



Fish and Aquatic
CONSERVATION
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Solar Panel Shade Evaluation Study

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Motivation



• Benefits

- ↓ Evaporation = ↑ Water Savings
- ↓ Plant/Algal growth
- ↑ Solar panel performance
- ↑ Water and air quality

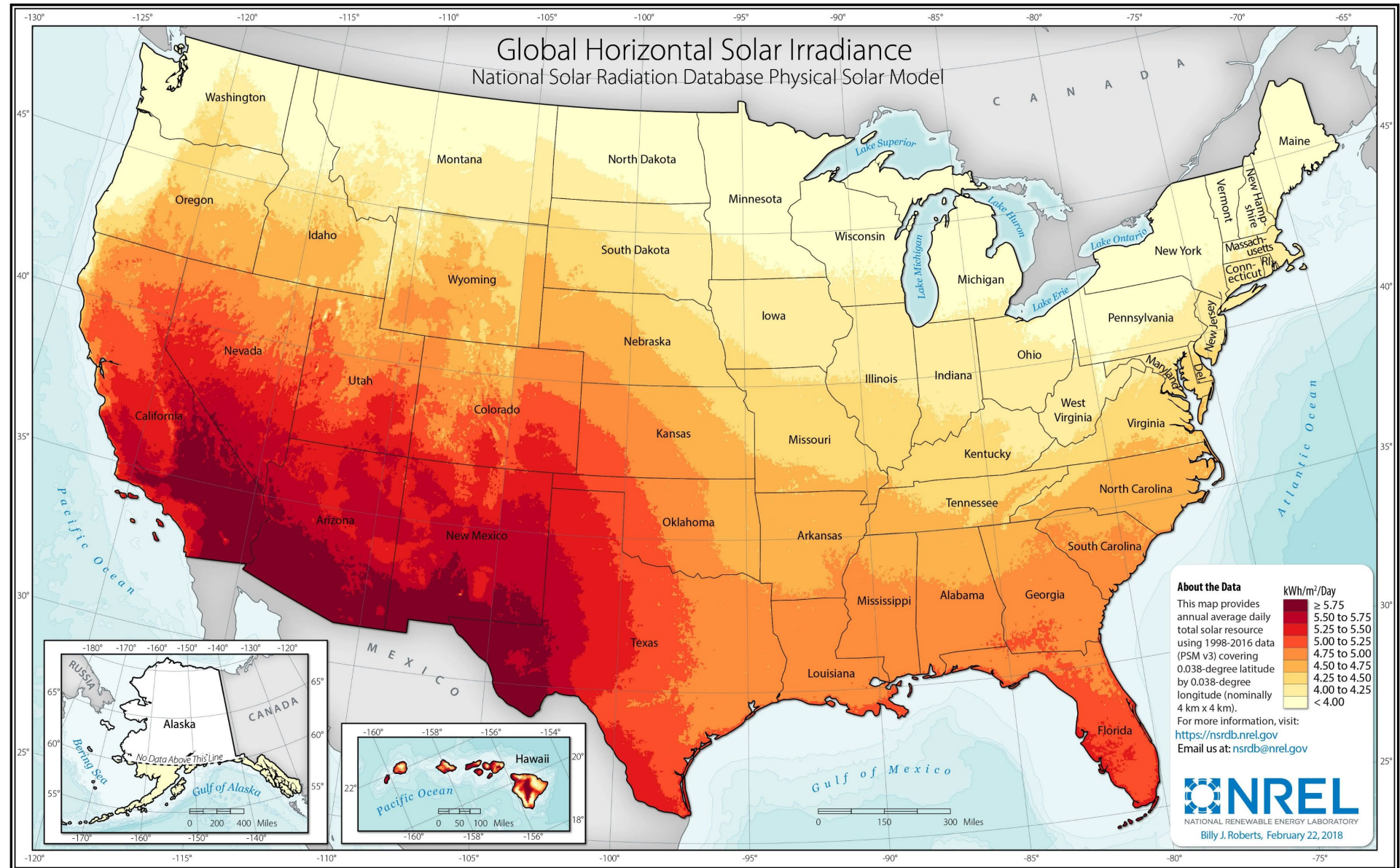


Applications for Fish Hatcheries

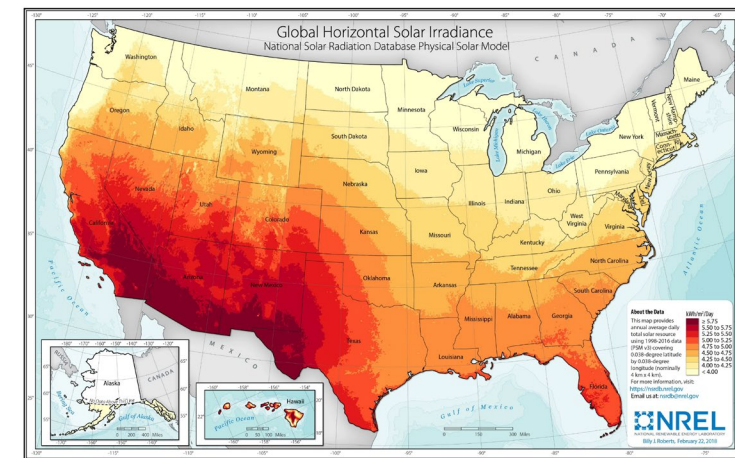
- Hatcheries are water and energy intensive
- Salmonids prefer shade (Meehan et al 1987)
 - UV light factor in steatitis in Steelhead (Twibell et al. 2017)
- Benefits
 - ↓ Evaporation = ↑ Water Savings
 - ↓ Plant/Algal growth
 - ↑ Solar panel performance
 - ↑ Water and air quality
 - ↑ Shading contribute to ↓ steatitis
 - ↓ Electricity costs through power generation



