

# Project Level Effectiveness Monitoring in the Estuary and Response in Fish Communities



# Who is CREST?

- **Council of Governments (b. 1974)**
  - **Members:** Port of Astoria, Wahkiakum Port Dist. #2, Port of Peninsula, Port of Ilwaco, City of Seaside, City of Warrenton, City of Astoria, City of Gearhart, City of Ilwaco, Clatsop County, Wahkiakum County, Clatsop Soil & Water Dist., City of Cannon Beach



# CREST DEPARTMENTS:

## 1. Coastal/Estuarine Planning

## 2. Habitat Restoration

Project Types:

- dike breach
- riparian enhancement
- stream realignment
- culvert/bridge replacement
- in-stream enhancements

## 3. Ecosystem Monitoring



# Effectiveness Monitoring

NOAA Technical Memorandum NMFS-NWFSC-97



## **Protocols for Monitoring Habitat Restoration Projects in the Lower Columbia River and Estuary**

February 2009

U.S. DEPARTMENT OF COMMERCE  
National Oceanic and Atmospheric Administration  
National Marine Fisheries Service

# ■ Fish Community Parameters

- Species
- Abundance
- Length
- Weight



Tributary & Mainstem Baseline Seining



Restoration & Reference Site Fyke Net Trap

# ■ Additional Parameters

- Genetics
- Prey Availability\*
- Prey Utilization\*
- Residence Time



Insect Fallout Traps  
& Gastric Lavage



*\*lab analyses at AHS*

# ■ Habitat Parameters

- Water Quality
- Vegetation
- Sediment Accretion
- Hydrology (channel formation)

# ■ Sampling Design

- Before & After
- Comparison to baseline
- Comparison to reference sites



# Coordinated Regional Effort

## AEM for individual restoration projects (EP Coordination, BPA funding)

- NOAA Fisheries (multiple sites)
- CREST, Columbia Land Trust, Scappoose Bay Watershed Council, Ash Creek Forest Management, Parametrix

## Cumulative Effects Study (USACE funding)

- Measuring hydrology, channel morphology, vegetation, fish presence and community structure, and flux of nutrients and organic matter
- Developing monitoring protocols (Roegner et al. 2008)

## Reference Site Study (EP & PNNL Coordination, BPA funding)

- Measuring hydrology, channel morphology, vegetation, elevation profiles, and sediment accretion

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### Coordination to ensure:

- ✓ Data are comparable across sites and time for similar types of actions and habitats
  - ✓ Results are scalable

