

2022 State of Salmon in Watersheds

EXECUTIVE SUMMARY



WASHINGTON STATE
RECREATION AND CONSERVATION OFFICE

Governor's Salmon
Recovery Office

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Development of this report is not possible without data from many individuals. Especially significant are contributions from the Columbia River Inter-Tribal Fish Commission, salmon recovery lead entities, the Northwest Indian Fisheries Commission, the Office of the Washington State Climatologist, the Salmon Recovery Funding Board, salmon recovery regions, the Washington Department of Ecology, the Washington Department of Fish and Wildlife, and the Washington Stormwater Center.

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About the cover: Chinook (king) salmon photograph by John R. McMillan, National Oceanic and Atmospheric Administration (NOAA) Northwest Fisheries Science Center (NWFSC).

ALL OTHER PHOTOGRAPHS ARE FROM THE RECREATION AND CONSERVATION OFFICE UNLESS NOTED OTHERWISE.

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JOHN R. McMILLAN, NOAA / NWFSC

**Salmon are
important to the
Pacific Northwest.
Their fate is determined
by society's decisions.**



Chinook (King) salmon

TRIBAL LANDS ACKNOWLEDGMENT

The Washington State Recreation and Conservation Office and the Governor's Salmon Recovery Office acknowledge the ancestral and contemporary lands called home by Indian tribes and nations¹ from time immemorial. We recognize tribal sovereignty and that this place and the region of the Pacific Northwest hold spiritual, cultural, and personal significance for Indian tribes and nations. This acknowledgment is an expression of gratitude for the historic and ongoing self-determination of the tribes to be stewards for these lands, waters, natural resources, and many creatures including salmon that we are so privileged to enjoy here. The salmon recovery community is committed to honoring the role of Indian tribes and nations as it works collectively to recover salmon.

Salmon Continue to Struggle

EXECUTIVE SUMMARY



Salmon are important to the Pacific Northwest. They support the economy, provide food for orcas and other wildlife, and are intricately linked to the health and well-being of the region. Their

fate is determined by society's decisions about how to accommodate an increasing human population and its use of land and water. While there still are pathways where salmon and people can thrive in the Pacific Northwest, the options are narrowing quickly. To fully seize the moment and make real progress, Washingtonians must recalibrate their relationship with salmon and the environment. Reimagining a future with abundant salmon requires people to remove barriers, discard outdated preconceptions, listen to each other, and elevate shared values.

Salmon continue to struggle in Washington. No salmon species have been removed from the federal Endangered Species Act list in Washington and most of the species on the list are in crisis or not keeping pace with recovery goals.

Salmon face many challenges: warming waters, streams drying up, vanishing floodplains, polluted water, and a gauntlet of predators. Yet, they persist. While remarkably resilient, salmon cannot adapt quickly enough to the changing world without bold intervention. If climate projections prove accurate and are not slowed, extinction, not recovery, is the likely outcome.

Fortunately, there are a few bright spots, including lower Columbia River coho, Hood Canal summer chum, and Snake River fall Chinook. These populations are either making progress or approaching recovery. The federal government has not listed more salmon under the Endangered Species Act even though threats such as climate change continue to build. Increased state and federal funding for salmon recovery supports changes to stormwater infrastructure, habitat protection and restoration, fish passage barrier removal, and climate resiliency.

In 2021, Governor Jay Inslee updated the statewide salmon recovery strategy. The new strategy highlights creating climate resiliency, increasing habitat protection and restoration, cleaning up polluted water, removing barriers to fish migration, addressing salmon predators and food supply shortages, and strengthening coordination, monitoring, and accountability across state agencies and programs. To implement this work, state agencies developed a biennial work plan outlining budget and policy priorities that align with regional recovery plans and known tribal priorities.

The road to salmon recovery spans decades. To reach the destination will require increased investments, a renewed dedication to environmental stewardship, and everyone working together.

Salmon continue to struggle in Washington. Most species are in crisis or not keeping pace with recovery goals.

Why Recover Salmon?



Washingtonians rely on healthy, harvestable populations of salmon to support a robust economy, feed iconic orcas, maintain

recreational opportunities, and fulfill obligations to Native American tribes. The federal Endangered Species Act also requires protection of species at risk of extinction, such as many of Washington's salmon, steelhead trout, and bull trout populations.

Salmon are central to Washington tribes' cultures, identities, and businesses. Through treaties with the federal government, many tribes exchanged land for guaranteed, perpetual access to hunting and fishing areas. Other tribes in Washington never ceded their claims to ancestral lands and still rely on salmon. Washington State is obligated to uphold fishing rights for tribes and has a duty to ensure salmon are abundant enough for harvest. Tribes and the State co-manage salmon resources, and tribes have led salmon recovery efforts throughout the state.

What's at Stake

Economy

Salmon contribute directly and indirectly to the robust statewide economy. Domestic commercial fisheries create nearly 23,000 jobs in Washington, with salmon harvest alone worth almost \$14 million a year.¹ Recreational fishing generates more than \$1.5 billion in economic activity annually in Washington State,² and salmon are the prized quarry of many Washington anglers.

Recovering salmon also means protecting the scenic landscapes, accessible open spaces, and abundant, charismatic wildlife, including salmon and orca, that attract residents and tourists to the state.

Environment

As keystone species, salmon support diverse food chains, bringing nutrients from the ocean to rivers and streams. Scientists estimate 138 species of wildlife, from whales to insects, depend on salmon for their food.³ Even trees and shrubs use salmon as fertilizer.

Salmon fertilize shrubs and trees with nutrients they bring back from the ocean, supporting the streamside forests on which their species rely. When salmon populations are healthy, Washington's ocean, rivers, and streamside forests likely are healthy too.

1.1 million



In the past decade, recreational anglers harvested between 305,000 and 1.1 million salmon from Washington waters each year.

Recreation Opportunities

Recreational anglers catch Washington salmon from the ocean of southeast Alaska to tiny mountain streams in the Blue Mountains. Every year, the State issues about 500,000 fishing licenses with catch record cards (required when fishing for salmon, steelhead, sturgeon, and halibut), providing opportunities to fish for salmon in the ocean, Puget Sound, and rivers. The opportunity is significant: in the past decade, recreational anglers harvested between 305,000 and 1.1 million salmon from Washington waters each year.⁴

For those who would rather watch salmon than catch them, salmon viewing opportunities abound. Every year, visitors and locals gather at public viewing sites to see salmon returning to streams and rivers around the state.

Food

Salmon provide excellent nutrition to Washingtonians. While many salmon populations are in crisis or are continuing to struggle, some are abundant enough to harvest. These salmon feed families across political, economic, and social spectrums and are important particularly to Native Americans. Salmon are rich in omega-3 fatty acids, high in protein, and an excellent source of micronutrients such as B-vitamins and selenium.



JUVENILE COHO: JOHN R. MCWILLAN; NOAA / NWFS; FISHING BOAT: ANNA KAGLEY

WHAT DOES RECOVERY MEAN?

Congress passed the Endangered Species Act in 1973, declaring that United States' imperiled fish, plants, and other wildlife possessed "esthetic, ecological, educational, recreational, and scientific value to the Nation and its people." Upon signing the bill into law, President Richard Nixon stated that "[n]othing is more priceless and more worthy of preservation than the rich array of animal life with which our country has been blessed."

Recovery is the process of reducing the risk of extinction for a species across its geographic range until it no longer requires protections under the Act.



Quileute Tribal School in Lake Ozette, Olympic Peninsula.

Culture

Pacific Northwest people have identified themselves with salmon since time immemorial. The state's first inhabitants—Native American tribes—define themselves as Salmon People.⁵ Salmon are woven throughout tribal lives as a source of food, income, art, literature, heritage, and celebration. Washington tribes remain committed to protecting and recovering salmon and have worked tirelessly to restore their habitat. To this day, government agencies that co-manage salmon populations rely on the traditional ecological knowledge and scientific expertise that tribes provide.

Salmon are an icon of the Pacific Northwest. Catching a first salmon is a rite of passage for many Washingtonians, and salmon fishing has long supported many family traditions and businesses.

Tribes are committed to healthy, harvestable populations that sustain a broad range of cultural, ecological, and economic benefits.

Scientists estimate 138 species of wildlife, from whales to insects, depend on salmon for their food.³

Indian Tribes and Salmon Recovery



Indian tribes who witnessed the 150-year decline in Washington salmon populations now are leaders in salmon recovery.

Tribal governments are responsible for hundreds of successful salmon habitat restoration and protection projects on and off tribal lands. They employ a range of scientists, technicians, and policy staff that advocate for salmon recovery, lead planning and implementation efforts, and monitor progress toward recovery.

