Improving Chinook Salmon Monitoring in the Lower Cowlitz

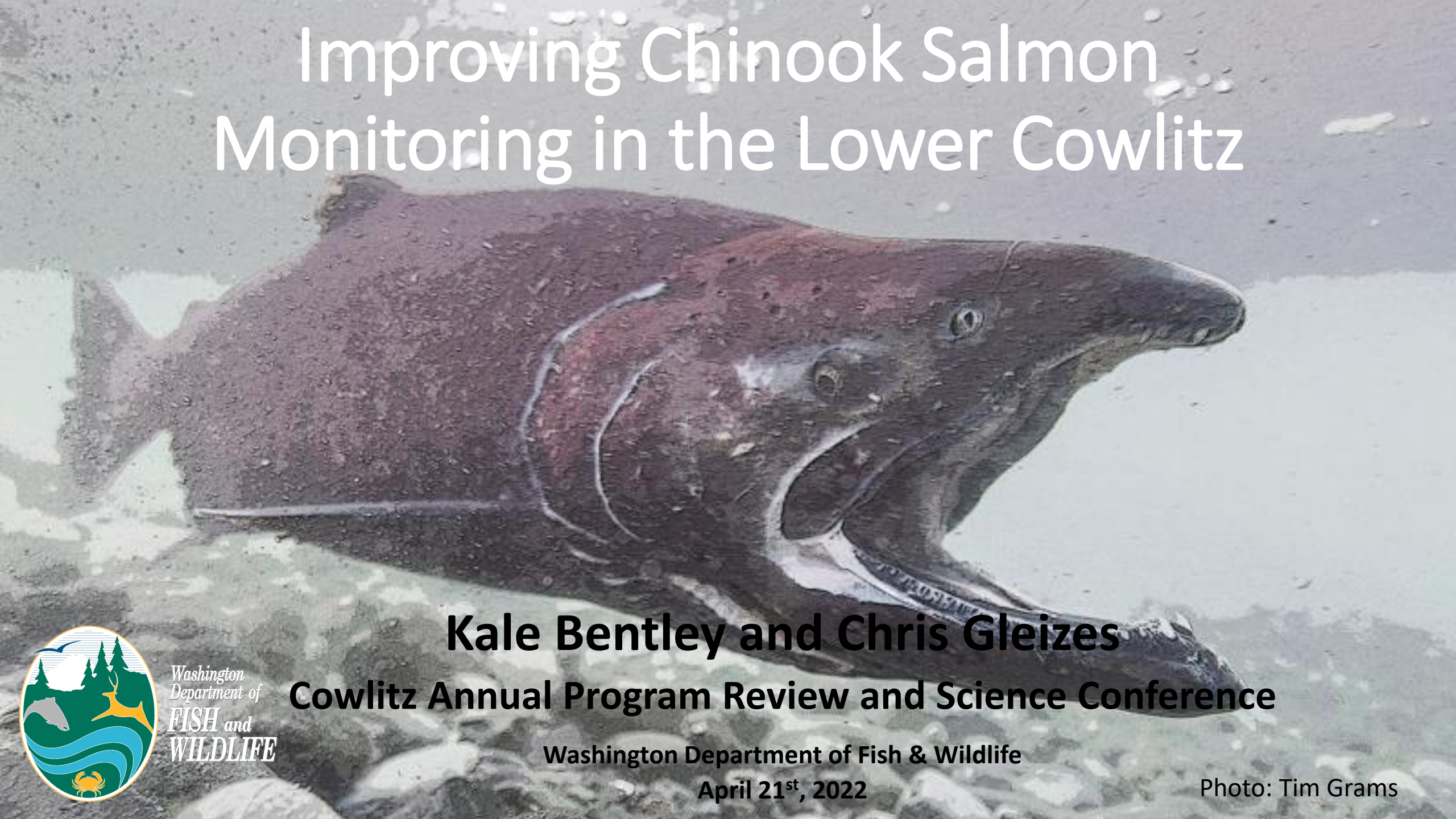

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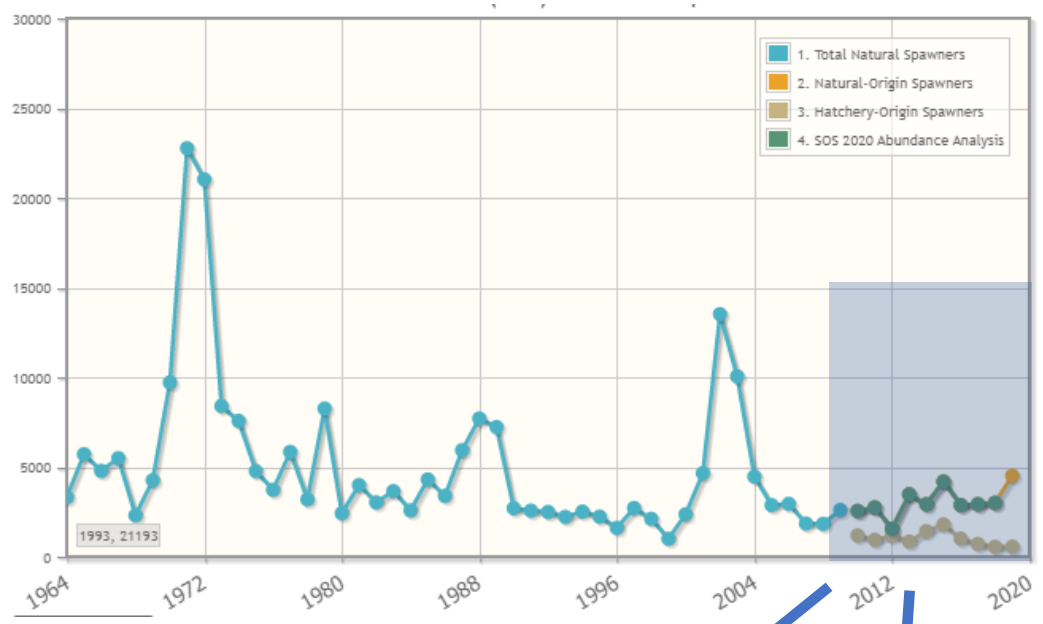
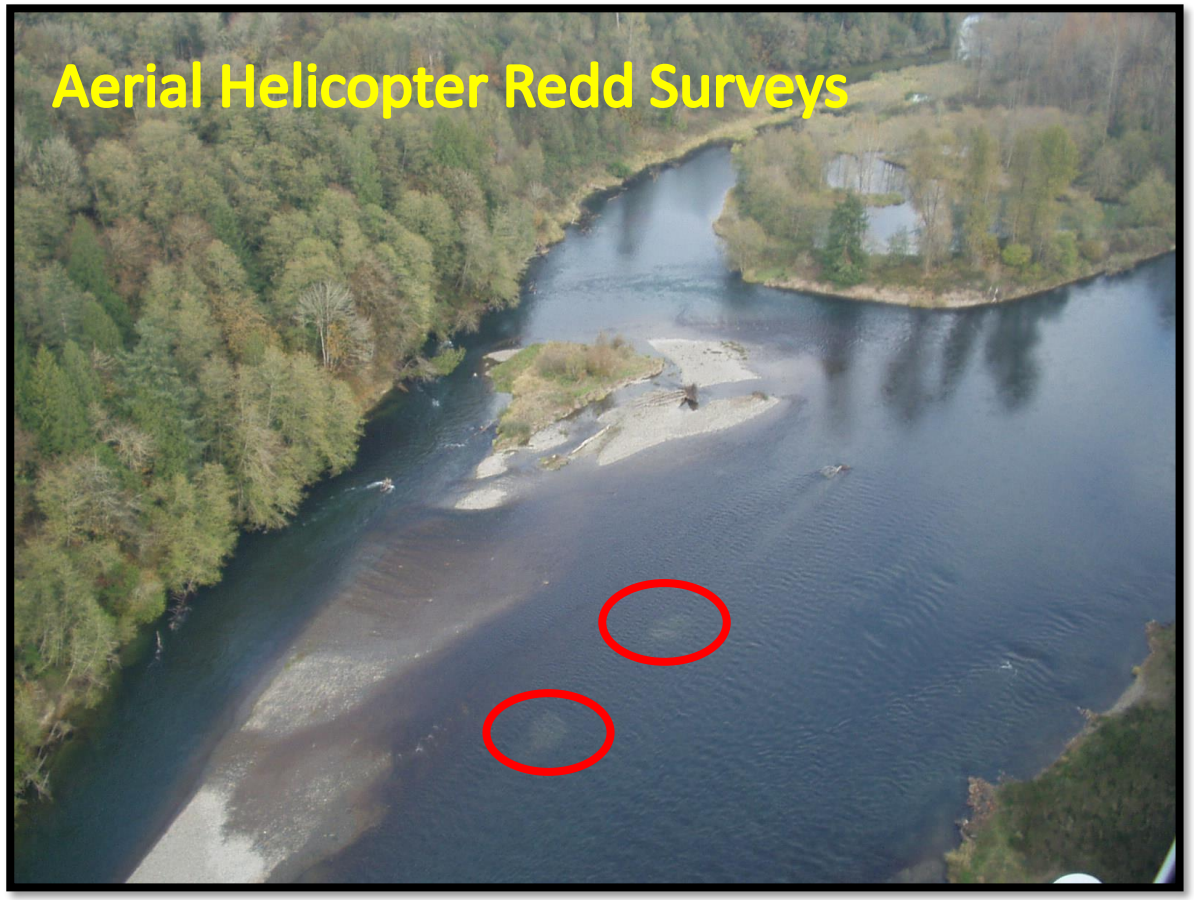
Photo: Tim Grams

Background

- Estimates of fall Chinook abundance in the lower Cowlitz R. have been generated since the 1960s

- Since 2010, Chinook are monitored with aerial redd counts in conjunction with carcass sampling





Estimating Abundance:

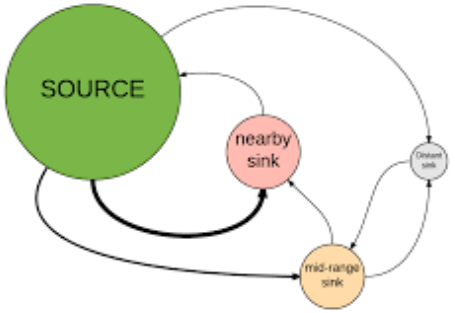
Total = Peak Redd Count * Peak Count Expansion Factor (2.84)
HORs = Total Abundance * Prop. Hatchery carcasses
NORs = Total Abundance - HORs

Challenges with Peak Count Expansion

- Multiple lines of evidence suggest current estimates are negatively biased
  - Creel surveys
  - Smolt trap estimates
  - Peak count expansions elsewhere
- Known limitations to current approach
  - Aerial Surveys
    - Redd superimposition
    - High/turbid water
  - Peak Redd Count Expansion
    - Assumes constant
