Journey of the Pacific Salmon

The migration of Pacific salmon from ocean feeding grounds to the streams of their birth—a journey of 3,000 miles or more—is a remarkable feat of endurance and homing. It is a long, strenuous, and desparate race, with every obstacle taking an enormous toll. Only one out of a thousand salmon may live to reach the stream where it was hatched.

Human cultures have seen the death of adult salmon on their spawning grounds as a symbol of ultimate sacrifice, and the generosity of nature. But to the salmon it is an investment in the future of the species. The bodies of the adults help enrich otherwise infertile streams, ensuring an abundant crop of insects to feed the next generation.

Above: Pink salmon ascending falls

Salmon and the U.S. Fish and Wildlife Service

The U.S. Fish and Wildlife Service's fisheries program is one of more than 20 resource agency programs that share responsibility for management of salmon and steelhead trout in the Northwest. We help restore degraded fish habitat, and operate hatcheries to compensate for habitat and fish loss caused by dams and water diversions. In 1996, 66 million salmon and steelhead fry were released from 17 national fish hatcheries in the western states. Hatcheries contribute 900,000 adult salmon annually to sport, commercial, and Tribal fisheries.

To ensure the health of hatchery fish, we conduct genetic, disease and nutrition research at four fish health centers and a technology center. Through our eight fishery resource offices, we monitor salmon populations and work to restore wild salmon and steelhead runs. We also identify endangered and threatened runs, determine their habitat needs, and propose actions that would allow species to recover.

Perhaps most importantly, we work in partnership with Federal and State agencies, private organizations, businesses and private landowners to find ways for salmon and people to coexist in years to come.

Right: Fishery biologist with summer chum salmon, Quilcene National Fish Hatchery, Washington

Below: Trapping smolts for migration study, Elwha River, Washington

What You Can Do

- Speak up for salmon restoration. Request that agencies provide adequate stream flows and other habitat protection.
- Be an informed consumer. Don't use products that are harmful to the environment where safer alternatives exist.
- Don't dump antifreeze, motor oil, or other chemicals into street drains. Many drains empty directly into rivers!
- Conserve water and electricity; recycle and reuse paper products. Reducing demand will help save habitat and fish.
- Volunteer for stream enhancement projects with the U.S. Fish and Wildlife Service or your State fish and wildlife agency.
- Report violations of fishing laws and seasons.
- Anglers: Know the difference between trout and salmon smolts, and release any smolts you catch.
- Avoid boating, canoeing, or kayaking through spawning areas when adult salmon are in the river.
- Enjoy watching salmon courtship and spawning from a distance, using glasses with polarized lenses. Salmon may be frightened from their nests if you approach too closely.
- Educate others about salmon and what they can do to help.

