

**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

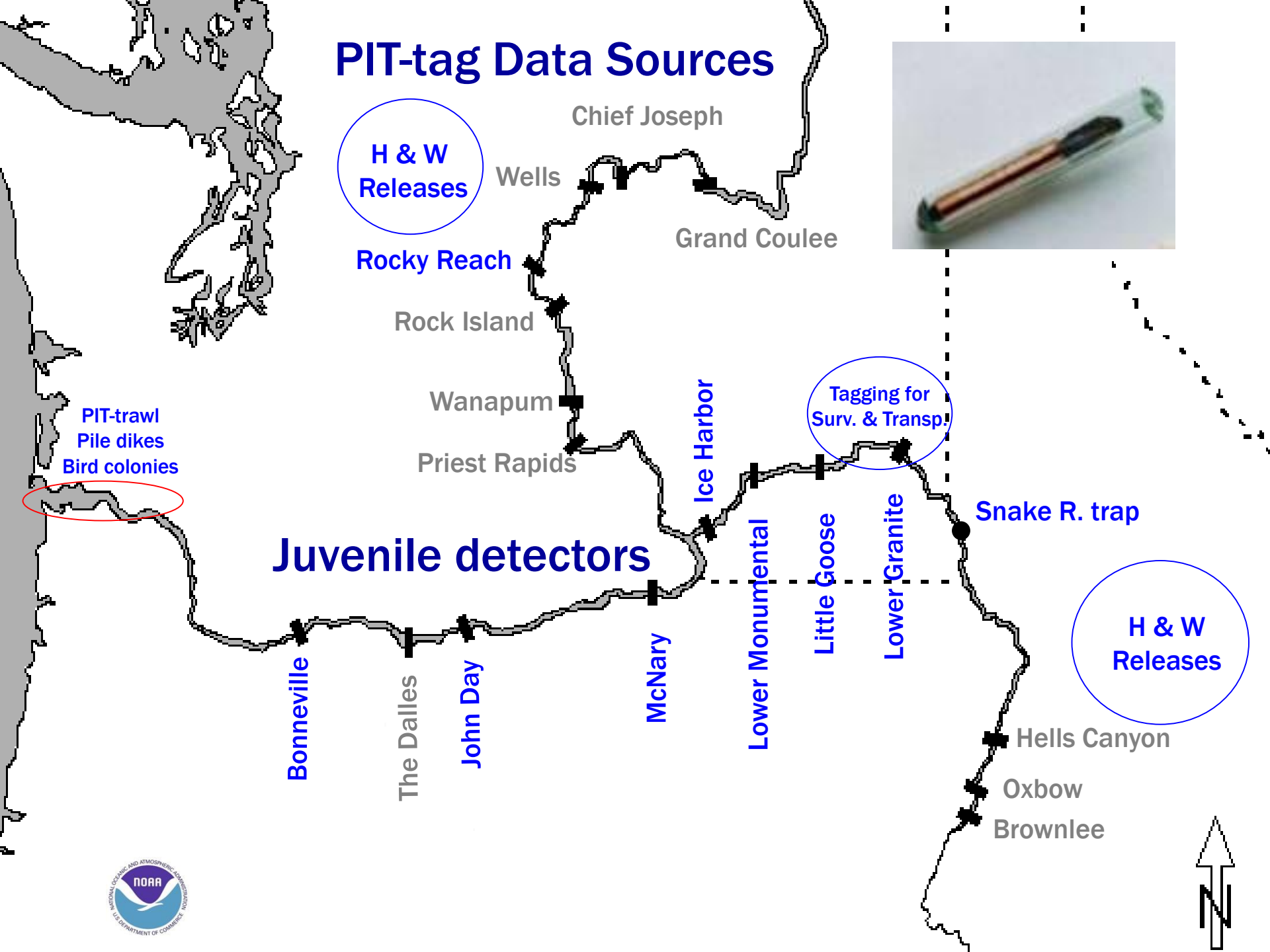
January 22, 2024

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

# Smolt Survival

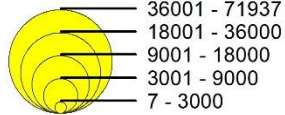
- Migration conditions, travel time and survival of PIT-tagged smolts through the hydropower system in 2023
  - Preliminary Results Memo: October 7, 2021
  - Reanalysis with estuary avian recoveries is in progress  
(today: all but sockeye include “bird data” – still considered preliminary)
  - Only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

# PIT-tag Data Sources



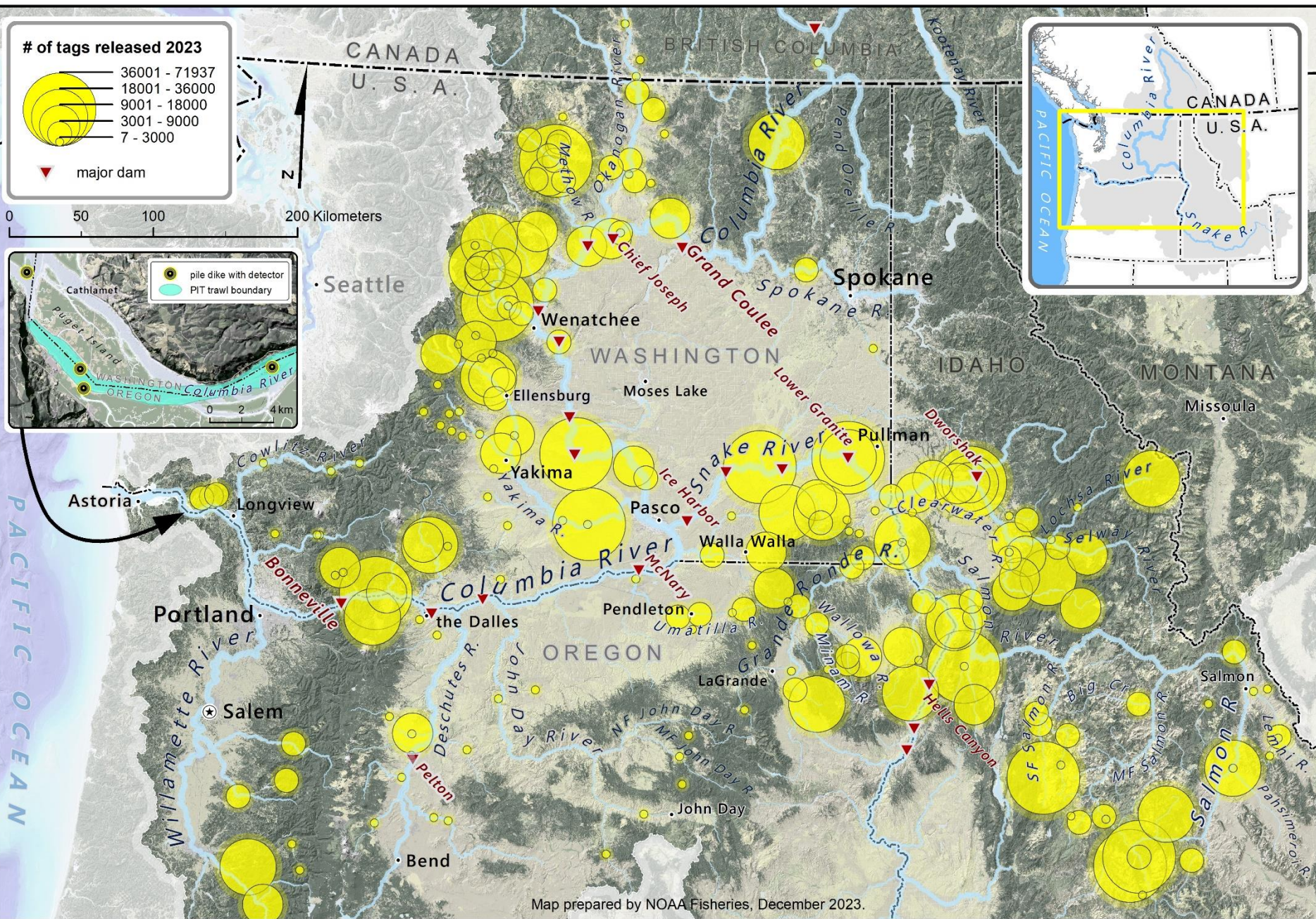
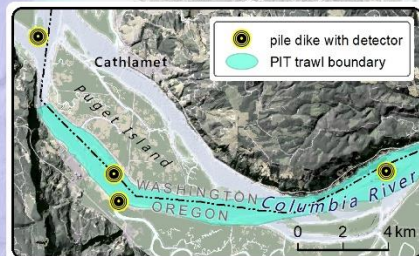


# # of tags released 2023



major dam

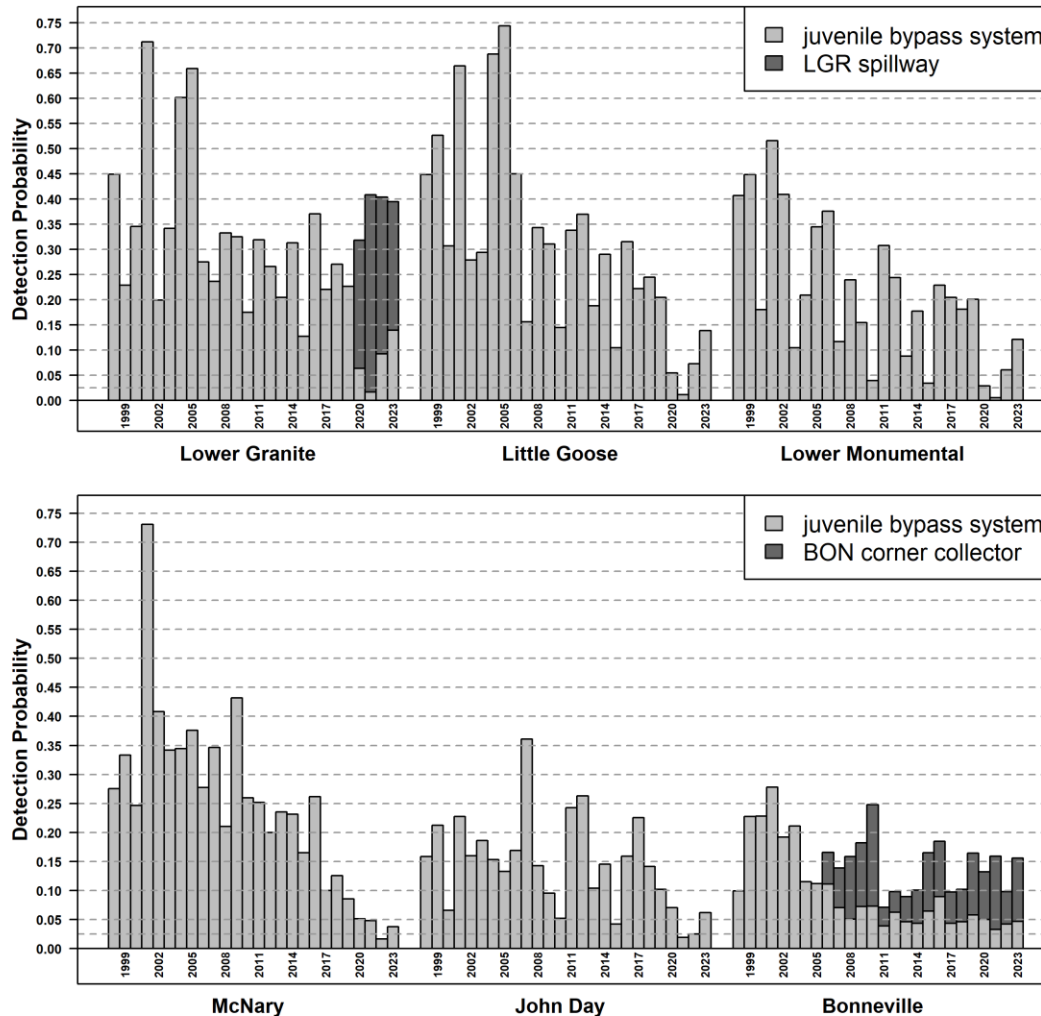
0 50 100 200 Kilometers



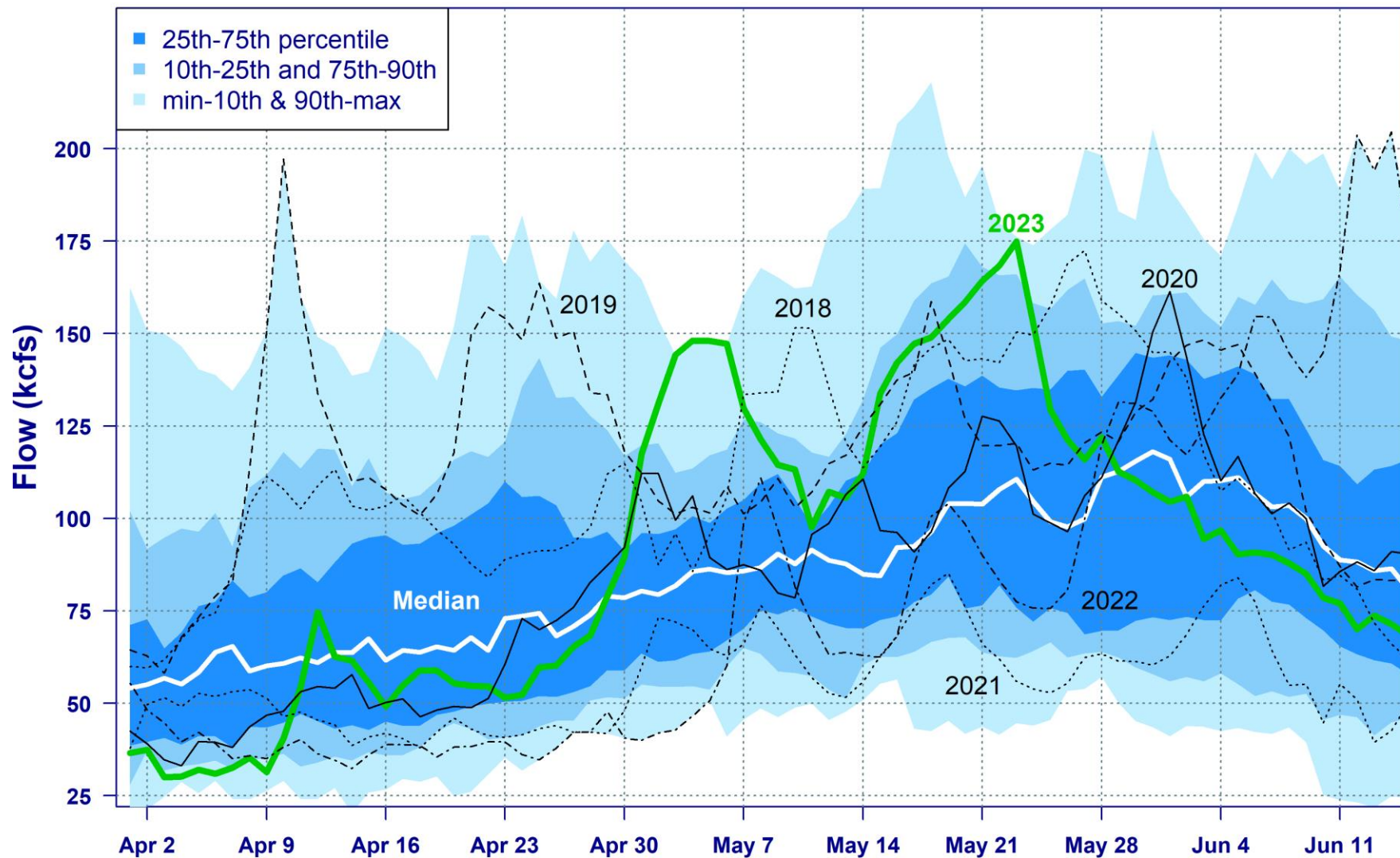
Map prepared by NOAA Fisheries, December 2023.



