



Pacific Northwest
NATIONAL LABORATORY

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Variations in Habitats and Their Use by Juvenile Salmon in Tidal Freshwater: Implications for Evaluating Restoration

PACIFIC NORTHWEST NATIONAL LABORATORY

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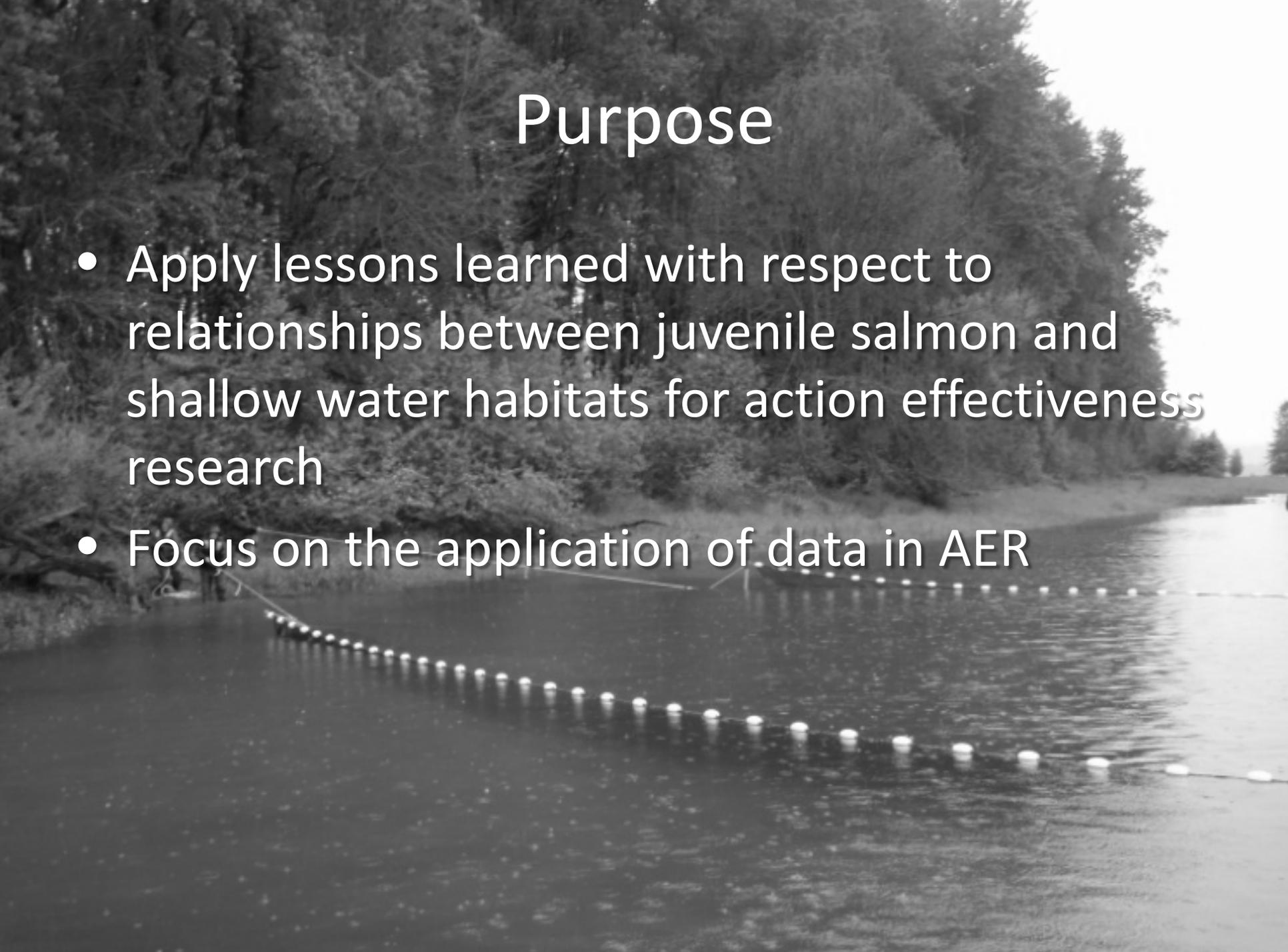
Jeffrey Johnson



