NOAA FISHERIES
West Coast Region

Southern Resident Killer Whales and West Coast Chinook Salmon

Endangered Southern Resident killer whales prey primarily on Chinook salmon that historically returned in great numbers to rivers up and down the West Coast. NOAA Fisheries analyzed Chinook salmon stocks based on their estimated importance to the whales and found that the most crucial stocks are those returning to the Fraser River in British Columbia, other rivers draining into Puget Sound and the Salish Sea, and the Columbia, Snake, Klamath, and Sacramento rivers. Tracking studies show that some of the whales visit the mouths of these West Coast rivers in search of their preferred Chinook salmon prey, but all of the rivers help support the whales over the course of each year.

Recent declines underscore the urgency of addressing the threats facing the Southern Residents:

- reduced prey (Chinook salmon) in some areas,
- vessel traffic and noise,
- toxic contaminants, and
- health risks such as inbreeding.

This fact sheet looks at the latest research on the prey question—what is the status of the salmon stocks the Southern Residents rely on, and where can we make the greatest difference for the whales now?

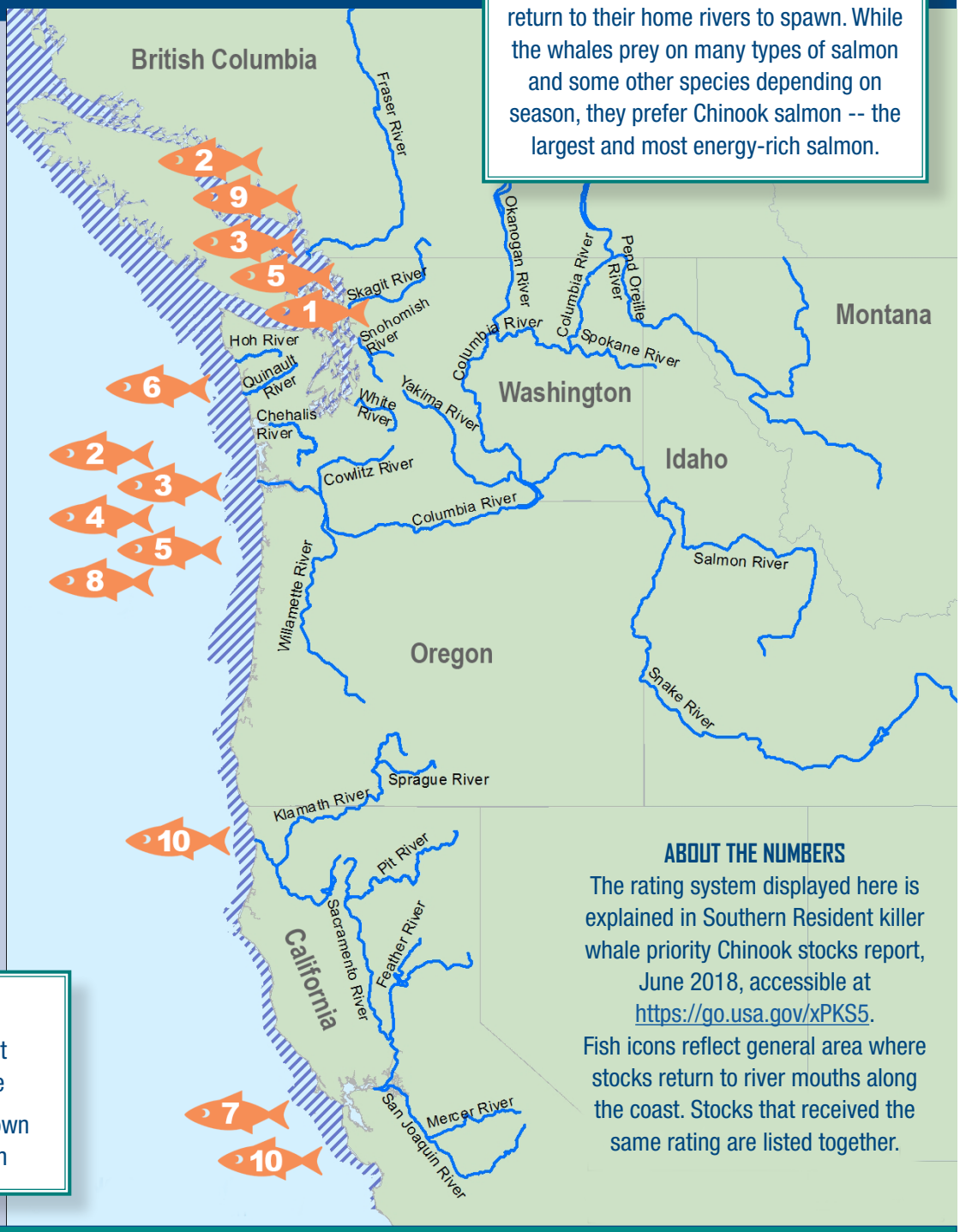
The number of juvenile salmon produced by West Coast rivers has increased since the 1970s, as have adult returns to the Columbia and Snake rivers. Puget Sound rivers have not seen the same increases but remain very important because Southern Residents can access them throughout much of the year. This makes salmon stocks around the Salish Sea and Puget Sound a primary target for recovery as described in NOAA Fisheries' Puget Sound Chinook Salmon Recovery Plan.