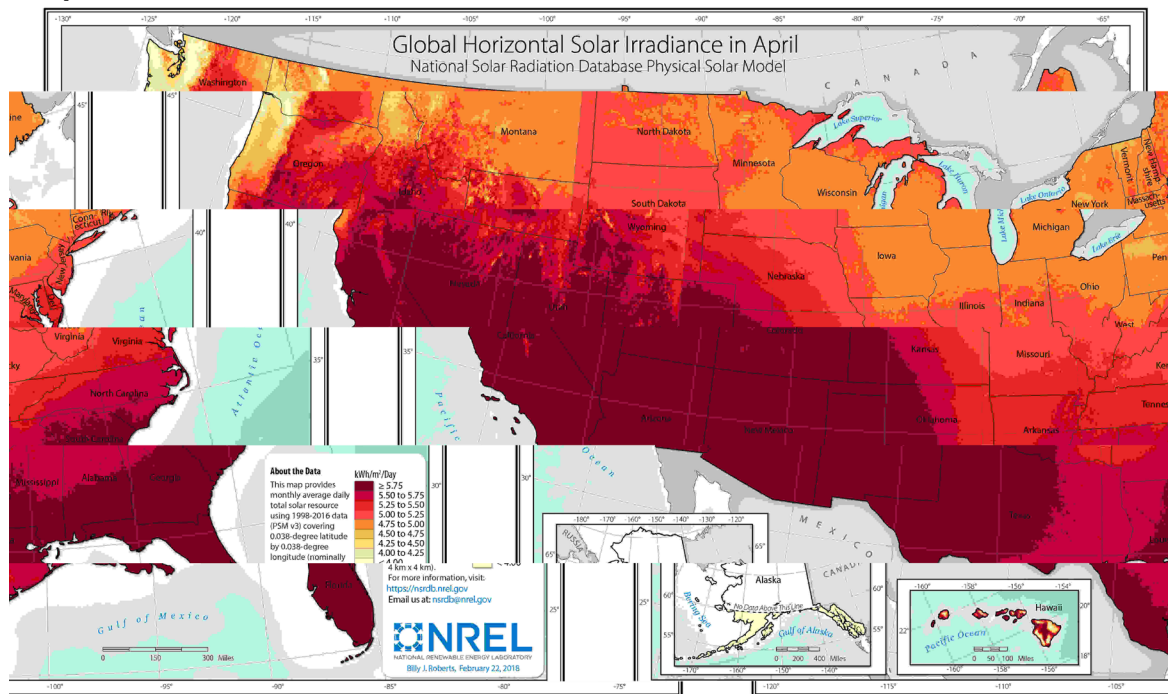
Solar Potential



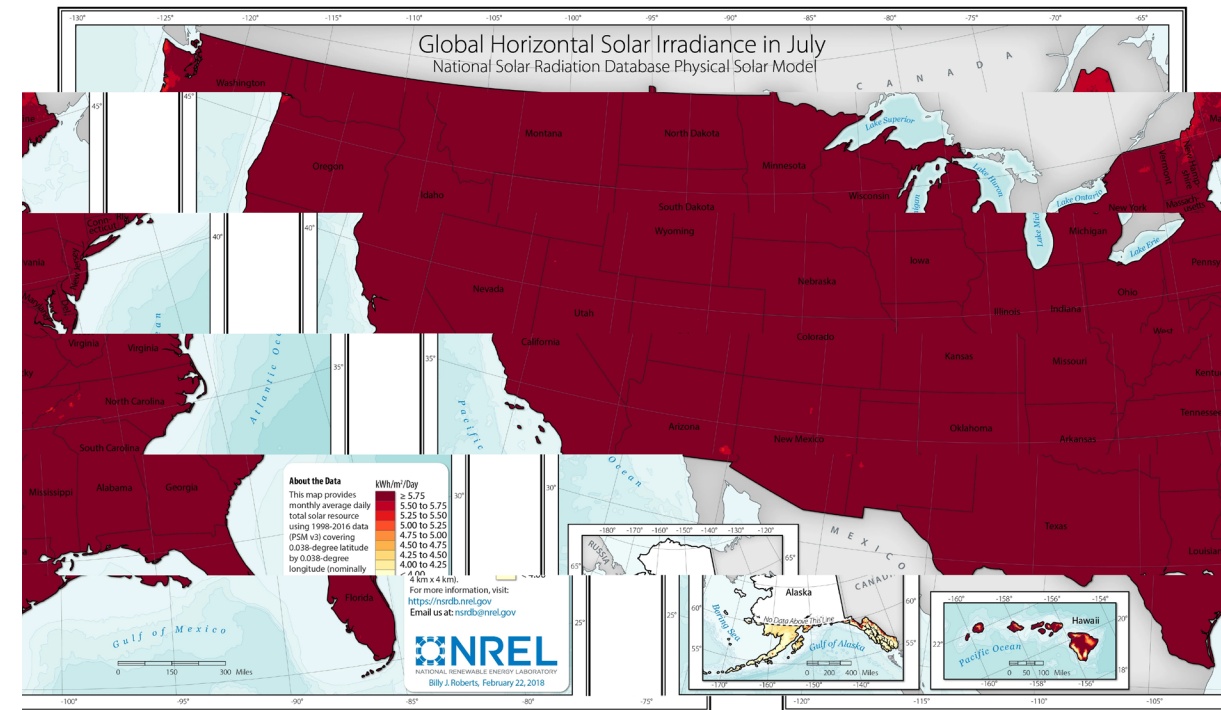
Solar Potential



April



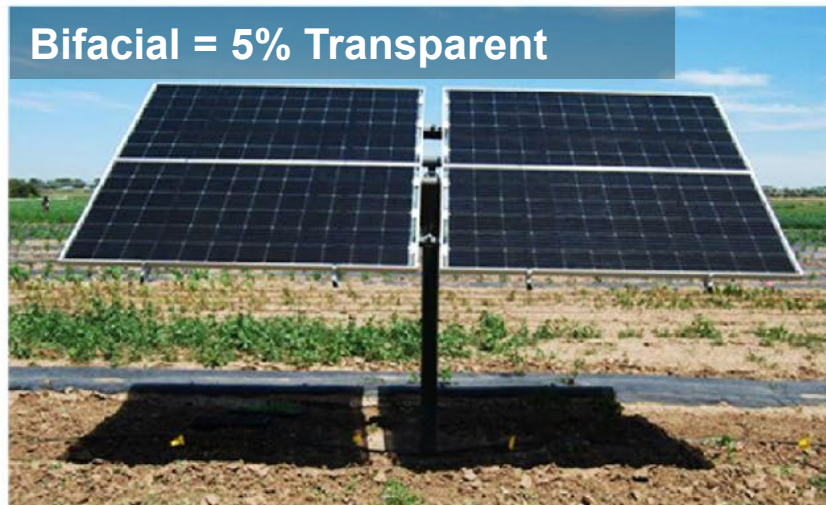
July



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Advancements in Solar Panels

- 2 main types of panels
 - Monofacial- electrical generation on surface facing sun
 - Bifacial- variable transparencies available
 - Electrical generation both sides of panel



