A 10-year review of Spring Chinook and Sockeye Salmon restoration initiatives within Washington's Skokomish Watershed

Jenise Bauman, Andy Ollenburg, and Matt Bleich

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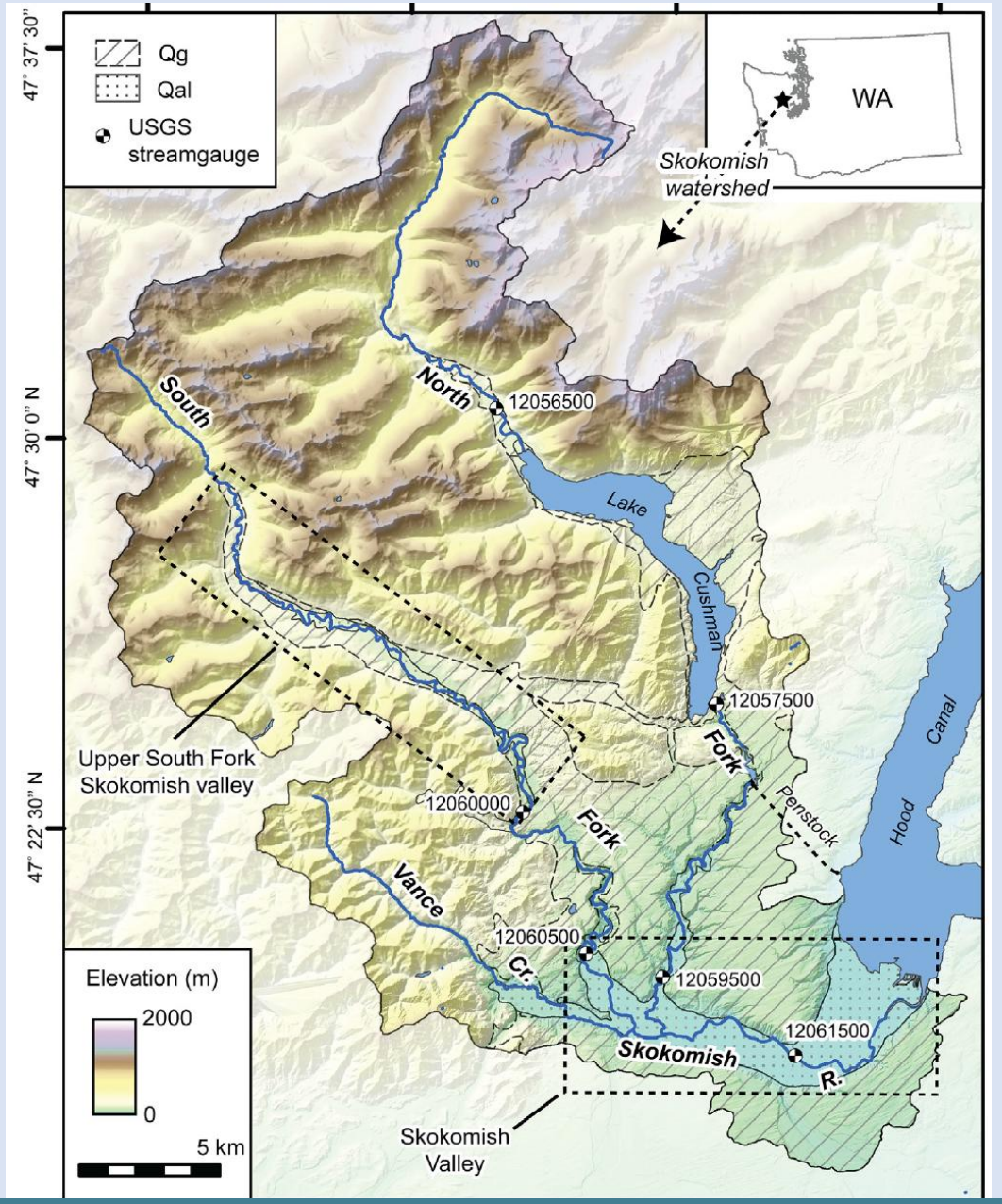
Watershed history:

The Skokomish River drains 622 km2 of the southeast, forested Olympic Mountains into Hood Canal

South Fork: glaciated valley, steep valley slopes, broad valley bottom – significant sediment source

North Fork: historic, natural lake harbored native Sockeye Salmon and acted as sediment sink



History of the Cushman Dams:

North Fork:

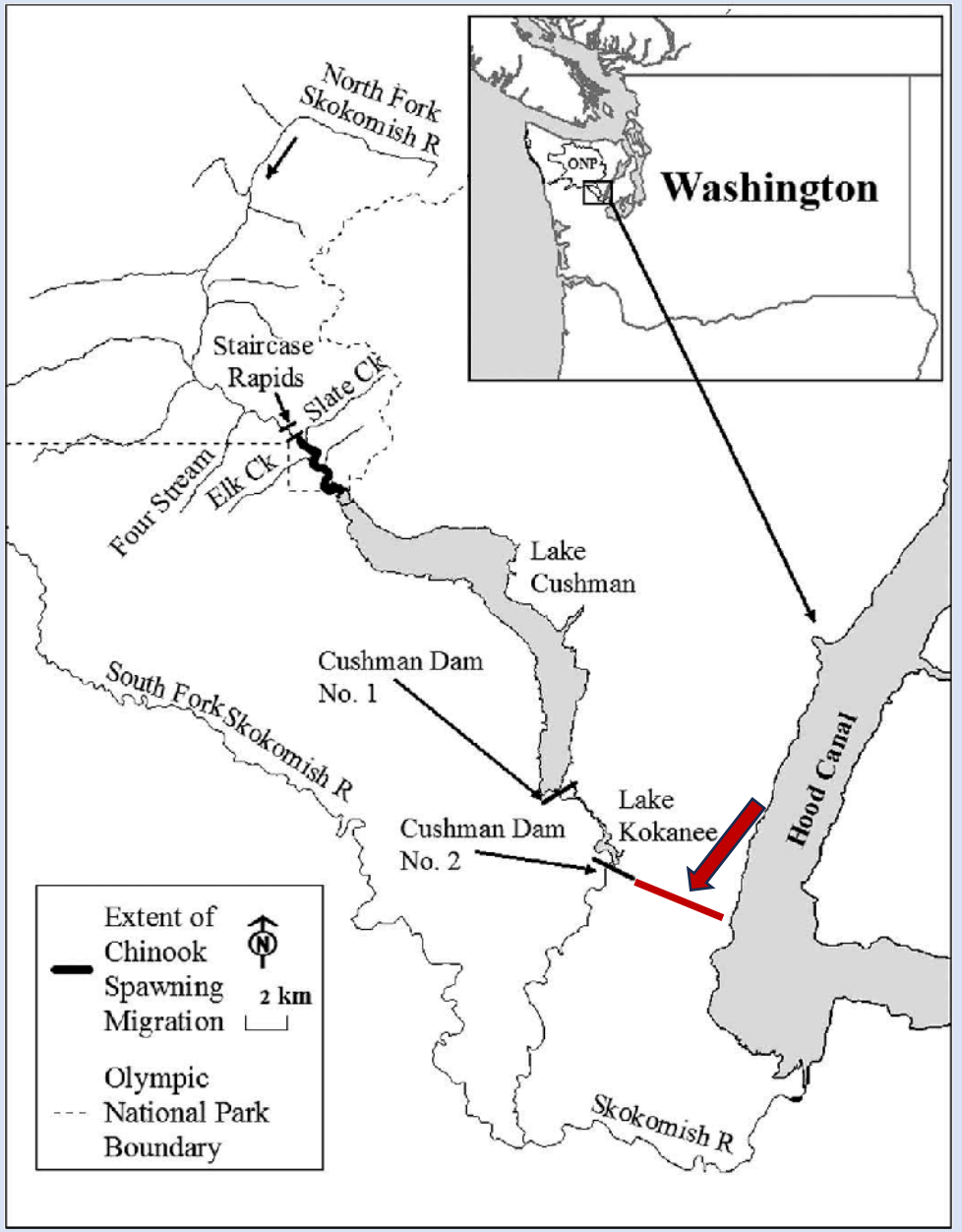
Cushman Dam 1: operational in 1926 – expanded Lake Cushman

Cushman Dam 2: operational in 1930 – created Lake Kokanee and transfers water out of the Skokomish basin to the powerhouse.

Prior to 1988, flow in the North Fork immediately downstream of the Cushman Project was limited to seepage or spill during floods or project maintenance.

