Restoring a place where salmon and people can live together

Lake Washington/Cedar/Sammamish Watershed (WRIA 8) 2025 Progress Report

Prepared on behalf of the WRIA 8 Salmon Recovery Council | February 2026

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2025 PROGRESS REPORT

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Overview

Do the sum of recovery actions lead to improved Chinook salmon viability?

WRIA 8 tracks the status and trends of the Cedar and Sammamish Chinook salmon populations to understand the progress and pace of Chinook recovery in the watershed. We report on five indicators of population abundance, productivity, and diversity:

- Egg-to-migrant survival rate
- Number and percent parr migrants
- Number of adult spawners
- Percent natural-origin spawners
- Returns per spawner

Chinook salmon in Cottage Lake Creek (photo: Craig Barbaccia).

This Progress Report focuses on recent data (typically the recent five-year average) to evaluate near-term (2025) population recovery goals established in the 2005 WRIA 8 Plan. These goals are intended to support a trajectory toward sustainable, harvestable Chinook salmon populations. Unfortunately, most population indicators fell short of their 2025 goals, and we are not on track to meet long-term (2055) population objectives. Chinook recovery in WRIA 8 will take time but also continued support for science, restoration, and ongoing programs.

Are overall conditions in the watershed related to Chinook salmon habitat improving?

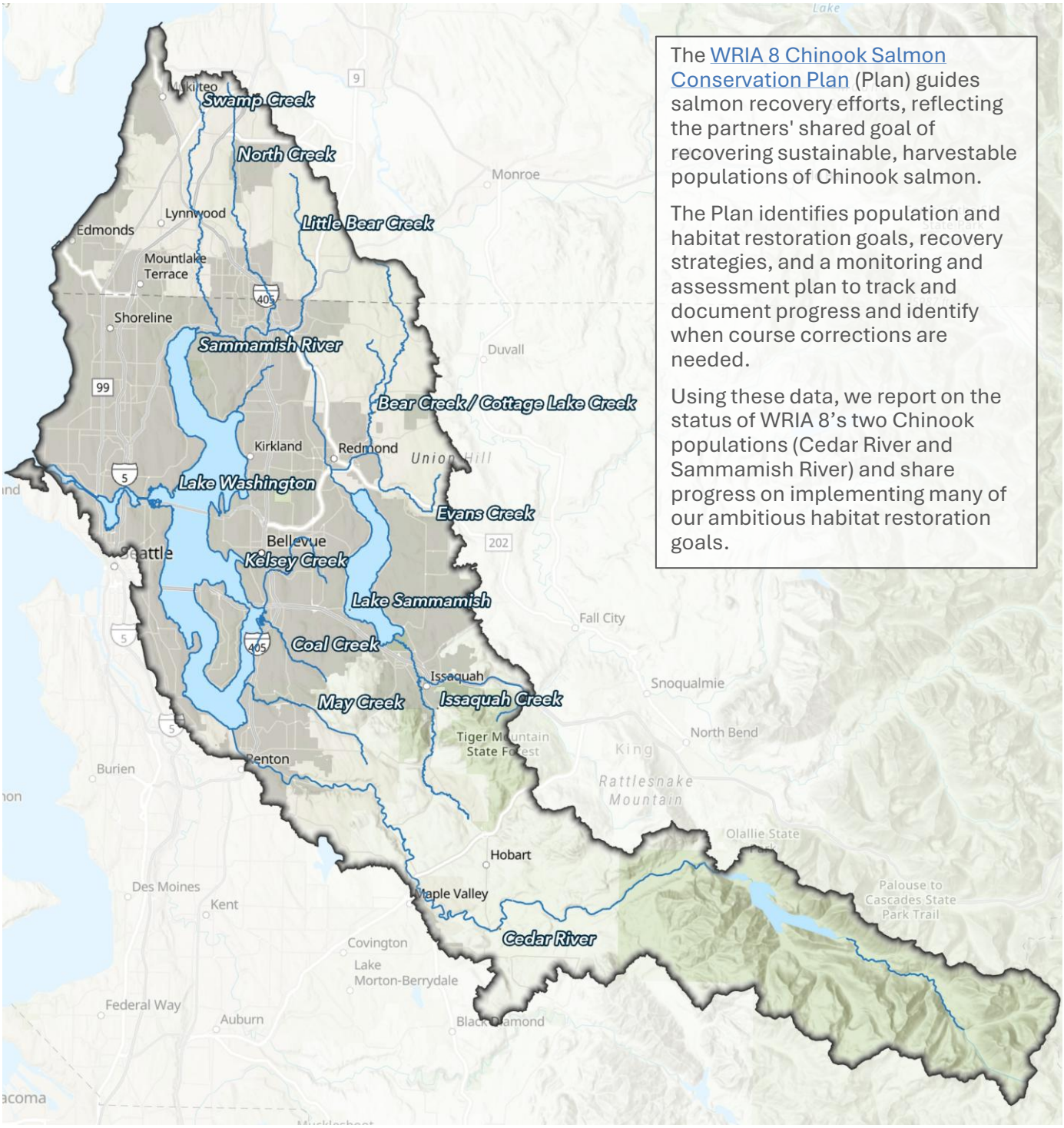
Habitat goals were developed as part of the 2017 WRIA 8 Plan update, focusing on improvements needed in key habitat elements for conservation and recovery of Chinook salmon in the watershed, including:

- Cedar River: floodplain connectivity and large wood
- Sammamish River: riparian forest cover and thermal refugia
- Priority streams: riparian forest cover and large wood
- Lakes: natural shoreline
- Puget Sound nearshore: pocket estuaries

Most indicators showed habitat conditions improved over the last 10 years, though not at the pace needed to achieve our 2025 goals. One indicator, Lake Sammamish natural shoreline length, showed a decline in condition with more new armor installed than removed. Inadequate investment of resources, administrative requirements, and regulatory processes slow our progress to rebuild salmon habitat. As the most populous watershed in the state, WRIA 8 must also balance the needs of nature and community and push for projects that provide multiple benefits. Moving forward, the WRIA 8 Technical Committee will consider new near-term, measurable, and relevant goals that describe the improvements needed in key Chinook salmon habitats.

Locally-based Collaborative Recovery Effort

In 1999, Puget Sound Chinook salmon were listed as threatened under the Endangered Species Act. Since then, the Lake Washington/Cedar/Sammamish Watershed (WRIA 8) Salmon Recovery Council, a partnership between 28 local governments and community groups, state and federal agencies, businesses, and residents, has worked to recover our watershed's native iconic Chinook salmon populations.



The [WRIA 8 Chinook Salmon Conservation Plan] (Plan) guides salmon recovery efforts, reflecting the partners' shared goal of recovering sustainable, harvestable populations of Chinook salmon.

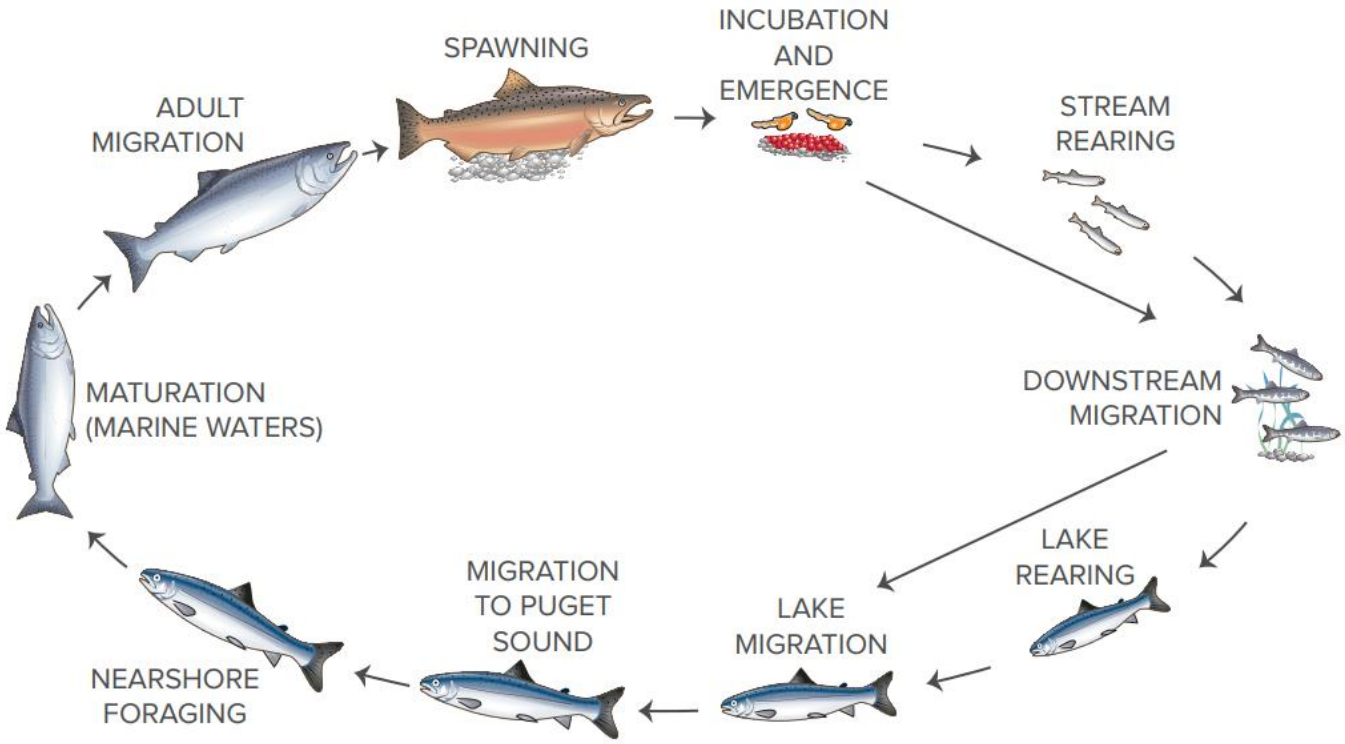
The Plan identifies population and habitat restoration goals, recovery strategies, and a monitoring and assessment plan to track and document progress and identify when course corrections are needed.

Using these data, we report on the status of WRIA 8's two Chinook populations (Cedar River and Sammamish River) and share progress on implementing many of our ambitious habitat restoration goals.

Chinook in the Lake Washington Basin

Chinook salmon spend most of their life (typically 3-4 years) maturing in marine waters. However, critical parts of their lifecycle are spent in the watershed, occupying different habitats at each stage of their lives. In WRIA 8 this includes a lake rearing and migration phase that is unique among Chinook in Puget Sound with Lake Washington and Lake Sammamish occupying significant portions of their migration pathway.

As the co-managers of fisheries resources in WRIA 8, the Washington State Department of Fish and Wildlife (WDFW) and the Muckleshoot Indian Tribe lead monitoring programs to assess salmon populations. The co-managers, in coordination with local partners, annually conduct Chinook spawner surveys on Tier 1 and 2 streams, and juvenile outmigrant trapping on Bear Creek and the Cedar River. These monitoring data help us understand whether the sum of recovery actions are resulting in improved Chinook viability.



