Fall Chinook SAR and Fishery Contribution

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Biologist, Hatchery Monitoring and Evaluations

Cowlitz Science Meeting 04/16/2025

Washington Department of FISH & WILDLIFE

Outline

Outline

Today's presentation will consist of:

- Acknowledgements
- Background
- Problem statement
- Methodology
- Results
- Takeaways and next steps

Acknowledgements- Thank you!

- WDFW
  - Kevin See
  - Thomas Buehrens
  - Phil Sandstrom
  - Kale Bentley
  - Ben Cox
  - Anja Huff
  - Josua Holowatz
  - Bryce Glaser
  - R5FPMT & others
- TPU
  - Scott Gibson
  - Jenise Bauman
  - Matt Bleich

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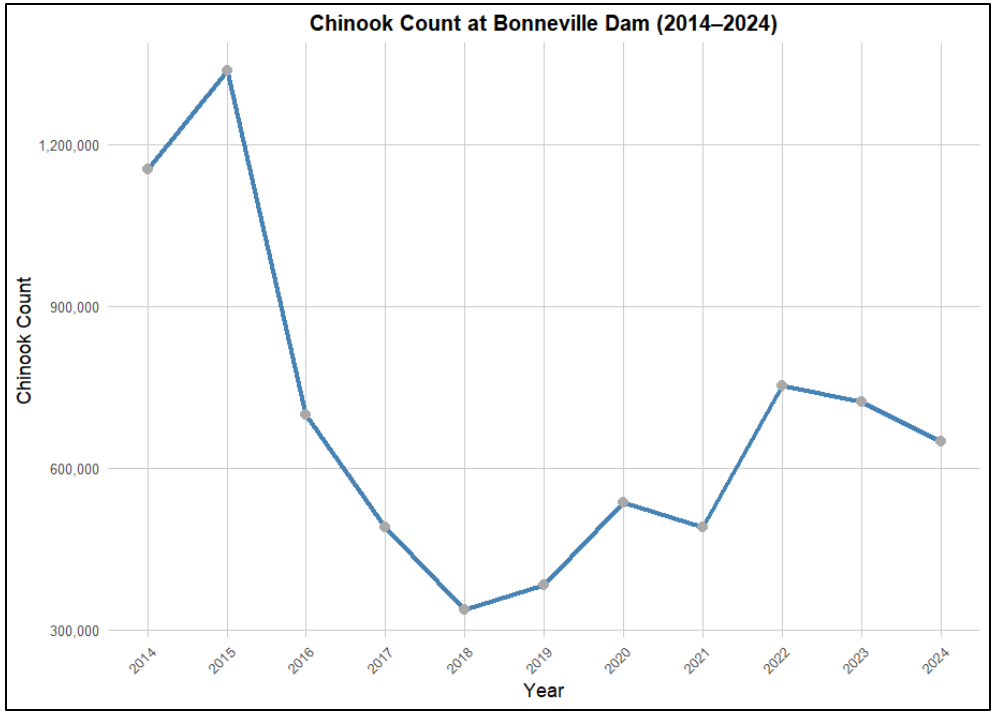
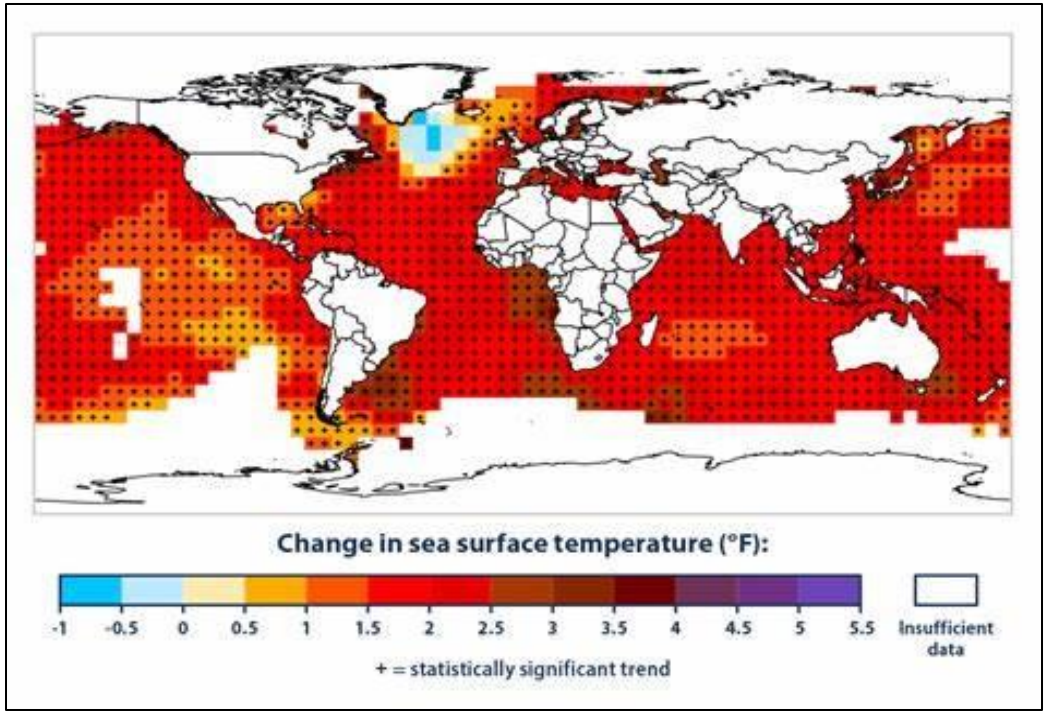
Background

- Most Pacific salmon are in decline, multiple factors including but not limited to:





Background

Cowlitz Salmon Hatchery

Brood Year	Total Estimated Release
2008	5,104,829
2009	5,077,356
2010	4,405,456
2011	4,494,944
2012	1,519,271
2013	3,153,131
2014	3,447,633
2015	3,416,089
2016	2,894,928
2017	3,274,631
2018	1,755,813
2019	2,311,145
2020	3,596,659
2021	3,503,839
2022	1,187,707
2023	964,251

- Target release of 3.5million (WDFW Future Brood Document)
- Since brood year 2012, release targets have been missed by more than 10% seven times (Hatchery data)
- Chinook fisheries have been modified or closed since 2018/2019 (J. Holowatz)
- Impacts upstream goals

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Problem statement

Problem Statement

- Hatchery-origin fall Chinook returns to the Cowlitz have been depressed for the past decade.
    - Is relative survival of hatchery Fall Chinook in the Cowlitz disproportionate to other programs?
    - Are these observed trends hatchery specific?
    - Are these observed trends basin specific?

