

## ***The Case for Snake River Dam Removal is Scientifically Dishonest***

-David Welch, Ph.D. & President, Kintama Research Services.

Two recent reports repeat the claim that removing the lower Snake River dams will spur recovery of Chinook salmon populations. This long-standing belief, if accepted at face value, will drive policy decisions around whether the dams should stay or be breached.

Unfortunately, breaching is unable to deliver the promised effect because the biologists authoring these reports are, in some cases, being scientifically dishonest and are hiding the now overwhelming evidence that their long-standing claims have been mistaken.

The most recent example is the peer-reviewed paper by Storch et al [1]. The authors ably list the many ways in which dam construction changed the river. No problem from me—dams certainly changed the river. However, the authors then say that these changes CAUSED the poor returns of adult salmon from the ocean without actually showing this is true. Despite the survival of Chinook runs coastwide falling to similarly low levels to the Snake River [2], the default belief continues to be that the dams cause much of the harm for Snake River populations. In fact, the authors are ignoring the many lines of evidence that indicate the dams are not a large factor. Their willingness to deliberately hide the contrary findings—let alone discuss them—should set off warning bells for the various tribes, ENGOs, and government policy experts who have been assured that the authors' beliefs are correct.

Last year I responded to a letter sent by a "Group of 68 biologists" to state and federal policymakers which claimed that Snake River dam removal was the only way to restore salmon [3]. I wrote and distributed my response to the same policymakers because I was frustrated by the letter writers' simplistic thinking. I explained why even removing ALL 8 federal dams would barely change adult return rates. Not one of those 68 co-signers or any of the ENGOs pressing for dam removal saw fit to write and counter my reasoning, so it seems that my analysis stands up to scrutiny. Now, in Storch et al's new paper the authors make this bold assertion: "*Snake River populations in particular are likely impaired by substantial delayed mortality in the marine environment because of out-migration experiences*". The authors then confidently list a series of papers supporting this view (their own, since some of the authors on the paper were the distinguished developers of the original theory nearly 25 years ago).

Although never explicitly stated in this way by the proponents, for their premise to hold water huge amounts of delayed mortality must be caused by the dams, because otherwise dam removal won't meaningfully increase salmon survival. Unfortunately, for any reader expecting some sort of balanced analysis of the issue, there is not even a hint suggesting that delayed mortality isn't real. Storch and co-authors apparently think it is acceptable to publish a scientific review without breathing a word about the extensive contrary published peer-reviewed evidence that directly addressed whether delayed mortality actually exists. Yet, the authors know very well that I and my co-authors published multiple peer-reviewed papers addressing this very topic.

The key finding from all those papers was that below Bonneville Dam direct experimental tests of the delayed mortality theory showed that smolts migrating through the Snake River dams had the same survival as smolts originating from the Yakima River population all the way to northern Vancouver Island, some 1,500 km and more that one month after passing Bonneville Dam. Thus, the “*I was abused as a smolt*” theory that has great currency amongst some biologists because it allows them to blame poor ocean survival on the Snake River dams was refuted by direct experimental test using replicated treatment and control groups—the gold standard in science.

It is worth laying out the chronology here so that people can understand why this willful blindness is so important to the credibility of the ongoing efforts to remove the Snake River dams. In 2009 we published the first tentative results (one year of data) showing that Snake & Yakima River spring Chinook smolts had nearly identical survival all the way to northern Vancouver Island [4]. In 2013 we followed up with a multi-year analysis in the Proceedings of the US National Academy of Sciences (ranked as one of the top five peer-reviewed scientific journals in the world—not just in fisheries) [5]. We reported using three years of data that Snake and Yakima River smolts had nearly identical (1:1) survival in all migratory segments and all years: the lower river, estuary, plume, and coastal ocean. Yet, by the time the run returned as adults the Yakima population had 3.4X higher survival than our Snake River population. This directly refuted the belief that Snake River smolts have poorer survival because of extra dam passage (Fig. 1).

