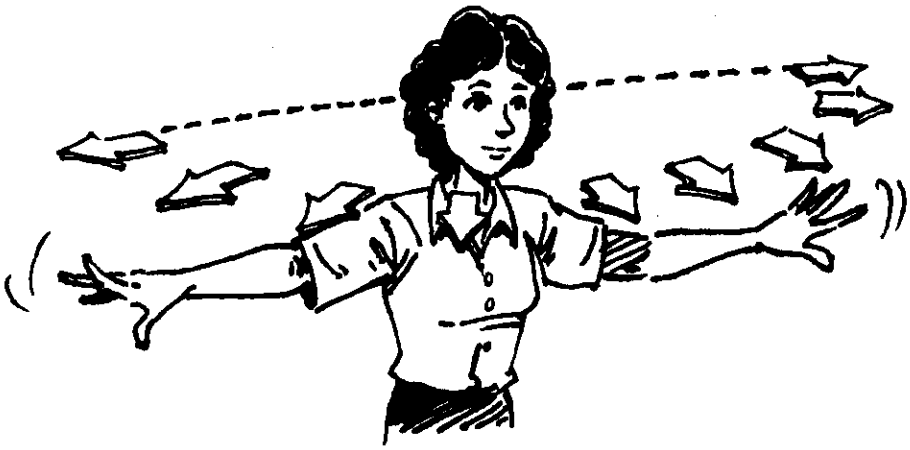
Would you like to see twice as much – even in your own back yard?

Most people have learned to focus on one small area at a time. We look at a person's face, a book or a television and blot out the surrounding areas. It is like looking through a little tube all the time.

Most animals see in a different way. They have to be aware of what is moving in the forest – is it food or will it eat me? They need to see and hear in all directions – not just in front of them. Their lives depend on this.

We can learn from our animal friends how to see much more – try **splatter vision**.

First put your arms straight out to the sides at shoulder level.
Then point your fingers forward and wiggle them.
By looking straight ahead – get so that you can see both hands:



Think of seeing out of the corners of your eyes.

Everything may seem a little blurry – but you will now be able to catch the slightest *movement* around you – even at your sides. If a bird blinks, you'll see it! A blade of grass moving differently than the others – is there a mouse there? Every bug in the vicinity will be seen too! If you spot something you want to look at – then you can focus as you normally do.

After a few tries **splatter vision** becomes automatic and easy for anyone to do.

The next step is to sit down in your back yard, field or forest and try **splatter vision**. Welcome to a new world!

For more information, see books and field guides by Tom Brown Jr.

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Focused Hearing

How much can you hear? As much as a deer, a fox or an owl?

Close your eyes, take a deep breath, relax and listen . . .

Take your time and focus:

What is the most distant sound you hear?

What is the nearest sound you can pick out?

How about all the sounds in between the near and far?

Can you hear your own breathing?

Can you hear your heart beating?

Listen closely to what the birds are saying.

Are they making long and musical sounds? If they are – they are *singing* and all is well with them.

Are they making a short, choppy and hard to locate sound? That is called an *alarm call*. Birds use alarm calls to warn other birds and animals of approaching danger. Some alarm calls are loud and easy to hear – like a jay or a crow. But even very small birds have alarm calls – it may be tiny chirp that is hard to hear. Even the smallest alarm call is the birds' way of shouting, "There is danger coming! Hide! Run away!" to all other animals in the forest.

If you hear an alarm call near you, chances are that the bird is warning other animals in the forest that *you* are approaching! If you hear an alarm call not in your immediate area, it could mean that there is another animal moving. Or it could be that there is a disturbance being made even further away . . .

You see, if a loud, scary, dangerous animal moves through the forest (like a *human* for example), the alarm calls will move outward from the source of the danger. It is like dropping a rock in a pond – the **concentric rings** of disturbance move out in larger and larger circles.

Can you detect any **concentric rings**?

Birds will make different types of alarm calls for different dangers – people, deer, fox, snake, etc. You can learn to understand them!

For more information, see books and field guides by Tom Brown Jr.

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Another type of **concentric ring** is a bird flying rapidly. Or if the forest is very quiet it means that some danger is near, passed through recently, or that you are creating a disturbance.

Try putting on **deer ears**. Just cup your ears with your elbows pointed *forward*. This will let you focus and amplify the slightest rustle, swish or sound in the forest.

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The Fox Walk

We can learn from our four-legged friends how to walk silently and unseen. The fox is especially good at sneaking softly through the forest.

