# Six Policy Realities Revealed by Analyzing the 200-Year Salmon Decline on the Pacific Coast

**Robert T. Lackey**
Department of Fisheries, Wildlife, and Conservation Sciences
Oregon State University
Corvallis, Oregon 97331

**Abstract:**

The huge decline of salmon runs in California, Oregon, Washington, Idaho, and southern British Columbia has been typical of those that have occurred elsewhere. No one was bent on eradicating salmon. Similarly, at least abstractly, everyone is generally in favor of "saving" salmon runs. Additionally, for many years, scientists have had a fairly solid understanding of the major causes of long-term decline, although the relative importance of individual causes remains subject to debate. Rather than sinister motives or lack of knowledge, it is the reality that policy choices are made among *desirable* but *conflicting* alternatives. For *every* salmon recovery option, the benefits come with costs for particular segments of society. Thus, from a policy perspective, achieving the goal of restoring salmon entails many of the characteristics of a *zero-sum game*. What is the policy dynamic that causes this impasse to persist for decades and centuries? I propose that it is driven by six nearly immutable *realities* about salmon policy. Failure to seriously consider (and change) these realities will perpetuate the 200-year history.

**Salmon Policy Reality 1** — Despite its noble intent, the ESA, as currently written and interpreted by courts, does not well serve salmon recovery, and may be a hindrance in some situations, and such discussions are essentially taboo.

**Salmon Policy Reality 2** — Fisheries scientists, managers, and analysts are systemically pressured to avoid explicitly conveying unpleasant facts or trade-offs to the public, senior bureaucrats, and elected or appointed officials.

**Salmon Policy Reality 3** — For *wild* salmon, especially, the rules of commerce, especially trends in international commerce and trade, tend to work against increasing their numbers.

**Salmon Policy Reality 4** — Competition for critical natural resources, especially for water, will continue to increase and will work against recovering salmon.

**Salmon Policy Reality 5** — The aggregate resource demands of humans will continue to swell, thus tending to work against increasing the abundance of salmon, and this fact is rarely made clear to the public.

**Salmon Policy Reality 6** — Individual and collective lifestyle preferences directly determine the future of salmon, and substantial changes must take place in these preferences if long-term downward trends are to be reversed.

## Introduction

The huge decline of salmon runs in California, Oregon, Washington, Idaho, and southern British Columbia has been typical of those that have occurred elsewhere. In other regions of the world where salmon were once plentiful, the increasing human population and consequent alteration of the landscape coincided with a decline in salmon abundance. Thus, what is happening to salmon runs along the Pacific Coast of North America is the latest example of a pattern that has played out multiple times in other locations.

Until the 1800s, large runs of *Atlantic* salmon were found in many coastal rivers of western Europe and eastern North America. By the mid-to-late 1800s, many of these runs were drastically reduced, concurrent with population growth and economic development. Overall, salmon runs continue to be much diminished on both sides of the Atlantic Ocean. The largest remaining runs, although shrunken by historical standards, occur in eastern Canada, Iceland, Ireland, Scotland, and the northern rivers of Norway, Finland, and Russia, locations with relatively few people and limited landscape alteration. Nevertheless, Atlantic salmon are readily available in the retail market because aquaculture provides an ample supply.

Overall, the original abundance of Pacific salmon was much greater than that of Atlantic salmon. Regardless, Pacific salmon (Chinook, coho, sockeye, chum, pink, and steelhead) found on both sides of the North Pacific declined significantly from historical levels, although not as dramatically as Atlantic salmon. Hatchery production has been used to maintain most runs in southern portions of the range (*e.g.*, Japan, Korea, California, Oregon, and Washington). In California, Oregon, Washington, Idaho, and southern British Columbia, runs that are sufficiently large to support commercial, recreational, and tribal fishing, comprise mainly hatchery-produced salmon. Runs of wild salmon in the northern portions of the range (*e.g.*, Russian Far East, Alaska, Yukon, and northern British Columbia) are in much better condition, although there are large hatchery programs in these regions as well. There are indications that salmon numbers are increasing in Arctic habitats.

Beginning in the mid-1800s, following the discoveries of gold in California and elsewhere, restoring much-reduced salmon populations in California, Oregon, Washington, Idaho, and southern British Columbia has been technically challenging, socially contentious, and politically painful. Overall, past recovery efforts for *wild* salmon (in contrast to salmon bred and raised in hatcheries) have been largely unsuccessful. Over many decades, thousands of scientists have been involved with salmon recovery efforts, but prospects for the recovery of wild salmon remain elusive. Of the thousand-plus distinct Pacific salmon populations that occurred before 1848 in California, Oregon, Washington, Idaho, and southern British Columbia, an estimated 29% are extinct. The remaining

populations of wild salmon are greatly reduced, usually at less than 5% of their historical levels, and many are formally listed as either threatened or endangered as mandated by the Endangered Species Act. Salmon recovery efforts are costly, although determining which specific expenses should be considered legitimate recovery costs is an ongoing and contentious debate. Considering only the Columbia River Basin, for example, salmon recovery costs have totaled billions since 1978, although part of this cost estimate reflects the electricity sales lost (e.g., "forgone revenue") when the hydro system curbed generation to meet constraints imposed by salmon recovery requirements.

As a public policy case study, I characterize wild salmon recovery in California, Oregon, Washington, Idaho, and southern British Columbia by several apparent conundrums:

1. For well over a century, both scientists and the public have recognized the dramatic decline of wild salmon runs, but consensus remains elusive on a recovery policy that would actually work.

2. Billions of dollars have been spent to restore wild salmon, but their overall, long-term downward trajectory continues.

3. Many populations of wild salmon are listed as "threatened" or "endangered," but wild salmon are available seasonally in grocery stores, and farm-raised fresh salmon are sold year-round.