In partnership with the Washington Department of Fish and Wildlife, treaty tribes co-manage the state's salmon, including collaborating with the federal government to set harvest seasons. Tribal hatcheries produce about 40 million juvenile salmon annually to support commercial, recreational, and tribal harvest, and to sustain important populations.

Tribal knowledge, expertise, experience, and understanding is critical for salmon recovery. Along with co-managing salmon, individual tribes and tribal organizations produce reports, such as *The State of Our Watersheds* by the Northwest Indian Fisheries Commission, that provide an ongoing scientific foundation for recovery. The tribal perspective and vision of keeping salmon strong and harvestable for future generations is a model that has maintained salmon in the rivers and can help propel successful recovery across the state.

PHOTO, LEFT, NOAA

Salmon Status in Washington



Today, 14 population groups⁶ of steelhead trout and Chinook, coho, chum, and sockeye salmon in Washington State are listed

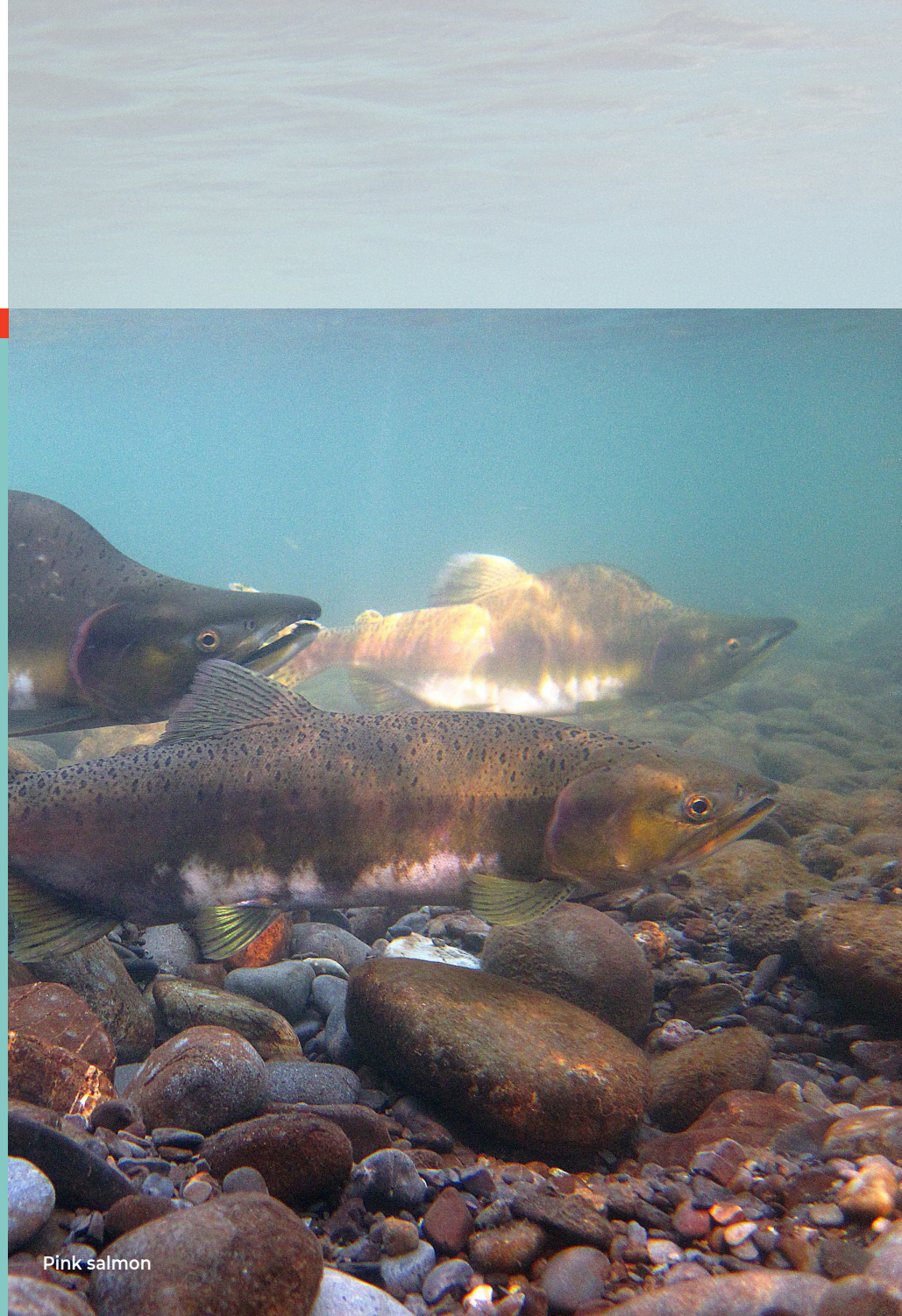
as threatened or endangered under the Endangered Species Act.

The chart at right provides a snapshot of the abundance of these population groups relative to their recovery goals. Some populations are moving in the right direction and are approaching their goals, such as Hood Canal summer chum and Snake River fall Chinook, while others, such as Puget Sound Chinook and upper Columbia River spring Chinook, continue to fall further behind and are in crisis.

The chart only depicts salmon and steelhead listed under the federal Endangered Species Act. While some populations are not listed currently, they face many of the same threats and many are declining in number. Without concerted effort to protect and restore habitat, history suggests they also are at risk.

Today, 14 population groups⁶ of steelhead, and Chinook, coho, chum, and sockeye salmon in Washington State are listed as threatened or endangered under the Endangered Species Act.

JOHN R. MCWILLAN, NOAA / NWFS



Pink salmon

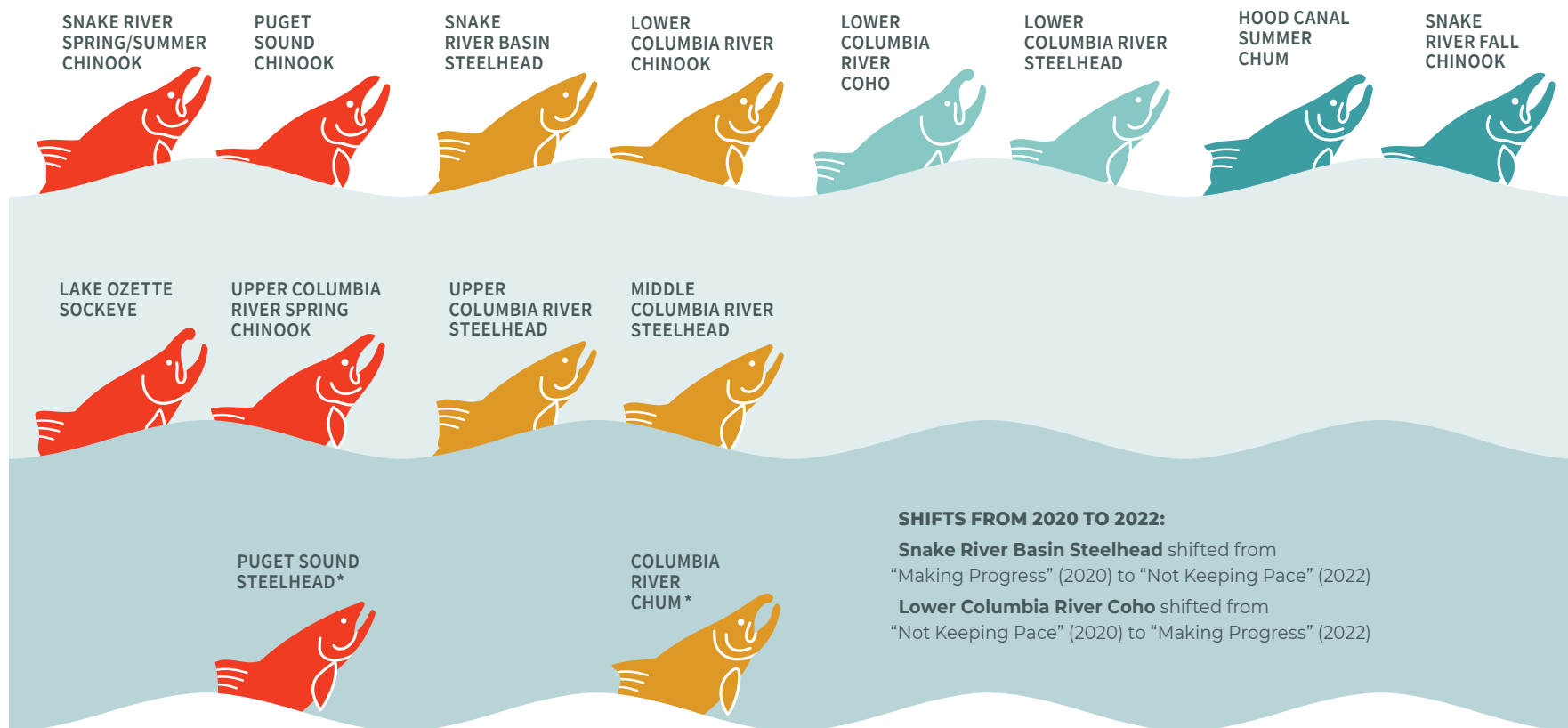
Salmon Abundance | 2022

IN CRISIS

NOT KEEPING PACE

MAKING PROGRESS

APPROACHING GOAL



* Lacks complete data

Data and analysis by Washington Department of Fish and Wildlife

Salmon Recovery in Washington



The National Oceanic and Atmospheric Administration is the federal agency responsible for

overseeing salmon recovery. When reviewing the status of listed populations every 5 years, the agency evaluates threats, including degraded and disconnected habitat, dams, hatcheries, and fishing. While the number of returning adult salmon (abundance) is important, it is not the only measure of a population's ability to survive over the long term. In addition to abundance, the agency evaluates each population's risk of extinction due to threats from environmental changes and limited genetic diversity.

