EMP Habitat Monitoring 2019-2020

Lower Columbia Estuary Partnership

Sarah Kidd
LCEP, Principal Wetland Scientist
October 2019 Science Work Group

Franz Lake Slough 2018

2019-20 Habitat Sampling

Vegetation Surveys, Soil Chemistry, Water Surface Elevation, Sediment Accretion/Erosion Monitoring, Drone Imagery:

- Ilwaco Slough
- Whites Island
- Welch Island
- Campbell Slough/Cunningham Lake
- Franz Lake

- *Biomass and Macrodetritus Sampling*

20’ Winter & Summer: Whites, Welch, Franz

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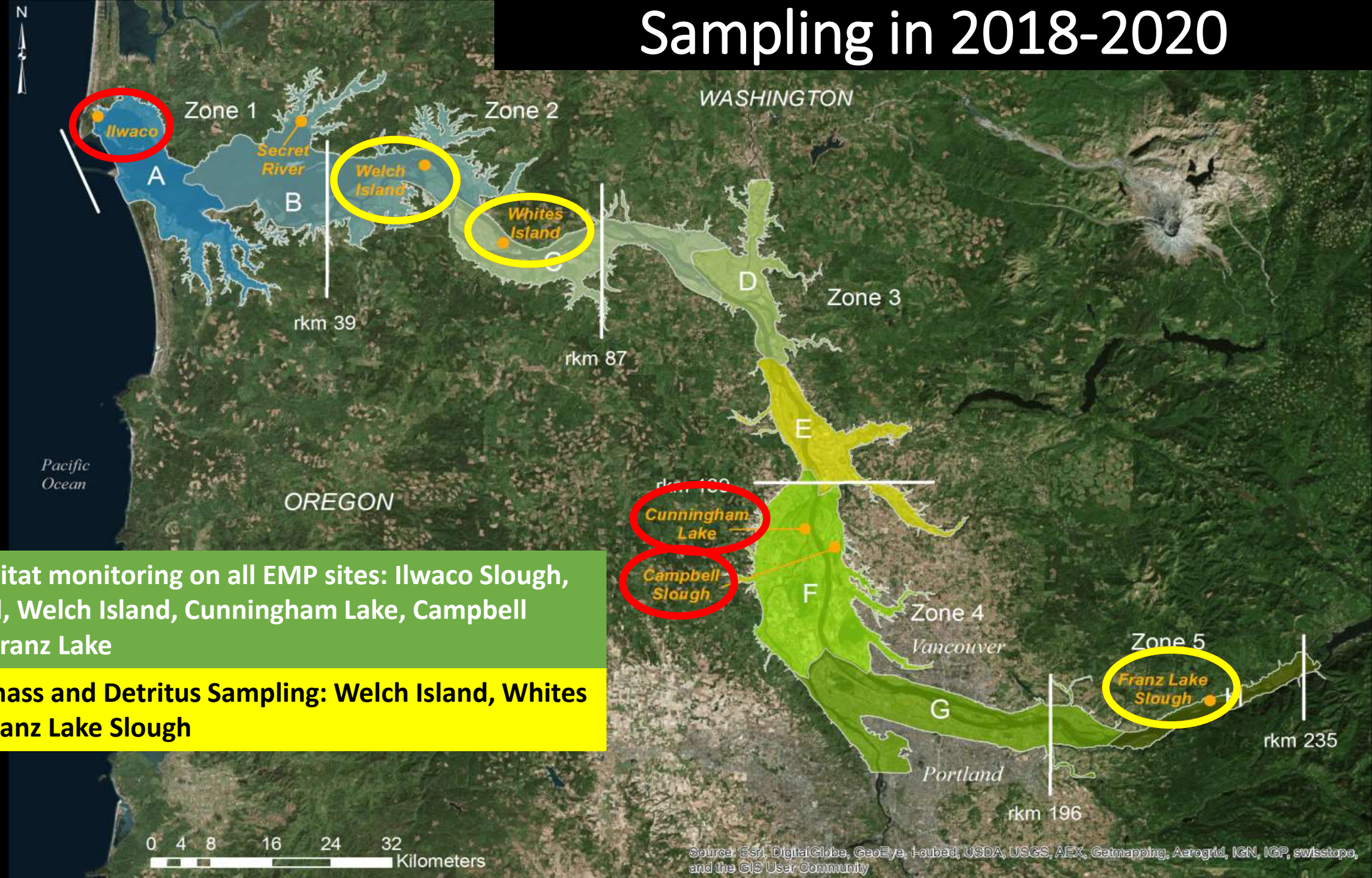
Sampling in 2018-2020

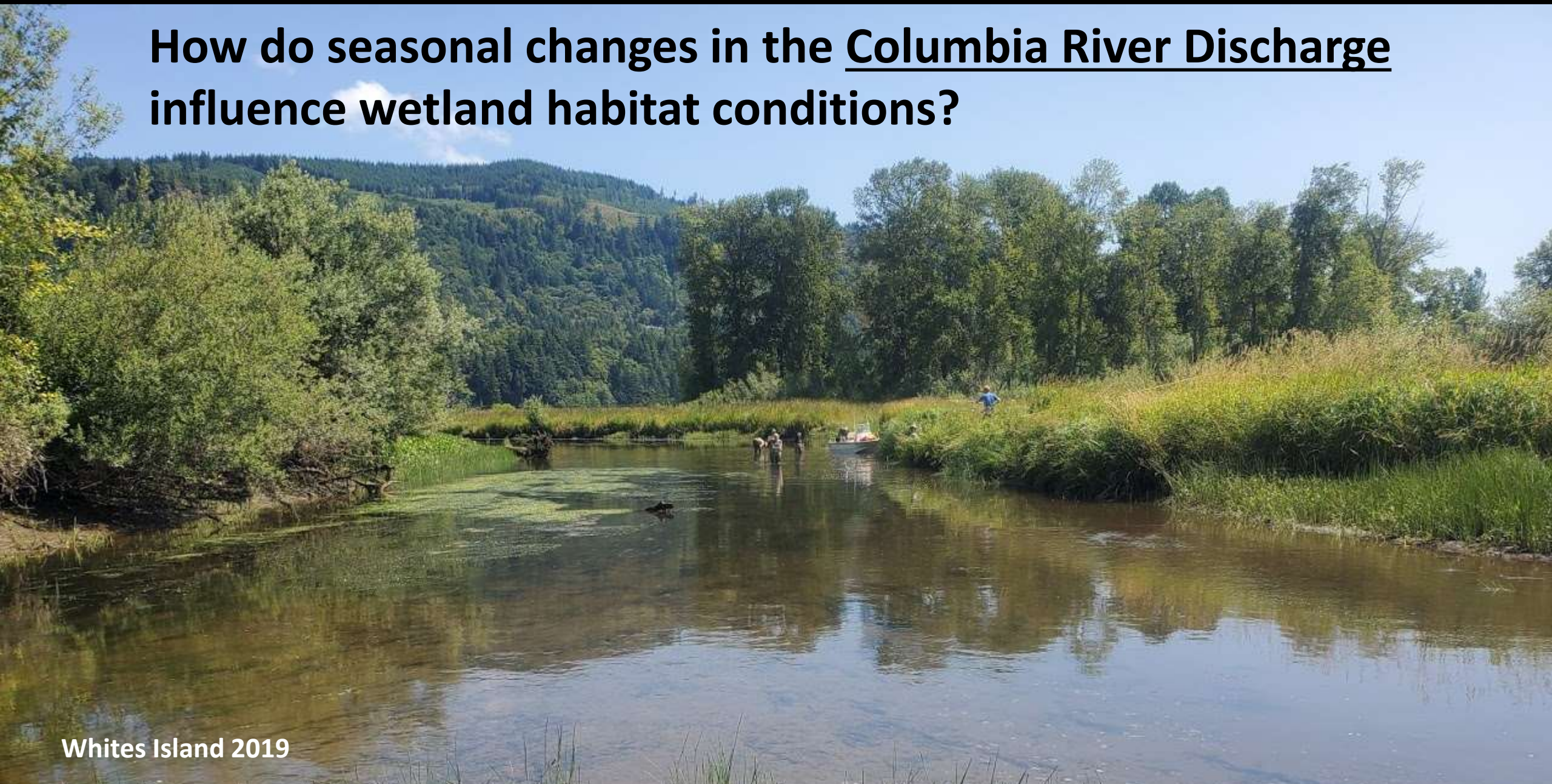


Continue habitat monitoring on all EMP sites: Ilwaco Slough, Whites Island, Welch Island, Cunningham Lake, Campbell Slough, and Franz Lake

Focused Biomass and Detritus Sampling: Welch Island, Whites Island, and Franz Lake Slough

Result Highlights: Habitat and Hydrology

How do seasonal changes in the Columbia River Discharge influence wetland habitat conditions?



