



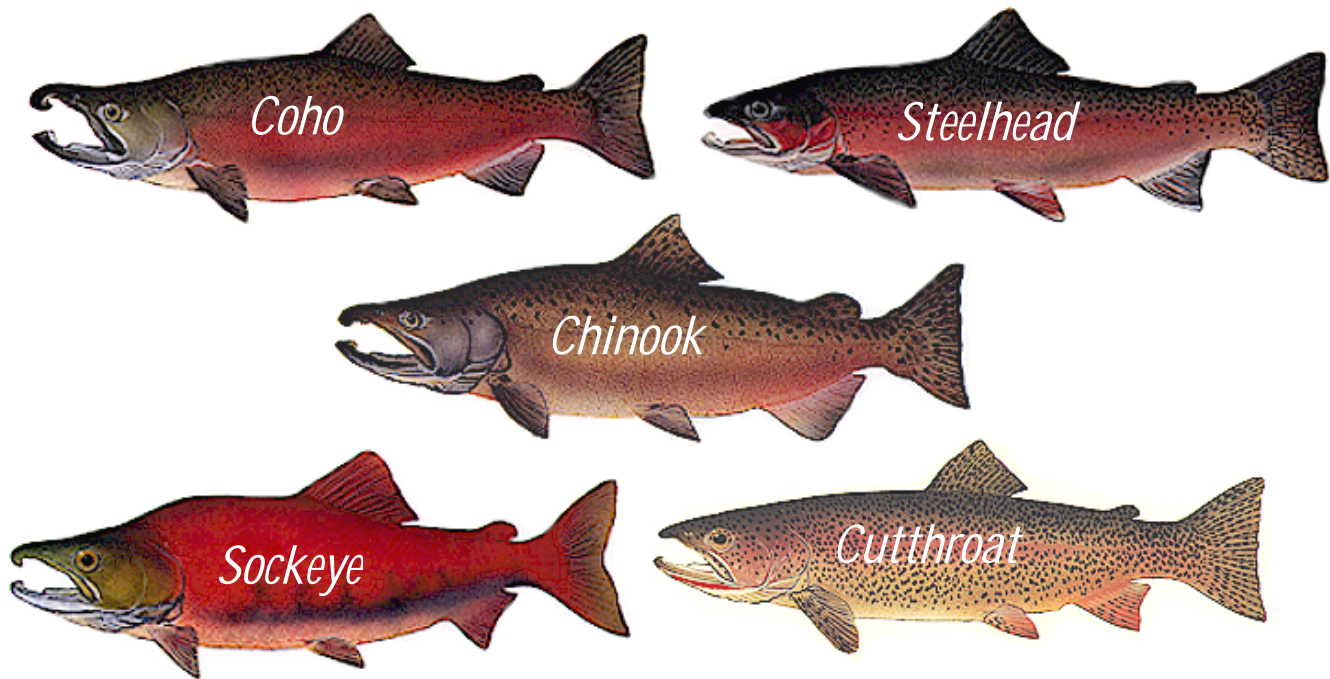
Eco-Link

Linking Social, Economic, and Ecological Issues

Anadromous Fish & Pacific Forests

Volume 8, Number 3

One of nature's greatest dramas is the upriver salmon migration. Pacific salmon (Chinook, Coho, Sockeye, Chum, Pink, plus sea-run Steelhead and Cutthroat "trout") belong to a group known as *anadromous fish*. These fish hatch and live the first part of their lives in fresh water, then migrate to the ocean to mature for months or years before returning to their natal stream to spawn. Most salmon complete this cycle once before dying and returning valuable nutrients to the stream.



All species illustrated as males in spawning colors

Migration between salt and fresh water occurs every season of the year, depending on latitude and the genetic characteristics of the fish. Salmonids (anadromous salmon in *salmonidae* family) spawn in virtually all types of freshwater habitat, from inter-tidal areas to high-mountain streams. Pacific salmon may swim hundreds, or even thousands of miles to get back to the stream where they hatched. However, only a very small percentage live to reach their natal stream or spawning grounds.

Salmonid Life Cycle

Female salmon build a series of small gravel nests, called redds, on the spawning grounds. Each female Coho deposits, on average, 2,500 eggs, which are fertilized by one or more males. Roughly 30 percent survive to become “fry.” Once they emerge from the gravel the fry must find a place in the stream that will provide food and shelter. These special places are called *habitat*. Approximately 3 percent of the fry find adequate rearing habitat to survive. Each species of salmon has its own unique habitat requirements. Chinook fry live near gravel bars and in side channels of larger streams. They like stable stream flows and well-vegetated banks. Coho fry are found in small streams that flow year around. They like shaded pools with overhanging trees and shrubs. Sockeye fry live in large lakes for one or two years before migrating to sea.

