Salmon Biology Station

OBJECTIVES:
Students learn:

- Wild salmon are indicator species and keystone species whose survival is connected to the health of the watershed.
    - Riparian – salmon need trees and trees need salmon
    - Aquatic Macroinvertebrates feed on carcasses
    - Water Quality – Salmon can only survive in high quality water (high dissolved oxygen, low turbidity, neutral to slightly alkaline pH, and cool temperatures).
- Salmon life cycle stages
- Significance of salmon to our economy and culture

MATERIALS:

- Polarized sun glasses
- Salmon life cycle diagram
- Adult salmon carcasses
- Knife for dissecting carcasses and removing tail at end of day (only the station leader uses the knife)
- Hand sanitizer

VOCABULARY:

alevins	anadromous
eggs	fry
milt	parr marks
percolation	porous gravel
redd	Salmonids
smolt	smoltification
spawn	vitelline vein
yolk sac	

PREPARATION:

- Arrange to have an adult salmon carcass at the station for dissection.
    - Check with Federal or State salmon hatcheries or your local ODFW fish biologist for carcasses. ODFW salmon hatcheries are often spawning fish at the same time as Salmon Watch.
    - Carcasses also freeze well for future use.
- Arrive early to scope out the river/park. Check out the designated Salmon Biology station then walk around the park and look for other places there may be salmon. For example, at Clemens Park on the Alsea River there is a small tributary called Sealy Creek. When there are high flows and turbidity in the Alsea River, you can sometimes find salmon in Sealy Creek. Knowing the park will also help if you need to take the students for a nature walk or have a disabled student with the school. Even if you are familiar with the location, it is still good to arrive a bit early to scope out the situation and find where the salmon are in the river.

INTRODUCTION: (10 minutes)

- Tell the students that we are upstream from the ocean, where the adult salmon migrated from. Ask them where they live in relation to where they are in the watershed. Are they upstream or downstream?
- Using information from the World Salmon Council information sheets “Where Are the Salmon When?” and “Habitat Requirements for Salmonids in Oregon Coastal Streams” (attached) review the salmon species that might be found at the site.
- Review some basic information about Salmon (you do NOT have to address all of these questions):

    - What conditions are necessary for growing young salmon?
    - What do salmon fry feed upon?
    - What is smoltification?
    - What is the importance of stream flow to salmon migration?
    - How do salmon migrate back to their native streams?
- Review the important roles salmon played in the lives of the native tribes of the PNW.
    - The annual return of the salmon was celebrated as a renewal and continuation of life.
    - The abundance of salmon and subsequent trade made the tribes wealthy.
    - Salmon and the rivers they come from provide native people with a sense of place, and a requirement to take care of the land and water.
- Review the salmon life cycle
    - When available, use the life stages display model to show the students what eggs, sac fry, and fry look like.
    - Be sure to cover the fact that Coho and Chinook salmon die after spawning, but Steelhead can return to the ocean. Ask the students why they think Coho and Chinook die in the spawning streams.
      The streams where the salmon spawn are nutrient poor. The salmon have evolved to die after spawning in order to provide nourishment for the next generation so they can grow large and strong enough to survive in the ocean.
- Talk about why this area of the river might be good for salmon spawning.
  Shade, lack of predators, gravel substrate, clear water, fast-flowing water and/or pools, macroinvertebrates for young salmon to feed upon, good water quality.

NOTE: Adult chaperones don't always control the students so be assertive if necessary. Don't allow the chatty or restless students to dominate the group. For example, if two students won't stop whispering to each other, separate them to either side of the group.

ACTIVITY (25 minutes?)

If spawning salmon are present:

- ***DO NOT allow the students to harass or disturb the fish.***
    - Don't allow running, yelling, or wading in the creek.
    - Explain that salmon are sensitive to disturbances and have limited energy for spawning.
    - Admonish any student that throws rocks or attempts to wade into the creek
- Allow the students to observe the fish.
    - Interject information about the salmon life cycle.
    - Ask about the female salmon behavior and actions. What are they doing? (Building or guarding red?)
    - Ask about the male salmon behavior and actions. What are they doing? (Fighting, chasing other males?)

If fish are not present:

- Take the students on a nature walk to other location where you may find spawning salmon or carcasses
    - Have a garbage bag to collect litter if you walk the students around.