**US Army Corps
of Engineers** ®
Portland District

Purpose

- Apply lessons learned with respect to relationships between juvenile salmon and shallow water habitats for action effectiveness research
- Focus on the application of data in AER



Overview

- Sampling approach
- Habitats
- Salmon-habitat linkages
- Genetic stock
- Food web
- Residence time
- Application to action effectiveness

Julia Butler Hansen NWR
&
Tenasillahe Island
rkm 56-58



Lower River Reaches
(LRR)
rkm 110-141



Sandy River Delta
(SRD)
rkm 188-202



0 7.5 15 22.5 30
Kilometers

Habitat Diversity



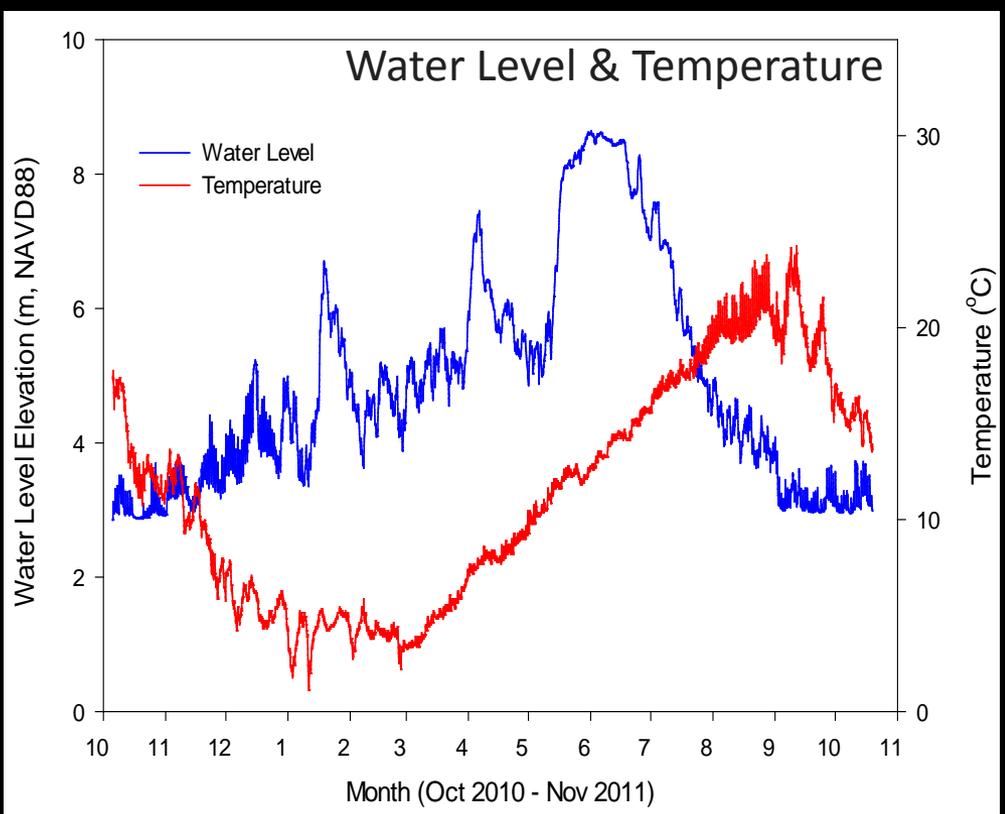
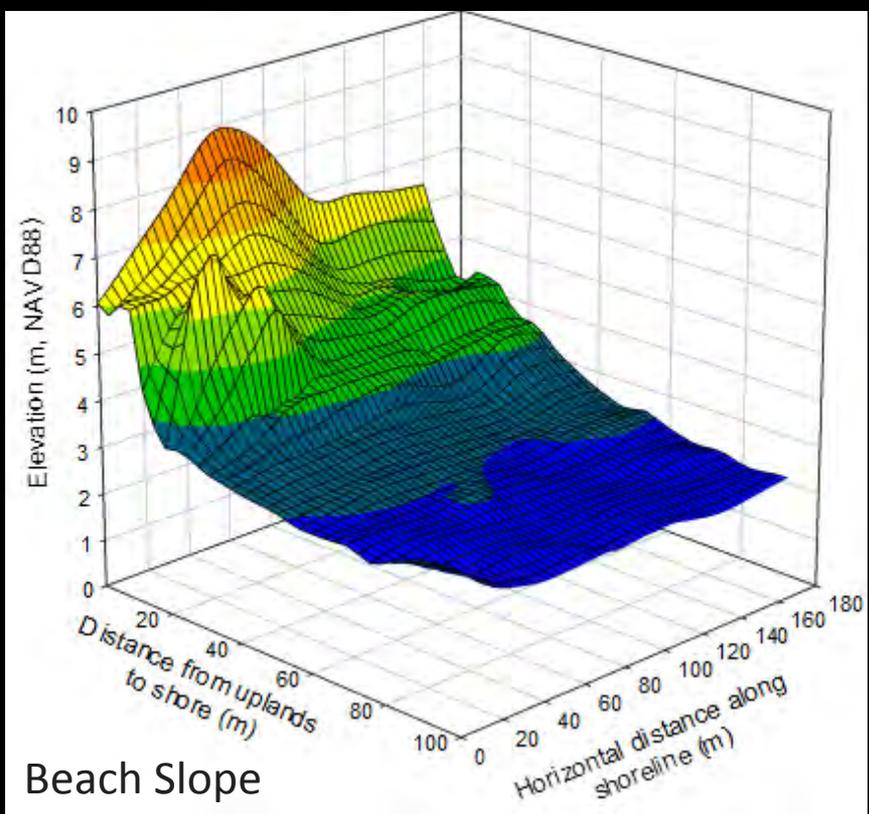
A misty, overcast landscape with bare trees and a body of water. The scene is dimly lit, with a grey, cloudy sky and a foggy atmosphere. The trees are silhouetted against the light, and the water in the foreground is calm and greyish. The overall mood is somber and quiet.

