



**NOAA**  
**FISHERIES**

Northwest  
Fisheries  
Science Center

# Smolt Survival and Travel Time & Transportation Analyses

Update with 2023 Data

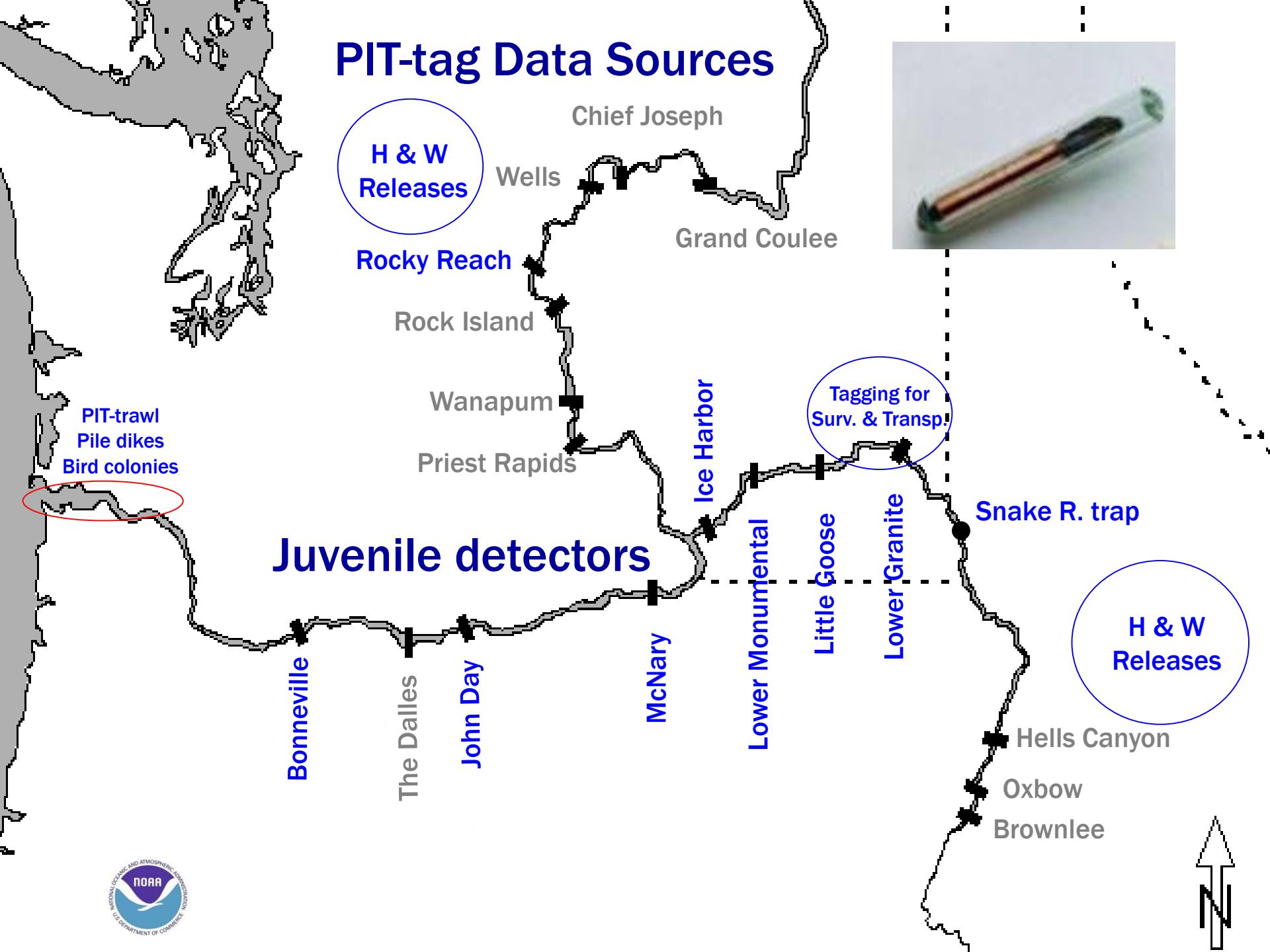
USACE Anadromous Fish Evaluation Program  
Annual Review 2023  
January 22, 2024

Steven G. Smith  
[steven.g.smith@noaa.gov](mailto:steven.g.smith@noaa.gov)

# Smolt Survival

- Migration conditions, travel time and survival of PIT-tagged smolts through the hydropower system in 2023
  - Preliminary Results Memo: October 7, 2021
  - Reanalysis with estuary avian recoveries is in progress
    - (today: all but sockeye include “bird data” – still considered preliminary)
    - Only those fish left to migrate in-river
    - Only juvenile data, not survival to adult

# PIT-tag Data Sources

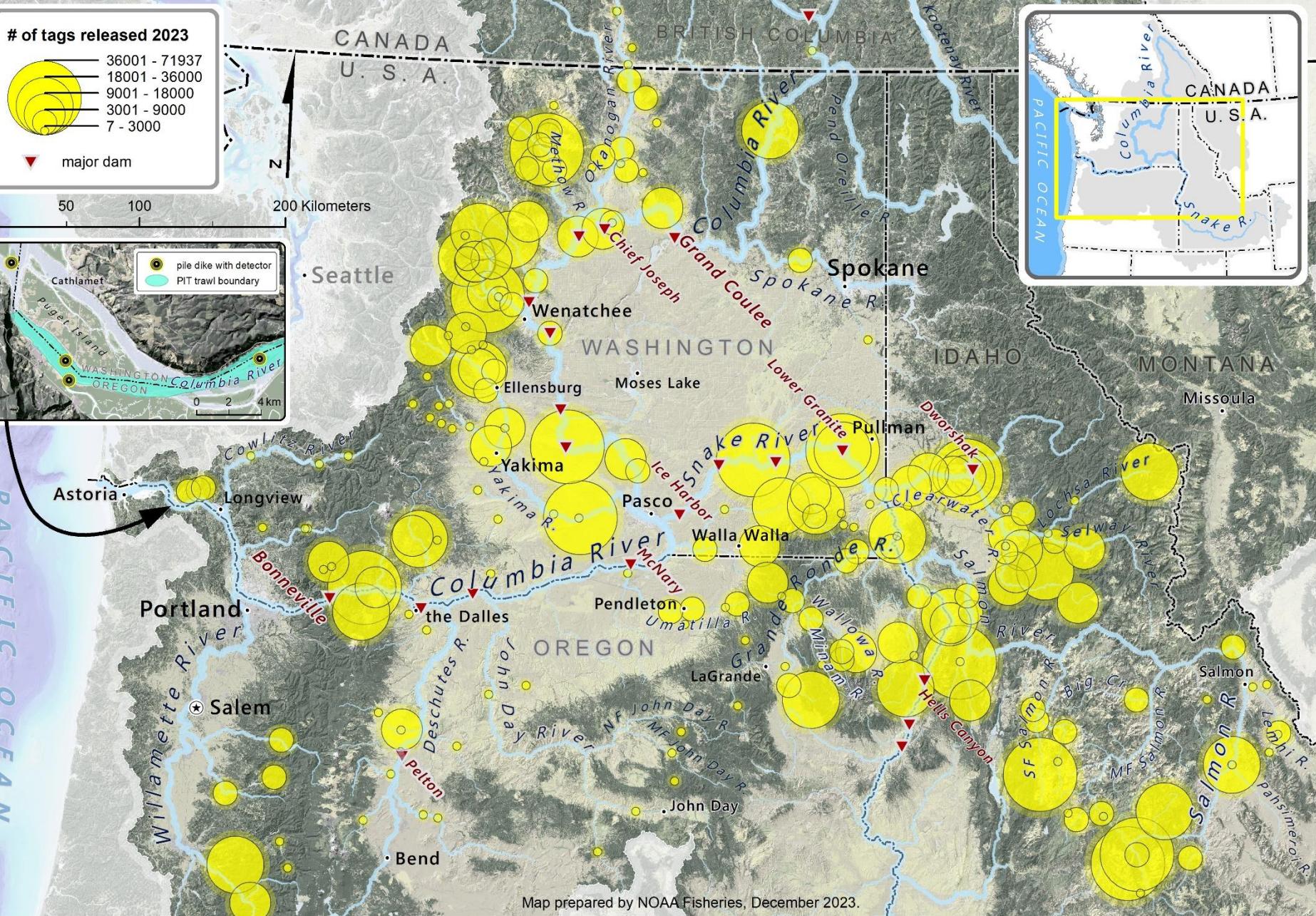
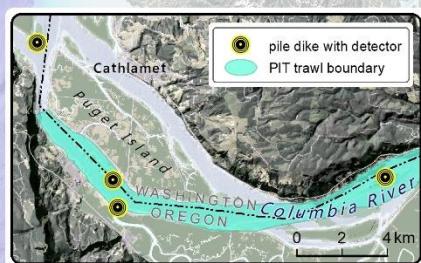


# of tags released 2023

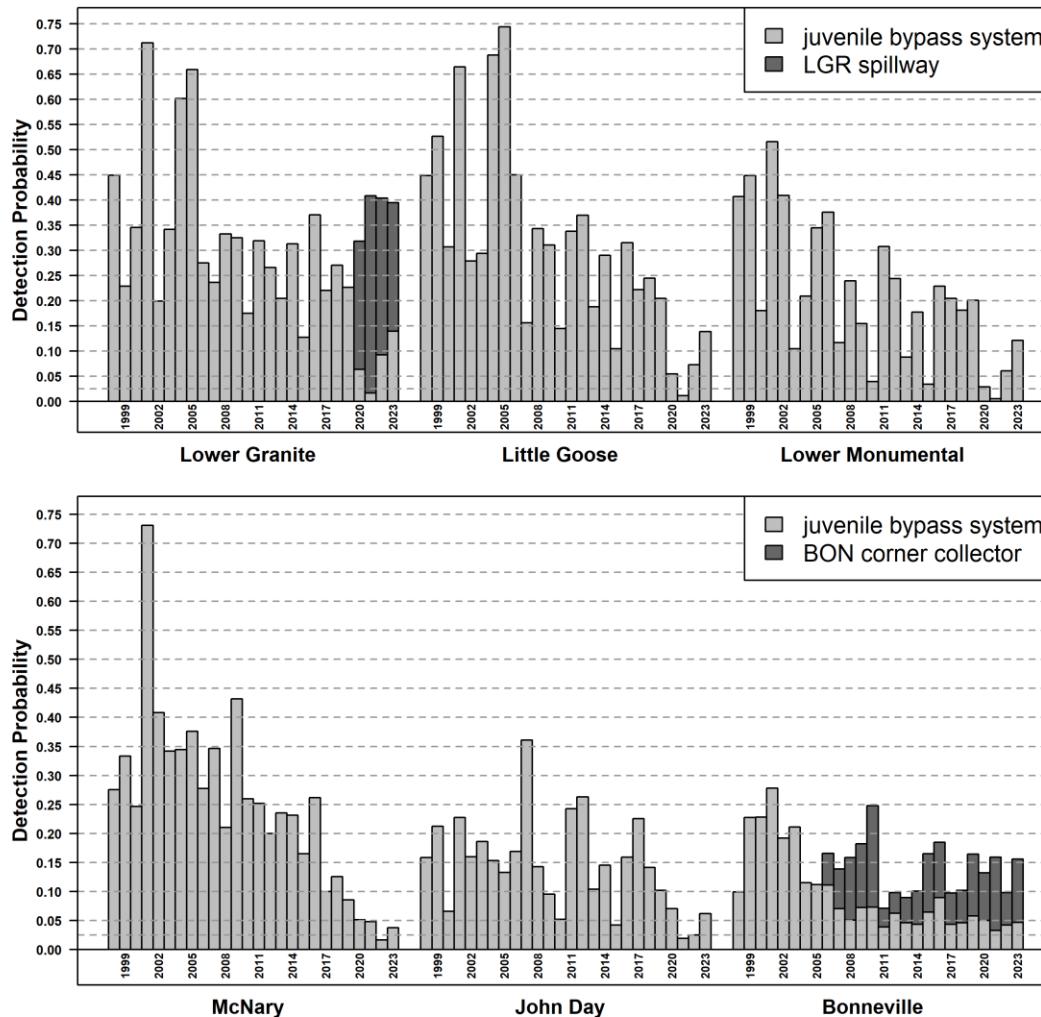
36001 - 71937  
18001 - 36000  
9001 - 18000  
3001 - 9000  
7 - 3000