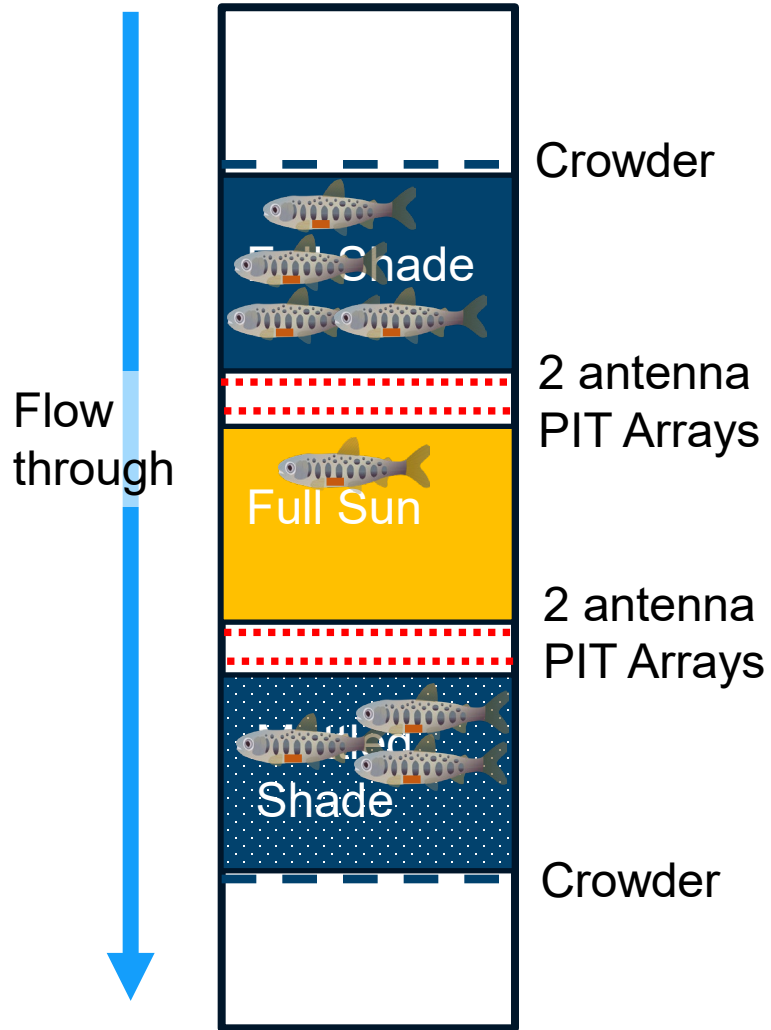
Goal

- Evaluate impact of shading intensity and pattern on fish distribution

