Smolt Survival and Travel Time and Seasonal Transportation Evaluation for Salmonids in the Snake and Columbia Rivers

Update with 2014 Data

Technical Management Team
Year-End Review
December 3, 2014

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Northwest Fisheries Science Center
NOAA Fisheries

Outline

- Summary of migration conditions, travel time and survival of PIT-tagged smolts through the hydropower system
  - September 17 Memo; Draft report to BPA in prep

- Information from return of PIT-tagged adults – transported from and bypassed at Lower Granite
  - Spring migrants: Final report (returns through 2010) to USACE March 2013 (updated with returns through 2014 here)
  - Fall chinook: Draft report submitted to COE December 2

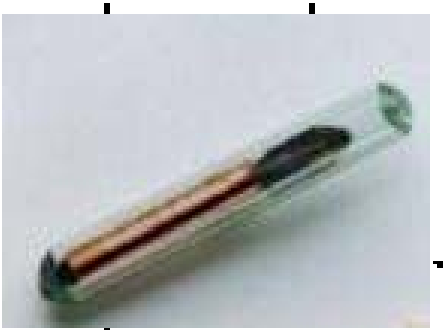
2014 Spring Survival Summary

- Flow, spill, and water temperature all average
- Surface passage and spill continue to promote shorter travel times
- A little over one-third of smolts transported

2014 Spring Survival Summary

- Average survival for yearling chinook, just under 50% for hydrosystem
- Average survival for steelhead LGR-MCN
- Very high steelhead estimate for steelhead MCN-BON, probably due to model assumption violations

PIT-tag Data Sources



Hatchery Releases

Chief Joseph

Wells

Grand Coulee

Rocky Reach

Rock Island

Wanapum

Priest Rapids

Ice Harbor

Snake R. trap

Juvenile detectors

Lower Granite

Little Goose

Lower Monumental

McNary

John Day

The Dalles

Bonneville

PIT tag trawl

Hatchery & Trap Releases

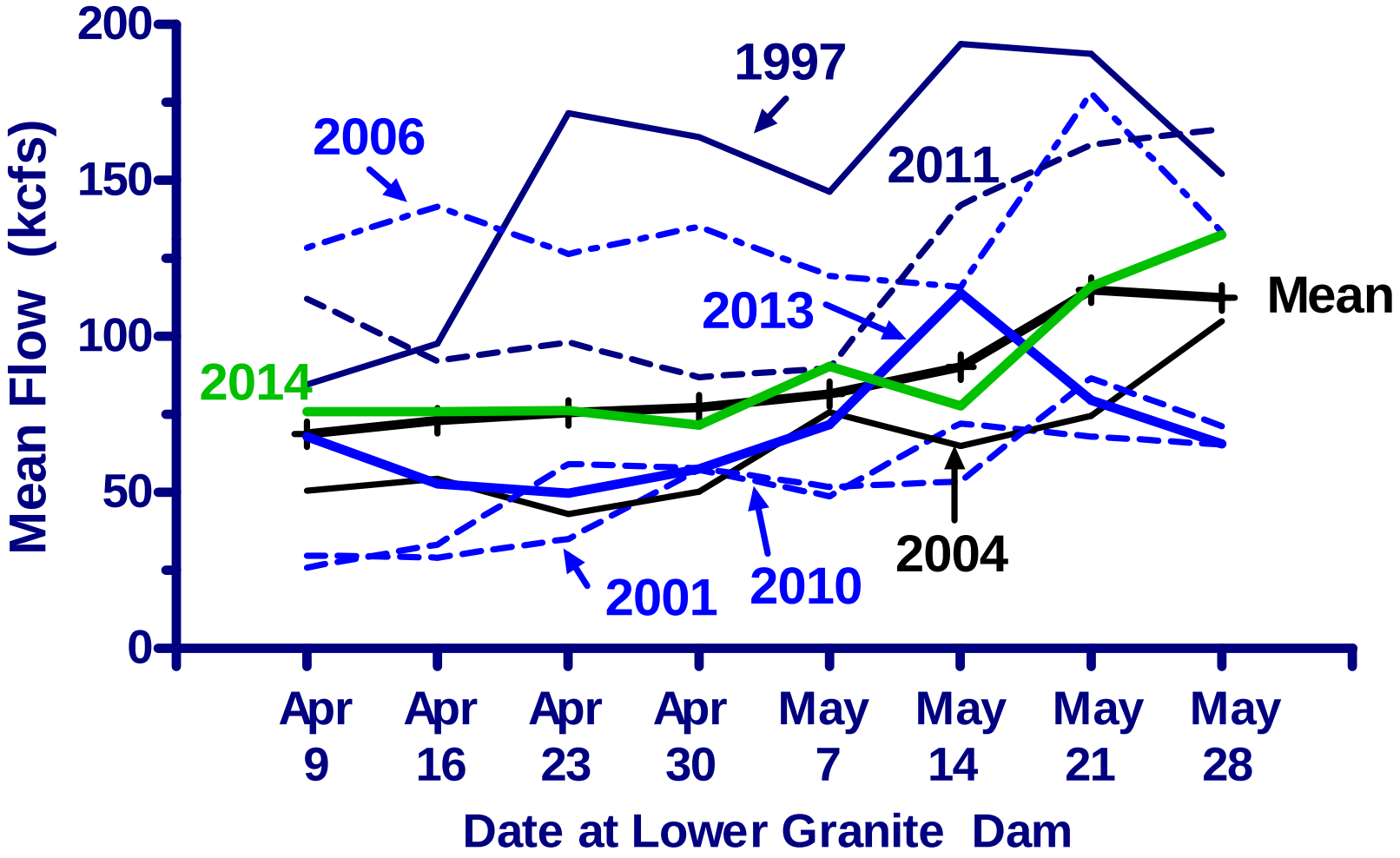
Hells Canyon

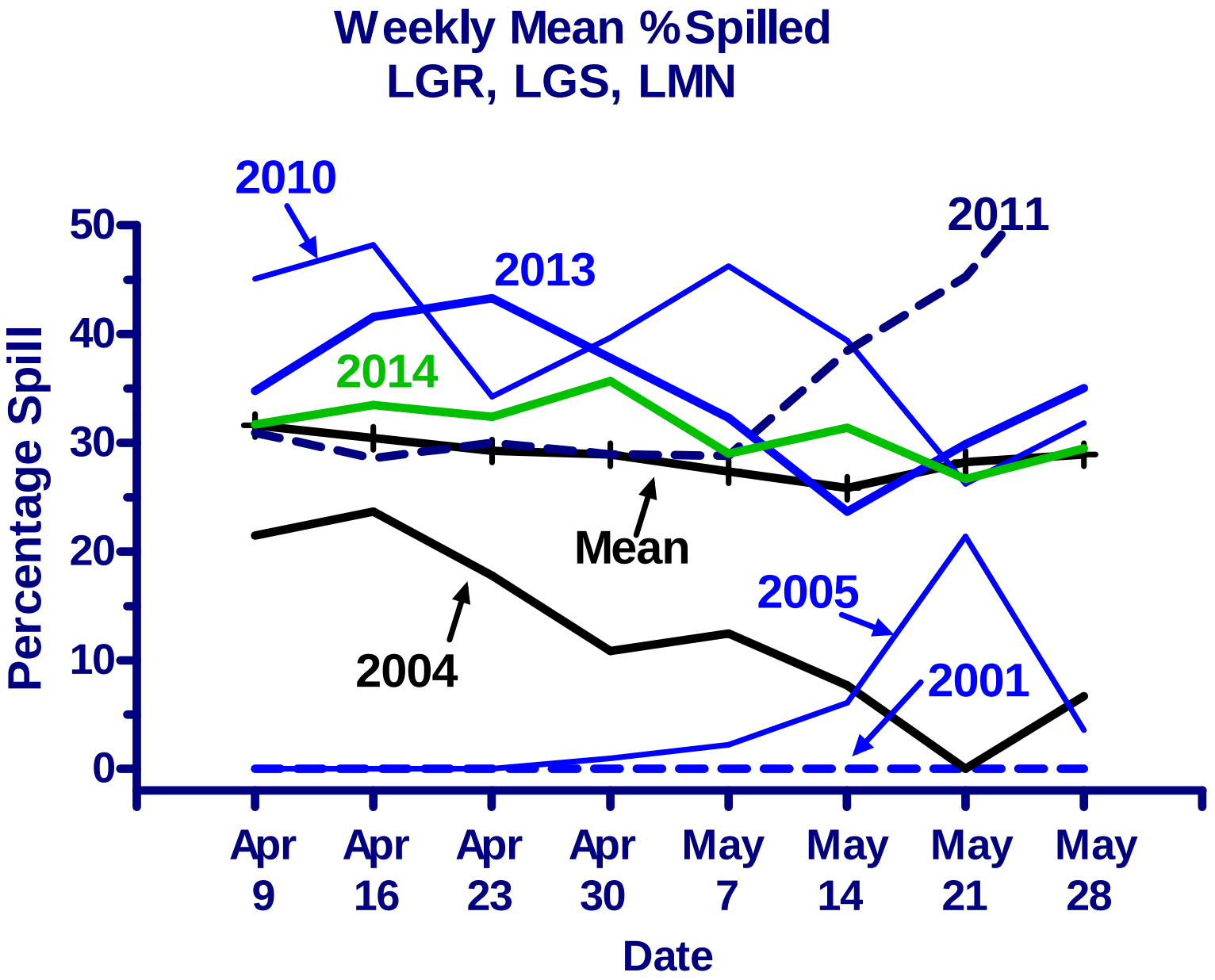
Oxbow

Brownlee

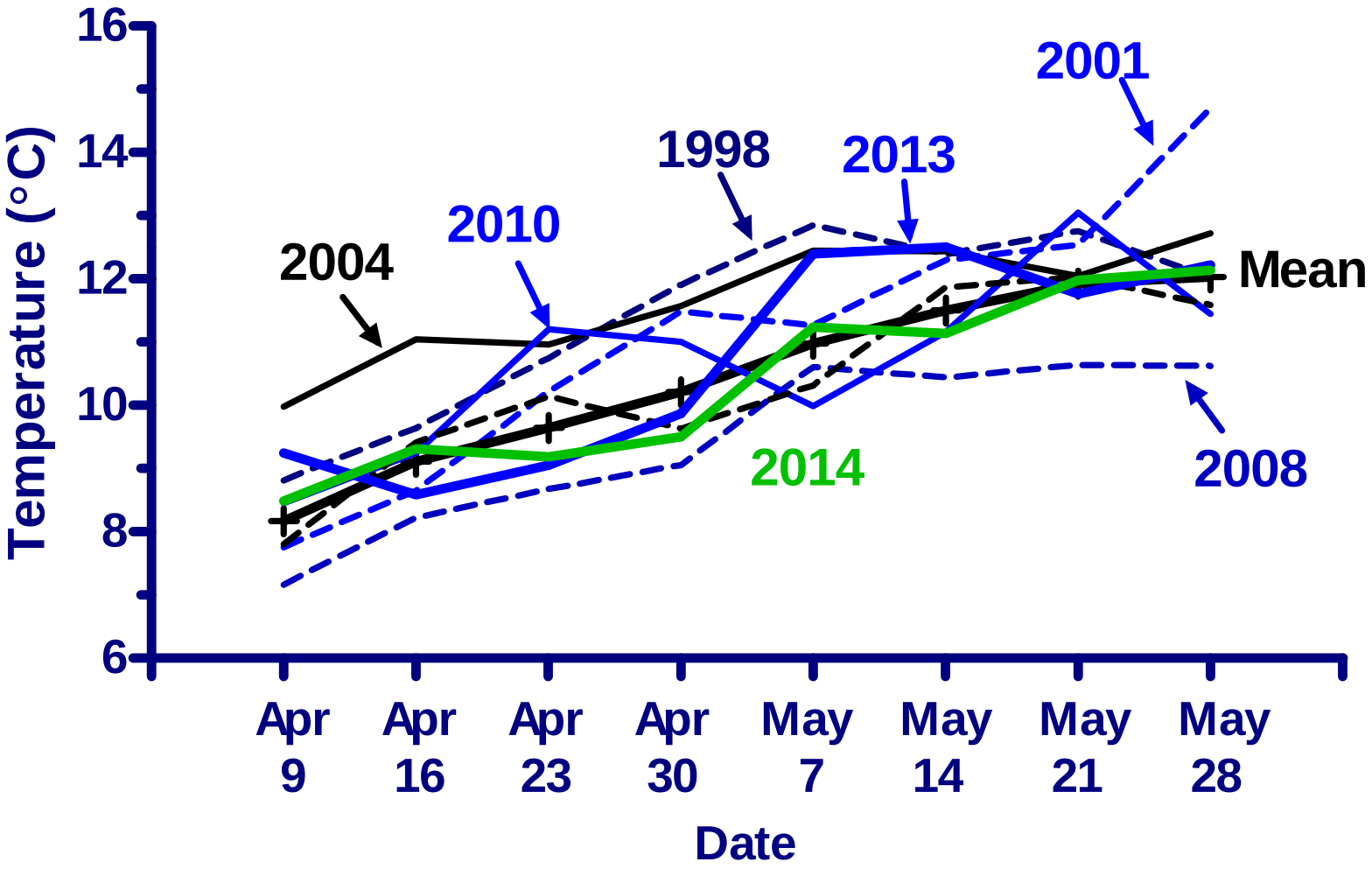
N

Weekly Mean Flow (kcfs)
Lower Granite Dam

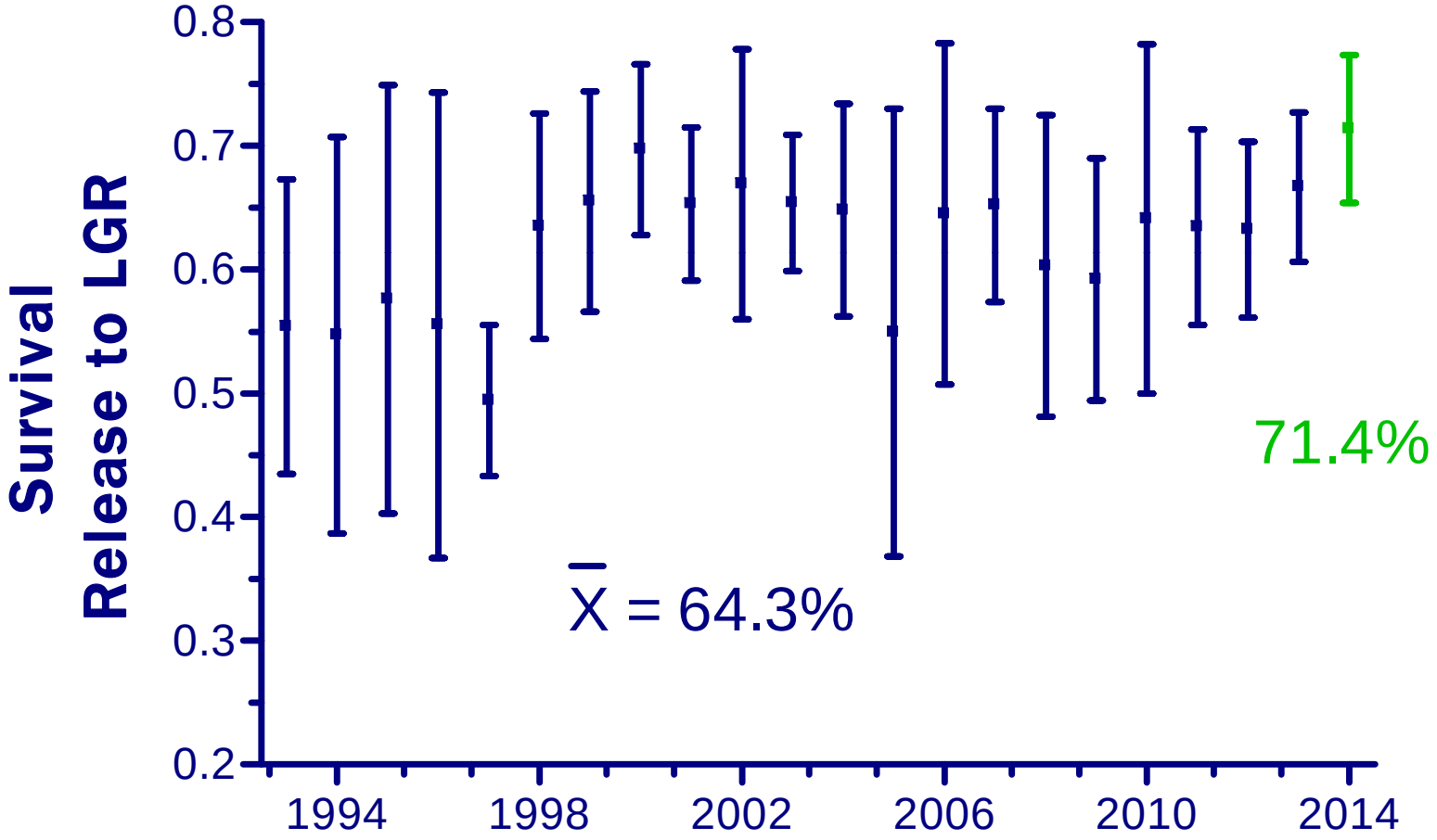



Weekly Mean %Spilled
LGR, LGS, LMN
2010
2011
2013
2014
Mean
2004
2005
2001
Percentage Spill
50
40
30
20
10
0
Apr 9
Apr 16
Apr 23
Apr 30
May 7
May 14
May 21
May 28
Date

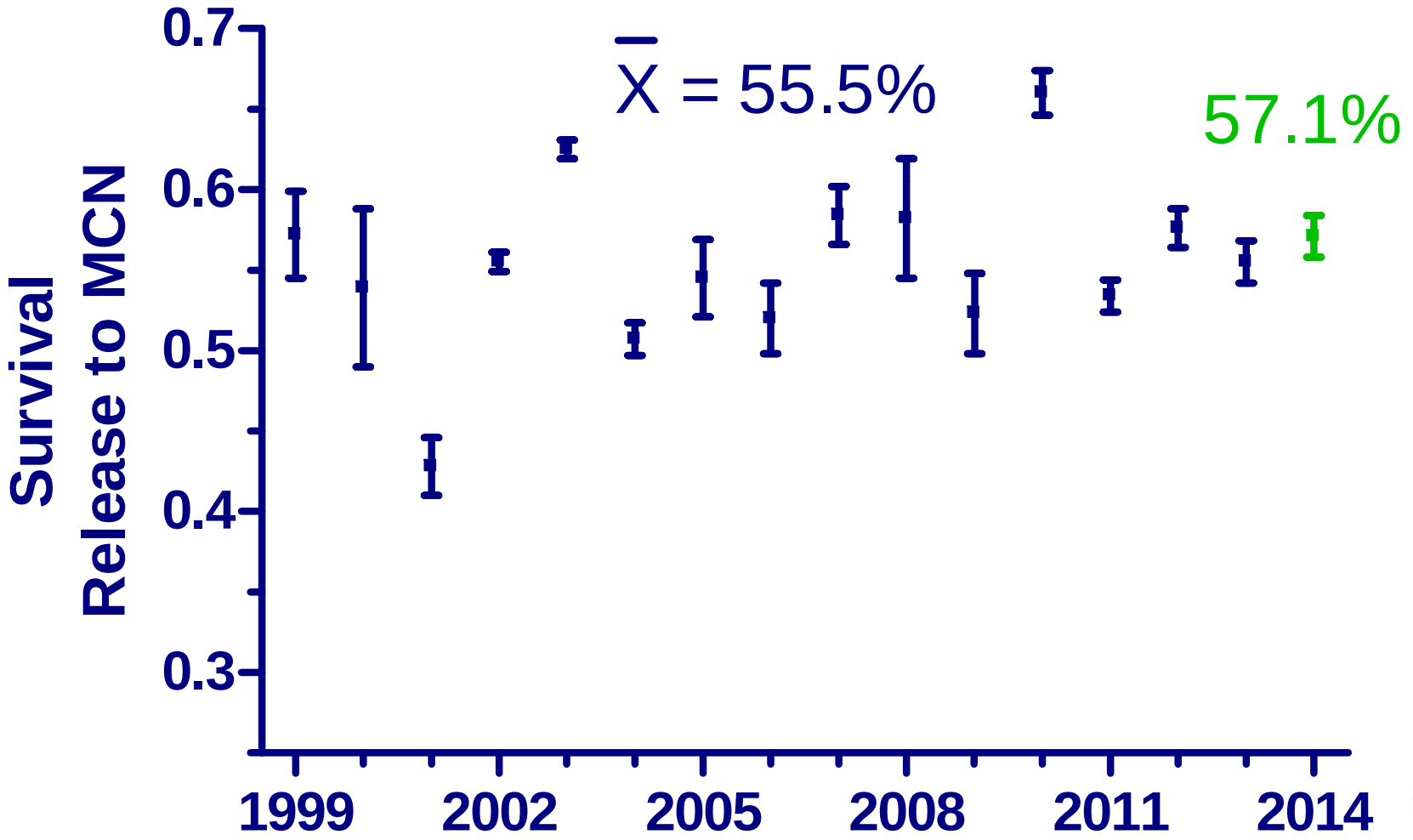
Weekly Mean Temperature
Little Goose Dam



