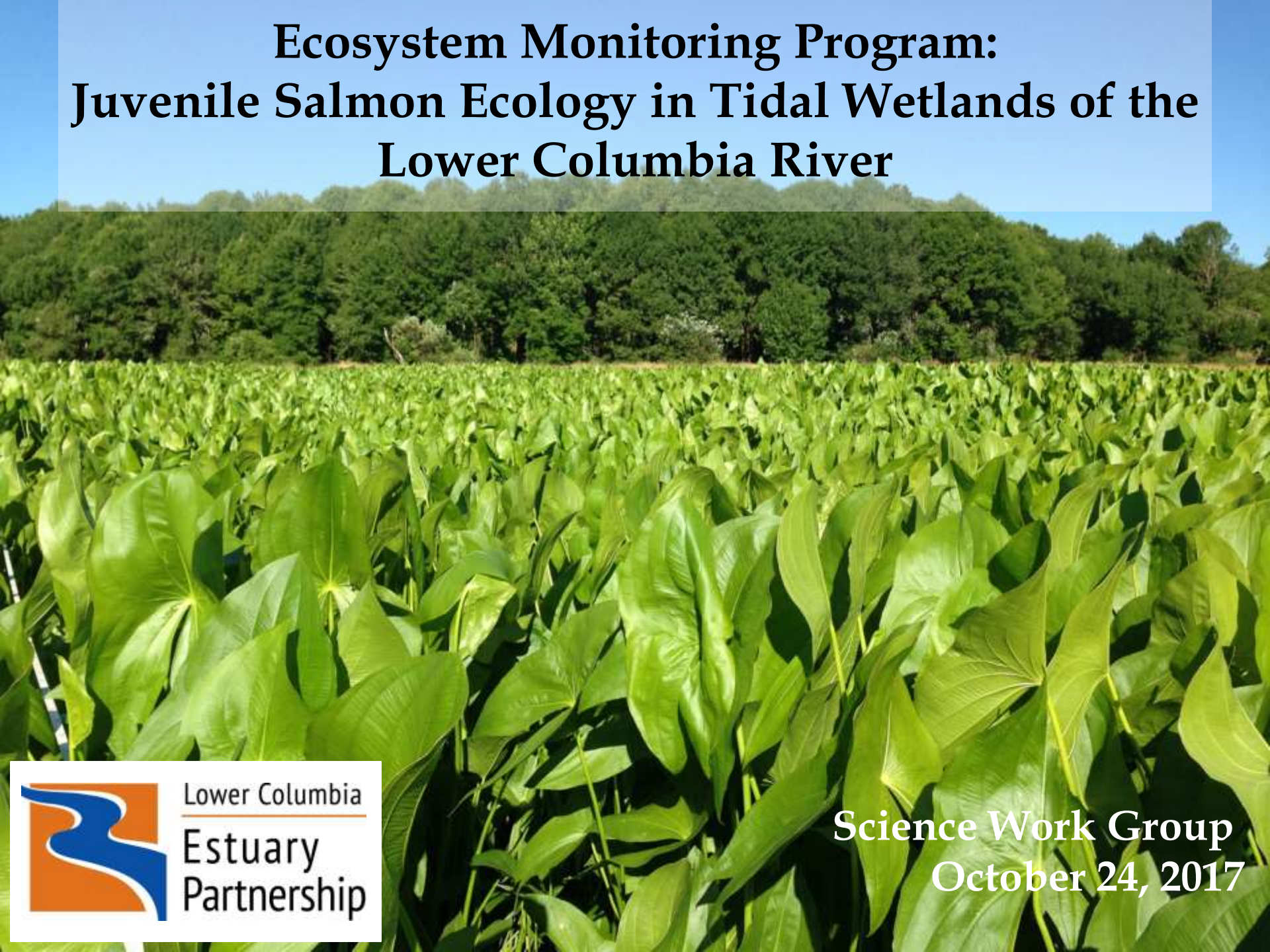
Ecosystem Monitoring Program: Juvenile Salmon Ecology in Tidal Wetlands of the Lower Columbia River