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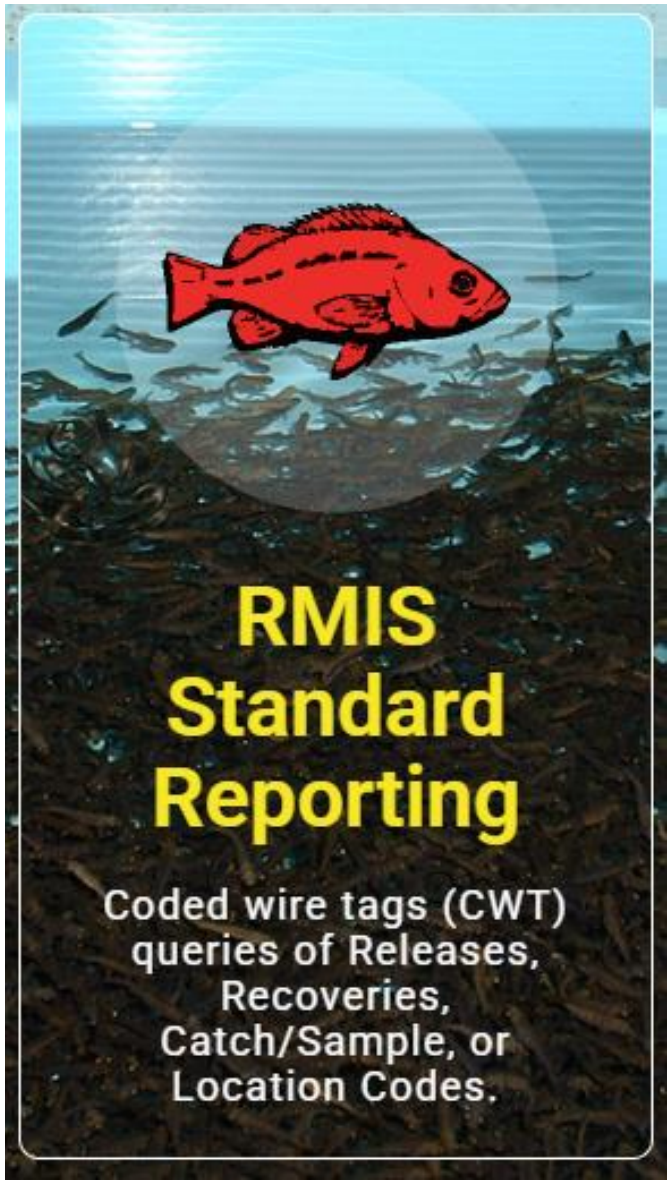
Methodology

Data Wrangling- Coded Wire Tags

- Data retrieved from the Regional Mark Processing Center's Regional Mark Information System (RMIS)
- Data retrieved using the rRMIS and RMISr packages in R (both in development)
- Data wrangled according to the principles of "tidy" data

Data Wrangling- CWT cleanup

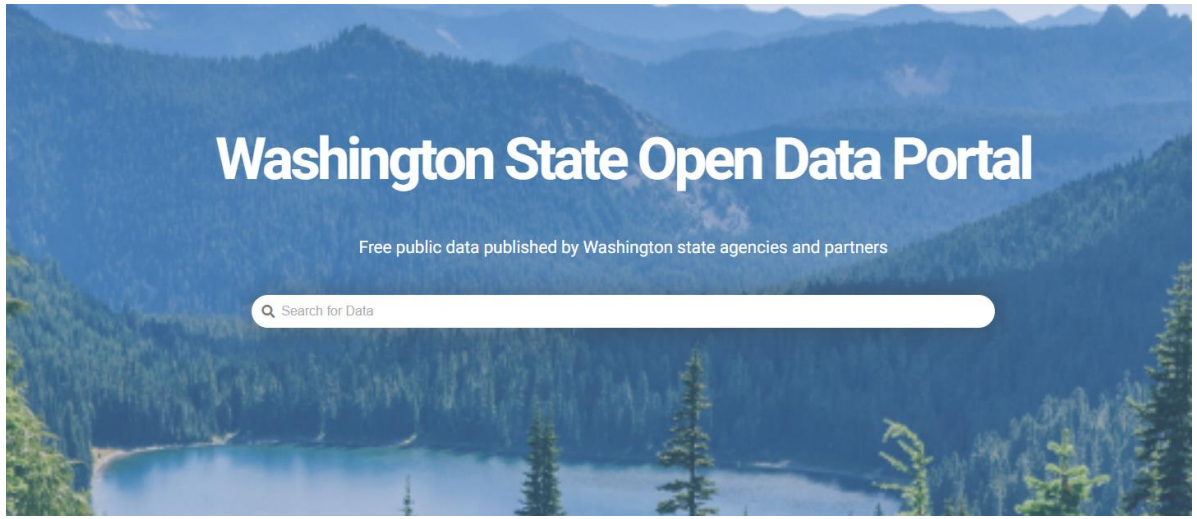
- Data needed significant “cleanup” to be in a comparable state
- Efforts during Mitchell Act consultation helped shore up a significant portion of the escapement-oriented tag recoveries
    - E.g.- Mismatched spatial resolution



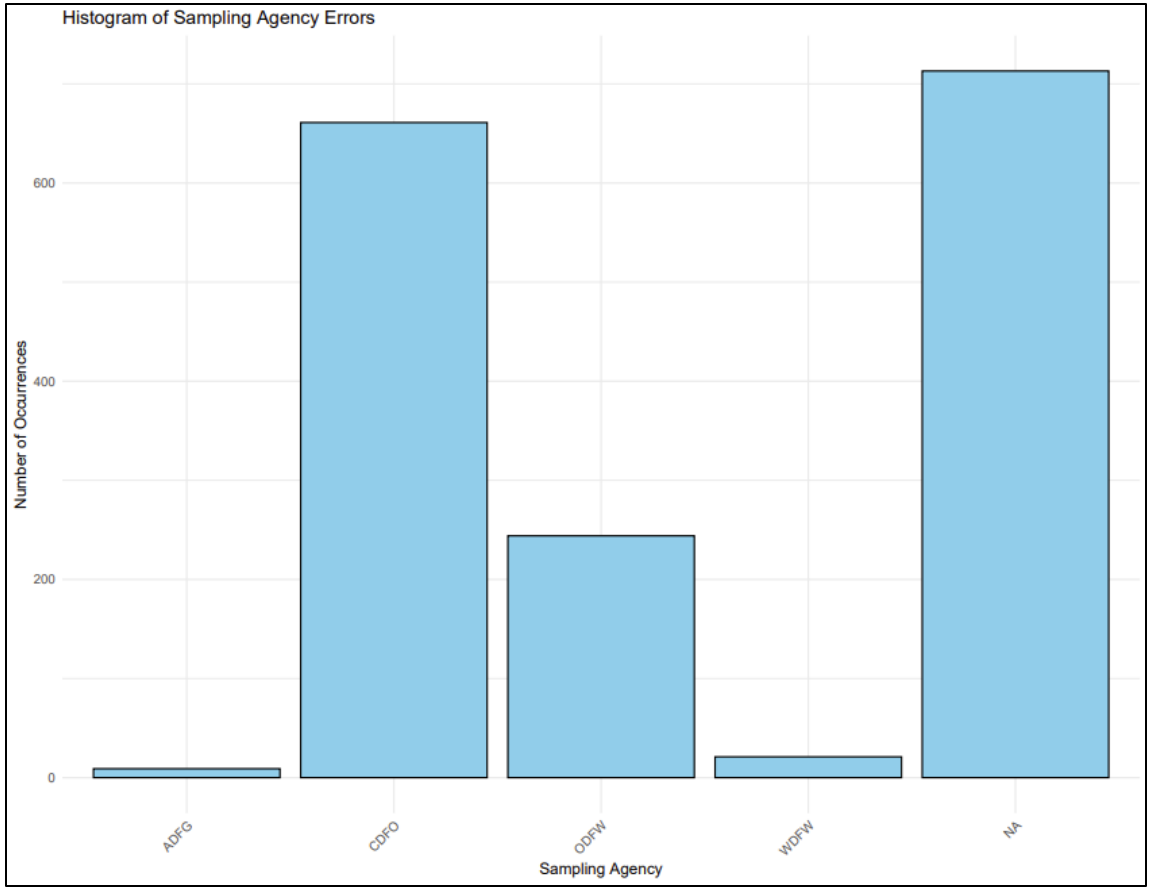
Data Wrangling- Salmon Population Indicators

