Either/Or? Will Climate Change Force a Choice Between Salmon and Electricity in the Northwest?

John M. Volkman

EITHER/OR? WILL CLIMATE CHANGE FORCE A CHOICE BETWEEN SALMON AND ELECTRICITY IN THE NORTHWEST?

By John M. Volkman*

I. INTRODUCTION

Salmon and other cold-water fish species play a significant role in the debate over the Columbia River. For many decades the objective has been to avoid either/or choices between salmon and human uses of the river; the assumption has been that we can have both. The viability of this assumption was drawn into question when salmon populations reached critical levels in 1980s, and even more so with the Endangered Species Act listings in the 1990s. The question will press more sharply with climate change because these species are so sensitive to streamflows, water temperatures and ocean conditions, all of which are likely to warm with the climate.

One of the most important human enterprises on the Columbia River and one of the most significant factors in the salmon declines is hydropower generation, and thus the question posed by the title of this paper: is the either/or point finally upon us? It is a fair question in one sense, but I have some caveats: First, no one supposes that the whole Columbia River hydropower system could be removed to make the river more hospitable to salmon; the debate has always been over smaller compromises. Even the dam-breaching debates of the 1990s involved four dams, not the whole system. Second, focusing on the role of hydropower dams alone in the salmon declines is an over-simplification. Salmon spend most of their lives outside the Columbia River – in mountain headwaters, tributary streams, the estuary and the Pacific Ocean. How these areas function ecologically in a changing climate will have a great deal to do with salmon survival regardless of what happens to hydropower. Finally, Columbia River policy will be even more complicated as the climate changes because various human systems – energy, irrigation, water supply – may be destabilized as salmon decline. How these sources of instability interact will change the way the salmon declines are seen and dealt with.

There are so many unknowns about how these things will take shape that all one can do in a paper like this is reexamine what is known (the past) and speculate about the unknown (the future). This paper does that. The next section provides the background and the section following it speculates about what may be coming, near-term and long-term.

II. BACKGROUND

A. Hydropower and other contributors to the salmon declines

Salmon declines can be traced to the early 20th century, before hydropower was a gleam in the Army Corps of Engineers' eye. Salmon habitat has been under pressure from mining, timber harvest, irrigation, grazing and other activities since the 19th century. A mining boom hit

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many parts of the basin in the 1860s and generated demand for grain, sheep and cows. Livestock production began to take off in the 1850s and 1860s, and climbed through the end of the century. Crops required irrigation in the Basin's dry interior, and by the end of the 19th century many of the basin's streams were fully appropriated. Timber cutters used streams and rivers to float huge numbers of logs to market. Salmon harvest began to decline in the early 1920s, and one can assume the population declines began before they began to show up in harvest statistics.

Hydropower development occurred between 1930 and the mid-1970s, when the flood gates on the last dam on the Lower Snake River closed. By 1975, a salmon from Idaho, northeastern Oregon, or northern Washington would have to traverse eight major mainstem dams twice: once as juveniles on their way to the ocean and again on the return journey to their spawning beds. Just one mainstem dam kills something like 5-10% of the juveniles migrating downstream and 5-15% of the adults migrating back upstream. Multiply these numbers by eight for Snake River or Upper Columbia populations. Moreover, the effects of dams are not just in direct fish mortality, but in the way the river works ecologically. Dams alter river temperature, chemistry, turbidity, nutrients, and flow. While it is difficult to tie any one of these things to specific changes in salmon survival, they clearly have ecological consequences, favoring non-native species over the species that evolved in an unregulated river.[1]

These impacts landed on top of the impacts of continuing habitat development. We sometimes think of habitat development as having been a less significant factor in the salmon declines because they were incremental, site-specific and, one assumes, reversible. But they are a major factor cumulatively. The idea that they are readily reversible ignores factors such as private property, western water law, the economic momentum of development, and the fact that people rely on these activities for their livelihoods.

Reversing hydropower development is no less difficult a prospect. It is almost idiotic to say it, but remember that the dams are already there. It would take an enormous and unprecedented effort to remove them. It isn't so much that there would be a lot of concrete to remove as that the concrete is connected to a powerful and far-reaching energy and economic system that reaches into every corner of the Northwest and beyond. The Columbia River dams supply energy, almost half the electric energy in the Northwest. The dams light homes and drive industry. While there are other ways to generate energy, one would have to replace hydropower with something more expensive or polluting, and it would take a great deal of political will and economic investment to make such a transition. The dams currently generate about $2 billion annually in energy revenues, support a massive energy and transmission system, and fund large-scale fish, wildlife and energy conservation programs. Hydropower radiates out from the Northwest into other parts of the country. The Columbia River feeds California and Southwest energy markets. The hydropower system is not just a U. S. system; more than half of the river's hydropower and flood control storage is in Canada. Canada is also linked to California and Southwest markets through the Northwest's transmission lines. And the hydropower dams are not just energy producers. They make navigation possible as far as the Oregon-Idaho border, connecting farms from Montana and other inland states to international markets, are hydraulically connected into some of the country's largest reclamation projects, supply flat water

[1] Independent Scientific Group, *Return to the River: Restoration of Salmonid Fishes in the Columbia River Ecosystem* at 148 (1996).

for recreation, and protect areas like Portland from floods. So, this is a big, complex system of interacting benefits that reach into virtually every corner of the Northwest. This is what people usually mean when they talk about the benefits of the Columbia River, and it strongly colors discussions of un-doing hydropower development.

