

AN OVERVIEW OF THE ECOSYSTEM MONITORING PROGRAM AND INTRODUCTION TO TABLEAU FOR DATA SHARING AND SYNTHESIS (18 YRS!)

OCTOBER 2023

SCIENCE WORK GROUP MEETING



Lower Columbia
Estuary
Partnership

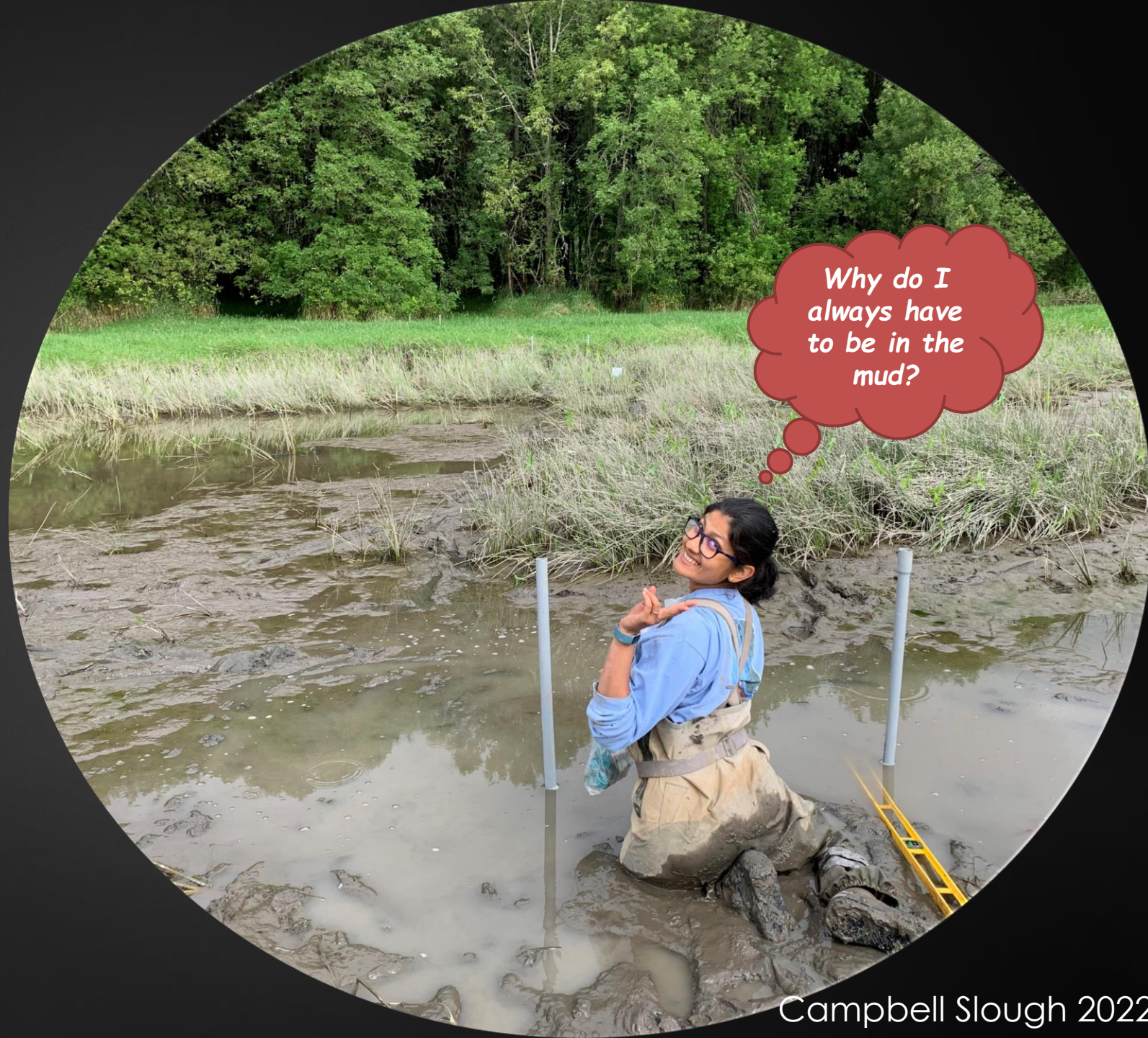
SARAH KIDD, PHD

IAN EDGAR

SNEHA RAO

OUTLINE OF TALK

- ▶ Introduction to the EMP and AEMR programs
- ▶ Brief overview of data collection
- ▶ The 2023 EMP Report -- with Examples
- ▶ Next Steps regarding Data Management and the future goals of the EMP program