4. Thousands of scientists and other technological experts are employed to facilitate the recovery of wild salmon, but, over the long-term, salmon populations have rarely responded significantly.

5. The various species of salmon are among the most thoroughly studied fishes in the world, but the failure of recovery efforts is often attributed to a lack of scientific information.

6. Polling data show that the public is supportive of restoring wild salmon in general, but the politicians and most people are also reluctant to make specific policy choices that would actually recover wild salmon.

7. The Endangered Species Act (ESA), arguably the most powerful of U.S. environmental laws, has been extensively used by some policy advocates to force imposition of Federal authority (i.e., ESA listing), but this approach has been insufficient to achieve salmon recovery.

8. The overarching goal of the ESA is to protect at-risk species and the habitat upon which they depend, but this law, counterintuitively, may impede recovery of wild salmon in watersheds where the chances of recovery are greatest.

9. To offset the effects of certain dams on salmon runs, Federal, State, and Tribal governments are required to operate salmon hatchery programs to supplement runs to sustain fishing, but these programs may actually be hurting *wild* salmon runs.

10. Federal and state agencies are mandated to protect and restore wild salmon runs, but they are also tasked with promoting harvest (i.e., fishing), which can work against restoring wild runs.

Scientists tend to depict the policy debate as a scientific or ecological challenge, and the "solutions" they offer are usually focused on aspects of salmon science. There is a massive scientific literature about salmon, but the reality is that the future of wild salmon will largely be determined by factors outside the scope of science. More specifically, to effect a reversal in the long-term, downward trajectory of wild salmon, a broad suite of related public policy issues must be considered:

- *Hydroelectric energy — how costly and reliable does society want energy to be, given that wild salmon will be sacrificed to provide relatively cheap and reliable power?*

- *Land use — where will people be able to live, how much living space will they be permitted, and what personal choices will they have in deciding?*

- *Property rights — will the acceptable use of private land be altered, and who or what institutions will decide what is an acceptable use?*

- *Food cost and choice — will food continue to be subsidized by taxpayers (e.g., publicly funded irrigation, crop subsidies) or will the price of food be solely determined by a free market?*

- *Economic opportunities — how will high-paying jobs be created and sustained for this and subsequent generations?*

- *Individual freedoms — which, if any, personal rights or behavioral choices will be compromised or sacrificed if society is genuinely committed to restoring wild salmon?*

- *Evolving priorities — is society willing to substitute hatchery-produced salmon for wild salmon, and, if so, will the ESA permit this?*

- *Political realities — will society and the political dynamic support modification of the ESA such that salmon recovery expenditures can be shifted to those areas offering the best chance of success?*

- *Cultural legacies — which individuals and groups, if any, will be granted the right to fish, and who or what institutions will decide?*

- *Indian treaties — will treaties between the United States and various tribes, negotiated over 150+ years ago, be modified to reflect today's dramatically different biological, economic, and demographic realities?*

- *Population policy — what, if anything, will society do to influence or control the level of the human population in California, Oregon, Washington, and Idaho, or indeed the U.S. as a whole?*

- *Ecological realities — given likely future conditions (*i.e.*, warming), what wild salmon recovery goals are biologically realistic?*

- *Budgetary realities — will the fact that the annual cost of sustaining both hatchery and wild salmon runs in California, Oregon, Washington, Idaho, and southern British Columbia exceeds the overall market value of the harvest eventually mean that such a level of budgetary expenditure will become less politically viable?*

These are a few of the key policy questions pertinent to the public debate over wild salmon policy. Scientific information, while at some level relevant and necessary, is clearly not at the crux of the wild salmon policy debate. Scientists can provide valuable technical insights to help the public and decision-makers answer these policy questions, but science is only one input.

## Historical Context

The question of whether wild salmon will continue to exist in the western United States is not new. In California, Oregon, Washington, and Idaho, the decline started in earnest with the California Gold Rush. By the 1850s, excessive harvest and the impacts of

mining activities were decimating salmon in streams surrounding the California Central Valley. In response, by the 1870s, the Federal government had begun what would eventually become a massive hatchery program in an unsuccessful attempt to reverse the decline. A similar scenario to sustain salmon runs followed gold discoveries in other locations. By the late 1800s, supplemental salmon stocking from hatcheries was widespread from California to British Columbia.

Considering one specific example, by the late 1800s, even the massive Columbia River salmon runs had been greatly reduced, largely due to minimally regulated fishing. In 1894, the head of the agency that preceded the National Marine Fisheries Service proclaimed to Congress that the Columbia's runs were in very poor condition and declining. Before 1933, the year the first main-stem dam on the Columbia was finished, the total Columbia salmon run had been reduced to one-fifth or less of the pre-1850 level. One can argue that the most severe Columbia River salmon decline took place in the 19th century — not the 20th or 21st centuries — though that is not to suggest that the latter two centuries have been favorable ones for salmon.

In California, Oregon, Washington, Idaho, and southern British Columbia, supplemental stocking of juvenile salmon spawned and raised in hatcheries has long been used to sustain runs at levels sufficient to support fishing. On average, approximately 80% of the Pacific salmon in the United States are now of hatchery origin. Advocates for restoring wild salmon runs often assert that hatchery-origin salmon are an imperfect substitute for naturally produced (wild) salmon. In fact, many analysts have concluded that large-scale hatchery supplementation programs actually hinder the recovery of wild salmon because the relatively large numbers of hatchery-produced fish enable policy makers to allow fishing to continue. During fishing (whether conducted in open ocean, coastal, or river environments), some wild fish will be caught, and even though fishing regulations may require their release, some will die. Other opponents of hatcheries argue that the dispersal of hatchery fish to different streams over many decades has resulted in a massive mixing (and weakening) of the original gene pool. Hatchery-origin salmon do interact ecologically with wild salmon and, depending on the favored management goal, the effect can be positive or negative. Given the current relatively low levels of wild salmon, the absence of supplemental stocking from hatcheries would mean that salmon fishing would not currently be viable in California, Oregon, Washington, and Idaho, at least for the foreseeable future.