Whether or not salmon are present in the stream:

- Review and have the students complete the Salmon Biology worksheet
- Ask the students lots of "why do you think the salmon do…" questions to get them thinking about behavior. For example, why is there so much variation in salmon behavior (ocean vs stream type Chinook salmon).
- Ask the students why they think salmon don't just live in either the river or the ocean. Why might they migrate between the two?
- Talk in detail about how important salmon are to us (economic, social, and cultural).
- Talk in detail about the relationship between salmon and their ecosystem.
    - Keystone species
    - Indicator species

    - How might a healthy riparian zone benefit salmon? (bank stabilization, flood protection, shade, food for invertebrates, fallen trees slow currents and add structure).
    - How do returning salmon benefit the forest? (forest animals eat salmon & their feces fertilize the forest. More than 20% of the nitrogen in the tissues of riparian trees and shrubs comes from salmon.
    - Salmon carcasses feed macroinvertebrates. Macroinvertebrates, in turn, feed salmon fry.
- DISSECT THE SALMON CARCASS
    - For detailed information, see attached dissection curriculum.
- Cut through and remove the caudal fin of the carcass and put the carcass and the fin into the stream. This insures that the carcass is not counted when fish counts are done on the stream.

DISCUSSION (10 minutes)

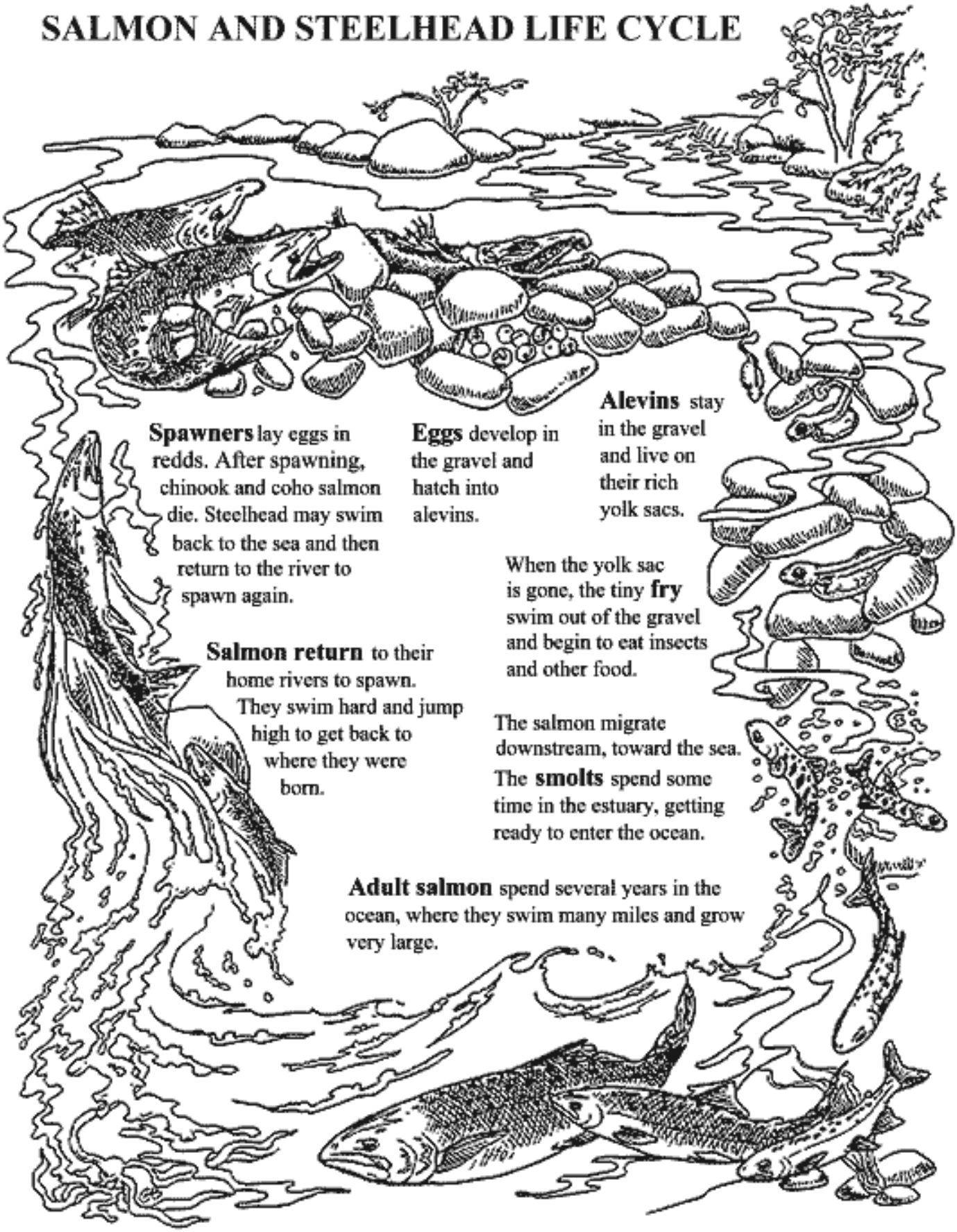
- Talk about similarities and differences in salmon and human biology.
- Ask the students about where they are in the watershed, the salmon life cycle, the importance of salmon to the ecosystem, and their cultural significance to Native Americans.
- Talk about all the challenges salmon face in a healthy ecosystem, and all the new challenges humans have added. Make the connection between how the students live their lives and how it affects the salmon in a positive or negative way
    - *How humans affect salmon in their daily lives (water use, pollution, habitat degradation)*
    - *How students can help salmon in their daily lives (use less water, protect water quality, restore healthy fish habitat).*
- Being a Good Steward: Lead by Example. Talk to the students about things **you** do to help salmon (conserving water, using minimal pesticides and fertilizers, driving less, using less electricity)
- If time allows, go around the group and ask each student what they have learned. Ask for something specific like something humans have in common with salmon (anatomy/physiology) or what they think is the most awesome thing about the fish
- Relate the lesson from the Salmon Biology station to the station they came from and are going to.
- Ask each student what they can do in their daily lives to make things better for the salmon.

