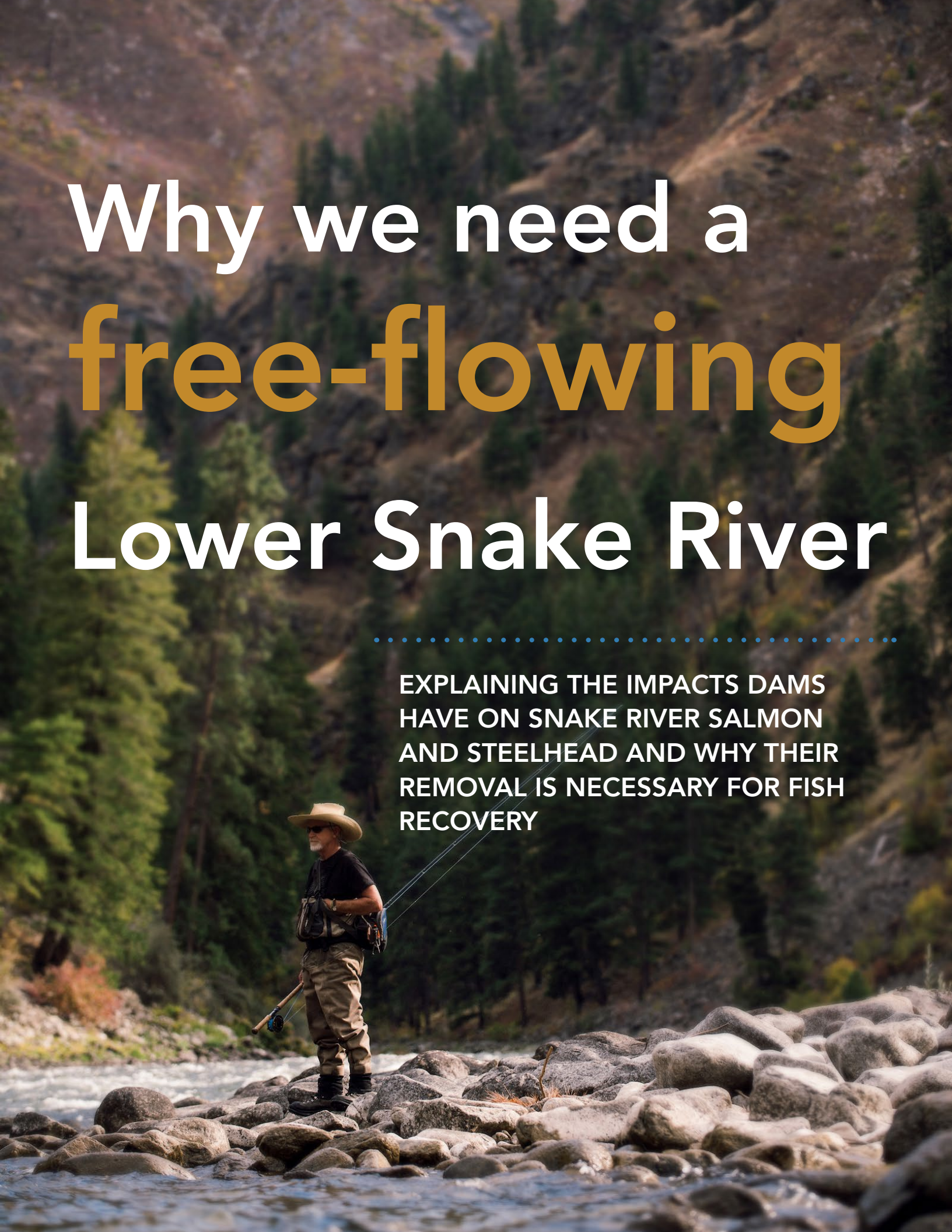
Why we need a free-flowing Lower Snake River

EXPLAINING THE IMPACTS DAMS HAVE ON SNAKE RIVER SALMON AND STEELHEAD AND WHY THEIR REMOVAL IS NECESSARY FOR FISH RECOVERY



How do we bring back salmon and steelhead?

Look to the science.

Making decisions based on sound science and information is a core principle of Trout Unlimited. With that in mind, we set out to better understand the science behind the decline of Lower Snake salmon and steelhead and what could be done to recover them.

Overwhelmingly, the evidence has led us to conclude that removal of the four lower Snake River dams is the single most important step we can take to recover abundant, fishable and harvestable Snake River salmon and steelhead. Dam removal, however, must be part of a comprehensive recovery plan that includes restoring and protecting habitat, improving hatchery and fishery management, and reducing predation.

We understand that not everyone sees it the way we do. As members of the communities that have been and will be impacted by this challenge, we recognize that all of the Pacific Northwest must benefit from actions designed to help salmon. This is not about sacrifice; it is about saving salmon and steelhead while strengthening the regional economy.

But we are committed – and determined - to seek solutions that work for fish and people while also meeting the needs of the industries and communities that are dependent on the dams. Science may not be the determining factor for every decision we make. But a sound foundation in the facts and good-faith efforts to find common ground with our neighbors should be where we start.

We have taken a deep dive into the science and data and come out with a clear conclusion: If the four lower Snake River dams are not removed, Snake River wild salmon and steelhead may soon become extinct.

We have compiled the evidence for dam removal and distilled it into an approachable series of questions and answers. We hope you will take some time to dig in, think about it, and then reach out to us, if you have questions, concerns or simply want to be involved in the effort to recover the Snake River's magnificent salmon and steelhead.