Campbell Slough 2022

RESEARCH GOALS – PROGRAM LEVEL

Ecosystem Monitoring Program (EMP)

- Status and trends monitoring of ecosystem condition – suite of reference sites throughout the estuary

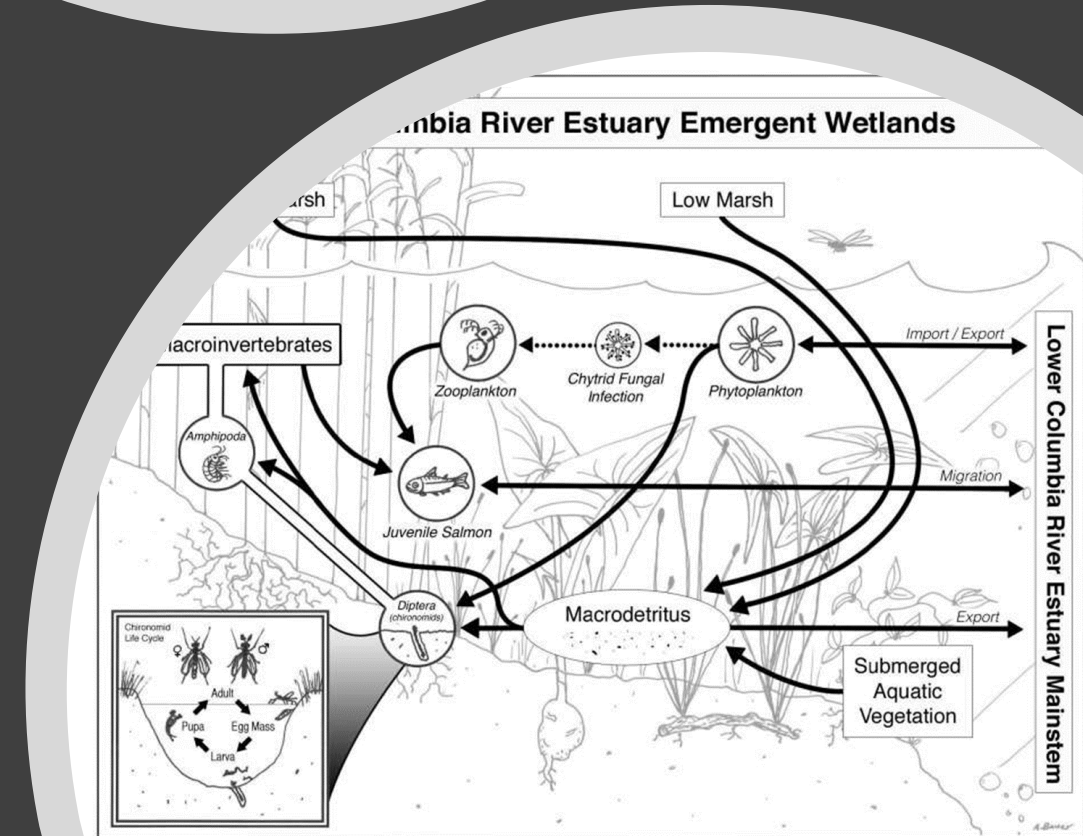


Action Effectiveness Monitoring & Research Program (AEMR)

- Evaluation of restoration actions- if projects achieve the goals of the project, inform adaptive management

Overarching Goals

- Improve our understanding of the ecology of the estuary so we may continue to inform and improve our restoration and conservation efforts!



ECOSYSTEM MONITORING PROGRAM

SALMONID HABITAT MONITORING PROGRAMS

EMP = Ecosystem Monitoring Program - Methods [here](#)

- ✓ Mainstem and Abiotic Site Conditions - **Joe Needoba (OHSU)**
- ✓ Habitat Structure, Hydrology, Soils, Sediment Accretion, Detritus - **Sarah Kidd, Sneha Rao, Ian Edgar (LCEP)**
- ✓ Food Web, e.g., Planktonic and Macrophyte contributions to Juvenile Salmon Food Web - **Tawnya Peterson (OHSU)**
- ✓ Fish Prey and Macroinvertebrate Community - **Jeff Cordell, Jason Toff, Kerry Accola (UW)**
- ✓ Fish Community and Occurrence - **(NOAA) Curtis Roegner, Susan Hinton, Jeff Grote, Paul Chittaro, Dan Lomax**
- ✓ Critical Field, Lab Support, UAV pilot - **April Silva, Narayan Elasmr (CREST)**