Adult spring Chinook. Photo: Michael Humling, USFWS

TOP 10 PRIORITY CHINOOK POPULATIONS FOR SOUTHERN RESIDENTS

As the southernmost resident killer whales on the West Coast, Southern Residents have access to salmon stocks as adult fish return to their home rivers to spawn. While the whales prey on many types of salmon and some other species depending on season, they prefer Chinook salmon -- the largest and most energy-rich salmon.

1. **Northern and southern Puget Sound (fall)**
2. **Lower Columbia River (fall), Strait of Georgia (fall)**
3. **Upper Columbia River and Snake River (fall), Fraser River (spring), and lower Columbia (spring)**
4. **Mid-Columbia River (fall)**
5. **Snake River (spring-summer), Northern Puget Sound (spring)**
6. **Washington Coast (spring and fall)**
7. **California Central Valley (fall)**
8. **Mid-Columbia River and upper Columbia River (Spring and summer)**
9. **Fraser River (summer)**
10. **California Central Valley (fall/late fall), Klamath River (fall and spring)**



LEGEND

Southern Resident Killer Whale range

Salmon stock shown near river of origin

ABOUT THE NUMBERS

The rating system displayed here is explained in Southern Resident killer whale priority Chinook stocks report, June 2018, accessible at https://go.usa.gov/xPKS5.

Fish icons reflect general area where stocks return to river mouths along the coast. Stocks that received the same rating are listed together.

SOUTHERN RESIDENT KILLER WHALE CHINOOK PREY BY SEASON

LATE SPRING/SUMMER

Whales in inland waters of British Columbia and Washington, sometimes west side of Vancouver Island, eating spring, summer and fall Fraser and Puget Sound Chinook salmon.

WINTER

K and L Pods on outer coast as far south as California, eating Columbia/Snake River, Central Valley, Puget Sound, Fraser River, and other coastal stocks.

J Pod largely in inland waters, eating British Columbia and Northwest United States Chinook salmon stocks.

LATE WINTER/EARLY SPRING

K and L Pods often off the Washington Coast and Columbia River, eating Columbia/Snake River and other coastal stocks.

J pod largely in inland waters and west side of Vancouver Island, eating British Columbia and Northwest United States stocks.

West Coast Chinook salmon production has increased over the last 50 years

While human activities caused significant declines in salmon abundance starting in the 1800s, particularly resulting from salmon habitat loss, progress has been made towards increasing salmon abundance in the last 50 years, in part due to supplemental hatchery production and enhanced fish passage. Combined natural and hatchery West Coast Chinook salmon production grew from an estimated 225 million juvenile salmon in 1975 to 406 million in 2015, according to recent studies. Fish hatchery production drove this increase until the mid-1980s, when hatchery production decreased. Increases in wild fish production from rivers including the Columbia and Snake rivers have since compensated for those decreases.

Today, the Columbia and Snake rivers produce most of the wild and hatchery Chinook salmon on the West Coast. The Independent Scientific Advisory Board, a panel of scientists that advises the Northwest Power and Conservation Council, concluded in 2015 that the Columbia and Snake Rivers may now produce more juvenile salmon than they did prior to dams and development, when hatchery fish are included. While ocean conditions impact their survival to adulthood and availability to the Southern Residents, this data indicates that passage methods have improved and more juvenile fish are getting to the ocean. As far as researchers can determine, the whales do not distinguish between hatchery and naturally produced adult salmon.