Recovery is not theoretical. It is not a distant vision on some yet-seen horizon. It is within our grasp: We can bring back our fish and do so in a way strengthens the regional economy and Columbia Basin communities.

And by working together, we will.

Chris Wood
President and CEO
Trout Unlimited

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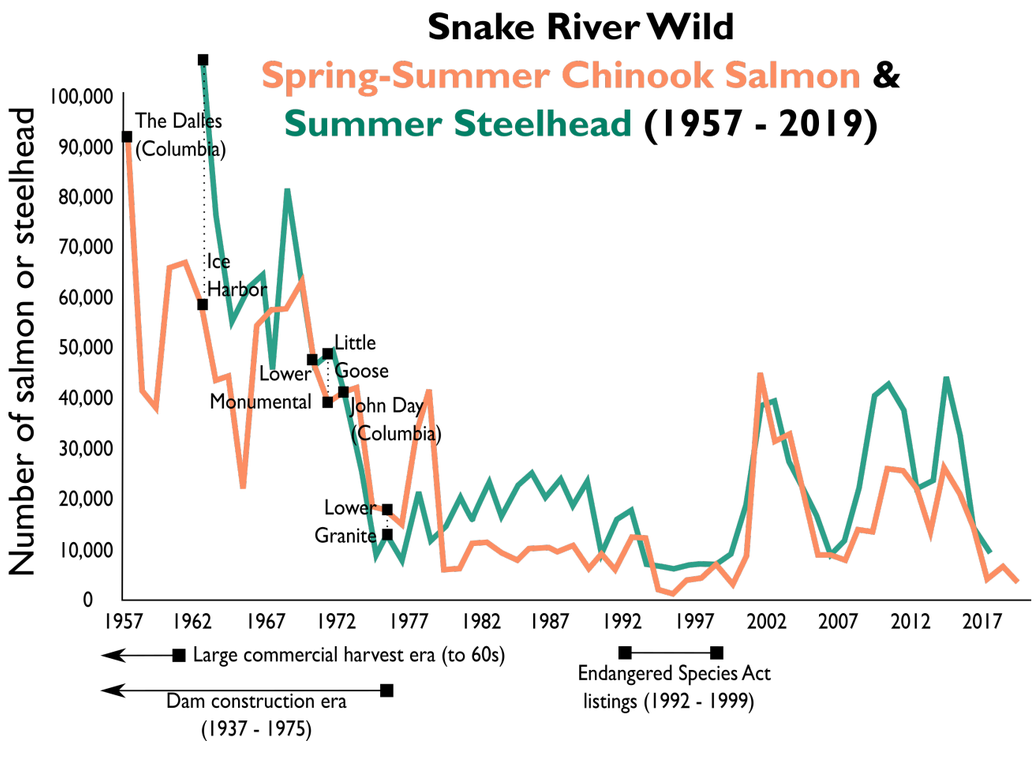
Q.) What is the current state of salmon and steelhead?

Salmon and steelhead populations fluctuate, sometimes widely so, on an annual basis due to variability in freshwater and ocean conditions. Just as one tracks the performance of a financial portfolio it is important to focus on long-term trends, not a single annual return. As the data clearly reveal, the long-term trends are not improving and there is no evidence to suggest that we can achieve abundant and harvestable populations without major changes in our recovery actions.



What does recovery mean?

And who decides?

For Trout Unlimited, recovery means abundant, healthy and harvestable populations of wild salmon and steelhead returning regularly. But to better quantify what that means, both scientifically and socially, we turn to the Columbia Basin Partnership.

What is the Columbia Basin Partnership?

The partnership is a diverse group of 31 Columbia Basin stakeholders and sovereigns, including representatives of the four Columbia Basin states, tribes, ports, public power entities, irrigators, commercial and recreational fishers and conservationists. It was the Partnership which unanimously defined "recovery" to mean "healthy and harvestable" naturally reproducing populations of salmon and steelhead.

How many fish do we need?

To more concretely define those terms, the Partnership created a range of goals – low, medium and high. The high-end goals are shown below. To achieve cultural and economic stability provided by healthy salmon and steelhead stocks, many more naturally produced fish are needed to meet the recovery goals established by the Partnership – roughly five times the number needed to lift ESA protections. Still, these goals are a modest percentage of historical numbers.

Species	CBP Recovery Goal	Numeric goal needed to remove ESA protection	CBP Goals compared to historical abundance
Spring/summer Chinook salmon	148,500	31,500	22%
Steelhead	124,000	21,000	21%
Fall Chinook salmon	23,360	4,200	5%
Sockeye	9,000	2,500	11%
Coho	47,400	10,000	24%

How are these different from the goals agencies set?

The way salmon and steelhead are currently managed by NOAA Fisheries sets a much lower bar. NOAA abides by the requirements of the Endangered Species Act (ESA). The ESA requires only that risk of extinction be sufficiently low over a 100-year timeframe. The Partnership's definition of recovery takes a much broader approach and considers both the health of the fish and the strong desire of people to fish for salmon and steelhead, which fuels rural economies and meets treaty obligations to Native American tribes.

many points of IMPACT

The four lower Snake River dams and the reservoirs they create harm fish in numerous ways.

1) The dams kill juvenile fish as they pass each structure on their migration to the Pacific.

2) The dams inundate 140 miles of spawning and rearing habitat, and create slow moving reservoirs that are devoid of food, become lethally hot in the summer, and lack cover fish can use to hide from predators.

3) The dams cause juvenile fish to expend much more energy to migrate to the Pacific because the fish must actively swim through reservoirs instead of migrating passively with river current.