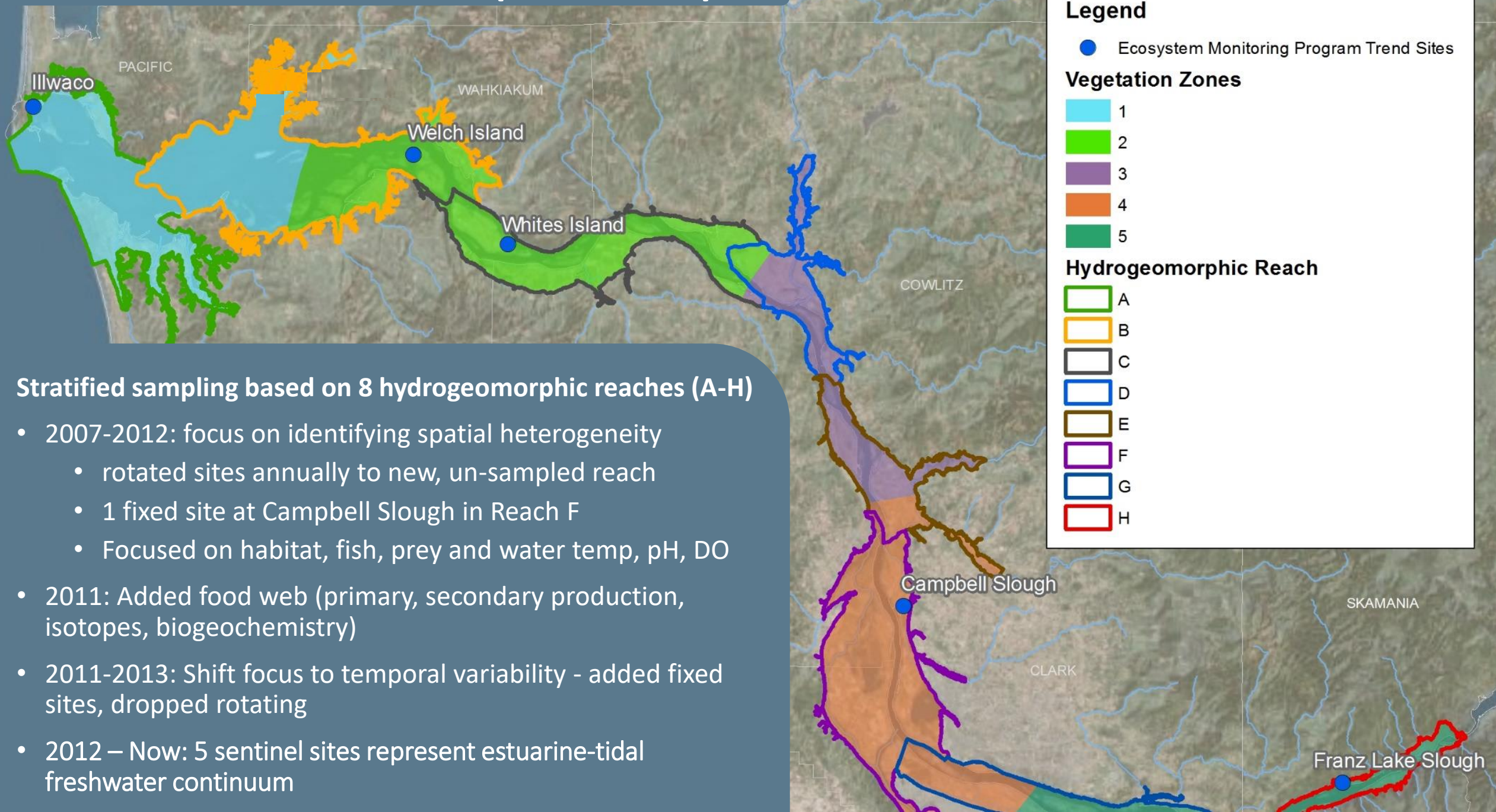
ACTION EFFECTIVENESS MONITORING RESEARCH PROGRAM

AEMR = Selected sites (Level 2) receive Full Habitat surveys – Pre, 1, 3, 5 and 10 yrs. post-restoration – Methods [here](#)
All sites (Level 3) receive Basic Hydrology and Sediment Accretion Monitoring Years 1-5, 10 yrs. post-restoration