Natural and hatchery Chinook salmon production by area

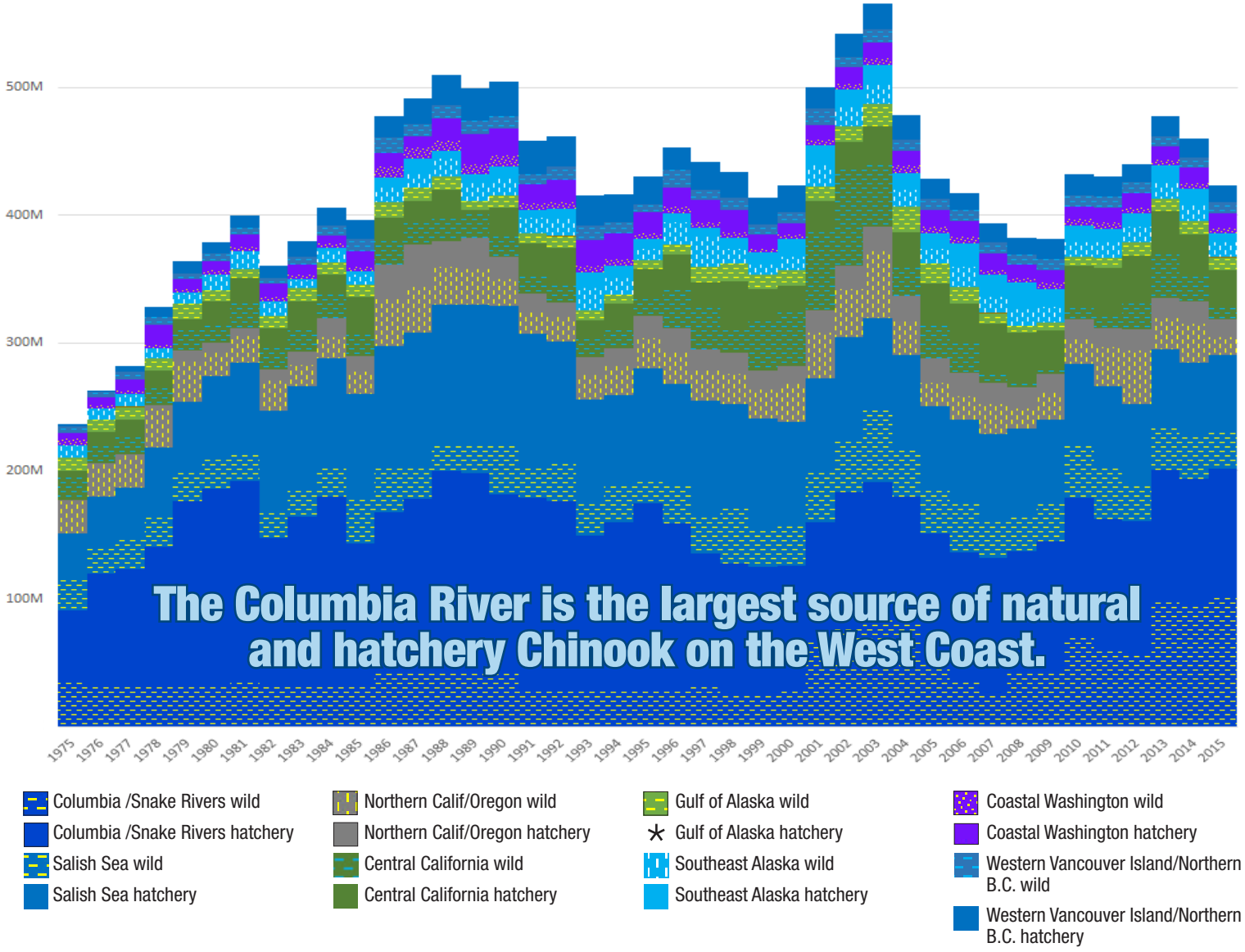


*Figure 1. Natural (patterned) and hatchery (solid) West Coast Chinook juvenile fish production by area. The Columbia River is the largest source of natural and hatchery Chinook on the West Coast. Modified from Chasco et al., 2017. *Gulf of Alaska hatchery numbers are not large enough to appear.*

Killer whales, including both the Southern Residents and other populations in Canada and Alaska, are large consumers of West Coast Chinook salmon in terms of biomass and numbers of adult Chinook salmon. Their estimated consumption exceeds the annual biomass of Chinook salmon consumed by pinnipeds (seals and sea lions) and annual catches by commercial and recreational fishermen, peer-reviewed research has found. The 74 Southern Resident killer whales, a small subset of all killer whales on the West Coast, consume an estimated 190,000 to 260,000 adult Chinook salmon each year.

Like the Southern Residents, some of these salmon stocks are endangered or threatened. This includes Puget Sound Chinook, as well as other Chinook from the Columbia, Snake, Klamath, and Sacramento rivers. The Southern Residents depend on a diversity of salmon stocks that together provide the food they need throughout the year. The more diverse and healthy stocks available to the whales, the better they can withstand variable ocean conditions, climate change, and other factors that may affect the availability of salmon.