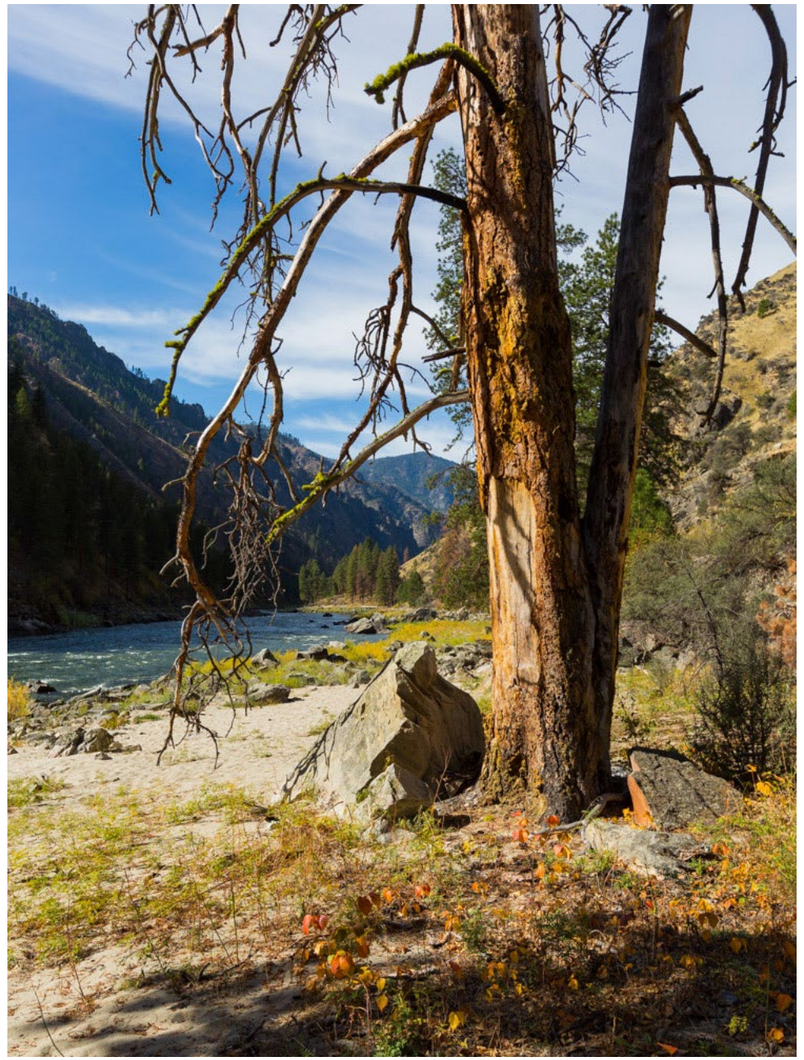
4) The dams cause sustained high-water temperatures during the summer and early fall that weaken or kill migrating fish.

5) The dams kill adult fish returning to their spawning grounds.

6) The dams increase, on average 10-times, the amount of time it takes juvenile salmon to reach the ocean; this increases their exposure to predators and causes a mismatch between timing of ocean entry and the process of smoltification (the physiological change juvenile salmon and steelhead undergo to prepare for a saltwater environment).

7) The dams diminish the food supply for juvenile fish by inundating river habitat that produces food.

8) The reservoirs behind the dams provide habitat for both invasive and native predatory fish and make juvenile fish easy targets for predatory birds.



Q.) How do you measure the impact of dams on fish populations?

Of these known impacts, only some can be quantified. Those in support of maintaining the dams often cite statistics regarding the high percentage of juvenile fish that survive as they pass each dam (from top to bottom of the physical structure), but as noted above physical passage over a dam is just one of the many ways the presence of dams hurts or kills salmon and steelhead.

Data also show that while juvenile fish initially survive the journey from one dam to another or through a series of dams, the cumulative impacts on survival are significant. However data capture only some aspects of the impact and don't represent the full effect.

Studies establish that some fish die after they have passed through the hydro-system because of the stressful experience of passing the dams and migrating through the reservoirs. This is referred to as "latent mortality" and it occurs at some point below Bonneville dam, the last dam fish must pass on their way to the ocean. The amount of latent mortality experienced by salmon and steelhead has been a hotly debated topic for decades. We cannot quantify it precisely because too many variables exist. But the fact that it is difficult to quantify does not negate its potentially significant impact. Recent estimates of latent mortality used by NOAA in the Columbia Basin Partnership process range between 9 and 60 percent.

For fish that survive passage through the dams and reservoirs, the experience also exerts significant stress on adults, which ultimately reduces the number of juvenile fish produced. Some female adults never spawn and others produce far fewer eggs. As is the case with latent mortality, it is not possible to quantify this harm, but that does not diminish the fact that it exists and contributes to depressed wild salmon and steelhead populations.

The combined impact of these factors shows us the four lower Snake River dams and the reservoirs behind them take a heavy toll on Snake River salmon and steelhead. The mortality that can be quantified is substantial. But when the harm caused by the dams and reservoirs that cannot be quantified is added to the equation it becomes clear that breaching the four lower Snake River dams would vastly improve the abundance and productivity of wild Snake River salmon and steelhead.

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Steelhead parr/John McMillan

Adult chinook salmon/John McMillan

Juvenile chinook salmon/John McMillan

What is a smolt-to-adult ratio and why is it important?