Cushman Dams No. 1 and 2:

The **North Fork** has been impounded and water diverted out of basin via penstocks. Flows were substantially reduced resulting in the expiration of salmonid populations.



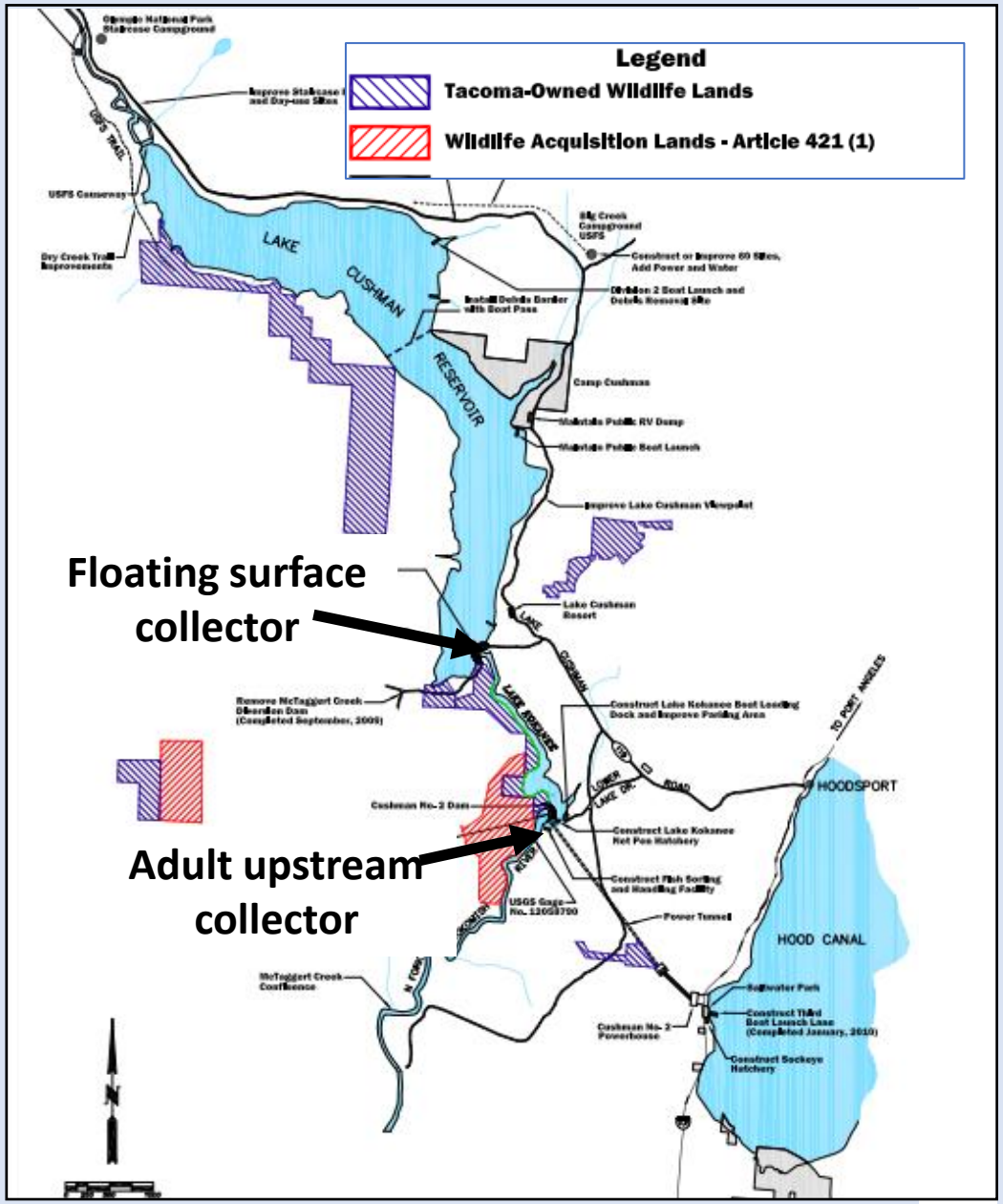
Settlement Agreements: 2010

North Fork Skokomish River (NFSR):

- Instream flows and flood reduction
- Fish Habitat
- Fish Passage
- Fish Populations - hatcheries operational 2015
- Wildlife habitat
- Recreation

Co-manage with:

- Skokomish Indian Tribe
- Washington Department of Fish and Wildlife



Restoring Instream Flows:

Biological Fact Check - Water Year Flow Plan

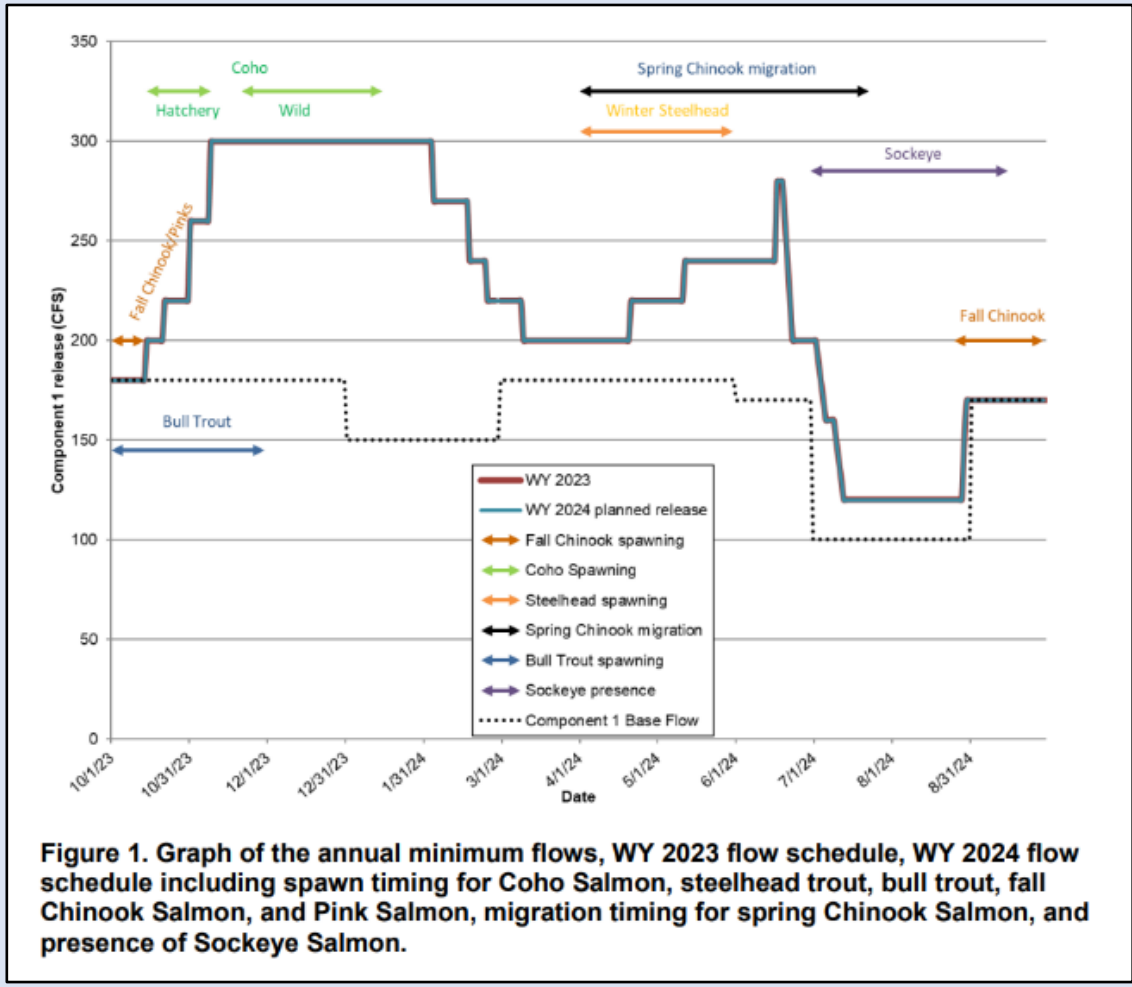
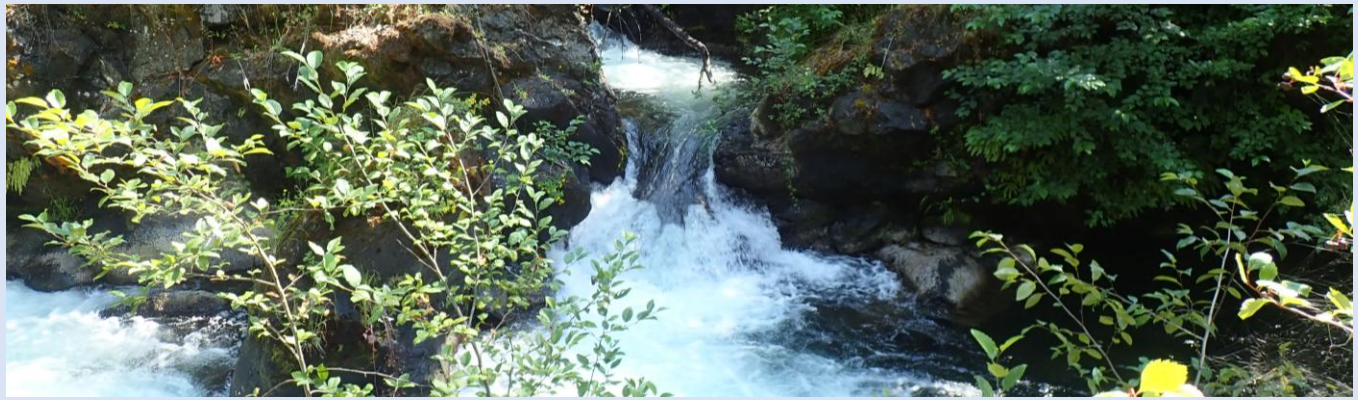


