

## SALMON LESSON: Vanishing Resources but Opportunity for Hope

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There are several species of salmon with different life pathways. Salmon are normally anadromous; hatched in freshwater streams they mature in the ocean and then return to fresh water to spawn. The general cycle tends to be similar even if the timing is different. Salmon rarely live more than 6 or 7 years — quite different from other large fish like cod and halibut that can live 30 years or more. Some remain in fresh water. The salmon that go to the sea have more food and can grow faster.

Five species of salmon in the genus *Oncorhynchus*, are known as Chinook or King (*O. tshawytscha*), coho or silver (*O. kisutch*), sockeye (*O. nerka*), chum (*O. keta*), and pink (*O. gorbuscha*). Since the 1980s, salmon farming has provided Atlantic salmon (*Salmo salar*) to consumers, and escaped fish have begun to invade the habitats of native species. Chinook/King salmon are the largest salmon and get up to 58 inches (1.5 meters) long and 126 pounds (57.2 kg). In the Columbia River they have spring, summer and fall runs. Pink salmon are the smallest at up to 30 inches (0.8 meters) long and 12 pounds (5.4 kg), although they average 3 to 5 pounds (1.3-2.3 kg).

Because salmon are so tightly linked to their home stream each stream should perhaps be the home to a subspecies. Once a stream population is lost it is hard for it to recover. Some salmon do wander and they may eventually end up in a stream that has lost its salmon and with luck, start the slow slow process of recovery.

Steelhead trout (*O. mykiss*) are sometimes listed as an sixth Pacific salmon because they also go to sea. Unlike other Pacific salmon, they are capable of repeat spawning and do not die after spawning.

### SALMON LIFE CYCLE

#### 1 & 2: Eggs & Alevins

The cycle begins in freshwater, when a redd, or a female's nest of eggs, is fertilized. These eggs have remained in the gravel throughout the winter as the embryos develop. In the spring, the eggs hatch and alevins emerge. These are tiny fish with the yolk sac of the egg attached to their bellies. Alevins stay close to the redd for a few months. When they have consumed all of the yolk sac and grown in size, these fish emerge from the gravel, and are then considered fry.

### 3: Fry

Fry swim to the surface of the water, fill up their swim bladders with oxygen, and begin to feed. Depending on the species, fry can spend up to a year or more in the stream where they were hatched (called their natal stream). Upon emerging from the gravel, both pink and chum are already silvery smolts, and head directly to sea. Sockeye fry tend to migrate to a lake, spending 1-2 years there before migrating to sea. Chinook fry usually spend less than 5 months in freshwater, while coho fry may spend over a year. Survival is dependent upon high-quality stream habitat with clean cold water and protection from predators. Boulders, logs, beaver dams, shade, and access to side channels is important. Side channels can also help prevent fry from getting flushed downstream by floods.

### 4: Seaward Migration

Eventually, the fry begin to migrate downstream towards the oceans. At this time, smolting begins, and scales grow as they turn a silvery color. At night to avoid predators, small fry (or developing smolts) drift tail-first downstream while larger fry swim towards the ocean. Estuaries, improve survival of young smolts. Estuaries and coastal wetlands can help smolts to adjust to the salt water, a dramatic change. They need to feed heavily to survive in the ocean.

### 5: Ocean Life

Salmon may spend one to seven years in the ocean. The pattern is regular but some fish don't and some species don't follow the typical timing. Some species are more flexible than others. Some populations remain in coastal water while others migrate northward to areas with more food. Chum may spend up to seven years at sea, but typically four. Pink salmon, on the other hand, spend a fixed 18 months at sea. Sockeye typically spend two years at sea, coho spend about 18 months, and chinook can spend up to 8 years before journeying back to their home stream to spawn.