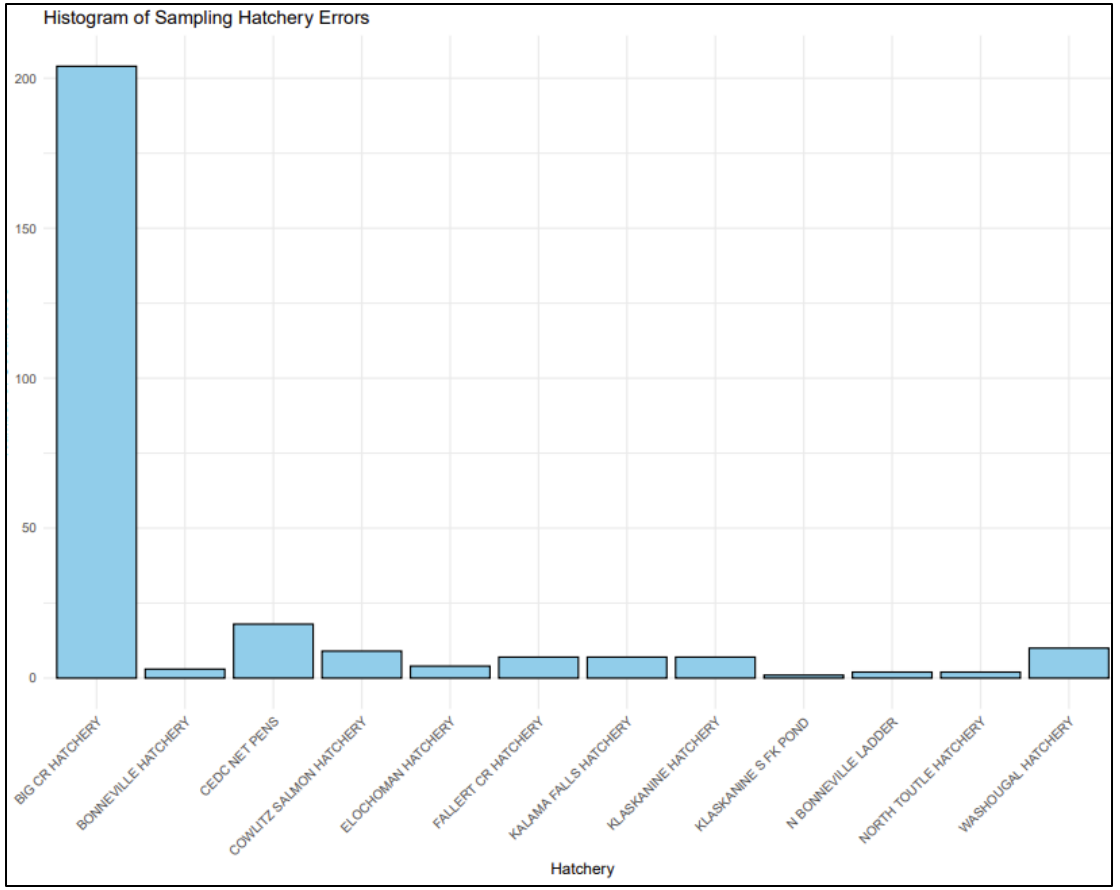
- Escapement data for bias-correction retrieved from SPI frontend at data.wa.gov

- Data retrieved manually via user interface and wrangled according to principles of tidy data