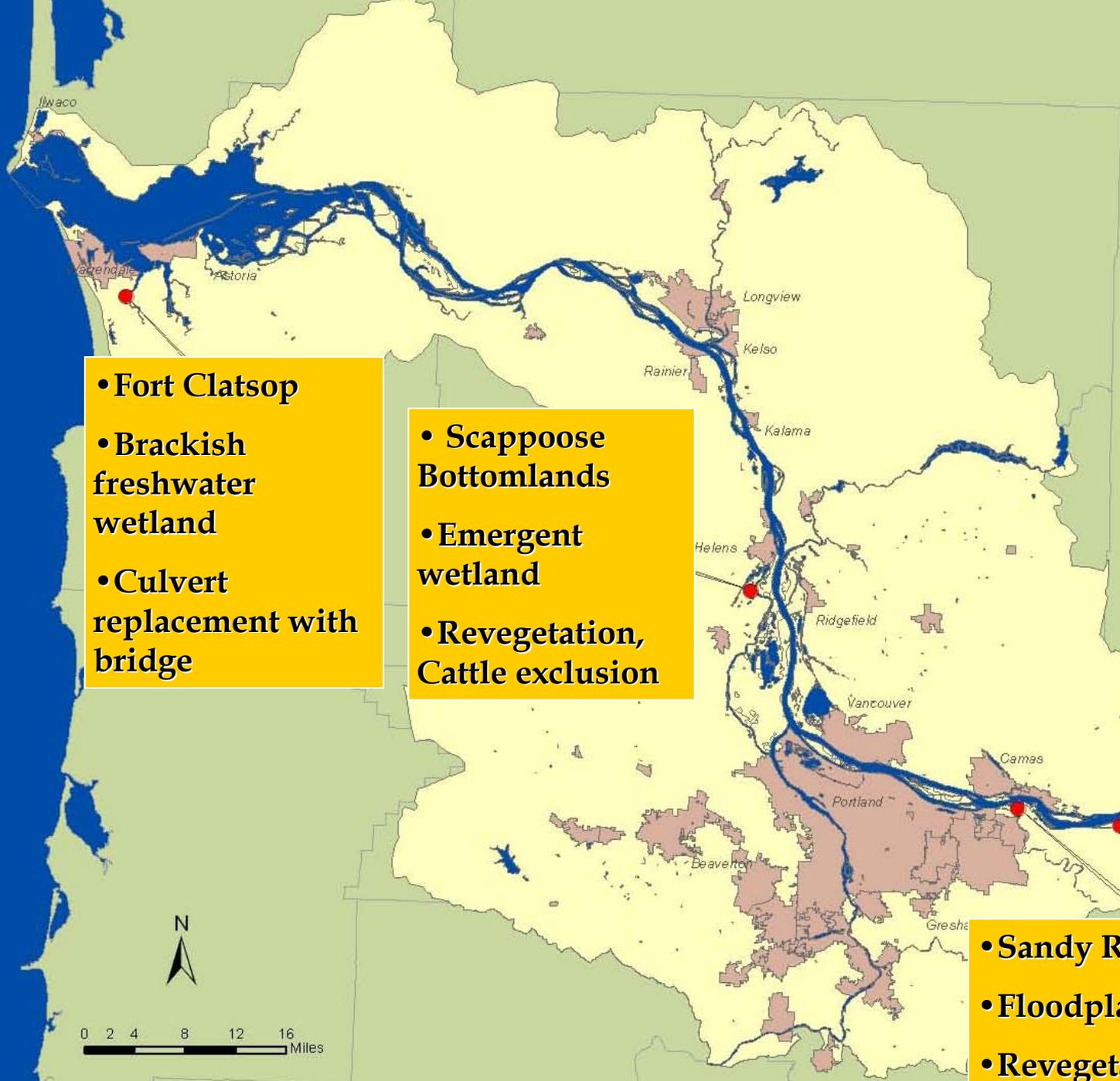
# Spring 2008: Selection of Pilot AEM Sites

(EP Science Workgroup, BPA funding)

- Developed a list of sites:
  - Multi year restoration projects had occurred
  - Some baseline monitoring was conducted
- Number of potential sites = 12
- Intensive versus Extensive
- Selected 4 sites representing project diversity
  - Different river reaches, habitat types, and restoration strategies
- Solicited feedback on sites from scientific working groups

**Estuary Partnership Potential Effectiveness Monitoring Sites**

- Effectiveness Monitoring Site
- City Limits
- Study Area



- Fort Clatsop
- Brackish freshwater wetland
- Culvert replacement with bridge

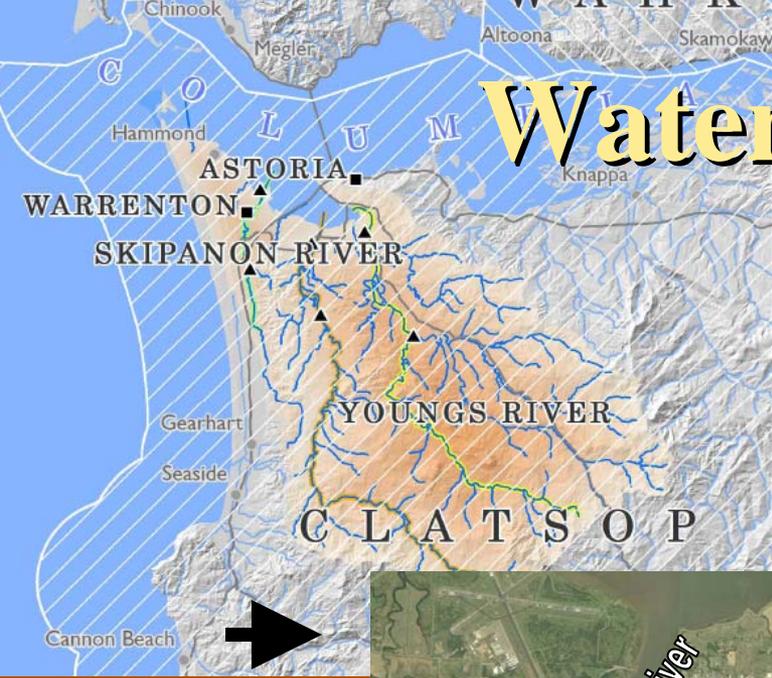
- Scappoose Bottomlands
- Emergent wetland
- Revegetation, Cattle exclusion