### 6: Spawning Migration

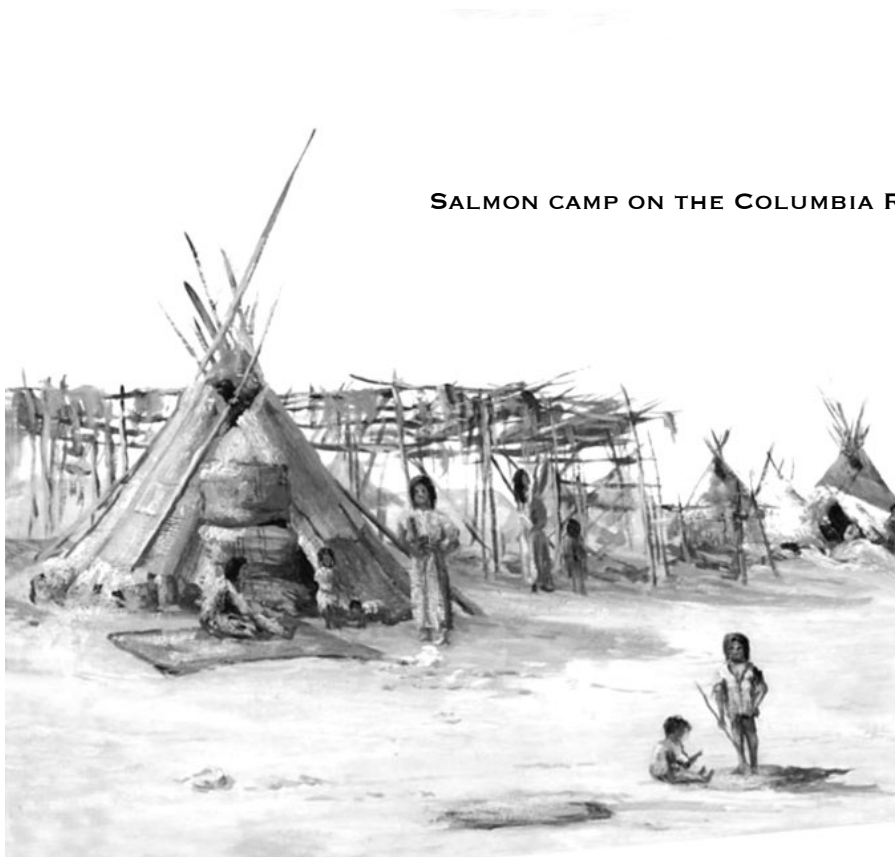
The salmon reach fresh water in peak condition. Once they hit freshwater they stop feeding even though they may have miles or hundreds of miles to go upstream. During the course of the journey, their bodies prepare for spawning. Some species of males develop a fearsome looking hooked jaw called a kype. The incredible journey draws energy from their fat storage, muscles, and organs, everything except the reproductive organs.

## 7 & 8: Spawning & Death

Salmon return to where they hatched. It is not certain how they do this after years away, perhaps smell, perhaps the sun or magnetic fields. When they reach their home the females build nests, or redds, in the gravel. The female turns on her side and uses her tail to dislodge stones or pebbles. Males fight with other males for spawning rights. The dominant male will female will release the eggs and the milt from the male simultaneously. The eggs settle into the gravel and the female tries to covers them with loose gravel. She make one or more redds. Eventually, both the males and females die, supplying the river and river valley with nitrogen, phosphorus and other nutrients as bears, coyotes, wolves and other animals eat the salmon and poop away from the stream. In some areas studied eighty percent of the nitrogen in the forest's trees comes from the salmon. In other words, salmon are crucial for the forest's long-term survival.

## VANISHING SALMON

When Lewis and Clark were exploring the Columbia and Snake River basins in 1805, they reported native people catching massive quantities of salmon, 10 - 16 million fish by current



estimates. Salmon was a dietary staple of the First Nations. Large, tasty, and available at predictable times and places, the fish were an ideal source of protein, easily caught with basic fishing technologies such as spears, baskets, nets, traps and brush weirs. In many areas there would be a succession of runs of salmon from spring to fall.

On the lower Kings River, the Choinimni (Yokuts) held a simple river-side ritual at their principal fishing sites. The local chief ate the first salmon speared, after cooking it and praying to Salmon for a plentiful supply. Then others partook of a salmon feast, and the season was officially open. Similar practices could be found in many parts of the Fur Coast.