Life stage conceptual model of WRIA 8 Chinook Salmon

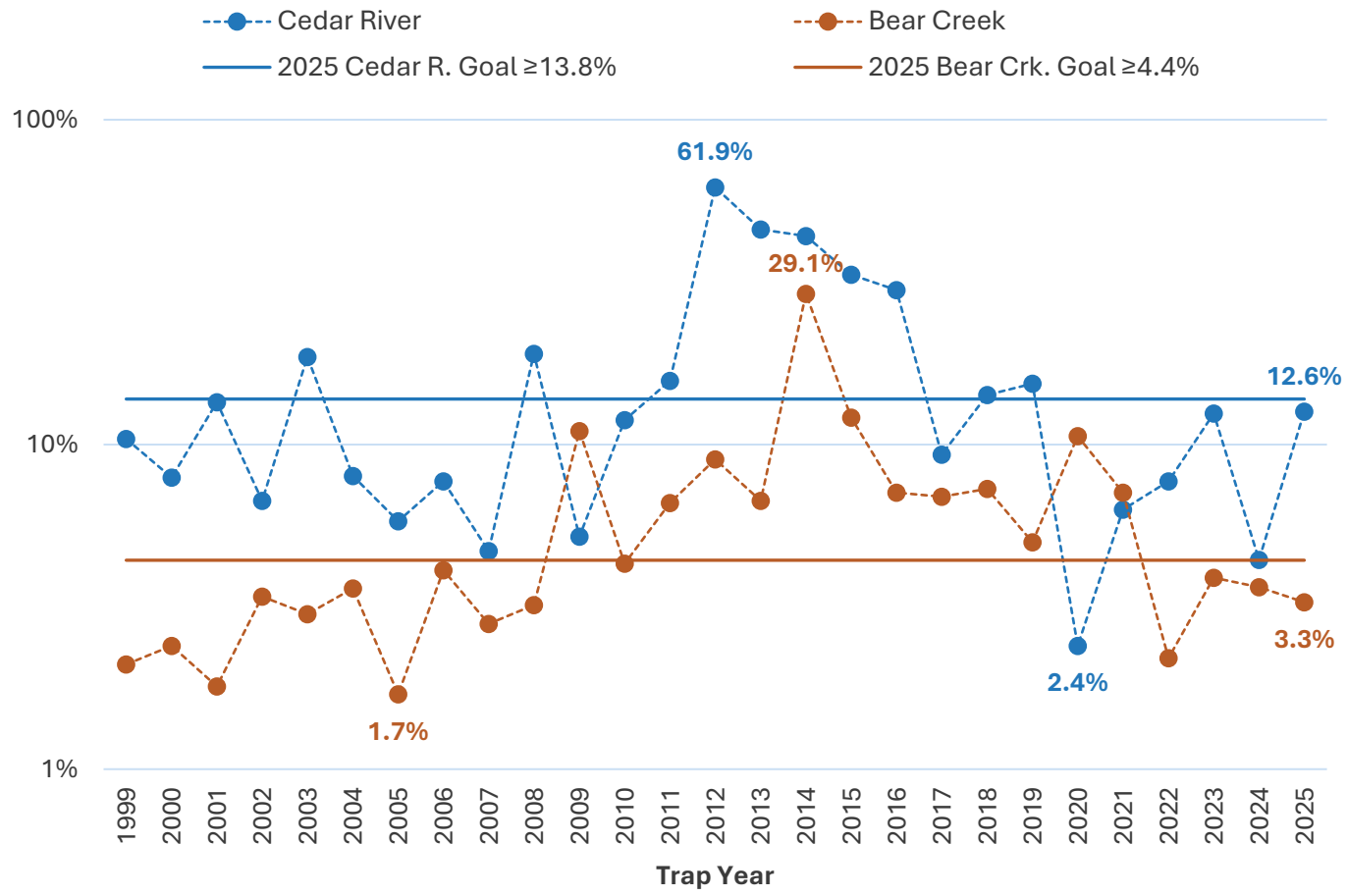
LIFE STAGE	SEPT	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG
Adult Freshwater Migration											AGE 3-4	
Spawning												
Incubation & Emergence												
Stream Rearing												
Lake Rearing												
Migration to Puget Sound												

Time spent in WRIA 8 by Chinook life stage

Juvenile Productivity

Chinook salmon begin their lives as eggs in the gravel. Juvenile salmon emerge from the gravel and seek places in the river with slow water and cover to grow and hide from predators. The egg-to-migrant survival rate estimates the total number of juvenile Chinook entering Lake Washington relative to the number of eggs deposited the previous fall. Spawner density and freshwater habitat conditions (abnormally high or low streamflow, excessive fine sediments, high temperature, and other water quality concerns) can affect Chinook egg-to-migrant survival. Our goal is for the Cedar population to achieve an egg-to-migrant survival rate of at least 13.8% and at least 4.4% for the Sammamish population.

Egg-to-migrant survival



Cedar

10-year average: 11.5%
5-year average: 8.7%

Bear Creek (Sammamish)

10-year average: 5.7%
5-year average: 4.0%

Data Source: Co-managers count the number of redds each fall (brood year) to estimate female spawners and egg deposition (assume average fecundity of 4,500 eggs/female). The estimated number of eggs deposited is compared to juvenile, outmigrant abundance the following year for egg-to-migrant survival.
https://data.wa.gov/dataset/WDFW-Salmonid-Population-Indicators-Database-SPI-M/x25s-cxg8/about_data
https://data.wa.gov/Natural-Resources-Environment/WDFW-Juvenile-Population-Abundance/cqra-s74n/about_data

Juvenile Rearing (Cedar)

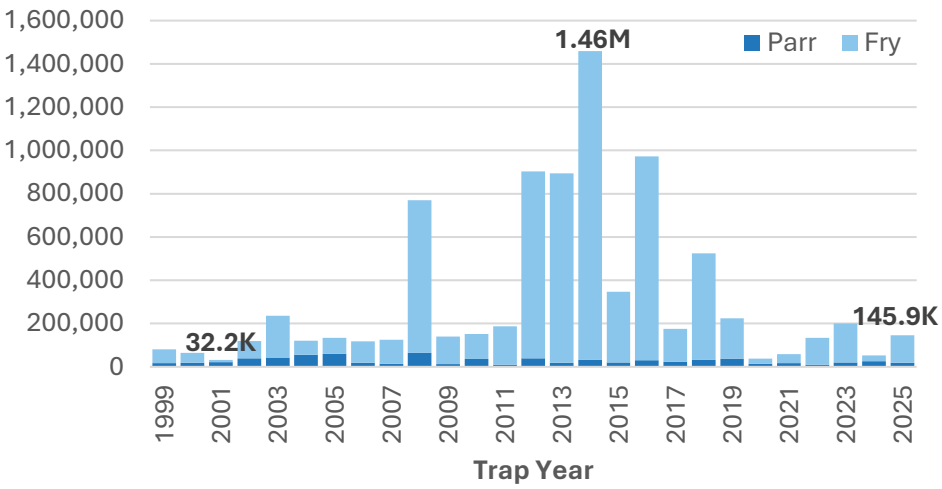
Juvenile Chinook spend their first few months rearing in streams and rivers (primarily Cedar River, Bear/Cottage Lake Creek, and Issaquah Creek) or migrating downstream as fry to rear in Lake Washington and Lake Sammamish. Instream rearing and refuge habitat is limited in WRIA 8 and one of the highest priorities for habitat restoration. Our goal in the Cedar is to increase the number and proportion of parr (late-season) migrants as an indicator of instream rearing capacity.

Juvenile abundance and diversity

Cedar

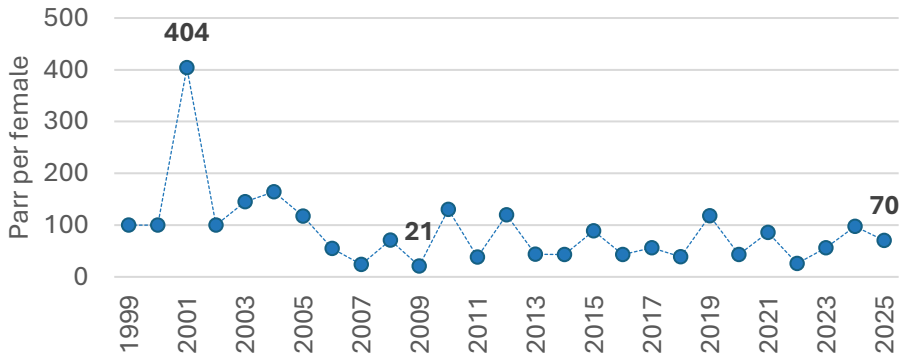
Total Juvenile Abundance

10-year average: 252,439
5-year average: 118,160



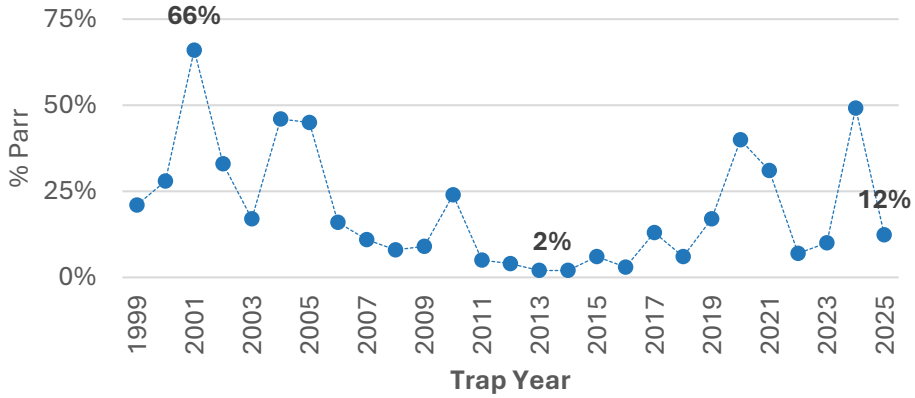
Parr Migrants per Female

10-year average: 63
5-year average: 67



Proportion Parr Migrants

10-year average: 19%
5-year average: 22%



Data source: WDFW tracks daily outmigration of Chinook from the Cedar River and Bear Creek using rotary screw traps to estimate natural-origin juvenile Chinook abundance and timing. https://data.wa.gov/Natural-Resources-Environment/WDFW-Juvenile-Population-Abundance/cqra-s74n/about_data

Juvenile Rearing (Sammamish)

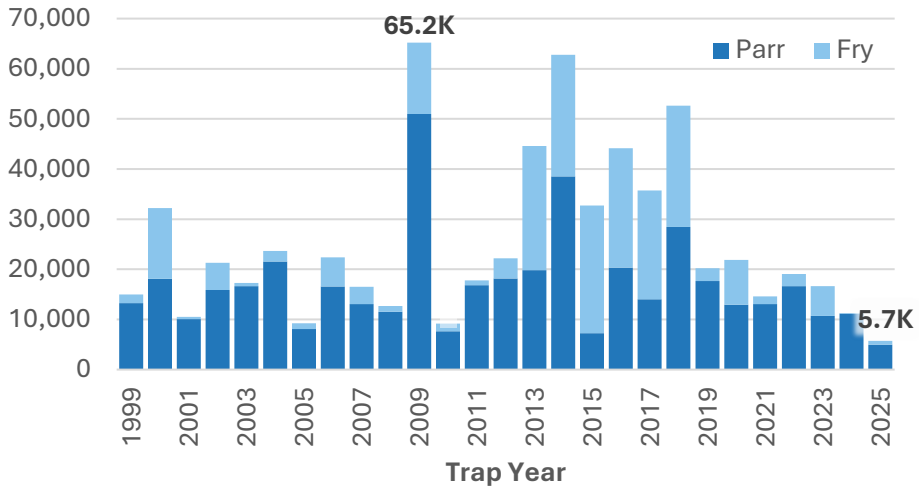
WDFW biologists estimate the abundance of Sammamish River juvenile Chinook through the number of juvenile migrants in Bear Creek. Bear Creek flows into the Sammamish River, which in turn flows into the north end of Lake Washington. Our goal for Bear Creek juvenile migrants and the Sammamish population is to improve Sammamish River habitat conditions to support parr rearing.

Juvenile abundance and diversity

Bear Creek (Sammamish)

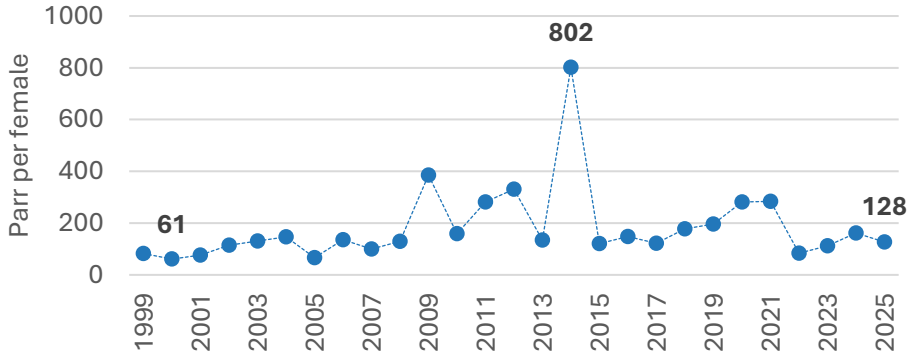
Total Juvenile Abundance

10-year average: 24,188
5-year average: 13,468



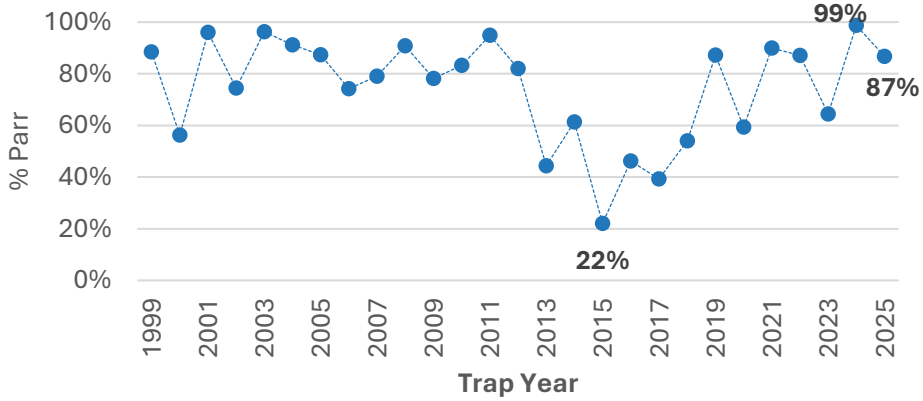
Parr Migrants per Female

10-year average: 170
5-year average: 154



Proportion Parr Migrants

10-year average: 71%
5-year average: 85%



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Returning to Spawn

After three to four years of growth in the ocean, adult Chinook return to the watershed to spawn, primarily in the Cedar River, Bear/Cottage Lake Creek, and Issaquah Creek. Biologists survey priority WRIA 8 streams for salmon redds during the spawning season to estimate the total natural-origin (NOS) and hatchery-origin (HOS) spawners. Abundance goals for adult Chinook were set by the state and tribal co-managers and adopted in the 2005 WRIA 8 Plan.