▼ major dam

0 50 100 200 Kilometers

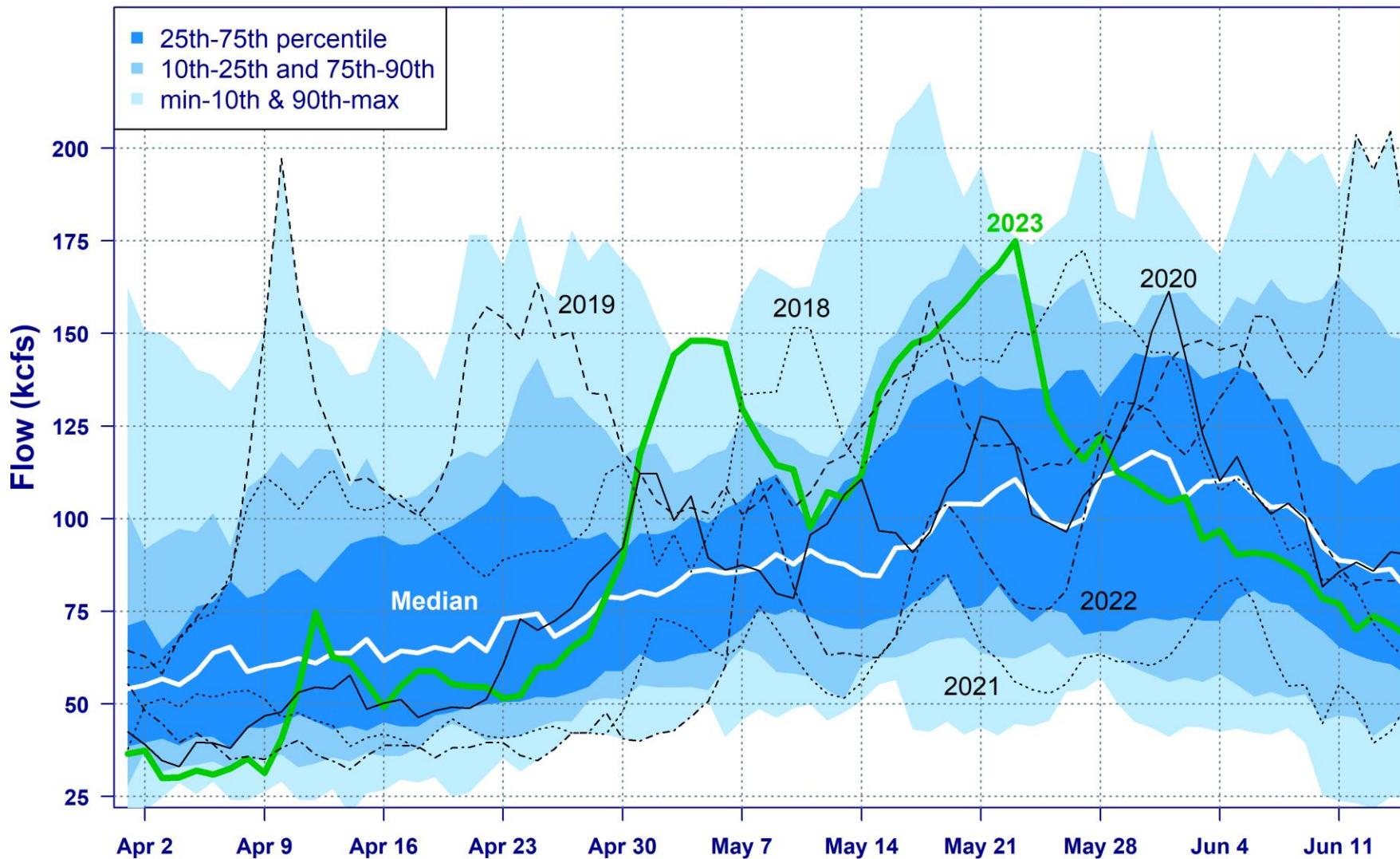


# Detection Probabilities – Yearling Chinook



# Daily Flow (kcfs) 1989-2023

## Little Goose Dam

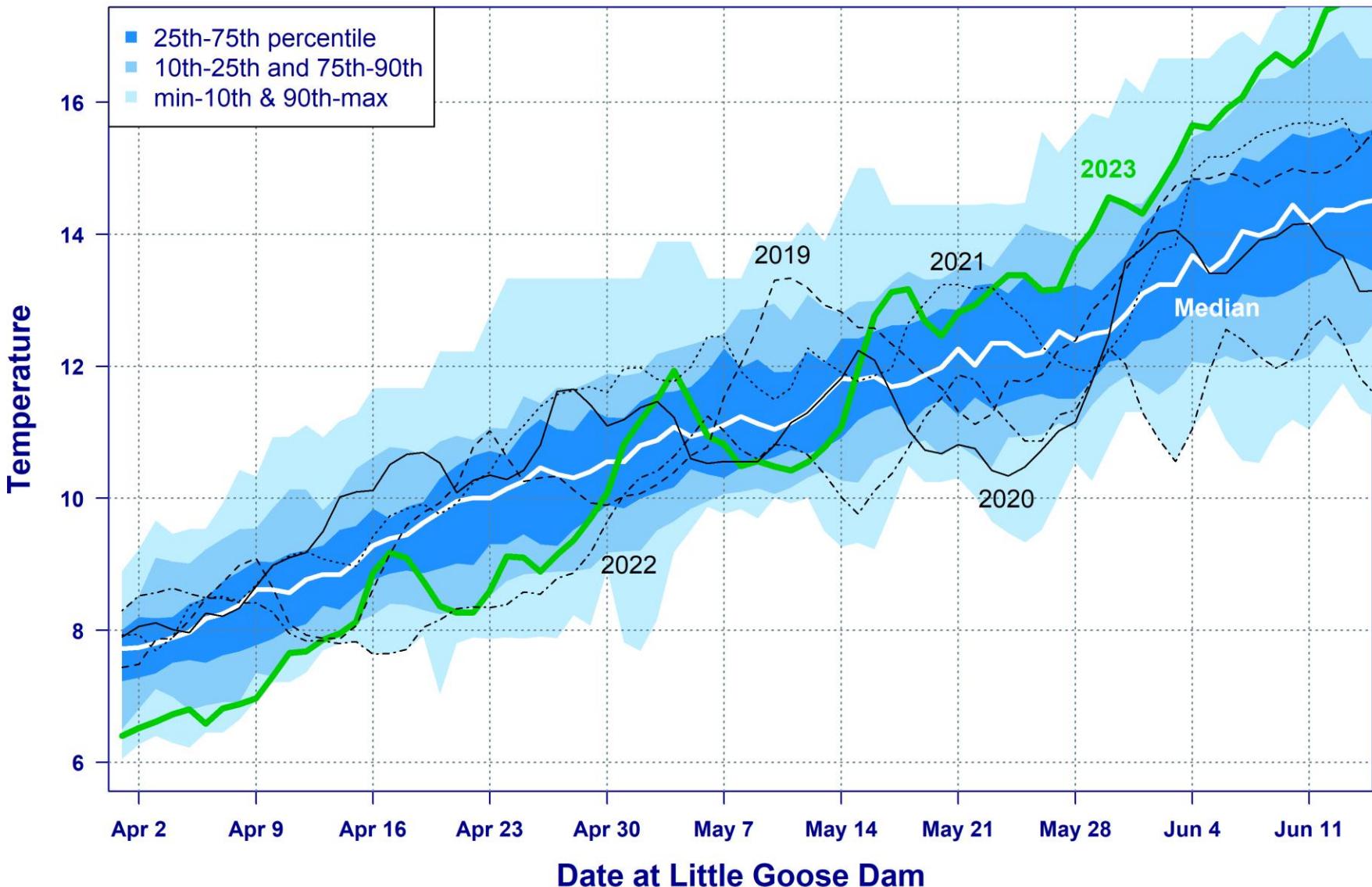


NOAA FISHERIES

U.S. Department of Commerce | National Oceanic and Atmospheric Administration | NOAA Fisheries | Northwest Fisheries Science Center

# Daily Temperature 1989-2023

## Little Goose Dam

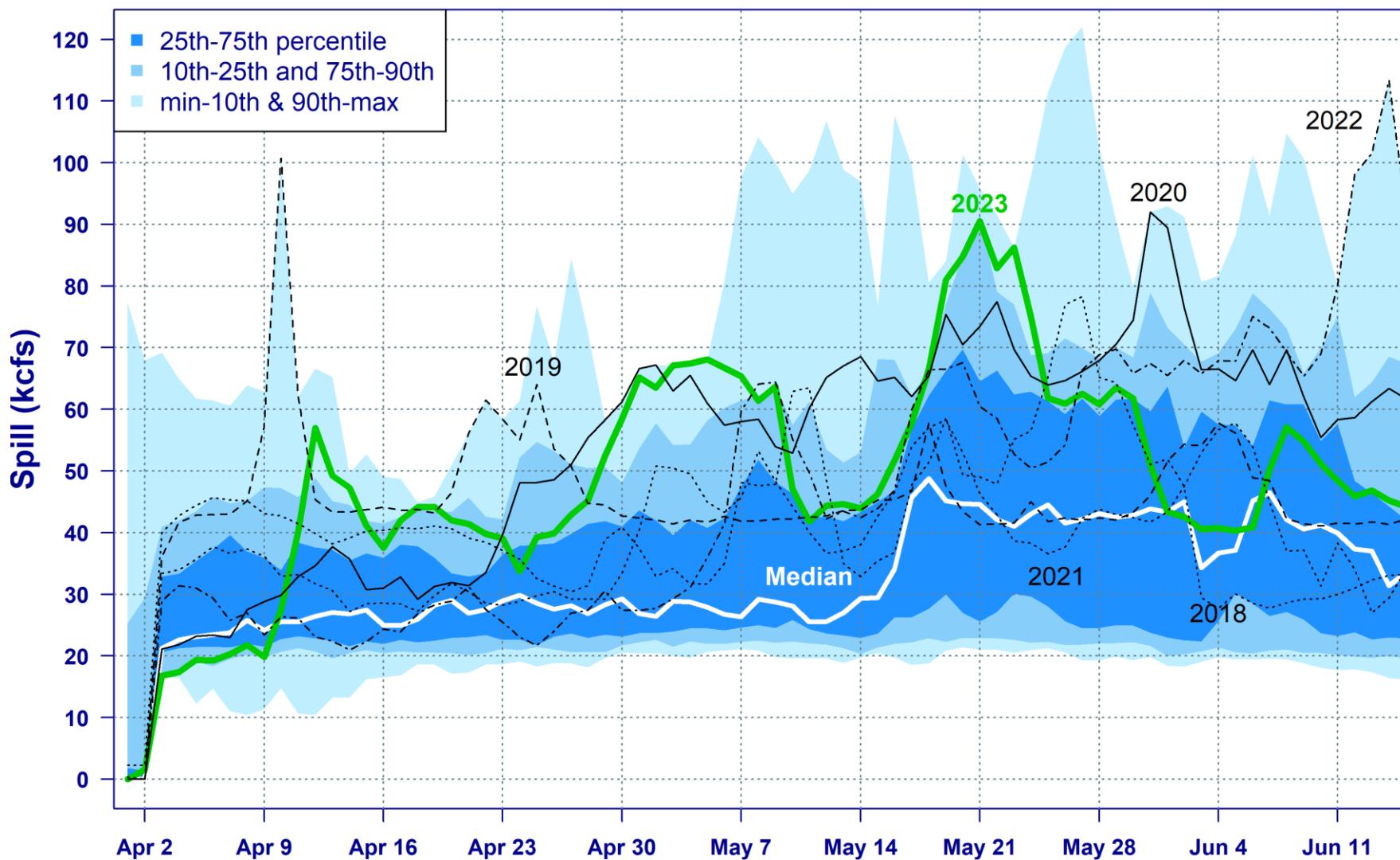


NOAA FISHERIES

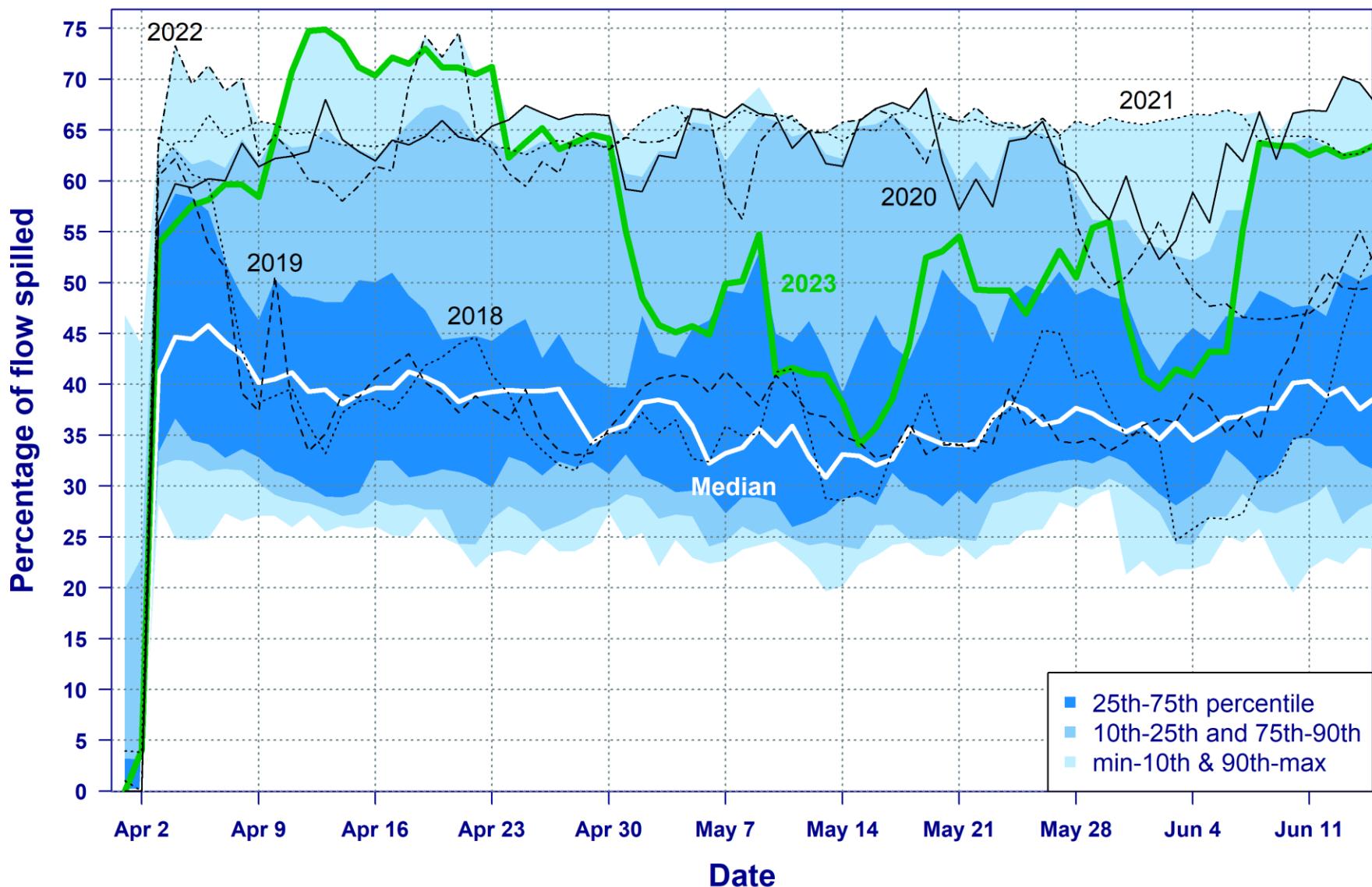
U.S. Department of Commerce | National Oceanic and Atmospheric Administration | NOAA Fisheries | Northwest Fisheries Science Center

# Daily Spill (kcfs) 2006-2023

## Mean LGR, LGS, LMN

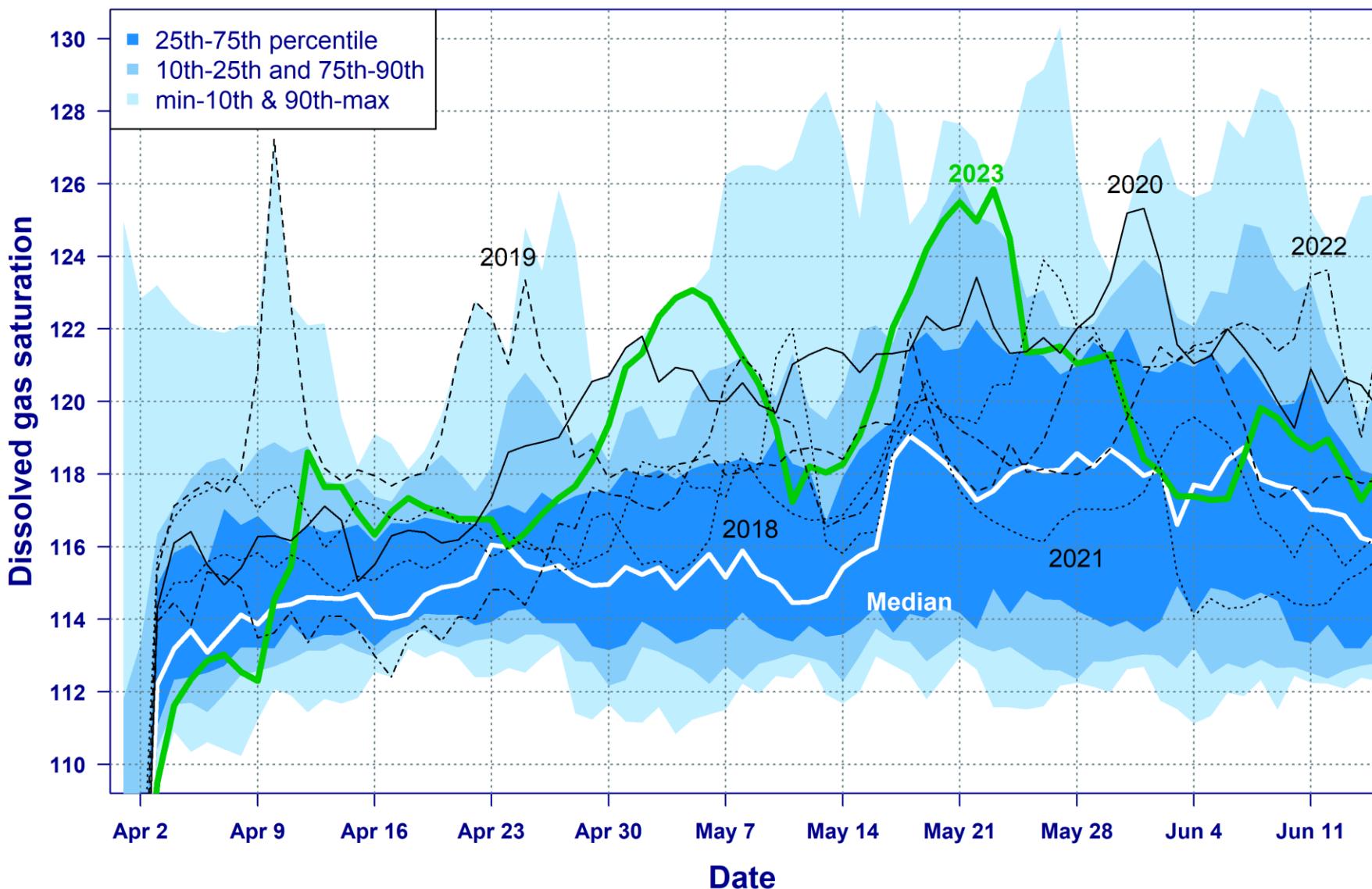


## Daily %Spill 2006-2023 Mean LGR, LGS, LMN



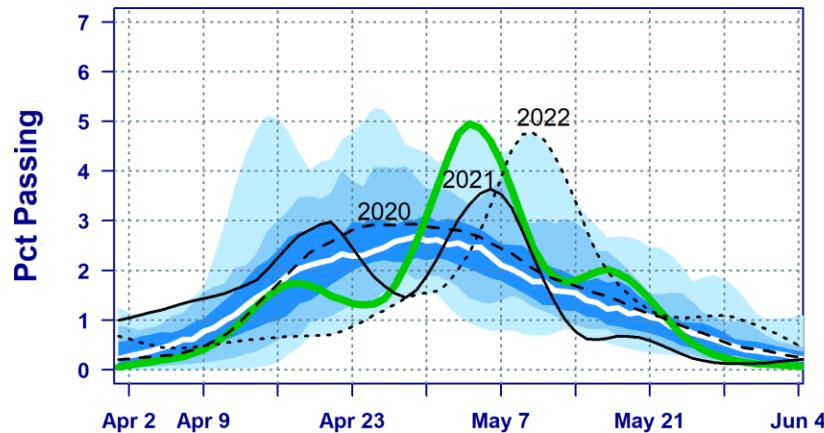
# Daily Dissolved Gas Saturation 2006-2023