Before long the native salmon harvest was halted by unfair treaties, broken treaties and land disputes. Then came dams that eliminated the best fishing spots at the falls. To make it even worse native fishermen were then blamed for the declining fish runs.

In the 1860s the first salmon cannery in North America was established near Astoria, Oregon. It led to many more. Since then pollution, over-fishing at sea, changes in stream habitat (channelized, woody debris removed, sediment) have wreaked havoc on the salmon spawning. For most streams and rivers in the western US the salmon are gone or going.

The Sacramento and San Joaquin rivers in California once hosted salmon runs so large that it was said you could walk across the stream on their backs. Sadly, the San Joaquin spring-run Chinook salmon is now classified as threatened under the Endangered Species Act. The fall run of Sacramento River chinook salmon was once a wildlife wonder to rival the herds of the Serengeti. Originally millions of salmon returned each year. The run survived with diminishing numbers until 2008, when it collapsed. In 2011 only 837 fish returned. The water was too warm, too choked with algae and salt, and too non-existent for the young salmon to survive their trip from their birth waters down to the Pacific Ocean. Federal officials closed the California chinook ocean fishery, and kept it closed for another year after that. In desperation they released millions of hatchery fish—despite the risk to the wild population. In 2019 the return improved after a heavy rainfall year in 2017 helped more smolts reach the sea.



**ONCE THERE WERE KINGS**

Most salmon populations in the west were quickly diminished or destroyed after the Gold Rush and settlement. They were killed by over fishing (20 canneries on the Sacramento River alone), pollution from gold mining (mercury and sediment from hydraulic mining), pollution from saw mills, and water diversion and dams for mining, logging and farming. Paper mills added further waste and choked the water.

Columbia River canneries consumed thousands of salmon every year and polluted the water with their wastes. Beginning in the 1870s, they employed mostly Chinese laborers to clean, chop, can, and cook salmon. At the peak of the salmon season in 1880 the population of Clatsop county was 7,055, and 2,045 were Chinese. Chinese people were excluded from fishing jobs and many left after the Chinese Exclusion Act was passed in 1882.

Things got worse with commercial fishing (in stream and offshore), streamside development, misguided hatchery policy, water pollution and large-scale environmental changes. Salmon runs have generally declined throughout the west. Changes in stream morphology and the loss of beaver dams have also adversely affect the salmon.

Since European settlement, 9 out of 10 wild salmon runs and 100 distinct salmon stocks have disappeared from the Pacific Northwest. Three times that many are at risk of disappearing.

### ***Restoration of big rivers and little streams***

Millions of dollars have been spent on hatcheries, dam bypass barges, fish ladders and other interventions but critical work on habitat and stream quality has been neglected. As a result often inappropriate genetic stocks are mating with and weakening the wild salmon by reducing fitness.

Not all the money has been wasted, Bigger streams and rivers are being improved by removing dams, adding large woody debris and large rocks to make protected pools, and allowing beaver to return. The Yakama Nation and other first nations have spearheaded salmon restoration work with encouraging results. Salmon runs on the Methow and Wenatchee Rivers in Washington are up. In California the Yurok people have worked hard in efforts to restore salmon on the South Fork of the Klamath.

Almost all of the small streams in the west once had salmon and efforts to improve salmon returns in small streams have had some success. Watching coho salmon jump through the Inkwells on Lagunitas Creek (just north of San Francisco) has become an event. It is like watching a Fourth of July fireworks show: At each jump, people ooh and aah. About 500 fish return in a typical year, but some years are worrisome. In January 2009 for example, so few coho salmon returned to the Lagunitas Creek watershed in Marin County, north of San Francisco, that one fisheries biologist told the San Francisco Chronicle “the fish are missing. They are gone.”

Efforts to daylight streams that have been buried in pipes is underway in many cities and towns. It adds beauty and opportunity. The discovery of a 24-inch fish, believed to be a Chinook salmon, in Codornices Creek creek along Berkeley's northern border with Albany was remarkable. Many years ago one fish reached the UC Berkeley campus on Strawberry Creek.

FURTHER READING — many reports on line, but many are not very balanced and neglect the ecological considerations essential for long time sustainability.

