Pacific Coast Salmon: Past, Present, and Future

by

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ABSTRACT

Wild Pacific salmon are an iconic part of the Pacific Rim from China, Korea, and Japan in the west to California Oregon, Washington, and Idaho in the east. Historically, and pre-historically, populations were huge and supported a substantial indigenous population, provided high quality protein to various large predators, and annually supplied sufficient nutrients to sustain freshwater and terrestrial ecosystems. On the eastern side of the Pacific Rim, the increasing human population in California, Oregon, Washington, Idaho, and southern British Columbia led to the significant reduction in populations through harvest, water development and diversion, urbanization, logging, mining, and agriculture. Currently, wild salmon are generally rare with fisheries supported by extensive hatchery production. There will be a future of wild salmon in these four states and southern British Columbia, but that future may not be one that sustains many wild salmon. Sustaining significant runs of wild salmon in the future, and the watersheds which depend on them, depends on implementing policy choices that address the increasing human population and major life-style changes in the region.

Pacific salmon are the focus of much concern on the Pacific Coast of North America. Historically, the fish provided substantial quantities of high quality food and sought-after recreation from southern California to Alaska. Their preservation and restoration has long been a widely held public policy objective. In spite of the often soothing rhetoric offered by Federal, State, and Tribal organizations, along with feel-good campaigns by various advocacy organizations, there is a gap between the status and needs of salmon and the political will to alter their status. What are the basic and relevant facts surrounding wild salmon? What do we know about them? We would like to discuss some aspects of the salmon's past, present, and future in the Pacific Coast especially from California through southern British Columbia. Our intent is not to belittle the efforts of any individual or organization, but, rather, bring a strong dose of reality to ongoing discussions about the future of wild salmon.

In order to maintain or restore wild salmon populations in this region it will be necessary to make some politically and personally distasteful policy choices if society is truly interested in restoring significant, sustainable runs of wild salmon. First, if society is indeed serious about assuring the future of wild salmon, then there is the need to significantly limit human population and its ever expanding footprint. Second, harvest must be greatly reduced until such time as wild runs reach a point where they are much closer to their historic escapement abundance. If society chooses to perpetuate the current situation, the future is for remnant runs of <u>wild</u> salmon in the Pacific Northwest by 2100, if not significantly sooner. We think that any credible assessment of the current situation and trajectories will come to the same conclusions.

Runs of wild salmon in California, Oregon, Washington, and Idaho are typically less than 5% of their historical size. Many runs are extinct. (Photo: Bob Lackey)

How did we come to this simple, but sobering conclusion? Here we will briefly summarize our analysis.

First, we are talking about wild, naturally produced salmonids. The five species historically called salmon; Chinook, coho, pink, chum, and sockeye are our focus. The anadromous trouts, steelhead and cutthroat, and the Dolly Varden/bull trout are similarly depressed but with significantly more complex life histories and won't be considered here.

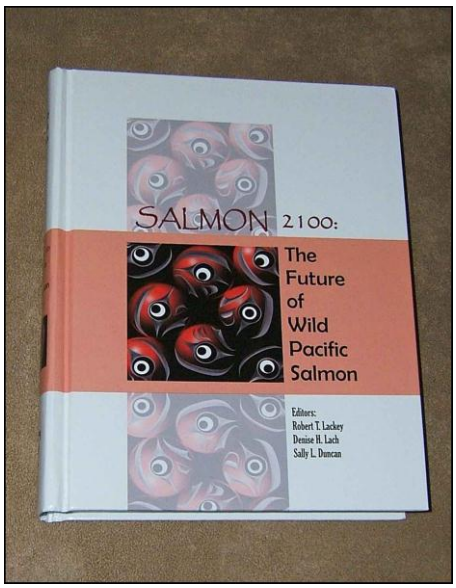
From California to southern British Columbia, fisheries directed at Chinook and coho salmon are primarily supported by hatchery-produced stocks. Fisheries directed at sockeye, pink, and chum salmon continue to be supported primarily by wild fish. Here, sustainable fisheries are those fisheries that occur after the productivity of the ecosystem is maintained. Wild salmon are one of the keystone species in Pacific Northwest watersheds. They provide significant amounts of nutrients to drive the ecosystem and services such as gravel cleaning. Currently, as will be discussed later, most salmon management results in spawner numbers that are about 1-5% of the spawning levels seen in the pre-1850s. When coupled with the same management practices on other resources, the result is that the whole ecosystem cycles significantly less energy and nutrients; the result being that animal populations are nearly always reduced.

Salmon enjoy an iconic status for many people in the coastal western states. (Photo: Bob Lackey)

Farms, roads, schools, airports, and parking lots all increased the challenges for maintaining wild salmon runs. (Photo: Bob Lackey)

Given that public policy goals focus on naturally produced (wild) salmon, then the role of supplemental stocking from hatcheries must be clarified. Hatchery produced salmon are the technological alternative to naturally produced fish. They are a partial substitute for wild fish. They provide harvestable fish that supply consumer's desire for fish. In fact, they provide significantly more harvest because they are incubated and reared in protected environments that result in an individual spawner producing more adults. Hatchery produced fish require a significantly smaller investment in land, water, and habitat protection. A terrestrial example would be Bison. Bison once existed in immense

numbers, but now are significantly reduced. The land is being used for other purposes and the protein is supplied by densely-reared cattle.