A Resource In Decline

Oregon Historical Society #G7193

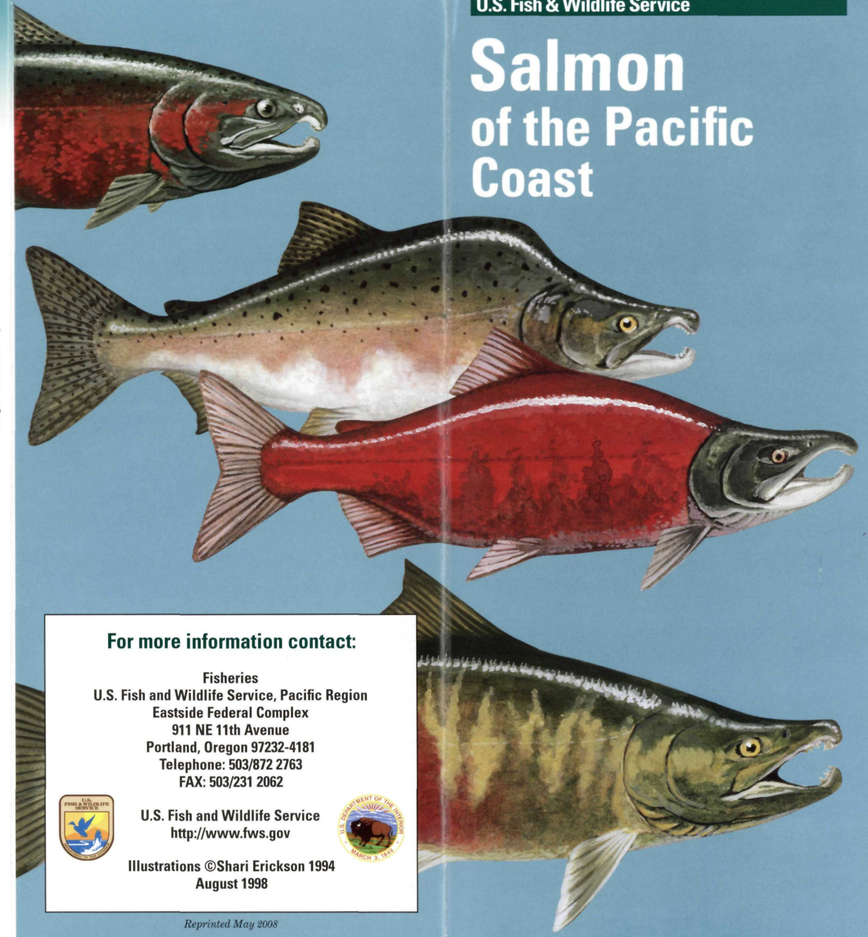
Above: Columbia River salmon cannery, c. 1880

In recent years, the plight of salmon has received much attention. But the problems of salmon are not new. In the late 1800s, overfishing caused a rapid decline of chinook salmon in Oregon, Washington, and California. By 1890, scientists predicted the collapse of the fishery. And even then, logging and mining operations were destroying spawning habitat.

From the 1930s on, dams blocked off spawning habitat and made migration more difficult for both adult salmon and smolts heading out to sea. An expanding human population impacted what habitat remained. In California, for instance, 85 percent of the spawning streams that existed in 1850 are now either inaccessible or too polluted for salmon to use. No single cause is to blame: urban growth, agriculture, industry, logging, mining, and grazing have all played a part in the loss of salmon habitat. The future of Pacific salmon depends on all of us setting a higher priority on preserving these magnificent fish for future generations.

U.S. Fish & Wildlife Service

Salmon of the Pacific Coast



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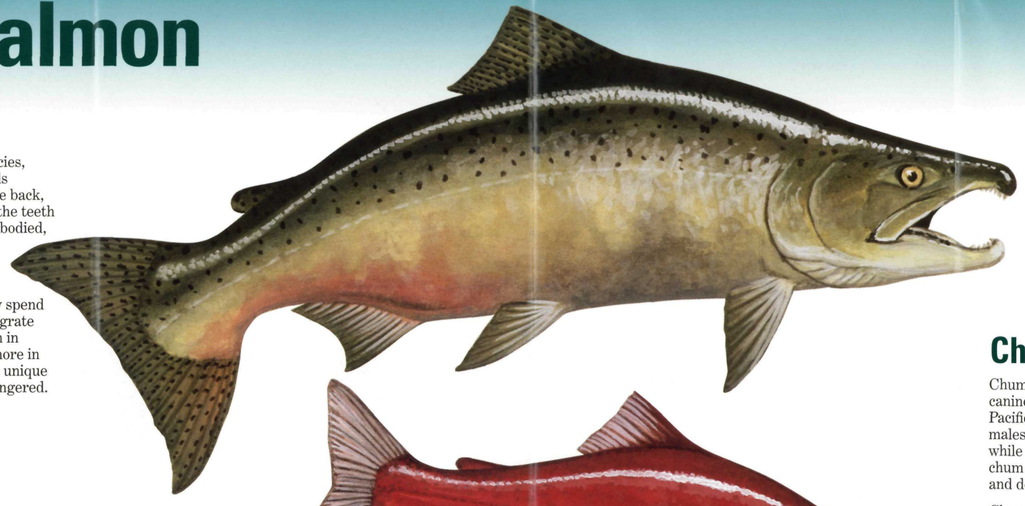
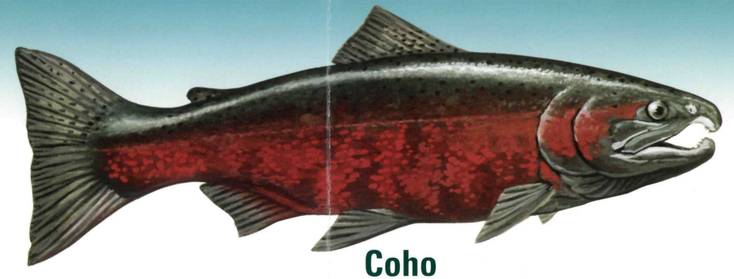
Pacific Salmon