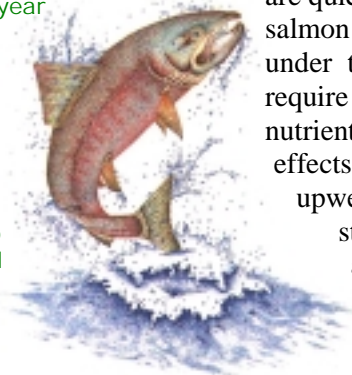
In the late spring, the juvenile salmon move into the ocean. Most turn north, following the coast of British Columbia to Alaska and some migrate far offshore into the North Pacific. Some stay relatively close to home or are restricted to the California Current. For two to five years they feed on zooplankton and small fish. They must grow rapidly and gain strength for the long journey that lies ahead. The zooplankton and baitfish require a narrow range of ocean temperatures and salinity to survive, otherwise salmon populations can decline dramatically.

After years at sea the adult salmon return to spawn in the streams of their birth. They stop feeding and lose their shiny, silver color. Males develop a pronounced hook-nose, large canine teeth, and may display vivid body colors. Females develop darker, subdued color patterns. The journey upstream is often long and difficult and many fish are lost to natural hazards before reaching the spawning grounds.

ANADROMOUS FISH	Key Salmonids Family: Salmonidae	Scientific Name (Genus/Species) Other Names	Avg. size (Max size) in lbs.	Spawning Area (season)	Runs	Rearing in Fresh Water	Feeding and Maturing in Ocean
	Chinook	Oncorhynchus tshawytscha King / Tye	10-15 (135)	Large rivers or mainstreams (fall)	Spring Summer Fall	months – years	2-5 years
	Coho	Oncorhynchus kisutch Silver	6-12 (31)	Small streams and tributaries of larger rivers (fall)	Summer Fall	1-2 years	1-2 years
	Cutthroat	Oncorhynchus clarki clarki Blueback Trout Coastal Cutthroat	1-4 (6)	Minimal flow headwaters (spring)	Summer Fall	2-4 years	Only feed at sea in warmer months
	Sockeye	Oncorhynchus nerka Red	3-7 (15)	Streams flowing into or from lakes (summer)	Summer	1-3 years (lakes)	1-3 years
	Steelhead	Oncorhynchus mykiss Sea-run Rainbow Trout	8-11 (42)	Fast water in highest reaches of watershed (spring)	Summer Winter	1-3 years	1-4 years

Estuaries are formed when seawater and freshwater streams meet. This mixing creates a unique and productive aquatic habitat. Many species of wildlife and fish, including salmon, depend on estuaries to survive. Ocean bound juvenile salmon may spend several days or weeks in the estuary feeding and adjusting their body chemistry to the saltwater environment. Adult salmon, returning from the ocean, also pause in the estuaries to allow their bodies to adjust to the fresh water before moving upstream to spawn. The importance of the estuary habitat cannot be overstated.

- A Chinook (king) salmon tagged in the central Aleutian Islands and recovered a year later in the Salmon River, Idaho had traveled over 3,500 miles!
- Successful people and anadromous fish have a lot in common. They will not quit until they reach their goal. Perhaps this is one of the reasons we place such high value on wild fish runs. They symbolize our ability to overcome obstacles, and to renew and sustain life.



The declines in salmon and sea-run trout cannot be denied, but there is no single cause. Wild anadromous fish have been programmed over thousands of years to reproduce effectively. However, *habitat*, *harvest*, *hydropower*, *hatcheries*, and many other threats exist.

Habitats and Hazards

Salmonids need three kinds of habitat. They rear and spawn in fresh water streams. They need estuaries to adjust to salt water and back to fresh water again. They need oceans for feeding and maturing.

Inland streams must have cool and well-oxygenated water, with places to rear and spawn. The estuaries are quickly disappearing, and these are the places where salmon may be eaten by seals or sea lions protected under the Marine Mammal Protection Act. Salmon require cool ocean waters with lots of upwelling of nutrients, zooplankton, and baitfish. The El Nino effects have warmed the ocean habitat and reduced upwelling, while inland droughts have caused streams to dry up. Life is a constant struggle for anadromous fish.

