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Salmon in Western North America: *Assessing the Future*

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1. Introduction

The [future of salmon](#) in California, Oregon, Washington, Idaho, and southern British Columbia is not bright even though people in the region have been and continue to be concerned about the decline of the once immense salmon runs. [Billions](#) of dollars already have been spent in a so-far failed attempt to reverse the long-term decline, which is largely due to altered or inaccessible freshwater and estuarine habitat. The option of using hatcheries to maintain runs is another story, but given the limited quantity and quality of spawning and rearing habitat now available to salmon, the region will not support self-reproducing runs of *wild* salmon even remotely like those of the [1840s](#).

Wild salmon in California, Oregon, Washington, Idaho, and southern British Columbia have been on a 160-year [downward trend](#) and are now at very low levels. Efforts to reverse the decline have been extensive and expensive, but have not met with much success.

Our choices, both individually and collectively, are the most important determinant of the future of wild salmon. Salmon are only one of many, usually conflicting, priorities that society professes to rank high. [Societal priorities](#) are difficult to measure and subject to change. Forecasting changes in societal values several decades in the future is problematic.

2. The Salmon 2100 Project

The [Salmon 2100 Project](#) began in 2002 as a response to the apparent dichotomy between public and private understanding of the likely future of wild salmon in the region. The overarching goal of the Project was to assess the potential policy options needed to protect and restore wild salmon runs from southern British Columbia southward to California.

Thirty-three salmon scientists, salmon policy analysts, and salmon advocates were enlisted, ranging from hardcore technical scientists to aggressive champions of particular salmon recovery policies, and representing a spectrum from quasi-institutional to highly individual opinions. The authors often did not agree with each other. Several only grudgingly concede each others' right to an opinion about salmon recovery. Nonetheless, all their views enriched the current debate and the book, whether we agree

with them or not.

Project participants were asked to identify and describe practical policy options that, if adopted, could successfully sustain significant runs of wild salmon in California, Oregon, Washington, Idaho, and southern British Columbia. We did not define what should be considered a significant run, but it was something sufficient to allow for at least some level of [sustainable fishing](#).

Everyone who participated in the project recognized that restoring and maintaining wild salmon in significant numbers through this century is a daunting challenge. Since 1848 with the discovery of gold in California, salmon runs have dramatically declined across the region due to many direct causes: water pollution; loss of spawning, rearing, and riparian habitat from a multitude of human actions; over-fishing; dam construction; water withdrawal for irrigation and industrial uses; and competition with hatchery-produced salmon and various non-indigenous fish species. These direct causes of the decline were the result of [policy choices](#) that reflected society's overall priorities.

The purpose of the Salmon 2100 Project was not to advocate in favor of any particular policy. Rather, it endeavored to stimulate serious and informed dialog about the likely future of wild salmon, along with presenting the choices society has regarding the future of wild salmon.

The prescriptions offered in the book are universally candid, sometimes uncomfortably radical, and occasionally sobering. Nearly all participants concluded that major, sometimes wholesale modification of core [societal values](#) and preferences would have to occur if significant, sustainable populations of wild salmon are to be present in the region by 2100.

3. Policy Prescriptions that Would Work

All Salmon 2100 Project participants were asked to address the same question:

What specific policies must be implemented in order to have a high probability of sustaining significant runs of wild salmon through 2100 in California, Oregon, Washington, Idaho, and southern British Columbia?

This challenging question forced project participants to address society's failure to restore wild salmon. The salmon recovery [policy debate](#) is a puzzle that is characterized by: **(1)** claims by a majority to support the restoration of wild salmon runs; **(2)** competing societal priorities; **(3)** the region's rapidly growing human population and its pressure on all natural resources (including salmon and their required habitats); **(4)** society's expectation that [experts](#) should be able to solve the salmon problem by using a technology; **(5)** use of selected experts and "[scientific facts](#)" by political proponents to bolster their policy positions; **(6)** lack of a trusted source of scientific information because many [scientists](#) wind up as supporters of a particular political faction; and **(7)** the confusion caused by presenting value-based [policy preferences](#) as scientific fact.

Somewhat surprisingly, nearly every project participant concluded that current recovery efforts have a low probability of success. Yet none of the participants considered recovery hopeless, and all concluded that salmon recovery could be accomplished. There was considerable disagreement about how best to recover wild salmon runs, but each author was able to formulate at least one recovery strategy that, if implemented, could potentially restore wild salmon runs to significant levels.

[Policy prescriptions](#) tend to fall into one of several broad categories.

5.1 Category #1 — Employ Technological Intervention

Several authors proposed habitat enhancements or replacements based on existing technology, including creation of new streams that replace lost or suboptimal salmon habitat. An engineered stream could duplicate or even improve natural habitat by providing excellent security, flow control, and [nutrient](#) productivity. While much of the scientific knowledge exists to construct these streams, the proponents recognized that new technologies will be needed for efficient operation and refurbishing of streams. Greater genetic knowledge of local stocks would be critical to maintaining salmon distinct to particular watersheds. These proponents suggest that by using technology and what we currently know about salmon habitat, society could reverse the proximal causes of salmon habitat loss by removing dams, allowing floods, restoring vegetation, and reducing logging and road building.