The salmon *policy* issue is full of paradoxes. For example, no species of Pacific salmon (Chinook, coho, sockeye, chum, pink, and steelhead) is in danger of extinction, but many distinct, locally adapted populations (also called runs or stocks) are extinct, and hundreds more are at risk. North American stocks that spawn in the "north" (northern

British Columbia, Yukon, and Alaska) are *generally* doing well, but most wild stocks that spawn in the "south" (California, Oregon, Washington, and Idaho) are not.

The decline in wild salmon was caused by a well-known but poorly quantified combination of factors, including: blockage of upriver habitat by dams built for electricity generation, flood control, and irrigation, as well as for many other purposes; loss of spawning and rearing habitat from various mining, farming, ranching, and forestry practices; unsustainable harvests from commercial, recreational, and subsistence fishing; unfavorable ocean and/or climatic conditions; reduced stream flow due to diversions for agricultural, municipal, or commercial needs; hatchery production to supplement diminished runs or produce salmon for the retail market; predation by marine mammals, birds, and other fish species; competition, especially with exotic fish species; diseases and parasites; and many others.

Salmon experts continue to study and debate what proportion of the decline in wild salmon is attributable to which factor. Having participated in numerous multi-organizational salmon science and policy meetings, I have observed that many affected organizations have developed, or funded the development of, sophisticated assessments of salmon populations that often end up — probably not surprisingly — supporting their organization's preferred policy. All major organizations involved in salmon recovery employ or have access to scientists. No one, not even the most astute salmon scientist, knows for sure the relative importance of the various factors that caused the decline of wild salmon. Debate over scientific issues often reflects clashing ethical attitudes, personal beliefs, and policy preferences.

There is also the incongruity of apparent high salmon *abundance* with simultaneous concern about *extinction*. Try explaining to the average person that salmon are at risk of extinction when fresh salmon are available year-round at the local grocery store. Most wild salmon sold in California, Oregon, Washington, and Idaho now come from Alaska and northern British Columbia. Salmon are still relatively abundant in these more northern locations due to the presence of comparatively unaltered spawning and rearing habitat, reasonably restrictive regulations to control harvest, and favorable ocean conditions. Also, large quantities of "farm-raised" salmon are available year-round from many sources (e.g., British Columbia, Norway, Scotland, Chile, and New Zealand).

In California, Oregon, Washington, and Idaho, salmon fishing rights guaranteed by treaties between certain Indian tribes and the United States Government further complicate salmon recovery. Tribal governments with treaty-established fishing rights are in the legal position of being co-managers, along with State governments, of salmon runs. Such an unusual legal context is one more policy feature that must be considered when

assessing the range of salmon policy options that are available to society. Tribal governments have become significant players in salmon policy debates, alongside numerous large and well-funded non-governmental advocacy groups.

## Salmon Recovery Successes

The various salmon species are impressively resilient, but the few recovery successes for *wild* salmon have been in locations where salmon spawning and rearing habitat was in comparatively good condition, migratory blockages from dams or other obstructions were not present or were minimal, and harvest occurred at levels that assured that sufficient numbers of adults reached the spawning grounds. The sockeye salmon runs of the Fraser River, British Columbia, are the best documented long-term example of at least partial recovery after decimation. In this case, the cause was the substantial 1914 Hell's Gate rockslide that hindered salmon migration. Runs recovered appreciably after fish passage was improved, stringent harvest controls were implemented, and other vigorous management actions were taken.

The resilience of salmon was also illustrated when a landslide (about 500 years ago) blocked the Columbia River just east of Portland, and salmon were thus prevented from reaching upriver streams to spawn. After the slide was breached naturally, salmon eventually reestablished themselves in streams above the blockage. Such blockages of the Columbia River and its tributaries almost certainly occurred at various other times.

In both the Fraser River and Columbia River blockages, freshwater salmon habitat was in excellent condition above the obstruction. Presently, there are few locations in California, Oregon, Washington, or Idaho where pristine spawning and rearing habitats are intact (pre-1850 condition) and accessible to salmon. For example, the distribution of salmon once included not only California, Oregon, Washington, and Idaho, but also Montana and Nevada. Today, river and stream blockages have left 44% of this original spawning and rearing habitat *inaccessible* to returning salmon.

## Endangered Species Act

Beyond the usual suite of historically competing policy priorities found in most natural resources issues, for the past 20 years, the ESA has become the major policy driver of salmon recovery. Advocates of salmon recovery have utilized this law to effect numerous changes in salmon policy; however, this has also led to several policy paradoxes.

For example, threatened or endangered salmon are the only ESA-listed animals for which a government routinely licenses large numbers of people to harvest them. If society's paramount salmon concern was with the depleted state of *wild* salmon runs in California, Oregon, Washington, and Idaho, government agencies could outlaw salmon fishing, cease supplementing runs with hatchery releases, and wait to see if wild salmon runs rebounded. Recreational, commercial, and tribal fishermen would object for various reasons, but most people would not be affected by a ban on fishing or stocking hatchery-origin salmon. Furthermore, farm-raised salmon (from British Columbia, Chile, Scotland, and Norway) would remain abundant and could continue to supply the retail market. Taxpayers would save hundreds of millions of dollars by closing the hatchery system and eliminating the subsidies currently needed to maintain salmon runs.