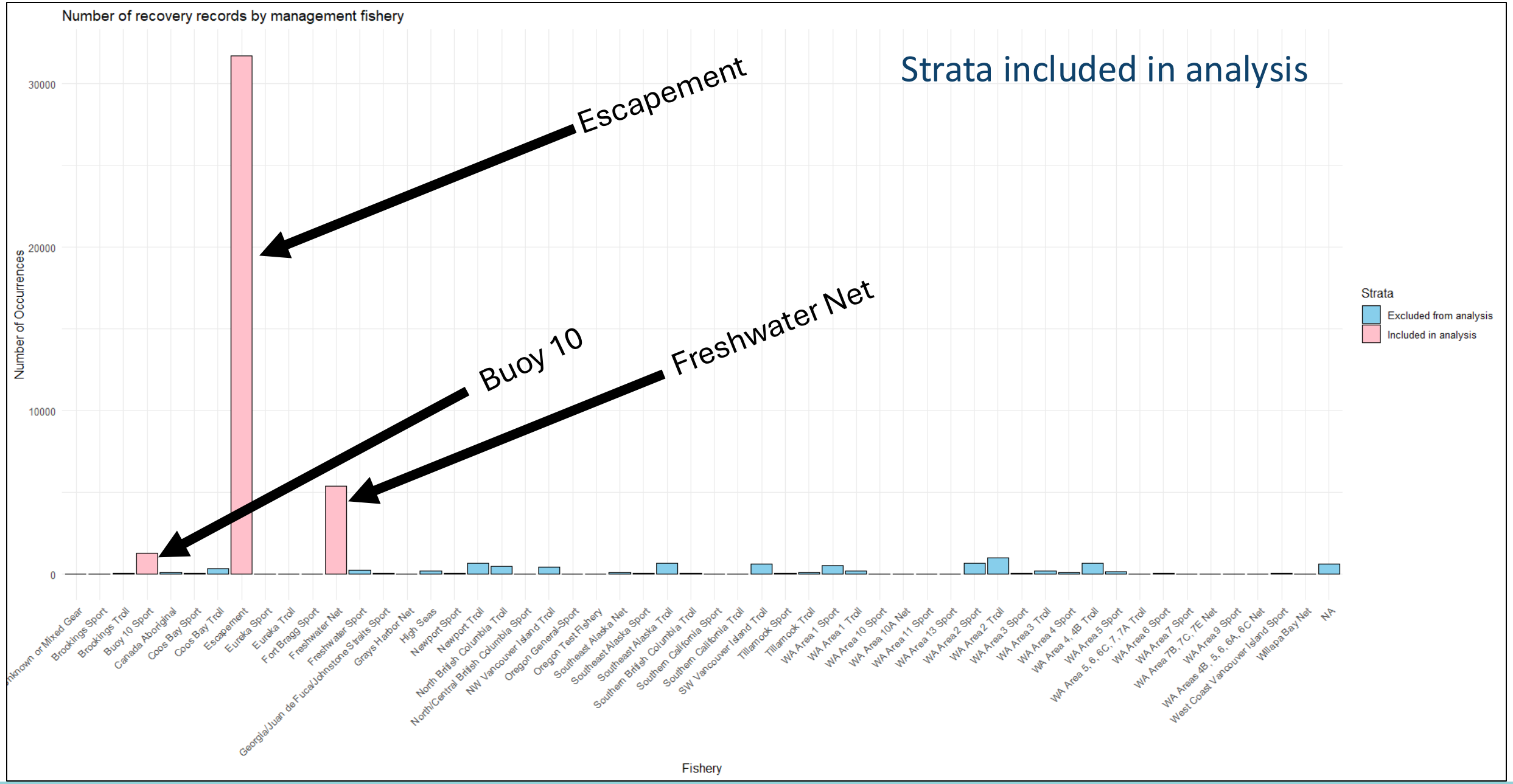


Data wrangling- systematic revision of data set





Strata included in analysis



Data Analysis- Generalized additive model (GAM)

- Quasi-binomial GAM portioning variance into multiple parts:
  - Effects accounting for space (hatchery and basin)
  - Effects accounting for time, year representing interannual variance
  - Effects accounting for size of fish and day of release to capture potential influence of hatchery practice
  - *After* accounting for these- is there still a difference in the Cowlitz Fall Chinook relative recoveries?

