

NOAA
FISHERIES

Smolt Survival and Travel Time & Seasonal Transportation Analyses

Update with 2015 Data

- Northwest Fisheries Science Center
 - Fish Ecology Division
 - Steven G. Smith
 - December 2, 2015
 - Technical Management Team
- 2015 Year-End Review

Outline

- Summary of migration conditions, travel time and survival of PIT-tagged smolts through the hydropower system in 2015
 - September 11 Memo; Draft report to BPA in prep
- Information from return of PIT-tagged adults – transported from and bypassed at Lower Granite Dam
 - Updated with adult returns through Nov 25, 2015
 - Added smolt migration year 2013

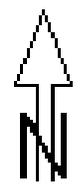
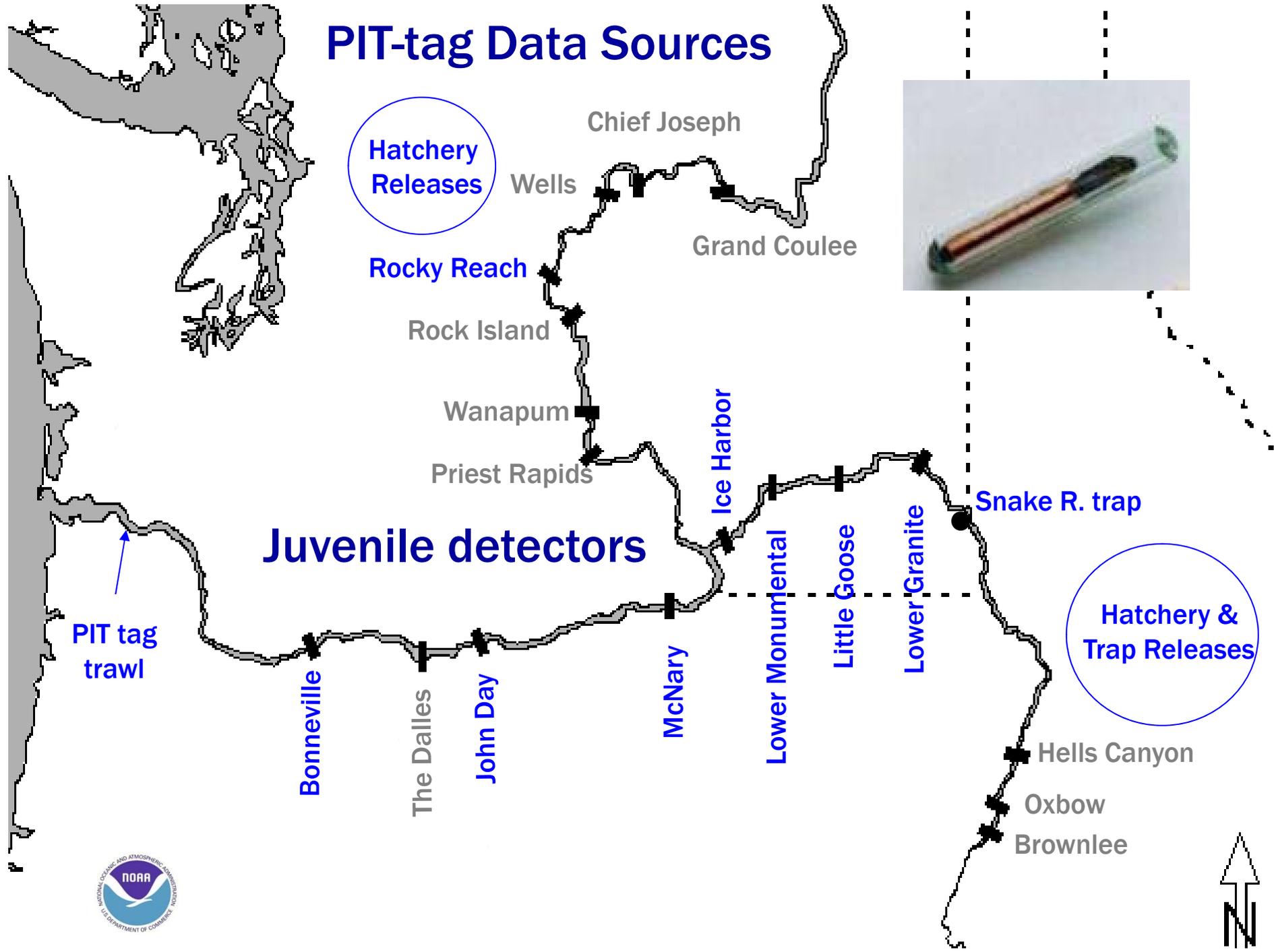
2015 Spring Conditions

- Very low flow and very warm water
- High spill percentage
- Longer travel times than in most-recent years
- Very small percentage (<15%) of smolts transported

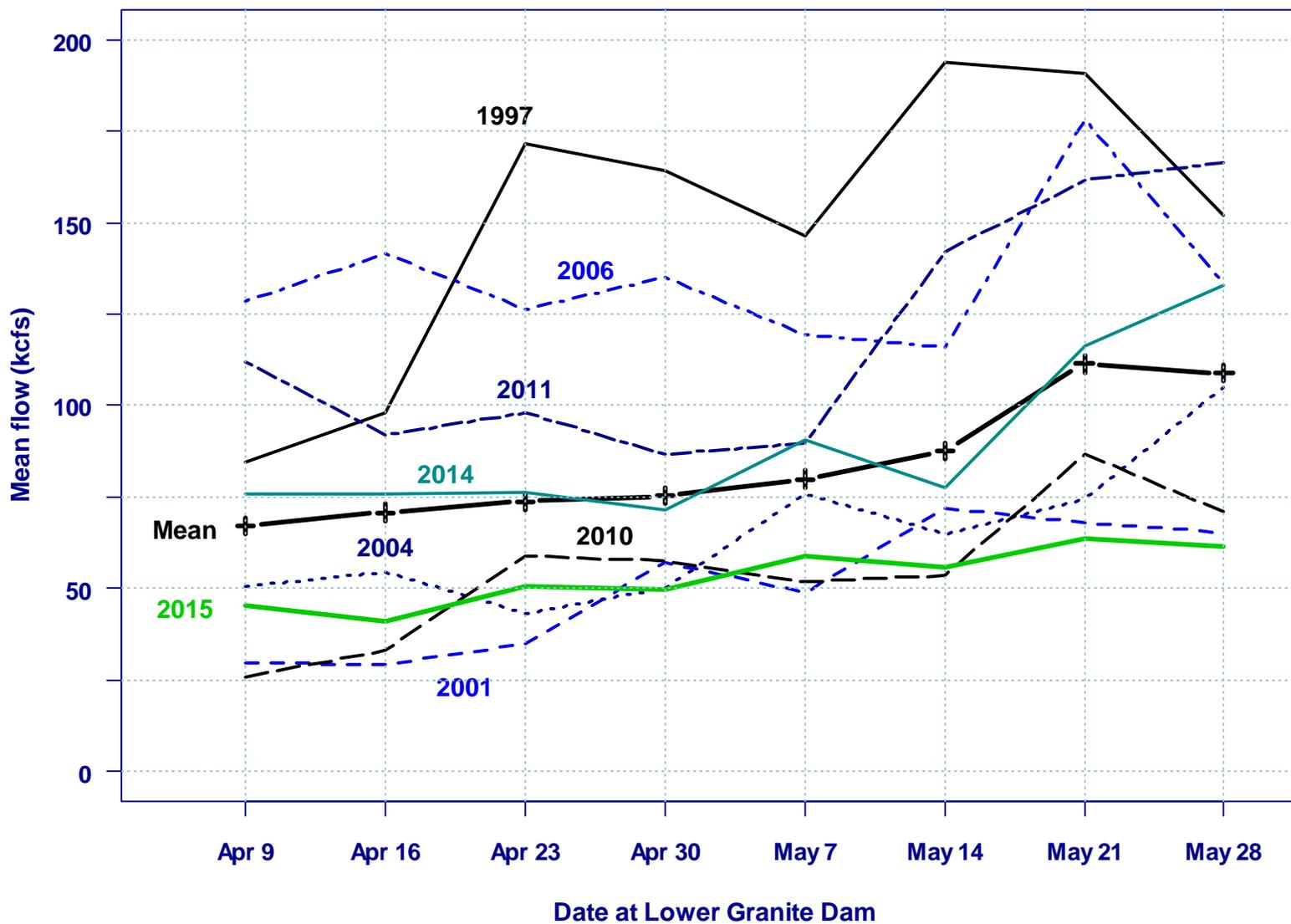
2015 Spring Survival Summary

- Survival for yearling chinook and steelhead lower than average in most reaches
- Overall hydrosystem survival about 10% lower than average for both species
- Hydrosystem survival considerably lower (15-25%) than in 2010

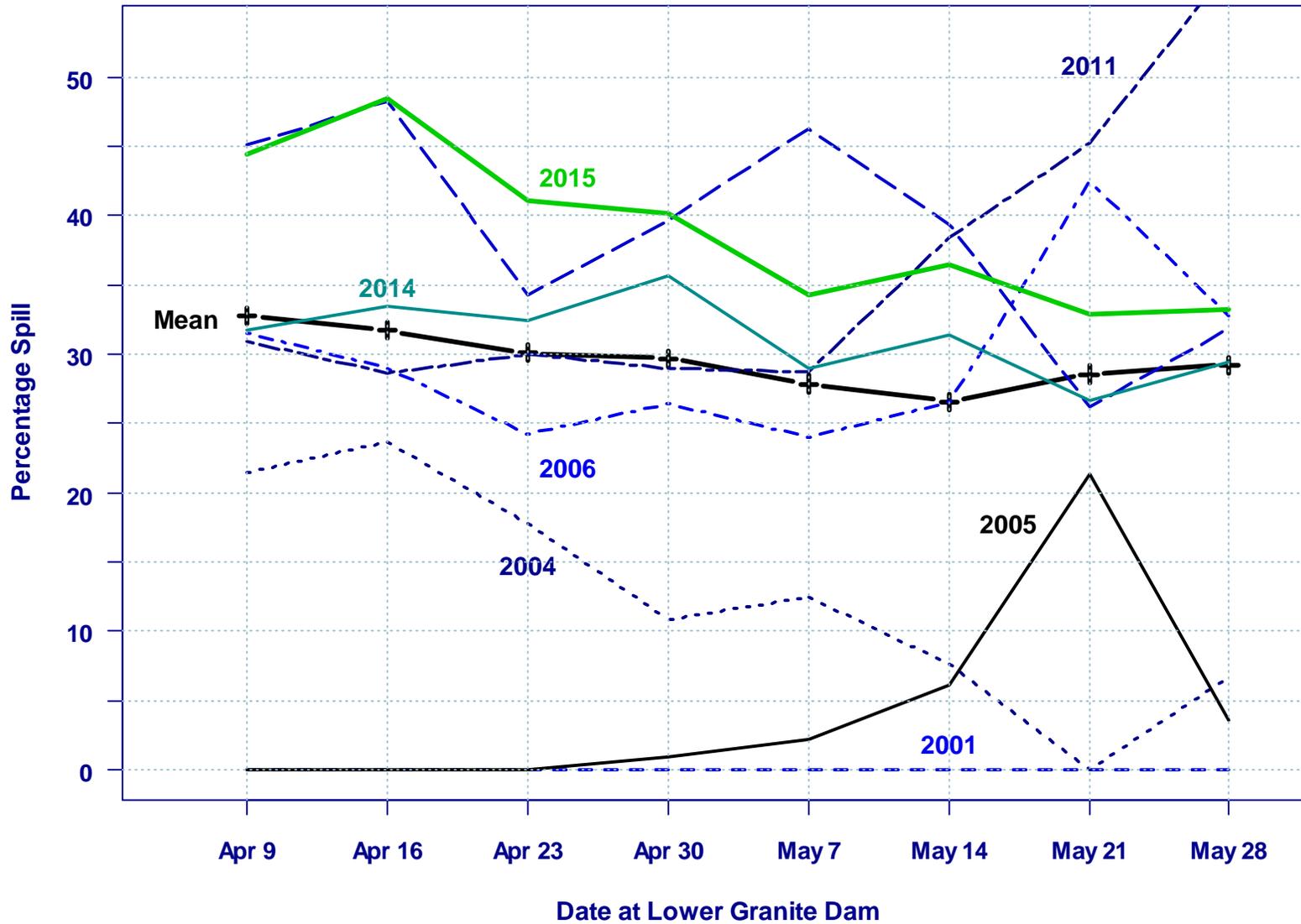
PIT-tag Data Sources



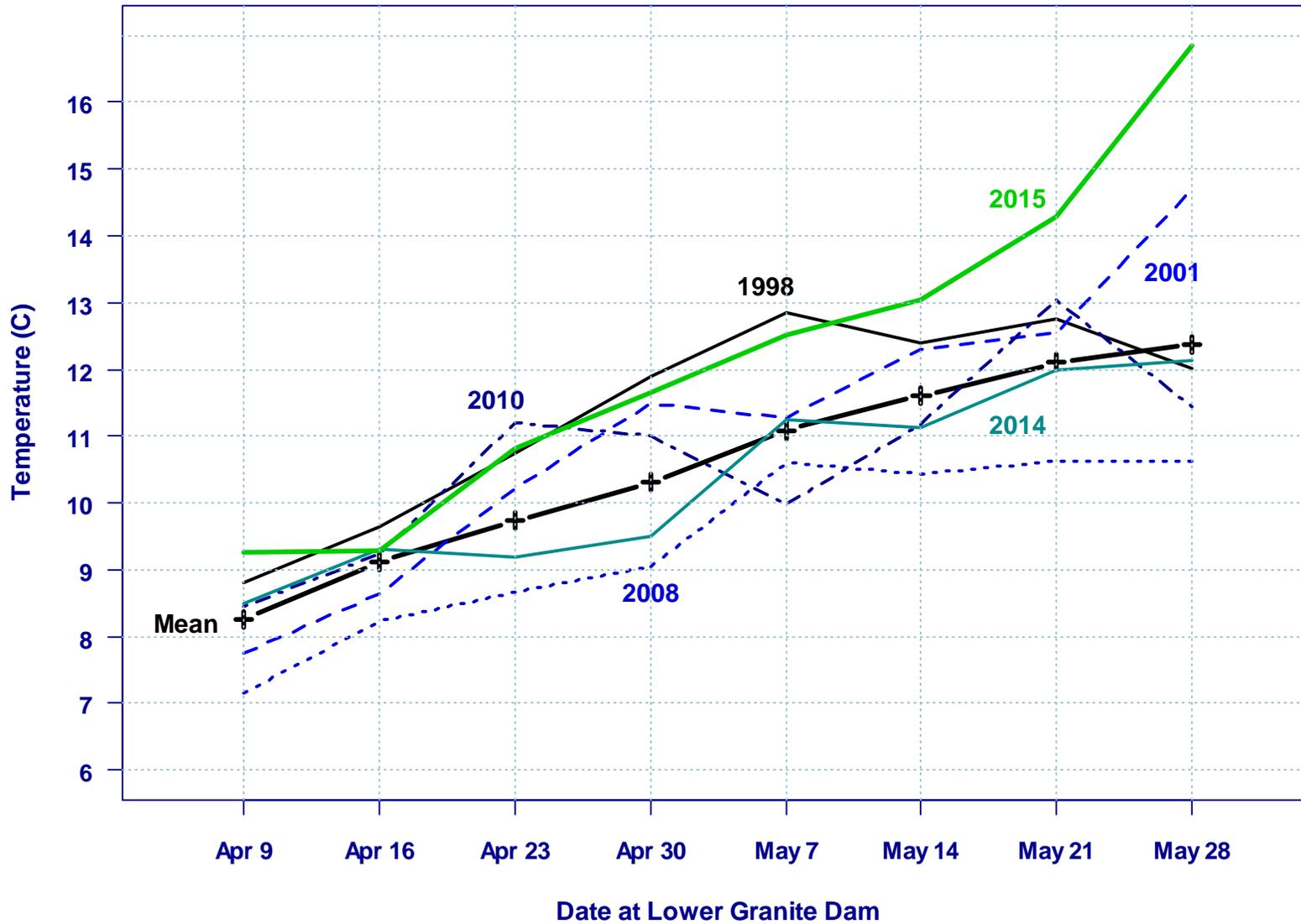
Weekly Mean Flow (kcfs) Lower Granite Dam



