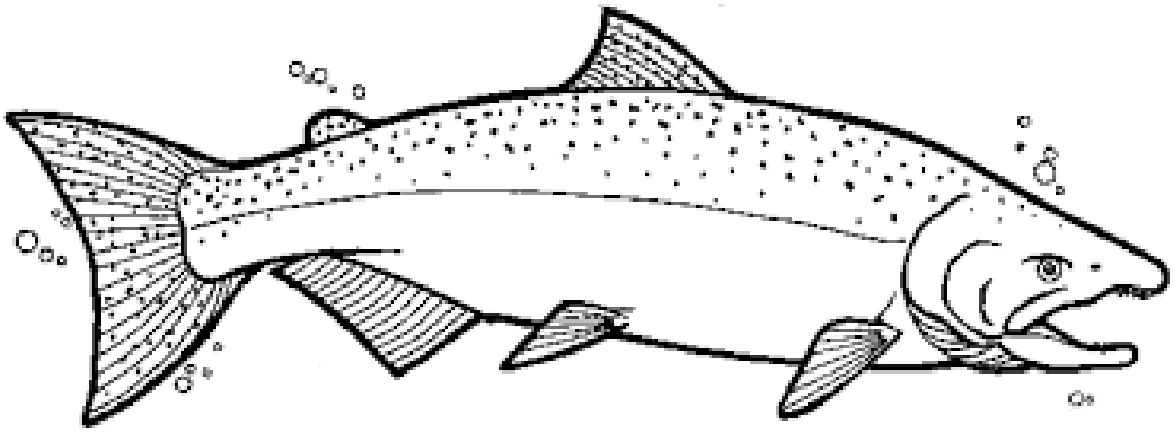
My Salmon Journal



by

Tri-State Steelheaders 2017

Hello students! My name is Sally the Salmon. I am a spring chinook salmon-exactly like the one of the 100 salmon eggs in your classroom's aquarium-but all grown up. Over the next six months, you will get to watch these salmon eggs hatch, grow, learn how to swim, and then release them into a river nearby. Please make sure my eggs are in **cold**, **clean** water-and when they hatch and get bigger, don't forget to feed them!

In this salmon journal, we will be able to figure out when the salmon eggs will hatch using math and science. You will draw pictures and make observations about how the eggs develop and grow into juvenile salmon. We will also explore why salmon are so important not only to our town, but to our entire world. We'll also do lots of fun activities and games, too. Pretty cool, huh?

Let's get started! Our classroom aquarium has _____ chinook salmon eggs in it. We received them from a hatchery in _____ on _____, 2017. If we keep the tank at _____ degrees (°F), the eggs will hatch on/near _____, 2017.

Good Job! Looks like you guys are ready to take care of my egg friends!

PREDICTING HATCH RATES – Cumulative Temperature Units-

This is just a scientific way of saying "How to find out when your salmon will hatch!"

ATU's, or Approximate Thermal Units, is a measurement of how fast your salmon will develop. The *colder* the water is in your tank, the *slower* the development will be. To calculate the daily ATU, subtract 32°F (degrees) from your tank temperature. For example, if your tank is set for 48°F, your ATU for the day would be 16 (48 – 32 = 16). Every day, you will need to calculate and record the cumulative ATU's for your salmon. Looking at the chart below, most spring chinook salmon will hatch at between 850-900 ATU's. If you keep your tank temperature at 48°F, then your salmon will gain 16 ATU's/day. Knowing this, you can divide 900 (highest hatch ATU) by 16 (daily ATU) to get a ballpark hatch date (56.25 days from fertilization to hatching.) If you received your eggs on September 7, for example, you can expect your eggs to hatch around 56 days later-November 2.

Approximate Developmental Rates in Cumulative Temperature Units (TU's)

SPECIES	To Eyed	To Hatch	To Emergence	To Button-Up
Spring Chinook	536 – 650	850 - 900	1200-1400	1650 - 1857

What does all of that stuff above ↑ mean?

Well, it basically shows you how to keep track of *when the eggs will hatch*. Each day, your eggs will get older-just like you do. However, how fast they grow depends on how warm or cold the aquarium is. Colder water *slows* fish development, while warm water *speeds it up.* One egg raised in a 50°F tank will hatch faster than an egg raised in water that is 45°F.

Knowing this, we can figure out when your salmon will hatch. To do this, simply subtract 32 from your current tank temperature. This will give you the daily ATU, or fish age. If your tank temperature is 46°, your daily ATU/fish age will be 14 (46 °F – 32 °F = 14 ATU's.)