- ✓ **Habitat Structure, Hydrology, Soils, Sediment Accretion** - Sarah Kidd, Sneha Rao, Ian Edgar (LCEP)
- ✓ *Spot Check of Macroinvertebrate Community* - Jeff Cordell, Jason Toft, Kerry Accola (UW)
- ✓ *Spot Checks at Year 5 and 10 Post - Fish Community and Occurrence* - (NOAA) Curtis Roegner, Susan Hinton, Jeff Grote, Paul Chittaro, Dan Lomax
- ✓ Critical Field, Lab Support, UAV pilot - April Silva, Narayan Elasmr (CREST)

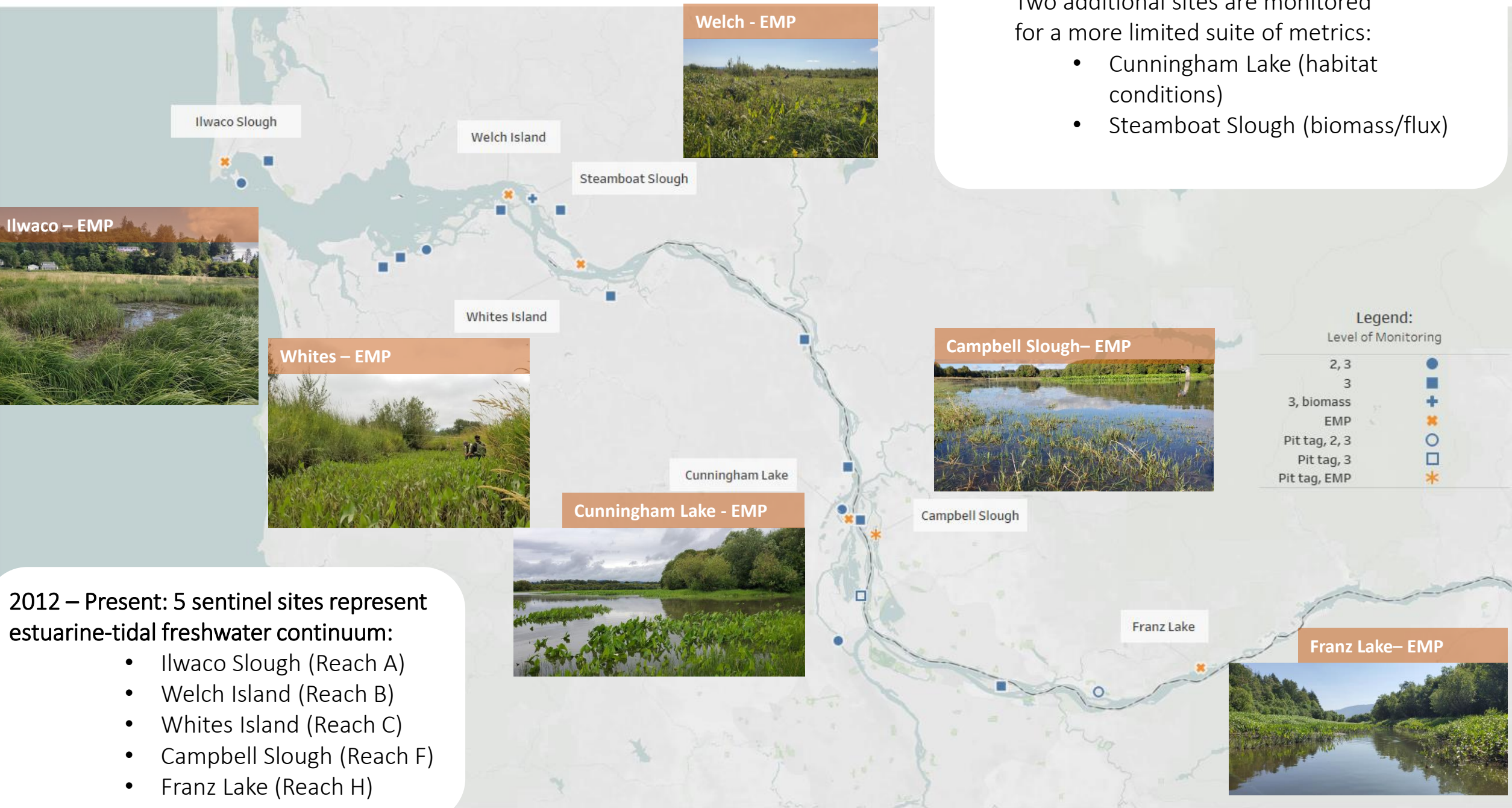


EMP SAMPLING TIMELINE (2005-Now)