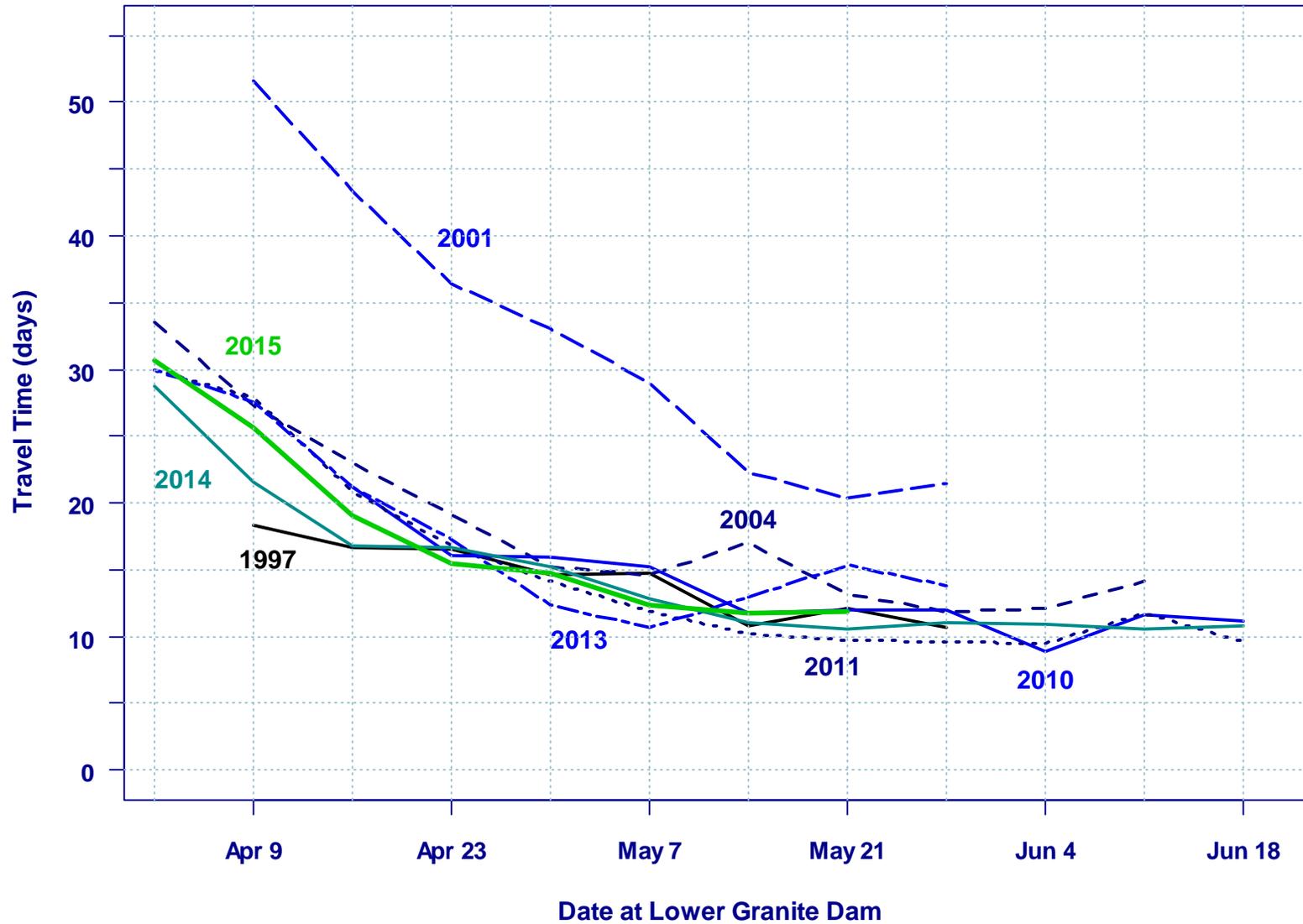
Weekly Mean %Spilled LGR, LGS, LMN



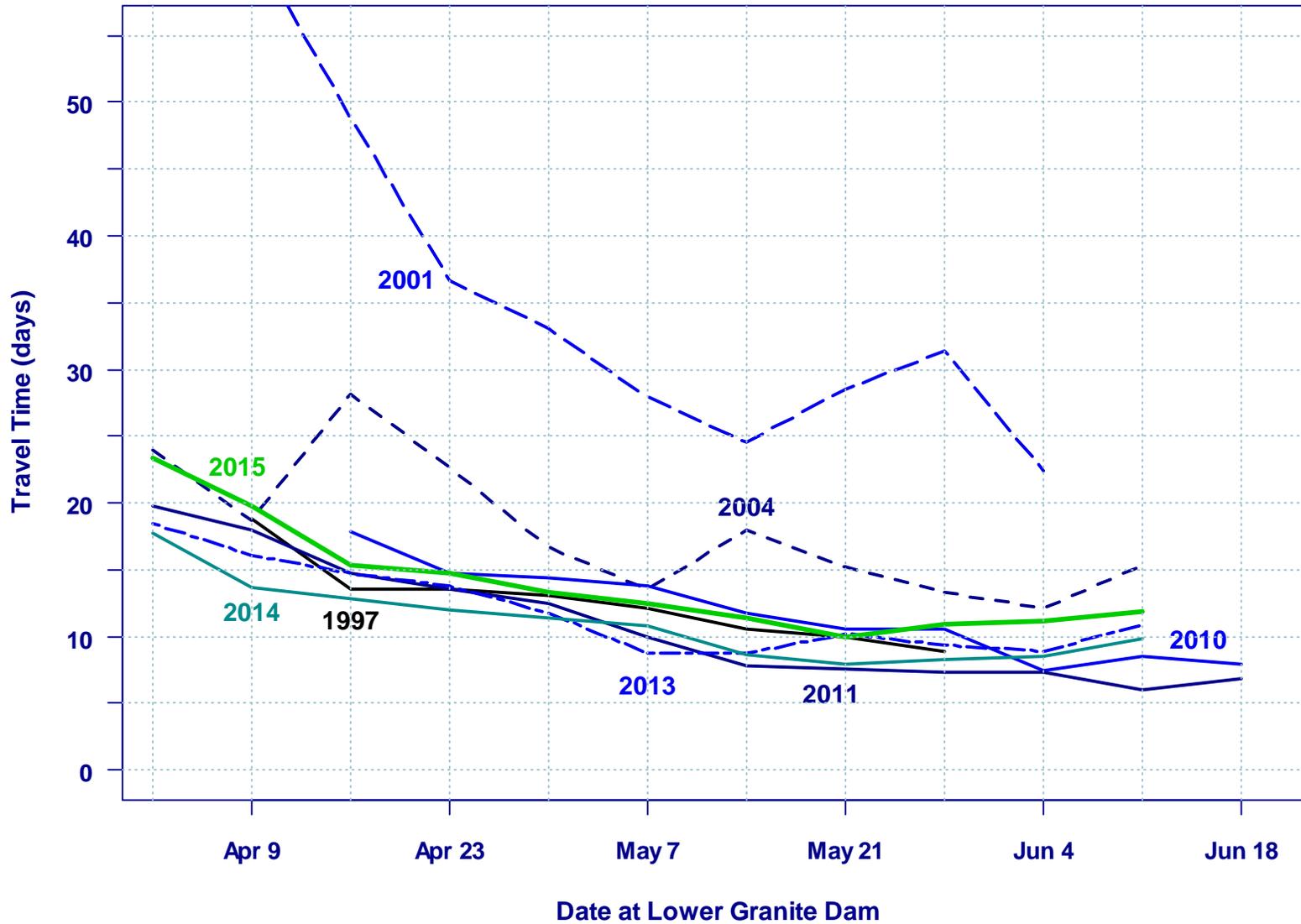
Weekly Mean Temperature Little Goose Dam



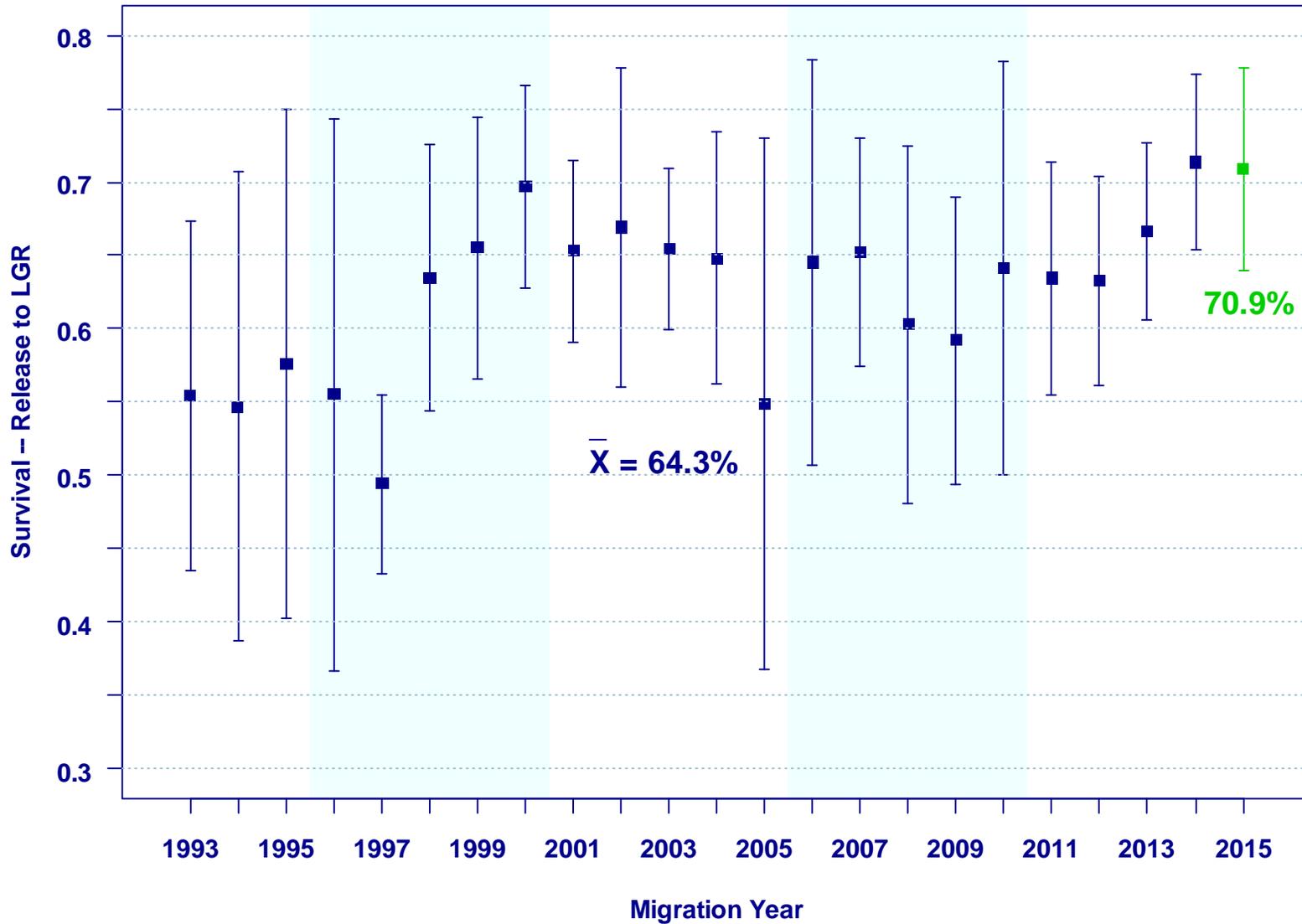
Yearling Chinook Median Travel Time Lower Granite to Bonneville (461 km)



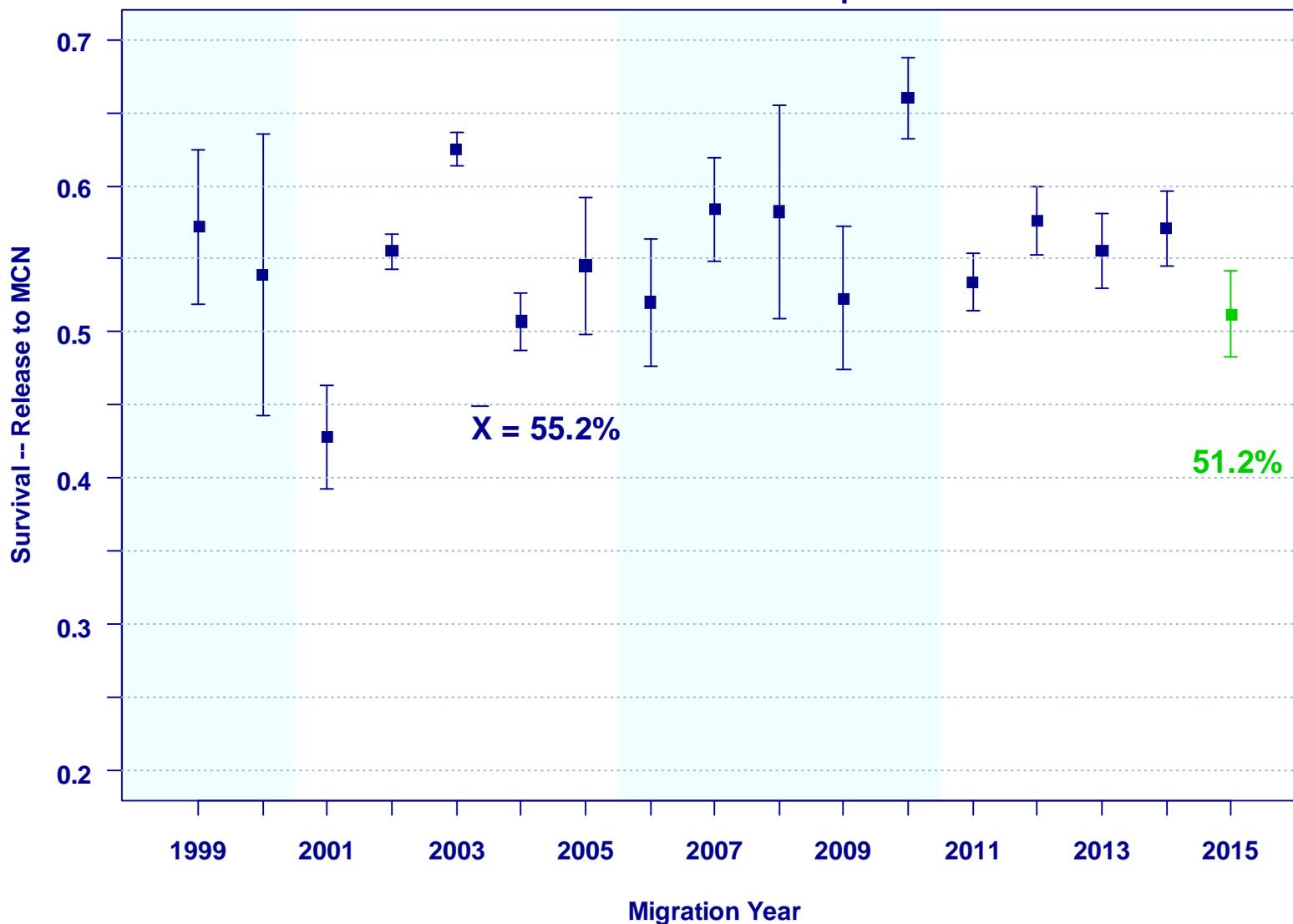
Steelhead Median Travel Time Lower Granite to Bonneville (461 km)



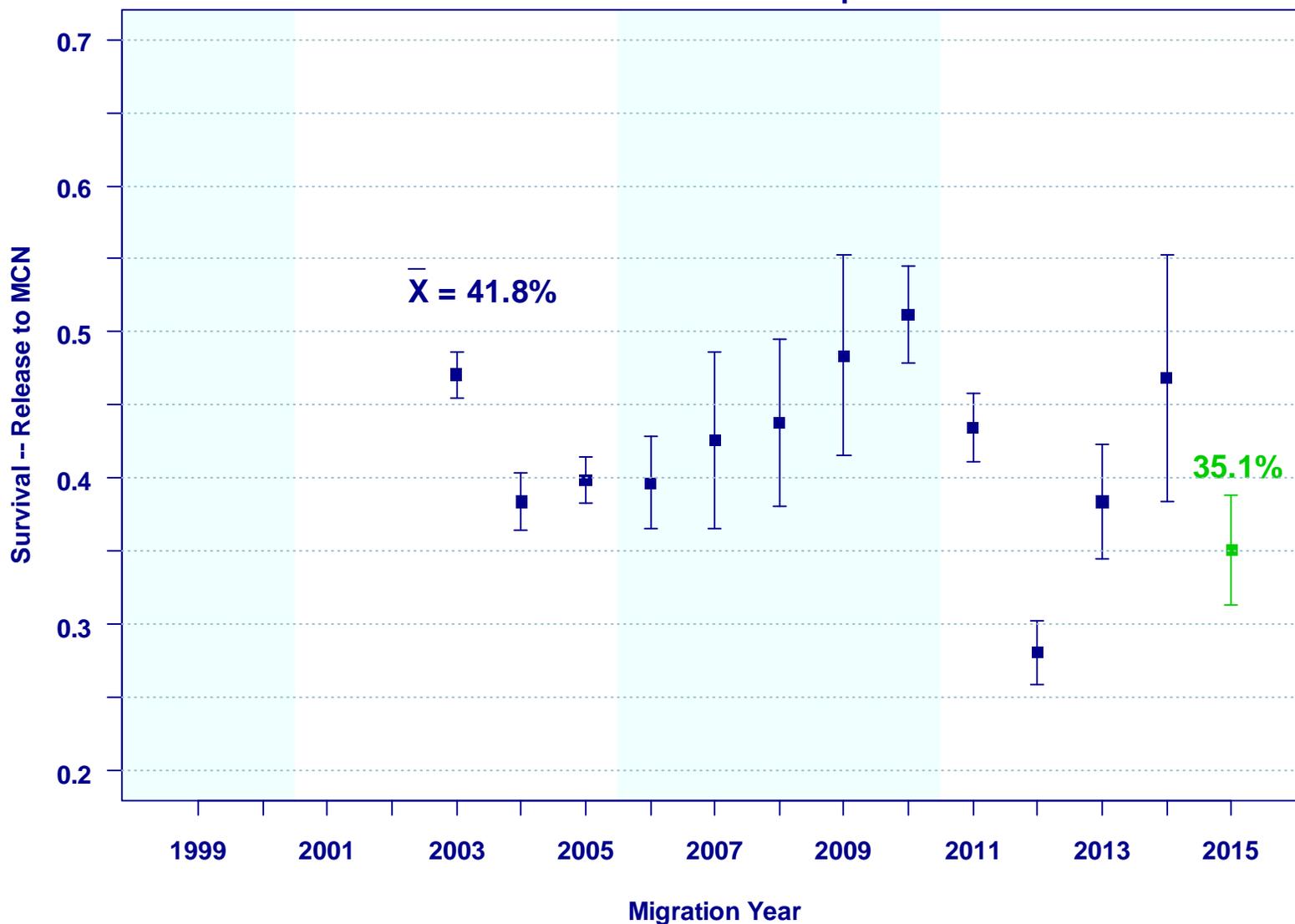
Yearling Chinook Snake River Basin Hatcheries Mean of Index Groups



