

# **Columbia River Estuary Restoration Effectiveness Monitoring**

**Chris Hathaway (Lower Columbia River Estuary Partnership)  
and Gary Johnson (PNNL)**

**Columbia River Estuary Conference  
April 30, 2008  
Astoria, Oregon**

# Outline

- Background
- Monitoring indicators and protocols
- Summary of ongoing monitoring
- Intensive and extensive monitoring
- Reference sites
- Estuary Partnership Effectiveness Monitoring plans for summer 2008
- Management applications
- Recommendations

# Background

- Lots of ecosystem restoration happening
- Many funders, implementers
- Many types of restoration projects
- Many different goals and drivers
  - Specific restoration project goals
  - Ecosystem goals
  - Funder/implementer goals
- How do we determine if goals are being achieved? Particularly project effectiveness?



# Effectiveness Monitoring

- Activities designed and undertaken to assess how well a particular restoration project performs relative to its reference site.

# Effectiveness Monitoring – also

- Allows for comparison between habitat restoration projects
- Can help determine the overall, long term cumulative impacts of restoration in the lower Columbia River and estuary
- Requires consistent effectiveness monitoring protocols

# Consistent Monitoring Protocols Have Been Developed!

- Curtis Roegner
- Heida Diefenderfer
- Amy Borde
- Ron Thom
- Earl Dawley
- Allan Whiting
- Shon Zimmerman
- Gary Johnson

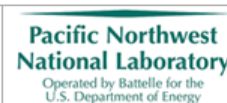
## Protocols for Monitoring Habitat Restoration Projects in the Lower Columbia River and Estuary



G. C. Roegner  
H. L. Diefenderfer  
A. B. Borde  
R. M. Thom  
E. M. Dawley  
A. H. Whiting  
S. A. Zimmerman  
G. E. Johnson

Final Report  
April 25, 2008

Prepared for the U.S. Army Corps of Engineers  
Portland District, Portland, Oregon  
Under a Related Services Agreement  
with the U.S. Department of Energy  
Contract DE-AC05-76RL01830







# Document Outlines

- Monitoring metrics and rationales specific to the tidal lower Columbia River estuary
- Standardized set of research and monitoring metrics
- Ultimate goal – develop compatible time series data of physical and biological metrics collected from many restoration projects



# Monitoring Indicators

- Hydrology
- Water quality
- Elevation
- Landscape features
- Plant community
- Vegetation plantings
- Fish community





# Core Monitoring Metrics

- Limited number
- Straightforward, doable
- Economical
- Applicable to most sites
- Tie into common restoration goals
- Relevant to current and future research
- Characterize controlling factors, structure, functions



# Summary Table of Core Metrics

Indicator Category	Monitored Metric	Collection Method	Sampling Frequency
Physical			
Hydrology	surface water elevation	data-logging instrument	hourly
Water Quality	temperature, salinity	data-logging instrument	Hourly
Habitat	landscape features	photography, GIS	annually
	elevation	ground survey	annually
Biological			
Plants	species composition	ground survey	annually
	percent cover		
	elevation		
	planting success		
Fish	species composition	ground survey	monthly-seasonally
	size structure		
	temporal presence		



# Monitoring Protocols

- Provided for each indicator
  - Purpose
  - Goal
  - Design
  - Equipment needed
  - Site selection
  - Sampling periodicity
  - Sampling protocol
  - Calculations and analysis
  - Site specific contingency considerations