Whites Island 2019

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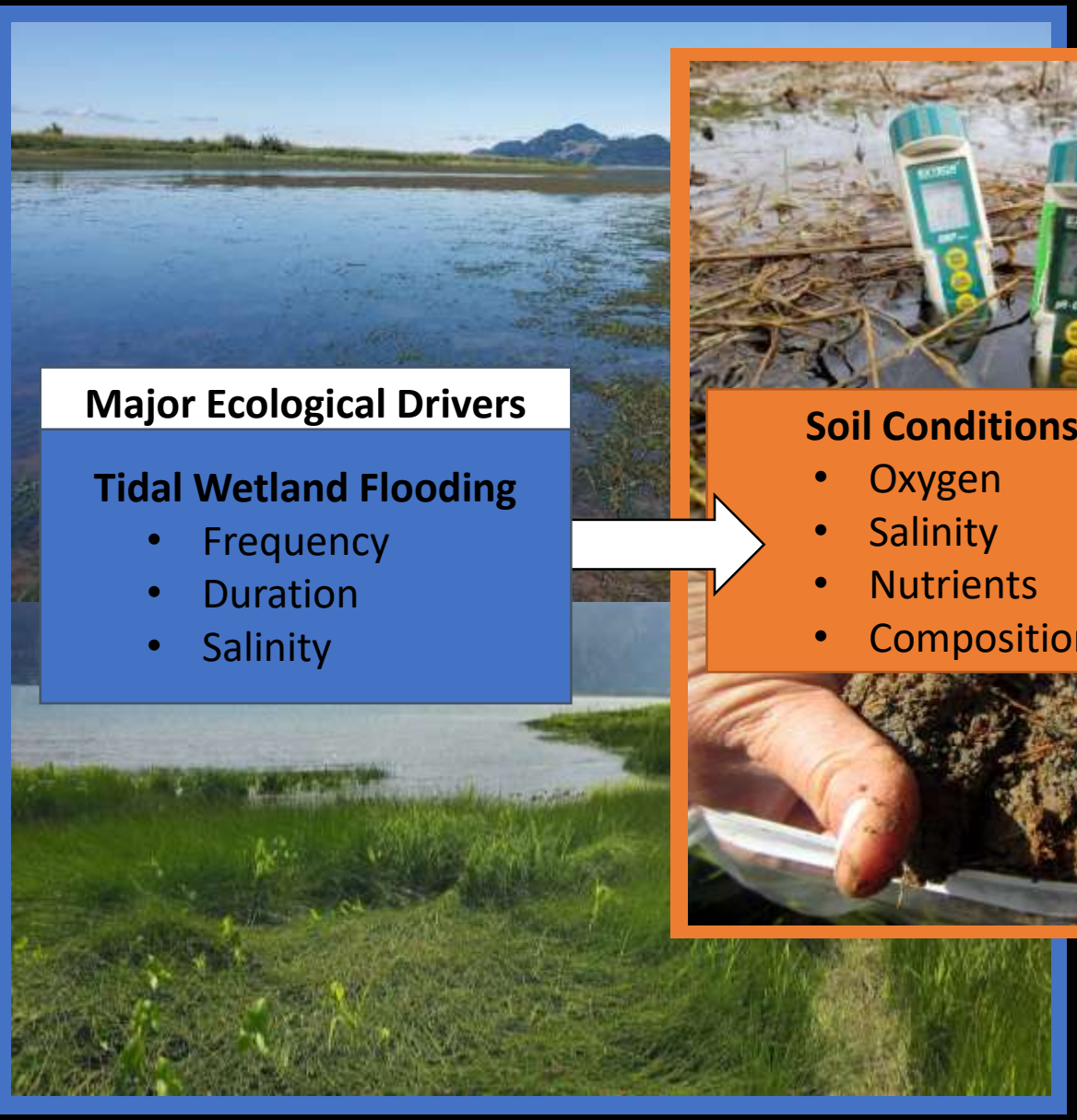
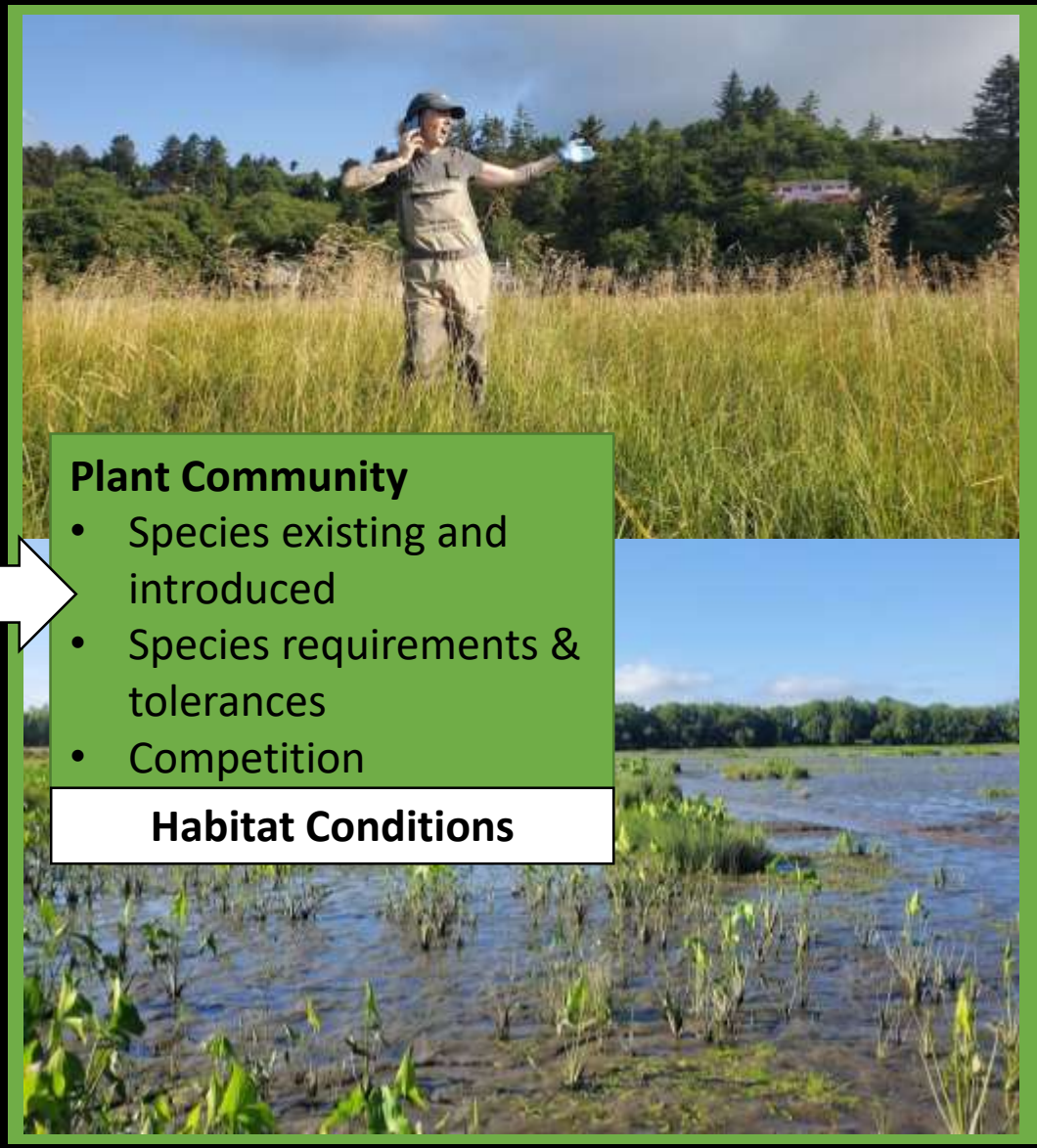


Major Ecological Drivers

Tidal Wetland Flooding
- Frequency
- Duration
- Salinity

Soil Conditions
- Oxygen
- Salinity
- Nutrients
- Composition

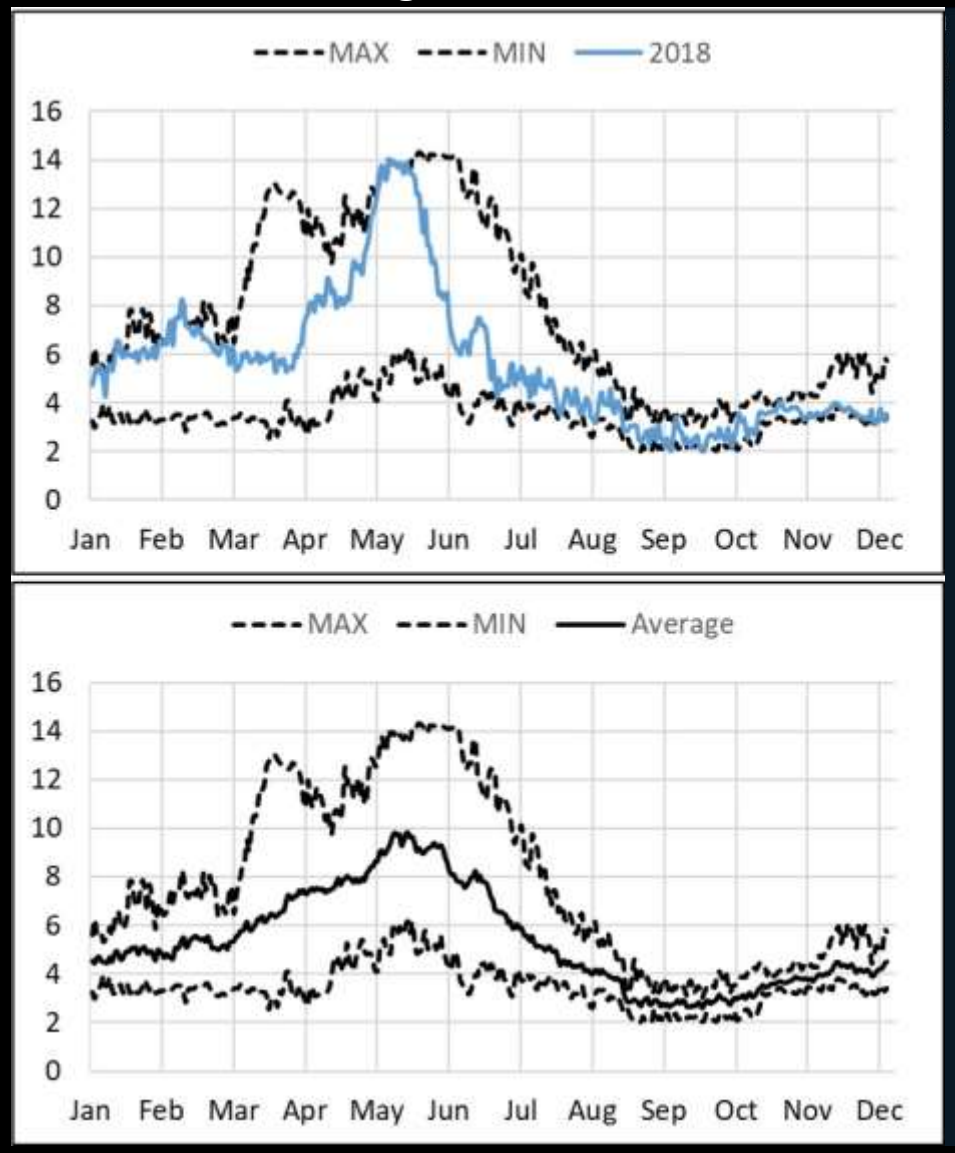


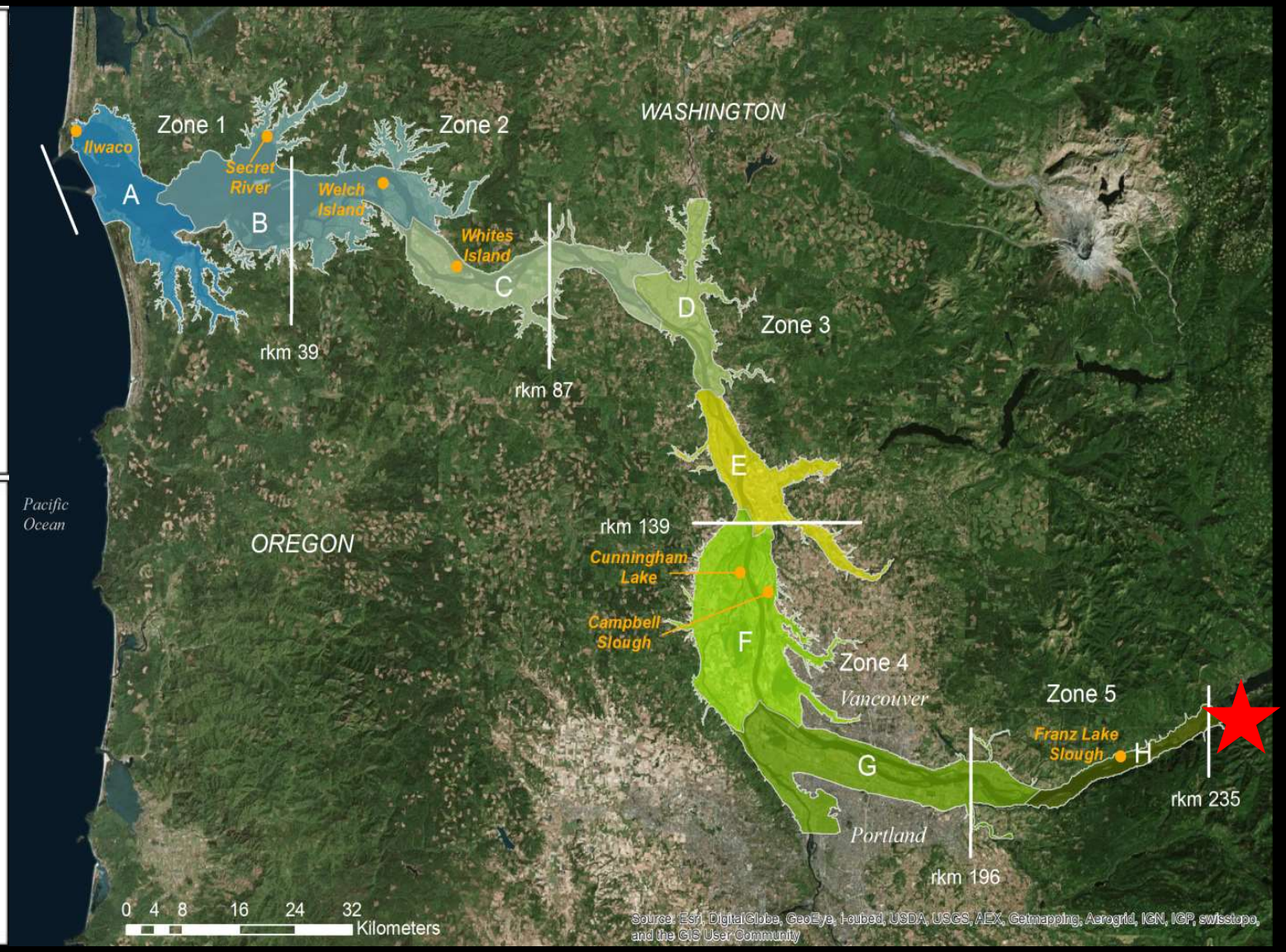
Plant Community
- Species existing and introduced
- Species requirements & tolerances
- Competition

