

# **Characterizing the condition of outmigrating Chinook salmon and steelhead in the Columbia River Estuary**

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**PNNL**

**Columbia River Estuary Conference Astoria, OR**

# Presentation Objectives

- Describe a “new” study occurring in the Columbia River estuary.
- Describe other, relevant work connected to this study.

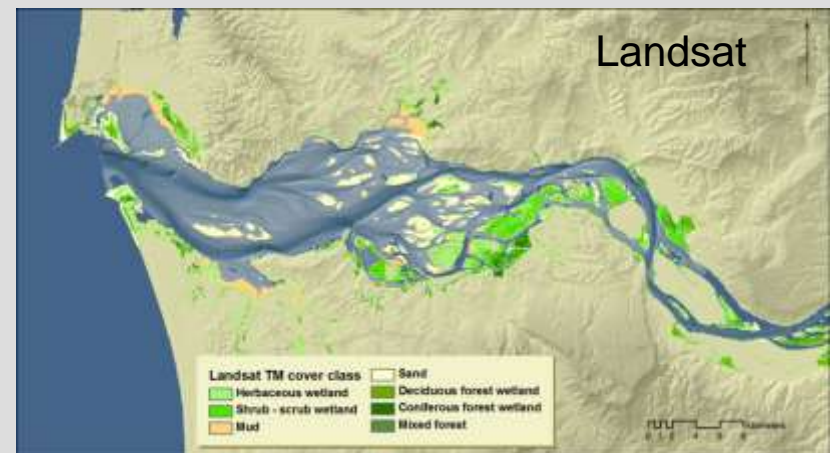
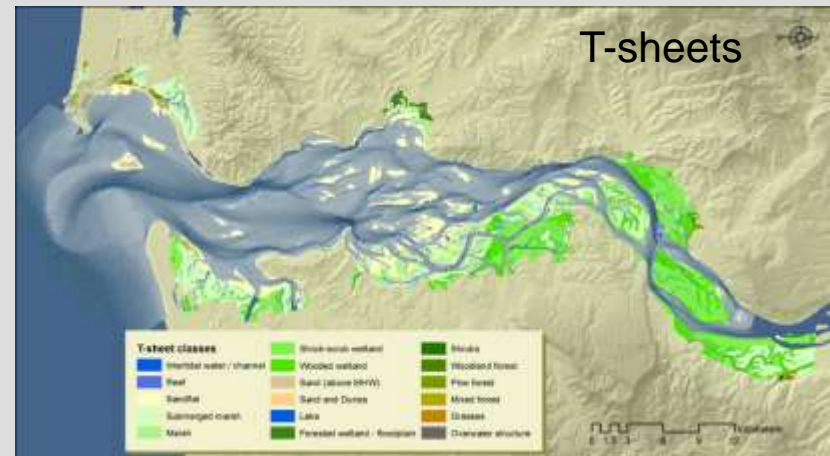
# Columbia River Estuary Salmon

- Fundamental management question addressed: Are estuary habitat restoration actions (estuary= rkm 0-234), which are focused on recovering tidal wetlands, achieving expected biological and environmental benefits, especially with respect to juvenile salmon?
  - Are particular actions having the desired effect and, if not, why not?
  - Do responses to restoration actions vary as a function of species, populations and life history type (e.g., yearling vs. sub-yearling)?

# Reduced Off-channel Rearing Habitat in the Columbia River Estuary

- Historical floodplain habitat (mouth – Bonneville) ~1468 km<sup>2</sup>
- 68% to 70% of tidal wetlands (mouth to Bonneville Dam) lost to diking, filling, flow changes, etc. (Marcoe and Pilson, LCEP)

Wetland Habitat Change Lower Estuary



from Jennifer Burke

# Study Progression

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FY15	FY16	FY17	FY18
Ramp up	Data collection and analysis	Data collection and analysis	Synthesis of results

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# Approach

- To measure benefits we will compare indicators of performance (metrics) in two ways.
  - Direct benefits. Compare between treatment and reference sites. Focus is sub-yearlings. (PNNL)
  - Indirect benefits. Hypothesis is that transport of organic matter from wetlands is consumed by salmon outside the wetlands. Pertains mostly to yearling sized fish. (NOAA)
    - Measure flux (Net transport) of organic matter from restored sites.
    - Compare fish metrics between “zones” of the estuary- Bonneville Dam area, several sites in the mid-river, and at the mouth of the estuary.