Several authors argued that supplemental stocking from salmon hatcheries will be required to sustain salmon production at fishable levels. While most authors found fault with current hatchery practices, a [few](#) suggested that the controversy over *wild* vs.

hatchery salmon is misplaced. They argued that the dispersal of hatchery fish to different streams over many decades has resulted in a massive mixing of the gene pool. Recovery programs to achieve genetic purity are thus unrealistic and unnecessary.

Many authors suggested that if a harvestable number of salmon is desired by society, improvements in hatchery effectiveness will be critical. In their view, technology is currently available — or soon will be — to make supplemental stocking a useful tool to assist in salmon recovery.

5.2 Category #2 — Apply Ecological Triage

One category of policy prescriptions focused on concentrating resources and recovery efforts on the most productive watersheds. The rationale is that rarely has anyone successfully restored a run once it had become threatened or endangered, in spite of spending [billions](#) of dollars and many years in the effort.

Various authors proposed different types of “triage” approaches, but they shared a common philosophy that at least some streams should be managed as refugia where there is no salmon harvest or other detrimental practices allowed.

One proposed, for example, a Wild Salmon National Park distributed across the area and purchased with public money. In support of this proposal is the observation that one of the most successful methods for protecting endangered species is to provide national parks where citizens are allowed to experience species in their habitat. Several other triage policy prescriptions included as their core element creating salmon sanctuaries in watersheds where salmon would be protected and restored over the next 100 years and beyond.

These triage authors insisted that such a sanctuary system is the only realistic way to ensure the survival of wild salmon given the downward pressures they will face in California, Oregon, Washington, Idaho, and southern British Columbia through this century. But with nearly all the triage prescriptions, there was great reluctance to bluntly identify the [political downside](#), or to be explicit about “writing off” the watersheds and regions that show little promise for maintaining wild salmon runs through the century.

5.3 Category #3 — Change Bureaucracy

Several authors linked the failure of wild salmon recovery to deficiencies in various elements of governance, or to failures of specific organizations. From their perspective, successful salmon recovery would require major changes in “the bureaucracy”.

Several authors observed that bureaucratic institutions, especially state, provincial, and federal management agencies, have many [practices and ideologies](#) supporting the continued existence of the institution rather than the solution of any particular problem.

Authors identified many examples of what they perceive to be institutional incompetence in salmon recovery: applying inflexible rules, protecting the institution (or individual) rather than the salmon, and allowing elected officials and/or citizens to make recovery decisions not based on the best available science.

Policy prescriptions included moving toward a much more decentralized recovery effort with rural residents playing leadership roles. Others encouraged the appointment of government leaders who are more willing to solve problems based on the best available science rather than on personal preferences or philosophical beliefs.

5.4 Category #4 — Domesticate the Policy Issue

The prescriptions from some of the authors were what political scientists call “domesticating” the policy issue.

Domestication is the process of taking difficult, divisive policy issues off the table until a solution emerges or the problem disappears by solving itself (e.g., the species is extirpated). The most common forms of domestication are funding more research, more workshops and venues to get stakeholders involved through collaboration, and tweaking current regulations to provide the illusion of substantive action.

It is easy to see why offering policies to *domesticate* the salmon decline policy challenge is easier than developing policies that would actually work. Reversing the long-term decline requires changing at least some of the current political realities: **(1)** most [rules of commerce](#) and economic growth work against salmon recovery; **(2)** increasing

scarcity of key natural resources, especially high quality water, will constrain ecological options; (3) the current trajectory for the region's [human population](#) precludes some frequently stated recovery goals; and (4) individual and collective [life-style preferences](#) demonstrate that recovery is less important than many advocates assert.

Few authors explicitly proposed ways to change these political realities. Instead, they suggested variations on existing policy options to revise the [Endangered Species Act](#) (U.S.) or the Species at Risk Act (Canada), protect more salmon habitat, create more effective hatchery practices, add a "salmon awareness" component to K-12 education, and/or transform people's attitudes to natural ecosystems and specifically wild salmon runs.

Most domesticating strategies did not propose revolutionary approaches or a fundamental challenge to existing beliefs. Rather, they tacitly assume that at some future time we will formulate and agree on a viable solution. In reality, the public may not even be sure what the problem is, much less know what possible solutions exist.

4. Reflections about the Salmon 2100 Project

Collectively, we need to engage new ways of thinking; we need to recognize that politics and power structures, not science, make natural resource decisions; and that transformation of our approach is essential if indeed we wish to save wild salmon in appreciable numbers by 2100.

The way forward will not be through a single solution: more science will not restore significant, sustainable runs of wild salmon if institutional arrangements are inflexible; new institutional arrangements will not restore salmon runs if economic priorities are not reassessed; and technological fixes alone will not allow us to muddle through this phase of problem solving. There is not a single policy prescription (that has any chance of widespread adoption) that will quickly restore endangered salmon. And if we accept the future challenges, we have to accept that some of the current "unmentionables" may become more politically and socially palatable over the next 100 years.