First – **stop talking!**

Then – try the **Fox Walk**:

1. Try taking a short slow step and place only the outside edge of your foot on the ground.
2. Gently roll your foot down flat.
3. Then slowly move your weight forward.
4. Repeat with the other foot . . .

With this walk you can **freeze** easily (if an animal looks towards you or you hear an alarm call). If you feel a twig that might break – just pick up your foot and place it in a new spot. You don't need to look down – just feel the way.

It is best to use **slow motion**.

Try the **Rabbit Game**: Have your group form a circle with one person in the center pretending to be a rabbit. When the rabbit looks at you **freeze!** When the rabbit is not looking at you, **Fox Walk** toward it. See who can reach the rabbit first. Try two rabbits. This is the same way to sneak up on a real animal.

Try the **Fox Walk** at home. See if you can sneak up on a cat or dog. Don't scare them. Just try to get near them, and then let them know that you are there and just practicing.

Then go outside and try the **Fox Walk** on beetles, bugs, birds, frogs, chipmunks, squirrels, deer or anything else. With care you can get close to lots of different animals. Remember just get near and enjoy watching them, don't touch them or startle them. This is part of becoming invisible and enjoying the world of the four-legged and winged creatures!

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DAY 4 **TEACHER NOTES**

Estimation Game: Estimate the age of a tree using a cross section piece of wood. The age of the cross section piece will vary with each piece of wood. Instructors need to count the rings prior to starting this activity. (The winners will be announced during the break.)

Story Time: Journey of the *Oncorhynchus*-Chapter 4. Each student will need their Journey of the *Oncorhynchus* story book. Before starting the story, set up the Journey of the *Oncorhynchus* mural by adding **section four** or the poster. Call attention to the mural/poster by having the students search for the hidden salmon in section four. The first student to find the hidden salmon will be awarded a prize.

ACTIVITY 4-1: **A SLICE OF TIME**

SCIENCE CONCEPTS/PROCESSES: Change, Interactions, Perception, Symmetry, Observe, Question, Communicate

OBJECTIVE(s): After completing the activity, students will be able to:

- understand the relationship between tree rings and tree age.
- perceive time from the prospective of tree growth.
- understand the difference between old and second growth forests.

MATERIALS:

50 sheets of white paper (8½" x 11")	crayons
40 metric rulers	1 box push pins
50 labels (1" x 2" cardstock)	40 glue sticks
20 small tree cross-section pieces (20-30 years old)	
1 large tree cross-section piece (100-150 years old)	
50 sheets of assorted colored construction paper (12" x 18")	

BACKGROUND INFORMATION:

WATERSHED

A watershed is the whole region from which a river or stream receives its supply of water. It includes all the land that carries rainfall to the same stream or river. Pacific salmon live in watersheds. The common assumption that salmon live in streams and not watersheds has contributed to the demise of fisheries in the Pacific Northwest. We need to understand that 99% of what happens to a stream occurs outside of its corridor in the watershed. By only protecting activities in or immediately along the stream doesn't assure the protection of salmon habitat. Once damage is done to a watershed, repairing the stream corridor does not necessarily assure the survival of fish.

Unfortunately, watersheds are very complex, subtle systems. Each one is unique and will respond differently to interference. Scientists have not determined the threshold levels of watersheds. For example--what percent of vegetative cover can be removed before a significant adjustment will occur in the river or stream? Much of the watershed is out of sight--unknown are the subsurface drainage patterns resulting from springs, soils, geology and aquifers.

CHRONOLOGY OF PACIFIC NORTHWEST EVENTS

Event	Date	Years Ago (1994)
Lewis & Clark Expedition - To the Pacific Northwest	1805	189
Columbia River Chinook - peak harvest 43 million pounds	1883	111
Fort Stevens - Founded during the Civil War	1887	97
Peter Iredale - Wrecked, sailing from Australia to Portland to pick up a load of wheat.	1906	88
Bonneville Dam - Constructed	1938	56
Pearl Harbor -United States enters World War II	1941	53
Ape Cave - Discovered by logger	1946	48
Celilo Falls - Sacred Native American fishing and trading spot, flooded due to The Dalles dam construction	1957	37
Boldt Decision - Native American fishing rights - entitled to 50% of salmon destined to pass the usual and accustomed places (includes hatchery fish and native).	1970	24
Mount St. Helens - Most recent eruption	1980	14
Northwest Electric Power Planning and Conservation Act - Measures aimed at protecting salmon runs.	1980	14
Columbia River Chinook - Harvest 1.2 million pounds	1983	11

PROCEDURE:

1. In this activity, students will trace tree rings and compare them to events in their lives (Part 1) and the history of the Columbia River salmon (Part 2). Provide a short explanation of how annular tree rings can tell a tree's life story (tree ring study is called dendrochronology).