- Mirror Lake
- Bottomland riparian forest
- LWD, Culvert enhancement, Revegetation

- Sandy River Delta
- Floodplain forest
- Revegetation



# Watershed Context



- Extensive diking for flood control and agriculture
- Dredging and removal of woody debris to fill lands and aid navigation
- Pesticide and fertilizer use
- Runoff and sedimentation from logging operations and road building
- Encroaching development
- Erosion & poor riparian cover

A satellite image of the Lewis & Clark River watershed. The river is labeled 'Lewis & Clark River'. Several locations are marked with arrows and text: 'Otter Point Dike Breach', 'South Slough Bridge Install', 'Seaside Dike Breach II', and 'Seaside Dike Breach I'. A large black arrow points from this image towards the zoomed-in satellite image on the right.

Otter Point  
Dike Breach

South Slough  
Bridge Install

Seaside Dike  
Breach II

Seaside Dike  
Breach I



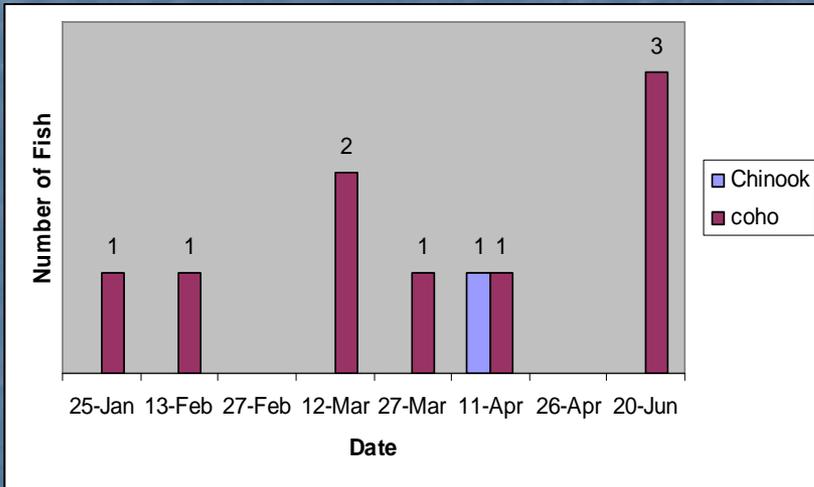
# Fort Clatsop's South Slough

- Restore tidal processes
- Reconnect 50 acres of historic off-channel rearing habitat
- Minimize risk to County Rd.