The Salmon 2100 Project provided a rigorous, no-nonsense analysis of the future of wild salmon in the western states and British Columbia.

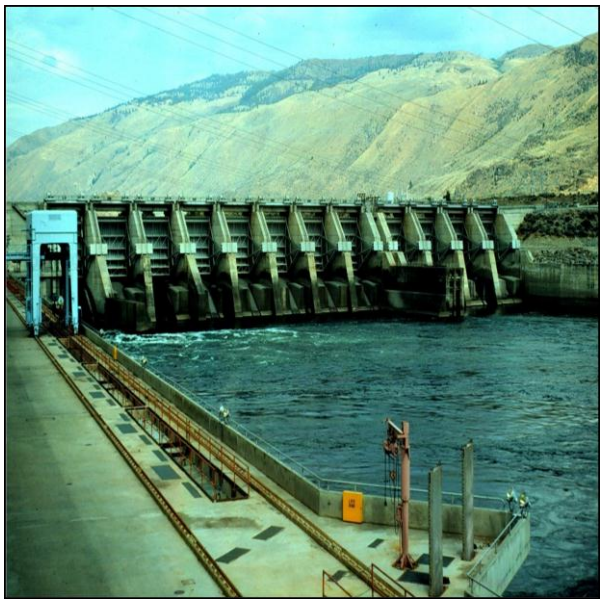
The primary challenge to evaluating the past abundance and distribution of salmon in the region is the fact that the first humans in the area were poor record keepers by contemporary standards. There are no written records and oral records provide only a very general assessment of the status of salmon runs. Regardless, salmon were abundant enough to support indigenous peoples, support nutrient replenishment to watersheds, and support terrestrial and marine predators.

Journal and newspaper accounts provided by the next wave of people were much more quantifiable than oral tradition. Catch records were kept from the mid-late 1800s onward. By the mid-1900s there was some effort to collect spawning escapement data. Also in the mid-1900s, and expanding over the years, was the development of fisheries remote from the stream or origin, concentrating on mixed stocks of immature fish. This makes accounting for catch by stock significantly more difficult. The greater the mixed stock harvest, particularly of immature fish, fish with multiple age classes, and different species in the fishery, the less confidence one can have in data on the total size and productivity of the run. This makes the evaluation of and determination of spawner escapement goals more difficult.

The best record we have of historic salmon abundance is contained in lake sediments, tree rings, and other sites that sequester marine derived nutrients. Among these data sets the longest is associated with Karluk Lake, in Alaska. The data show that the present run and particularly spawning escapement, managed on a sustainable basis, is significantly smaller than it was prior to the commencement of industrial fisheries. The take-home message here is that this lake system supported significantly more salmon than it does now, that it also has supported significantly fewer fish than it does now, and that given the opportunity salmon populations can rapidly expand. The reconstruction of salmon runs back to 250BC in Karluk Lake (Alaska) showed that salmon runs were pretty variable on the multiple century time-frames.

This long-term data set offers many intriguing areas of study. How did the medieval warming (900 – 1200) affect salmon? We appear to be going into a similar warming period. It would be interesting to compare salmon runs from 900-1200 with the Little Ice Age (1400-1850)

to obtain a comparison. That would give us some idea of what the effects on salmon of the current warming might be. Currently, the retreat of glaciers in Glacier Bay, AK, is allowing us to see how newly created streams are colonized by salmon.



Dams and irrigation structures have greatly altered the freshwater environment for salmon. (Photo: U.S. Army Corps of Engineers)

The present status of salmonid stocks is very mixed on both sides of the North Pacific. In a broad-brush view, wild salmonids are increasingly abundant as one moves north. Generally speaking, as the density of humans in watershed increases the density of wild salmonids decreases. There are exceptions but the general rule, particularly for wild anadromous fish, is that they are most abundant in Alaska, northern BC, and the Russian Far East and then decline to the southern end of the range where most populations are at risk of extinction or have been extirpated. Japan would appear to be an anomaly in that the nation has a dense human population and large runs of salmon. The runs, though, are primarily supported through hatcheries.

The current depressed size of wild salmon runs along the West Coast is not a new phenomenon, associated only with that area. Nor is it unique. The decline in wild salmon numbers started with the California gold rush in 1848; the causes included water pollution, habitat loss, over-fishing, dams, irrigation projects, predation on salmon by many species, competition with hatchery-produced salmon and non-native fish species, and many others. Scientists, managers, and policy makers have known this for a long time.

It is also true that the long-term decline is not uniformly downward. There are periods of apparent reversal. For example, the most common measure of salmonid abundance is catch. In the last few years Alaska has had a harvest of 47 million pink salmon, in 2010 the Fraser River sockeye run was the largest since 1913, and the Green and Puyallup river systems in Puget Sound have had pink salmon runs in excess of a million fish, which is significantly higher than any previously recorded run. At the same time, and in the same watersheds, Chinook and steelhead runs number in the multiple hundreds to few thousand and are showing little or no consistent increase.