Figure 1. Graph of the annual minimum flows, WY 2023 flow schedule, WY 2024 flow schedule including spawn timing for Coho Salmon, steelhead trout, bull trout, fall Chinook Salmon, and Pink Salmon, migration timing for spring Chinook Salmon, and presence of Sockeye Salmon.

Restoring Fish Habitat and Passage:

Restoration of Little Falls:



Fish Populations and Passage:

Hatcheries, downstream, and upstream:

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Hatcheries, downstream, and upstream:

Though hatcheries have been identified as a stressor to natural origin salmon populations, they can also serve different roles for varying populations.

These include:

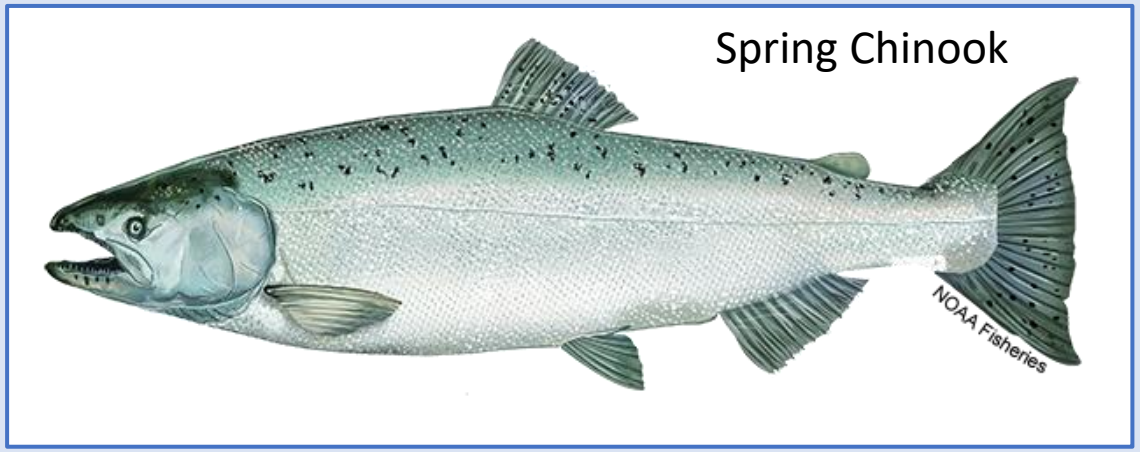
- Augmenting harvest
- Serve as gene banks
- **Tools for recolonization**
- Demographic safety nets for imperiled endemic populations

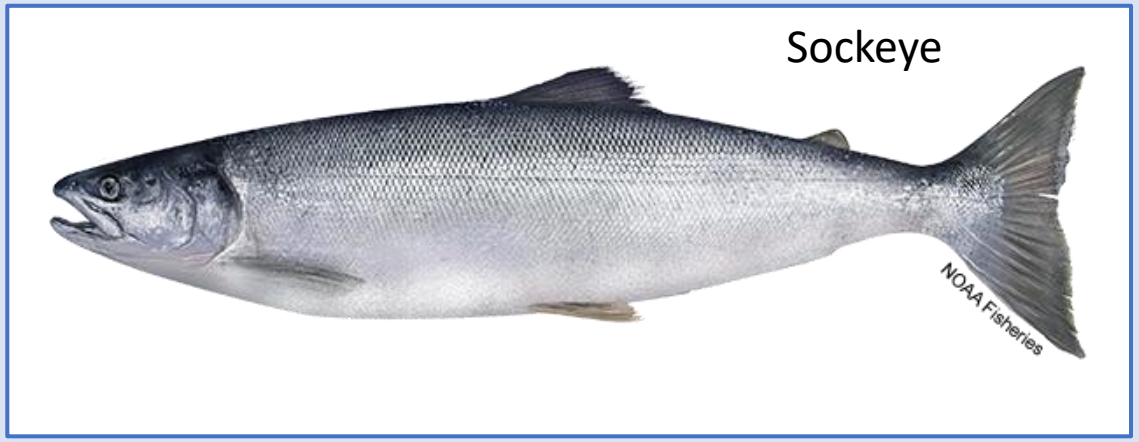
Reintroduction of two Salmonid Species:

Spring Chinook (*Oncorhynchus tshawytscha*): Puget Sound populations listed as threatened, reintroduced to the Skokomish basin using Skagit River source population.

Sockeye Salmon (*Oncorhynchus nerka*): historically spawned in natural lake prior to dam construction and reestablished using Baker River stock.

Hatchery production began in 2015 with varying release strategies to adult trap.





Spring Chinook Salmon: *Oncorhynchus tshawytscha*

The 10th year of operations at North Fork Salmon Hatchery, 8th year of adult spring Chinook Salmon returns.

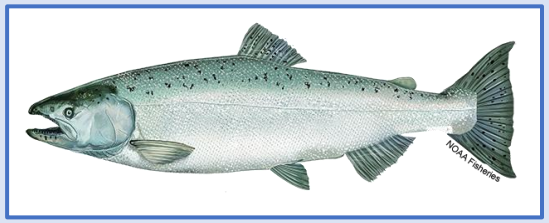
Production goal:

- 300,000 subyearlings
- 75,000 yearlings

~500,000/yr eggs are incubated and reared (97.2% survival)

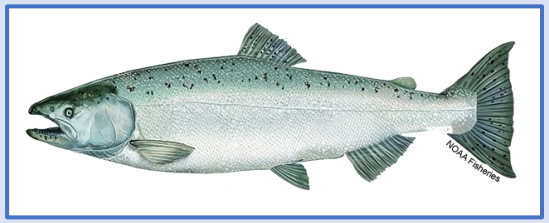
2024 reared 1,129,533 juveniles (CWT)

Spring Chinook -2024 Releases



BYs	Source	Released	Age	Egg to Release	Date 2023	Location	Mean wt.	FPP
2022-23	**Total**	**518,061**						
2022	NFSH	77,764	Yearlings	97.8%	April	NFSR	56.1 g	8
2023	NFSH	99,809	Subyearlings	97.3%	April	NFSR	5.7 g	80
2023	MMH	211,537	Subyearlings	97.3%	April	NFSR	5.9 g	76
2023	MMH	127,762	Subyearlings	97.3%	May	SFSR	5.8 g	78
2023	NFSH	78,953	Subyearlings	97.2%	Sept	NFSH	25.61	18