5. The Near-term Future

Historians of 2100 may wonder why we spent billions of dollars on attempting to recover salmon when we had so many other pressing needs. Perhaps part of the current impasse is caused by the fact that we have not clearly agreed about whether there even is a problem worth fixing. Society may eventually decide that the best we can do is to create large-scale salmon “zoos” like we have for buffalo in Yellowstone, so that our great-grandchildren will have a tangible reminder of California, Oregon, Washington, Idaho, and southern British Columbia of the 1800s. Ultimately it is society at large that must become knowledgably engaged in the salmon policy debate if intelligent, efficacious decisions are to be made.

Consider 2100, less than 10 decades away, only a few dozen generations of salmon beyond today’s runs, just 2 or 3 Pacific Decadal Oscillations from now. In my view, for fisheries experts, it is a time for neither crippling pessimism, nor for [delusional optimism](#). Rather, it is a time for uncompromising ecological realism and forthright policy analysis.

6. Acknowledgements

The Salmon 2100 Project, four years in the making, resulted in 23 policy alternative prescriptions developed by 33 senior salmon scientists, policy analysts, and wild salmon advocates. The contributions from these individuals in shaping my thinking about the future of salmon was immense. In addition, my two co-project leaders, Denise Lach and Sally Duncan, with their sociological and political science perspectives, worked diligently to broaden my technocratic view of ecological policy, a view formed largely by spending my professional career surrounded by other biologists. This article benefited greatly from candid review provided by colleagues. Outside reviewers are always helpful and appreciated. Particularly important were the suggestions provided by Joan Hurley.

7. Summary

The overall public policy goal of restoring runs of wild Pacific salmon in California, Oregon, Washington, Idaho, and southern British Columbia enjoys widespread public support. Billions of dollars have been spent in a so-far failed attempt to reverse the long-term, general decline of wild salmon in this region of western North America. Of the Earth's four regions where salmon runs occurred historically (Asian Far East, Atlantic Europe, eastern North America, and western North America), it appears probable that this region of western North America, without a dramatic change in current and long-term trends, will emulate the other three: extirpated or much reduced runs. Since 1850, an array of factors has caused the decline and a plethora of specific impediments has prevented their recovery. The primary goal of the Salmon 2100 Project was to identify practical options that have a high probability of maintaining biologically significant, sustainable populations of wild salmon. The Project enlisted 33 scientists, policy analysts, and policy advocates, all well versed and experienced in salmon science and policy. Three overarching realities must be addressed if society wishes to prevent the remaining current runs from becoming remnant populations by 2100: (1) in large part, because of altered and restricted freshwater habitat, salmon runs continue to be at low levels compared to historical abundances and thus recovery efforts start with relatively few wild fish; (2) restoring wild salmon is only one of many priorities that society professes and society must make drastic changes in individual and collective life style choices if wild salmon have any chance at recovery; and (3) the human population trajectory for British Columbia, Washington, Oregon, and Idaho must change dramatically for any wild salmon recovery effort to have much chance of success (California's human population is already large and will be much larger by 2100). The Salmon 2100 Project developed 23 different recovery strategies, each of which likely would be ecologically viable (i.e., it would actually recovery wild salmon) and appreciably less socially disruptive than are current strategies, but each of the 23 options also has much more modest restoration objectives, requires extensive hatchery or other aquacultural intervention, and/or involves creating protected areas. Most policy prescriptions fall into one of four general categories: (1) technological intervention often accompanied by a recalibration of the notion or definition of what is a "wild" salmon; (2) triage approaches that would concentrate recovery efforts on areas where successful recovery is most likely; (3) revamped salmon recovery bureaucracies and institutions including jettisoning "symbolic politics" pervasive in salmon policy; and (4) changed individual and societal behaviors. The policy prescriptions developed as part of the Salmon 2100 Project, if implemented, would likely restore wild salmon runs, though most would require significant alterations in people's lifestyles.

8. Further Reading

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Author Profile

Dr. Robert T. Lackey, senior fisheries biologist at the U.S. Environmental Protection Agency's research laboratory in Corvallis, Oregon, is also courtesy professor of fisheries science and adjunct professor of political science at Oregon State University. Since his first fisheries job more than four decades ago mucking out raceways in a trout hatchery, he has dealt with a range of natural resource issues from positions in government and academia. His professional work has involved many areas of natural resource management and he has written 100 scientific and technical journal articles. His current professional focus is providing policy-relevant science to help inform ongoing salmon policy discussions. Dr. Lackey also has long been active in natural resources education, having taught at five North American universities. He continues to teach a graduate course in ecological policy at Oregon State University and was a 1999-2000 Fulbright Scholar at the University of Northern British Columbia. A Canadian by birth, Dr. Lackey holds a Doctor of Philosophy degree in Fisheries and Wildlife Science from Colorado State University, where he was selected as the 2001 Honored Alumnus from the College of Natural Resources. He is a Certified Fisheries Scientist and a Fellow in the American Institute of Fishery Research Biologists.