Columbia/Snake River Chinook salmon returns have increased

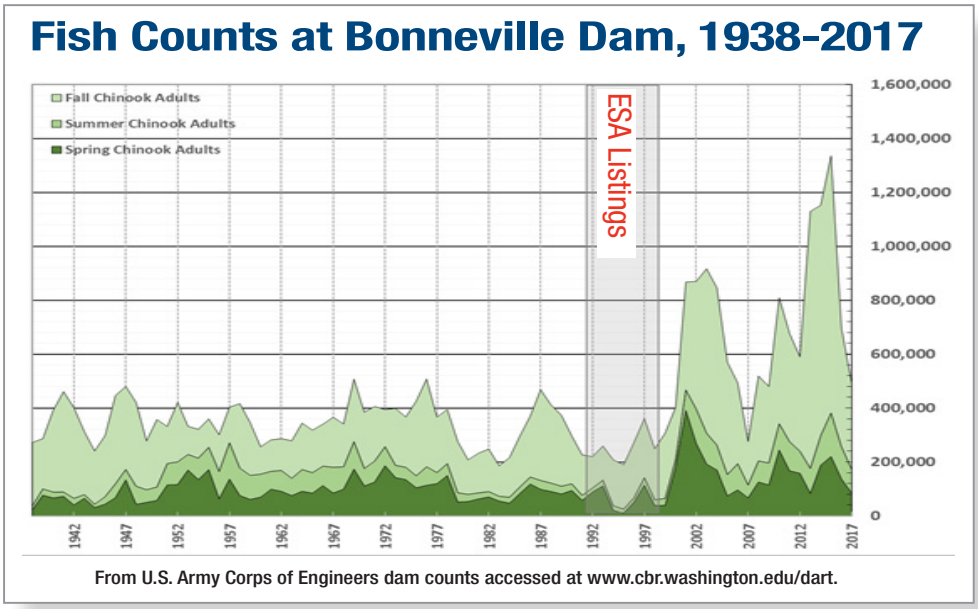
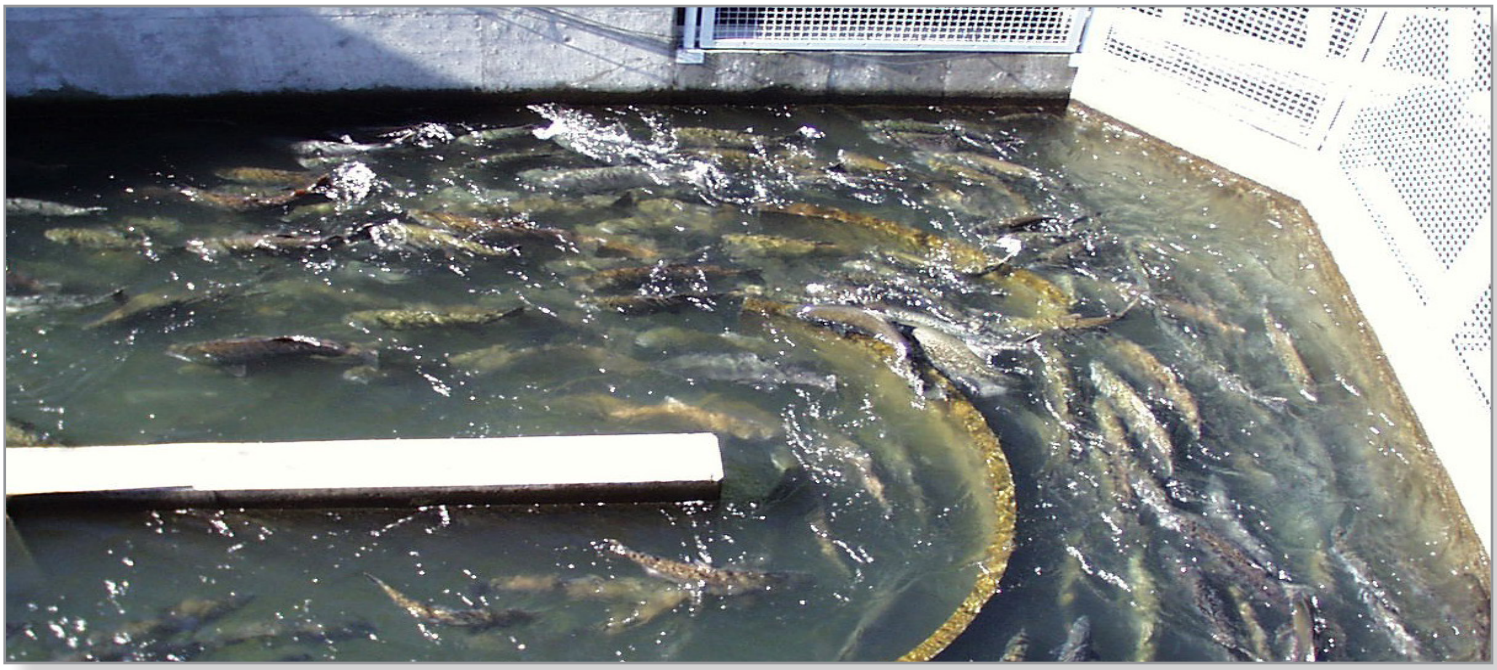


Figure 2. Chinook salmon returns to Bonneville Dam since its construction. Numbers do not reflect the many returning salmon harvested or consumed by predators prior to reaching the dam. From U.S. Army Corps of Engineers counts accessed at www.cbr.washington.edu/dart.