## Mean LGR, LGS, LMN

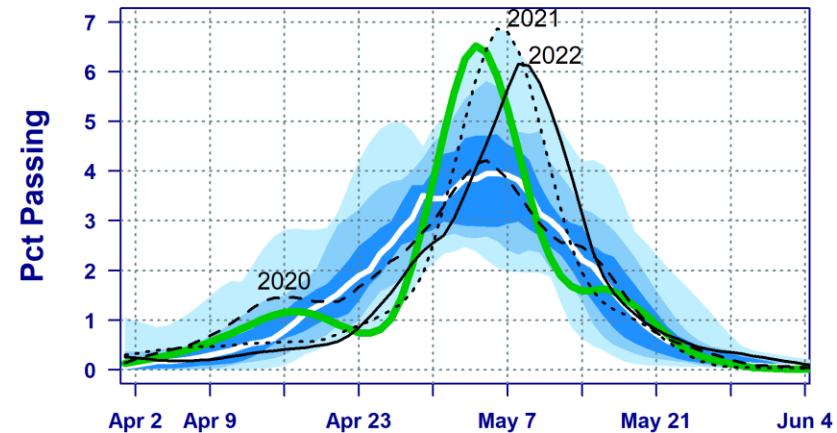


# Passage Timing at Lower Granite Dam

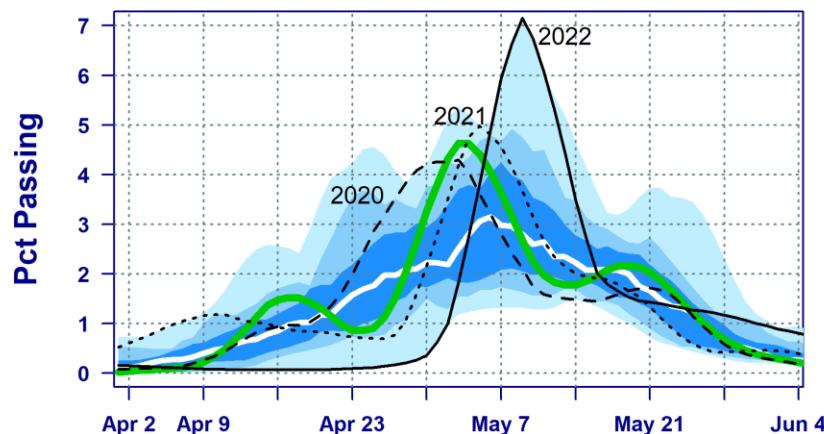
Wild Chinook



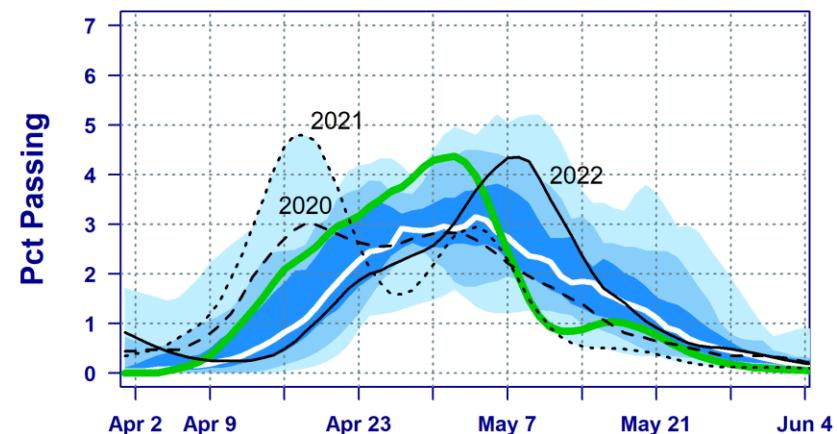
Hatchery Chinook



Wild Steelhead



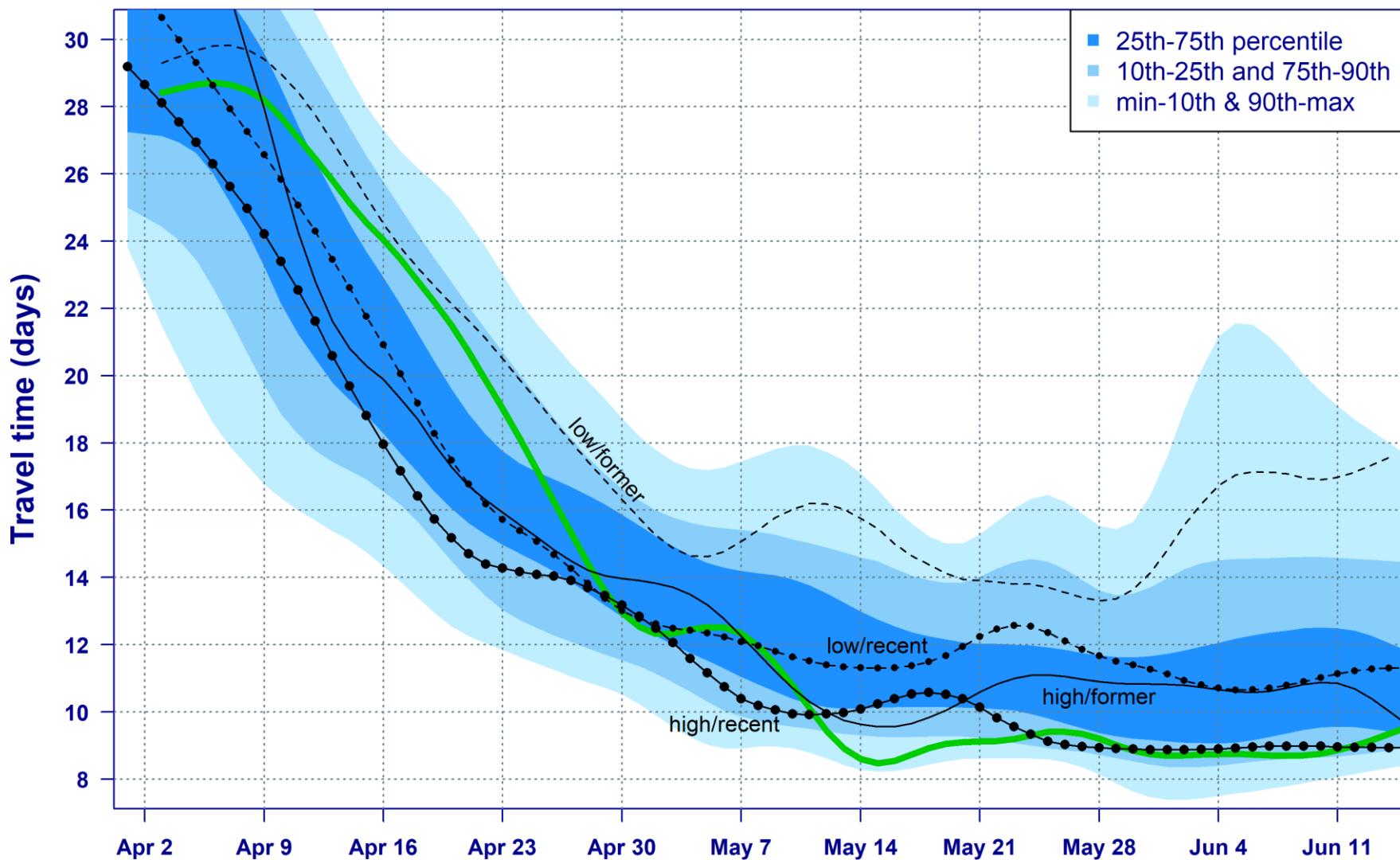
Hatchery Steelhead



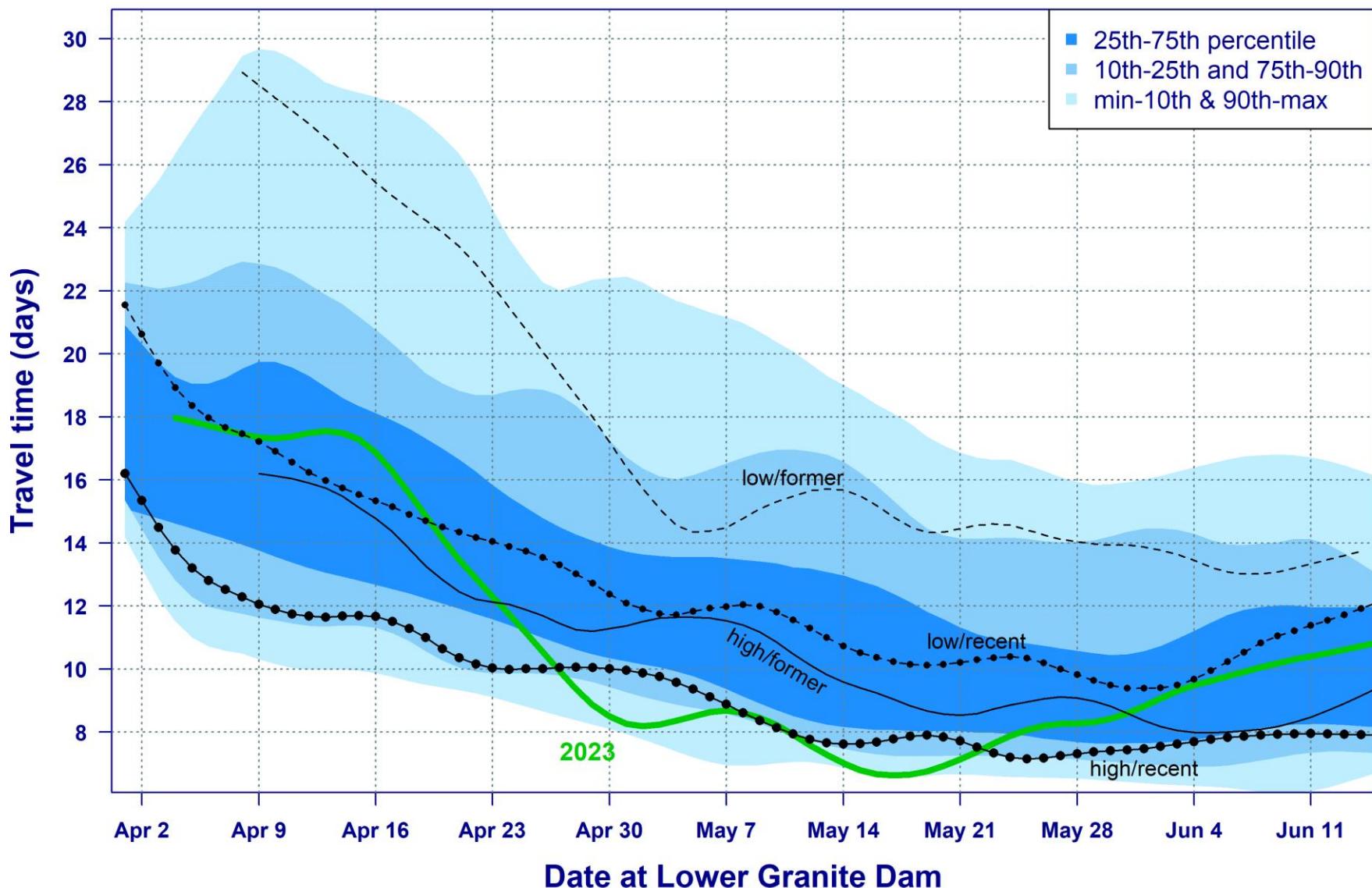
NOAA FISHERIES

U.S. Department of Commerce | National Oceanic and Atmospheric Administration | NOAA Fisheries | Northwest Fisheries Science Center

