Kokanee Karnival Youth Education Program
Fall Streamside
Spring Creek Curriculum

Introduction

This document is Part 2 of the curriculum for the Fall Streamside program at Spring Creek. Part 2 is for the instruction at the Streamside stations. This curriculum forms a basic framework for instruction of 4th and 5th grade students, ages 9 and 10. Additional information and expertise you may have will be welcome additions to this framework. Also, the order that you choose to follow is strictly your own. The only exceptions are the streamside walk and the Incredible Journey/hatchery/spring walk. Each group of students and instructor will be assigned a time for those walks to occur. Please keep track of the time, so that your group doesn't overlap with others.

The Part 2 curriculum contains the following information:

A. Wading In The Creek
B. Streamside Walk
C. Macroinvertebrate Collection
D. pH Testing
E. Dissolved Oxygen Content
F. Water Tempertature
G. Kokanee Live Cycle a.k.a. Incredible Journey
H. Hatchery Walk And Spring Walk
I. Summary

The *goals* for this curriculum are as follows:

- Students will demonstrate an understanding of the lifecycle of Kokanee salmon;
- Students will demonstrate an understanding of the importance of healthy riparian areas and the habitat in which fish live and Kokanee salmon spawn;
- Students will demonstrate an understanding of the importance of clean, cold, oxygenated water;
- Students will demonstrate an understanding of food sources and the variety of food fish eat;
- Students will understand the concept of pH and the effect it can have on fish;
- Students will demonstrate an understanding of safety in and around the water;
- Students will understand and use pertinent vocabulary.

The *materials and kits* in your materials tub to accomplish these goals are as follows:

- A kit for testing pH (plus additional liquids for pH extremes)
- A kit for testing dissolved oxygen content
- Materials for observing and capturing insects (net, white pan, white ice-cube trays, tweezers, specimen "vials", turkey baster, magnification devices)
- Two thermometers

- White boards (large and small) and markers
- Laminated sheets for explaining temperature, dissolved oxygen, pH and macroinvertebrate identification.

Additional materials available:
- Polarized glasses
- Game to demonstrate life-cycle of Kokanee salmon
- D-net for collecting aquatic life samples
- Aquascopes for underwater viewing

Each of the following small-group units is complete in itself, but discussion of how they work together for effective fish habitat is useful. Again, this curriculum is meant as a framework only. Your experience and/or training are useful and desired. Feel free to *ad lib*. **Also included in each tub are several explanation sheets. You will find it helpful to read these *before* beginning your class**.

A. Wading In The Creek

When you get to the group station all the students want to get into the water. You should do this first because it calms them down. The Instructor should tell the students how to wade safely and what to do in case of a dunking. The instructor should lead the group of students while the other volunteer or chaperone at the bank helps the students enter the water. Have the student hold hands because the chain is more stable then individuals. It is important to be really attentive with 4th grade students because they are smaller and lighter than 5th graders, thus are more susceptible to the force of the water. Have the students face the current and feel the power of the water. Then have them turn so the water hits them on one leg so they can feel how the power is reduced. This will be helpful when performing water quality test and collecting macroinvertebrate samples.

After you get the students back on land it is a good opportunity to review what fish need. You will be surprised how much they know. Topics to discuss and list on the white board are:
- Water
  - Clean or turbid
  - Moving or still
  - Temperature – hot medium or cold
  - Oxygen
  - pH but this is hard for them to understand
- Shelter
- Food

This is really useful for setting the stage for the stream experiments.

B. Streamside Walk

Walk to the upstream bridge alone the road that boarders the private land. This is the Metolius River. When you look upstream from the bridge you can see where Spring Creek joins the Metolius River. You will be walking on private land, so have the students be respectful. You will find a box of polarized dark glasses. There should be enough for each student. Most years fish have been observed from that bridge, but sometimes they haven't arrived yet. You may find evidence of old or new redds (Kokanee or bull trout). Once the students have been shown what the Kokanee looks like it the water, you will find they are excellent fish spotters. Have the students look at the water with and without the sunglasses so they can see how Polaroid sunglasses work.