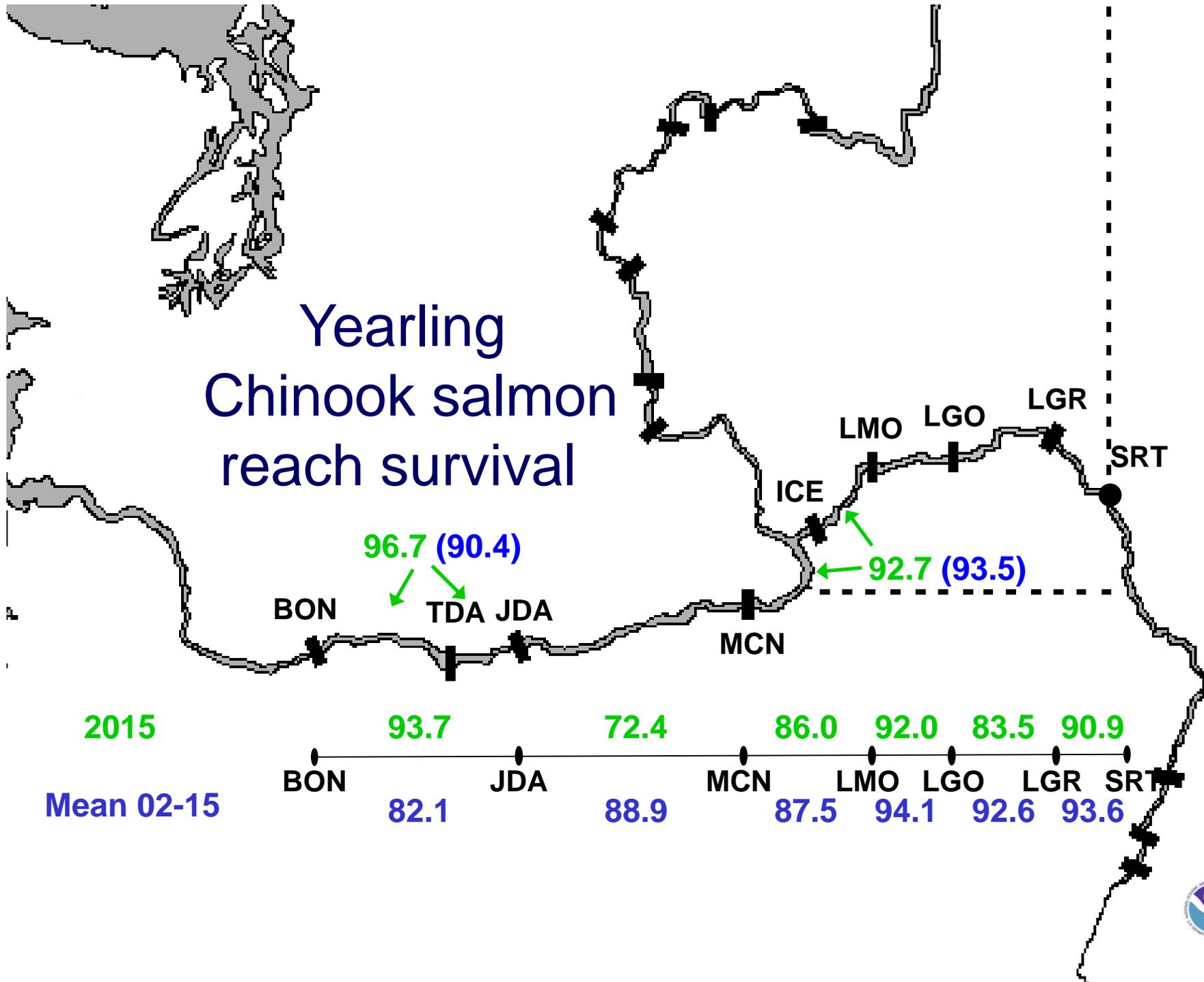
Yearling Chinook Upper Columbia River Hatcheries Mean of Index Groups

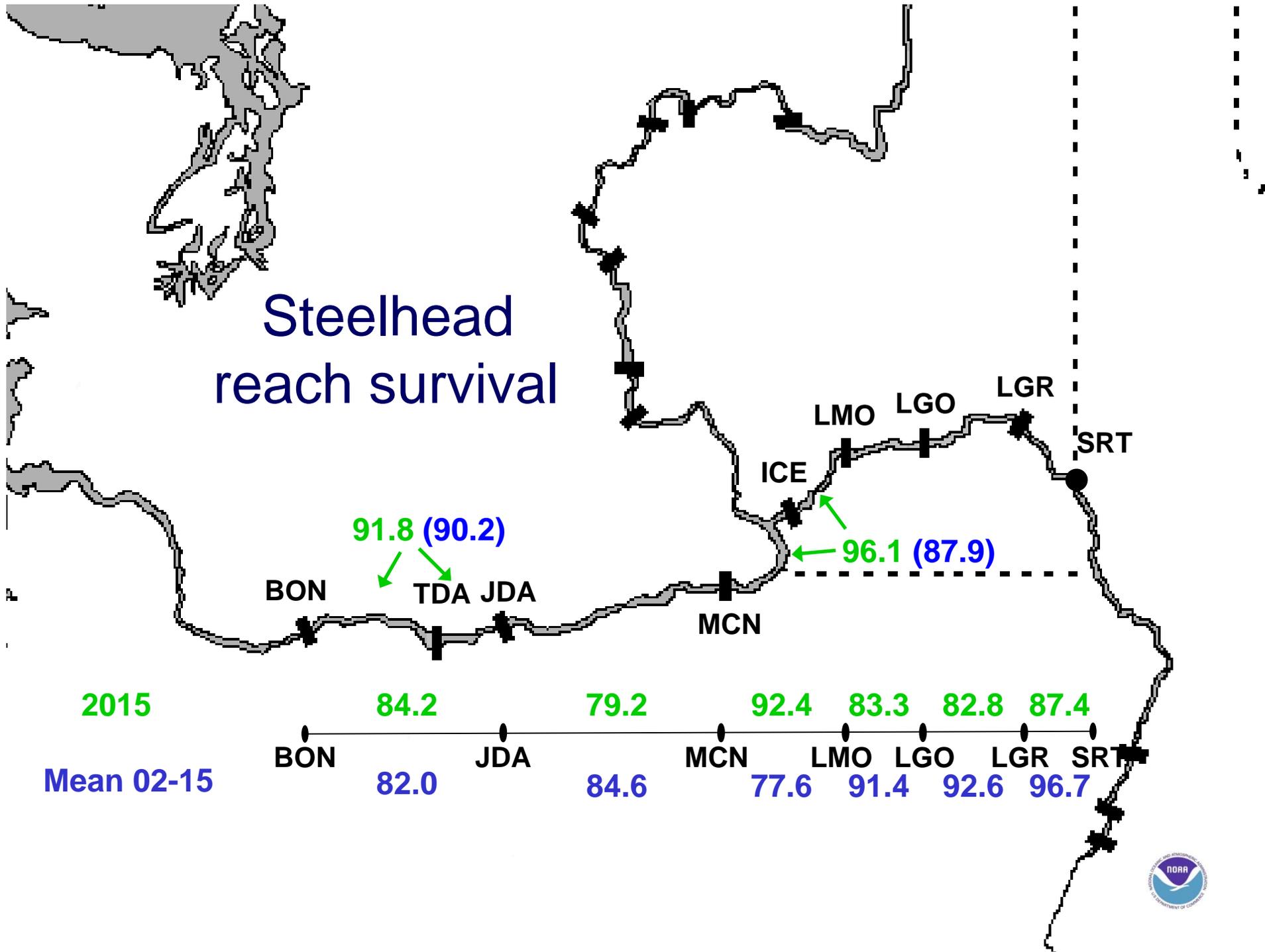


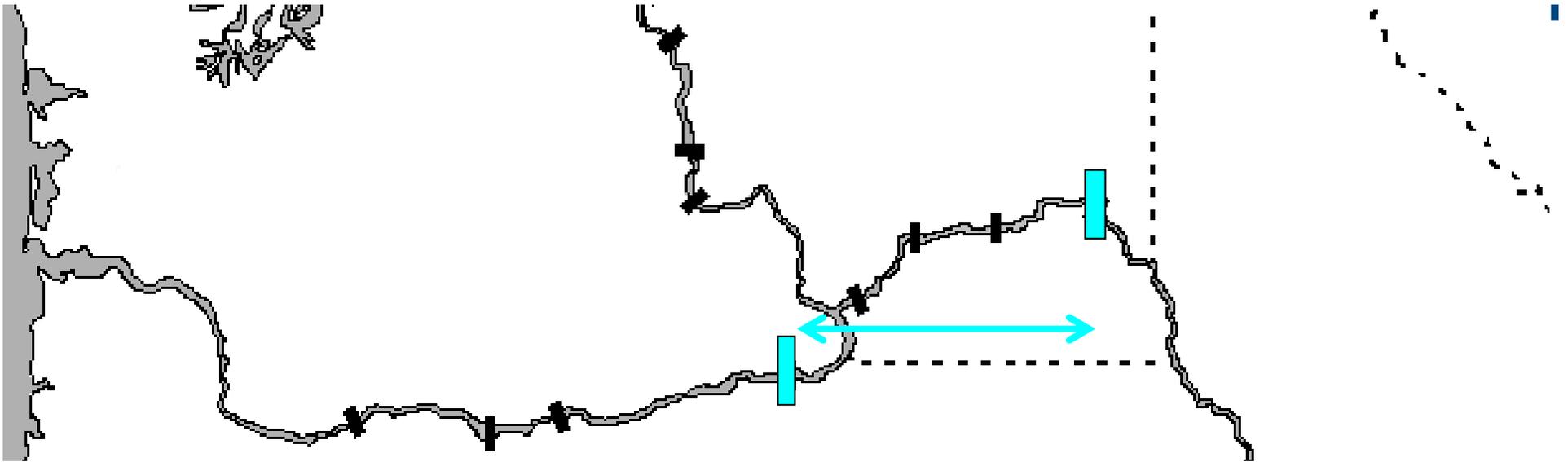
Steelhead Upper Columbia River Hatcheries Mean of Index Groups



Yearling Chinook salmon reach survival



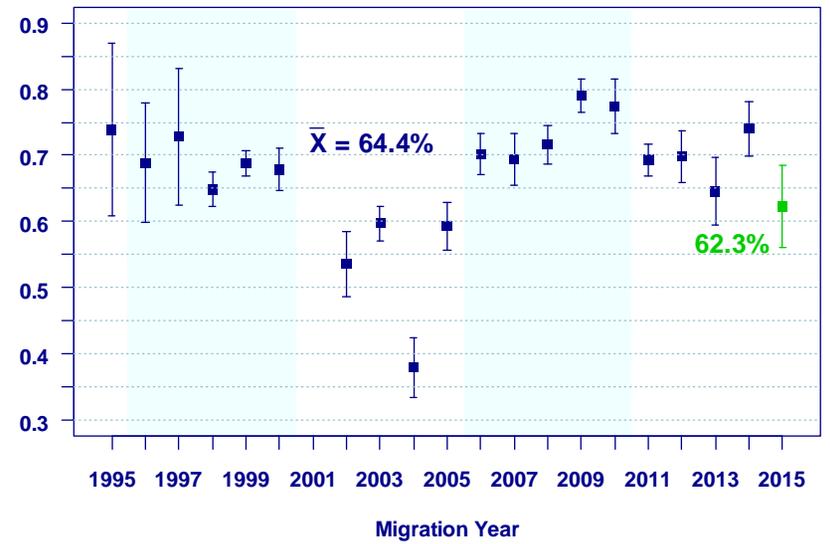
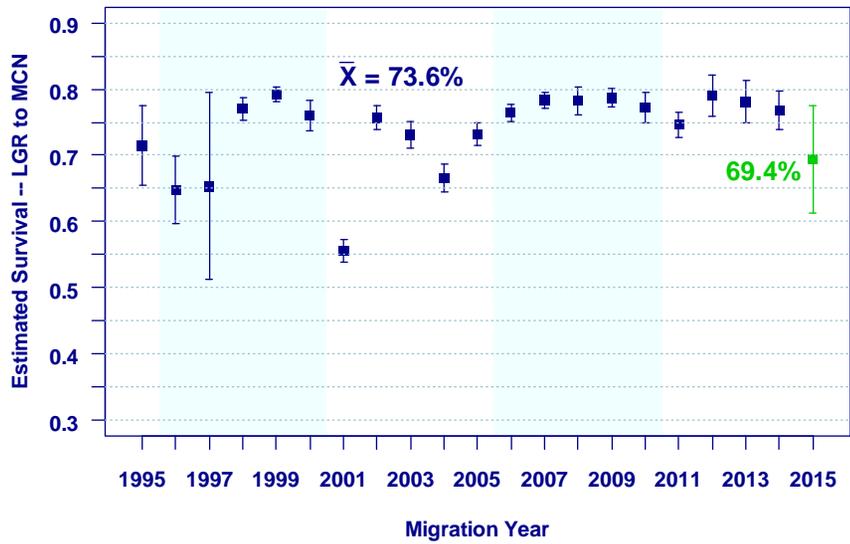


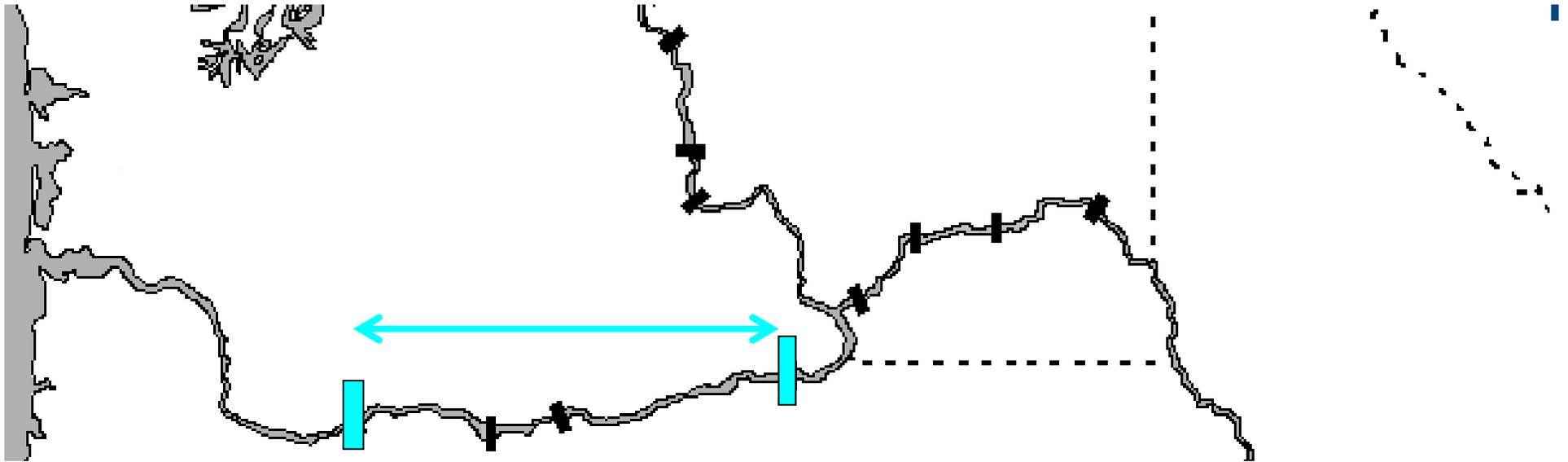


Yearling Chinook

Lower Granite to McNary

Steelhead

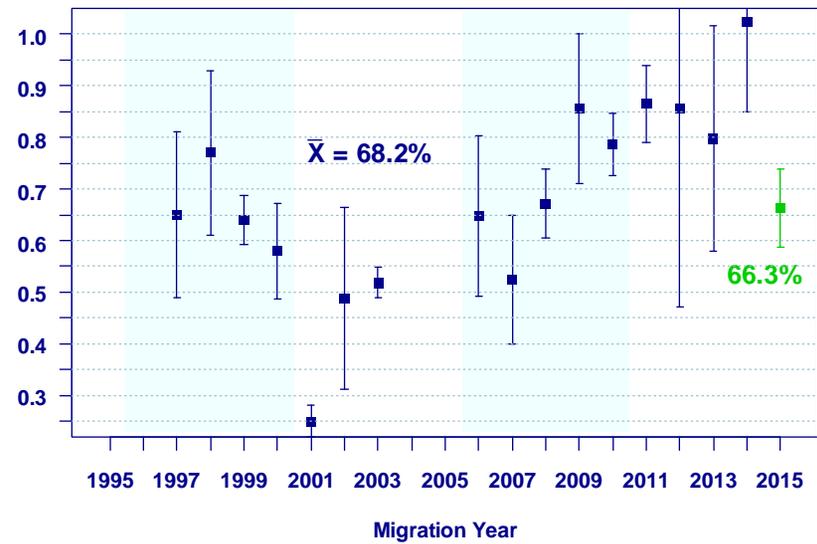
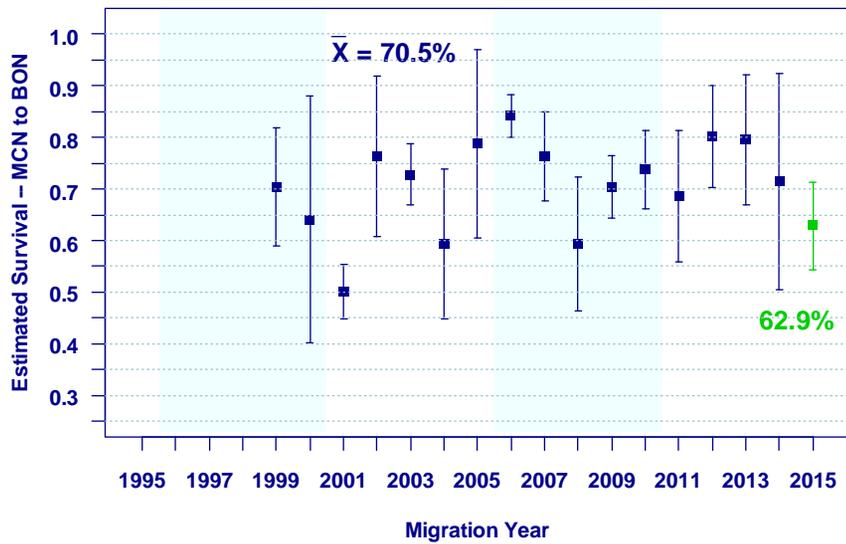


