

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



Science Work Group
October 25, 2016

Ecosystem Monitoring Program (EMP)

- Long-term annual monitoring since 2005
 - Status and trends of ecosystem condition
 - Comprehensive assessment of spatial and temporal variation of habitat, fish, food web, and abiotic conditions in the lower river
 - Relatively undisturbed shallow water vegetated habitats
 - Tidally influenced emergent habitats used by juvenile salmonids for rearing and refugia
- Integrated and collaborative effort with multiple partners
- Supported by funding from BPA/NPCC



Ecosystem Monitoring Program Goals

- Characterize structure and function of estuarine and tidal freshwater habitats
 - Provide baseline data on reference conditions
 - Track trends in ecosystem condition over time
 - Better understand range of ecological variability



Lower Columbia Monitoring Timeline

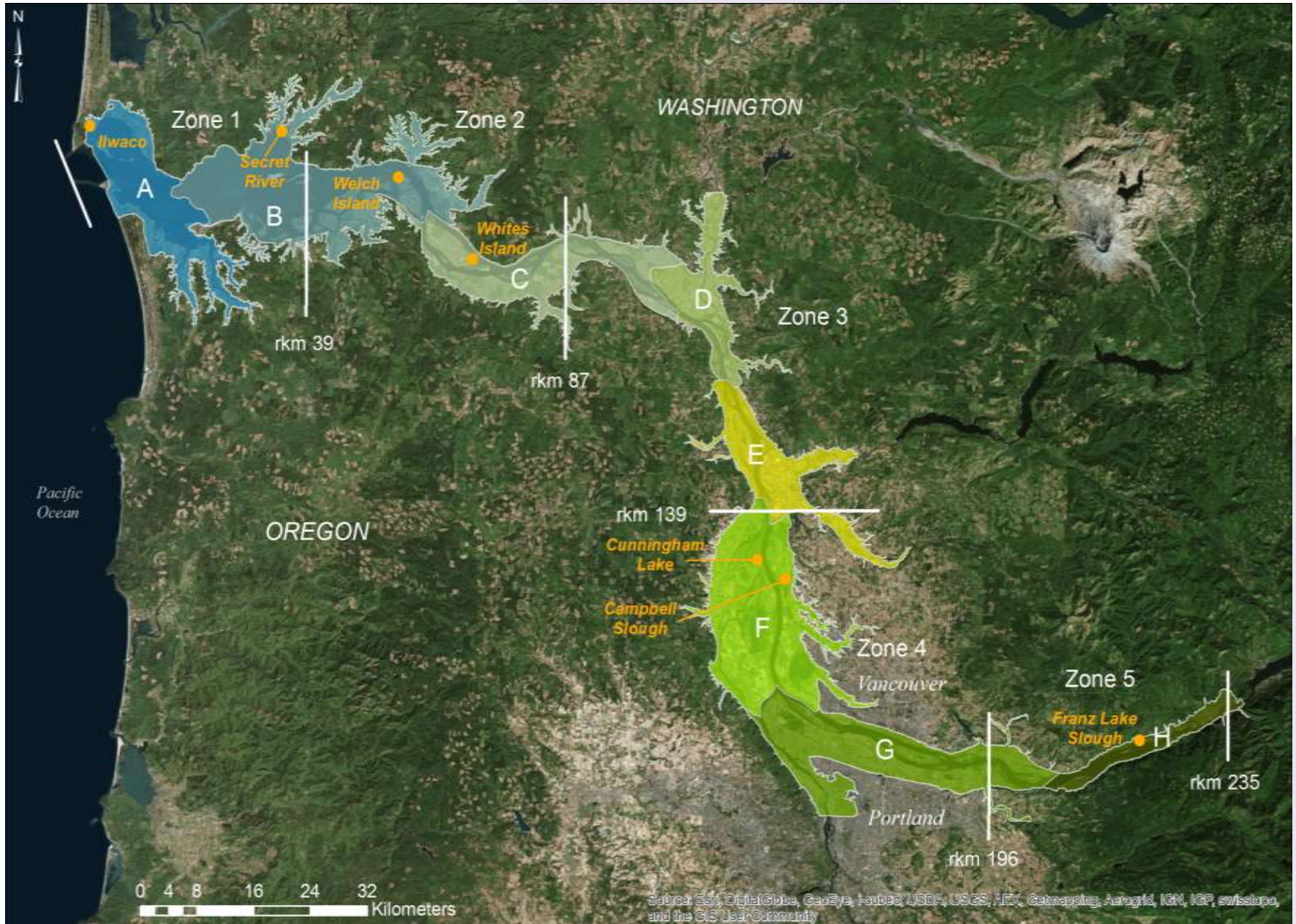
- Pre-2004: research focused on lower reaches, lack of information from tidal freshwater reaches
- 2004-2007: habitat and toxic contaminant monitoring in water, sediment, and fish
- 2007-2016: shifted focus to understanding role of tidal freshwater habitats in juvenile salmon life history
- Synthesis of results:
 - 2005 to 2010: habitat structure, hydrology, water quality, fish
 - 2005 to 2013: variability of habitat structure, hydrology, water quality, fish; food web synthesis