Stratified sampling based on 8 hydrogeomorphic reaches (A-H)

- 2007-2012: focus on identifying spatial heterogeneity
 - rotated sites annually to new, un-sampled reach
 - 1 fixed site at Campbell Slough in Reach F
 - Focused on habitat, fish, prey and water temp, pH, DO
- 2011: Added food web (primary, secondary production, isotopes, biogeochemistry)
- 2011-2013: Shift focus to temporal variability - added fixed sites, dropped rotating
- 2012 – Now: 5 sentinel sites represent estuarine-tidal freshwater continuum



Two additional sites are monitored for a more limited suite of metrics:

- Cunningham Lake (habitat conditions)
- Steamboat Slough (biomass/flux)

2012 – Present: 5 sentinel sites represent estuarine-tidal freshwater continuum:

- Ilwaco Slough (Reach A)
- Welch Island (Reach B)
- Whites Island (Reach C)
- Campbell Slough (Reach F)
- Franz Lake (Reach H)

Tableau Integration in the Ecosystem Monitoring Program



75+ Sites with over a decade of data

Excluding drone datasets, over 15gb of raw data.
>10tb of drone data



Habitat

Hydrology

- 10+ million datapoints

Sediment Accretion

- 8000+ datapoints



Food Web

Vegetation and Soil

- 10+ million datapoints

Biomass

- 20,000+ datapoints



Drone

Multispectral

- Each flight > 7,000 high-res pics

LiDAR

- 100+ million datapoints per site



Animals

Macroinvertebrates

- 10,000+ datapoints

Fish

- 40,000+ datapoints



Others

Zooplankton

Isotope analyses

Nutrients









Tableau

- ✓ **Data Visualization** Software with advanced **analysis** capabilities
- ✓ **No data limits**
- ✓ Automatically creates underlying PostgreSQL database
- ✓ **In-memory** data engine optimized for **large** and **complex** data structures
- ✓ Use databases across multiple projects; no information repeating required
- ✓ **No required coding knowledge/ Low barrier for entry**
- ✓ Easy Data Visualization and Analysis - **Can import/use R and Python code** and pivot inside Tableau
- ✓ Includes **Geospatial** Data Management, **Mapping**, and Analysis
- ✓ **Easy collaboration** and sharing of results
- ✓ No Application Required (can be used via web browser)
- ✓ Cost: Varies – but can be **FREE for most collaborative needs**
- ✓ Replaces and/or compliments written reports

More info: <https://www.tableau.com/why-tableau/what-is-tableau>



 Tableau Desktop	 Tableau Public	 Tableau Reader
		
Desktop (Personal) = Varies Online (Professional) = Varies	Desktop Application is completely free of cost!	Desktop Application is completely free of cost!


2023 EMP Hybrid Report

- ▶ Combination of written report and Tableau dashboard
- ▶ Written report includes
 - ▶ **Brief Executive Summary**
 - ▶ **Background and Methods, static results and discussion**
 - ▶ **Links to tableau dashboards**
- ▶ Tableau Dashboards
 - ▶ Standalone tableau dashes for research focus showing detailed results and discussions
 - ▶ All dashes are interlinked, allowing for easy navigation
- ▶ **New Standalone:** Protocols for Monitoring Juvenile Salmonid Habitats in the Lower Columbia River

Lower Columbia River Estuary Ecosystem Monitoring Program Overview Dashboard by [Ecosystem Monitoring Program](#)

Welcome to the Ecosystem Monitoring Program Overview Dashboard

Click on the beautiful sneezeweed below to see the written report.



Lower Columbia River Ecosystem Monitoring Program Hybrid Tableau Report

Citation: Kidd, S.A., Edgar, I., Rao, S., Accola, K., Cordell, J., Chittaro, P.M., Grote, J., Hinton, S.A., Needoba, J.A., Peterson, T.D., Roegner, C., Toft, J.D., Borde, A.B., Corbett, C.A., Cook, L.P., Cullinan, V.I., Fuller, R.N., Hanson, A.C., Kuligowski, D., Lomax, D., Johnson, L.L., McNatt, R., Poppe, K., Zimmerman, S.A., Ylitalo, G.M., et al. 2023. Lower Columbia River Ecosystem Monitoring Program Annual Report for Year 17 (October 1, 2021 to September 30, 2022). Prepared by the Lower Columbia Estuary Partnership for the Bonneville Power Administration.

