



SALMON PROTECTION AND WATERSHED NETWORK

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SPAWN Teacher Activity Booklet

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4. "Salmon Web of Life. *Students experience the concept of interdependence in a salmon habitat.*

NOTE: *There is a wide variety of appropriate grades listed for each activity-these activities are meant to be adaptable to many ages, from K-8th grade.*

You may wish to use these activities to offer students some pre-field trip background information, or as post-field trip activities.

SALMON IN THE LAGUNITAS WATERSHED:

Every rainy season, from about November to February, coho salmon and steelhead trout make their way from the Pacific Ocean, through Tomales Bay, and up into Olema Creek, Lagunitas Creek, San Geronimo Creek, and the San Geronimo Creek Tributaries. These fish have lived their adult lives in the ocean, but began as tiny eggs laid in the creeks. They are returning to the creeks where they were hatched (known as **natal** streams) to **spawn**, to find a mate and lay or fertilize their own eggs. Scientists believe that salmon and steelhead use their sense of smell and temperature to find their natal creeks.

Female salmon use their tails to dig a series of gravel nests along the creekbed, collectively know as a **redd**. A male fish will swim along side the female and fertilize the eggs as she lays them. For coho salmon, the adults will die soon after spawning: the trip is very difficult for them, and their bodies are often very battered by the time they finally spawn. Steelhead on the other hand live through spawning and return to the ocean shortly afterward.

The eggs in the gravel will hatch after about a month, at which point the tiny **alevins** with yolk sacs live and migrate through the gravel until they emerge out of the gravel as tiny, young **fry** a few weeks later. These baby salmon and steelhead spend the next 14-16 months living in Lagunitas Creek. Then, in late winter, these young fish will swim out to the Pacific ocean to live out their adult lives and return about a year and a half later to their natal stream to spawn. This magnificent cycle occurs all along the West Coast of the United States, from central California north to Alaska.

Salmon and steelhead are known as **anadromous** fish. Anadromous means that they spend part of their lives in salt and part of their lives in fresh water. There are five

species, or different kinds, of Pacific salmon, and two kinds of trout that are anadromous. They all **migrate**, or travel, from rivers to the ocean and back again to the river to spawn.

Ten percent (10%) of Central California's wild Coho salmon spawn in the Lagunitas Creek Watershed. Lagunitas Creek, which is in West Central Marin County, lies in the Lagunitas **Watershed**, which covers an area of 103 square miles! A watershed is the land that water flows across or under. The things that people do or have done in their watersheds can affect salmon. Things like logging, water and air pollution, dams, and litter can make salmon habitat less liveable. Luckily, there are things we can do to help salmon! We can work together to plant plants by Lagunitas creek, pull out dangerous weeds, pick up trash, and do other kinds of **habitat restoration** to help make the Lagunitas Watershed a safe and healthy place for salmon to live!

References:

SPAWN Naturalist Training Manual, unpublished, www.spawnusa.org

U.S. Fish and Wildlife Service, Pacific Region, www.fws.gov/salmonofthewest/salmon.htm

Activity: Watershed in Your Hand

Standards:

Grade 4 Earth Science:

5. *Waves, wind, water, and ice shape and reshape Earth's land surface.*

Summary: Students use crumpled paper to create a miniature watershed model that demonstrates the basic geography of a watershed, how water flows through this system, and the impact people can have on the quality of our water.

Grades: K-12

Time: 10 to 30 minutes

Materials:

~8 1/2" X 11" paper; one sheet for each student

~3 different colors of water soluble markers

~several spray bottles of water

Background:

A watershed is a geographic area in which water, sediments and dissolved minerals all drain into a common body of water like a stream, creek, reservoir or bay. A watershed includes all the plants, animals and people who live in it, as well as the non-living components like rocks and soil. We are all part of a watershed, and everything we do can affect the surface and ground water that runs through this system. When you create your miniature watersheds, be sure to use water soluble markers-as the markers "bleed" they demonstrate how rain moving through the watershed affects soil erosion and urban runoff.

Procedure:

1. To create the watershed, crumple a piece of paper up into a tight ball. Gently open up the paper, but don't flatten it out completely. The highest points on the paper now represent mountain tops, and the lowest wrinkles represent valleys.
2. Choose one color of water soluble markers and use it to mark the highest points on the map. These points are the mountain ridge lines.
3. Choose a second color and mark the places where different bodies of water might be: creeks, rivers, lakes, etc.
4. With a third color mark four to five places to represent human settlements: housing tracts, factories, shopping centers, office buildings, schools, etc..
5. Use the spray bottles to lightly spray the finished maps. This spray represents rain falling into the watershed. Discuss any observations about how water travels through the system.