## Travel Time - Lower Granite to Bonneville (461 km) Chinook 1997-2023 (exc. 2001)



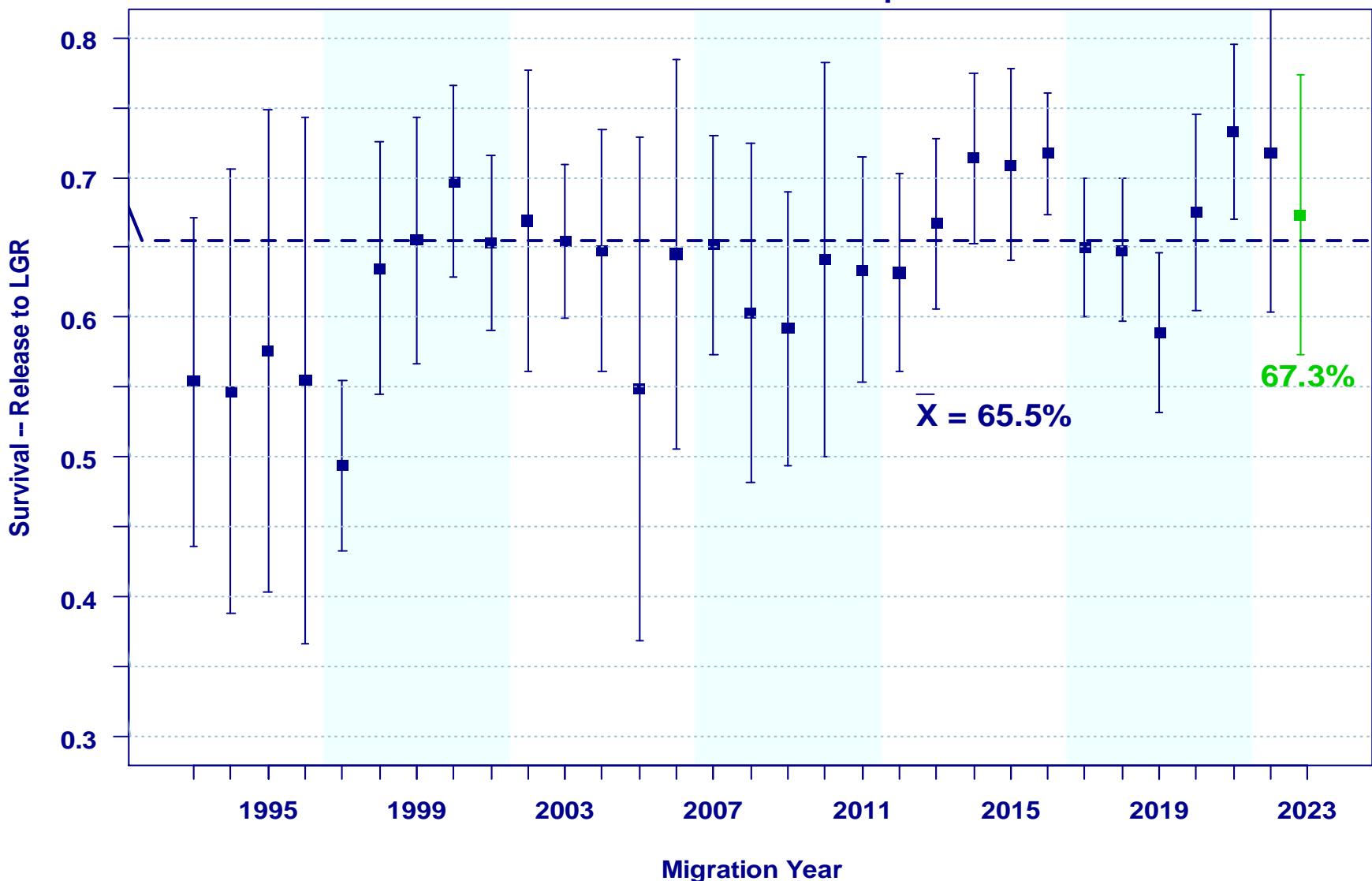
## Steelhead 1997-2023



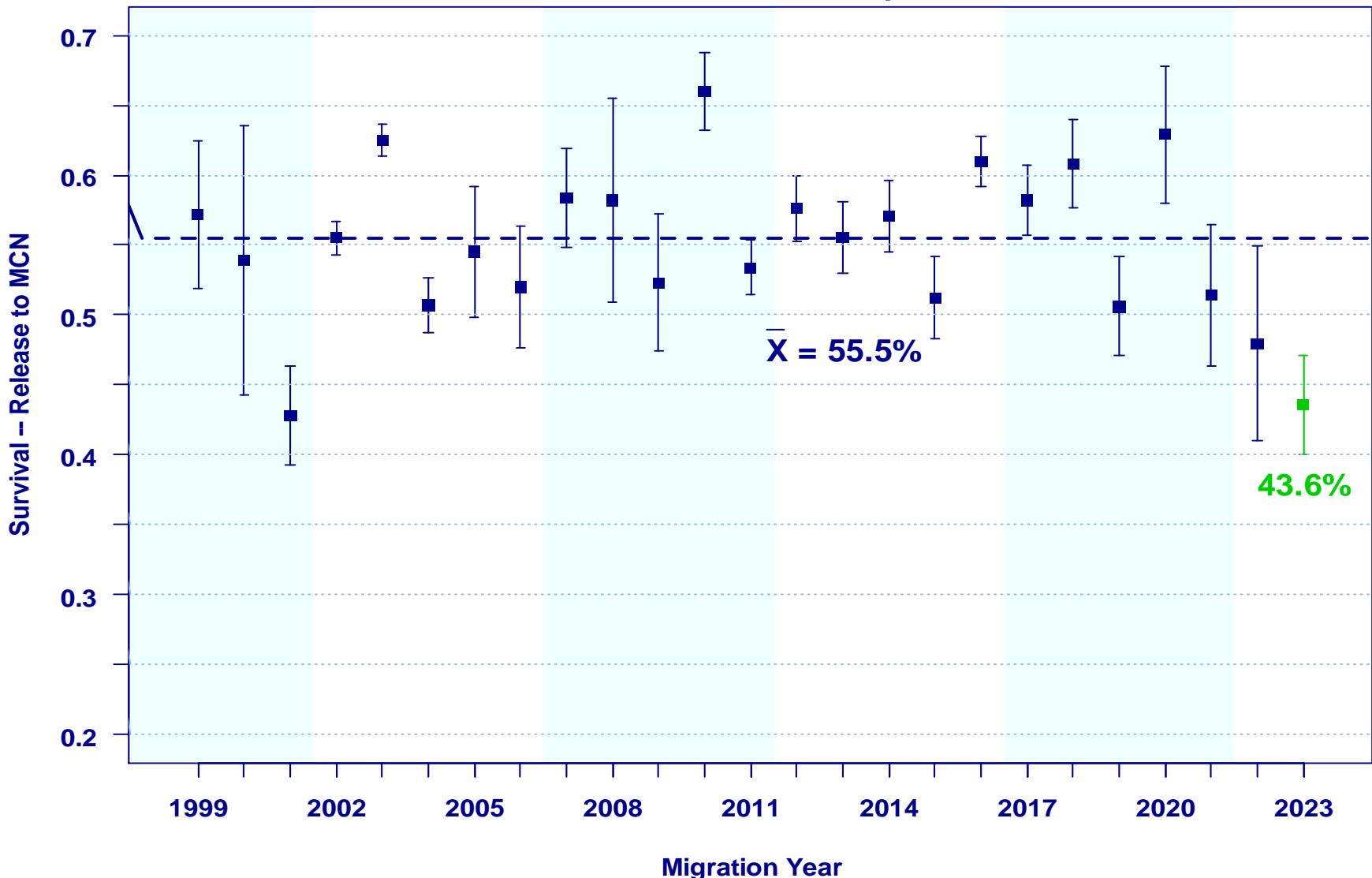
NOAA FISHERIES

U.S. Department of Commerce | National Oceanic and Atmospheric Administration | NOAA Fisheries | Northwest Fisheries Science Center

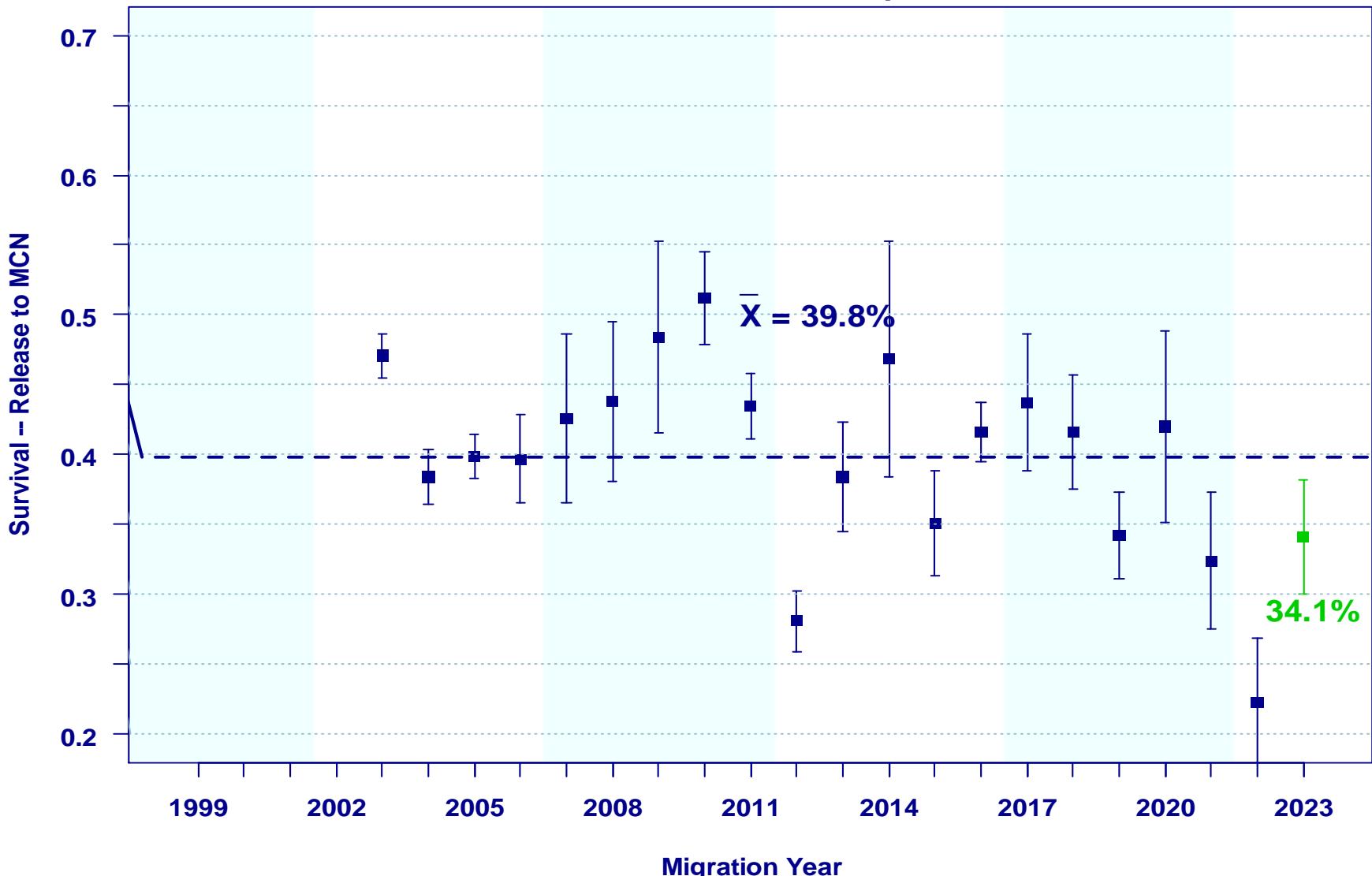
Yearling Chinook  
Snake River Basin Hatcheries  
Mean of Index Groups



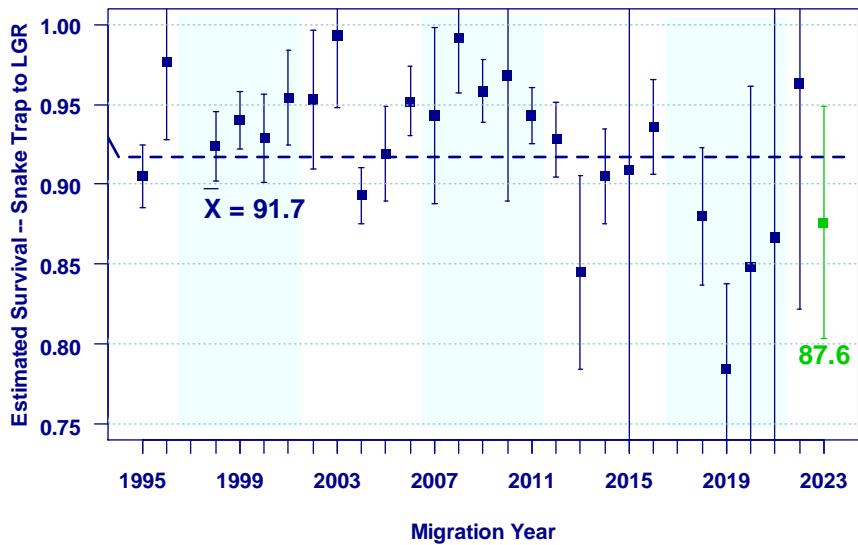
Yearling Chinook  
Upper Columbia River Hatcheries  
Mean of Index Groups