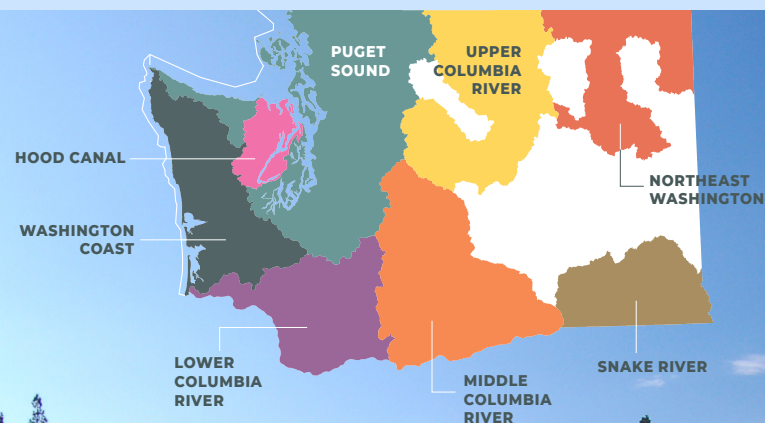
While the federal government is responsible for overseeing recovery under the Endangered Species Act, Washington has pioneered and embraced a decentralized approach, known as the Washington Way, that emphasizes local planning and decision-making. Listed salmon population groups have diverse needs and require specialized conservation strategies to achieve recovery. For Washington, this means that salmon recovery regional organizations

developed specific recovery plans to address threats to different population groups. While some threats, such as climate change, impact all populations, many populations face more specific threats.

The regional organizations work with state agencies and the federal government to prepare and maintain locally based recovery plans, oversee and monitor implementation of the plans, and report on salmon recovery. Each organization is responsible for maintaining and updating lists of priority actions to achieve regional recovery objectives. These prioritized lists inform funding decisions for state, federal, and private grant programs to ensure that funded projects are locally appropriate, supported, and provide benefits to fish at reasonable costs.

Some regions have multiple lead entities, which are local organizations guided by citizen committees and technical advisors that guide watershed-level recovery activities. Lead entities ensure that local expertise guides salmon recovery actions.

SALMON RECOVERY REGIONS



The regional organizations work with state agencies and the federal government to prepare and maintain locally based recovery plans, oversee and monitor implementation of the plans, and report on salmon recovery.

Chewuch River in the upper Columbia River region

Funding



Rebuilding healthy, harvestable salmon populations requires funding to address all threats to salmon. Voluntary and regulatory programs to protect existing habitat, hatchery and

harvest management and reform, fish population monitoring, and predator control are all important to achieve salmon recovery goals, and they are all expensive.

A 2011 study⁷ pegged the statewide cost of implementing only habitat-related elements identified in regional salmon recovery plans for 2010-2019 at \$4.7 billion in 2011 dollars. To date, only \$1.6 billion has been invested, meaning that recovery has fallen further behind. As construction costs increase and habitat continues to be lost to development, increased investment will be needed.

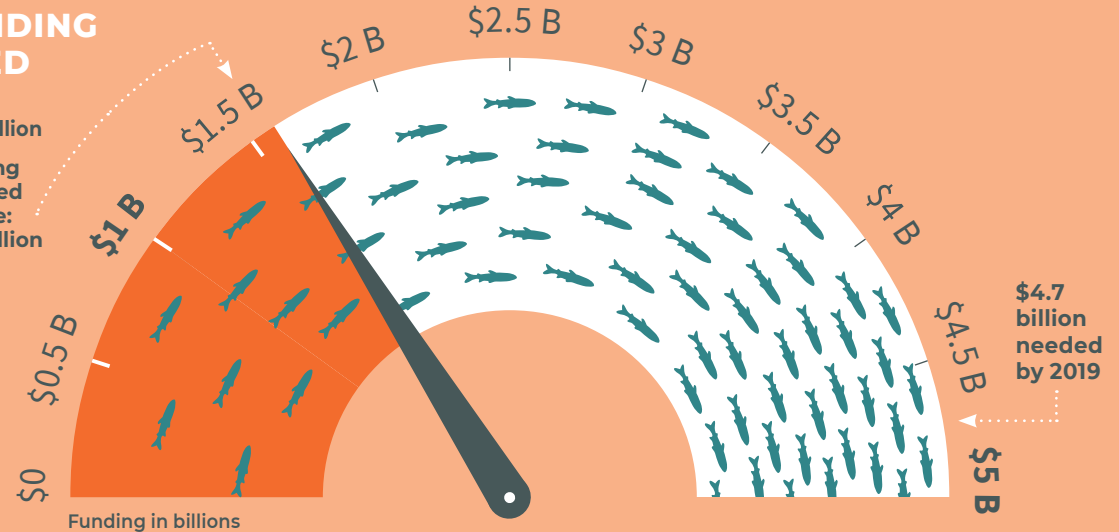
Federal and state investments in salmon recovery have increased in recent years. The federal government is distributing infrastructure and climate-related funding, both of which benefit salmon recovery goals. The Washington State Legislature approved \$200 million in supplemental funding in 2022 to increase the pace of investment. These infusions have been important to recovery, which will require significant ongoing funding.

The 2023-2025 Biennial Work Plan to implement the *Governor's salmon strategy update*⁸ outlines about \$830 million in specific funding needs, providing a roadmap for near-term actions that, if funded, will help achieve recovery goals statewide.

A 2011⁷ study pegged the statewide cost of implementing only habitat-related elements identified in regional salmon recovery plans for 2010-2019 at \$4.7 billion.

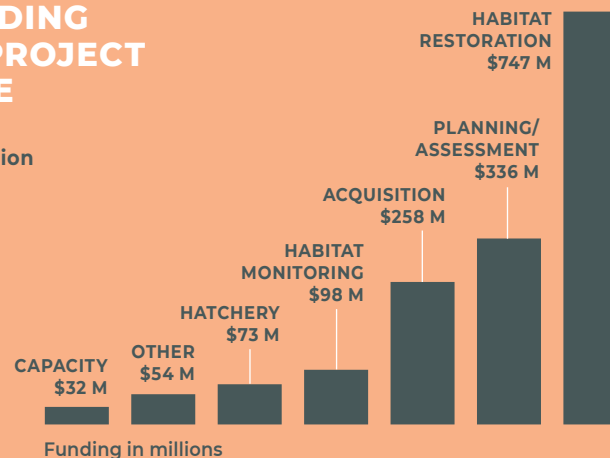
FUNDING NEED

Total:
\$4.7 billion
Funding
received
to date:
\$1.6 billion



FUNDING BY PROJECT TYPE

Total:
\$1.6 billion



As construction costs increase and habitat continues to be lost to development, increased investment will be needed.

The Salmon Struggle



Salmon lead complex lives, which make them resilient to change but also make them vulnerable to a wide variety of threats. Salmon are born in freshwater, rear in streams, then head downstream to spend time in estuaries where they can grow large enough to survive in the ocean. They return home to spawn, beginning the cycle all over again.

Rebuilding healthy, harvestable salmon populations requires funding to address all threats to salmon.

Salmon recovery in Washington focuses on the key factors that led to salmon declines: climate change, habitat degradation, water quality and quantity declines, fish passage barriers, hydropower operation, harvest, hatchery impacts, predation, and scarcity of food.



TOAN CHU / UNSPLASH

SEVEN SPECIES OF PACIFIC SALMON, STEELHEAD, AND BULL TROUT LIVE IN WASHINGTON STATE.