**Steamboat**



**Batwater**



**Dibblee**

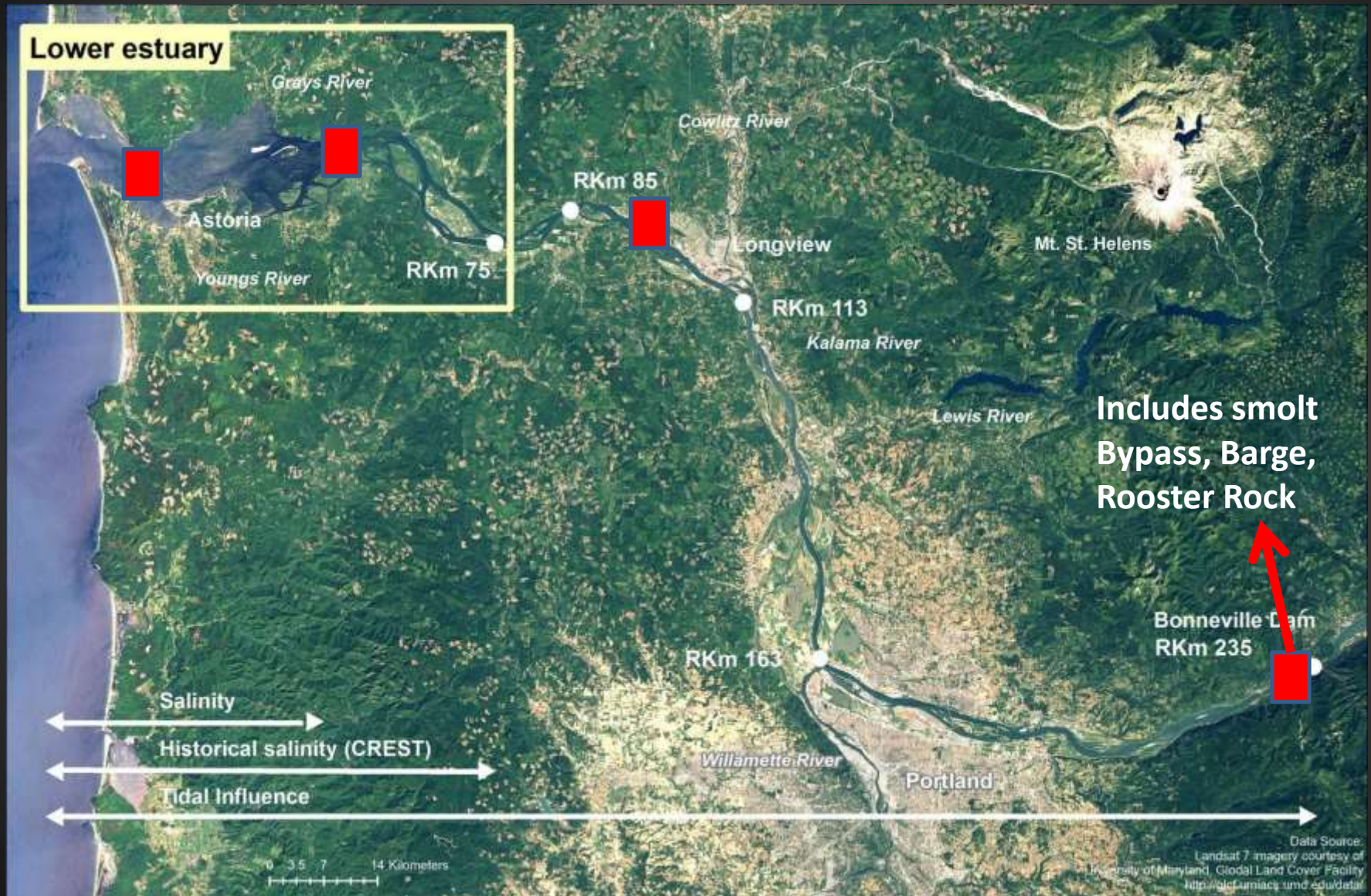


**Karlson**





# Columbia River Estuary





# Approach Flux



# Approach

## Flux

- Definition- NET amount of organic material transported out of a wetland into mainstem that becomes available to juvenile salmon.
- Hypothesis: Scaling up. By knowing certain wetland characteristics, we believe we can predict/model flux for other, non- studied wetlands.

# Approach

- Measure direct and indirect benefits at the same location.
  - Sample multiple habitat types.
- A variety of sampling methods will be used.
- Multiple time periods.



Rooster Rock SP





**Setting the net**



**Pulling the net on deck**



**Pursing the net**



**Fish crowded in bunt**



# Approach

## Horizontal Gradient



# Metrics, Selected

- Genetic Stock Composition
- Growth/Condition
  - Liver glycogen
  - IGF
- Fish Performance
  - Diet
  - Smoltification
- Prey Community
  - Insects
- Processes
  - Flux
  - Stable isotopes
  - Smolt Physiology
- General
  - Channel morphology
  - Temperature

