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POLICY NOTE

Real-world data contradicts letter on Snake River dams and temperatures

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Key Findings

1. Using a 2003 EPA model, a letter signed by fish researchers and activists claimed the four Lower Snake River dams are increasing river temperatures by up to 6.8° C.
2. Examining the 16 years of temperature data on the Snake River since the study was released finds the model overstated the warming impact of the dams by at least 20%.
3. Temperature data also show the potential impact of the dams on temperatures is declining.
4. The greatest temperature variance between the dams has also moved away from the time when salmon are returning.
5. The letter cites 2015 as an example of the worst temperature impact. It is also the year of the largest returns at the Lower Granite Dam, which is the farthest dam upstream.
6. The temperature impact of the Lower Snake River dams is smaller than claimed, declining, and outside the time when it would have most impact on salmon and steelhead. Destroying the dams is unlikely to yield significant temperature improvements based on the data.

In October 2019, advocates for destroying the four Lower Snake River (LSR) dams released a letter arguing that the four dams were increasing water temperatures, harming populations of returning steelhead and salmon.[1] The letter, signed by 55 "scientists," was cited in several news articles and in Governor Inslee's draft report on the dams.

The claim is based on a computer model that argues the dams slow down the flow of river water, which in turn increases the risk of heating from the sun. High water temperatures are harmful to salmon and steelhead, so an increase in temperature would add an additional stress to the fish as they move upstream to spawn. The letter claims, "When considered collectively, the four lower Snake Dams could affect temperatures up to a potential maximum of 6.8° C/12.2° F."

A look at the real-world data, however, indicate the impact of the dams is much lower than the model claims and is, in fact, declining, having less effect on fish populations. Additionally, the period of greatest apparent temperature impact from the dams does not occur during months when Chinook and steelhead are returning.

It should also be noted that although the letter is described as coming from "55 scientists," many of the signers do not have expertise in the science covered in the letter. For example, one of the signatories works for Defenders of Wildlife and published a master's thesis on "Adapting the community based social marketing framework to create actionable messages about plastic pollution."[2] Other signers are environmental lawyers or political activists.

Most importantly, scientist or not, none of them appear to have looked at the actual temperature data from the river to confirm the model's predictions.

Finally, an advance draft of this Policy Note was shared with the lead authors of the letter and one of the other signers who requested it. The draft was provided in early December 2019, but no comments were received.

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1 Cannamela, David, et al., "Science-based solutions are needed to address increasingly lethal water temperature in the lower Snake River," October 22, 2019, at https://www.orcaconservancy.org/6401-2/.

2 Oregon State University, "M.S. Thesis Defense - Katy Bear Nalven," at https://events.oregonstate.edu/event/ms_thesis_defense_-_katy_bear_nalven#.Xg6Ezfx7mUk.

Despite the rhetoric of the letter, the data demonstrate that the impact of the dams on river temperature is limited and has declined significantly over the past dozen years. This does not mean the dams have no effect on temperatures, but it does indicate that spending billions of dollars to destroy the dams would likely yield only small changes in river temperatures. Given the many options for expenditures to improve salmon recovery, this is another indication that destroying the dams has high costs but would provide very small benefits for salmon.

Is the model accurate?

The letter's claim that the Lower Snake River dams increase water temperature is based on an EPA model from 2003.[3] I asked the authors of the letter to share the modeling parameters and they directed me to the EPA, noting "the studies quoted in the letter were conducted by the EPA, not the 55 scientists who support and signed the letter, or by any of the spokespersons. The letter simply cites the modeling and conclusions of the EPA."

The key question is whether the model they cite is accurate. We have 16 years of actual temperature data since 2003 with which to test the accuracy of the older model.

The EPA 2003 model includes this chart which outlines the potential maximum impact from each of the dams on water temperature.

Table 4.2: Each dam's maximum effect on temperature at that dam site

FACILITY	MAXIMUM IMPACT (°C)	FACILITY	MAXIMUM IMPACT (°C)
Grand Coulee	6.23	John Day	1.39
Chief Joseph	0.69	The Dalles	0.147
Wells	0.22	Bonneville	0.27
Rocky Reach	0.13	Lower Granite	2.08
Rock Island	0.86	Little Goose	1.31
Wanapum	0.86	Lower Monumental	1.31
Priest Rapids	0.28	Ice Harbor	1.20
McNary	0.36		

3 U.S. Environmental Protection Agency, "Columbia/Snake Rivers Temperature TMDL, Preliminary Draft July 2003," page 30, at https://www.columbiariverkeeper.org/sites/default/files/2015/07/Preliminary-Draft-TMDL-Draft-6-30-03-editing-9-5-03.pdf.

Adding the maximum temperature increase from the four LSR dams (Lower Granity, Little Goose, Lower Monumental, and Ice Harbor) is apparently where they get the potential of a 6.8 degrees Celsius increase on the river. We can test the accuracy of this model estimate by using the real-world data collected since 2003 by the Army Corps of Engineers.