Number of adult spawners

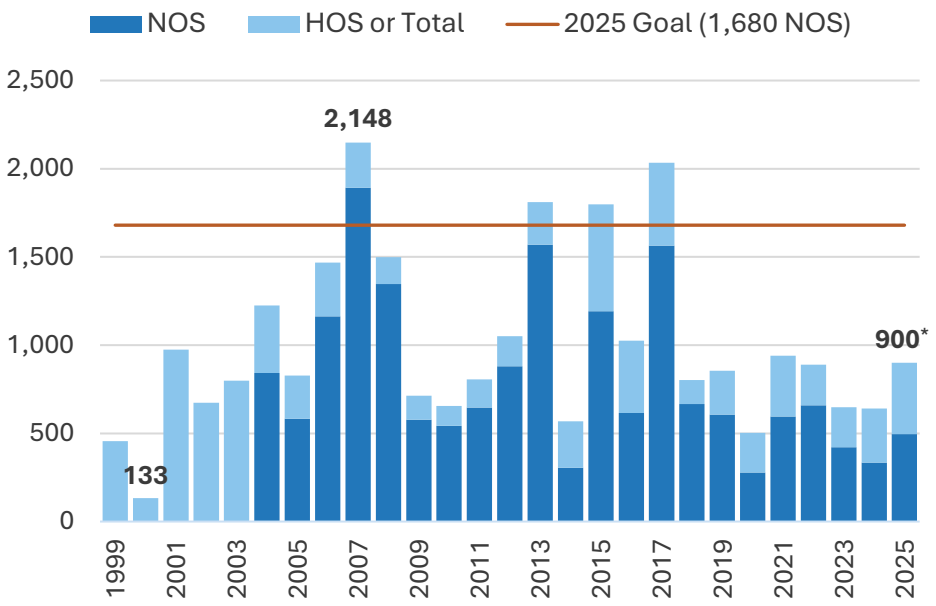
Cedar

Total Abundance

10-year average: 924
5-year average: 804

NOS Abundance

10-year average: 624
5-year average: 501



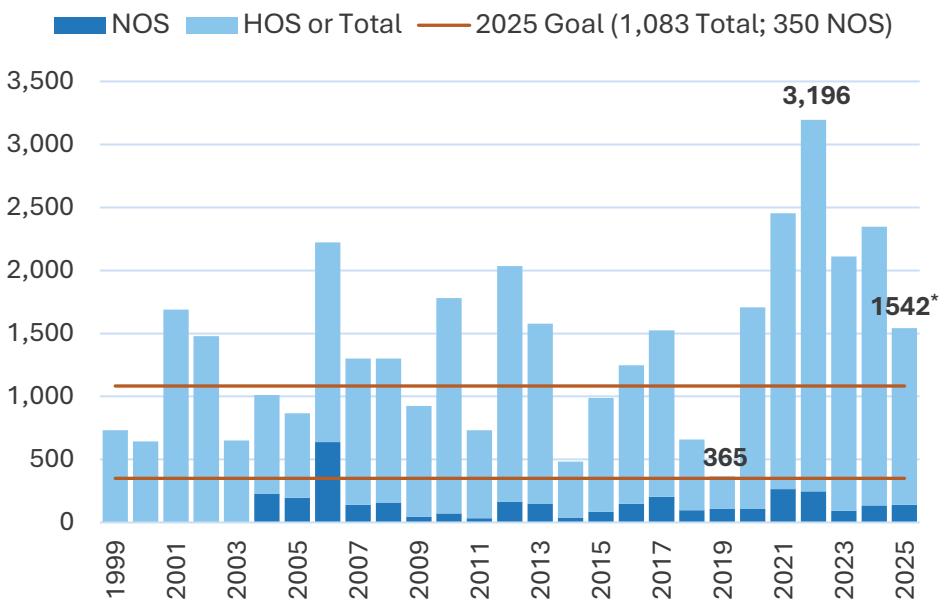
Sammamish

Total Abundance

10-year average: 1,715
5-year average: 2,330

NOS Abundance

10-year average: 154
5-year average: 176



2025 abundance estimates are preliminary and subject to review

Data Source: Annual spawning ground surveys where the Cedar population is represented by fish returning to spawn in the Cedar River and the Sammamish population is represented by fish returning to spawn in Sammamish River tributaries (Bear Creek, Cottage Lake Creek, Little Bear Creek) and lower and East Fork Issaquah Creek. https://data.wa.gov/dataset/WDFW-Salmonid-Population-Indicators-Database-SPI-M/x25s-cxg8/about_data

Returning to Spawn

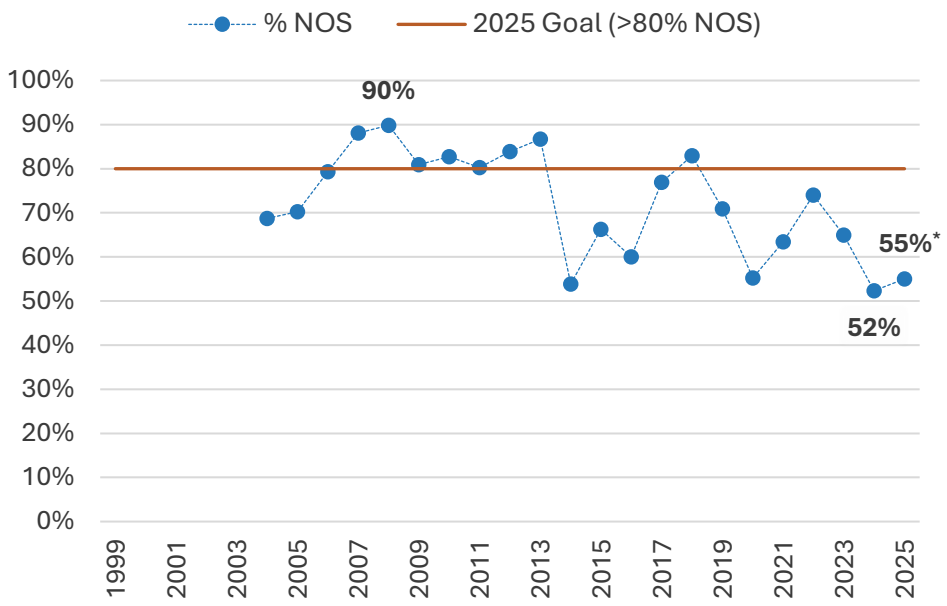
In addition to goals set for Chinook spawner abundance, WRIA 8 tracks the proportion of natural-origin and hatchery-origin fish on the spawning grounds. Our goal for both populations is to maintain or increase the proportion of natural-origin spawners (NOS) relative to the 2006-2015 average (status quo). For the Cedar population, that equates to 80% or more NOS, and 10% or more NOS for the Sammamish population.

Adult spawner origin

Cedar

Proportion Spawner Origin

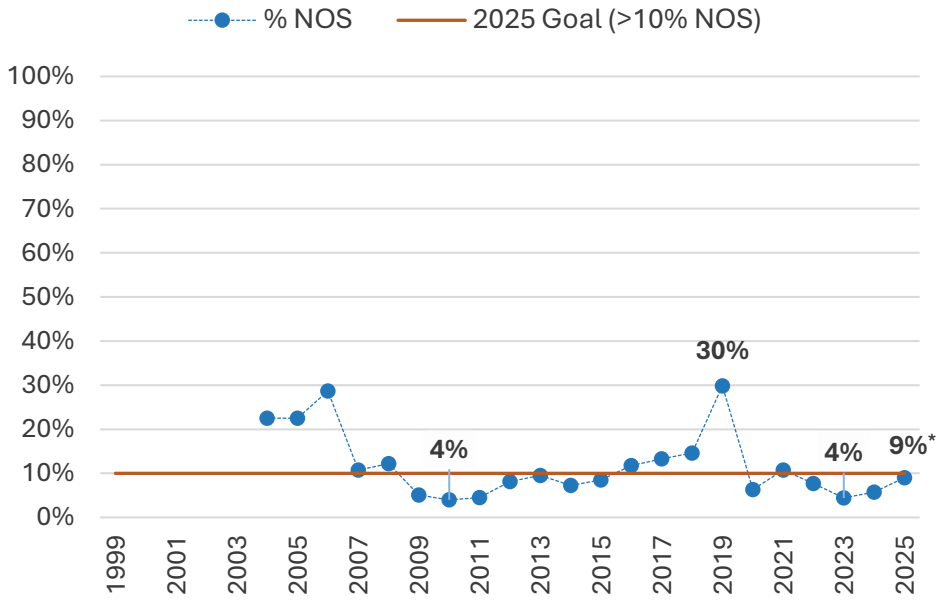
10-year avg: 66% NOS
5-year avg: 62% NOS



Sammamish

Proportion Spawner Origin

10-year avg: 11% NOS
5-year avg: 8% NOS



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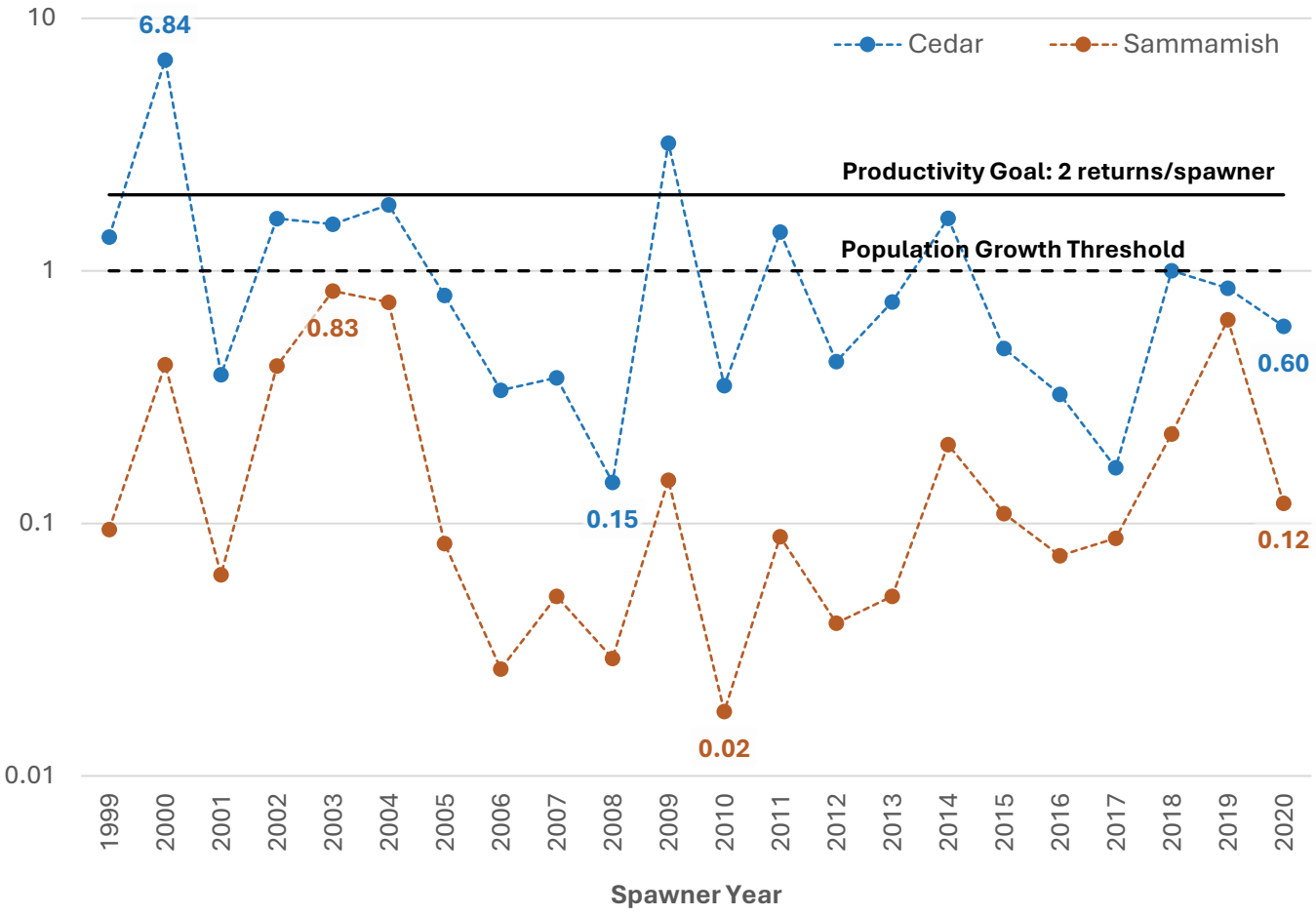
Adult Productivity

The number of salmon returns per spawner is a key indicator of population growth. A population growth rate above one return per spawner indicates a population is increasing in size and a rate below one indicates a population in decline. The 10-year productivity goal for both populations is 2 or more returns per spawner in 2 to 4 years out of 10. An additional goal for the Sammamish population is to increase average productivity to 1 or more returns per spawner.

Returns per spawner



Cedar

Between 2011-2020 the Cedar population did not exceed 2 returns per spawner in any year but did exceed the population growth threshold (≥1) in three of ten years: 2011, 2014, and 2018.