Simply put, the smolt-to-adult Ratio (SAR) is the percentage of smolts that survive and return to spawn:

ADULTS / SMOLTS = SAR

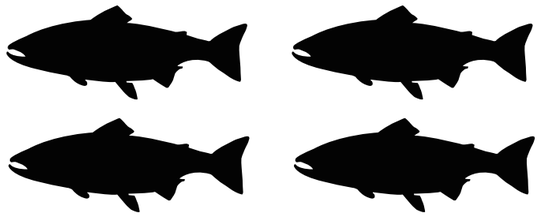
For example, if 100 steelhead smolts pass Lower Granite dam on their downstream migration and 2 adult steelhead from that group return and survive to pass Lower Granite on their way to spawn, the SAR would be 2 percent (adults/smolts).

SAR is an important metric because it is the only metric that captures (most of) the cumulative impacts of the hydro system on salmon and steelhead, telling us how sustainable the returns of adults are over time. This is critical because even if high quality habitats produce a lot of smolts, the population will only be sustained if those smolts can make it out to the ocean and survive to return and spawn as adults.

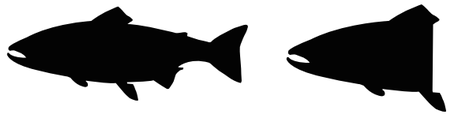
For Snake River stocks SAR is often calculated by dividing the number of returning adult salmon and steelhead that pass the uppermost lower Snake River dam, Lower Granite, on their way to spawn, by the total number of smolts (juvenile salmon and steelhead) that previously passed Lower Granite dam earlier as they were migrating to the ocean.

The scientific consensus is that SARs must be at least 2 percent for Snake River adult salmon and steelhead to replace themselves and simply avoid extinction. To rebuild stocks, that percentage will need to be 4 to 6 percent.

To recover populations in the Snake River Basin, we need at least four adult fish for every 100 smolts to survive the hydro system and return to spawn.

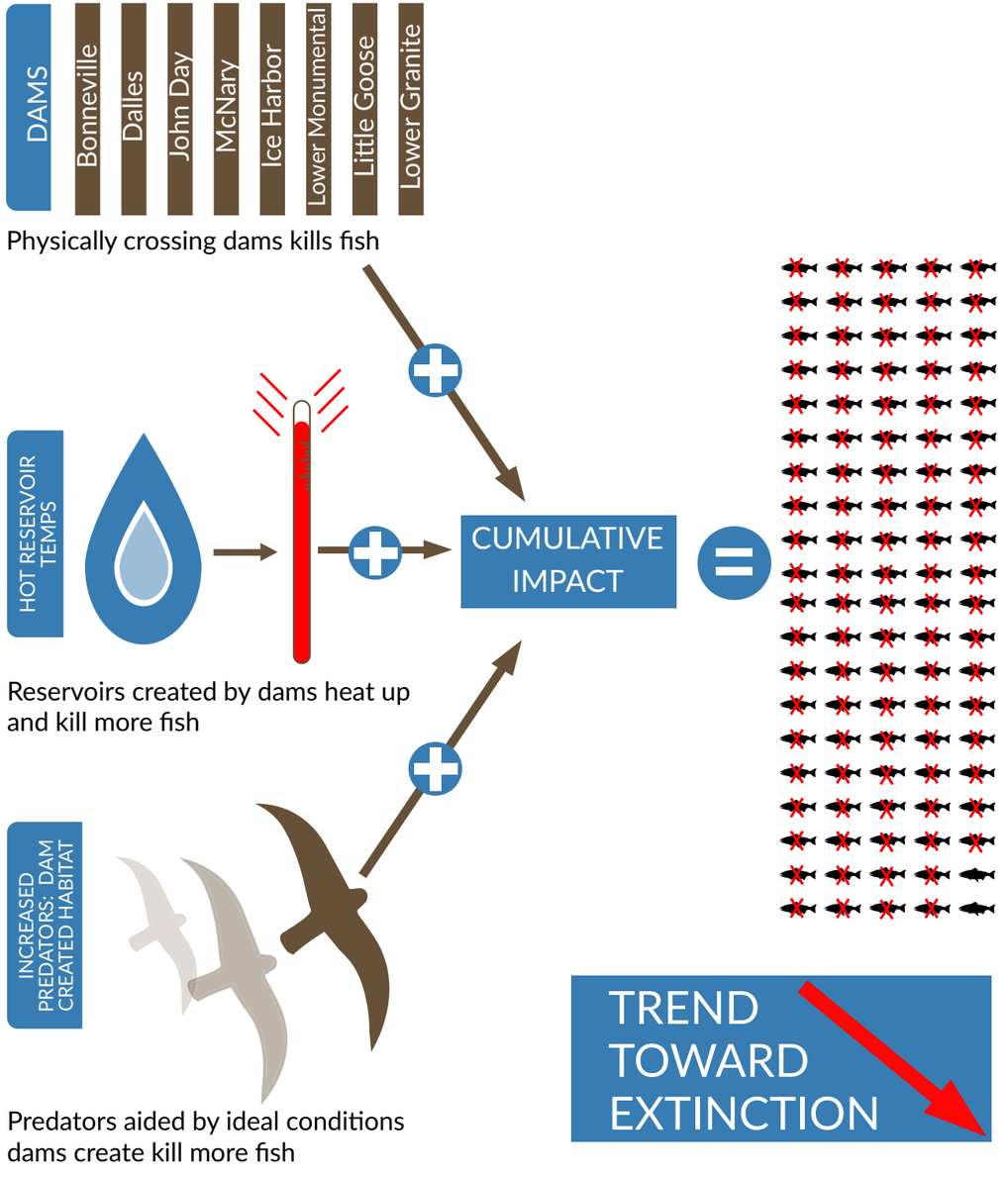


BUT in the last 25 years, the Snake River Basin has not even averaged 2 adults.



