



**NOAA**  
**FISHERIES**

West Coast  
Region

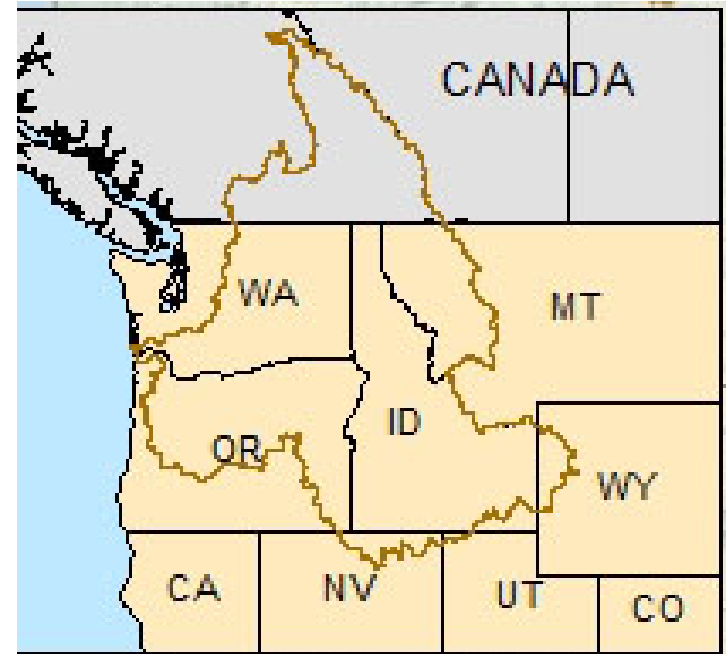
# Patterns of migration and delay observed in Summer Steelhead from the Upper Columbia and Snake River Basins from PIT tag data

Blane Bellerud

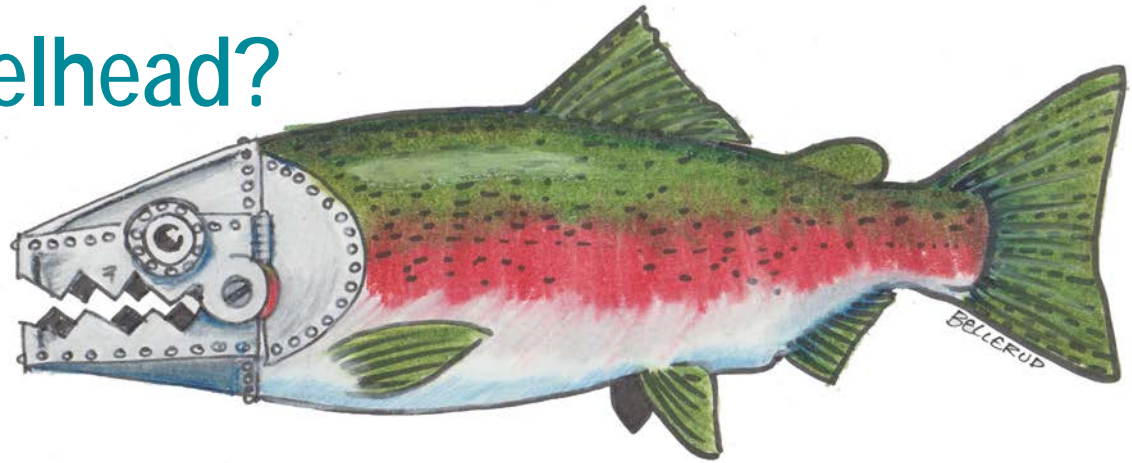
August, 2015

# Columbia River Basin

- Columbia and Snake Rivers
- Drains 258,000 square miles, spans 6 states and the Province of British Columbia
- You are sitting approximately 1000 feet from one its tributaries



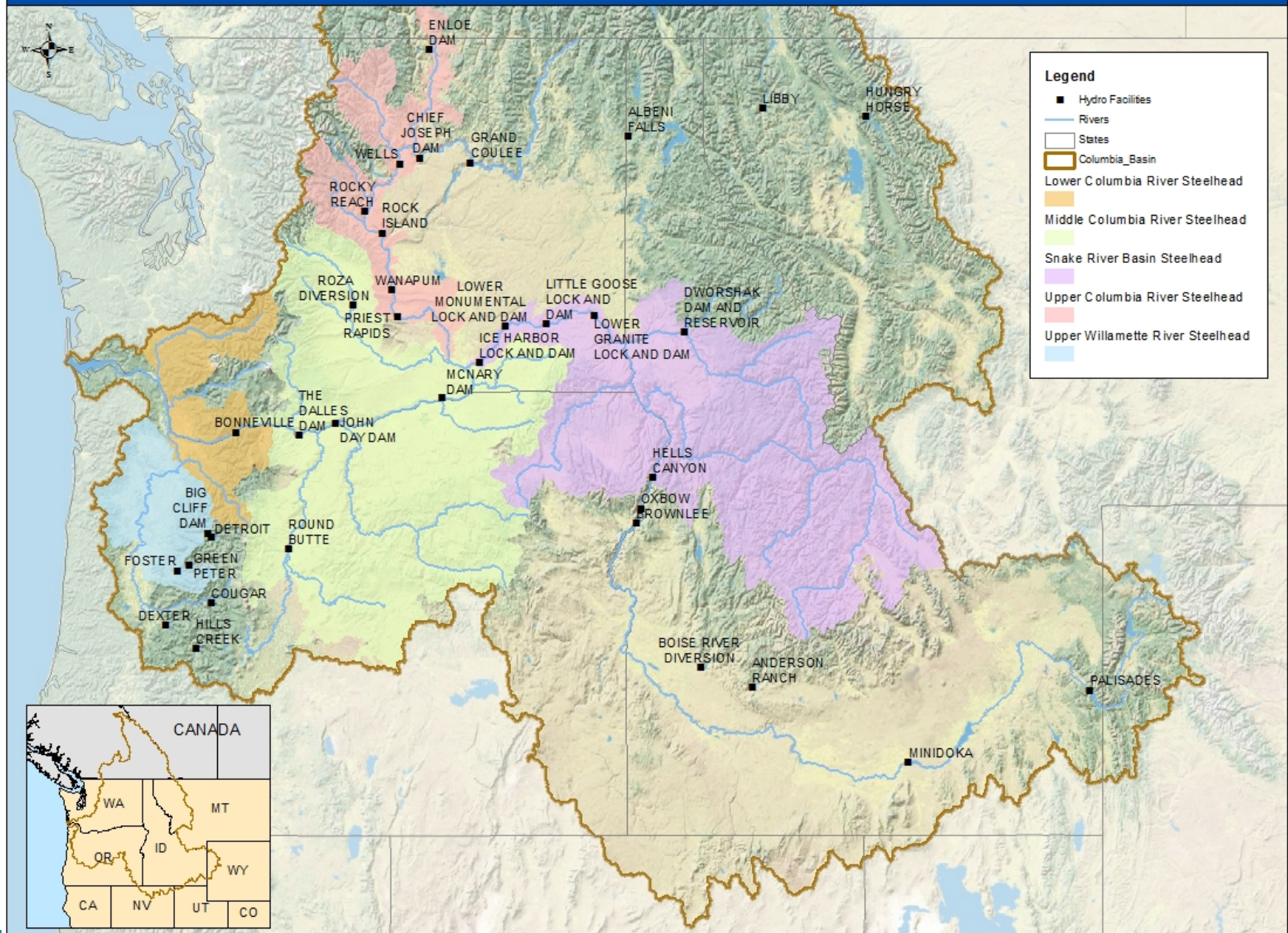
# What are Steelhead?