There also should be no mistaking the seriousness with which many people in the Northwest regard the decline of salmon. To many people, the Northwest is defined by wherever salmon spawn. People my age grew up around rivers that teemed with salmon, where Indian fishermen were still netting big fish at Celilo Falls, and coastal canneries supported a vibrant fishing economy. The public's response to the fact that Columbia River salmon are now endangered is visceral and grim. Gratitude for cheap energy and pride in great structures like Grand Coulee Dam don't erase the sense of loss that comes with the salmon declines, or the sense that we are leaving a poorer world to our grandchildren.

B. The salmon debate[2]

1. The debate leading up to 2000

People have assumed that hydropower and salmon do not represent an either/or choice, just as they assumed in the 19th century that salmon could not be wiped out by mining, timber harvest and other activities. Salmon were so bountiful that they seemed inextinguishable. However, more than 100 years after the great summer Chinook runs were over-harvested into oblivion, we have yet to find that balance point between robust salmon runs and human uses of the river.

Since the early 1970s, Columbia River policy has been driven by salmon declines on the one hand and the importance of hydropower on the other. In response, the region has developed a large-scale salmon program. In the 1970s, the salmon declines provoked Indian treaty litigation over harvest and, to a lesser extent, the Columbia River dams. During the 1980s, a spate of remedial salmon programs was enacted, to coordinate harvest management and address the effects of the dams. Ten years later, when the salmon declines persisted and salmon were listed under the Endangered Species Act (ESA), various policy initiatives engaged: the so-called Salmon Summit, Northwest Power Planning Council rulemaking processes and ESA consultations over federal dams, land management, hatcheries and harvest. In the mid-1990s, a multi-year drought, unfavorable ocean conditions and litigation deepened the crisis and remedial programs again ratcheted up. In 2002, the General Accounting Office reported estimated direct federal agency expenditures on salmon recovery at almost $1.8 billion from 1982 through 1996 and about $1.5 billion from 1997 through 2001, not counting the cost of replacement energy and foregone energy revenues.[3] Using federal power marketers' calculations of foregone energy

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[2] For further reading on salmon policy in the Columbia, *see* J. Lichatowich, *Salmon Without Rivers* (1999); J. Taylor, *Making Salmon: An Environmental History of the Northwest Fisheries Crisis* (1999). For a summary of the conflicts between salmon and other human uses of the river, see J. Volkman, *A River in Common: The Columbia River, the Salmon Ecosystem, and Water Policy* (1997).

[3] United States General Accounting Office report GAO-02-612, *Columbia River Basin Salmon and Steelhead: Federal Agencies' Recovery Responsibilities, Expenditures and Actions* 46-61 (July 2002).

revenues and replacement power costs, the Columbia-Snake River flow program costs many millions of dollars per year. The marketers calculate these costs in light of market conditions and so they vary greatly year to year, but the energy marketers put a staggering $1.5 billion value on it for FY 2001, a year when west coast energy prices went through the roof.

The effects of these mitigation measures are more difficult to assess. To take one example, the biological effects of flow augmentation, the most costly single element in the salmon program, cannot be measured directly, and the rationale for flow augmentation has changed over time. At first, it was thought to help spring-migrating juveniles but was unimportant for summer migrants. The initial flow program, then, worked exclusively in the spring. Now, the evidence suggests some positive benefit for spring migrants but a much stronger benefit for summer migrants. But for spring or summer migrants, the benefits are hard to measure. Another example: it is no longer clear whether fish hatcheries, the staple of salmon mitigation for decades, have positive or negative effects on salmon populations. So, the point is that dams have big effects on salmon for which there are no very good remedies.

It was in part frustration with these elusive increments of benefit that gave rise to the idea of radically lowering the Lower Snake River reservoirs in the early 1990s. Snake River salmon and steelhead were listed under the Endangered Species Act (ESA) in 1990. Just before the listings were final, a regional Salmon Summit was convened. There, Idaho Governor Andrus proposed that the four lower Snake River reservoirs be radically lowered to decrease their cross-sections and speed the flow of the river to help salmon. The idea was received cautiously, although the Northwest Power Planning Council endorsed a significant test of the idea in 1994 (the Council never pressed this). By 1995, the Lower Snake River draw-down idea had evolved: Corps of Engineers analysis showed that removing earth-fill portions of the dams would be cheaper and more effective than retrofitting them to operate at lower head. This became the Lower Snake River dam-breaching concept.

Since the concept was developed, the rationale for breaching has shifted. It was originally conceived as a way to speed up the river's flow, on the theory that juvenile spring migrants need to reach the estuary on a biological time clock that can't be met with the slow-moving behind the dams. In 1996, an independent scientific panel suggested that fewer reservoirs in the river's mainstem would open up important habitat for fall chinook, historically the largest populations in the Columbia. Rather than just seeing the river as a corridor through which fish should pass as quickly as possible, this theory proposed that the mainstem of the river could serve as habitat for large "core" populations of fish that could anchor the runs through environmental fluctuations. Finally, dam-breaching proponents have argued that breaching could improve river temperatures, a growing concern under the ESA and the Clean Water Act.