Some Chinook stocks are now available in increasing numbers to support the Southern Residents. For example, in the last decade more adult Chinook salmon have returned past Bonneville Dam on the Columbia River than at any other time since the dam was completed in 1938. NOAA Fisheries has found that hatchery Chinook more than compensate for fish lost to the dams in terms of the total numbers of Chinook available to the killer whales.

Below: Fall Chinook returns in Bonneville Dam fish ladder. Photo: U.S. Army Corps of Engineers.



Snake River Fall Chinook salmon

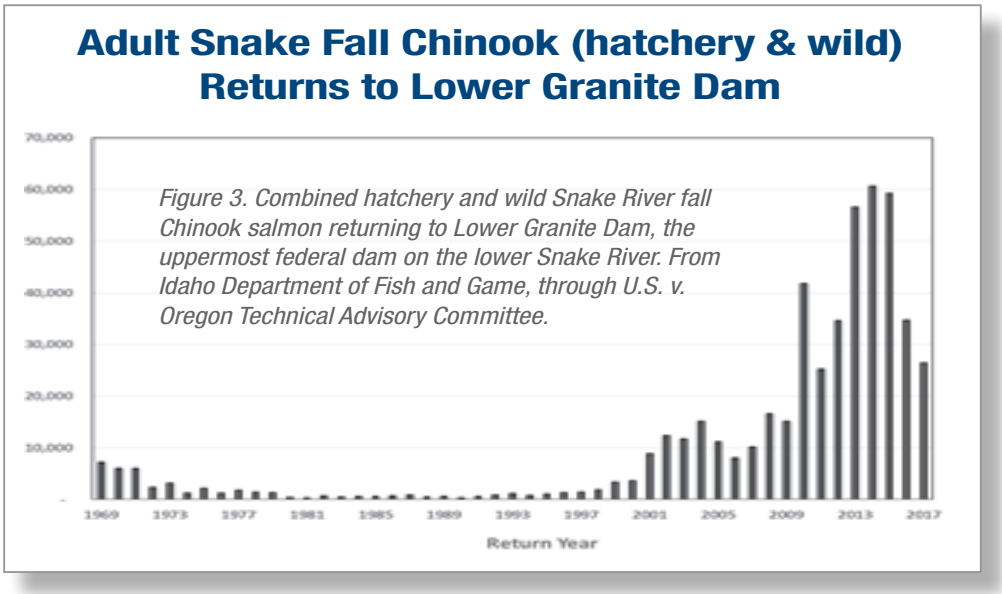


Figure 3. Combined hatchery and wild Snake River fall Chinook salmon returning to Lower Granite Dam, the uppermost federal dam on the lower Snake River. From Idaho Department of Fish and Game, through U.S. v. Oregon Technical Advisory Committee.

A joint evaluation of West Coast Chinook salmon stocks by NOAA Fisheries and Washington Department of Fish and Wildlife identified Snake River fall Chinook salmon as among the most important to Southern Resident killer whales. Safer passage at hydroelectric dams, hatchery production, and other recovery and protection strategies have helped Snake River fall Chinook rebound recently to some of their highest numbers in decades. This is true for both hatchery and wild fall Chinook salmon, as reflected in figures 3 and 4.