Sammamish

The Sammamish population did not increase productivity to 1 or more returns per spawner in any of the most recent 10 years reported (2011-2020).

Data Source: Co-managers calculate age-specific recruits from each brood (spawner) year for an estimate of the total returns per spawner. Reporting requires 5 years of return data post spawner year. https://data.wa.gov/dataset/WDFW-Salmonid-Population-Indicators-Database-SPI-M/x25s-cxg8/about_data

WRIA 8 Chinook Population Goals Summary

WRIA 8 Chinook salmon population recovery goals were developed for the 2005 Chinook Conservation Plan based on population status at the time and the Viable Salmonid Population (VSP) concept. A "viable" population is one that has a negligible risk of extinction in its native habitat over a 100-year time frame. Unfortunately, we are not seeing enough progress toward most near-term (2025) goals, and we are not on track to meet long-term (2055) population objectives.

- **Abundance** The recent 5-year average of Cedar River natural-origin spawners (NOS) is 501, well below the 2025 recovery goal of 1,680 NOS. Progress toward WRIA 8 goals for the Sammamish population is mixed. Since 2020, total Sammamish River spawners (natural- and hatchery-origin) have consistently exceeded the Sammamish abundance goal of 1,083 adults. The recent 5-year average of total Sammamish spawners is 2,330. However, over 90% of naturally spawning Sammamish Chinook are of hatchery-origin and the population is not meeting its goal of 365 NOS. WRIA 8 has no quantitative goals for juvenile Chinook salmon abundance.

- **Productivity** Juvenile productivity (egg-to-migrant survival) declined over the recent 5-year period in both populations, with neither meeting the 2025 goal on average. While the egg-to-migrant survival rate in Bear Creek (Sammamish population) has declined in recent years, it remains close to the 4.4% target on average. We observed relatively high egg-to-migrant survival during the 2010's and the 2020 WRIA 8 Progress Report noted both populations were meeting their 2025 goals. Unfortunately, average egg-to-migrant survival rates have declined in recent years, and we anticipate impacts on egg survival from the historic December 2025 flooding in the 2026 trap year.

  Adult productivity (returns per spawner) for the Sammamish population is far below the growth threshold needed to sustain a natural population. The Sammamish population has not increased productivity to 1 or more returns per spawner in any year since 1999 (return estimates reported through spawner year 2020). The Cedar population achieved at least 1 return per spawner (population growth threshold) in just 3 of the most recent 10 years reported (2011-2020) and did not reach the goal of 2 or more returns per spawner which is needed in the face of critically low population numbers.

- **Diversity** Progress toward the goal to increase the number and proportion of parr migrants is mixed. In the Cedar, the number of parr migrants per female has been relatively steady over the last 20 years. The proportion of juveniles migrating from the Cedar as parr increased from a low period in the mid-2010s (2% in 2013 and 2014) to the recent 5-year average of 22%. However, the increased proportion may be a result of lower total juvenile abundance in recent years more so than improved instream rearing capacity. In Bear Creek, the recent proportion of parr migrants is relatively high (85% recent 5-year average) and has increased from a low in 2015 (22%). We currently do not have clear criteria for evaluating the goal to improve Sammamish River habitat rearing conditions to support eventual parr rearing and therefore, we do not report a conclusion on whether we are meeting the goal for Sammamish juvenile diversity.

  The WRIA 8 goal for adult diversity is to maintain or increase the proportion of NOS relative to each population's 2006-2015 average. In 2024 and 2025, nearly half of Cedar spawners were hatchery-origin and the recent 5-year average of 62% NOS is far below the 80% goal. The proportion of hatchery-origin spawners is consistently high for the Sammamish population with no evidence of an increasing proportion of NOS.

WRIA 8 Chinook Population Goals Summary

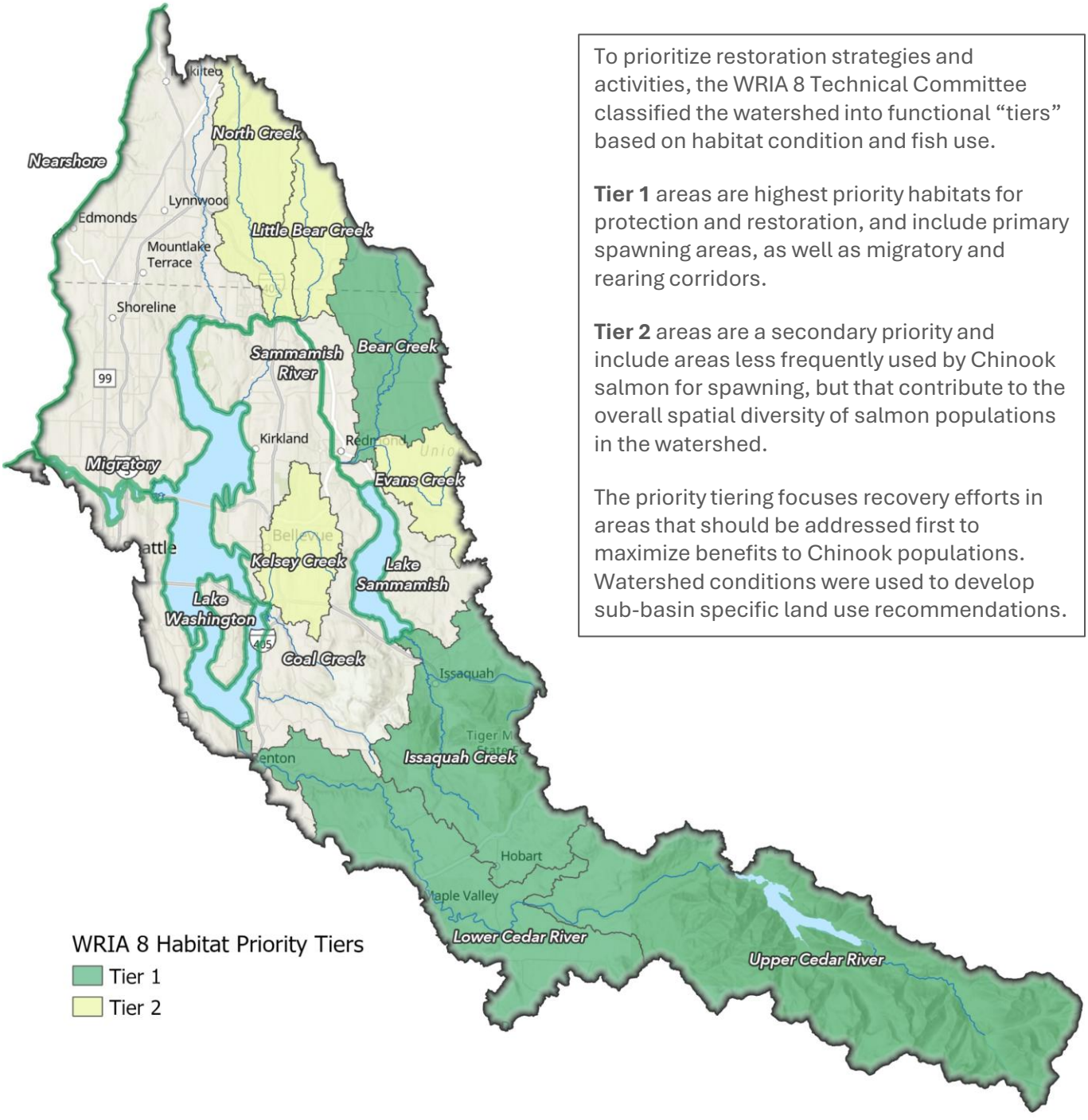
Below is a summary table of Chinook population metrics and progress toward WRIA 8 2025 goals. Goal Status is evaluated relative to the most recent 5-year average, typically 2021-2025 unless noted otherwise. A 'mixed results' conclusion indicates a component of a multi-part goal was met.

	2025 Goal	5-year Average (2021-2025)	Goal Status
Cedar Population			
Adult Abundance Number of adult spawners	1,680 natural-origin spawners (NOS)	501 NOS	
Adult Productivity Returns per spawner	≥2 returns per spawner in 2-4 years out of 10	Below 2 returns each year from 2011-2020; 0.59 5-year average return (brood years 2016-2020)	
Adult Diversity Natural-origin spawners	NOS >80%	NOS 62%	
Juvenile Productivity Egg-to-migrant survival	≥13.8%	8.7%	
Juvenile Diversity Instream rearing	Increase number and proportion of parr migrants	67 parr per female (stable), 22% of total (increase)	
Sammamish Population			
Adult Abundance Number of adult spawners	350 NOS and 1,083 total spawners	176 NOS; 2,330 total spawners	
Adult Productivity Returns per spawner	Average ≥1 and ≥2 returns per spawner 2-4 years out of 10	Below 2 returns each year from 2011-2020; 0.23 5-year average return (brood years 2016-2020)	
Adult Diversity Natural-origin spawners	NOS >10%	NOS 8%	
Juvenile Productivity Egg-to-migrant survival	≥4.4%	4.0%	
Juvenile Diversity Instream rearing	Improve Sammamish River habitat to support parr rearing	154 parr per female (decline), 85% of total (increase)	

Meeting 2025 Goal | Mixed Results | Not Meeting 2025 Goal | Unknown

Habitat Condition and Restoration Progress

The WRIA 8 2017 Plan Update identified a short list of near-term (2025) and long-term (2055) goals that describe the desired future conditions of habitat components needed to conserve and restore the Cedar and Sammamish Chinook salmon populations. Key WRIA 8 habitat components include the Cedar River, Sammamish River, priority streams (tier 1 and 2), South Lake Washington, Lake Sammamish, and Puget Sound nearshore. Unique indicators were identified for each habitat component, focusing on the most important constraints and habitat elements for Chinook conservation and recovery. This progress report describes the condition of these important salmon habitats and our progress toward 2025 goals.



To prioritize restoration strategies and activities, the WRIA 8 Technical Committee classified the watershed into functional "tiers" based on habitat condition and fish use.

Tier 1 areas are highest priority habitats for protection and restoration, and include primary spawning areas, as well as migratory and rearing corridors.

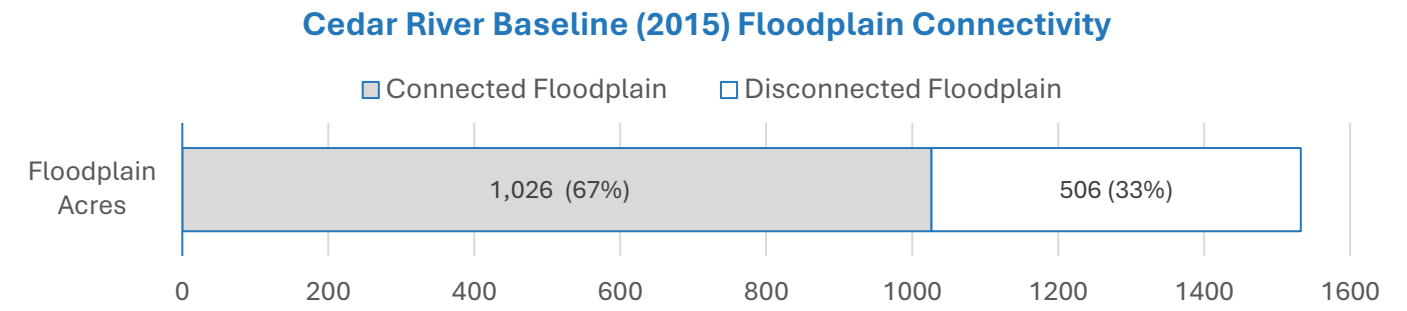
Tier 2 areas are a secondary priority and include areas less frequently used by Chinook salmon for spawning, but that contribute to the overall spatial diversity of salmon populations in the watershed.

The priority tiering focuses recovery efforts in areas that should be addressed first to maximize benefits to Chinook populations. Watershed conditions were used to develop sub-basin specific land use recommendations.

Cedar River: Floodplains

The Cedar River contains the highest priority spawning and rearing areas and supports the largest number of natural-origin Chinook in WRIA 8. Floodplains provide juvenile Chinook rearing and refuge habitat by slowing fast-moving water and creating channel complexity through formation of side channels, backwater channels, and off-channel wetlands. Protecting and restoring floodplain connectivity is a key WRIA 8 salmon recovery strategy. Our goal is to reconnect 130 Cedar River floodplain acres between Lake Washington and Landsburg Diversion Dam by 2025.

Indicator: acres connected floodplain



The Riverbend Restoration Project reconnects 52 acres of floodplain habitat and accomplishes 40% of WRIA 8's goal to reconnect 130 acres of Cedar River floodplain (photo: Seattle Public Utilities).

Cedar River: Floodplains

In the last 10 years WRIA 8 partners reconnected 76.2 acres of Cedar River floodplain across four habitat restoration or mitigation projects. This work accomplishes nearly 60% of the WRIA 8 goal to reconnect 130 floodplain acres by 2025 and improves Chinook salmon habitat by removing failing levees, creating side channels that provide critical slow-water habitat, and planting native trees and shrubs. Two additional Cedar River floodplain projects are in the planning stage.