There is scientific debate over the need for and sufficiency of dam breaching as a Snake River salmon recovery measure. In 1998, a relatively exhaustive technical analysis of salmon recovery options (called PATH, the Plan for Analyzing and Testing Hypotheses) had concluded that breaching Lower Snake River dams would likely enable Snake River spring chinook salmon to reach ESA recovery thresholds. The Northwest Fisheries Science Center, a group of scientists associated with the National Marine Fisheries Service (NMFS), the federal ESA agency for salmon, agreed that breaching would help Snake River fish. However, Center scientists were not

persuaded that the fish would reach recovery thresholds or that the same thing could not be achieved by other means: "even for the best studied ESU [population], the Snake River Spring/Summer Chinook salmon, there is good evidence that dam breaching would increase [population growth], but not enough evidence to say by how much. Similarly, there is some evidence that habitat improvements might increase [population growth] for this ESU, but not enough evidence to calculate a likely percent increase."

More broadly, the rationale for dam breaching is therefore limited in two ways: it is largely theoretical, and it plays out differently for different dams and fish populations. A faster Lower Snake River might or might not make enough of a difference to restore Snake River salmon. The Lower Snake may or may not be good mainstem habitat. Breaching Lower Snake River dams would provide no benefit for any but Snake River fish. The weakest fish populations, like those in the upper Columbia, would see no benefit at all.

So, while dam-breaching has been part of the debate since the early 1990s, it hasn't left the launch pad. The two Northwest political figures who publicly endorsed the concept of breaching dams – Governor Andrus in the early 1990s and Oregon Governor John Kitzhaber in the late 1990s – were lone political voices on this issue. Neither generated significant support for the idea in state legislatures or Congress. In 1994, the Northwest Power Planning Council majority that endorsed the idea of lowering two lower Snake River reservoirs to help fish lasted about a month after the vote. At about the same time, some breaching proponents reported such slack-jawed amazement in Congress at the idea of dam-breaching that it became hard even to keep saying the words on lobbying trips. This was at a time in which the salmon crisis was at a crest, the focus riveted on Snake River fish populations that were so close to extinction that some could be counted on one hand.

2. <u>The 2000 biological opinion and its rejection</u>

In the early 1990s, regional and federal salmon initiatives met with strong skepticism in court. In 1994, a federal district court characterized a National Marine Fisheries Service biological opinion as:

> seriously, 'significantly' flawed because it is too heavily geared towards a *status quo* that has allowed all forms of river activity to proceed in a deficit situation, that is, relatively small steps, minor improvements and adjustments, when the situation literally cries out for a major overhaul. Instead of looking for what can be done to protect the species from jeopardy, NMFS and the action agencies have narrowly focused their attention on what the establishment is capable of handling with minimal disruption.

Idaho Department of Fish and Game v. National Marine Fisheries Service, et al., 850 F Supp 886 (D. Ore. 1994).

The Ninth Circuit delivered a similar message to the Northwest Power Planning Council:

> The Council's approach seems largely to have been from the premise that only small steps are possible, in light of entrenched river user claims of economic hardship.

Northwest Resource Information Center v. Northwest Power Planning Council, 35 F.3d 1371 (9th Cir. 1994).

The Council strengthened its program in 1994 (and then backed away from its limited endorsement of Lower Snake River reservoir draw-downs). The Fisheries Service developed an interim biological opinion to provide protection for the runs until 1999, when it hinted that major decisions about dam reconfiguration (read dam-breaching) would be made. As 1999 approached, however, the Fisheries Service faced an obvious dilemma. It has no authority to require dam breaching and even if it did, breaching Snake River dams would do nothing for other populations. The question was whether there was any other way to avoid jeopardy to the runs? If not, the salmon-hydropower conflict would have to go to the Endangered Species exemption committee.

In 2000, the Service completed a new biological opinion concluding that the dams pose jeopardy to the runs, but jeopardy could be avoided by improving habitat in tributary watersheds and the estuary. The strategy was strongly supported by the Clinton Administration, Vice President Gore in particular. The current Administration has been more lukewarm about the strategy, and funding for many elements of the strategy has been slowed. Whether for these or other reasons, a group of environmental groups challenged the biological opinion in court.

On May 7 of this year, a federal judge in Oregon found the 2000 biological opinion arbitrary and capricious.[4] The opinion's primary defect, in the court's view, was the its reliance on federal habitat programs that had not gone through ESA consultation and non-federal habitat programs that were not "reasonably certain to occur." The judge remanded the opinion to the NMFS with instructions to develop a new opinion within a year. The judge has not yet said whether the 2000 biological opinion can remain in place pending development of the new opinion. If the 2000 opinion is not left in place, it could mean that by continuing to operate the hydropower dams, the federal agencies would illegally "take" fish in violation of the ESA. If the 2000 opinion were left in place, it would provide only interim protection against take liability.

The is the backdrop against which my speculations about the effects of a changing climate are played.