- Anadromous form of *Oncorhynchus mykiss*
- "Summer" stocks enter river mainly July – September, spawn the following April-mid June
- NOAA divides Columbia Basin Steelhead into 5 Distinct Population Segments (DPS)



# Columbia River Basin Steelhead

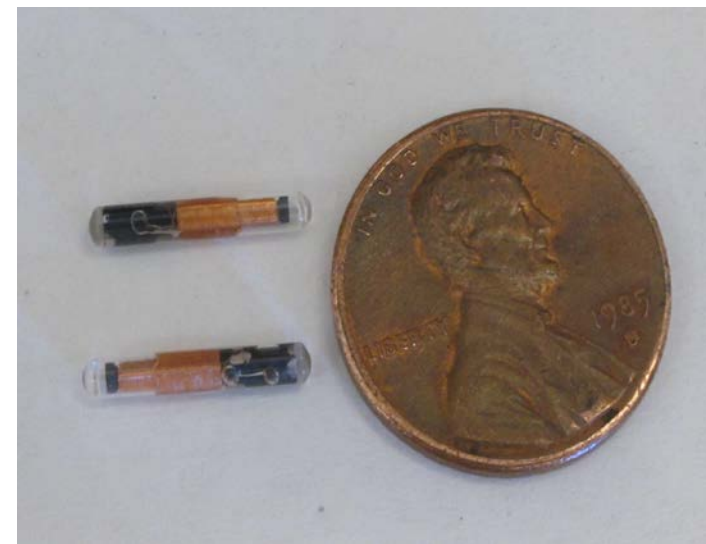
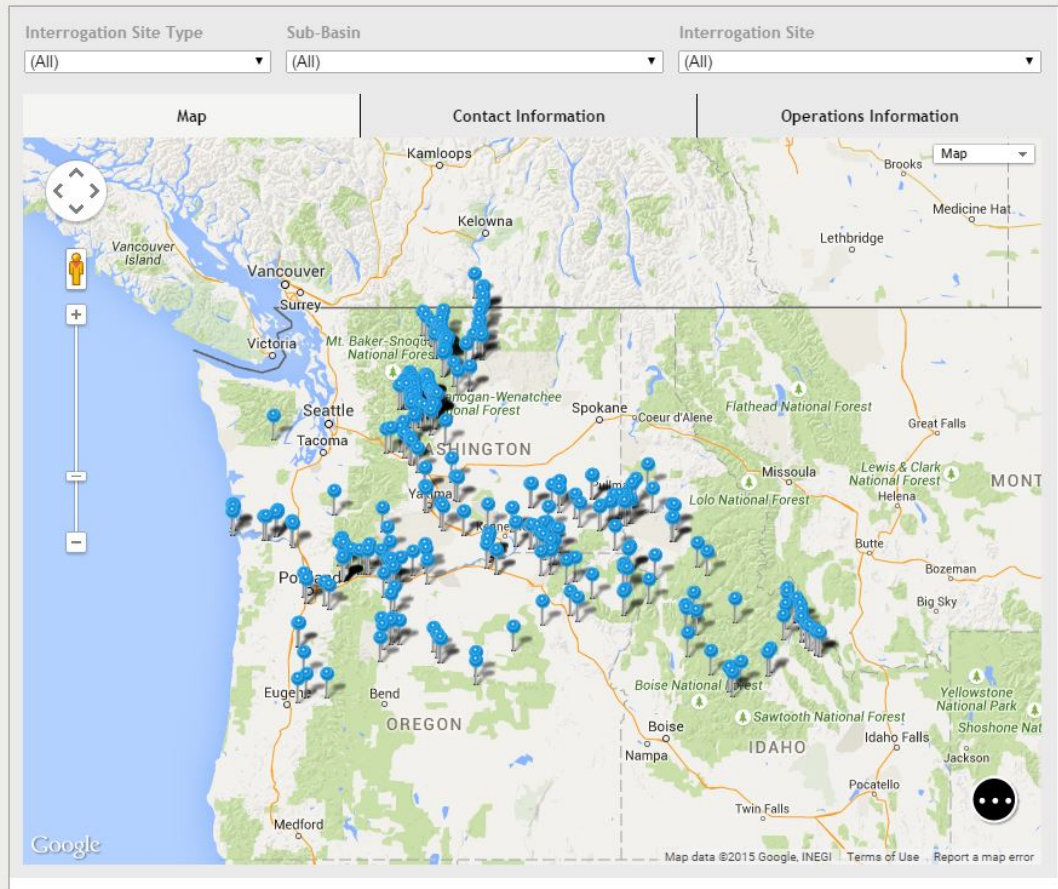




# Passive Integrated Transponder (PIT) Tags

## INTERROGATION SITES

Locations of interrogation sites that were previously or are currently active in PTAGIS. For a more full-featured web map or to download the spatial data for use in your GIS software, please visit the GIS Data page.



## PIT tag Detection Network

PTAGIS

Log in

HOME

DATA

SITES

SERVICES

RESOURCES

COMMUNITY

LEARN

SOFTWARE

SUPPORT

Search

PTAGIS is a regional database of fish marked with PIT tags by fisheries management agencies and research organizations in the Columbia River Basin.

FORUMS

Feel free to post comments on our forum.

QUICK REPORTS

View reports without logging in.

TUTORIALS

Watch videos on how to create reports with the new tools.

ADVANCED REPORTING

**REQUIRES LOGIN.** Create and save custom queries, download query results, and interact with data in a pivot table

ABOUT PTAGIS

The Columbia Basin PIT Tag Information System (PTAGIS) is the centralized database for PIT-tagged fish in the Columbia River Basin. PTAGIS provides custom software for contributors to collect tagging and interrogation data, manages the database, and coordinates with fishery agencies and organizations. In addition, PTAGIS collects automated detection data and designs, installs, and maintains the equipment that records those detections. All data contributed to and collected by PTAGIS are freely available through this website.

NEWS

New Website Features

Jun 19, 2015

PTAGIS System Maintenance Completed June 18

Jun 18, 2015

PTAGIS System Maintenance Scheduled for Thursday, June 18

Jun 10, 2015

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# Methodology

- 5,000-8,000 PIT tagged adult steelhead of known origin pass Bonneville dam every year since 2008
- Download Data from PTAGIS database
- Use MS access database to sort and query data
- Steelhead Year by observation date at Bonn, June 1-May 31