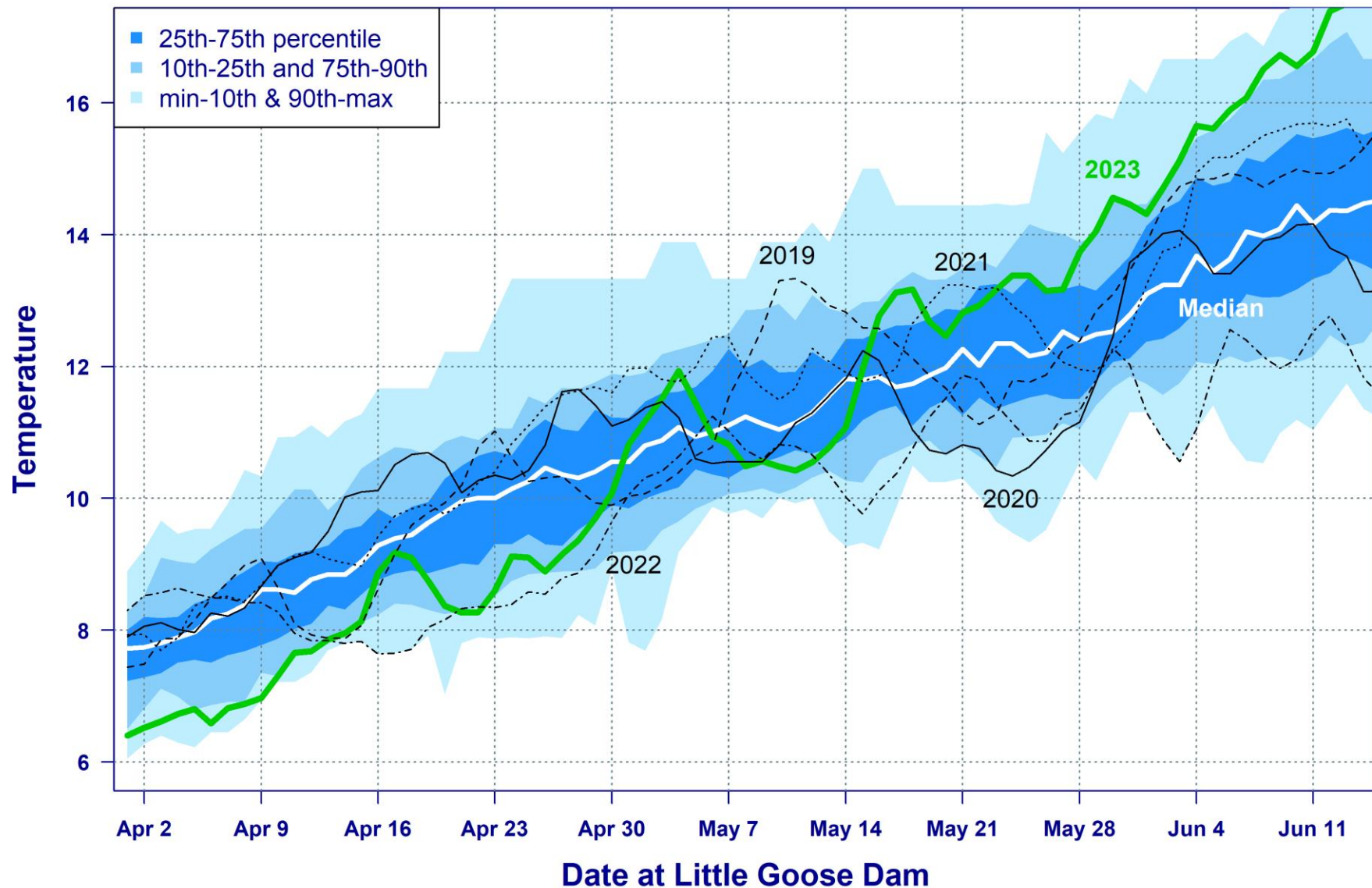
# Detection Probabilities – Yearling Chinook



## Daily Flow (kcfs) 1989-2023 Little Goose Dam

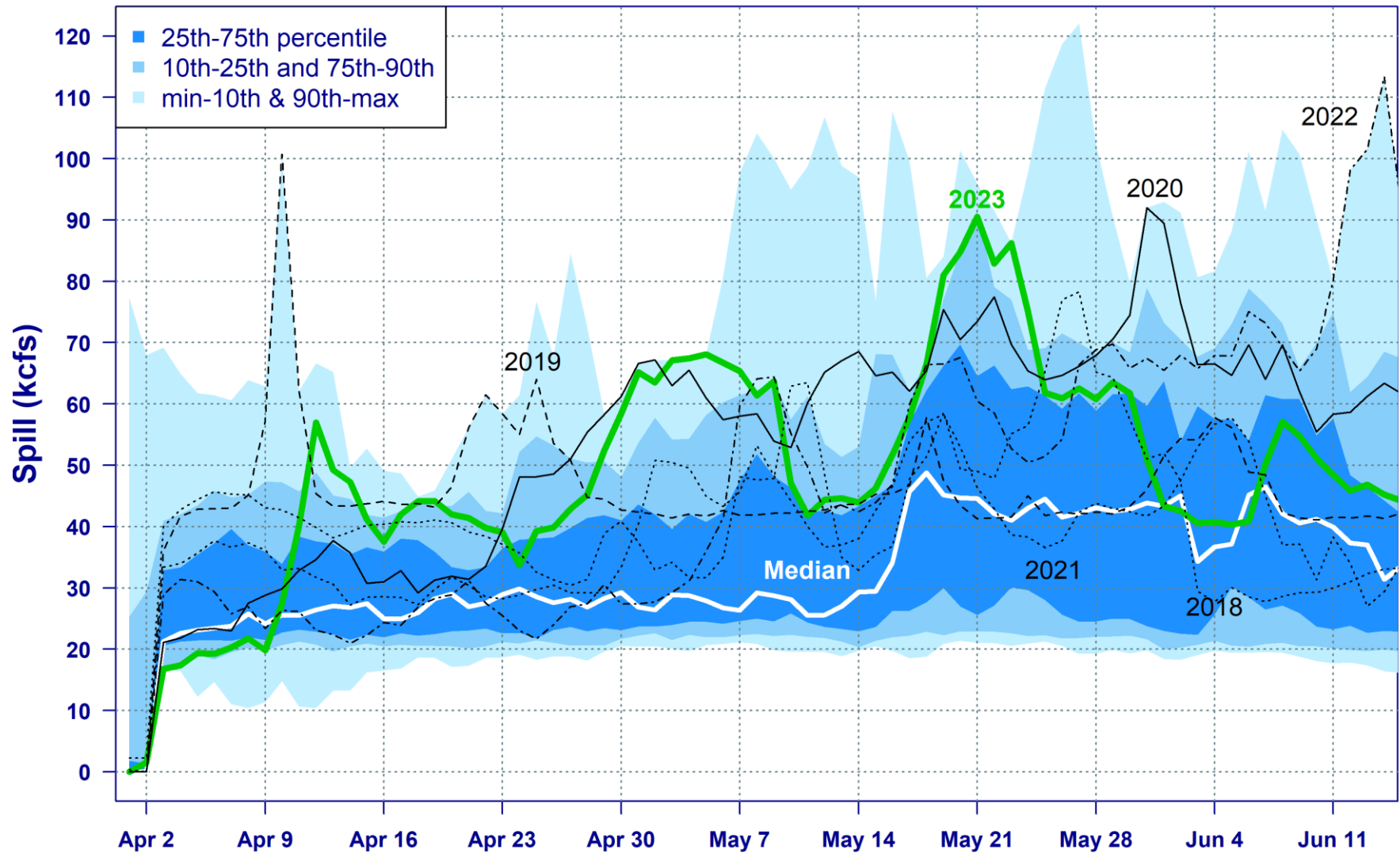


## Daily Temperature 1989-2023 Little Goose Dam



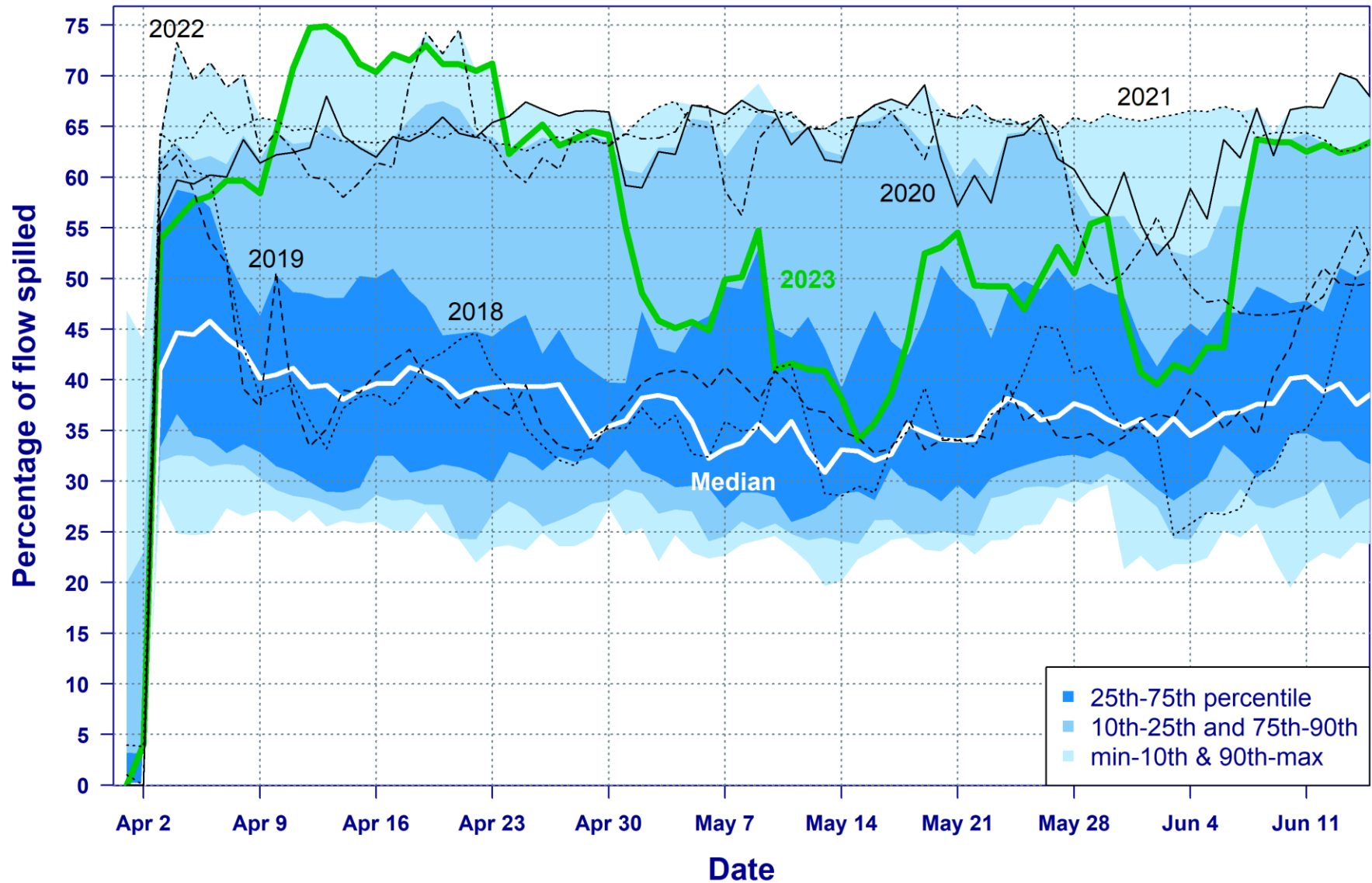
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## Daily Spill (kcfs) 2006-2023 Mean LGR, LGS, LMN