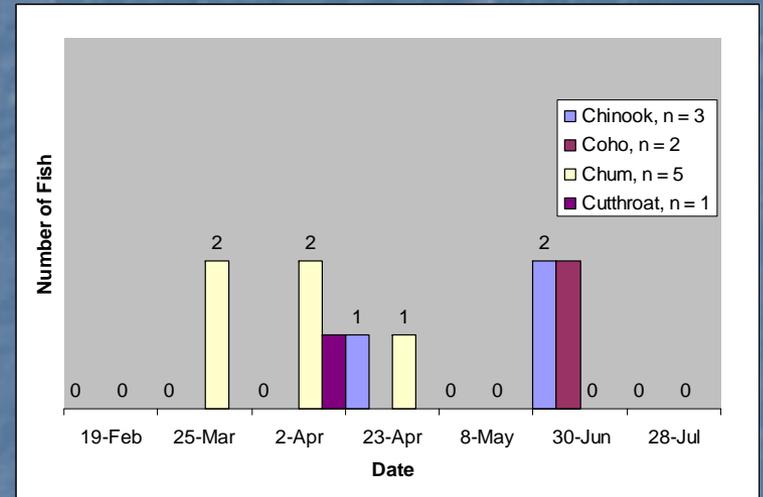


# South Slough Salmonid Abundance

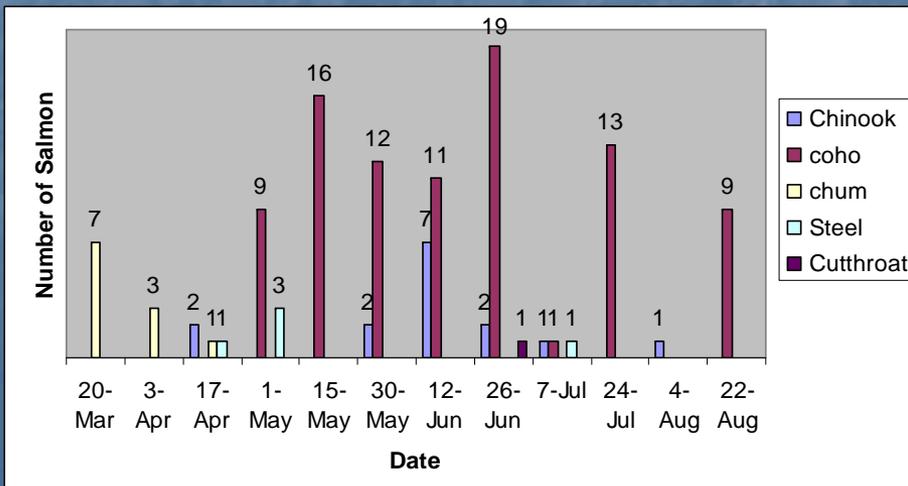
## South Slough Pre-construction (2007)



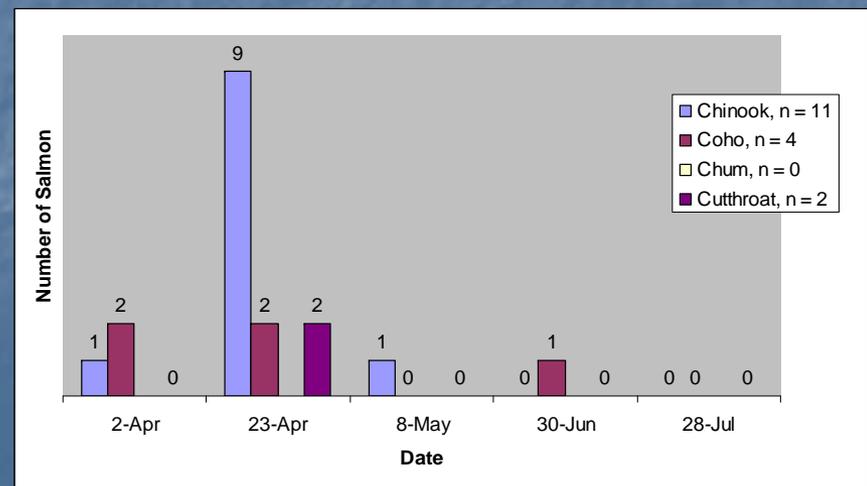
## Post-Construction (2009)



## Post-Construction (2008)



## Reference Site (2009)



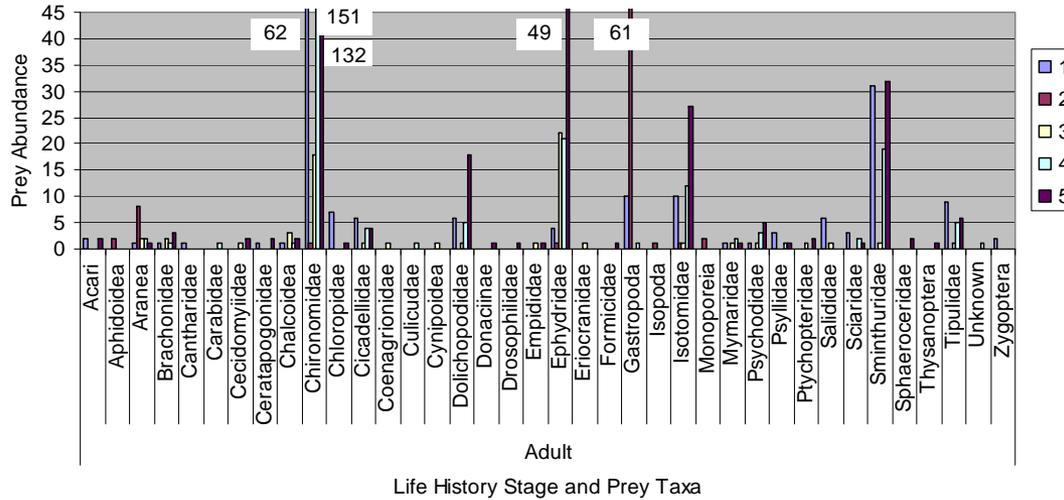
# Salmonid Average Lengths 2008

Date	Chinook salmon	Chum	Coho	Steelhead	Cutthroat Trout
6-Mar		43*			
20-Mar		38			
3-Apr		32			
17-Apr	104	50*		192*	
1-May			40	119	
15-May			43		
30-May	46		51		
12-Jun	50		56		
26-Jun	55		59		139
7-Jul	51*		73*	78*	
24-Jul			69		
4-Aug	127*				
22-Aug			69		