Discussion:

What changes do you observe in the maps? Where does most of the 'rain' fall? What path does the water follow? Where does erosion occur? What happens to the human settlements-are any buildings in the way of a raging river or crumbling hillside? How does the flow of water through the watershed affect our choice of building sites? How does this map demonstrate the idea of watershed?

Activity: Life Cycle Chain

Standards:

Grade 2 Life Sciences:

2. *Plants and animals have predictable life cycles.*

Grade 3 Life Sciences:

3. *Adaptations in physical structure or behavior may improve an organism's chance for survival.*

Purpose: Students will become familiar with the life cycle of the Pacific Salmon.

Grades: 1-4

Time: 25-40 minutes

Materials:

- ~ Paper Strips, about 3" wide and 9" long, or so.
- ~ Staplers or clear tape
- ~ Colored pencils, markers, or crayons
- ~ Salmon Life Cycle Sheet, attached

Vocabulary:

alevin: fish larvae; the first stage of a salmon's life cycle after hatching.

***fry:** the second stage in a salmon's life cycle after hatching. Fry are tiny (1-5 inches) young salmon living in creeks.*

***redd:** a salmon nest. The female salmon digs a redd in creek gravel using her tail, and lays her eggs in it.*

***smolt:** the third stage in salmon life cycle after hatching. Smolts are young salmon who begin leaving the fresh water of the creek for the salt water of the ocean.*

***spawn:** the process whereby a female salmon lays her eggs and a male salmon swims alongside and fertilizes them.*

Background:

Coho Salmon undergo five different stages of growth and change throughout their lives: **egg**; **alevin** (tiny fish living off the egg sack attached to its belly); **fry** (young fish who live in schools in the creek for over a year); **smolt** (juvenile salmon that undergoes the transition from fresh to salt water); and **adult** (who lives in the ocean and returns to the creek to **spawn**.) The salmon life cycle begins in a stream, where the young fish will remain for about 16 months, until it is time to swim out to the ocean as a smolt. After 16-18 months in the ocean, salmon will begin the journey back to the stream where they were hatched in order to lay their own eggs. After laying or fertilizing eggs, (known as **spawning**) adult salmon will die.

Procedure:

PART 1: Have students close their eyes as you read them the following visualization:

*Imagine that you are a tiny egg, in a pile of 2,000 eggs buried underneath marble-to fist-sized gravel in a cool, clear stream. Over a month ago, your mother dug a nest to lay you in, and covered you up with gravel to protect you. Both your mother and father died, as all mother and father Coho do, after they lay their eggs. Gradually, you and your brothers and sisters emerge from your eggs, although many of the eggs around you will not hatch. Part of the yolk sack stays on your belly, and will provide nutrition for you for the next few weeks as you hide in the gravel. If there is a flood in the creek or a hungry bird or insect nearby during this stage, then you and your fellow young salmon (called **alevins** at this phase) are in trouble. Finally, one night, you feel ready to leave the cover of the gravel where you were hatched. You are only a little over an inch long, and huddle in schools with the other young fish. Now you are known as **fry**- this is the next phase in your life. For the next 14 to 16 months you will stay in these groups, hiding under woody debris from fallen logs and branches, in deep pools where there is a lot of food available. During this period, young fry may be eaten by hungry birds or other, larger, fish, so you must stay hidden. Finally, the next spring, after over a year in the creek, you are ready to head out to the ocean. You and the other fish that hatched when you did will start swimming downstream toward the opening in the creek that reaches the ocean. Your body will start to change as you go from living in a fresh water habitat*

*to a salt water one. In this phase you are called a **smolt**, and may be only a few inches long. For two years, you live as an **adult** in the ocean eating squid, small fish, and crustaceans like crabs. Then, on a late fall day, you will begin the long journey back to the stream where you were hatched three years before. You will have to leap over rocks or fallen logs, keep away from predators, and find a mate before you will have your own nest of eggs. After you lay your eggs, you will die and your body will give nutrients to insects that will feed your young. The cycle then continues.*

PART 2: Show students the diagram (attached) of what the salmon look like at each stage in their life cycle, and go over the life cycle of salmon again with the students.

Hand out 6 strips of paper to each student, and disperse drawing materials.

Have students, on each strip of paper, draw one part of the salmon life cycle. Tell them to leave at least a half inch of blank paper on either end of the strip.

Once a student has finished his/her drawings, help him/her staple each individual picture into interlocking rings on a chain. Staple link the spawning adult and the egg chain links together so that the chain becomes a circle.