- **Salmon-Habitat Link**

- Genetic Stock

- Food Web

- Residence Time



Environmental Relationships to Unmarked Chinook salmon densities

- SRD
 - Of 21 variables 18 (single variable) or 10 (multiple stepwise) were significant.
 - 3hr temp range, DO
- LRR
 - Of 16 variables 12 or 5 were significant.
 - % bare ground and distance to trees and waters edge
- Relationships were not spatially consistent



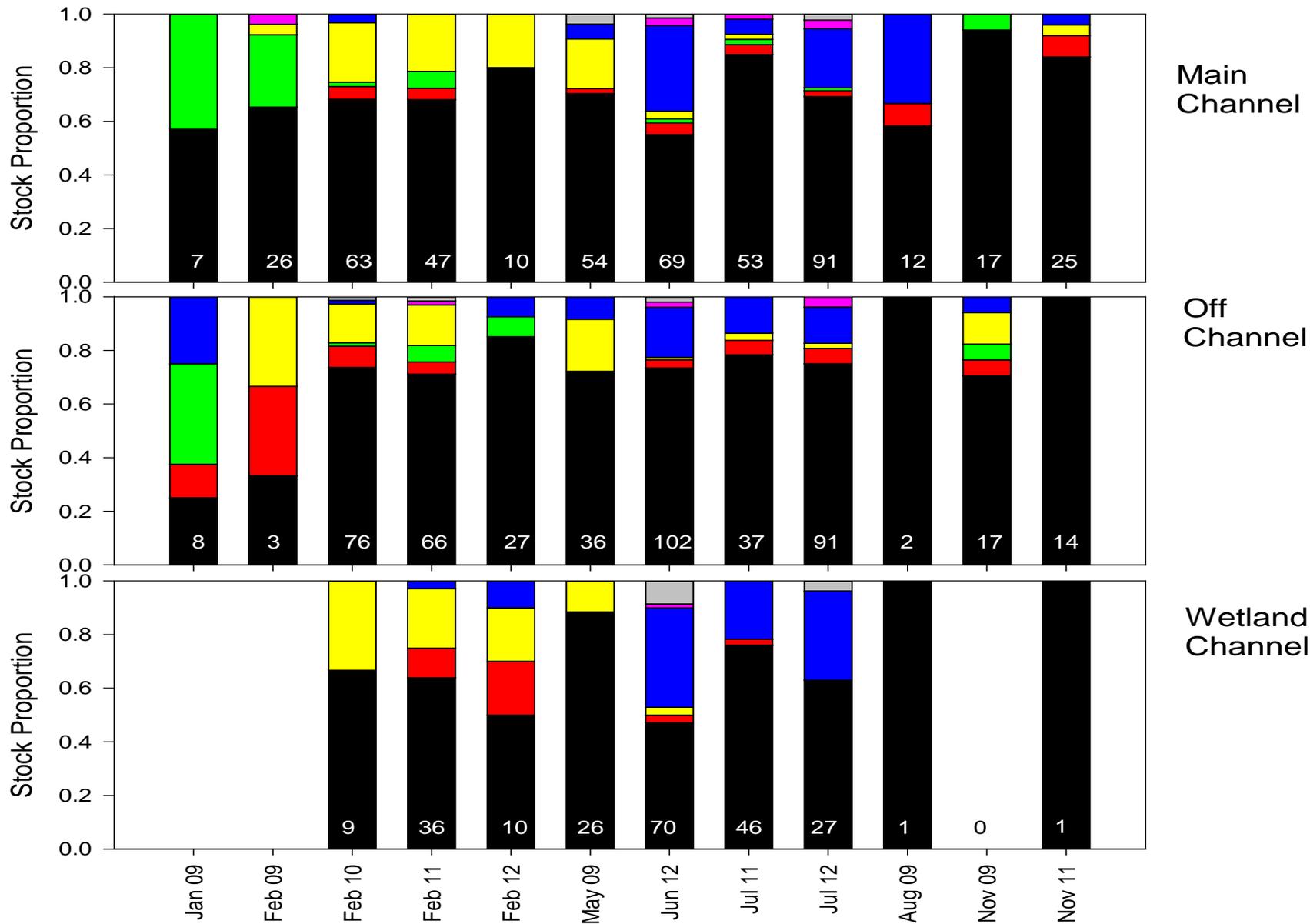
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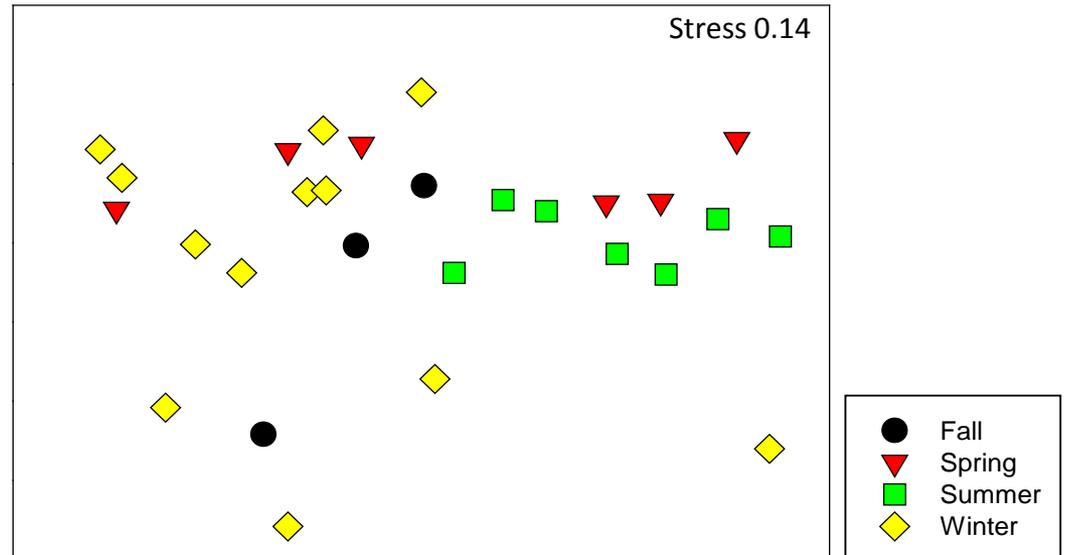
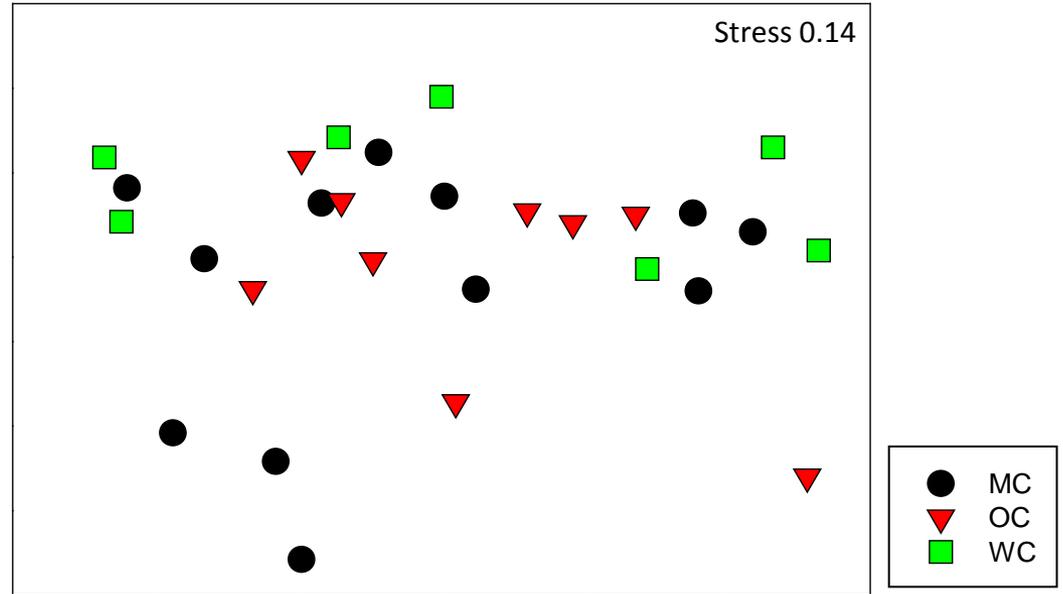