Lower Columbia Estuary Partnership

Science Work Group
October 24, 2017

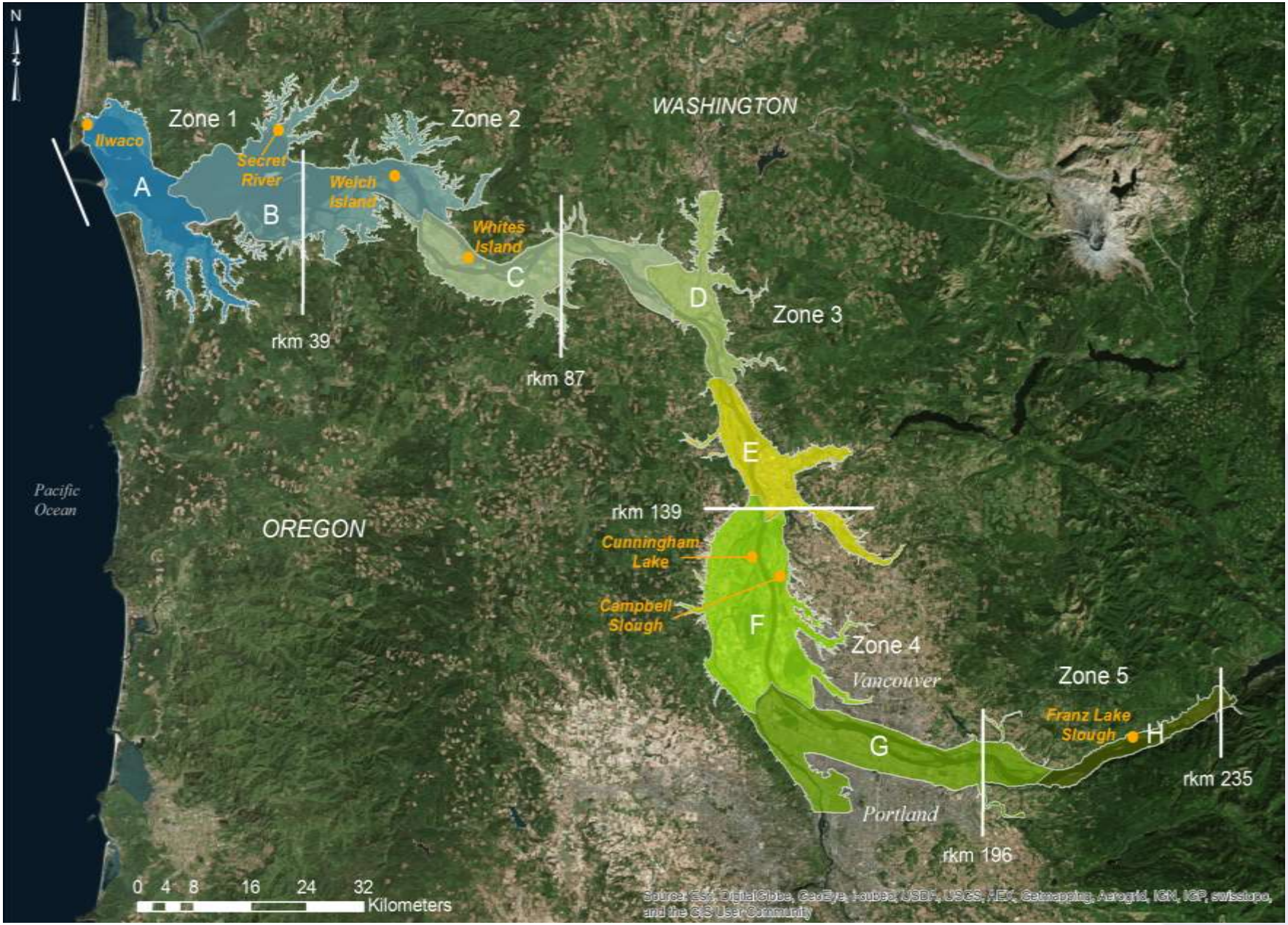
Ecosystem Monitoring Program (EMP)