Mark Kurlansky. 2020. Salmon: A Fish, the Earth, and the History of Their Common Fate.

Patagonia Books. The appendix on Pacific wild salmon is excellent.

Alan Lufkin. 1990. California's Salmon and Steelhead: The Struggle to Restore an Imperiled Resource. UC Press.

Wildfish Conservancy. [wildfishconservancy.org](http://wildfishconservancy.org)

Western Rivers Conservancy <http://www.westernrivers.org/>

Fish in the Methow <https://www.methowsalmon.org>

*When I was a kid our house was on the Methow River near Winthrop, Washington. My brother and I would catch the tired salmon by hand after they spawned by chasing them through the shallow water. Our cat gorged on the dead salmon and smelled terrible for a couple of weeks. We were also lucky to know the local ranger and he took us diving in the river during the fall run. The dry suits didn't fit us very well, brrr cold water, but it was still amazing to drift down the river with a view of the red Chinooks underwater.*

*There weren't too many salmon. Dams had blocked most of the runs, the river was in poor condition from farm runoff and loss of protected side channels and removal of the beaver dams and woody debris that could make cool safe pools.*

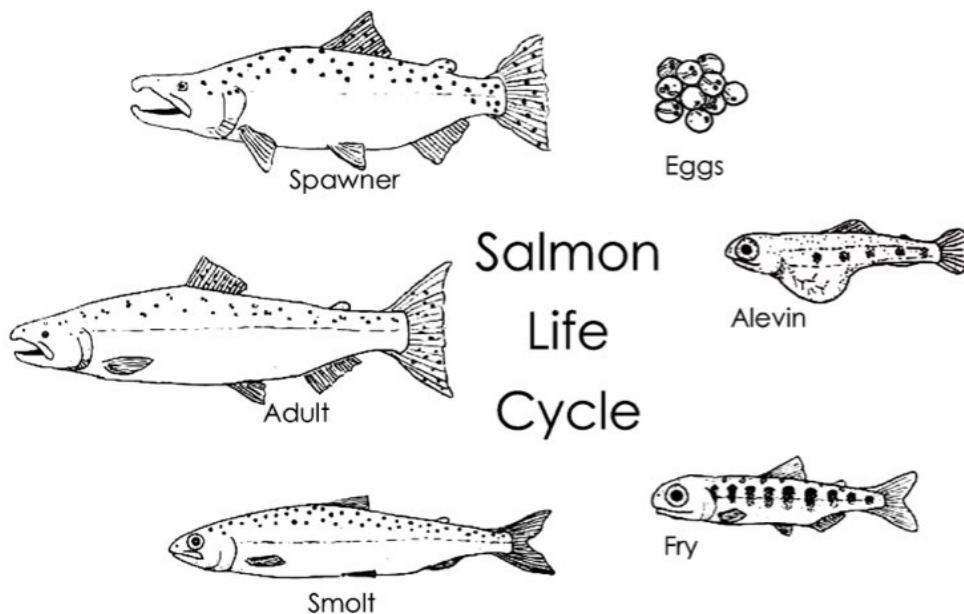
*Biologists now think about 64,000 salmon—24,000 spring and summer Chinook (King), 36,000 coho (silver) and 3,600 steelhead (seagoing trout) lived in the Methow river system in 1860. Methow salmon enter the Columbia River at Pateros and travel the 424 miles to sea and back past nine dams. In 2002, only 2,637 made it home.*

*Thanks to intensive local restoration work by landowners, the Methow Salmon Recovery Foundation, the state, feds, the Yakama tribe, Wildfish Conservancy and many other groups the salmon are returning.... but numbers are still low, just a few thousand wild salmon in a good year with more hatchery fish than wild.*