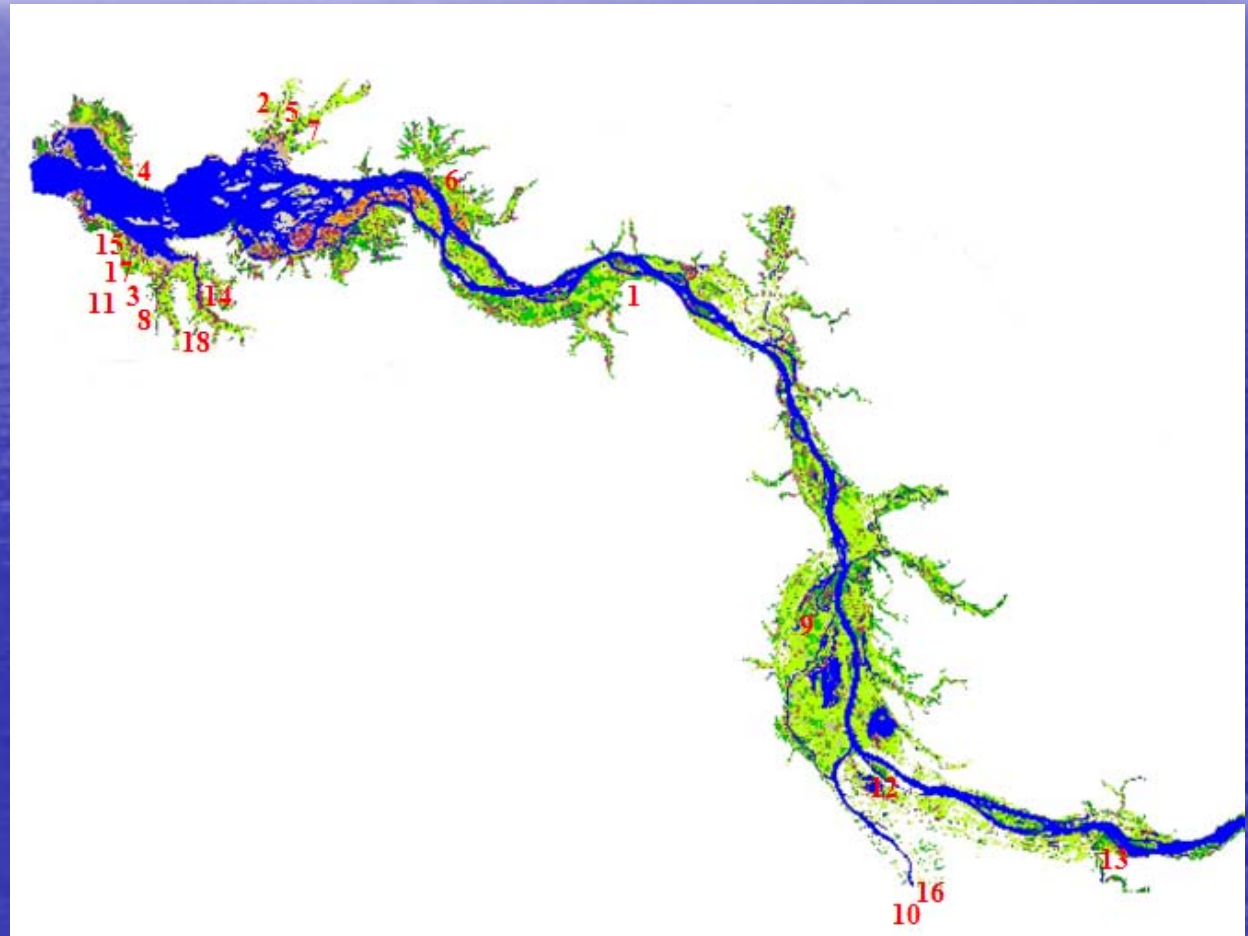
# Implementing Effectiveness Monitoring

- Rational for effectiveness monitoring
- Regional protocols recently released
- Who's doing what?
- Fortunately, many agencies and organizations have initiated effectiveness monitoring projects

# Ongoing Estuary Effectiveness Monitoring Sites

## Index

1. Crims Island
2. Deep River
3. Fort Clatsop
4. Fort Columbia
5. Johnson Farm
6. Julia Butler Hansen
7. Kandoll Farm
8. Lewis and Clark River  
Dike Breach
9. Malarkey Ranch
10. Oaks Bottom
11. Otter Point
12. Ramsey Lake
13. Sandy River Delta  
a) Revegetation  
b) Rechannelization
14. Sharnelle Fee Dike  
Breach
15. Skipanon Wetland  
Reconnection
16. Stephens Creek
- 17.. Vera Slough
18. Walluski River Dike  
Breach



# Different Scales of Monitoring at Different Sites

- Lewis and Clark River Dike Breach (CREST)
  - Effectiveness monitoring metrics are:
    - Temperature
    - Water depth
    - Fish community



# Different Scales of Monitoring at Different Sites

- Alder Creek (Scappoose Bay Watershed Council)
  - Effectiveness monitoring metrics are:
    - Geomorphology
    - Vegetation
    - Fish presence
    - DO, pH, turbidity, conductivity, temperature

# Different Scales of Monitoring at Different Sites

- Crims Island (USACE)
  - Effectiveness monitoring metrics are:
    - Fish use and abundance
    - Salmonid residence time and food habits
    - Invertebrate abundance
    - Temperature
    - Vegetation
    - Sediment
    - Tidal volume
    - Topographic/bathymetric info

# Different Scales of Monitoring at Different Sites

- Dependent on:
  - Project goals
  - Funding
  - Capacity
  - Site specific circumstances
- Sliding scale of effectiveness monitoring intensity



# Extensive → Intensive

- Extensive - monitor a few indicators at many sites across the estuary
- Intensive - monitor many indicators at a few sites