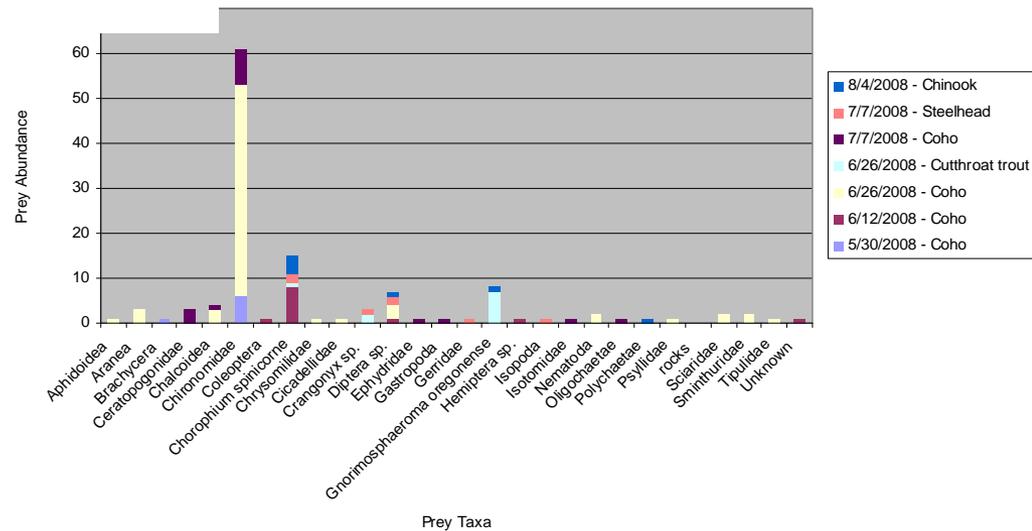
\* Indicates individual length measurement

# Prey Availability & Utilization

Adult Insect Prey Availability  
Ft. Clatsop South Slough  
Traps 1 through 5 (see legend)  
04 August, 2008



Salmonid Diet Composition  
South Slough, 2008



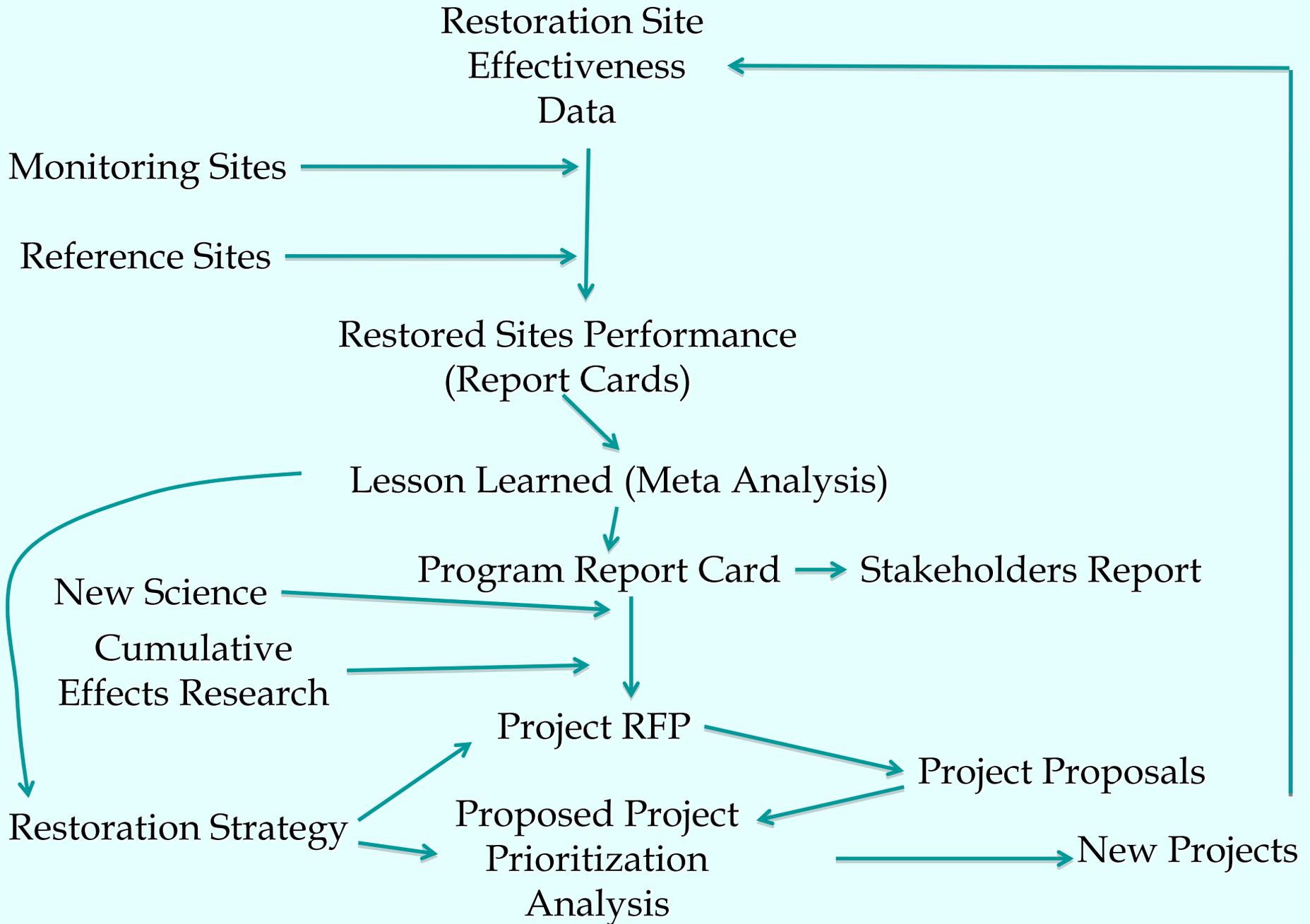
# Site Specific Lessons:

- Juvenile salmon occupy restoration sites in accordance with their life histories; similar abundances in restored marshes compared to mainstem tributaries.
- Juvenile salmon are utilizing the dominant prey types available in the site.
- Recruitment & migration corridor factors, as well as site maturity, may control variability in fish populations.

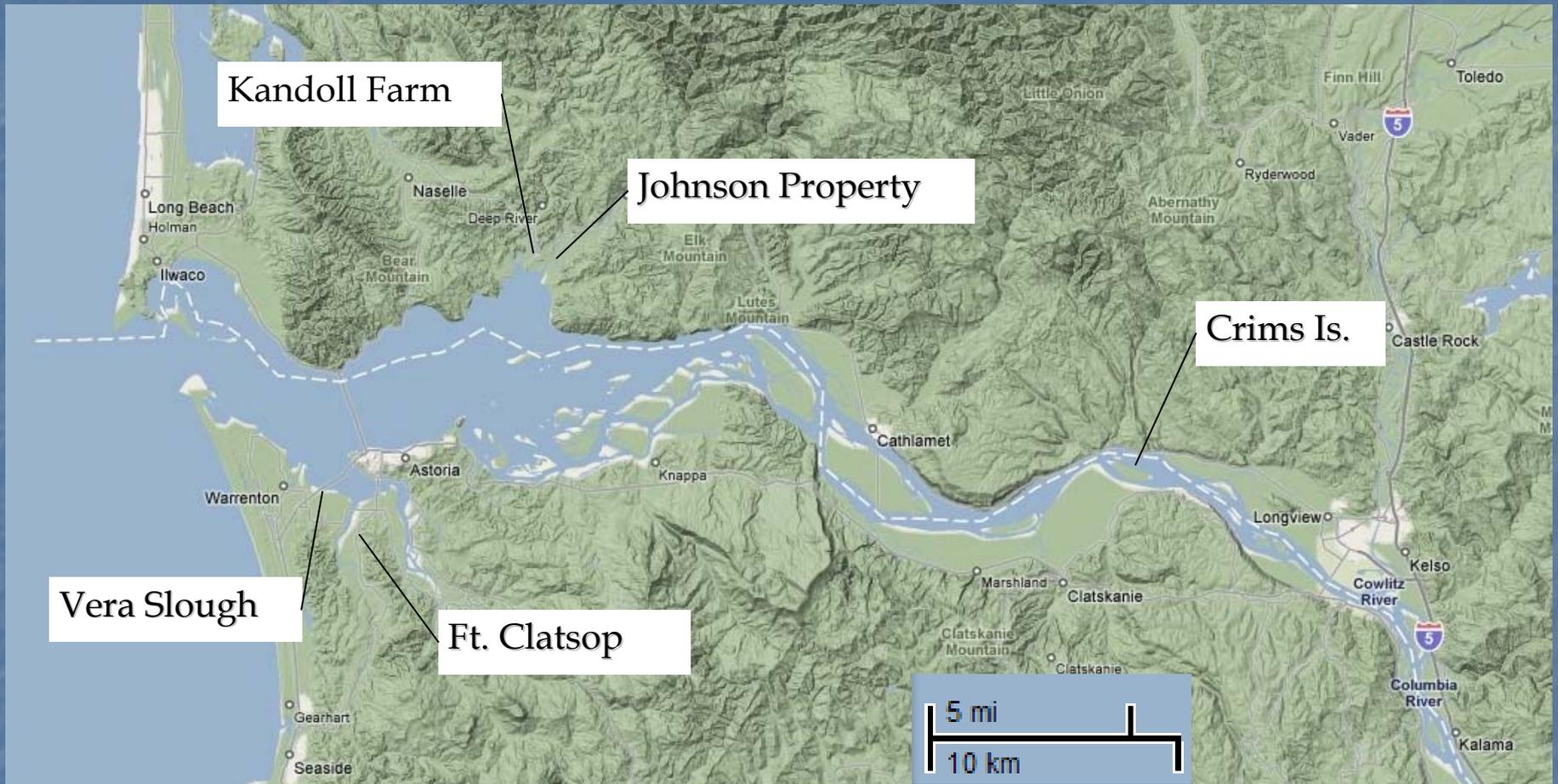
# Meta-Analysis of Data for Monitoring Programs