Chinook

The chinook (or king) salmon is the largest species, averaging 18 to 24 pounds with up to 127 pounds recorded. Chinook have small black spots on the back, dorsal fin, and tail fin. The gums at the base of the teeth are gray. Fall-run chinook are robust and deep-bodied, while spring chinook are smaller, slimmer, and not as brightly colored when spawning.

Fall chinook spawn soon after arriving at their spawning grounds, usually large rivers. The fry spend 3 to 4 months in fresh water. Spring chinook migrate earlier, but delay spawning until fall, and spawn in smaller tributaries. Their fry spend a year or more in fresh water. The Sacramento River also hosts a unique winter run chinook, which is now listed as endangered.





Coho

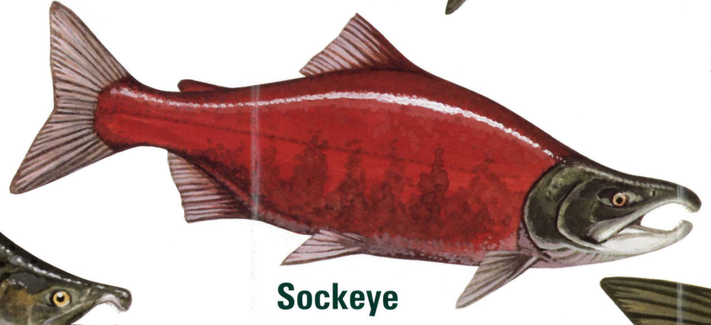
Coho (or silver) salmon are powerfully built, and can jump falls that most salmon cannot negotiate. They have small black spots on their backs and the upper lobe of the tail fin. The gums at the base of the teeth are white. Although sea-run coho have silver sides, spawning males develop bright red sides and greenish backs. Spawning females are paler. The jaws of spawning males often become grotesquely hooked.

Most coho spend 18 months at sea, sticking to coastal waters, and return to their home streams at 3 years of age and 8 to 10 pounds. The fry spend over a year living in streams.

Chum

Chum, also known as "dog" salmon from the large canine teeth of spawning males, are the second largest Pacific salmon, weighing up to 40 pounds. Spawning males develop reddish vertical bars on their flanks, while females have a reddish lateral band. Although chum are fast swimmers, they are not good jumpers, and do not migrate far inland to spawn.

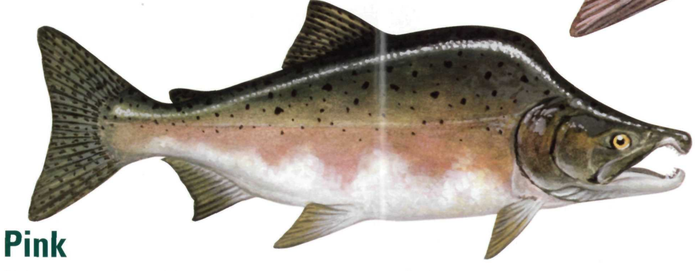
Chum fry migrate to the sea soon after they emerge from the gravel. They spend up to 7 years at sea, but 4 years is typical.