Beyond the ESA goal of restoring wild salmon, there is the broadly supported goal of sustaining recreational, commercial, and tribal fishing. Although most people would not be affected by a ban on salmon fishing, these interest groups would, and their political preferences are strongly advocated. Other support for continued hatchery operations comes from governmental organizations. State and tribal fish and wildlife agencies usually operate salmon hatcheries with funds provided by the Bonneville Power Administration, U.S. Bureau of Reclamation, U.S. Army Corps of Engineers, an assortment of private and public power companies, and the sale of fishing licenses. The loss of these funds and jobs would be bureaucratically traumatic to the recipient state agencies.

Ultimately, listing wild salmon as endangered or threatened, as defined by the ESA, means that everyone, not just fishermen, is affected. As mandated by court decisions, efforts to protect and/or restore wild salmon often conflict with many other individual and societal priorities. For example, two of the most visible contemporary examples of such conflict are the ongoing debate over how to balance Columbia River electricity generation with salmon survival, and the contentious lawsuits over how to divide up scarce Klamath Basin water among threatened salmon, endangered suckers, migratory waterfowl, treaty Indian tribes, farmers, and a host of other demands.

Critics often characterize the ESA as a naive piece of legislation in search of a credible public policy goal. The Act's consultation requirements aimed at avoiding actions that could jeopardize the continued existence of protected runs apply only to "Federal actions," but arguably, the most important actions affecting at-risk species occur in the private sector, and these are usually beyond the scope of the ESA. Critics have long doubted whether Congress, four decades ago, really understood the policy implications of passing the ESA. Most of the discussion at the time, these critics argue, involved the status of bald eagles and California condors. Was it anticipated that the ESA's grand, but ambiguous wording would result in sweeping Court interpretations? More specifically, did

Senators and Congressmen who voted for the bill grasp the Act's ultimate policy implications? Not likely — one point upon which both critics and supporters of the ESA agree.

Supporters of the Act, on the other hand, maintain that the ESA is forcing society to make the necessary, though painful, decisions for the future well-being of society or, perhaps, even society's very survival. What would be the status of wild salmon in California, Oregon, Washington, and Idaho had the ESA not been invoked? They assert that. while the Act may not be perfect, it is needed more than ever, as salmon declines clearly attest. Although there may be references to the economic value of salmon fishing, salmon serves as a cultural icon for certain segments of society. To other policy advocates, salmon may be a surrogate for the overall "health" of the natural environment. To yet other advocates, the fundamental policy debate is whether humans have a duty to save wild salmon from extinction.

## Recovery Goals and Objectives

Presupposing, abstractly at least, that society regards "saving" wild salmon populations as a worthwhile endeavor, substantial tension exists over what the *unambiguous* and *specific* recovery goal ought to be. For example, from an ESA perspective, should the policy goal be to save from extinction as a species, an evolutionarily significant unit, or an individual run? Such a policy objective (e.g., saving a species, an evolutionarily significant unit, or a run) can be achieved by conserving relatively low numbers of wild salmon (i.e., small, remnant runs), but such numbers would be insufficient to sustain fishing. Conversely, from a treaty rights perspective, advocates argue that the proper salmon recovery goal must be to levels sufficiently high to permit fishing. Or, from the perspective of recreational and commercial fishermen, maintaining runs at sufficiently high levels to sustain fishing should be the overarching goal, and achieving this goal requires heavy reliance on supplemental stocking from hatcheries. Perhaps even more contentious, *who* decides which goal is appropriate?

Beyond any ESA requirements, a much more challenging recovery objective is to increase runs of wild salmon to levels that would sustainably support fishing. Restoring wild salmon runs across their entire range to levels before 1850, or anything close to those run levels, is not realistic. Almost certainly, this objective is not achievable with *wild* salmon unless human impacts are reduced to pre-1850 levels. More fundamentally, will society continue to demand that salmon runs comprise entirely wild fish to achieve whichever level of recovery demanded? If recovery success is constrained to wild fish, it becomes much more challenging and would be especially difficult to produce enough fish

to support significant fishing. If hatchery fish are used to sustain large runs and salmon fishing is permitted, there will continue to be adverse effects on the relatively small portion of that run that is wild, but what level of adverse effect is acceptable to society? Given the social and monetary costs to restore *wild* salmon, perhaps much of the public would opt for using *hatcheries* to sustain runs, despite the adverse effects on wild salmon. Thus, there is no best approach to recovery, but rather a suite of alternatives with "best" largely being a function of which vision of the recovery objective one accepts.

No one is bent on eradicating salmon. Furthermore, scientists typically have a fairly solid understanding of the major causes of long-term declines, even if the relative importance of these causes is subject to debate. Rather than sinister motives or lack of knowledge, it is the reality that policy choices are made among *desirable* but conflicting alternatives. For *every* recovery option, the benefits come with costs. Thus, achieving the goal of restoring salmon engenders some of the features of a policy zero-sum game.

## Policy Realities

Given the complicated policy and ecological context of the salmon policy case study, coupled with my personal observations while participating in the bureaucratic process, what specific realities are to be learned? Whether these should be called policy lessons learned, frustrating truths, or candid insights, I propose that collectively they will circumscribe the future of wild salmon in California, Oregon, Washington, and Idaho. I will call them *policy realities*.

> **Salmon Policy Reality 1 — In spite of its noble intent, the ESA, as currently written and interpreted by courts, does not well serve salmon recovery, and may be a hindrance in some situations, and such discussions are essentially taboo.**

Beginning with the early listings of threatened or endangered salmon populations (i.e., *evolutionarily significant units* or *distinct population segments*) three decades ago, the ESA has been a powerful tool employed by salmon recovery advocates. Lawsuits have forced the allocation of billions of dollars for salmon recovery, as well as untold additional billions in direct and foregone private costs. Some advocates argue that such expenditures are justified because the bureaucracy is responding to society's wishes. Conversely, others argue that such expenditures are largely a waste of money and, worse, society has never been asked to choose between wild salmon and other competing policy priorities. In essence, they argue, the ESA has pre-empted the normal democratic process of selecting policy choices.