III. EFFECTS OF CLIMATE CHANGE

A. "Facts" About Climate Change in the Northwest[5]

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[4] *National Wildlife Federation v. National Marine Fisheries Service*, CR 01-640-RE (D. Ore. 2003).

[5] Much of the work on climate change in the Northwest comes from the Climate Impacts Group at the University of Washington, and this section of this paper is drawn largely from that work. The Climate Impacts Group's work is summarized in U. S. Global Change Research Program, *Climate Change Impacts on the United States: The Potential Consequences of Climate Variability and Change, Final Synthesis Team Report*, "Impacts of Climate Variability and Change, Pacific Northwest" (1999)

Of course, we don't have many facts about climate change. Computer models and analytical indices of climate change don't actually predict, at most they tell us about likelihoods. But here is what the modelers tell use about potential trends in the Northwest: Annual precipitation will probably not change a great deal as the climate changes. The effects are likely to be seasonal – winters will be warmer and wetter. The models diverge on whether summers will be wetter or drier. Much of the debate over climate change revolves around these few likelihoods, deceptive in their simplicity.

The effects of climate change on water storage in the Columbia system are likely to be significant. Warmer winters would mean "sharply less" snowpack (*Impacts of Climate Variability* at 27) and earlier spring snowmelt. Unlike the Colorado River, whose reservoirs store ten times the river's annual runoff, Columbia reservoirs store only 60 percent of a year's runoff. The rest of the Columbia's storage is in snowpack. Less snowpack and earlier snow melt will have "profound" effects on streamflow; late spring and summer flows are also likely to be "sharply" reduced.[6] Moreover, this shift will have a political element. Snowpack is likely to shrink more in southern areas than northern areas, and because Canada is further north, more and more storage will be in the Canadian part of the basin.

As snowpack changes, mainstem reservoirs will be drier in the summer for reasons related to flood control operations. The Army Corps of Engineers, which manages flood control in the Columbia, drains the Columbia River storage reservoirs in late winter so there is room to store runoff in the spring to protect against floods. So, even though there is likely to be more rain and higher flows in the rivers in the winter, it will be evacuated before spring, and so have little or no benefit in the salmon migration season – spring and summer. Rather, because there will be less snowpack to supply spring and summer streamflows, storage reservoirs will have to work much harder to meet irrigation and streamflow needs. Lower reservoir levels at the end of summer will be harder to refill in time for fall and early winter energy loads before the rains begin. It is not hard to imagine more successive years where storage projects don't refill and are drafted deeper and deeper.[7]

The effects of less snowpack and earlier snow-melt will also be felt in smaller tributaries, where many fish populations spawn and rear. In these areas, the tension between instream needs of fish and the out-of-stream needs of water users, largely for irrigated farming, is already considerable. Even apart from the competition for instream flows, economic pressures on agriculture may be leading to practices that will be unsustainable in a warmer climate. The University of Washington Climate Impacts Group describes how some of these pressures are affecting the Yakima basin: junior water users drill illegal wells to minimize crop damage in drought years; water reuse and other efficiencies reduce return flows to streams; and crops that can sustain an occasional dry year are being replaced by higher-value crops that can't. These things wring slack out of the system and leave less ability to adapt to a warming climate. Conflicts between instream flow programs for species and consumptive water users can be expected to heighten.

(hereafter "*Climate Change Impacts*") available online at http://www.usgcrp.gov/usgcrp/Library/nationalassessment/pnw.pdf.

[6] *Climate Change Impacts* 37.

[7] Personal communication, James Ruff, NMFS Hydro Division, March 7, 2003.

Climate change also has implications for stream temperatures. Salmon, bull trout and other cold water fishes are highly sensitive to temperature. In the fall, cooling rivers trigger upstream migrations. Spawning begins when water temperatures decrease. Eggs incubate over the winter or early spring when temperatures are coolest. Rising spring water temperatures are thought to cue downstream migration.[8] Temperatures are a problem in the Columbia River mainstem and in many tributaries.[9] Federal agencies in the Northwest have struggled to develop Clean Water Act water temperature standards that pass ESA muster and can be achieved across a landscape that has lost much of its natural cooling mechanisms (watershed groundwater storage and riparian cover).[10] To state the obvious, this problem will worsen as stream temperatures creep up.

Finally, climate change will have effects in the Pacific Ocean, which will affect anadromous fish there and inland. Salmon and other anadromous fish spend most of their lives. If ocean conditions are unfavorable to Columbia River populations, fewer fish will return to spawn.[11] Fluctuations in the ocean can cause qualitative shifts in the structure of entire communities of species.[12] Coupled ocean–atmosphere changes impact inland areas through drought, flood, heat, cold and storms. Researchers are developing the ability to predict some effects, such as the El Niño/Southern Oscillation or ENSO, in which warm water at the ocean's surface in the eastern tropical Pacific off South America affects weather and climate in the Pacific. However, ENSO is only one of the mechanisms by which the ocean and atmosphere influence one another. Ocean-atmospheric coupling occurs on many time scales, even over centuries.[13] The risk of crossing critical climate thresholds, triggering irreversible change (such

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[8] Policy Workgroup of the EPA Region 10 Water Temperature Criteria Guidance Project, *Technical Synthesis Scientific Issues Relating to Temperature Criteria for Salmon, Trout, and Char Native to the Pacific Northwest,* pp. 5-6 (August 1, 2001).