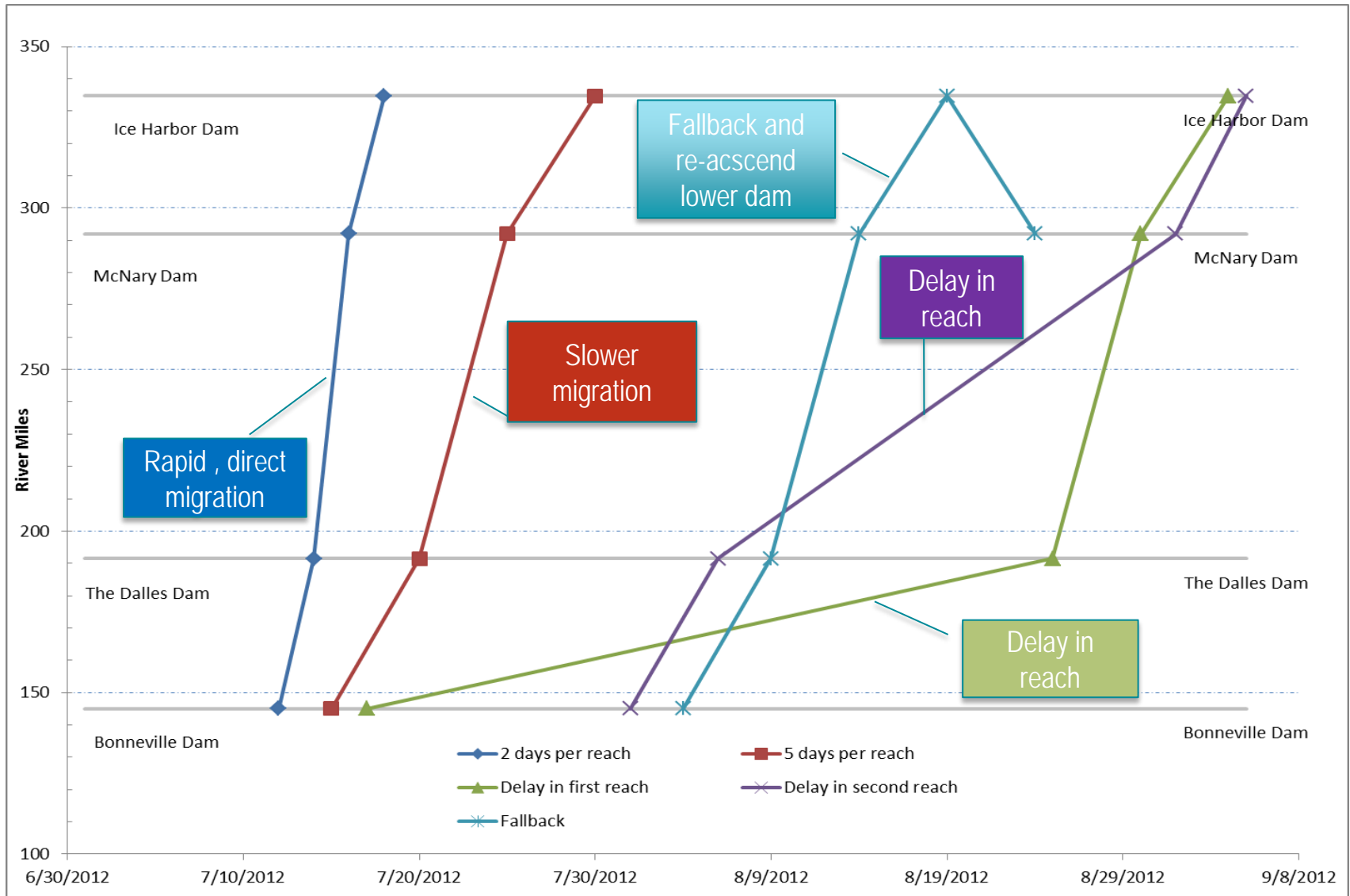


# Mass plotting of steelhead passage data

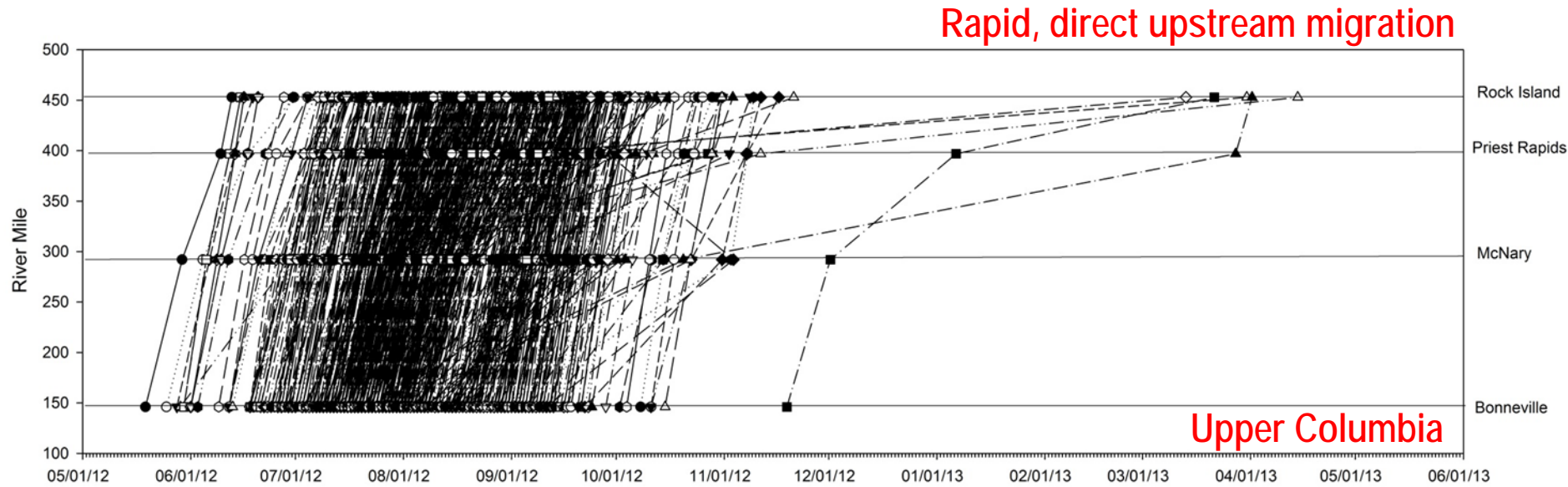
- “Time and Space” diagram
- Based on an example of a train schedule presented by Edward Tufte in “The Visual Display of Quantitative Information” (1983)
- Y axis represents river miles travelled, X axis represents time (date). Slope of resulting trace indicates rate of travel.
- Allows visual identification of patterns from large volumes of data for further investigation



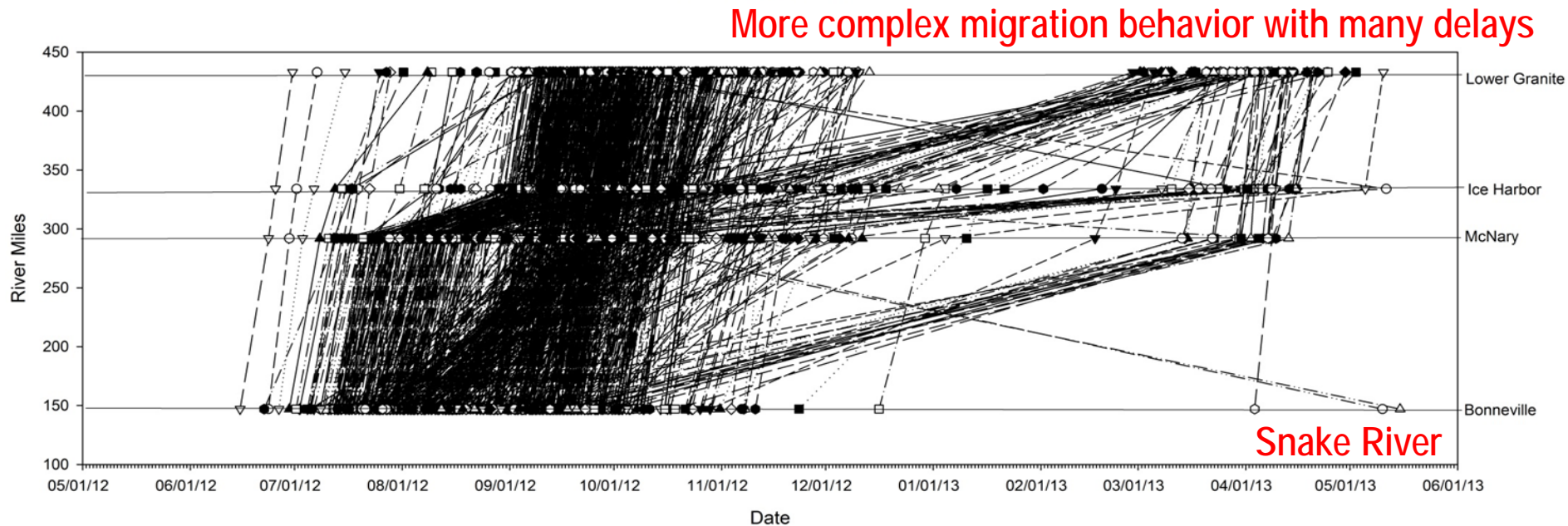
# Time and Space Diagram-Typical Fish Traces



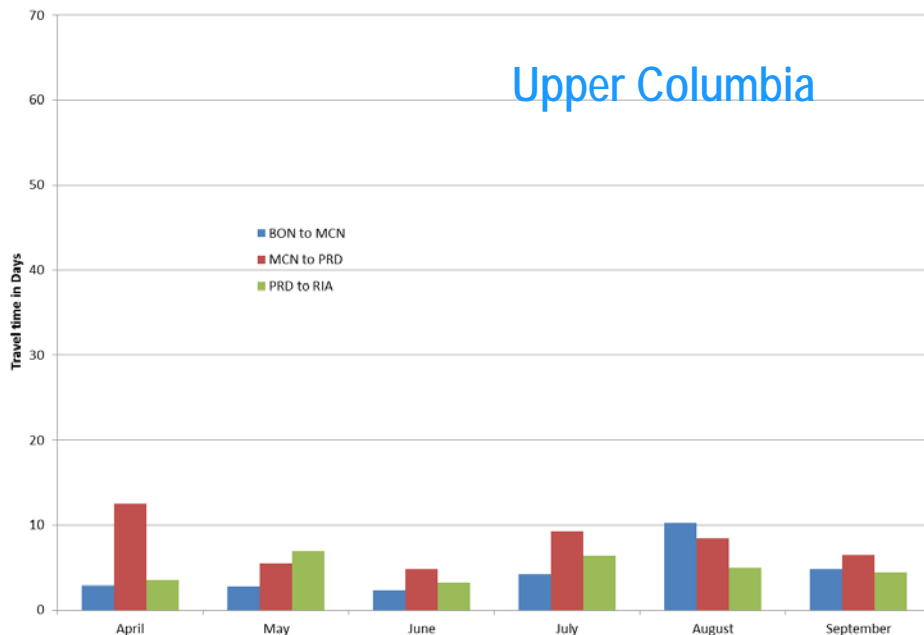
### UC Steelhead in 2012



### SR Steelhead in 2012



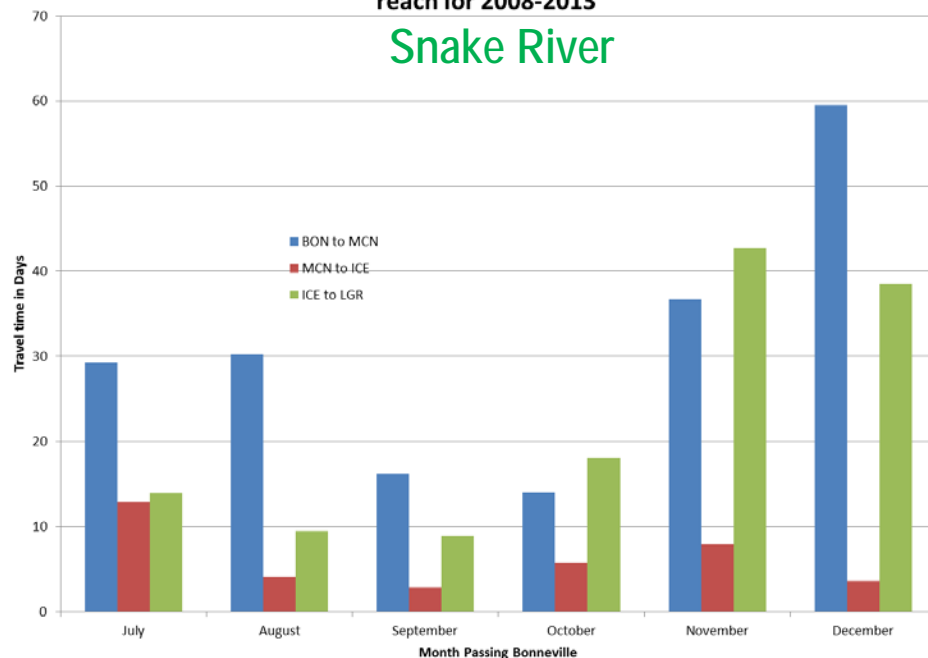
Average monthly average travel times for Upper Columbia River Steelhead by reach for 2008-2013