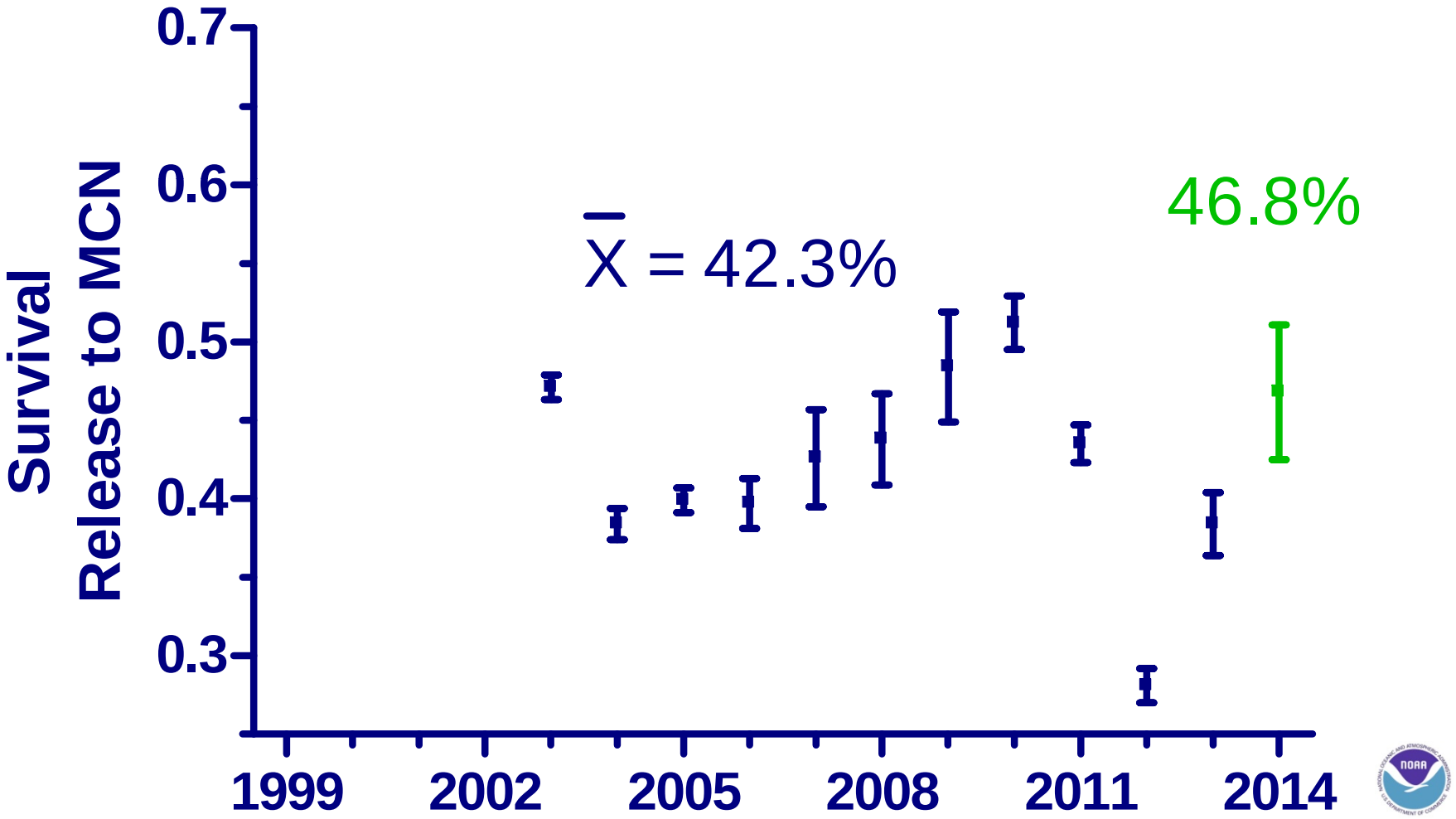
Yearling Chinook
Snake River Basin Hatcheries
Mean of Index Groups



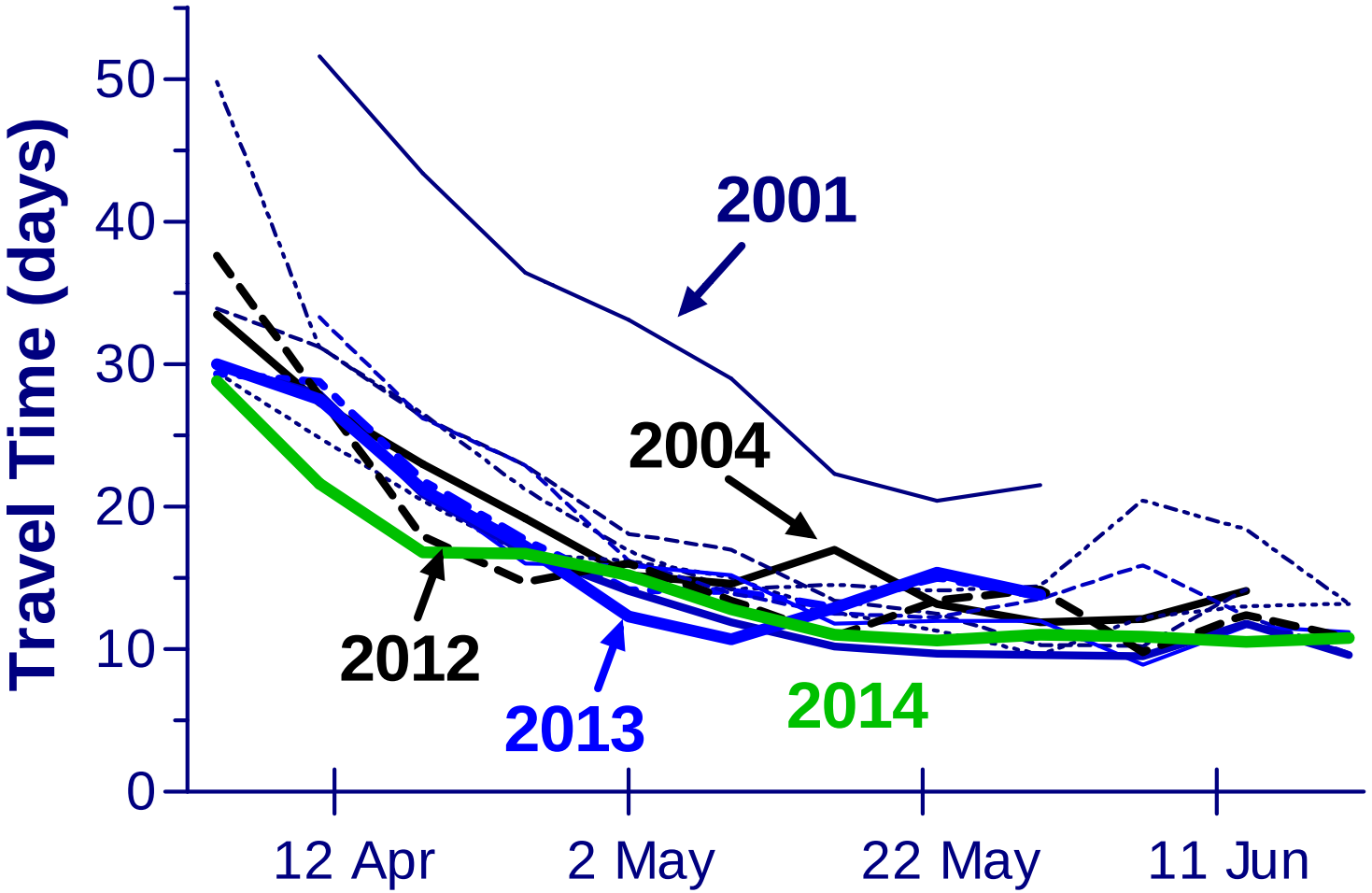
Yearling Chinook
Upper Columbia River Hatcheries



Steelhead
Upper Columbia River Hatcheries



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



Steelhead Median Travel Time
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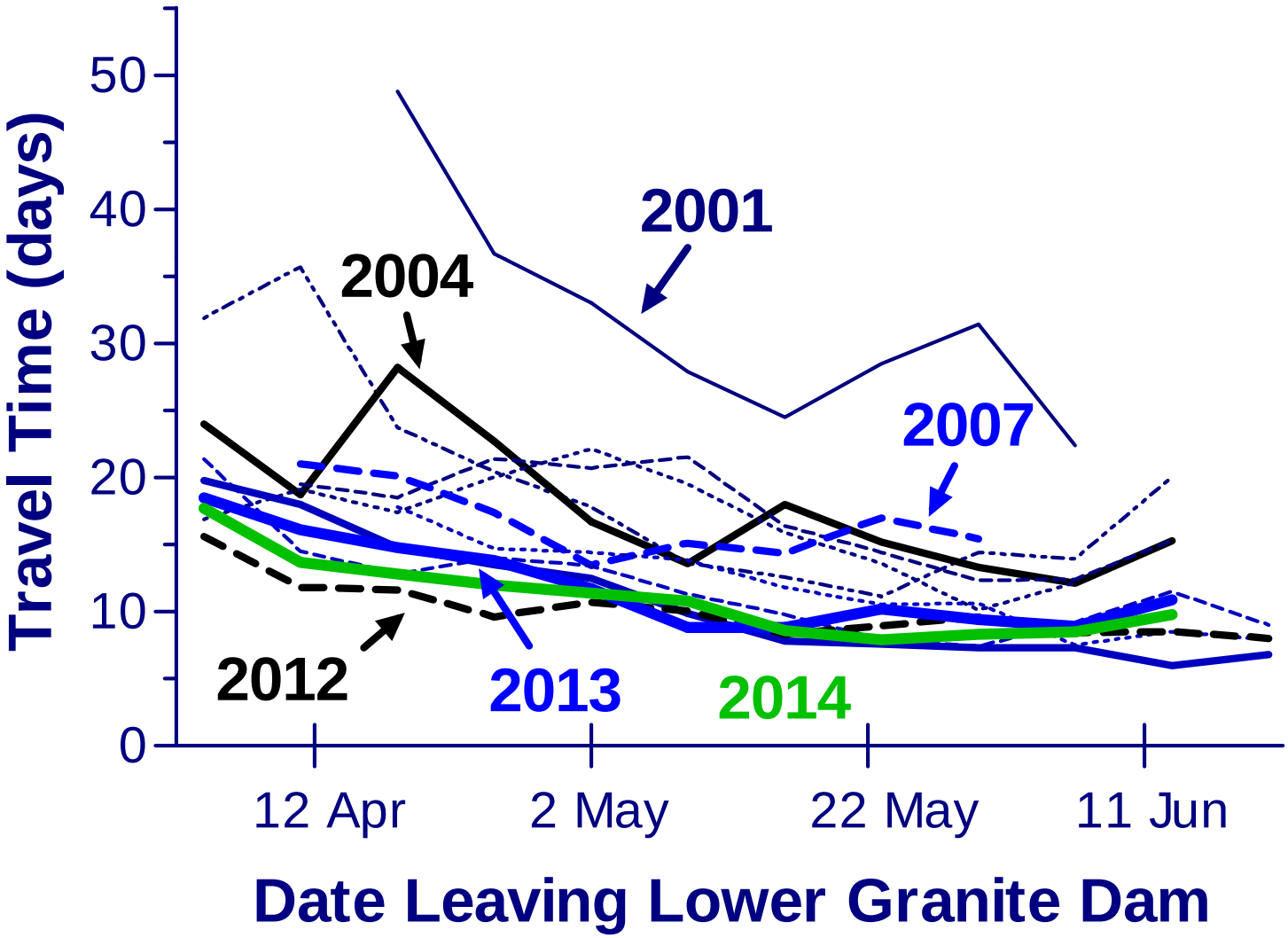
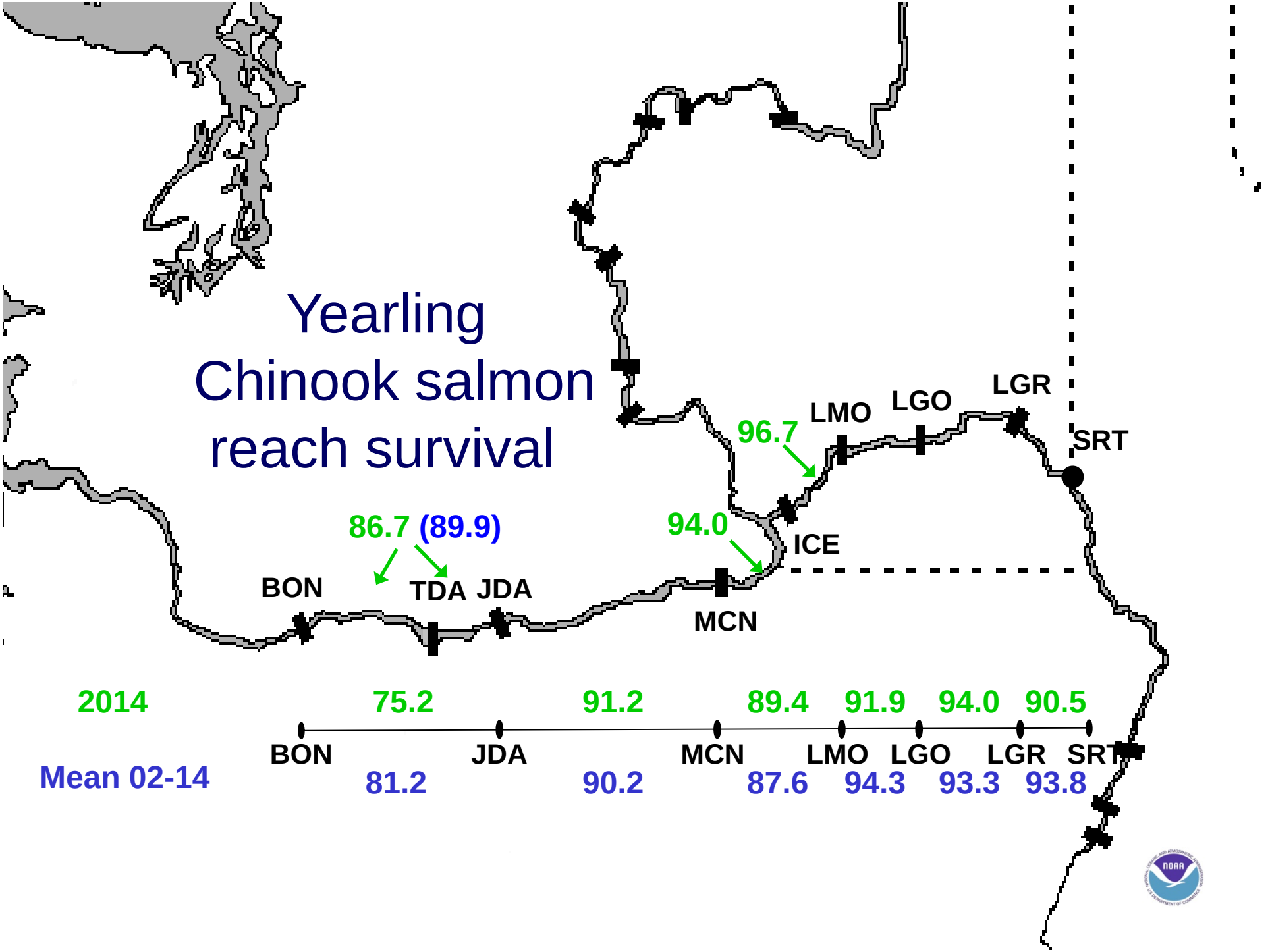
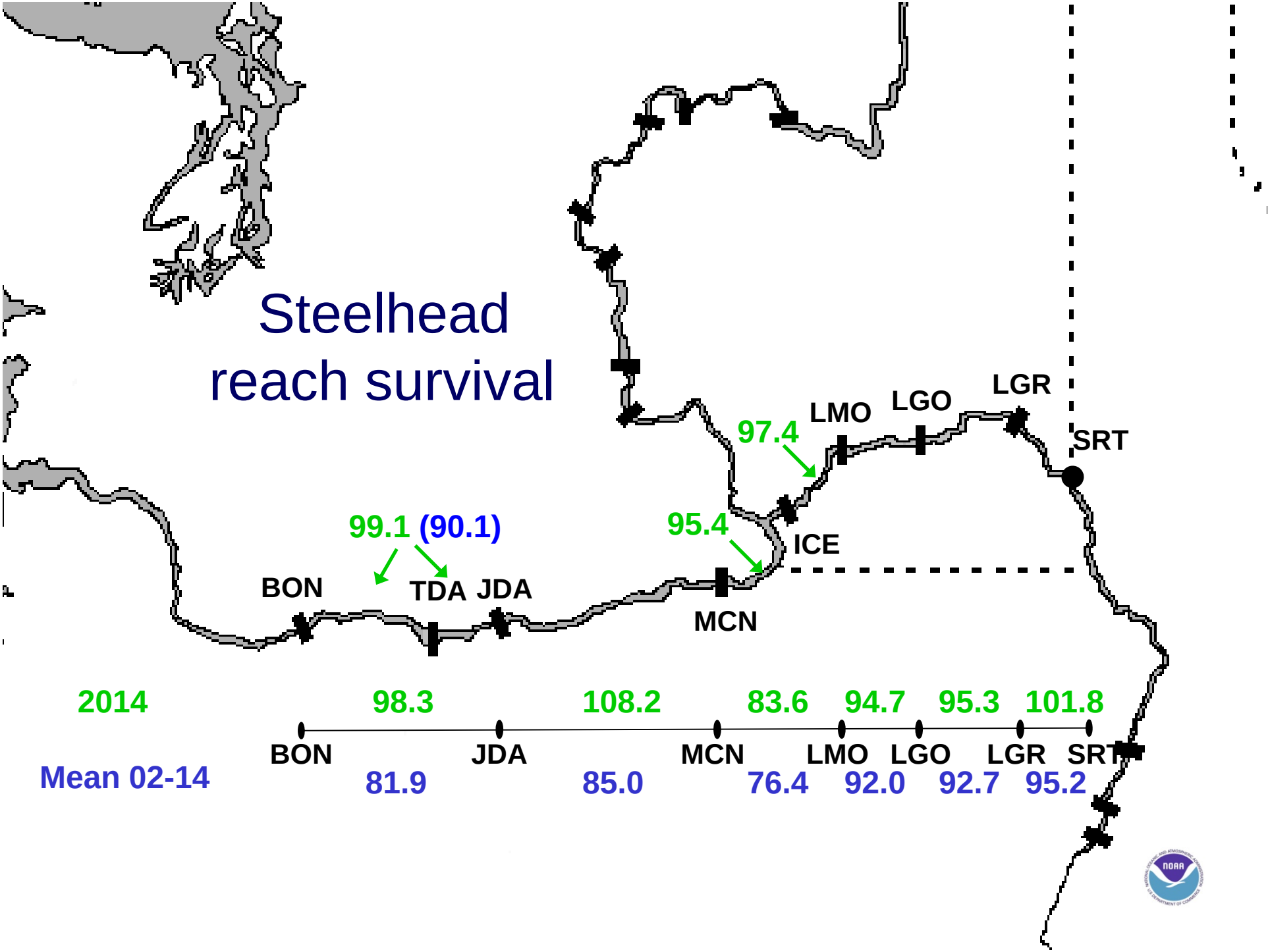
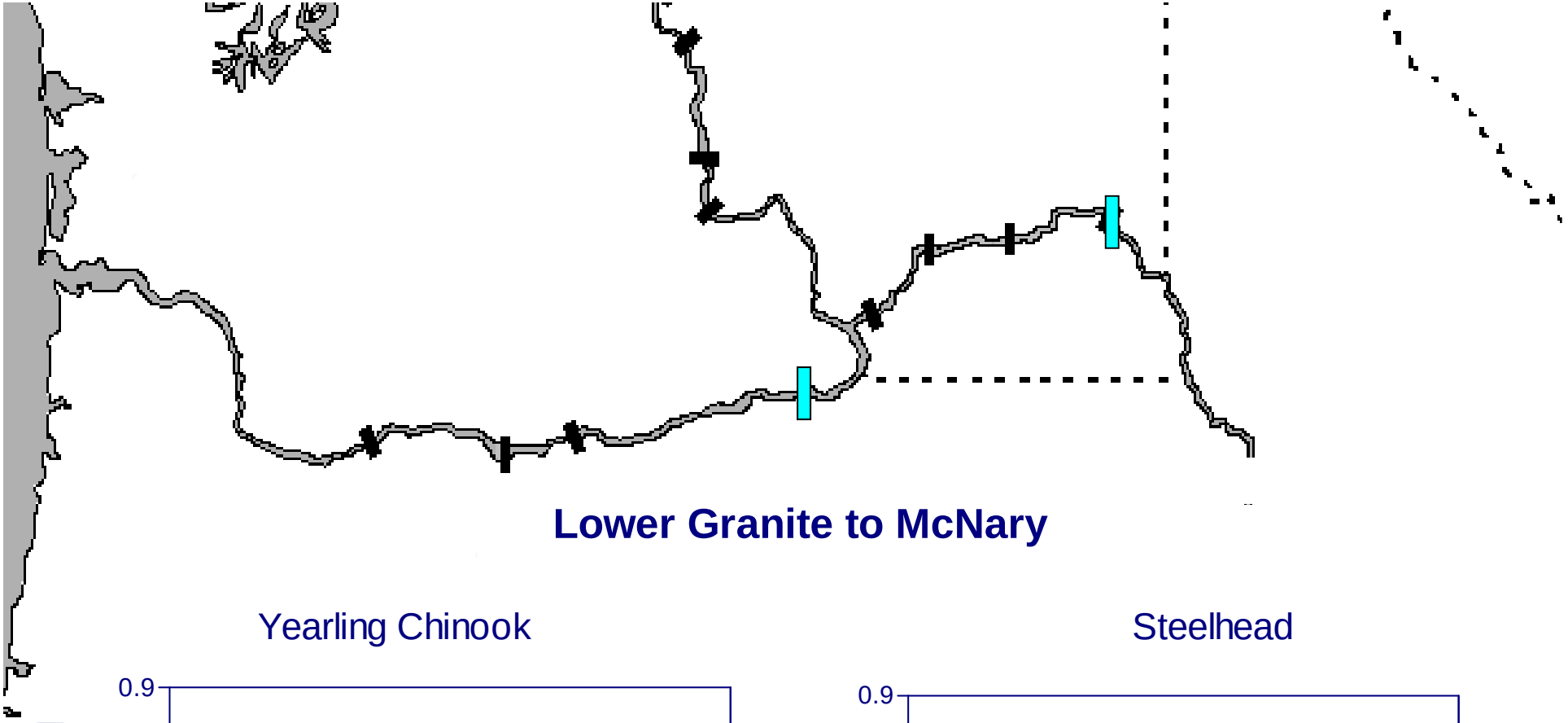