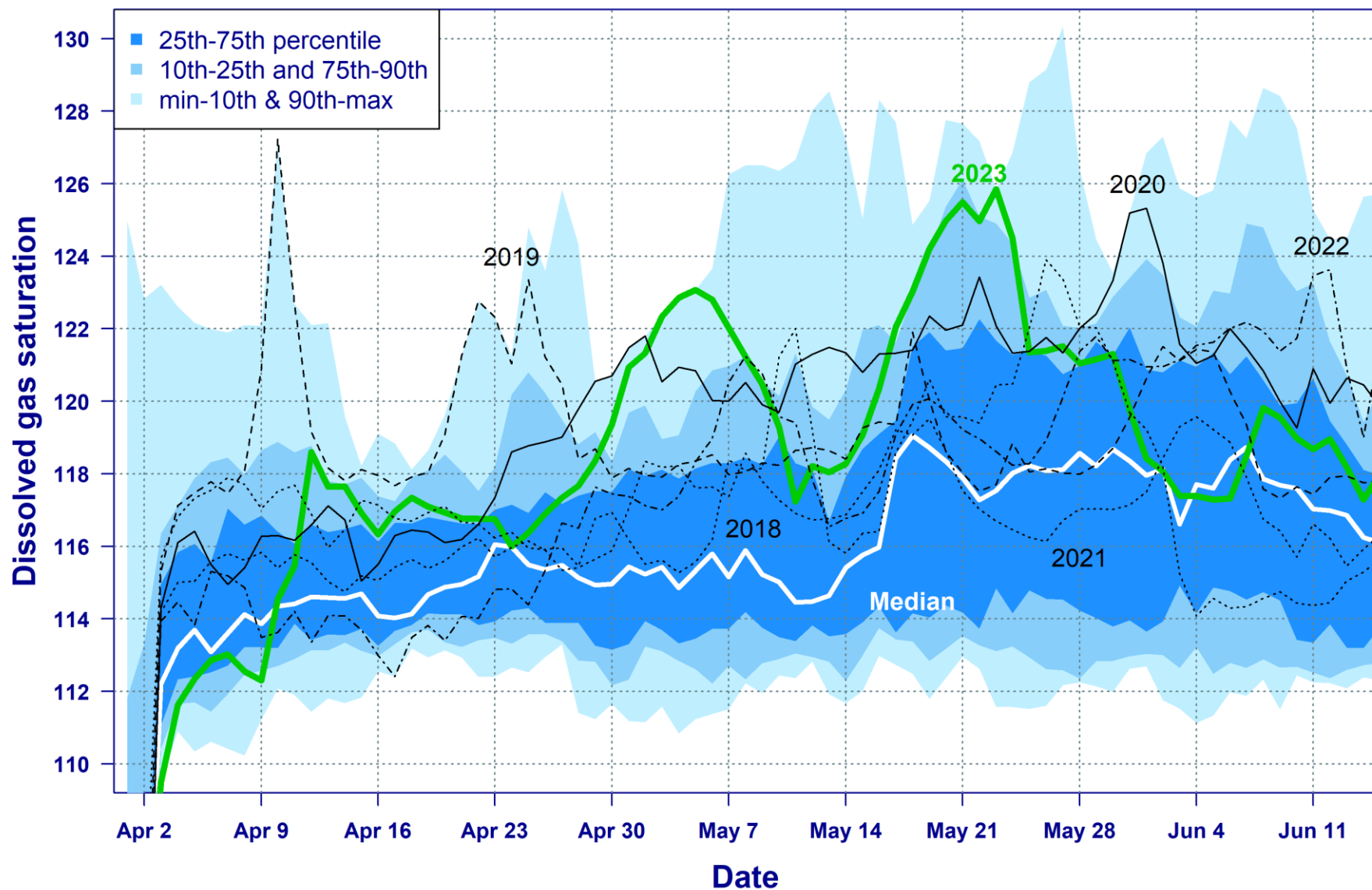




# Daily %Spill 2006-2023 Mean LGR, LGS, LMN

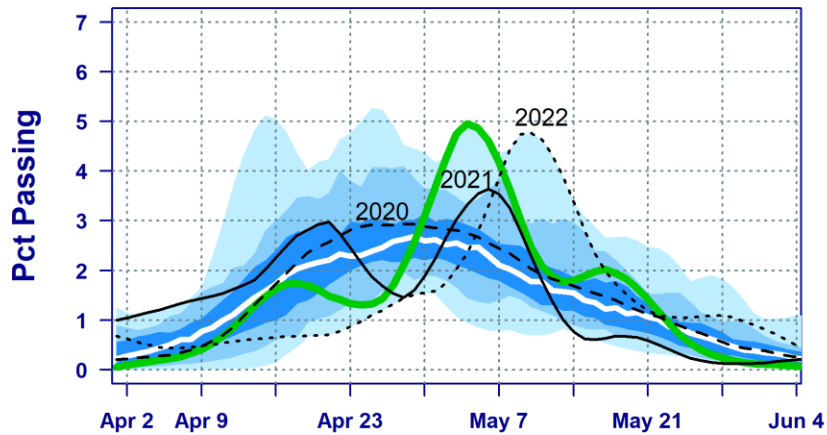


## Daily Dissolved Gas Saturation 2006-2023 Mean LGR, LGS, LMN

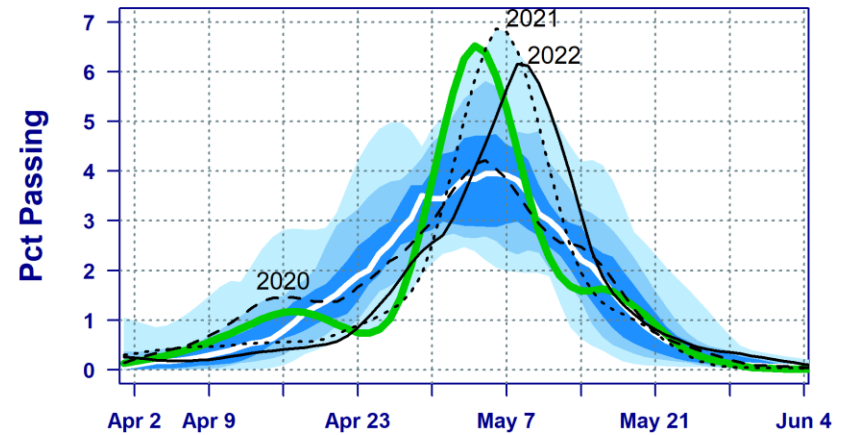


# Passage Timing at Lower Granite Dam

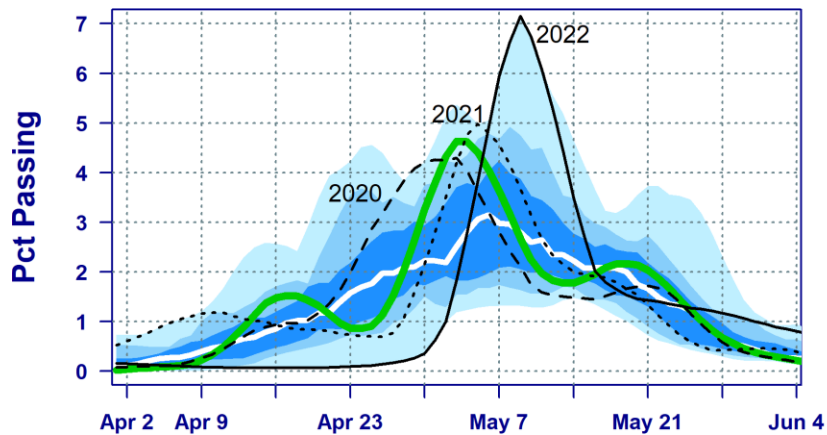
## Wild Chinook



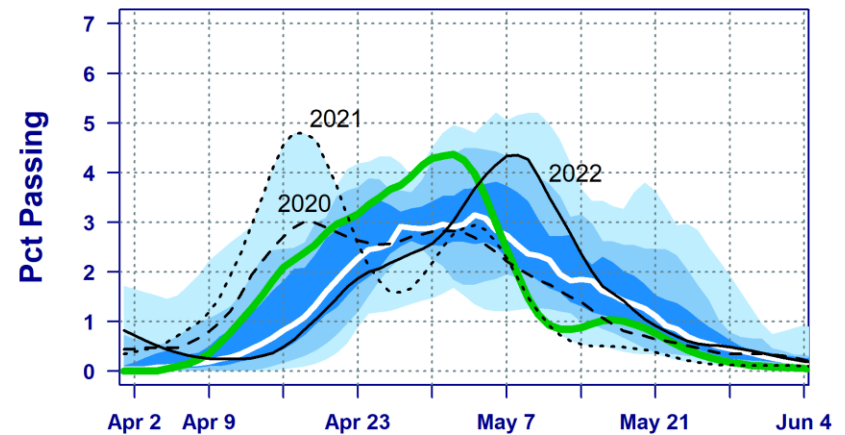
## Hatchery Chinook



## Wild Steelhead

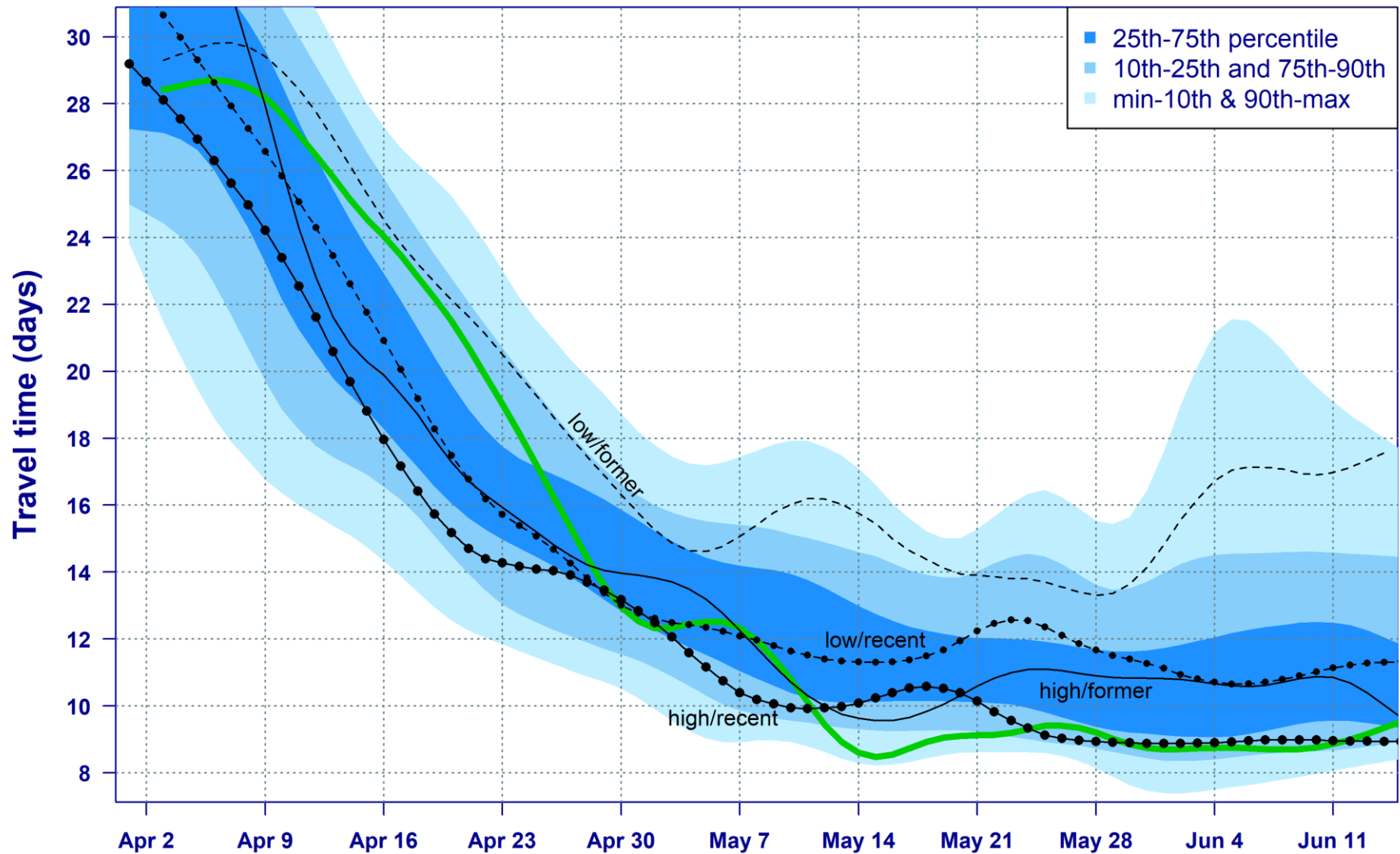


## Hatchery Steelhead

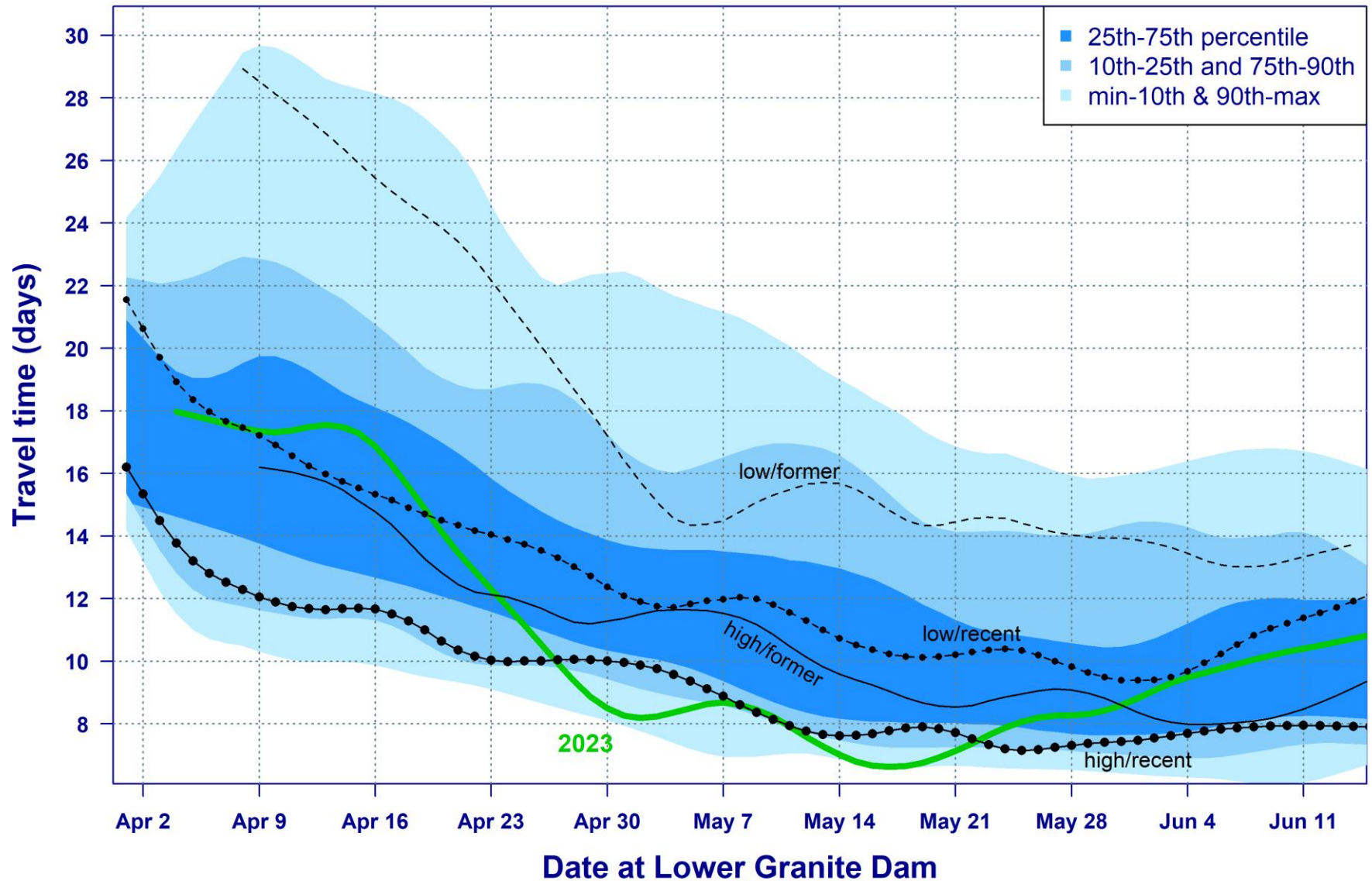