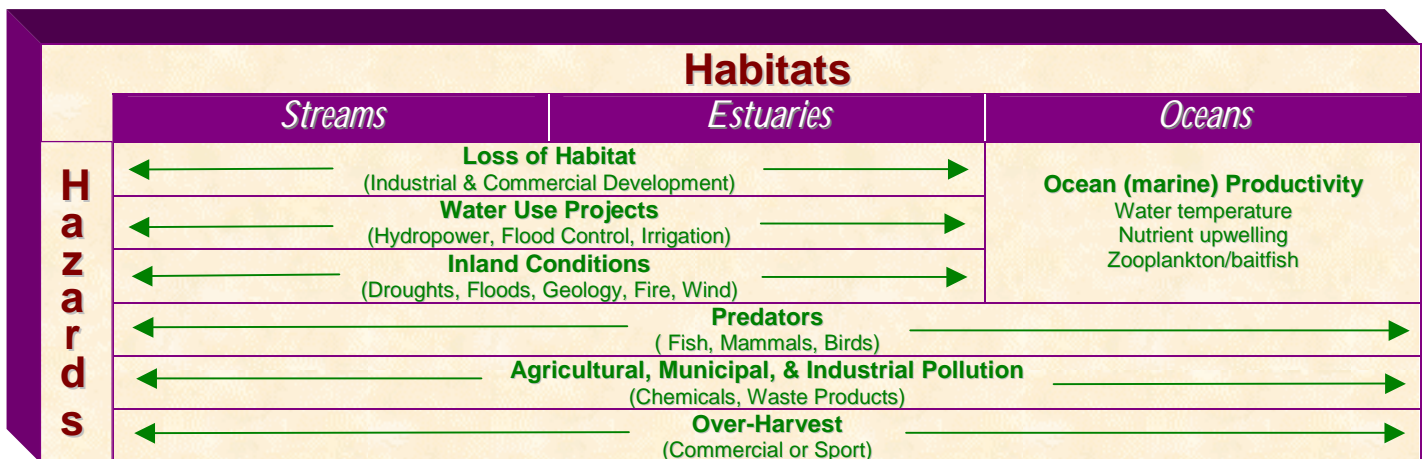
Ocean Conditions

There has been a huge decline in the ocean survival rates of salmon. As an example, Fisheries Scientist, Dr. V. W. Kaczynski, reported that ocean survival of Coho salmon has fallen from 6.5% between 1965 and 1975, to 1.2% between 1991 and 1997, based on hatchery returns of all hatchery Coho from Southwest Washington, Oregon, and California. This is an 80% decline in survival. Baitfish appear to have been hit hard by the effects of El-Nino, reducing "Ocean Productivity." Ocean warming and downwelling prevent the growth of primary food sources such as plankton. The decline in marine survival rates is unprecedented and typifies the "salmon crisis."

None can deny the negative impacts of the dams on fish nor the positive impacts to humans in terms of hydropower, irrigation, flood control, navigation and recreation.

Habitat Loss

The loss of estuary habitat where salt and fresh water mix is significant. As an example, it is estimated that the Columbia River Estuary has suffered a 40% loss in area and a 70% reduction in invertebrate production. Unfortunately, smolt survival is most critical in the estuaries and during the first few months in the ocean. The restoration of inland freshwater habitat is much more encouraging than the reclamation of estuaries.



Fish Harvests

Fish harvests must be carefully controlled to maintain wild salmon stocks. The combination of over-harvests and poor marine conditions have been lethal to wild Coho salmon populations on the Pacific coast. The over-harvest of wild stocks and under-harvest of hatchery stocks have significant implications on the gene pool and survival of wild fish. Commercial, treaty, and sport fisheries must conform to the mandates of the National Endangered Species Act. The National Marine Fisheries Service is mandated to issue a "biological opinion" on potential harm to threatened and endangered species before fishing can occur.

Predators



Salmonids are particularly vulnerable to predators in the estuaries. A recent study showed that fish-eating birds (e.g. Caspian Terns) ate approximately 30% of the Chinook smolt (juvenile fish) that made it to the lower Columbia River Estuary.



Mackerel and marine mammals are also voracious smolt predators. Sea lions and seals, both protected, have had a devastating impact on fish populations, particularly adult fish returning to spawn.



Hatchery Fish

An argument can be made that hatchery fish are necessary to keep salmonid populations at levels essential for long-term survival. However, there are indications that hatchery fish compete with wild stocks for habitat and transmit diseases to them. The inbreeding of hatchery and wild fish also clouds the genetic delineation between the two.



Dams

Dams have had a major impact on fish populations, particularly in the Columbia-Snake River system. To make it to the Salmon River, a fish has to get past four federal dams on the Columbia and four federal dams on the Snake. Smolt have to return through the turbines or spillways unless they are trucked or barged around the dams. Some estimate 10% mortality at each dam. Fish are also lost as irrigation water is drawn off. Predator fish (e.g. pikeminnow) thrive in the slow currents of the reservoirs created behind each dam.

Forestry & Fish

Foresters and the forest products industry are doing many things to restore, maintain and enhance inland fish habitat. These include well-built roads, placing woody debris in streams, quick reforestation following harvest, leaving Riparian Management Zones (buffer strips) along streams, and planting shade tolerant trees, such as Western Red Cedar, along stream banks. Of all the hazards impacting salmonids, today's sustainable forestry has the lowest negative impact and can, in fact, have a very positive impact on fish habitat.