Sockeye

Sea-run sockeye salmon have dark blue backs with few spots, and bright silver sides. When they enter fresh water after a typical 2 years at sea, both males and females develop bright red bodies and green heads. The males' bodies become laterally compressed, a hump appears behind the head, the jaws become hooked, and sharp canine teeth appear.

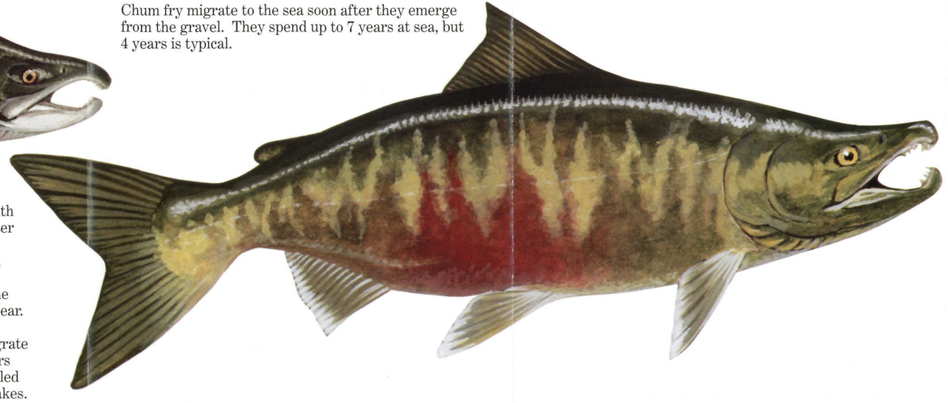
Sockeye fry, after emerging from the gravel, migrate to freshwater lakes, where they spend 1 to 2 years before heading out to sea. Some populations, called kokanee, spend their entire lives in freshwater lakes.



Pink

Pink salmon rarely travel far upriver to spawn; they are typically found in shorter coastal streams. When the fry emerge from the gravel they already have the silvery color of smolts, and migrate directly to sea. Pinks spend a fixed 18 months at sea; thus, all returning pink salmon were born in the same year, and different year classes do not interbreed.

Pinks average 2 to 5 pounds. Sea-run pinks are easily distinguished by the large oval spots on their backs and tail fins. Spawning males develop a large hump on their backs, earning the species its other name, "humpback." Some biologists think the males' conspicuous hump diverts the attention of predators away from the females.



Salmon on the Brink

Above: Snake River fall chinook (Idaho). Only a few hundred of these endangered salmon return to their native streams each year.

Each of the 5 species of Pacific salmon — chinook, coho, chum, sockeye, and pink — has several runs, each returning at its genetically appointed time. Within runs, there are many races, whose physiology and behavior are adapted to conditions in their home rivers. Thus, biologists usually refer to wild salmon by their run (time of return) and race (river of origin): Sacramento River winter chinook, Snake River spring chinook, and so on. Diverse and resilient, these wild salmon are a precious genetic legacy.

But much of this legacy has already been lost. The Snake River coho (Idaho), the Wallowa River sockeye (Oregon), and an estimated 104 other wild stocks may now be extinct; others are close to oblivion. Once a wild run is lost, it will not return; transplanting of non-native stocks is rarely successful.

The U.S. Fish and Wildlife Service is working to preserve wild salmon through research and monitoring, habitat improvement, and hatchery propagation of pure wild strains. We also advise businesses and private landowners about ways to reduce the impact of their activities on salmon.

The Pacific Salmon Life Cycle: Survival Against the Odds

Pink salmon, ocean phase

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 trackless miles of ocean, even in overcast weather, when sun and stars cannot help their navigation. When they reach 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!

Spring chinook

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. Their bodies undergo many changes: bright spawning colors appear, their stomachs and intestines shrink, and their ability to fight disease and heal injuries declines. Males develop hooked jaws, sharp canine teeth, and in some species, humped backs.