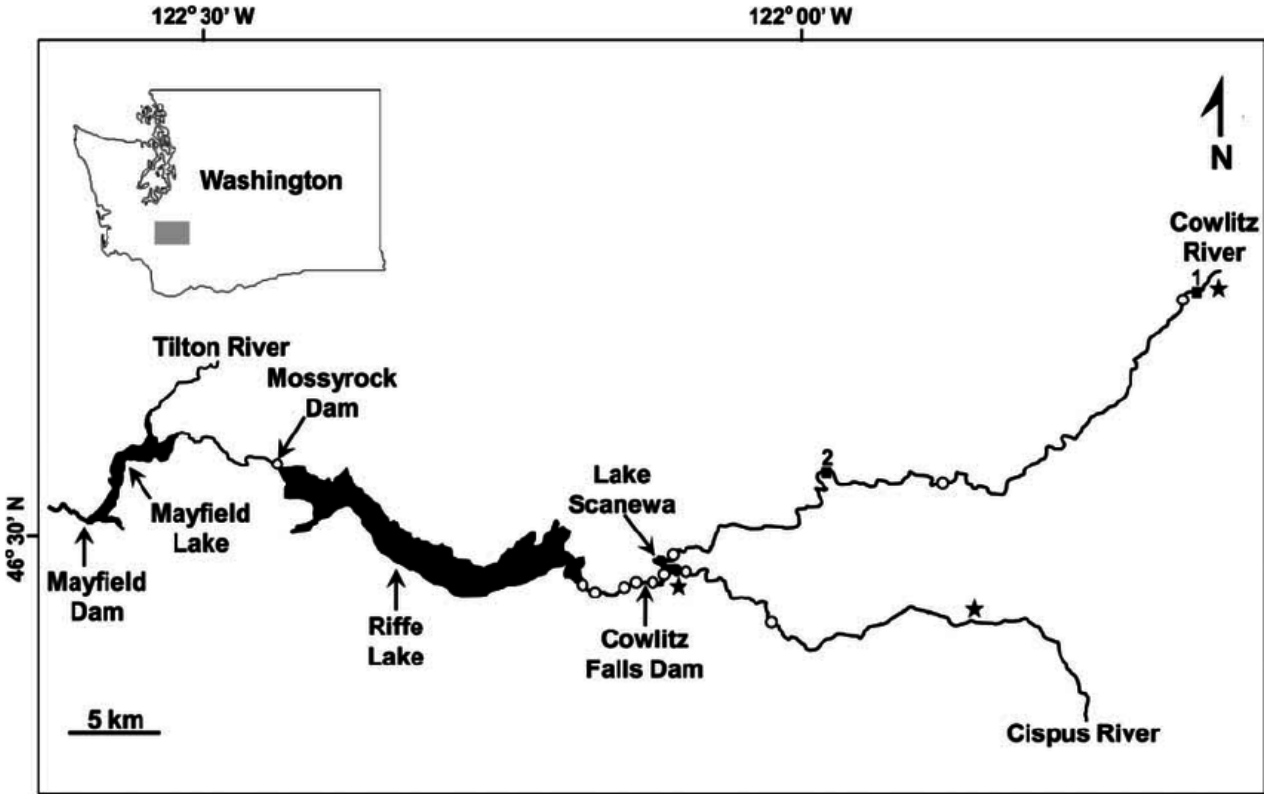


Photo credit: T.L. Liedtke

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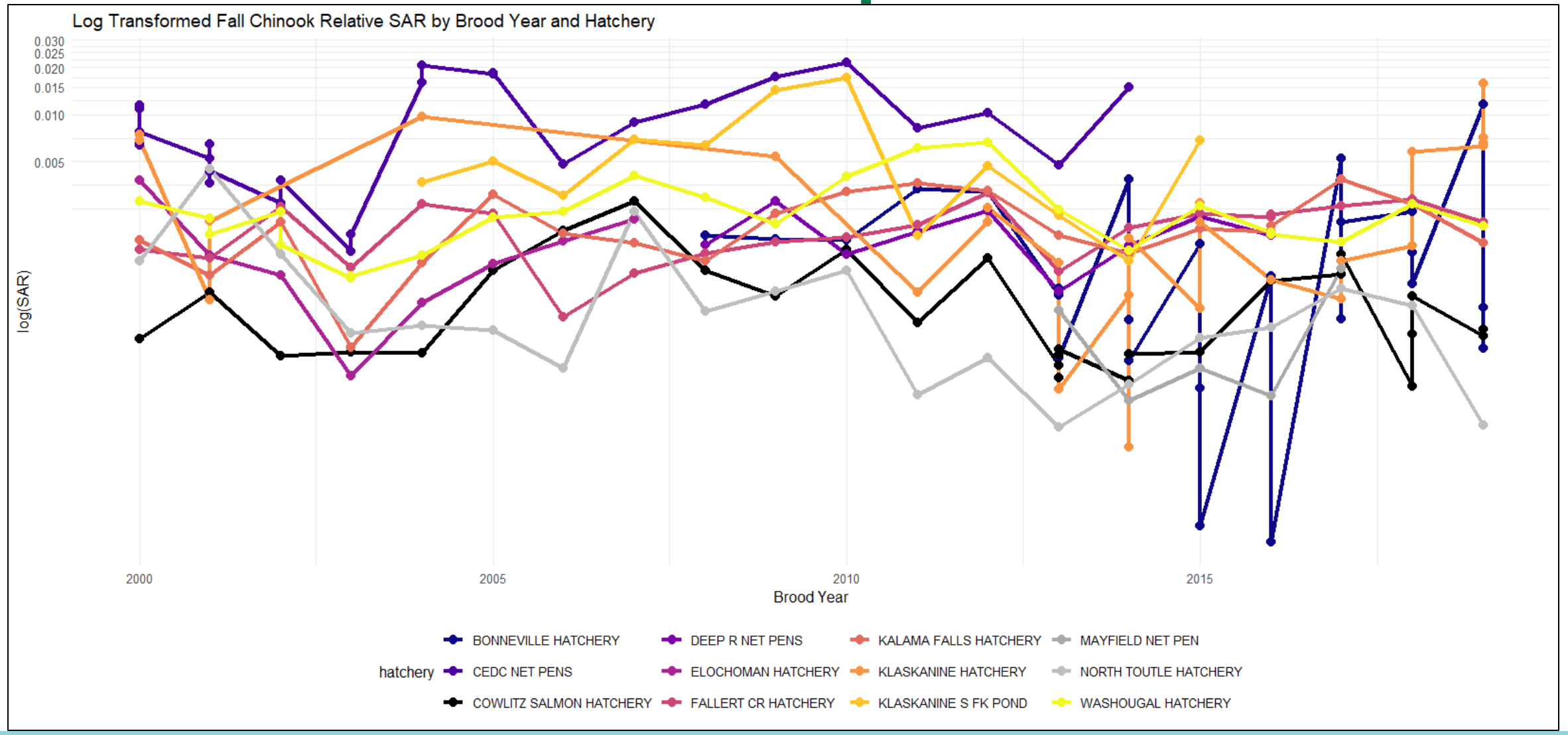
Results