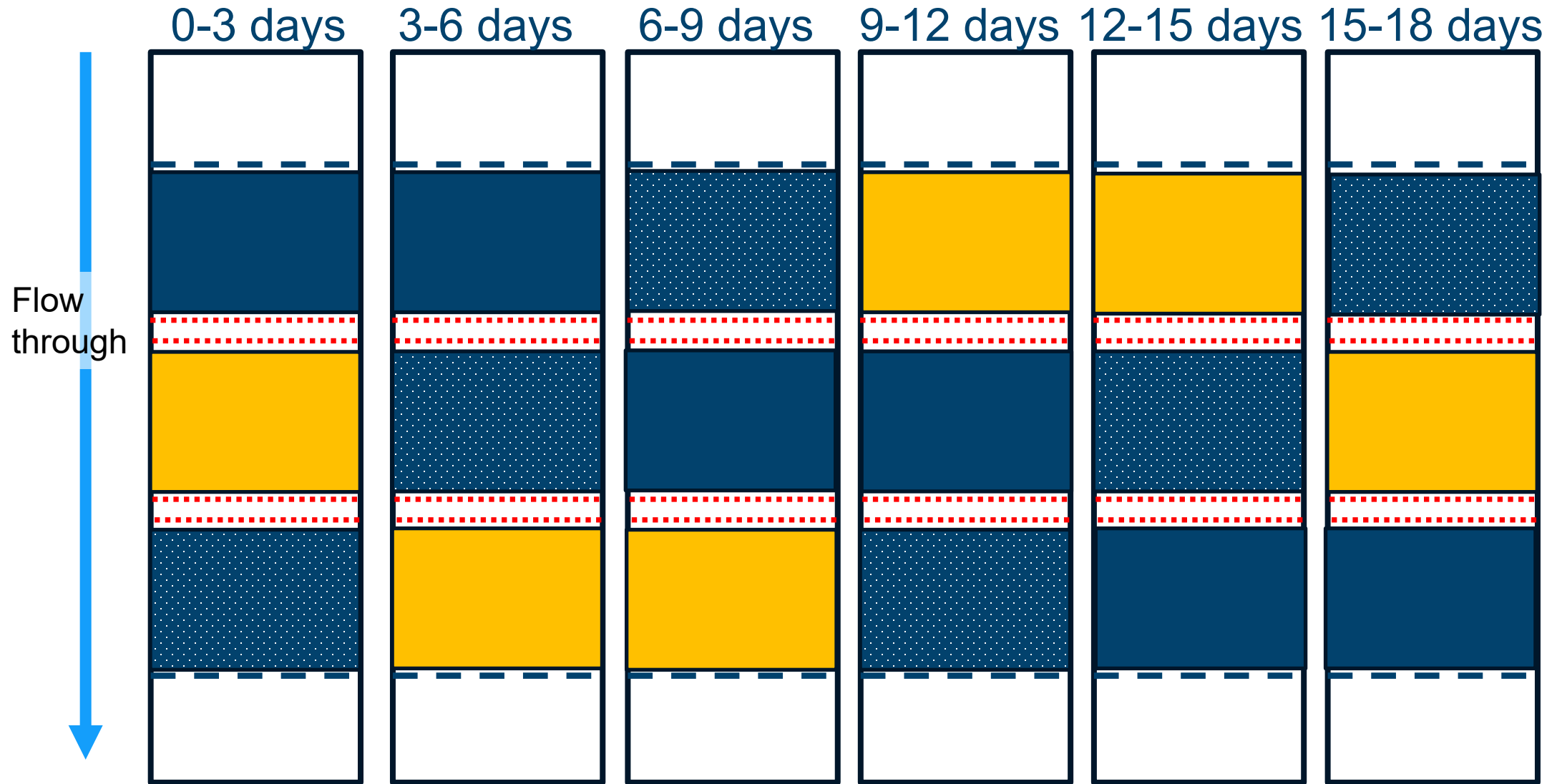


Study Design

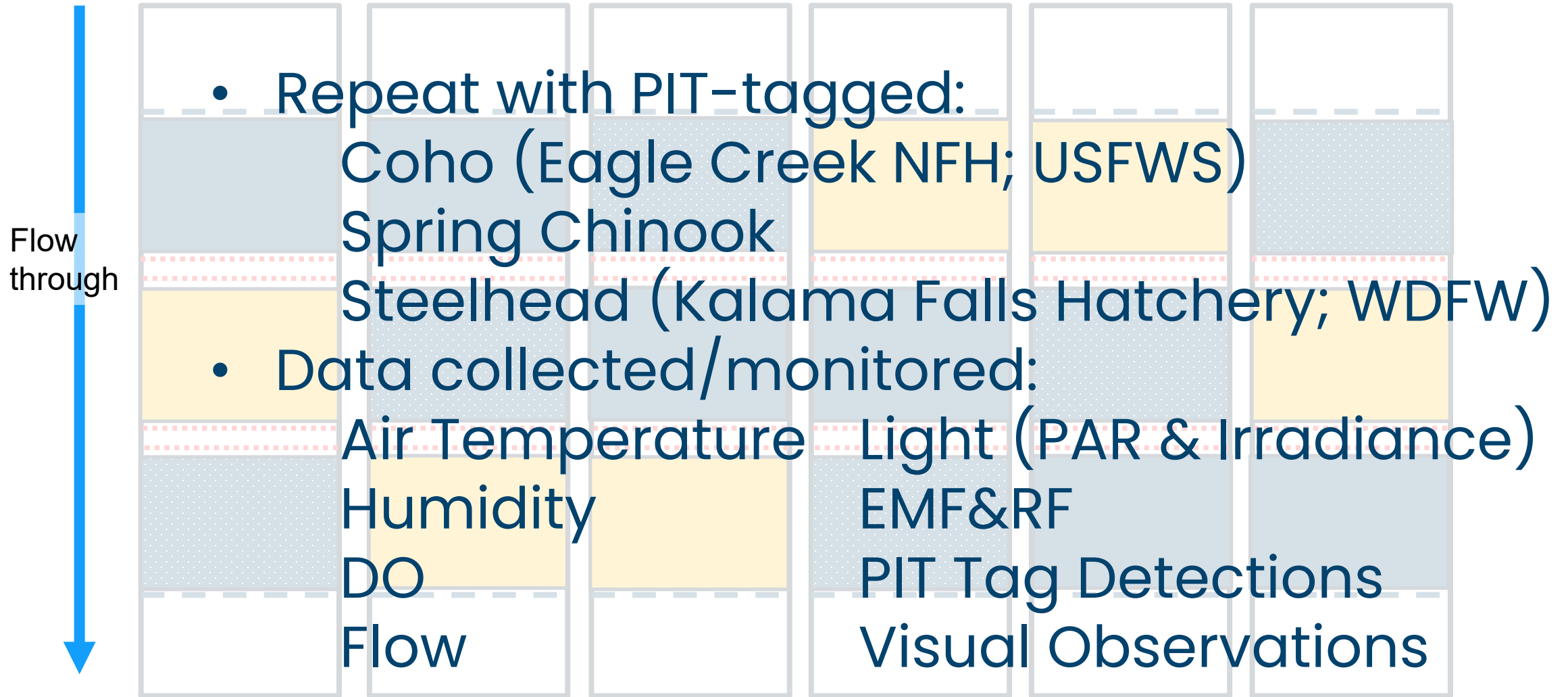
Overhead View



Study Design- Adjust every 3 days

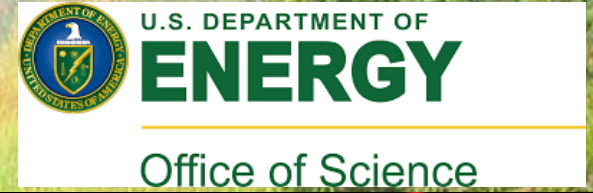
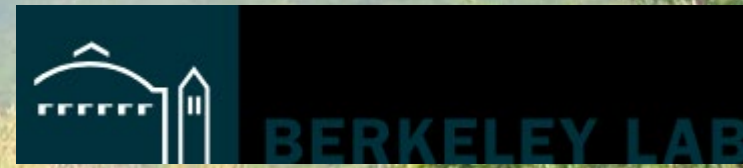


Study Design- Adjust every 3 days



Thank you!