Dr Steve Haeseker submitted a criticism of our paper to the PNAS journal [6] to which we replied [7]. (The Fish Passage Center (FPC) also posted a much longer review of our paper on their website, but the key criticisms are the same [8]). Dr Haeseker argued in part that the fish we used were “non-representative” of the wild population (a common chestnut in the Columbia—if you don’t like the results, dismiss them by claiming that the fish weren’t “representative”). But lost on the critics, and the reason we are proud of our study, is that we had made all the conditions of the study as similar as humanly possible, EXCEPT that the Snake River smolts first migrated through the 4 Snake River dams before co-migrating out to sea with the Yakima smolts. Under THOSE conditions, Snake and Yakima River smolts had the same survival, directly contradicting the delayed mortality theory that migration through the Snake River dams is bad for smolts.

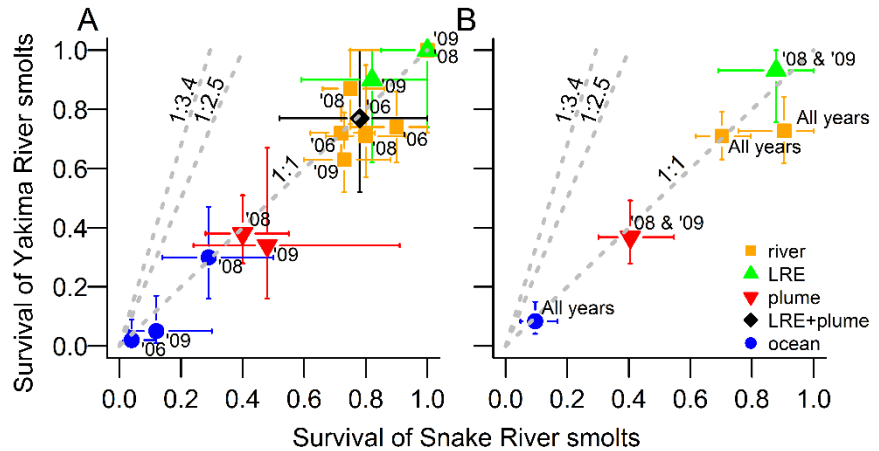


Figure 1. The key result from the PNAS (2013) paper. The higher adult return rate of Yakima adults relative to Snake R adults (3.4X in our study years; indicated) is the basis for arguing that delayed mortality exists. We found no evidence for this, with equivalent (1:1) survival for the outmigrating smolts from both populations. This suggests that the higher adult survival of the Yakima population happens later in marine life and was unlikely to be because the Snake River smolts' migrated through the Snake River dams.

The original delayed mortality theory never put conditions on how or why the dams would be bad. The critics were now in essence arguing that some subtle difference in the biology of the animals (timing or smolt size) interacted with dam passage to cause the Snake River smolts to have poorer survival. But this was something that they had never originally claimed.

The other part of Dr Haeseker's (and the FPC's) criticism was that the smolts we used were larger than the general population, because the tracking technology originally available was only suitable for larger smolts. However, despite the evolution of the technology to allow tracking much smaller smolts, and thus allow testing the delayed mortality theory for the smaller sizes not originally tested, we haven't seen any scientific curiosity from the critics to encourage further study with a more "representative" sample—instead they have opted to just ignore the peer-reviewed science not fitting with their beliefs.

With the publications of this core study, we had moved the goal posts—or so we thought, until we discovered that those promoting how bad the dams are for salmon were simply prepared to entirely ignore the work.

We also published several other research papers plus annual reports to BPA that directly address the delayed mortality debate, all of which Storch et al [1] also studiously avoid mentioning. Perhaps most important is our final paper [9] where we moved the tagging operations downstream and blindly tagged the migrating smolts at John Day or Bonneville Dams (Fig. 2).

In this case we used genetic analysis post-release to sort out which population each animal originally came from. Again the Snake and Columbia River populations had essentially the same survival (Fig. 2) and we didn't need to manipulate the release timing of the various populations to make the smolts co-migrate, as the FPC & Dr Haeseker objected to in our earlier papers [9].