    - Requires peak to be observed
- Take away: ***accuracy*** and ***precision*** of the estimate is unknown

Benefits of Improved Chinook Monitoring

- Improved recovery status for ESA→ closer to recovery goal, delisting
- Non-Mark Selective Fisheries
- NOAA VSP monitoring guidelines
- Properly size hatchery programs for integration
- Understand source-sink dynamics of Chinook populations within the basin



Alternative Approach: M-R Carcass Surveys

- Ideal monitoring program:
  - Accurate abundance estimates
  - Measurable precision
  - Cost-effective
- Carcass tagging offers a high probability of success
  - High logistical feasibility
  - High probability of accurate estimates with known precision
  - Cost-effective

Objectives: Chinook monitoring in 2021

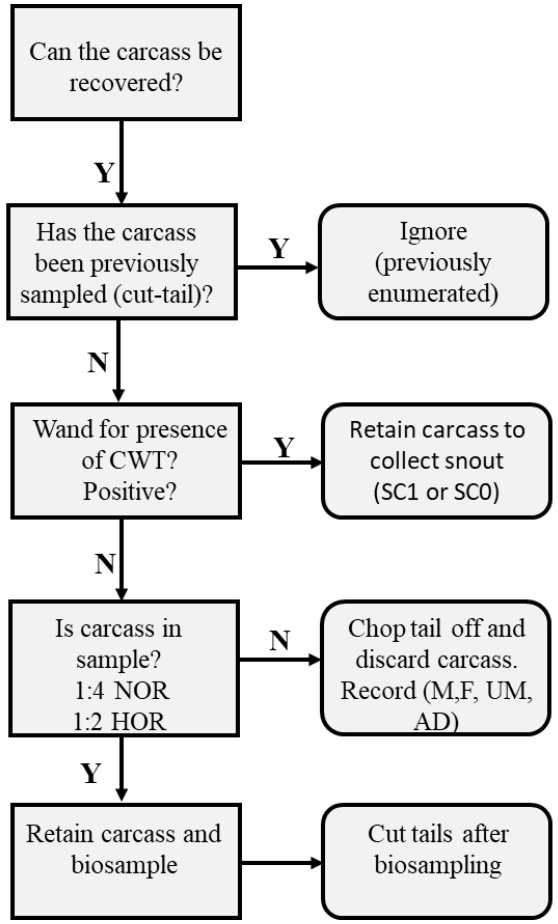
- Conduct carcass surveys w/ M-R
  - Obtain accurate abundance estimates
  - Estimate precisions
- Conduct aerial flights
  - Continue existing time series of abundance
  - Data for future bias-correction