Spring Chinook -2024 Releases



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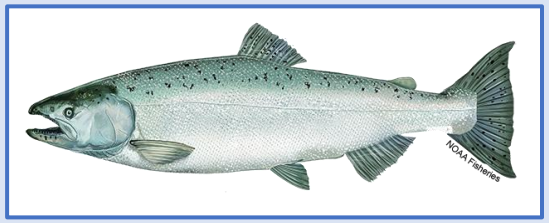
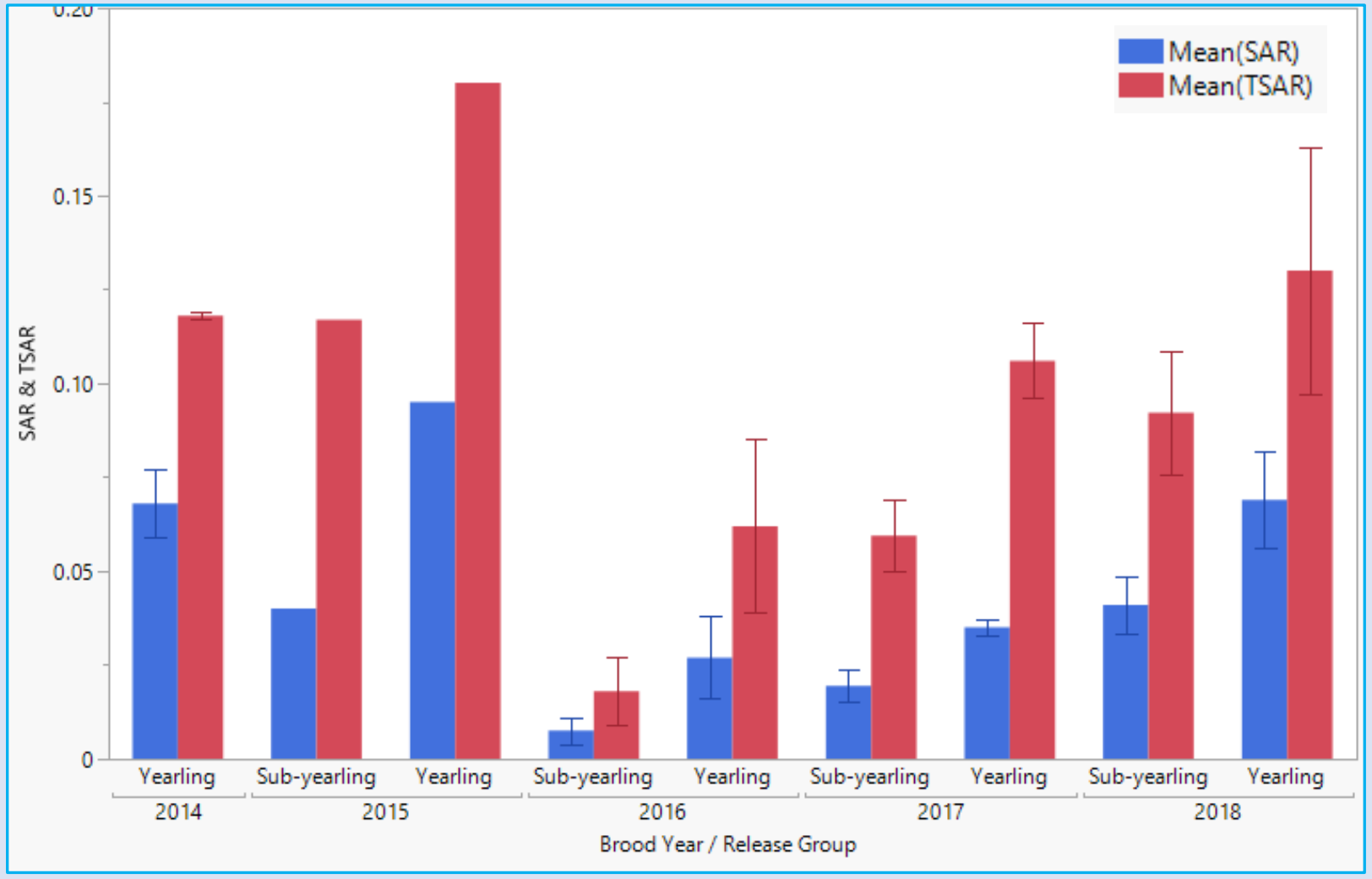
- Met license requirement consistently since 2017
- *Third year releasing spring Chinook into SFSR

Yearling vs Subyearling Releases:

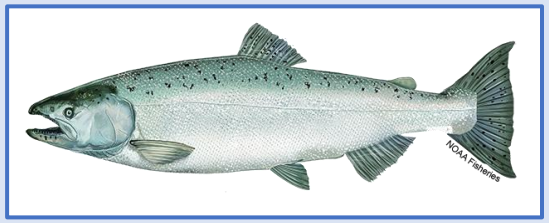




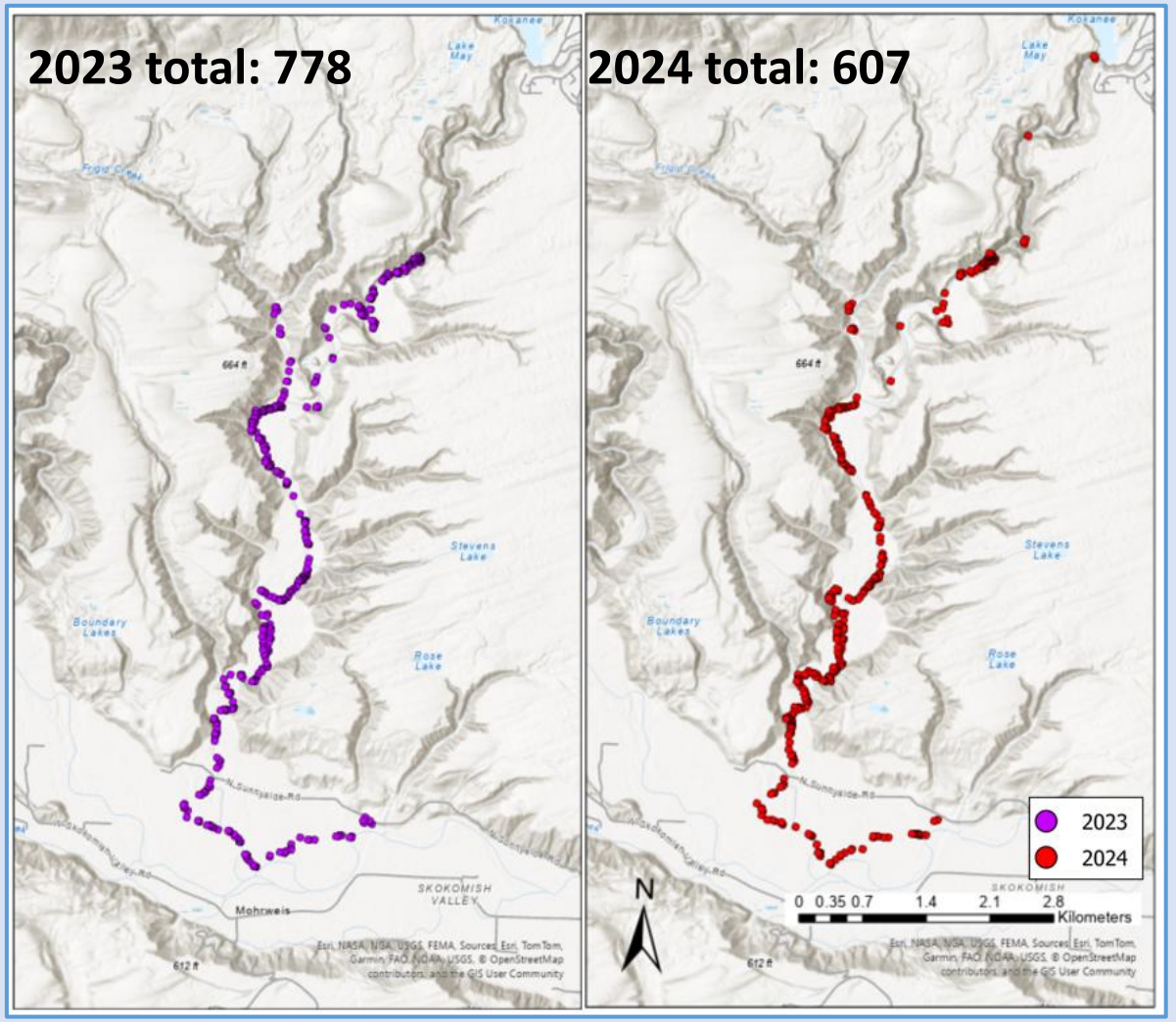
Four complete BYs have returned (2015-2018):

- Smolt to adult returns (SAR) two times better for yearlings
- Productivity was also more than 2 times better for the yearlings
- Subyearlings are much less likely to stray.