A downward trend:

Salmon and steelhead have survived the swim to sea for millennia, but dam construction has made that journey more deadly. As fish migrate to and from the ocean, countless obstacles will kill a percentage of the population. While some causes are natural, many, such as high water temperatures in reservoirs and increased predators are caused or exacerbated by the presence of dams.



Q. Is it possible to recover salmon and steelhead without removing the dams?

The short answer is no.

Rebuilding salmon and steelhead populations will require increasing the number of adults that return to spawn relative to the number of juveniles that migrate to the ocean. This is known as the smolt-to-adult ratio, or SAR

However, in the past 25 years, salmon and steelhead SARs have failed to reach 2 percent despite restrictions and closures of modern fisheries, and massive investments in Snake River Basin habitat restoration and juvenile fish passage systems at the lower Snake River dams.

The Northwest Power and Conservation Council determined that an SAR of 4 to 6 percent (that is for every 100 smolts, 4 to 6 adults return to spawn) is needed to achieve robust populations.

While many actions like habitat restoration and increased spill over dams have been taken and billions of dollars have been spent, populations have not rebounded.

According to the scientific evidence, achieving a 4 to 6 percent SAR will require breaching the four lower Snake River dams and additional actions.

Restoring a free-flowing lower Snake River, when coupled with complementary actions such as predator control, habitat restoration and spill, is the only meaningful action left in our toolkit with the potential to attain the Columbia Basin Partnership's recovery goals. An ongoing, long-term study called the Comparative Survival Study, conducted by biologists from the Oregon and Idaho, Fish and Wildlife Service, and the Tribes estimates that Snake River dam breaching in concert with increased flow at downstream dams will increase SARs 2-3 times.

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Despite restrictions and closures, SARs have failed to reach even 2 percent in the past 25 years on the Snake River.

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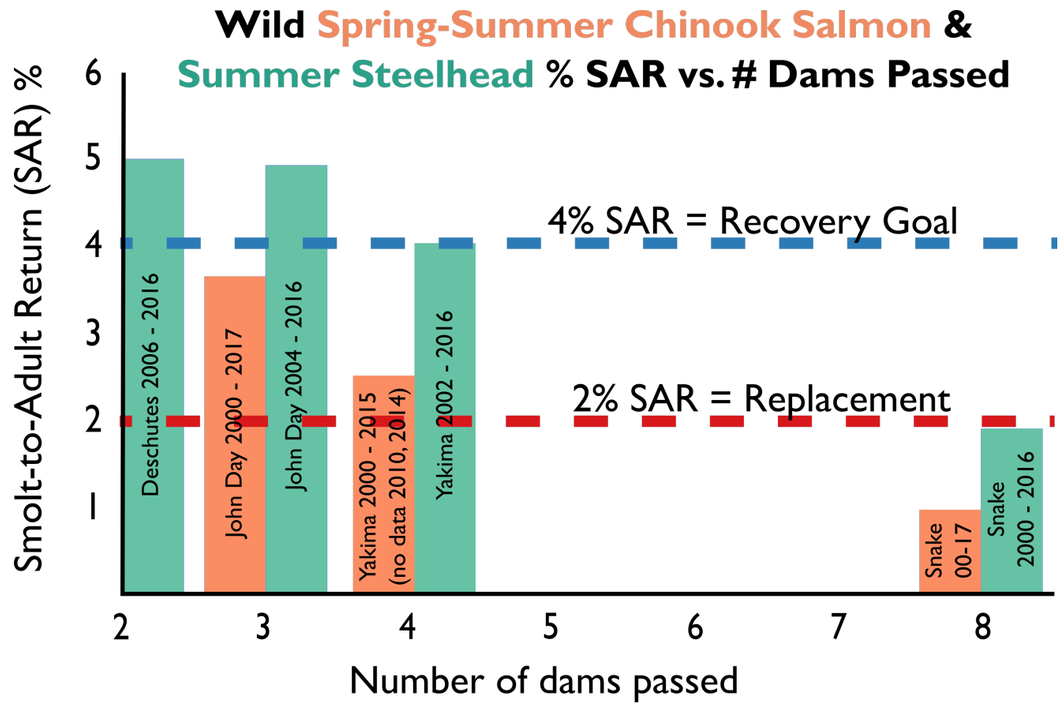
Will breaching the dams solve the problem?

For some context, in the mid-1960s, before the last three Snake River dams were completed (Ice Harbor was in place as were the Columbia dams) SARs for Snake River spring/summer Chinook salmon ranged from 3.5-6.5 percent (average 4 percent from 1964-1968).

In contrast, over the last 25-years, SARs for Snake River spring/summer Chinook salmon have exceeded 2 percent in only two years and Snake River sockeye and fall Chinook salmon have never hit 2 percent. Snake steelhead have hit 2 percent in a handful of years, but their mean SAR is below 2.

This represents a trajectory toward extinction because not enough smolts are surviving to return and spawn as adults.

Below: This graph shows the average smolt-to-adult ratio in the context of how many dams the fish must pass. Fish with fewer dams to navigate such as populations in the Deschutes and the John Day typically have higher SARs.



Why is the Snake River Basin the right place to make this kind of investment?

The Snake River has, by far, the greatest potential for wild fish recovery of any watershed in the Columbia Basin.