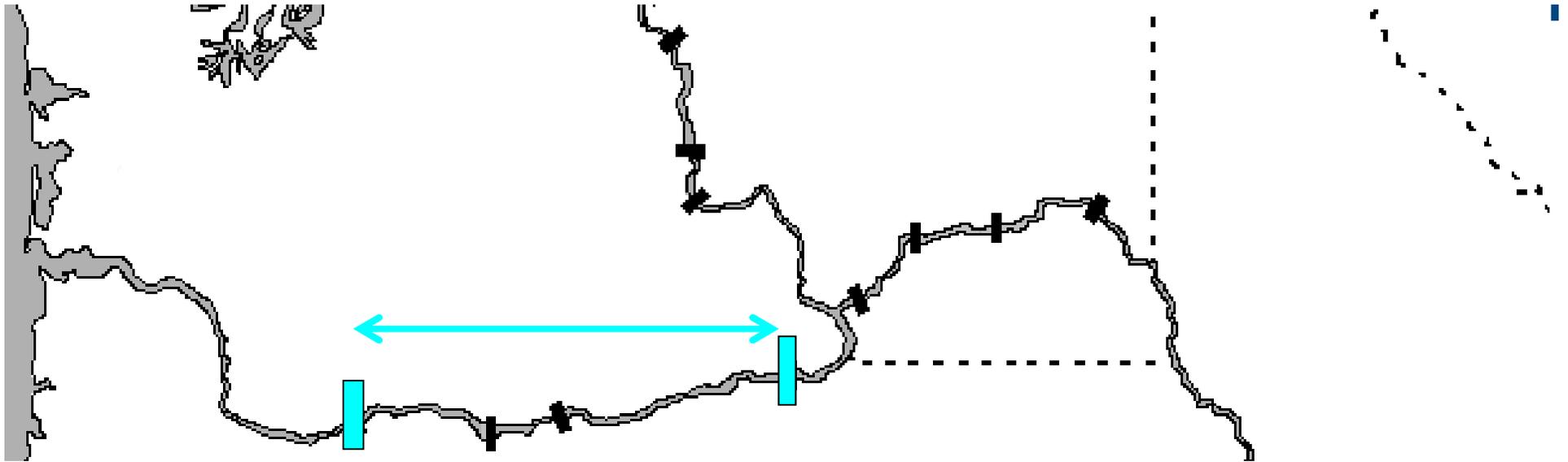


McNary to Bonneville
Fish from Snake River

Yearling Chinook

Steelhead

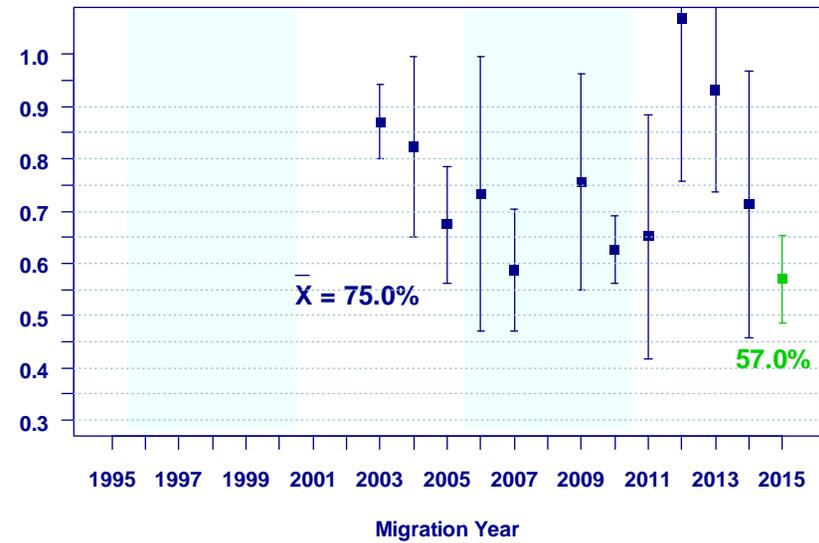
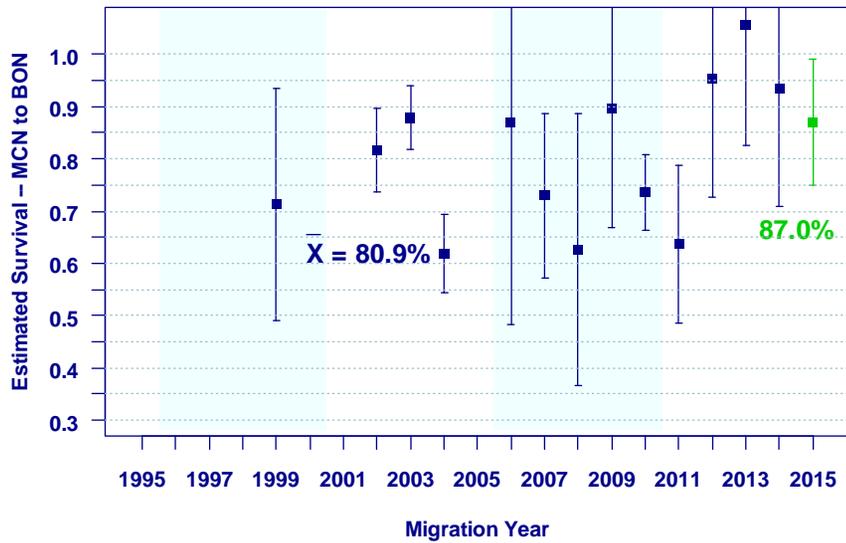


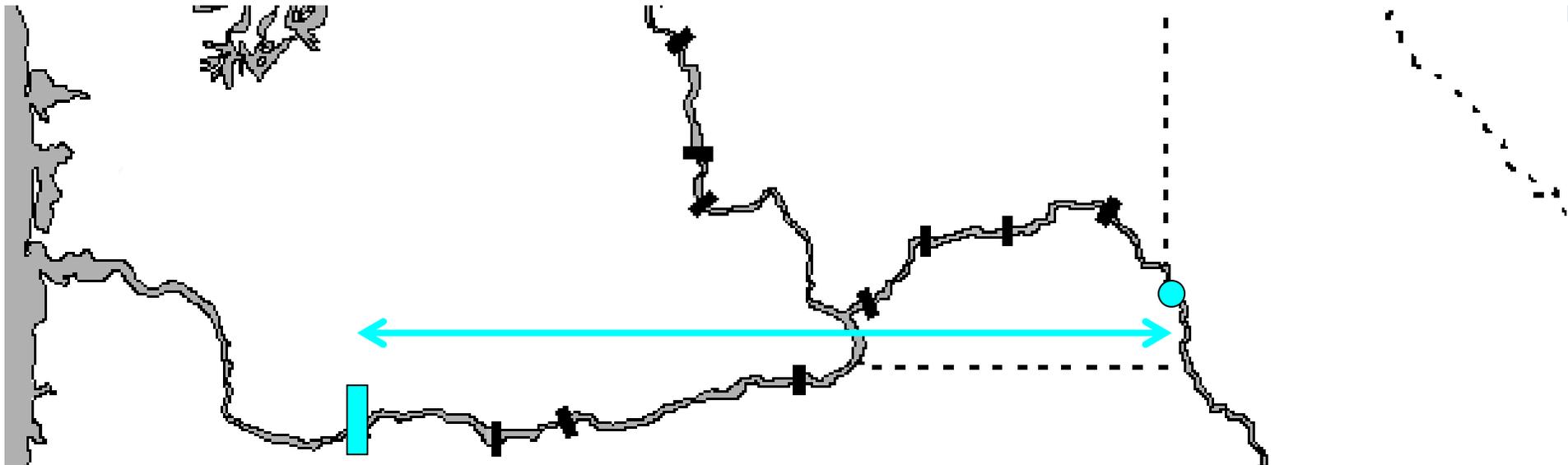


McNary to Bonneville
Fish from Upper Columbia

Yearling Chinook

Steelhead

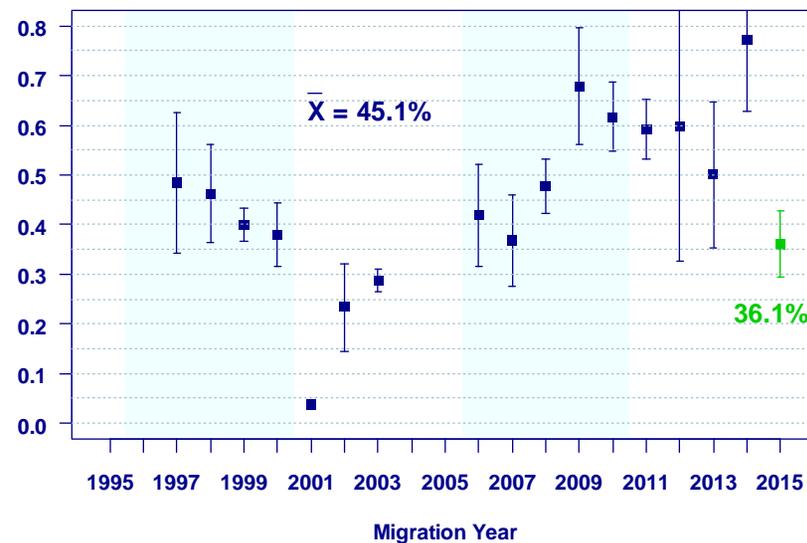
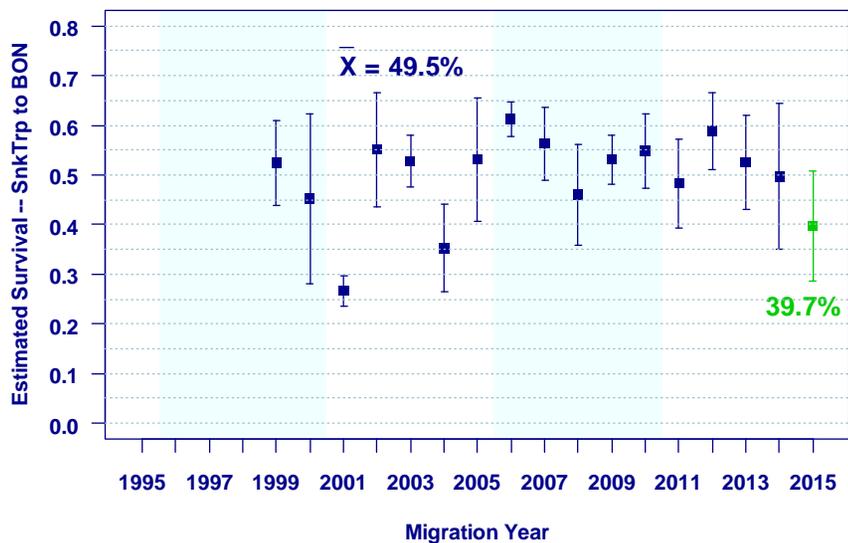


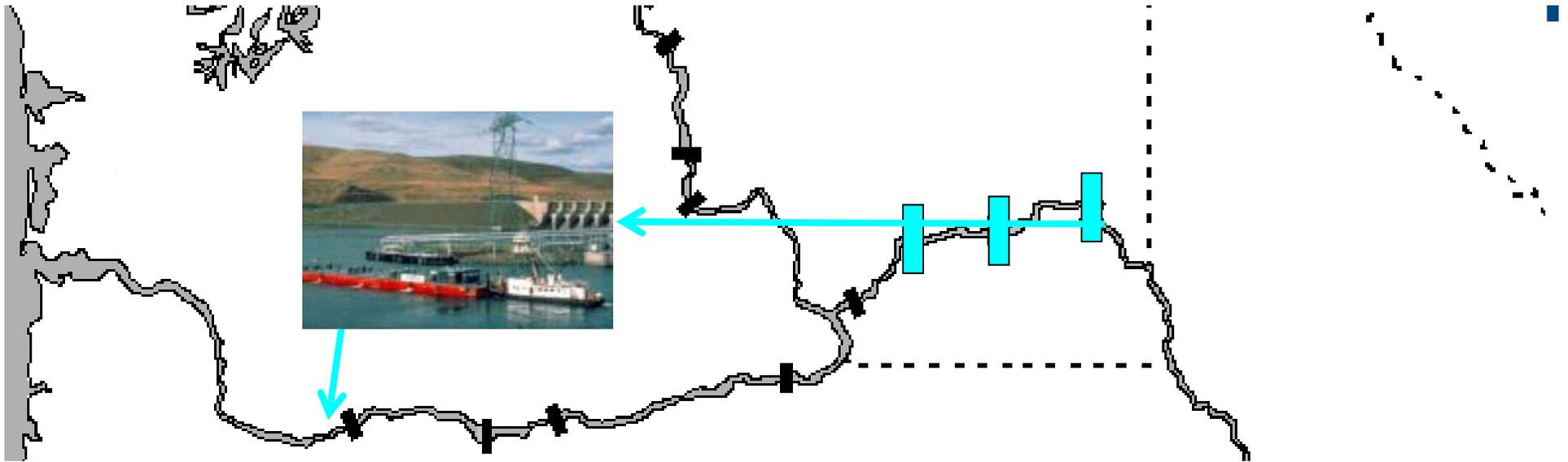


Yearling Chinook

Snake River Trap to Bonneville

Steelhead

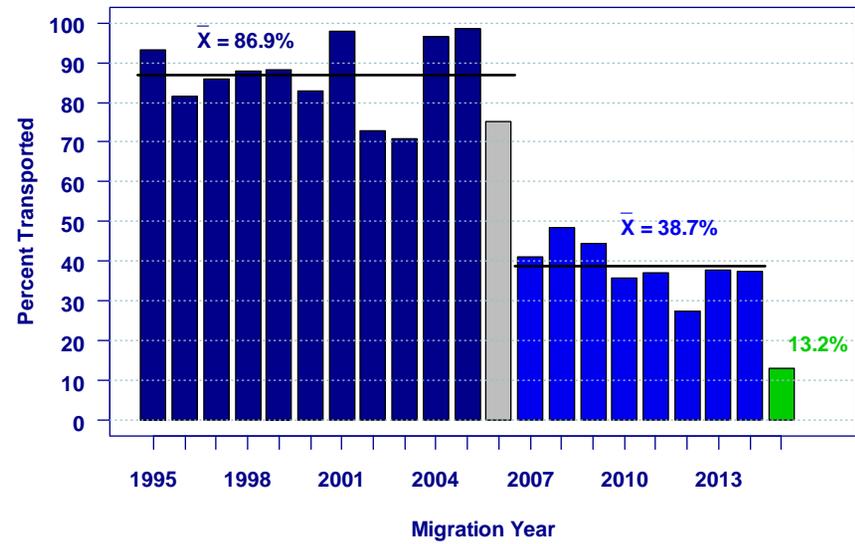
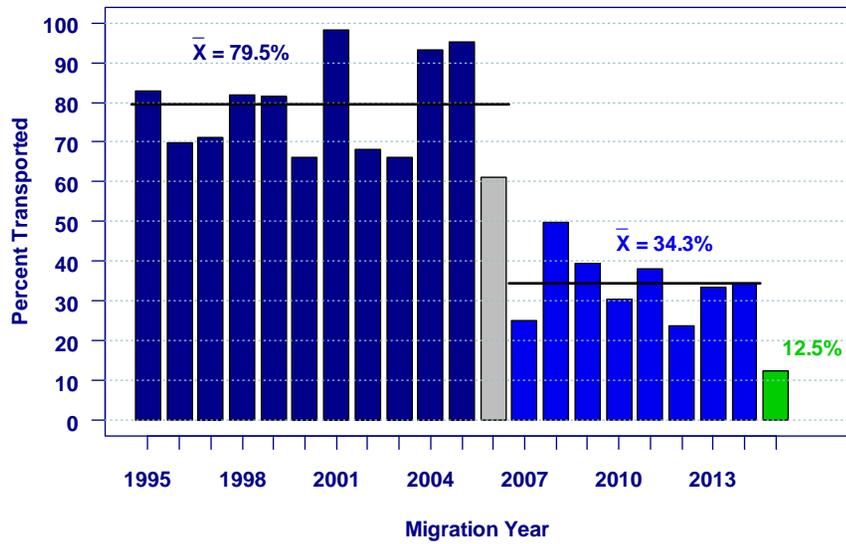