Indicator: acres connected floodplain

King County research confirms a diversity of restored floodplain habitats promote juvenile Chinook growth and provide distinct, abundant food resources (photo: Josh Kubo).

76.2 Floodplain Acres Reconnected (2015-2025)

1	Riverbend (2022)	52.0 ac
2	Jan Road Levee Setback (2022)	9.0 ac
3	Rainbow Bend Mitigation (2023)	5.9 ac
4	Upper Royal Arch (2023)	9.3 ac

Near-Term Planned Floodplain Projects

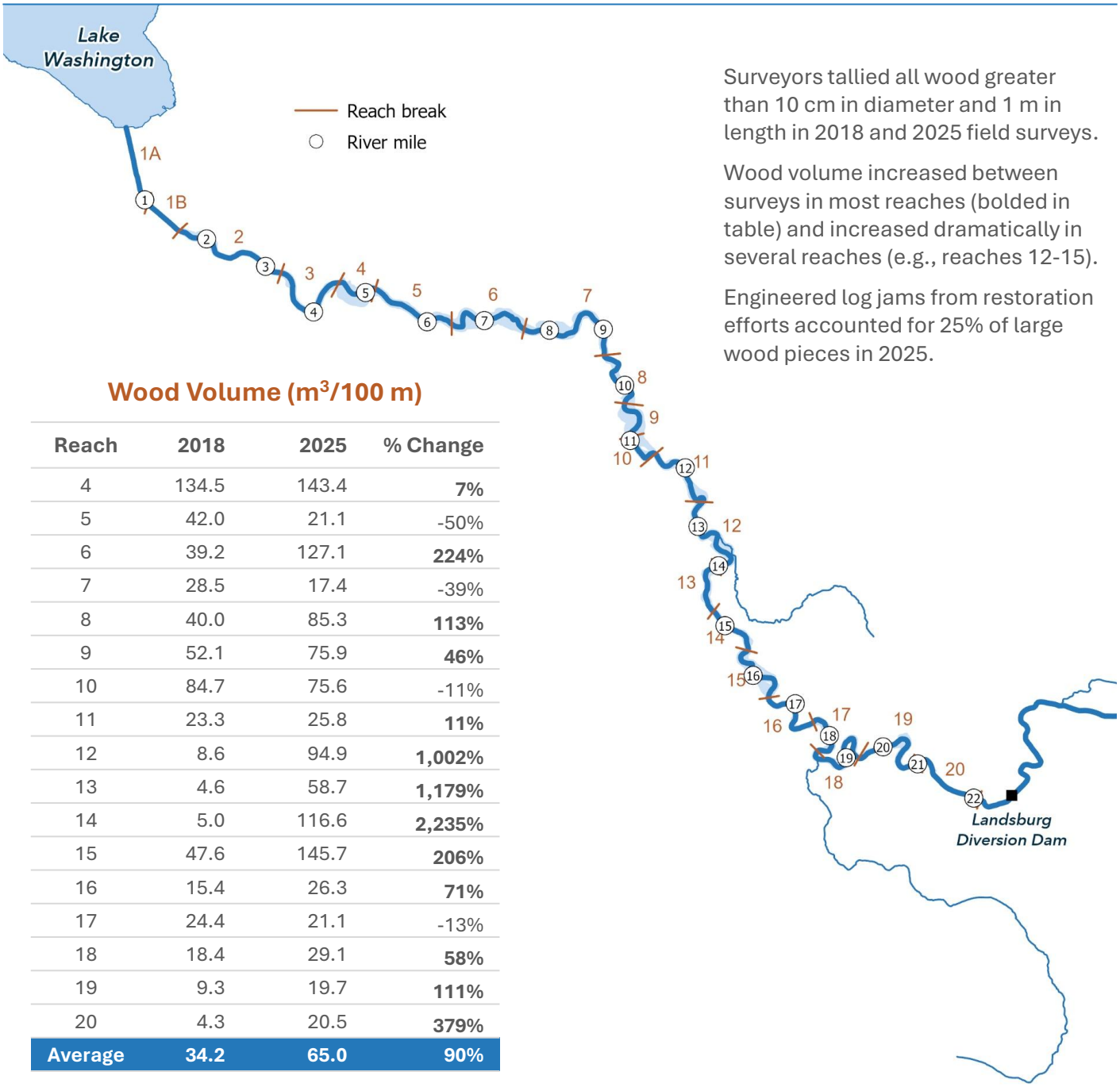
5	Rutledge Johnson	*16 ac*
6	Upper Royal Arch Phase II	*11 ac*

Data Source: Disconnected floodplain includes areas within the unconstrained channel migration zone (CMZ) landward of levees or other flood facilities. Reconnected floodplain acres summarized from Salmon Recovery Portal or project reporting.

Cedar River: Large Wood

Large wood in rivers improves habitat conditions and cover for salmon and can help with formation of new islands and side channels. Wood loads in the Cedar River vary by reach but are on average below regional standards for rivers of similar size (median standard wood volume is 93 m^3/100 m [Fox and Bolton, 2007]). Our goal is to increase average wood volume to at least 42 m^3/100 m from Reach 4 (approximately RM 4) to Reach 20 (Landsburg Diversion Dam) by 2025.

Indicator: average wood volume



Surveyors tallied all wood greater than 10 cm in diameter and 1 m in length in 2018 and 2025 field surveys.

Wood volume increased between surveys in most reaches (bolded in table) and increased dramatically in several reaches (e.g., reaches 12-15).

Engineered log jams from restoration efforts accounted for 25% of large wood pieces in 2025.

Wood Volume (m^3/100 m)

Reach	2018	2025	% Change
4	134.5	143.4	**7%**
5	42.0	21.1	-50%
6	39.2	127.1	**224%**
7	28.5	17.4	-39%
8	40.0	85.3	**113%**
9	52.1	75.9	**46%**
10	84.7	75.6	-11%
11	23.3	25.8	**11%**
12	8.6	94.9	**1,002%**
13	4.6	58.7	**1,179%**
14	5.0	116.6	**2,235%**
15	47.6	145.7	**206%**
16	15.4	26.3	**71%**
17	24.4	21.1	-13%
18	18.4	29.1	**58%**
19	9.3	19.7	**111%**
20	4.3	20.5	**379%**
Average	**34.2**	**65.0**	**90%**

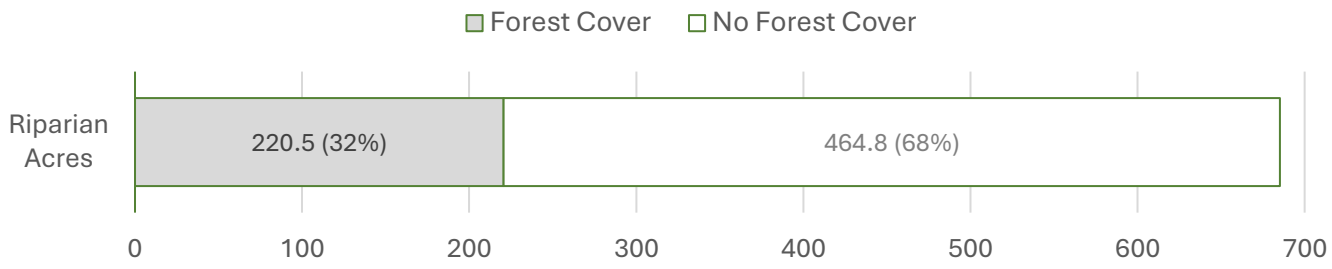
Data Source: Wood volume is estimated from field surveys of wood pieces greater than 10 cm diameter and 1.0 m length within the channel (below the approximate ordinary high-water mark in main-channel and side-channels) following classification approach developed by Montgomery (2008).

Sammamish River: Riparian

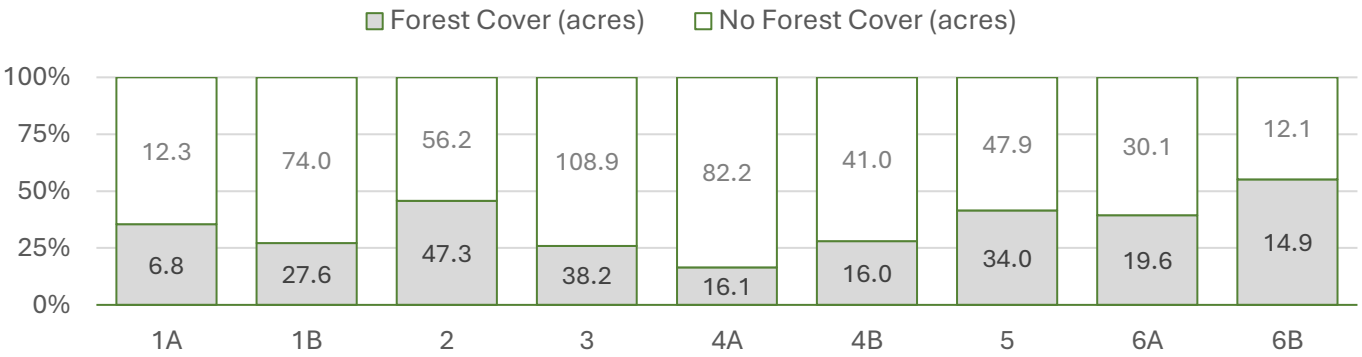
The Sammamish River provides the critical migratory pathway to and from Lake Washington for salmon originating in the Issaquah and Bear/Cottage Lake Creek systems, as well as for Chinook and coho salmon produced at the Issaquah Salmon Hatchery. Riparian trees along the Sammamish River provide important benefits to salmon via food web inputs and water quality protection. Our goal is to increase riparian cover along the Sammamish River by at least 10% (69 acres) over baseline conditions by 2025.

Indicator: acres riparian forest cover

Sammamish River Baseline (2021) Riparian Forest Cover



Baseline (2021) Riparian Forest Cover by River Reach

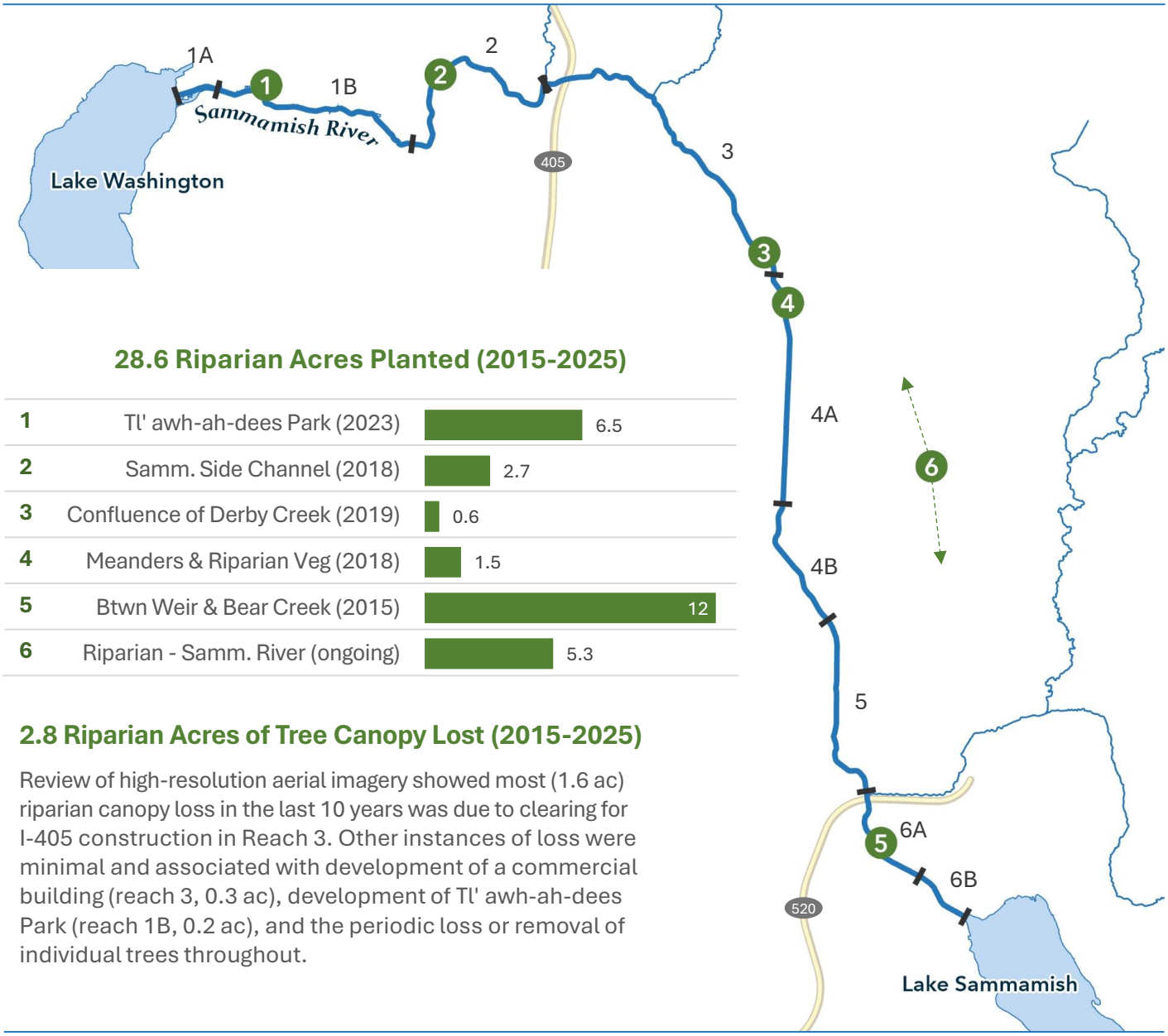


Riparian forest cover varies along the Sammamish River which is on the state's 303(d) impaired waterbodies list due to temperature and dissolved oxygen conditions.