Discussion: How did you feel, imagining that you were a salmon? Did anything surprise you about the life cycle of a salmon? Why did we make our chains into a circle?

Activity: Samson the Salmon

Standards:

Grades 4 and 5 English Language Arts:

Word Recognition 1.1 *Read narrative and expository text aloud with grade-appropriate fluency and accuracy and with appropriate pacing, intonation, and expression.*

Purpose: Students will engage in a simulation of human impact on fish habitats.

Grades:3-6

Time: 30-40 minutes

Background: Humans have an enormous impact on the well-being of salmon populations. Salmon depend on non-polluted, flowing rivers for their survival. **Over fishing**, habitat loss due to dams and **siltation** (i.e., the filling up of a creek bed with *silt*, a fine dirt,) and pollution all affect the numbers of salmon that can successfully live and reproduce in their habitat. In this activity, students will role-play to imagine some of the impacts that humans have on salmon populations in their watershed.

Vocabulary:

Over fishing: *The fishing of so many of a certain species of fish from their habitat that the population numbers go down.*

Pollution: *Substances that are harmful or poisonous.*

Siltation: *The process whereby a creek or river bed fills with **silt**, a fine sediment. Siltation endangers salmon eggs, as they can become buried beneath it and lose oxygen flow.*

Toxic: *poisonous.*

Materials: (per each group of 8 students)

Clear plastic canister

Water

Large mixing bowl

Marker

Sponge cut in the shape of a little fish

Role Playing Cards (included)

Scissors

Film canister each of: *(In italics is the role-playing card it corresponds to)*

~ vegetable oil (*brother*)

~ dish soap (*Youth group*)

~ dirt (*Developer*)

~ water with green food coloring (*Farmer*)

~ tiny ripped-up pieces of paper and plastic (*People at the fair*)

~ vinegar (*Manufacturing Plant*)

~ baking soda (*House cleaner*)

Procedure:

1. Cut the role-playing strips out-you may want to laminate them for continued use.
2. Place each item mentioned in its film canister and label which role the canister corresponds to with masking tape and a marker.
3. Fill the plastic canister 2/3 full with clean water. Place the sponge fish inside.
4. Tell the students that the plastic container is a river, close to the mouth of the ocean. The sponge fish inside is Samson the Salmon, and he is a young *fry*, a salmon who has not yet left the river to head for the ocean. Explain that the students are community members in the *watershed* surrounding the river, and they will each read their role card, then dump the contents of their canister into the "river, the large plastic canister.
5. Divide your students into groups of 8 and have them perform this activity separately, or do this activity as a demonstration.
6. Hand each child a role-playing card and the film canister that corresponds to it. (See "materials section to find out what film canister each role should use.) (*note:*

Power Company does not have a film canister-he/she will dump out half of the water in the jar.)

7. Instruct students to read their cards aloud to the group and dump their film canister contents one by one. Gather the class together for a discussion when everyone is finished.

ROLE PLAYING CARDS:

Brother

You just changed the oil in your car and decided that the best thing to do with it is to dump it in the dirt behind your house. When it rains, the rain will carry it through the ground to the creek.

What else could you do with your used motor oil?

Youth Group

You had a car wash to raise money and used soaps that contain dangerous chemicals. The soapy water ran off the parking lot and into the creek next to it.

What could you use instead of toxic soaps?

Developer

In order to build Fox Haven Apartments, you had to cut down the forest that had been growing on a hill above the creek. The roots of the trees were keeping the soil in place, and during construction, much of the soil fell into the creek (this is called *erosion*.)

What might your other options for building be?

Power Company

In order to provide electricity to the people in your town, you dam the river, cutting off much of the water that usually flows. You use the power of the water to create electricity that you see to the townspeople. There is much less water in the creek now.

(DUMP OUT HALF OF THE WATER IN THE CONTAINER, KEEPING SAMSON INSIDE!)

What are other ways that people can get electricity that might be more earth-friendly?

Farmer

When you planted your vegetables, you sprayed them with *fertilizers*, which are chemicals that help plants grow faster, but can cause problems in water where fish and insects live. When it rains, the fertilizers seep into the creek.

What else could you do to take care of your crops?

People at the Fair

There is a big fair with rides, food, and games in the town. As all the people eat their candy and hot dogs, and drink their sodas, they throw their wrappers on the ground. The wind blows them to the creek.

What could the people do with their trash and recycling?

Manufacturing Plant

You own a manufacturing plant that sits next to the creek. You dump extra chemicals that are leftover into the creek.

What could you do with your chemicals instead?