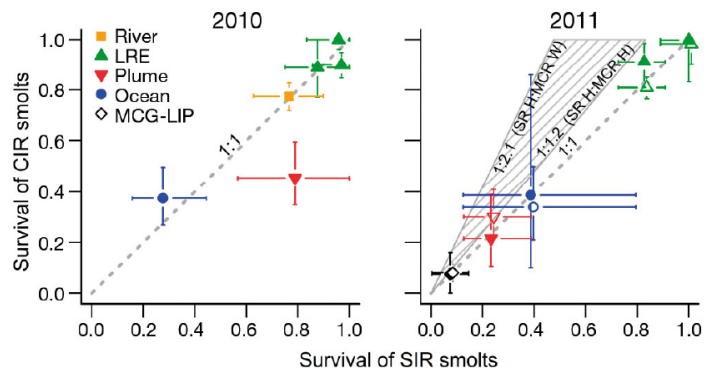


Figure 2. Comparison of Snake In-river migrating smolts (SIR) with Columbia-origin smolts migrating in-river (CIR). Note that in no case was the survival of the Columbia group materially higher than the Snake River despite not migrating through the Snake River dams. Smolts were tagged and released at John Day dam in 2010 and at Bonneville Dam in 2011. See the 2014 paper [8] for further details.

as the FPC & Dr Haeseker objected to in our earlier papers [9].

Curiously, to this day our critics in the Columbia have never cited that final paper, which removed most of the criticisms about “*non-representative*” animals—it is almost as if people are afraid to engage in the issue.

Finally, another of our papers similarly found the same survival for Snake River smolts transported around the dams in barges as those that migrated through the dams [10], where we politely pointed out the obvious conclusion is that transportation isn’t bad for smolts (as usually thought) but rather that biologists were likely just shifting where the transported fish died, because the ocean and hydrosystem had similar survival conditions (Fig. 3). This was, of course, heresy.

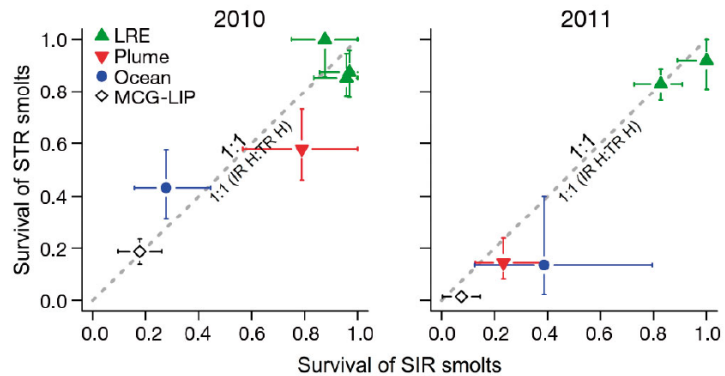


Figure 3. Comparison of the survival Snake R Chinook smolts that migrate in-river (SIR) with the survival of Snake R smolts transported around the dams (STR).

It is a curious fact that the Storch et al authors—who are well-aware of these papers—refuse to even cite the existence of these studies, let alone discuss their strengths and weaknesses. The issues are even more serious than I have outlined because even if all the authors had collective amnesia, in the single paper of ours that they do cite (our 2021 paper showing that survival was essentially the same everywhere along the coast), we pointed out that data in the Fish Passage Center’s own “Comparative Salmon Study” do not support the claims of delayed mortality because three other mid-Columbia River Spring Chinook populations in the CSS report that do not migrate through the Snake River dams (Warm Springs, Cle Elum, and Carson) have the *same* survival as the Snake River populations, but neither the CSS nor Storch et al discuss this point—they only highlight the two mid-Columbia populations that had better survival.