LRR
2009-2012

NMDS

nonmetric multidimensional
scaling

Genetic Stock Proportions



2012



January



June



August



October

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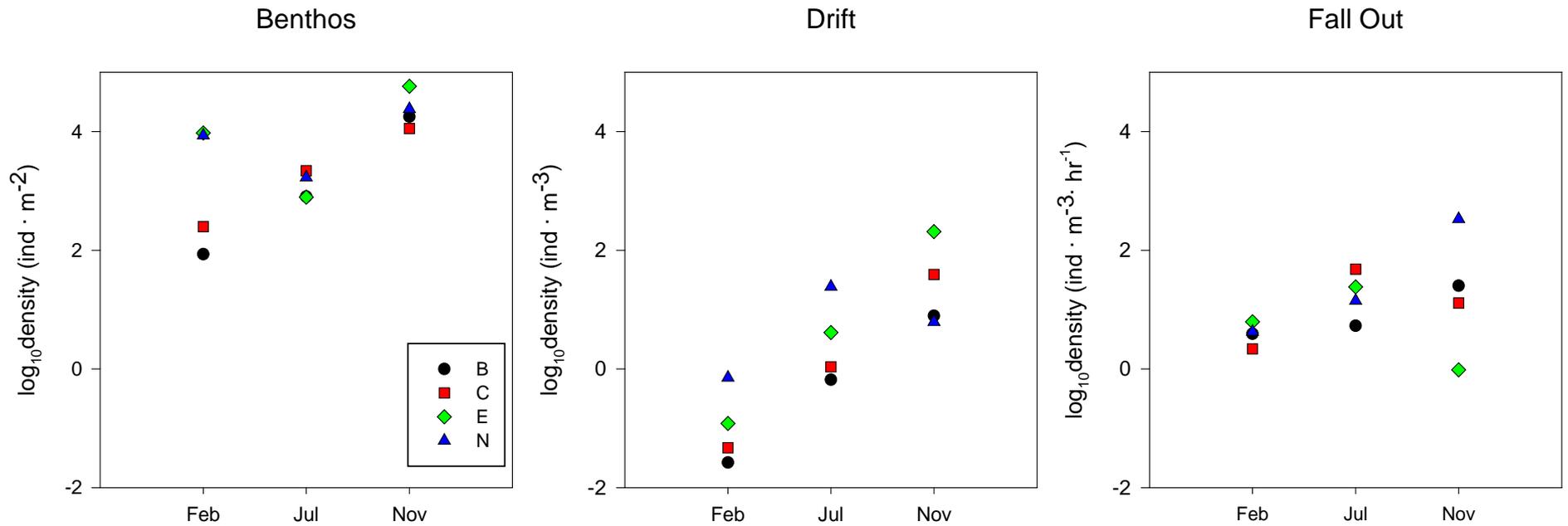
- Salmon-Habitat Link