- Status and trends monitoring of ecosystem condition
  - Started in 2005 to provide basic information, fill knowledge gaps on tidal freshwater section of lower river
  - Now used extensively in restoration design and comparison to action effectiveness data
    - Only monitoring in lower river that collects spatial and temporal variability of concurrent habitat, fish, food web, and abiotic conditions
    - Tidally influenced emergent habitats used by juvenile salmonids for rearing and refugia
    - Sites are relatively undisturbed shallow water vegetated habitats – used as end points for restoration design
    - Created an inventory of habitats across estuary-tidal freshwater continuum
- Funded by BPA/NPCC

EMP Overview

- **2003-2005:** developing program design, inc. initiating Columbia River Estuary Ecosystem Classification
- **2004-2007:** habitat and toxic contaminant monitoring in water, sediment, and fish (resulted in two reports, model of how toxics bioaccumulate in salmon food web)
- **2007-2016:** shifted to filling information on juvenile salmon ecology in tidal freshwater habitats
- **Two Syntheses Reports:**
  - **2011:** Data POR 2005 to 2010 - habitat structure, hydrology, water quality, fish
  - **2013:** Data POR 2005 to 2013 - food web synthesis and inter-annual variability of habitat structure, hydrology, fish metrics

EMP Trends Sampling Sites



EMP Sampling Timeline (2005-Now)

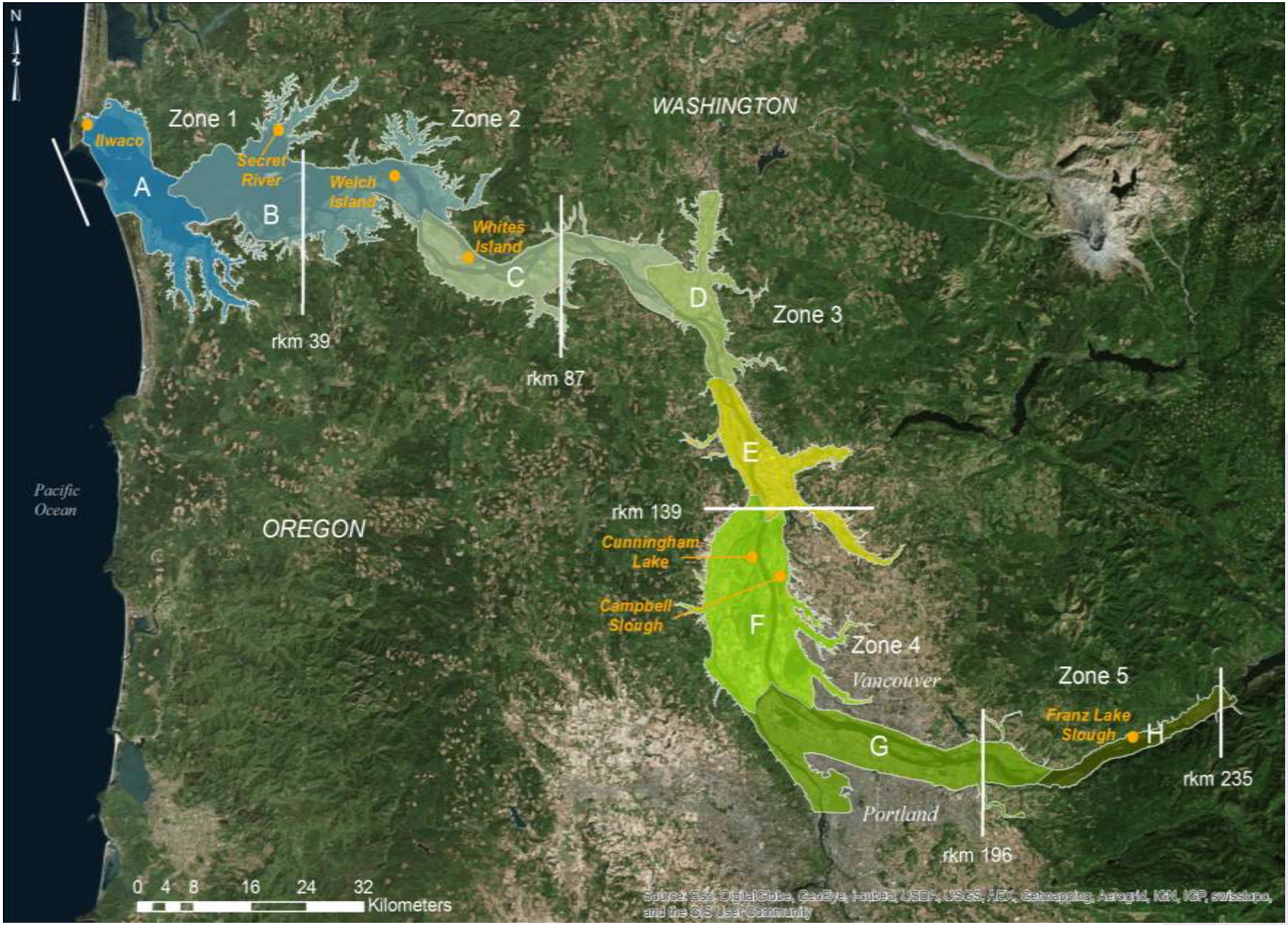
Stratified sampling based on 8 hydrogeomorphic reaches (A-H)