## Travel Time - Lower Granite to Bonneville (461 km) Chinook 1997-2023 (exc. 2001)

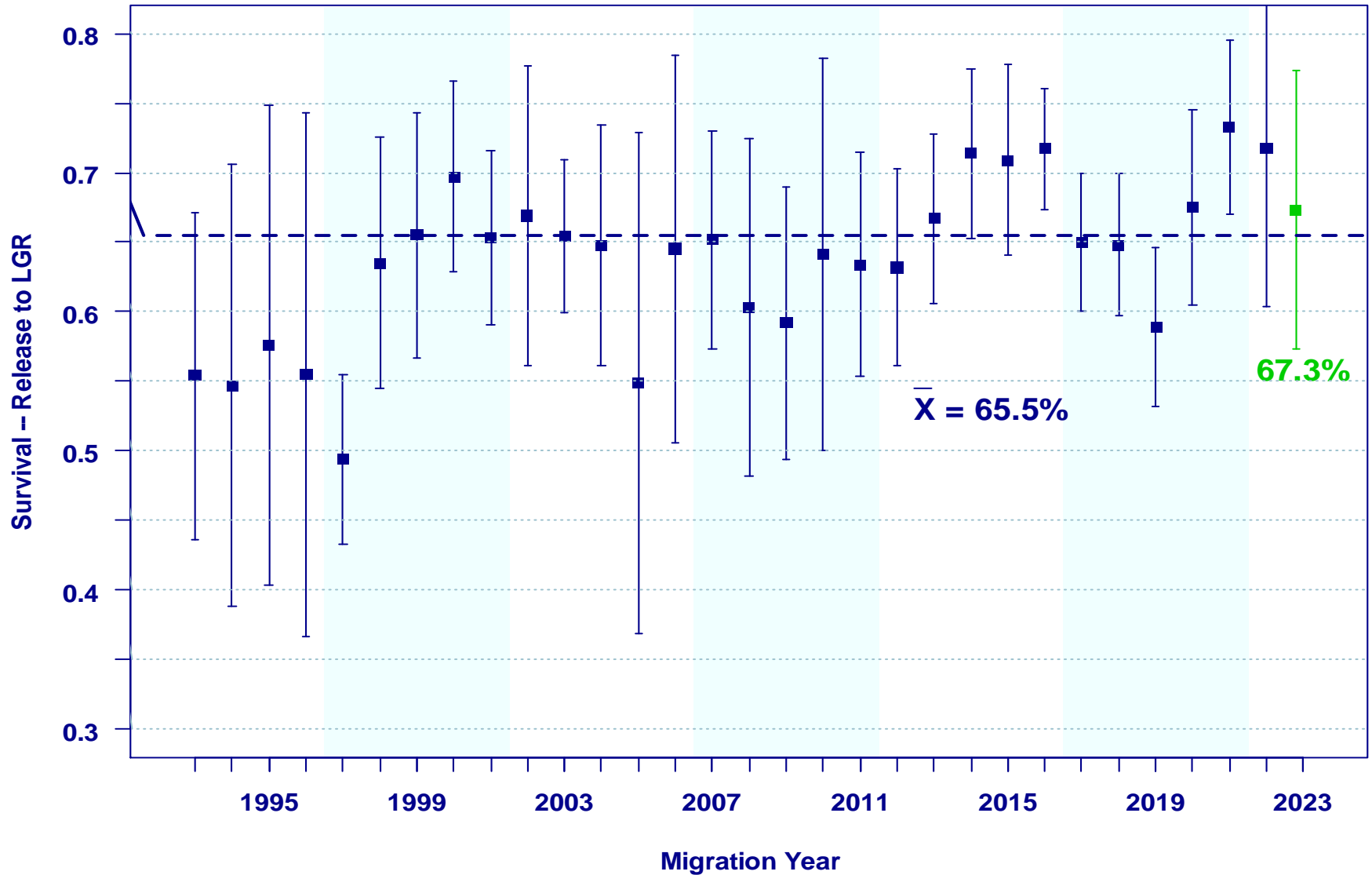


## Steelhead 1997-2023



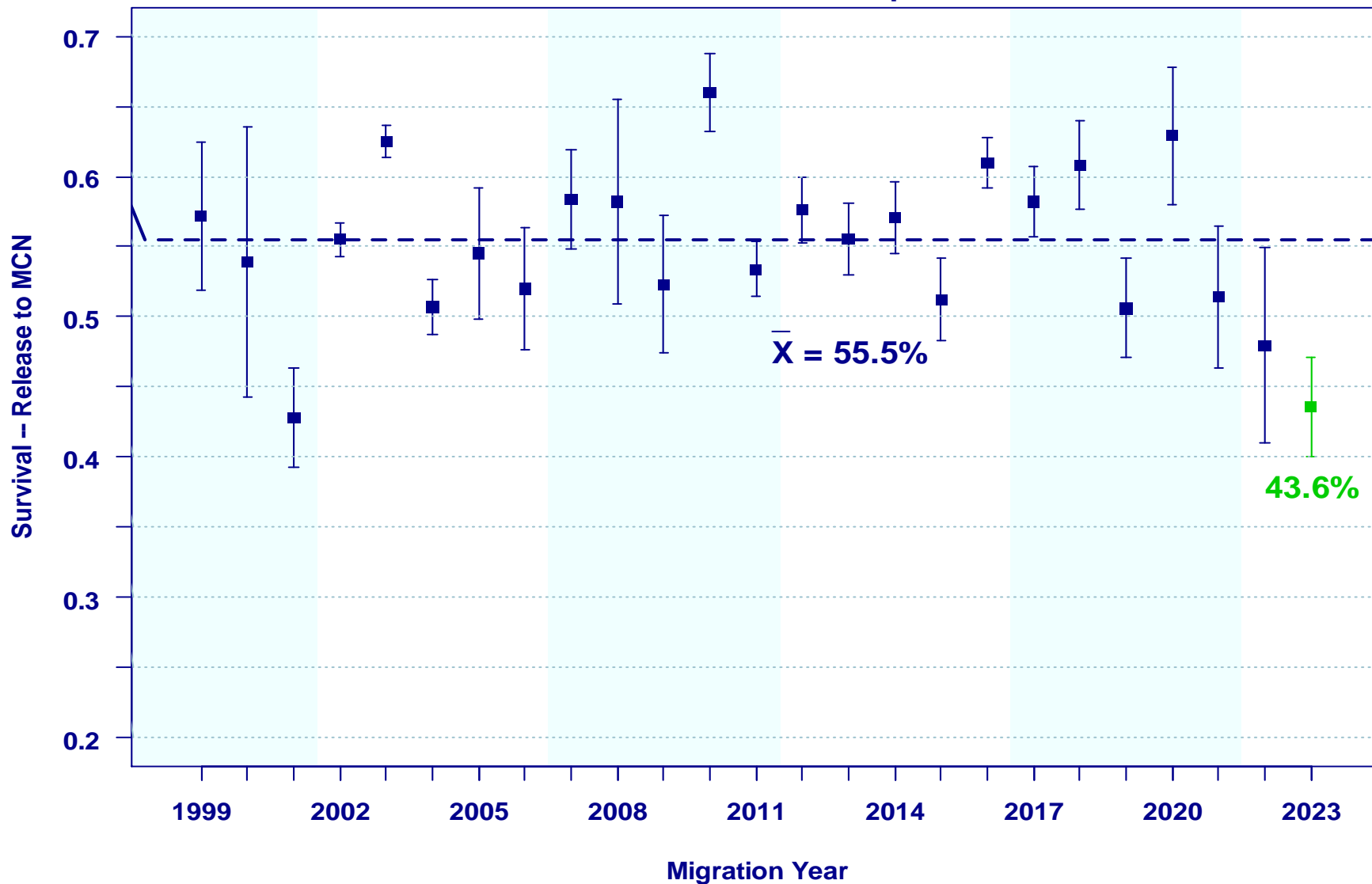
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# Yearling Chinook Snake River Basin Hatcheries Mean of Index Groups

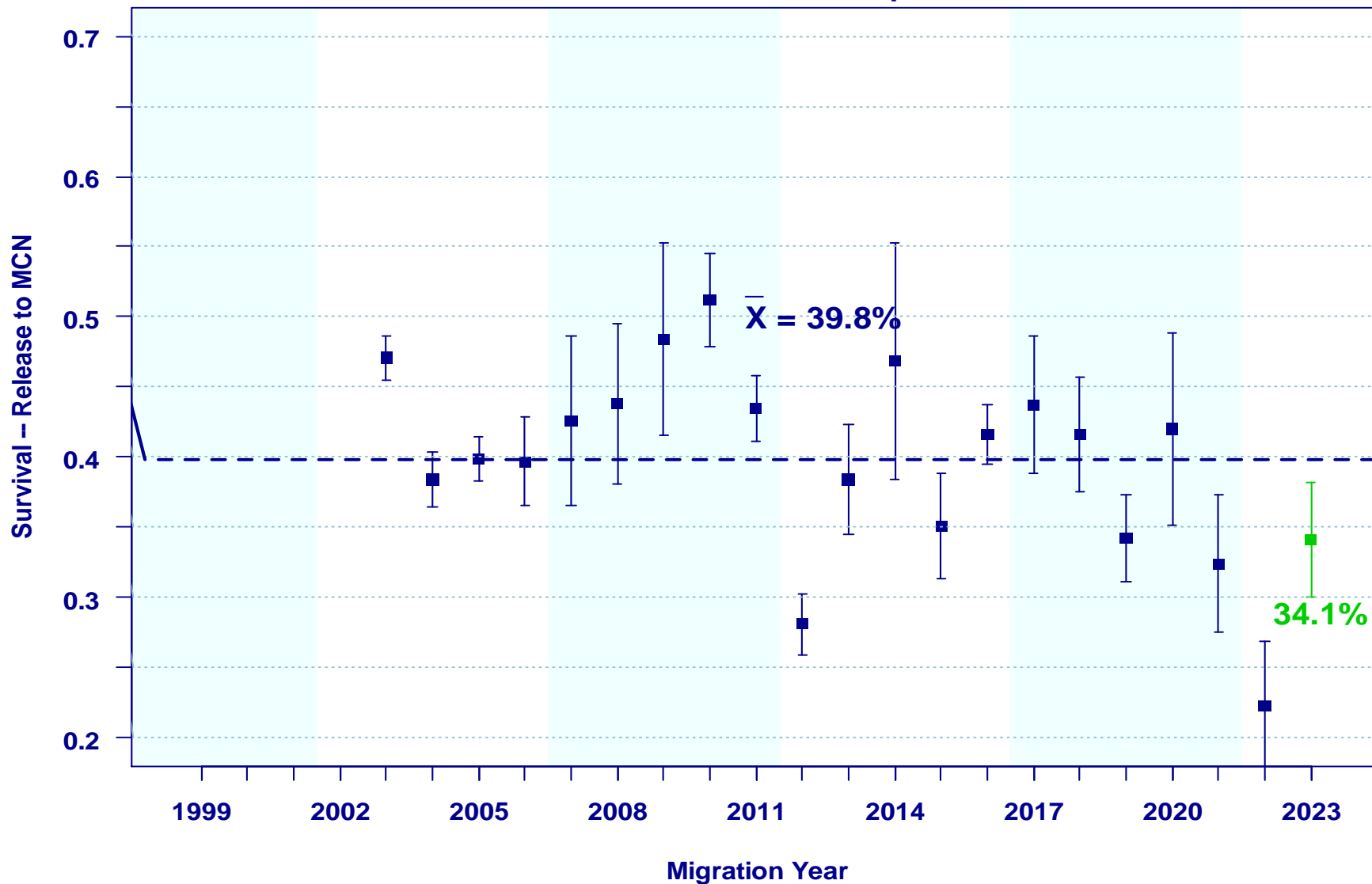




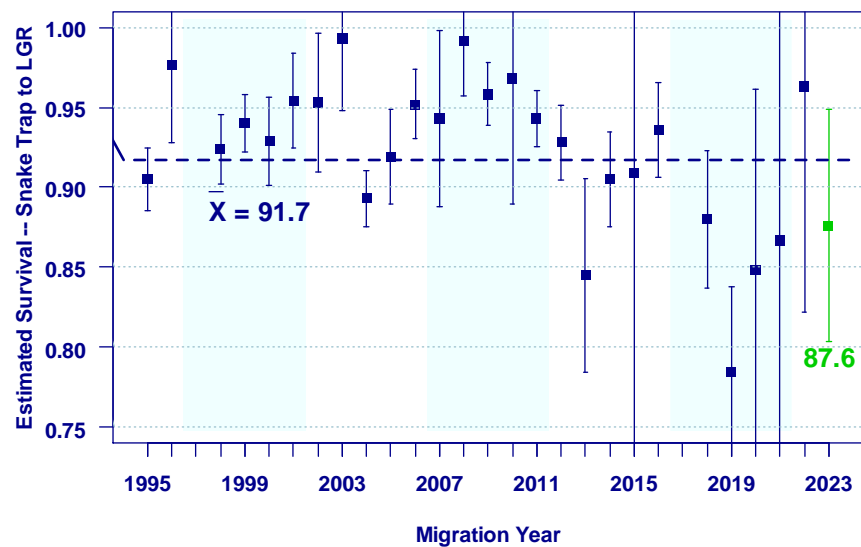
# Yearling Chinook Upper Columbia River Hatcheries Mean of Index Groups