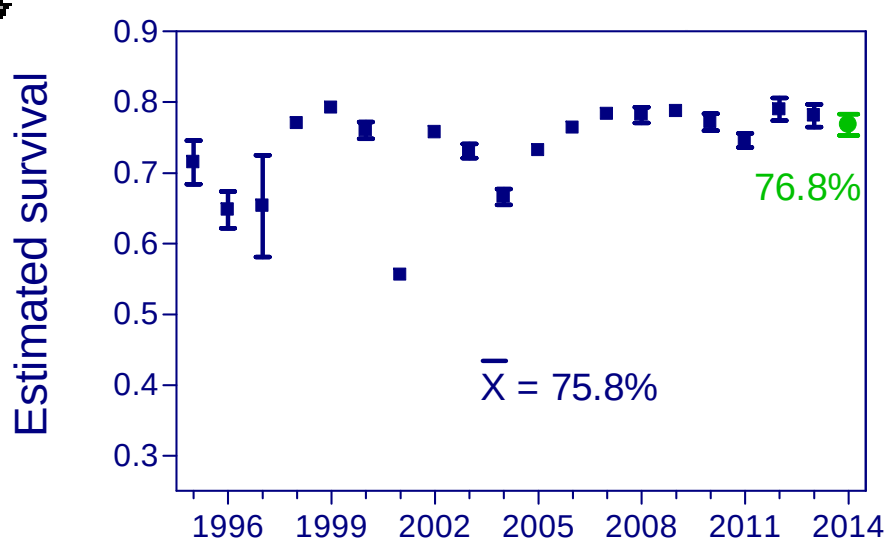

Yearling
Chinook salmon
reach survival
96.7
LMO
LGO
LGR
SRT
ICE
86.7 (89.9)
94.0
BON
TDA
JDA
MCN
2014
75.2
91.2
89.4
91.9
94.0
90.5
BON
JDA
MCN
LMO
LGO
LGR
SRT
Mean 02-14
81.2
90.2
87.6
94.3
93.3
93.8


Steelhead
reach survival
LMO
LGO
LGR
SRT
97.4
ICE
95.4
99.1 (90.1)
BON
TDA
JDA
MCN
2014
98.3
108.2
83.6
94.7
95.3
101.8
BON
JDA
MCN
LMO
LGO
LGR
SRT
Mean 02-14
81.9
85.0
76.4
92.0
92.7
95.2

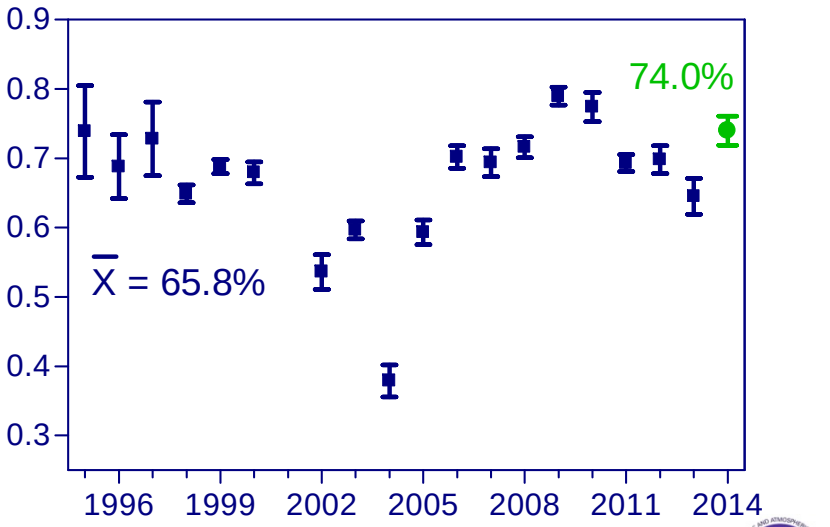


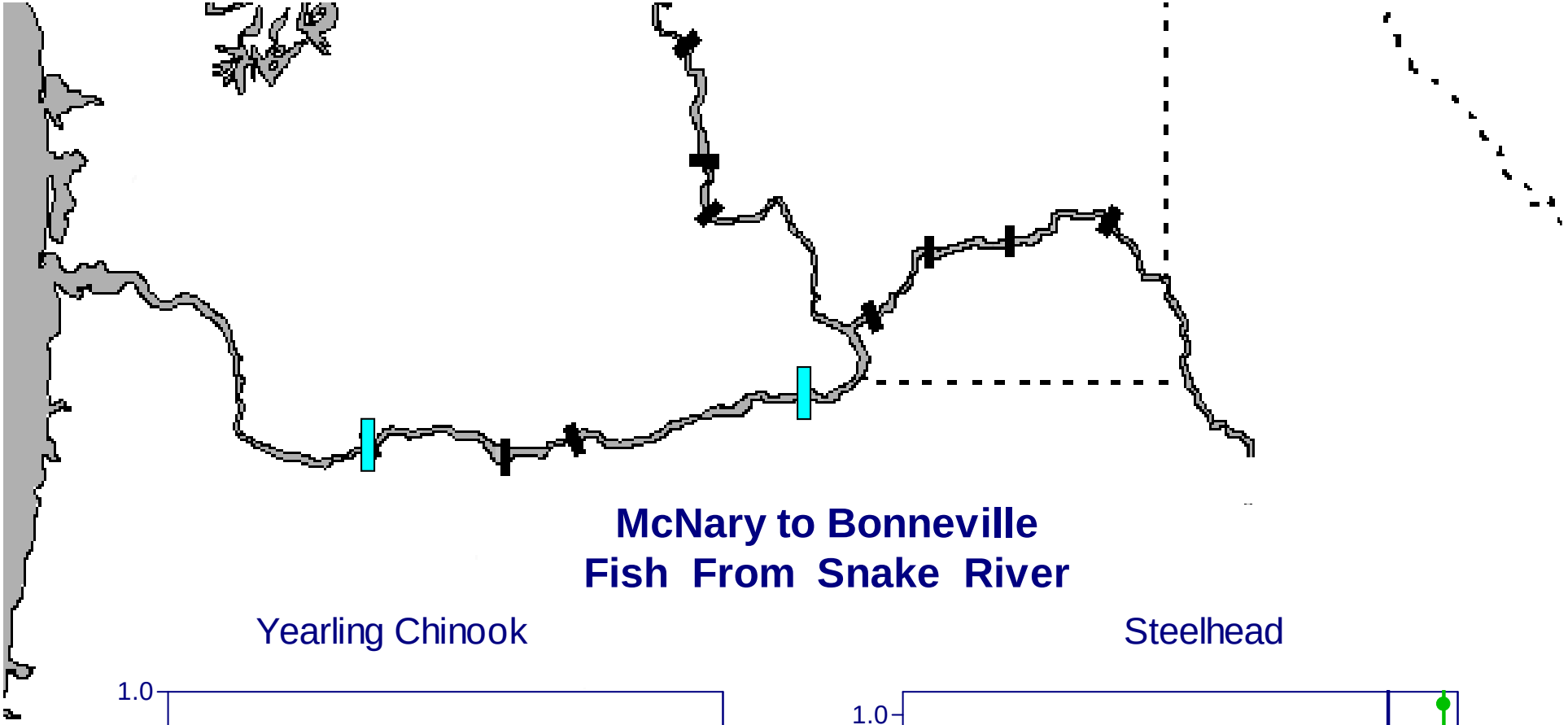
Lower Granite to McNary

Yearling Chinook



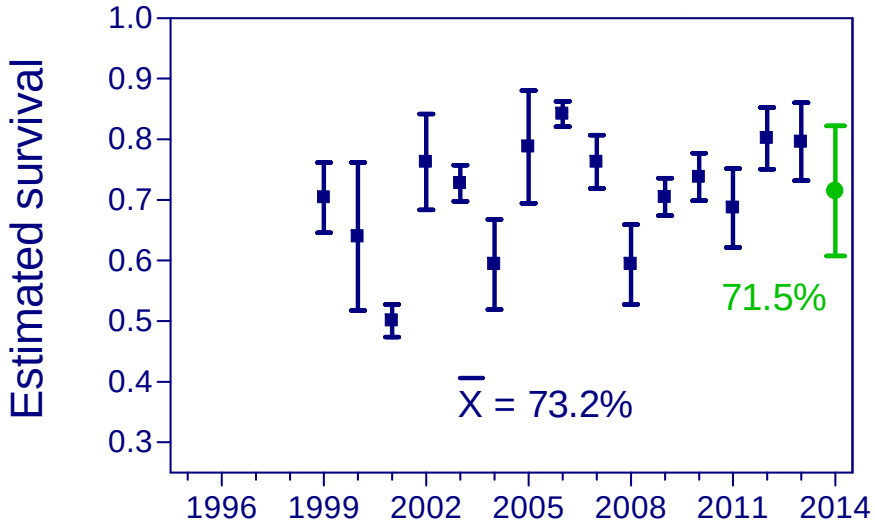
Steelhead



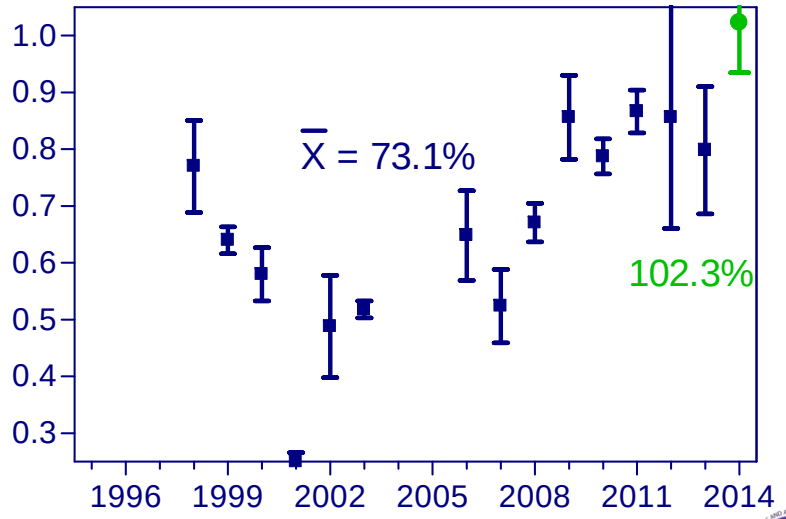


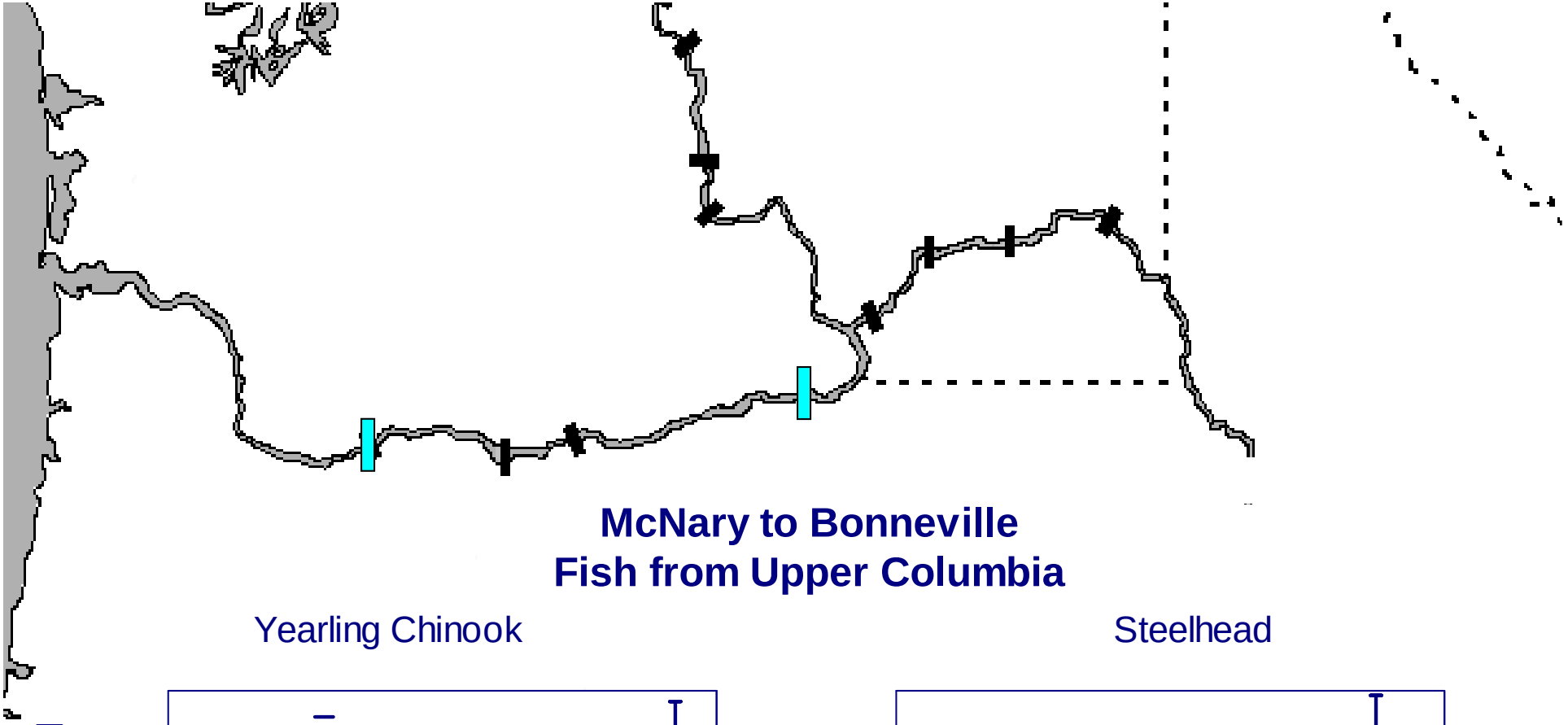
McNary to Bonneville
Fish From Snake River

Yearling Chinook



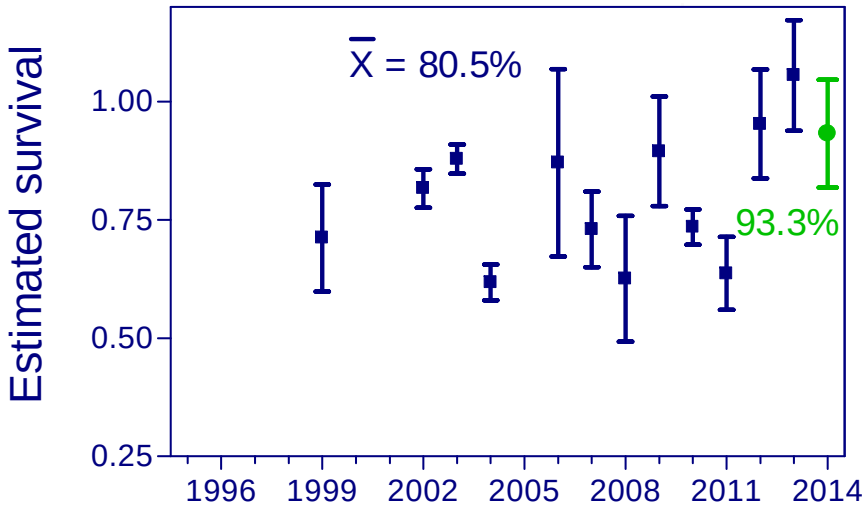
Steelhead



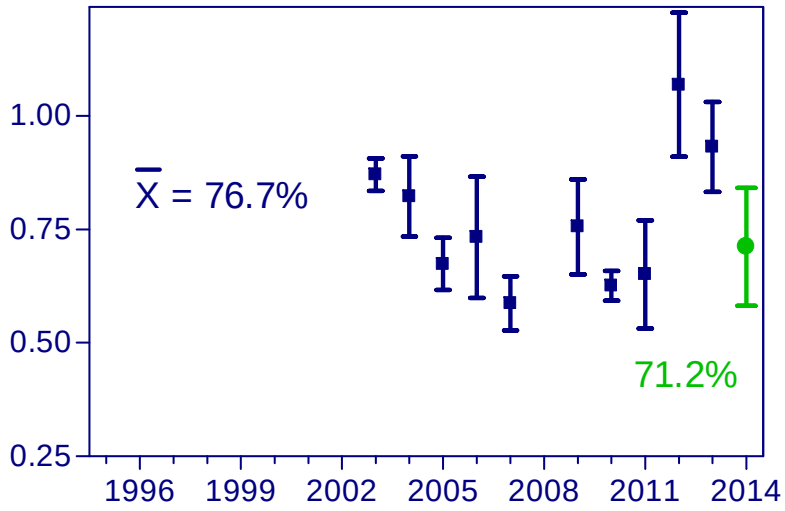


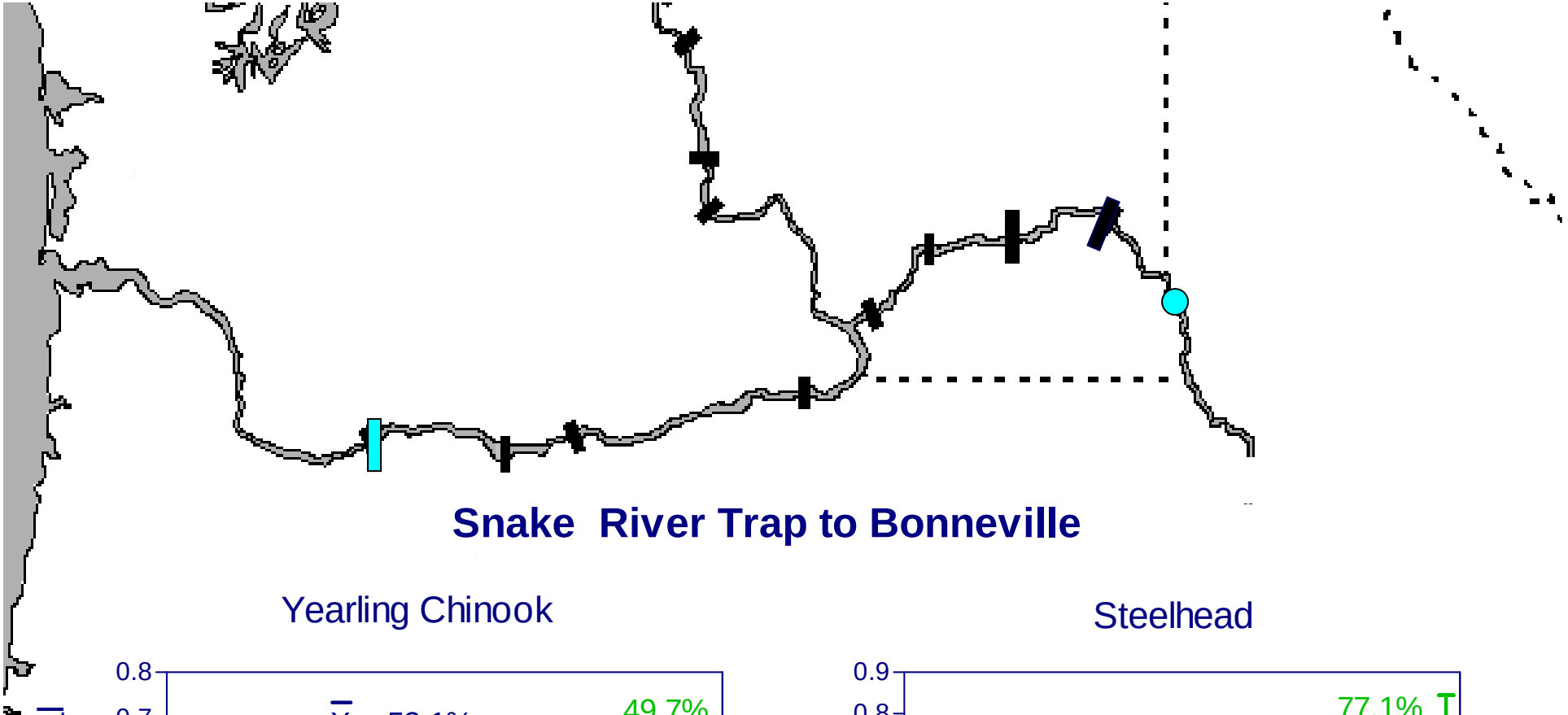
McNary to Bonneville
Fish from Upper Columbia