Yearling Chinook

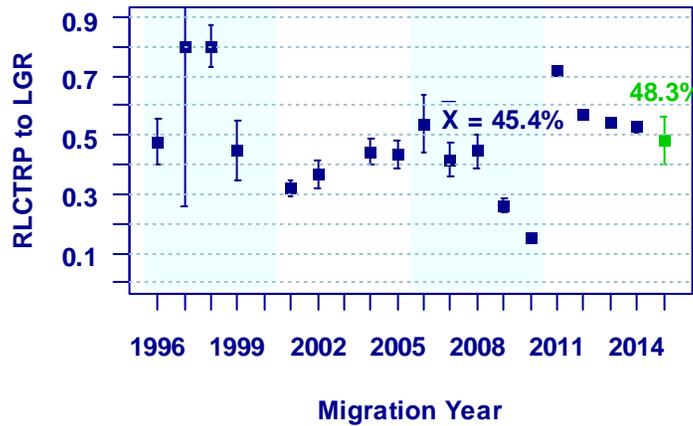
Estimated Percent Transported

Steelhead

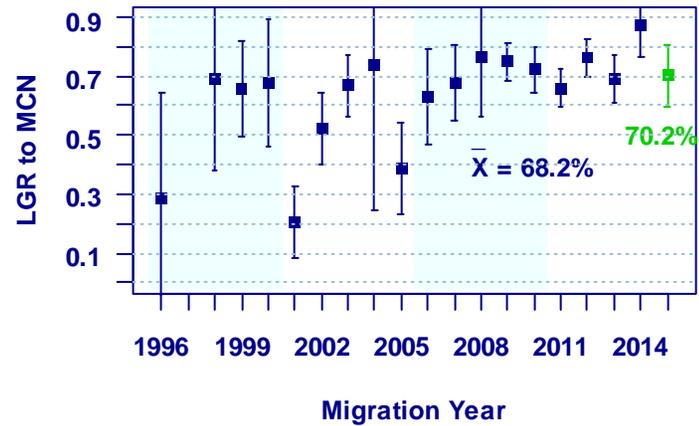


Snake River Sockeye: Estimated Survival

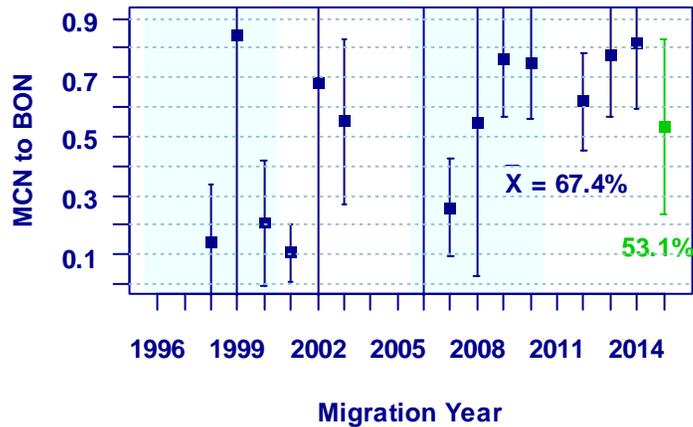
Redfish Lake Trap to Lower Granite



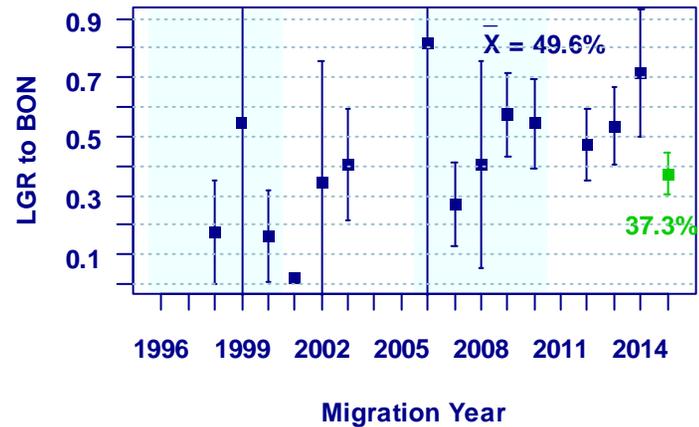
Lower Granite to McNary



McNary to Bonneville

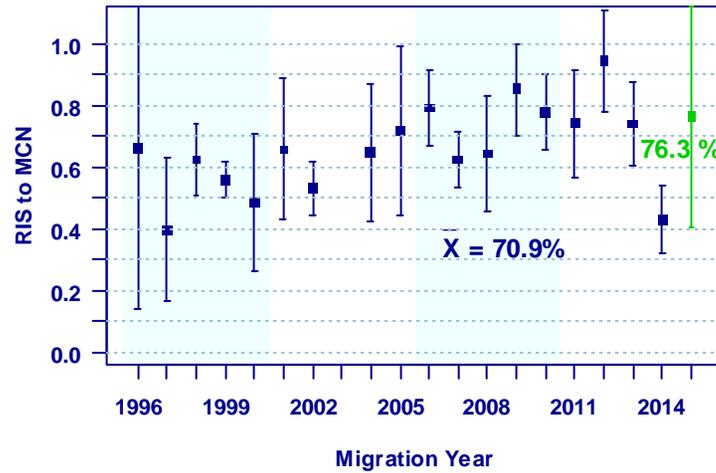


Lower Granite to Bonneville

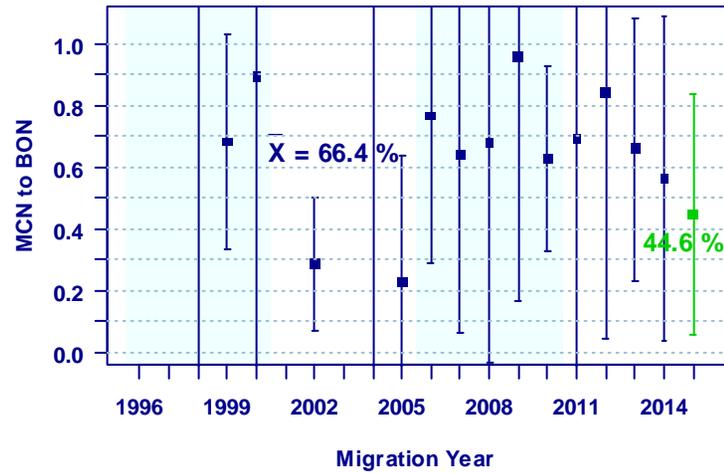


Columbia River Sockeye: Estimated Survival

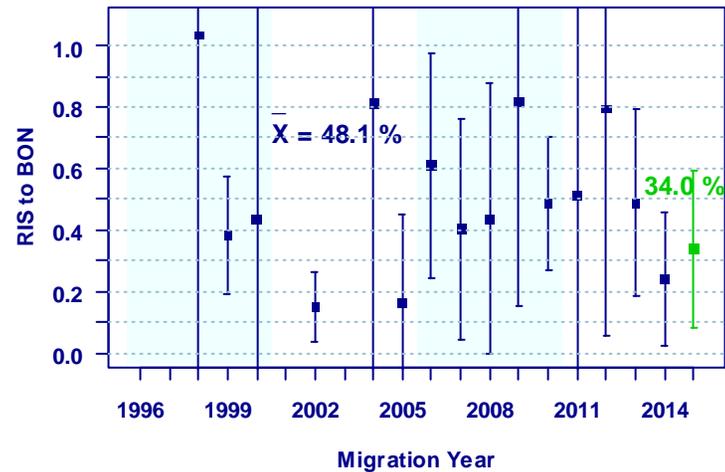
Rock Island to McNary



McNary to Bonneville



Rock Island to Bonneville



Smolt Transportation Seasonal Analyses

Yearling Chinook & Steelhead Migration Years 2010-2013

Estimating Seasonal SAR Patterns

- Need a “time-stamp”
- We use fish detected at Lower Granite Dam
 - either transported or bypassed

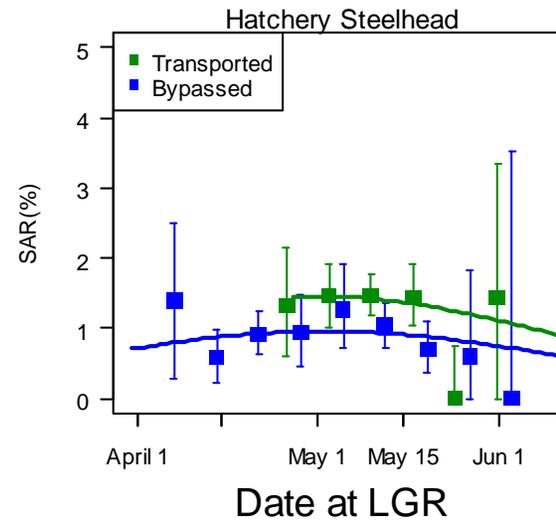
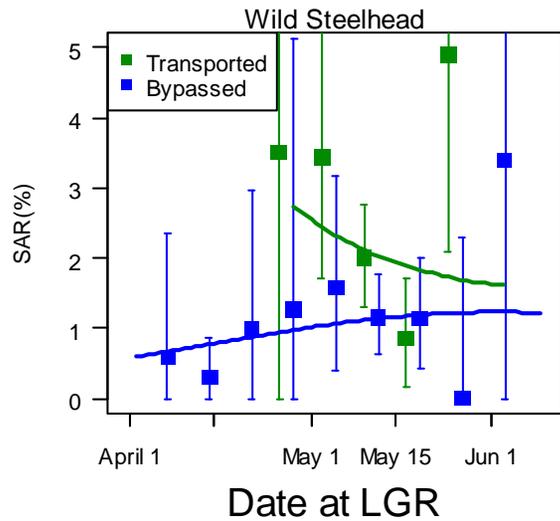
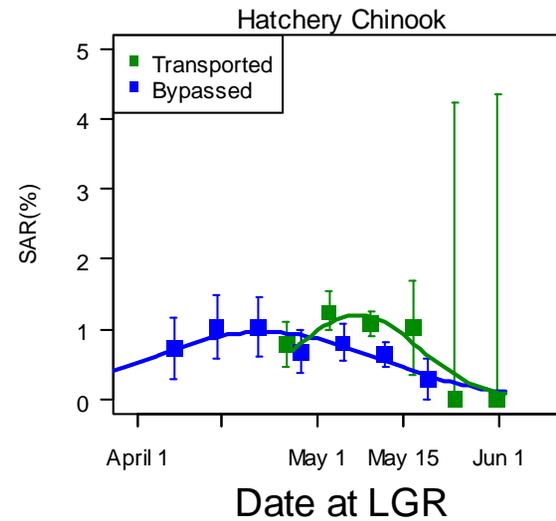
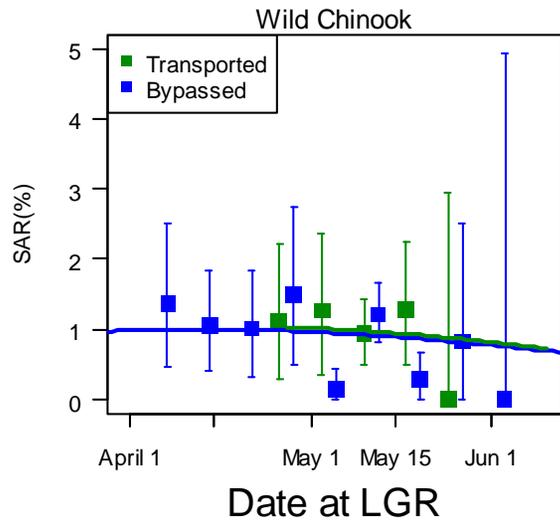
Transportation Summary

Yearling Chinook & Steelhead

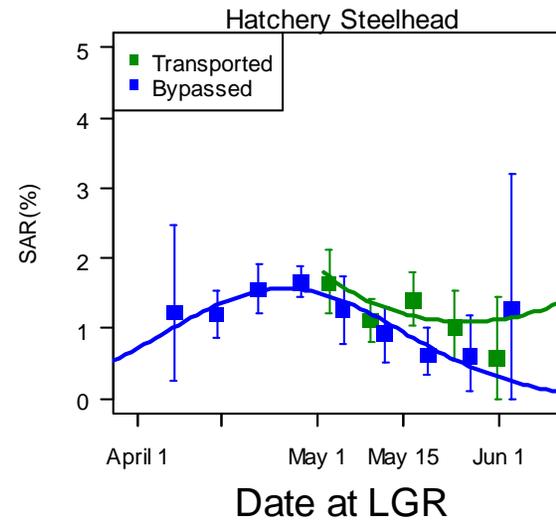
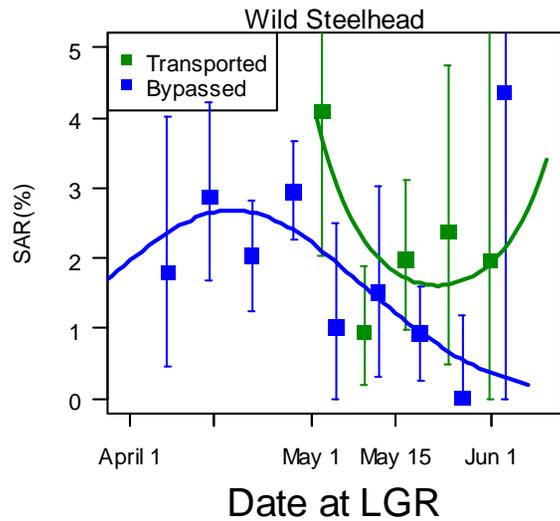
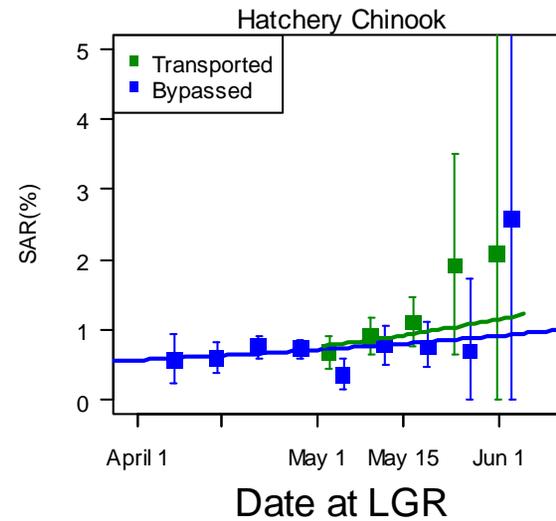
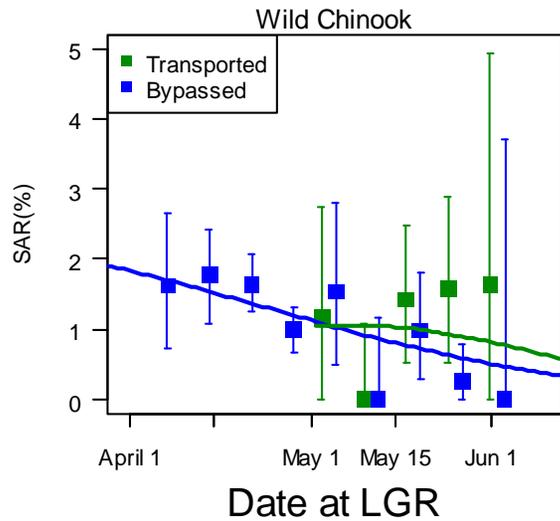
- Benefit of transportation was reduced in 2006-2013 compared to earlier years
- SAR for transported fish tagged upstream of LGR still exceeded that for **bypassed** fish for most of the season (except 2011 wild chinook)
- Benefits of transportation small enough that evaluation depends on standard applied



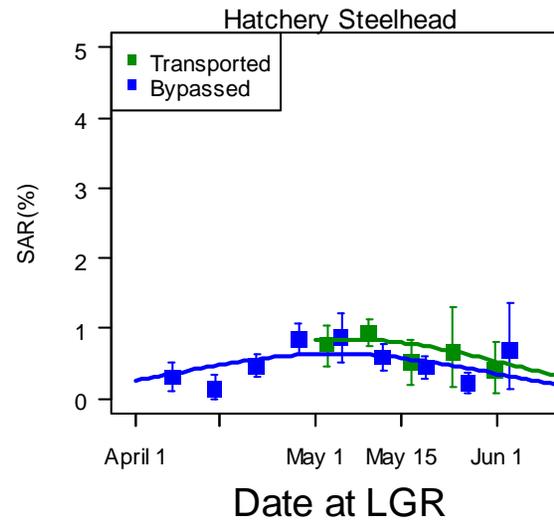
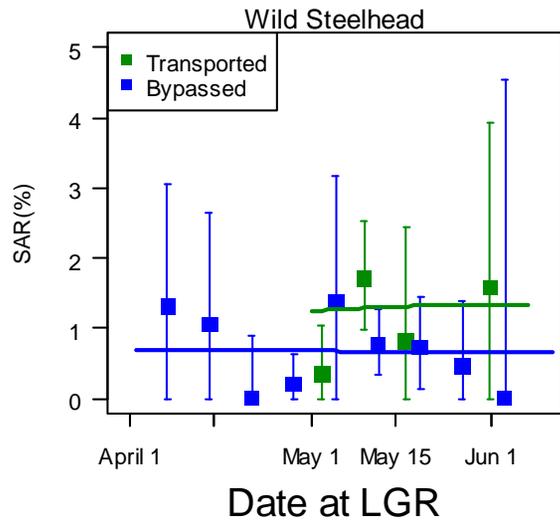
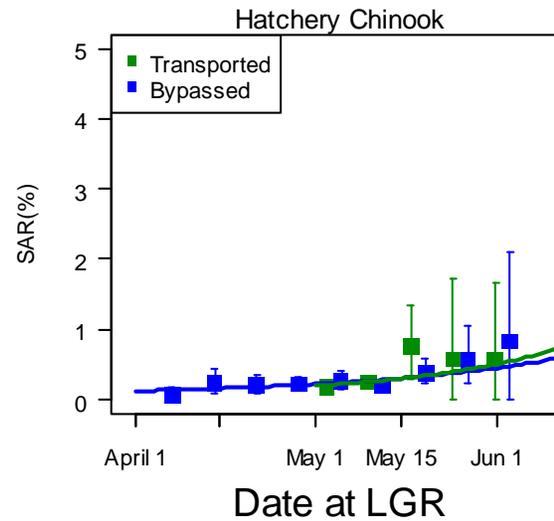
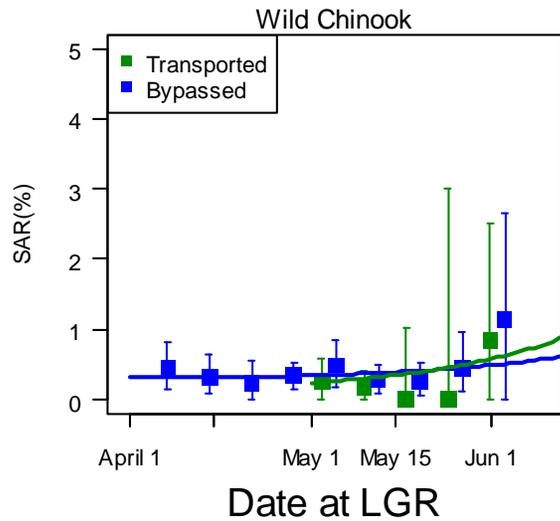
MY 2013 - Tagged Upstream of Lower Granite Transported or Bypassed at Lower Granite Dam



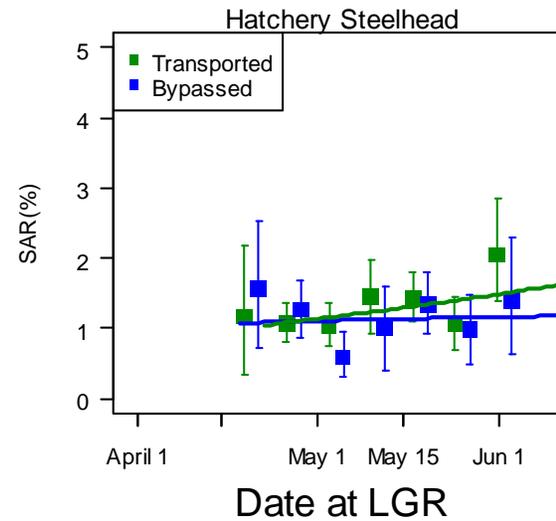
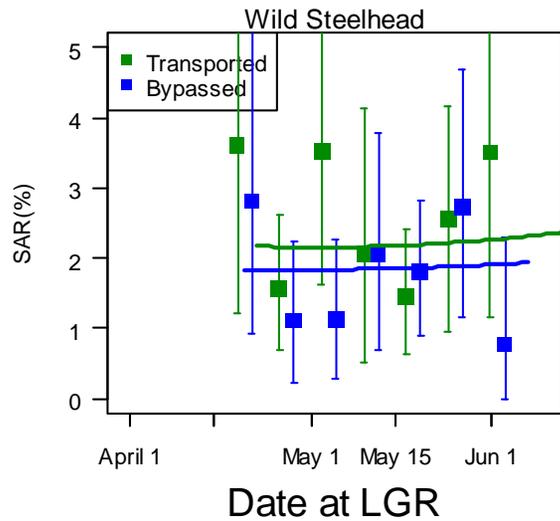
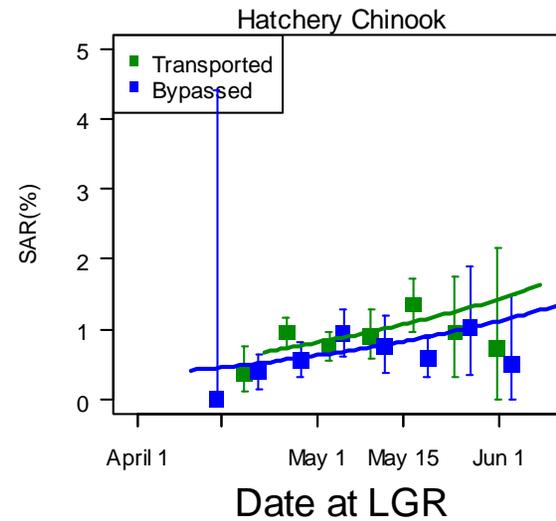
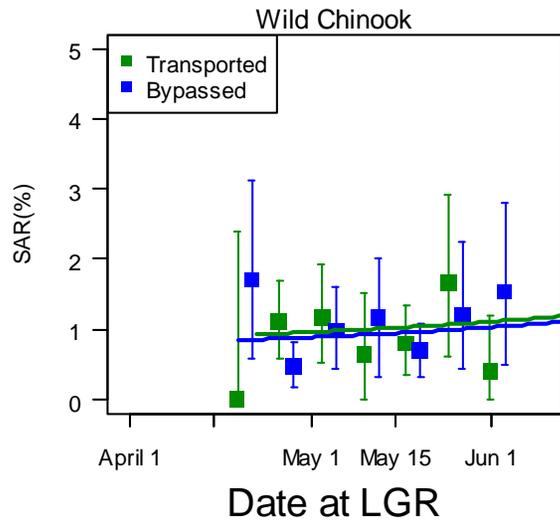
MY 2012 - Tagged Upstream of Lower Granite Transported or Bypassed at Lower Granite Dam



MY 2011 - Tagged Upstream of Lower Granite Transported or Bypassed at Lower Granite Dam



MY 2010 - Tagged Upstream of Lower Granite Transported or Bypassed at Lower Granite Dam



Transportation Evaluation

- Based on Relative SAR = “**T:B Ratio**”

- $T:B > 1 :$

transported SAR > bypassed SAR

Transportation Evaluation

- Based on Relative SAR = “**T:B Ratio**”

- $T:B > 1$:

transported SAR > bypassed SAR

- What about fish never in a collection system?