It's good to caution students about creating a disturbance on the bridge, sending vibrations through the water. At this point, you might mention the fishes' lateral lines and their vibration sensors. You could also take this opportunity to mention their vision and sense of smell. How *do* fish from the ocean find their way back to their original stream? This is a good place to discuss the main difference between Kokanee and Sockeye. Information on spawning, redds and the life cycle will be done at the Incredible Journey display.

Depending on the amount of time you have, it's permissible to walk to the lower bridge (either side), discussing riparian areas, etc., as you go. Return to the upper bridge, collect and return the polarized glasses to the box, and return to class area. If the Kokanee are present, the students can spot them in the stream. This walk is a good opportunity to discuss current again, where the Kokanee are positioned in the stream, which way they are facing, and how the fish use the streambed for resting, spawning sites and hiding from predators.

Significant vocabulary:

- Riparian area = space between land and water
- Polarized = certain rays of light are separated from the remaining light to cut glare
- Lateral line = a line down the center each side of a fish that senses vibration

C. Macroinvertebrate Collection

This is an activity that should involve several helpers. If students haven't already received instruction about wading in fast, cold water, do so now. They may know about hypothermia, so find out what they know and emphasize the dangers. Lead them into the stream (holding hands is good) so they can feel the power and cold temperature. Show them how to walk facing the flow, sidestepping, one foot down before lifting the other.

Return to shore and distribute materials—one student on the net, two to kick up insects, one to hold the white pan. (Note: Make sure to avoid any redds in the area). Trade off with other students on shore. Have students find cased caddis over and under rocks as well. This is also a good time to use the aquascopes as well. Dump the treasures in the white pan and return to shore.

Have a student fill the ice-cube trays with water and begin transferring bugs from white pan with tweezers or turkey baster. In addition to the cased caddis, you may find mayfly nymphs (three tails), golden stone nymphs (two tails), worms, leeches, snails, and maybe sculpins. *Refer to peach-colored handout for a*

description of possible life you have collected. If a hatch is occurring, explain the process. Students can observe insects in magnification boxes and on the stream bottom through bucket viewers. Mention the variety (or lack thereof) of possible food for native fish.

Significant vocabulary:

- Nymph = underwater stage of an insect before adulthood
- Macroinvertebrate = small animal without a backbone
- Zooplankton = small aquatic organisms that are animals, not plants
- Habitat = food, water, shelter. An animal's home
- Sediment or silt = small particles of earth, clay, sand, or similar matter that smothers insect and fish eggs.
- Cold blooded = blood temperature that varies by the warmth of the environment

D. pH Testing

Discuss pH and what it tests (range of acid to base). Near neutral is best for fish. Ask who knows what and acid or base is. For and acid you can relate it to vinegar used in salad dressing or orange or lemon juice. Base is a bit more complicated but you can relate this to some house cleaning liquids. Your kit contains a viewer (with two test tubes) and a bottle of indicator solution. Fill one tube with water and it is the blank for the viewer. Put the blank in the side where the color wheel changes color. Fill the other tube to the first mark with some solution (ammonia, vinegar or creek water). Ask a student to add **six** (6) **drops** of indicator solution to the liquid. Put this tube in the other slot. Hold the comparator up to the light and have a student turn the dial. Ask students to find the color that equals the test liquid. Have another student record the results. Have a student clean tube that held the test solution. Have them fill the tube shake it and empty it three times. This should be sufficient to clean the tube. Repeat the process with another test liquid. Finally, test the water in Spring Creek. Record the results. What are the conclusions? (Water in stream should be near 7.0, ideal for fish). *Refer to the Cascade Streamwatch pH Scale (white information sheet) and Table B (chartreuse information sheet) for optimal ranges of pH*. Have the students find where the acid, base and creek water fit on the chart and read the text for optimum conditions for aquatic life.

Significant vocabulary:

- Acid
- Base
- Neutral

Relate pH to their initial list of what fish need to survive.