Actual temperatures are taken at several locations along the river, including at each dam. The impact of the Lower Granite dam, which is farthest upstream, is difficult to ascertain because the closest temperature reading is from Lewiston, 30 miles upstream. The temperature change between Lewiston and the dam is affected by a number of natural factors as well as by the dam itself. Rather than speculate, I chose to measure the temperature difference between Lower Granite, which is farthest upstream, and Ice Harbor, which is farthest downstream. By including all four dams in the gap ensures we capture most of the warming that could be caused by the dams. This also includes some natural warming, but it is a way to test the accuracy of the modeling.

According to the EPA model, the maximum temperature impact between Lower Granite and Ice Harbor is estimated at 4.69 degrees C. Using data collected by the Army Corps of Engineers, over sixteen years there is not a single instance of temperatures reaching that level of difference.[1] We measured the difference two ways. First, we looked at same-day comparisons between the two dams. The highest real-world difference we found was 3.9 degrees C on August 10, 2007.

We also looked at temperature differences over the course of a week because it takes time for the water to travel downstream. The highest variance we saw over the course of a week was 3.7 degrees, which occurred during the last week of July 2007. The amount of time it takes water to travel downstream varies, and other calculations are possible. But, it is unlikely that any timeframe would yield the 4.69 degrees temperature rise projected in the model.

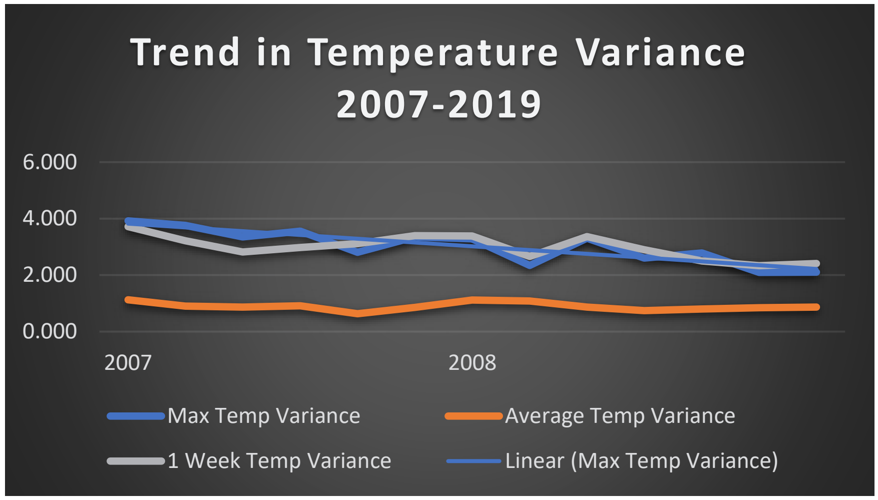
It is important to note that part of that 3.7-degree difference is from natural causes, so the dam-related variance is likely to be smaller. Even so, the highest difference between the dams over the course of sixteen years is about 20 percent lower than what the model projected.

The temperature difference is declining

The letter claims several times that the temperature impact of the dams "remains unmitigated." This claim is contradicted by the data. Between 2007 and 2019, there was a steady decline in the temperature variance between the Lower Granite dam and the Ice Harbor dam downstream.

Using the same-day comparison, the maximum temperature difference – and the maximum potential impact of the dams on temperature and fish – between the two dams fell from 3.9 degrees C in 2007 to 2.1 degrees C in 2019 – a reduction of 46 percent. Using the one-week difference, the trend shows a similar decline, falling from 3.7 degrees C to 2.4 degrees C – a decline of 35 percent.

4 Columbia Basin Research, "Columbia Basin Conditions Year Comparisons for Single Project," at http://www.cbr.washington.edu/dart/query/basin_conditions_projcomp.



Meanwhile, the average temperature variance between the dams has stayed about the same. This is largely due to the impact of non-summer temperatures, which are fairly similar throughout the Snake.

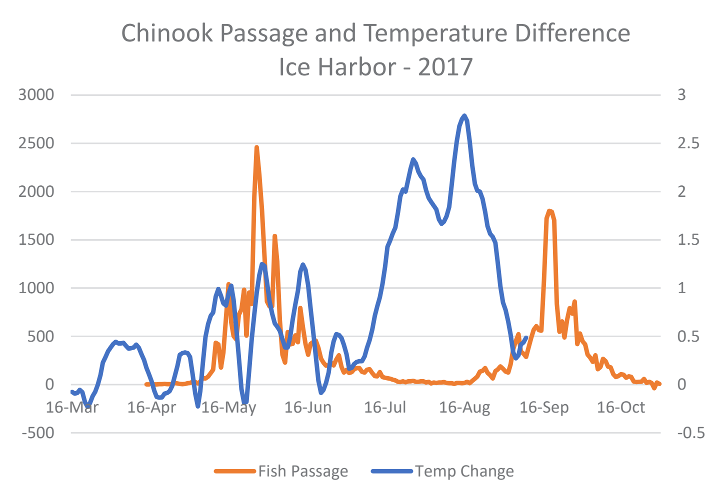
This significant decline in the temperature difference implies the Army Corps is improving the management of the dams, by introducing cool water from Dworshak dam and other techniques to reduce potential temperature impacts from the dams during the summer months.

