



# EYED EGGS

When adult salmon swim upstream to spawn, the **female chooses a spot with a gravel bed** and plenty of flowing, fresh water. **She digs a shallow depression called a redd**, like a nest in the gravel. Depending on the species and size, **each female lays from 2,000 to 6,000** round, pinky-orange eggs. Laying eggs in **gravel helps the eggs get plenty of oxygen**.

Instead of a hard shell like a chicken, **each egg has a soft, transparent wall**. This wall, or membrane offers little protection against predators or other disturbances, so after the male fertilizes them the female covers the eggs with gravel. **Birds, bears and raccoons eat the eggs** if they can find them, and flooding, pollution and disease also destroy eggs.

**Salmon eggs are very sensitive**—only one in 10 survives to hatch. In the first days, even a slight disturbance of the streambed can be fatal. Changes in water level or temperature can kill many eggs; they are also very sensitive to pollution in the water. **The eggs need pure, clean water to grow**.

Salmon begin to develop inside the egg. Because they are cold-blooded, the **water temperature controls the rate at which the salmon develop**. Eggs develop more slowly at lower temperatures.



# ALEVIN

Wiggling energetically, the salmon embryo breaks through the egg lining and makes its way out of its egg and into the gravel. For the next **30 to 50 days, it lives as an alevin** (like Alevin and the Chipmunks!) **in the dark spaces between gravel stones** in its home stream.

**The yolk sac, which remains attached to the alevin's belly, provides the food it needs.** The sac shrinks as the alevin develops, gradually allowing it to move about more easily. The alevin's respiration, or breathing, system also develops, allowing it to breathe through its gills.

Clear, flowing water is still important, but an **alevin can swim through spaces in the gravel** away from gravel that is too silty. Also, an alevin can clear small amounts of silt from its gills, so it can live in water that has more silt than salmon eggs can accept. **Alevins need cold running water and clean gravel with spaces to hide.**

Because alevins keep the orange color of the salmon egg and their yolk sac slows their movements, they are **easy targets for predators.** **Alevins avoid light** and live as much as 30 cm down in the gravel. However, as they grow stronger and their yolk sac grows smaller, they begin to move up to the surface of the gravel. **They develop dark markings on their skin that help them hide.**

**When the yolk sac is completely absorbed, they are "buttoned up."** Time to look for some food!



# FRY

When salmon **“emerge” from the gravel and start swimming around**, they are at “swim-up” stage or fry stage. Rapidly vibrating their tail, they push themselves up to the surface of the water and swallow a mouthful of air. The air is not for breathing, but to help them balance and float in water. It goes into a **swim bladder**, an organ like a balloon in their abdomen. They may have to take several gulps until they have enough air.

Fry are not strong enough to swim upstream, so they drift downstream until they find calm pools where they can feed. **“Free-feeding fry”** (say that 3 times fast!) **eat Macroinvertebrates...** the nymphs and larvae of insects such as stonefly, mayfly, and caddisfly.

Salmon fry are a perfect snack size for birds and larger fish. To hide, salmon fry develop dark-colored bars across their bodies called **Parr marks** as camouflage. They also dart very quickly from spot to spot. Almost 90 per cent of all fry die from predators, disease or lack of food.

A crucial part of the salmon life cycle begins at the fry stage— **imprinting**. Salmon fry remember the smell of the water they grew up in. When they return as adults, they try to find the same spot. The rocks and soil in the stream bed, plant life and other aquatic organisms all create the scent that salmon return to. Changes in the environment of the stream can confuse the returning salmon, and prevent them from spawning.

Chum salmon fry may spend just a few days in their home stream, while Coho fry may stay for a year before **migrating to the ocean** as “fingerlings” (the size of your finger!).



# Smolt

As salmon begin to mature, they leave their home stream to head to the ocean. Salmon fry have only the physiological mechanisms needed for fresh water; they would die in saltwater. **They become smolts when they begin the process of adapting to salt water, a process called smoltification.** In the estuary of a river, where the fresh water mixes with the salt water, salmon smolts gradually get used to life in salty water. Some species spend up to a year in estuaries, while others leave almost immediately.

All anadromous fish, including salmon, can **adapt to the changes that salt water causes to their bodies.** Salt water draws fresh water out of an organism's body. Saltwater fish must drink salt water to replace the fresh water that is lost. However, they must also **develop a way to get rid of the excess salt.** Salmon excrete salt in concentrated urine and through the fine membranes in their gills.

**Smolts also change their appearance to prepare for ocean life.** They lose the dark colors that helped them hide shady forest streams, and begin to take on the silvery color of adult salmon. In the open ocean, there is no shade – only the bright color of sunlight reflecting on the waves. The **smolts' new silvery color helps them hide in the silvery light at the surface of the ocean.**

Salmon **smolts feast on microscopic animals and on smaller fish that live among estuary plants.** Smolts can grow from 4 or 5 cm in length to as much as 9 cm. However, **smolts are a favorite snack for many fish predators.** Herons stalk fish in the marshes, while hawks watch for them in the sky. Larger fish, snakes, seals and even orcas also prey on smolts.





# Adult Spawner

After adapting to life in salt water, salmon travel along the coast and then to the open ocean. Each species has its own migration route and length of time spent in the ocean. Salmon usually travel north in summer and south in winter, and can travel up to 30 miles per day. Their diet of small fish and plankton (the free seafood buffet!) is packed with **dense ocean nutrients**, and adult salmon can reach 40 pounds or more, depending on the species.

Salmon are prey for seals and orcas, as well as for fish, such as tuna and cod. **The largest number of salmon is probably taken by human fishers.** People catch salmon mainly in coastal waters.

After spending one to seven years at sea, depending on the species, salmon return to their home stream to spawn. It is a difficult journey, and only the fittest fish make it to the spawning grounds.

**Salmon stop feeding as they enter fresh water.** Their stomach is no longer needed and it disintegrates internally—leaving more room for eggs and milt. They begin living off the stored fat they accumulated in the ocean, and their flesh becomes pale and mushy. **Spawners stop drinking water** and process large amounts of urine to **get rid of excess water.** Different salmon species develop different spawning colors, and males may develop **hooked snouts called kype.**

**Spawning salmon return to their natal stream.** Males arrive first and stake out their territories. They look for particular gravel size and water flow. Females initiate spawning by digging a shallow depression or **Redd** in the gravel. She lays thousands of eggs, which are then fertilized by the male. **Salmon die after spawning,** and their carcasses decompose and fertilize surrounding forests.