[9] Independent Science Group, *Return to the River: Restoration of Salmonid Fishes in the Columbia River Ecosystem* (2000): "Temperature is a critical habitat variable that is very much influenced by regulation of flow and impoundments. The mainstem reservoirs are relatively shallow and heat up in late summer causing concern for salmon survival. The lower reaches of some key tributaries also are very warm in late summer because they are dewatered by irrigation withdrawals. Due to the extreme importance of temperature regimes to the ecology of salmonids in the basin, temperature information merits special attention as a key habitat descriptor (Coutant 1999)." (Quoted in U. S. Environmental Protection Agency, *EPA Region 10 Guidance For Pacific Northwest State and Tribal Temperature Water Quality Standards* at p. 8 (EPA 910-B-03-002, April, 2003).

[10] Many streams in the region are on the Clean Water Act section 303(d) list because of elevated temperatures. A 1999 ESA biological opinion on Oregon's water temperature standards provided only interim ESA coverage pending the Environmental Protection Agency's development of water temperature guidance that would lead to more protective temperature standards. In 2003, the biological opinion and the Oregon standards were struck down in federal court. *See Northwest Environmental Advocates v. EPA*, No. CV-01-510-HA (D. Or. Mar. 31, 2003). EPA quickly released new temperature guidance. U. S. Environmental Protection Agency, *EPA Region 10 Guidance for Pacific Northwest State and Tribal Temperature Water Quality Standards, supra.*

[11] National Research Council, *Upstream: Salmon and Society in the Pacific Northwest* 39 (1996).

[12] *Return to the River* at 376.

[13] M. McCartney, "Oceans and Climate: The Ocean's Role in Climate and Climate Change," *Oceanus* 2-3 (fall/winter 1996).

as a major ocean circulation change) is taken increasingly seriously in discussions of climate change.[14]

B. Speculation about near-term effects

Intellectually, I know there is no way to say that any single year actually is the result of climate change or represents what we can expect from climate change over the longer term. But we know that snowpack is actually receding in the Canadian Rockies – those glaciers have already shrunk, it's not just a distant possibility. And in my heart of hearts, I am afraid that 2001 does illustrate what's likely to happen as the climate warms up. In 2001, a combination of circumstances that journalists called "the perfect storm" occurred: hot weather, the second-driest water year on record, over-stretched energy supplies and sky-rocketing energy prices. Columbia River hydropower operators were under immense pressure to generate power to avoid blackouts in California, and they swung operations into full generation mode. In the first operating year after adoption of the 2000 biological opinion, longstanding salmon operations were abandoned. Two years later, the federal energy system is still trying to recover financially, squeezing fish and wildlife programs to save money. This is telling my instincts something about what we can expect from a warmer climate and a river that is stressed by growing energy demands and energy markets that live on prices swings.

At the same time, however, look at what was happening to salmon population numbers in 2000-2002: Salmon have rebounded, at least temporarily. Populations for which harvest had been closed for decades have returned in harvestable numbers. Most scientists attribute the upswing to favorable ocean conditions, the duration of which they cannot predict.

If 2001 is a sample of what is in store for us over the longer term, then, here is what we can expect: human uses of rivers will be under more strain, making it hard to look to them for sacrifices to help species, while the response of the species to what is going on in the environment is unclear, sometimes surging in a positive direction at the same time human-managed salmon recovery programs are being scaled back.

With the court's opinion in *National Wildlife Federation v. National Marine Fisheries Service* finding the 2000 biological opinion arbitrary and capricious, there is an opportunity to re-test the hydropower-salmon equation. Over the next year, the federal agencies will have to come up with a new opinion whether the hydropower system jeopardizes salmon. If my instinct is right, it is one of the early tests of how we (the societal "we") adjust salmon conservation policy to a climate that is already changing, seeing the kinds of interacting pressures of warm weather, low water, and destabilized industries. My speculation about what will happen on remand is: not very much.

The world on remand is different from that of 1998-2000, when the first biological opinion was developed. While ESA populations are still in trouble, salmon populations generally are bigger. The ESA salmon listings are under a coast-wide review, the result of a 2001 court ruling that NMFS had improperly failed to list hatchery components of the

[14] Editorial comment, "The Thermohaline Ocean Circulation: a System With Dangerous Thresholds?" 46 *Climatic Change* 247–256 (2000).

"evolutionarily significant" population units it had identified for ESA consideration.[15] The ruling has prompted the agency to review its approach to hatchery fish, with unknown implications.

The world is also different on the energy front. The stratospheric energy prices and chaotic energy markets of the late 1990s and early 2000s have settled down, so there is no saying that hydropower salmon operations have to be curtailed to avert blackouts in California. But the industry is edgy and uncertain, no longer so confident about the marvels of the market and still trying to recovery from the effects of the perfect storm of 2001.

With these things in the mix, my guess is that NOAA-Fisheries[16] will go back, complete ESA consultation on federal habitat programs and try to pin down non-federal habitat programs so that they are more certain. Perhaps the agency will add an element of hatchery supplementation. But my speculation is that the result will be a similar to that reached in 2000: some strengthening of habitat restoration programs; no suggestion of dam breaching.