Legally, once a species is deemed at risk of extinction, then the full force of the ESA comes into play. In California, Oregon, Washington, and Idaho, many wild salmon runs are at risk because of the varied and collective actions of the human population. Wild salmon runs in the worst condition are almost always in rivers and streams least likely to ever support significant wild runs. There are, however, rivers and streams in relatively better condition, but salmon runs in these environments are not at-risk and therefore receive little of the benefit of ESA-mandated expenditures.

Some analysts argue that recovery resources ought to be spent on watersheds with the greatest chance of sustaining wild salmon, not in watersheds where success is very unlikely. Critics lambast this approach as a form of wild salmon *triage*. It is highly doubtful whether ESA has the flexibility to permit writing off certain rivers and streams (for wild salmon) and moving the recovery dollars to places where achieving success would be much easier. For example, what if the billions of dollars spent on restoring wild salmon to the California Central Valley and the Columbia River had been spent on watersheds of the California northern coastal watersheds and the coastal watersheds of Oregon and Washington?

After watching such recovery debates play out for decades and in spite of the social turmoil caused by ESA, it looks to me like society has already made a choice relative to the future of "wild" salmon in California, Oregon, Washington, and Idaho. Runs are now generally less than 5% of the 1850 levels. Most of the current runs in these four states are of hatchery origin, and society is not willing to alter its lifestyles to reverse the long-term decline. ESA will not greatly alter the long-term trajectory for wild salmon. Conversely, however, no one knows what would have happened to wild salmon had the money *not* been spent, although it is likely that they would be worse off.

In my interactions with senior government *bureaucrats*, they recognize most of the facts and realities surrounding wild salmon science and policy. I have also found that *politicians* generally recognize the facts and realities, at least in private. Those in leadership roles with *nongovernmental* advocacy organizations recognize them. Most definitely, knowledgeable salmon *technocrats* (including scientists) recognize the facts and realities. In short, the overarching "facts of the case" are rarely in dispute, but the probability of success of a specific recovery effort is.

As required by ESA and other laws and policies, billions of dollars continue to be spent to recover wild salmon, and such funding distorts the behavior of individuals and organizations. Bureaucratic, professional, and personal conflicts of interest, both real and perceived, abound. Because agencies are obtaining large amounts of funding to try to

reverse the decline, they are unlikely to publicly point out the obvious inadequacies of current recovery plans. Because many scientists receive significant research funding to work on interesting scientific questions, they are unlikely to point out the obvious defects in recovery plans. Because advocates from NGOs (and their lawyers) are well funded from membership fees and taxpayer-reimbursed costs for their lawsuits, they are not likely to point out the obvious. Because politicians use the argument that they are *already* spending billions to recover salmon runs, unpopular decisions do not have to be made (so they, too, are not likely to point out the obvious flaws in salmon recovery strategies).

**Salmon Policy Reality 2 — Fisheries scientists, managers, and analysts are systemically pressured to avoid explicitly conveying unpleasant facts or trade-offs to the public, senior bureaucrats, and elected or appointed officials.**

Over my career and involvement with salmon recovery, one fascinating aspect was the recurring recommendation, even a plea, from some colleagues to "lighten up" and be more *optimistic* and *positive* in assessing the future of wild salmon. Regarding salmon recovery, I am firmly in the camp that scientists and policy analysts ought to be blunt, realistic, and avoid both pessimism and optimism. Many colleagues tend to urge "realists" to abandon blunt assessments and forthright honesty in favor of a more encouraging sense of optimism.

Such a message to "lighten up" is also reflected in the comments of some colleagues in reviewing salmon recovery manuscripts. For example, a common sentiment is captured by one reviewer's comment on a manuscript: *"You have to give those of us trying to restore wild salmon some hope of success."*

In contrast, some colleagues, especially veterans of the unending political salmon wars, confessed their regret over the "optimistic" approach that they had taken during their careers in fisheries, and they now endorsed the "tell it like it is" tactic. They felt that they had given false hope about the effectiveness of fishways, hatcheries, and the ability of their agencies to manage mixed stock fishing. Many professional fisheries scientists have been pressured by employers, funding organizations, and colleagues to "spin" fisheries science and policy realism to accentuate optimism. Sometimes the pressure on scientists to cheerlead is blunt; other times it is subtle. For example, consider the coercion of scientists by other scientists (often through nongovernmental professional societies) to avoid highlighting the importance of U.S. population policy on sustaining natural resources. The existence of such institutional and organizational pressure is rarely discussed except among trusted colleagues but it is real.

Other colleagues took professional refuge in the reality that senior managers or policy bureaucrats select and define the policy or science question to be addressed, thus constraining research. Consequently, the resulting scientific information and assessments are often scientifically rigorous, but so narrowly focused that the information is only marginally relevant to decision makers. Rarely are fisheries scientists encouraged to provide "big picture" assessments of the future of salmon. Whether inadvertent or not, such constrained information often misleads the public into endorsing false expectations of the likelihood of the recovery of wild salmon.

For salmon experts, is adopting unfounded "professional" optimism a harmless adaptive behavior of little import? After all, "think positive" slogans are a hallmark of many self-improvement programs. What is wrong is that optimism does not convey the current state of wild salmon, and it allows the public, elected officials, and fisheries managers to escape the torment of confronting species triage. No one ever seriously argues that you can have wild salmon everywhere they once were, but few are willing to be explicit about identifying those locations where the cost is high and the chance of success is low.