This Dashboard Provides all the Overview and Results Links. Click any of the buttons below to access more data.


Ecosystem Monitoring Program Overviews Can Be Found Below
(Click on Overview of Interest)

- [Navigate to Executive Summary](#)
- [Navigate to Program Background](#)
- [Navigate to Site Descriptions](#)

Ecosystem Monitoring Program Focal Research Topic Overviews Can Be Found Below
(Click on Metric of Interest)

- [Navigate to Mainstem and Abiotic site conditions](#)

Lower Columbia River Ecosystem Monitoring Program
Annual Report for Year 17



Lower Columbia River Ecosystem Monitoring Program Annual Report for Year 17

BPA Project Number: 2003-007-00

Report covers work performed under BPA contract # 80237

Report was completed under BPA contract # 90999

Report covers work performed from: October 2022 – September 2023

Technical Contacts: Sarah Kidd & Ian Edgar

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PROTOCOLS FOR MONITORING JUVENILE SALMONID HABITATS IN THE LOWER COLUMBIA RIVER ESTUARY



Monitoring Protocol Progression Timeline



2018: SWG Meeting: Initiated protocol refinement; enhanced WSE & Temp data collection methods.



2019: SWG meeting - dived deep into Roegner protocol modifications; incorporated CREST best practices through April Silva's work.



2020: SWG meetings - Explored UAV integration for advanced data collection; updated community on progress despite pandemic delays.



2021: Continued refinement in SWG meeting; adjusted finalization target to Fall.



2022: Integrated EMP Research Methods, SWG and ERTG meeting updates provided.



PROTOCOLS FOR MONITORING JUVENILE SALMONID HABITATS IN THE LOWER COLUMBIA RIVER ESTUARY



Comprehensive guide on ecological methodologies used in the Lower Columbia.



Expert contributions from a diverse set of authors.



A go-to resource for the future of ecological assessments.



PROTOCOLS FOR MONITORING JUVENILE SALMONID HABITATS IN THE LOWER COLUMBIA RIVER ESTUARY

WHAT IS THIS DOCUMENT?

- ▶ Critical update with technical details for all methods used through the AEMR and EMP programs (and beyond)
- ▶ Does not dramatically alter any existing methods – but provides best practice and technical recommendations and context for improved application

Next Steps:

- ▶ Version one is completed!
- ▶ Solicited feedback from the research and monitoring community, incorporate this feedback into V2
- ▶ Plan a follow-up workshop to discuss protocols
- ▶ Continue to update MonitoringMethods.org as appropriate

Lead Editors

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1 - Lower Columbia Estuary Partnership

2 - Columbia River Estuary Study Taskforce

3 - Northwest Fisheries Science Center, NOAA-National Marine Fisheries Service

4 - Ocean Associates, Inc

5 - Oregon Health & Science University

6 - University of Washington


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Ecosystem Monitoring Program

Lower Columbia Estuary Partnership | Portland, Oregon, United States

In order to restore and protect Columbia River habitats, we need to know on-the-ground conditions. Our monitoring programs help us better understand river conditions and increase the effectiveness of our...

[Read more](#)

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Lower Columbia River Estuary
Ecosystem Monitoring Program



Macroinvertebrate Communities



Fish Communities



Habitat Structure

USE OF TABLEAU FOR REPORTING AND DATA SHARING

salesforce

tableau public

Create ▾

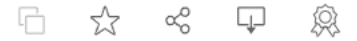
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WASHINGTON

Tableau Engagement

- ▶ Toggle between metrics to answer your question.
- ▶ Toggle between maps, years, and parameters to answer your question.
- ▶ This is showing river discharge at Bonneville Dam



2. Mainstem Conditions



SUMMARY: 2022

River Discharge

- spring freshet was large, peaking in mid-June
- winter flows were average
- spring flow prior to the freshet were below average
- summer flows were average

River Temperature

- The number of days with average temperatures exceeding 19oC (n=55) was similar to the long-term average

River Discharge Results

The graphs below show daily averaged river discharge at Bonneville Dam, Beaver Army Terminal (River Mile 53), and the difference between the two (i.e., river discharge associated with the Willamette River, the largest tributary on the Columbia). iver discharge volumes observed in 2022 are shown in red. For comparison to other years, click on the boxes in the legends to the right of the figures.