- 4-6 sites
- 2007-2012: focus on identifying spatial heterogeneity
  - rotated sites annually to new, un-sampled reach
  - 1 fixed site at Campbell Slough in Reach F
  - Habitat, fish, prey and water quality
- 2011: Added food web (primary, secondary production, isotopes, biogeochemistry)
- 2011: Added 2 more fixed sites - Franz Lake (Reach H) and Whites Island (Reach C)
- 2013: Shifted focus to identifying temporal variability (trends)
  - Added 3 more fixed sites – Ilwaco (Reach A), Secret River and Welch Island (Reach B)
  - Sites located to represent estuarine-tidal freshwater continuum

Historic Rotating Site Locations

- ✓ Focused on <u>spatial inventory</u> of habitats
- ✓ widely distributed
- ✓ Representative of undisturbed emergent marshes across continuum

EMP Trends Sampling Sites



EMP Components

- **Habitat and Hydrology** - Habitat accessibility/quality for fish, macrodetritus production and flux offsite
- **Mainstem and Abiotic Site Conditions** – water quality, organic matter and nutrient flux; factors affecting primary productivity and food-web resources during peak salmon outmigration period
- **Food Web** - Role of different food web components in supporting juvenile salmon (primary/secondary production)
- **Fish and Fish Prey** - Assessment of salmonid habitat use, prey availability, and diet preference




EMP Team

Amy Borde (PNNL) – Habitat and Hydrology

Joe Needoba (OHSU) – Mainstem and Abiotic Site Conditions

Tawnya Peterson (OHSU) – Food Web

Jeff Cordell, Mary Ramirez (UW) - Fish Prey

Lyndal Johnson, Regan McNatt (NOAA) – Fish Community

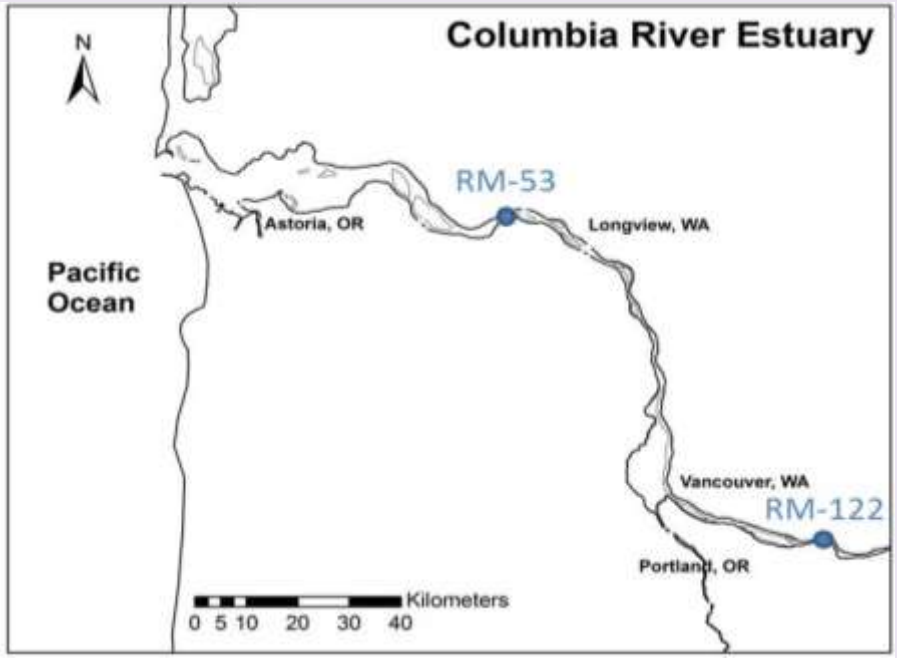
Mainstem Conditions (OHSU)