Bias-corrected relative SAR point estimates



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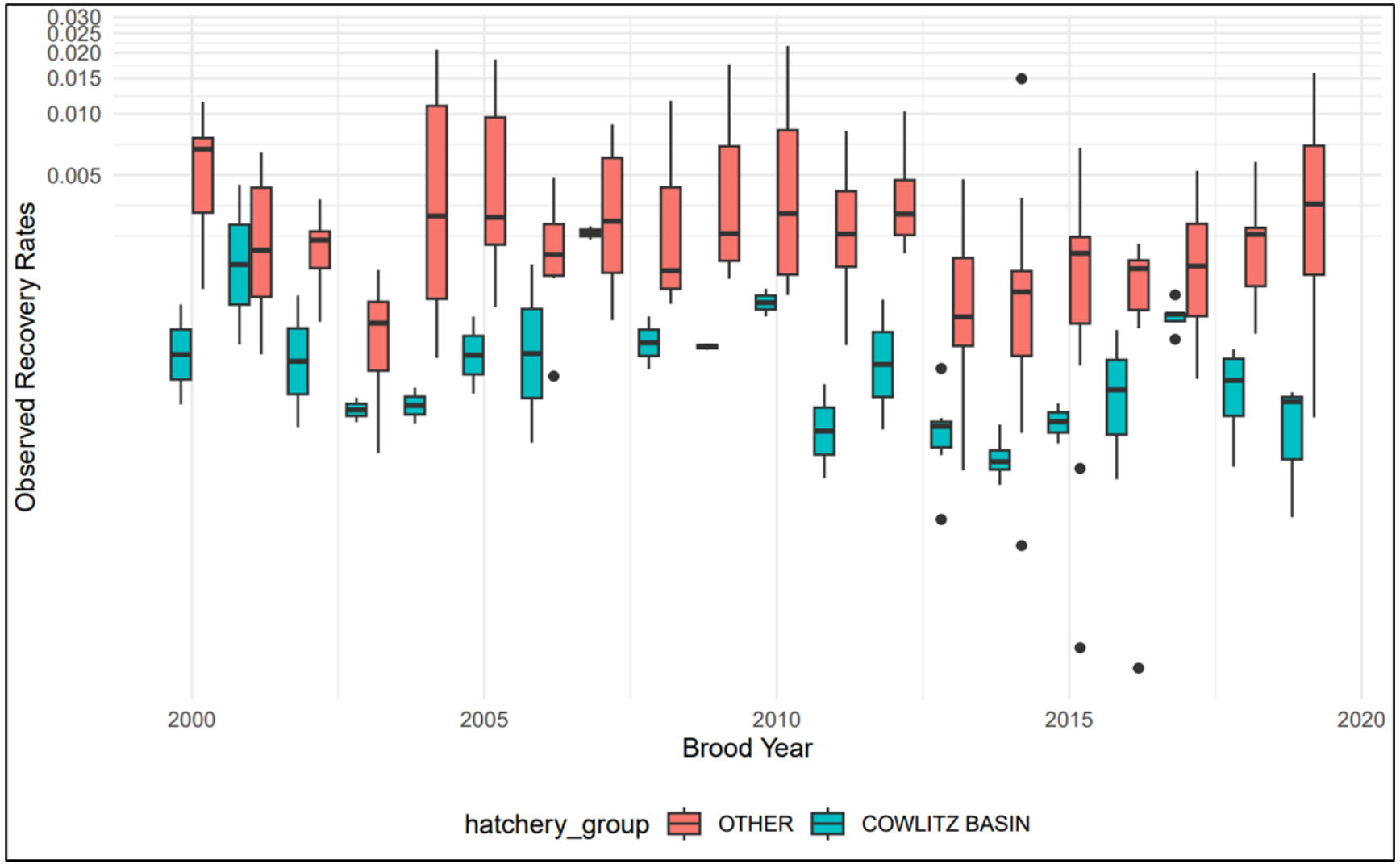
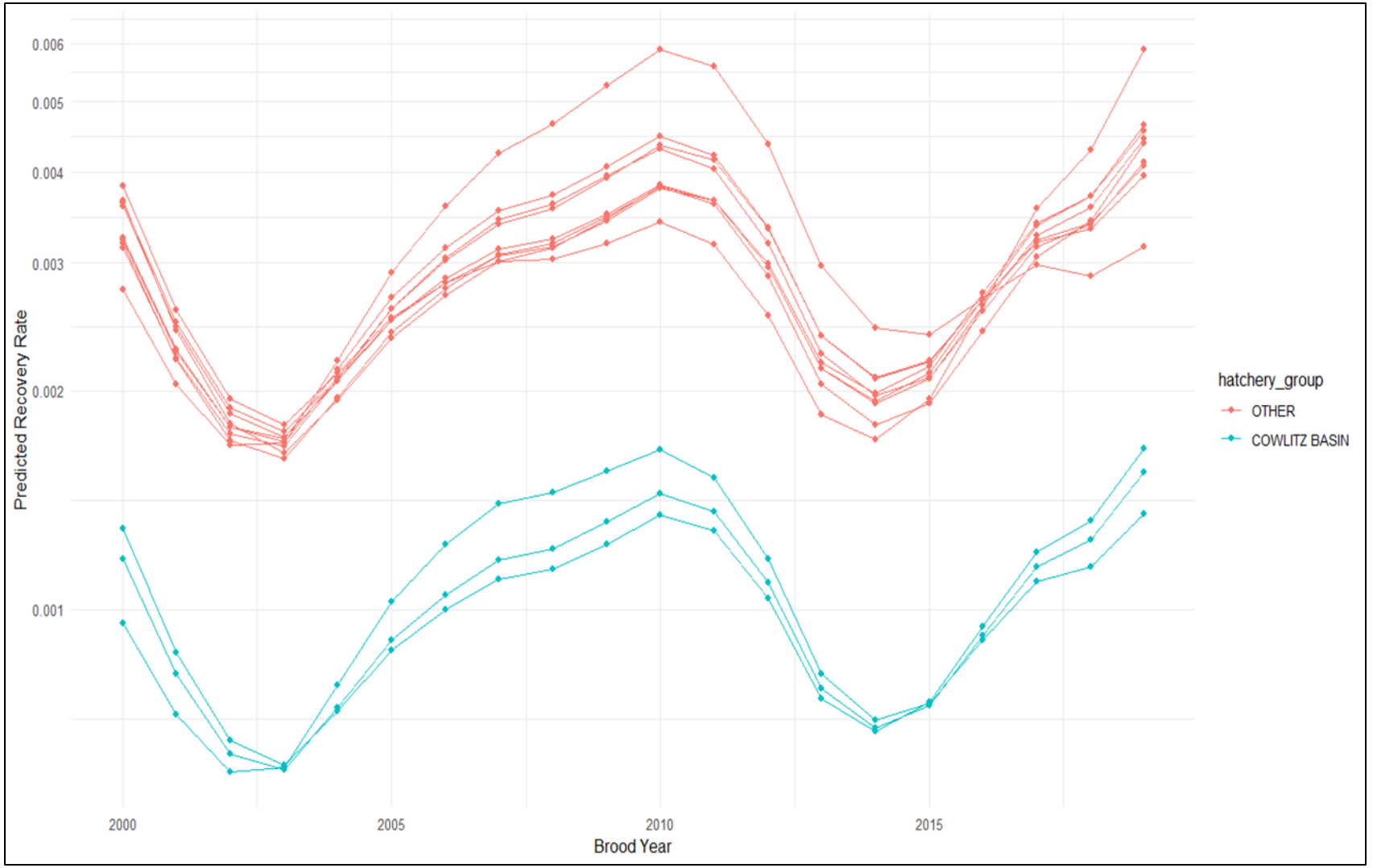
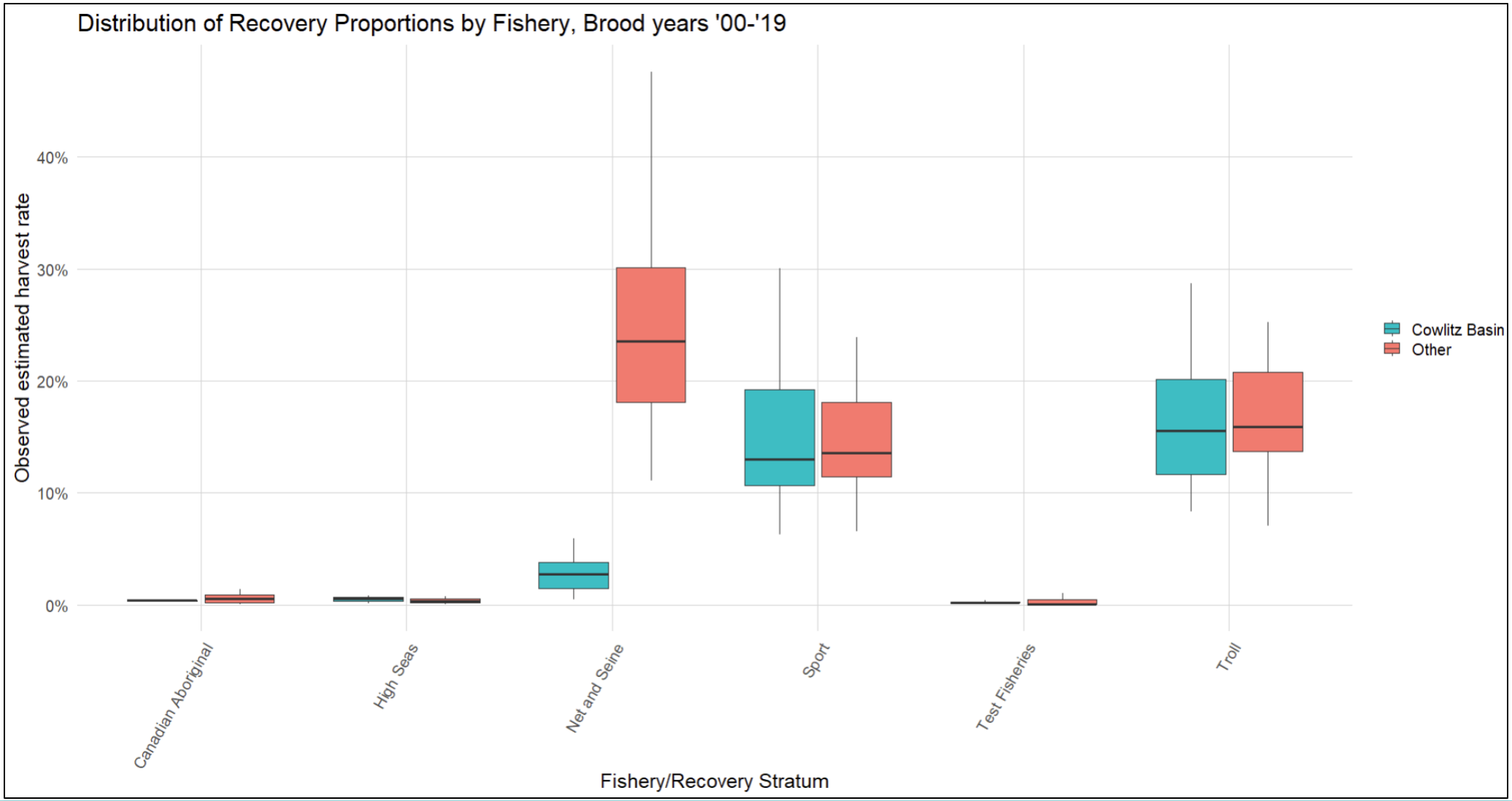