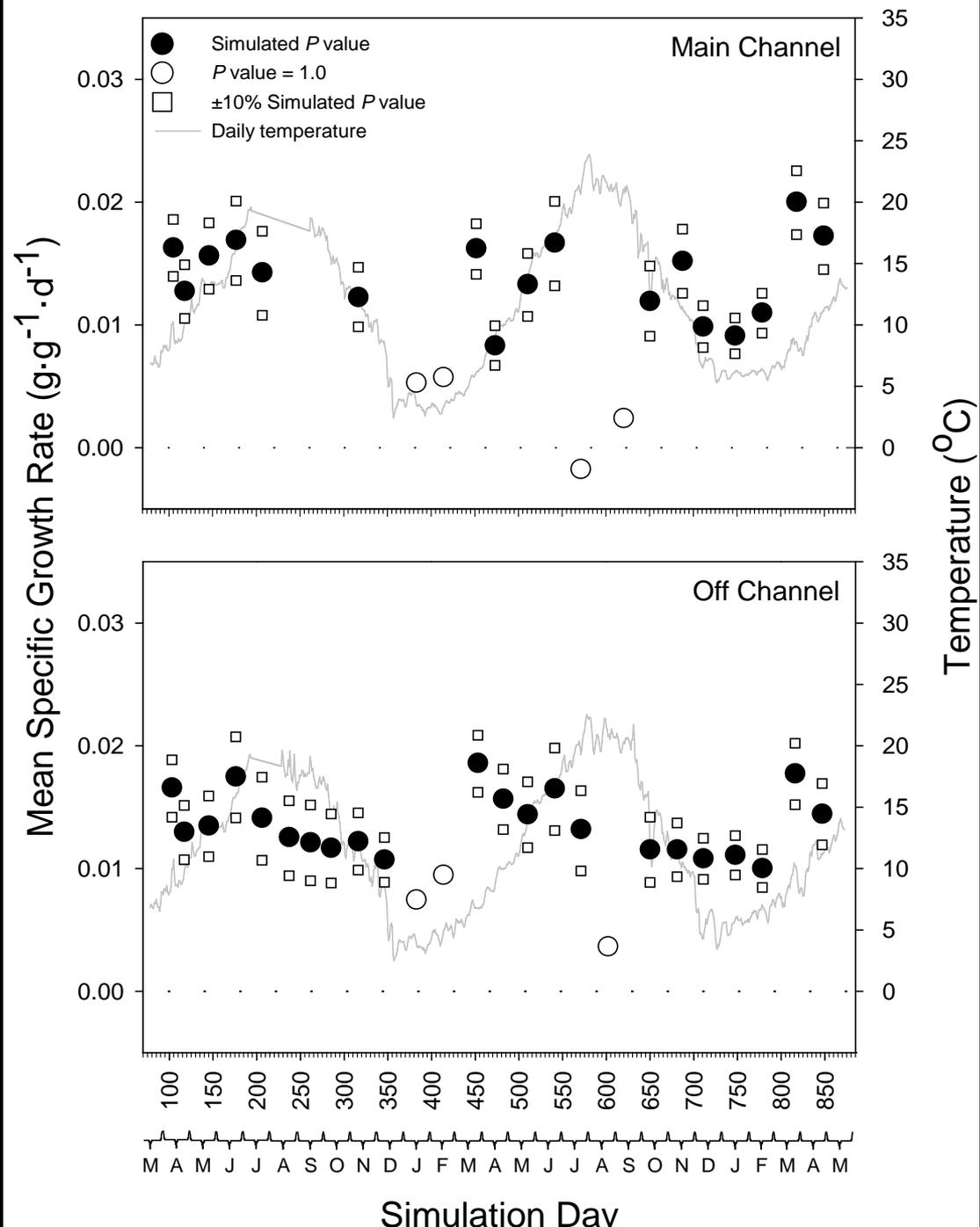
- Genetic Stock

- **Food Web**

- Residence Time

Prey Availability





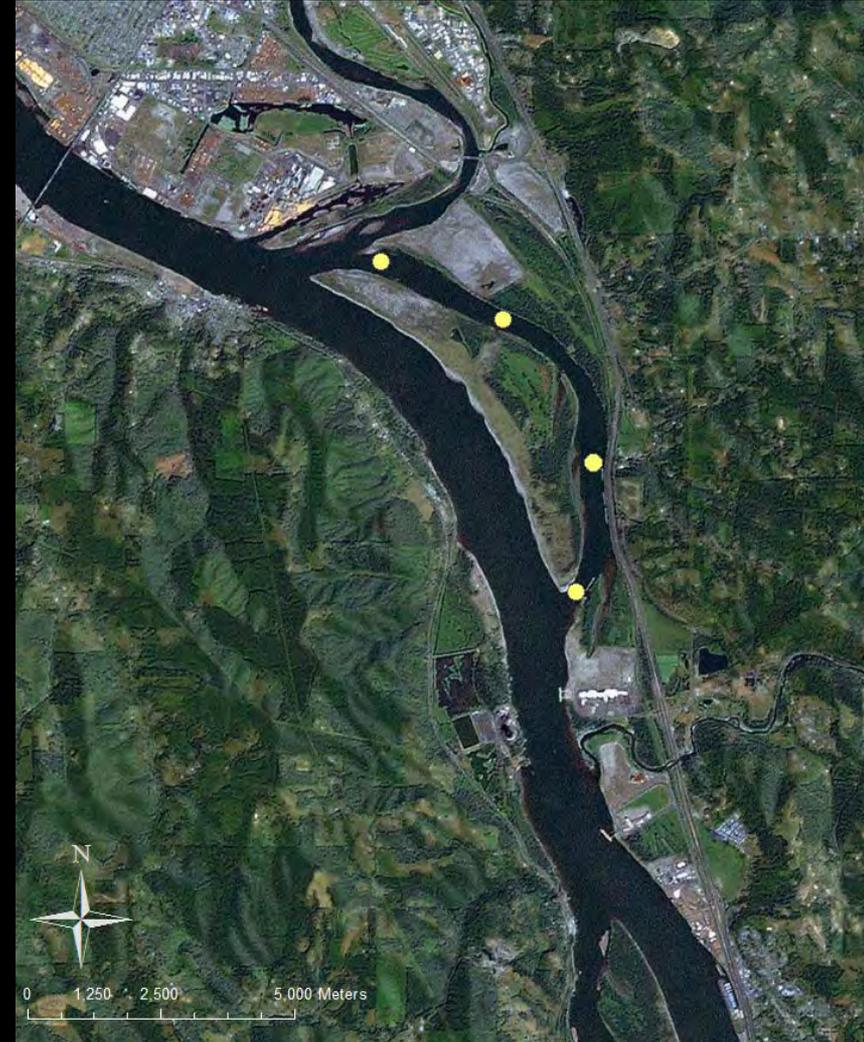
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- Salmon-Habitat Link
 - Genetic Stock
 - Food Web
 - **Residence Time**

Residence Time: Acoustic Telemetry

- February 2012
- Chinook Salmon (n=16)
- Genetic Stock
 - West Cascade fall
 - West Cascade spring
 - Willamette River spring

Residence	Days
Minimum	0.03
Maximum	62.3
Mean	24.1

n=13



Residence Time: PIT Telemetry

- Julia Butler Hansen
 - 2010
 - Tagged fish entering Winter Slough
 - Range: 5-40 d
 - Multiple detections:
 - 32 d between first and last detection



Application to AER

- **Salmon-habitat link**
 - general linkages are apparent and make biologic sense, but preferences for specific habitat types and characteristics are uncertain
- **Genetic Stock**
 - landscape patterns are more discernible than patterns at site or habitat strata scales
- **Food Web**
 - integration of diet and prey informs foraging success and salmon performance
- **Residence Time**
 - a measure of salmon performance informs site fidelity and migration behavior



Summary

- Can structural conditions inform salmon performance?
- Restoration and research goals must be clearly articulated
 - Ecosystem processes vs. salmon performance
 - Opportunity, capacity, realized function
- Evaluating salmon response to ecosystem restoration has been strengthened by the research efforts within the estuary.



Acknowledgements

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