As long as your tank temperature doesn't change, every day your fish will get 14 ATUs/fish days older. After one week (7 days), 7 x 14 = 98 ATUs. Your salmon will hatch around 850-900 ATU's. 14 ATU's per day divided by 900 = 64.2 days. Therefore, your salmon will hatch *about* 64 days after they were fertilized.

Remember to adjust your daily ATU's/fish age as you adjust the temperature in your tank. A 50°F tank will have 18 ATU's per day. A salmon raised in a 50°F tank will hatch in 50 days-14 days earlier than a tank at 46°F.

Now that we can figure out how fast our salmon are growing, let's discuss the Salmon life cycle.

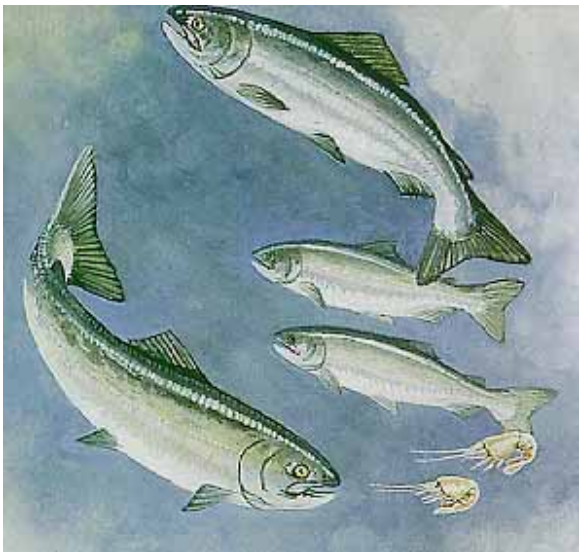
It all starts right here, at the egg stage-where the salmon in your tank are.

We will be raising our eggs until the salmon reach the **fry/parr** stage of their development. In human terms, your class will take care of them until they are almost teenagers-possibly your age-then releasing them into the water, where they will grow up.

The **eggs** lie in the gravel through the winter, as the embryos within develop. In early spring, yolk-sac fry, or **alevins**, hatch. The tiny fish carry a food supply (a sac of egg yolk) attached to their bellies. They will not leave the protection of the gravel until the yolk is used up, 12 weeks or more. At that time, the young salmon, now called fry, swim up to the surface, gulp air to fill their swim bladders, and begin to feed.

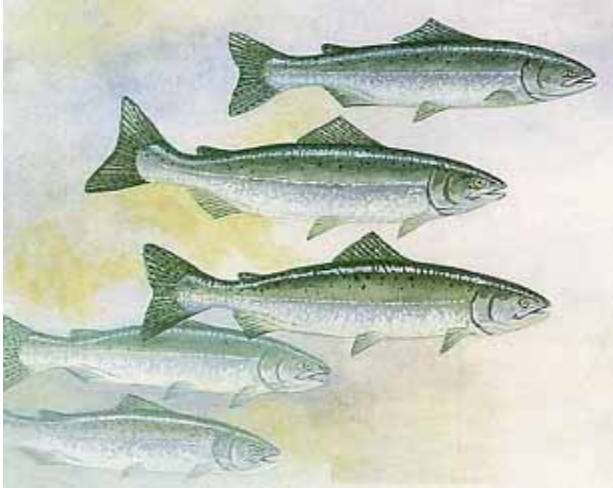
Fry spend a year or more in their home stream in the case of some species, feeding on insects and other tiny animals. For these species, high quality stream habitat is particularly important. Streambed vegetation creates shade and supports many of the insects the young fish will eat. Snags, roots, and boulders provide hiding places and act as "breaks" that keep flood waters from sweeping the fry downstream. Chinook salmon head for the sea soon after they emerge from the gravel.

Environmental cues cause physical and behavioral changes called **smolting**: scales become larger, color turns silvery, tails lengthen and become more deeply forked. Smaller **smolts** let the current carry them downstream, tail first, while larger smolts swim actively. Much of their traveling is done at night to avoid predators. Human activity has created additional hazards, from dams to pollution, which reduce their chances of survival.



Reaching the estuary, an area near the ocean where fresh and salt water mix, the young salmon linger to allow their bodies to adjust to salt water. They feed voraciously. The larger a young salmon grows before entering the sea, the more likely it will survive. Finally, they head out to sea. Some species, such as coho, stay in coastal waters, while others migrate more than 2,000 miles to feeding grounds in the north Pacific.