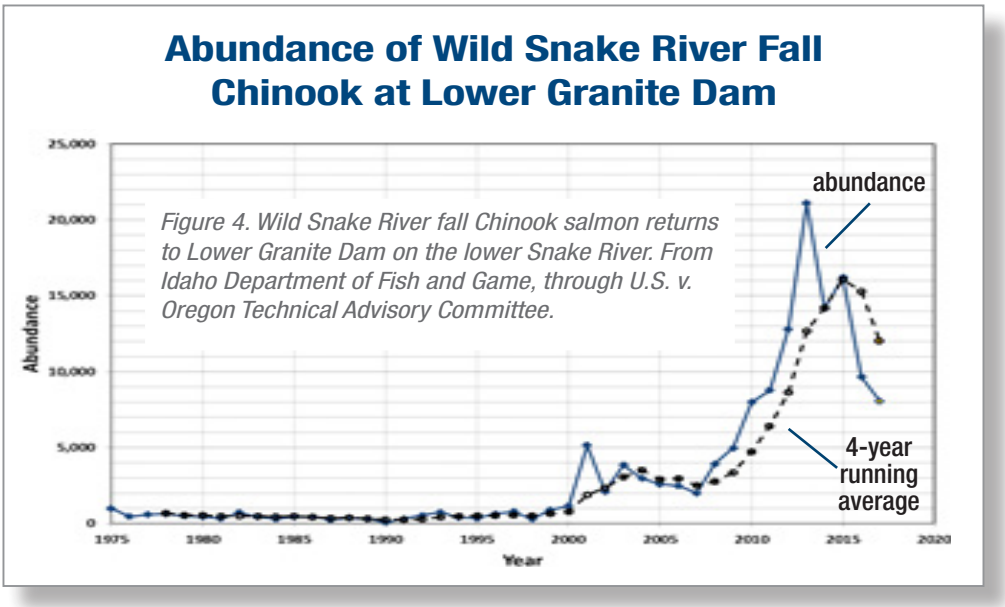


Figure 4. Wild Snake River fall Chinook salmon returns to Lower Granite Dam on the lower Snake River. From Idaho Department of Fish and Game, through U.S. v. Oregon Technical Advisory Committee.

Photo: Karoline Cullen

Snake River spring-summer Chinook salmon

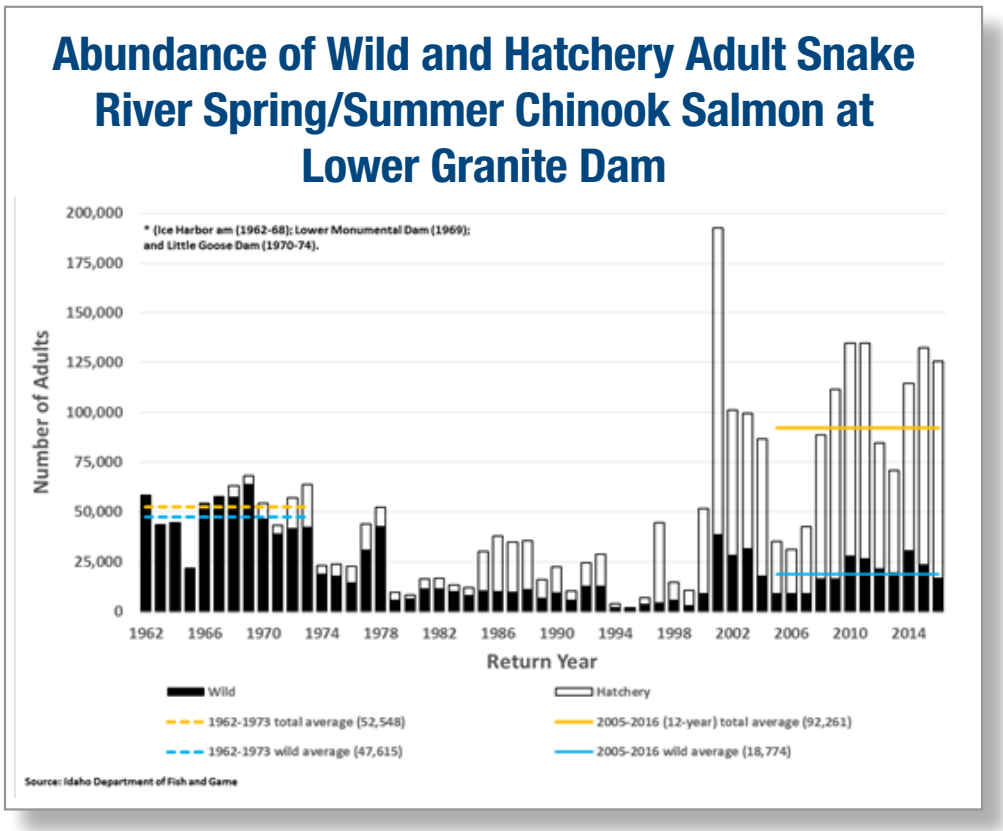


Figure 5. Abundance of wild and hatchery adult Snake River spring-summer Chinook salmon returning to Lower Granite Dam, the uppermost of the four lower Snake River dams. From Idaho Department of Fish and Game.