Summary

Our need for wild stocks of anadromous salmon is primarily a values issue. We can certainly grow and harvest hatchery fish. This is one of the options for society. Before we had the giant dams on the Columbia and Snake Rivers, devastating floods were a common occurrence. Irrigation has greened up thousands of square miles of semi-arid land to feed world populations. Hydropower has provided inexpensive and reliable electricity to build the economy. At the end of the day, we are going to have to decide what we are willing to give up to enhance wild fish stocks (currently a genetic mix of hatchery and wild), and what price we're willing to pay. We will also have to understand that some major causes of decline, such as low natural marine productivity, are beyond our control, while others, like allowable harvest, are controllable. The first step is to get a clear understanding of the issues and options so we can all make informed choices about the things we can influence. The future of pacific forests, anadromous fish, and the people who inhabit this ecosystem are all permanently linked.

Glossary

- Alevin:** The life stage of a salmonid between egg and fry. An alevin looks like a fish with a huge pot belly which is the remaining egg sac.
- Anadromous:** Fish that hatch and live the first part of their lives in fresh water; migrate to the ocean to spend their adult lives (which may be as short as six months or as long as seven years); then return to freshwater to spawn.
- Cumulative Effect:** The sum total of all impacts affecting anadromous fish.
- Endangered Species:** Species that are likely to become extinct.
- Fishery:** One or more stocks of fish which can be treated as a unit for purposes of conservation and management, plus any fishing for such stocks.
- Fry:** A juvenile salmonid that has absorbed its egg sac and is rearing in the stream.
- Milt:** Salmon sperm
- Pacific Salmon:** Members of the *Salmonidae* family and *Oncorhynchus* genus including; Chinook, Coho, Sockeye, Pink and Chum. Also includes sea-run Steelhead and Cutthroat.
- Parr:** Also known as a fingerling. A large juvenile salmonid, between a fry and a smolt.

Productivity: The ability of a stream, estuary, or the ocean to produce the food needed by anadromous fish at the various stages of their life cycle.

Redd: A series of small nests for laying eggs built in bottom gravel by the female salmon.

Roe: Salmon eggs

Smolt: A juvenile salmonid which has reared in-stream and is preparing to enter the ocean. Smolt exchange the spotted camouflage of the stream for the chrome of the ocean.

SMZ: Streamside Management Zone, also know as RMZ (Riparian Management Zone). Provides buffer for shade, soil stability and woody debris.

Stocks: Groups of fish that migrate together are called runs, or stocks. The threatened or endangered species listing usually refers to stocks on specific rivers (e.g. winter-run Chinook on Sacramento River).

Substrate: The material that comprises a stream bottom.

Threatened Species: Species that are likely to become endangered in the near future.

Treaty Tribes: The Umitilla, Warm Springs, Yakima, and Nez Perce tribes are guaranteed fishing rights in the Columbia by 1855 treaties.

Zooplankton: Small aquatic invertebrates that live in the sunlit waters of streams, lakes, or oceans and feed on algae and other invertebrate animals. Zooplankton are the most prolific life forms on earth.

Sources

California Dept. of Fish & Game www.dfg.ca.gov
Fish FAQ www.wh.who.edu/homepage/faq.html
Idaho Dept. of Fish & Game www2.state.id.us/fishgame
National Council on Clean Air & Stream Improvement www.ncasi.org
National Marine Fisheries Service www.nmfs.gov
Northwest Power Planning Council www.nwppc.org
Oregon Dept. of Fish & Wildlife www.dfw.state.or.us
Oregon Plan for Salmon and Watersheds www.oregon-plan.org

For a current list of what's threatened or endangered visit the U.S. National Marine Fisheries Service web site @ www.nmfs.gov/tmcintyr/fish/anadromo.html or the U.S. Fish & Wildlife Services Endangered Species section @ www.fws.gov/r9endspp/endspp.html

Pacific Fishery Management Council www.pcouncil.org
Pacific States Marine Fisheries Commission www.psmfc.org
U.S. Army Corps of Engineers www.nwd.usace.army.mil/ps
U.S. Bureau of Reclamation www.usbr.gov
U.S. Fish and Wildlife Service www.fws.gov
U.S. Forest Service www.fs.fed.us/outdoors/wildlife
Washington Dept. of Fish & Wildlife www.wa.gov/wdfw
"Oregon's Wild Salmon and Steelhead Trout" by Oregon Forest Industries Council, 1993

Discordant Harmonies

Disturbance

The dynamic nature of the physical environment must be considered before humans can begin to assess the type and severity of their impacts. Earthquakes, volcanoes, floods, fires, and landslides have occurred forever. Often, a seemingly catastrophic event (in human terms) actually benefits and shapes the long-term environment.

Recovery



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