Salmon of the Snake River

A closer look at the peer-reviewed science on dams, salmon, and climate change

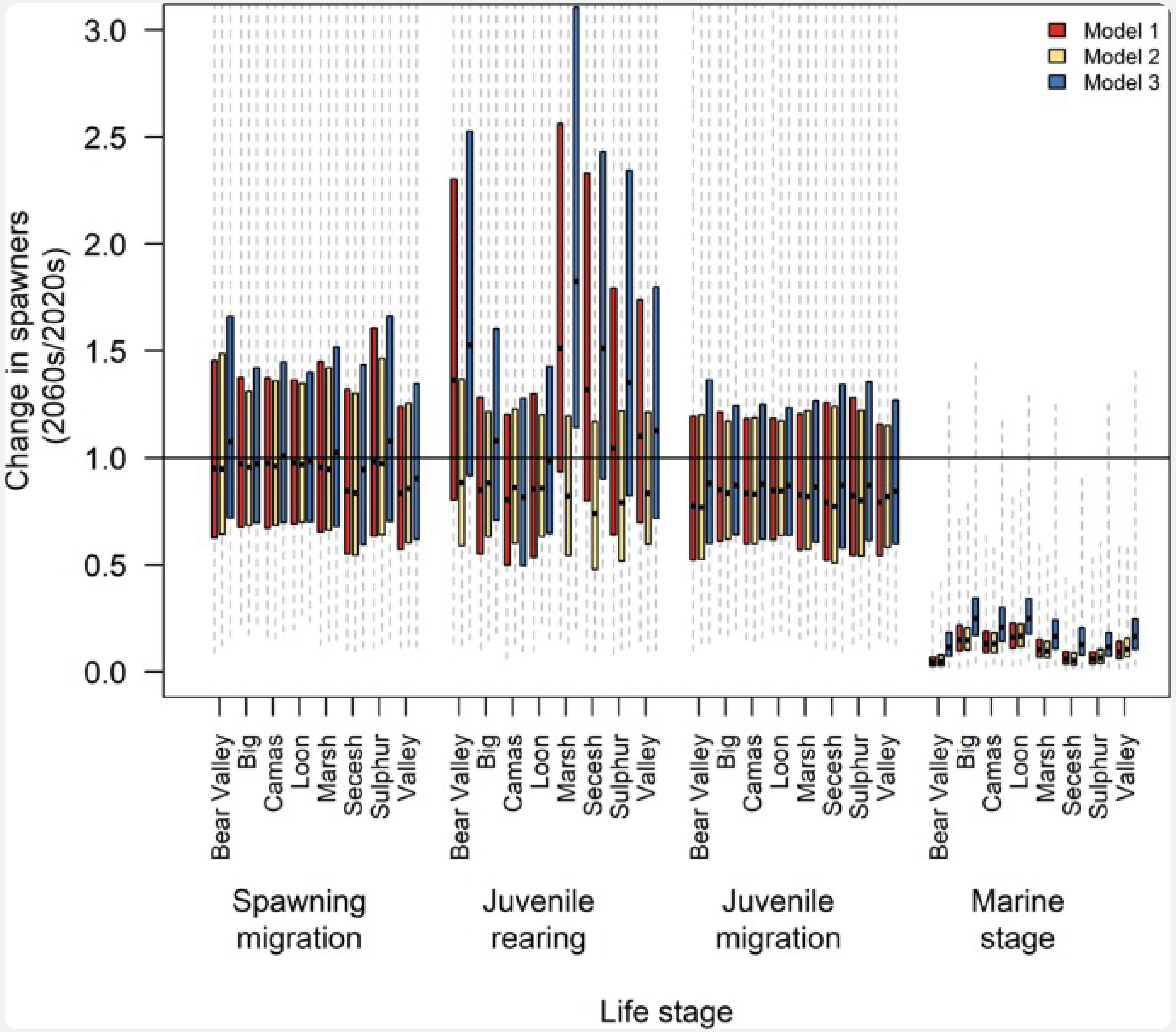
Introduction

Salmon are part of the lifeblood of the Pacific Northwest. They enrich our environment, feeding forests and rivers and wildlife with valuable nutrients from the ocean. To the people who call this place home, especially the indigenous tribes, they are woven into the fabric of culture itself. Yet, these iconic fish face the very real possibility of extinction, and the downstream result could be disastrous.

A particular spotlight has been placed on four run-of-the-river dams on the lower Snake River that produce thousands of megawatts of clean energy and allow for the navigation of barges to and from inland ports. Although they offer excellent fish passage, some still maintain they are limiting salmon recovery.

Today, the Snake River is home to four endangered or threatened salmon and steelhead populations. In the United States, there are a total of 31 endangered or threatened populations of Pacific salmonids in rivers throughout the West Coast. Additionally, Canada lists an additional 45 salmon and steelhead populations in their waterways as at risk.