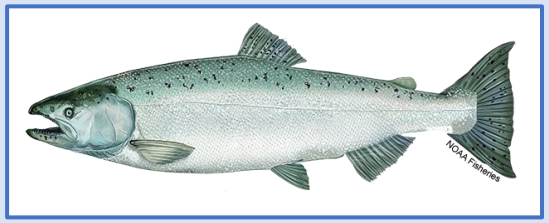
Chinook Redd Counts:



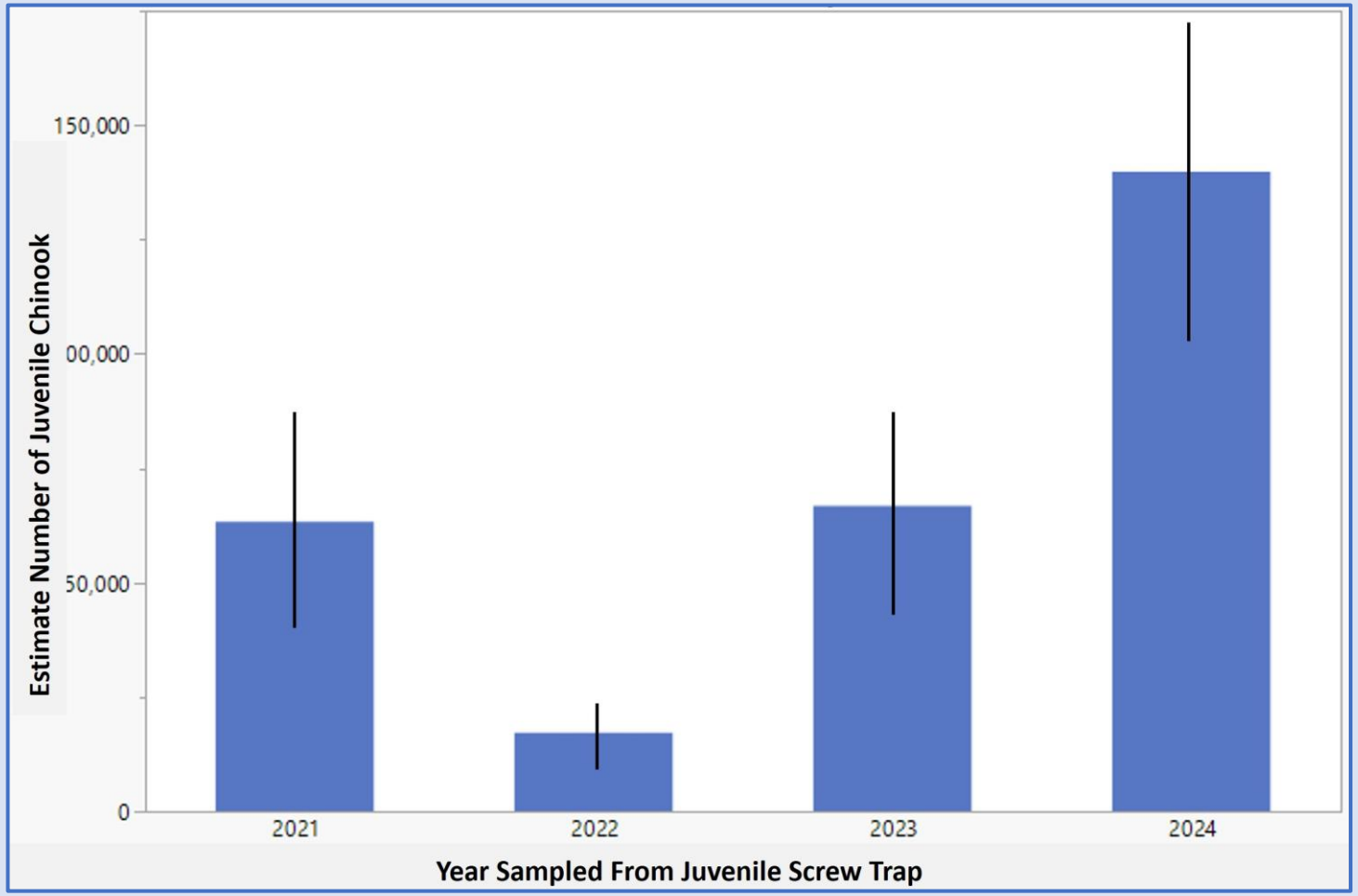
- Adult returning Chinook salmon are returning to the adult trap and are used for broodstock collection.
- However, the majority of returning Chinook are reproducing in the North Fork Skokomish River – basin recovery.
- This georeferenced data illustrates areas of heightened use, which guide river restoration priorities such as flood plain improvements and side channel reconnection.



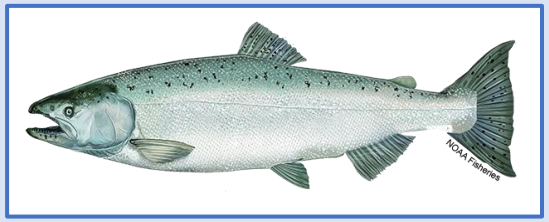
Chinook in the Basin: Wild Populations



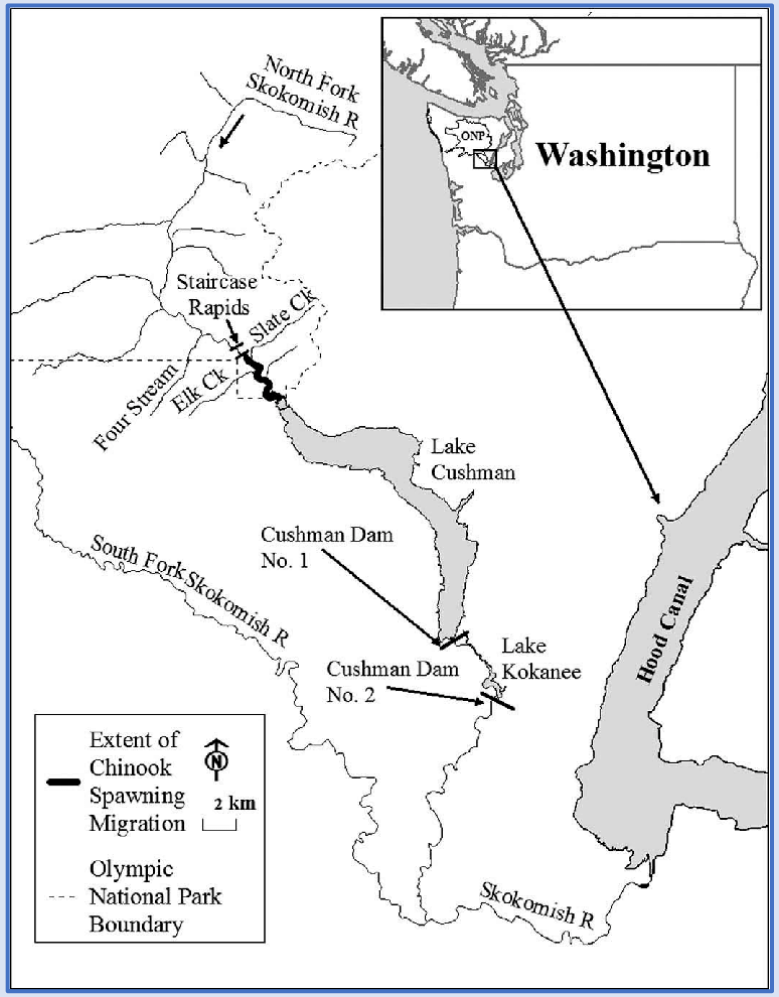
- Natural Origin Chinook observed rearing in the North Fork Skokomish
- Estimated NOR migrating Chinook fry (98%) and parr (2%) sampled from the screw trap in the NFSR
- 2024 had the highest number estimated from the 2023 productivity



Spring Chinook Summary:



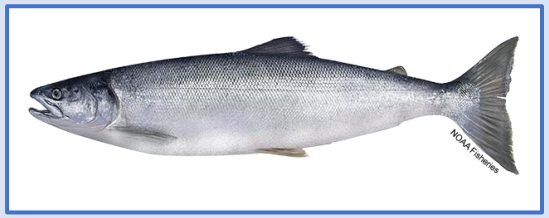
- Production goals are being met.
- Smolt-to-adult returns (SAR) and productivity are two times better for yearlings.
- Wild Chinook spawning and rearing in NFSR
- **2025:** Current surveys are tracking the returns of the South Fork spring Chinook.
- **Challenges:** Mean productivity is currently <1, indicating the population is not yet self-sustaining



Sockeye Salmon: *Oncorhynchus nerka*

- Tenth year of operations at Saltwater Park Sockeye Salmon Hatchery (SWPH)
- Fifth year of Sockeye Salmon adult returns to the NFSR
- Production goal: 2,000,000 juveniles
- Investigating release strategies