Gerald Robinson (Department of Energy)
Caroline Kreiser (FWS-IMD)
Brian Mijiga (Kiwa PVEL)
Kalama Falls Hatchery Team (WDFW)
Eagle Creek NFH Hatchery Team (USFWS)



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Thiamine Monitoring in the Pacific Northwest

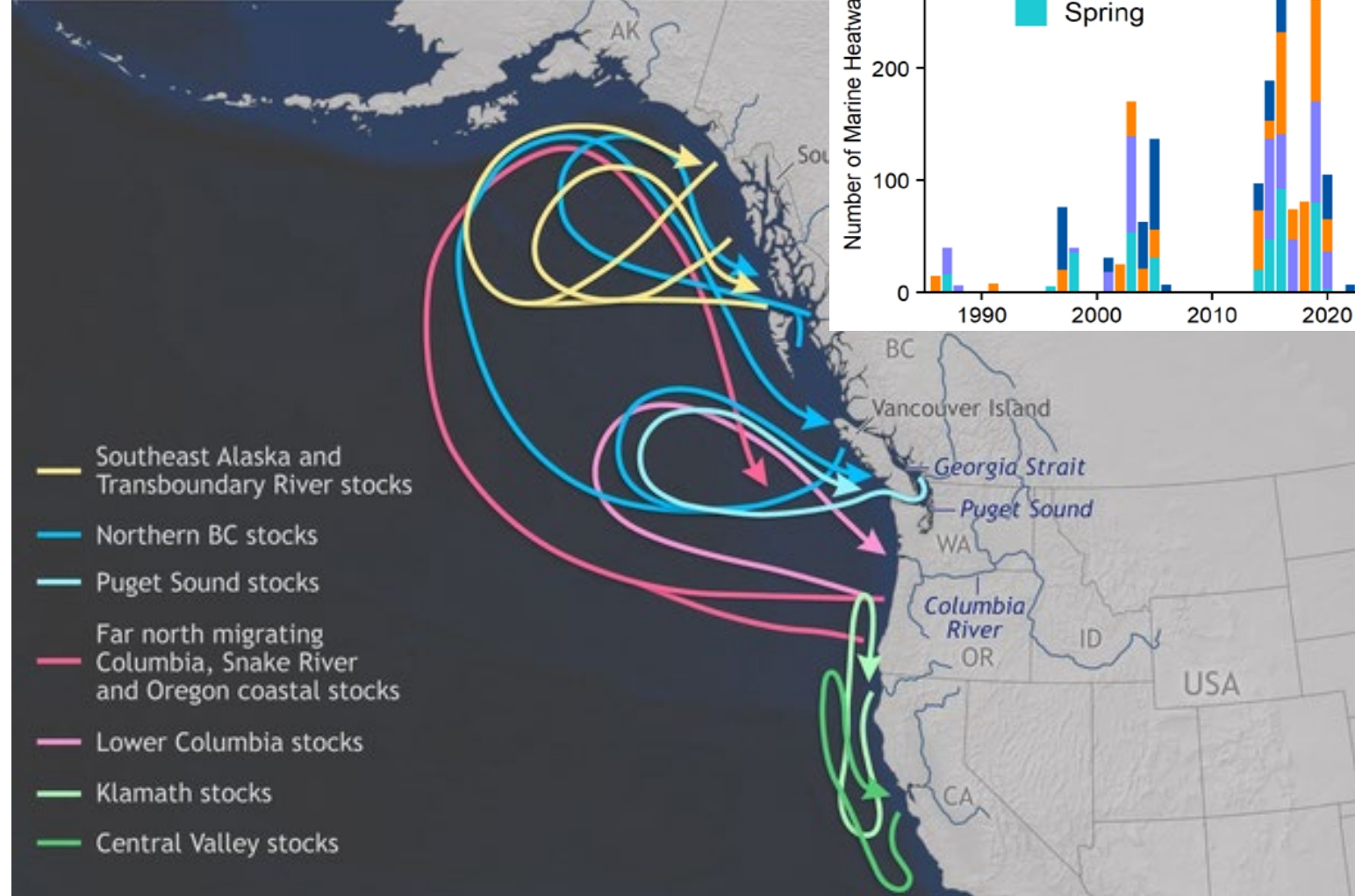
Alison Deary¹

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Thiamine 101

- Essential vitamin
 - Required for metabolism and energy production
 - Building block for neurotransmitters, antioxidants, and myelin
- Thiamine Deficiency Complex
 - Brain tissue necrosis as evidenced by
 - Corkscrew swimming
 - Lethargy
 - Unable to maintain posture
 - Ataxia
 - High early mortality