Methods: Chinook monitoring in 2021

- Aerial flights for redds
  - Timing: bi-weekly (late Sept. – early Dec.)
  - Space: Castle Rock to Barrier Dam (~33 miles)
  - Approach: Count & GPS all redds via helicopter
- Carcass surveys
  - Timing: Weekly (Sept. – Dec.); 4 – 5 days/week
  - Space: Olequa Ck to Barrier Dam (~26 miles)
  - Approach:
    - Jet boats + gaffes + CWT wand
    - 2 – 4 people & 1 – 2 boats
    - Recover all carcasses
    - Sample & tag representatively

Mark-Recapture: Data Collection & Analysis

Carcass Survey Flow Diagram



Abundance and composition of adult Chinook escapement is estimated using an ***"open" population Jolly-Seber (JS) model*** (Seber 1982, Pollock et al. 1990).

- "super population" JS model was developed by Schwarz et al. (1993, 1996) specifically for estimating salmon spawning escapement using mark-capture methods
- Has been successfully implemented to estimate spawner escapement for other salmon populations within the Lower Columbia River (Rawding et al. 2014) and other Washington state watersheds (Ashcraft et al. 2017).

Results: Aerial flights for redds

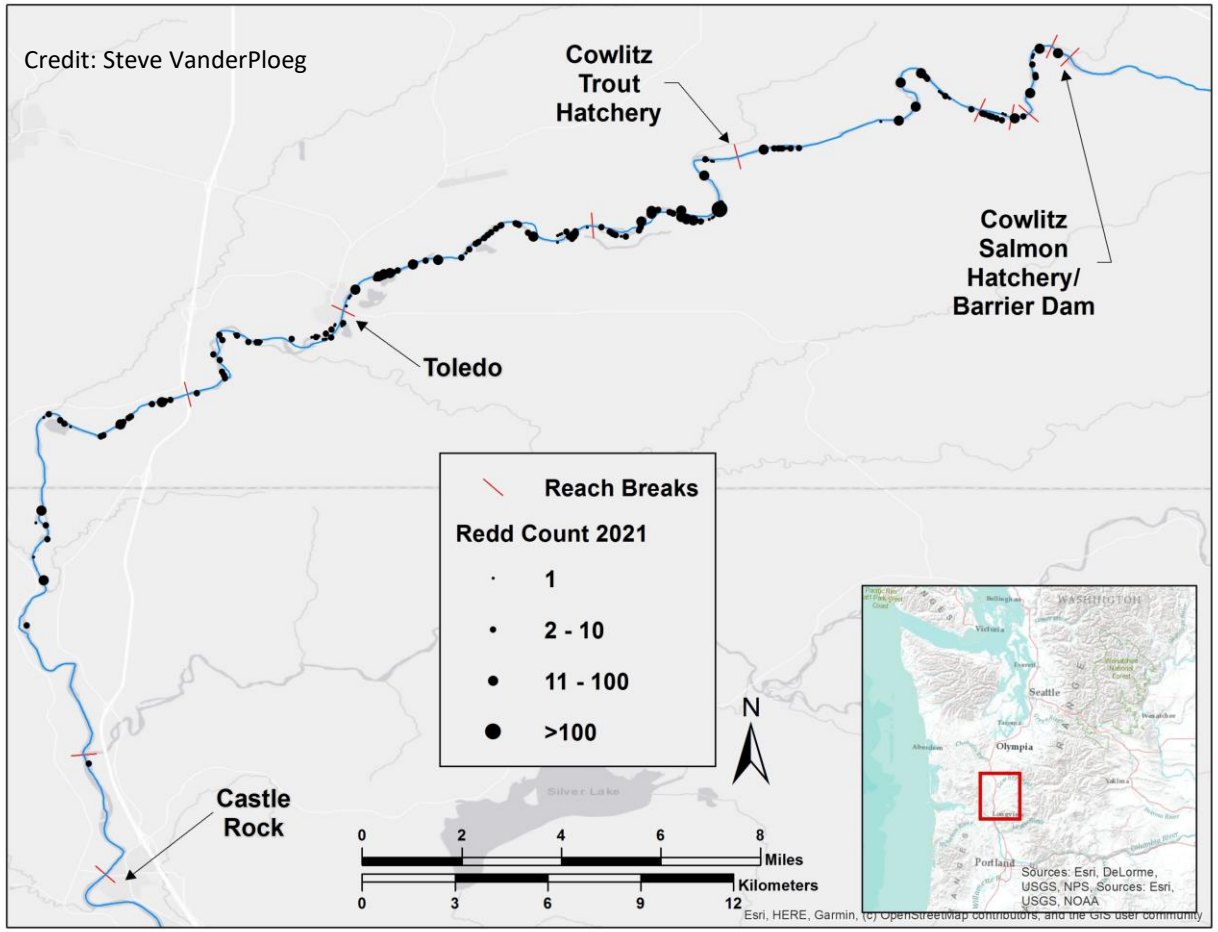