- Literature Search
- Contact restoration & monitoring partners for data
- Identify sites with comparable restoration actions & pre/post data
- Compile data on select metrics
- Select analyses methods and apply
- Preliminary meta-analysis metrics:
  - Water temperature
  - Sediment accretion rate
  - Juvenile salmon presence/absence
  - Photo points





# Meta-Analysis Sites



5 sites chosen

Tidal reconnection projects (dike breach, culvert & tide gate replacements)

Restoration actions between 1999-2008

# Data Available

		Photo Point*	Water Depth	Water Temp.*	Sediment Accretion*	Vegetation Similarity	Fish Presence*	Fish Diet	Biomass Flux
Crims Is.	Pre	Y	N	N	n/a	N	Y	N	N
	Post	Y	N	N	Y	?	Y	Y	N
	Ref	Y	N	N	Y	Y	Y	N	N
Ft. Clatsop	Pre	N	Y	Y	n/a	N	Y	N	N
	Post	Y	Y	Y	Y	N	Y	Y	N
	Ref	N	N	N	Y	N	Y	Y	N
Johnson Property	Pre	Y	Y	N	n/a	N	Y	N	N
	Post	Y	Y	N	Y	N	Y	Y	N
	Ref	Y	Y	N	N	N	N	N	N
Kandoll Farm	Pre	Y	Y	Y	n/a	Y	Y	N	N
	Post	Y	Y	Y	Y	Y	Y	Y	Y
	Ref	Y	Y	N	Y	N	N	N	Y
Vera Slough	Pre	Y	Y	N	n/a	Y	Y	N	N
	Post	Y	Y	N	Y	Y	Y	Y	Y
	Ref	Y	Y	N	Y	Y	Y	N	Y