Historically it produced half of the spring/summer Chinook salmon and summer steelhead in the Columbia system. Annual run estimates prior to the 1850s exceed two-million fish for all Snake River stocks. Even with significant areas of the Snake River blocked by impassable dams (Hells Canyon Complex and Dworshak) it still has tens of thousands of miles of high-quality salmon and steelhead habitat in the Clearwater, Salmon, Grand Ronde and Imnaha sub-basins. About 46 percent of Idaho's historic spawning and rearing habitat for spring and summer Chinook Salmon and summer steelhead remains accessible.

More broadly, within the current, native distribution of salmon and steelhead on the West Coast (CA, OR, WA, and ID), the 30,000 miles of stream habitat in the Snake River Basin represents:

-- 20 percent of the total amount of accessible stream habitat

-- 50 percent of the current coldwater habitat

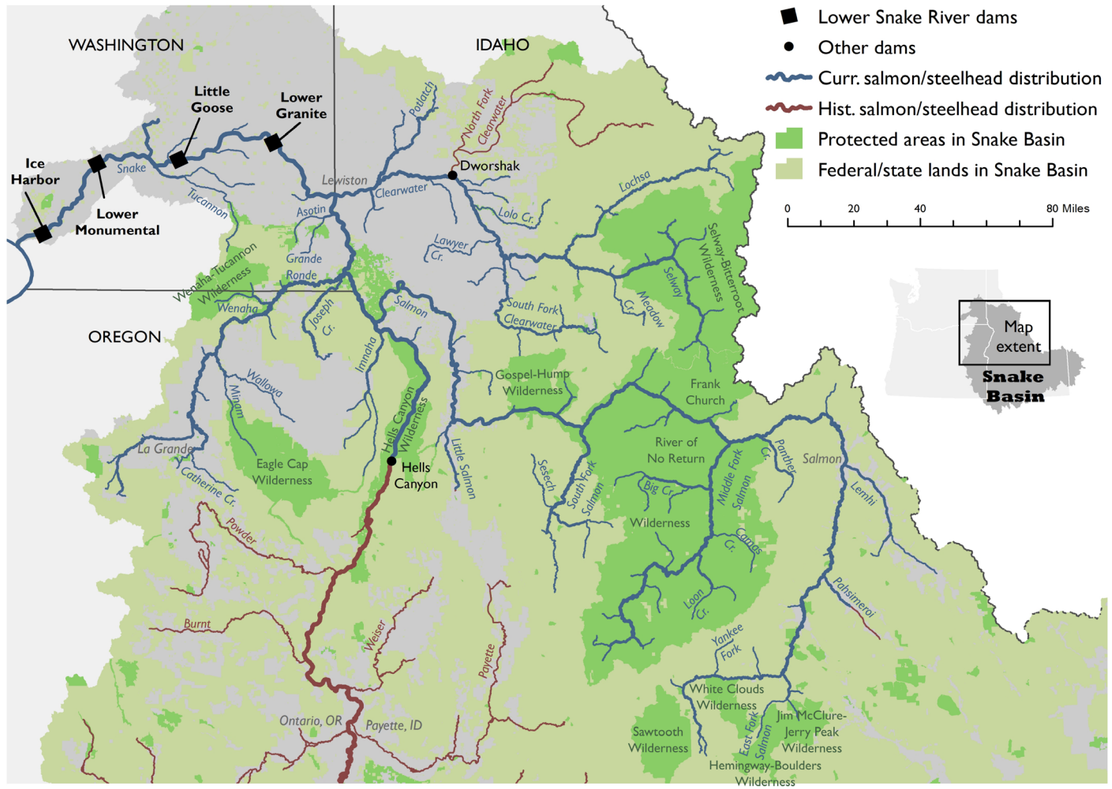
-- 65 percent of the predicted coldwater habitat in 2080

-- 40 percent of protected public lands with wilderness qualities

Mile-for-mile, the Snake River basin contains the coldest, most undisturbed stream habitats in the Lower 48.

The bottom line is that if we are going to make major investments in wild fish recovery in the Columbia Basin, the Snake is the place to put our money.

Salmon and Steelhead Habitat in Snake River Basin



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40% of protected public lands with wilderness qualities.

Q.)

Can we restore Snake river salmon and steelhead by improving habitat?

Idaho has the largest, connected federally managed Wilderness in the lower 48, much of it protecting rivers in the Snake River Basin. If habitat were the limiting factor for Snake River salmon, we would expect fish in Idaho wilderness to be relatively abundant.

Instead, return patterns in the Middle Fork Salmon River, anchored in the Frank Church Wilderness of No Return, mirror those in the rest of the basin. These fish continue to straddle extinction and suffer a large recovery gap – in wilderness. Since 1995 redd (salmon and steelhead nests) counts in the Middle Fork Salmon River have averaged just 3 percent of estimates from the 1950s and '60s, and the National Marine Fisheries Service explicitly recognizes that "natal habitat actions in the [Middle Fork Salmon River] basin will not produce the increases in survival needed … to achieve viability."

That is not to say that habitat restoration would not be helpful in the Snake River Basin. Watersheds like the Lemhi, Pahsimeroi, and Yankee Fork have been considerably altered by mining and agriculture. Large partnerships are working to improve these habitats and much progress has already been made, but despite millions of dollars invested in habitat restoration adult fish are not increasing.

It is also telling that 50 years ago when habitat in rivers including the Lemhi was more degraded than it is today, more adult salmon and steelhead were present. For example, from 1960-62, when habitat was severely degraded, inaccessible or totally absent due to dewatering, redd counts in the Lemhi averaged 1,588 -- in 2019 only 81 redds were observed.