CHINOOK (KING)



CHUM (DOG)



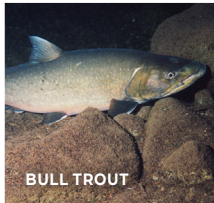
COHO (SILVER)



PINK (HUMPBACK OR HUMPY)



SOCKEYE (RED OR BLUEBACK)



BULL TROUT



STEELHEAD

■ CHINOOK (KING)

salmon are the largest Pacific salmon and can live up to 7 years. Chinook have highly diverse life history strategies: some spend more than a year in freshwater as juveniles, while others migrate to estuaries or the ocean after just a few weeks. Some populations return as adults to freshwater in early spring while other populations return in summer through late fall. Chinook are the preferred food of Southern Resident orcas and many humans, who covet their rich, oily meat. Chinook populations have decreased in recent decades across the species' range. In Washington, Endangered Species Act protections apply to Snake River spring/summer and fall Chinook, upper Columbia River spring Chinook, lower Columbia River Chinook, and Puget Sound Chinook, while several wild populations are more robust.

■ CHUM (DOG)

are a colorful, locally abundant species in coastal rivers, Puget Sound, Hood Canal, and the Columbia River. Juvenile chum

migrate to the ocean almost immediately after emerging from their natal gravels, generally returning 3 to 4 years later to spawn. In Washington, chum favor lower river habitats with upwelling water, particularly in areas scoured by ice-age glaciers. Chum often are targeted for their large eggs, cured and eaten as caviar. In Washington, Endangered Species Act protections apply to lower Columbia River chum and Hood Canal summer chum, while abundant wild Puget Sound fall chum support recreational and commercial fishing.

■ COHO (SILVER),

like their close relative the Chinook, are popular targets for sport and commercial fishing. Coho generally spawn in small streams and spend a year in freshwater before migrating to the ocean. Most return as 3-year-old adults. In Washington, Endangered Species Act protections apply to lower Columbia River coho. Snake River and mid-Columbia River coho are being reintroduced after being driven to extinction.

Tribally led efforts to reintroduce coho in several Columbia River watersheds are showing promise, and more abundant populations persist in Puget Sound and on the Coast.

■ PINK (HUMPBACK OR HUMPY)

are the smallest and most abundant Pacific salmon throughout their native range. Like their close relative chum salmon, pinks spend very little time in freshwater after emerging from the gravel. Unlike other salmon that spawn at various ages, pinks only return to their rivers as 2-year-old adults. In Washington, this results in abundant runs of adult pink salmon during odd years, while in even years they are almost absent. Pink salmon are harvested in large numbers and used for affordable, processed salmon products such as salmon patties or frozen fillets. Pink salmon populations are considered healthy throughout their ranges.

■ SOCKEYE (RED OR BLUEBACK),

like chum and pink salmon, are near the southern end of their ranges in Washington State. Prized for their deep red meat, sockeye populations

that are not Endangered Species Act-listed are targeted by tribal, commercial, and sport fishers along the Coast, Columbia River, and a few rivers in Puget Sound. Sockeye juveniles spend substantial time in lakes, a unique life history choice for Pacific salmon. Further north, sockeye form the backbone of the Bristol Bay fishing industry in western Alaska, where tens of millions of fish are harvested annually. Lake Ozette sockeye are protected by the Endangered Species Act in Washington, as are Snake River sockeye, which pass through Washington en route to their spawning areas in Idaho.

■ BULL TROUT

are more closely related to brook trout and arctic char than Pacific salmon. Bull trout live complex lives. Some travel to saltwater as adults, while others spend their entire lives in freshwater, sometimes spending their adult years in reservoirs. All bull trout populations in Washington are Endangered Species Act-listed, and all require extremely cold, clean water to survive. Bull trout populations are found throughout the state.

■ STEELHEAD

are a type of rainbow trout that migrate to the ocean to grow to adulthood. Unlike their other Pacific salmon relatives, steelhead do not always die after spawning and can sometimes return to their natal rivers to spawn several times. Steelhead juveniles rear in freshwater longer than other salmon, often for 2 or more years before migrating to the ocean. Adults return to rivers throughout the year, with major run peaks in winter and summer, depending on the population. Steelhead are popular sport fish throughout their ranges. Endangered Species Act protections apply to lower, middle, and upper Columbia River steelhead, Snake River steelhead, and Puget Sound steelhead in Washington. The last populations of steelhead in Washington without Endangered Species Act protection are on the Washington Coast, where returns have been poor in recent years.

Climate Change

▼ PRESSURE

Warming Temperatures Are Altering Salmon Streams



Climate change is threatening the clean, cold, and plentiful water in rivers that salmon need to survive. The average annual air temperature across Washington increased by 1.77 degrees Fahrenheit between 1960 and 2020,⁹ a trend that is projected to continue but at an even faster rate as heat-trapping atmospheric carbon dioxide levels continue to climb.

Glaciers, which provide cold water to streams in the Pacific Northwest, are vanishing. In addition, mountain snowpacks are becoming smaller over time as average temperatures increase and freezing elevations rise. The amount of water in streams in the summer, when young salmon are at a critical life stage, has become lower in most streams,¹⁰ and for longer periods of time. Scientists estimate that the amount of water that was released from melted snow declined 21 percent in the western United States from 1955 to 2016.¹¹ Compounding the low-flow problem, water is being removed from rivers to irrigate farmland and accommodate an increasing human population.

As summer low flows decline and the air warms, water temperatures in rivers increase. Water temperatures greater than 64 degrees Fahrenheit stress salmon, and temperatures above 70 degrees Fahrenheit can be lethal.¹² Without actions to reduce water temperatures, there will be fewer salmon and fewer rivers where they can survive.

The changing climate also is bringing rain instead of snow to some areas. With more rain, winter stream flow will increase by 25-34 percent by the 2080s, increasing the likelihood of severe flooding in the winter.¹³ Severe flooding becomes catastrophic when floodplains, which are natural storage areas for flood water, are developed for commercial and residential use.

As peak flows change in volume and season, the life cycles of salmon are being disrupted. More intense floods can destroy redds (salmon nests), reduce habitat complexity, and flush young salmon out of their calm-water habitat, reducing their chance for survival. While some juveniles may survive this premature transition from freshwater to saltwater, many won't be large enough to catch prey or avoid being eaten.¹⁴

CLIMATE AFFECTS WATER IN STREAMS



The amount of snow in the mountains is decreasing. Scientists project that the average spring snowpack in Washington will decline by 56-70 percent by the 2080s.¹³

Some Washington streams are getting hotter, stressing salmon. Scientists estimate that by the 2080s, an additional 1,016 Puget Sound river miles will exceed 64 degrees Fahrenheit for the entire month of August.¹²

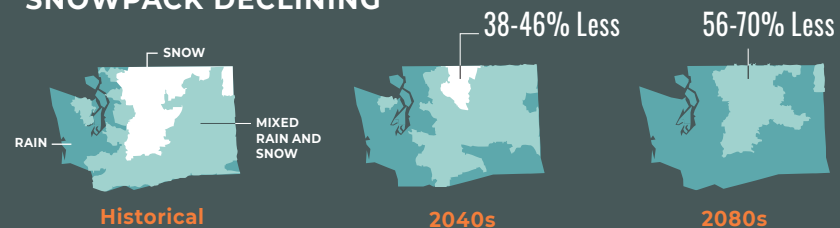
As temperatures warm, the point that rain turns to snow moves higher up the mountain, decreasing the snowpack. Salmon count on plentiful snowpack to melt and deliver cool, clean water in the summer and during droughts. Less snowpack means less water. Less water means warmer water. Both threaten salmon and salmon recovery.

Less and Warmer Water

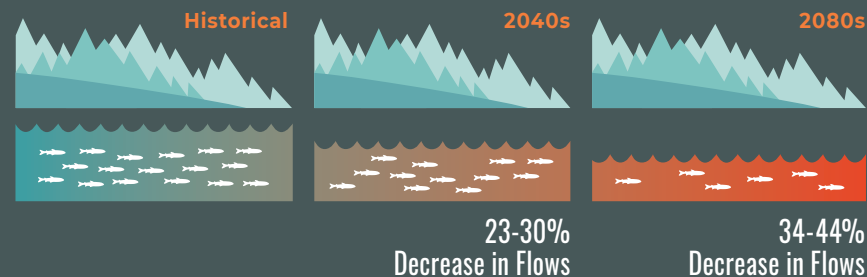
STATEWIDE AVERAGE FREEZING ELEVATION GOING UP

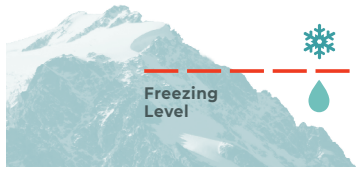


SNOWPACK DECLINING¹³



SUMMER STREAMFLOWS DECREASING AND WARMING¹³





16%

Decline in rain-falling-as-snow since 1949.
Across Washington, freezing levels
have risen nearly 900 feet.