Yearling Chinook



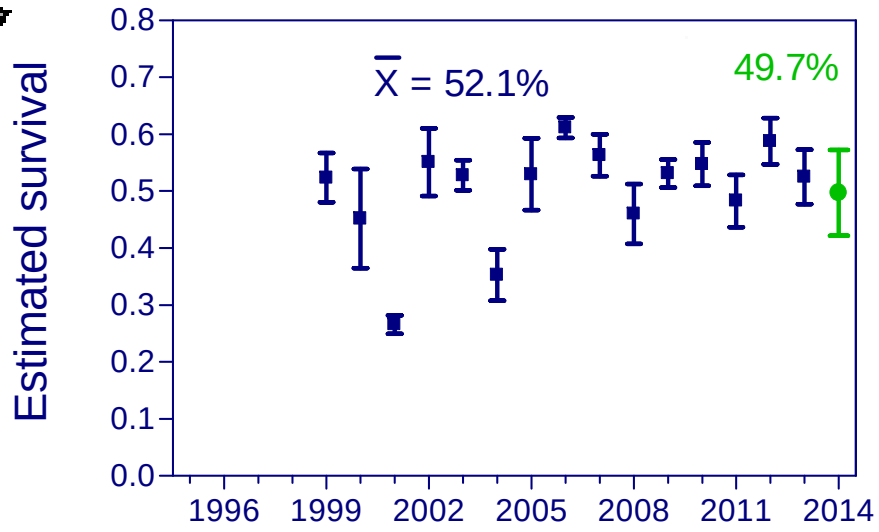
Steelhead



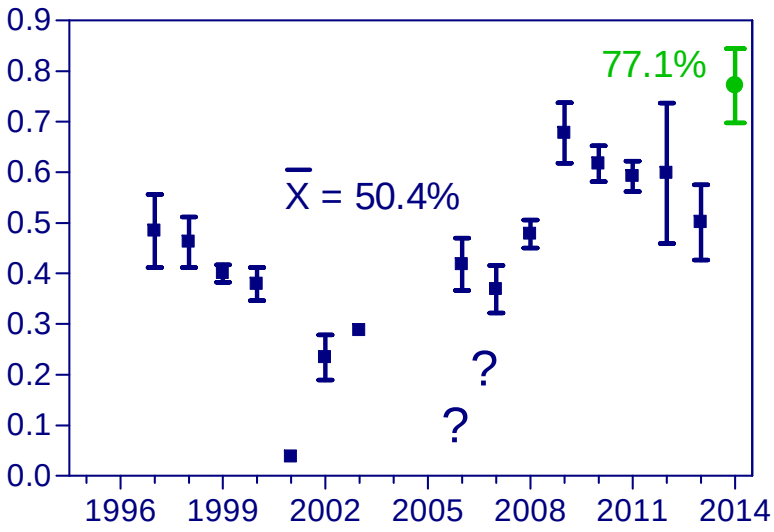


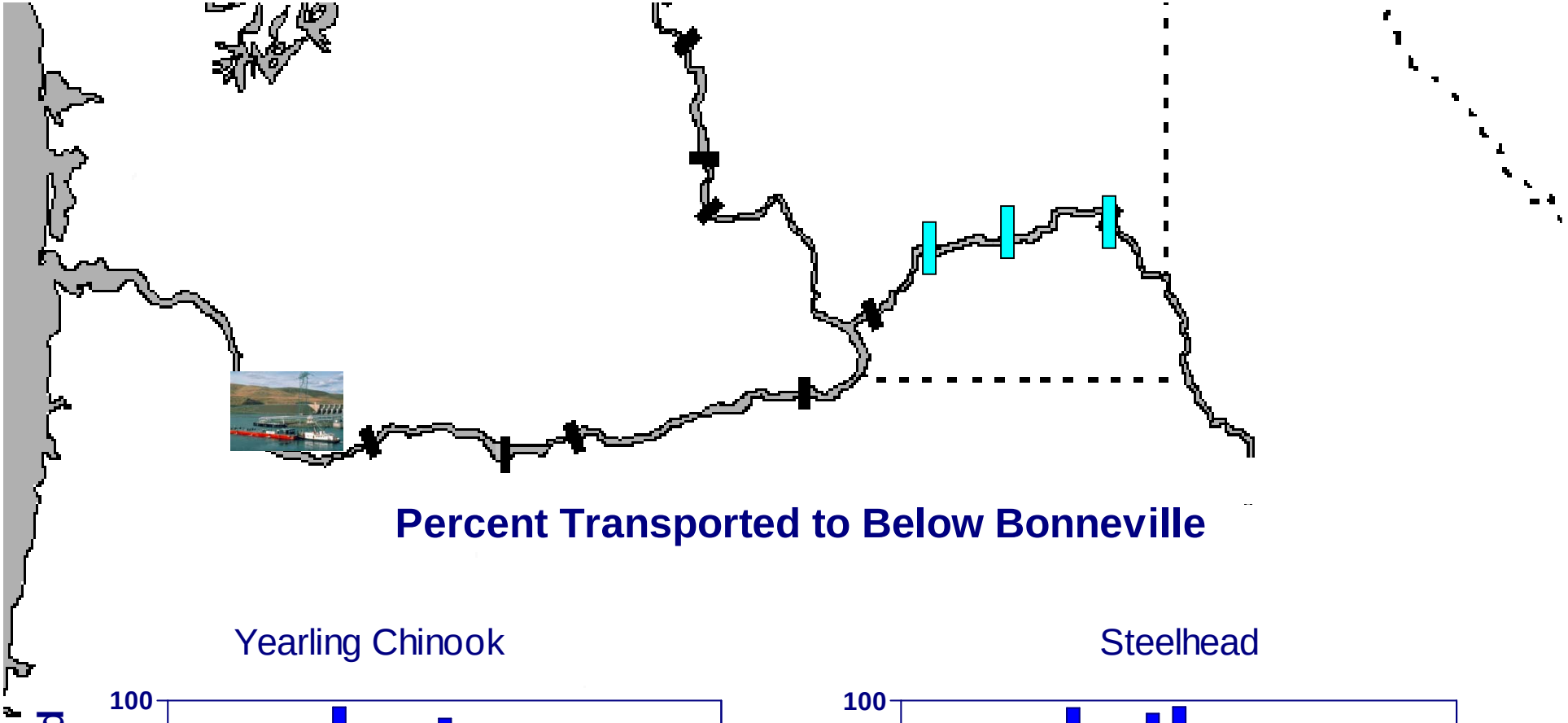
Snake River Trap to Bonneville

Yearling Chinook



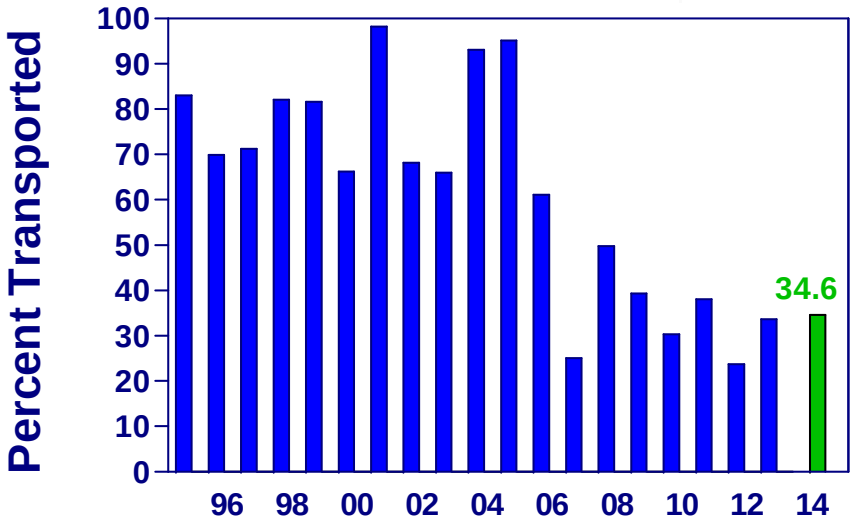
Steelhead



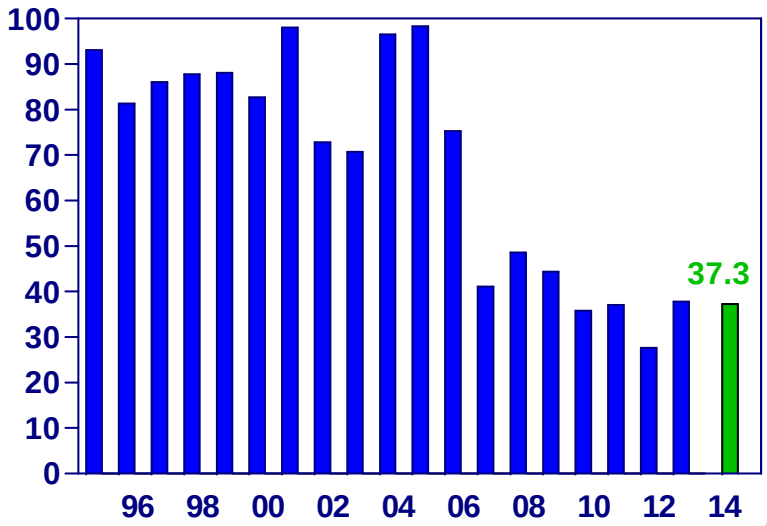


Percent Transported to Below Bonneville

Yearling Chinook



Steelhead



Smolt Transportation Seasonal Analyses

Yearling Chinook & Steelhead Migration Years 2009-2012

Estimating Seasonal SAR Patterns

- Need a “time-stamp”

- We use fish detected at LGR –

  transported or bypassed

Transportation Summary
Yearling Chinook & Steelhead

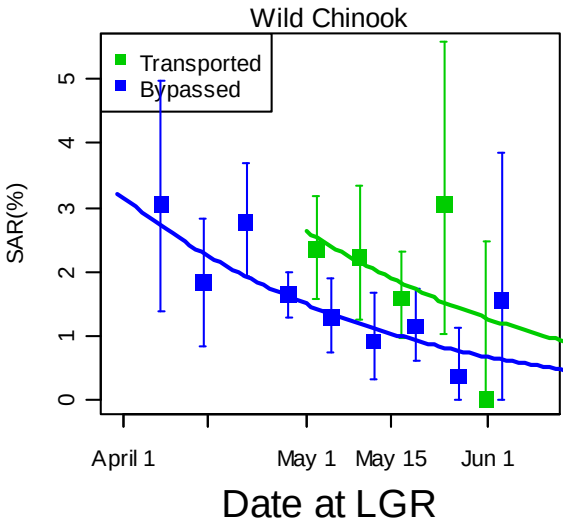
- Benefit of transportation was reduced in 2006-2012 relative to earlier years
  - due to improved conditions for in-river migrants

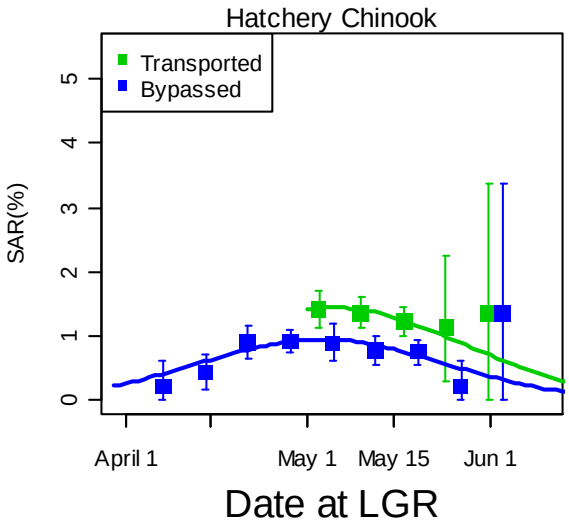
- SAR for transported fish tagged upstream of LGR still exceeded that for **bypassed** fish for most of the season (except 2011 wild chinook)

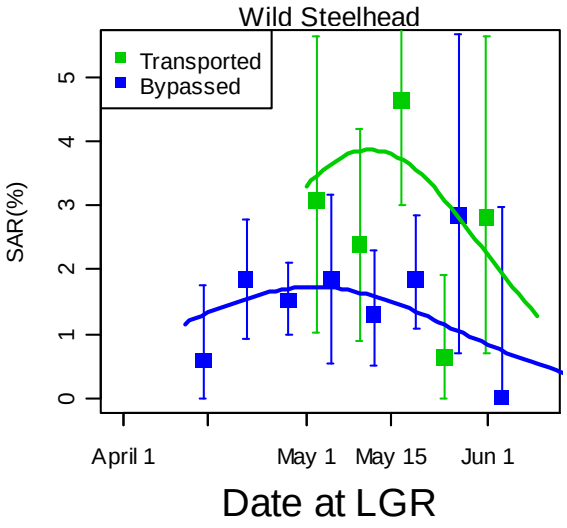
- Benefits of transportation small enough that evaluation depends on standard applied

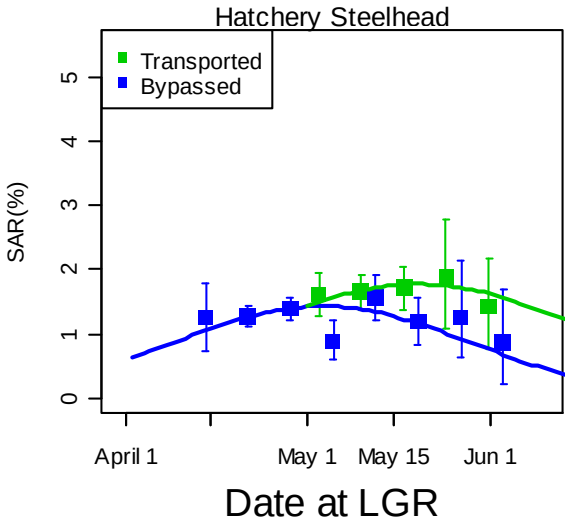
MY 2009 - Tagged Upstream of Lower Granite

Transported or Bypassed at Lower Granite Dam



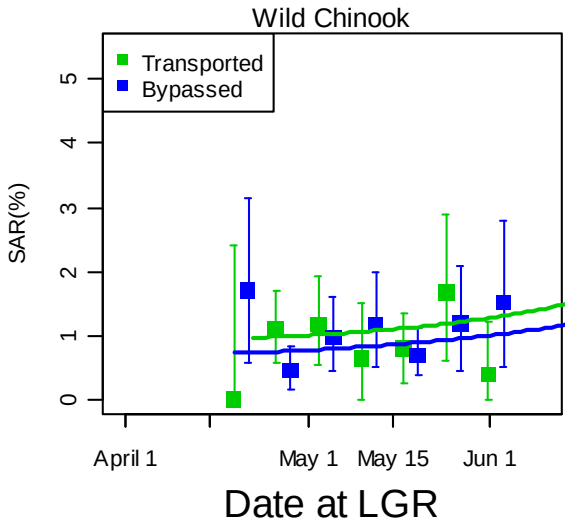


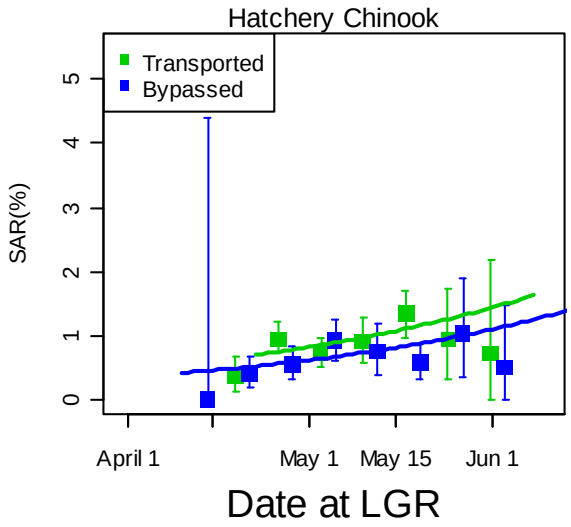


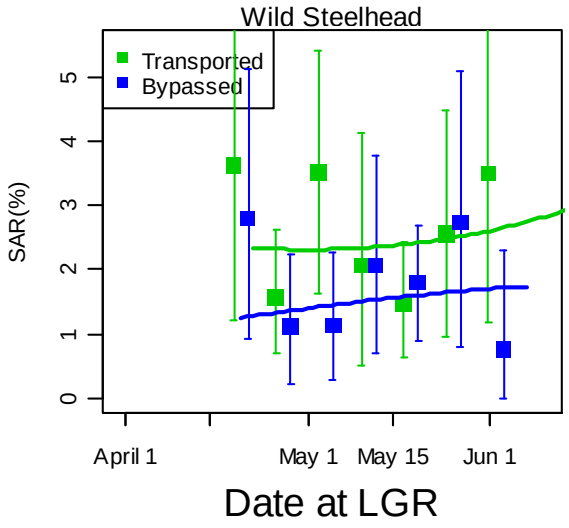


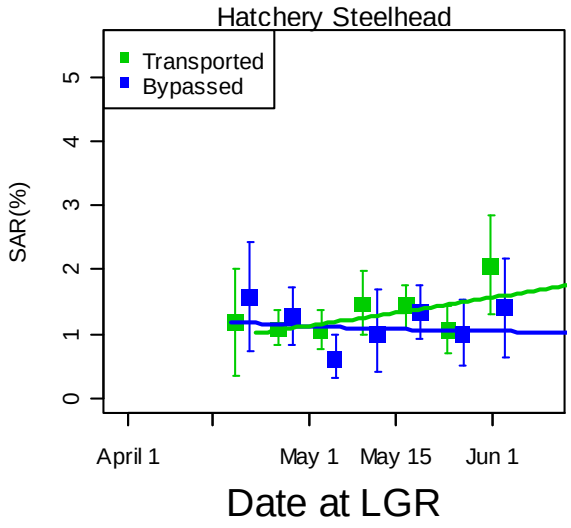
MY 2010 - Tagged Upstream of Lower Granite

Transported or Bypassed at Lower Granite Dam



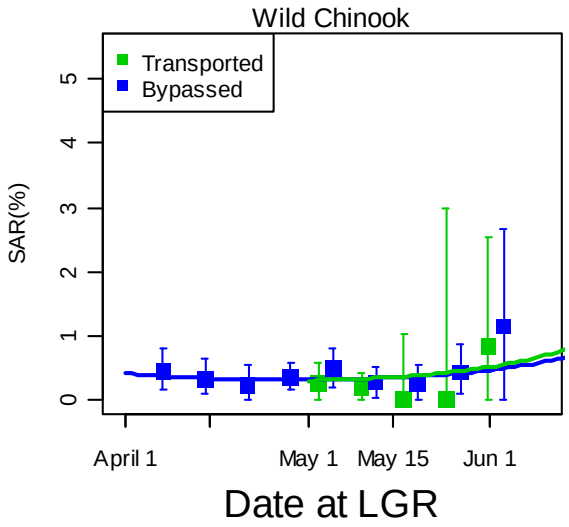


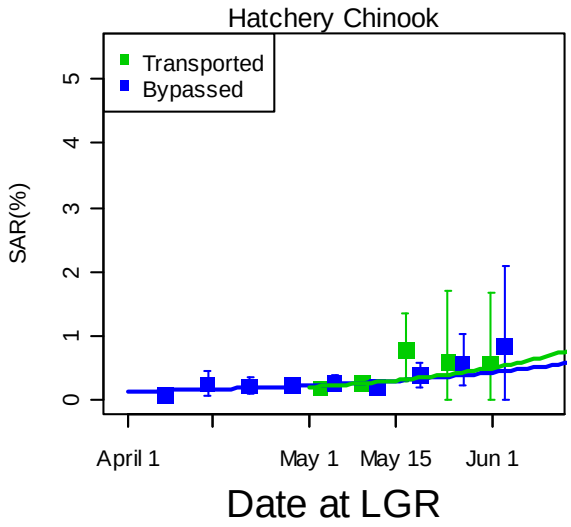


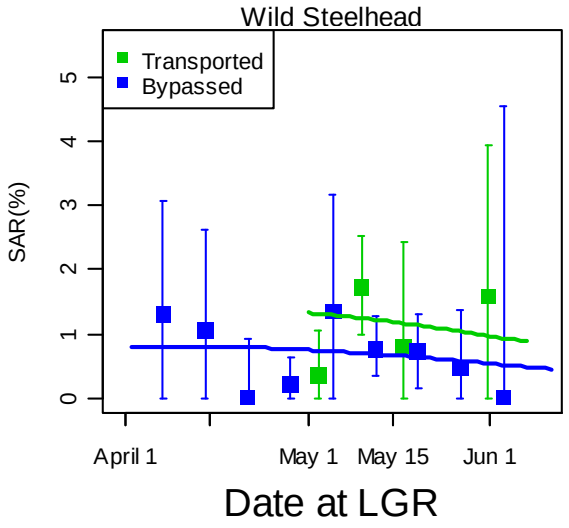


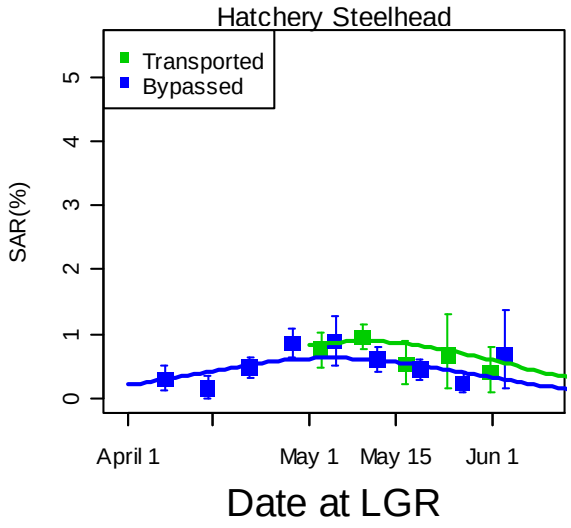
MY 2011 - Tagged Upstream of Lower Granite

Transported or Bypassed at Lower Granite Dam



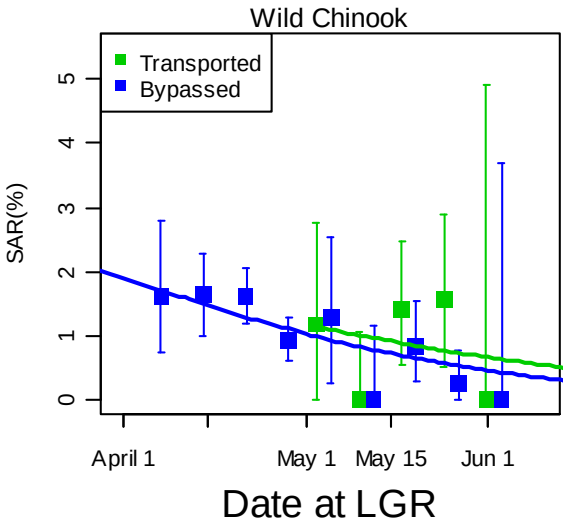


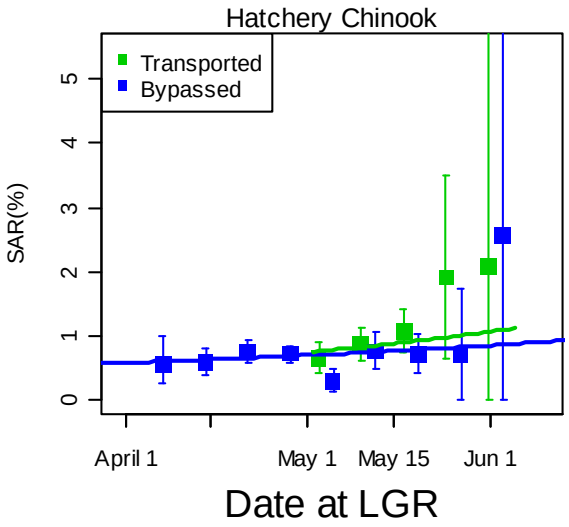


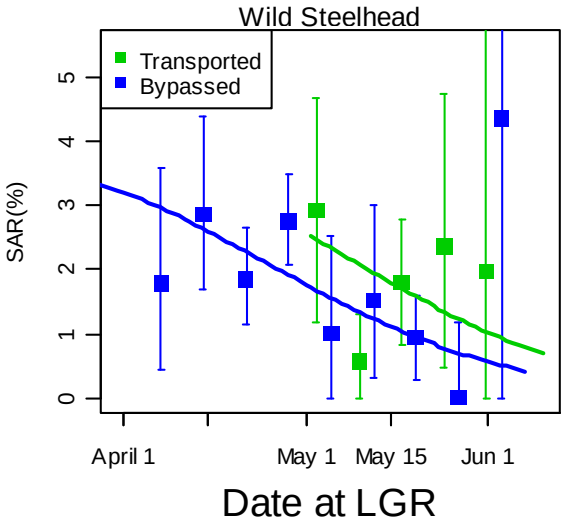


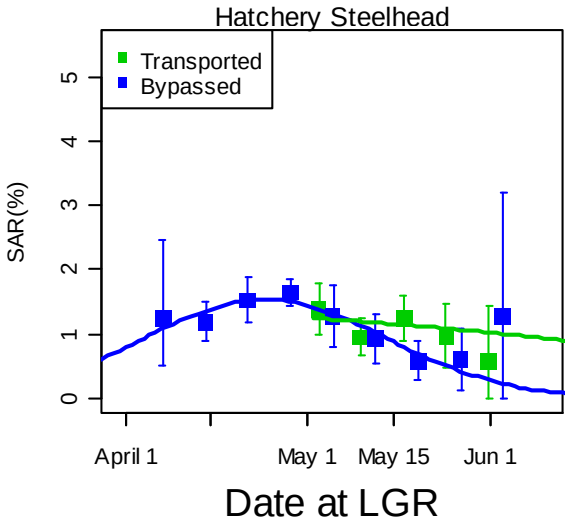
MY 2012 - Tagged Upstream of Lower Granite

Transported or Bypassed at Lower Granite Dam









Transportation Evaluation

- Relative SAR = “T:B Ratio”
  - T:B > 1 :

    transported SAR > bypassed SAR

Transportation Evaluation

- Relative SAR = “T:B Ratio”
  - T:B > 1 :

    transported SAR > bypassed SAR

- What about fish never in a collection system?