Even worse, in the Welch et al (2021) paper [2] we found that the CSS’s own data shows that 4 of 5 Snake River Fall Chinook populations have **higher** survival than mid-Columbia populations! Although the Storch et al paper cited this one paper of ours, they did not actually discuss the evidence we marshalled there that even the CSS study contained ample data contradicting the delayed mortality theory. In fact, if we apply the dam breacher’s logic to the CSS’ own data one would conclude that migrating through the Snake River dams was a tonic boosting survival for Fall Chinook and therefore constructing more dams in the Snake River should further increase survival.

That more dams will boost survival is, of course, not what we would conclude—we believe that SAR rates are largely determined by ocean conditions and the better (higher) SARs of Snake River Fall Chinook is likely due to something that differs in the ocean phase of the life history. However, randomized controlled trials are the gold standard of scientific research, and their use largely avoids bias creeping into the interpretation of the results. Whether the Snake River dams are good or bad depends on which pieces of data are cherry picked. The key point however, is that looking at all

the data means that the case for delayed mortality essentially vanishes... it is only a tenable conclusion if the wide swathes of contrary evidence are excluded from consideration.

That the Storch et al authors would deliberately suppress any mention of the wealth of experimental tests contradicting their claims is a serious failure. However, it is perhaps just as alarming that the authors state in the acknowledgements that *"We note, this manuscript underwent a full and thorough internal review process as prescribed by Oregon Department of Fish and Wildlife publication policies"*.

ODFW, as a state agency, should be operating to a high standard. Yet, ODFW's review process was also incapable of flagging the existence of any of this contrary information on our delayed mortality experiments. So much for a balanced and reasoned science-based analysis over the role of the dams.

It gets worse. In January the Fish Passage Center released the most recent iteration of their Comparative Salmon Study (CSS). The new CSS report has two key messages: first, that *"increases in PIT tag costs, combined with BPA's flat funding policy, threatens the CSS project continuation and future data quality"*, so a budget increase is needed to continue their good work. Second, their prior years' conclusions remain unchanged that *"dramatic increases in SARs are only likely if the lower Snake River dams are breached and spill is maximized at the lower Columbia River dams"*.

Nowhere in this massive report is there any mention of the implications from our 2021 Welch et al paper for the CSS' analyses. In our original paper [2] we were kind to the CSS, simply noting that because salmon harvests are not checked for PIT tags the adult return (SAR) actually measures what escapes the fisheries, not survival.

This distinction is hugely important. The FPC has assumed for two decades that salmon harvests were around 1% and were thus trivial, something I had always accepted at face value. Yet, in trying to sort out the comparability of PIT and Coded Wire Tag survival estimates for our paper I was stunned to discover that even in the very best case, just the harvest removed in the lower river alone was varying between 10% and 25% over time. (For many populations harvests were far higher).

Worse, as we pointed out in our paper, fisheries managers adjust harvest levels based on their perception of whether salmon returns will be good or bad based on their forecasts of ocean conditions. So, the CSS may primarily be studying the effect of the managers on salmon survival and not the influence of the dams. These are HUGE scientific issues.

Scientists make mistakes. But scientists should also own up to those mistakes when they are identified, not bury them and claim that somehow their analyses are immune to changes in the input data, which is what is happening here with the CSS analysis.

It has been over a year since our paper identified this critical error in the PIT tag methodology, but the CSS report literally makes no reference to the harvest issue. As a result, most of the CSS' survival estimates are in fact badly biased downwards by varying amounts that depend on the year, the run, and the managers.

A simple fact of science is that when the data changes the analysis and conclusions will probably change as well. However, not so with the CSS report—apart from some mild comments from the ISAB reminding the CSS authors of the existence of the Welch et al (2021) report, the CSS itself makes no mention of the issues or how they have addressed them.

Both dam breachers and dam supporters should be feeling deep disquiet that a potentially bogus analysis is being presented as fact. Despite the huge implications of not accounting for harvest the CSS report confidently states that “*CSS analyses have shown that dramatic increases in SARs are only likely if the lower Snake River dams are breached and spill is maximized at the lower Columbia River dams*” (p. vi).