▼ PRESSURE

Climate Change in the Ocean



Human activities have resulted in record-breaking levels of carbon dioxide in the atmosphere and in the oceans.¹⁵ Excess carbon dioxide is absorbed by the ocean, forming carbonic acid, which increased

the average ocean acidity level by 30 percent since the Industrial Revolution.¹⁶

Increased acidity damages the phytoplankton, zooplankton, and crustaceans salmon eat. Excess carbon dioxide also can change the way salmon use their sense of smell to find food, avoid being eaten, and find their natal streams.¹⁷

The warmer climate also impacts ocean temperatures. The near-surface average water temperatures off Washington's coast have been warming during the past 50 years.¹⁸ Warmer water has fewer nutrients and less oxygen than colder water and creates conditions less beneficial for salmon. For example, warmer water favors sub-tropical zooplankton, which are poor food for juvenile salmon and the fish they eat, making survival less likely.

Salmon have demonstrated during the past 10,000 years that they can adapt to a changing environment. However, climate change is speeding up these environmental changes, and when combined with fewer natural buffers, degraded habitats, and their lost genetic diversity, salmon struggle to adapt quickly enough, threatening their continued existence.

ALICE RUBIN



PRIORITIES AND PROGRESS



The climate crisis requires immediate action to reduce pollutants that are accelerating climate change and build climate resiliency for people and salmon. In 2021, Governor Jay Inslee signed the Climate Commitment Act into law, committing to reduce Washington's greenhouse gas emissions by 95 percent by 2050.¹⁹

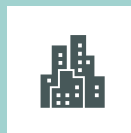
In addition, several grant programs are focusing on mitigating the increasing toll of climate change on watersheds. Salmon Recovery Funding Board grant applications require recipients to address climate resiliency and the innovative Floodplains by Design grant program supports floodplain reconnection and streambank protections, which can reduce the impacts of climate change. Without actions to reduce water temperatures, there will be fewer salmon and fewer rivers where they can survive.

Climate change is speeding up environmental changes and salmon are struggling to adapt.

Habitat

▼ PRESSURE

Human Population Growth



Washington's population grew by 63 percent between 1990 and 2020²⁰ and is expected to exceed 9 million by 2040.²¹ This is equal to adding more than three cities the size of Seattle during the next 20 years. Salmon, like people, need habitat. For salmon, this means rivers with cool, clean water and a variety of habitat features that allow them to rest, hide from predators, and spawn. It means diverse estuaries where salmon can grow and transition to and from saltwater. And it means rivers, shorelines, and an ocean with ample food. In many cases, however, habitat for people and salmon conflict: residential, commercial, and industrial development displaces or destroys salmon habitat.

As the number of people in the state continues to increase, more land and water are needed for people to live, work, and play. As a result, more Washington salmon habitat will be lost unless development practices change dramatically to favor increased growth in urban areas, rather than developing rural areas.

▼ PRESSURE

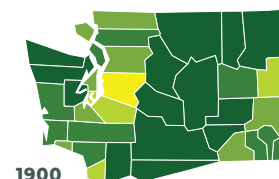
Shoreline Armoring



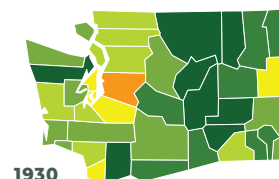
Puget Sound has lost habitat function across one-third of its 2,500 miles of shoreline to armoring.²² Armoring includes bulkheads, seawalls, and other structures built on the shoreline to protect houses and other infrastructure. These hardened shorelines alter salmon and forage fish habitat and significantly impact natural shoreline processes. Armor prevents waves from eroding bluffs to create beaches, where salmon find the insects and other fish they eat.



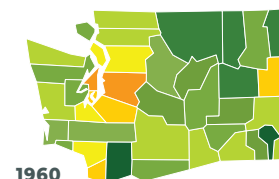
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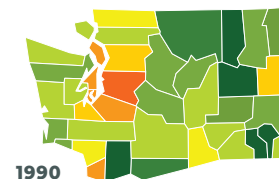
1900



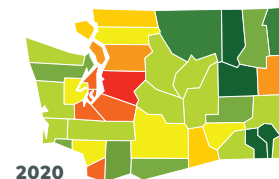
1930



1960



1990



2020

People per square mile

0-5

700-1100

▼ PRESSURE

Cleared and Developed Floodplains



Riparian (vegetated streamside) zones and floodplains are critically important for aquatic species such

as salmon²³ and serve to buffer the effects of climate change. Well-vegetated riparian areas shade and keep water cool, filter polluted water, and support trees with roots that help stabilize banks and provide hiding places for fish. Floodplains slow, filter, and store flood water; provide shelter and food for young fish; and buffer communities against floods. Unfortunately, 50-90 percent of land along waterways in Washington has been lost or extensively modified by humans.²⁴

POPULATION DENSITY BY COUNTY

Washington's population is expected to grow—adding more than three cities the size of Seattle—during the next 20 years.

DATA SOURCE: WASHINGTON STATE OFFICE OF FINANCIAL MANAGEMENT

As the number of people in the state continues to increase, more land and water are needed for people to live, work, and play.

Preserving habitat is far less expensive than restoring degraded habitat.

PRIORITIES AND PROGRESS



The 2021 *Governor's salmon strategy update* emphasizes the value of maintaining, preserving, and restoring riparian lands. This will ensure cooler rivers and streams, climate resiliency, and the health of fish, other wildlife, and ecological systems for the economic and social well-being of this state and its people.

Increased state and federal funding is supporting grant programs that conserve and restore freshwater streams and riparian areas, marine shorelines, and estuaries. This infusion of funds has allowed groups around the state to approach larger, more complex projects that make meaningful progress toward habitat restoration and conservation targets. Despite this infusion, much more funding and predictability of funding is necessary to achieve habitat goals in support of salmon recovery.

Preserving habitat is far less expensive than restoring degraded habitat. Current regulations protecting habitat generally aim for “no net loss,” meaning that development avoids or mitigates damage to habitat and watershed functions. In practice, however, these regulations are interpreted, administered, and enforced inconsistently across the state, and habitat is being lost. Updating local, state, and federal land-use programs (and enforcing them) is the only certain way to reverse the decline of habitat in Washington while accommodating growth.

Water

▼ PRESSURE

Stormwater Runoff

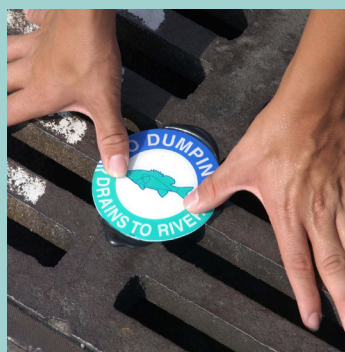


Stormwater running off impermeable surfaces is the top pollution source impacting Puget Sound.²⁵ As cities and suburbs have expanded, impermeable surfaces such as pavement, roofs, and other hard surfaces have increased.

As rain runs off these surfaces, it collects pollution from oil, fertilizers, pesticides, vehicles, and animal manure before heading, usually untreated, into street drains and then directly into streams, bays, and the ocean. Untreated stormwater can decrease the oxygen levels in the water,²⁶ limit the ability of some salmon species to find food and avoid predators, make fish more susceptible to disease, and kill large numbers of fish in urban streams.²⁷



U.S. MARINE CORPS



▼ PRESSURE

Low Summer Flows



Washington regularly experiences dry, warm summers, and climate change appears to be taking this pattern to extremes. Snow- or groundwater-fed streams gradually reduce flows throughout the summer. With rising snow elevations and reduced snowpacks, low summer flows are becoming lower, warmer, and longer lasting based on several decades of streamflow data. Agricultural, industrial, municipal, and residential water withdrawals from surface water or wells exacerbate low flows and high temperatures that limit salmon survival.

Peak flow days have increased 8-10% statewide in the past 30 years.

Low flow days increased 11% (10 days) in the past 30 years.

With rising snow elevations and reduced snowpacks, low summer flows are becoming lower, warmer, and longer lasting based on several decades of stream gage data.

PRIORITIES AND PROGRESS

Increasing Summer Streamflow



Washington State, through the Department of Ecology, has developed rules for maintaining minimum flows and maximum temperatures for streams in many areas of the state. These rules ensure that water withdrawals supporting development will not create water shortages for salmon.

In areas of the state where legal rights to withdraw water from streams exceed biologically critical minimum flows, groups are working to buy water rights for environmental functions. Irrigation upgrades, such as higher efficiency watering systems and lined or enclosed irrigation ditches, decrease the amount of water needed to grow crops and may be eligible for grants to reduce costs to the landowner.

Addressing Stormwater Pollution

In 2021, after years of investigation, University of Washington researchers isolated 6-PPD-quinone, a compound formed from a common chemical used in tire manufacturing, as the chemical killing coho salmon in urban streams.^{28, 29} Researchers previously found that running stormwater through systems like rain gardens removes pollutants and reduces harm to coho.³⁰ These discoveries, coupled with effective stormwater requirements, will protect salmon in cities, ensuring that Washington's growing population coexists with salmon.