Sockeye Salmon Program: Lake Cushman



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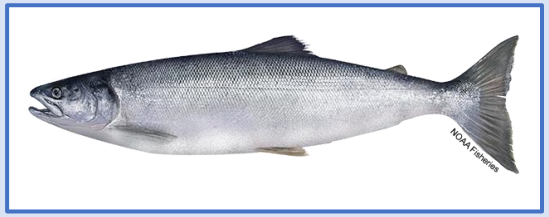

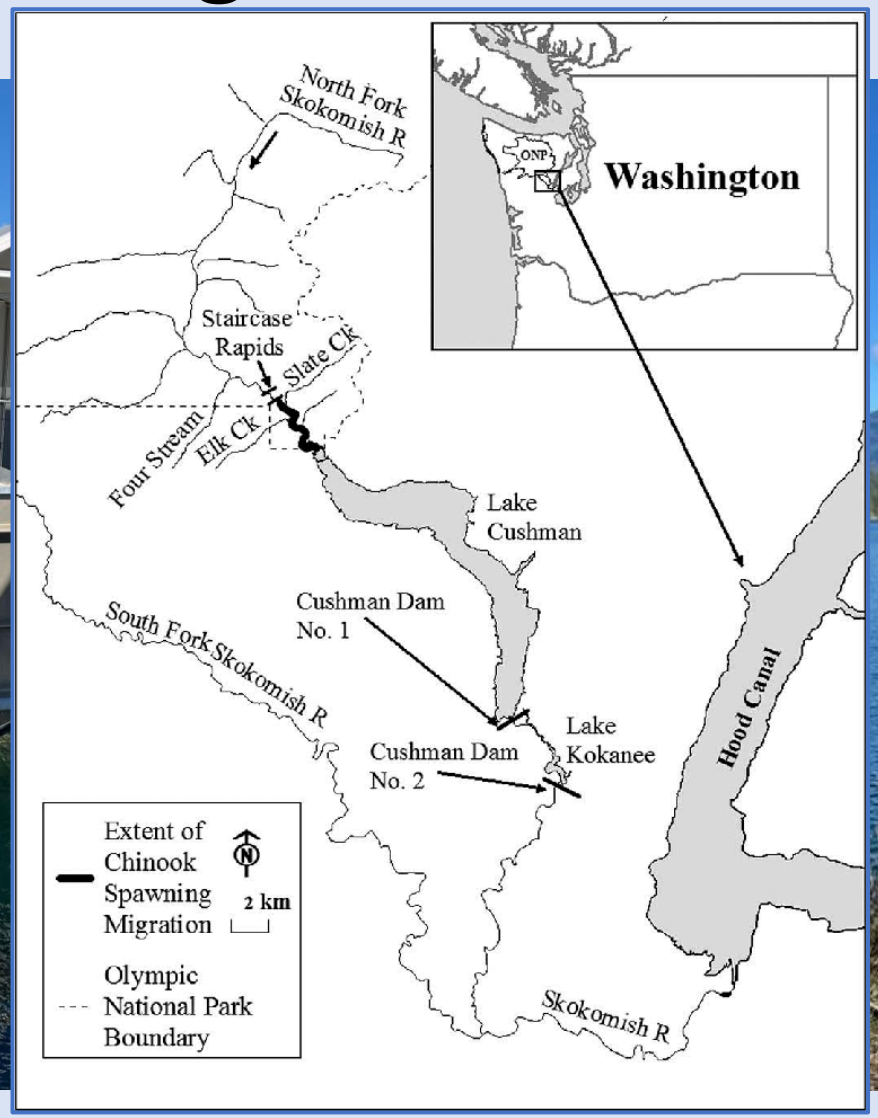

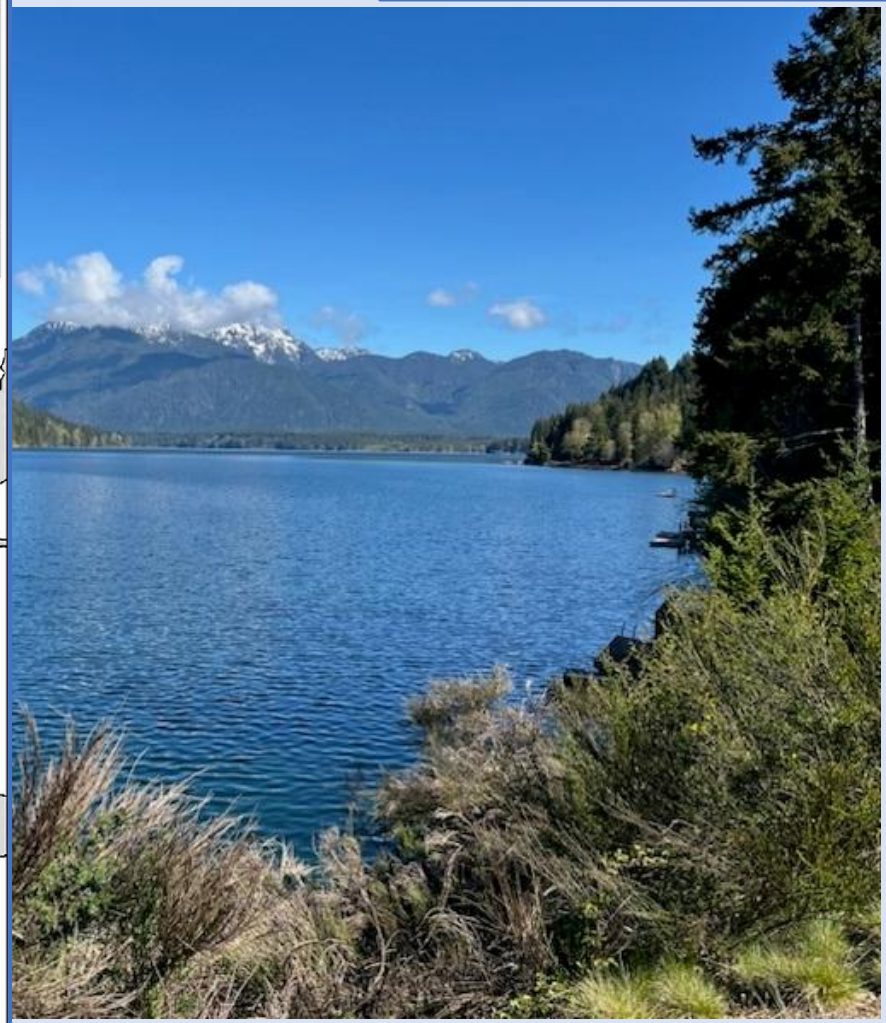

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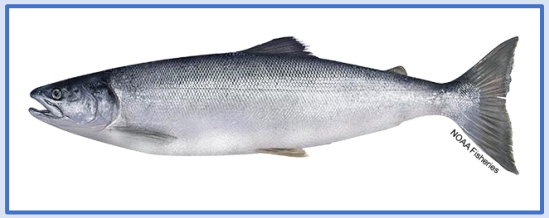
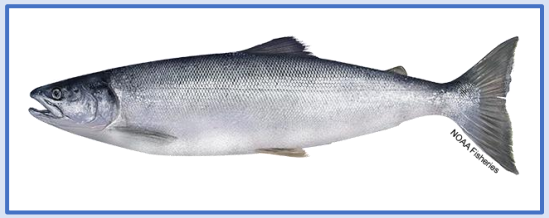
Sockeye Salmon -2024 Releases



BYs	Released	Egg to Release	Mean wt.	FFP	Mortality/mo.
2022	**159,999**	**93.5%**	**31.2 g**	**14**	**0.10%**
yearlings	156,957	Released into the lower NFSR April 2024			
yearlings	3,042	Released into Lake Cushman April 2024			
2023	**718,833**	**97.8%**	**6.9 g**	**75**	**0.39%**
subyearlings	317,902	Released into Lake Cushman July 2024			
subyearlings	252,990	Released into the lower NFSR August-Sept 2024			
subyearlings	147,941	Released into Lake Cushman September 2024			

- Total released in 2024 = 878,832
- Varying strategies: lake, river, age class

Lake Cushman Collection Efficiency:



- **Tested using Coho Salmon in 2015-2018.**
- **Collected Sockeye Salmon since 2018.**

	System Survival (Goal = 75-95%)		Collection Efficiency (Goal = 95%)	
Year	Coho Salmon	Sockeye Salmon	Coho Salmon	Sockeye Salmon
2015	18.7%	--	32.9%	--
2016	18.6%	--	36.5%	--
2017	31.2%	--	54.0%	--
2018	48.4%	35.3%	61.4%	40.5%
2019	--	24.0%	--	39.4%
2020	--	42.6%	--	65.7%
2021	--	46.1%	--	64.3%
2022	--	32.4%	--	42.4%
2023	--	43.1%	--	60.7%
2024	--	48.7%	--	67.9%