How can they possibly know this? The FPC made much over the years about how many other researchers’ studies have used “unrepresentative” samples. Yet even when given ample time to address the major bias caused by not accounting for harvest and either correcting their analyses or refuting the harvest data we reported (see Fig. 7 of our 2021 report), they chose instead to just bury the issue.

Perhaps the lower river harvest data we found in the government databases is wrong, though that is hard to believe that harvests are essentially zero as the FPC has assumed for decades. However, surely any group wanting to be taken as professionally credible should acknowledge the issues and take the time to sort them out instead of issuing yet another annual report stating that their analysis comes to the same conclusion as in the past. Their professional obligations should actually require as much.

The publication this year of the Storch et al and CSS studies thus primarily demonstrates that the authors involved refuse to objectively review even their own data and address the many weaknesses we documented. They may be sincere in their beliefs, but their beliefs are causing them to author deeply compromised reports that skirt the issues they can’t recognize, let alone explain.

It is almost as if the authors have no need of data because they already know what the conclusion is.

This behaviour should worry everyone interested in how to best manage Pacific salmon, but particularly the tribes who are being told that taking out the dams is the one sure fix to ensure they get the salmon that they are legally entitled to.

If delayed mortality doesn’t exist—and “gold standard” scientific experiments using randomized treatment and control groups with replication across years say it doesn’t—then other approaches to getting more salmon should be considered. In fact, the constant drumbeat by some salmon biologists that taking out the dams will help may in fact harm salmon returns if fossil-fueled power generation is used to replace the dams’ hydroelectric output. For reasons too long and complicated to lay out here, similar errors of logic and willful ignorance of contradictory evidence stretch back half a century to the original studies blaming the dams, and may have precluded identifying more effective paths to restoring Snake River salmon runs.

However, the key issue for discussion now in the run-up to policymakers making some momentous decisions about the Snake River dams is that the dams provide many benefits (CO<sub>2</sub>-free power, transport, and irrigation) that have been given short-shrift by single-issue groups who have amply demonstrated that they are incapable of balanced assessment.

This is doubly unfortunate because the intense focus on the dams means Columbia Basin may lose out on potentially creative alternative approaches that might better address the Columbia's salmon problems while strengthening the region's ability to shift to a carbon-free economy—which will help all salmon stocks.

To be sure, a decade on from our original studies there are things that we could improve on. In particular, the claim that smolts smaller than we could originally study suffered from “extreme delayed mortality” should be checked.

Given the stakes, these improvements are all desirable. Nevertheless, the original randomized treatment/control experiments we conducted still meet the gold standard for providing scientific evidence to policy makers, and it is striking that the critics of the Snake River dams could neither bring themselves to even admit the existence of these studies nor are they willing to address the potentially severe problems we found in their own data.

Squabbling scientists arguing over data is nothing new and hardly limited to the Columbia. However, as we concluded nearly a decade ago in our response to Dr Haeseker's original criticism “*In other scientific fields, formal experimental tests of theories historically resulted in very rapid scientific progress. The stakes are high in the Columbia River region; the window for resolving the salmon conservation problem is likely closing fast, given the large predicted changes in future climate and poor ocean survival of salmon that will likely ensue*” [7].

Nearly a decade on from when we wrote that, many Columbia River biologists still reject the abundant evidence directly contradicting what they believe and are even prepared to ignore their own data when it doesn't fit their claims. In so doing, they cheapen the debate and move from providing objective advice to policy makers to single-issue activists.

Such analytical intransigence may be hampering major opportunities for better salmon management: a more open-minded and careful analysis could show that carbon-free hydropower production (and the other economic benefits of dams) may be more compatible with salmon management than the current group of analysts are willing to concede. The recently released Inslee-Murray study has put the cost of replacing the Snake River dams at \$10-\$27 billion, somewhat lower than Rep. Simpson's \$33 billion proposal. Either way, that's a lot of dough to spend if the science of dam breaching is as weak as I have outlined.

Readers are invited to point out mistakes or omissions. The author will be happy to revise this document as appropriate given well-reasoned arguments. Please direct any comments to [david.welch@kintama.com](mailto:david.welch@kintama.com)

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