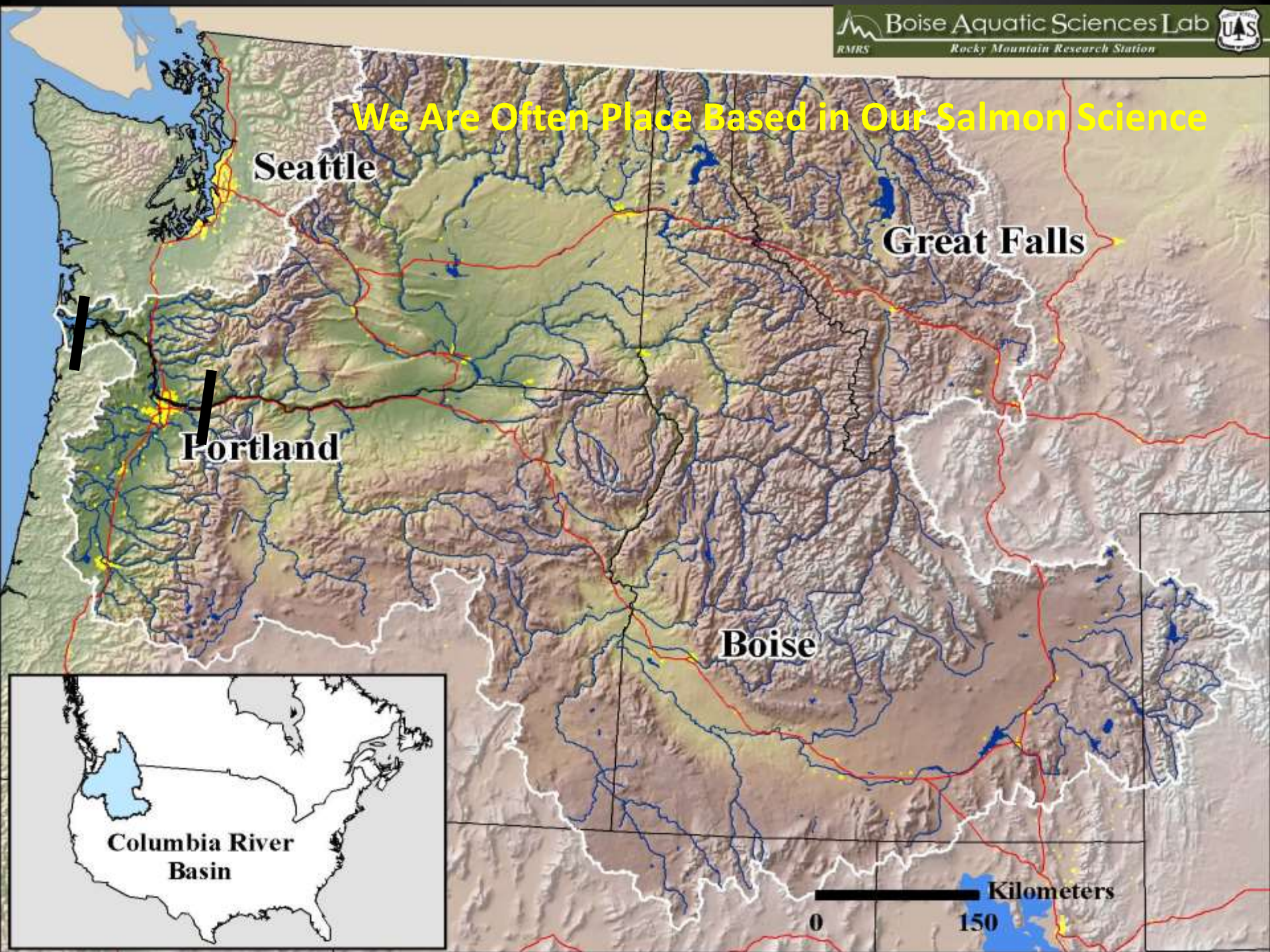


# Bleeding Fish, Taking Livers





## We Are Often Place Based in Our Salmon Science



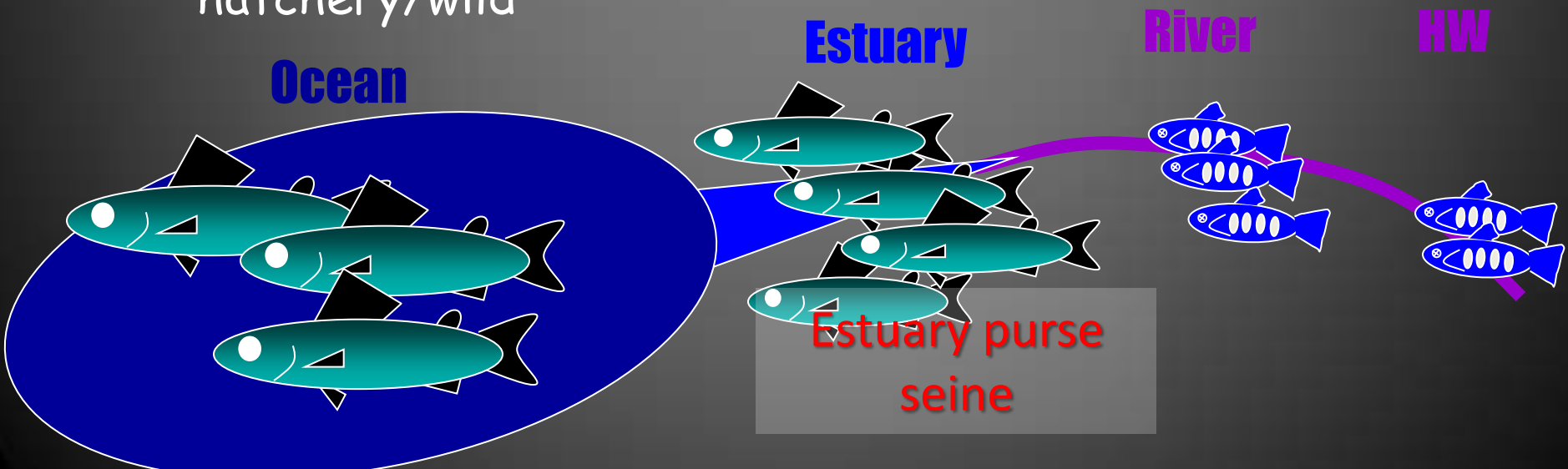
# Connectivity

- Physical
  - Flow is a function of snowpack and rainfall
  - Flow is an important determinant of plume features.
- Biological
  - The fish