Salmon live in the ocean for 1 to 7 years. Pacific salmon range as far south as Monterey, California and as far east as the coast of Siberia. When conditions are right, an unknown signal tells them to begin the migration home. Somehow they find their way across thousands of miles of ocean, even in overcast weather, when sun and stars cannot help their navigation. Reaching the coast, they pick up the scent of their home river with noses so sensitive that they can detect dissolved substances in parts per 3,000,000,000,000,000,000!



Once they enter fresh water, the salmon stop feeding. Their stored fat and muscle must last long enough to take them past numerous obstacles, and sustain them while they build nests, fight for dominance, and spawn. They undergo many physical changes: bright spawning colors appear, the males of some species get humped backs, hooked jaws, and sharp canine teeth. The digestive tract degenerates, and the ability to fight disease and heal injuries declines

When a female salmon arrives at her home stream, she chooses a nesting site with just the right combination of clean gravel, adequate depth, and good flow to provide oxygen for her eggs. She digs her nest by rolling onto her side and pumping her tail against the gravel. Stones are dislodged and carried downstream by the current. Every so often, she checks the depth of the nest by "crouching": lowering herself into the nest and inserting her anal fin into the spaces between the stones.

Males fight for access to nest-building females. The dominant male courts the female by quivering and crossing over her back.

When she is ready to lay, he moves alongside her and together they release eggs and milt. At the last moment subordinate males rush in and may manage to fertilize some of the eggs. The eggs settle into the spaces between the stones. The nest is covered with loose gravel as the female builds another nest upstream. Both male and female soon die after spawning, but females will defend the nest until they are too weak to do so.

Challenges: Stream Life

- Water diversions and natural drought dries up creeks and strands **fry** in pools, making them easy prey for birds and other predators.
- By removing streamside vegetation, clearcutting and livestock use removes shade and raises water temperatures - sometimes to lethal levels.
- Agricultural, urban and industrial pollution kills salmon fry.
- Cutting of trees along streams reduces insect food available to young salmon.
- Coho and spring chinook **smolts** are taken by anglers who mistake them for trout.
- Floods, either natural or caused by human activity, can sweep fry from streams before they are ready to migrate.

Challenges: Spawning

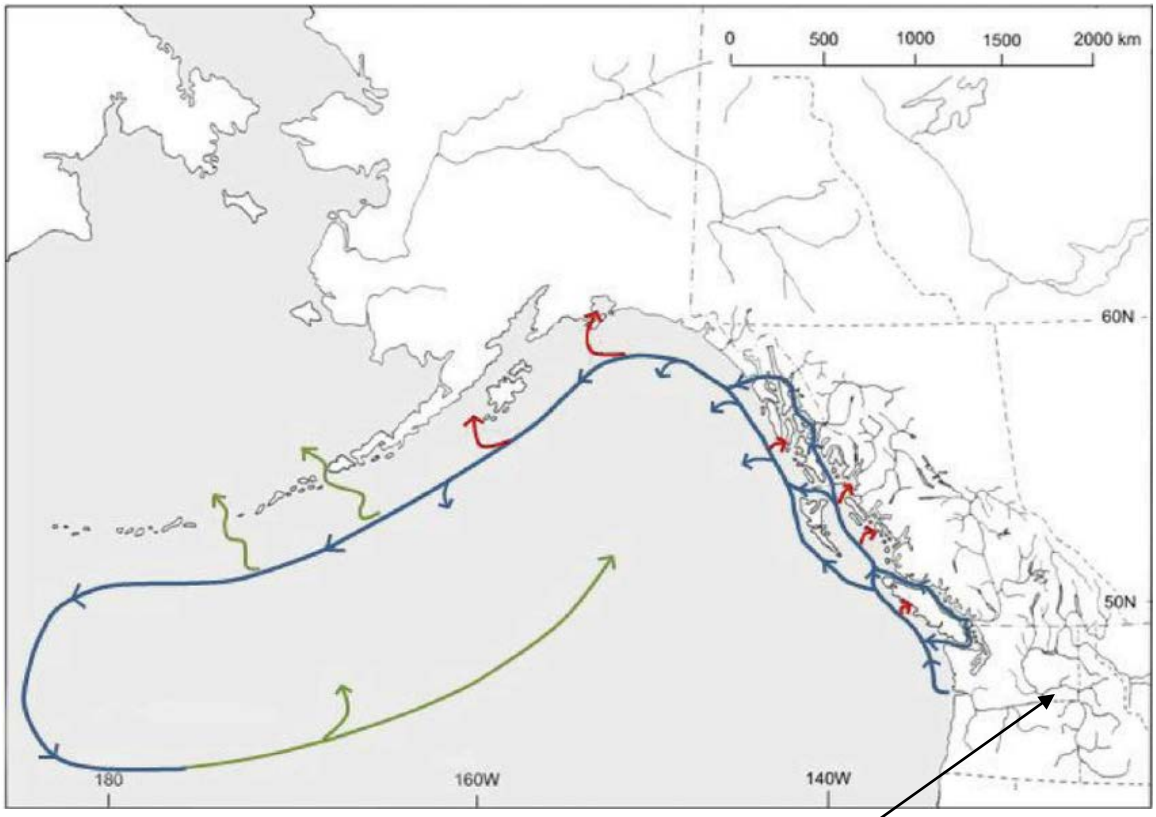
- People can disrupt courtship behavior or frighten spawning salmon from their nests if they approach too closely
- Drought and water diversions lower water levels, making nests vulnerable to freezing in winter.
- Erosion, following clearcutting or fires, smothers nests with silt.
- Floods can sweep eggs out of gravel.
- Fish and birds eat salmon eggs.
- If good spawning habitat is scarce, females may dig up each other's' nests.
- Clear-cutting along streams raises water temperatures and reduces oxygen in water - eggs suffocate.
- By controlling and diverting water, human activity interferes with natural cycles of flushing and gravel deposition that create new spawning habitat.