# Steelhead Upper Columbia River Hatcheries Mean of Index Groups

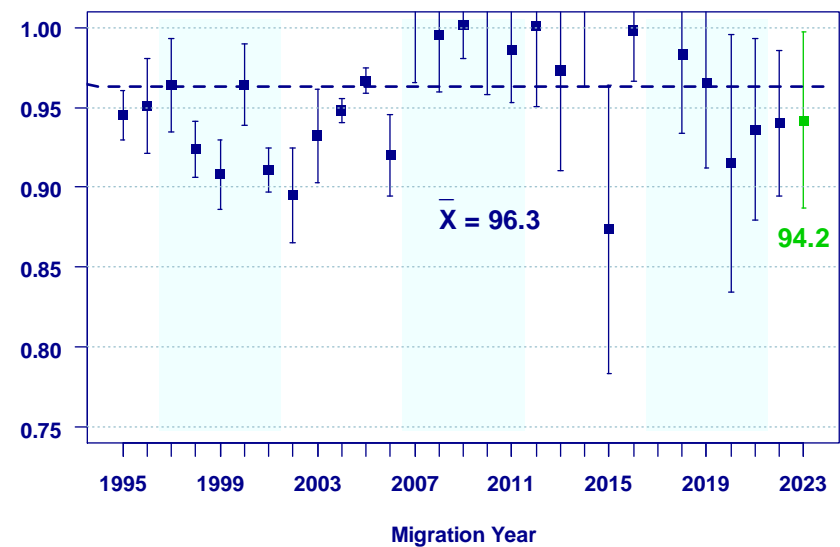


Yearling Chinook

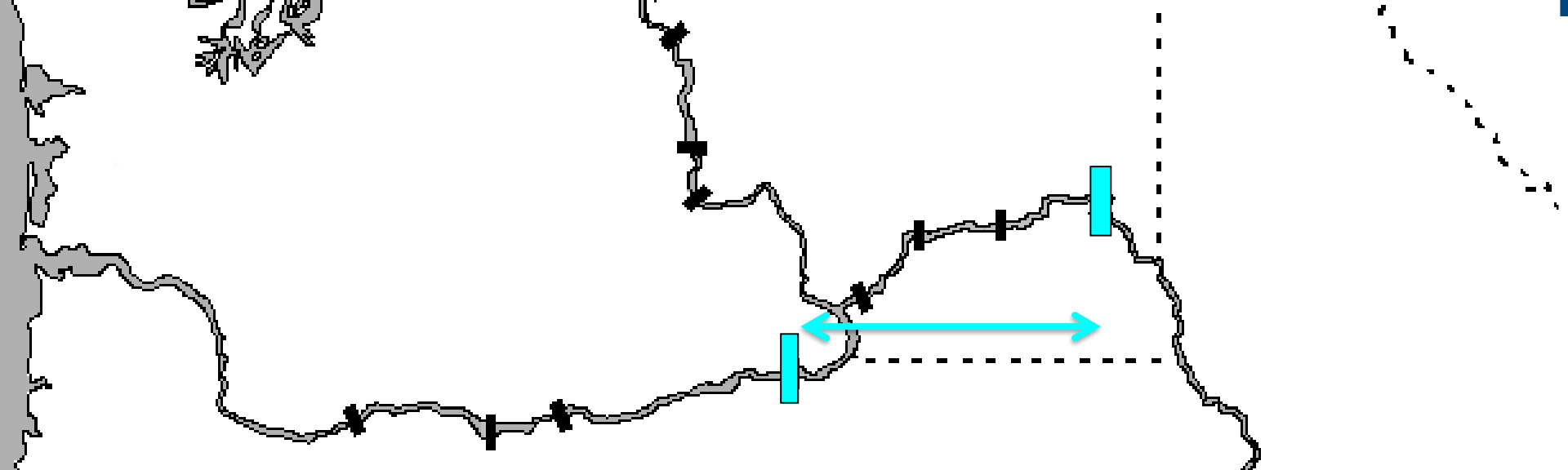


Snake Trap to Lower Granite

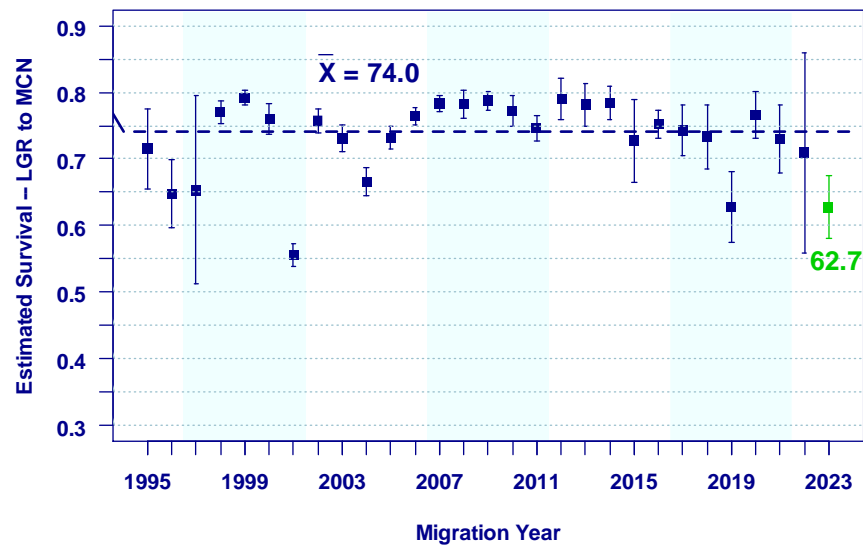
Steelhead





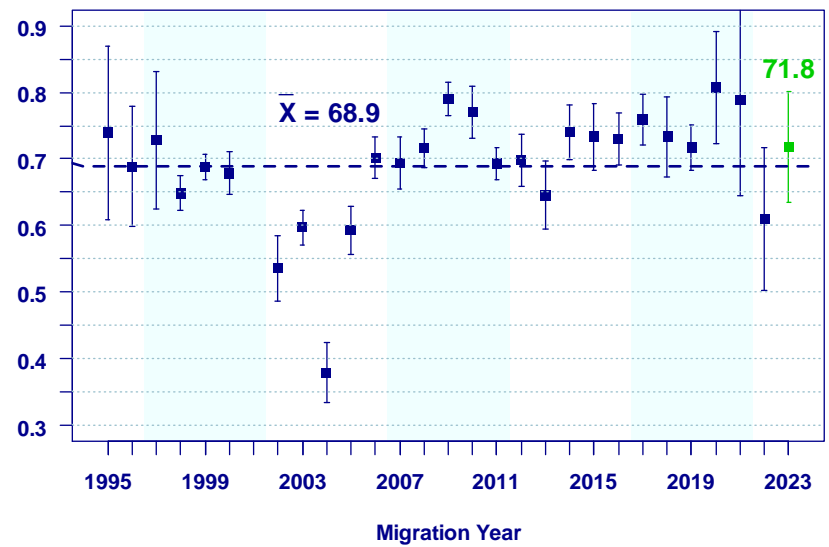


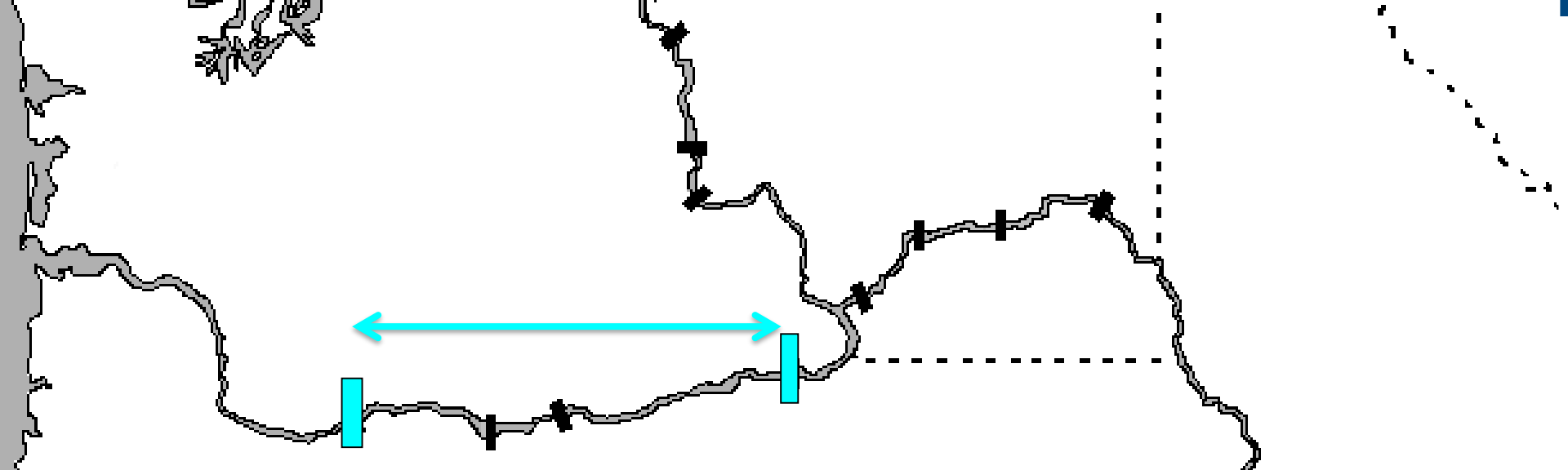
Yearling Chinook



Lower Granite to McNary

Steelhead

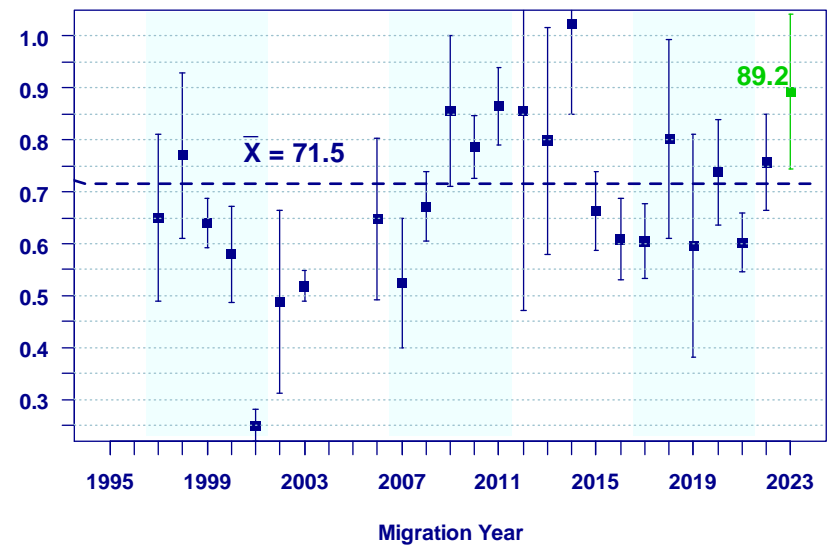
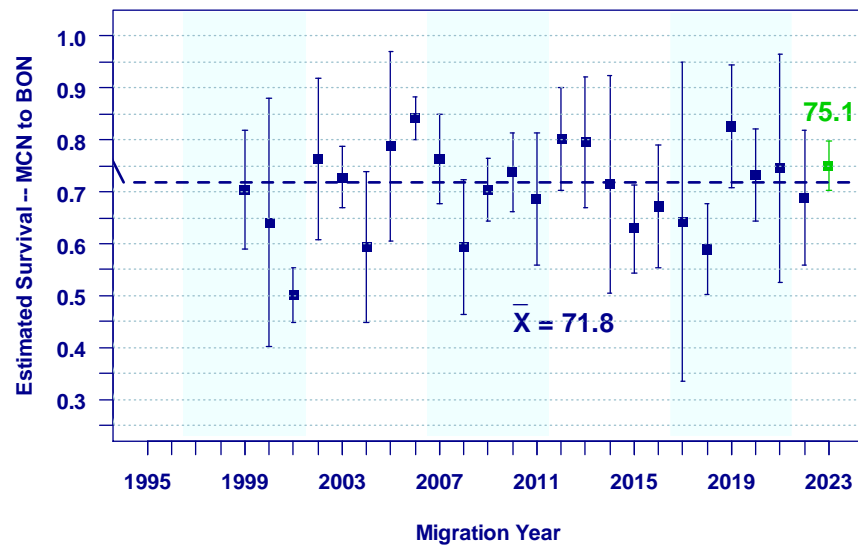




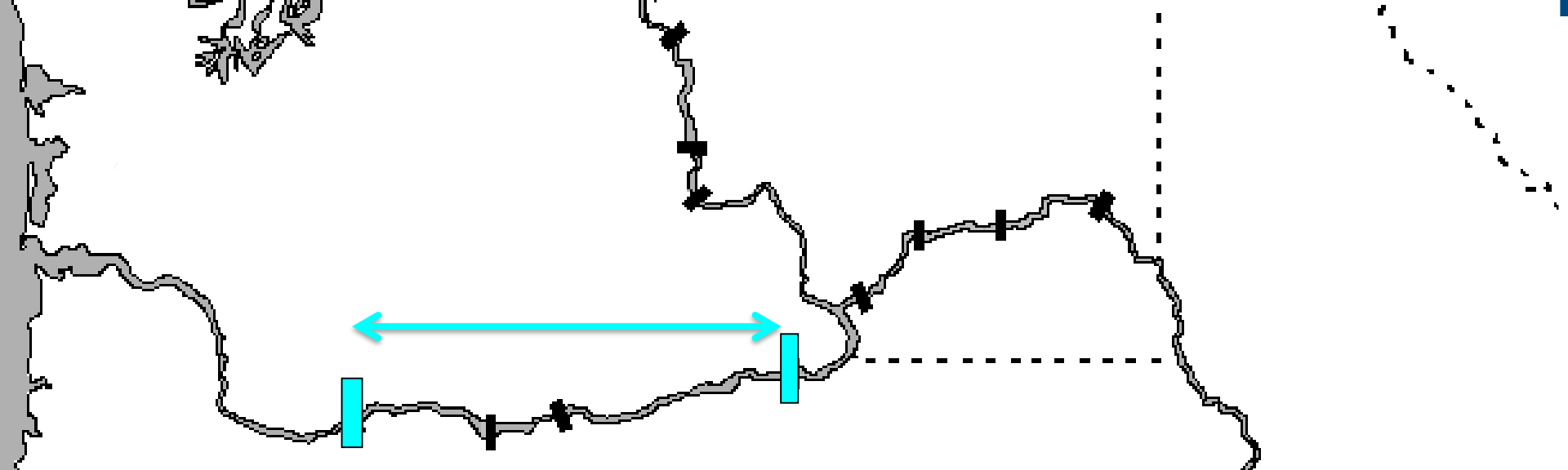
### McNary to Bonneville Fish from Snake River

Yearling Chinook

Steelhead



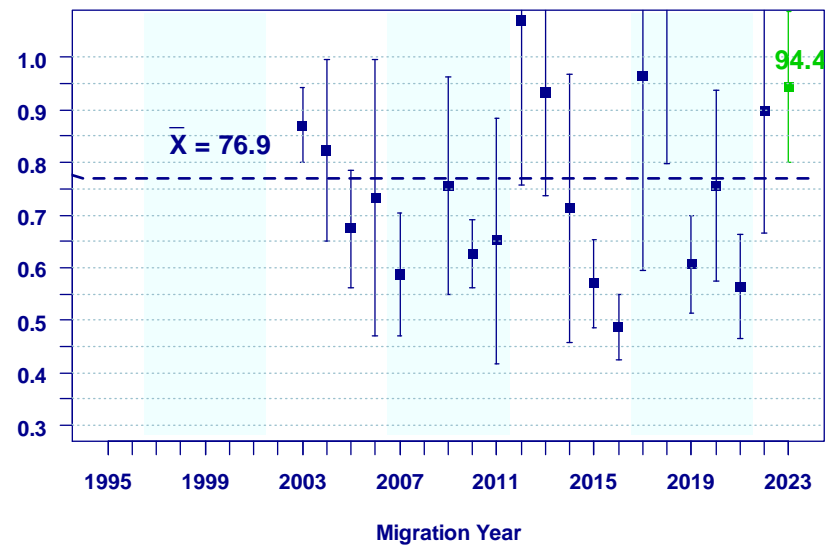
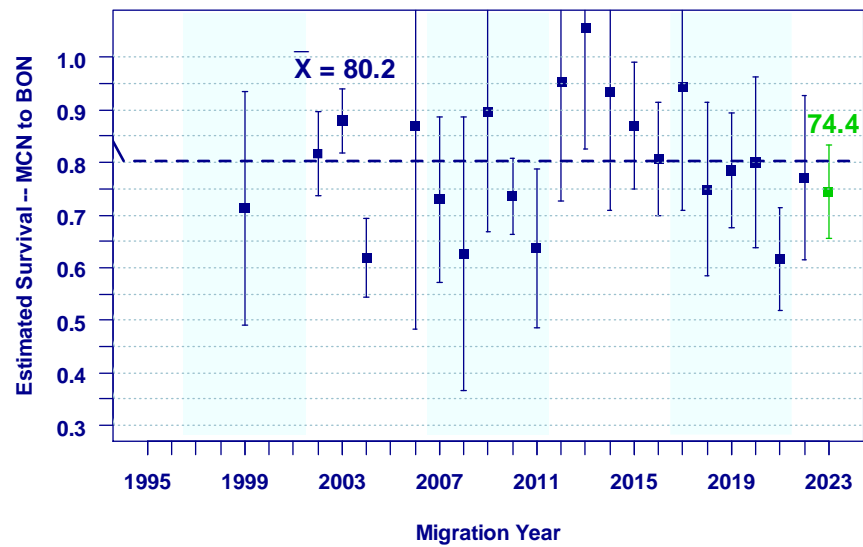
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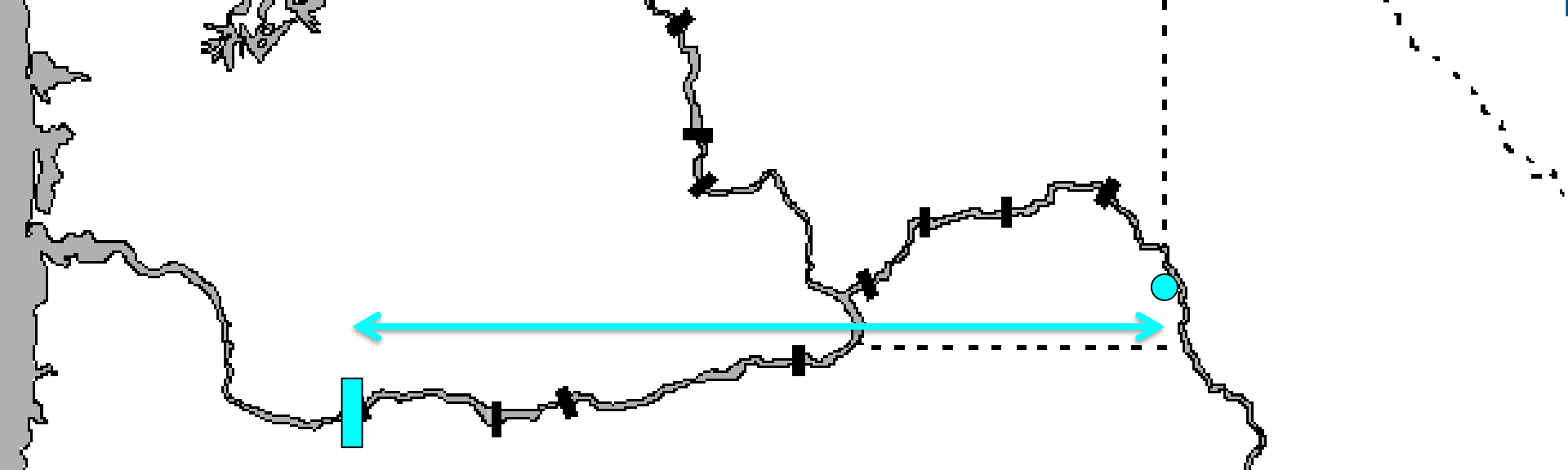
### McNary to Bonneville Fish from Upper Columbia