Results- comparing predictions



Results- Observations in Fisheries



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Takeaways and next steps

- After accounting for facility, release size/timing, and year
  - The model suggests the Cowlitz basin is a driving factor in poor recoveries

- We have a framework for examining fisheries contributions across multiple programs

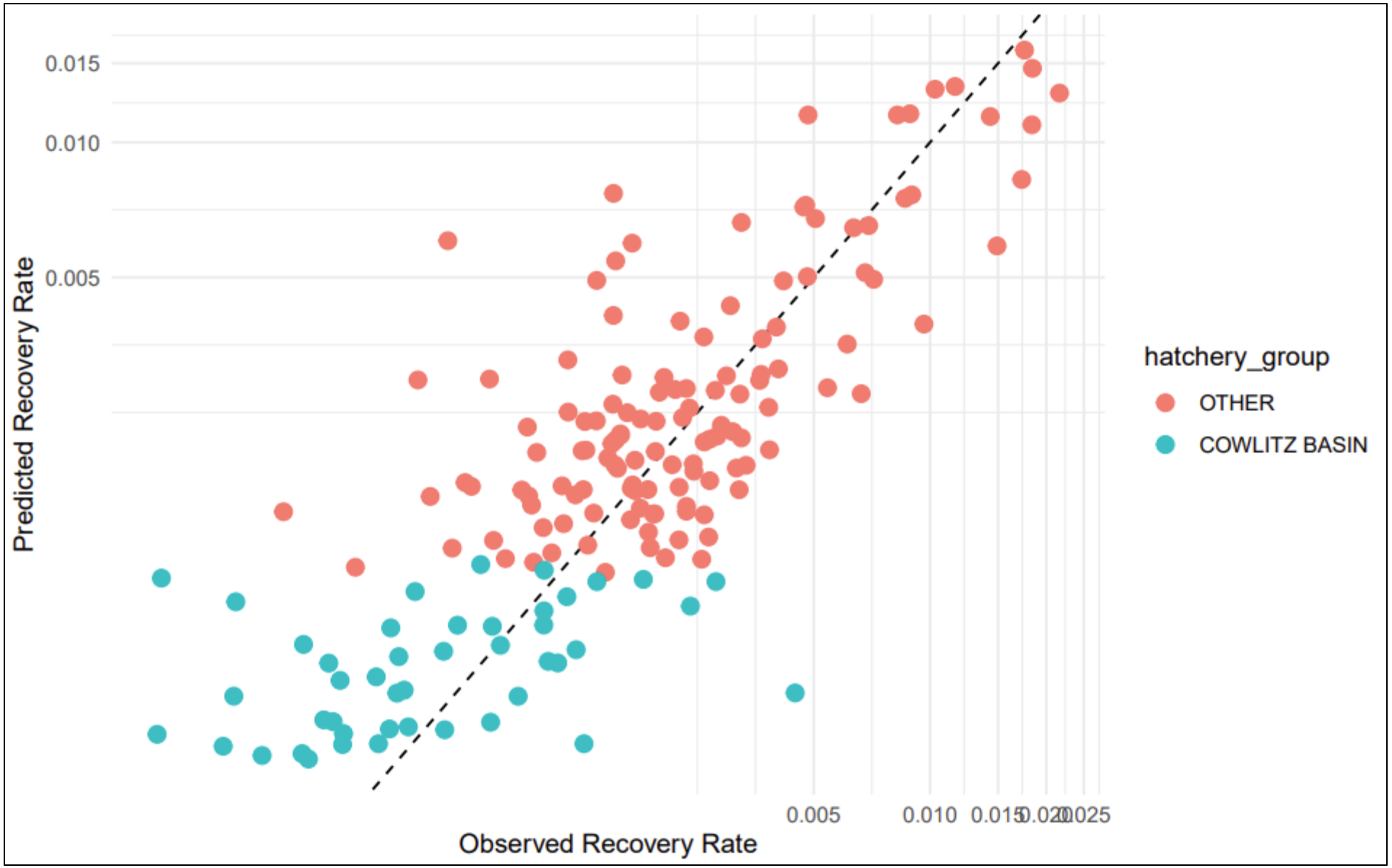
- We plan to adapt the process for hatchery programs elsewhere

Questions?