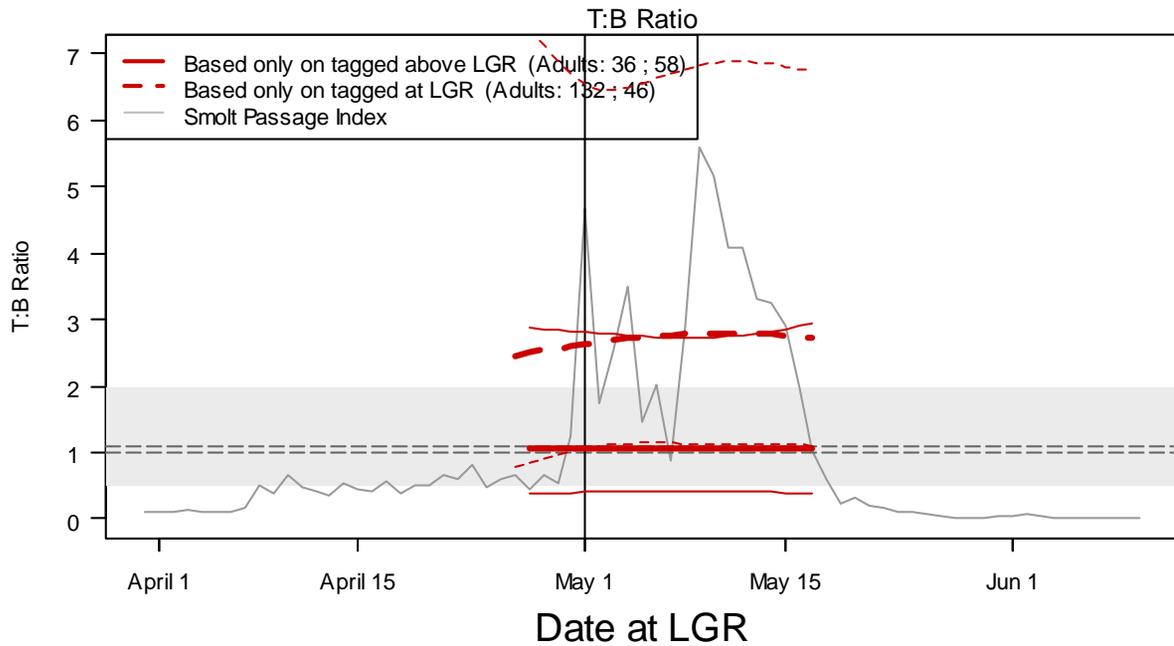
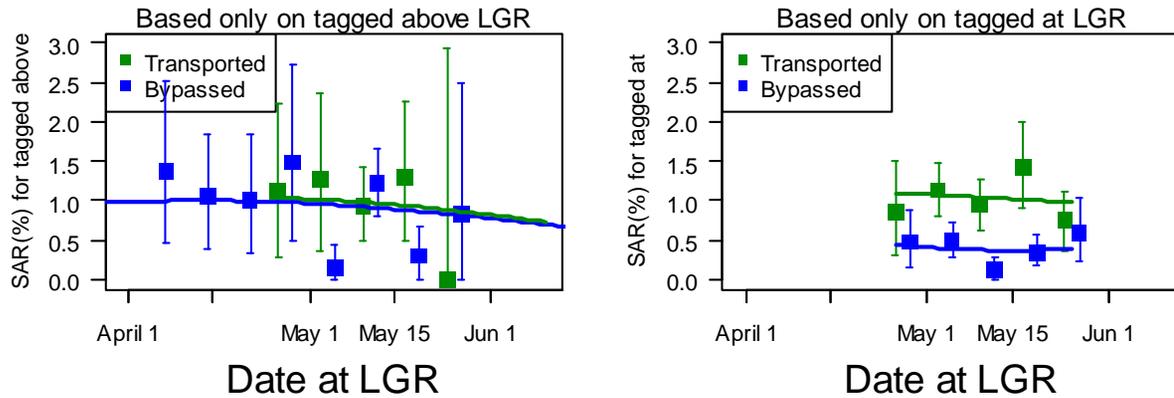
SAR Ratio Standards

Migration Year	Wild Chinook			Hatchery Chinook			Wild Steelhead			Hatchery Steelhead		
	SAR Ratio ^a	Prop. Nondet ^b	Alt. Std.	SAR Ratio ^a	Prop. Nondet ^b	Alt. Std.	SAR Ratio ^c	Prop. Nondet ^b	Alt. Std.	SAR Ratio ^a	Prop. Nondet ^b	Alt. Std.
1998-2005	1.14	0.39 ^d	1.06^e	1.22	0.57 ^d	1.13^e	1.39	0.40 ^d	1.16^e	1.52	0.41 ^d	1.22^e
2006	1.14	0.28	1.04	1.22	0.43	1.10	1.39	0.18	1.07	1.52	0.15	1.08
2007	1.14	0.54	1.08	1.22	0.69	1.16	1.39	0.54	1.21	1.52	0.39	1.20
2008	1.14	0.38	1.05	1.22	0.55	1.12	1.39	0.35	1.14	1.52	0.50	1.26
2009	1.14	0.30	1.04	1.22	0.56	1.13	1.39	0.25	1.10	1.52	0.31	1.16
2010	1.14	0.63	1.09	1.22	0.84	1.19	1.39	0.71	1.28	1.52	0.75	1.39
2011	1.14	0.28	1.04	1.22	0.46	1.10	1.39	0.38	1.15	1.52	0.36	1.19
2012	1.14	0.29	1.04	1.22	0.48	1.11	1.39	0.36	1.14	1.52	0.39	1.20
2013	1.14	0.56	1.08	1.22	0.75	1.17	1.39	0.59	1.23	1.52	0.67	1.35

- a. Geometric mean of annual ratio of SAR of “never-detected” fish to SAR of fish detected at Lower Granite Dam, 1998-2013 (excl. 2001).
- b. Proportion of inriver migrants (LGR-equivalent) not detected at Snake River collector dams.
- c. Geometric mean of annual ratio of SAR of “never-detected” fish to SAR of fish detected at Lower Granite Dam, 1998-2013 (excl. 2001, 2004, 2005).
- d. Arithmetic mean of 2006-2013 values.
- e. Geometric mean of 2006-2013 values.

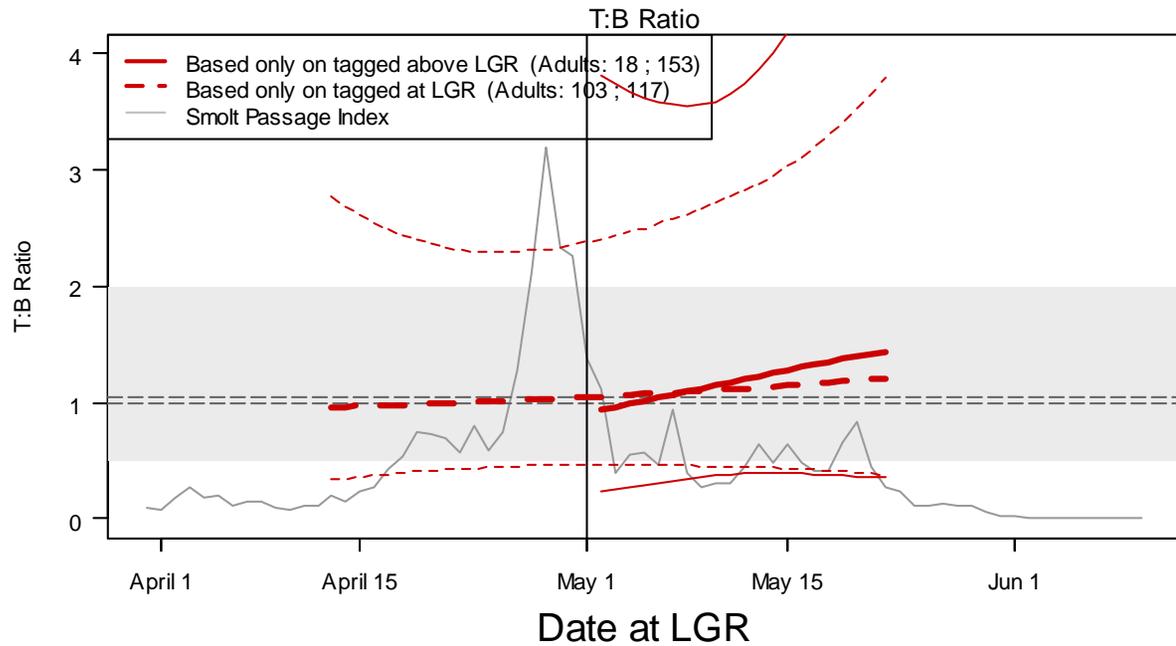
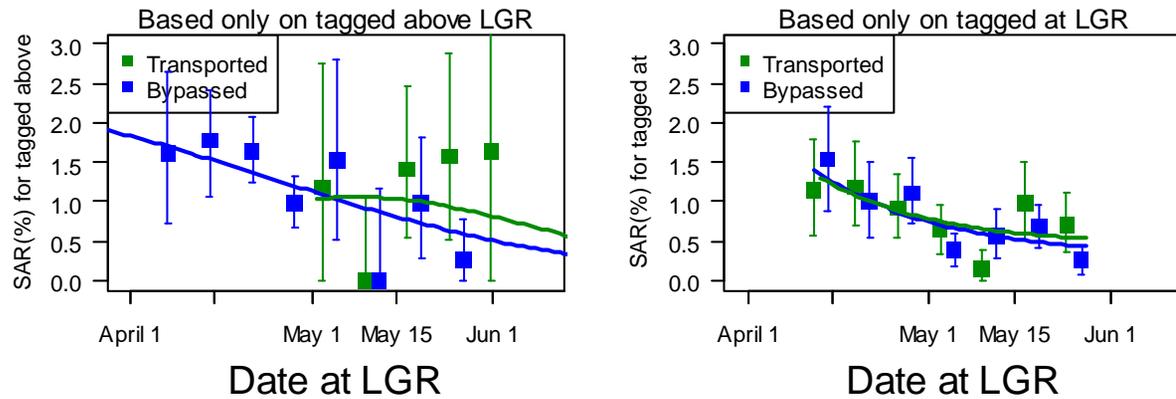
Wild Chinook 2013

Transported or Bypassed at Lower Granite Dam



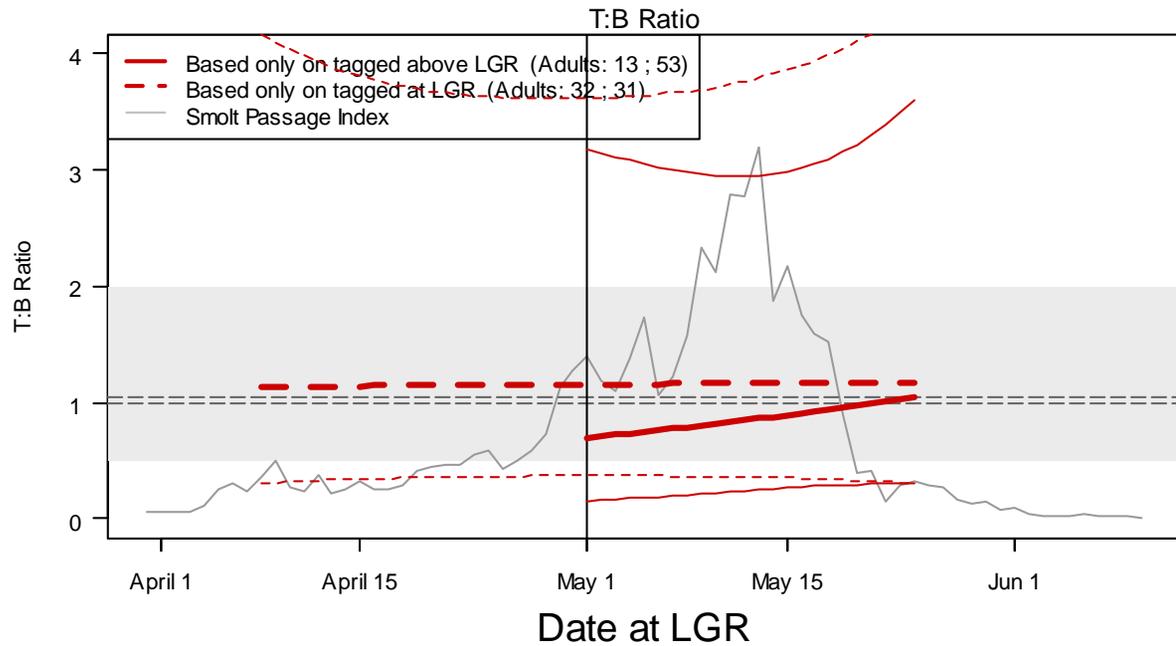
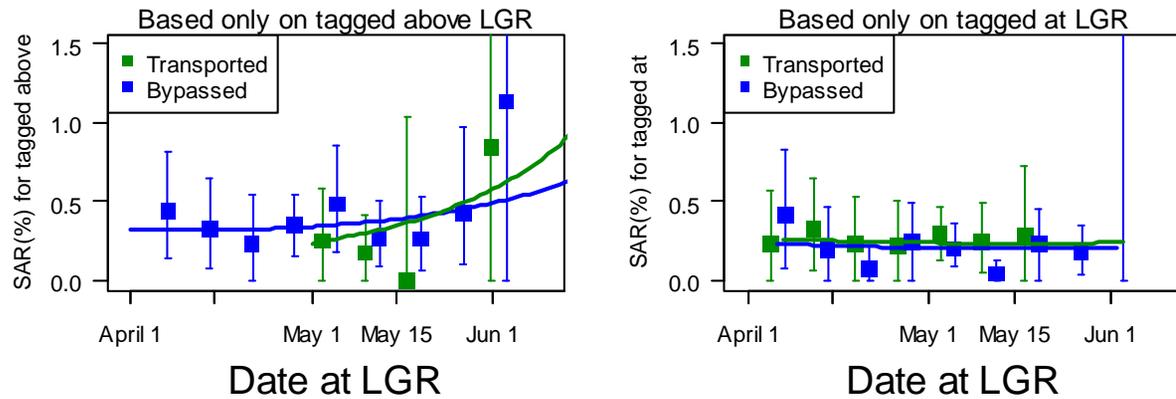
Wild Chinook 2012

Transported or Bypassed at Lower Granite Dam



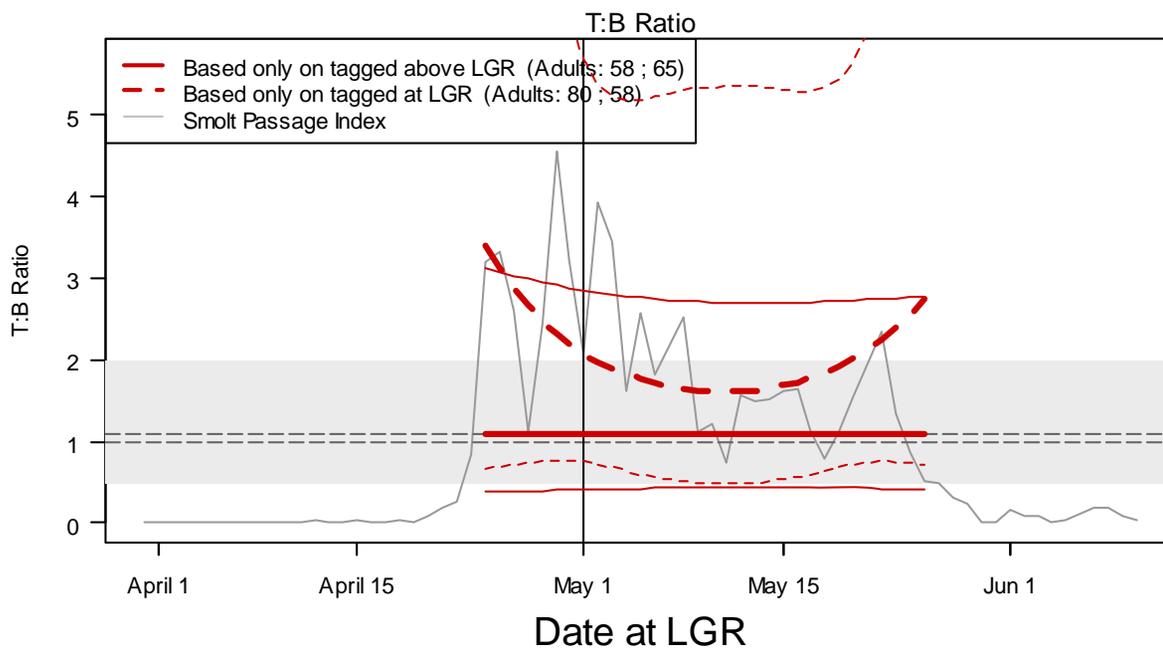
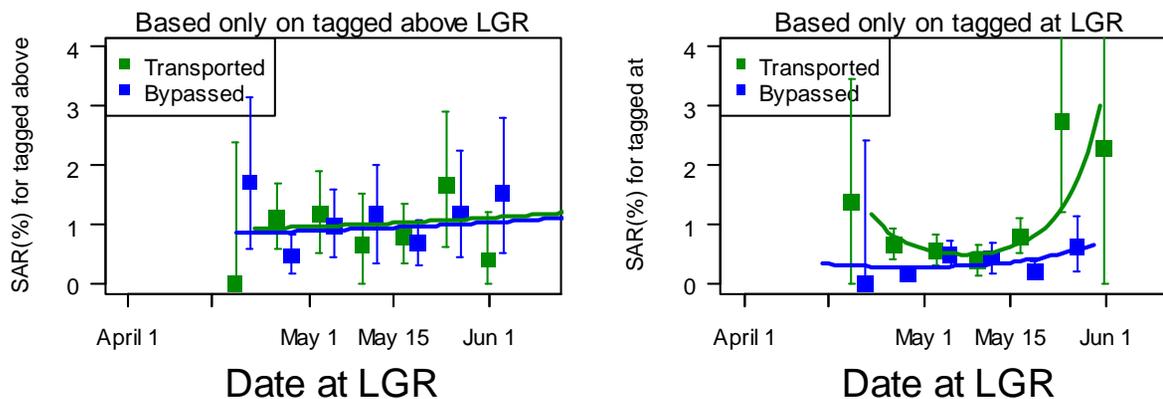
Wild Chinook 2011