Sammamish River: Riparian

Between 2015 and 2025, project sponsors planted 28.6 acres of riparian forest along the Sammamish River, less than half (41%) the 69-acre goal. WRIA 8 partners report that staff capacity, administrative requirements, and regulatory processes are significant challenges to progress on riparian recovery. While we do report positive change through riparian plantings, the young trees planted will take decades to have the desired effect on ecosystem conditions. For example, shading from trees to improve water temperatures requires many years for trees to grow tall enough to block sunlight and almost a century is needed for riparian forests to begin contributing large wood to streams.

Indicator: acres riparian forest cover



28.6 Riparian Acres Planted (2015-2025)

1	Tl' awh-ah-dees Park (2023)	6.5
2	Samm. Side Channel (2018)	2.7
3	Confluence of Derby Creek (2019)	0.6
4	Meanders & Riparian Veg (2018)	1.5
5	Btwn Weir & Bear Creek (2015)	12
6	Riparian - Samm. River (ongoing)	5.3

2.8 Riparian Acres of Tree Canopy Lost (2015-2025)

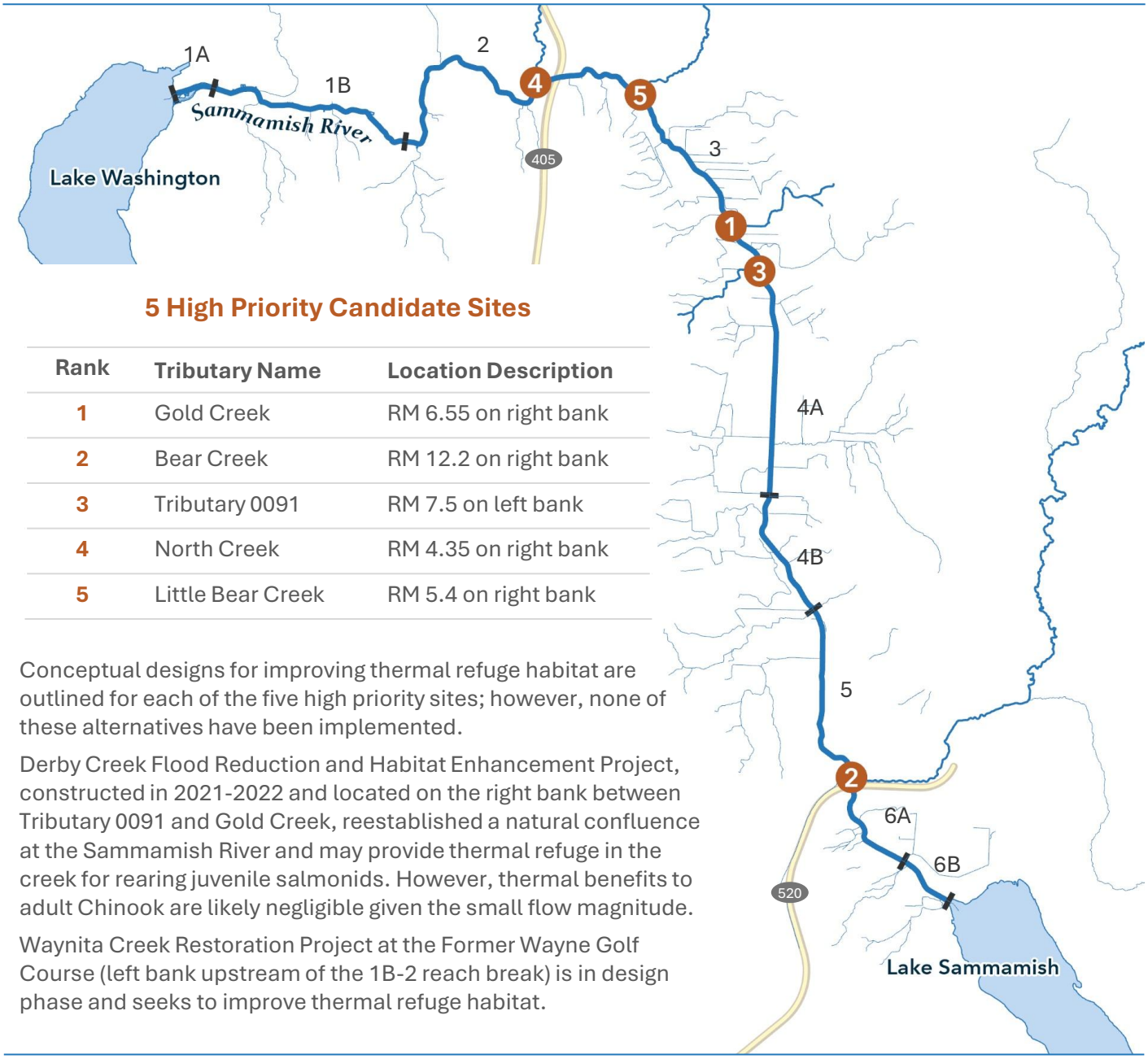
Review of high-resolution aerial imagery showed most (1.6 ac) riparian canopy loss in the last 10 years was due to clearing for I-405 construction in Reach 3. Other instances of loss were minimal and associated with development of a commercial building (reach 3, 0.3 ac), development of Tl' awh-ah-dees Park (reach 1B, 0.2 ac), and the periodic loss or removal of individual trees throughout.

Data Source: Baseline forest cover based on 2021 King County Tree Canopy features summarized within 200-foot buffer of Sammamish River channel edge delineated from the King County Open Water layer. Riparian Acres Planted summarized from Salmon Recovery Portal. Areas of tree loss identified and delineated within the riparian buffer from the WDFW High-Resolution Change Detection dataset and visual inspection of high-resolution aerial imagery over time (Nearmap imagery through April 2025).

Sammamish River: Thermal Refugia

High water temperature, a water quality issue that is linked to and can exacerbate many other pressures, is a long-standing concern in the Sammamish River. Cold-water refugia provide local-scale areas where salmon may find protection or relief from unfavorable temperatures. The Muckleshoot Indian Tribe commissioned a 2010 study[1] to assess summer temperatures and opportunities to provide thermal refuge in the river. The study identified five highest priority tributary confluence sites for thermal refuge restoration based on factors influencing feasibility and potential benefits. Our 2025 goal is to create two thermal refugia to benefit adult migrant Chinook salmon.

Indicator: number of thermal refugia



5 High Priority Candidate Sites

Rank	Tributary Name	Location Description
1	Gold Creek	RM 6.55 on right bank
2	Bear Creek	RM 12.2 on right bank
3	Tributary 0091	RM 7.5 on left bank
4	North Creek	RM 4.35 on right bank
5	Little Bear Creek	RM 5.4 on right bank

Conceptual designs for improving thermal refuge habitat are outlined for each of the five high priority sites; however, none of these alternatives have been implemented.

Derby Creek Flood Reduction and Habitat Enhancement Project, constructed in 2021-2022 and located on the right bank between Tributary 0091 and Gold Creek, reestablished a natural confluence at the Sammamish River and may provide thermal refuge in the creek for rearing juvenile salmonids. However, thermal benefits to adult Chinook are likely negligible given the small flow magnitude.

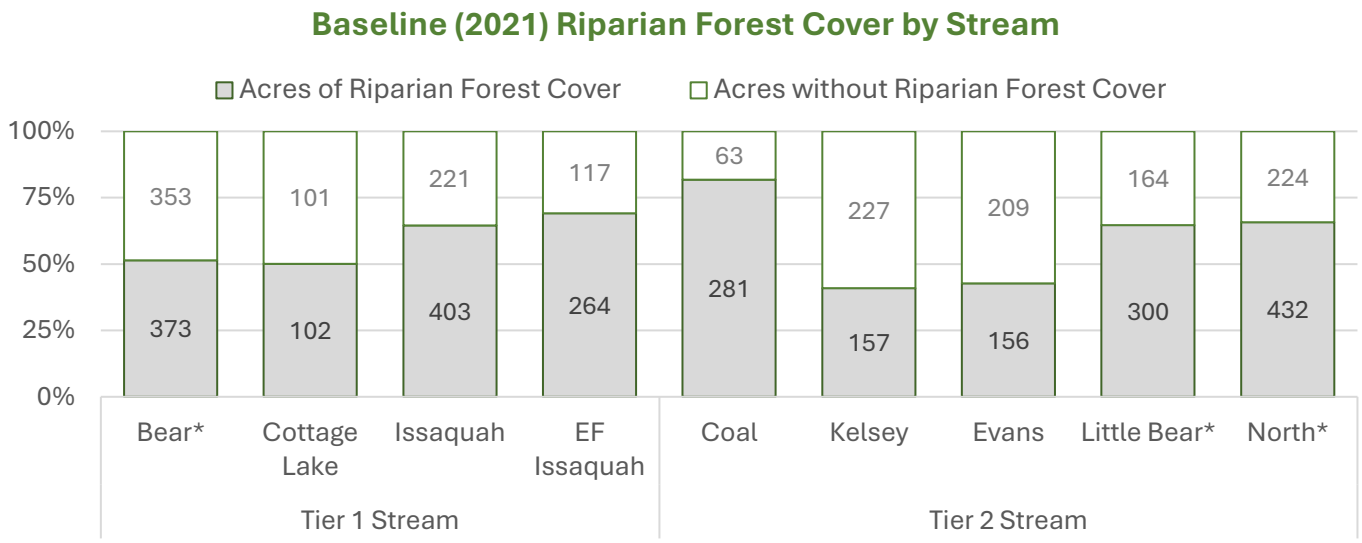
Waynita Creek Restoration Project at the Former Wayne Golf Course (left bank upstream of the 1B-2 reach break) is in design phase and seeks to improve thermal refuge habitat.

[1]Assessment of Summer Temperatures and Feasibility and Design of Improved Adult Chinook Salmon Thermal Refuge Habitat in the Sammamish River. Prepared for Muckleshoot Indian Tribe. Prepared by R2 Resource Consultants. December 30, 2010.

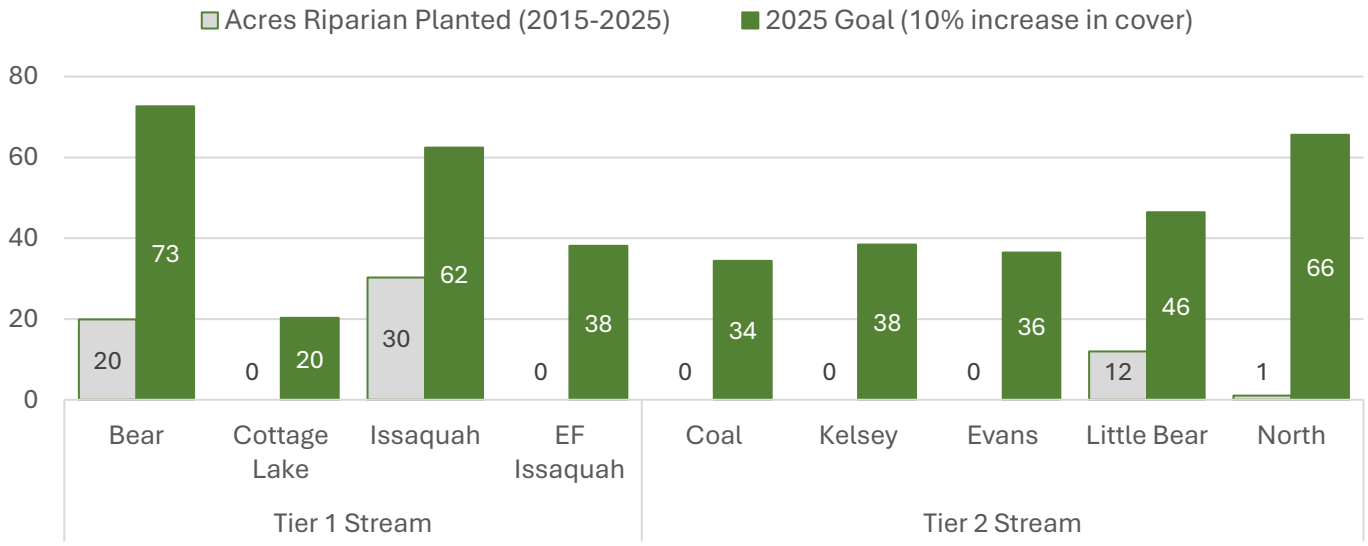
Priority Streams: Riparian

Priority streams in the watershed for Chinook habitat protection and restoration are divided into highest priority streams (Tier 1, primary spawning areas), and second priority streams (Tier 2, used less frequently for spawning). Protecting and restoring riparian trees is a key recovery strategy throughout the watershed. This strategy mitigates some of the impacts of land conversion and urbanization, shoreline armoring, invasive plant infestations, polluted stormwater runoff and increased water temperature from climate change. Our goal is to increase riparian cover by 10% over baseline conditions in each Tier 1 and Tier 2 stream by 2025.