House Cleaner

You use lots of different strong chemicals to clean houses. You even wear a mask that covers your mouth so you don't have to breathe in those toxic chemicals! When you are done mopping, you dump your bucket of cleaners onto the sidewalk in front of the house. Rain washes these chemicals slowly into the creek.

What could you do instead?

Teacher's Guide to salmon-friendly alternatives:

You may want to look through these suggestions as students brainstorm salmon-friendly alternatives to the actions on their cards.

Brother-used motor oil can be recycled at hazardous waste management sites and transfer stations.

Youth Group-there are many soaps available that do not pollute water ways. These are available at many grocery stores. Look for soaps that say "Biodegradable and "Contains No Phosphates. "Biodegradable means that the soap will "break down and not leave any dangerous substances behind. Phosphates, if they reach waterways, can cause tiny plants called algae to grow out of control. As the algae dies, it is eaten up by bacteria, who use up much of the oxygen in the water, causing

problems for the fish and other animals who depend on the oxygen in the water for survival.

***Developer**-perhaps the apartments could be built in a place that is flat, has already had buildings that have been torn down, etc. Perhaps the developer could leave lots of trees on the hillside and decide to build smaller apartments...It's really up to students to brainstorm different creative solutions to this question.*

***Power Company**-Every form of electricity affects wildlife in some way. Many environmentalists agree that solar power (using photovoltaic panels to generate electricity from the sun's energy) is the most "eco-friendly" of the energy sources. Have students identify different power sources and imagine their possible impact.*

***Farmer**-Organic farming, meaning growing crops without human-made chemicals being sprayed on them, is the safest method of farming as far as wildlife is concerned. Organic farmers use manure, other animal products, and compost to help their plants grow healthy and strong. These things do not pollute the creek nearly as much as using chemicals.*

***People at the Fair**-People should always hold on to their litter until they see a trash can or, with recyclables such as cans and bottles, a recycling bin.*

***Manufacturing Plant**-Manufacturing plants are required to dispose of harmful chemicals at a hazardous waste site. This is a place where dangerous substances are carefully recycled, in some cases, or stored so that they do not leak into the environment.*

***House Cleaner**-Soaps should always be dumped down the drain! Even better, the house cleaner could use biodegradable, phosphate-free soaps!*

Discussion: What happened to Samson? What happened to the creek when it was dammed? What could we do to help salmon in their habitat? How do you feel about what happened to Samson? Can we, as students, make a difference in the health of salmon habitat and our watershed? Would you want to drink this water? Why or why not?

Extension: Have students try to "clean up" the water in the river. Provide paper towels, a strainer, a spoon, a straw, pipe cleaners, etc. for students to experiment with. Was it easy or difficult to clean up? Would you drink the water now that it seems cleaner?

Activity: Salmon Web of Life

Standards:

Grade 4 Life Science:

- 2. All organisms need energy and matter to live and grow.*
- 3. Living organisms depend on one another and on their environment for survival.*

Purpose: Students will explore the interdependence between living elements in a salmon's habitats (both fresh and salt water.)

Time: 45 minutes

Grades: 3rd-7th

Background:

In natural ecosystems, all living things are **interdependent**, meaning that they depend on each other one way or another for their survival. *Predators* are dependent on the animals that they eat for their survival. Because of this, predators are also dependent on what their *prey* feeds upon. Prey need their predators, too- for instance, wolves historically kept deer populations in check so that the deer do not overgraze, in their habitat, and end up running out of food.

The relationship between **producer** (plants, who make their own food,) **consumer** (an animal that eats something else, in this case a plant) **tertiary consumer** (an animal that eats another animal, a.k.a a predator) and **decomposers** (organisms that feed on, and help break down dead things) is known commonly as a food chain or food web.

As adults, Coho salmon eat herring, a kind of ocean fish. As juveniles, salmon prey upon insect larvae (young insects) and small crustaceans (crayfish and shrimp are examples of crustaceans.) As the young salmon grow, they begin to feed on small fish and adult insects.

Young Coho in creeks may be eaten by birds such as herons, crows, and robins; other fish; or raccoons. Once at sea, there are many species of birds (such as sea gulls and loons) and marine mammals (such as sea lions and some whales,) and fish who prey upon salmon. Once adult cohos die after spawning, their bodies may become food for a **scavenger** such as a raccoon or turkey vulture; some may **decompose** as they are eaten by insects and bacteria; all will provide nutrients to the soil in the **ecosystem**, which in turn helps the plants grow.