Challenges: Adult Migration

- Salmon are confused and slowed by slackwater pools above dams and turbulence below dams, using up their energy reserves.
- High temperatures in slackwater pools contribute to "warmwater disease," a major killer of adult salmon.
- Adults run a gauntlet of predators: humans, sea lions, bears, and others.
- Poorly constructed dams and natural rockslides block migration.
- Pollution can weaken or kill adult salmon.

Female chum salmon digging nest

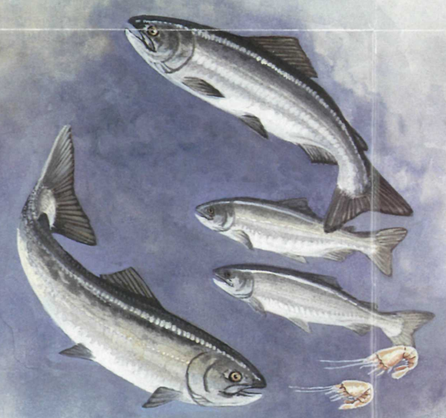
When a female salmon arrives at her home stream, she chooses a nesting site with just the right combination of clean gravel, adequate depth, and good flow to provide oxygen for her eggs. She digs her nest by rolling onto her side and pumping her tail against the gravel. Stones are loosened and carried 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.

Sockeye salmon, fighting males (above) and spawning pair (below)

Challenges: Spawning

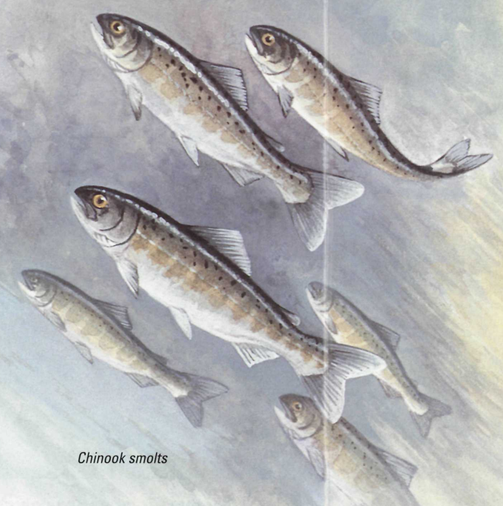
- People can disrupt courtship or frighten spawning salmon by approaching too closely.
- Drought and water diversions lower water levels, making nests vulnerable to freezing in winter.
- Erosion, following clearcutting or fires, smothers nests with silt.
- Floods can sweep eggs out of gravel.
- Fish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

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.



Subadult chinook

Reaching an 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 can grow before entering the sea, the more likely it will be to survive. Finally, they head out to sea. Some species, such as coho, will stay in coastal waters, while others migrate over 2,000 miles to feeding grounds in the north Pacific.



Chinook smolts

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, tailfirst, while larger smolts may swim actively. They do much of their travelling at night to avoid predators. Human activity has created additional hazards, from dams to pollution, which reduce smolts' chances of survival.

Challenges: Smolt Migration

- Without currents to carry them downstream, smolts use extra time and energy to swim through slackwater pools above dams.
- The warm, quiet waters of slackwater pools have created ideal habitat for predatory fish that eat young salmon.
- Many smolts are killed and injured passing through hydroelectric turbines or over spillways.
- Smolts are preyed on by birds, mammals, and larger fish.
- Pollution of estuaries kills or weakens smolts, and reduces their food supply at a critical time.

Coho fry

Several species of salmon fry spend from 6 months to a year or more in their home streams, feeding on insects and other small animals. The fry of some species head for the sea soon after emerging from the gravel. Healthy streams are important for all young salmon. Streamside vegetation keeps water temperatures cool and supports many of the insects the young fish will eat. Snags, roots, and boulders provide hiding places and act as "brakes" that keep floods from sweeping the fry downstream.

Challenges: Stream Life

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

Salmon fry hatch in their gravel nest

The eggs lie in the gravel through the winter, as the embryos within develop. In early spring, yolk-sac fry, also called 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 (a sac-like organ that provides buoyancy), and begin to feed.

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FISHERIES: A Future Legacy