- Total Redds by Date

Date	Redds
22-Sep	149
6-Oct	960
21-Oct	1,076
2-Nov	1,730
17-Nov	-
1-Dec	-

Spring peak

Fall peak

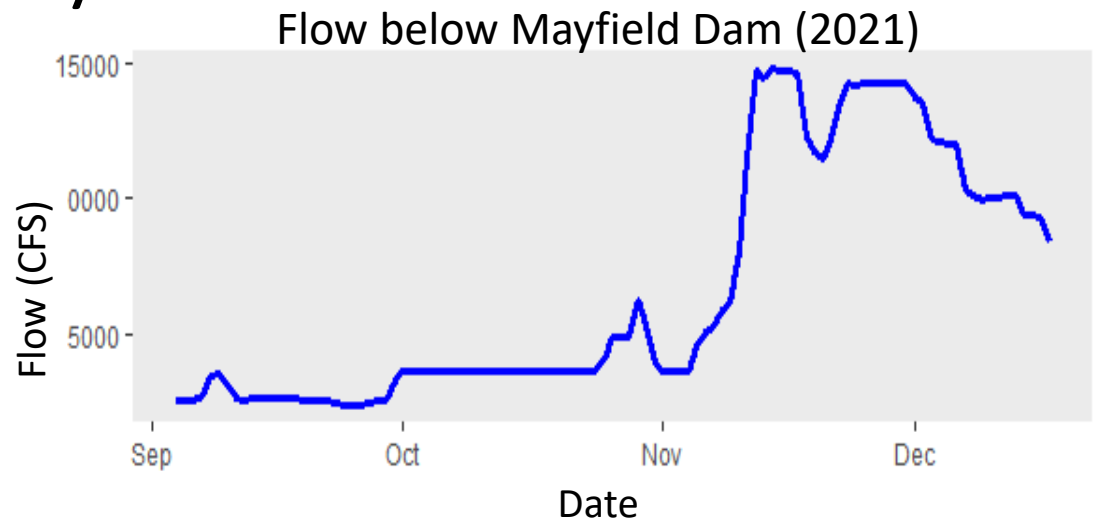
- Abundance
  - Total Spawners: **5,336** (2.84 x (149+1,730))
  - Spring-run
    - Spawners: **423*** (149 redds x 2.84 fish/redd)
    - pHOS = 100% (6/6 HOR carcasses)
  - Fall-run
    - Spawners: **4,913** (1,730 redds x 2.84 fish/redd)
    - pHOS = 15% (317/1,829 HOR carcasses)

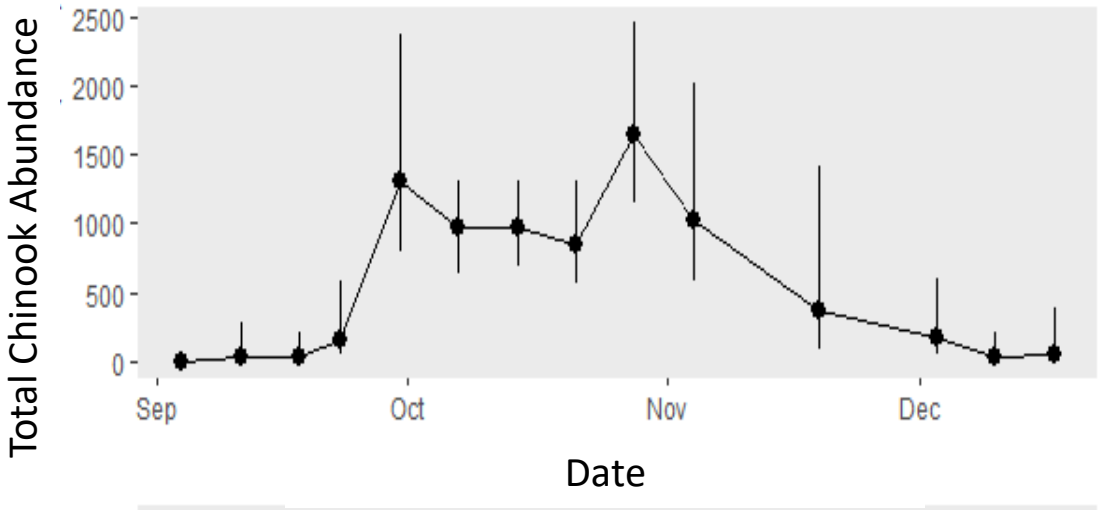


** **Preliminary** (peak spring count conducted later in Sept than normal and redd count was likely a mixture of spring and fall-run Chinook)*

Results: M-R carcass surveys

- Surveys
  - 42 days across 14 weeks (Sept. 8th – Dec. 21st)
  - Missed two weeks in mid-Nov (high flows resulting in unsafe survey conditions)
- Carcasses
  - Maiden (unique) = 2,167
  - Tagged = 903
  - Recaptured = 189
- Abundance
  - Total = **7,894** (median: 95% CI 6,380 – 10,987)
  - Spring-run
    - Spawners: **47** (median: 95% CI 9 – 310)
    - pHOS: 57%
  - Fall-run
    - Spawners: **7,827** (median: 95% CI 6,342 – 10,801)
    - pHOS: 14%