Vocabulary:

consumer: *in the food chain, an animal who eats **producers**, which are plants.*

decomposer: *insects, fungus and bacteria that help dead things to "break down" or decompose.*

ecosystem: *the living and non-living (such as rocks or weather) elements in a habitat community, and the interactions between them.*

interdependent: *a state of needing, or depending upon, one another.*

producer: *in the food chain, organisms that make their own energy from the sun-plants. They would be considered the "bottom" of the food chain.*

scavenger: animals who look around for whatever food is available, be it dead, alive, or even human garbage. Ravens and raccoons are examples.

tertiary consumer: an animal who eats other animals. The highest level on the food chain.

Materials:

~A ball of yarn or string

~Blackboard area for brainstorming

~Index cards, one for each student. Each card should have one of the following words written on it-you may need to duplicate cards to accommodate your students:

GRASS

RACCOON

MAYFLY

HERRING

BEETLE

ORCA WHALE

SEA LION

BACTERIA

TURKEY VULTURE

MOSQUITO

MAPLE TREE

SALMON

Procedure:

1. Write the names of the animals and plants on the index cards.

2. Review the Coho salmon life cycle with students.

3. Introduce the idea of a food chain using something that a student ate for lunch. For instance for a hamburger it would be: *sun>grass>cow>hamburger*. Ask who is the predator in that relationship? Who is the prey?

Add that in natural food chains, there is another link: *decomposers* such as fungus, insects, and bacteria will feed on dead plants and animals, breaking them down and adding nutrients to the soil in the ecosystem. These nutrients are then used by the producers, (plants) to make food, and the food chain cycle continues.

3. Begin a brainstorming session where you have students think about what they might expect to be living in or near a creek. Now ask them which of these mentioned things might eat or be eaten by a young salmon. You may want to, at this point, give students some examples from the Background section in this activity.

4. Introduce the idea of interdependence. Ask students to think of people in their family or community who they are dependent upon and who also need them.(For

instance, a student may be dependent on his/her best friend who is also dependent on him/her for sharing concerns and secrets. This is like interdependence.)

Explain that, in the natural world, plants and animals in their food webs are dependent on one another. If one species in a food web is taken away (through hunting, habitat loss, disease, etc.) then all other species in that web will be affected.

5. Hand out the index cards to each student. Have students stand in a circle around the student with the “Salmon” card, holding out their cards so they are visible.

Tell students that they represent the food web throughout a salmon’s life-both in the ocean and in the creek.

6. Hand the end of the ball of yarn to the salmon student. Now, have him/her look around the circle and find one animal or plant that he/she is dependent upon. Have him/her hand the ball of yarn to that student while still holding the end of the string. Now, the student with the ball of yarn will find a different animal or plant that he/she is dependent upon, and hand the ball of yarn to him/her, while still holding a piece of yarn. Continue until all students are holding a piece of the yarn. It should look a little bit like an interconnected web. Have the last student see if he/she can think of a way that his/her animal or plant is interconnected with the salmon.

7. To show the effect that one species has on the food web, tell the students that farmers near the creek have been spraying pesticides which have lowered the beetle and mosquito populations. Have the “beetle” and “mosquito” students tug on their part of the string. Ask students who felt the tug. This is who could be affected if something happened to these insects.

Discussion: In what ways are humans interdependent with their surroundings? In what ways can humans affect food chains? How might pollution in the creek affect the food chain? How might people coming and picking up trash and planting plants around the creek affect the food chain?

Suggested Post-Field Trip Activities:

Students can:

- ~ write a poem about what they experienced on their field trip.
- ~ research one of the seven salmon species and write a report.
- ~ brainstorm ways that they can help salmon populations, and then start a letter writing/sign making campaign.

Teacher Resources:

Books:

Cone, Molly: *Come Back, Salmon*; photographs by Sidnee Wheelwright. San Francisco : Sierra Club Books for Children, c1991

Cole, Joanna: *SCHOLASTIC'S THE MAGIC SCHOOL BUS GOES UPSTREAM: A Book About Salmon Migration* . Scholastic, c1997

Khosla, Maya: *Web of Water : Life in Redwood Creek*; illustrated by Maryjo Koch. San Francisco: Golden Gate National Parks Association, c1997

Paul, Tessa: *By Lakes & Rivers* . New York : Crabtree Publishing, c1997

Reed-Jones, Carol: *Salmon stream.*; Illustrations by Michael S. Maydak
Nevada City, CA : Dawn Publications, c200

Other Resources:

California Classroom Aquarium Education Project: (Raise salmon in the classroom!)
<http://www.dfg.ca.gov/coned/caep.html>

Magic Schoolbus Salmon Activity Online:
<http://www.scholastic.com/magicschoolbus/games/teacher/migration/print.htm>