Fish Passage Barriers

▼ PRESSURE

Aging Road Crossings and Dams



Large amounts of historic fish habitat in Washington are blocked to salmon by roads, dams, railways,

and agricultural water diversions.

The Washington Department of Fish and Wildlife estimates that at least 18,000 barriers either partially or fully block salmon from reaching their spawning grounds in Washington.³¹

Most of the barriers are created when roads cross streams, forcing streams into pipes known as culverts. Poorly designed culverts often block fish from swimming upstream. Many are aging and need to be replaced for safety, as well as fish passage. Coho and steelhead are particularly affected because they travel further upstream to spawn and live as juveniles, and are blocked from large areas of headwater streams.

Other fish barriers are less obvious. Levees and elevated roadbeds can limit fish movement into side channels and floodplains, which are important areas of calm water where young salmon grow.



Since 2005, more than 3,700 barriers have been corrected, reopening more than 4,700 miles of habitat to salmon and steelhead.

BRIDGES ALLOW FISH PASSAGE ▲

Bridges allow streams to move more naturally under roads, making it easier for fish to travel. A barrier, like a culvert with an outfall drop, *right*, blocks fish passage.

FISH BARRIER ▼



PRIORITIES AND PROGRESS



Washington has been fixing barriers steadily. Since 2005, more than 3,700 barriers have been corrected, reopening more than 4,700 miles of habitat to salmon and steelhead.

Forest and Fish Law

Under the 1999 Forests and Fish Law, private landowners and state forestland managers in Washington have corrected more than 9,000 barriers, including many that are higher in watersheds than salmon or steelhead travel. Unfortunately, this success has not been achieved evenly across other sectors.

Culvert Injunction

In 2001, the western Washington tribes sued Washington State for its failure to correct fish-blocking culverts, arguing it damaged their treaty-reserved rights to harvest fish. The U.S. Supreme Court affirmed a lower court's ruling requiring four state agencies³² to correct barriers by 2030 at an estimated cost exceeding \$3.6 billion. Most state-owned culverts are larger and costlier than those in industrial forests. As of June 2022, the Washington Department of Transportation had fixed more than 100 barriers, opening 474 miles of habitat for salmon, but much more funding will be necessary to meet the court-ordered deadline.

Grant Programs

Washington State has recognized the need to correct fish passage barriers and has several efforts underway including work funded by the Salmon Recovery Funding Board, Brian Abbott Fish Barrier Removal Board, and Family Forest Fish Passage Program. Newly approved state and federal infrastructure spending also is promising to address fish passage barriers, particularly where transportation safety and reliability intersect with fish needs.

Harvest

▼ PRESSURE Overharvest



Salmon harvest in many parts of Washington peaked in the late 1800s. Many populations, further depressed by habitat destruction and dam construction, were pushed to local extinction. The federal government identified persistent overfishing as one of the primary factors in the 1990s Endangered Species Act listing of many salmon and steelhead populations as threatened or endangered.

Current harvest is managed by the tribes, state, and federal government through treaties, agreements, congressionally established management councils, and compacts. Harvest is highly coordinated and closely monitored and managed to protect threatened and endangered salmon. This is particularly true for Chinook, which bring high market prices for commercial fishers and are prized by recreational anglers. Chinook often are harvested in the ocean and large rivers, where differentiating between Endangered Species Act-listed fish and non-listed fish is impossible. This requires careful coordination and regulation among states, tribes, the federal government, and the Government of Canada.

NOAA

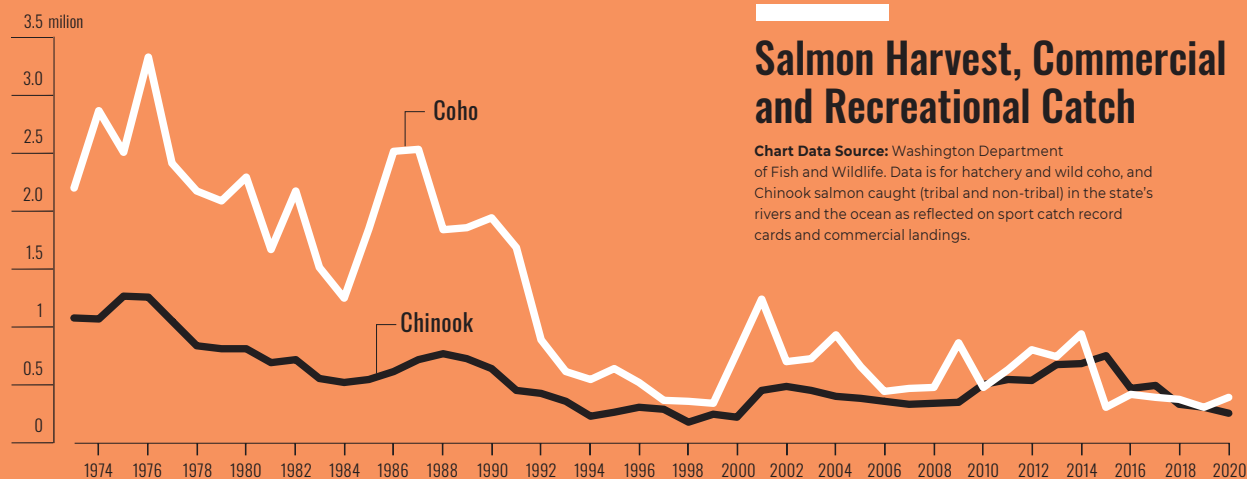


Harvest is highly coordinated and closely monitored and managed to protect threatened and endangered salmon.

PRIORITIES AND PROGRESS



Effective co-management between the State and tribes has reduced harvest impacts in Washington on threatened or endangered salmon. Fishing is sustained by some healthy wild populations and many abundant hatchery-origin runs. Effectively catching hatchery fish while avoiding at-risk wild populations is a key harvest management priority.



Hatchery

▼ PRESSURE

Genetic and Ecological Impacts



Since the first Washington hatchery opened in 1883, managers hoped that hatchery production

could compensate for degraded or blocked habitat and overharvest. Hatcheries are an important tool to provide harvest opportunities and to produce salmon to reintroduce to areas where they have gone extinct, but they also can hinder salmon recovery if they are not managed to minimize risks to wild populations. Hatchery-reared fish can compete with wild salmon for food and other resources and weaken the fitness of wild stocks if they interbreed.

Crews, *right*, handle chum salmon at the Washington Department of Fish and Wildlife hatchery in Hoodport.

WASHINGTON DEPARTMENT OF FISH AND WILDLIFE



Hatcheries are essential to meet tribal fishing obligations and to provide salmon for commercial and recreational fishing, orcas, and other wildlife.

PRIORITIES AND PROGRESS



Most hatcheries in Washington that operate in areas with Endangered Species Act-listed salmon and steelhead operate under strict management protocols, known as Hatchery Genetic Management Plans, intended to allow hatcheries to produce young salmon while minimizing impacts to wild salmon. Maintenance, capital improvements, and monitoring remain persistent needs across the hatchery system.

The Washington hatchery network raises more than 200 million juvenile salmon at more than 100 state, federal, and tribal facilities each year. Hatchery fish enable harvest to continue even though the number of wild fish are low. Most steelhead, coho, and Chinook produced in hatcheries are individually marked as juveniles by removing the small adipose fin (located on their backs, just forward of their tails). This allows sport, commercial, and tribal fishers to catch hatchery fish while protecting wild-spawned fish from harvest.

Hatcheries are essential to meet tribal fishing obligations and to provide salmon for commercial and recreational fishing, orcas, and other wildlife. Looking to the future, state, tribal, and federal partners will continue to monitor, evaluate, and adaptively manage hatcheries to limit impacts to wild salmon populations. Hatchery managers will continue efforts to reduce genetic effects on wild populations, while managers work to effectively target hatchery and healthy wild populations.