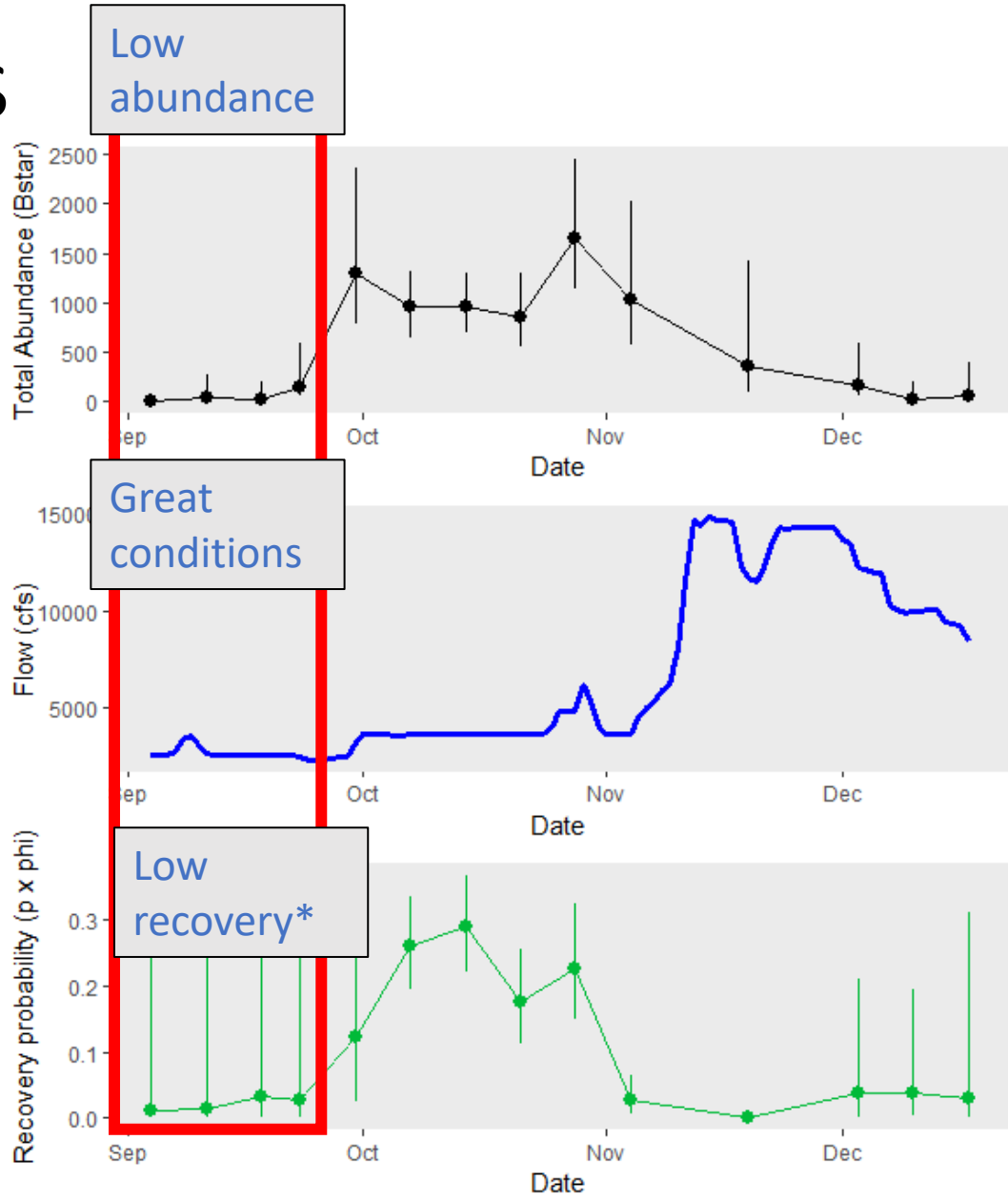




Assessment of M-R surveys

Date	Maiden	Tagged	Recap
Sept. 8	1	1	0
Sep. 15	3	3	0
Sept. 20	3	3	0
Sept. 27	18	18	0
Oct. 4	275	202	1
Oct. 11	401	210	47
Oct. 18	432	134	68
Oct. 25	284	109	30
Nov. 1	516	156	34
Nov. 8	185	48	8
Nov. 15	-	-	-
Nov. 22	-	-	-
Nov. 30	10	9	0
Dec. 7	27	9	0
Dec. 13	5	1	1
Dec. 21	7	0	0

Low catch/ tags/recaps



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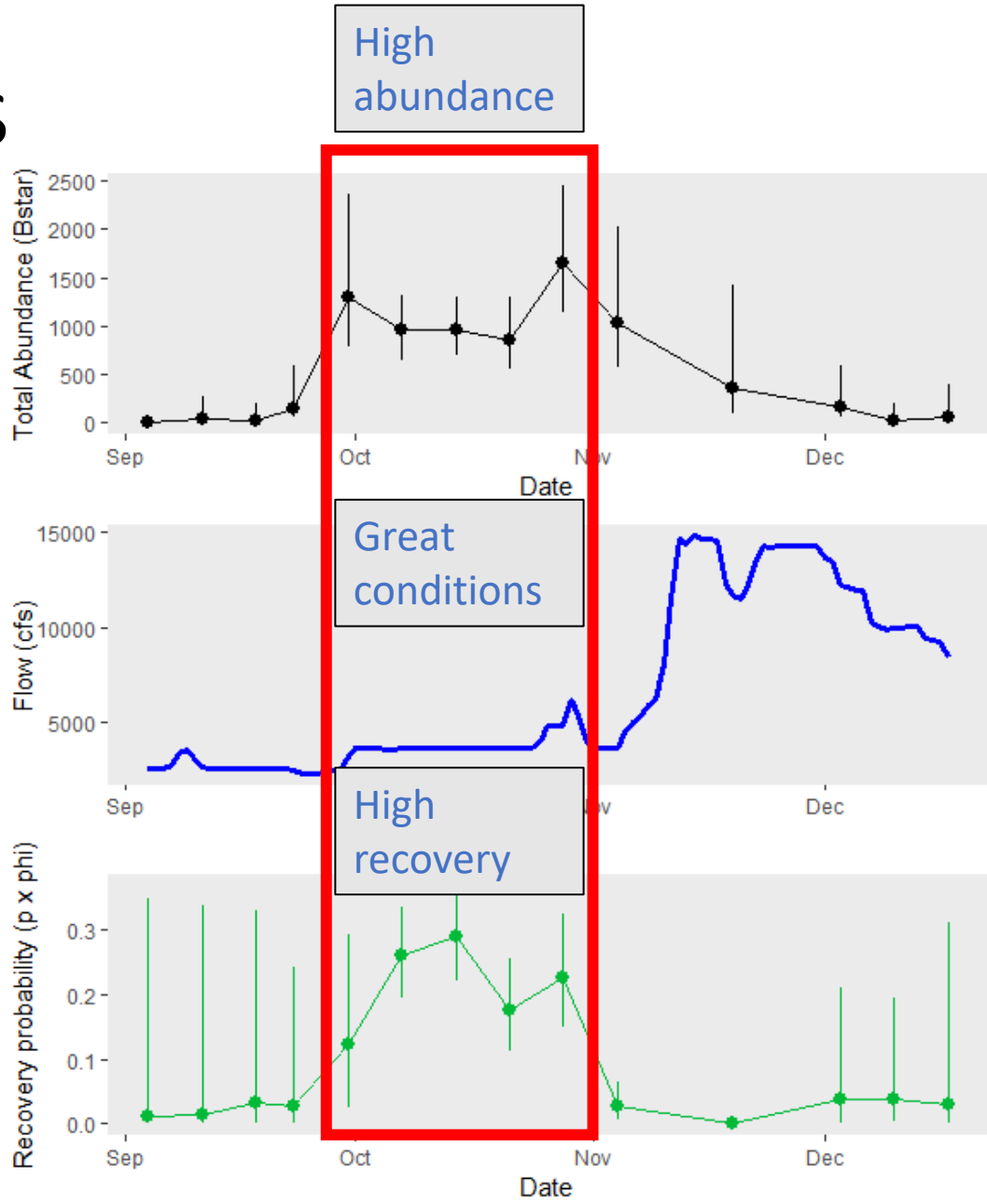