Upper Columbia Steelhead move rapidly through the Lower Columbia River

Snake River steelhead move more slowly, with some fish holding for significant lengths of time in downstream reaches

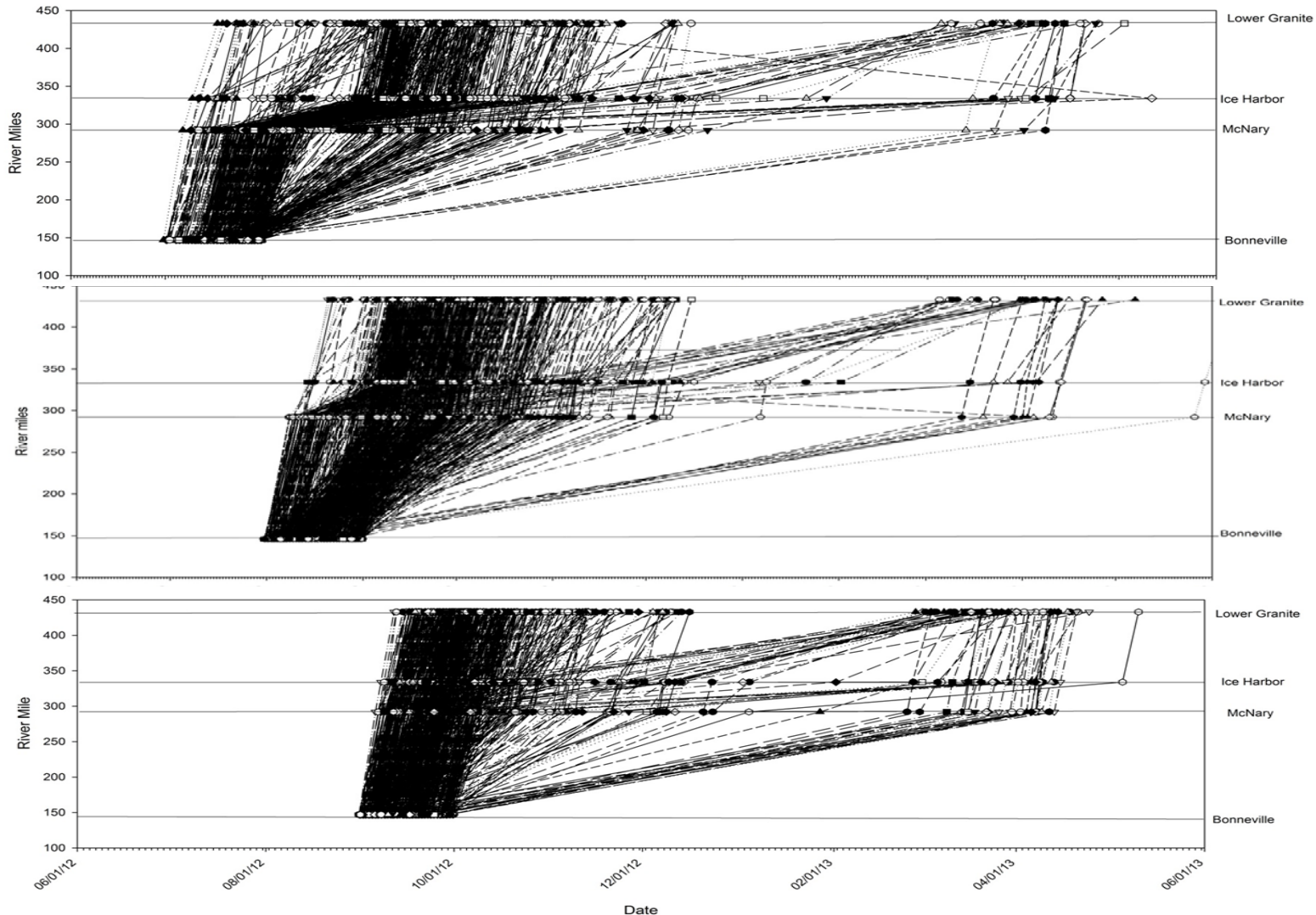
Average monthly average travel times for Snake River Steelhead by reach for 2008-2013



NOAA FISHERIES



# Change in migration/delay patterns through the year



July

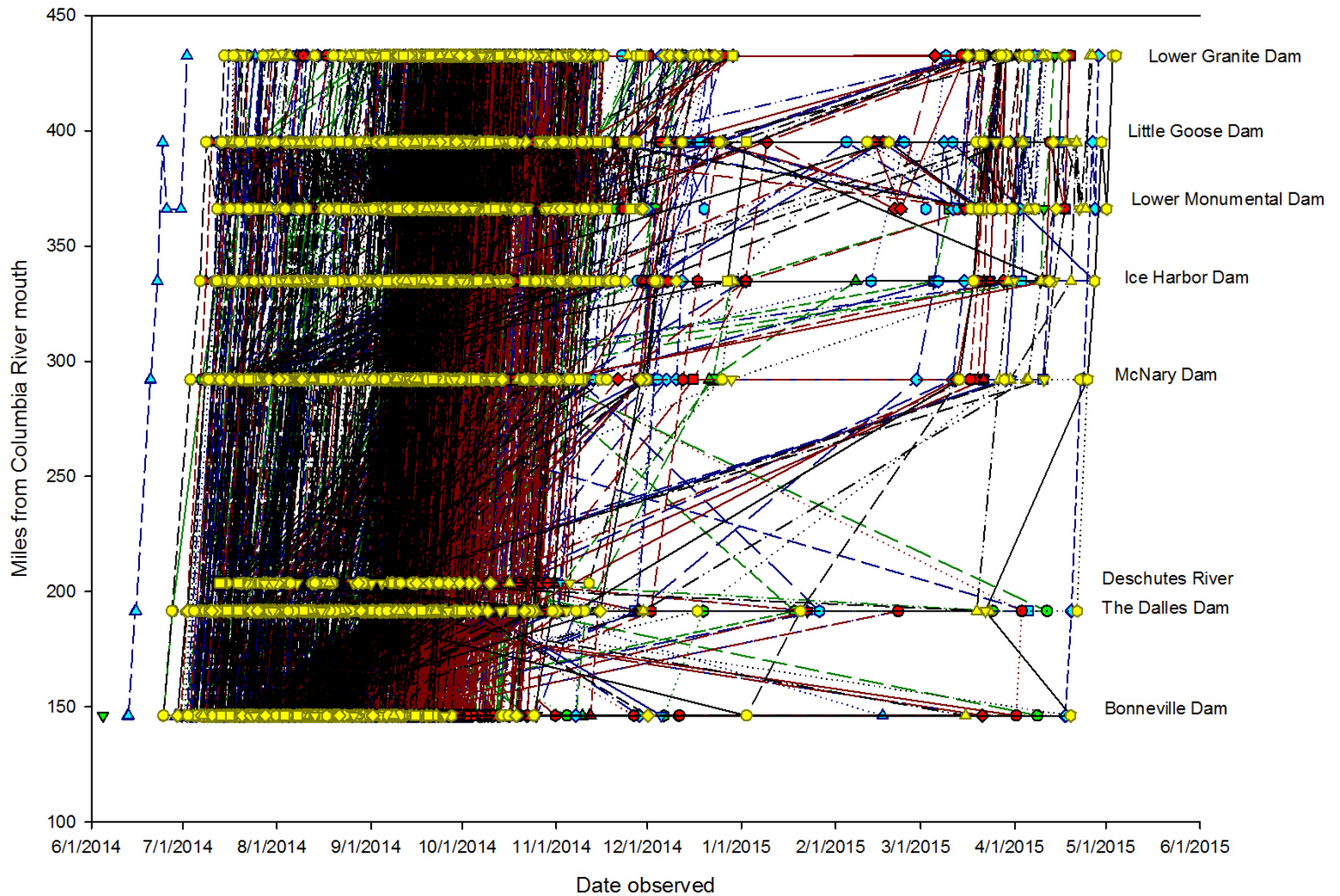
August

September

# Snake River Steelhead exhibit complex upstream migration behavior

- Characterized by delays in various reaches of the river
- Consistently observed in PIT tag detection data
  - 2002-2015
  - Hatchery and wild origin,
  - Transported and in-river smolt migration histories