# Hypotheses

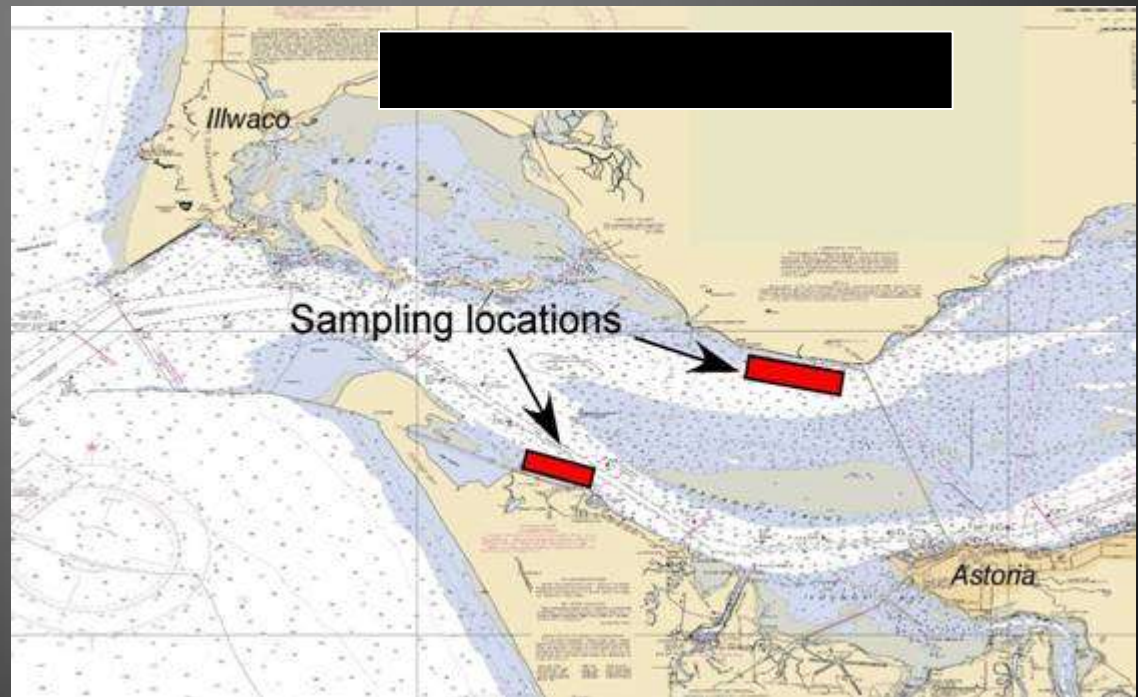
- Better understand **salmon marine ecology** by knowing when and **what** is entering the ocean
- Better understand **salmon river passage** by knowing when and **what** reach the estuary
- **What** = species, age class, abundance, stock origin, condition (size, diet, parasites, pathogens, etc.), hatchery/wild