Another possibility is that NOAA-Fisheries will conclude that the hydropower system jeopardizes salmon and there is no reasonable and prudent way to avoid it. In that event, an Endangered Species Committee would likely be convened to consider an exemption for the hydropower system. The Committee would be obliged to look for reasonable and prudent ways to conserve the species. If jeopardy cannot be avoided, the Committee must determine whether operating the hydropower system is "in the public interest and is of national or regional significance," and "the benefits of such action clearly outweigh the benefits of alternative courses of action."

This option has its own risks. The process has been invoked only a few times, and it is invariably contentious. It has sometimes reached a clear result (e.g., authorizing closure of the flood gates at Tellico Dam) and sometimes reached inconclusive, messy results (exempting certain BLM timber sales while courts continued to issue injunctions to protect spotted owls from other timber sales). It seems an unlikely choice in an election year. For the short term, I think we are headed for some version of the *status quo*: the 2000 biological opinion, reloaded.

C. Unbridled speculation about the longer term

The longer term involves even grosser speculation. I have already tipped my hand on the either/or question. If it is truly either/or, it is unlikely to be salmon. With climate change, the reluctance to breach dams is like to be stronger for two reasons: First, as in 2001, climate-induced crises are more likely to come in waves, and energy-related waves tend to be bigger than others. Second, climate change is partly an energy problem, and hydropower helps with that problem. Unless wind, solar and energy conservation can carry a great deal more of the energy load than anyone thinks they can, existing hydropower will be too attractive to sacrifice.

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[15] *Alsea Valley Alliance v. Evans*, 2001 U.S. Dist. LEXIS 14443 (D. Ore.) (Sept. 10, 2001). The basic holding of the case is that once the agency defines a relevant population unit for ESA consideration, the whole unit must be addressed in determining listing status.

[16] The re-named National Marine Fisheries Service.

At any given time, the choice may look either/or, or it may be clouded by confusing signals from the species. The current, positive jump in salmon populations that people ascribe to favorable ocean conditions is an example. No one at this point can say whether or how long good ocean conditions will persist. If, somehow, ocean conditions are generally better in the long term than they were in the 1990s, and if inland water temperatures don't get too warm, maybe we don't reach the either/or point. Sorting out genuine signals from "noise" in the ecosystem will play a critical role in understanding the effects of climate change so we have opportunities to react to them.

As long as questions like this are unclear, people will continue to look for middle ground, taking small additional bites out of hydropower and working on riparian, watershed and estuary restoration to try to help salmon while also contending with pressures from population growth. As long as climate change doesn't drive everything to extremes, people will continue to muddle through.

III. CONCLUSION

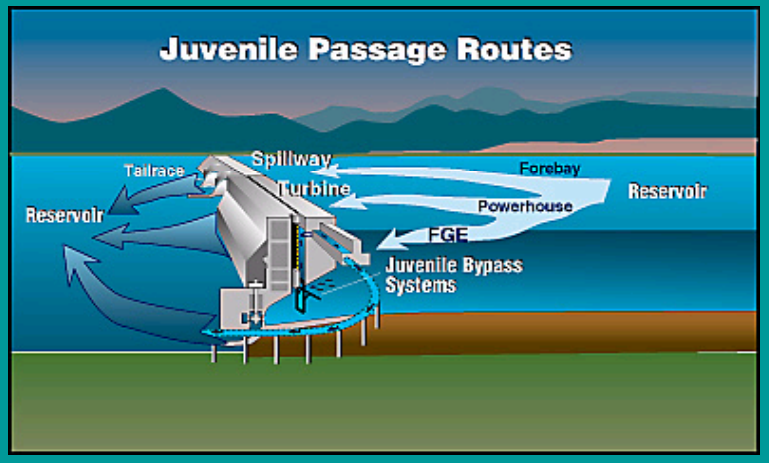
Climate change may (and probably will) narrow the range of ecologically workable choices to accommodate species and human uses of the Columbia. We have experienced something like this in the past in milder ways, but even so the complexity and pervasiveness of the causes of salmon declines have led to a tense and confused political debate. Climate change is likely to push us to harder choices. The question is how we can avoid repeating the patterns of the past, quarreling about whose fault it is, complaining about the lack of scientific certainty and looking for ways to have it all, while salmon and other cold-water species edge toward extinction.

Either/Or? Is it Hydropower or Salmon in the Northwest?