2. Each group of 2 students should obtain a small evergreen cross-section, 2 sheets of white paper and crayons.

3. Instructors should demonstrate how to trace the tree rings. Place a piece of paper on top of a cross-section and lightly rub the long side of the crayon over the cross-section (paper must be peeled off the crayon). For the best results, start from the center of the ring and work outward following the grain of the wood.

4. When tracing is completed, students should mount their cross-section on a piece of colored construction paper using glue sticks.

5. Using the wooden cross-section for reference, students should count the rings on their tracings to determine the age of the tree it came from. Instructors should assist students by placing an "X" on the center growth ring. For the best results, students should start counting from the center of the cross-section.

6. Students should make a short list (5-6 items) of important dates to plot on their tracings. These could include: the year they were born, siblings and parents birth dates, when they started school, the year the tree was planted, etc.
7. To plot the events, students should count the appropriate number of rings matching the event and place a small "x" on the ring. Using a ruler, draw a line from the "x" to a place outside the tracing where the event can be labeled.

8. For Part 2, instructors should use the large cross-section piece of wood. Throughout the rest of the camp, students should use push pins and paper labels to identify the significant dates/events pertaining to the Columbia River salmon and other pertinent information learned during Hydromania II. Examples can include the following: wreck of the Peter Iredale, Fort Stevens history, World War II, eruptions of Mount St. Helens, Ape Cave discovered, flooding of Celilo Falls. (See Chronology of Pacific Northwest Events table in the Day 4 teacher notes section.)

9. The term watershed should be discussed here. Students should refer back to their Oxbow Old Growth Forest experience--the Sandy River watershed. It is important to stress that 99% of what happens to a stream or river occurs outside of its boundaries in the watershed. In other words, what happens in the watershed affects the life cycle of the Pacific salmon. In order to save the salmon we must protect their watersheds.

CONCLUSION:

Instructors should assist students with Part 2 throughout the camp. Instructors should lead the discussion using the following questions:

1. Are all tree rings equally spaced?
2. What do you think causes the different spacing between tree rings?
3. How many rings would you have if you were a tree?
4. What is a watershed?
5. Why is it important to protect watersheds to save the salmon?

ACTIVITY 4-3: **TO CUT OR NOT TO CUT?**

SCIENCE CONCEPTS/PROCESSES: Cause & Effect, Change, Population, Interactions, Communicate

OBJECTIVE(s): After completing the activity, students will be able to:

- understand the delicate balance of an ecosystem.
- identify how the parts of an ecosystem are inter-related.
- identify the similarities between the story and the Pacific Northwest clear-cutting issue.

MATERIALS:	
The Lorax (Dr. Seuss) video	TV/VCR

BACKGROUND INFORMATION:

THE LORAX

In the story The Lorax, the Once-ler settled in a beautiful truffula forest. The creative Once-ler found a use for the truffula trees. He used the trees to make garments called thneeds. Thneeds were wanted by everyone because of their versatility. These useful garments were used as socks, shirts, gloves, pillows, sheets, curtains, and even bicycle seat covers. As the demand increased the Once-ler needed some help, so he contacted many of his relatives. Even with the help, it was very difficult to keep up with the demand for thneeds, so a factory was built. More and more truffula trees were being cut down to supply the factory. The Lorax, a strange creature who lived in the truffula trees, kept begging the Once-ler to stop destroying the tree population. In the manufacturing process, the air and water were being polluted, destroying the wildlife habitat in the truffula forest. The Swomee Swans could no longer sing, the Brown Bar-ba-loots had no truffula fruit to eat, and the Humming fish could no longer swim in their water and were consequently forced to leave. As time went on, all the truffula trees were cut down. The factory closed and all that was left was a ring of stones in a barren landscape. Upon one of the stones is written the word "Unless." The Once-ler tells a boy that "Unless someone like you cares, nothing is going to get better." The last truffula seed is then tossed to the boy which represents the last hope for the truffula forest.

PROCEDURE:

1. In this activity, the students will watch the video The Lorax by Dr. Seuss.
2. Following the video, students should work in small groups to complete the table on Student Activity Sheet 4-3.
3. Each group will be presented with their own truffula forest and thneed factory. The group will make decisions/policies that will change the ending to the story.
4. Student groups should share their results with the class.

CONCLUSION:

Instructors should bring closure to this activity by asking the following questions:

1. What are the similarities and differences between the story endings?
2. How can we control pollution and waste caused by factories?
3. Where do you think factories should be located in our society?
4. Did your decisions/policies try to create a balance between the environment and industry? If so, how?
5. How does this story relate to the logging practices in the Northwest?