# Estuary purse seine methods

## Focus on spring outmigration of juv. salmonids

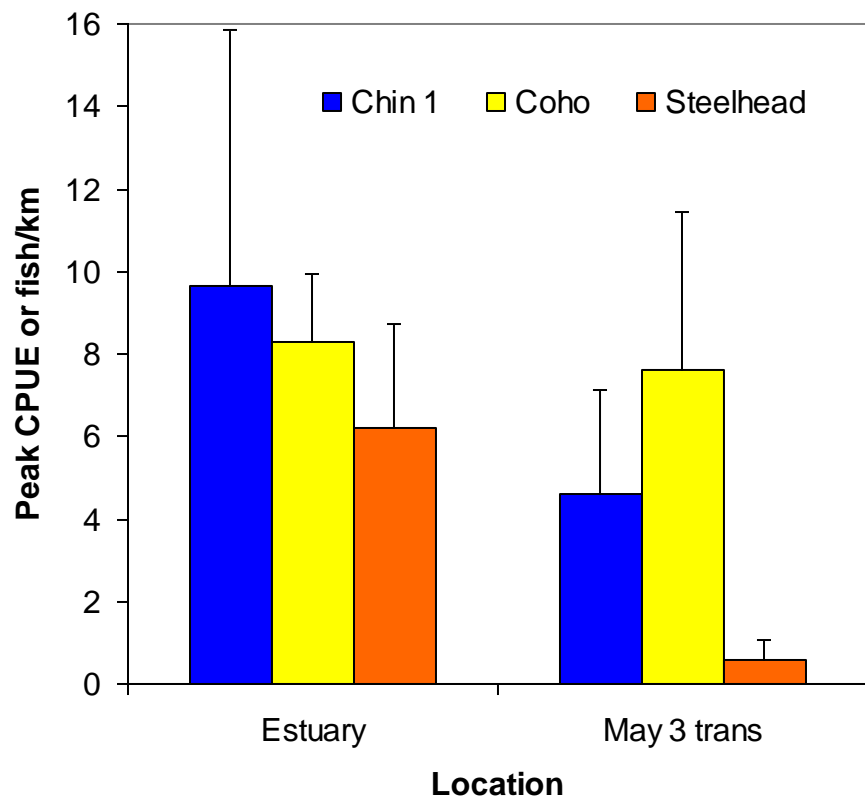
- Sampling at edges of deep channels (~30 ft depth)
- Mid April to late June
  - every other week (2007-13)
- Monthly
  - Sep. only (2007-08)
  - July-Oct. (2009-12)
- 6-8 sets per station per cruise
- Temp/salinity profiles every set