John M. Volkman June 13, 2003

I. Background

- A deep-seated conflict:
  - Salmon: cultural icon, mainstay of a fishing economy, central focus of treaties, ESA and Clean Water Act
  - Hydropower: half the region's energy; vital to NW economy; tied to Canada, California and Southwest energy systems
  - Flood control, navigation, irrigation and recreation


Juvenile Passage Routes
Tailrace
Spillway
Turbine
Forebay
Powerhouse
Reservoir
Reservoir
FGE
Juvenile Bypass
Systems


OPERATION FISH RUN II
CORPS OF ENGINEERS

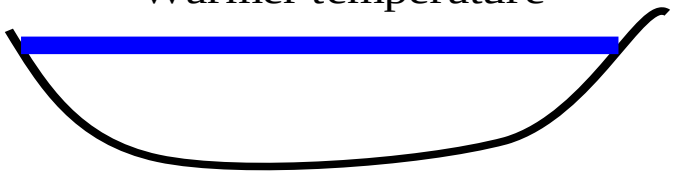
- Lower Snake River draw-down

Effects of Channel Development on Streamflow

•Small X-sec area
•High flow velocity
•Short travel time
•Cold temperature

Natural River Channel

•Large X-sec area
•Low flow velocity
•Long travel time
•Warmer temperature



Reservoir Pool

- Litigation and its aftermath:
  - 1994 court rulings concluded that federal recovery efforts were flawed
  - 1994-99 interim opinion hinted at major changes at dams in 1999
  - Dam-breaching looks cheaper, easier, more effective than draw-down
  - The dilemma in 1998:
    - no authority for breaching
    - breaching would help only Snake River fish

- The 2000 biological opinion:
  - Avoid jeopardy with federal and non-federal habitat restoration (long-term); tributary water solutions (short-term)
  - Still hinting at major changes 5-10 years out based on monitoring and evaluation

- ***National Wildlife Federation v. National Marine Fisheries Service***:

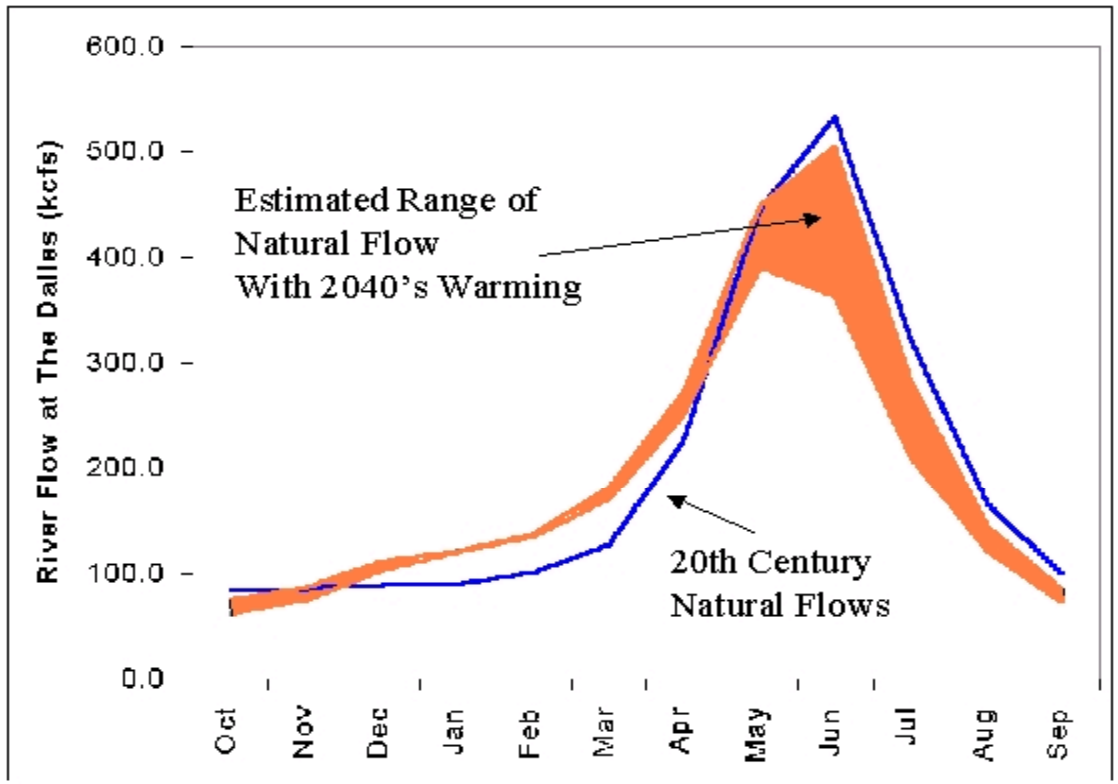
  2000 biological opinion is arbitrary and capricious because it improperly relied on federal habitat programs that weren't cleared through ESA and non-federal programs not "reasonably certain to occur."

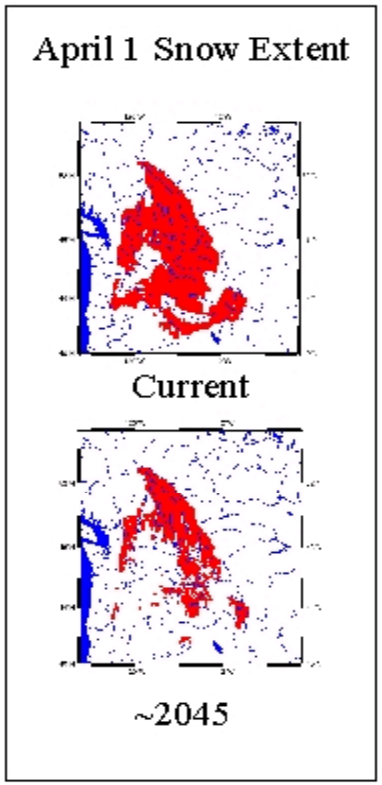
II. Effects of climate change

- "Facts:"
  - 3 degrees F higher average temperatures
  - More rain, less snow
  - Higher winter streamflows, lower summer streamflows
  - Spring runoff peaks about 2 weeks earlier
  - About the same annual runoff