Steelhead  
Upper Columbia River Hatcheries  
Mean of Index Groups

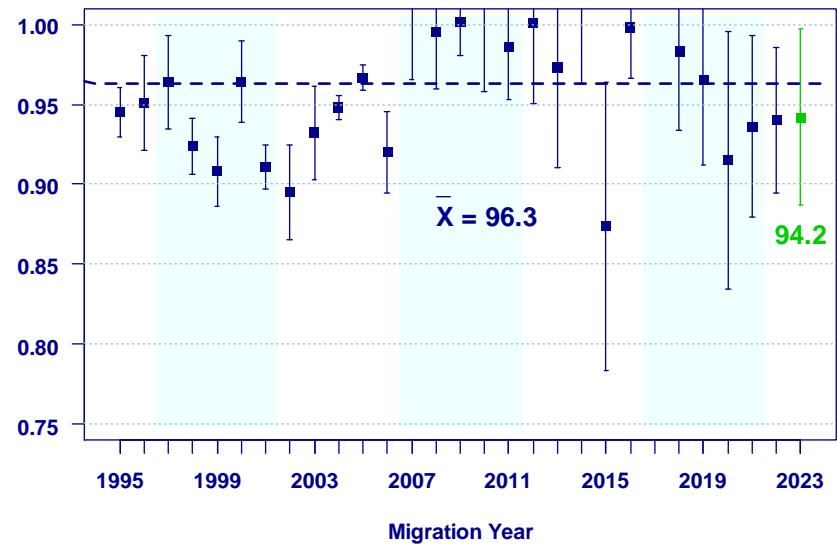


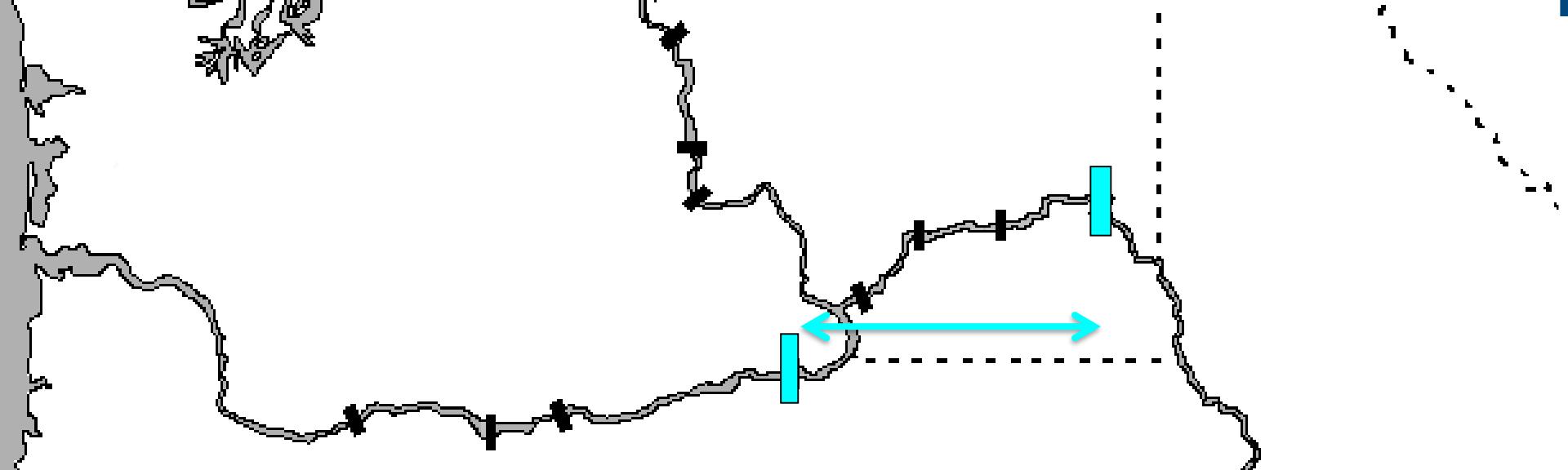
### Yearling Chinook



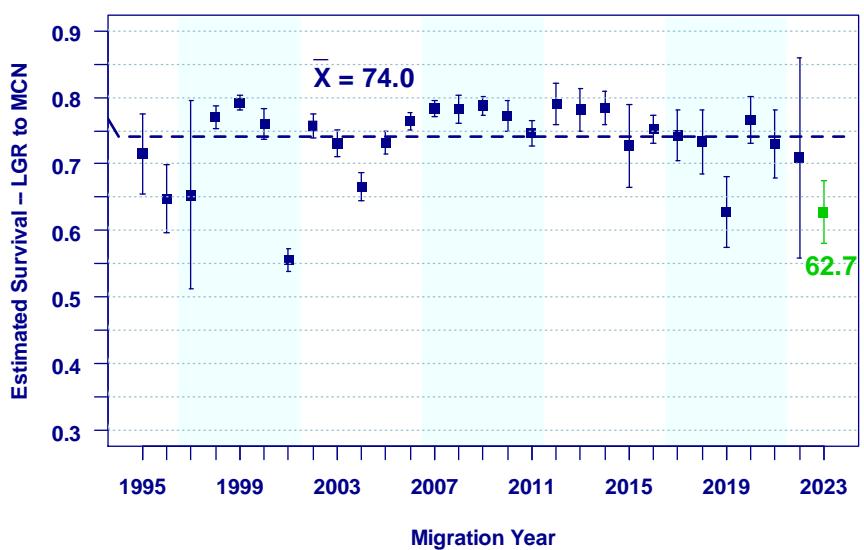
### Snake Trap to Lower Granite

### Steelhead



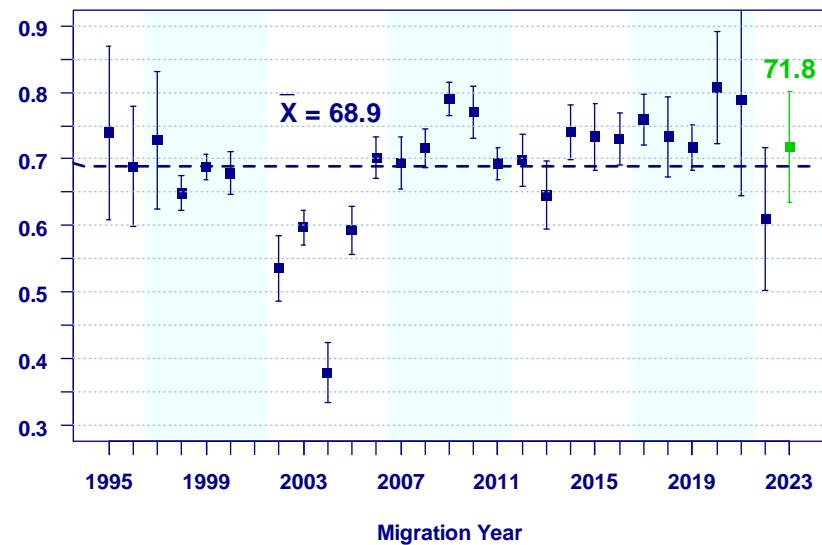


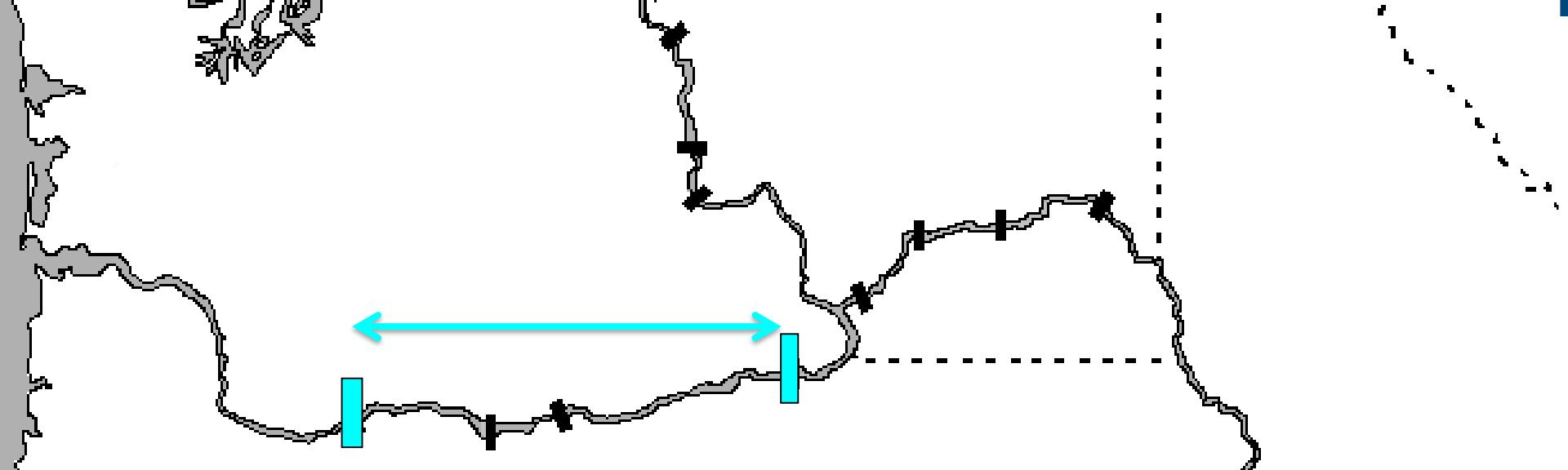
Yearling Chinook



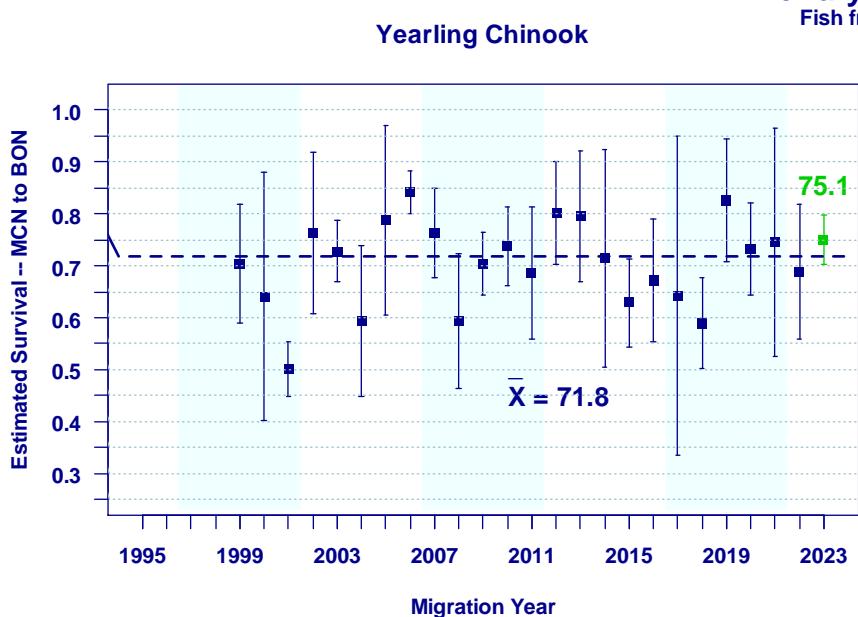
Lower Granite to McNary

Steelhead

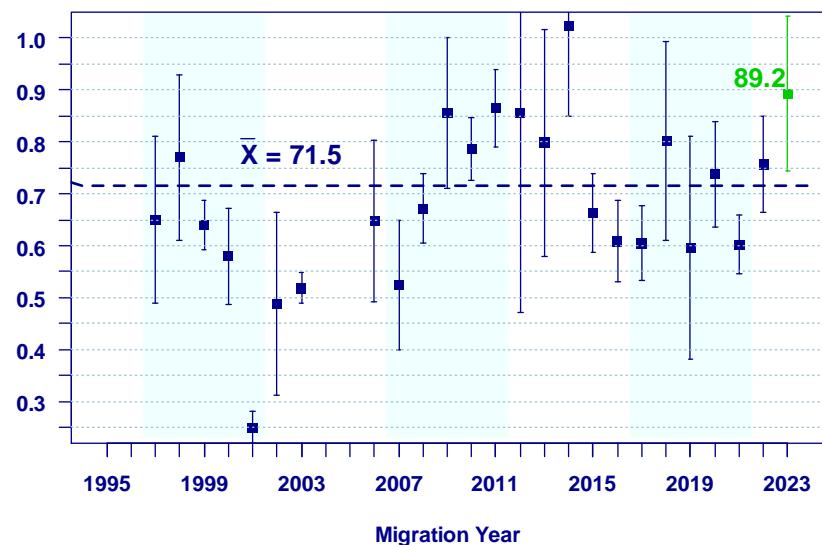


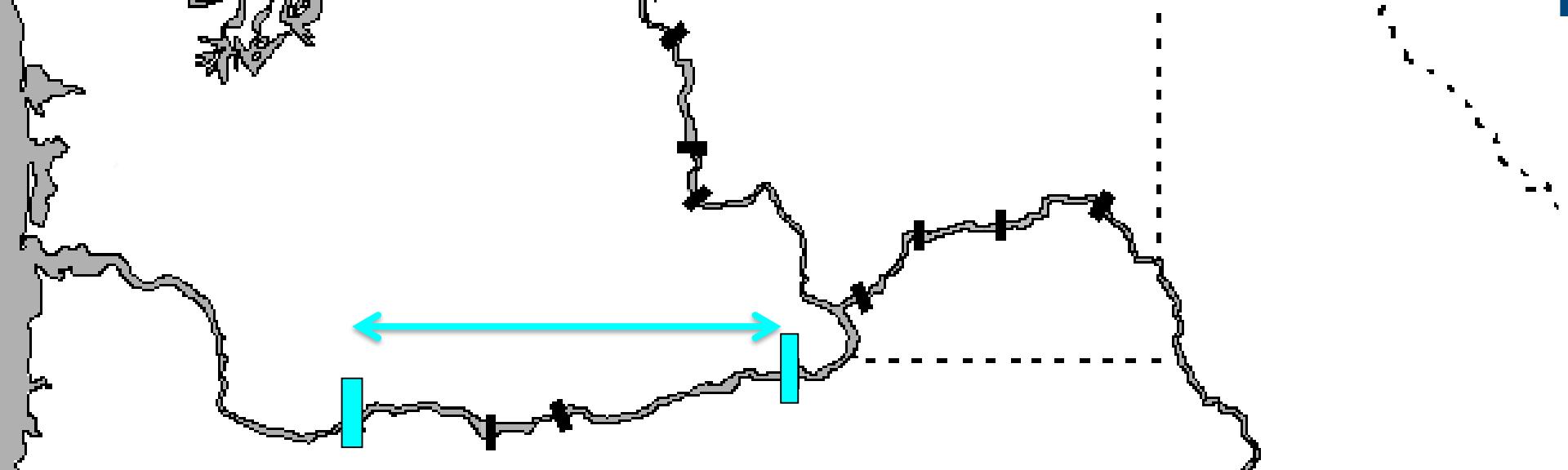


Yearling Chinook

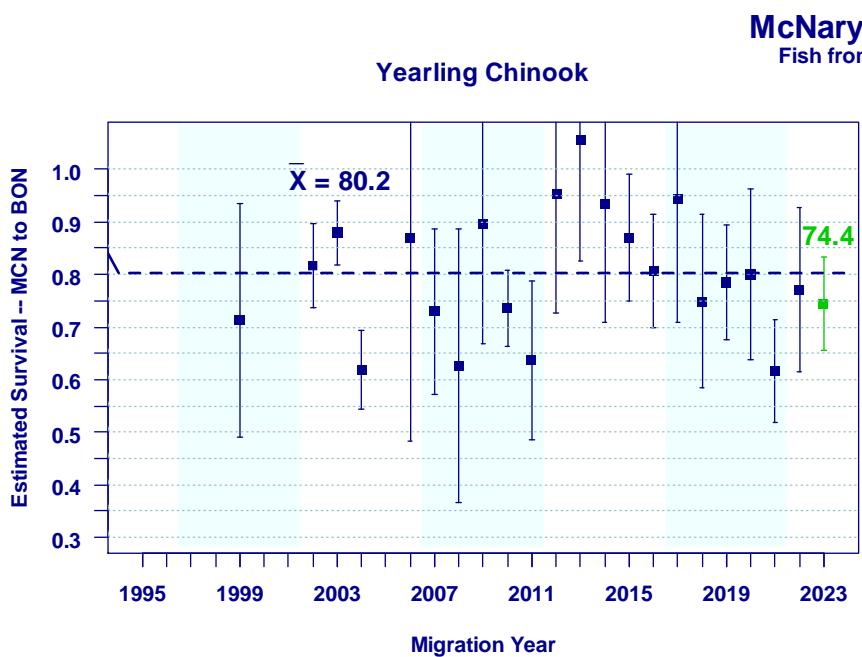


Steelhead

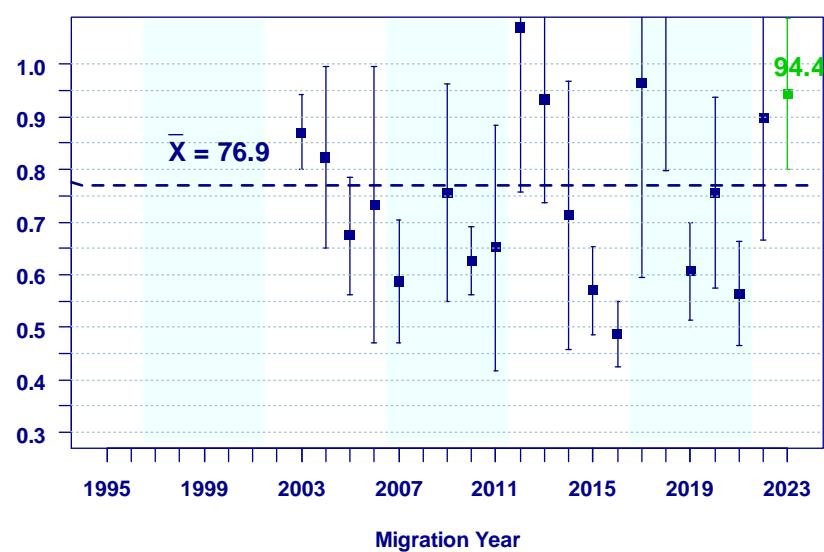


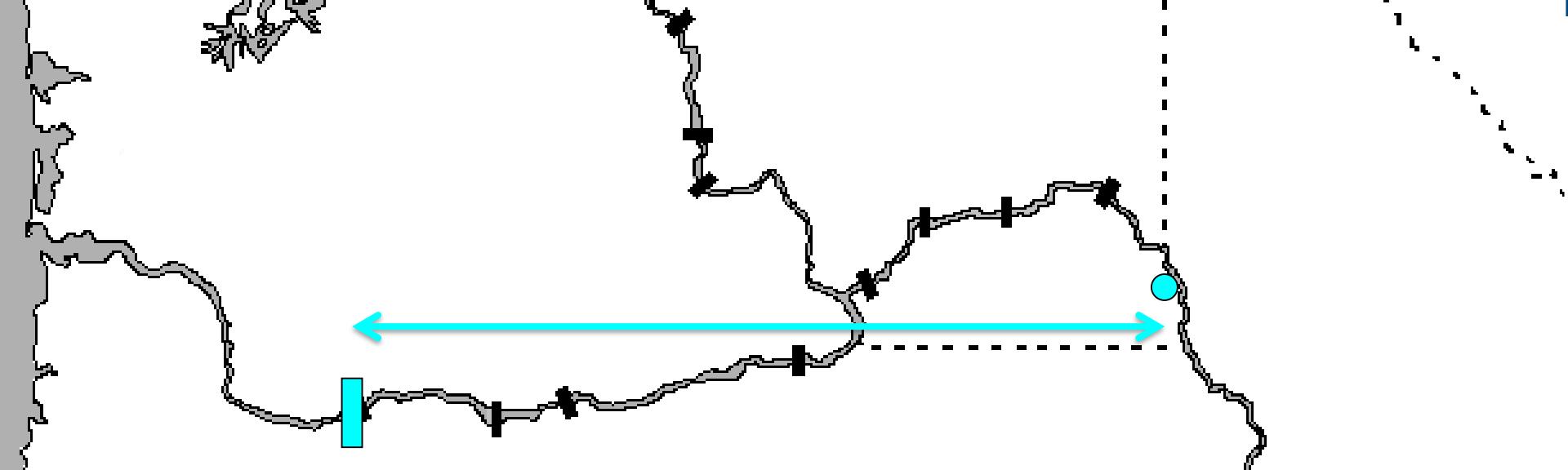


Yearling Chinook

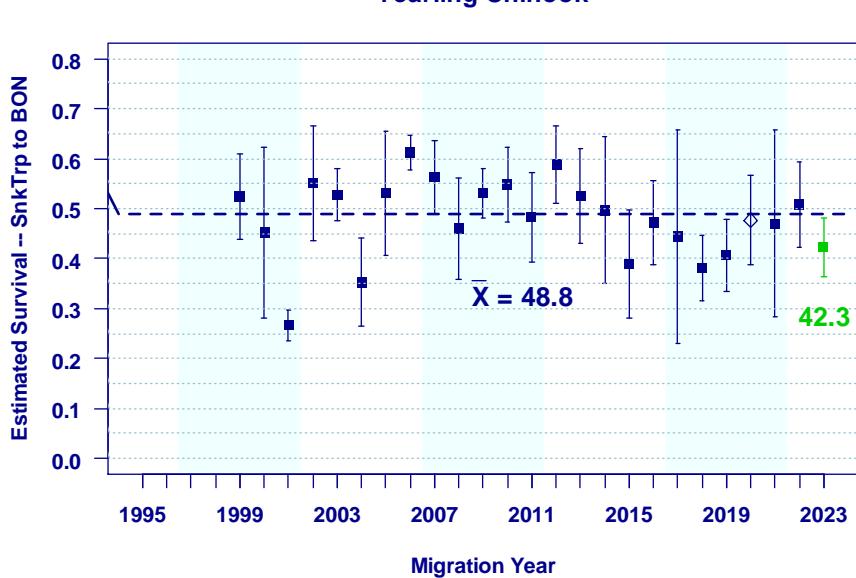


Steelhead



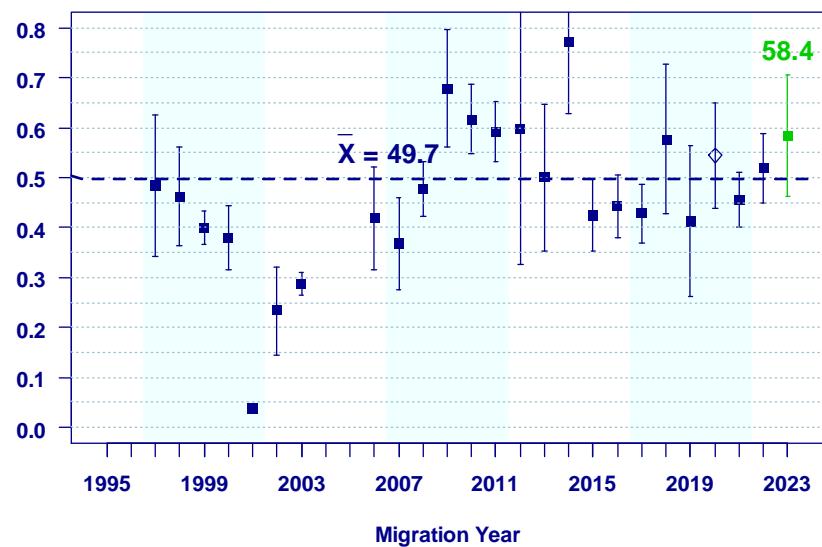


Yearling Chinook



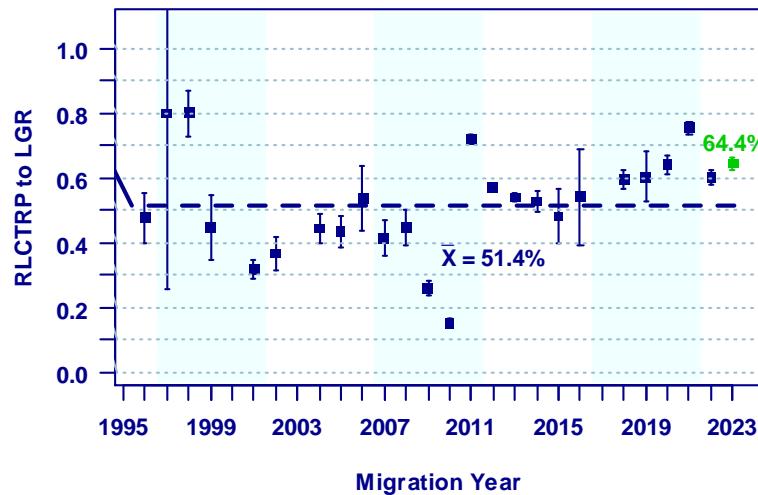
Snake River Trap to Bonneville

Steelhead

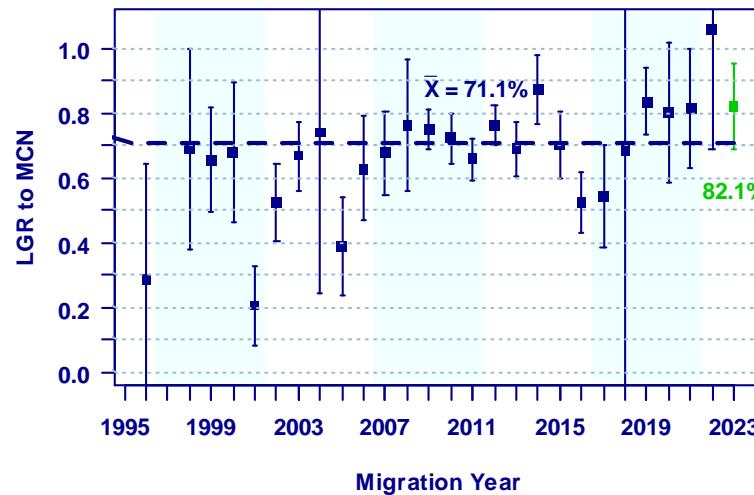


# Snake River Sockeye: Estimated Survival

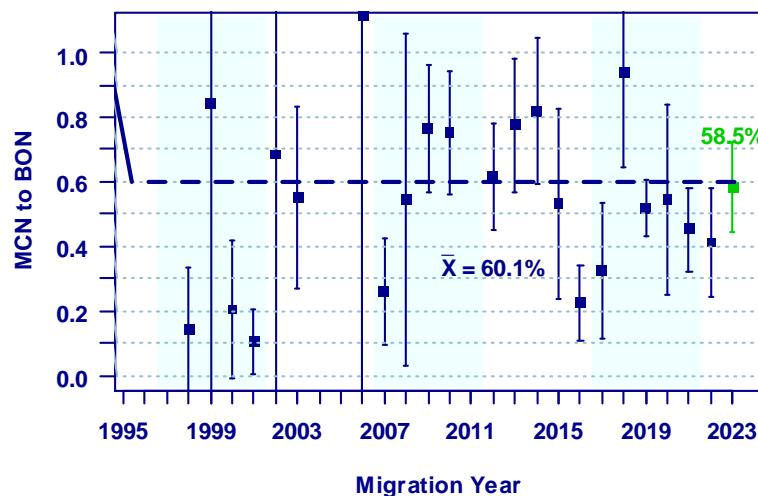
Redfish Lake Trap to Lower Granite



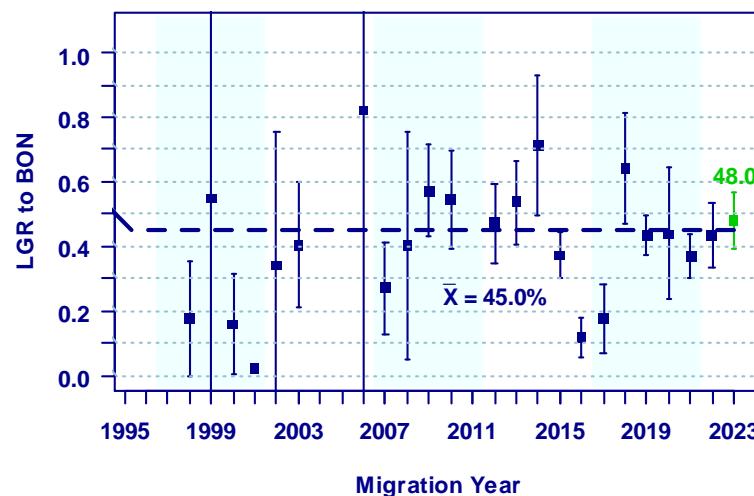
Lower Granite to McNary



McNary to Bonneville



Lower Granite to Bonneville

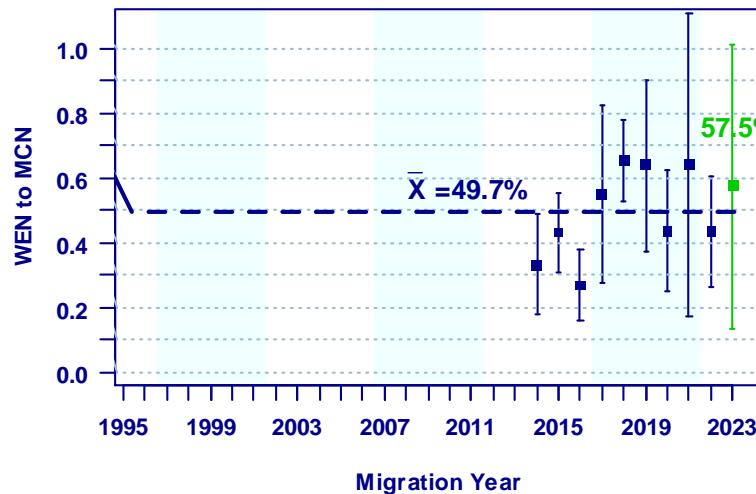


NOAA FISHERIES

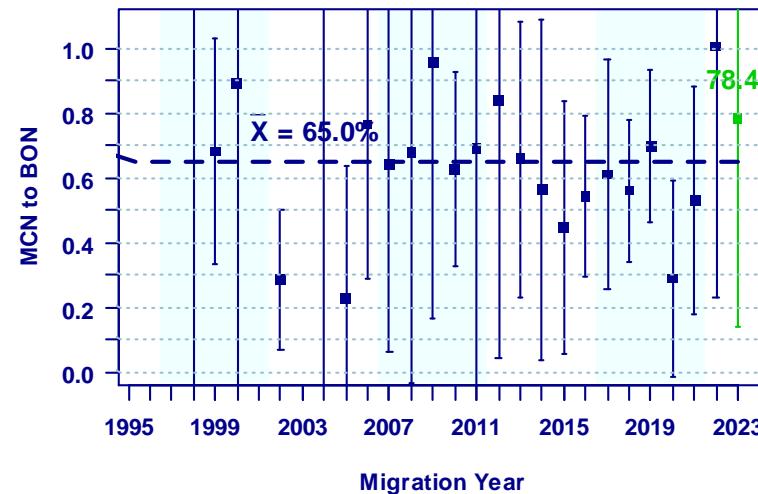