- Center for Coastal Margin Observation and Prediction (CMOP) platforms
  - RM122 (Port of Camas-Washougal; Reach G), 2012-2017
  - RM53 (Beaver Army Terminal; Reach C)
- Temperature, conductivity, chlorophyll *a* fluorescence, dissolved oxygen, colored dissolved organic matter, nitrate, nitrite, and dissolved ortho-phosphate
- Cycling and flux of OM and nutrients

➢ Understanding of riverine influences on floodplain habitat conditions (e.g., temperature, DO, etc)

➢ Understanding of riverine vs marine influences on estuary

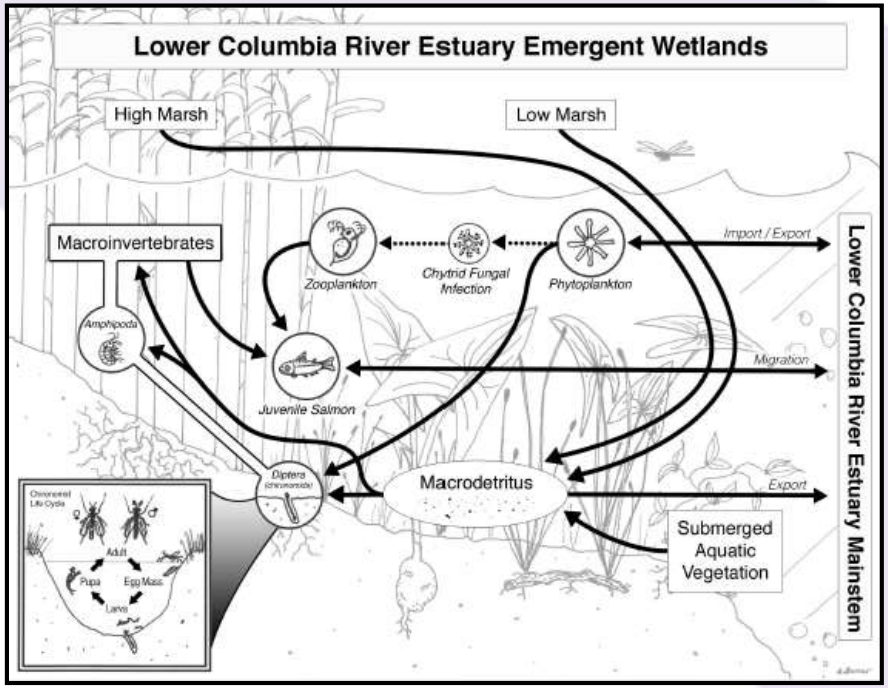
➢ Understanding of how lower Columbia tributaries effect conditions in mainstem



Food Web (OHSU, PNNL)

2011-2017, Reaches A-H

- Food web monitoring at trend sites – April to July
- Primary Production: biomass and productivity of phytoplankton (free-floating algae) and periphyton (attached algae), stable-isotope analysis (plant, insect, and fish tissue), nutrient concentrations, macrodetritius
- Secondary Production: zooplankton abundance, species composition



Fish (NOAA)

2007-2017, Reaches A-H

- Monthly beach seine sampling (year-round)
- Fish: Species richness, abundance, CPUE, stock ID, length, weight, otoliths (growth), marked/unmarked, condition, contaminants, residency