The evidence is overwhelming that restoring habitat, while needed to improve the productive potential of the Snake River basin, will not recover wild salmon and steelhead. The key to restoring healthy, harvestable/fishable salmon and steelhead is greatly increasing the number of adult fish that return to Snake River basin to use the 30,000 miles of available habitat.

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"If habitat were the limiting factor for the Snake River salmon, we would expect fish in Idaho wilderness to be relatively abundant. … (However), these fish continue to straddle extinction…"

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Q. What role does climate change play in the debate over removing the four Lower Snake dams?

The data show conclusively that the Pacific Northwest's climate is warming. The Snake River basin will experience hotter temperatures in the summer, which will make water conditions in the lower Snake River more problematic than they are at present.

High water temperatures in the Snake under current conditions can take a devastating toll. In 2015, 96 percent of Snake River sockeye returning to spawn succumbed to high water temperatures in the Columbia and Snake. This makes the need for restoring a free-flowing river more imperative.

Dams increase water temperature in the Snake to lethally high levels. The reservoirs warm during the summer months and create a block of slow-moving hot water that does not cool until fall air temperatures drop and remain cool. In contrast, though a free-flowing river will also occasionally warm to unhealthy levels during hot summer days, it will cool again at night when air temperature drops. This does not happen with the reservoirs because they retain their heat through the night.

Another key thermal difference between reservoirs and rivers is that in unstratified reservoirs like those in the lower Snake, water temperature is uniform so there are no cold-water refuges for fish to use. In contrast, dynamic rivers have different water temperatures in different locations.

For example, downstream of gravel bars where there is a lot of subterranean flow, temperatures can be substantially cooler than adjacent areas. These cooler areas provide refuges for migrating salmon and steelhead, which use them as "stepping stones" on their migratory journey. While it is true that instantaneous high water temperatures in a free-flowing river can exceed harmful levels, an argument often made by supporters of the lower Snake dams, in complex river habitats fish can find cool water when they need it and migrate safely.

In October 2019, a large group of scientists sent a letter to Pacific Northwest elected leaders informing them of the fact that restoring a free-flowing lower Snake River is the only known option for substantially cooling the lower Snake and enabling salmon and steelhead to migrate through it safely. They cited modeling by the Environmental Protection Agency that shows that removing the four lower Snake River dams would reduce Snake River water temperatures by 6.3 degrees F, on average, during the summer and early fall.

As discussed in the scientists' letter, cold-water releases from Dworshak dam on the North Fork Clearwater are currently used to cool water temperatures in the lower Snake. The beneficial impact of those cold-water releases is limited to the area around the upper-most dam, Lower Granite, because the relatively small volume of the cold-water releases gets overwhelmed by the volume of hot water that accumulates in the reservoirs. If a free-flowing lower Snake River is restored, the cold water Dworshak releases will penetrate much further down the Snake and even help cool the mainstem Columbia.

Last but not least, most of the available habitat in the Snake River basin will remain productive for salmon and steelhead even with a warmer climate. The Snake Basin currently contains 20 percent of the stream habitat occupied by salmon and steelhead on the West Coast, but by 2080 it is forecast to contain 65 percent of the coldest, most climate-resilient stream habitats on the West Coast. In short, the Snake is our best hope for a large wild salmon and steelhead stronghold in the continental United States.

Climate change at a glance:

96%

In 2015, 96% of Snake River sockeye returning to spawn succumbed to high water temperatures in the Columbia and Snake.

20%

The Snake Basin currently contains 20% of the stream habitat occupied by salmon and steelhead on the West Coast.

65%

By 2080 the Snake River Basin is forecasted to contain 65% of the coldest, most climate-resilient stream habitats on the West Coast.

Q.) Aren’t ocean conditions the primary cause of the decline?

Ocean conditions are certainly a major driver of salmon and steelhead abundance, and always have been. Conditions that salmon and steelhead experience in the eastern Pacific can change dramatically, based on natural global ocean-atmospheric interactions (like the Pacific Decadal Oscillation or El Niño Southern Oscillation) that create blocks of years (multiple years to decades) that are alternately warmer or colder.

Ocean temperatures are also warming due to climate change. Conditions become particularly difficult for salmon when general ocean warming coincides with warm-water phases of the oscillations mentioned above. As one example, in 2014 an extreme (high) anomaly in surface temperatures, colloquially referred to as “the Blob,” set up and spanned from California to southern Alaska for several years. Yet, even with a greater frequency of adverse ocean conditions, there will continue to be years when ocean conditions are favorable to salmon and steelhead. When these positive conditions exist we need to enable salmon and steelhead to take advantage of them.

How do we do that? By increasing their abundance, productivity and diversity. It is these attributes that have allowed salmon and steelhead to withstand extreme environmental conditions throughout their evolutionary history. This history included four glacial cycles during which ocean conditions vacillated dramatically, and a period when the ocean was 115 meters below our current sea level.

Not only did salmon and steelhead endure these extreme conditions, but it is this dynamic landscape that has sculpted their main means of persistence: diverse life histories. Just as a financial portfolio spreads risk for us, their different migratory and reproductive strategies spread risk for them. The different strategies mean that not all of a given population or stock is in one place at one time – some are in the ocean, some are in freshwater, all at different ages.

For example, Chinook salmon are known to have 18 distinct life histories and steelhead an incredible 38. This portfolio of life histories buffers the population as a whole from environmental impacts that may be particularly bad in any single year, season, river, or creek. It is what allows them to persist through modern floods, fires, landslides, volcanic eruptions and changing ocean conditions. No doubt they will respond to take advantage of a free-flowing Snake River as ocean conditions cycle through to more productive conditions.