U.S. Department of Commerce | National Oceanic and Atmospheric Administration | NOAA Fisheries | Northwest Fisheries Science Center

# Columbia River Sockeye: Estimated Survival

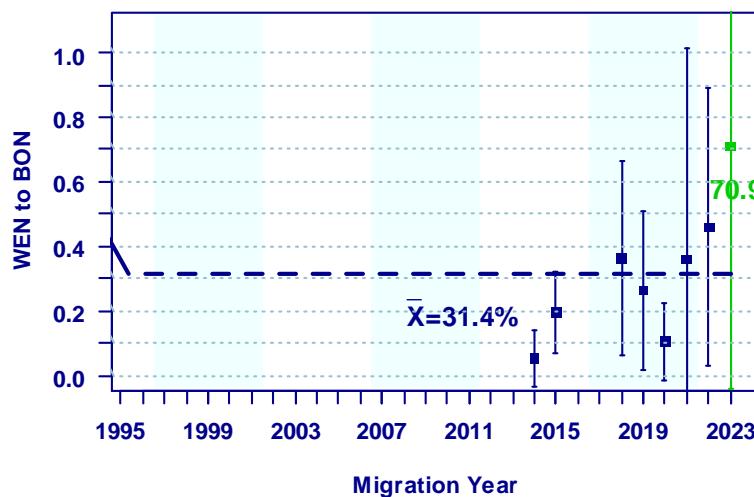
Lower Wenatchee to McNary



McNary to Bonneville

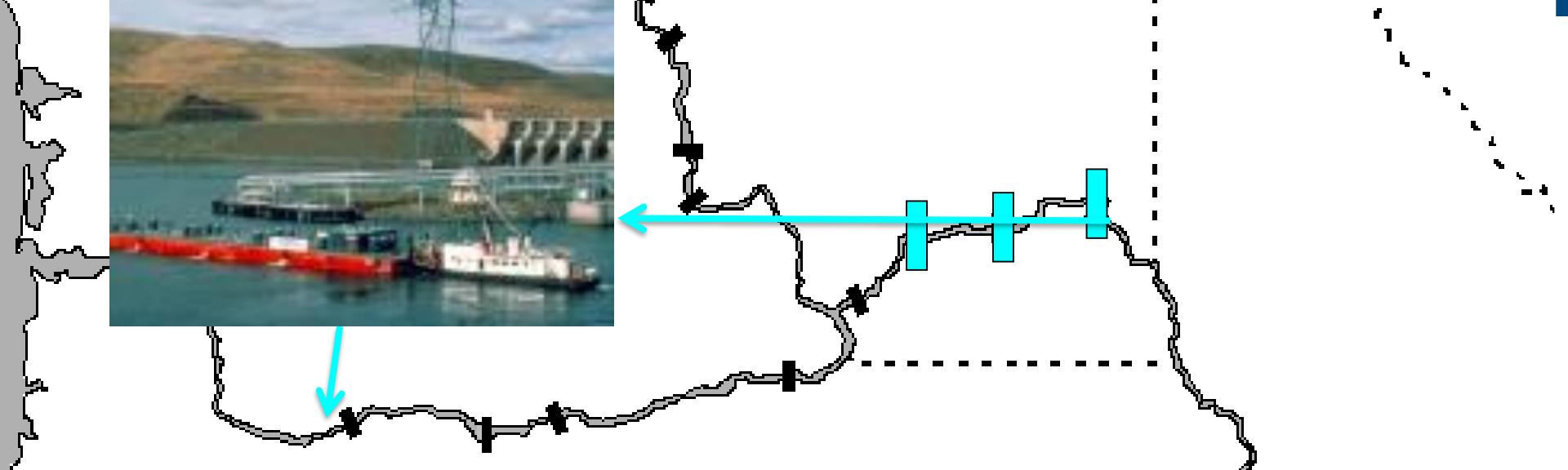


Lower Wenatchee to Bonneville



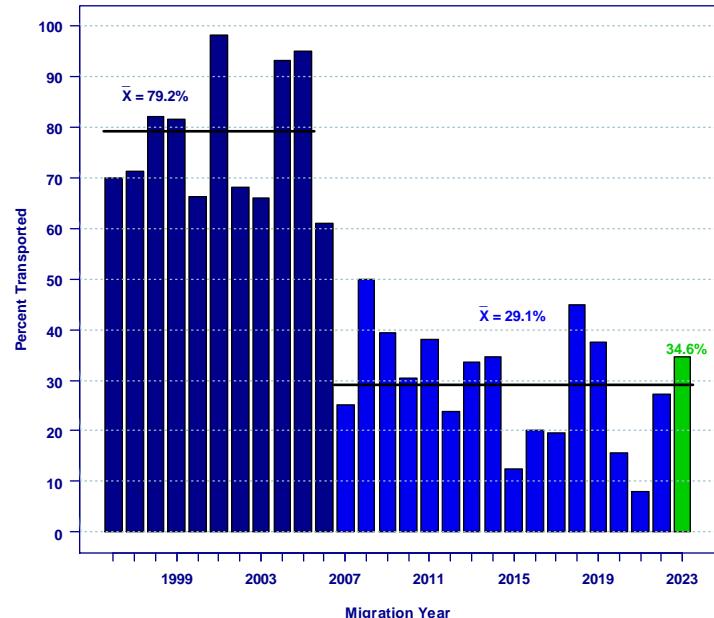
NOAA FISHERIES

U.S. Department of Commerce | National Oceanic and Atmospheric Administration | NOAA Fisheries | Northwest Fisheries Science Center

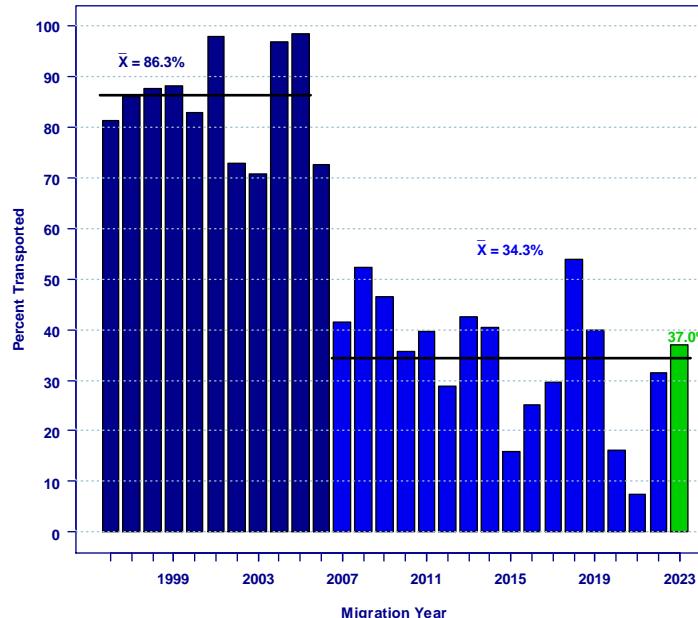


### Estimated Percent Transported

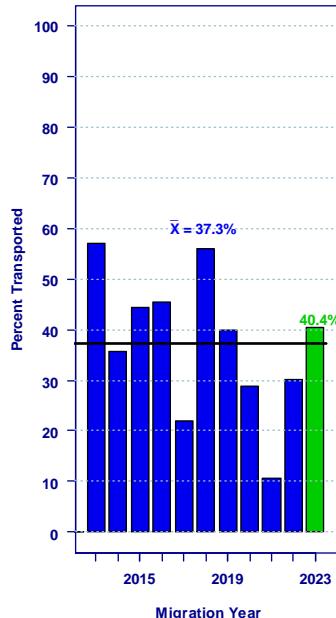
Yearling Chinook



Steelhead



Sockeye



NOAA FISHERIES

# Acknowledgments

- Bonneville Power Administration
- PTAGIS – Pacific States Marine Fisheries Commission
- Avian Predation Detection Project
  - Real Time Research -- Astoria-Megler Bridge etc.
  - Corps of Engineers Fish Field Units – East Sand Island
- DART – University of Washington Columbia Basin Research
- NOAA Colleagues: Jim Faulkner, Dan Widener, Tiffani Marsh
- Legions of Taggers, Coordinators, Agencies, etc.

# Smolt Transportation

## Yearling Chinook & Steelhead Data from Migration Years 2018-2021

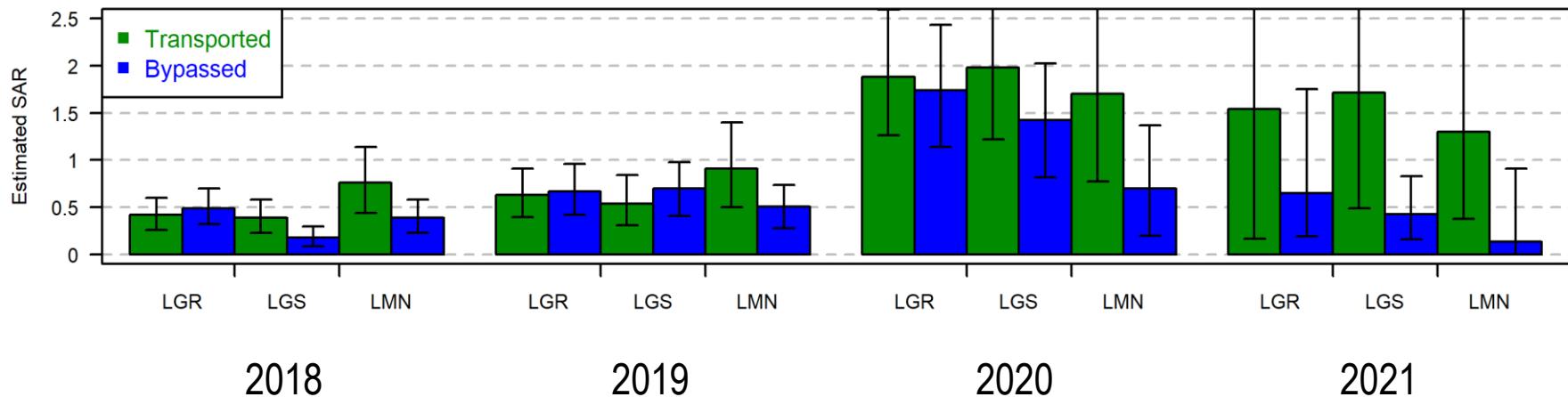
- Updated with adult returns through Dec 31, 2023
- Added smolt migration year 2021
- Spillway-passed fish at LGR, 2020-2021