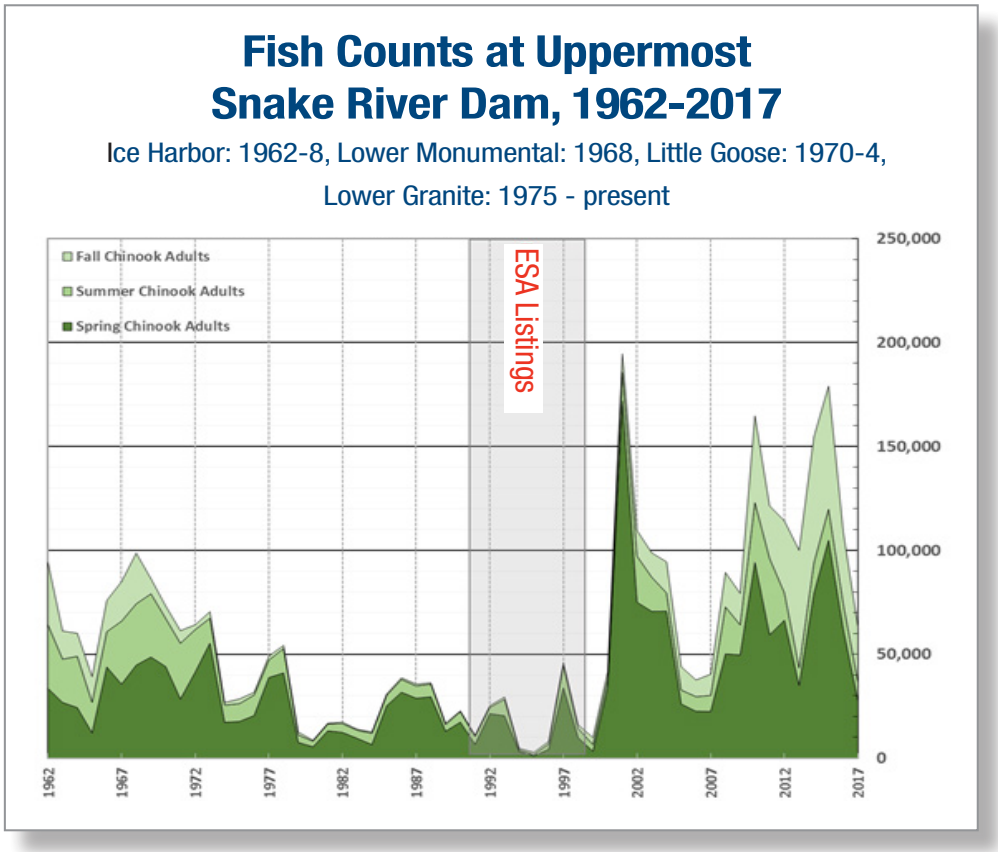


Figure 6. Combined returns of spring-summer, and fall Chinook salmon returning to the uppermost of the four lower Snake River dams, indicating the total number continuing on to spawning habitat in Idaho. From U.S. Army Corps of Engineers counts, accessed at www.cbr.washington.edu/dart.

In addition to Snake River fall Chinook salmon, the average abundance of Snake River spring-summer Chinook salmon has also increased. While hatchery fish that have supplemented this spring-summer run abundance cannot on their own recover the species in the long-term, they provide more Chinook salmon for Southern Resident killer whales in the shorter-term, while recovery strategies such as habitat restoration take hold and further increase natural abundance.

Major commitments to habitat restoration across the Columbia River Basin are also helping more fish return to some watersheds. Salmon returns always have and always will fluctuate from year to year as ocean conditions and the climate vary, and the last few years have seen weaker returns as an unusual warming pattern dominated the Pacific Ocean.

Snake River spring-summer Chinook salmon are mainly available to Southern Resident killer whales when the fish gather off the mouth of the Columbia. Snake River fall Chinook remain closer to the coast and would be available for a longer period before migrating upriver in the fall. Other stocks, especially those surrounding Puget Sound and the Salish Sea, remain essential to provide prey for the whales at other times of the year.

Puget Sound Chinook Salmon stocks are not showing improvement

Unfortunately positive trends are not playing out everywhere. For instance, NOAA Fisheries' analysis showed that Puget Sound Chinook salmon stocks are one of the most important salmon stocks for Southern Resident killer whales, since they surround the heart of the whales' habitat and the whales have access to them for a greater part of the year than fish from the Columbia, Snake, and Fraser rivers.

The abundance of Chinook salmon returning to Puget Sound rivers has scarcely changed in recent decades, in large part because much of their habitat has been lost entirely or degraded so it cannot support healthy runs as it once did. In addition, many juvenile Puget Sound salmon and steelhead do not make it through their first few months at sea. NOAA Fisheries researchers have further found that young Puget Sound Chinook salmon carry high levels of contaminants of emerging concern such as prescription drugs and antibacterial compounds, likely from local wastewater, at levels high enough to adversely affect their growth, reproduction, and behavior.