(Preliminary Results, University of Washington Climate Impacts Group)

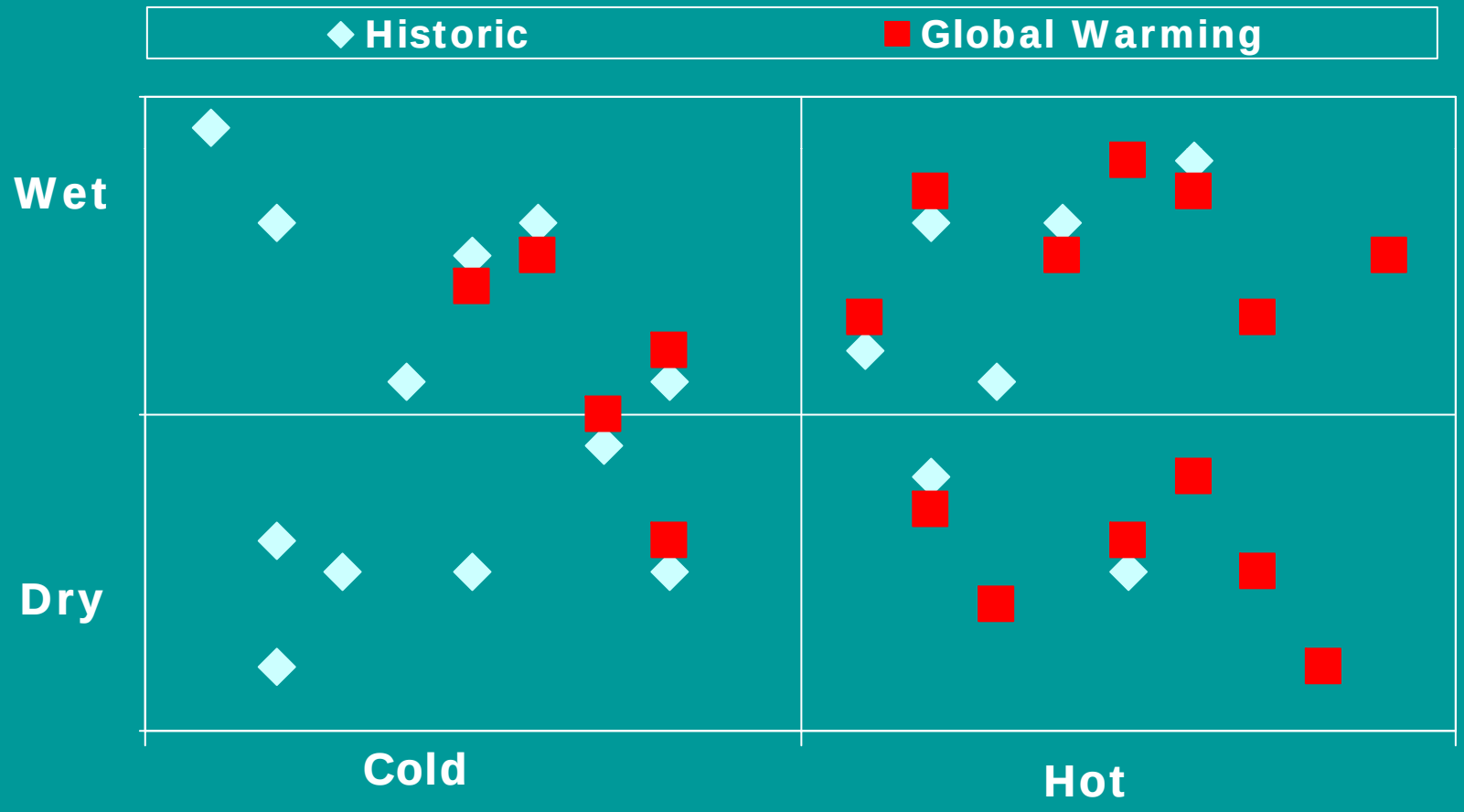
Potential Long-Term Effects of Climate Change





Source: A. F. Hamlet, *Seeds of Crisis, Water Resources Policy and Development in the Columbia River Basin* (University of Washington Climate Impacts Group, February 2002)

Historic vs. projected climate



- What might it be like?
- For the mainstem, consider 2001:
  - hot, dry weather
  - chaotic energy markets
  - hydro operations for salmon abandoned
  - upturn in the ocean
  - record salmon returns

III. What's Next?

- Near term: **NWF v. NMFS** remand:
  - Is the 2000 opinion void?
  - Shore up habitat programs (with a dash of hatchery supplementation?
  - Flood control bottleneck
  - Renegotiate Columbia River Treaty?
  - Breach dams (which ones)?
  - Jeopardy opinion, followed by exemption process?

- Longer term:
  - Multiple crises overlap with little predictability, sharper conflicts and narrower choices
  - Greenhouse concerns favor hydropower, given current technologies and economics
  - Confusing signals from ecosystems