That means that just four of the 76 listed groups are impacted by the presence of the lower Snake River dams. The biggest threat that each of these populations share is the warming of their ocean habitat due to climate change, and recovery efforts should address this problem directly. This paper will examine the science behind these threats more closely and wade through some of the mixed claims about the Snake River dams.



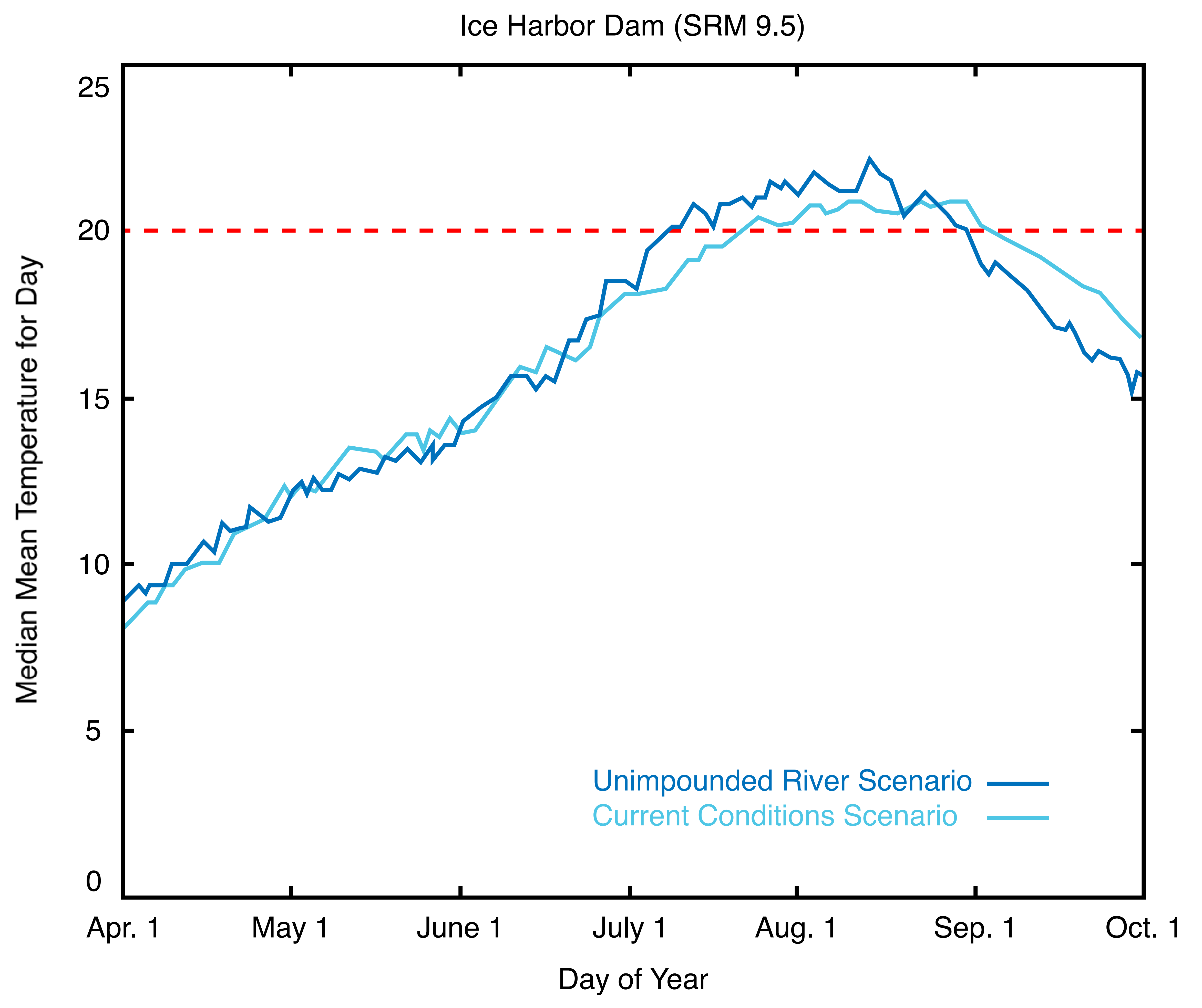
Climate impacts were most dramatic in the marine stage, where survival was reduced by 83–90% (Fig. 7). This occurred despite the fact that smolts arrived at Bonneville Dam about 6.5 days earlier, indicating an earlier initiation of the marine stage, which generally improves marine survival. (Figure from NOAA Fisheries paper)

Climate change

To understand the climate change threat, it's necessary to examine the context. In 2021, NOAA Fisheries issued a peer-reviewed study which predicted key Chinook populations may go functionally extinct by 2060 if the Pacific Ocean continues to warm at its current rate. This study also identified the threat salmon face from ocean warming is much greater than the threat from warming rivers.