# Terminology – Groups of Fish

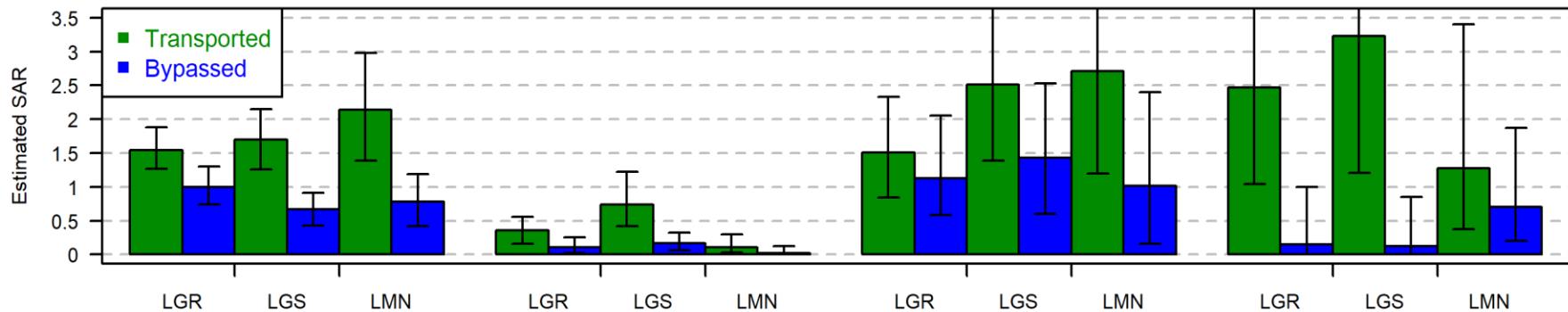
- “Transported” – Entered gatewell, guided into Juvenile Fish Facility, collected in raceway, loaded into barge, transported in barge to below Bonneville Dam
- “Bypassed” – Entered gatewell, guided into Juvenile Fish Facility, directed to tailrace
- “Spilled” – Passed LGR via spillway

# Annual Estimated SARs – Transport Period

## Wild Yearling Chinook

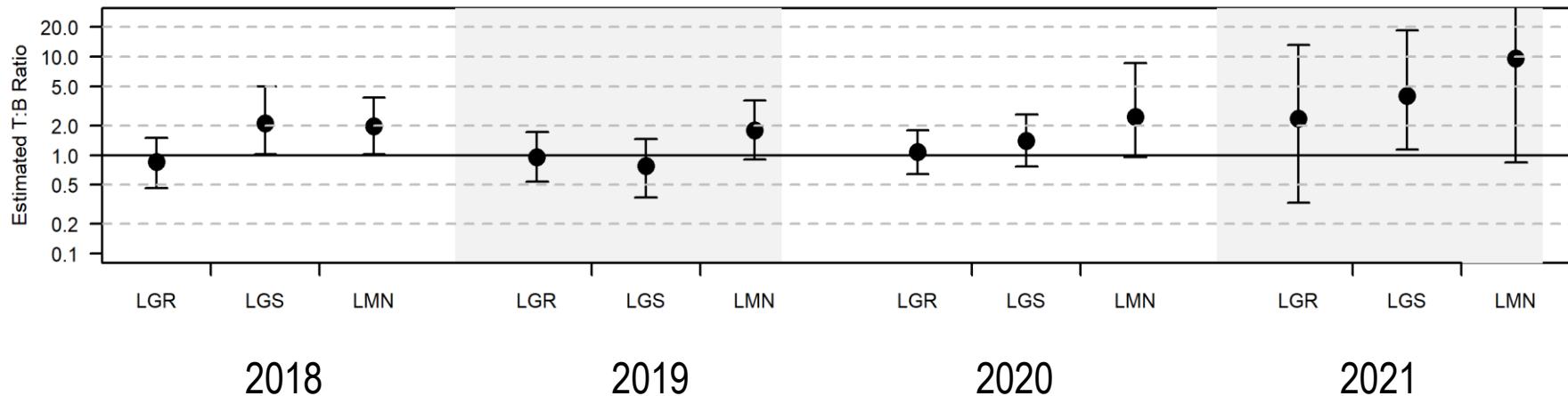


## Wild Steelhead

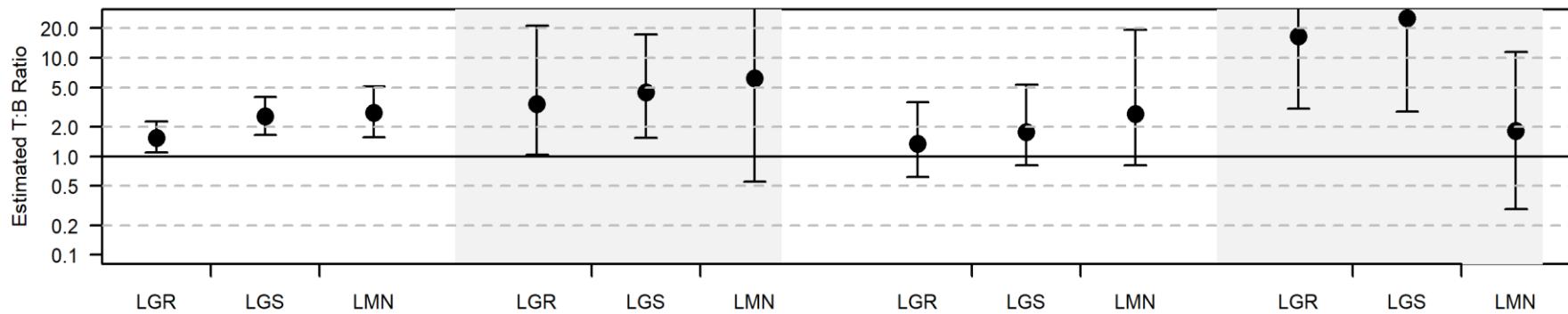


# Annual Estimated T:B – Transport Period

## Wild Yearling Chinook - T:B



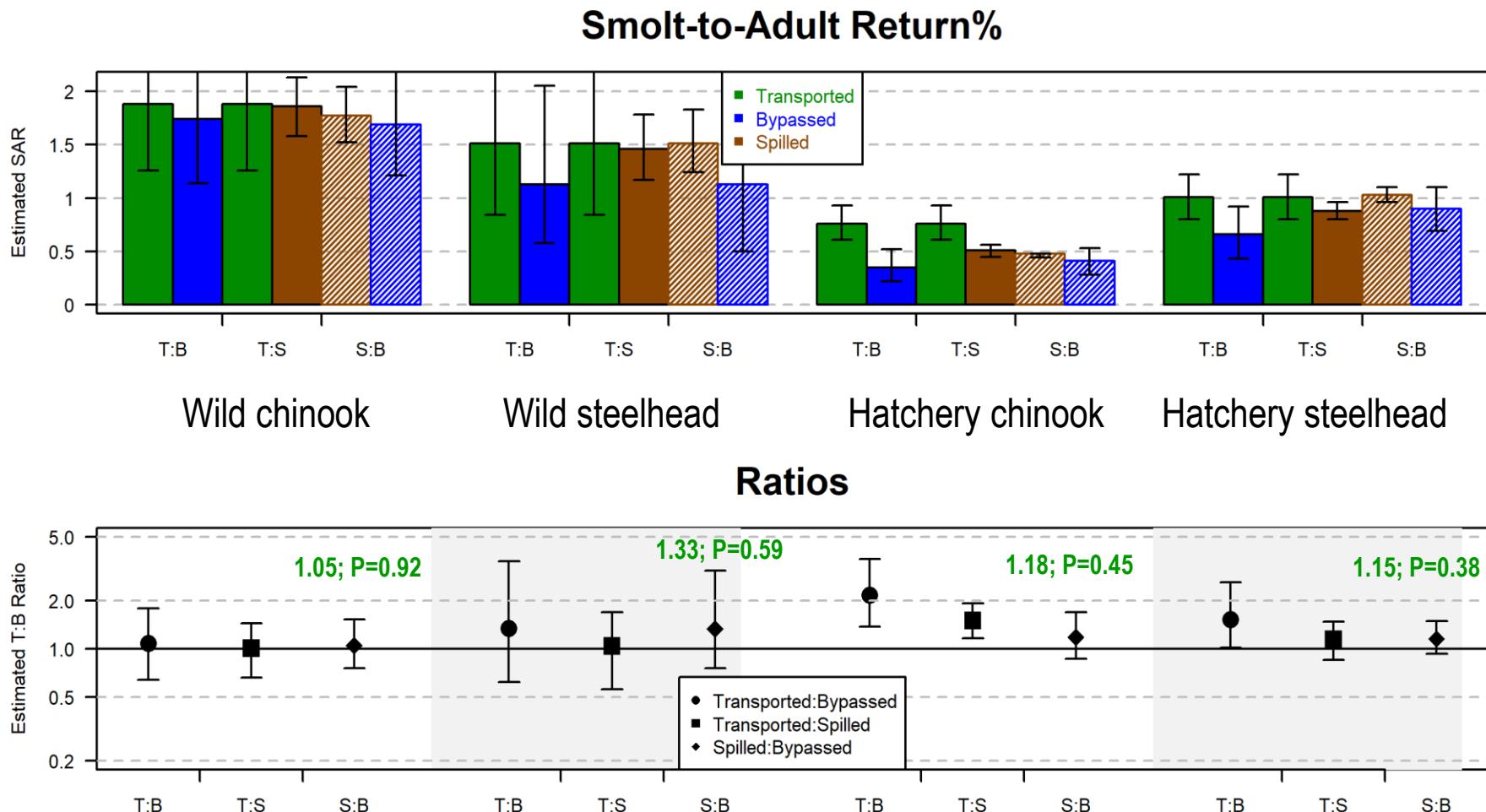
## Wild Steelhead - T:B



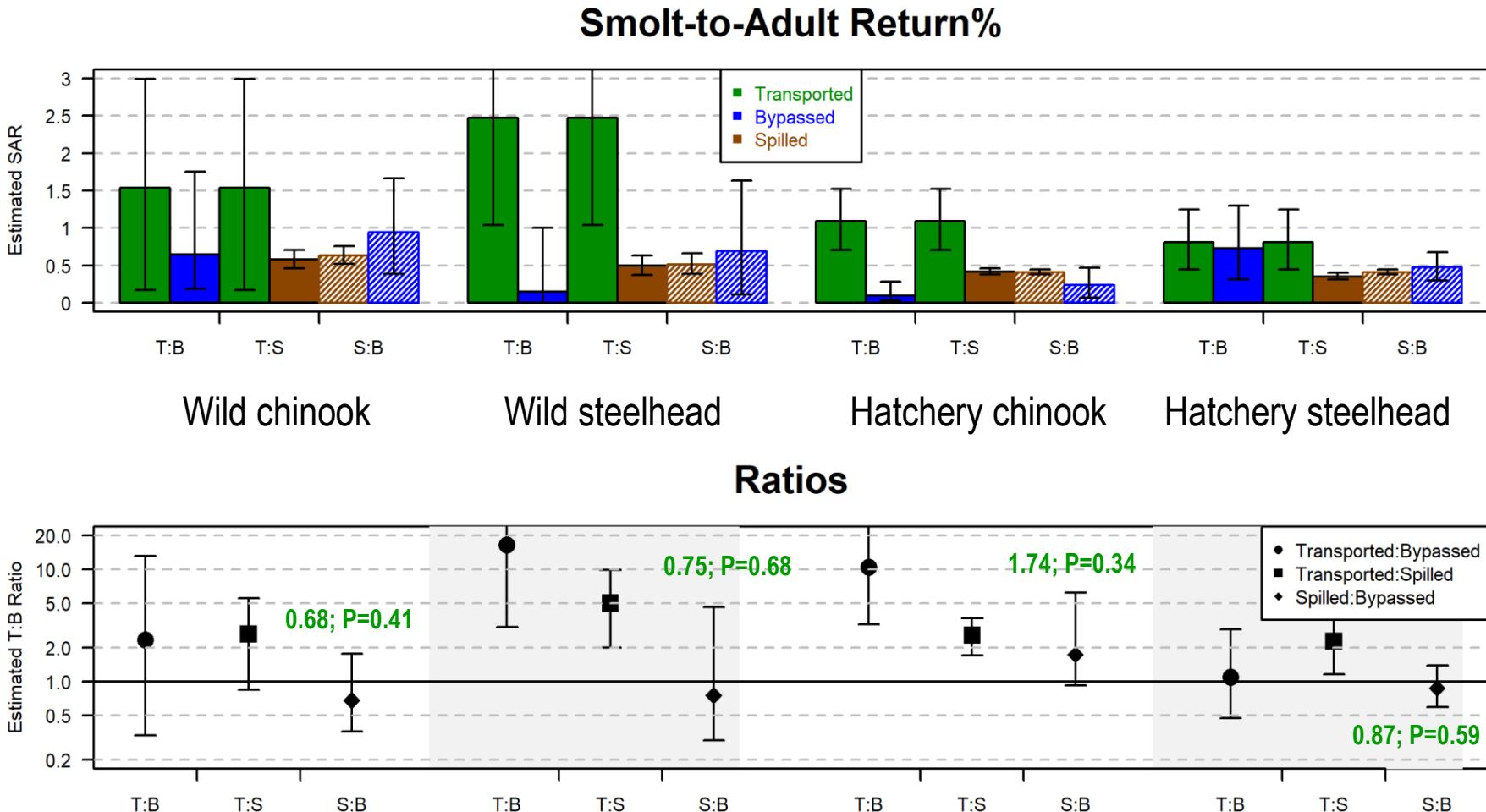
NOAA FISHERIES

U.S. Department of Commerce | National Oceanic and Atmospheric Administration | NOAA Fisheries | Northwest Fisheries Science Center

# Spillway Passage – Migration Year 2020



# Spillway Passage – Migration Year 2021



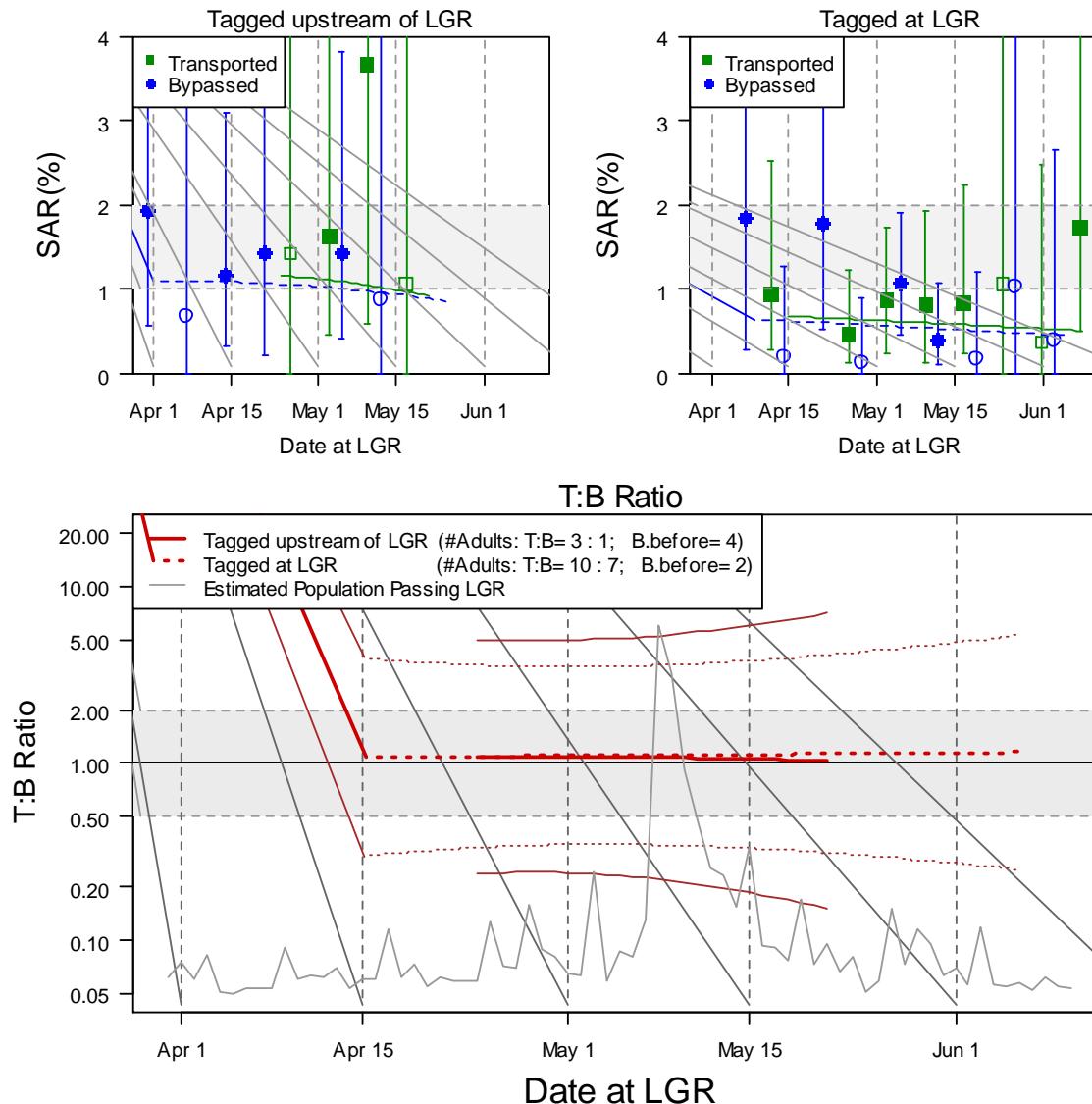
# Small T:B Sample Sizes In 2021!