# Extensive → Intensive

- Implies a time scale too
  - Extensive – shorter period of time
  - Intensive – longer period of time
- Intensive higher order metrics:
  - Process-related derivations of core metrics
  - Fish growth rate, primary productivity, material flux, sediment accretion rates, species diversity and distribution, hydraulic geometry, etc.
  - Needed to help reduce fundamental uncertainties in our understanding of the Columbia River ecosystem



# Also Important - Reference Sites

- Reference sites represent “the state of an environment undisturbed by human activity”
- Reference site conditions can be a target against which restoration site conditions are measured over time
- Where possible reference sites should be:
  - Within the same geography
  - Subject to the same large scale climate and environmental processes as the restoration project
  - Not affected by the restoration project

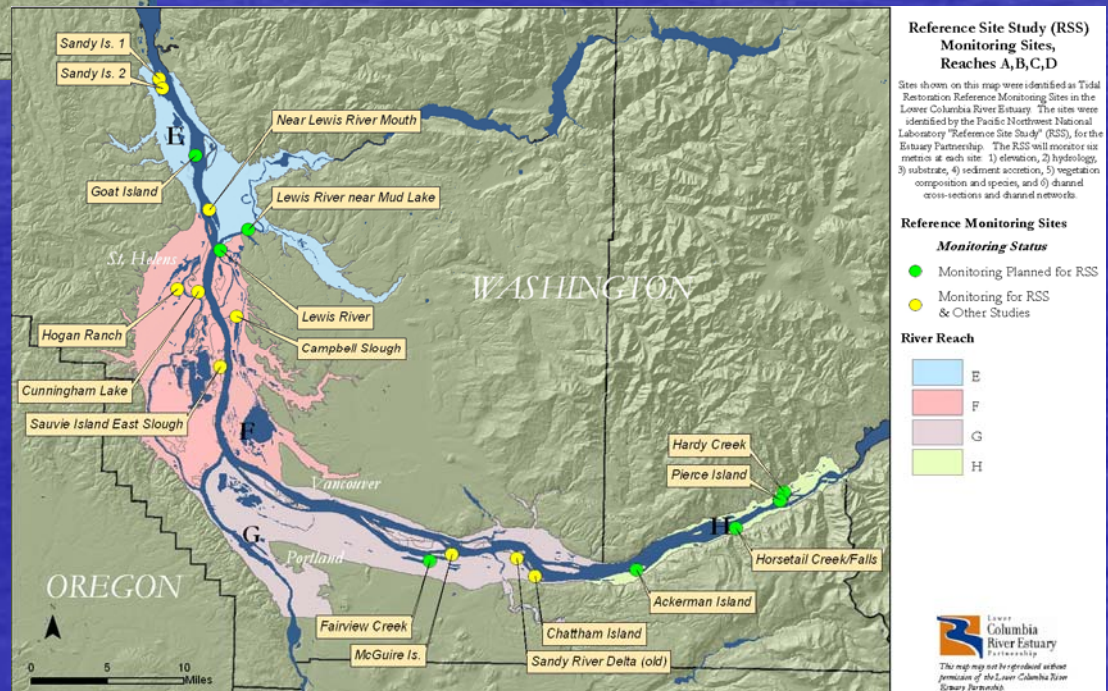
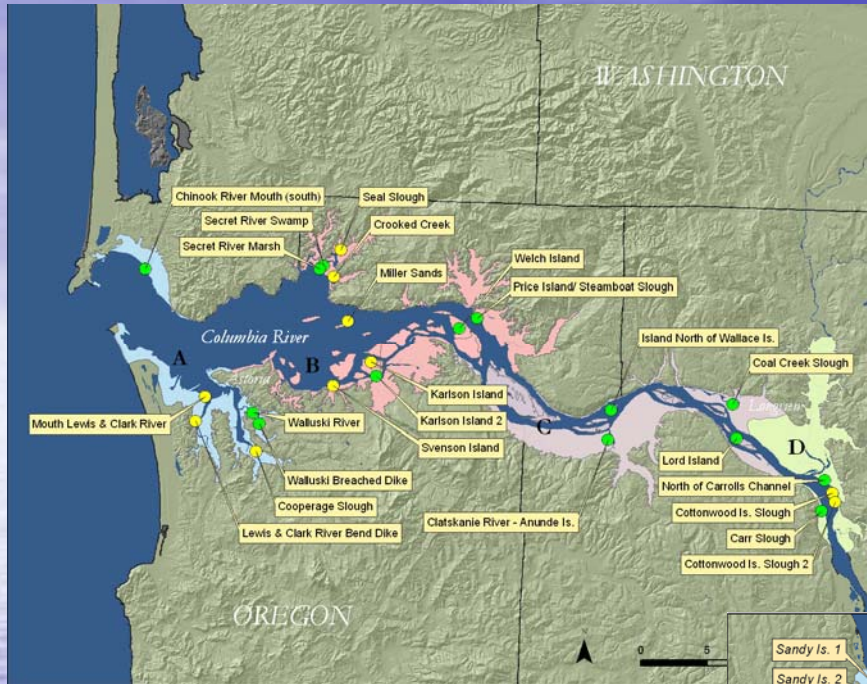