I believe that fisheries scientists should be *realistic* and avoid being either optimistic or pessimistic. This professional stance does not covertly argue in favor of an "imperative" to save wild salmon or any other species, regardless of the cost to society, nor does it necessarily support a "defeatist" strategy. Such choices, at least in democratic forms of governance, are made by an informed public that is aware of the difficult tradeoffs. Furthermore, restoring wild salmon is only one of *many* competing, important priorities, and the public is entitled to be accurately informed about the long-term prospects of success.

In discussions about the future of salmon, for scientists at least, it is easy to find comfort in debating the scientific nuances of hatchery genetics, evolutionarily significant units, dam breaching, fishing regulations, predatory bird control, habitat restoration, atmospheric and oceanic climate, and thus to unintentionally mislead the public about the realities of the situation. As discomforting as it may be to disclose the future of wild salmon relative to society's apparent values and preferences, fisheries scientists should provide information and assessments that are policy-relevant but policy-neutral, understandable to the public and decision makers, and scrupulously realistic about the future.

It is not only fisheries scientists, managers, and analysts who avoid explicitly conveying unpleasant facts or trade-offs to the public. Such an inclination exists on the part of elected and appointed officials. The 200-year track record of salmon policy makers in California, Oregon, Washington, Idaho, and southern British Columbia has demonstrated an unceasing propensity on the part of elected and appointed officials to slip into the behavior

of "domesticating" the policy issue. By this, I mean the practice of removing difficult, divisive policy issues from the political table until a solution emerges or the problem resolves itself (e.g., the species is extirpated). The most common indicators of "domestication" include funding more research or scientific reviews, holding more workshops and venues to engage stakeholders through collaboration, forming more planning teams to assess policy options, and revising current regulations or policies. Starting in the 1850s with the first efforts by politicians to reverse the decline of wild salmon in the California Central Valley, policy domestication through generous funding of such activities has provided the public with the illusion of progress in salmon recovery.

To appreciate how the current political circumstances evolved, consider that offering political actions to *domesticate* the political conflict is easier than offering political actions that will *reverse* the decline. Thus, few elected or appointed officials will explicitly propose ways to change political realities about the recovery of wild salmon. Instead, they suggest permutations of existing policy options (e.g., revise the ESA, protect more and/or different salmon habitats, create new and/or modified hatchery practices, change K-12 education to stress the importance of wild salmon, and/or somehow transform attitudes through public awareness).

**Salmon Policy Reality 3 — For wild salmon, the rules of commerce, especially trends in international commerce and trade, tend to work against increasing their numbers.**

The rules of commerce and the marketplace over the long-term are not wild salmon friendly. The drive for near-term, low-cost production in free market economies is a widely professed approach to trade, both within nations and between nations. Wild salmon policy protagonists do argue whether so-called "free" markets are actually free, but my purpose is not to argue either in favor of or against such a philosophy of commerce. Rather, I conclude that the market will continue to adversely affect the status of wild salmon runs in California, Oregon, Washington, Idaho, and southern British Columbia.

I presume that "open trade" and largely market-driven economies will continue to be a dominant government policy through this century because the public broadly supports them. One consequence is that non-economic values, such as preserving at-risk wild salmon runs as required by the ESA, tend not to get weighted very heavily in decision-making.

This tendency is neither inherently good nor bad, but simply a fact. For example, *cell phones* and *computers* are generally obtained from wherever they can be assembled at the least cost. *Automobile assembly plants* typically locate where manufacturers can

produce cars most cost-effectively. *Electricity* tends to be generated in the most cost-efficient way. *Wheat* is primarily produced in areas where it can be grown most productively and consistently. *Wood* is also typically produced in places where trees can be grown and harvested most efficiently and milled at the lowest cost. As many observers point out, it may not be a completely free market (e.g., the widespread use of tariffs or taxpayer subsidies to manipulate the market), but a majority seems to accept the ideal of free trade and free markets.

Of course, individual and collective choices are not entirely driven by cost. Perception, personal preferences, and risk tolerance play important roles. Consider how society chooses to generate electricity. Power from hydroelectric dams is usually inexpensive, and generation does not result in significant greenhouse gas emissions; however, dams are not beneficial to salmon. Wind power is comparatively expensive, but once installed, it does not produce greenhouse gas. Unfortunately, it is not ideal for birds, bats, or vistas, at least in the opinion of many. Depending on a person's perceptions, nuclear, coal, natural gas, solar, biofuels, wind, and wave power all have their strengths and weaknesses. Thus, it is not merely cost that determines a market preference, yet cost is enormously important.

Although the benefits of free market economies are well recognized, some consequences are at odds with wild salmon recovery. In the marketplace, how much more are people willing to pay for food, electricity, or transportation produced in ways that will not degrade salmon habitat? Any serious effort to answer this question must avoid the twaddle that such goods and services can be produced just as cheaply in a "salmon-friendly" manner. As with all policy choices, there are winners and losers, and this policy axiom should be made clear.

Searching for the ever-tantalizing *win-win* wild salmon recovery solution ends up frustrating everyone. Except for the most trivial policy aspects of wild salmon recovery, compromise is necessary to craft a proposed policy that is politically possible. Thus, salmon policy analysis ultimately reveals many of the characteristics of a classic zero-sum decision-making game.

**Salmon Policy Reality 4 — Competition for critical natural resources, especially for water, will continue to increase and will work against recovering wild salmon.**

It could be argued that this policy reality borders on the brilliantly obvious (e.g., salmon need water), but this biological reality is often overlooked in policy analysis and forecasting. Many watersheds in California, Oregon, Washington, and Idaho suffer from

human-induced water shortages; however, unless the competition for scarce water escalates into open political conflict, most people remain unaware of the magnitude of the challenges. Even with media stories about impending water scarcity, most written in a doom-and-gloom style, the apparently insatiable demand for fresh water shows little sign of easing.