EXTENSION ACTIVITIES:

Take advantage of times when you can share information about your profession.

- Talk to them about what you do as a fish biologist;
- Relate stories about cool or interesting things you have seen or learned on the job;
- Discuss what they need to do if they want to be a fish biologist, what classes are important in high school and college, and what job shadow or internship opportunities there are at your office.

SALMON AND STEELHEAD LIFE CYCLE



Spawners lay eggs in redds. After spawning, chinook and coho salmon die. Steelhead may swim back to the sea and then return to the river to spawn again.

Eggs develop in the gravel and hatch into alevins.

Alevins stay in the gravel and live on their rich yolk sacs.

When the yolk sac is gone, the tiny **fry** swim out of the gravel and begin to eat insects and other food.

Salmon return to their home rivers to spawn. They swim hard and jump high to get back to where they were born.

The salmon migrate downstream, toward the sea. The **smolts** spend some time in the estuary, getting ready to enter the ocean.

Adult salmon spend several years in the ocean, where they swim many miles and grow very large.

From *Salmon & Trout Go To School* by D. Higgins Illustration by Gary Bloomfield CDFG 1996

WHERE ARE THE SALMON, WHEN?

GENERALIZED LIFE HISTORY PATTERNS OF SALMON, STEELHEAD, AND TROUT IN THE PACIFIC NORTHWEST*

	Adult Return	Spawning Location	Eggs in Gravel**	Young in Stream	Freshwater Habitat	Young Migrate Downstream	Time in Estuary	Time in Ocean	Adult Weight (Avg.)
COHO	Oct-Jan	coastal streams, shallow tribs.	Oct-May	1+yrs	tributaries, main-stem, slack water	Mar-Jul (2nd yr.)	few days	2 yrs	5-20 lb (8)
CHUM	Sep-Jan	coastal rivers and streams lower reaches	Sep-Mar	days-weeks	little time in freshwater	shortly after leaving gravel	4-14 days	2.5-3 yrs	8-12 lb (10)
CHINOOK		mainstem large and small rivers			mainstem-large and small rivers		days-months	2-5 yrs	
spring	Jan-Jul		Jul-Jan	1+yrs		Mar-Jul (2nd yr.)			10-20 lb (15)
summer	Jun-Aug		Sep-Nov	1+yrs		Spring (2nd yr.)			10-30 lb (14)
fall	Aug-Mar		Sep-Mar	3-7 months		Apr-Jun (2nd yr.)			10-40 lb
CUTTHROAT (Coastal-Sea Run)	Jul-Dec	tiny tributaries of coastal streams	Dec-Jul	1-3 yrs (2 Avg.)	tributaries	Mar-Jun (2nd-4th yr.)	less than one month	0.5-1 yrs	0.5-4 lb (1)
PINK	Jul-Oct	mainstem of large and small streams, tribs, lower reaches	Aug-Jan	days-weeks	little time in freshwater	Dec-May	few days	1.5 yrs	3-10 lb (4)
SOCKEYE	Jul-Aug	streams, usually near lakes	Aug-Apr.	1-3 yrs	lakes	Apr-Jun (2nd-4th yr.)	few days	1-4 yrs	3-8 lb (6)
STEELHEAD* **		tributaries, streams & rivers			tributaries		less than one month	1-4 yrs	
winter	Nov-Jun	Nov-Jun	Feb-Jul	1-3 yrs		Mar-Jun (2nd-5th yr.)			5-28 l b(8)
spring	Feb-Jun	Feb-Jun	Dec-May	1-2 yrs		Spr & Sum (3rd-4th yr.)			5-20 lb
summer(Col. R)	Jun-Oct	Jun-Oct	Feb-Jun	1-3 yrs		Mar-Jun (of 3rd-5th yr.)			5-30 lb (8)
summer(coastal)	Apr-Nov	Apr-Nov	Feb-Jul	1-2 yrs		Mar-Jun (of 2nd-5th yr.)			5-30 lb (8)