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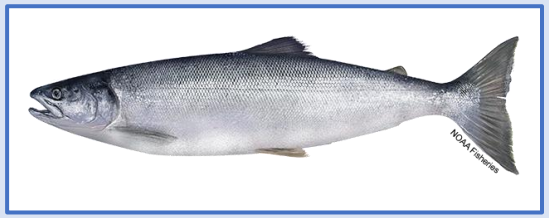

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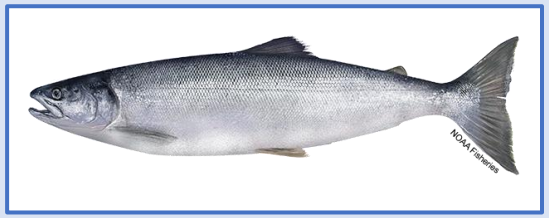
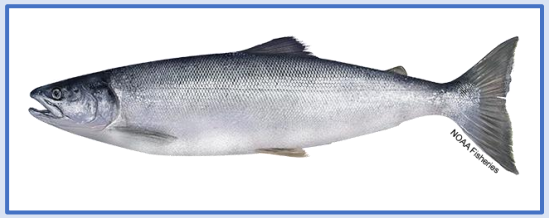
Actual Releases and Returns: Sockeye



Year	Brood Year 2016	2017	2018	2019	2020	Total/ Mean
Number Released in Lake Cushman	228,583	433,231	446,866	242,032	16,968	**1,367,680**
2018	65,040	0				65,040
2019	7,674	62,899	2,558			73,131
2020	4,589	10,453	64,247	0		79,289
2021	671	168	2,179	56,328	0	59,346
2022	0	113	452	1,356	5,535	7,456
Total Recaptured	77,974	73,633	69,436	57,684	5,535	284,262
Recapture Rate in JFC	34.1%	17.0%	15.5%	23.8%	32.6%	**24.6%**
Number Released into the Lower NFSR[1]	**86,954**	**123,941**	**118,640**	**83,067**	**83,508**	**496,110**
Adults Caught	**154**	**238**	**379**	**357**	**58**	**1,186**

Actual Releases and Returns: Sockeye



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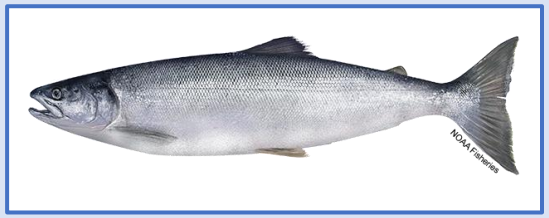
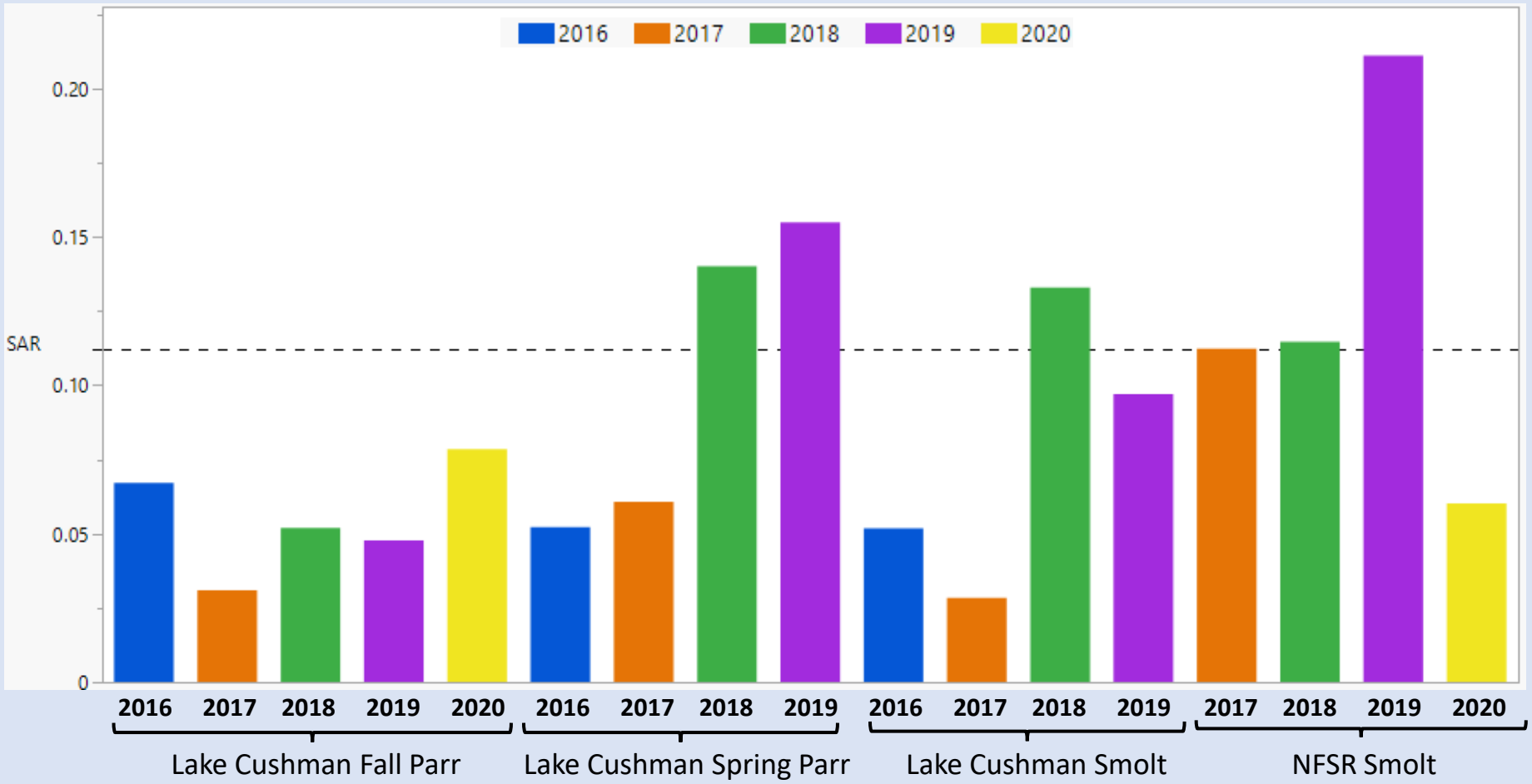
60-75% loss from lake and resulted in river release strategy

Sockeye Release-to-Adult Survival Rate:





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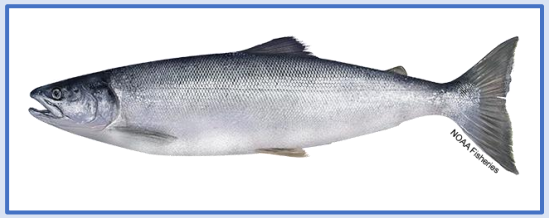
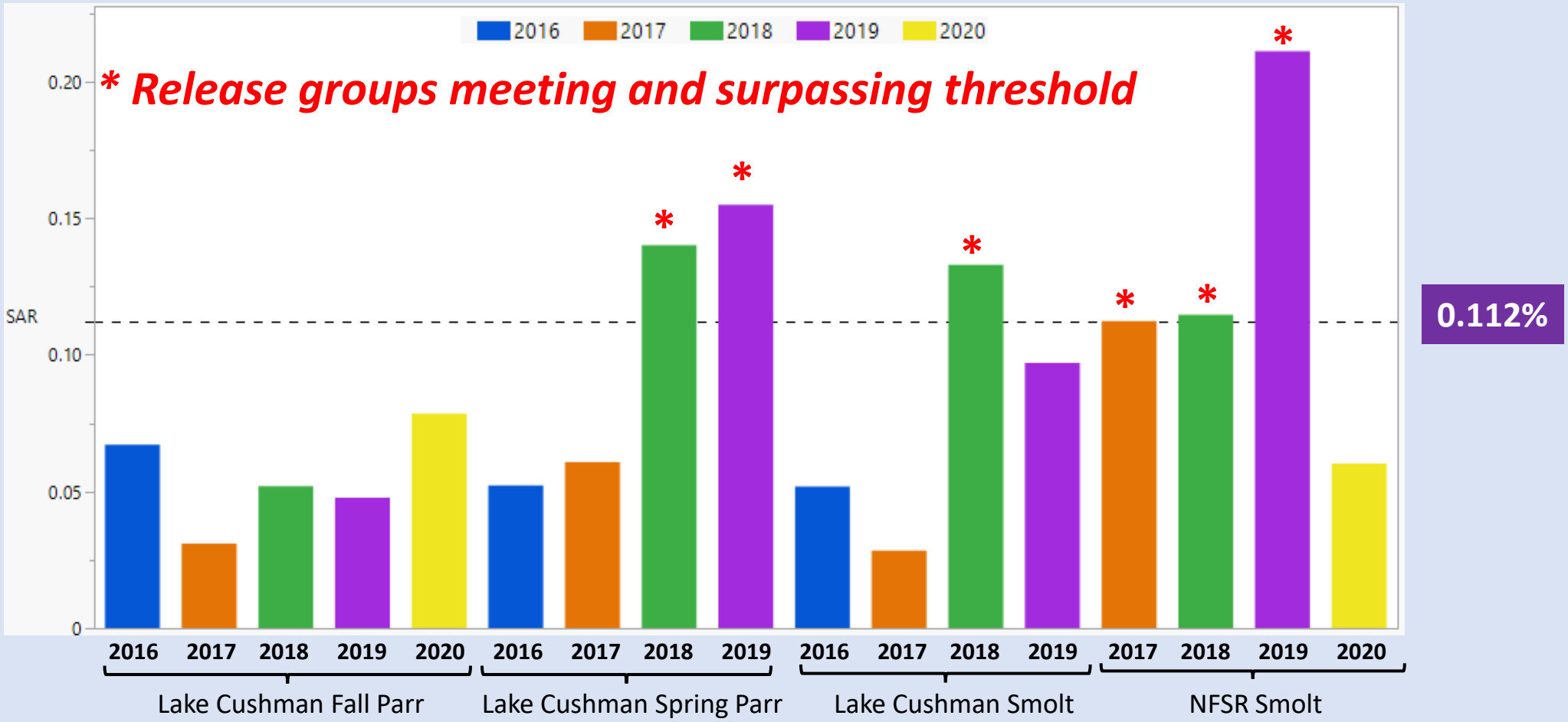
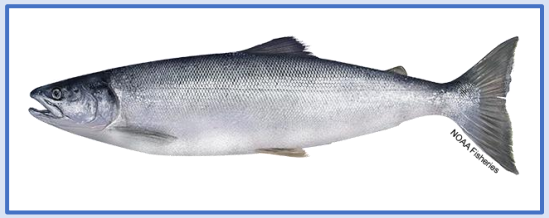




0.112%

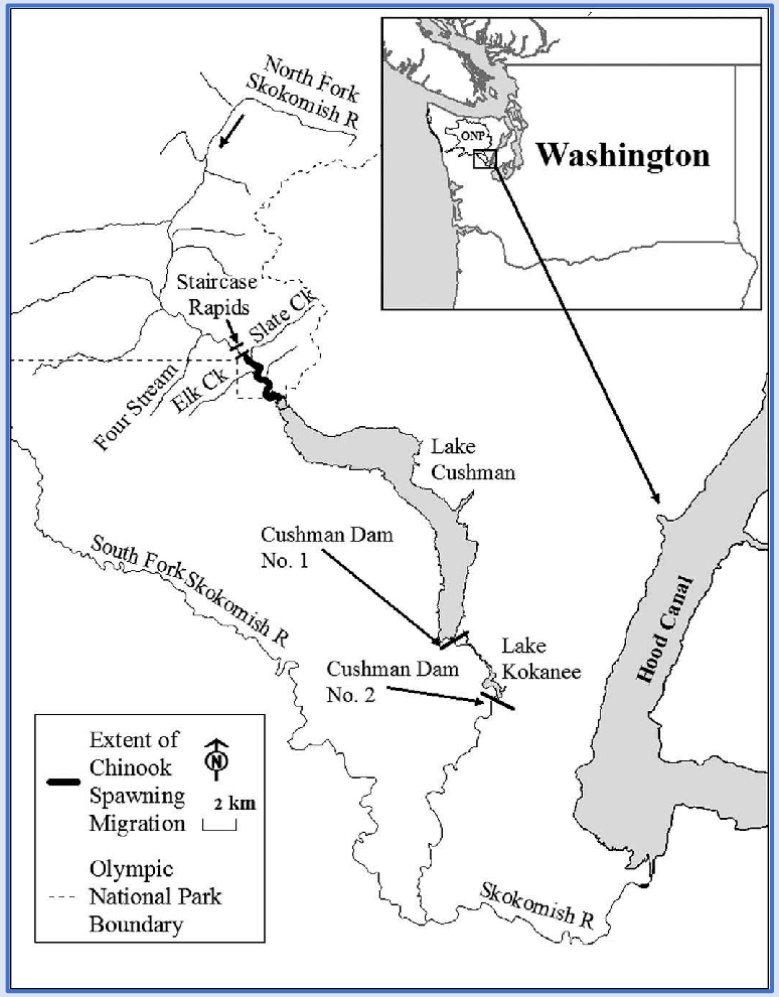
Sockeye Salmon 2024 Summary:



- Production goal = 2 mil -> 2,390,519 reared
- Total released = 878,832 (Cushman Lake and NFSR)
- Some BYs averaging above the replacement threshold
- Highest FCE and SS to date, however, still a barrier

Factors that may limit FCE:

- sub-optimal hydraulic conditions
- predator presence
- delayed migration

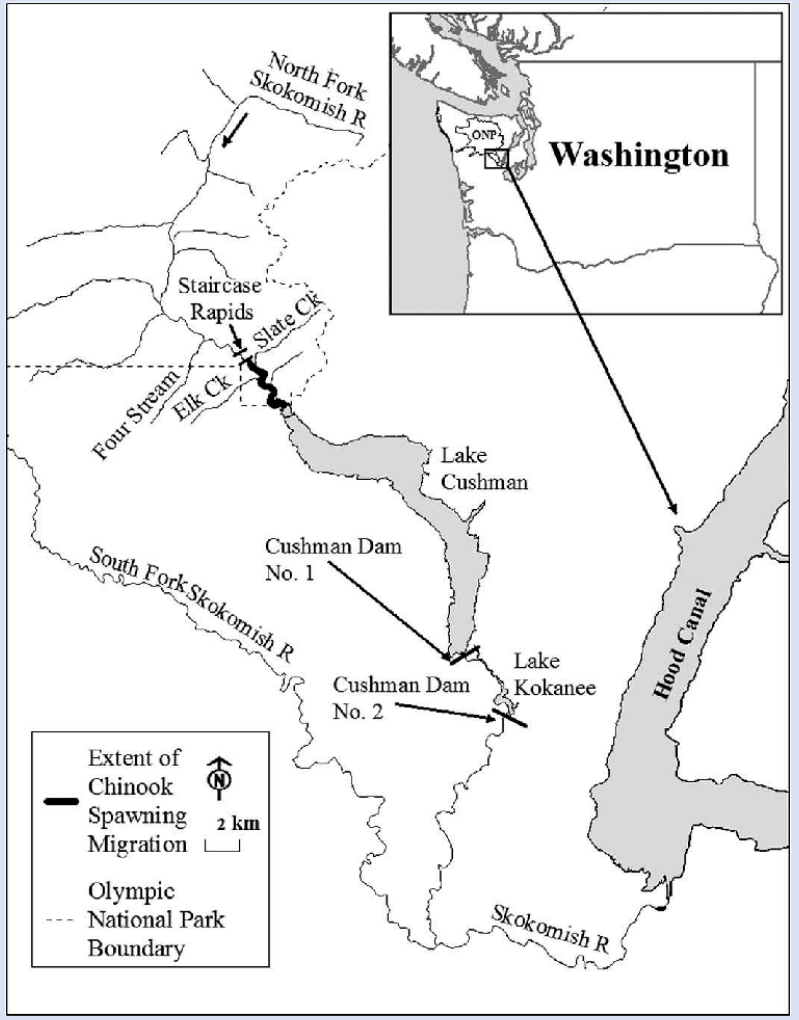


Looking Ahead for Chinook and Sockeye:

- Complete BYs 2018-2021 are currently being analyzed for SARs and Productivity

- This will form the basis of hypotheses to base experimental designs to determine strategies:
  - Release locations – Lake vs River
  - Release Size Classes
  - Habitat restoration – shorelines and floodplains

- **Challenges:**
  - Ocean Conditions and Predation
  - Lake Cushman Collection Efficiency



Thank you!

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