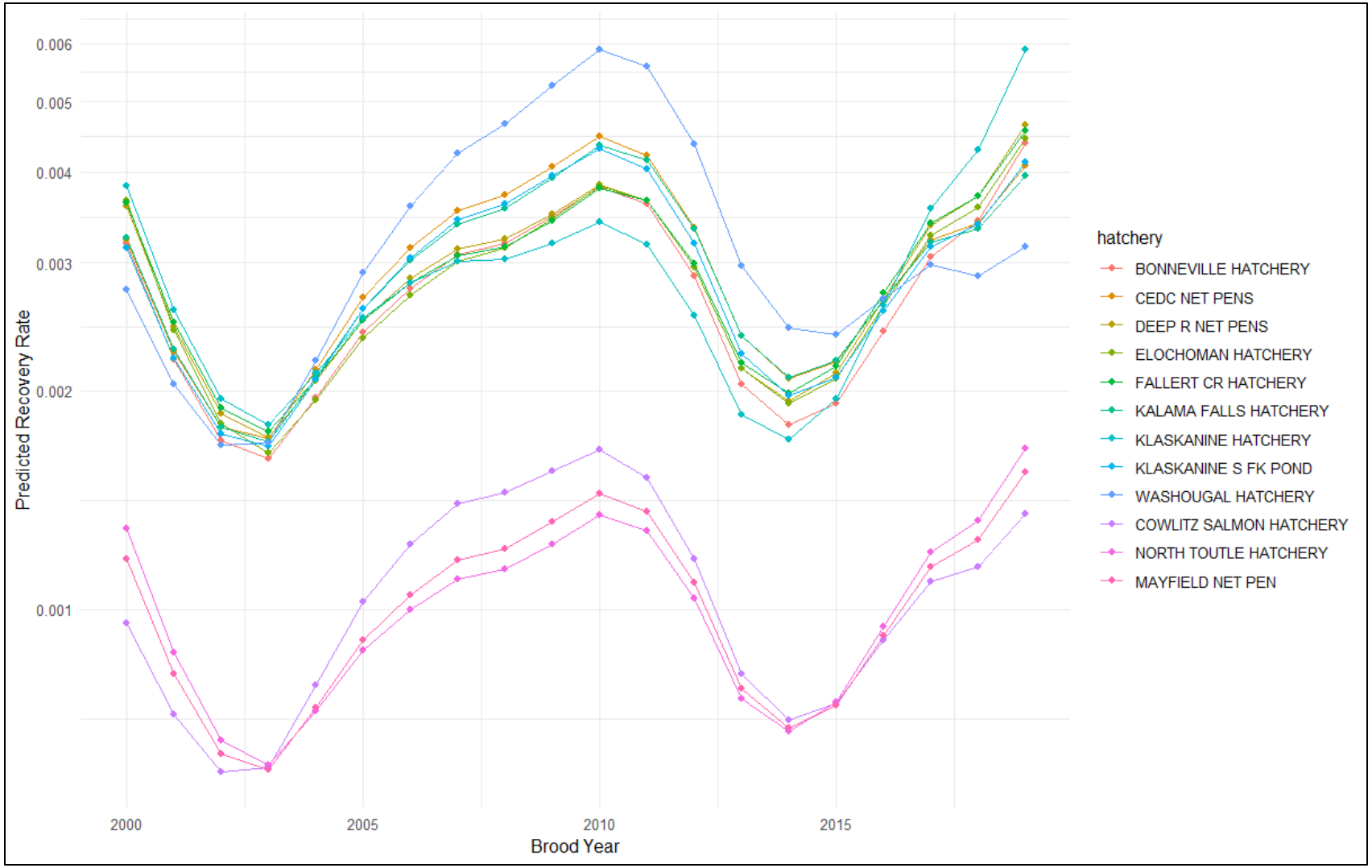
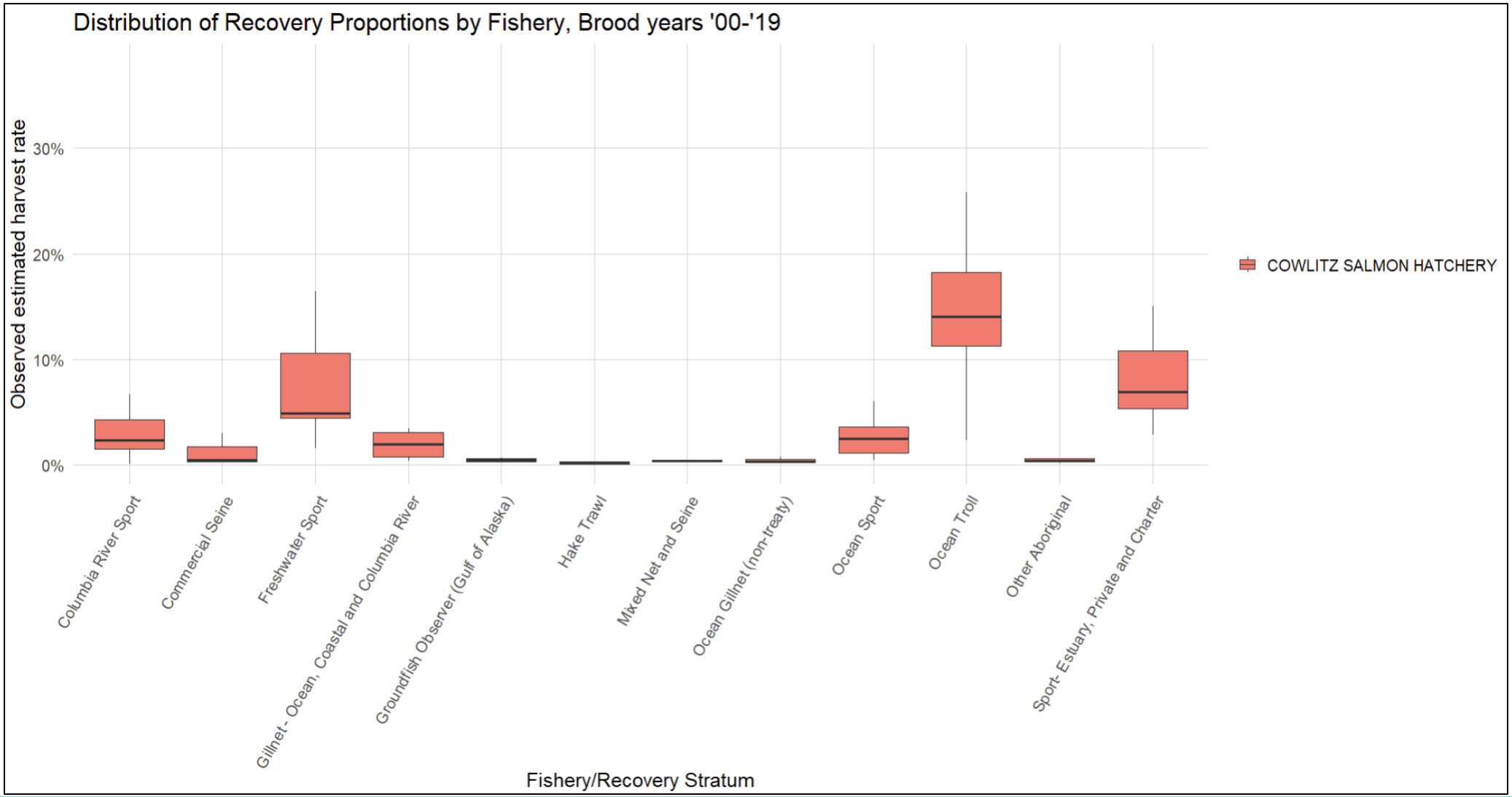
Data Analysis- Model Structure

- Expanded recoveries ~ quasibinomial(proportion recovered, number released, theta)
  - theta = overdispersion parameter

- $\text{logit}(SAR) = \beta_0 + s(\text{brood year}) + \text{hatchery group} + s(\text{hatchery}) + s(\text{average weight at release}) + s(\text{julian day of release}) + s(\text{hatchery, brood year})$


0.015
0.010
0.005
Predicted Recovery Rate
0.005
0.010
0.015
0.020
0.025
Observed Recovery Rate
hatchery_group
OTHER
COWLITZ BASIN

Results- comparing predictions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