Habitat Conditions

Result Highlights: Habitat and Hydrology

Bonneville Discharge

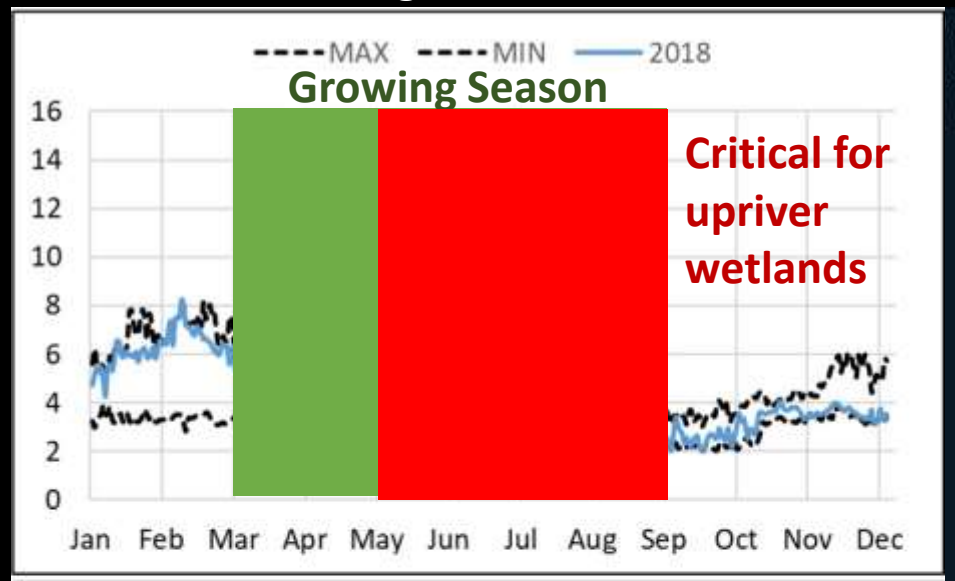


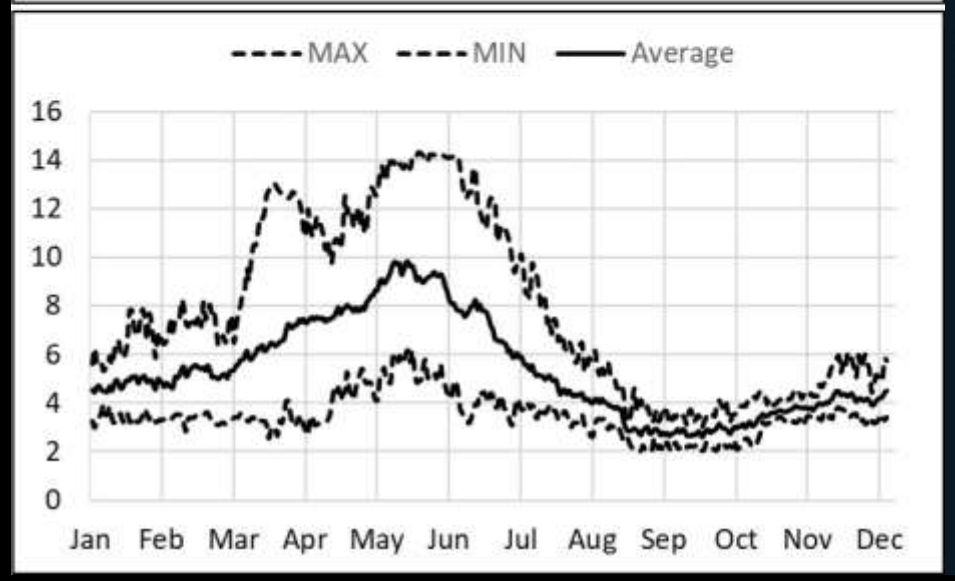


Graphs From Joe Needoba OHSU (EMP report 2019)

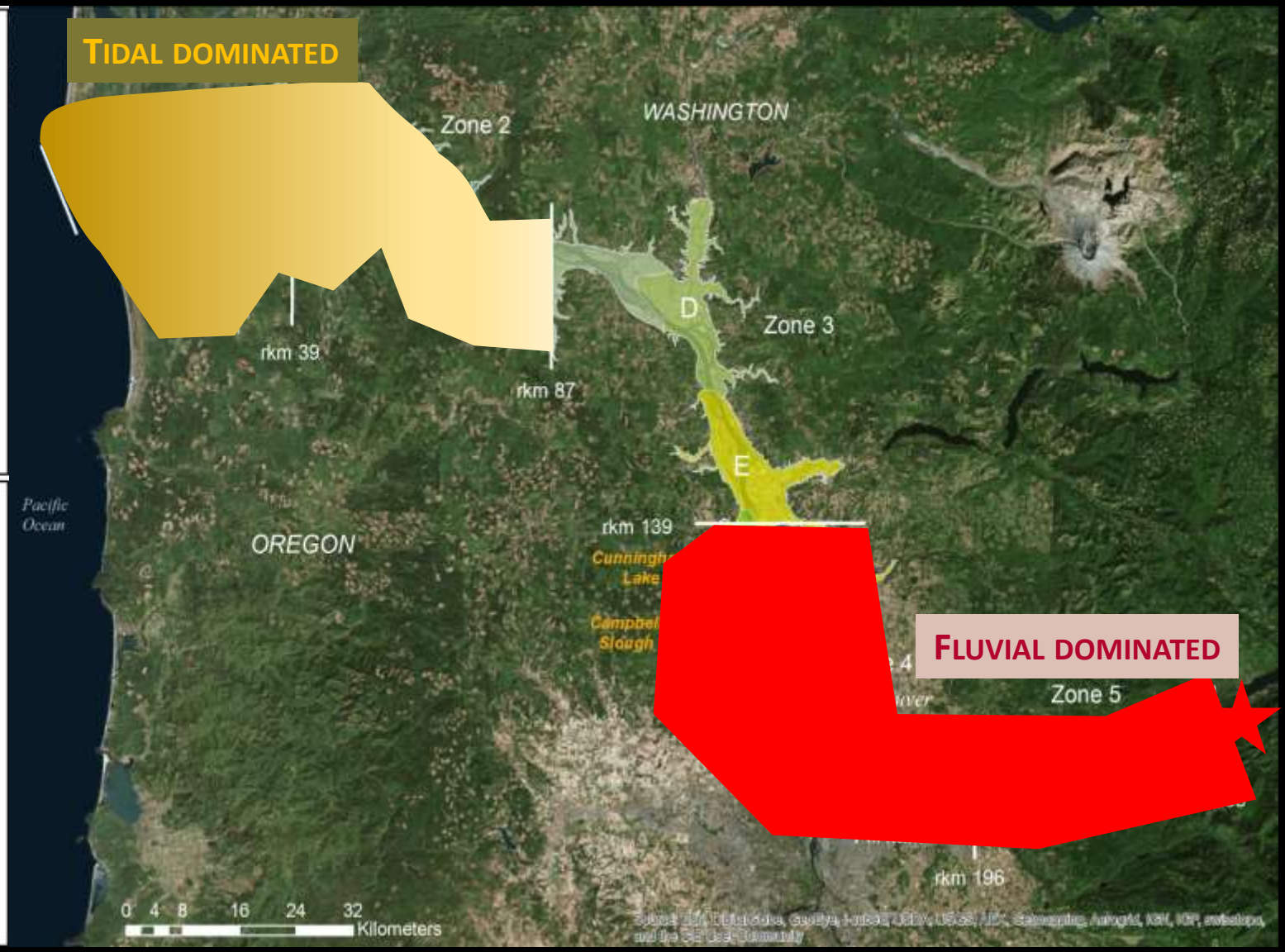
Result Highlights: Habitat and Hydrology

Bonneville Discharge





Daily water discharge (m^3/s) at Bonneville



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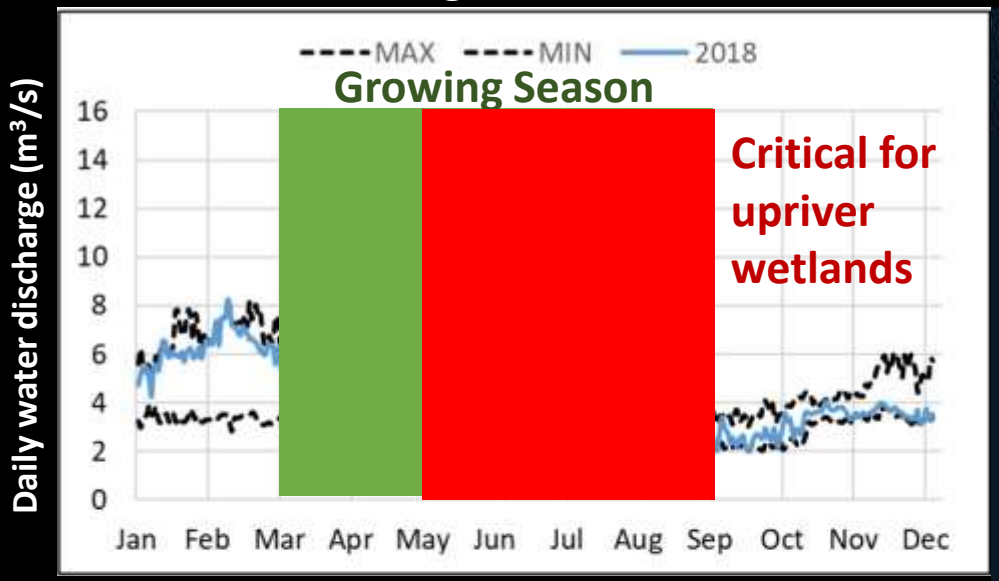
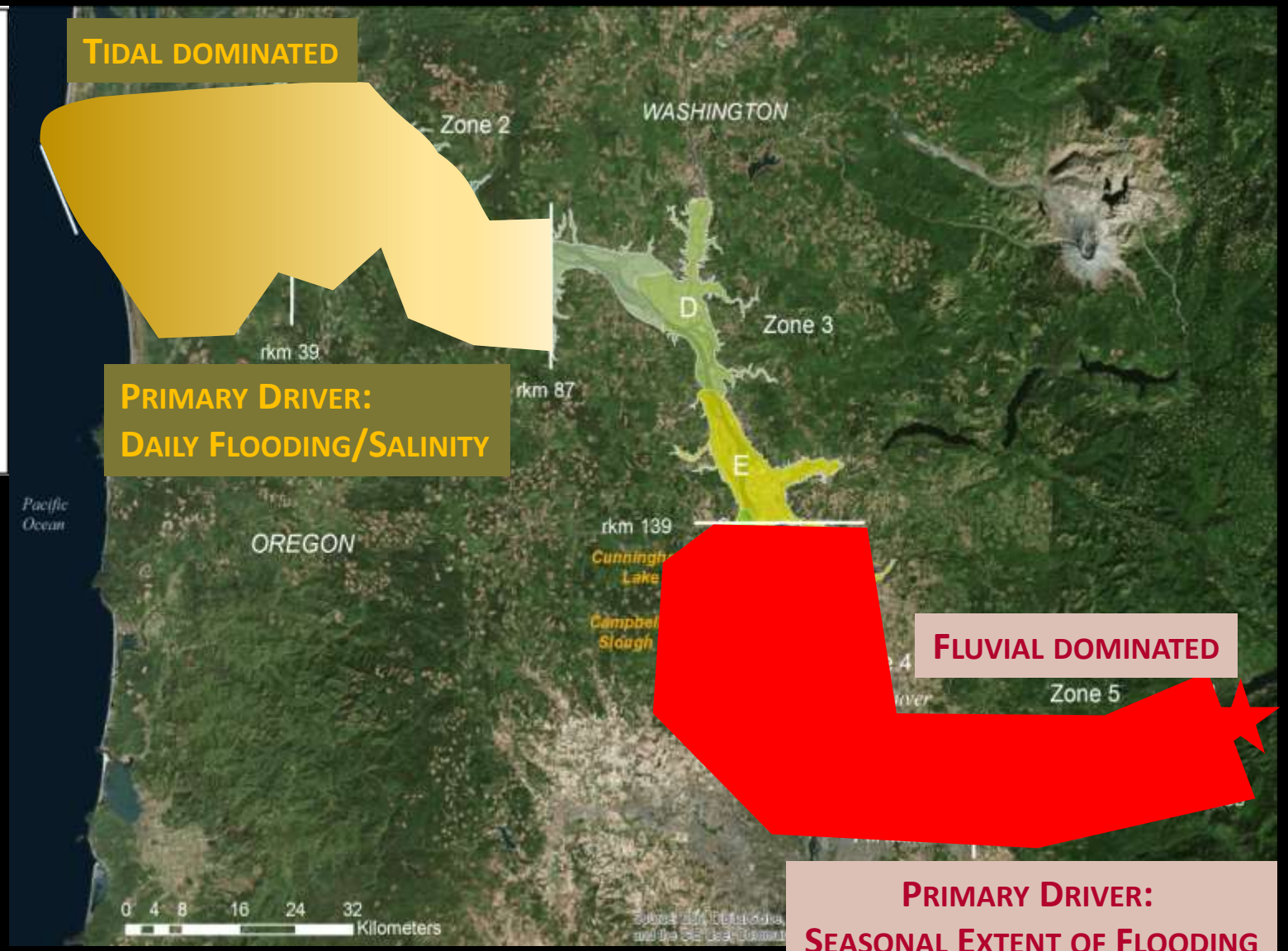
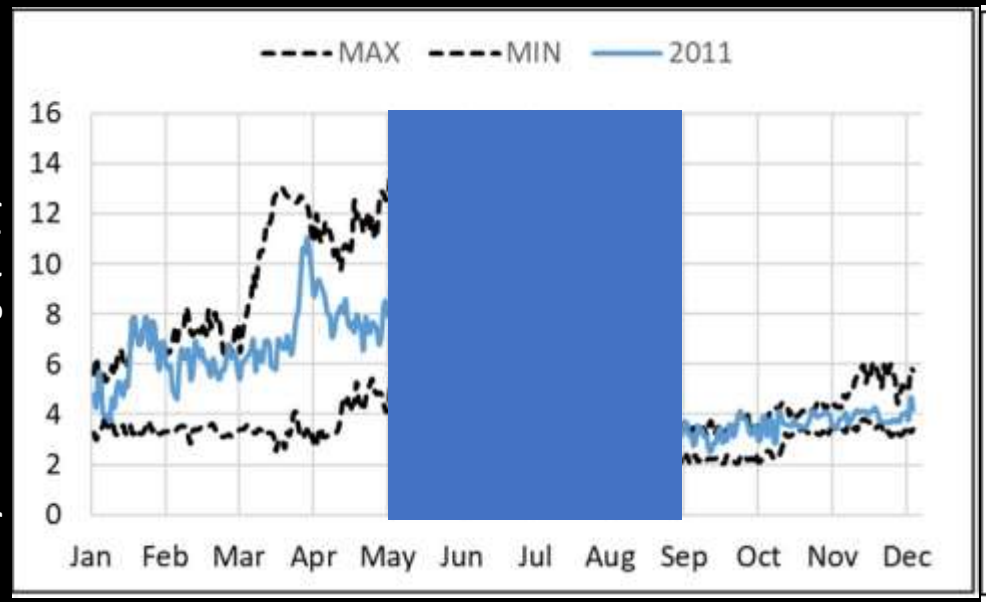