EMP Sampling Design (2005-2016)

- Stratified sampling based on 8 hydrogeomorphic reaches (A-H) :
 - Habitat structure in 2005-2006
 - Added fish, prey, water quality, hydrology in 2007
 - Added food web (primary, secondary production, isotopes, biogeochemistry) in 2011
 - Rotating sites for spatial analysis of habitats across the lower river (almost all reaches) thru 2012
 - Added fixed sites for inter-annual variability (or “trends”) while rotating sites for spatial variability dropped off – only trend sites since 2013
- Sampling occurs primarily in **relatively undisturbed tidally influenced emergent wetlands**

EMP Trends Sampling Sites



EMP Components

- **Habitat and Hydrology** - Habitat accessibility/quality for fish, macrodetritus production
- **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



Additional Questions 2015-2016

- **Tributary Sampling (2015)**

- Lewis River and Grays River
- Sampled fish and food web (Grays only) in lower reaches
- Do juvenile salmon originating from upriver use tributary habitats during migration?



- **Tidal Cycle Sampling (2016)**

- Three trend sites (Campbell Slough, Whites Island, Ilwaco Slough)
- Sampled fish and food web metrics from low to high tide
- How does the fish community and food web structure vary with the incoming tide?



Importance of the EMP

- Baseline data from high quality habitats
 - Natural variation
 - Climate change
- Provides basic understanding of how the lower river functions
- Fills data gaps and addresses scientific uncertainties
- Provides context and reference data to assess effectiveness of our restoration actions
- Informs regional restoration strategies
 - Hydrology/vegetation modeling
- Only consistent fish tissue contaminant burden data



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



Newest Member of the Team



Welcome Angus Ragnar
Hanson!

Born on 10/12/16

Weighing in at 7lbs

15oz, 20.5in with loads
of hair!

Habitat Structure and Hydrology (PNNL)

2005-2015, Reaches A-H

- Percent veg cover, species richness, water level elevation, inundation, channel morphology, sediment accretion
- Summer and winter vegetation biomass
- Accessibility/quality for fish, macrodetritus production



Abiotic Site Conditions (OHSU)