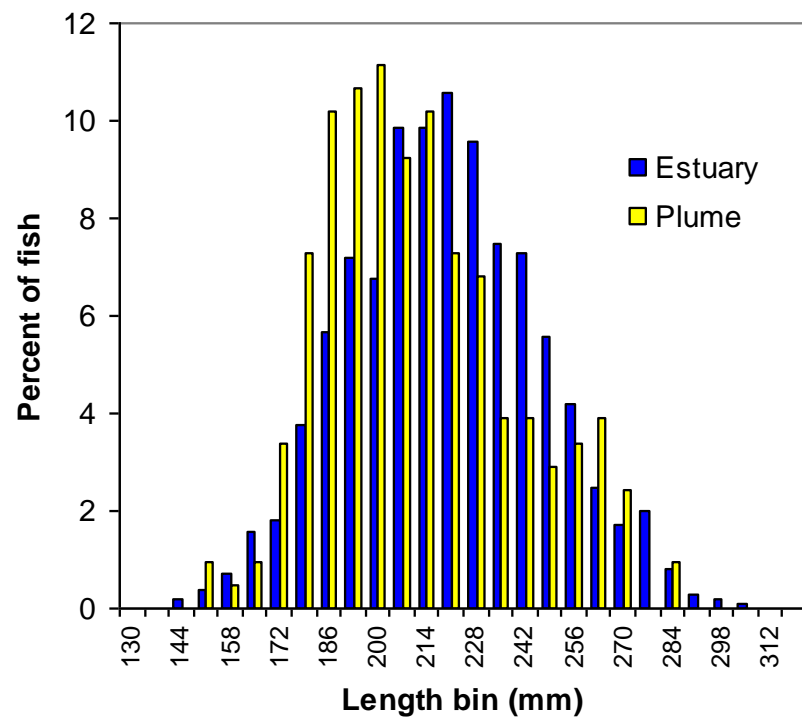


# Are we missing steelhead in the plume?

## Abundances, EPS vs Plume (2007-2010)



## Length frequency (2007-2010)

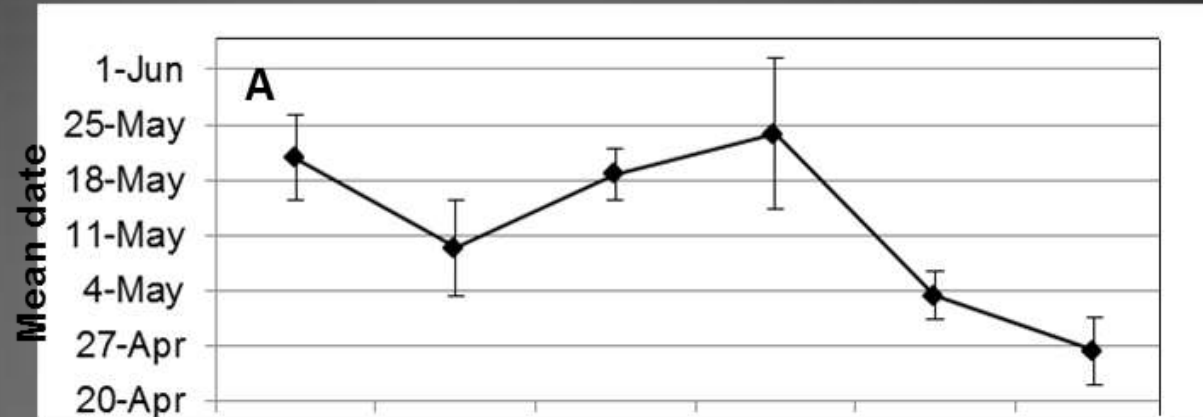


From L. Weitkamp

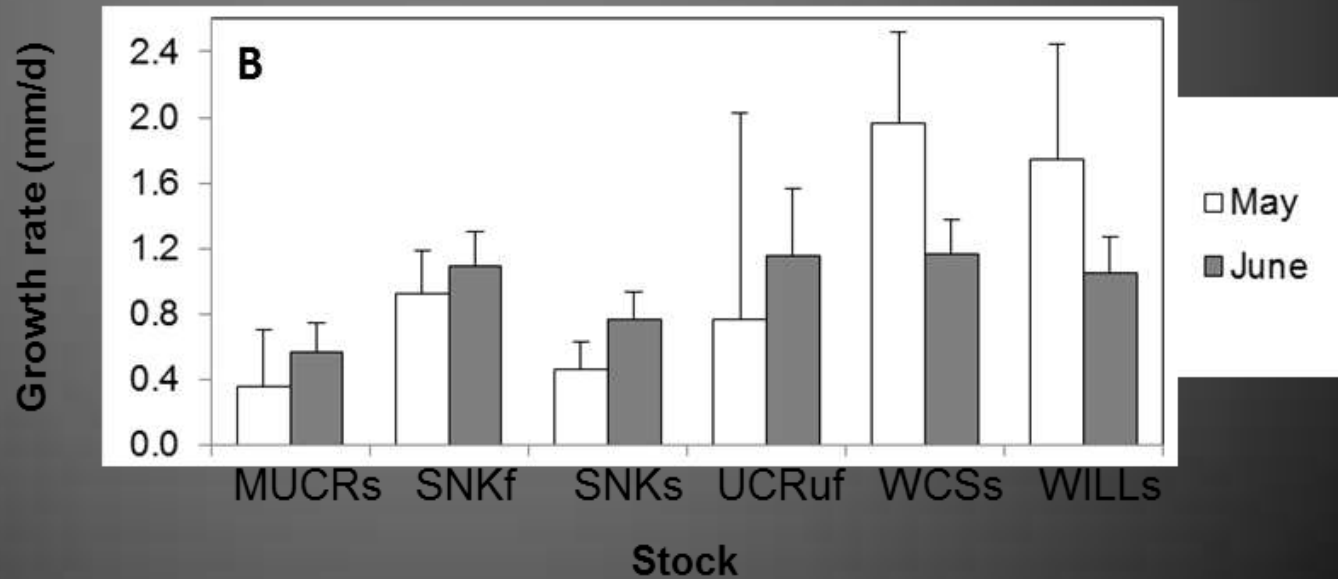
Means (mm FL)  
Plume: 208.1  
EPS: 216.58