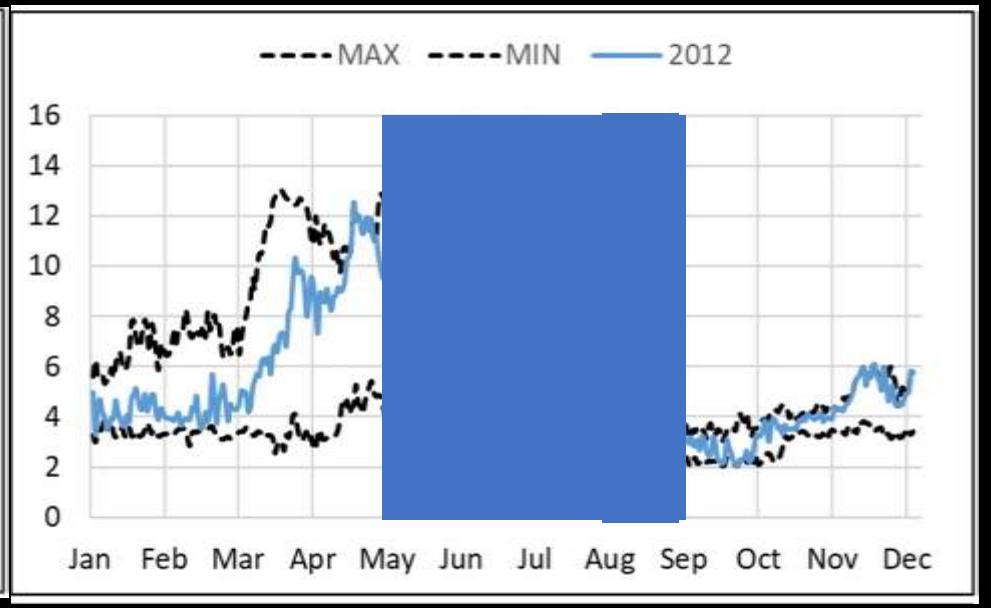
Reed canarygrass (PHAR) *Phalaris arundinacea*



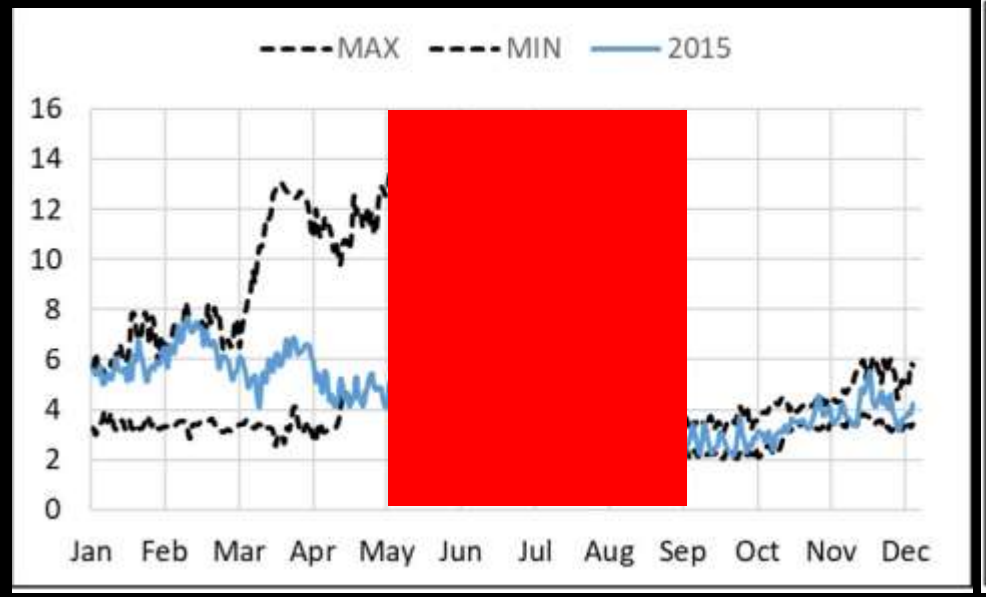
Graphs From Joe Needoba OHSU (EMP report 2019)

How do seasonal changes in the Columbia River Discharge influence habitat conditions?





2011/12:
Relatively High Water



2015/16:
Relatively Low Water

Graphs From Joe Needoba OHSU (EMP report 2019)

Reed Canarygrass Abundance

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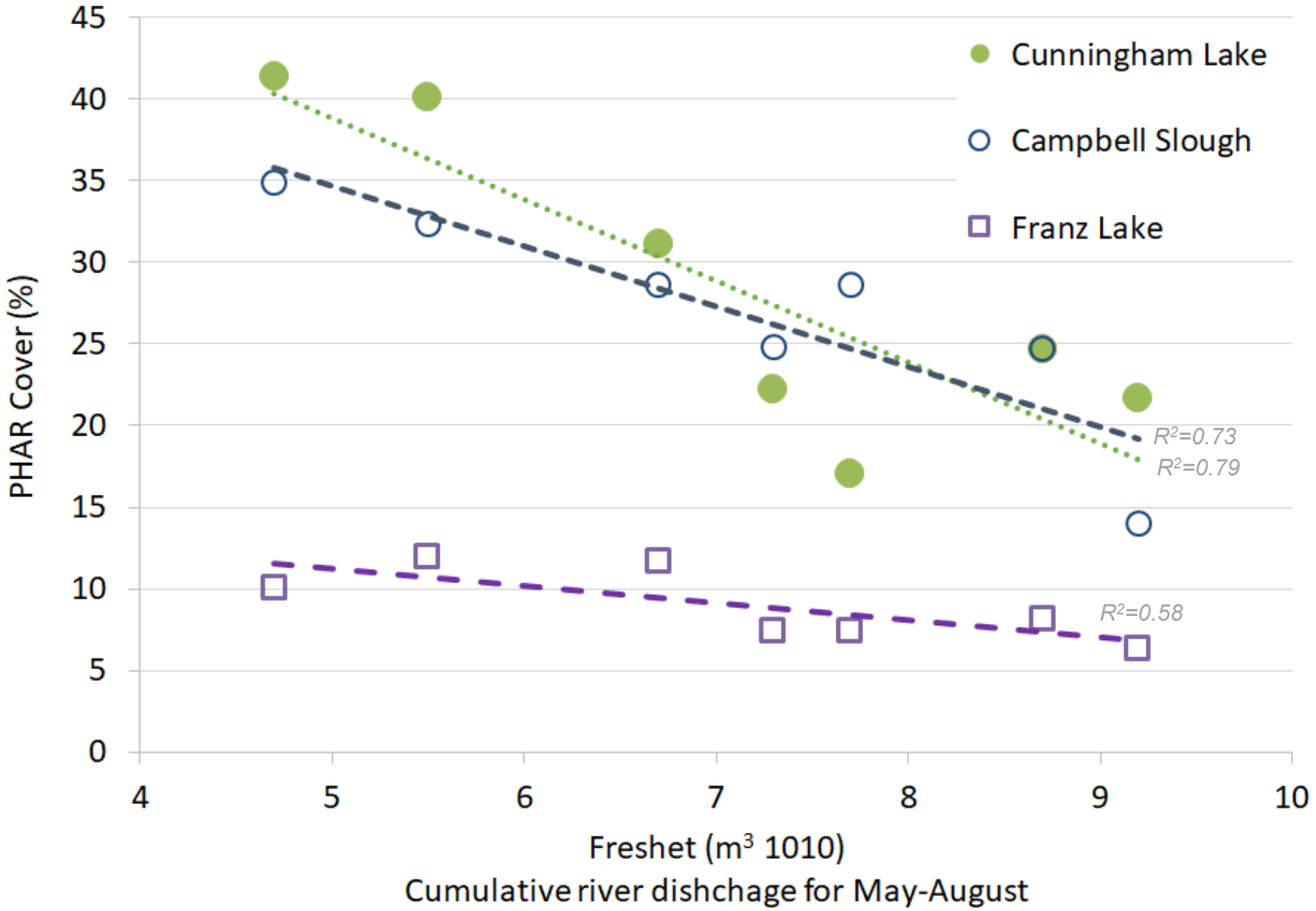
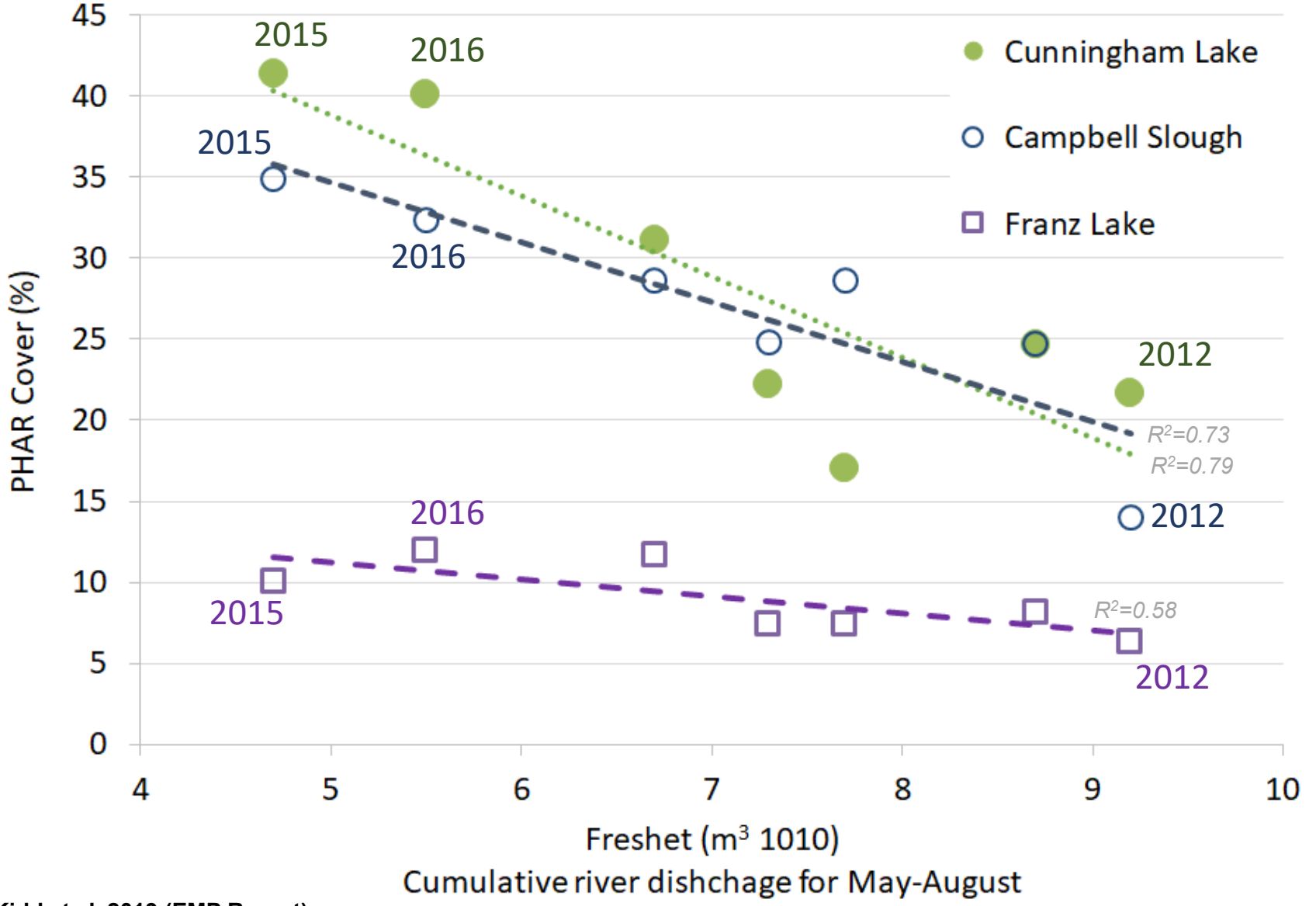