I am not declaring that allocating water for salmon is more important than allocating it for alternative uses, but, as competition for scarce water intensifies, how will advocates for wild salmon fare relative to advocates for competing priorities such as water for domestic use, irrigation, manufacturing, generating electricity, and a host of other needs?

For example, the ongoing water conflict in the Klamath Basin, situated along the California-Oregon border, serves as a likely indicator of future scenarios in California, Oregon, Washington, Idaho, and southern British Columbia. A quarter century ago, national newspapers described Klamath Basin farmers defying law enforcement agents and illegally opening locked valves to release water and irrigate their fields. The evening television news showed the Klamath River choked with dying salmon caused by low water flows, poor water quality, and diseases. Lawyers from various competing interest groups dueled in court over who will get how much water. At the end of the day, every faction in the battle was dissatisfied with the result, feeling that their interest did not get a fair share of the water, and grappling for ways to be more politically effective in the next water battle.

Suppose the human population of California, Oregon, Washington, Idaho, and British Columbia stays on track and expands several-fold through this century. How will wild salmon recovery programs stack up against competing demands for scarce water?

> **Salmon Policy Reality 5 — The aggregate resource demands of humans will continue to swell, thus tending to work against increasing the abundance of salmon, and this fact is rarely made clear to the public.**

Assuming that there are no major changes in immigration or population policy in the U.S., the most probable scenario for the human population trajectory through this century for places like California, Oregon, Washington, and Idaho is one of substantial upward growth. Any serious discussion about the future of salmon must consider human population and land use trajectories, but it is not fashionable to raise these issues.

Environmental advocacy groups avoid highlighting the overarching influence of population levels, even though it dwarfs most of the human behaviors they aim to modify. Even fish advocacy groups rarely mention it, much less take a clear policy position. It is the

proverbial elephant in the room that few want to acknowledge. As one of my colleagues warned me after reading a draft of a paper about the future of wild salmon:

> *"Bob, you are absolutely right, most people already know it, and that's exactly why you should let it rest. Back off. You'll leave the proponents of wild salmon recovery depressed. Worse, you'll have the rest of the audience wondering why you are pontificating on the intuitively obvious. And you run the risk of being attacked as a racist, nativist, xenophobe, cultural imperialist, sexist, or, at the least, an economic elitist."*

Perhaps this is sound advice, and I should back off. However, if society wishes to do anything meaningful about moving wild salmon off their current downward trajectory, then something must be done about unrelenting human population growth in California, Oregon, Washington, and Idaho. It is not simply the number of people that causes problems for wild salmon, but also their individual and collective ecological footprint and the fact that humans and salmon need much the same resources.

What amount of population growth should be expected? The latest demographic forecasts indicate a slowing of the global population throughout this century, with a leveling off by around 2100. Yes, a leveling off is predicted, but at a population of 9 *billion* people. Especially for regions like the Pacific Northwest and the U.S. generally, there is a different story. It is largely one of past, current, and future immigration. Currently, Washington, Oregon, Idaho, and British Columbia are home to 15 million humans. In the absence of policy changes and assuming a range of likely human reproductive rates, migration to the Pacific Northwest from elsewhere in Canada and the United States, and continuing immigration policy and patterns, by 2100 this region's human population will not be its present 15 million, but rather will be somewhere between 50 and 100 million, a potential quadrupling or more of the region's population by the end of this century.

Consider those 50 to 100 million people in the Pacific Northwest in 2100, and their demands for housing, schools, sewer treatment plants, tennis courts, football stadiums, roads, parking lots, airports, coffee shops, restaurants, stores, electricity, drinking water, pipelines, marinas, movie theaters, ski resorts, golf courses, and on and on. The consumer demand from the millions of current and new residents is immense.

Visualize the western region of the State of Washington and the southwestern corner of British Columbia in 2100 with its metropolis of *Seavan*. Seavan morphed into a truly great metropolis as smaller, discrete cities grew together. Seavan in 2100 stretches from Olympia in the south, along Puget Sound northward through the once stand-alone cities of Tacoma and Seattle, and on to Vancouver (BC), east to Hope at the head of the

Fraser Valley, and west to cover the southern half of Vancouver Island. Rather than the 6 million people back in at the turn of the millennium, Seavan in 2100 rivals present-day Mexico City and Tokyo with 30 million inhabitants. Or think about the New York City to Boston corridor transplanted to the Pacific Northwest. It is within this context that salmon recovery strategies must be developed if they are to have any chance of succeeding.

Regardless of the accuracy of this forecast, population issues are not easy ones to highlight without implying a preferred policy option. After all, there are strategic and financial reasons why the large, well-funded environmental advocacy groups, most groups in fact, stay clear of population issues these days. Yet an explicit recognition of the expected overall increase in world population, coupled with the spectacular increases in certain "fill-in" regions such as western North America, must be at the core of any credible analysis of potential recovery strategies of wild salmon. Without such recognition, recovery strategies for salmon are doomed to fail.

**Salmon Policy Reality 6 — Individual and collective lifestyle preferences directly determine the future of wild salmon, and substantial changes must take place in these preferences if long-term downward trends are to be reversed.**

This policy reality is perhaps the most obvious and arguably the most important. Among most fisheries scientists, it is easy to assume that wild salmon are near the top of the public's priorities. Just look at the polling results regarding restoring depleted salmon runs. *Everyone* supports salmon, and especially wild salmon. The fact is that salmon recovery is only one of many priorities that individuals, when not forced to make a choice, profess to rank high. When forced to make a choice, salmon recovery drops substantially in importance as compared to other priorities. Society's collective behavior, rather than public opinion polls or thick salmon recovery plans, is what offers the best indication.