\*Used in preliminary meta-analysis

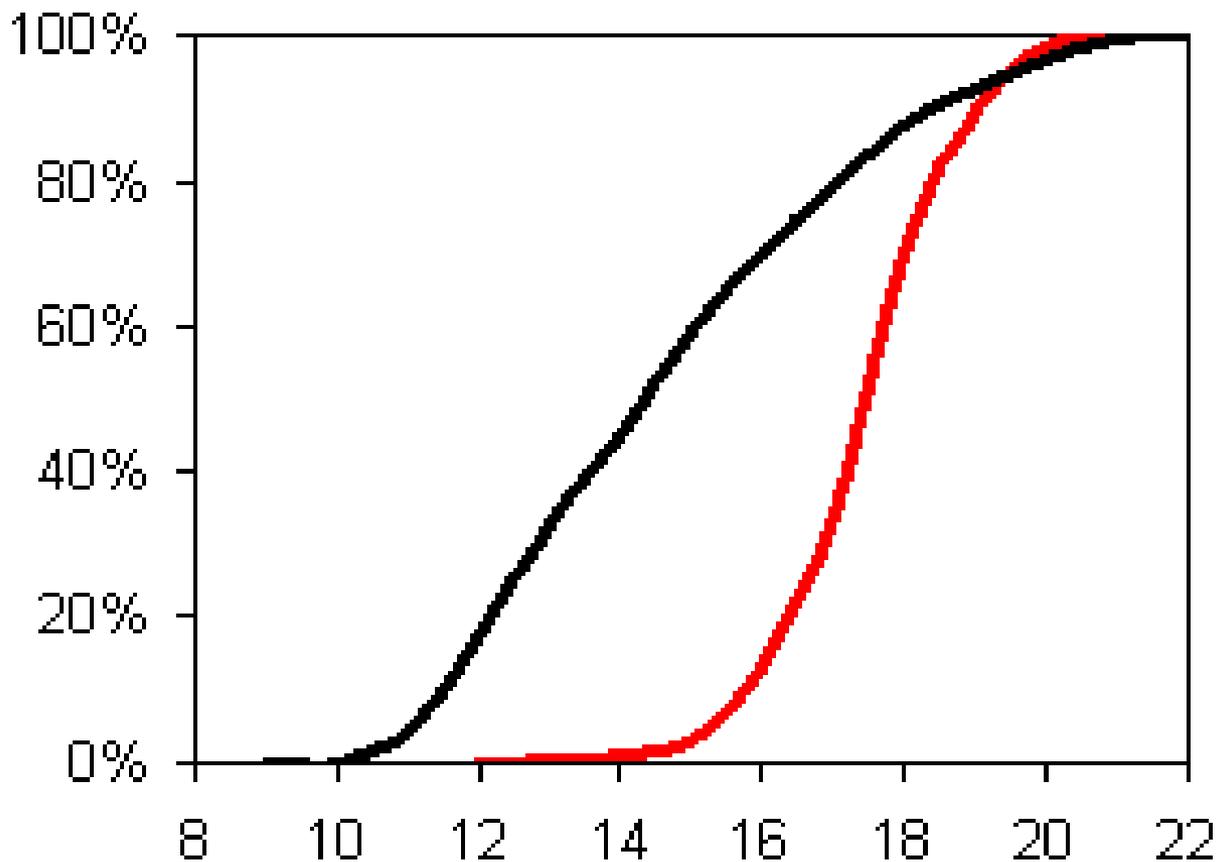
# Vegetation Photo Points: South Slough



# Water Temp: South Slough

June

— Pre restoration, 2007  
— Post restoration, 2008



Result:  
Water  
temperatures  
were lower  
post  
restoration

# Sediment Accretion Rates

Sediment Accretion Rates (cm y<sup>-1</sup>) at Paired Restoration & Reference Sites

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	Restoration Site	Reference Site
Crims Is. <sup>[1]</sup>	1.1	0.1
Ft. Clatsop <sup>[2]</sup>	--	1.0
Johnson Property <sup>[3]</sup>	2.1	--
Kandoll Farm <sup>[4]</sup>	2.6	-0.1
Vera Slough	--	--

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<sup>[1]</sup> Measurements taken September 2006 and February 2007

<sup>[2]</sup> Measurement taken July 24, 2008 (restoration) 8/15/08 (reference).

<sup>[3]</sup> Measurements taken 2005 and 2007.

<sup>[4]</sup> Measurements taken 2005 and 2007.

# Salmon Presence

	Pre-Restoration	Post-Restoration
Crims Is.	No	Yes
Ft. Clatsop	Yes (sparse)	Yes (abundant)
Johnson Property	No	Yes
Kandoll Farm	No	Yes
Vera Slough	No	No

4 of 5 sites demonstrated increased fish presence post project implementation

Vera Slough outside of migratory pathway?

# Summary--Is the response variable trending in the desired direction?

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	Photo Point	Water Temperature	Sediment Accretion Rate	Juvenile Salmon Presence
Crims Island	Yes	--	Yes	Yes
Ft. Clatsop	--	Cooler in Summer	--	Yes
Johnson Property	Yes	--	--	Yes
Kandoll Farm	Yes	Cooler in Summer	Yes	Yes
Vera Slough	Yes	--	--	No

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# Take Home Message

- Long-term monitoring data is invaluable
  - Variability in level of effort / metrics between sites limit analyses
  - Pre/post project implementation bare minimum
  - >10 year per site preferable to get long-term trajectory
- Include report cards
  - lists project objectives and expected outcomes
  - monitoring data results then document whether objectives were met
- Restored sites are responding measurably to restoration actions on individual site scale
- Differences in response among sites, for example temperature and accretion rates, can likely be explained by differences in geomorphology, elevation and location
- Important considerations in assessing cumulative effects on large scale
- How much is enough...and where should we focus our limited resources for biggest uplift are difficult questions



**Thank you!**

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