Salmon migration



NOAA Climate.gov
Data: NOAA Fisheries



Thiamine Analysis Laboratories

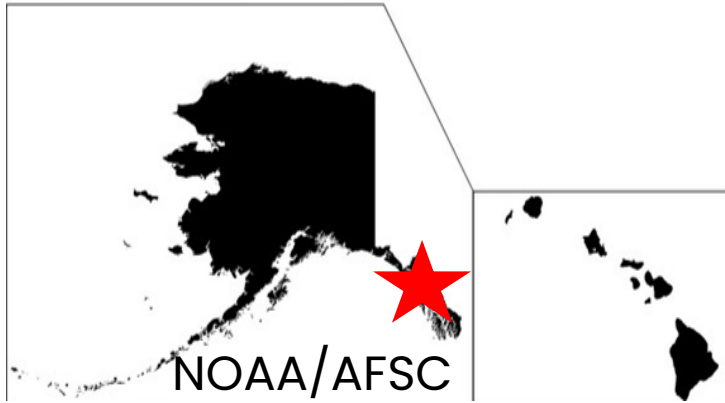
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Jacques Rinchard



USGS/CERC
Columbia, MO
Don Tillitt
Freya Rowland



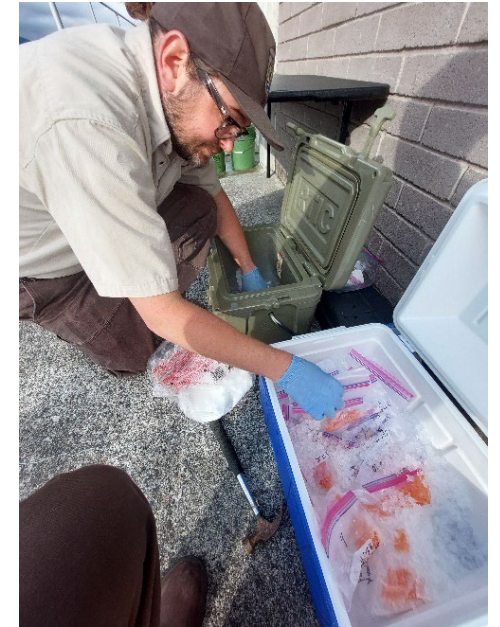
NOAA/AFSC
Juneau, AK
Cody Pinger



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Recent Collections *as of 4/25/2025

1. Winthrop NFH (Winter)- Summer Steelhead, n=30*
2. Carson NFH (8/14)- Spring Chinook, n=30
3. Winthrop NFH (8/14, 8/21, 8/28)- Spring Chinook, n=29
4. Leavenworth NFH (8/20, 8/27)- Spring Chinook, n=30
5. Little White Salmon NFH (8/23)- Spring Chinook, n=30
6. Spring Creek NFH (9/17, 9/24)- Fall Chinook, n=35
7. Makah NFH (9/25, 9/26, 10/2)- Fall Chinook, n=33
8. Quilcene NFH (10/1, 10/15)- Coho, n=25
9. Little White Salmon NFH (10/23, 11/6)- Upriver Bright Chinook, n=32
10. Makah NFH (10/23, 10/30)- Coho, n=32
11. Eagle Creek NFH (11/6)- Coho, n=32
12. Quinault NFH (10/31, 11/12)- Coho, n=35
13. Quinault NFH (10/31, 11/12)- Winter Steelhead, n=30
14. Quinault NFH (10/31)- Chum, n= 32
15. Makah NFH (12/10, 1/7/25)- Winter Steelhead, n=30
16. Dworshak (Winter '25)- Summer Steelhead, n=6*



Challenges

- Recent staffing reductions
 - Similar staffing reductions at NOAA and USGS labs that analyze for thiamine
- Purchase card freeze during Dworshak spawning