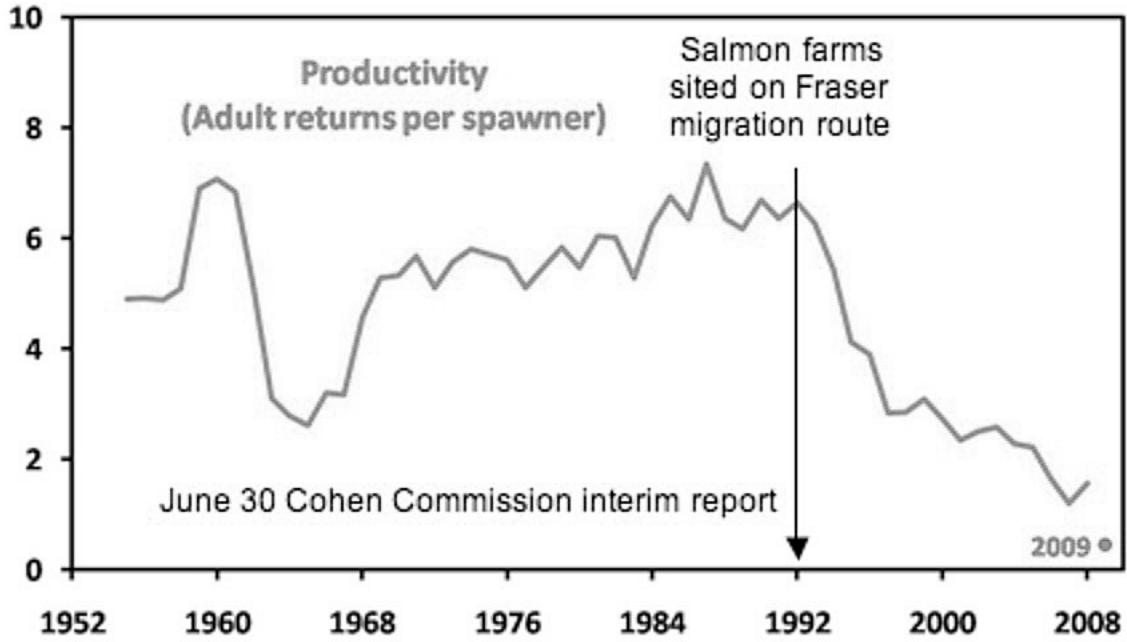
## ASSIGNMENT: SALMON

- ❖ Using Google Earth or maps determine the distance to the stream closest to your school that would have had salmon. They will use quite small creeks.
- ❖ Who are the local First Nations, what special ceremonies did they have for salmon? How did they store the salmon?
- ❖ Find the current size of the salmon run or when the last salmon was seen?
- ❖ Are salmon being farmed nearby?
- ❖ Is there a salmon hatchery nearby — What have critics said about its success or failure?
- ❖ Try to find the nearest beaver dam
- ❖ Draw a diagram of the life cycle of the salmon
- ❖ Draw a map of where the salmon travels over its lifetime - note all the dams
- ❖ Put the salmon in a diagram of the web of life
- ❖ Look for local groups supporting salmon restoration
- ❖ For urban students - any stream daylighting underway?
- ❖ How did scientists learn that the nitrogen in forest trees came from salmon?
- ❖ Explore the native folk tales involving salmon

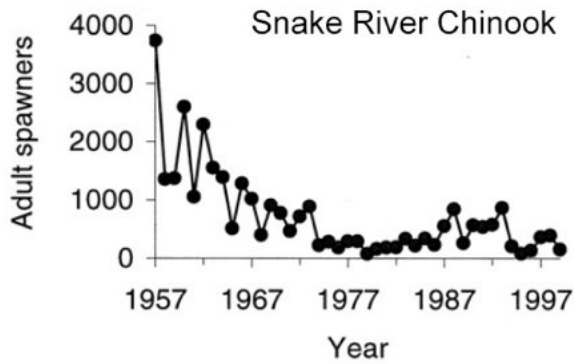
Write a paper or prepare a presentation on something about the salmon that interests you.