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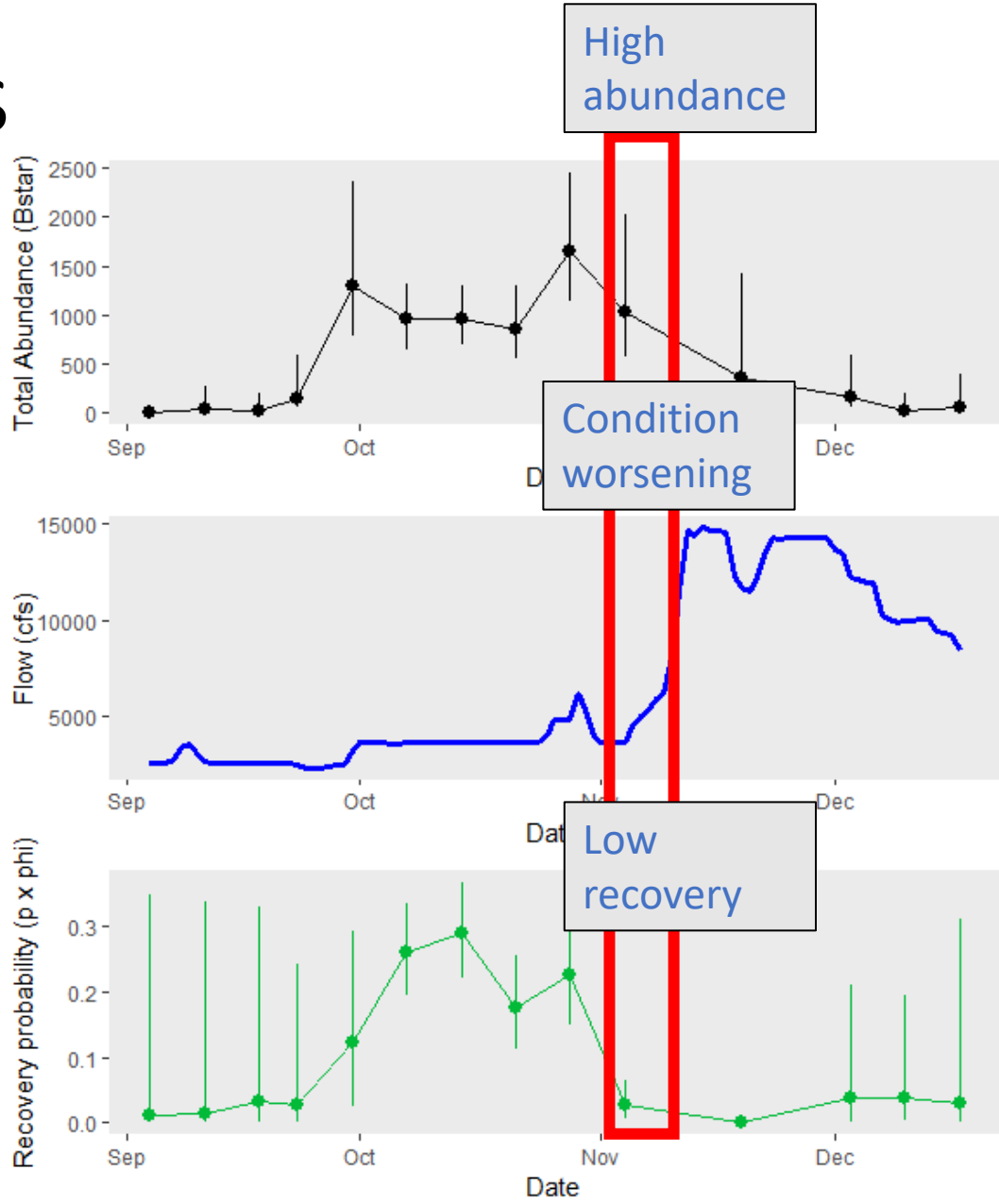
Medium Catch, low recaps



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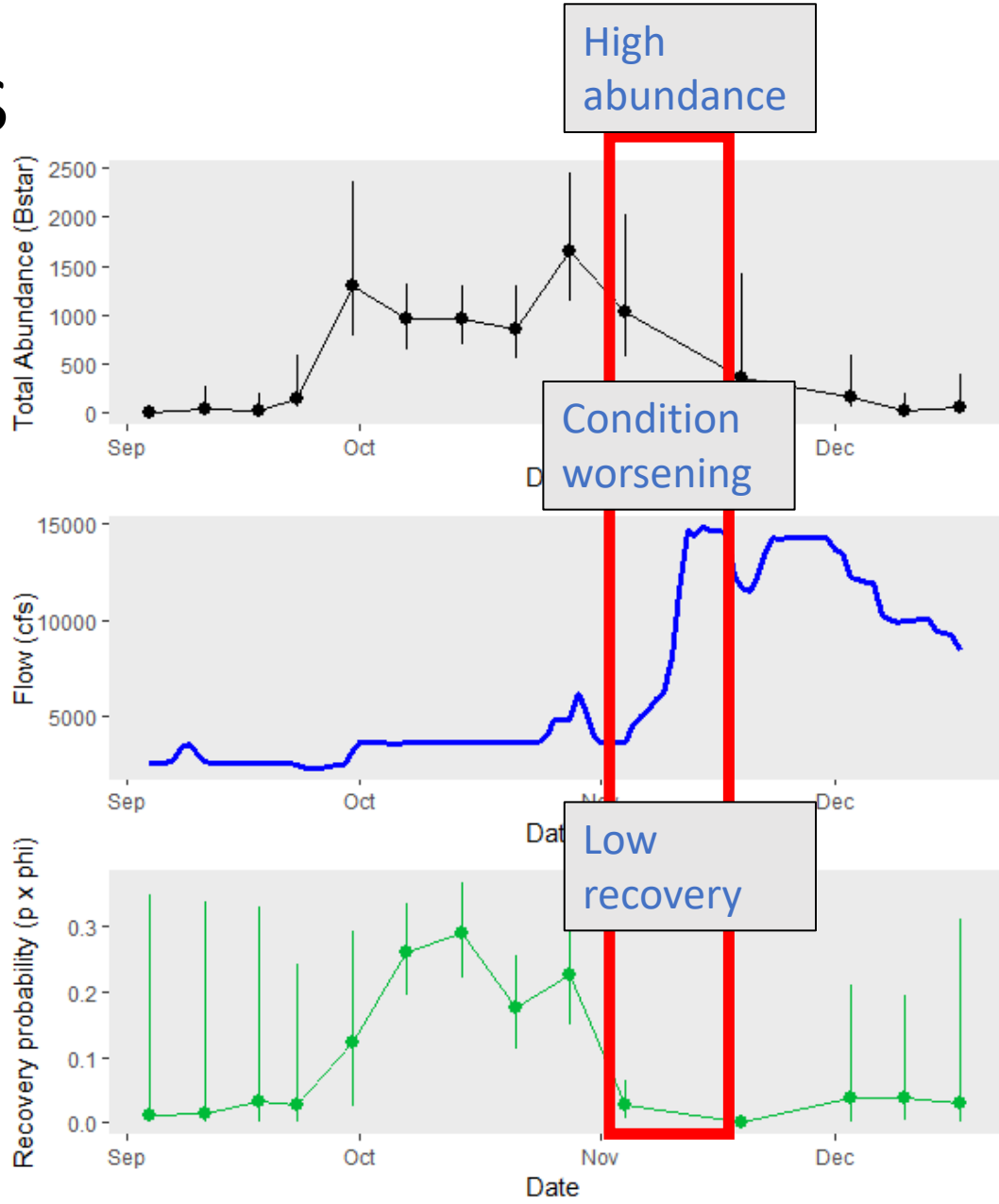
Missed