SAR Ratio Standards

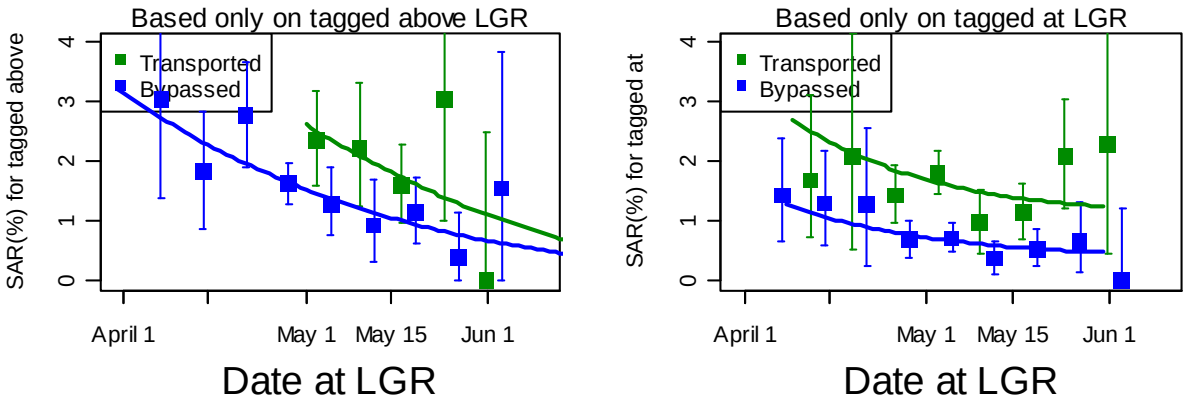
Migration Year	Wild Chinook			Hatchery Chinook			Wild Steelhead			Hatchery Steelhead		
	SAR Ratio[a]	Prop. Nondet[b]	**Alt. Std.**	SAR Ratio[a]	Prop. Nondet[b]	**Alt. Std.**	SAR Ratio[c]	Prop. Nondet[b]	**Alt. Std.**	SAR Ratio[a]	Prop. Nondet[b]	**Alt. Std.**
1998-2005	1.14	0.39[d]	**1.05**[e]	1.21	0.57[d]	**1.12**[e]	1.38	0.40[d]	**1.15**[e]	1.57	0.41[d]	**1.23**[e]
2006	1.14	0.28	**1.04**	1.21	0.43	**1.09**	1.38	0.18	**1.07**	1.57	0.15	**1.08**
2007	1.14	0.54	**1.08**	1.21	0.69	**1.14**	1.38	0.54	**1.20**	1.57	0.39	**1.22**
2008	1.14	0.38	**1.05**	1.21	0.55	**1.11**	1.38	0.35	**1.13**	1.57	0.50	**1.28**
2009	1.14	0.30	**1.04**	1.21	0.56	**1.12**	1.38	0.25	**1.10**	1.57	0.31	**1.17**
2010	1.14	0.63	**1.09**	1.21	0.84	**1.17**	1.38	0.71	**1.27**	1.57	0.75	**1.43**
2011	1.14	0.28	**1.04**	1.21	0.46	**1.10**	1.38	0.38	**1.14**	1.57	0.36	**1.21**
2012	1.14	0.29	**1.04**	1.21	0.48	**1.10**	1.38	0.36	**1.14**	1.57	0.39	**1.22**

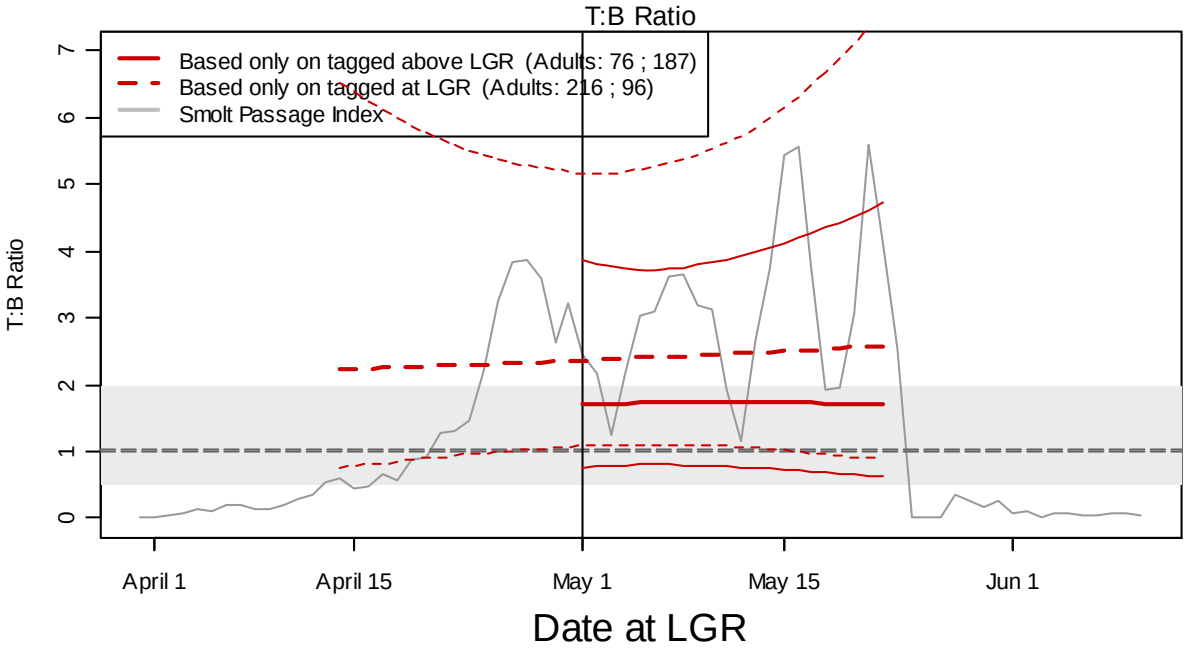
a. Geometric mean of annual ratio of SAR of "never-detected" fish to SAR of fish detected at Lower Granite Dam, 1998-2012 (excl. 2001).

b. Proportion of inriver migrants (LGR-equivalent) not detected at Snake River collector dams.

Wild Chinook 2009

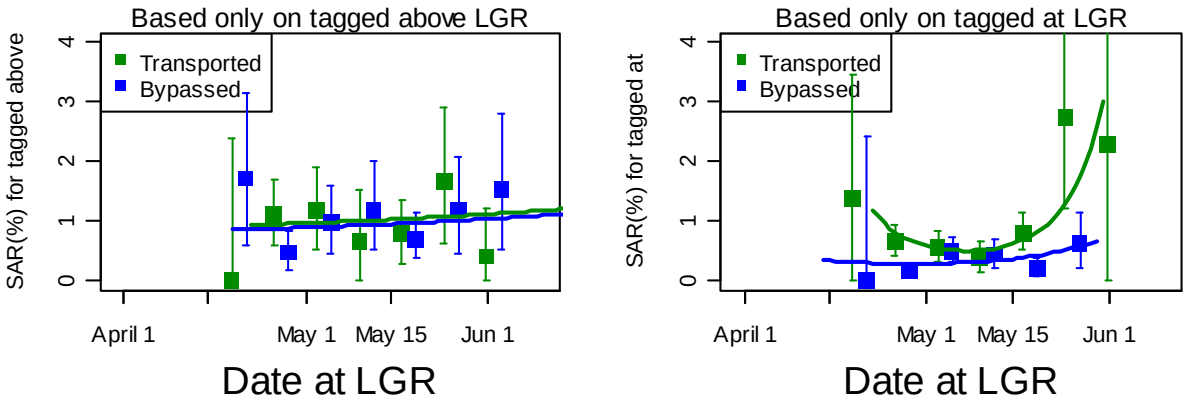
Transported or Bypassed at Lower Granite Dam

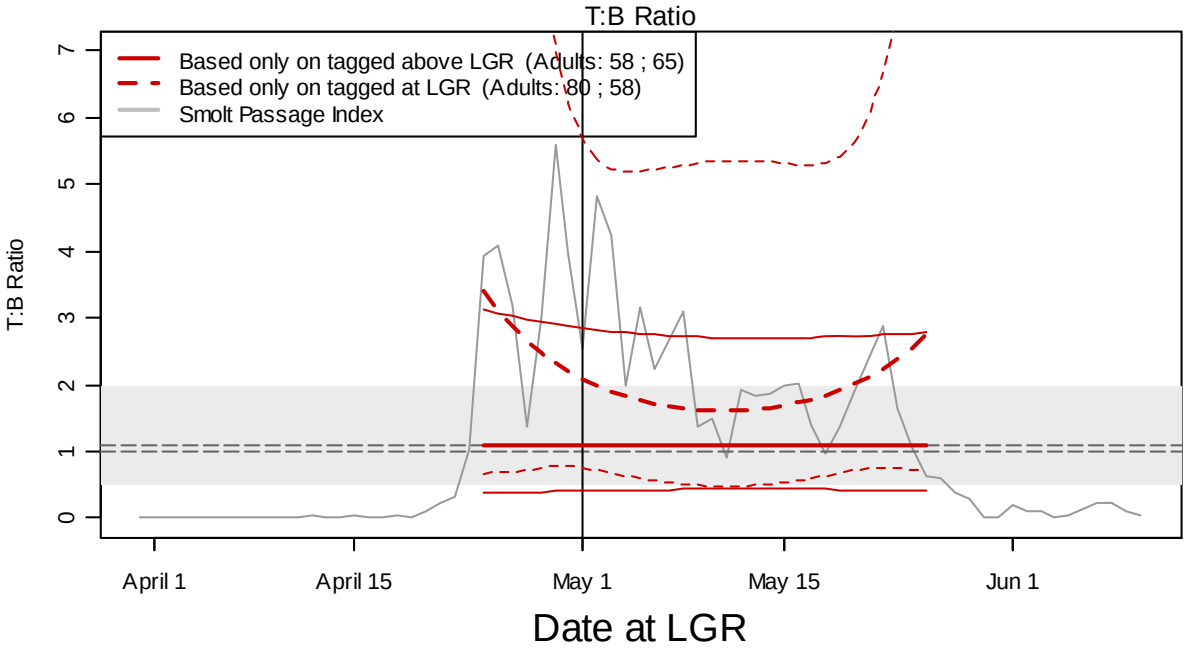




Wild Chinook 2010

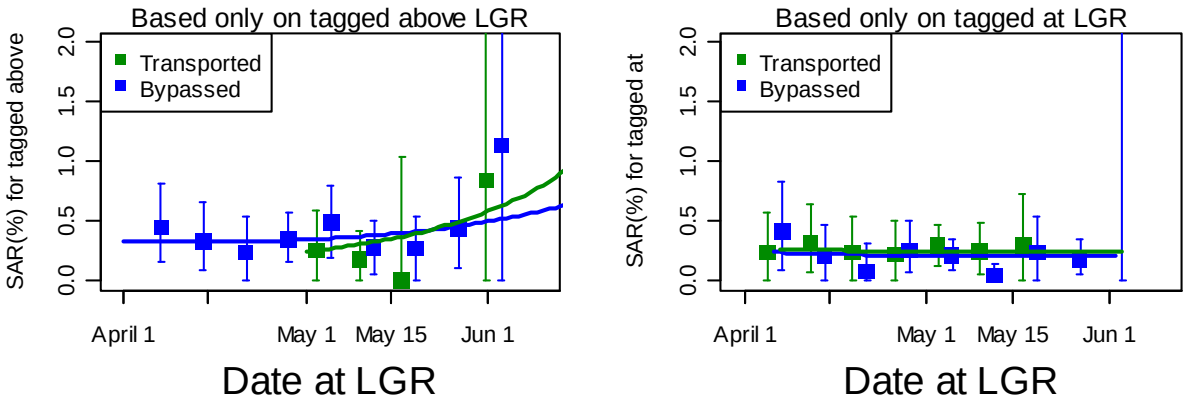
Transported or Bypassed at Lower Granite Dam

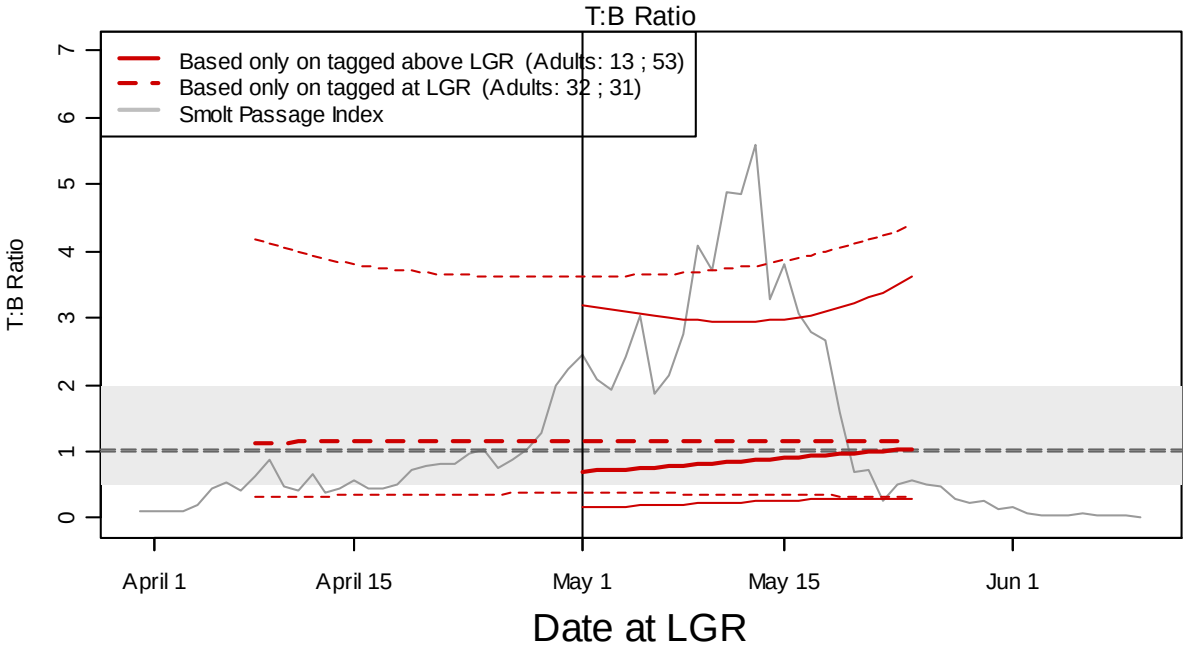




Wild Chinook 2011

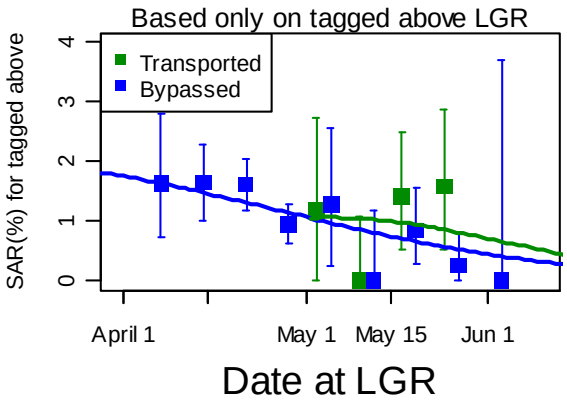
Transported or Bypassed at Lower Granite Dam