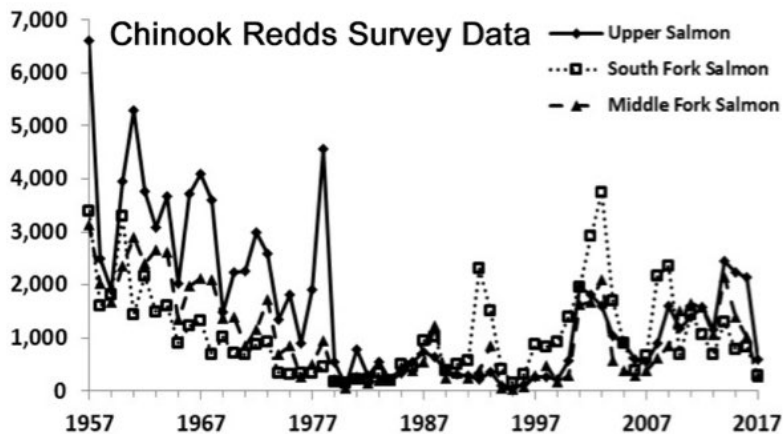
# Fraser River Sockeye



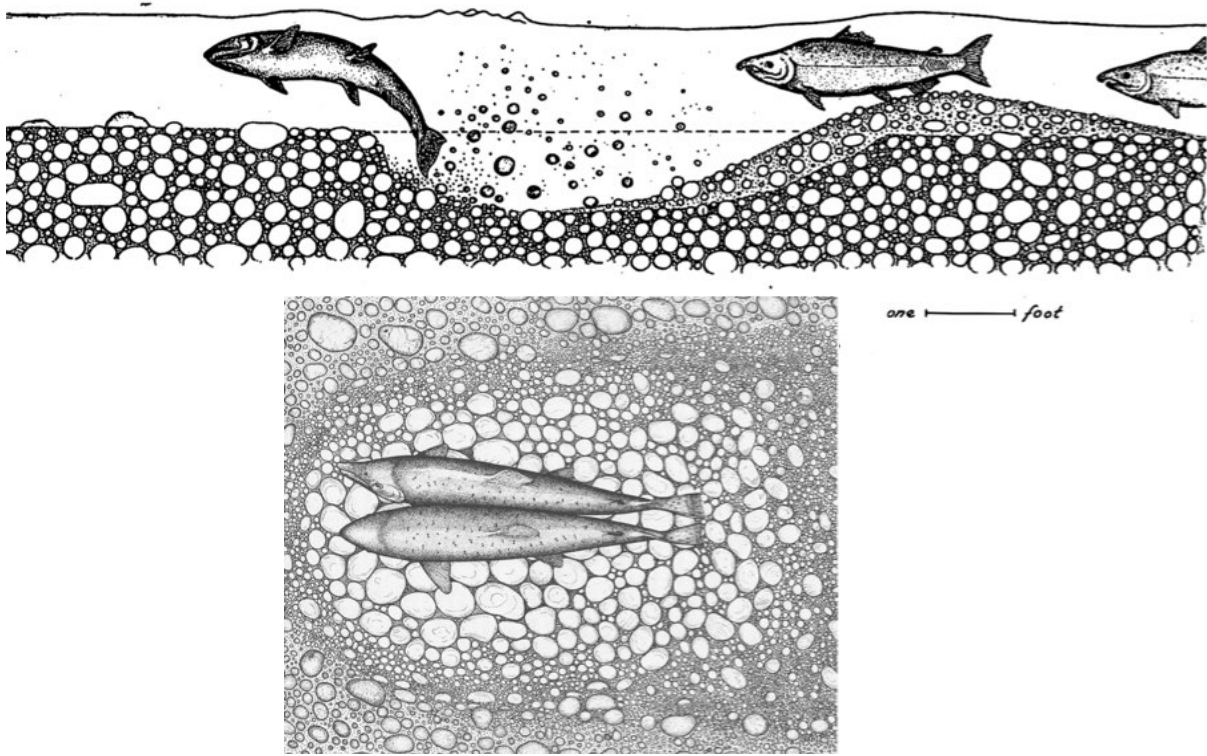
The only sockeye runs that declined migrate through areas with salmon farms.