Out –
2 weeks



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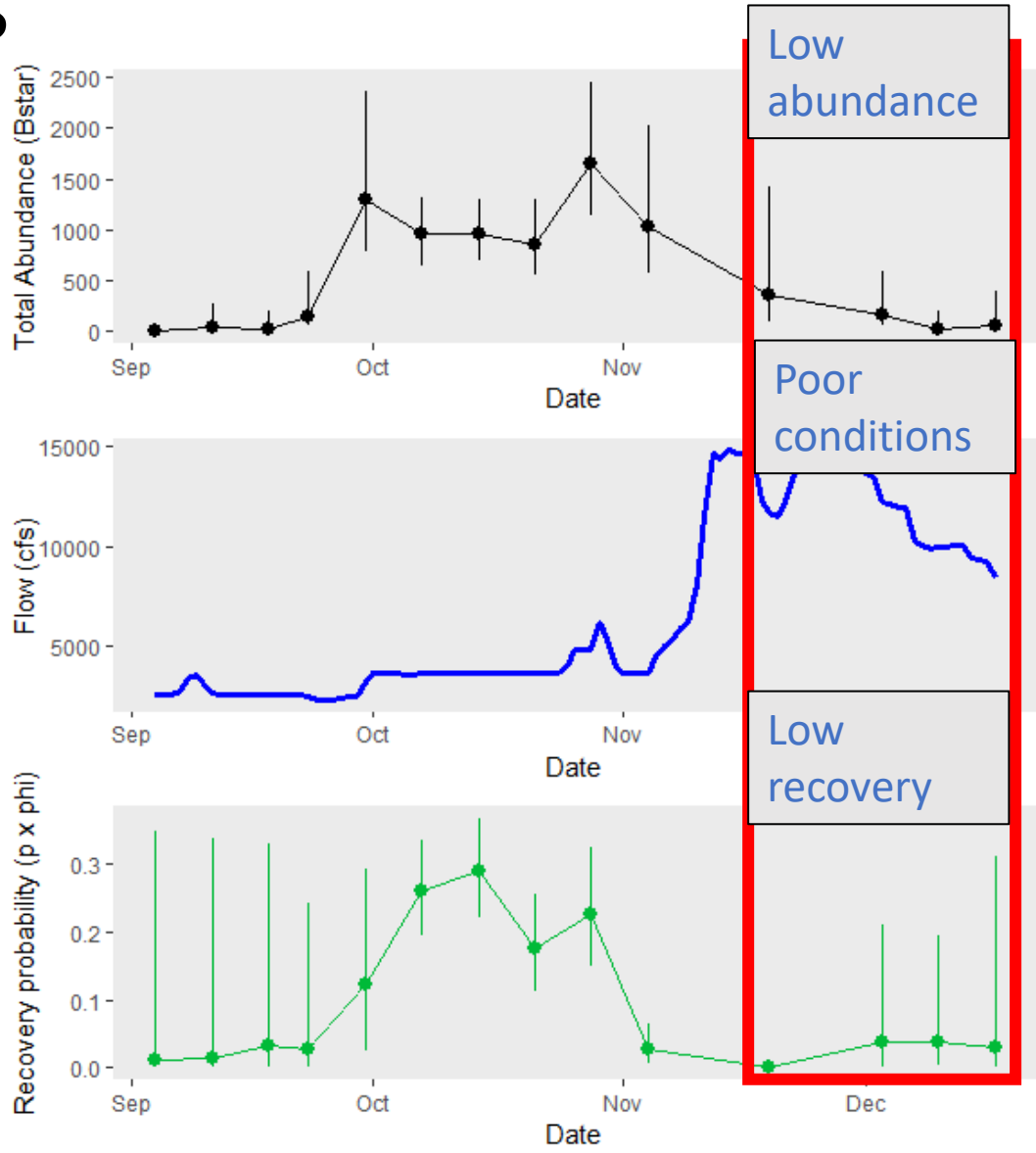