Kidd et al. 2019 (EMP Report)

Naturally varies based on river discharge conditions

- Up to 20% annual shift in PHAR

Reed Canarygrass Abundance



Kidd et al. 2019 (EMP Report)

Naturally varies based on river discharge conditions

- Up to 20% annual shift in PHAR
- **Decline in PHAR during high water years across all upper river sites**
- Further analysis will evaluate plant community similarity across sites and years, high vs low marsh site plant community composition, and discharge conditions.

Bare Ground Abundance

Naturally varies based on river discharge conditions

Bare Ground Abundance

Bare Ground vs. Freshet (m3 x 1010) cumulative river discharge			
Sites	Correlation	R^2	Discharge
Ilwaco Slough	-	0.73	May-Aug
Welch Island	+	NA	
Whites Island	+	0.47	Aug
Cunningham Lake	+	0.85	Aug
Campbell Slough	+	0.89	May-Aug
Franz Lake	+	0.69	Aug

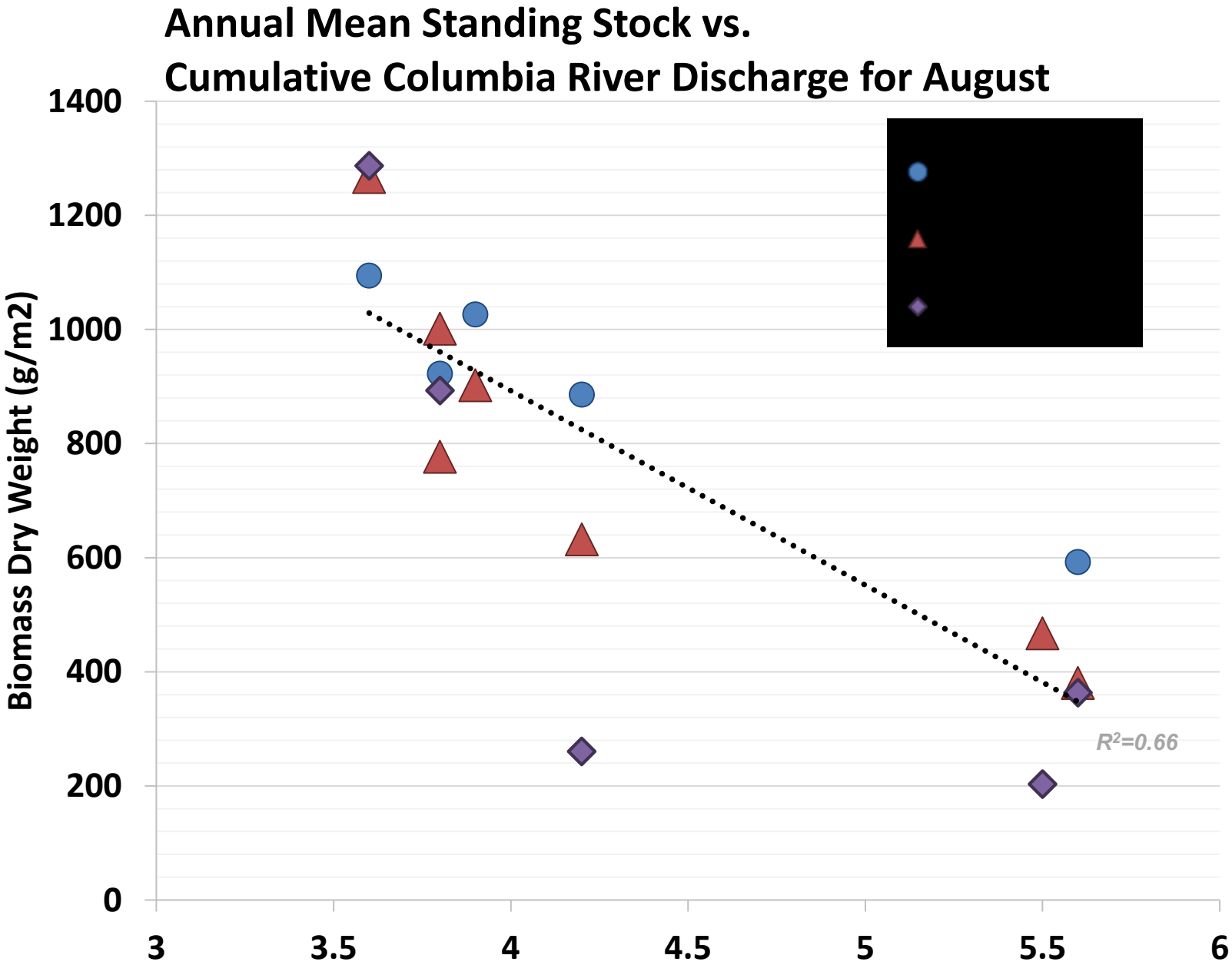
All p-values <0.001

Naturally varies based on river discharge conditions

- Similar relationships with bare ground across upper river wetlands, increased discharge = more bare ground
- Further *site hydrology, river discharge, high and low marsh plant community* analysis forthcoming

Total Above Ground Biomass

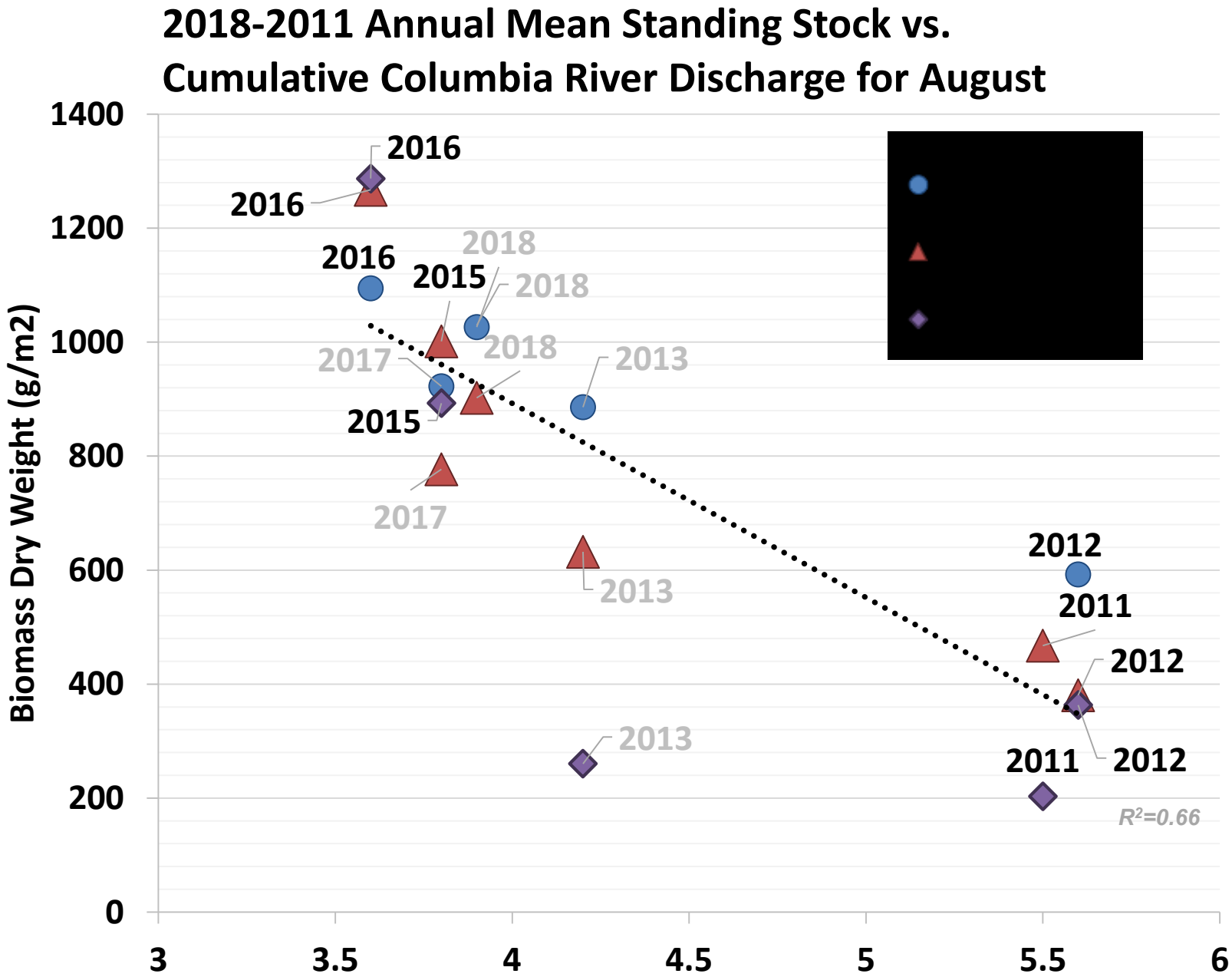
Total Above Ground Biomass (2011-2018)



Also naturally varies based on river discharge conditions

- Overall mean above ground biomass correlated with August discharge conditions

Total Above Ground Biomass (2011-2018)



Also naturally varies based on river discharge conditions

- Overall mean above ground biomass correlated with August discharge conditions

- ***Further analysis will include estimated export, historic biomass data, and high vs. low marsh conditions, soil chemistry***

But what is going on at Ilwaco – Bakers Bay?