At Bonneville Dam (i.e., Columbia River flow without contributions from the Willamette River or other tributaries downstream of the dam), river discharge was close to the 2009-2022 average during the winter months; after mid-March flows were lower than average and reached minimum values for the time period in mid-April. Flows increased from early and peaked in mid-June at volumes close to the long-term maximum observed in 2017. The decline in river discharge following peak flows was steeper than in 2017, but flow remained above average through the end of August after which they were close the long-term average.

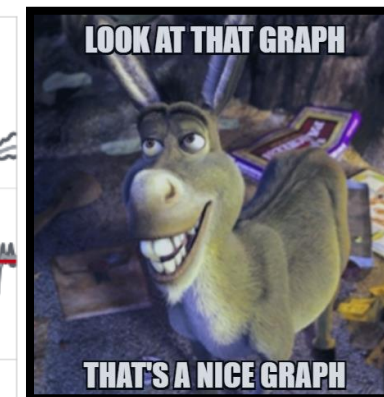
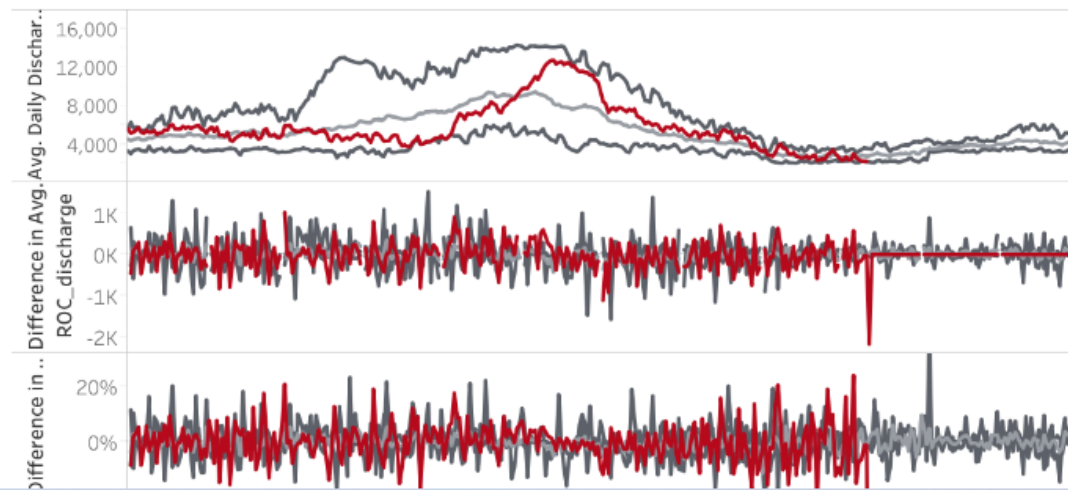
At Beaver Army Terminal (BAT) winter flows were higher than average in January 2022, but declined to average and then below-average values from mid-January to the end of February. Aside from a peak in early March, flows were below average until early-mid May at the onset of the spring freshet. Peak flows at BAT were observed in mid-June, similar to observations at Bonneville Dam. Similar to discharge volumes at Bonneville, flows at BAT were approximately average through September.

The difference between observations at Bonneville Dam and at BAT approximates flow associated with the **Willamette River**. River discharge associated with the Willamette was higher than average during a few peaks in winter and spring (early January, early March, early May and early June) and was otherwise close to or below average values observed between 2009-2022.

Discussion

The 2022 water year was characterized by periods of high pluvial flow associated with the Willamette River in the winter, below average flows in the early spring, and higher-than-average flows associated with the spring freshet, which peaked in mid-June.

River discharge at Bonneville Dam



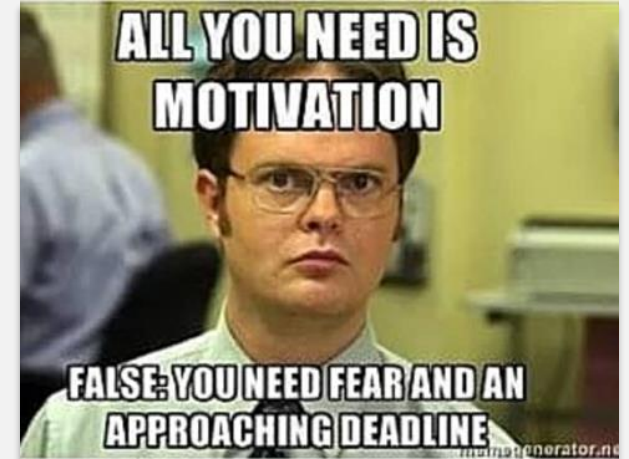
- ☒ 2022
- ☒ average
- ☒ maximum
- ☐ minimum