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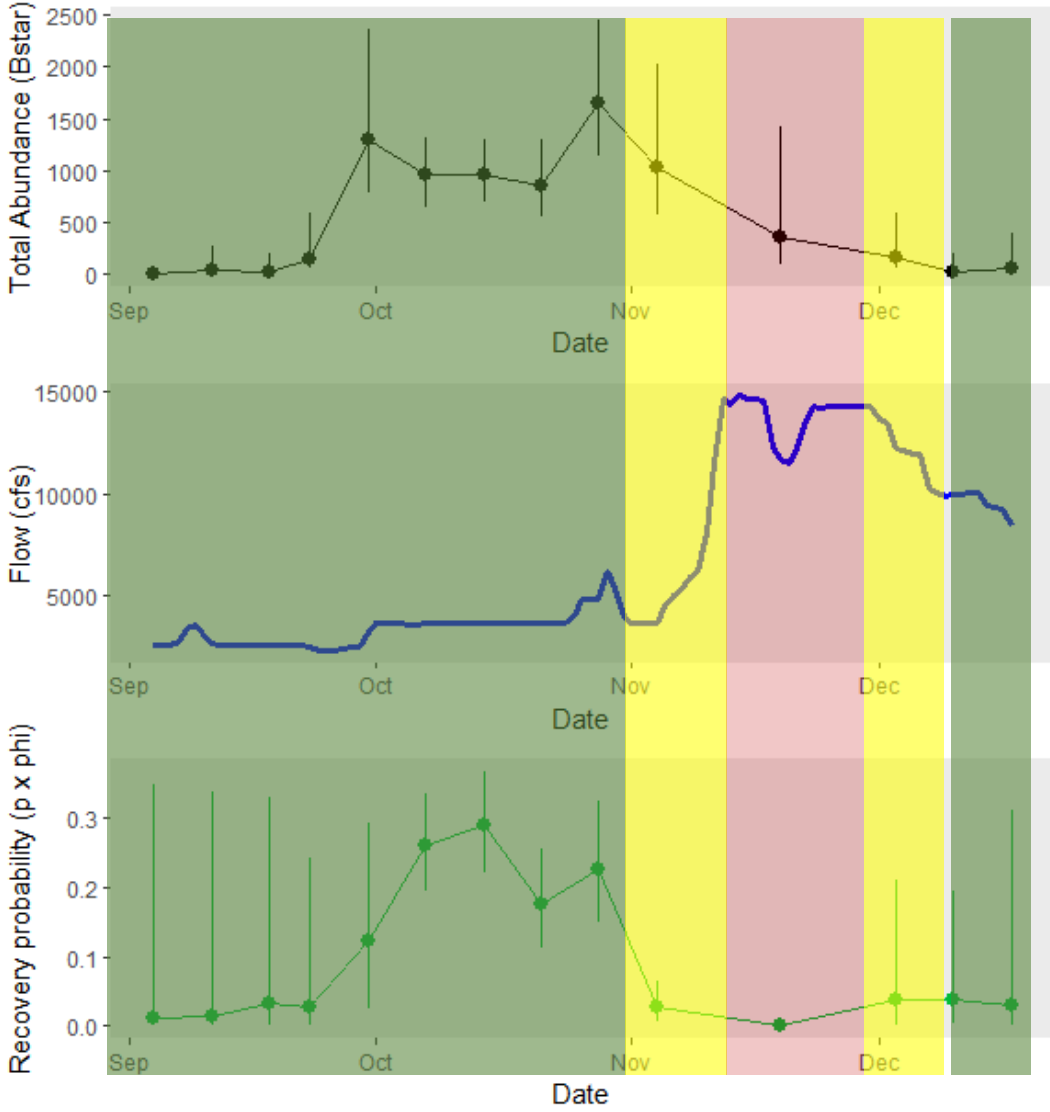

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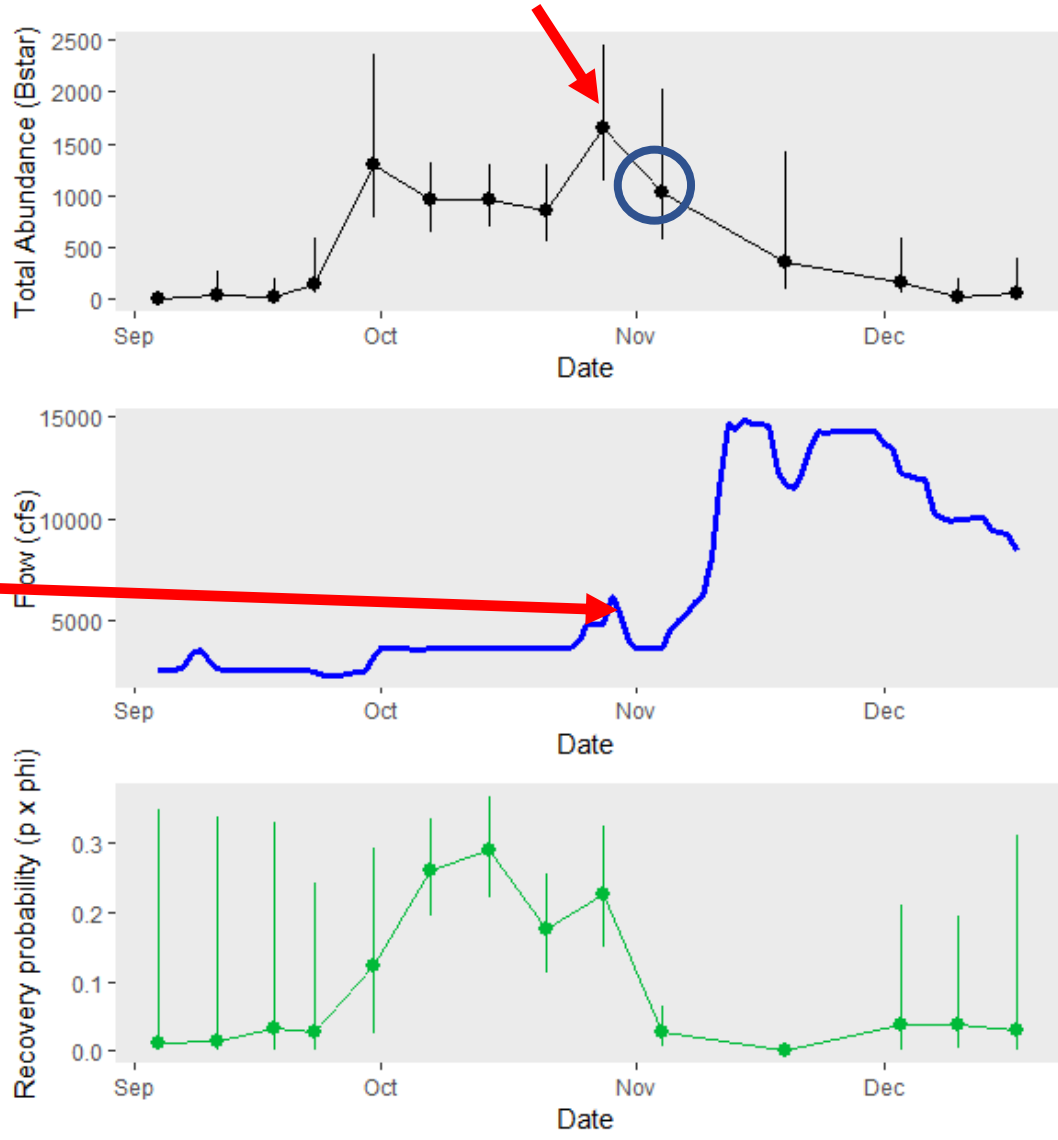
Declining catch before major flooding

True Peak Abundance



Conclusions

- First implementation of M-R for Chinook in lower Cowlitz surveys in 30 years
- Estimates of Fall Chinook (by method):
  - Spawners: 4,913 (flight) vs. 7,827 (M-R)
  - pHOS: 15% (flight) vs. 14% (M-R)
- Recommendations:
  - Tag more fish
  - Increase survey effort following outages
- Next steps:
  - Short term → continue concurrent surveys
  - Long term → carcass tagging or updated expansion

Acknowledgments

- Survey crew
  - Erick Rockwood
  - Mike Blankenship
  - Carson Swart
  - Matt Pellinger
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  - John Serl
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  - Dan Rawding
- Data Management
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