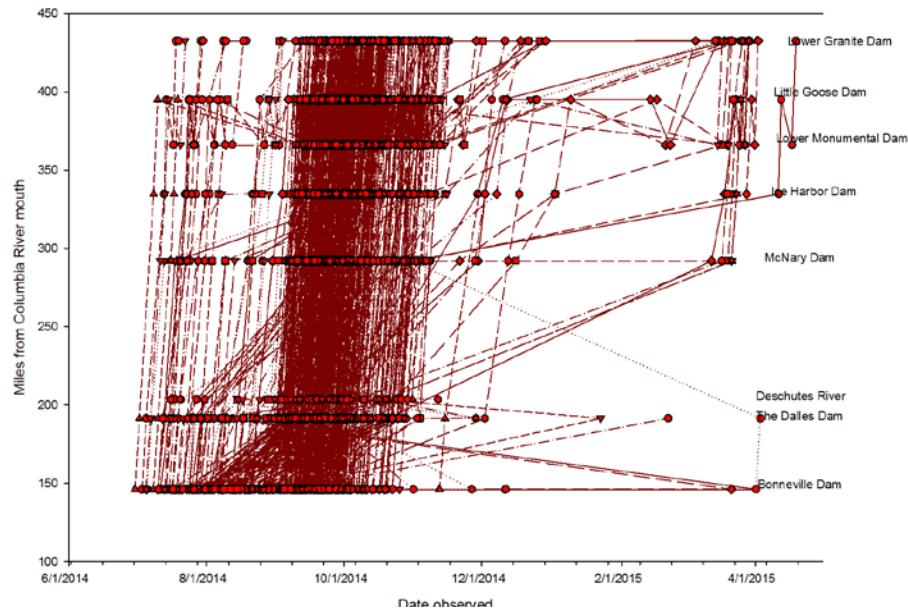
## Snake River Steelhead migration through the FCRPS in 2014-2015





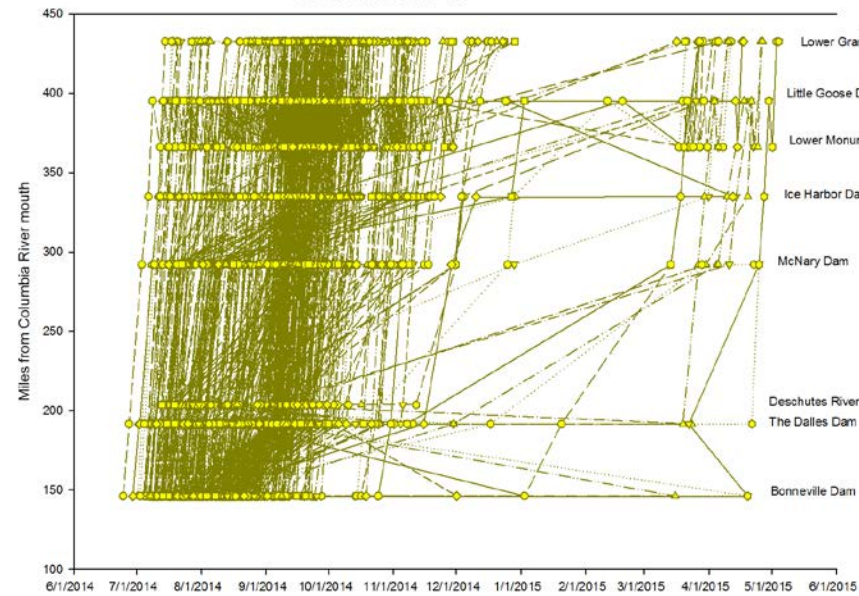
Snake River Steelhead migration through the FCRPS in 2014-2015

## Clearwater MPG



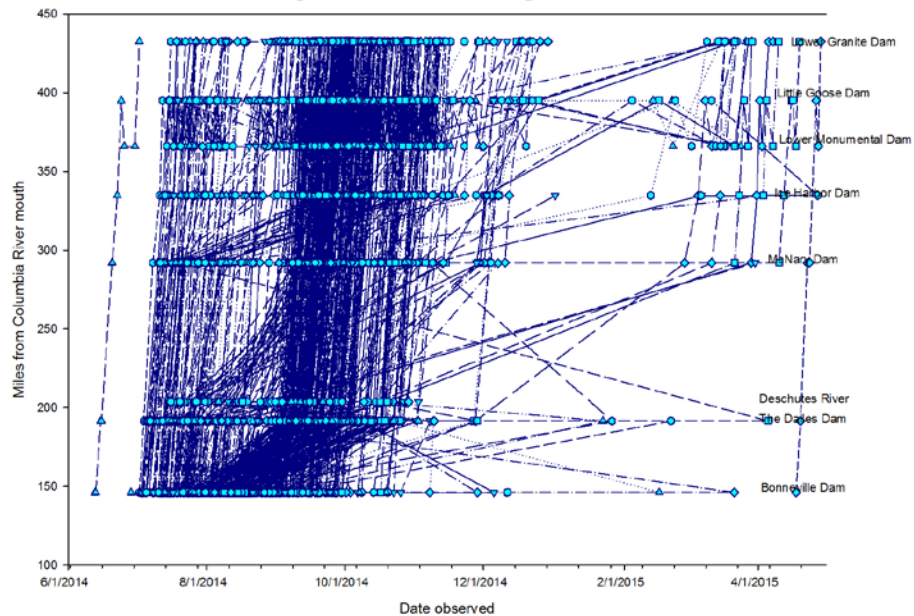
Snake River Steelhead migration through the FCRPS in 2014-2015

## Imnaha MPG



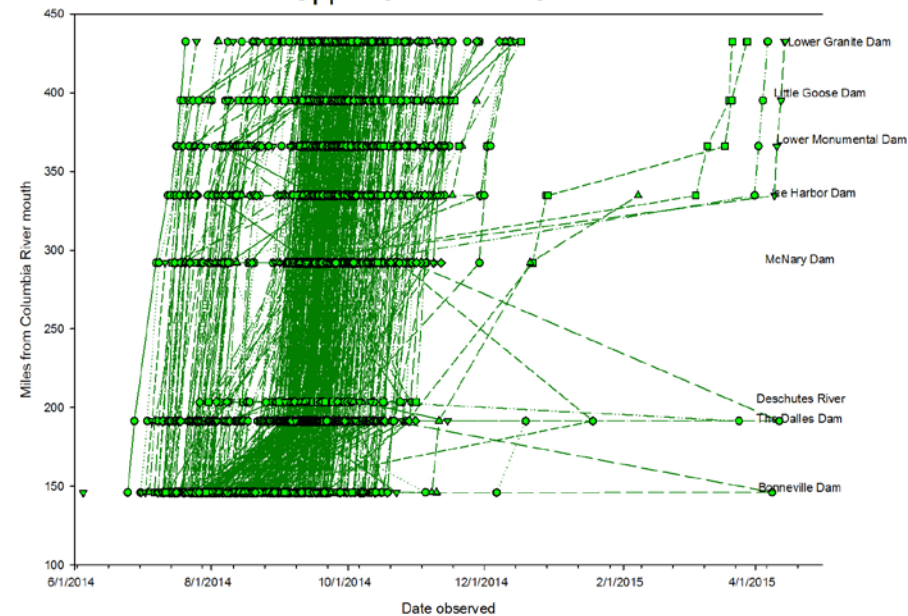
Snake River Steelhead migration through the FCRPS in 2014-2015