Transported or Bypassed at Lower Granite Dam



Wild Chinook 2010

Transported or Bypassed at Lower Granite Dam

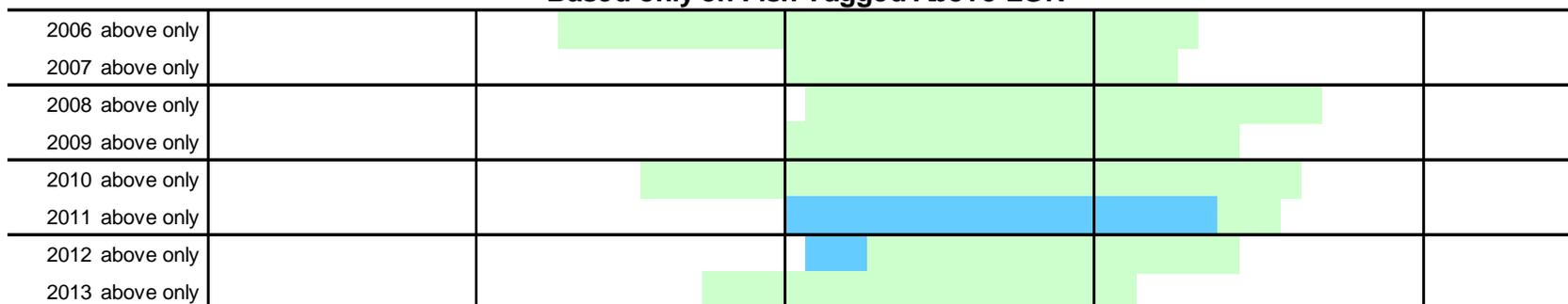


Wild Chinook Salmon - Lower Granite Dam

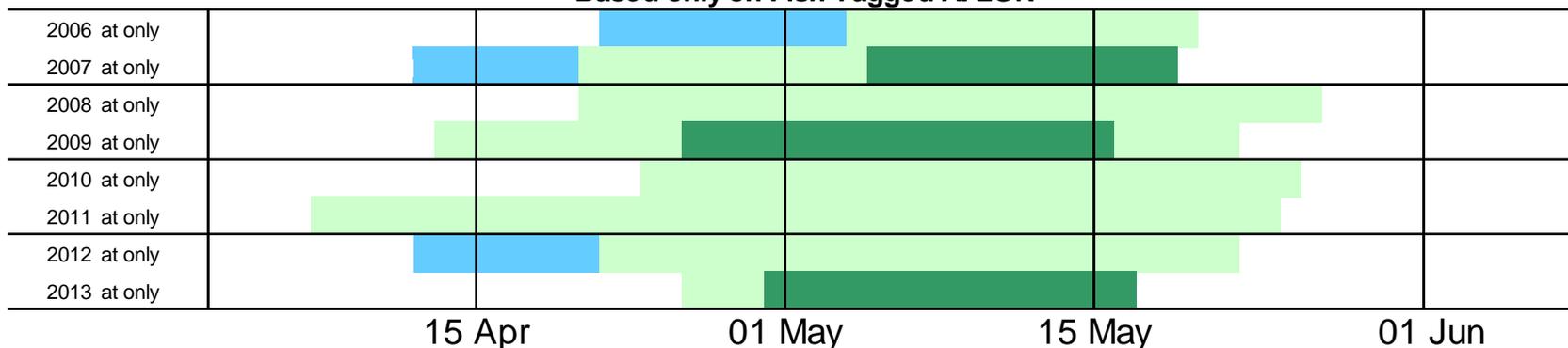
Summary of Model-Averaged T:B Values (Descriptive)

Standard = 1.0 (C1; Bypassed)

Based only on Fish Tagged Above LGR



Based only on Fish Tagged At LGR



Wild Chinook Salmon - Lower Granite Dam

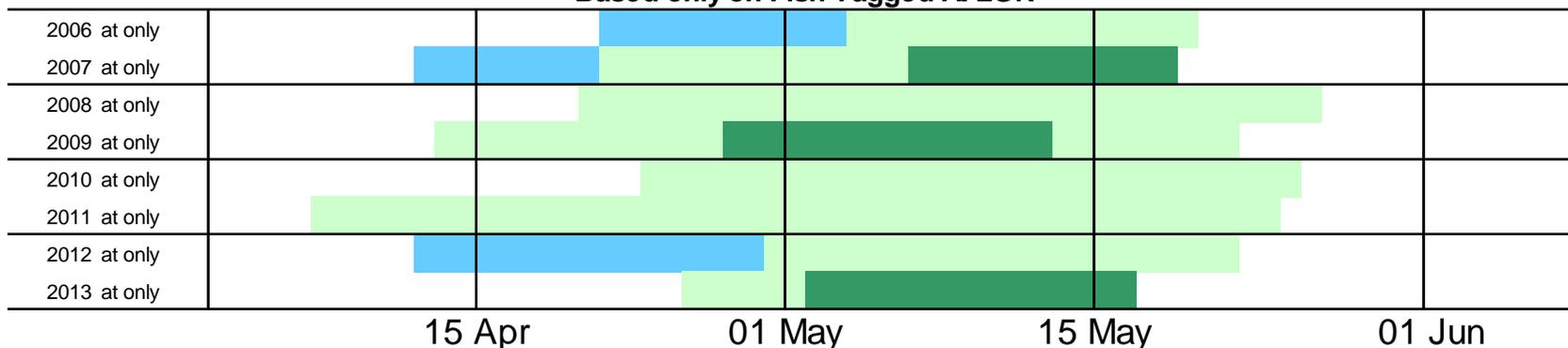
Summary of Model-Averaged T:B Values (Descriptive)

Standard = All Inriver (C0 & C1)

Based only on Fish Tagged Above LGR



Based only on Fish Tagged At LGR

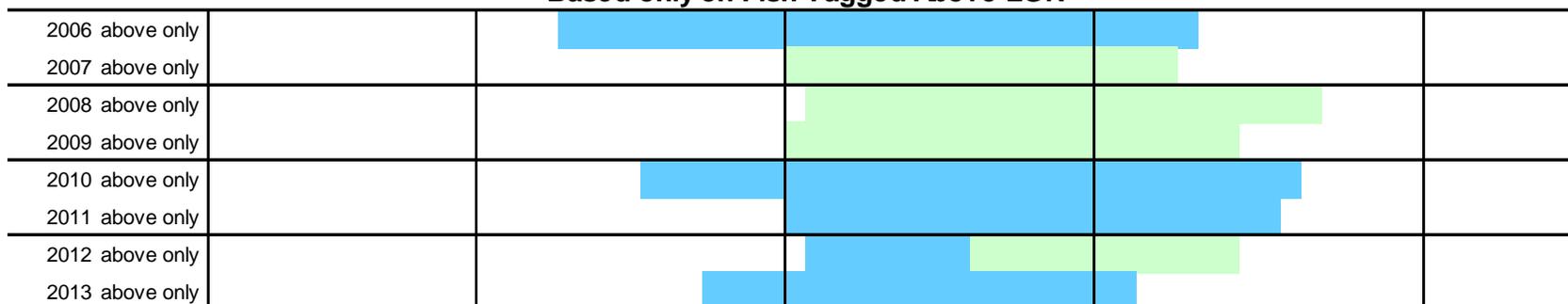


Wild Chinook Salmon - Lower Granite Dam

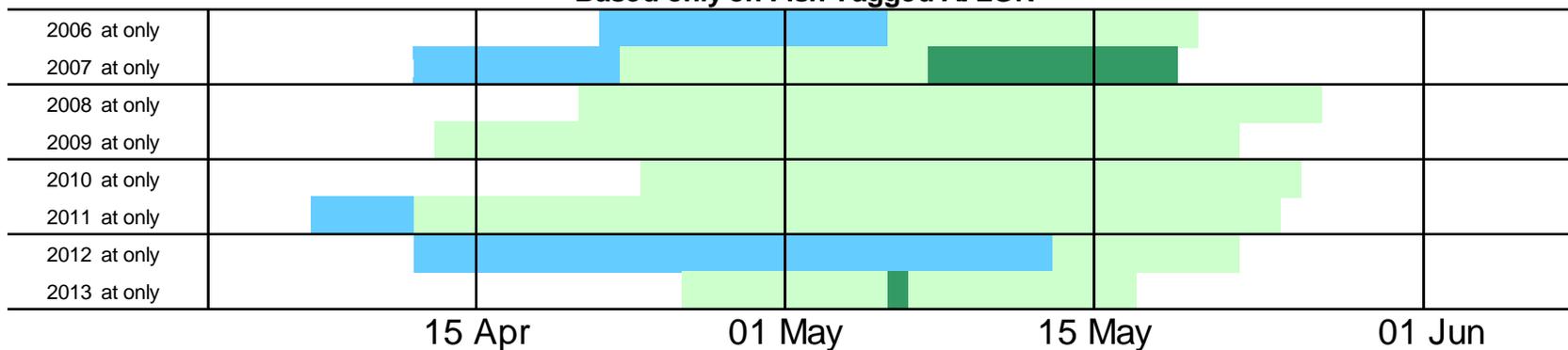
Summary of Model-Averaged T:B Values (Descriptive)

Standard = C0 (Never Bypassed)

Based only on Fish Tagged Above LGR

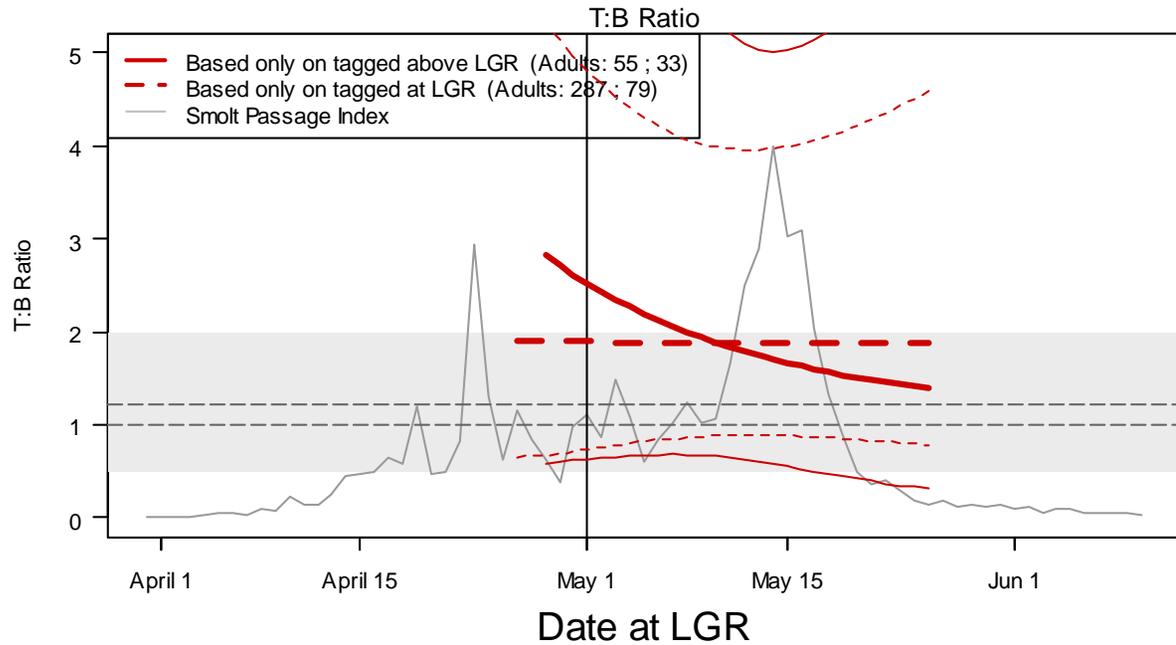
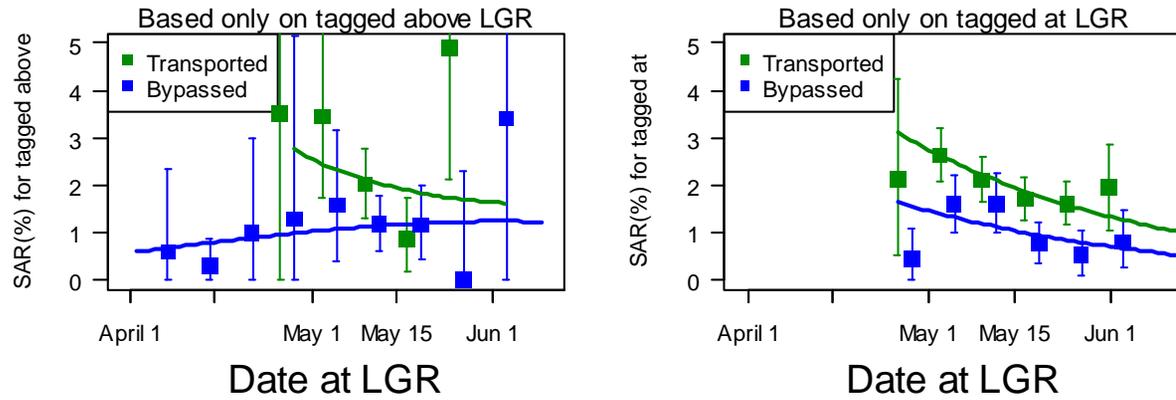


Based only on Fish Tagged At LGR



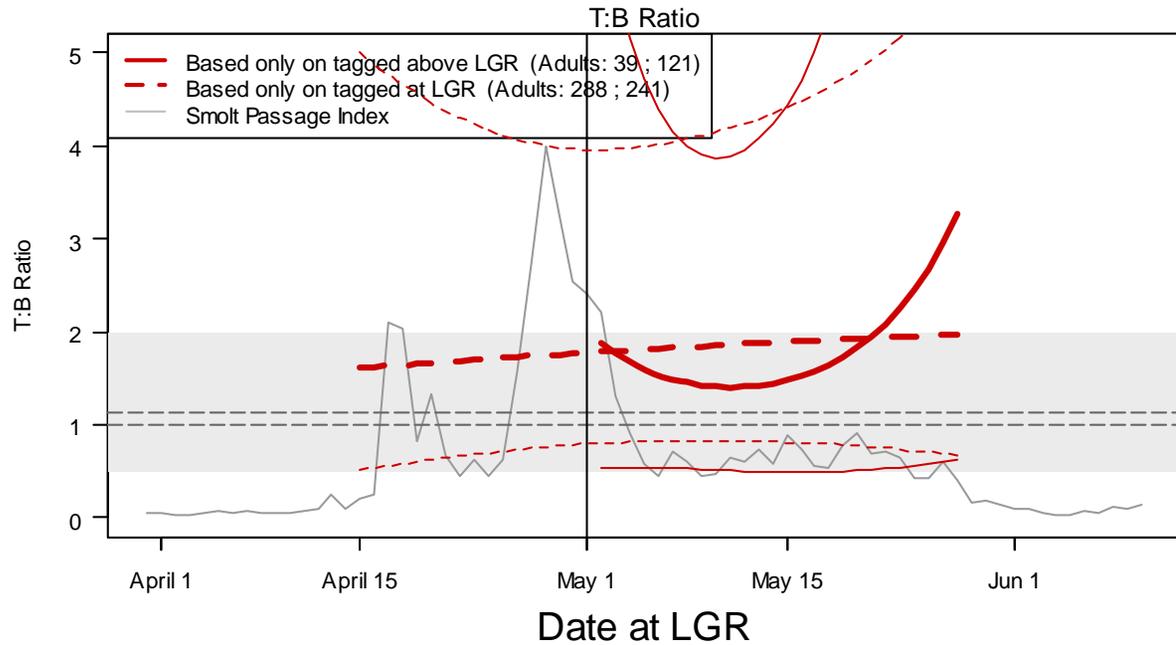
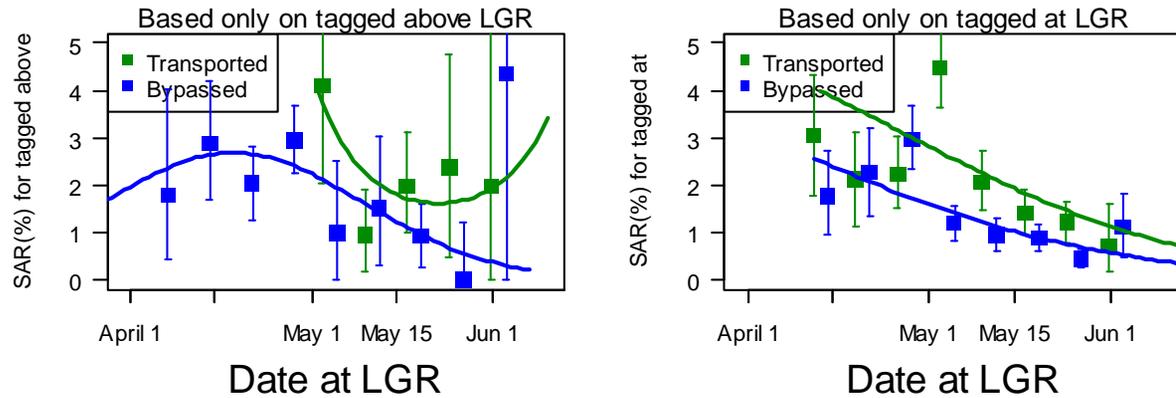
Wild Steelhead 2013