* There is much variation in life history patterns--each stream system having fish with their own unique timing and patterns of spawning, growth, and migration. Ask a local biologist about the specific patterns of the fish in your streams and update this chart for your area.

** The eggs of most salmonids take 3-5 months to hatch at the preferred water temperature of 50-55 degrees F; Steelhead eggs can hatch in 2 months.

*** Steelhead, unlike salmon and cutthroat trout, may not die after spawning. They can migrate back out to sea and return in later years to spawn again.

Adapted by Pacific States Marine Fisheries Commission. Sources: Ocean Ecology of North Pacific Salmonids, Bill Pearcy, University of Washington Press, 1992 Fisheries Handbook of Engineering Requirements and Biological Criteria, Milo Bell, U.S. Army Corps of Engineers, 1986; Adopting A Stream; A Northwest Handbook, Steve Yates, Adopt-A Stream Foundation, 1988.

SALMON HANDOUT 4.4

Table 2. Salmonid Habitat Requirements
Oregon Coastal Streams
Spawning (including upstream migration)

	Migration	Spawn Time	Location	Substrate Size	Water Depth	Water Velocity	Dissolved Oxygen	Spawning Water Temp	Percent Fines Tolerable	Notes
Chinook – Fall	Sept-Dec	Oct- Jan	Mainstem and large tributaries	Pea to Orange (1.3-10.2 cm)	Extremely variable 0.05-7 m	0.1 – 1.5m/s; max is 2.4 m/s	> 5 mg/l	5.6-13.9°C	Fines (<6.4 mm) make up less than 25% of substrate	Large body size limits movement over barriers
Chinook-Spring	Mar-Jun	Late Aug -Oct	Upper mainstem streams	Pea to Orange (1.3-10.2 cm)	Extremely variable 0.05-7m	.21-1.5 m/s; max is 2.4m/s	>5 mg/l	5.6 –13.9°C	Fines (<6.4 mm) make up less than 25% of substrate	Require deep water for travel-pools for summer habitat
Coho	Sept-Jan	Sept - Jan	Small tributaries	Pea to Apple (1.3-9.0 cm)	0.18 – 1 m	0.08 – 0.11 m/sec; max is 2.4 m/s	>8 mg/l	4.4-14°C	Fines (<6.4 mm) make up less than 25% of substrate	Primary target for many sport fisherman
Chum	Oct -Dec	Nov-Dec	Lower mainstem and tributaries	Pea to Orange (0.5-10.2 cm)	13-50 cm; ideal 21cm	0.21-0.83 m/s; max is 2.4 m/s	>5 mg/l; above 80% saturation best	7.2-12.8°C	Fines (<6.4 mm) make up less than 25% of substrate	Strong swimmer but doesn't jump
Steelhead-Winter	Nov-May	Dec -May	Small & mid-size tributaries with moderate gradient	Pea to Apple (0.5-9.0 cm)	> 18 cm	<2.4 m/s	>5 mg/l	3.9-9.4°C	Fines (<6.4 mm) make up less than 25% of substrate	May spawn more than once
Steelhead-Summer	May-Jul	Jan-Jun	Small & mid-size tributaries with moderate gradient	Pea to Apple (0.5-9.0 cm)	>18 cm	<2.4 m/s	>5 mg/l	3.9-9.4°C	Fines (<6.4 mm) make up less than 25% of substrate	May spawn more than once
Sea Run Cutthroat Trout	Jun-Oct	Dec-Feb	Small headwater tributaries 1st & 2nd order streams	Pea to Golf Ball (0.5-7.5 cm)	0.01 –1 m; 10-15 cm best	0.11-0.90 m/s; max is 2.4m/s	>5 mg/l	6-17°C; best is 10°C	Fines (<6.4 mm) make up less than 25% of substrate	May spawn more than once