Hydropower

▼ PRESSURE Fish Passage

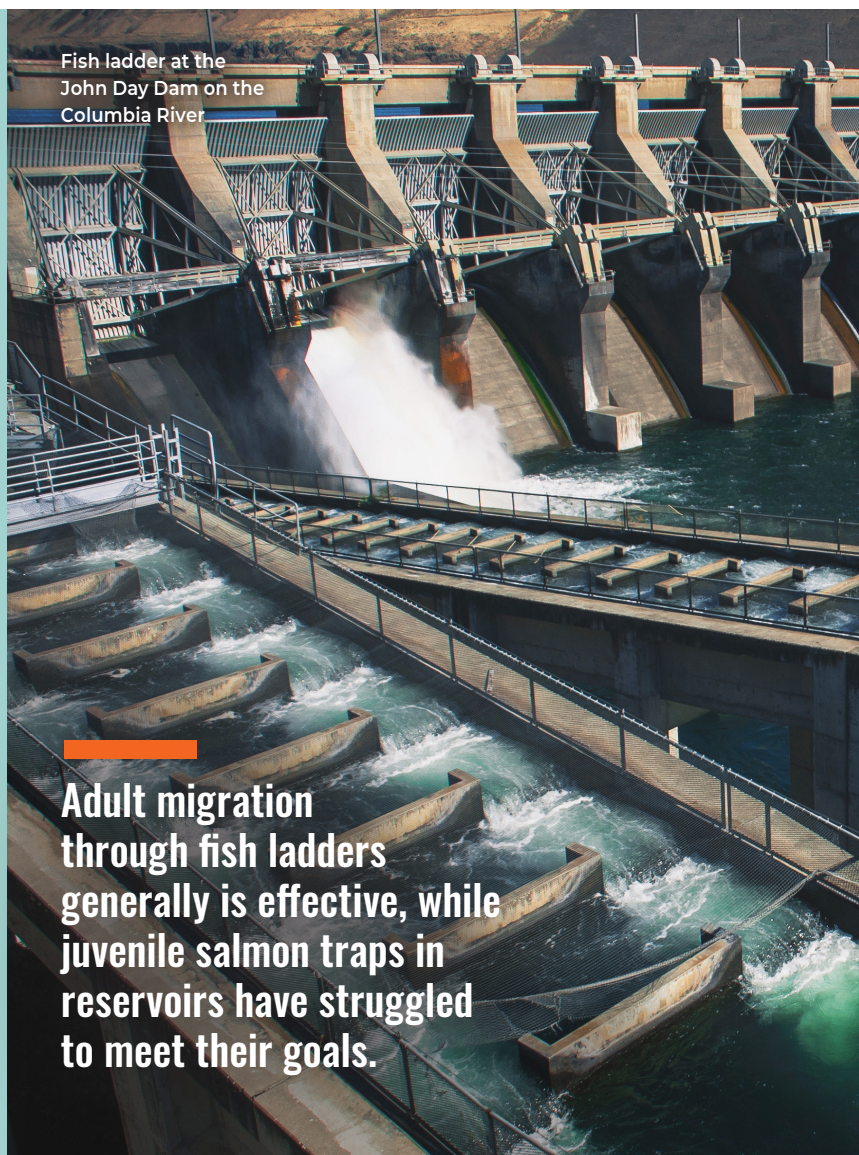


More than 1,345 dams impound water in Washington State,³³ including about 145 large dams

owned or regulated by the federal government. Hydropower dams block large areas of former salmon habitat, particularly in the Columbia River basin, where thousands of miles of spawning and rearing habitat are blocked in the watersheds of the upper Columbia and Snake Rivers.

Most hydropower dams in Washington allow fish to pass upstream and downstream of the dam, using fish ladders or bypasses, or by trapping and hauling fish by truck or barge. These methods have had varied success; adult migration through fish ladders generally is effective, for example, while juvenile salmon traps in reservoirs have struggled to meet their goals. Inefficient fish passage systems reduce the number of adults migrating upstream and can delay or prevent juveniles from moving downstream.

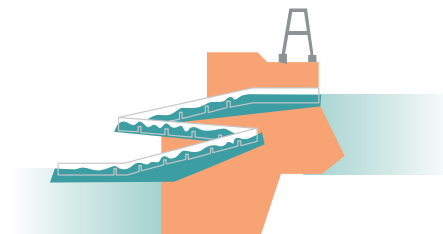
KARIM DELGADO



Fish ladder at the John Day Dam on the Columbia River

Adult migration through fish ladders generally is effective, while juvenile salmon traps in reservoirs have struggled to meet their goals.

Fish ladders, right, are a series of gradual steps that enable fish to swim around or over a dam. Ladders are in place at all federal projects on the lower Columbia and lower Snake Rivers.



▼ PRESSURE

Upstream and Downstream Effects

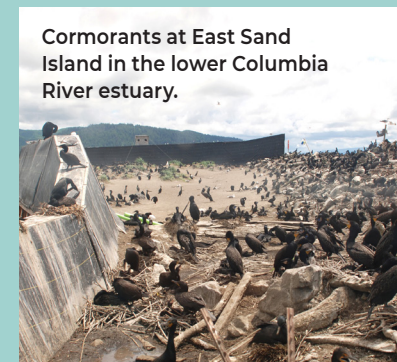
Dams interrupt river systems: they slow and often warm water in reservoirs, block gravel and large wood movement, disrupt beneficial floods, and inundate spawning and rearing habitat.

▼ PRESSURE

Predation

Dams delay migration upstream and downstream and can concentrate fish in small areas on either side of the dam, making them likely to be eaten by waiting birds, seals, and sea lions. Reservoirs behind dams also create ideal habitat conditions for native and non-native predatory fish such as northern pikeminnow and smallmouth bass that gobble up young salmon.

Cormorants at East Sand Island in the lower Columbia River estuary.



SONDRA RUCKWART / U.S. ARMY CORPS OF ENGINEERS

Hydropower managers recently have changed how much water is directed over dams in the Columbia and Snake Rivers, rather than through electricity-generating turbines, to benefit salmon.

Elwha River

In the Elwha, Middle Fork Nooksack, Pilchuck, and White Salmon Rivers, dams have been removed, greatly benefiting salmon.

PRIORITIES AND PROGRESS

Columbia River Basin Reform



Several recent high-profile efforts have focused on restoring Columbia River salmon and steelhead. In September 2022, the National Marine Fisheries Service released *Rebuilding Interior Columbia Basin Salmon and Steelhead*,³⁴ a report outlining major actions that the agency believes necessary to achieve mid-range goals for 16 salmon and steelhead stocks that spawn above Bonneville Dam, including large-scale reintroduction and breaching of the lower Snake River dams.

Separately, Governor Jay Inslee and Senator Patty Murray released the final *Lower Snake River Dams: Benefit Replacement Report*³⁵ in August 2022, detailing the costs of replacing services provided by the four lower Snake River dams. Many experts have concluded that the most impactful salmon recovery action in the region includes removing or bypassing these dams, improving fish passage, eliminating water quality impacts, and reestablishing spawning areas, particularly for Snake River Chinook and steelhead populations. The dams provide power, navigation, irrigation, and recreation services that Governor Inslee and Senator Murray recognize must be replaced before breaching or bypassing the dams.

Reintroduction

Fish passage technologies have improved, and salmon reintroduction efforts are underway in many watersheds that have been inaccessible for nearly 100 years, such as the upper Lewis, Cowlitz, and Green Rivers, and the Columbia River above Grand Coulee Dam. In some areas, such as in the Elwha, Middle Fork Nooksack, Pilchuck, and White Salmon Rivers, dams have been removed, greatly benefiting salmon.

Improved Downstream Migration

Hydropower managers recently have changed how much water is directed over dams in the Columbia and Snake Rivers, rather than through electricity-generating turbines, to benefit salmon. Known as spill, these flows have sped juvenile migration to the ocean and increased their survival by avoiding turbines.

Food Web

The Salmon Struggle

▼ PRESSURE

Decreased Food Availability



Salmon need food, and those food sources are increasingly at risk. Young salmon eat insects and other tiny animals. As they grow larger, they transition to eating shrimp-like creatures (called krill), squid, and forage fish. These food sources have declined because of harvest, habitat destruction, and poor ocean conditions. Forage fish populations in Puget Sound have been particularly impacted by shoreline armoring, which reduces their spawning habitat.

CANDICE EMMONS/NOAA

Salmon are highly regarded by animals great and small, notably humans and Southern Resident orcas.



When ecological systems are altered by humans, salmon become more vulnerable to certain predators.

▼ PRESSURE

Increased Predation

Salmon are nutritious and delicious, and therefore highly regarded by animals great and small, notably humans and Southern Resident orcas. They bring ocean-derived nutrients to otherwise nutrient-poor streams and forests, feeding organisms from bacteria to bears. But this tremendous service salmon provide has a downside: when ecological systems are altered by humans, salmon become more vulnerable to certain predators.