Transported or Bypassed at Lower Granite Dam



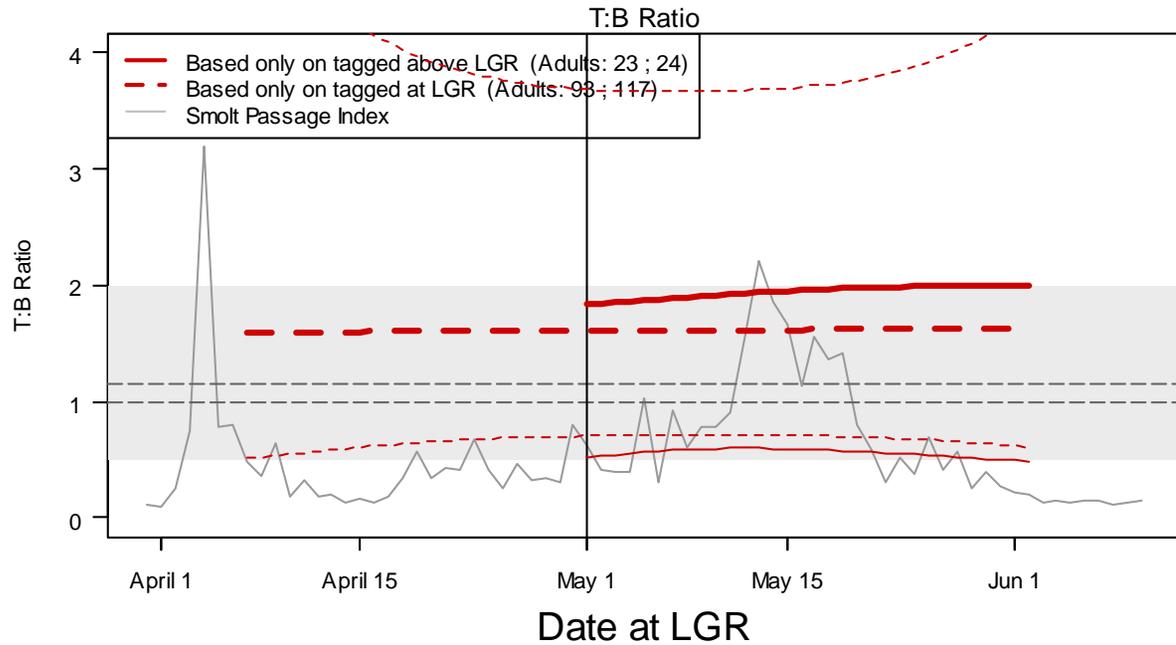
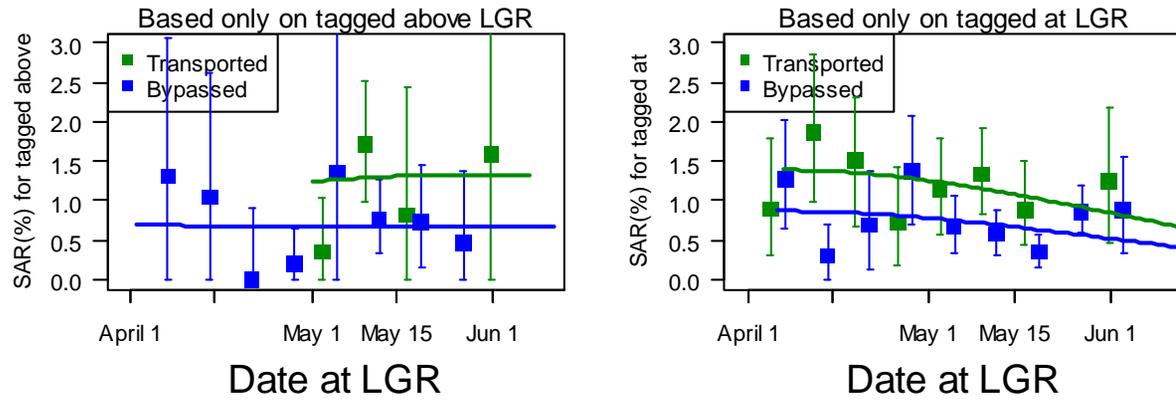
Wild Steelhead 2012

Transported or Bypassed at Lower Granite Dam



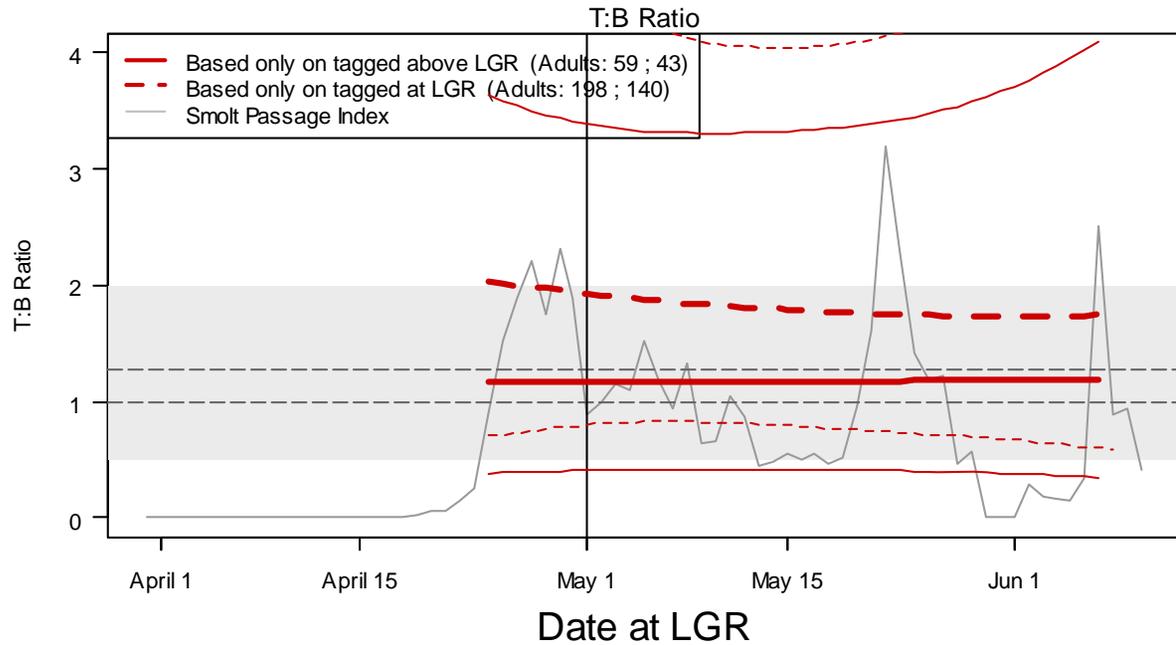
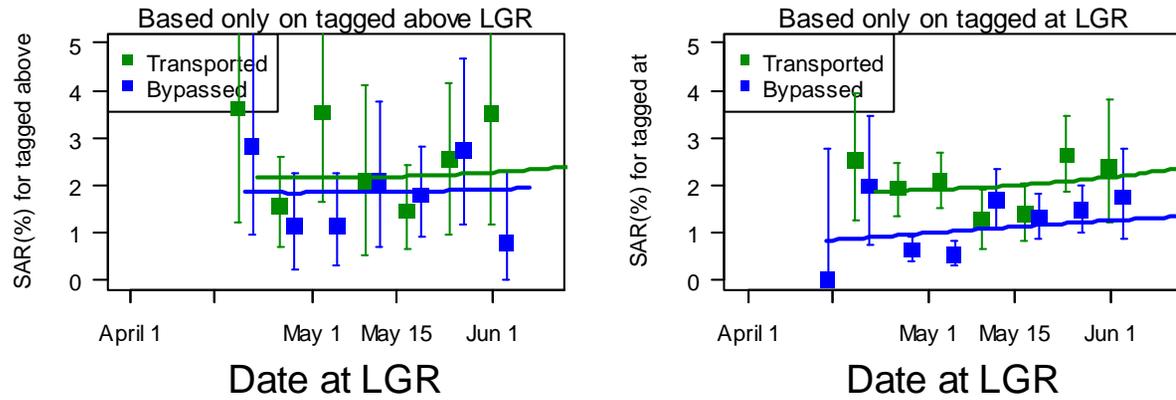
Wild Steelhead 2011

Transported or Bypassed at Lower Granite Dam



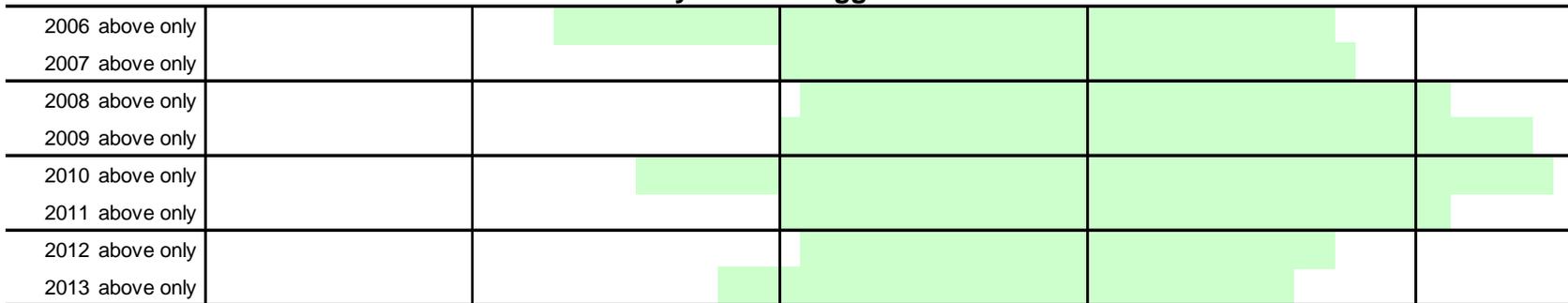
Wild Steelhead 2010

Transported or Bypassed at Lower Granite Dam

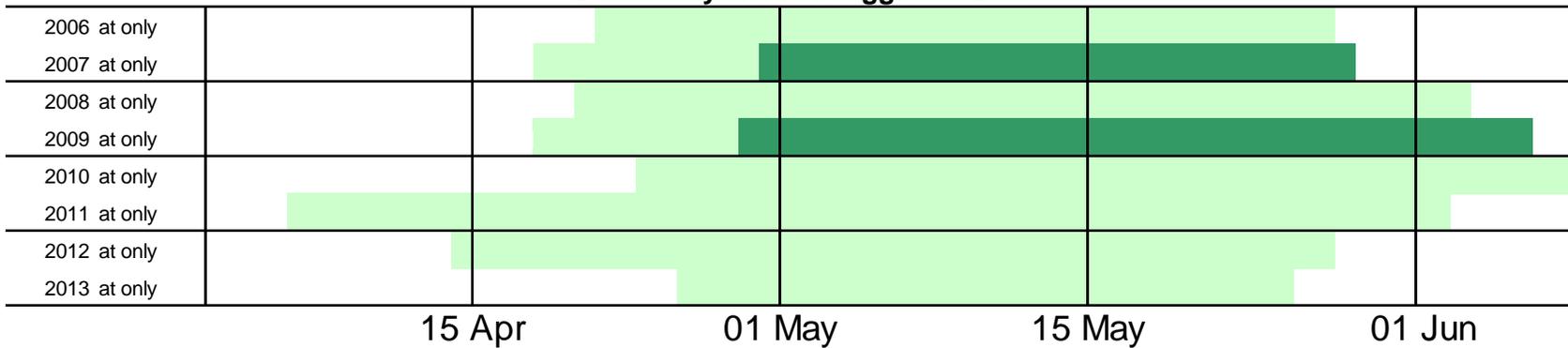


Wild Steelhead - Lower Granite Dam
Summary of Model-Averaged T:B Values (Descriptive)
Standard = 1.0 (C1; Bypassed)

Based only on Fish Tagged Above LGR



Based only on Fish Tagged At LGR

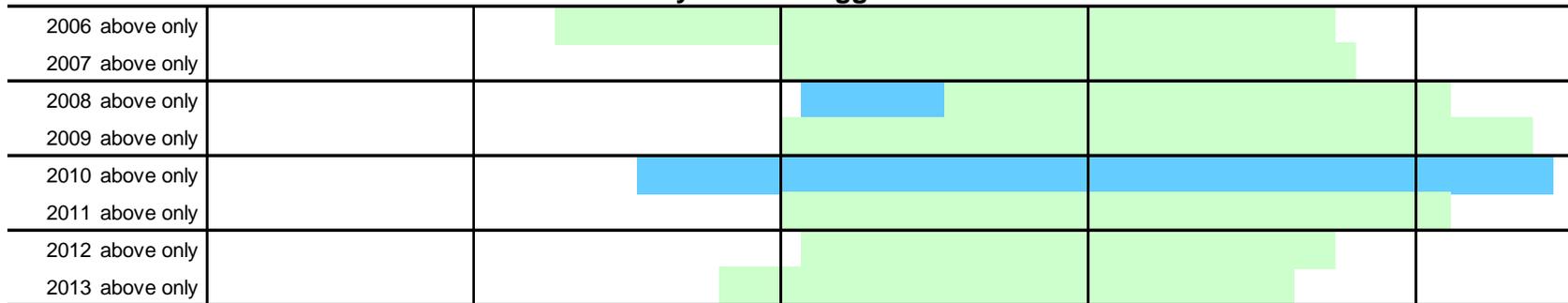


Wild Steelhead - Lower Granite Dam

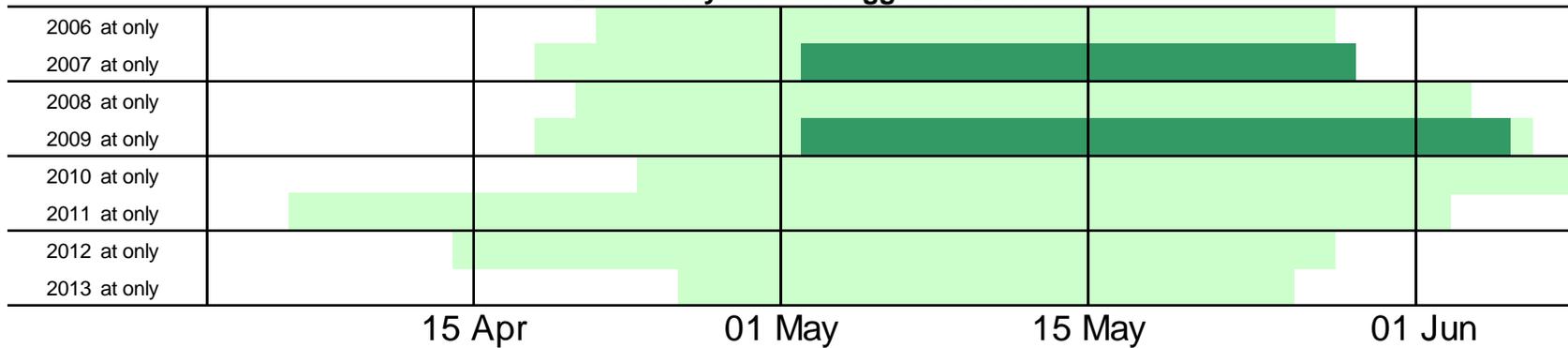
Summary of Model-Averaged T:B Values (Descriptive)

Standard = All Inriver (C0 & C1)

Based only on Fish Tagged Above LGR



Based only on Fish Tagged At LGR

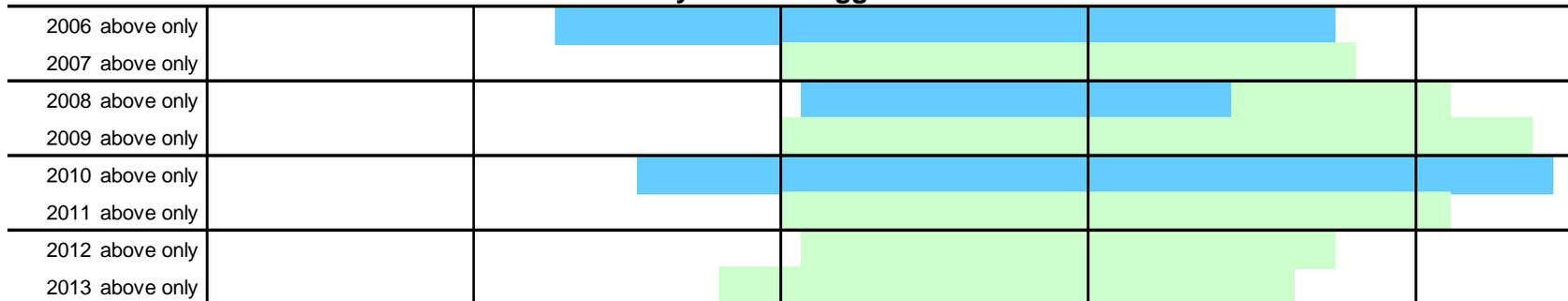


Wild Steelhead - Lower Granite Dam

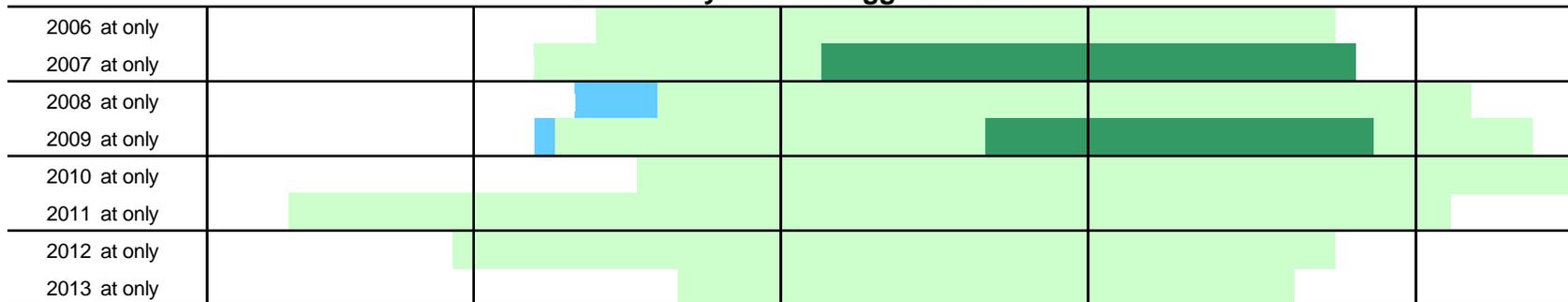
Summary of Model-Averaged T:B Values (Descriptive)

Standard = C0 (Never Bypassed)

Based only on Fish Tagged Above LGR



Based only on Fish Tagged At LGR



15 Apr

01 May

15 May

01 Jun

Sockeye Transportation ((Very) Preliminary)

Year	%Tran	Tran @ LGR	Byp @ LGR	T:B (95% bootstrap CI)
2013	49.8	15 / 6041 = 0.25%	12 / 5384 = 0.22%	1.11 (0.50 – 2.57)
2012	NA	29 / 6490 = 0.45%	8 / 4334 = 0.185%	2.42 (1.14 – 6.46)
2011	NA	4 / 3142 = 0.127%	11 / 8548 = 0.129%	0.99 (0.17 – 2.72)
2010	NA	0 / 27	2 / 1668	NA

Other Analyses Being Updated

- T:B analysis for yearling chinook and steelhead at Little Goose and Lower Monumental
- Fall chinook transportation study (2006-2012)
 - Report on all study years to be completed in 2016



Questions