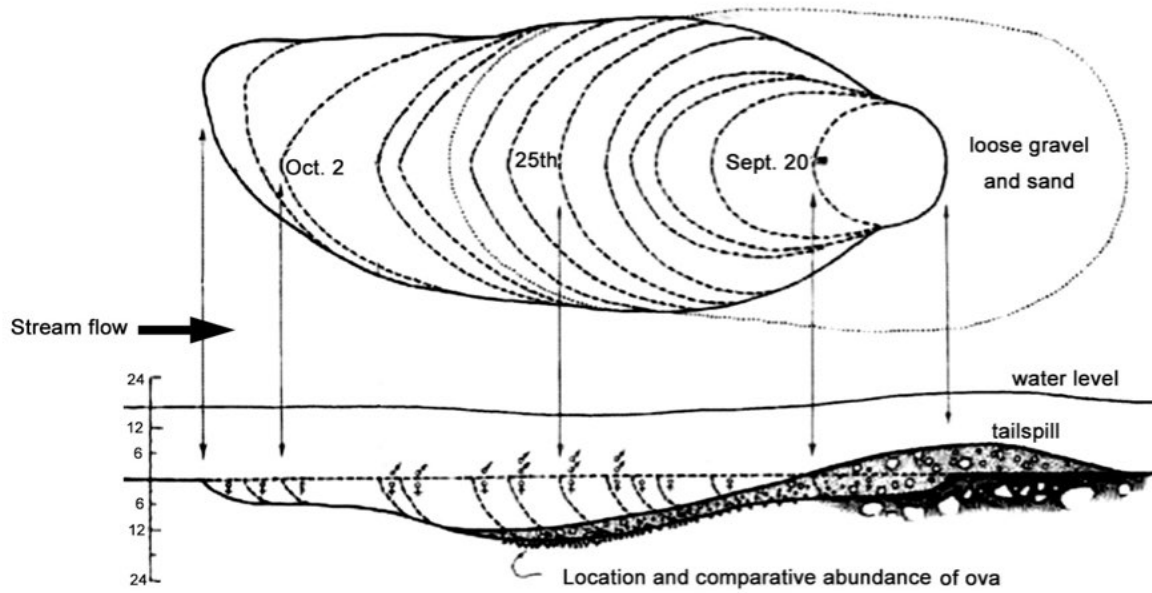
Total adult (4- and 5-year-old) spawners from 1957–1999 in Poverty Flat index stock of SRSS chinook salmon. Data are based on redd (nest) counts made along a standardized segment of each stream and extrapolated to the full length (8). Poverty Flat is presented because it exhibited the median predicted rate of population growth (9).







## Chinook Redd



Dashed lines mark upstream growth day by day

Burner 1951

## WILLAMETTE FALLS AND THE MAGIC FISH TRAP

Posted on January 19, 2020 by Haven under Blog, Folklore

<http://www.gatheringthestories.org/tag/salmon/>

Coyote came to a place near Oregon City and found the people there very hungry. The river was full of salmon, but they had no way to spear them in the deep water. Coyote decided he would build a big waterfall, so that the salmon would come to the surface for spearing. Then he would build a fish trap there too. First he tried at the mouth of Pudding River, but it was no good, and all he made was a gravel bar there. So he went on down the river to Rock Island, and it was better, but after making the rapids there he gave up again and went farther down still. Where the Willamette Falls are now, he found just the right place, and he made the Falls high and wide.



All the Indians came and began to fish. Now Coyote made his magic fish trap. He made it so it would speak, and say *Noseepsk!* when it was full. Because he was pretty hungry, Coyote decided to try it first himself. He set the trap by the Falls, and then ran back up the shore to prepare to make a cooking fire. But he had only begun when the trap called out, “*Noseepsk!*”

He hurried back; indeed the trap was full of salmon. Running back with them, he started his fire again, but again the fish trap cried “*Noseepsk! Noseepsk!*” He went again and found the trap full of salmon. Again he ran to the shore with them; again he had hardly gotten to his fire when the trap called out, “*Noseepsk! Noseepsk!*” It happened again, and again; the fifth time Coyote became angry and said to the trap, “What, can’t you wait with your fish catching until I’ve built a fire?” The fish trap was very offended by Coyote’s impatience and stopped working right then. After that the people had to spear their salmon as best they could.