We must address all of the threats to Southern Residents, because plentiful salmon will provide less help to the whales if they carry toxic contaminants, or if ship noise drowns out the echolocation the whales use to track salmon prey.

One challenge of salmon recovery is to focus funding and other resources where they will make the most difference.

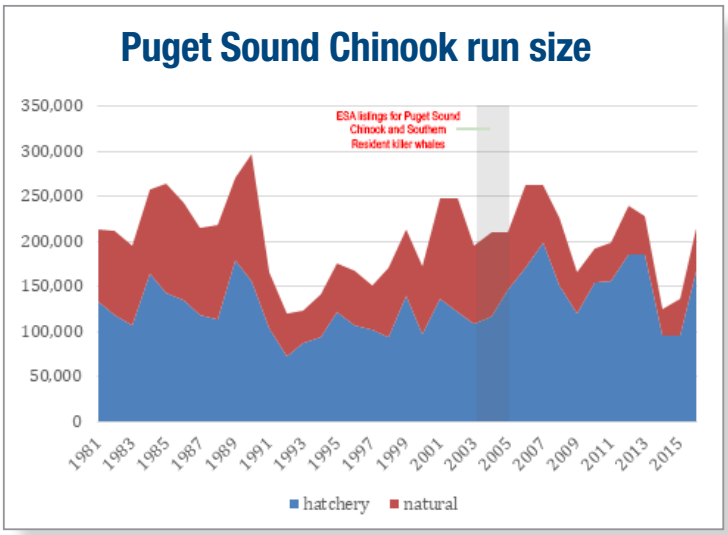


Figure 7. Puget Sound Chinook salmon returns, including harvest and returns to rivers. Does not include recreational harvest. From Pacific Fishery Management Council, 2017.

The analysis of Chinook stocks important to Southern Residents is already helping channel resources where they will best help the whales. For instance, the National Fish and Wildlife Foundation's Killer Whale Research and Conservation Program has dedicated more than $3 million to research and conservation of the Southern Residents, including habitat restoration for Chinook salmon in watersheds surrounding Puget Sound and the Salish Sea. NOAA Fisheries' Pacific Coastal Salmon Recovery Fund is further supporting habitat restoration across Puget Sound.

A young resident killer whale chases a Chinook salmon in the Salish Sea near San Juan Island, Washington State, in September 2017. Image obtained under NMFS permit #19091. Photograph by John Durban (NOAA Fisheries/Southwest Fisheries Science Center), Holly Fearnbach (SR3: SeaLife Response, Rehabilitation and Research) and Lance Barrett-Lennard (Vancouver Aquarium's Coastal Ocean Research Institute).

What about breaching dams on the lower Snake River?

The U.S. Army Corps of Engineers, Bureau of Reclamation and the Bonneville Power Administration are preparing an environmental impact statement (EIS) in accordance with the National Environmental Policy Act (NEPA) to assess and update their approach for long-term operations, maintenance, and configuration for the 14 federal projects in the Columbia River System. This process, scheduled for completion in 2021, will evaluate impacts of the 14 projects on both ESA-listed and non-listed anadromous fish species. Based on public input during NEPA scoping, the EIS also includes an alternative that evaluates breaching the four Lower Snake River dams.

During this NEPA process, and subsequent ESA Section 7 consultation with NOAA Fisheries on the final preferred alternative, the co-lead federal agencies will consider the effects of operating the lower Snake River dams on ESA-listed Pacific salmon, including any associated measures to avoid, offset, or minimize those effects.

Dam breaching is a long-term proposition. If it were decided on today, breaching one or more Snake River dams would take congressional authorization and several generations of salmon, at least, before any results could become clear.

NOAA Fisheries continues to consult with the agencies on recommended actions to improve fish passage, to address growing impacts of predators on salmon, such as sea lions and birds, and to restore salmon habitat.

Looking ahead

NOAA Fisheries and numerous partners have collaboratively developed recovery plans for salmon that outline strategies on all fronts to promote their recovery and eventual delisting from the ESA. These plans include continued and improved safe passage through dams, restoration of important rearing habitat, science-based improvements in hatchery operations, and adjustments in harvest levels. All play an important role in putting salmon on the road to recovery, and supporting Southern Resident killer whales.

Photo: Karoline Cullen

For more information on Southern Resident killer whales:

NOAA Fisheries West Coast Region Southern Resident killer whales
http://www.westcoast.fisheries.noaa.gov/protected_species/marine_mammals/killer_whale/

Southern Resident killer whale Recovery Plan
www.westcoast.fisheries.noaa.gov/protected_species/marine_mammals/killer_whale/planning_implementation.html