(Life cycle courtesy of the U.S. Fish and Wildlife Service brochure: Salmon of the Pacific Coast, Illustrations © 1994 by Shari Erickson)

Where do Chinook Salmon live?

Chinook Salmon in our region are born high up in small, cold streams in our local watershed. The eggs are laid there by their mothers in the spring, who will die shortly after laying their eggs. After they hatch, they will live in the stream where they were born for about a year. When the spring rains come, they will swim and be "flushed" down the Columbia River hundreds of miles until they reach the Pacific Ocean. The Columbia River is *freshwater*, while the ocean is *saltwater*. Where these bodies of river join, known as an *estuary,* the young salmon will turn into *smolts*. These smolts will hang out in the estuary for a few weeks, getting their gills ready to breathe the saltwater.

Once they are ready, they will head out into the ocean to get big and strong. Salmon will travel up the Canadian coast to Alaska and near Russia sometimes, looking for food. After between 1-3 years at sea, the salmon will be big and strong enough to return home. Salmon will swim hundreds of miles back to the estuary, then the long journey up the Columbia to where they were born. Once they reach the gravel *redd* where they were born, they will lay 2,000-3,000 eggs and the cycle will start over again.



This is where we are!

Date: _____ ATU's: _____ Life Stage: _____

What do you see?

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Date: _____ ATU's: _____ Life Stage: _____

What do you see?

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What do you see?

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Date: _____ ATU's: _____ Life Stage: _____

What do you see?

A

Alevins - hatched salmon still having a large yolk sack for nourishment

Alkalinity - is a measure of the ability of a solution to neutralize acids to the equivalence point of carbonate or bicarbonate

Ammonia - is a compound with the formula NH3

Anadromous - migrates from salt to fresh water

Aquatic invasives - a non-native plant or animal deliberately or accidentally introduced into a new habitat

E

Ecosystem - a natural unit consisting of all plants, animals and micro-organisms (biotic factors) in an area functioning together with all of the non-living physical (abiotic) factors of the environment

Eddies - water current moving contrary to main current

Erosion - natural processes including rain, weathering, dissolution, abrasion, corrosion and transportation, by which material is removed from the earth's surface

F

Fish Hatcheries - A place where select fish are spawned, hatched and released

Fry - a recently-hatched fish

H

Habitat - environment in which an organism normally lives

N

Nitrates - a salt of nitric acid with an ion composed of one nitrogen and three oxygen atoms

Nitrite - is either a salt or an ester of nitrous acid

P

Parr - parr is a juvenile fish, one preparing to leave the fresh waters of its home

pH - is the measure of the acidity or alkalinity of a solution

Phosphate - a salt or ester of phosphoric acid

Phosphorus - a highly reactive, poisonous, nonmetallic element occurring naturally in phosphates used in fertilizers

Plankton - microscopic water born-organisms

Potamodromous - migrates within fresh water

R

Redd - spawning bed

Rehabilitation - the process of restoring the land, and natural environment

Riffles - rocky shoal or sandbar lying just below a waterway

S

Sac fry - young salmon called Alevins

Smoltification - process of becoming physiologically adapted to saltwater and begins its trek to its salt water environment

Spawning - the act of laying eggs

Stocked fish - released by fish hatcheries into the wild

Y

Yolk sac - serves as the food source for the developing alevin