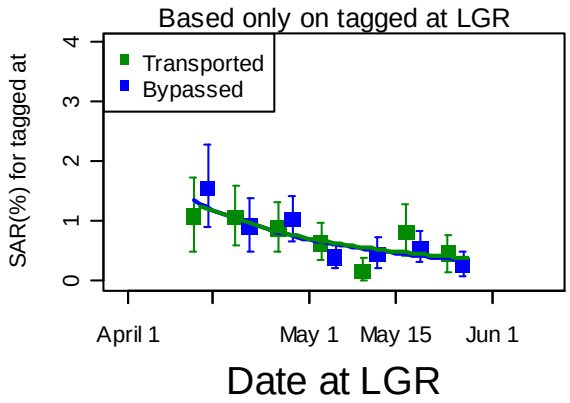


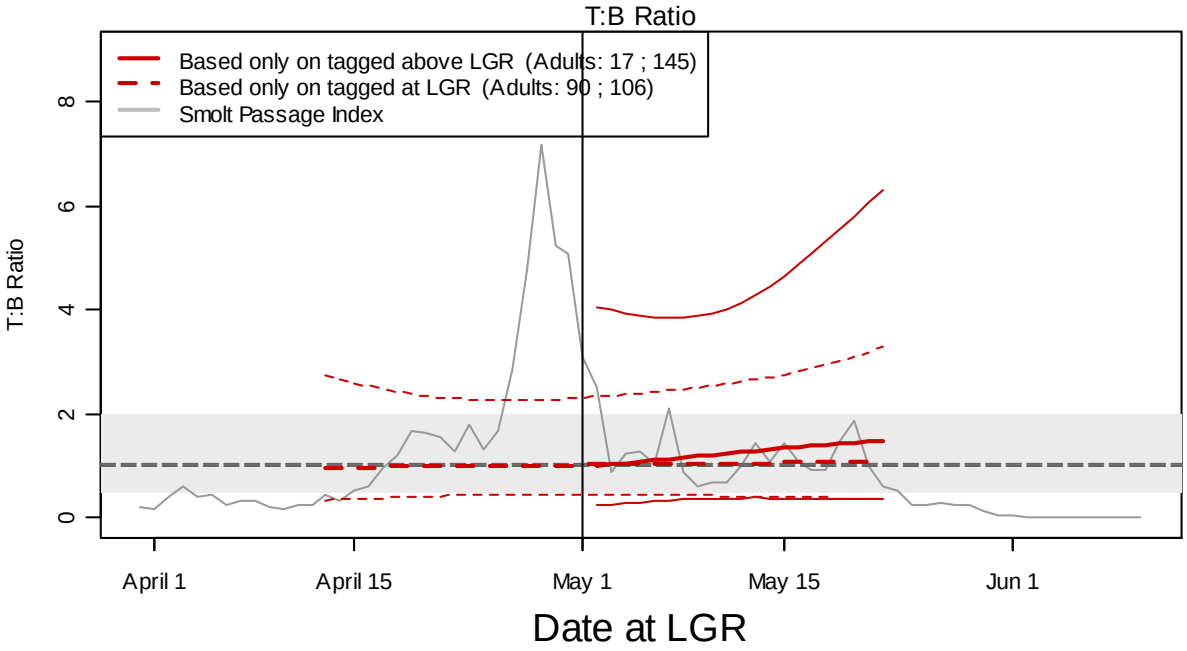


Wild Chinook 2012

Transported or Bypassed at Lower Granite Dam



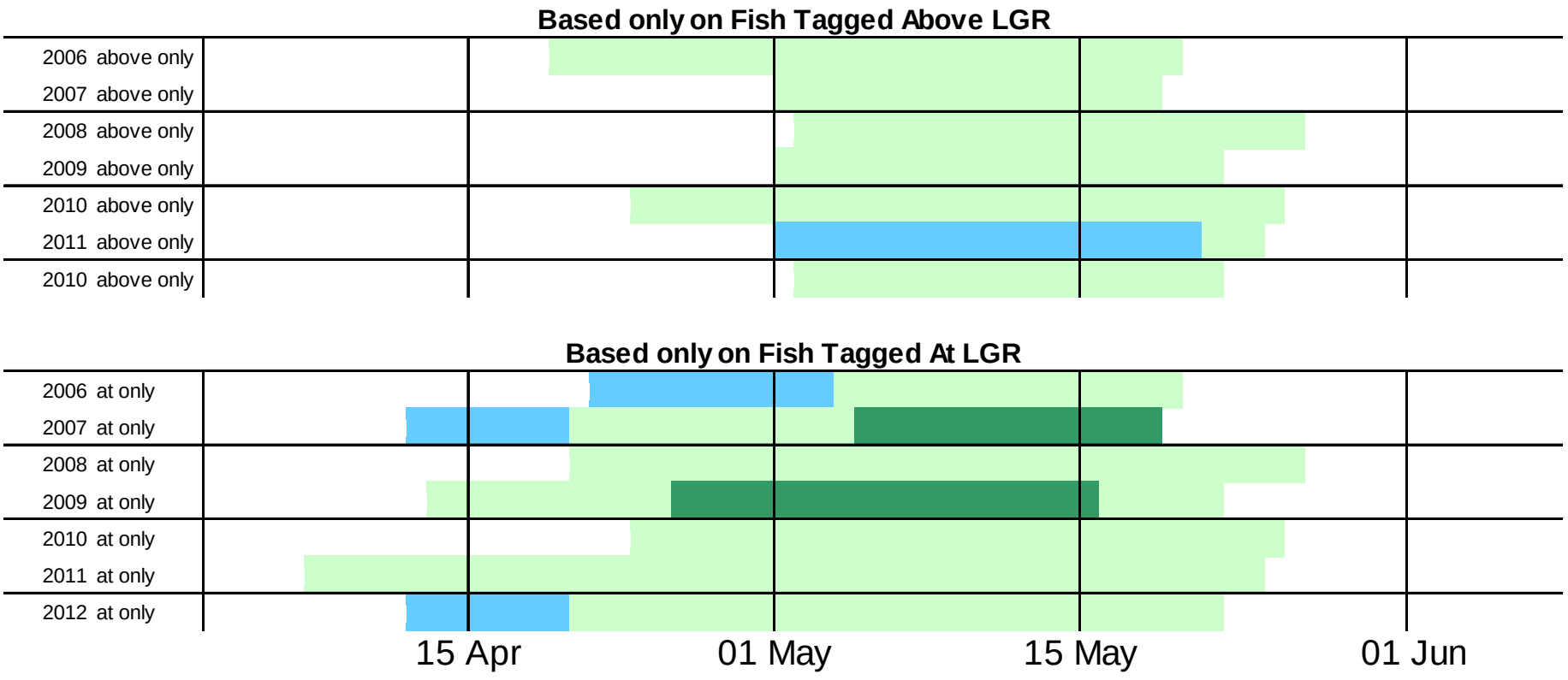




Wild Chinook Salmon - Lower Granite Dam

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

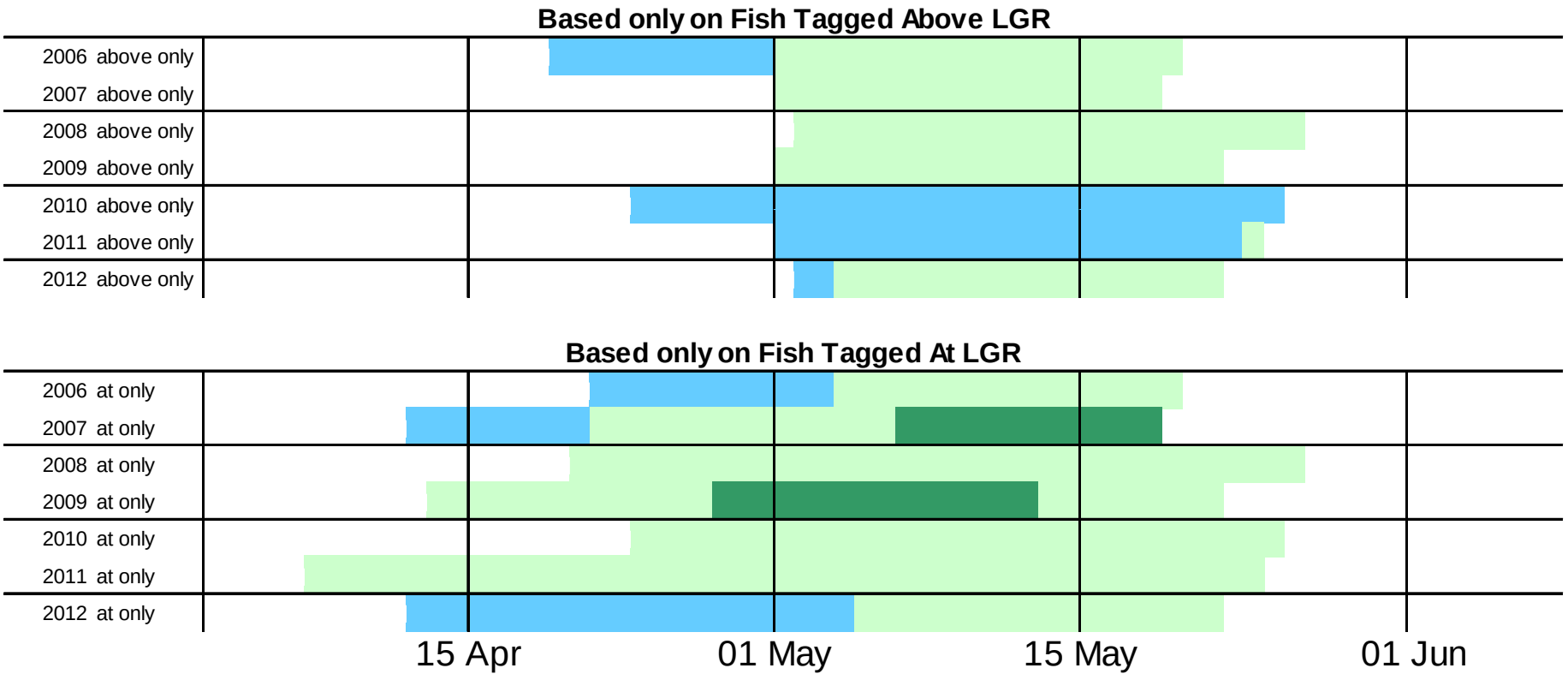
Standard = 1.0 (C1; Bypassed)



Wild Chinook Salmon - Lower Granite Dam

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

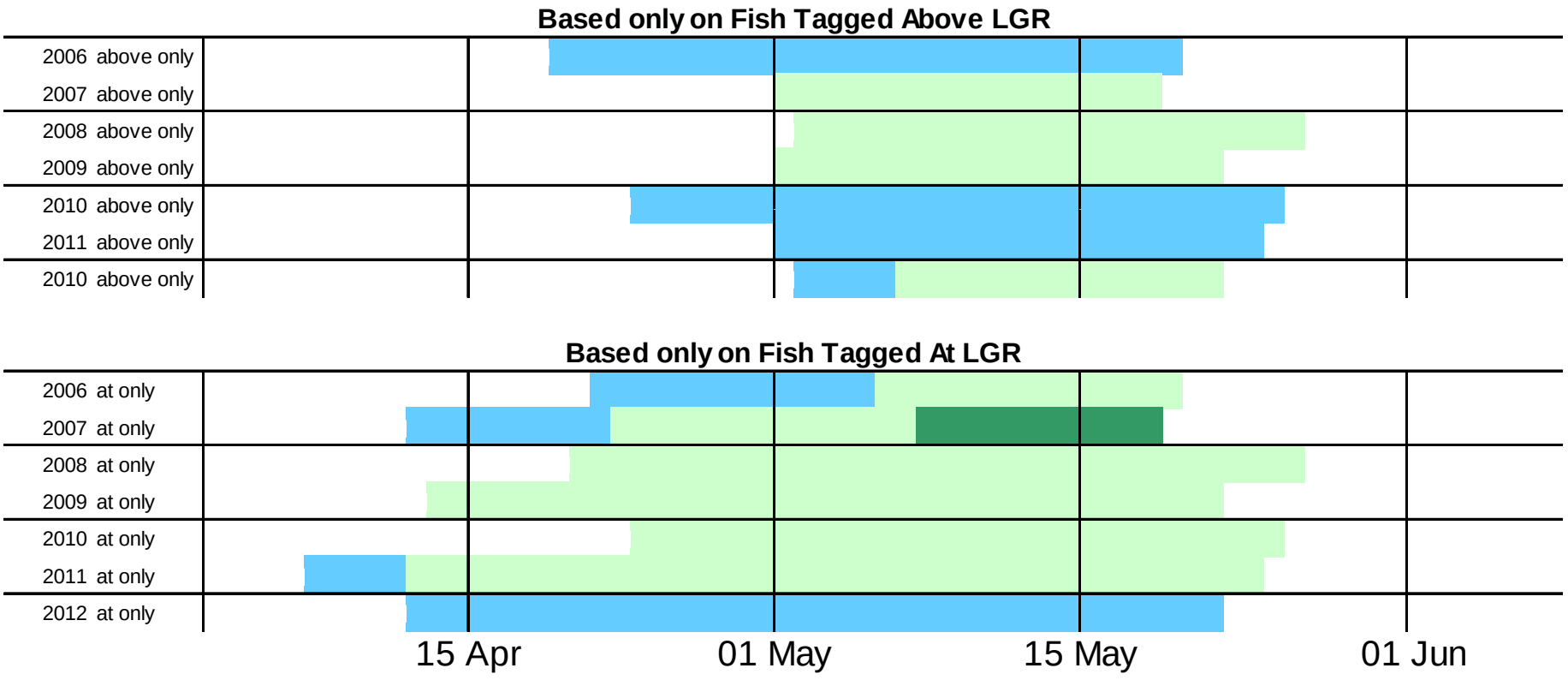
Standard = All Inriver (C0 & C1)



Wild Chinook Salmon - Lower Granite Dam

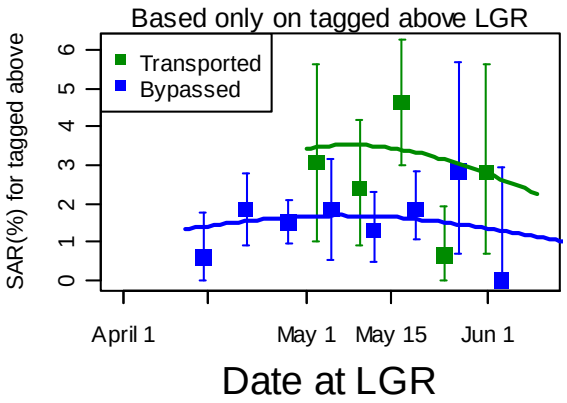
Summary of Model-Averaged T:B Values (Descriptive)

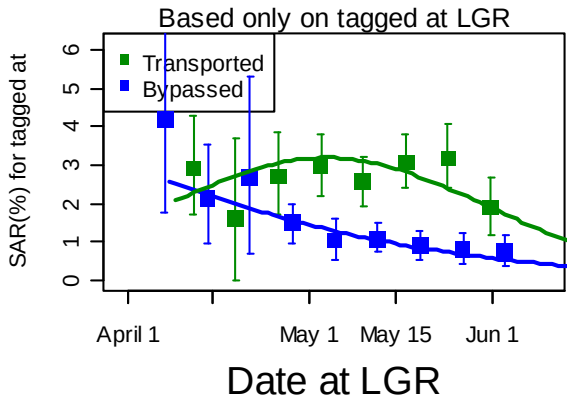
Standard = C0 (Never Bypassed)