Yearling Chinook

Steelhead



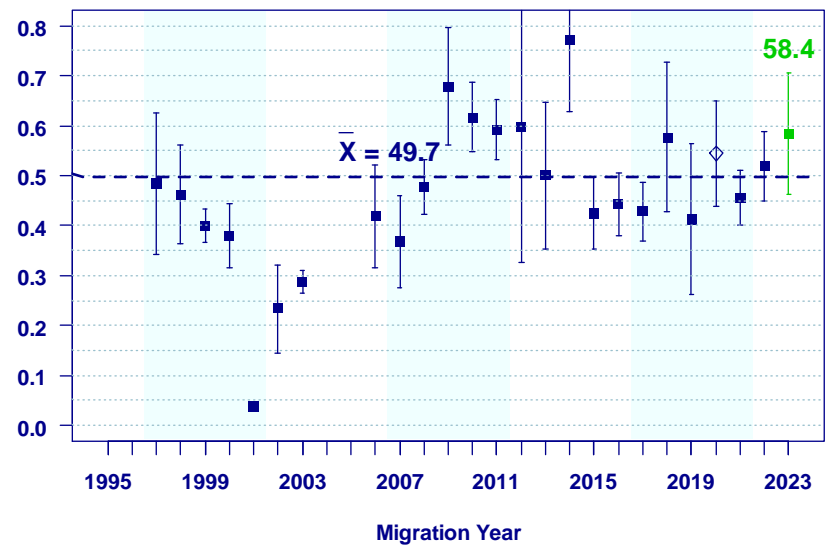
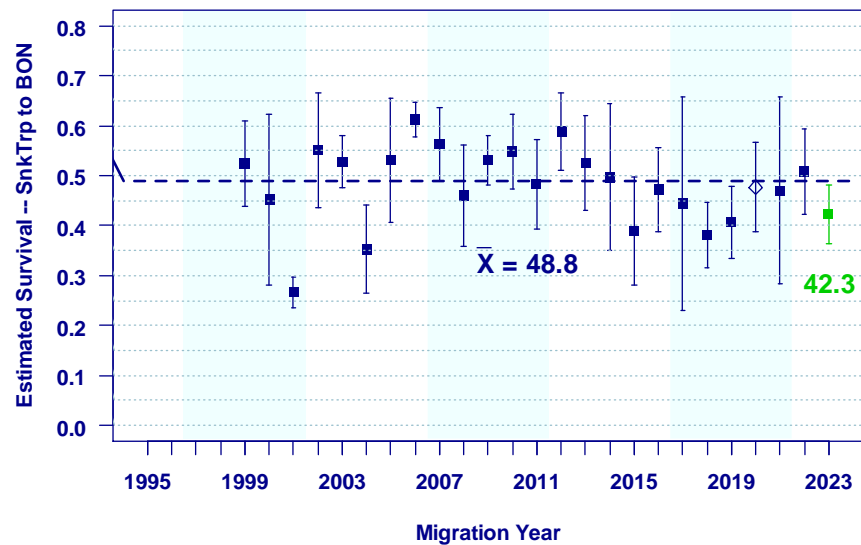
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Yearling Chinook

Snake River Trap to Bonneville

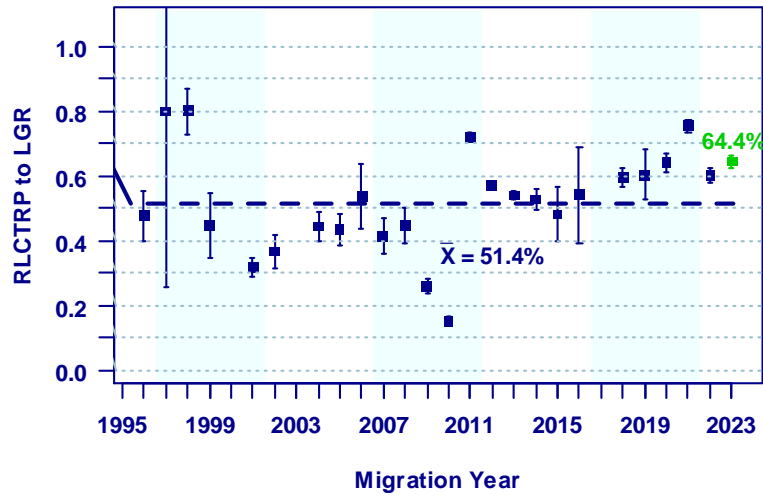
Steelhead



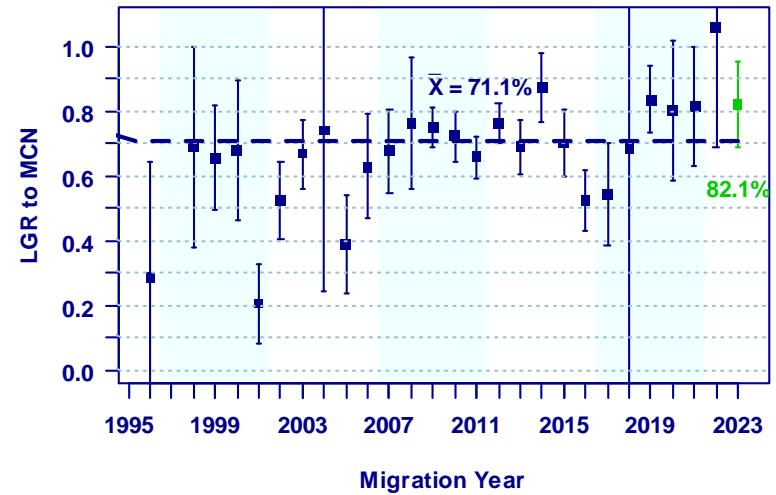


# Snake River Sockeye: Estimated Survival

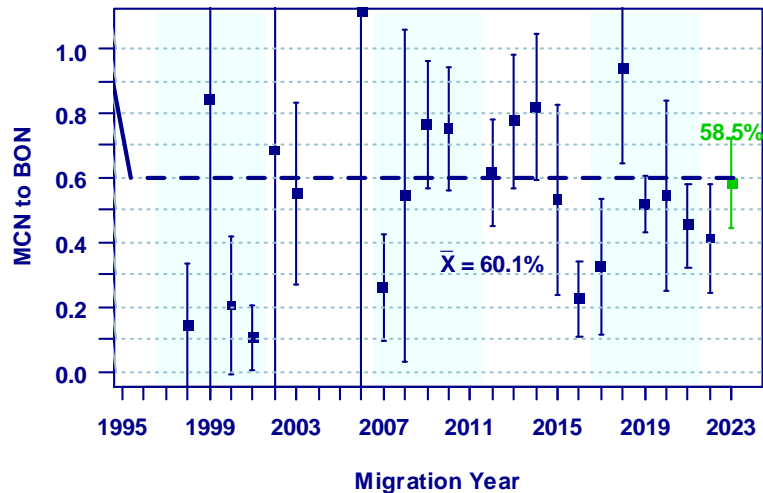
## Redfish Lake Trap to Lower Granite



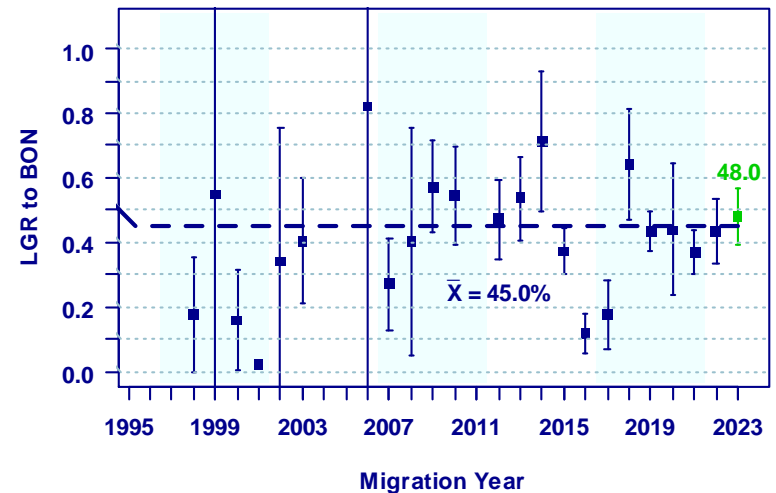
## Lower Granite to McNary



## McNary to Bonneville

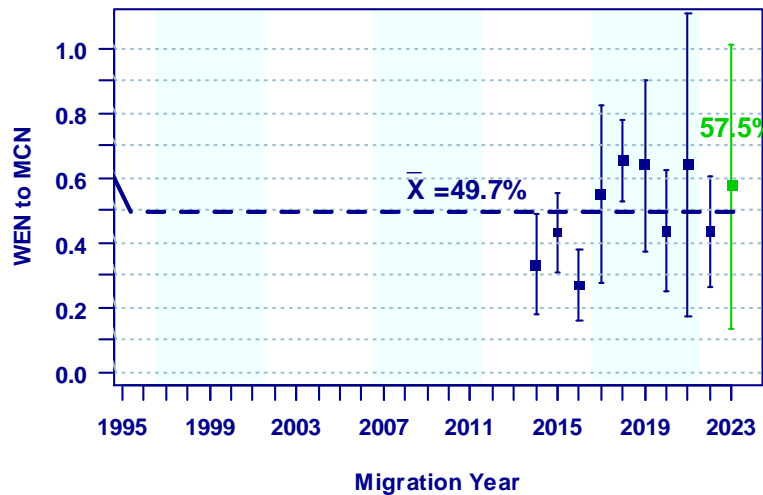


## Lower Granite to Bonneville

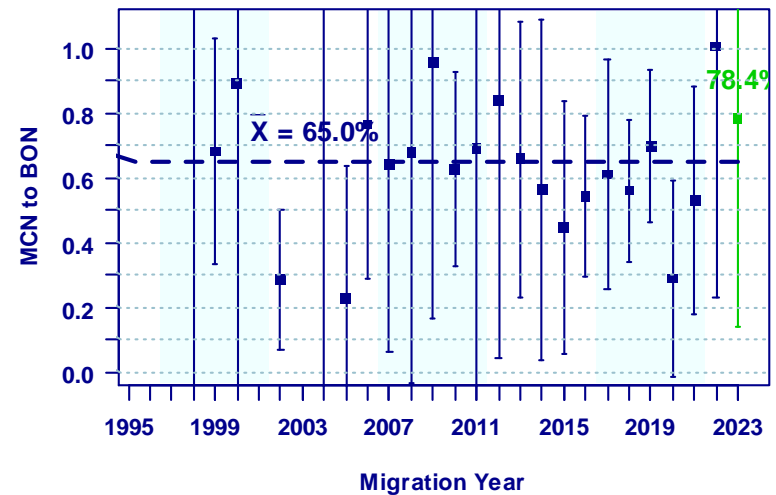


# Columbia River Sockeye: Estimated Survival

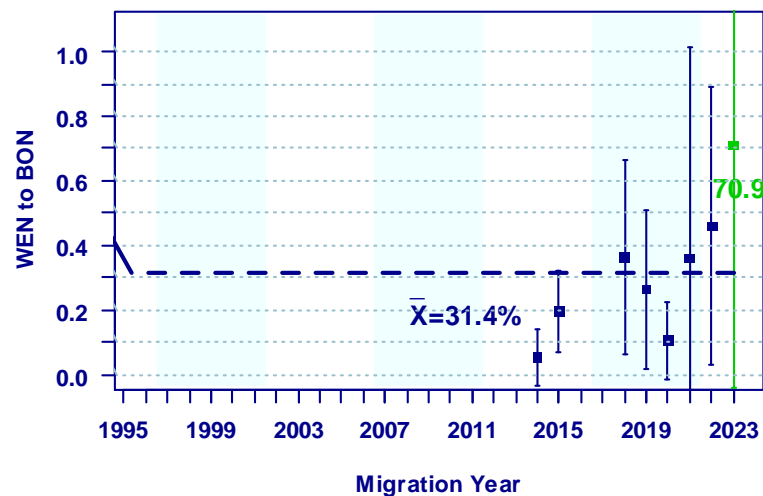
## Lower Wenatchee to McNary

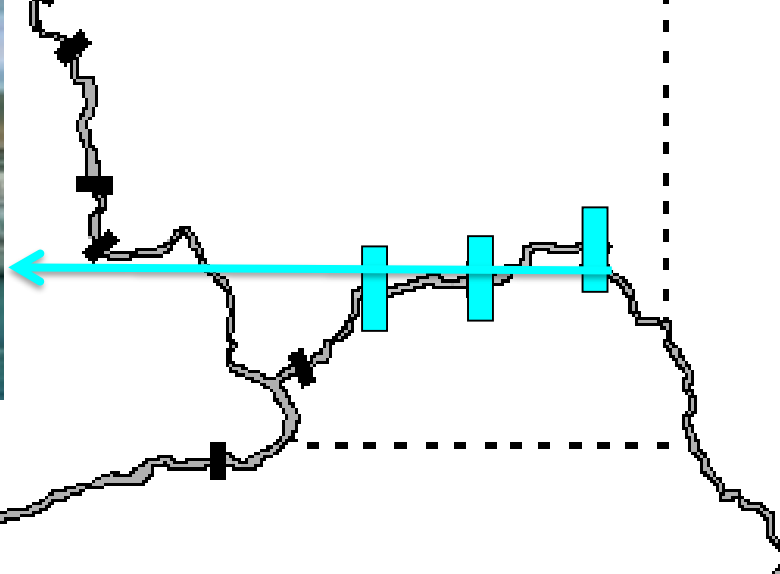


## McNary to Bonneville



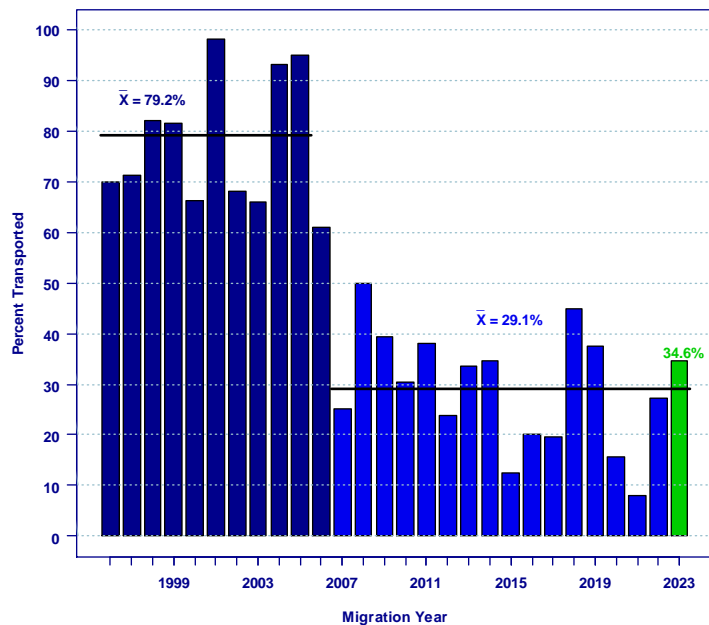
## Lower Wenatchee to Bonneville



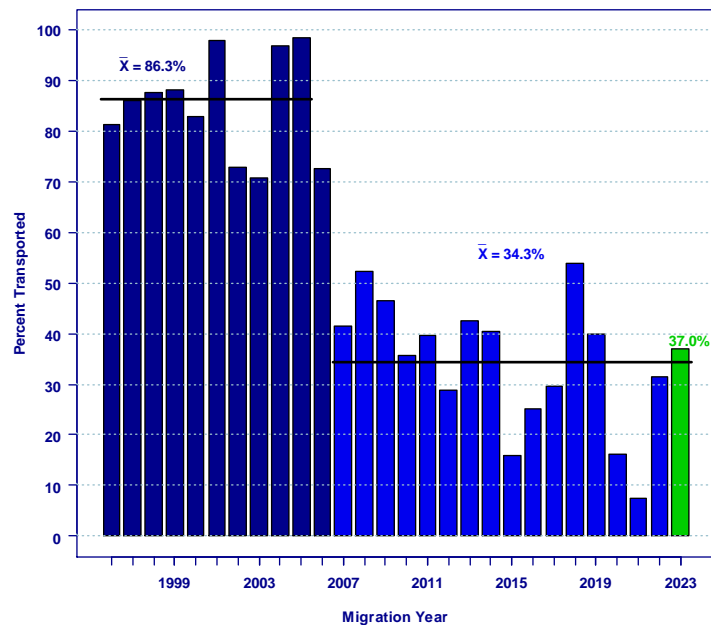


## Estimated Percent Transported

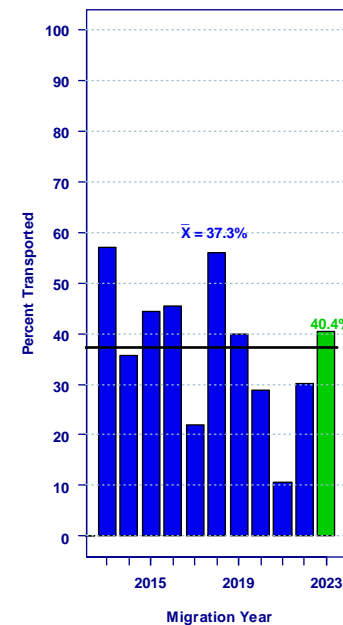
Yearling Chinook



Steelhead



Sockeye



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# 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