E. Dissolved Oxygen Content

Ask the students what we breath and how we do it (air – oxygen and lungs). Then ask how fish breathe, using gills for oxygen exchange. Ask them how they think oxygen gets into the water. This is a good opportunity to discuss how currents mix the water and distribute the dissolved oxygen. You are testing for dissolved oxygen in ppm. Have a student fill the test tube to the 25 ml level with Spring Creek water. Have another student place an ampoule, tip down, in the tube. Apply pressure to the ampoule to snap off

the end. The vacuum in the ampoule will draw the proper amount of water into the ampoule. Tip the ampoule back and forth a few times to mix the water and the contents of the ampoule. Have the students hold the indicator panel horizontally in good light. Place the ampoule between the colored ampoules until a match is found. Have a student record the results. Discuss conclusions. *See chartreuse handout for ranges necessary for aquatic life and peach-colored handout for factors affecting DO*. Have the students read the chart to verify how the dissolved oxygen concentrations relate to conditions for aquatic life.

Relate dissolved oxygen to their initial list of what fish need to survive.

Significant vocabulary:

- Dissolved oxygen
- Turbid = cloudy, muddy
- Photosynthesis = process a plant uses to create oxygen
- Pollution = material or chemicals in water to make it less pure

F. Water Temperature

You have two thermometers in the streamside kit. Have two students read the thermometers and say what the air temperature is. Ask them what they think is a cold temperature and what is a hot temperature for them. Ask them at what temperature water freezes. Have two students place thermometers in water for 1/2 minute or more. Compare results. If there is a difference, check again. Slow-moving water may provide different results. If results do vary, what could account for that? *Refer to Table A (chartreuse information sheet) and to light green information sheet for further information regarding temperature ranges required for certain organisms.* Have the students read the chart so they understand how the water temperature impacts the type of fish present, the maximum and minimum temperature of water where the fish can survive.

Relate the temperature measurements to their initial list of what fish need to survive.

Significant vocabulary:

- Temperature

G. Kokanee Life Cycle a.k.a. The Incredible Journey

This is done in conjunction with the hatchery walk. Usually the group starts with the Incredible Journey and ends with viewing the spring. KK has a "game" set up to illustrate the life cycle of the Kokanee salmon. Usually the main part of the game is set up for groups of 10 students so it is most effective to use the side of the display with the big circle diagram.

The object of this exercise is, obviously, to recognize how few adults are able to return from the huge number of eggs deposited, to discuss the hazards in the life cycle and to discuss the migration of the fish.

In the packet there are representations of a Kokanee in its silver lake coloring and in the red spawning color. Ask about the difference in appearance between male and female Kokanee, some students know this.

You can discuss spawning activity using the handouts in the packet (building redds, spawning process, protection of redds, etc). The female selects the proper sized gravel and digs a depression in the gravel with her tail. As she releases her eggs, the male releases milt to fertilize the eggs. She then covers the eggs with a thin layer of gravel. This allows the eggs and later alevin to receive oxygen. Tell them the eggs take about 6 weeks to hatch and the alevin spend 2 to 3 weeks in the gravel. Ask about how the alevin survive in the gravel without eating (egg sack).

Using the circle chart and the round fish examples do a presentation on the incredible journey. It is also useful to use the circle chart to relate the life cycle to the Deschutes drainage;

- First discuss the source of the water. Ask if they know what the mountains are: ans. Cascades. Ask if they know about the snow and how it gets into the rivers: ans. melting snow as runoff and it sinks into the ground and flows out at springs. Tell them that the source of water for Spring Creek is springs.
- The spawning salmon and eggs are in Spring Creek. Ask what Spring Creek is a tributary to or ask what does Spring Creek flow into: ans. Metolius River.
- Ask about the eggs, alevin and fry and tie this part of their life cycle to Spring Creek. Ask what hazards the eggs, alevin and fry face in Spring Creek.
- Ask what is the next stage in the fish life cycle; ans. Fingerlings. Ask where the Spring Creek fingerlings swim into when they get older: Ans. Metolius. Ask where does the Metolius flow into: ans. Lake Billy Chinook and the Deschutes River. Ask what hazards the fish face in Lake Billy Chinook. Ask what hazards they face in the Deschutes River. This is a good time to discuss the difference between landlocked salmon and ocean run salmon, ask if the students know what landlocked means. Landlocked Kokanee stay in Lake Billy Chinook while ocean run continue down river.
- Ask what the Deschutes River flows into: ans. Columbia River. Ask what the Columbia River flows into: ans. Pacific Ocean. Ask what hazards the fish face in the Columbia River.
- When the fish return to spawn, ask what hazards the fish face as they swim up stream. You can ask them to repeat the travel path but in reverse, from Billy Chinook, Metolius, Spring Creek.