[Return to Welcome Page](#)[Navigate to Section 1 - Sampling Effort](#)[Navigate to Section 3 - Abiotic Site Conditions](#)

Summary of Next Steps

Integrate and utilize these data to answer critical uncertainties at the site level and across the Lower River

- Current AEMR/EMP Point:
- ✓ Compile, QA/QC, Explore:
 - I. EMP Datasets
 - II. Drone Datasets
- ✓ Create Interactive Data Dashboards Reporting out for the EMP data (FY23-25)
 - Include all data collected analyzed with meaningful metrics
- ✓ **Seek feedback and continue to evolve our analysis and reporting**
- ✓ **Ongoing updates to the new Protocol Document**



Update all EMP datasets and Tableau dashboards

Continuing to focus on creating useable databases and dashboards for all metrics to increase accessibility of the data



Full EMP data synthesis analysis (FY23-25)

Macros, Fish, and Biomass
Compare and analyze all metrics at the estuary wide scale, across each reach, and each site.



Drone Inclusion (FY23-25)

Full site wide statistics and analysis based on drone data
LiDAR datasets and vegetation maps into Tableau



Full synthesis analyses of all sites (FY23-25)

Focus on the drivers and impact of each metric



27th Biennial Conference

CERF 2023

12-16 November 2023 - Portland, OR

[About](#) [Program](#) [Registration](#) [Experience](#) [Student & EC](#) [Hotel/Travel](#) [Sponsor/Exhibit](#) [Resources & More](#)

CERF 2023 Workshop

[Return to Workshop Schedule](#)

Tableau for Environmental Science: Easy Data Analysis, Mapping, and Sharing

Sunday, 12 November, 2023

Quick Links

[About the Conference](#)

[Sponsorship Opportunities](#)

[Register Now](#)

[Schedule-at-a-Glance](#)

Announcements



9:00 AM (20 mins)

Introductions and Updates - Members are encouraged to provide updates on projects of interest

9:20 AM (20 mins)

Overview of the Ecosystem Monitoring Program and Introduction to Tableau for Data Sharing and Synthesis

Presented by Ian Edgar and Sarah Kidd (LCEP)

9:40 AM (20 mins)

Mainstem and Abiotic Site Conditions

Presented by Joe Needoba (OHSU)

10:00 AM (20 mins)

Habitat Structure

Presented by Sneha Rao and Sarah Kidd (LCEP)

10:20 AM (20 mins)

Conditions Affecting Juvenile Salmon Food Web

Presented by Tawnya Peterson (OHSU)

10:40 AM (10 mins)

Break

10:50 AM (20 mins)

Exploring Relationships Affecting Site Productivity of Fish Prey Quality vs Quantity

Presented by Kerry Accola, Jason Toft, and Jeff Cordell (UW)

11:10 AM (20 mins)

Exploring Relationships Between Fish Density, Temperature, and salmon growth

Presented by Curtis Roegner, Jeff Grote, and Susan Hinton (NOAA Fisheries)

11:30 AM (25 mins)

Group Discussion: EMP data synthesis - next steps in terms of research, collaboration, and implementation

11:55 AM (5 mins)

Closing Remarks and Adjourn

Note: Each presentation has been allocated 15 minutes followed by a 5-minute discussion



Science Work Group Agenda
October 24, 2023
9:00 AM –12:00 PM

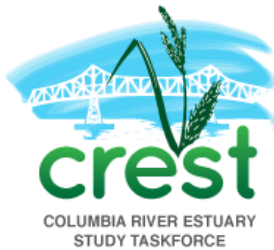


RESEARCH PARTNERS

THANK YOU



COWLITZ INDIAN TRIBE



Schott & Associates, Inc.



Institute for
Applied Ecology



LOOK AT EXAMPLES ONLINE

- ▶ Our EMP Report Page (With examples – no login required):
<https://public.tableau.com/app/profile/ecosystem.monitoring.program/vizzes>
- ▶ Our AEMR Report Page (With examples – no login required):
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- ▶ Our Tableau Public Page (With examples – no login required):
<https://public.tableau.com/app/profile/sarah.ann.kidd>
- ▶ Contact us if you are having any issues or questions:
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