## Grand Ronde MPG

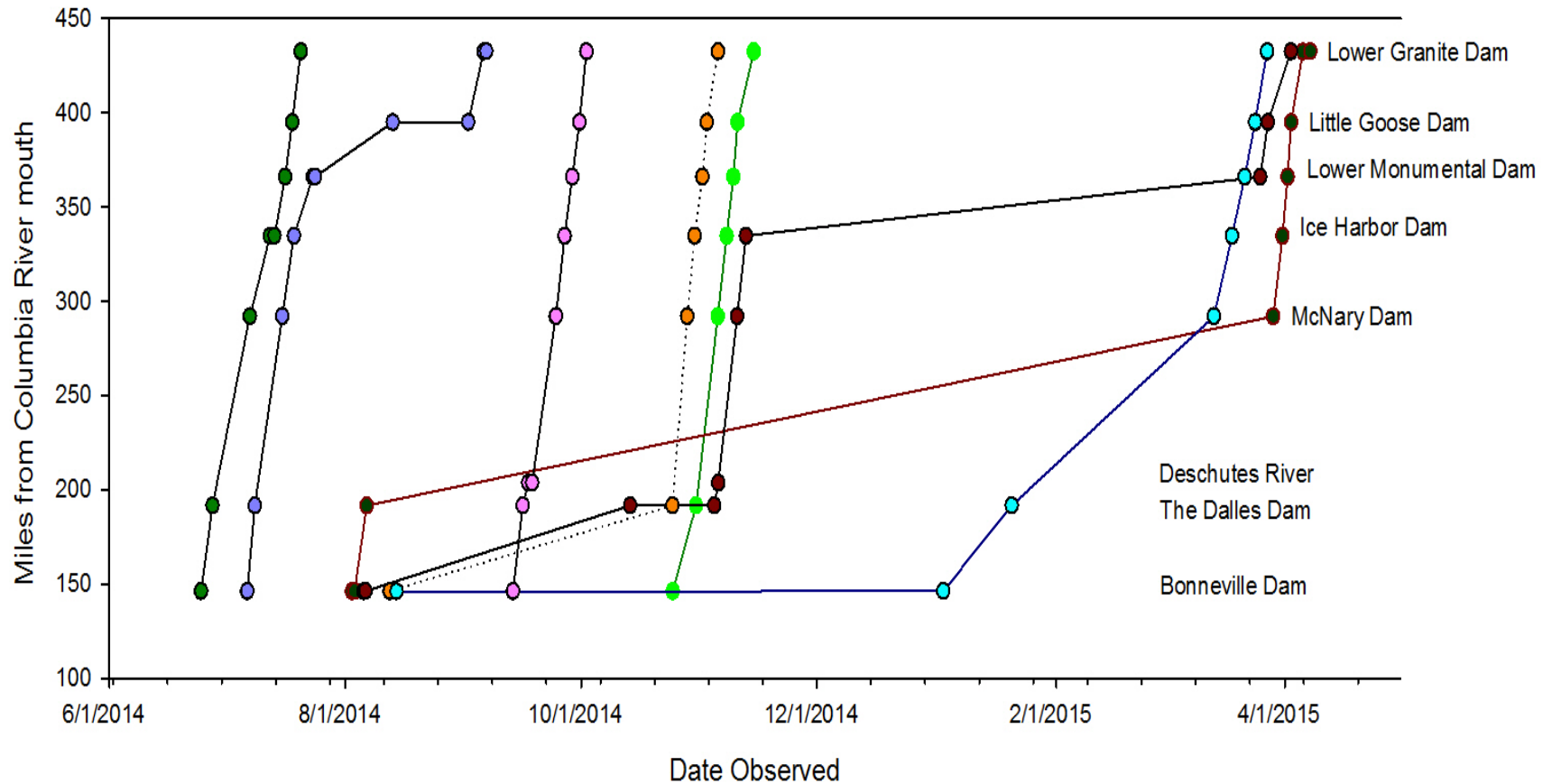


Snake River Steelhead migration through the FCRPS in 2014-2015

## Upper Salmon MPG

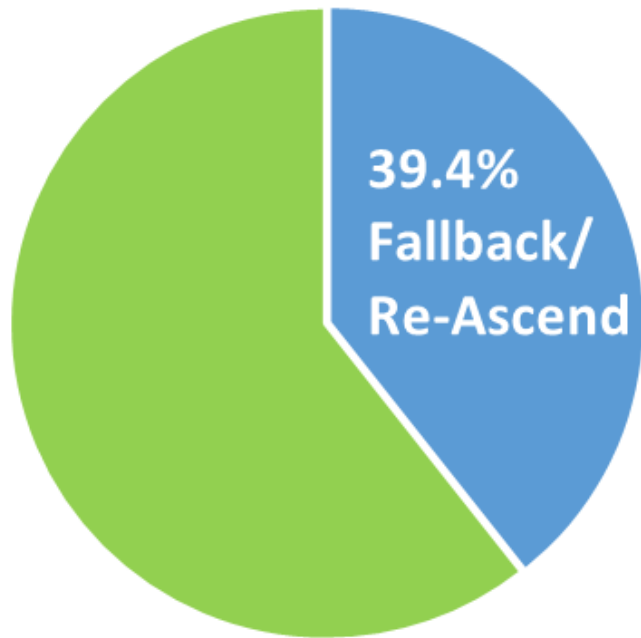


## Examples of Snake River Steelhead migration behavior

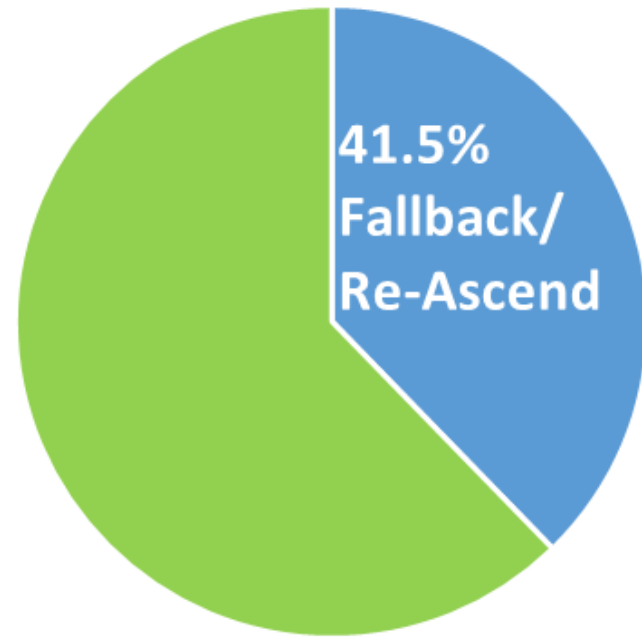


# Fallback/Re-ascend rates of Snake River Steelhead that successfully migrated through the Lower Columbia and Snake Rivers

2013



2014





# Conclusions

- Snake River Steelhead show complex migration behavior delaying in downstream reaches for varying periods of time with some overwintering there and moving upstream the following spring.

# Issues associated with the complex migration behavior of Snake River Steelhead

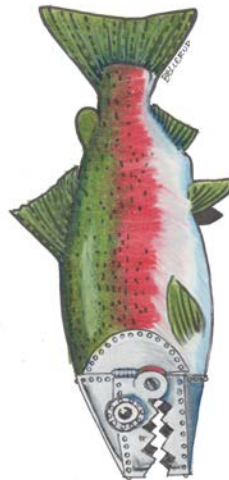
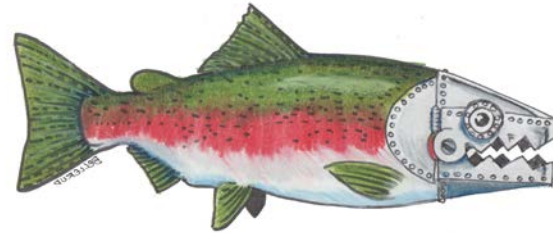
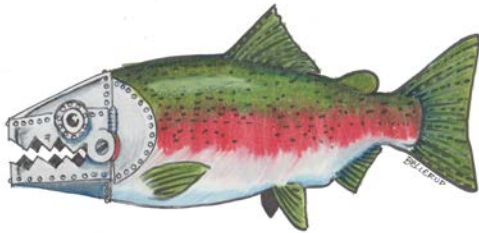
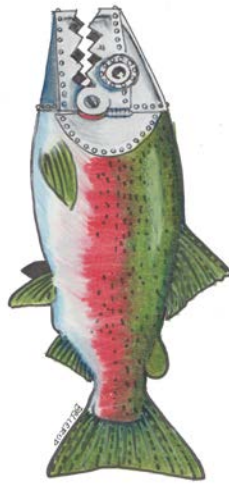
- Complicates Harvest Management because stocks are intermingled through the year
- Movements outside of expected “migration season” may present passage issues

# Acknowledgements

- Northwest Fisheries Science Center-NOAA
- PTAGIS- Pacific States Marine Fisheries Commission
- Washington Department of Fish and Wildlife
- Oregon Department of Fish and Wildlife
- All others tagging and collecting PIT tag data from Columbia basin steelhead