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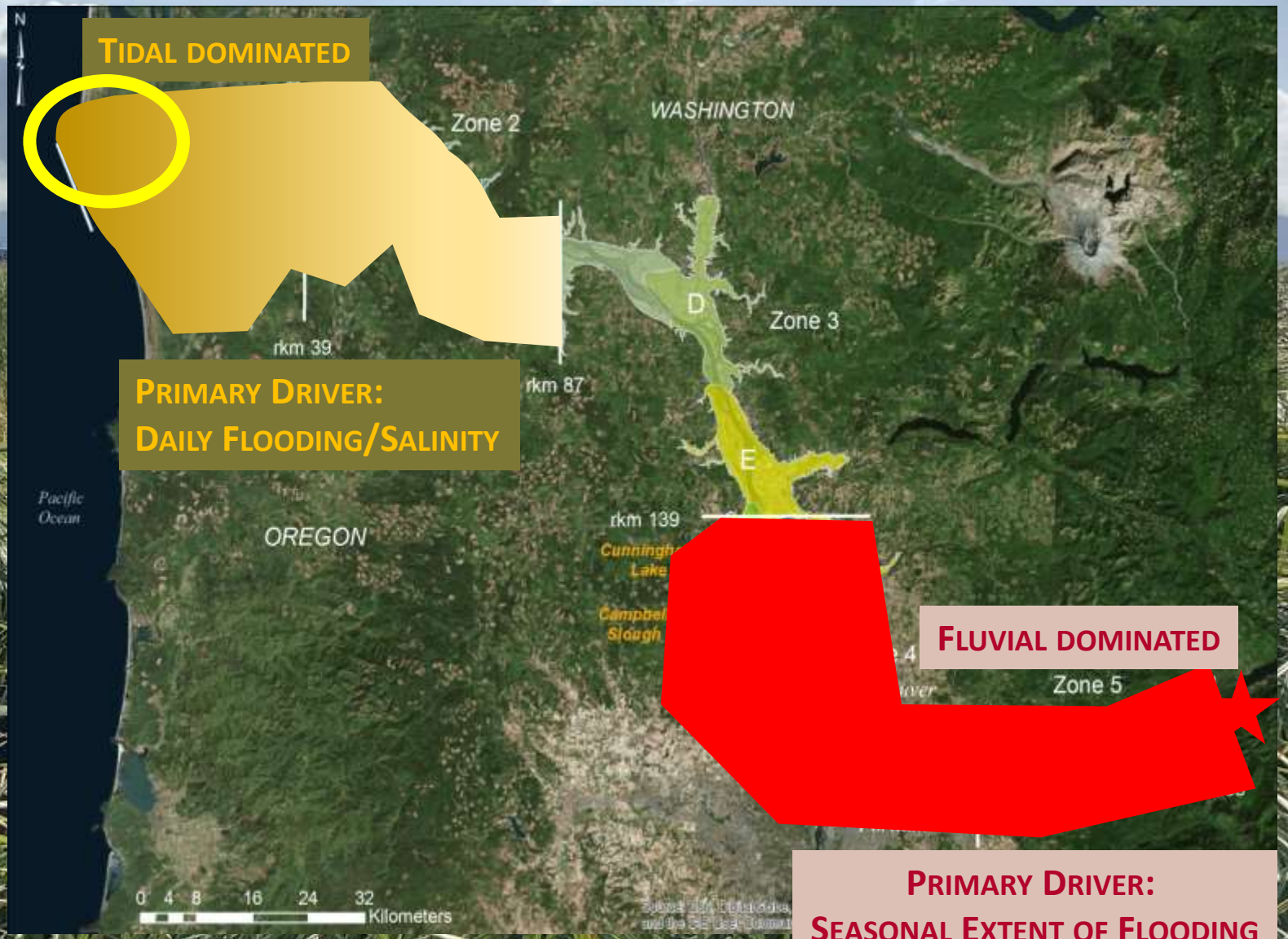
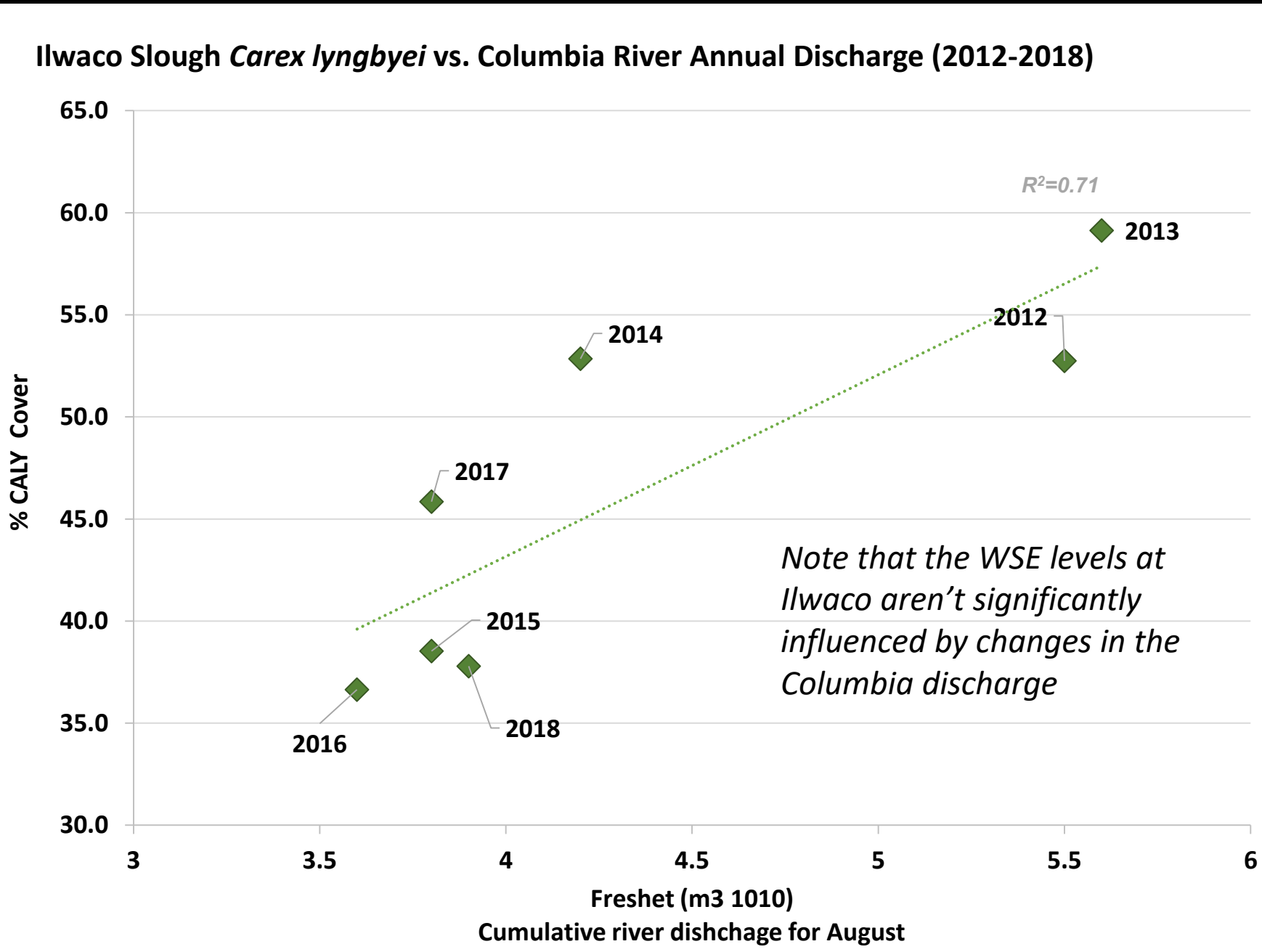
- Oligohaline to Brackish Marsh
- Mostly low salinity tolerant plant species (no PHAR).