Consistent with the previously mentioned NOAA study, a 2020 peer-reviewed study concluded that Chinook salmon survival has declined coast-wide on average by 65% over the last 50 years, whether salmon were returning to rivers with dams or to free-flowing rivers. The region's Independent Scientific Advisory Board confirmed this finding.

That 50-year period examined in the study coincides precisely with the same period noted by the Intergovernmental Panel on Climate Science as, "50 years of unabated ocean warming."



Comparison of the simulated median mean temperature at Ice Harbor Dam location for the current impounded and unimpounded conditions. (Figure from MASS 1 Model)

River temps

While the magnitude of the threat of river warming may not be nearly as large, scientists agree river warming still represents a serious problem for salmon in an era of climate change. What is much less clear is the role the lower Snake River dams have on river temperatures.

The EPA's RBM10 model indicates that because the dams slow the pace of the river, they cause river temperatures to be warmer in the summer months. The Pacific Northwest National Laboratory's MASS 1 model, on the other hand, shows a much different result.

The MASS 1 model indicates the larger body of water created by the lower Snake River dams' reservoirs takes more energy to warm—akin to boiling a large pot of water—and therefore provides a buffer against the most dangerous temperatures compared to an undammed river.

River temps (cont’d)

Data comparing river temperatures before and after the lower Snake River dams were constructed is sparse. However, a team of researchers conducted a water temperature study on behalf of the US Army Corps of Engineers in 2002, which compared pre-lower Snake River dam temperatures from 1955 to 1958 to measurements after the lower Snake River dams were constructed in the 60s and 70s.

The researchers found no evidence that river temperatures had increased following construction of the dams, although the data set was quite limited. The team identified air temperature and flow levels as the biggest influence on temperatures in the river.

Given there is missing data and different collection methods, this analysis should not be employed by itself, but it is fair to say that between the modeling disagreements and the lack of clear historical records, the science on the impact of the lower Snake River dams on river temperatures is mixed.

Delayed mortality?

The primary case made for breaching the lower Snake River dams is the theory of delayed mortality, which posits that salmon which pass more dams as juveniles return in fewer numbers than adults. However, the West Coast-wide study results seem to refute that conclusion. Also, the fact that fall Chinook from the Snake River return in higher percentages as adults than fall Chinook from the John Day and Yakima rivers runs contrary to the delayed mortality theory, even if the reverse is true for spring Chinook.

In 2007, the Independent Scientific Advisory Board studied the issue and found no measurable evidence of a cause-and-effect relationship between the number of dams by juvenile salmon and adult returns ratios.

Proposed Solutions

01

To restore salmon to abundance, we need a better understanding of the marine environment. Recently, NOAA Fisheries announced the largest expedition ever to study salmon in the North Pacific, but the $10 million in funding still pales in comparison to the billions of dollars invested on freshwater habitat and research. More resources are needed to fill our knowledge gap to help drive future salmon policy.

02

A 2019 peer-reviewed study showed estuaries along the West Coast of the United States have lost 85% of their historcial vegetated wetlands over the past 100 years. These wetlands—where the ocean and river meet—are critical to juvenile salmon as they make the transition from freshwater to the ocean. Natural, vegetated wetlands help hide these young fish from predators. Restoring estuary wetlands and vegetation could be a major step in salmon recovery.

03

We have partnered with the Columbia River Inter-Tribal Fish Commission to shine a light on Mitchell Act hatcheries. These hatcheries rely on the Department of Commerce rather than BPA for funding. Modernization has fallen behind due to low funding, resulting in reduced salmon production. When broodstocks are carefully selected and juvenile fish are raised properly, the abundance of hatchery fish can greatly benefit our ecosystem and economy.

04

Climate change clearly represents a critical and immediate threat to salmon. Hydropower represents close to 90% of the Pacific Northwest's renewable energy and half of its total electricity generation. As a result, we have the least carbon-intensive grid in the United States. These dams also balance the fluctuations of wind and solar by holding back or releasing water as needed. They perform the same kind of support you might expect from a large-scale battery without the same limitations and drawbacks.

05

Avian predation is a major source of mortality for listed Snake River steelhead, among other stocks. Studies have also shown that pinneped predation of salmon has increased greatly. Within the Puget Sound, alone, a 2017 study estimated pinneped predation of Chinook salmon increased from 68 metric tons in 1970 to 625 metric tons in 2015. The 2015 figure is double the consumption of the struggling Southern Resident orcas. Better management of these predators could restore balance to the ecosytem and ease salmon mortality.

As demonstrated, there is a lack of peer-reviewed scientific evidence to clearly identify the lower Snake River dams as the limiting factor for salmon and steelhead recovery. The context of a near-synchronous decline of salmon populations along the Pacific Coast of North America and even across the world—regardless of whether dams are present—provides sufficient reason for us to pause to consider what other factors may be at play.

If the threat is directly linked to ocean temperatures, then removing productive, zero-carbon hydropower projects is a step in the wrong direction for salmon.

Resources available at
nwriverpartners.org