Indicator: acres riparian forest cover



** Includes areas within Snohomish County*

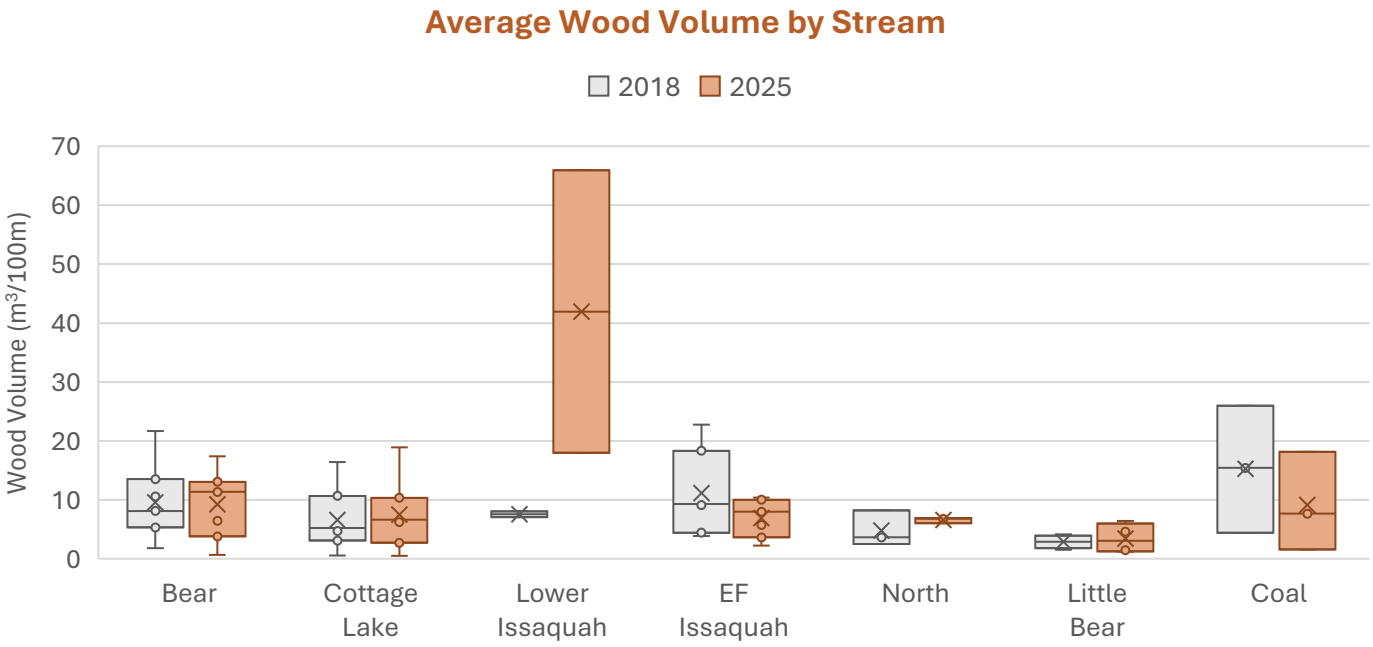


Data Source: Baseline forest cover based on 2021 King County Tree Canopy (within King County) and 2021 NOAA C-CAP High Resolution Canopy (within Snohomish County) features summarized within 200-foot buffers of King County Stream Type centerline. Riparian Acres Planted summarized from Salmon Recovery Portal.

Priority Streams: Large Wood

Complex stream channels offer a range of habitats necessary for Chinook salmon spawning, rearing, and survival. Large wood in streams improves natural processes for maintaining or creating the complex habitat (such as pools, side channels, and cover) that salmon require. Wood loads in WRIA 8 streams are well below regional standards for streams of similar size (median standard wood volume is 51 m^3/100 m [Fox and Bolton, 2007]). Adding large wood can improve natural processes for maintaining or creating the complex habitat that salmon require. Our goal is to double the average wood volume in priority streams over baseline conditions by 2025.

Indicator: average wood volume



	Average # Pieces (count per 100 m)		Average Volume (m^3/100 m)	
Stream	**2018**	**2025**	**2018**	**2025**
Bear	19.2	24.5	**9.6**	9.2
Cottage Lake	14.2	12.3	6.6	**7.5**
Lower Issaquah	10.4	33.5	7.6	**42.0**
EF Issaquah	14.8	17.0	**11.2**	6.9
North	11.5	10.9	4.8	**6.6**
Little Bear	11.2	11.0	2.9	**3.4**
Coal	18.0	22.4	**15.3**	9.1

Surveyors tallied all wood greater than 10 cm in diameter and 2 m in length in 2018 and 2025 stream surveys. Wood volume varied within and across WRIA 8 streams.

Between 2018 and 2025, average wood volume by reach increased in 4 of 7 streams surveyed (bolded in table).

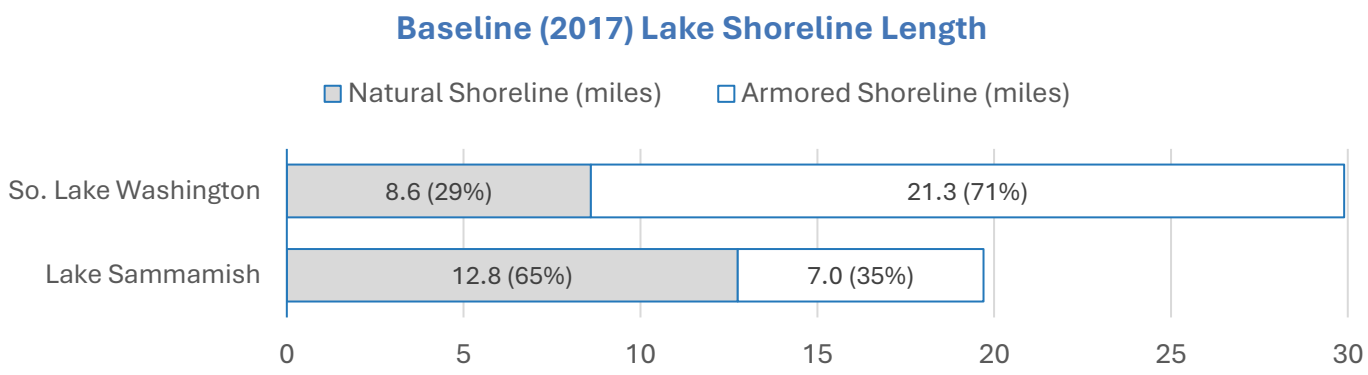
Restoration efforts in Lower Issaquah Creek (from mouth to hatchery) dramatically increased wood volume, meeting the 2025 goal.

Data Source: Wood volume is estimated from field surveys of within-channel large wood pieces following WA Ecology Status and Trends Monitoring for Watershed Health & Salmon Recovery Field Data Collection Protocol, Appendix O.

Lakes: Natural Shoreline

Shoreline habitats in Lake Washington and Lake Sammamish are important for outmigrating and lake-rearing juvenile Chinook salmon. Juvenile salmon fry use shallow nearshore areas to escape lake predators and to feed. Armoring, like bulkheads and riprap, alter this important shallow-water zone by disrupting the gradual, natural slope of the shoreline and sediment dynamics. Restoring shallow-water rearing and refuge habitat is a key WRIA 8 salmon recovery strategy. Our goal is to double natural lake shoreline south of I-90 in Lake Washington (8.6 miles) and maintain or increase natural lake shoreline throughout Lake Sammamish by 2025.

Indicator: length of natural bank profile



Dock Counts

1,169 docks in So. Lake Washington
39.1 docks per shoreline mile

977 docks in Lake Sammamish
49.6 docks per shoreline mile

Docks include recreational docks associated with single-family residences, small marinas, public piers or parks, and large marina docks associated with multifamily or commercial structures.

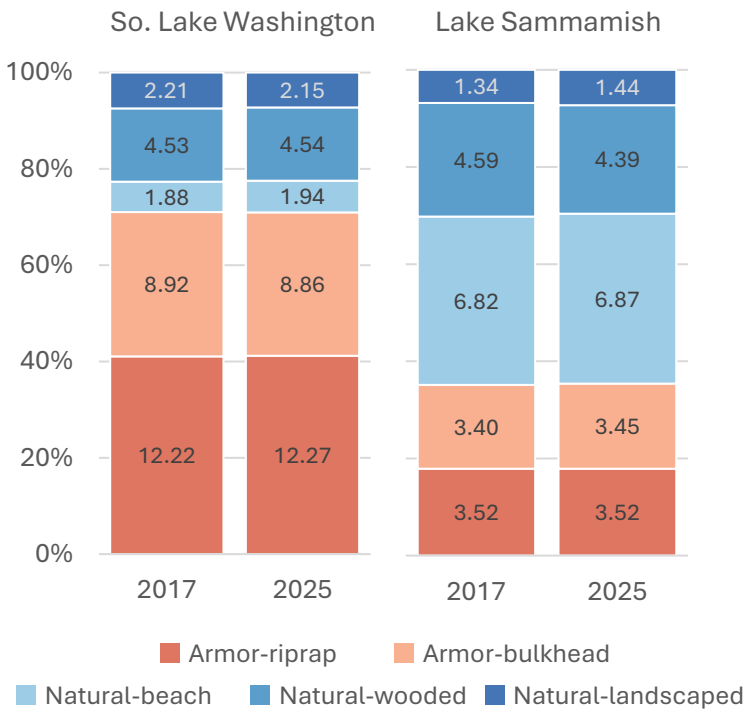
Data Source: Shoreline condition classified into categories of armor (riprap, bulkhead, boat ramp) and natural (unvegetated beach, wooded or naturally vegetated, landscaped) using high resolution aerial imagery and oblique photos (Nearmap imagery). Dock count and density summarized from King County Landcover Land Classification (2023).

Lakes: Natural Shoreline

Both Lake Washington and Lake Sammamish saw positive and negative changes in natural shoreline length between the 2017 baseline and 2025. However, changes were minimal overall and fell short of the ambitious goal to restore 8.6 miles of natural shoreline in South Lake Washington and to maintain or increase natural shoreline throughout Lake Sammamish.

Indicator: length of natural bank profile

Shoreline Length (miles) by Category



In South Lake Washington, approximately 510 ft of shoreline improved from armored to natural and approximately 320 ft of new armor was installed on previously unretained shoreline for a net change of 190 ft (0.04 mi) improved natural shoreline.

In Lake Sammamish, approximately 380 ft of shoreline improved from armored to natural and approximately 670 ft of new shoreline armor was installed for a net change of 290 ft (0.06 mi) natural shoreline lost.

Review of high-resolution aerial imagery showed new armor was installed on private property, often associated with house construction or landscape redesign. The average new armor length was 65 ft in Lake Washington and 75 ft in Lake Sammamish.

Shoreline Restoration

The Be'er Sheva Park Shoreline Restoration project (right) in South Lake Washington removed riprap to restore the natural bank profile and installed in-water features to build nearshore habitat complexity. Following construction, Seattle Parks Foundation is monitoring juvenile salmon habitat use and plant survival at the site.

Be'er Sheva Park Shoreline Restoration construction, December 2024.

Puget Sound Nearshore: Pocket Estuaries

Along the Puget Sound nearshore, stream mouths and pocket estuaries provide important rearing habitat, and recent research suggests these areas are important to the overall life history of Puget Sound salmon. Much of the approximately 24 miles of WRIA 8 nearshore is disconnected by armor along the BNSF railway. Juvenile salmon need viable nearshore rearing and refuge locations wherever possible, and our goal is to reconnect 2 stream mouth pocket estuaries by 2025.

Indicator: number of stream mouths reconnected

1 pocket estuary restored: Meadowdale Beach & Estuary Restoration Project

In 2023 Snohomish County completed restoration of the Lunds Gulch Creek estuary in Edmonds, replacing a 6-ft culvert under the BNSF railroad with a bridge spanning 90 feet to reestablish a 1.4-acre estuary. Meadowdale is the first Puget Sound coastal stream mouth restoration project along the railroad corridor and serves as a successful example for future coastal stream and pocket estuary restoration.

The restored estuary and new railroad crossing at Meadowdale Beach (photo: Snohomish County).

1 project in planning and design phase: Big Gulch Stream Restoration

The Tulalip Tribes is assessing feasibility, alternatives, and design for restoring intertidal processes at the Big Gulch stream mouth in Mukilteo. The stream is currently routed through a culvert under the BNSF railroad, and the project is working with partners to determine suitable alternatives for salmon and the railroad.