Rebounding populations of marine mammals, combined with human-made changes to the environment, has resulted in tremendous predation pressure on salmon. Between 1970 and 2015, seals and sea lions increased the amount of adult Chinook salmon they ate from 75 tons to 718 tons—double that of resident killer whales and six times more than the combined commercial and recreational catches.³⁶ Emerging science suggests that harbor seals inflict heavy tolls on juvenile salmon in Puget Sound and Hood Canal, especially in years when other species



Sea Lion

CASPIAN TERN: INGRID TAYLOR; SEA LION: NOAA

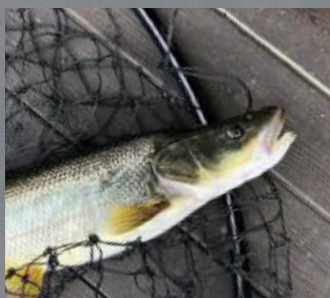


Caspian Tern

preferred by seals, such as herring and anchovies, are scarce.³⁷

Similarly, changes in river conditions caused by dams have allowed native and non-native fish and birds to eat more juvenile salmon. About 35 percent of the juvenile spring Chinook salmon from the upper Columbia River migrating to the ocean are consumed by birds, while predatory fish eat millions more in the Columbia and Snake Rivers.³⁸

35% of the juvenile spring Chinook salmon from the upper Columbia River migrating to the ocean are consumed by birds.³⁸



Northern pikeminnow, above, a fish native to Washington, has quickly adapted to dammed rivers, increasing the number of juvenile salmon they are able to eat.

Changes in rivers caused by dams have allowed native and non-native fish and birds to eat more juvenile salmon.



PRIORITIES AND PROGRESS



Tribe and state salmon co-managers in Washington and Oregon have secured federal permits and started removing sea lions that habitually gather at bottlenecks for salmon such as Bonneville Dam, which should reduce the number of salmon eaten.

The U.S. Army Corps of Engineers manages extensive programs to reduce rates of predation by birds in the Columbia River estuary and the middle Columbia River. A bounty program that pays recreational fishers to capture pikeminnow is credited with significantly reducing the number of salmon eaten by pikeminnow.

In the marine environment, researchers are working to identify bottlenecks where juvenile salmon are being eaten in large numbers, such as the Hood Canal Bridge. Once these bottlenecks are identified, engineering solutions may ease salmon passage and reduce attractiveness to harbor seals and birds.

While progress on forage fish research and restoration in Puget Sound has been slow, the reduced pace of shoreline armoring and increased attention to forage fish habitat is encouraging.

COLUMBIA COUNTY

Restoring the North Fork Touchet River



In 2022, the Confederated Tribes of the Umatilla Indian Reservation completed the third summer of construction to improve habitat for summer steelhead trout, spring Chinook salmon, and bull

trout in the North Fork Touchet River near Dayton. Working with several private landowners, the tribes used several techniques to improve habitat in the stream and its floodplain. Construction crews built log and boulder structures to encourage pool formation and provide overhead cover for fish, set back levees that previously confined the river, and replaced a bridge with a longer span to allow the river to engage with its newly broadened floodplain.

Projects that reconnect rivers with their floodplains are important salmon recovery tools. These are often complex, challenging projects because floodplains throughout Washington have been modified to provide agricultural, residential, commercial, and industrial benefits to society. In this case, grants and innovative partnerships combined to improve salmon and steelhead habitat while increasing climate resilience, reducing flood risk, and protecting agricultural uses.

Encompassing 3 miles of the North Fork Touchet River, the project reconnected 44 acres of floodplain with the river, planted 32 acres with native trees and shrubs, built nearly 2 miles of levee to protect adjacent farms, and placed 192 large wood structures and logs in the river to create habitat for fish. The tribes secured major grants through the Bonneville Power Administration, Department of Ecology's Floodplains by Design program, the National Oceanic and Atmospheric Administration's Pacific Coastal Salmon Recovery Fund, and Salmon Recovery Funding Board.

This project near Dayton improved fish habitat by replacing a bridge with a longer span to allow the river to engage with its newly broadened floodplain.



Salmon habitat restoration projects like this are happening around the state to return rivers and bays to more natural states, while still accommodating people.

GRAYS HARBOR COUNTY

Restoring Tidal Flow of the Middle Fork Hoquiam River



The Grays Harbor Conservation District completed a major project in 2021 by restoring tidal flow to a Sitka spruce wetland near Hoquiam. The project is

the culmination of more than a decade of work in which the Chehalis River Basin Land Trust bought the land and partnered with the conservation district to reconnect the wetland to the Hoquiam River. The wetland and stream channels were blocked by a logging railroad and log dump, disconnecting them from estuary tides for nearly 100 years.

Tidal wetlands and floodplain channels provide valuable rearing habitat for young salmon, which grow rapidly in these areas. Because young salmon are more likely to survive their time in the ocean if they are larger, projects like this tidal reconnection project will increase the number of fish returning as adults to the river.


This project reconnected and restored about 153 acres of tidal wetland and allowed salmon and steelhead to access about 3.5 miles of blocked streams. Streamside forests dominated by alder trees have been planted with Sitka spruce to speed the recovery of mature forests that will provide long-term benefits to the river and wetland. The Hoquiam River is home to chum, coho, and Chinook salmon; steelhead trout; and a variety of other fish. The project was funded with grants from the Salmon Recovery Funding Board and the Washington Coast Restoration and Resiliency Initiative.



Restored habitat absorbs carbon, offers refuge for wildlife, and provides economic opportunities for rural communities.



This project reconnected and restored tidal wetland habitat and allowed salmon and steelhead access to blocked streams.

A wide-angle landscape photograph showing the Skagit River in the foreground, with a rocky and driftwood-strewn shoreline. The background is filled with a dense forest of trees in vibrant autumn colors (yellows, oranges, and reds) interspersed with evergreens. In the far distance, the snow-capped peak of Mount Baker rises against a clear blue sky.

**“We must never forget the value of
salmon to the spiritual, community and economic
vitality of tribes and the ecology of the
watersheds that sustain us all.”**

—LORRAINE LOOMIS

Skagit River and Mount Baker

Lorraine Loomis

1940-2021



Lorraine Loomis served on the Northwest Indian Fisheries Commission for more than 40 years, including 7 years as chairperson. Among many accolades, she received the

Billy Frank Jr. Leadership Award for defending tribal sovereignty, treaty rights, and treaty-protected resources. Lorraine was a strong, passionate, and visionary leader with a gracious style. She was a fearless champion for salmon and habitat protection, played a significant role in developing and implementing the Pacific Salmon Treaty between the United States and Canada, and led the annual North of Falcon negotiation process to set fishing seasons. During her nearly 50 years as a fisheries manager for the Swinomish Indian Tribal Community, she was a leading light, demonstrating great moral integrity and clarity while fostering an environment of cooperation and consensus.

Terry Williams

1948-2022



Soft-spoken and tireless, Terry Williams spent decades advocating for climate change research and action. He served on the Northwest Indian Fisheries Commission, including 4 years as treasurer and vice

chair. Terry served more than 20 years on the Pacific Salmon Commission, and since 1982, was the Tulalip Tribes' Fisheries and Natural Resources commissioner. Terry was instrumental in negotiating Washington's landmark Timber/Fish/Wildlife agreement that protected salmon habitat. He served on Governor Gary Locke's Joint Natural Resources Cabinet as it developed the state's first salmon recovery strategy, and represented tribal interests locally, nationally, and internationally in appointed positions. Throughout his highly decorated career, Terry brought people together, regardless of their backgrounds, to find common-sense solutions to challenging problems.

Dale W. Johnson

1942-2022



A former chairman of the Makah Tribe and the Northwest Indian Fisheries Commission, Dale Johnson's leadership began before the 1974 decision by U.S. District Court Judge

George Boldt reaffirmed tribal treaty rights. His service on the Makah Tribal Council and Northwest Indian Fisheries Commission in the 1970s and 1980s placed him at a pivotal point for tribal treaty rights. His efforts were central to securing recognition of the Makah Tribe's treaty right to harvest halibut and sablefish, among other fish, creating a successful tribal industry. Before Dale passed away, the Makah Tribal Council proclaimed him one of the most inspiring leaders of our time, with qualities equal to the forefathers who negotiated the 1855 Treaty of Neah Bay.

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HABITAT RESTORATION ACCOMPLISHMENTS 2005-2022

While there still are pathways where salmon and people can thrive in the Pacific Northwest, the options are narrowing quickly. To fully seize the moment and make real progress, Washingtonians must recalibrate their relationship with salmon and the environment. Reimagining a future with abundant salmon requires people to remove barriers, discard outdated preconceptions, listen to each other, and elevate shared values.

Although restoration has improved habitat in many areas, much work remains and will be complicated by the enormous impacts of climate change and anticipated population growth. Without significant changes to how Washington accommodates human population growth, salmon populations will continue to decline. The fundamental question is whether Washington State can elevate the needs of salmon. Restoring habitat that already has been damaged will not be enough to recover salmon. How Washington manages the landscape, which is determined by local, state, and federal land-use decisions, will determine whether salmon can be saved from the brink of extinction.

3,750
FISH PASSAGE BARRIERS
CORRECTED

26,342
RIPARIAN ACRES
TREATED

4,734
MILES OF STREAM MADE
ACCESSIBLE TO SALMON

10,454
ACRES OF ESTUARIES
AND NEAR-SHORE AREAS
TREATED



Hamma Hamma River
headwaters in Skokomish
Wilderness.

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