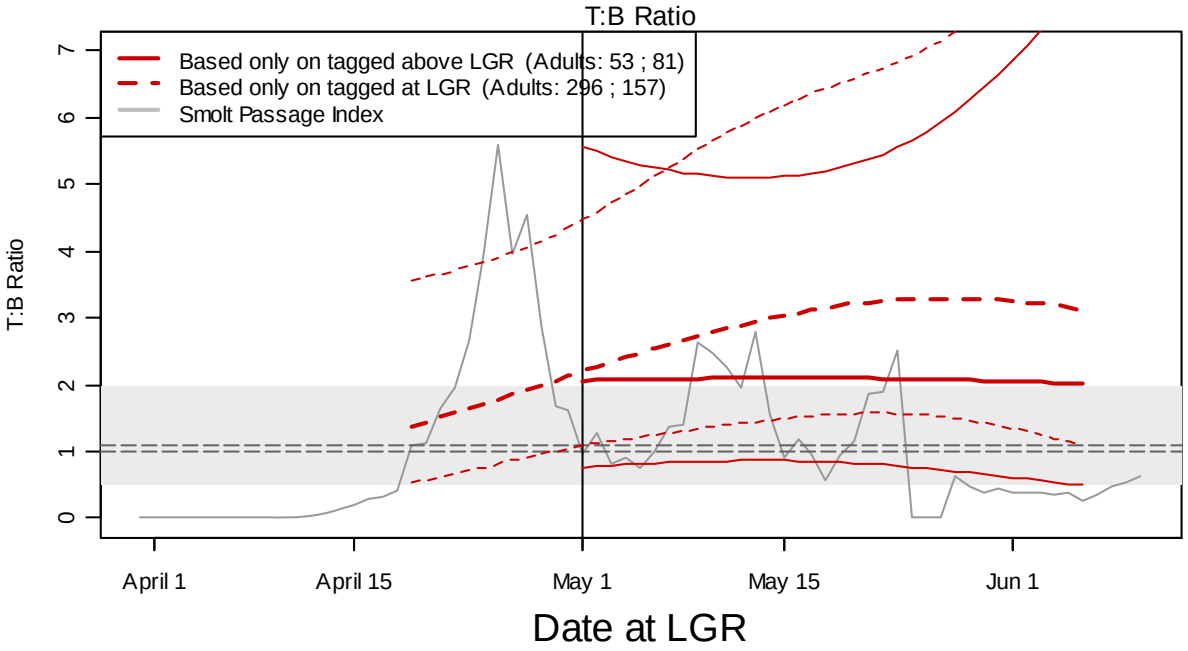


Wild Steelhead 2009

Transported or Bypassed at Lower Granite Dam

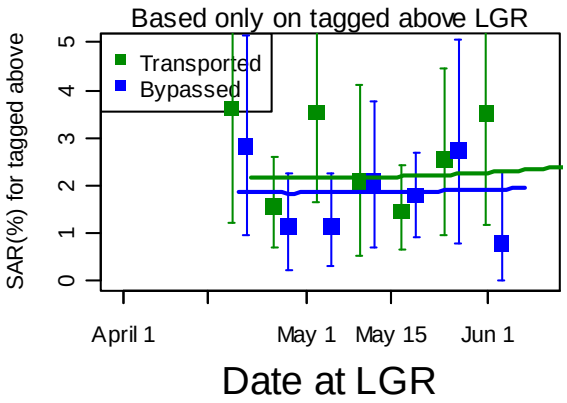


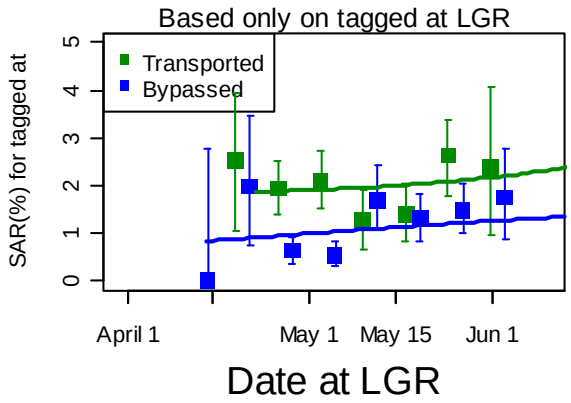


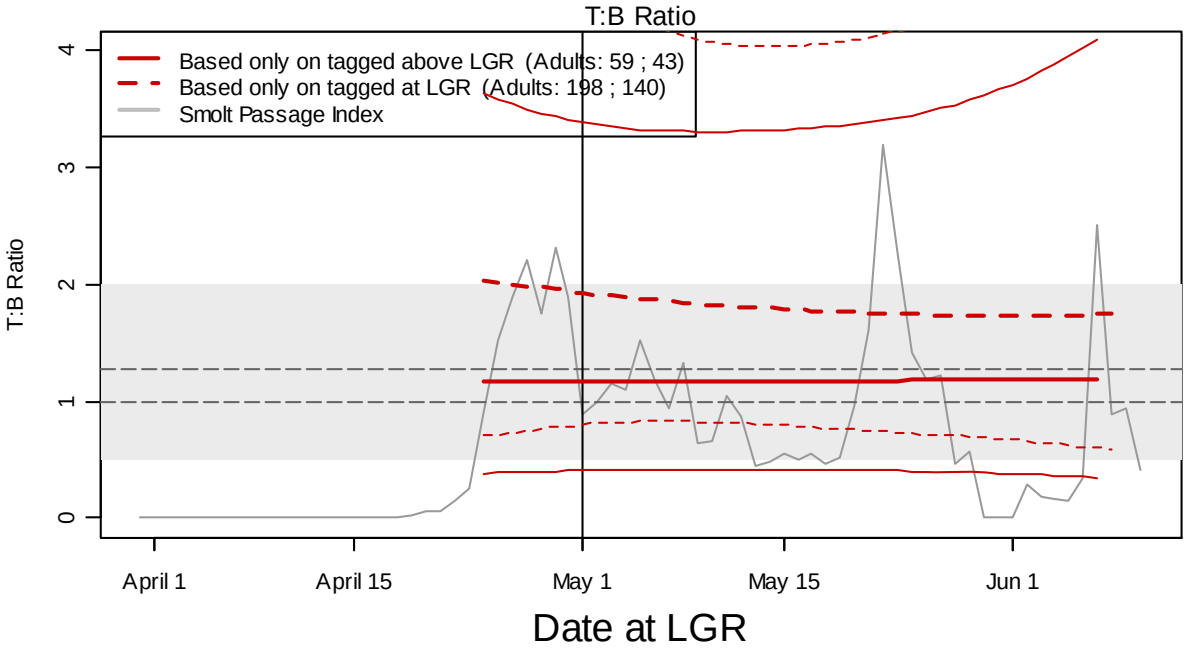


Wild Steelhead 2010

Transported or Bypassed at Lower Granite Dam

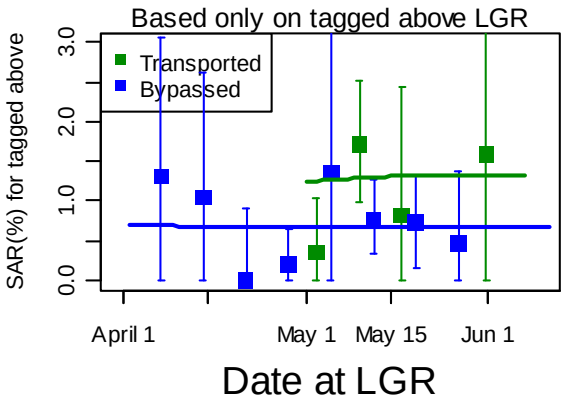


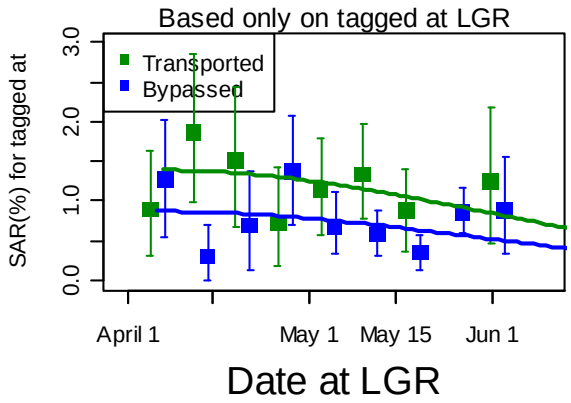


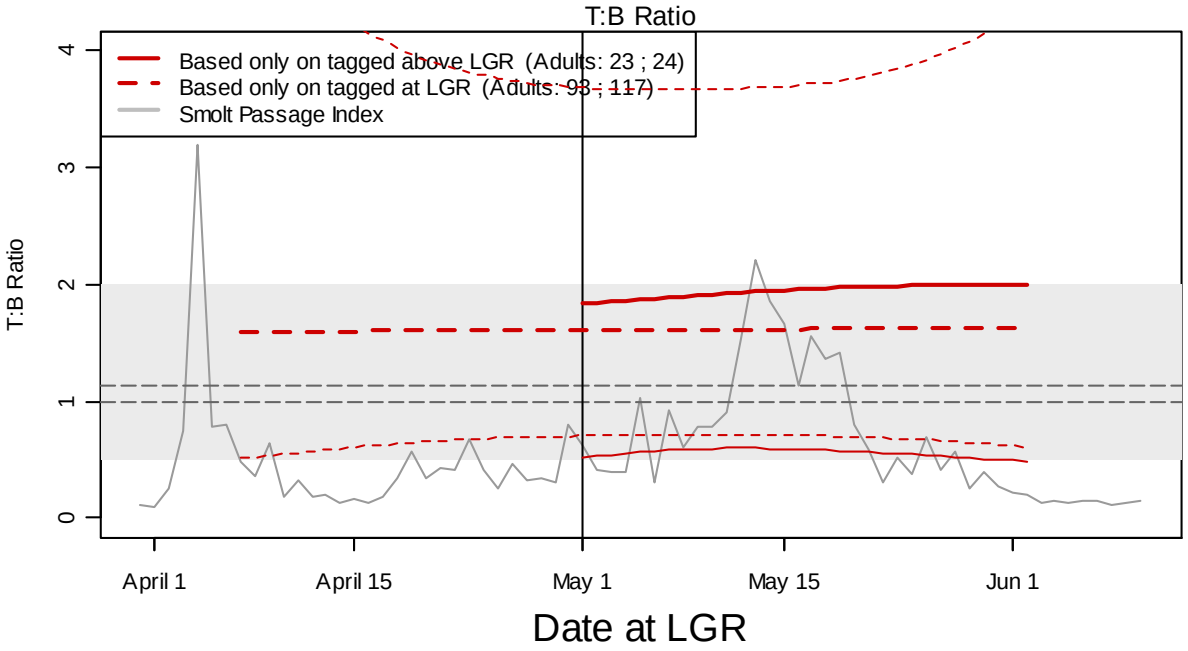


Wild Steelhead 2011

Transported or Bypassed at Lower Granite Dam

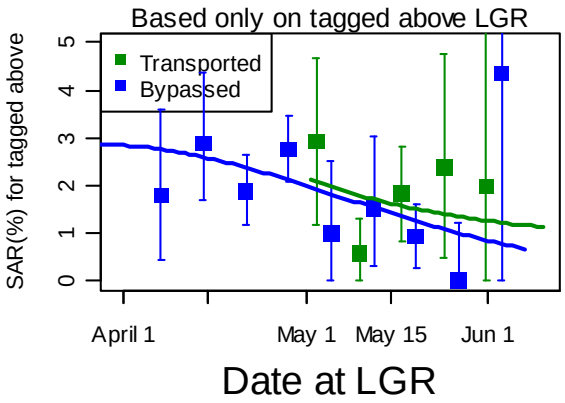


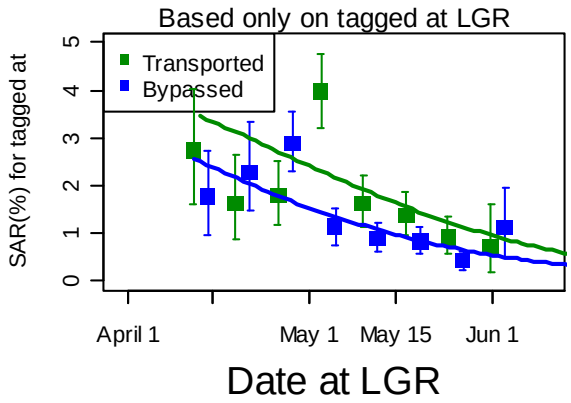


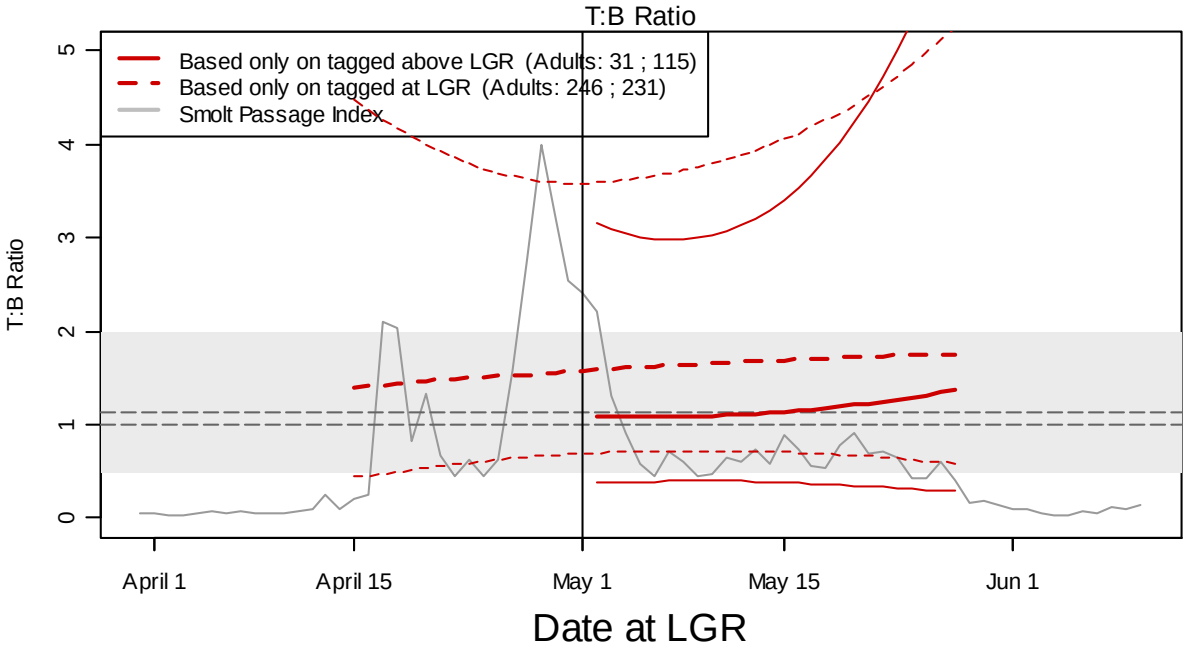


Wild Steelhead 2012

Transported or Bypassed at Lower Granite Dam



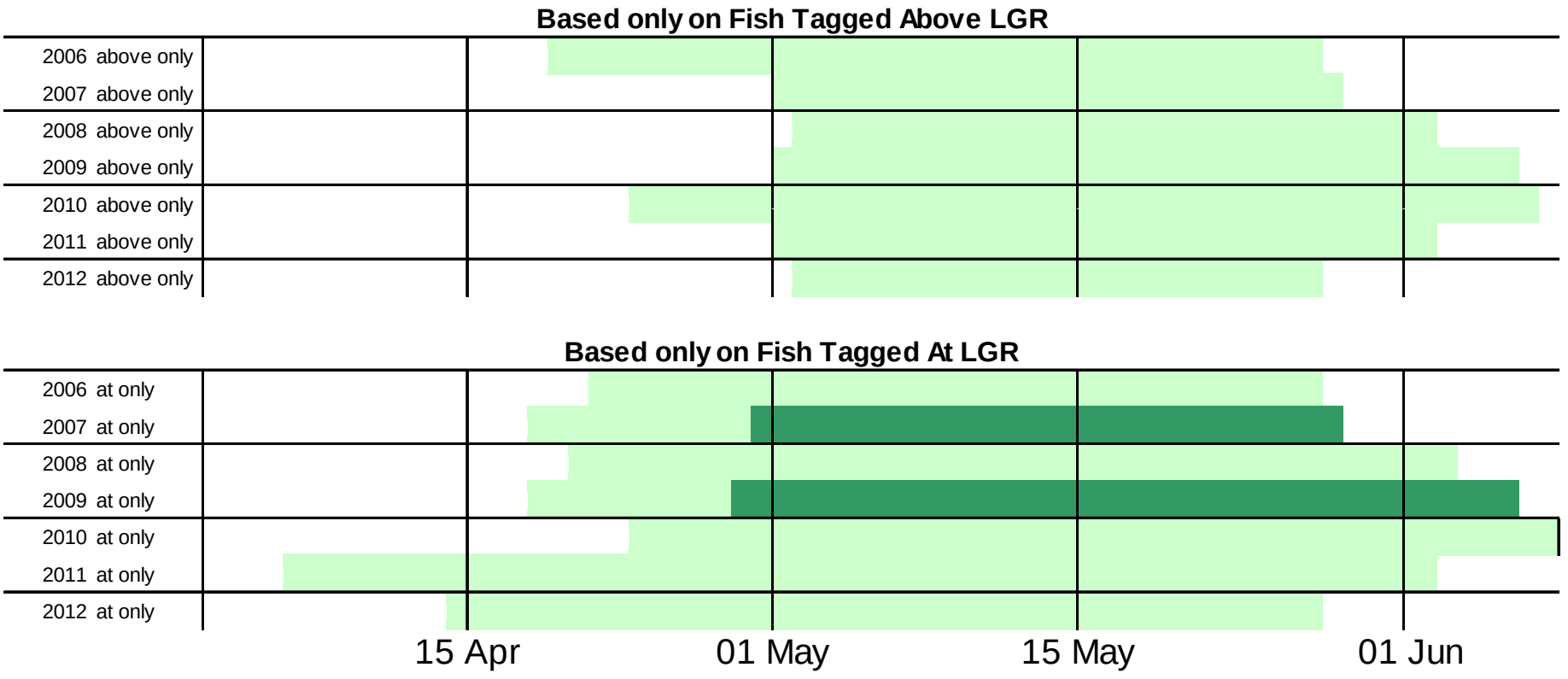




Wild Steelhead - Lower Granite Dam

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

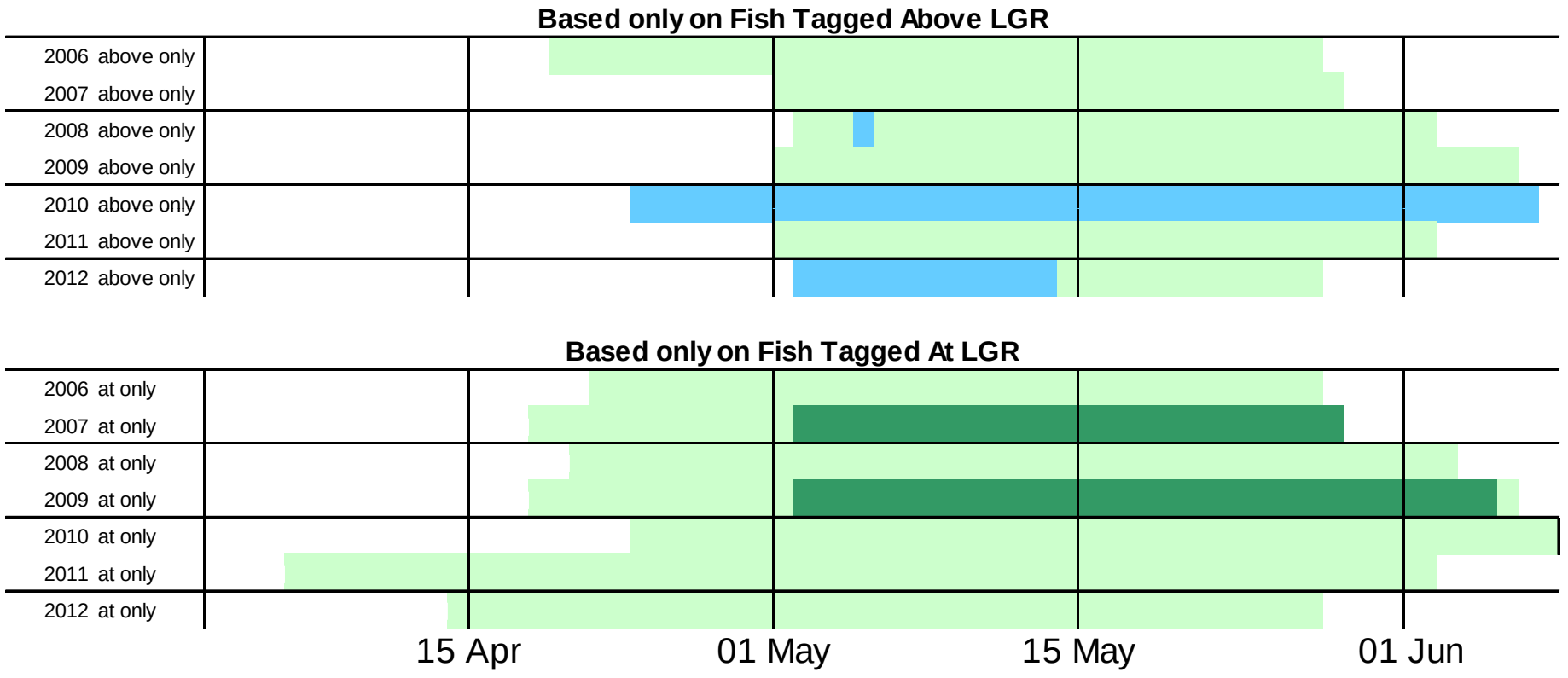
Standard = 1.0 (C1; Bypassed)



Wild Steelhead - Lower Granite Dam

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

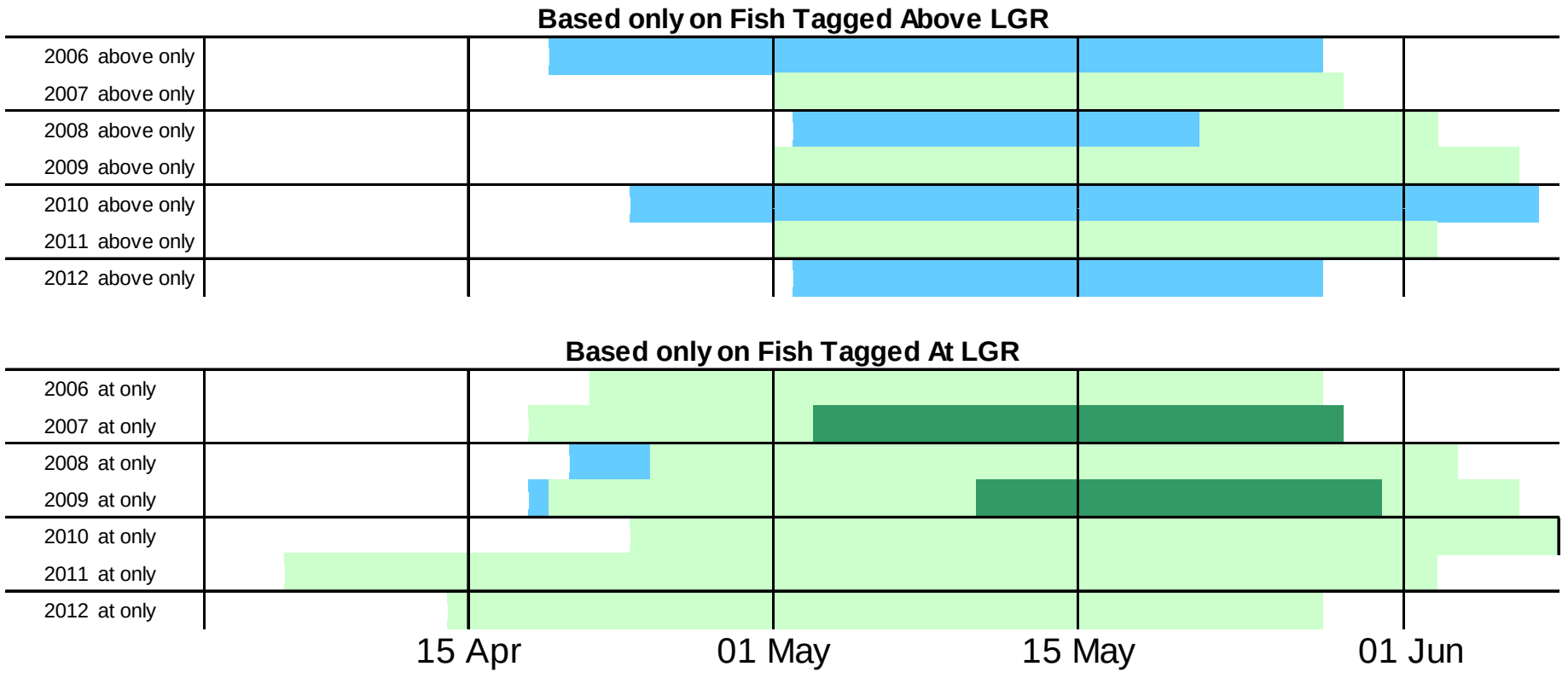
Standard = All Inriver (C0 & C1)



Wild Steelhead - Lower Granite Dam

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

Standard = C0 (Never Bypassed)



Other Analyses Being Updated

- T:B analysis for yearling chinook and steelhead at other dams
  - More fully developed from March 2014 TMT Transportation Workshop

- Fall chinook transportation study (2006-2012)
  - Revised report on 2006 and 2008 release years recently completed
  - 2009 and 2010 release years in process


Questions

Smolt Transportation Seasonal Analyses

Subyearling Fall Chinook Migration Years 2006 & 2008

Transportation Summary Subyearling Fall Chinook &

- Bypass > Transport for fish arriving at LGR, LGO, LMN earliest (before ~June 15)

- Transport > Bypass for fish arriving at LGR, LGO, LMN after ~June 15

(Not enough data for MCN)

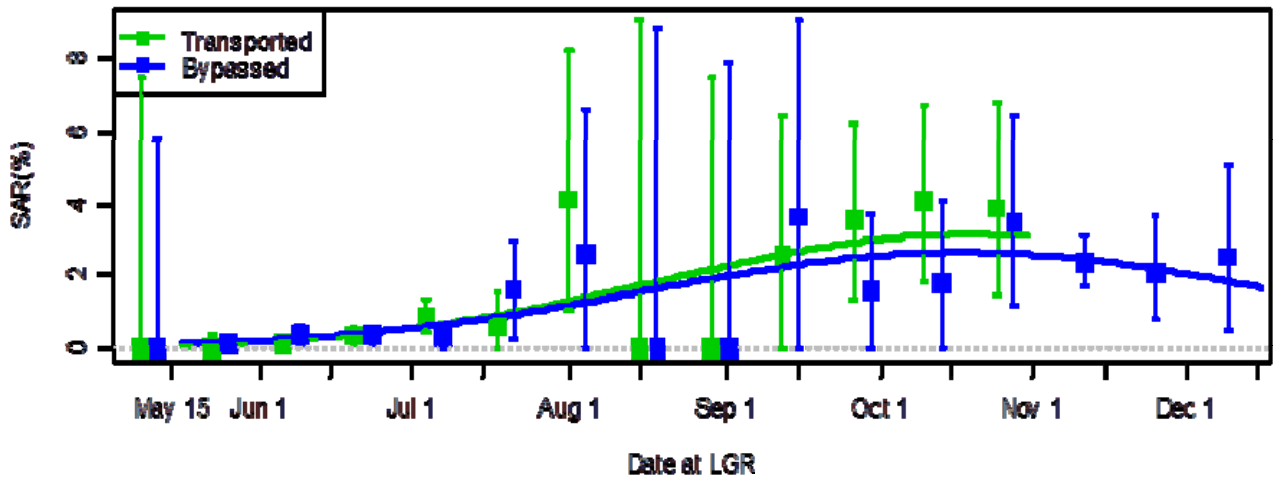
Categories of Fall Chinook Salmon

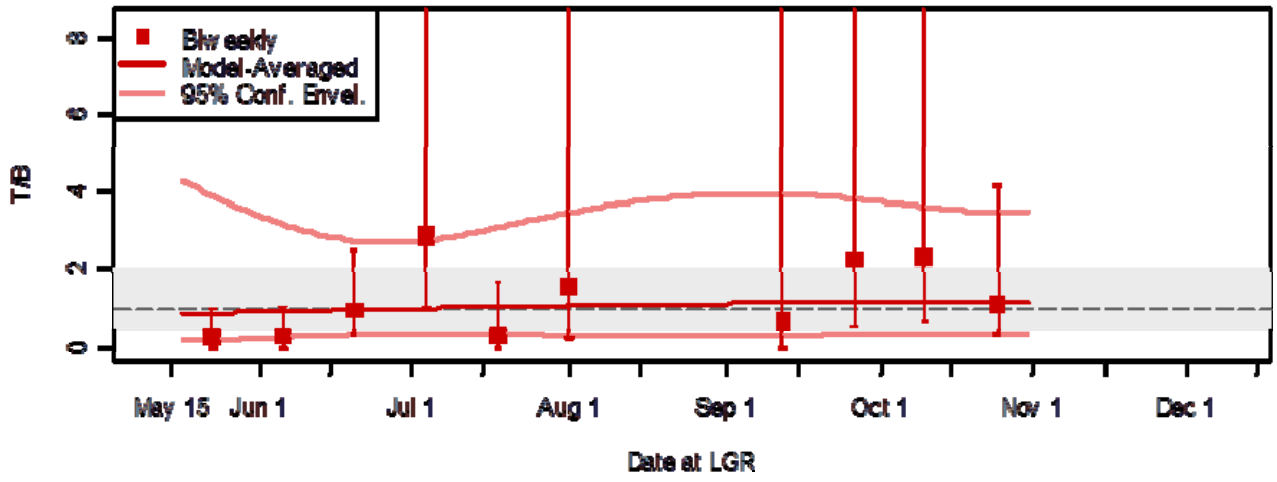
- Natural
  - Not enough of them to conduct a transportation evaluation
- Hatchery Surrogates for Natural Fish
  - Lyons Ferry fish specially reared at Dworshak NFH etc. (for study only)
- Hatchery Production Subyearlings
- Hatchery Production Yearlings
  - Lyons Ferry production rearing

2006 Surrogate Subyearlings

Lower Granite Dam

Smolt-to-Adult Return (%)