ACTIVITY 4-4: **CONNECTIONS**

SCIENCE CONCEPTS/PROCESSES: Cycle, Organism, Population, Order, Observe, Hypothesize, Predict, Communicate

OBJECTIVE(s): After completing the activity, students will be able to:

- understand that living things are dependent upon each other and upon their non-living environment.
- understand the sun is the ultimate source of the energy used by living systems.

MATERIALS:	
2 sets of organism cards	2 large balls of yarn
hole punch	2 scissors

BACKGROUND INFORMATION:

ECOSYSTEMS

An ecosystem represents a community of organisms and the physical environment that they occupy. Within an ecosystem, living and non-living things interact with one another and materials are recycled. Examples of ecosystems are forests, lakes, rivers, ponds, and meadows. The boundaries of a river system may not be as easy to define as those of a lake. As ecosystems are units of the biosphere, they are dependent on one another and on an important physical factor, energy. All the basic energy of an ecosystem is provided by the sun.

The pathway of energy flow in ecosystems begins with the autotrophs or food producers. Autotrophs or producers use the energy from the sun to synthesize its needed organic nutrients from inorganic substances. Examples of autotrophs are phytoplankon, algae, and plants. Energy is transferred from producers to consumers or heterotrophs when the plants are eaten. Herbivores, which feed on plants, are the primary consumers. The carnivores that feed on the plant-eating animals are secondary consumers. For example, field mice feed on plants and are primary consumers. The snake that eats a field mouse is a secondary consumer, while the hawk that eats the snake is a third level consumer. Since many consumers have a varied diet, they may be second, third, or higher level consumers, depending on their prey. Each of these feeding relationships forms a food chain, a series of organisms through which food energy is passed.

Feeding relationships in an ecosystem are never just simple food chains. There are many types of organisms at each feeding level, and there are always many food chains in an ecosystem. A food web is a complex relationship formed by interconnecting and overlapping food chains in an ecosystem.

At every level in an ecosystem there are decomposers. The decomposers make use of the wastes and remains of all organisms in the system. They use the energy in these materials for their own metabolism. At the same time, they break down organic compounds into inorganic ones and make substances available for reuse in the system. As part of the cycle, decomposers can be thought of as the final consumers in every food chain and food web. They provide an essential step in returning nutrients to the soil.

PROCEDURE:

1. In this activity, students will learn that living things are dependent upon each other and upon their non-living environment. They will also learn that the sun is the source of the energy used by living systems.
2. Divide the group of students in two equal teams.
3. This activity should be done outside if weather permits. Each student should choose a name card. Turn the name cards face down and make a game of each student selecting a card. The names on the cards include: sun, algae, caddisfly larva, mayfly larva, zooplankton, huckleberry bush, bear, smolt, great blue heron, bacteria, salmon, killer whale, seal, human, salmon fry, kingfisher, beetle, soil.
4. Each team should form a large circle. The students should wear their name cards.
5. The instructor should start the game by giving one student a large ball of yarn. That student is instructed to run the string to another "thing" that is directly related to it. For example, the sun's energy is used by plants, so the student sun could connect the string to the student huckleberry bush.
6. Challenge the students to create the longest food chain. Students should take turns using the string to connect things one to the other.

CONCLUSION:

Instructors should bring closure to this activity by asking the following questions:

1. Where does all of the energy in an ecosystem come from?
2. What happens to the fish if all the insects die?
3. What other connections or food chains can you come up with?
4. Is there anything that is not connected directly or indirectly to everything else?
5. What would happen to the predators if there were a large population of insect larvae present in a river?

Story Time: Journey of the *Oncorhynchus*-Chapter 5. Each student will need their Journey of the *Oncorhynchus* story book. Before starting the story, set up the Journey of the *Oncorhynchus* mural by adding **section five** or the poster. Call attention to the mural/poster by having the students search for the hidden salmon in section five. The first student to find the hidden salmon will be awarded a prize.

Student Activity Sheet 4-3

TO CUT OR NOT TO CUT?

1. Fill in the table below.

Organisms	How affected?	Alternatives
Truffula Trees		
Brown Bar-ba-loots		
Swomee Swans		
Humming Fish		
Humans		

2. A truffula forest is growing in your neighborhood. You and your team members are put in charge of managing the forest. A thneed factory opens down the street and provides your community with jobs. It is the team's responsibility to develop a plan which includes: harvesting guidelines, replanting of trees, providing a safe and healthly habitat for plants and animals, recreation area, working factory, and a clean environment for everyone.