# Yearling Chinook ocean entry timing influences ocean growth opportunity

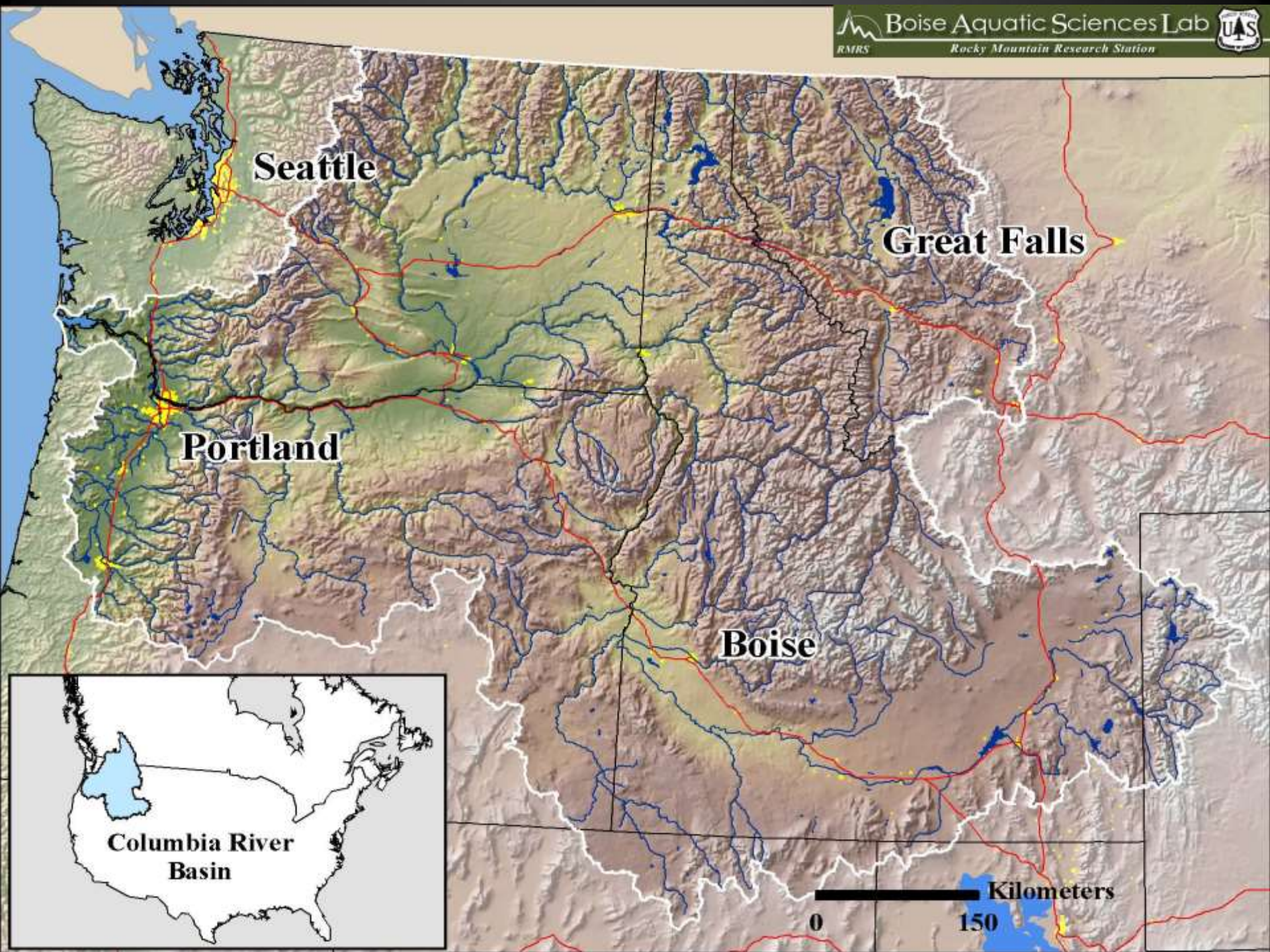
Mean date of  
ocean entry



Ocean growth rate  
for fish collected  
during May & June  
ocean surveys



From L. Weitkamp





# Thanks!!!!

- Site Scale Work: Nikki Sather, Gary Johnson
- Dam and Barge Sampling: Jennifer Goesslin
- Brian Beckman, Meredith Journey, Abby Fuhrman
- Field crews
- Funding: US Army COE (Cynthia Studebaker)



Questions?