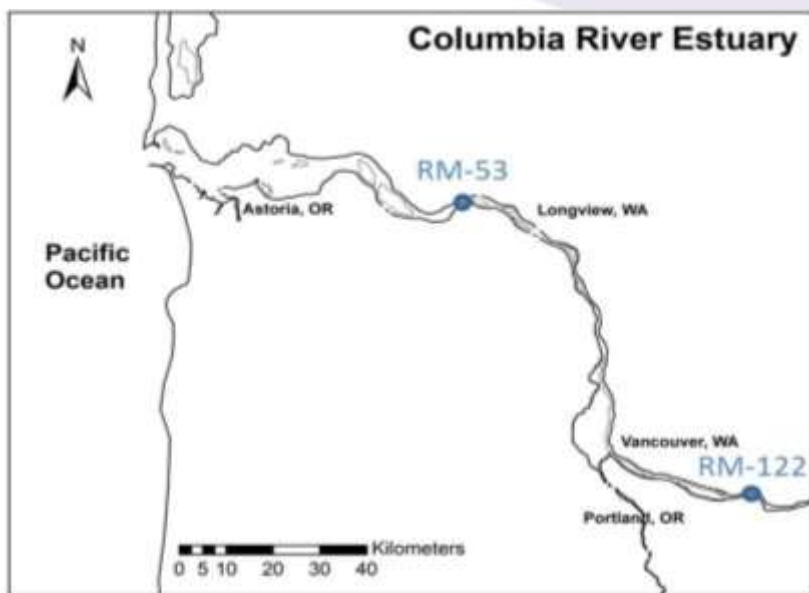
2005-2015, Reaches A, C, F, H

- Continuous water-quality data (temperature, DO, pH, specific conductance) – April to July
- Factors affecting primary productivity and food-web resources during juvenile salmonid migration



Mainstem Conditions (OHSU)

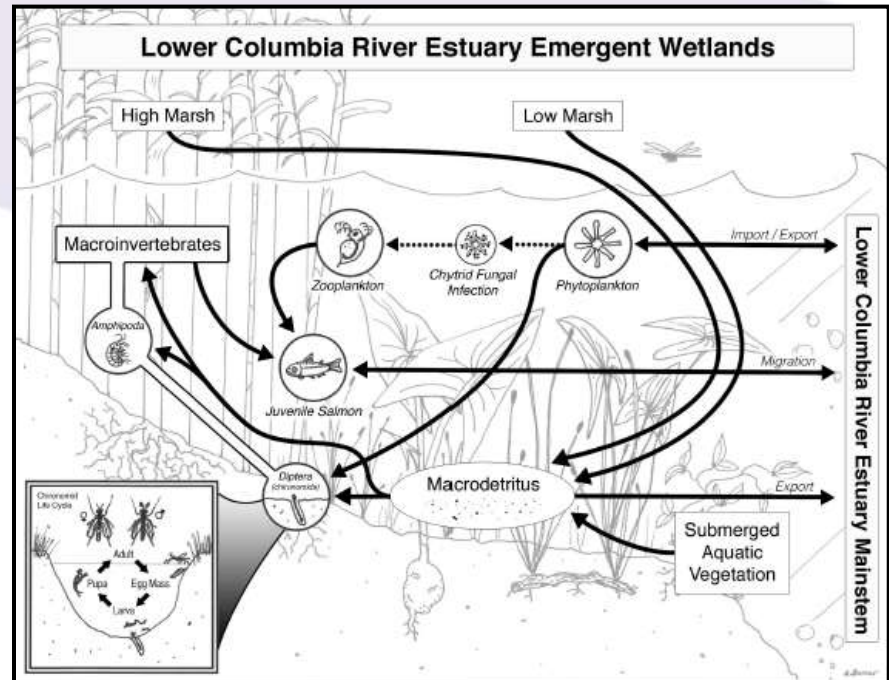
- Center for Coastal Margin Observation and Prediction (CMOP) platforms
 - RM122 (Port of Camas-Washougal; Reach G), 2012-2015
 - RM53 (Beaver Army Terminal; Reach C)
- Temperature, conductivity, chlorophyll *a* fluorescence, dissolved oxygen, colored dissolved organic matter, nitrate, nitrite, and dissolved ortho-phosphate
- Cycling and flux of OM and nutrients



Food Web (OHSU, PNNL)

2011-2015, 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, macrodetritus
- Secondary Production: zooplankton abundance, species composition



Fish Prey (UW)

2007-2013, 2015; Reaches A-H

- Monthly samples at trend sites - April to July
- Neuston tows (open water/emergent vegetation), Chinook stomach contents, benthic cores
- Salmon prey production, availability, and diet preference



Fish (NOAA)

2007-2015, 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