<b>LOWER GRANITE</b>	<b>Transported</b>		<b>Bypassed</b>	
	<b>Juv</b>	<b>Adult</b>	<b>Juv</b>	<b>Adult</b>
<b>Wild Chinook</b>	<b>206</b>	<b>3</b>	<b>181</b>	<b>1</b>
<b>Wild Steelhead</b>	<b>209</b>	<b>5</b>	<b>231</b>	<b>0</b>
<b>LITTLE GOOSE</b>	<b>Transported</b>		<b>Bypassed</b>	
	<b>Juv</b>	<b>Adult</b>	<b>Juv</b>	<b>Adult</b>
<b>Wild Chinook</b>	<b>243</b>	<b>4</b>	<b>741</b>	<b>3</b>
<b>Wild Steelhead</b>	<b>98</b>	<b>3</b>	<b>271</b>	<b>0</b>
<b>LITTLE GOOSE</b>	<b>Transported</b>		<b>Bypassed</b>	
	<b>Juv</b>	<b>Adult</b>	<b>Juv</b>	<b>Adult</b>
<b>Wild Chinook</b>	<b>91</b>	<b>1</b>	<b>254</b>	<b>0</b>
<b>Wild Steelhead</b>	<b>93</b>	<b>1</b>	<b>169</b>	<b>1</b>

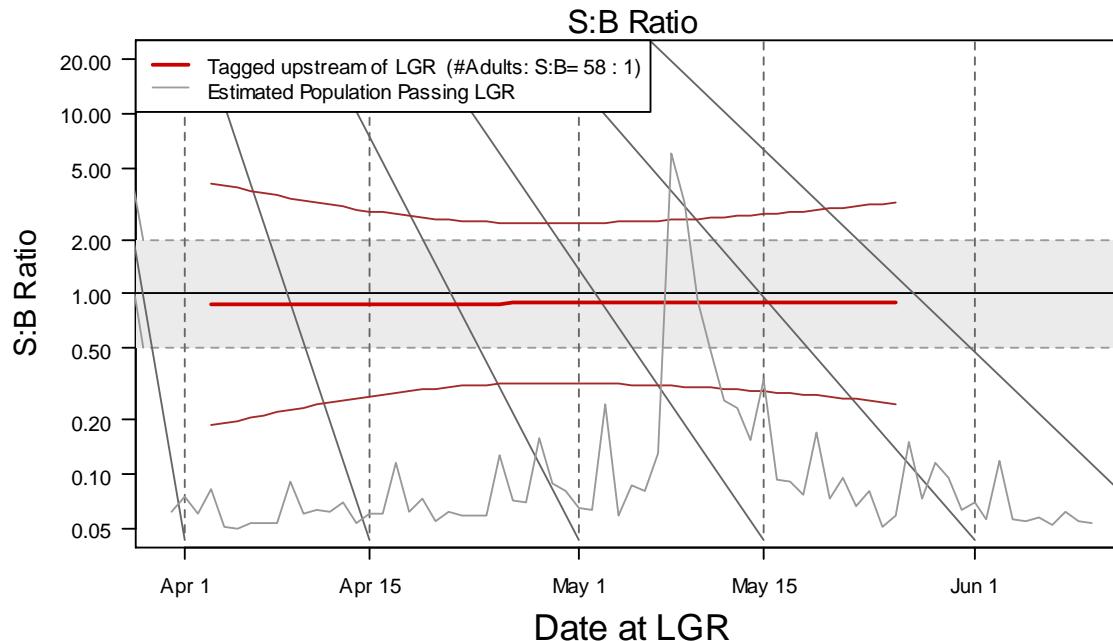
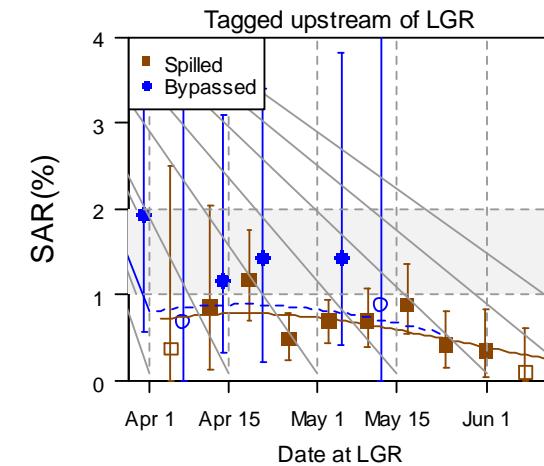
# Some Seasonal Stuff for MY 2021

# Wild Chinook 2021

## Transported or Bypassed at Lower Granite Dam

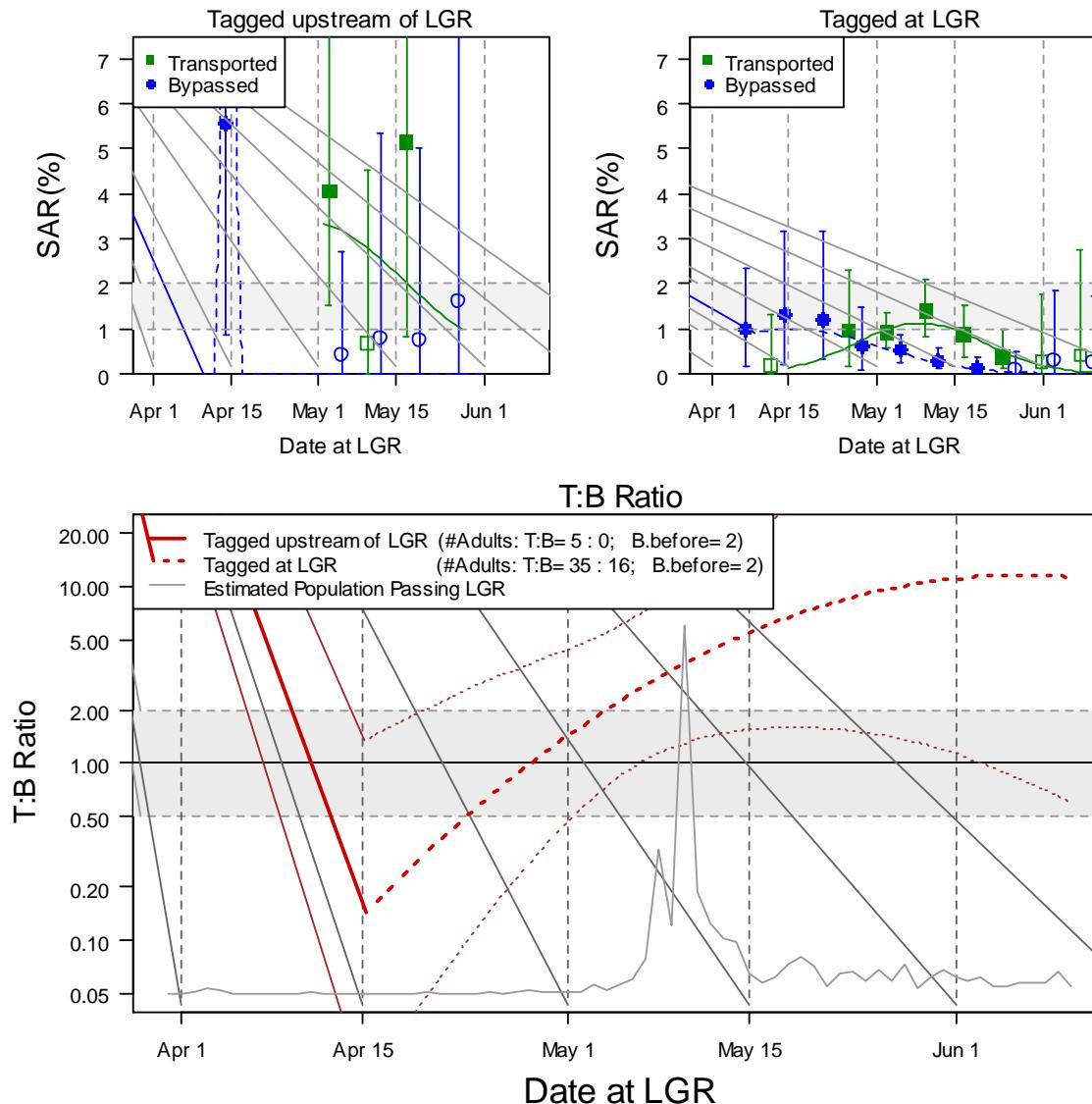


Wild Chinook 2021  
Spilled or Bypassed at Lower Granite Dam



# Wild Steelhead 2021

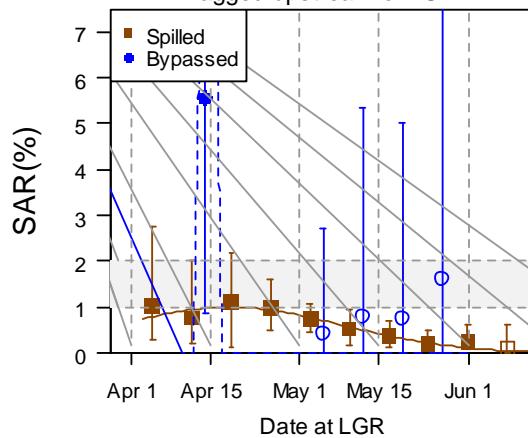
## Transported or Bypassed at Lower Granite Dam



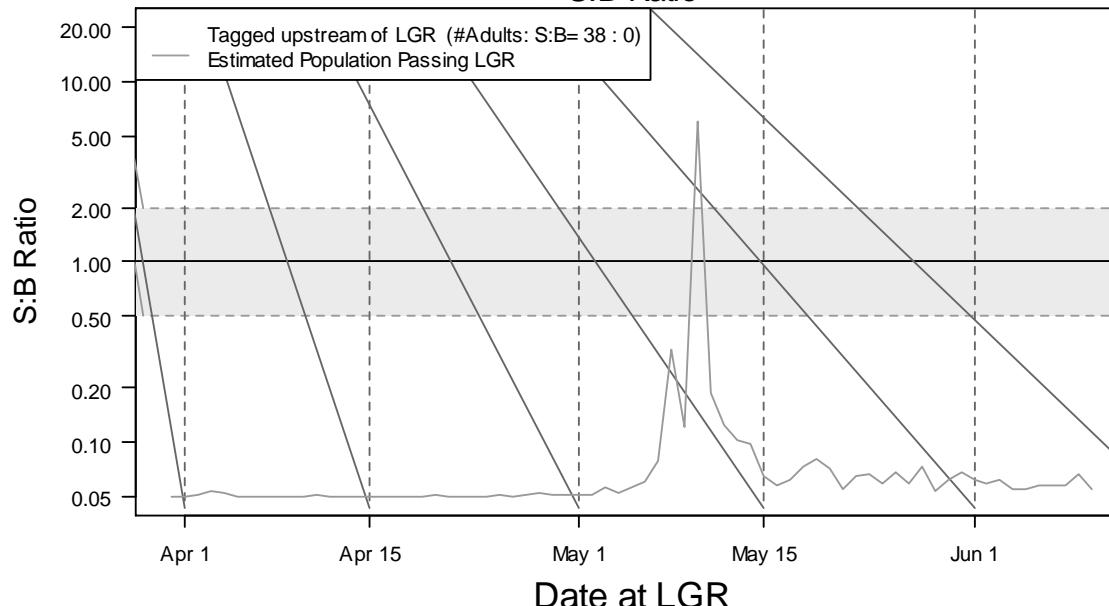
## Wild Steelhead 2021

### Spilled or Bypassed at Lower Granite Dam

Tagged upstream of LGR



S:B Ratio

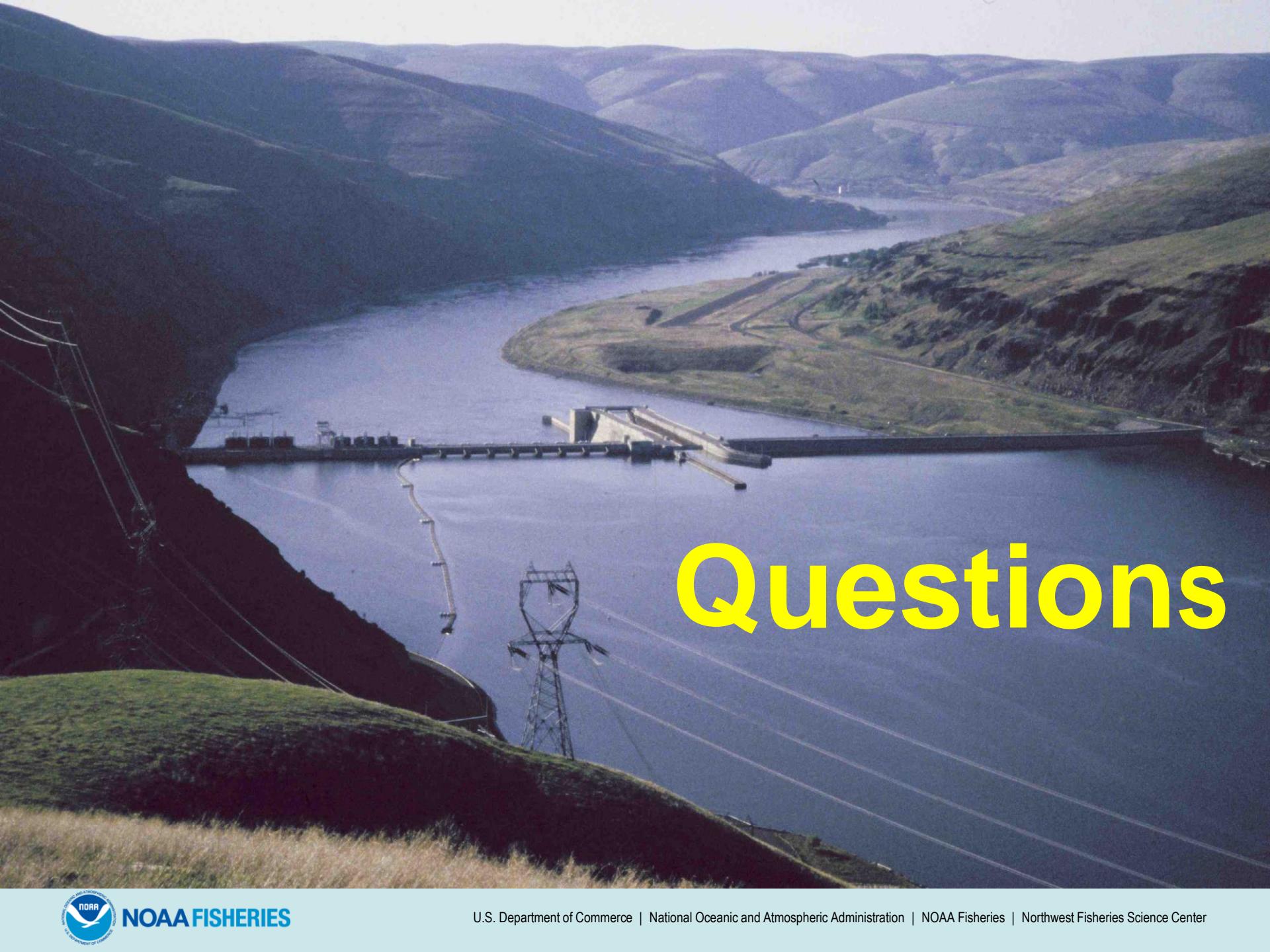


# Summary: Transportation/Bypass/Spillway

- Large amounts of spill hamper sample sizes of previously tagged fish, esp. in low flows
  - Sample sizes of fish collected and tagged at Lower Granite less affected
- Transported SARs higher than bypassed and spilled, esp. for MY 2021
- SARs higher for “spilled” fish than bypassed in MY 20, but not MY21
  - Data from only two migration years, one of which was low-flow

# Acknowledgments

- U.S. Army Corps of Engineers
- PTAGIS – Pacific States Marine Fisheries Commission
- Legions of Taggers, Coordinators, Agencies, etc.
- Tiffani Marsh, NOAA NWFSC, ret.



# Questions



**NOAA FISHERIES**

U.S. Department of Commerce | National Oceanic and Atmospheric Administration | NOAA Fisheries | Northwest Fisheries Science Center