Consider this example to illustrate this policy reality. In 1991, the first salmon "distinct population segment" in California, Oregon, Washington, and Idaho was listed under the terms of the ESA. With this listing of salmon as a legally protected species, the policy debate shifted away *from* restoring salmon runs to supporting *fishing* to protecting wild salmon runs from *extinction*, two very different policy objectives. Starting with this first ESA listing, followed by many others, protecting at-risk runs of wild salmon won out over maximizing fishing opportunities. The residents of the United States *apparently* made a choice about the relative importance of wild salmon compared to other policy priorities. Or did they?

Jump ahead 10 years to 2001, only a decade after the first salmon listing; ongoing electrical blackouts and brownouts in California prompted the U.S. Bonneville Power Administration to declare a power emergency, abandon previously agreed upon interagency salmon recovery commitments, and generate electricity at maximum capacity using water reserved to help salmon migrate. In one of the most striking and clear-cut examples of choices between competing societal priorities, electricity for air conditioners and refrigerators won out over both wild and hatchery-bred salmon. Perhaps even more instructive, there was scant public opposition. There were no street protests. There were minimal legal challenges. I do not remember any elected officials publicly pleading for salmon. No environmental group is blanketing the Internet with calls to mobilize in defense of salmon. Even among the wild salmon advocates, there was nearly complete silence.

The policy reality to be learned here is that many people will pay lip service to "saving wild salmon" as long as *their* individual lifestyles are not greatly impacted. Over the past 200 years, there have been many of these kinds of choices, often contradictory, apparently inconsistent, and these choices roughly reflect our collective and relative priority for wild salmon. These choices are tradeoffs, and society continues to make them; and they are a real measure of the relative importance of wild salmon. That is not good or bad, just a fact, however unwelcome to wild salmon advocates.

I am not extolling wild salmon or for any other species, or electricity, or property rights, or hatcheries, or placing a McDonalds, Starbucks, or Tim Hortons on every corner, but it is naive to consider salmon recovery for *most* people as anything but a minor element in a constellation of competing, often mutually exclusive policy preferences.

## Conclusion

There remains a near-pervasive delusion that wild salmon in California, Oregon, Washington, Idaho, and southern British Columbia *could* be greatly increased, concurrent with the present trajectory of the region's human population, coupled with most individuals' unwillingness to reduce *substantially* their consumption of resources and standard of living. Very few salmon advocates are arguing that society *should* make these substantial changes necessary to restore wild salmon. The *implicit* public optimism of salmon scientists and technocrats regarding the restoration of salmon tends to perpetuate this avoidance of reality. Furthermore, at least some of this delusional reality is validated by the fact that salmon technocrats are influenced by funding provided through salmon recovery programs.

As a scientist, I am not arguing that we *ought* to change any current public policy or our individual priorities. I am arguing, however, that those of us who are experts should be candid about how human priorities and individual choices affect salmon runs in California, Oregon, Washington, Idaho, and southern British Columbia. A simple and inescapable fact is that the growth in the human population level that we can realistically anticipate through the rest of this century will create a serious barrier to achieving any significant long-term recovery of wild salmon.

Some strategies *could* successfully restore wild salmon populations in California, Oregon, Washington, Idaho, and southern British Columbia, but each requires major and politically divisive decisions. It is not technical inadequacies that preclude such recovery strategies from being implemented. Rather, it is the unpleasant consequences that result from their implementation. The economic and social costs of implementing a wild salmon recovery strategy that has a good chance of restoring wild salmon runs to significant, sustainable levels in California, Oregon, Washington, Idaho, and British Columbia would be extremely high. Based on the experience of the past 200 years, it is unlikely that society as a whole is willing to bear such costs.

To have a chance of success, a wild salmon recovery strategy must change the trajectory of the major policy drivers; otherwise, it will be added to a long list, 200 years in the making, of noble, earnest, and failed salmon recovery strategies. Society will probably continue to spend billions of dollars on quick-fix efforts to restore wild salmon runs, and in most cases, these efforts will be only marginally successful. Perhaps such expenditures should be considered "guilt money" — a tax society and individuals willingly bear to alleviate their collective and individual remorse. It is money spent on activities unlikely to achieve the stated purpose (i.e., the recovery of salmon), but it makes people feel better as they continue the behaviors and choices that preclude the recovery of salmon.

## ***About the Author***

*Dr. Bob Lackey is a professor of fisheries science at Oregon State University. In 2008, he retired from the Environmental Protection Agency's research laboratory in Corvallis where, over a 27-year career, he served as Deputy Director and in various other senior science and leadership positions. Since his very first fisheries job as an undergraduate, mucking out raceways in a trout hatchery, he has worked on an array of natural resource issues, mostly at the interface between science and policy. He has published over 100 articles in scientific journals and authored or edited 5 books. Dr. Lackey has long been an educator, having taught at 5 North American universities. He continues to teach a graduate course in ecological policy at Oregon State University. A U.S./Canada dual citizen, he was a Fulbright Scholar at the University of Northern British Columbia during the 1999-2000 academic year. Dr. Lackey holds a Doctor of Philosophy degree in Fisheries and Wildlife Science from Colorado State University and was selected as the 2001 Honored Alumnus by the College of Natural Resources. He is a Certified Fisheries Scientist and a Fellow in the American Institute of Fishery Research Biologists. In 2008, he was awarded the U.S. Environmental Protection Agency's highest honor — the Gold Medal — for exceptional contributions in strengthening the role of science in ecological policy.*

Robert.Lackey@oregonstate.edu
(541) 602-5904

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