# WHERE



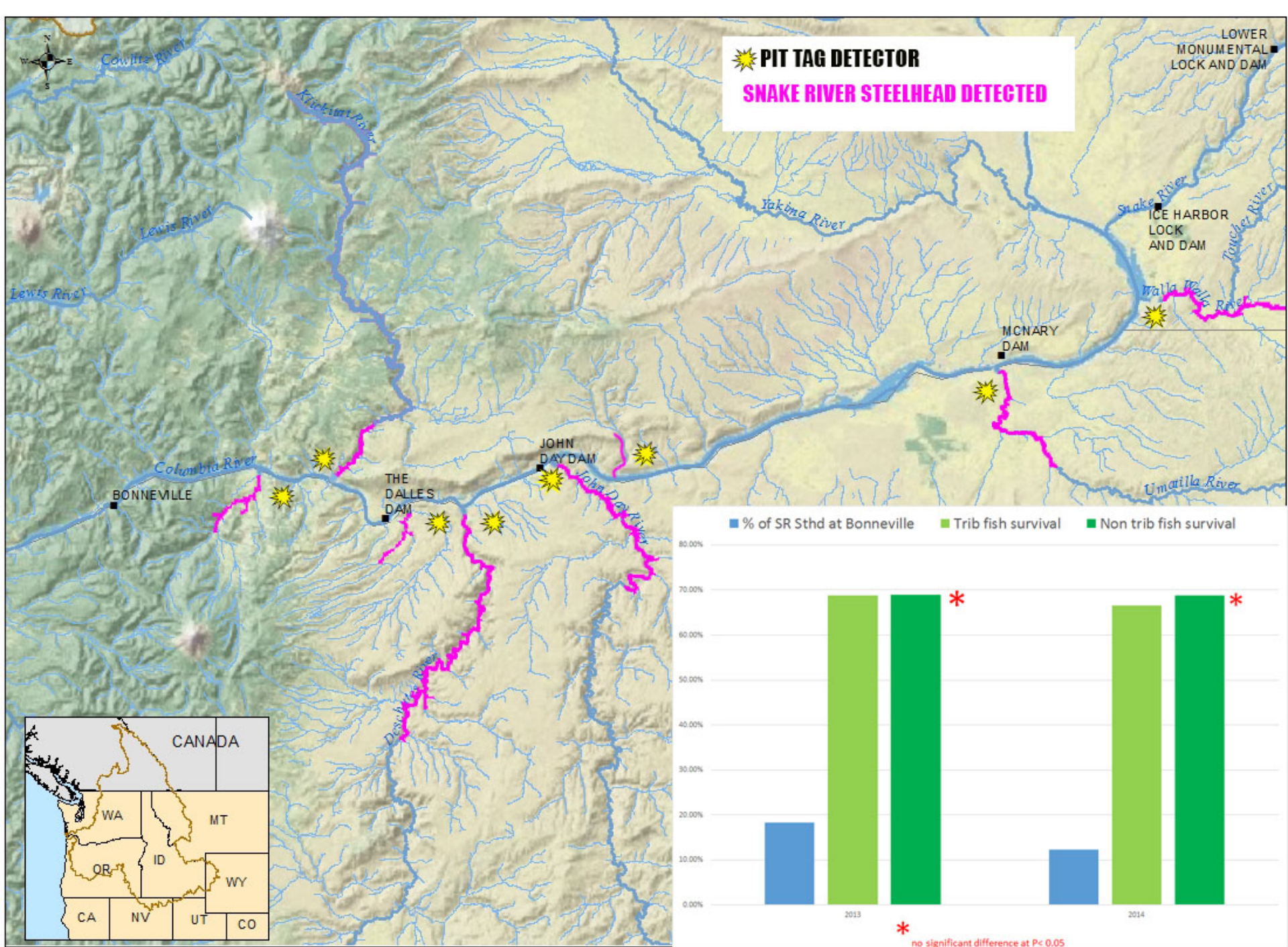
# DO THEY GO?



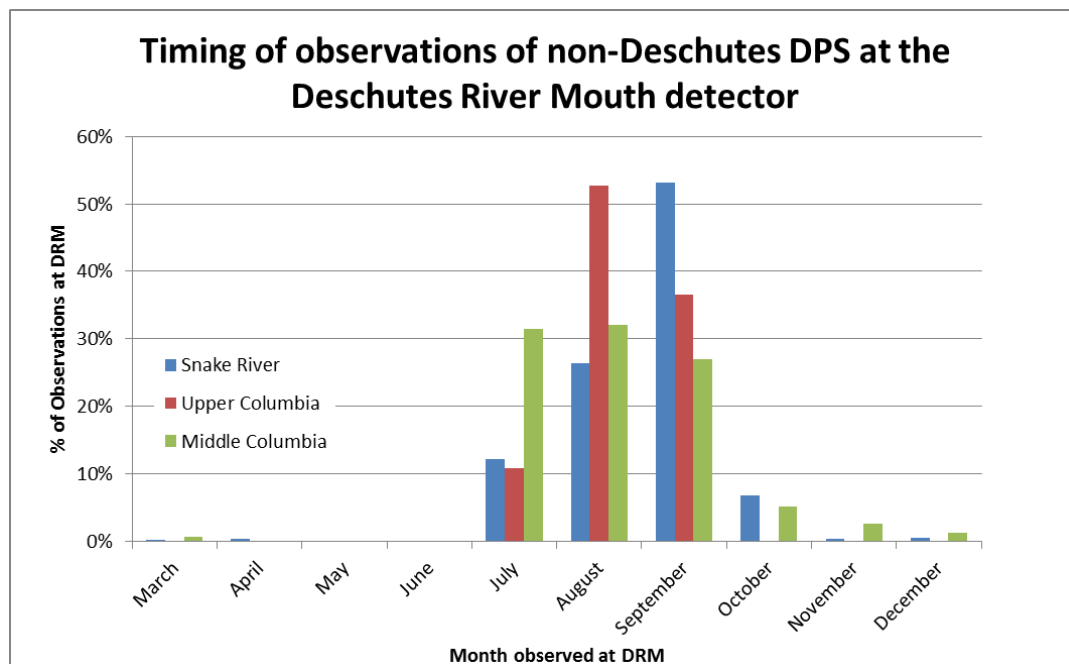
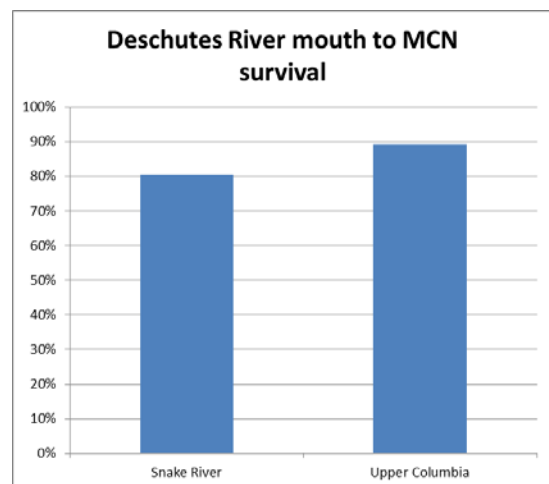
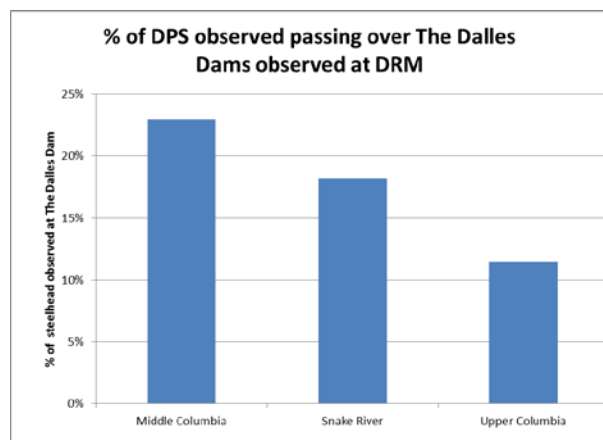
# Potential Holding Areas

- Mainstem Columbia and Snake Rivers
- “Thermal refugia”
- Cool Tributaries
  - Deschutes River

**PIT TAG DETECTOR**  
**SNAKE RIVER STEELHEAD DETECTED**



# CR Steelhead by basin of origin detected by Deschutes River mouth Detector in 2013 (Deschutes origin excluded)





# Conclusions

- .
- Snake River steelhead are observed in most tributaries downstream of Ice Harbor dam and show similar migration success to those not observed in tributaries, implying that they are not true “strays”

# WHY?



# Use of thermal refugia well documented in migrating steelhead and salmon

- B. High, C.A. Peery, and D.H. Bennett (2006) **Temporary staging of Columbia River Summer Steelhead in coolwater areas and its effect on migration rates.** Transactions of the American Fisheries Society, 135:2, 519-528
- **Location and use of adult salmon thermal refugia in the Lower Columbia and Lower Snake Rivers.** U.S. Army Corps of Engineers, Northwest Division, February 2013