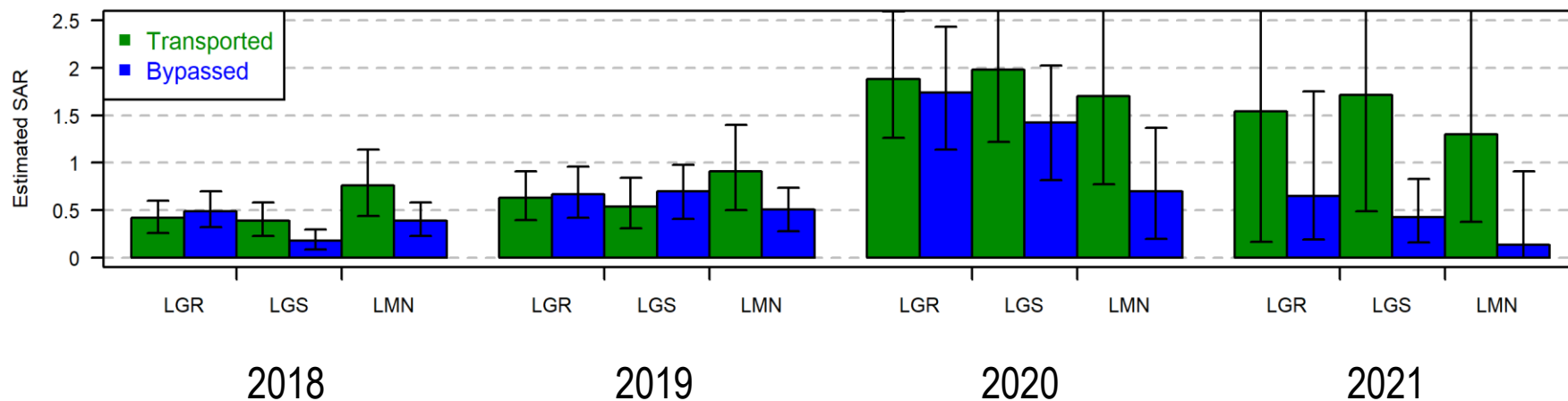


# Terminology – Groups of Fish

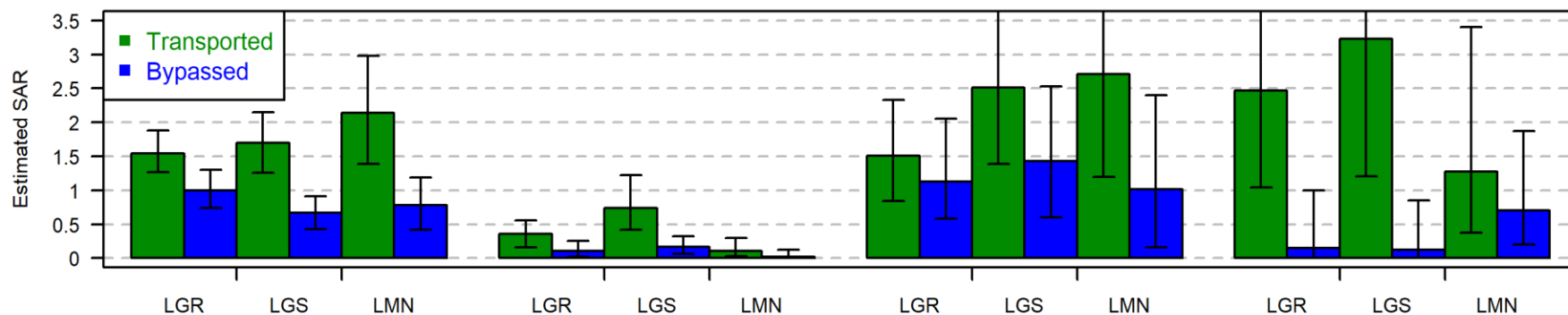
- “Transported” – Entered gatewell, guided into Juvenile Fish Facility, collected in raceway, loaded into barge, transported in barge to below Bonneville Dam
- “Bypassed” – Entered gatewell, guided into Juvenile Fish Facility, directed to tailrace
- “Spilled” – Passed LGR via spillway