It is good to involve the students by having them put the round examples on the board as you move through the explanations. Start with the 1000 egg circle and ask the students if they all will hatch, if they don't what can impact them; they can be eaten, some die, smothered by silt, squashed by people wading. Tell them about sculpins and how they like eggs, you may collect a sculpin when gathering macroinvertebrates.

Then use the 800 fry circle. Ask how many eggs did not hatch. Talk about what can happen to fingerlings. Ask about what can happen to the fry, eaten by birds (kingfishers and herons), other fish, pollution. When they suggest bears and eagles relate the size of the fry, too small for these predators.

Then use the 500 fingerlings circle. They can see how the initial egg population decreases. Ask if all the fingerlings will survive, if not what can happen to them. Answers include eaten by fish, birds (herons, king fisher) animals such as otters.

Then use the 200 adult circle and say when the enter the lake what can happen to them. Do they all survive? If not what can happen; people catch them, eagles. osprey.

Then have a student place the one adult circle on the chart. Ask what can happen to the Kokanee as they swim upstream, if they all survive? Eagles and osprey can catch them, scavengers along the bank such as otters, bears, raccoons.

This is also a good time to review how the 1000 eggs provided food for other animals throughout the life cycle. Ask what happens to the salmon when they die (remain in stream) and if this is good or bad. Tell them how the bodies feed bacteria and bugs that are food for other fish as well as the fry and fingerlings. Without the decomposing bodies the young salmon would have no food.

Significant vocabulary:

- Redd = "nest" the fish make in which to lay eggs
- Spawn = laying eggs and depositing milt (sperm)
- Sediment or silt= small particles of earth, clay, sand, or similar matter
- Migrate = to move from place to another
- Salmonid = a family if fish that include salmon and trout
- Alevin = stage of a fish that carries an egg sack
- Fry = small fish that feed mainly on zooplankton
- Smolt = a young salmonid that has not yet returned to the sea
- Kype = lengthened and deformed lower jaw of a spawning male salmon used for offense to drive off others

H. Hatchery Walk and Spring Walk

Next to the Incredible Journey site are the raceways of an abandoned hatchery. This hatchery was abandoned when Wizard Falls Hatchery was opened. Ask how many have visited a fish hatchery. Why do we have fish hatcheries? *More people fishing fewer fishable rivers and lakes due to destroyed habitat, reduced water flow, dams, irrigation means less water in fisheries. Hatcheries grow and distribute additional fish for release.*
Point out that the Metolius contains no stocked fish even though a working hatchery is downstream. Habitat restoration can increase natural production of fish.
Wild fish are often more genetically diverse and do better in wild conditions. Why?

Workers in hatcheries collect eggs from mature females and mixed with milt from mature males. These mature fish are known as brood stock. The fish are raised at the hatchery and later planted in lakes and streams by truck, helicopters, mules, llamas, and backpacks.

Next to the hatchery is a spring. It is fenced in to keep the students from falling in the water. There will be two polarized sunglasses so students can see the sand being pushed up by the water. They need to share the glasses. Ask if they know what a spring is and where does the water come from. Discuss the importance of springs to healthy creeks and rivers.
Mention the headwaters of the Metolius River and its location.

Significant vocabulary:

- Headwaters = the beginning of a stream, usually a spring or springs
- Springs
- Predators = all those who feed on fish, viz., man, eagles, herons, osprey, otters, bears, other fish

I. Summary

If time permits, often the classes come together for a summarizing session. One successful approach has been for students in each group write on the large white board what they learned, what they liked and what they feel is important. Then each group relates their findings to the group the class. Practice this in small group first. If there is insufficient time for this activity, discuss the procedure with the teacher and they can do this in the classroom.

If there is not enough time for the summary, return to the tarp for taking off the waders.