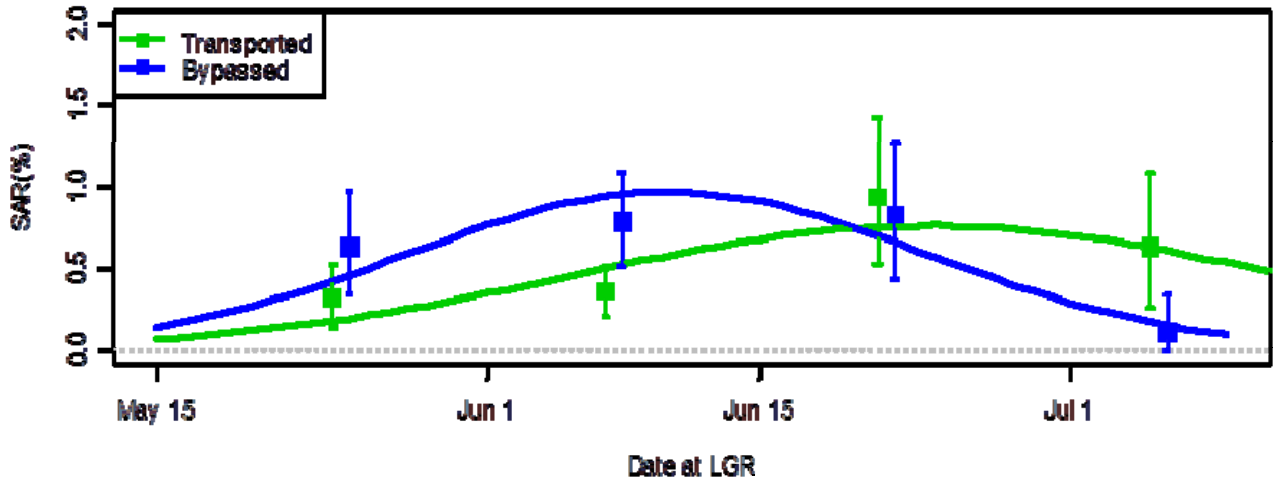


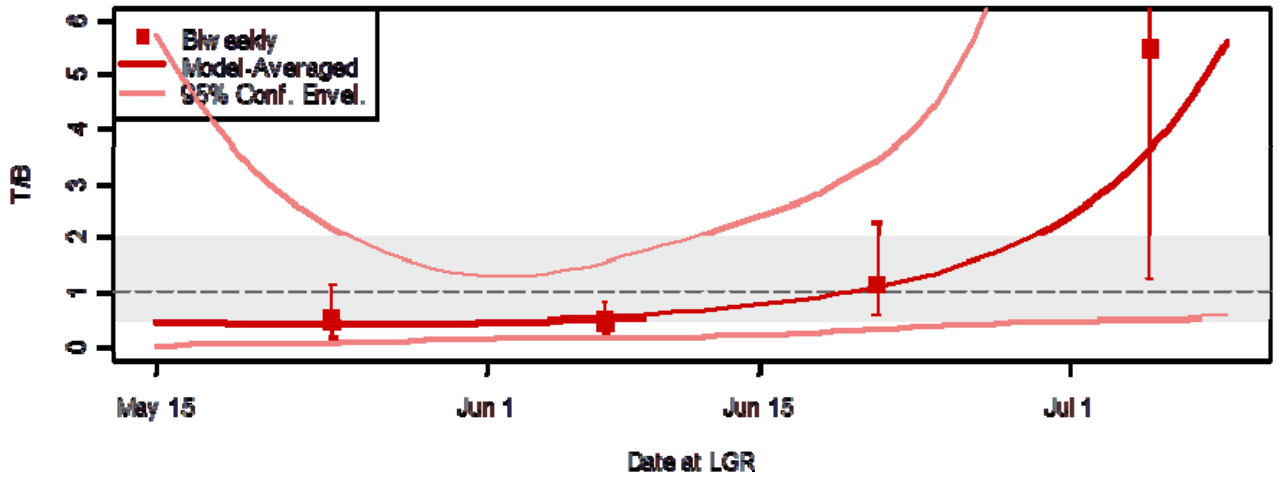


2006 Production Subyearlings

Lower Granite Dam

Smolt-to-Adult Return (%)

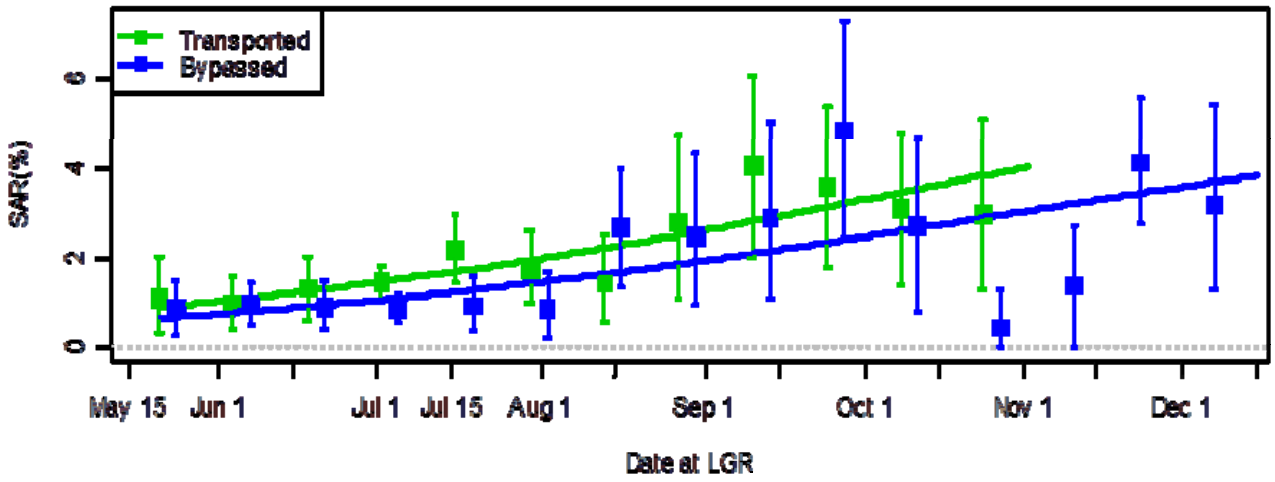


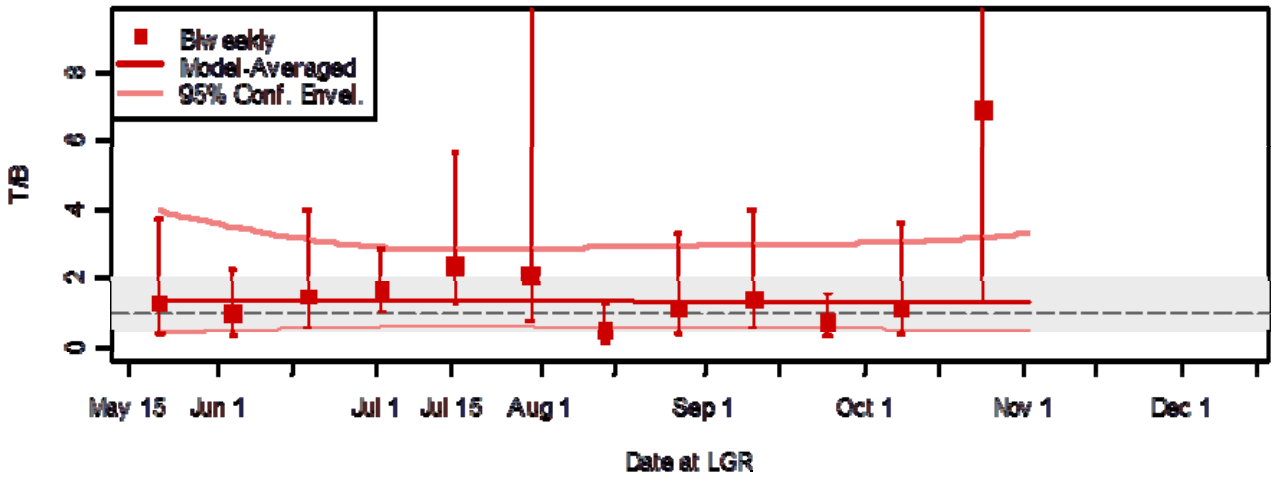


2008 Surrogate Subyearlings

Lower Granite Dam

Smolt-to-Adult Return (%)

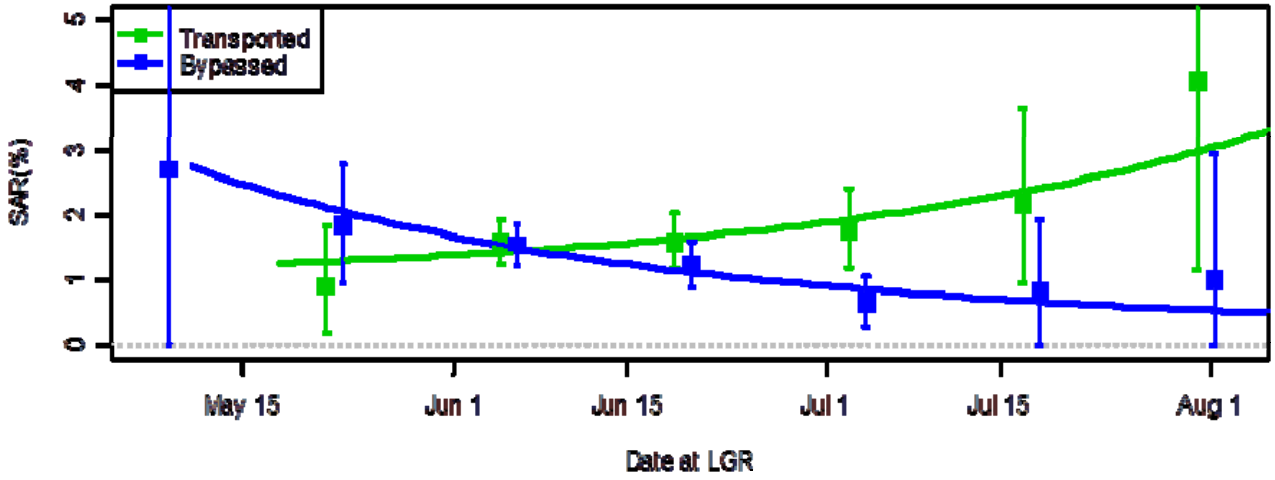


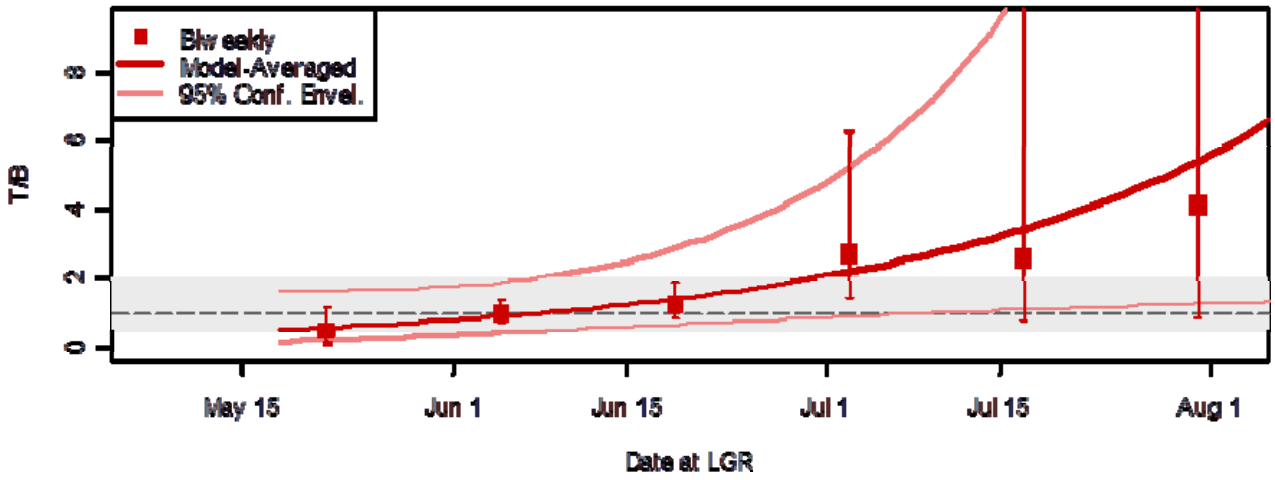


2008 Production Subyearlings

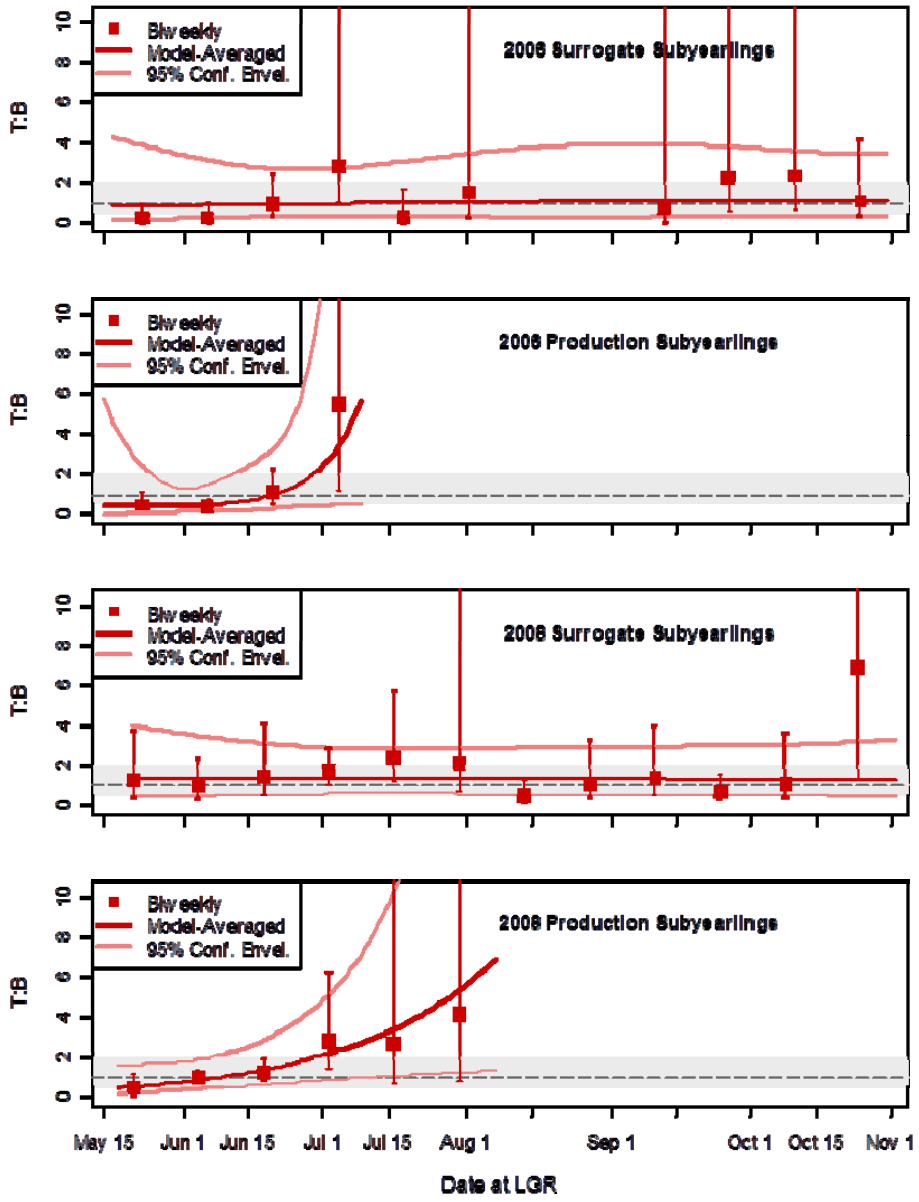
Lower Granite Dam

Smolt-to-Adult Return (%)

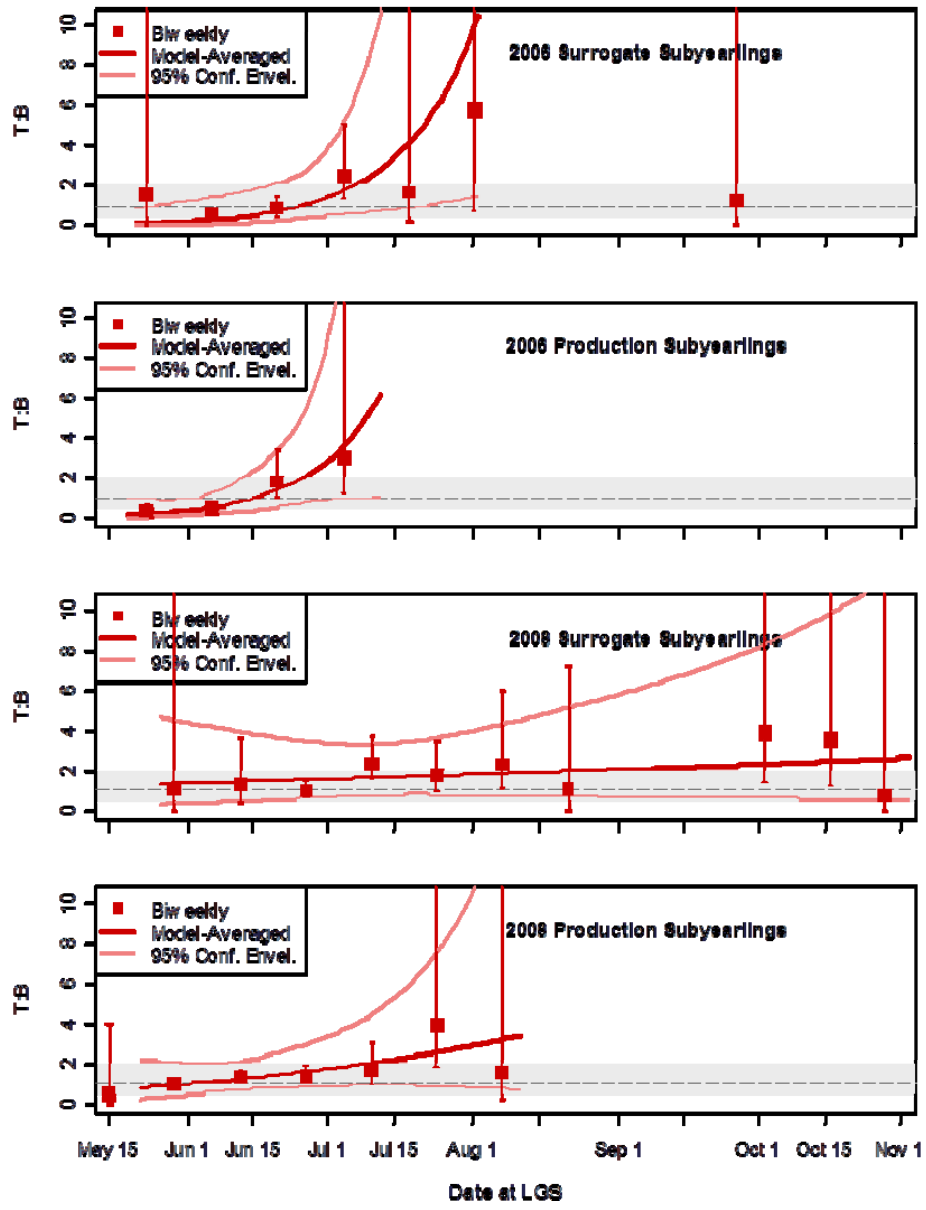




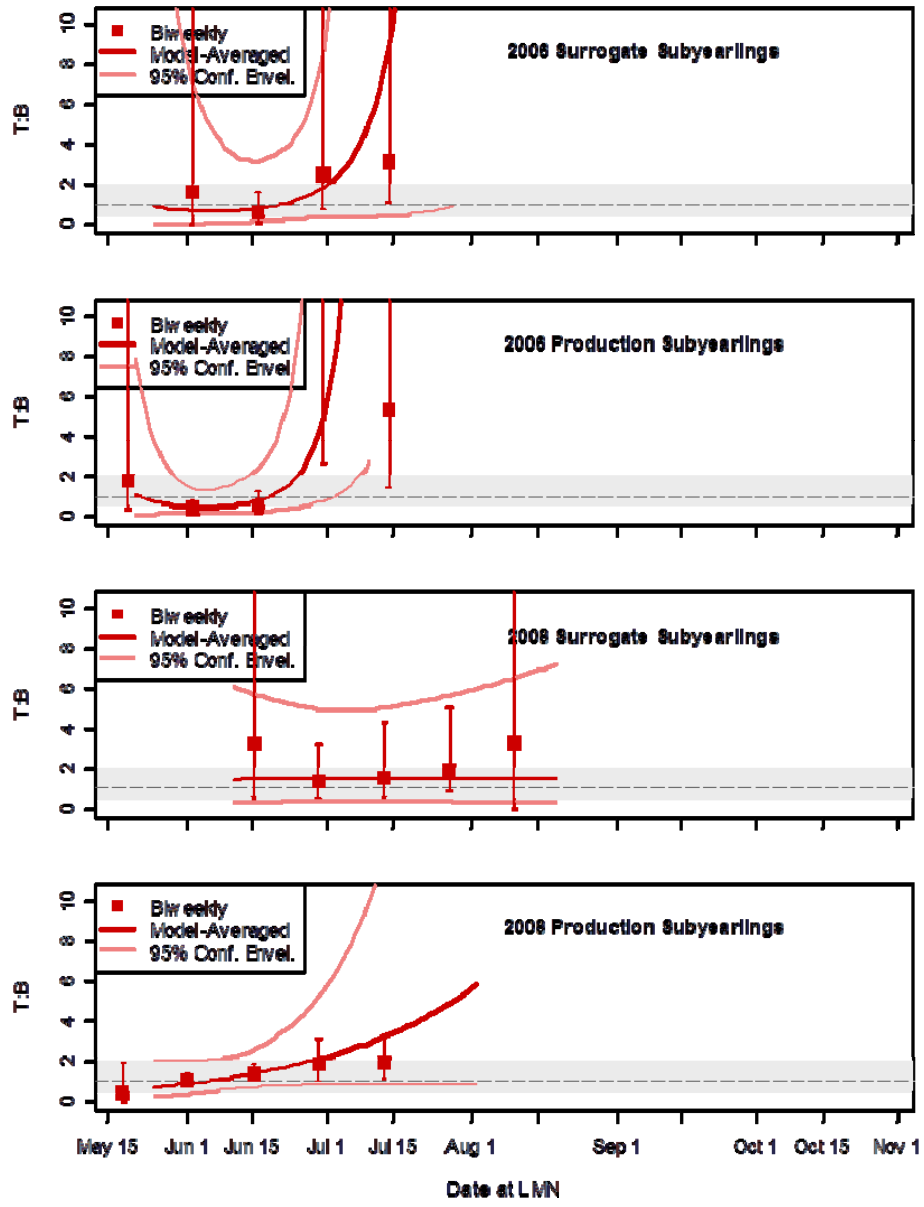
T:B Ratio by Date at Lower Granite Dam



T:B Ratio by Date at Little Goose Dam



T:B Ratio by Date at Lower Monumental Dam



Summary of estimated T:B relative to standard T:B=1.0