# Annual Estimated SARs – Transport Period

## Wild Yearling Chinook

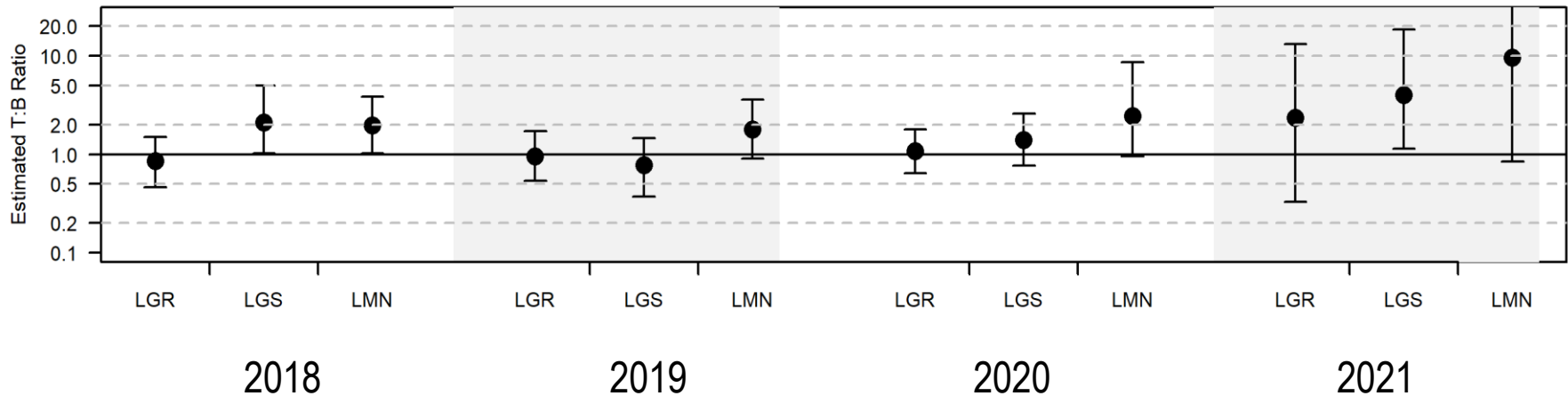


## Wild Steelhead

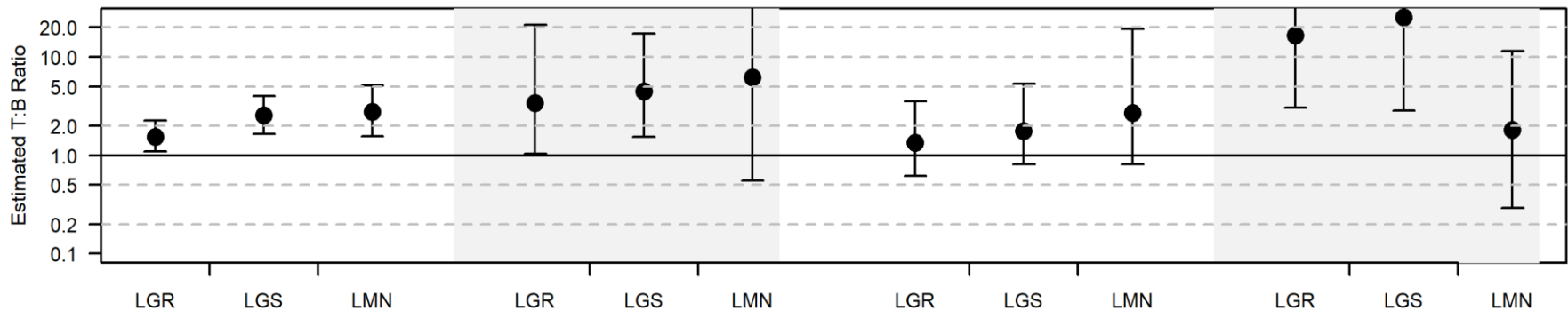


# Annual Estimated T:B – Transport Period

## Wild Yearling Chinook - T:B



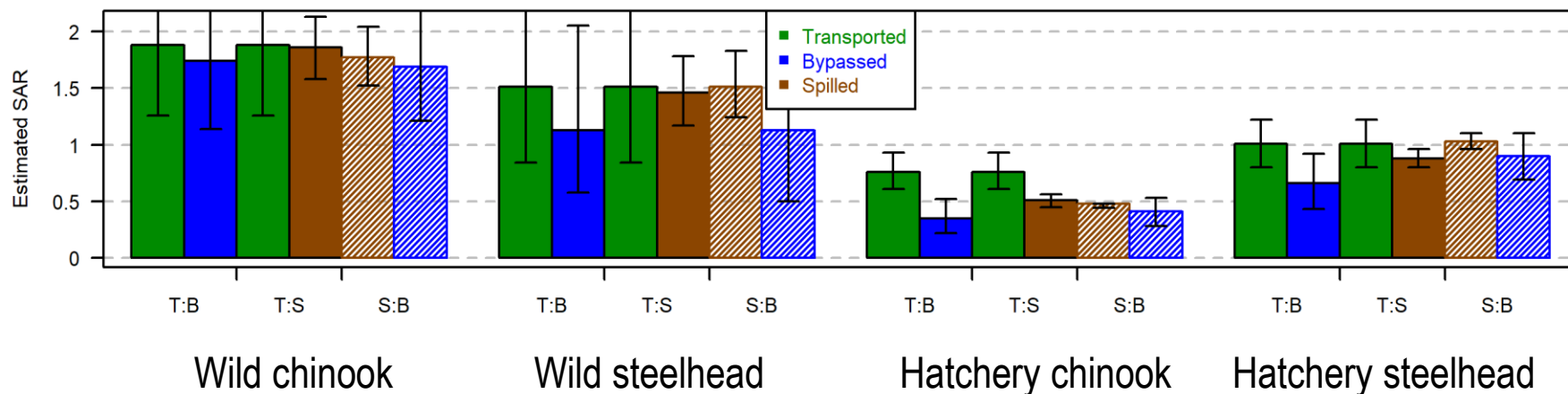
## Wild Steelhead - T:B



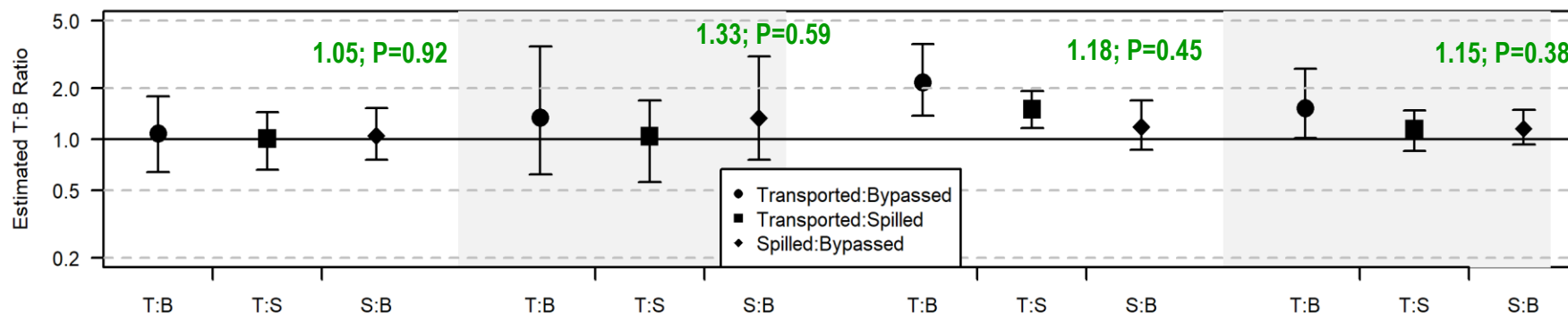


# Spillway Passage – Migration Year 2020

## Smolt-to-Adult Return%

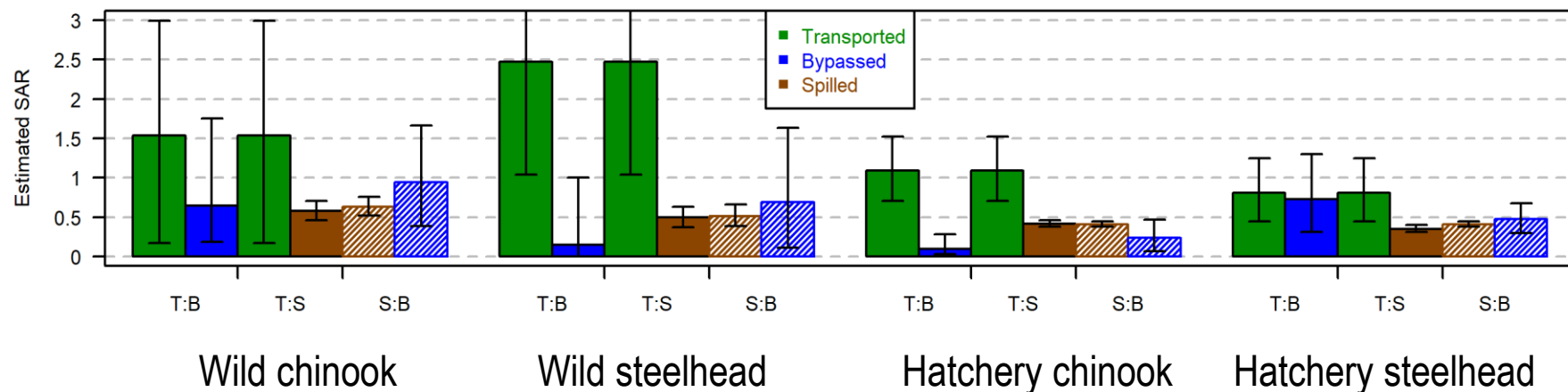


## Ratios

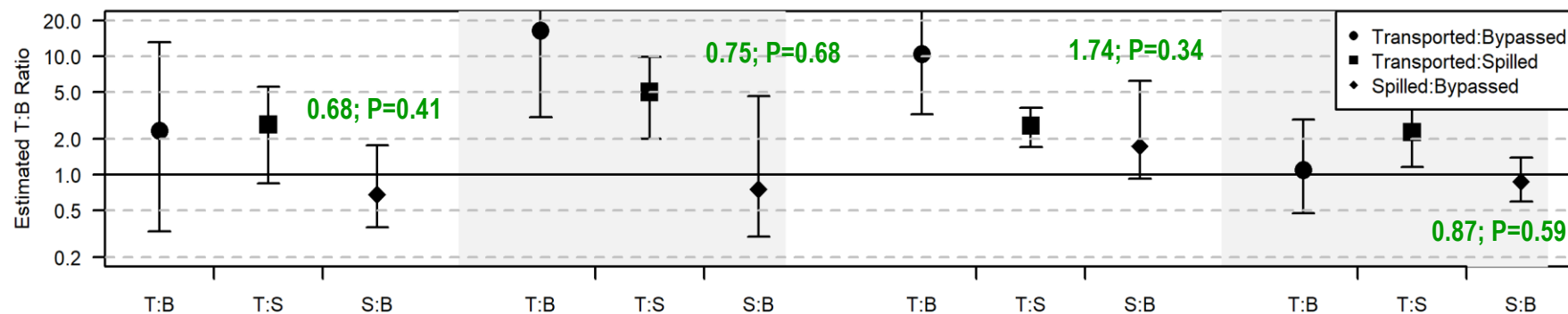


# Spillway Passage – Migration Year 2021

## Smolt-to-Adult Return%



## Ratios



# Small T:B Sample Sizes In 2021!

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

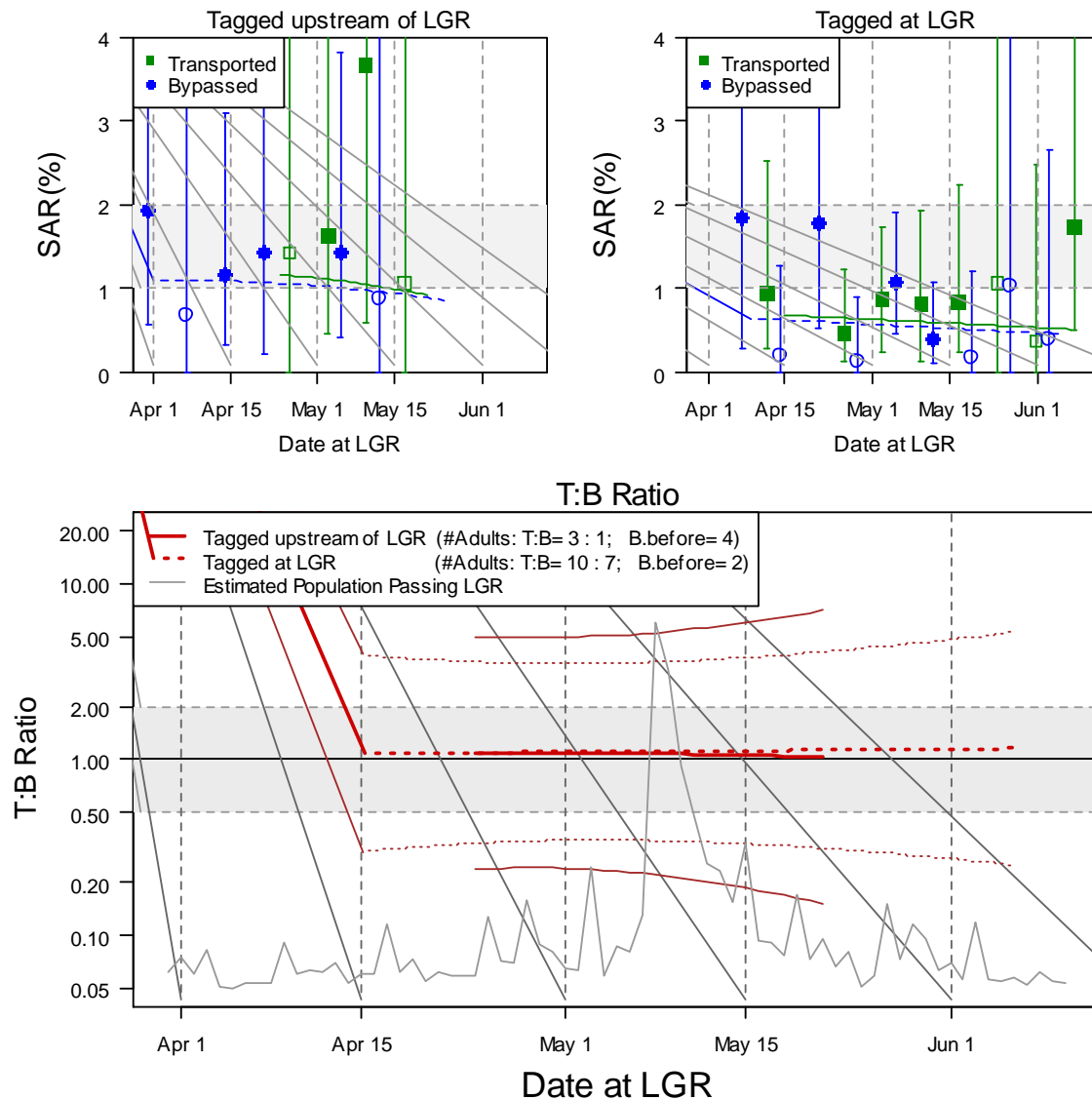


# Some Seasonal Stuff for MY 2021



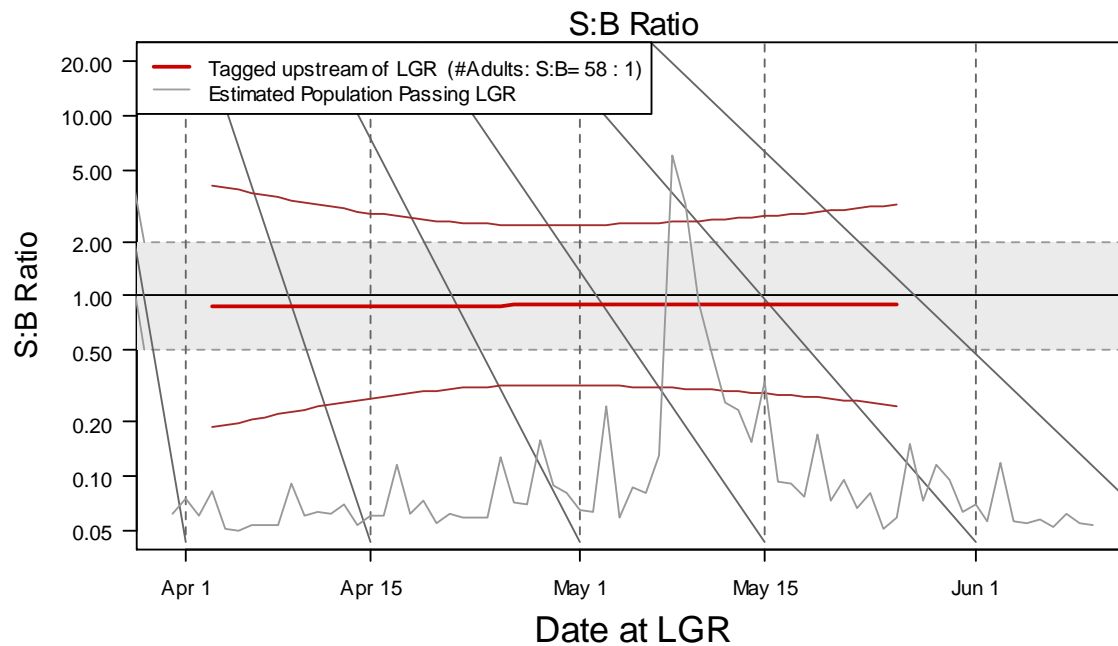
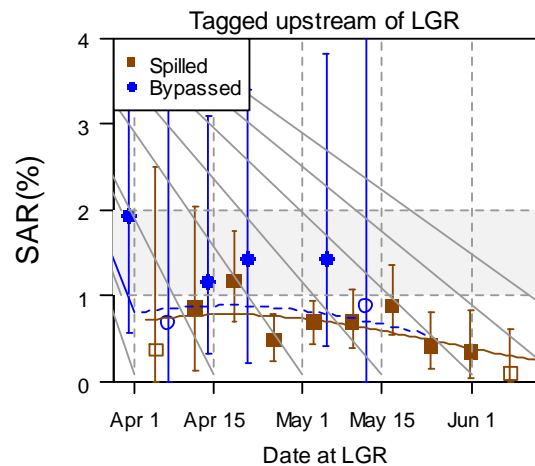
# Wild Chinook 2021

Transported or Bypassed at Lower Granite Dam



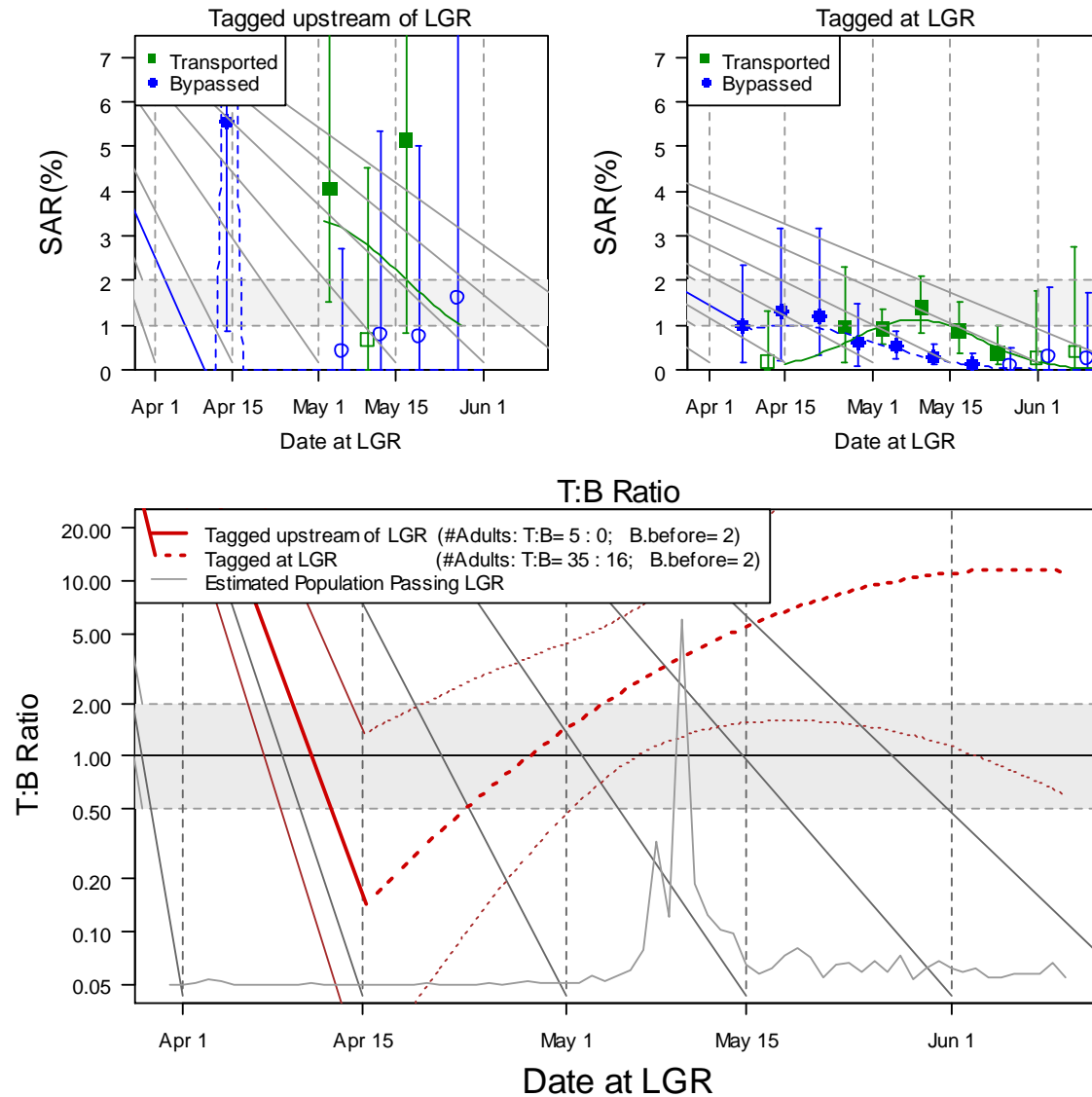
# Wild Chinook 2021

Spilled or Bypassed at Lower Granite Dam



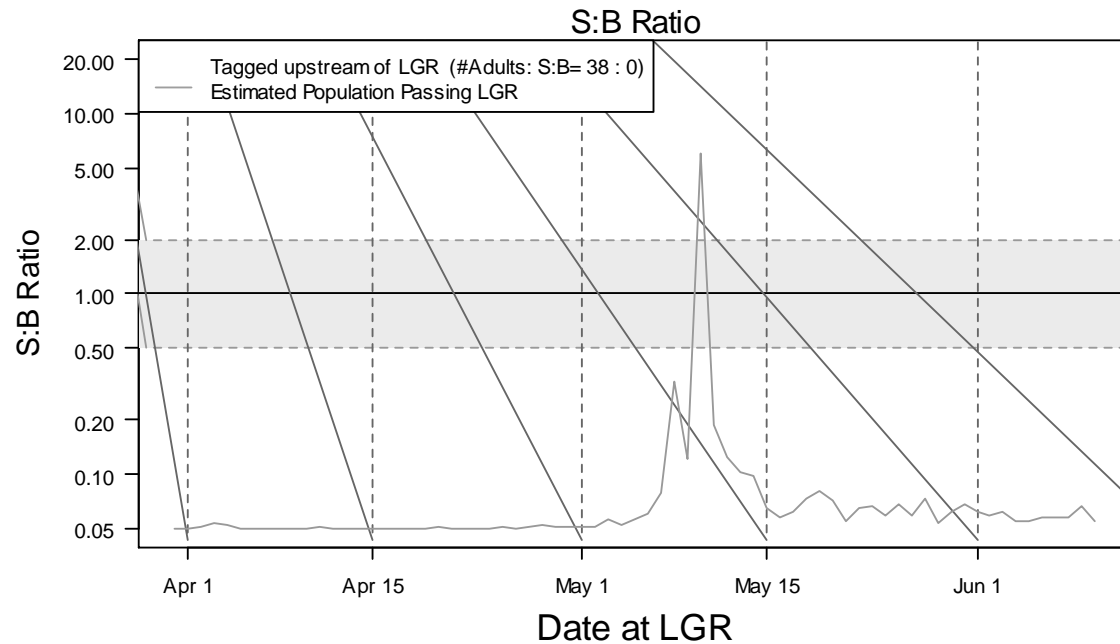
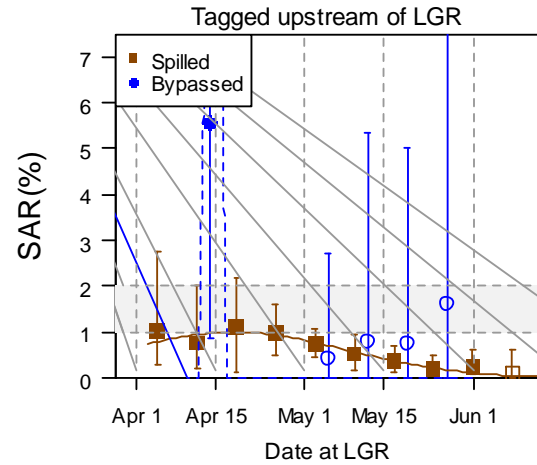
# Wild Steelhead 2021

Transported or Bypassed at Lower Granite Dam



# Wild Steelhead 2021

Spilled or Bypassed at Lower Granite Dam



# 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



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