The future of wild salmon in the Pacific Northwest was comprehensively assessed in The Salmon 2100 Project. The Project was publically presented in 2005 at the national meeting of the American Fisheries Society and summarized in a 2006 book. As the Project's participants forecast, the situation since then has continued to deteriorate. A series of drivers were identified in Salmon 2100, the primary two being the number of people and their demands on ecosystem services. As David Montgomery pointed out in *King of Fish*, man has consistently destroyed wild anadromous salmon populations across Europe, eastern North America, and now western North America, China, Taiwan, Korea, and Japan. Since the Salmon 2100 Project completion the situation as regards wild Pacific salmon's future has gotten even clearer.

The unfortunate reality is that as the density of human population increases in a watershed, the density of wild anadromous salmonids declines. The solution is simple, elegant, and politically unacceptable, at least in the past. Keep the human footprint in watersheds to levels commensurate with fully functional salmonid driven ecosystems. Even preserving the watersheds will not be enough to ensure the long term survival and productivity of these salmonid-driven ecosystems. It will be necessary to preserve and restore the marine ecosystems to levels of production that will support the salmonids. Current management paradigms for most aquatic species seek to keep spawner numbers in the neighborhood of 20-30% of what the spawner number would be in the absence of the intense industrial harvest. When this is applied across the board for fish resources from low on the food chain fish such as herring, anchovy, menhaden, and sardine up through the various predator levels one finds that the system is having a significant fraction of its production removed. Less herring means that salmon have fewer to eat. This becomes a cascade where the productivity of the whole ecosystem is reduced.

As the human population of the coastal western states expanded, the amount of altered land greatly increased. (Photo: Bob Lackey)

In conclusion, wild salmon in California, Oregon, Washington, Idaho and southern British Columbia are in serious trouble. Runs of wild fish are generally less than 5 percent of their pre-1850 levels and more than two dozen are listed as threatened or endangered under the U.S. Endangered Species Act. Worse, from California to British Columbia, many runs have completely disappeared, and more will follow unless there is a reversal of the long-term downward trajectory. The future of wild Pacific salmon, especially in the Lower 48, is expected

Supplemental stocking of salmon from hatcheries currently supports most fishing, but hatchery produced salmon do not fully replace the biological role of wild salmon. (Photo: U.S. Army Corps of Engineers)

to be similar to what exists in France, Spain, England, Germany, China, Taiwan, Korea, and the eastern coast of North America. That is, remnant runs until such time as the water temperatures and flows are incompatible with salmonid life. The future is for significantly reduced populations of wild salmon and the resources that depend on them such as killer whales, grizzly, and Bald Eagles.

If the 160 year trend in the North Pacific, and millennia in the North Atlantic, is to be changed, then something must be done about the unrelenting growth in the human population level along the West Coast. Currently, Oregon, Washington, Idaho and British Columbia are home to 15 million humans. By 2100, the area's human population will be somewhere between 50 million and 100 million, Similarly, extrapolating population growth rates for California, by 2100 that state alone will be home to over 160 million people. By 2100, from California to British Columbia, there could easily be 200 million to 250 million people.

Scientific experts need to tell the public the blunt truth: The options for restoring naturally reproducing wild salmon runs and their ecosystems in California, Oregon, Washington, Idaho, and southern British Columbia to significant, sustainable levels are, and will continue to be, greatly constrained and it is delusional to think otherwise. With so many more people inhabiting the West Coast, consider the demand for houses, schools, stadiums, freeways, planes, trains, automobiles, coffee shops, restaurants, malls, air conditioning, drinking water, pipelines, computer chips, smart phones, ski resorts, golf courses, sewage treatment plants, and well-manicured, green lawns, the options for sustaining large runs of <u>wild</u> salmon are minimal. Lacking significant political will to limit human population and harvest, the future is for remnant runs of <u>wild</u> salmon if we end up with the same number of people, much less if there are 3, 4, or 5 times more people in the

Good salmon habitat is pretty obvious, but sustaining such habitat with a rapidly increasing human population is extremely difficult. (Photo: Bob Lackey)

PNW by 2100.

The Russian Far East, Alaska, and Northern British Columbia generally have intact, unaltered freshwater habitats and, therefore, their salmon runs are typically close to historical levels. (Photo: Bob Lackey)

For those of us who are salmon biologists, it is easy to find comfort in debating the nuances of hatchery genetics, describing the intricacies of the U.S. Endangered Species Act, arguing about the likely consequences of dam breaching, determining the stream flows that maximize spawning success, tweaking fishing regulations to protect the few remaining wild salmon, quantifying the effects of shooting marine mammals, and forecasting the impact of climate change — and all the while unintentionally mislead the public about the realities of the future for wild salmon. As discomforting as it may be to describe the future of wild salmon given society's apparent values and preferences, we are obligated to convey the blunt reality about society's choices. Otherwise, we simply squander our professional credibility to become acolytes of delusion. Whether to change salmon policy is up to society, not us, but society is entitled to know the full truth.

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