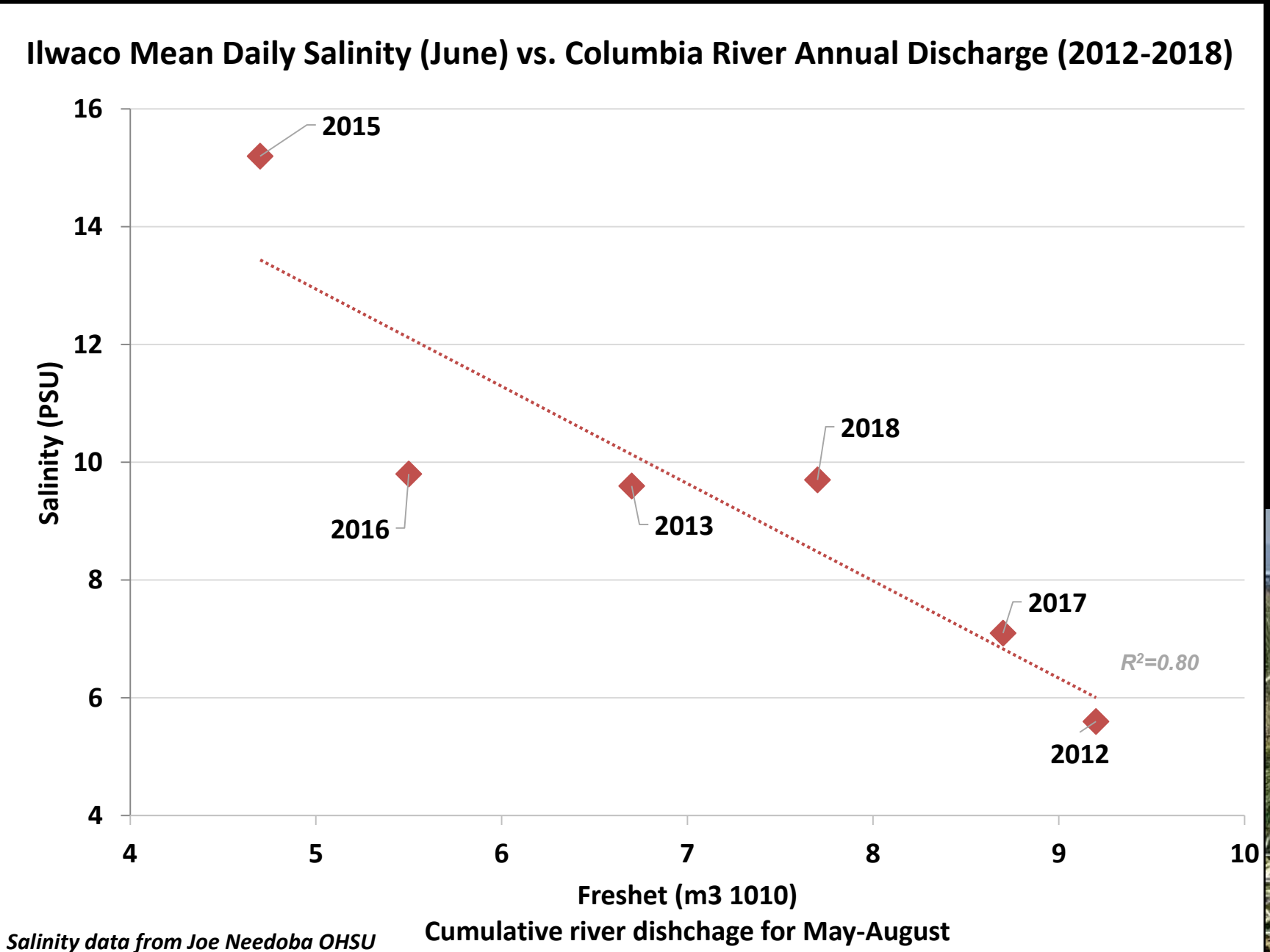


Carex lyngbyei Abundance



- **Annual mean *Carex lyngbyei* (CALY) positively correlated with discharge**

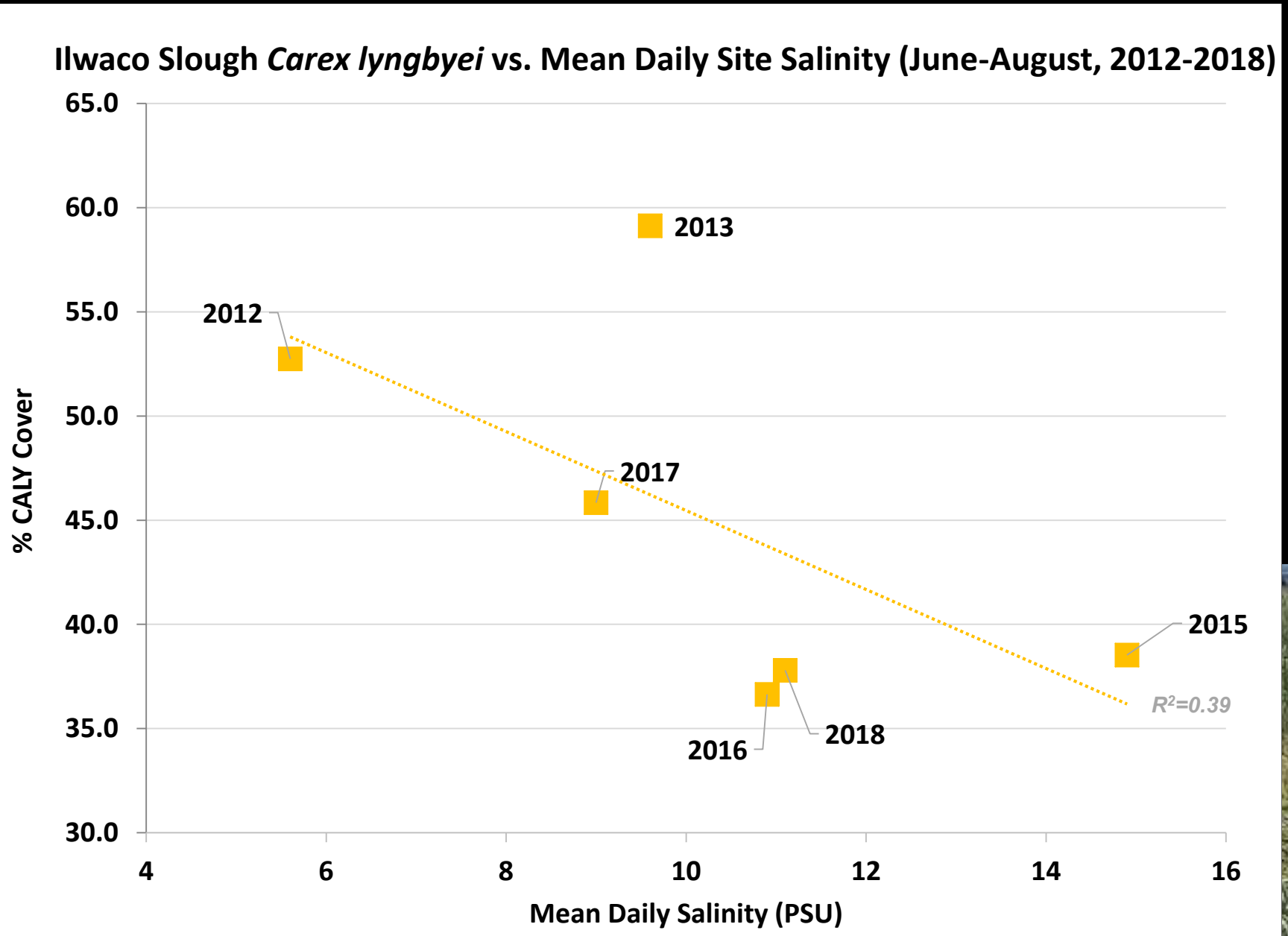
Ilwaco Salinity and Columbia Discharge



Salinity data from Joe Needoba OHSU

- Annual mean CALY positively correlated with discharge
- Seasonal discharge correlated with site salinity

Carex lyngbyei Abundance vs. Salinity



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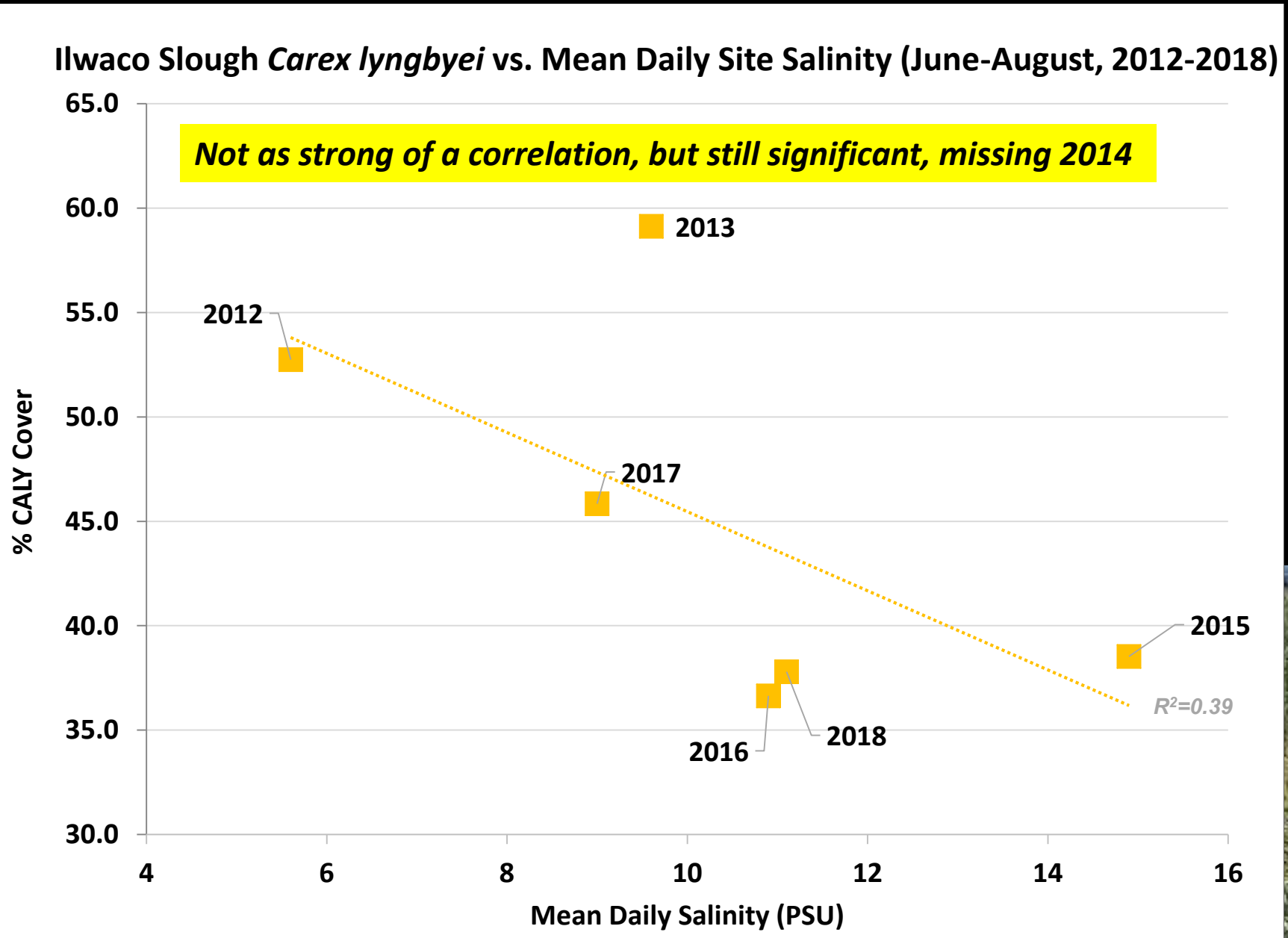
- **CALY abundance negatively correlated with Salinity**

Carex lyngbyei Abundance vs. Salinity



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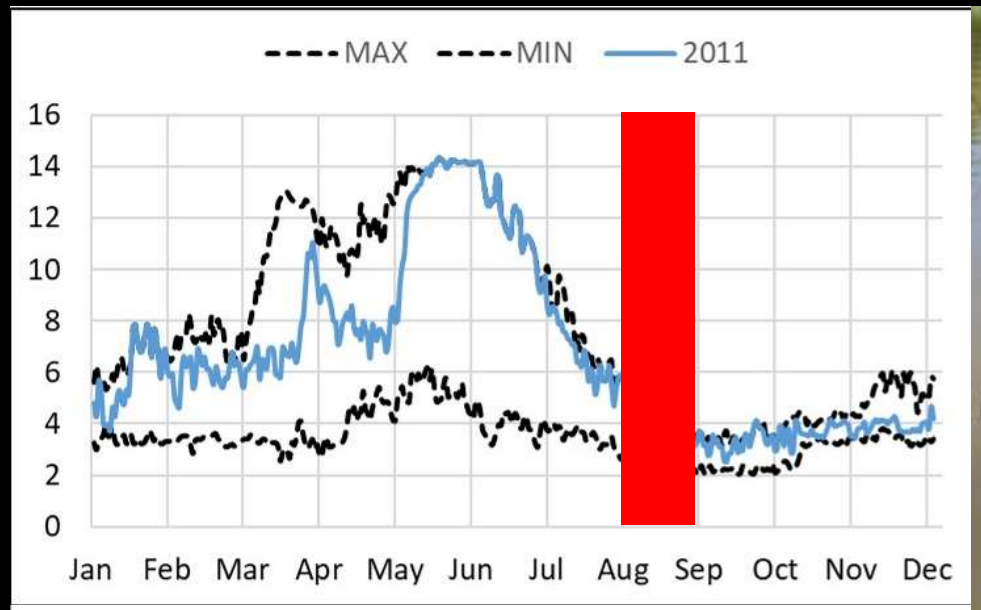
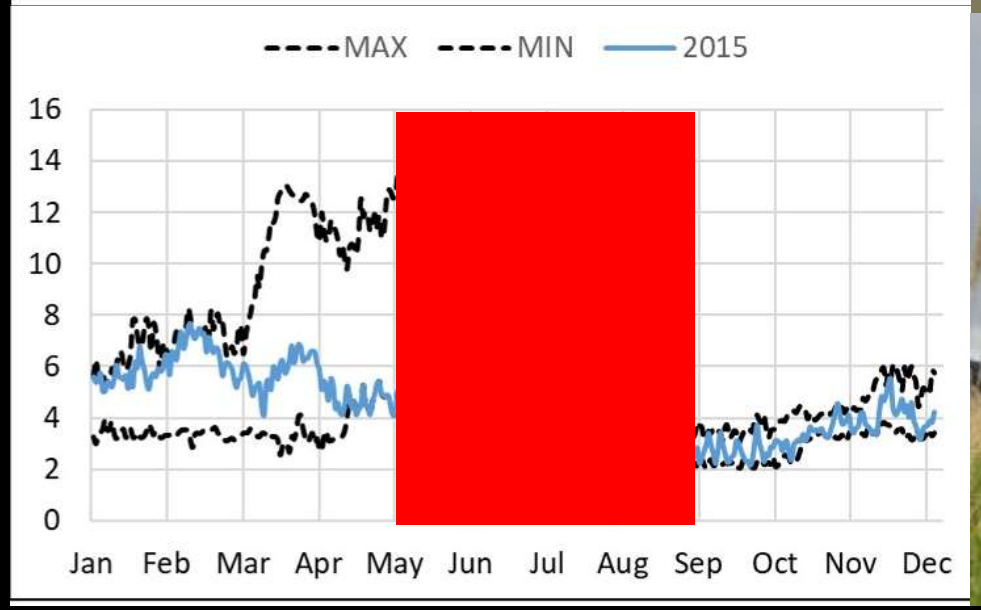
How do seasonal changes in the Columbia River Discharge influence habitat conditions?