Data Source: Salmon Recovery Portal. Meadowdale Restoration details: https://srp.rco.wa.gov/project/240/4764; Big Gulch Restoration details: https://srp.rco.wa.gov/project/240/90476

WRIA 8 Chinook Habitat Goals Summary

The WRIA 8 partnership actively works to protect and restore habitat and improve watershed health. Thanks to this work, we report progress under most habitat components despite falling short of our 2025 goals. The habitat goals set in WRIA 8's 2017 Plan were ambitious but deemed feasible within the framework of current conditions. More work is needed to achieve our vision for desired future conditions. However, we also acknowledge the constraints on habitat restoration in an urbanized watershed where the human population increased 34% from 2000 to 2020, from 1.3 million to 1.7 million. Moving forward, the WRIA 8 Technical Committee will consider new near-term, measurable, and relevant goals that describe the improvements needed in key habitats.

	2025 Goal	Progress	Status
Cedar River			
Total Connected Floodplain	Reconnect 130 floodplain acres	**Increase:** 76.2 floodplain acres reconnected	
Average Wood Volume	Increase average reach wood volume to 42 m^3/100m	**Increase:** Average wood volume increased from 34.2 to 65.0	
Sammamish River			
Riparian Tree Cover	10% increase over baseline conditions (add 68.7 acres)	**Increase:** 28.6 riparian acres planted	
Create Thermal Refugia	Add two thermal refugia	**No Change:** No adult Chinook refugia added	
Priority Streams			
Riparian Tree Cover	10% increase over baseline condition in each stream	**Increase:** Riparian acres planted in Bear, Issaquah, Little Bear, North	
Average Wood Volume	Double wood volume over baseline condition in each stream	**Mixed:** Doubled in lower Issaquah; increased in 4 of 7 streams	
Lake Washington and Lake Sammamish			
Natural Lake Shoreline	Double unretained shoreline in South Lake Washington (8.6 mi)	**Increase:** Net improvement of 0.04 shoreline miles	
	Maintain or increase unretained shoreline in Lake Sammamish	**Decrease:** Net change of 290 ft (0.06 mi) natural shoreline lost	
Puget Sound Nearshore			
Pocket Estuaries	Reconnect two pocket estuaries	**Increase:** 1 estuary restored and 1 estuary in design phase	

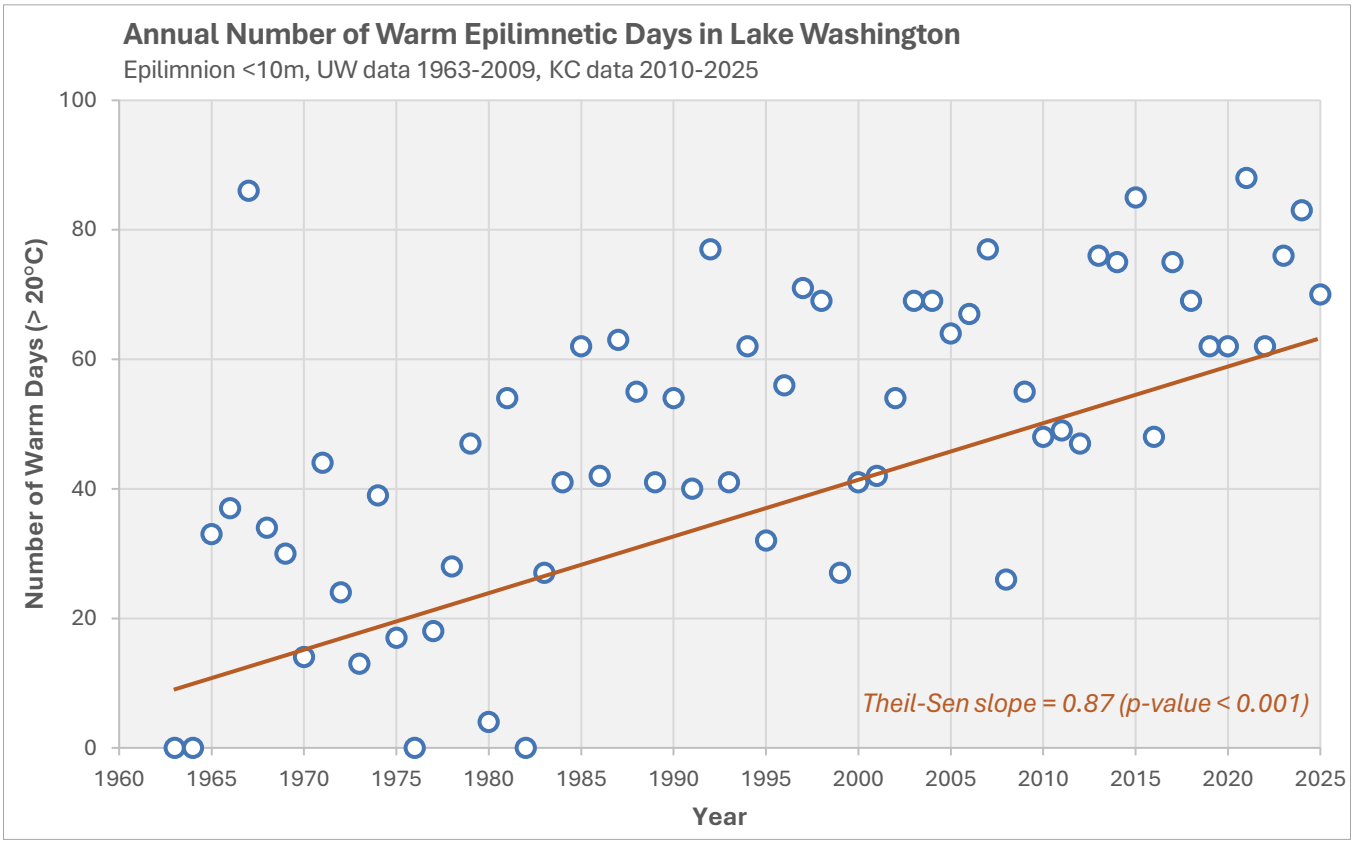
Meeting 2025 Goal Mixed Results Not Meeting 2025 Goal

Survival Bottlenecks: What We've Learned

While we need to increase the pace of habitat restoration, we are also working with partners to address critical Chinook survival bottlenecks. In many cases, traditional habitat restoration can not resolve the significant climate and urban impacts salmon face in WRIA 8. For these problems, we must strengthen local and regional partnerships and pursue innovative and emerging strategies.

High Water Temperature in the Lake Washington Ship Canal

- High water temperatures have been a problem in the Ship Canal for more than two decades, and the problem is only getting worse with Lake Washington experiencing an increasing number of days exceeding 20°C. The Ship Canal is shallow (mean depth 9-11 m) and therefore drains just the warm surface water from Lake Washington.
- Each summer, Chinook, sockeye, and coho migrate through the Ship Canal but only a fraction of salmon reach their spawning grounds or hatchery.
- High water temperature around the Locks and in the Ship Canal blocks or delays passage, reduces growth and increases susceptibility to predators, parasites and infectious diseases, and sometimes results in direct mortality.
- Long Live the Kings and WRIA 8 are working to lower water temperatures and reduce abrupt transitions in water quality between Puget Sound and the Ship Canal.
- Learn more about temperature conditions and solutions

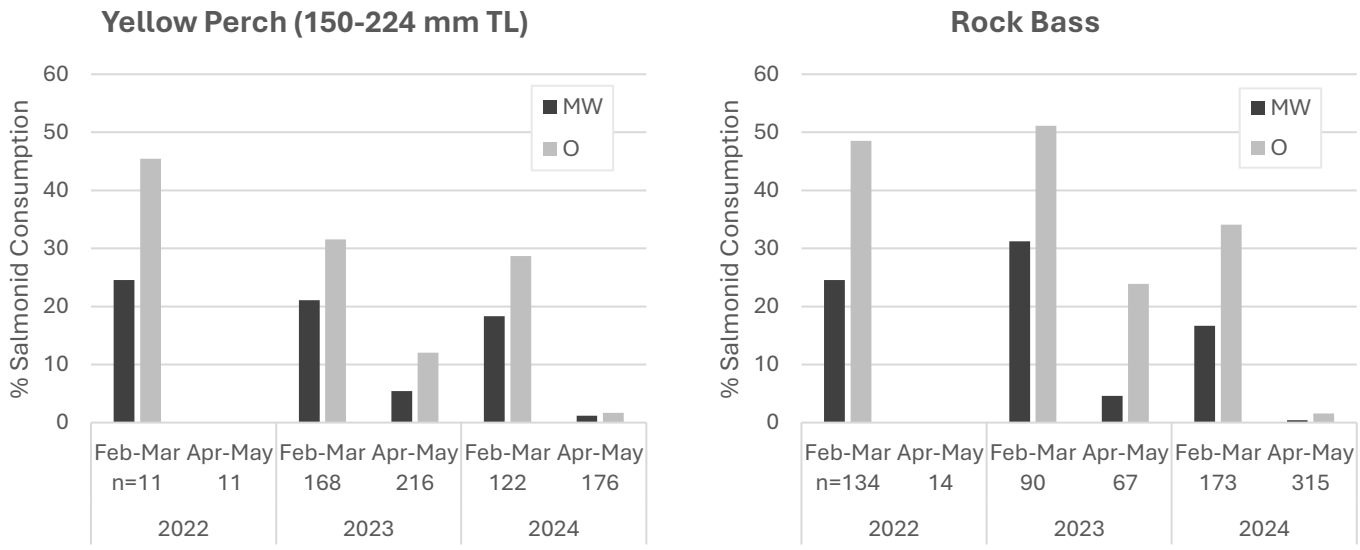


Number of days, by year, when the mean surface (epilimnetic, <10 m) temperature exceeded 20°C in Lake Washington. Surface temperatures in the lake are increasing over time and staying warmer longer. Data provided by R. Gravon, King County Department of Natural Resources and Parks. Adapted from Goetz and Quinn (2019).

Survival Bottlenecks: What We've Learned

Fish Predation in the Lake Washington Basin

- Abundant non-native fish, such as yellow perch, smallmouth bass and rock bass, consume juvenile Chinook in Lake Washington, Lake Sammamish, and the Ship Canal, and are capable of substantial impacts to threatened Chinook populations and other salmonids.
- Predation of juvenile Chinook is greatest at key sites along the migratory corridor (such as the mouth of major rivers and along peninsulas or points) when migrating salmon fry are abundant. South Lake Washington, near the mouth of the Cedar River, is an area of increasingly concentrated predatory fish that represents a deadly bottleneck for Chinook and sockeye salmon fry entering the lake.
- **Artificial light at night** (ALAN) attracts juvenile salmon, slowing or stopping migration and making them more visible and vulnerable to predators later into the night. The Salmon Friendly Lakes program shares resources to educate residents and municipalities about actions they can take to reduce ALAN like using shields to direct light only where necessary and implementing clear standards for outdoor lighting.
- Dense beds of **invasive aquatic weeds** along the shorelines of Lakes Sammamish and Washington degrade critical salmon habitat and provide spawning, rearing, and refuge habitat for non-native predators. Trout Unlimited, in partnership with King County, is testing aquatic weed control methods in Lake Sammamish and its effects on fish assemblages.
- A comprehensive and long-term strategy is needed to reduce predation pressure. Recommended management actions include strategically removing/suppressing non-native predator populations, restoring shallow-water habitat for lake-rearing juvenile salmon, reducing factors that lead to higher predation efficiency, and addressing issues of water quality and temperature.
- Learn more about predation impacts and reducing light pollution



Salmonid consumption rates by yellow perch (150-224 mm total length (TL); left) and rock bass (right) sampled in South Lake Washington in 2022-2024 during the fry migration period. Charts show the mean percent by weight (MW) of salmonids in the predators' diet and the frequency of occurrence (O) or the percent of fish that consumed salmon. Number below the sample month is the count of stomach samples analyzed (not including empty stomachs). Data provided by R. Tabor, US Fish and Wildlife Service.

Survival Bottlenecks: What We've Learned

Disease

- The Lake Washington Ship Canal (LWSC) is an infection hot spot for the parasite *Ceratonova shasta*, the cause of a lethal disease in juvenile and adult Chinook salmon.
- Climate change and anthropogenic stressors exacerbate impacts to salmon health and survival from infectious diseases.
- The USGS Western Fisheries Research Center is studying infection rates in the LWSC and developing a standardized protocol for monitoring parasites using eDNA. Monitoring parasite abundance will provide timely information on disease risks as Chinook salmon migrate through the watershed.

Pinniped Predation at the Ballard Locks

- The Ballard Locks is a regional hot spot for pinniped (harbor seals and California sea lions) predation on Chinook, sockeye, and coho salmon. Sea lion predation at the Ballard Locks was identified as a key factor in the functional extirpation of the Lake Washington steelhead population.
- Pinnipeds are at historical population levels in Puget Sound and regularly utilize the bottleneck to salmon migration at the Ballard Locks to successfully forage on adult and juvenile salmon.
- The Muckleshoot Indian Tribe and WDFW use underwater firecrackers and boat-based harassment opportunistically to keep seals out of the fish ladder and minimize predation in the spillway area. These techniques are only effective in the short term while actively enforced. Structural and operational upgrades are needed to mitigate pinniped predation and improve salmon migration at the Ballard Locks.
- Learn more about pinniped management

Chinook in the Ballard Locks fish ladder.

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