# Snake River Water summer water temperatures commonly exceed 20 degrees C during primary migration period 7/1-9/30

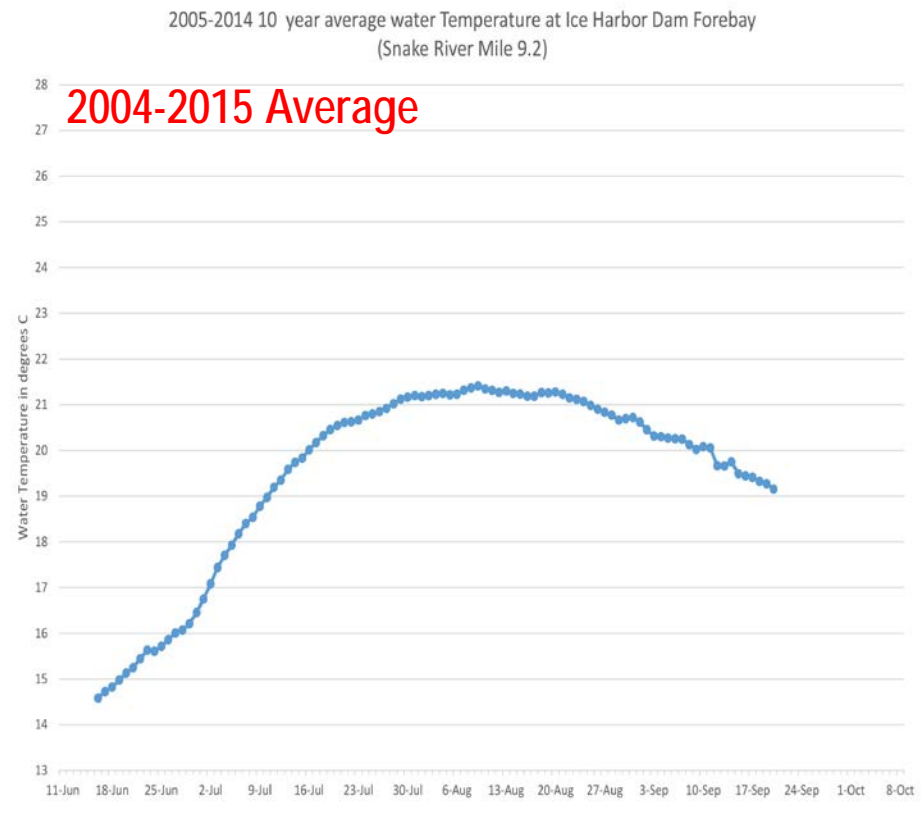
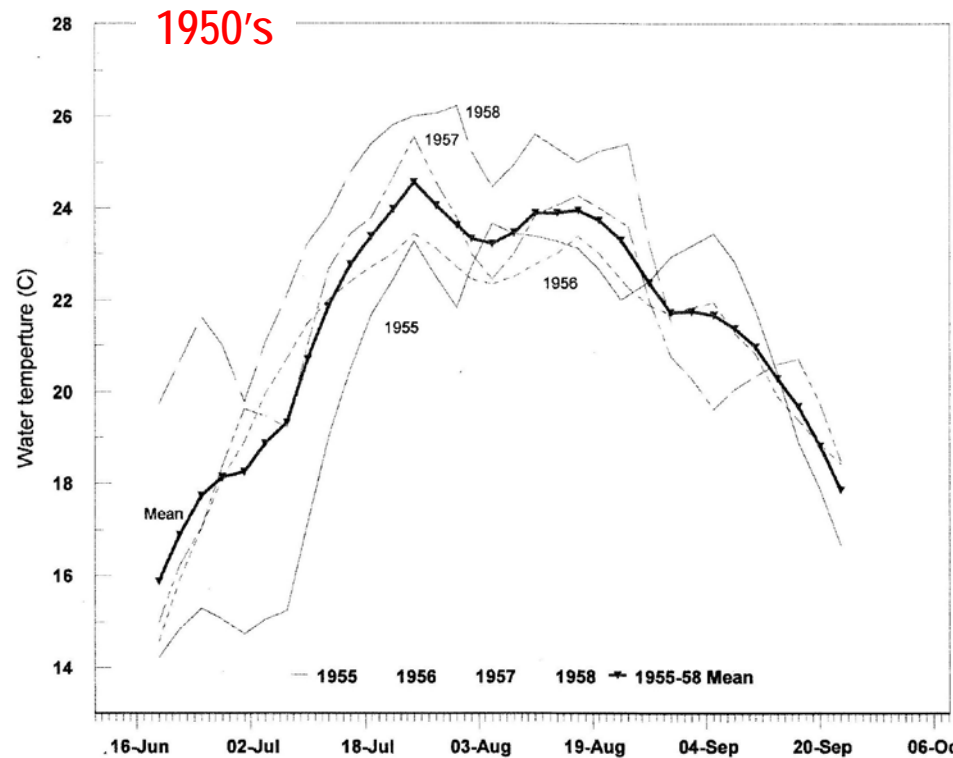
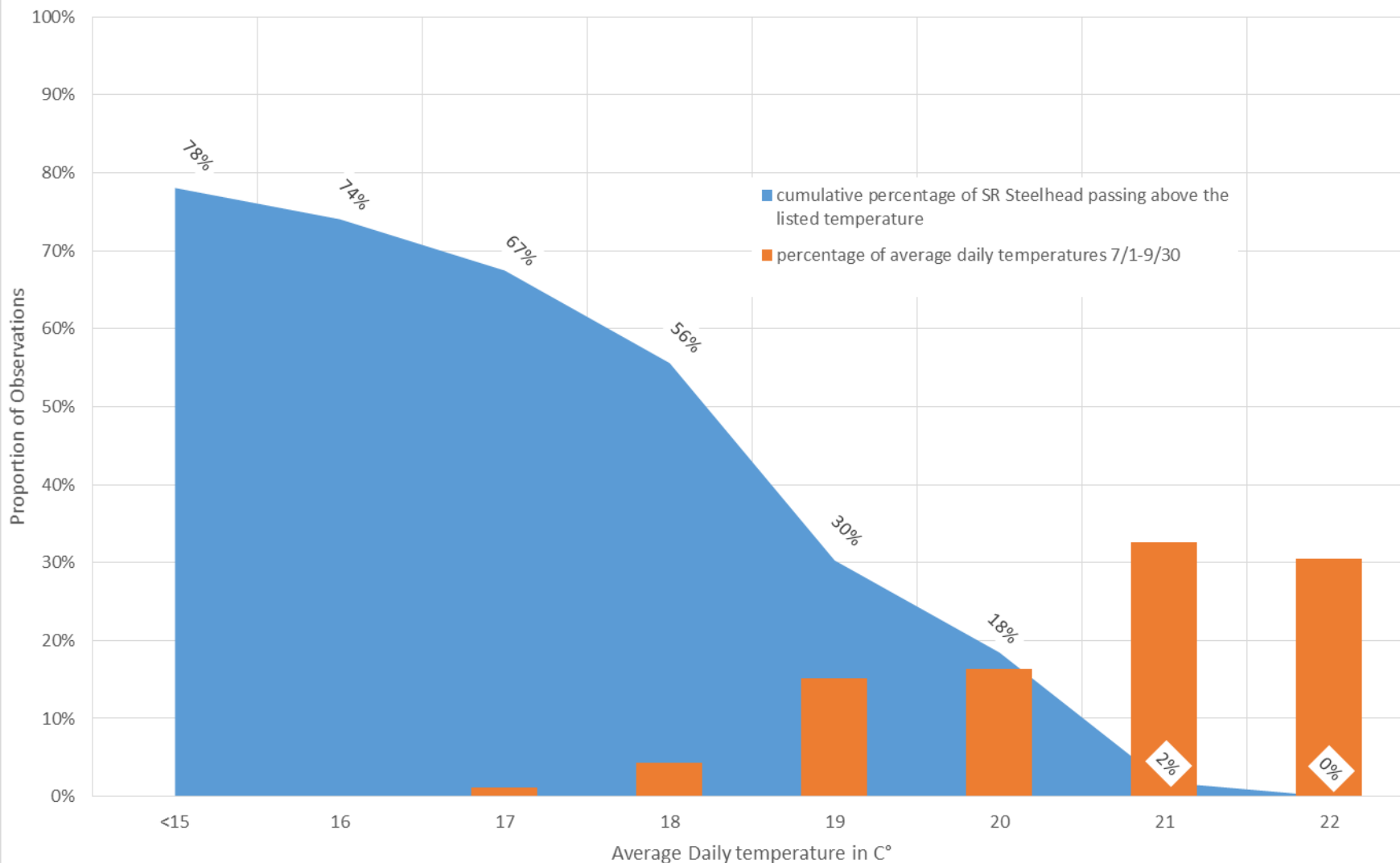


Figure 5. Water temperatures recorded at mouth of the Snake River (Sacajawea, WA) during 1955-58, and mean water temperatures for the four years. Taken from Eldridge (1963) and Bennett et al. (1997).



# Snake River Steelhead 2011-2014 average daily temprature at passing Ice harbor dam and the distribution of average daily temperatures at Ice harbor during the 7/1-9/30 (90%+ SR Steelhead pass Bonneville Dam)



# Conclusions

- Delay is possibly adaptation to avoid high summer water temperatures in the Snake River

## 2005-2014 Average

Comparison of water temperatures during the summer steelhead migration period in the Snake River and in the Columbia River above the Snake River confluence