Daily water discharge (m^3/s) at Bonneville

➢ **August**

Wapato, bare ground, *Carex lyngbyei*, and total biomass are strongly influenced by discharge conditions in August

➢ **MAY-AUGUST:**

Reed canarygrass abundance strongly influenced by discharge conditions May-August

Graphs From Joe Needoba OHSU (EMP report 2019)

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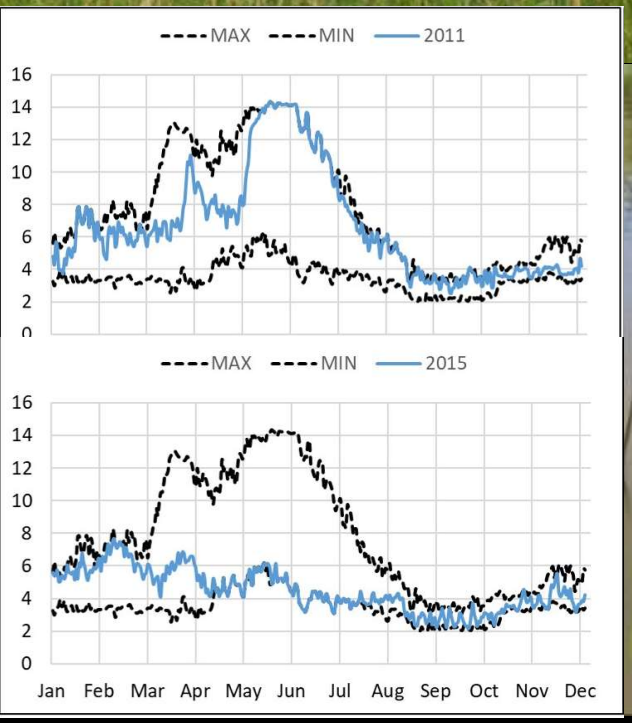
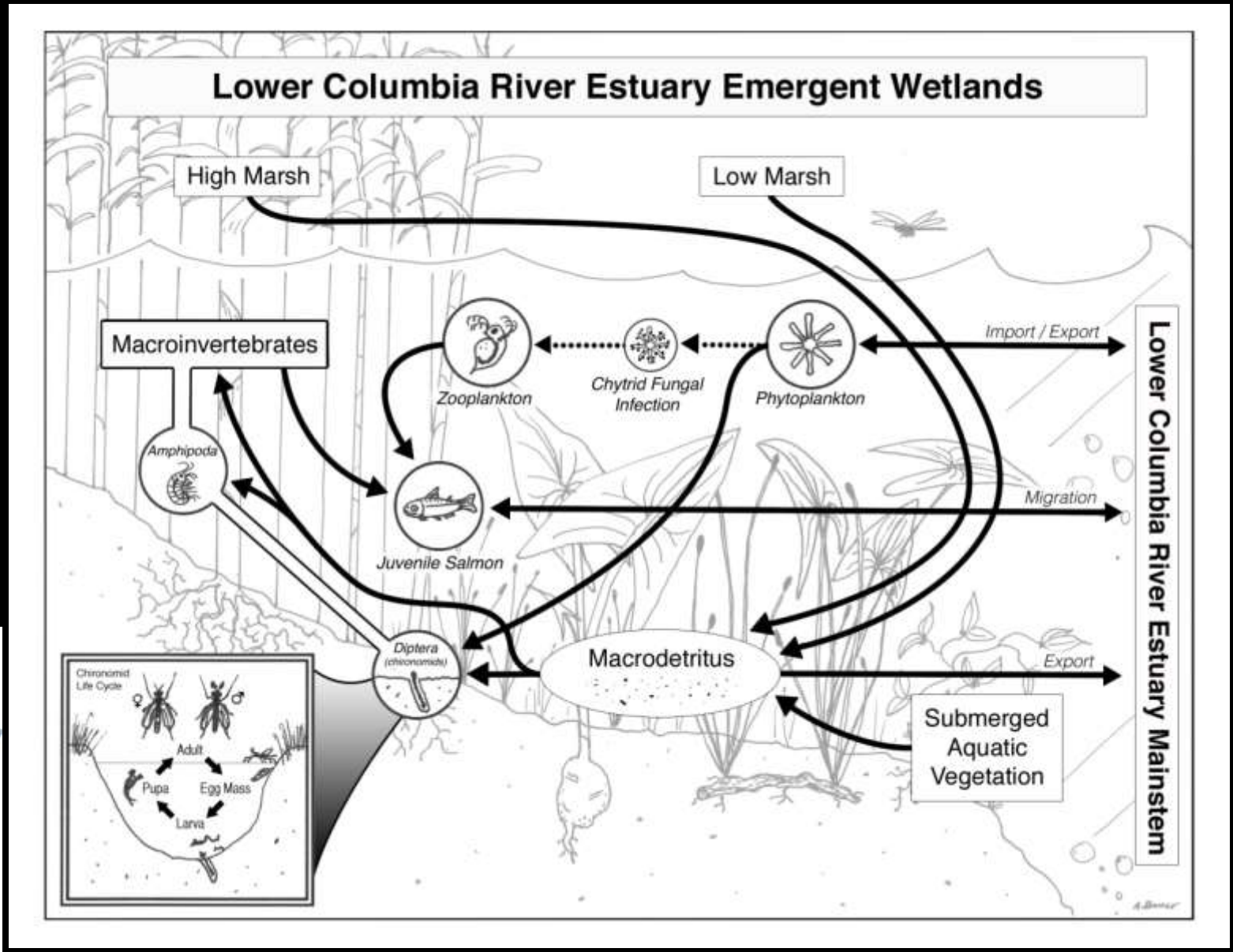


- Overall Extreme High and Low Columbia river discharge levels during May-Aug can significantly impact plant community distributions
- Declines in total biomass and reed canarygrass cover (PHAR) are associated with high water years in the upper river wetlands
- Increases in *Carex lyngbyei* (CALY) in Ilwaco are also associated with high water years, likely in part due to lower salinity levels

WHY DO WE CARE?

- **Understanding drivers of habitat variability is key to understanding estuary foodweb dynamics**
- **Predicting Impacts of Climate Change on**



What's Next?

- **Further investigations of wetland plant community and biomass dynamics and their relationship to annual and seasonal river discharge, WSE, salinity, soil conditions etc.**
- **Multivariate Analysis**
- **Multispectral Drone Image Analysis!**

Thank you! Questions?

Many thanks to everyone who assisted with data collection and sample processing and to Amy Borde for her legacy of amazing habitat data!

2019 Field Crew: Abe Lloyd, April Silva, Barry Wendling, Jason Smith, Katrina Poppe, Madison McKay, Narayan Elasmar, Roger Fuller, Rachel Yonemura, Sneha Rao, Tiffany Thio

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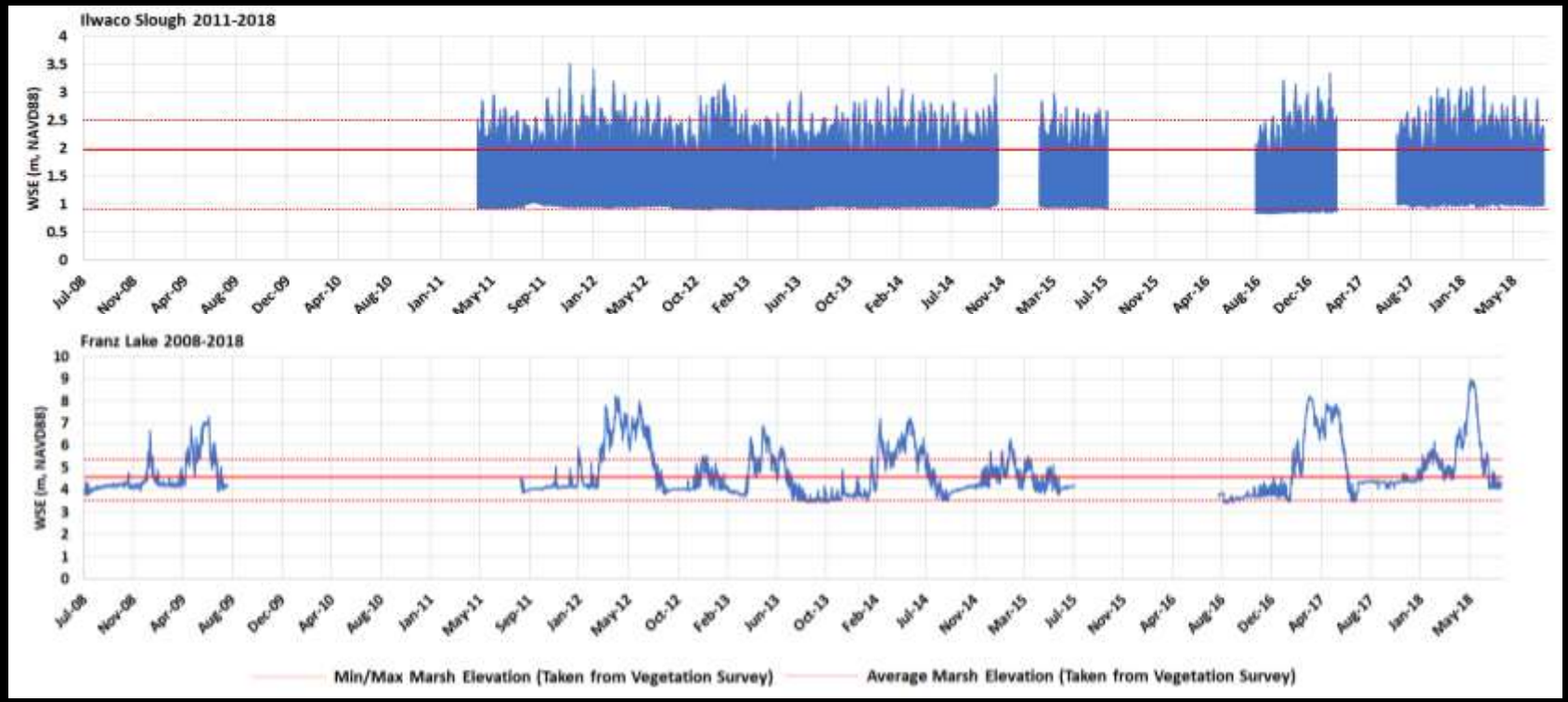

Plant Community Native and Non-native Species Dominance

Invasive species
Phalaris arundinacea, reed canarygrass

Reed canarygrass grows at the exclusion of natives – reduces native species abundance and richness

Non-natives limit/impact:

- Habitat Complexity & Diversity
- Detritus Quality – Nutrient Cycling
- Macroinvertebrate Communities/Food Web
- Salmonid Growth

(e.g. Mabry and Dettman 2010, Lavergne & Molofsky 2010, Borde et al. 2012, Kidd & Yeakley 2015, Hanson et al. 2016, Klopfenstein 2016, Kidd et al. 2019)

Habitat Data Status and Trends Analysis Plan

Water Surface Elevation and Temperature

- Evaluate differences in growing season and daily marsh inundation among the sites across years
- Calculate salmon habitat opportunity (using depth & temp data) across sites and years

Vegetation

- Compare species abundances, diversity, and similarity across sites and years, in **2019-20 we'll start using drone imagery to help track shifts in dominant plant community distributions from year to year**

Biomass

- Compare summer and winter biomass across sites and years, identify biomass export
- Evaluate detritus and biomass quality and quantity

Sediment accretion and erosion

- Calculate the accretion and erosion rates across the sites by year

Overview analysis

- **Continue to identify relationships between plant community, biomass production, and annual shifts in growing season and hydrology**