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“Not only did salmon and steelhead endure these extreme conditions, it is this dynamic landscape that has sculpted their main means of persistence: Diverse life histories.”

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Q.) Are there other benefits to restoring a free-flowing river?

Adding a large amount of spawning habitat would be a major benefit to breaching the four lower Snake River dams, primarily for fall Chinook salmon. Historically, fall Chinook spawned extensively in the mainstem Snake River above Hells Canyon. That spawning habitat was lost when the three-dam Hells Canyon Complex was built by Idaho Power in the 1960s creating an impassable fish barrier. Additional fall Chinook salmon spawning habitat was lost when Dworshak dam was built blocking access to the North Fork Clearwater River.

Consequently, the spawning habitat currently available to fall Chinook salmon is quite limited. This is reflected in the Columbia Basin Partnership's high-end goal of only 23,360 wild fall Chinook. This contrasts sharply with the Nez Perce Tribe's estimate of approximately 500,000 fall Chinook salmon produced in the Snake River system prior to the arrival of settlers of European descent.

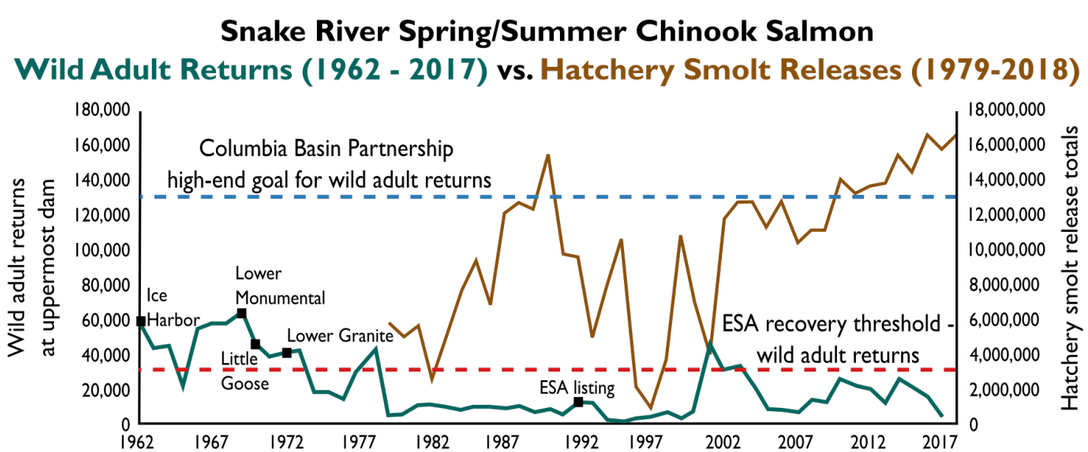
Restoring 140 miles of the lower Snake River to its free-flowing state would create new fall Chinook salmon spawning habitat, increasing the potential for wild fall Chinook production. In particular, the habitat currently inundated by Lower Granite and Little Goose dams, the two dams furthest upriver, likely fostered important diversity in spawn timing. Restored spawning habitat is a major additional benefit of dam breaching beyond improvement in migration survival.

Q.) Why can't we just release more hatchery fish to solve the problem?

When the dams were built it was thought that hatcheries would produce "replacement" salmon and steelhead to make up for the loss of natural production. Since then, our scientific understanding of what hatcheries can and can't do has grown by leaps and bounds. Today, we now know definitively that hatcheries can't substitute for wild salmon and steelhead. The Congressionally-established Hatchery Scientific Review Group stated this reality in no uncertain terms in 2015 in a report to Congress:

"...the traditional mitigation policy of replacing wild populations with hatchery fish is not consistent with today's conservation goals, environmental values, and prevailing science. Hatcheries cannot replace lost habitat and the natural populations that rely on it. It is now clear that the widespread use of traditional hatchery programs has actually contributed to the overall decline of wild populations."

If hatchery fish were the answer to the loss of wild salmon and steelhead in the Snake River basin, we would not have a problem today. Though hatcheries have been essential in preventing Snake River sockeye from going extinct and have provided harvest and fishing opportunity that could not have been sustained on depressed wild salmon and steelhead populations, wild salmon and steelhead continue to decline despite massive releases of hatchery fish.



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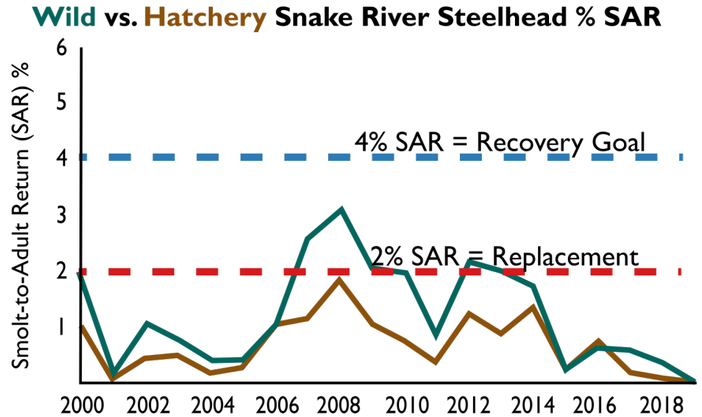
- Hatchery Scientific Review Group, 2015 report to Congress



(Left) The figure shows that, despite dumping over 16 million smolts into the Snake (brown line), wild returns of Spring/Summer Chinook have continued to decline precipitously (teal line).

(Right) Hatchery Snake River steelhead (brown line) generally have poorer returns than wild steelhead (teal line).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