# Reference Sites

- Estuary Partnership Reference Site Study
  - Part of Estuary Partnership's Habitat Restoration Program funded through BPA
  - Conducted by PNNL
  - Suite of reference sites established and monitored to allow comparison to existing and future restoration projects in effectiveness monitoring

# Estuary Partnership Reference Site Study

- Sites represent a range of habitat types
- Sites are geographically distributed throughout the lower river and estuary
- Typically extensive monitoring of hydrology, elevation and vegetation
- Many sites also being monitored through the Estuary Partnership's Ecosystem Monitoring Program – thereby providing more info





# Implementing Effectiveness Monitoring

- Estuary Partnership plans effectiveness monitoring at four sites this summer
  - BPA funding and support
  - Recognition that habitat restoration program needs a companion effectiveness monitoring program
  - Sites and basic protocols approved by EOS
  - Tracy Hillman and Charlie Paulson to provide input and comments as program moves forward



# Site – Mirror Lake

- Culvert enhancement, large wood placement, bridge installation, revegetation
  - Temperature
  - Channel cross section
  - Fish community
  - Photo points
  - Vegetation planting success
  - Locations of boulders within culvert
  - Low flow connectivity
  - Water depth/passage
  - Salmon prey availability
  - Salmon stock, lipid, otoliths
- Potential reference site – Franz Lake

# Site – Sandy River Delta

- Revegetation
  - Vegetation cover and density
  - Ash Creek Forest Management protocol
- Potential reference site - ?

# Site – Scappoose Bottomlands

- Livestock fencing, vegetation plantings, invasive plant removal
  - Temperature and depth
  - E coli
  - Vegetation monitoring and photo points
  - Fish presence
- Potential reference site – Other Scappoose Bottomlands site



# Site – Fort Clatsop

- Culvert/tide gate replacement with bridge
  - Temperature, salinity, DO
  - Water depth
  - Vegetation (% cover, species, distributions)
  - Channel cross sections
  - Fish community
  - Sediment accretion stakes
  - Photo points
  - Salmon prey availability and utilization
  - Salmon stock
- Potential reference site – Adjacent site

# Management Applications

- What are we going to do with all this data?
- Data must be:
  - Gathered from all habitat restoration effectiveness monitoring projects in the lower Columbia River estuary
  - Analyzed
  - Synthesized
  - Disseminated

# Management Applications

- Idea – to use data to answer key questions (from 2007 Action Agencies Biological Assessment)
  - Are restoration projects achieving biological and environmental performance targets?
  - Are projects improving juvenile salmonid performance?
  - Which actions are most effective at addressing the limiting factors preventing achievement of habitat, fish, or wildlife performance objectives?



# Recommendations

(program level recommendations from RME Plan for Columbia River Estuary – prepared for BPA by PNNL in conjunction with NOAA and USACE)

- Establish an estuary RME coordination committee that includes the Action Agencies, NMFS, the Estuary Partnership, and other entities charged with research and monitoring in the estuary.
- Establish an estuary RME data center -- a central, web-accessible repository for estuary data, and a publicly accessible homepage with links to a networked system of databases.

# Recommendations

(program level recommendations from RME Plan for Columbia River Estuary – prepared for BPA by PNNL in conjunction with NOAA and USACE)

- Convene biennial estuary RME workshops to present new data, evaluate the conduct of the estuary RME effort, exchange information, and provide input to the coordinating committee.
- Write a biennial estuary RME report – this estuary RME report series would summarize data and provide adaptive management recommendations at the program level for submittal to the Action Agencies, estuary restoration project leaders, and other related entities (e.g., PNAMP).



# Recommendations

(program level recommendations from RME Plan for Columbia River Estuary – prepared for BPA by PNNL in conjunction with NOAA and USACE)

- Upload, compile, manage, and disseminate project-level data at the estuary RME program-level and synthesize the data and periodically report it to the region.
- Use the synthesized data to evaluate the Estuary Program and refine estuary RME as necessary.



# Final Thoughts

- Estuary Partnership looks forward to participating in those conversations
- Thanks again to Gary for his help
- Thanks and congratulations to all the authors, contributors, and funders of the Protocols document
- Please pick up a copy – and use those protocols whenever possible.