The authors claim that temperature problems will grow worse with climate change. The data demonstrate that has not been the case over the past two decades, as salmon populations have generally increased and the apparent temperature impact of the LSR dams has declined.

The temperature variance isn't during Chinook runs

In addition to the fact that the temperature variance is shrinking, it is also moving away from the period when the Chinook salmon are running in the river in the fall. From 2008 to 2018, there was a significant change in the timing of the temperature variance.

In 2008, the largest variance of the year occurred on September 1, a day that preceded the three highest Chinook counts at the Ice Harbor dam. The temperature variance came at the worst time for fish survival.



By way of comparison, a decade later in 2018, the highest variance occurred on August 4, when there were very few Chinook passing Ice Harbor dam. The same was true in 2017, 2016, and even 2015 which the authors highlight as a bad year for temperatures. In 2015, the largest variance happened even earlier, on July 23, when only 175 Chinook passed the Ice Harbor dam. The Chinook run peaked a month and a half later, on September 19, when 3,089 Chinook passed the dam when temperatures were actually below their 10-year average at Ice Harbor

In addition to a significant reduction in the temperature variance between the dams, there has also been a shift in when the variance occurs. In the 2000s, the temperature variance was larger and overlapped with the fall months of the Chinook run. In the late 2010s, the variance was much smaller and no longer overlaps with the fall run.

In 2019, the single-day temperature difference between the dams was only 1.4 degrees C when the fall Chinook run hit its peak on August 18. The steelhead run occurs even later in the fall, when the temperature differences and overall water temperatures are even lower.

The authors of the letter cite mortality among sockeye salmon, implying this could also apply to other species. The authors say, "fall Chinook and sockeye have a greater exposure to high temperatures than adult spring/summer Chinook because they migrate later in the summer, when temperatures are hottest." This may be true, but the question is how much of that temperature rise is caused by the LSR dams. Based on the trends in overall temperature difference and timing, the impact of the dams is small and declining.

Population trends are upward for Chinook and sockeye salmon

Finally, it is important to note that the overall population trends for both Chinook and sockeye salmon are upward. The year. 2015, highlighted in the letter, is a dramatic case in point. For sockeye, the number of fish passing Lower Granite dam – the farthest upstream – was higher than in any year prior to 2008 for three decades. For Chinook, 2015 was the largest run in decades. The argument could be made that the runs might have been even larger without the dams, but that is speculation and it is useful to recognize that the influence of the dams in the total population is small relative to natural factors.

We are seeing this in 2019. Sockeye runs are very low along the Snake but are also extremely low in Lake Washington. Other factors are driving regional sockeye population cycles. If the influence of the LSR dams on temperature is the justification for destroying the dams, it is hard to make the case for the enormous expenditure of resources when the impact is small relative to natural factors in the ocean and elsewhere.

Steelhead numbers are slightly different, with populations on the Snake declining during the past decade compared to the 2000s. However, average population during the last decade is still higher at Lower Granite Dam than it was in the 1970s, 1980s, or 1990s. If the impact of the dams were increasing, fish populations would not be trending upward.

The data contradict the claims of the letter

Despite the claim in the letter that the LSR dams are increasing temperatures and that the impact "remains unmitigated," the real-world data from a decade and a half demonstrate that these claims are either exaggerated or simply incorrect. The water temperature impact from the dams has never reached the levels predicted by the computer models and the maximum real differential has declined significantly over the past dozen years.

Conclusion

The recent downturn in salmon and steelhead populations on the Snake, Columbia, and across the region are an indication that we still have work to do in helping increase regional salmon populations.

To do that effectively, we should rely on real-world data and the latest science to prioritize our conservation efforts. Relying on outdated computer models without doing any on the ground verification is not only bad science, it drains attention and public resources from parts of the state where we can provide the greatest benefit for salmon recovery. Unfortunately, this letter is likely to harm efforts to make positive, science-based policy decisions that help salmon and steelhead populations.

Todd Myers is the Director of the Center for the Environment at Washington Policy Center. He is one of the nation's leading experts on free-market environmental policy. Todd is the author of the landmark 2011 book *Eco-Fads: How the Rise of Trendy Environmentalism Is Harming the Environment* and was a Wall Street Journal Expert Panelist for energy and the environment. Todd's research on the failure of "green" school mandates has stirred a reassessment of those requirements in school districts across the country. He currently sits on the Puget Sound Salmon Recovery Council and served on the executive team at the Washington State Department of Natural Resources. Todd also served as Director of Public Relations for the Seattle SuperSonics and Director of Public Affairs for the Seattle Mariners, and he holds a Master's degree from the University of Washington. He and his wife live in the foothills of the Cascade Mountains with two dogs and 200,000 honeybees.

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