

STANDARDIZING AND ENHANCING BIOASSESSMENT PROTOCOLS: DEVELOPING A SCIENCE-BASED PERFORMANCE MEASURE OF STREAM CONDITION

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Overview

- Regional benthic macroinvertebrate monitoring issues that initiated this project
- Key project goals
- Preliminary results
- Next steps



Regional Benthic Monitoring Issues

- Inconsistent sampling and data analysis methods
- Puget Lowland BIBI – developed in early 1990's using limited data
- Taxa attributes inconsistent and not empirically derived
- Need to enhance data management tools
- Need for a regional freshwater biological indicator
- Need for regional coordination



EPA Grant

 Developed a proposal for funding under EPA's Scientific Studies and Technical Investigation Assistance Program to address these issues

 Awarded the grant in late 2010!



A screenshot of a web browser window showing the EPA's "Grants and Funding" page for the Puget Sound region. The browser is Internet Explorer, and the address bar shows "http://www.epa.gov/pugetsound/funding/index.html". The page header includes the EPA logo and navigation links like "LEARN THE ISSUES | SCIENCE & TECHNOLOGY | LAWS & REGULATIONS | ABOUT EPA". A sidebar on the left lists "Puget Sound Home", "Grants and Funding", "Ecosystem Indicators", "Partnerships", and "Transboundary Air Quality". The main content area has a breadcrumb trail "You are here: EPA Home » Puget Sound Home » Grants and Funding" and a heading "Grants and Funding". Below this, there is a paragraph of text explaining that EPA receives federal funding to support efforts to protect and restore Puget Sound, and that the majority of funds are used for financial assistance to state, local, and tribal governments. A "News" section follows, dated February 2011, stating that EPA awarded more than \$21 million to various organizations for restoration and protection projects. To the right of the text is a map of the Puget Sound region with several orange location markers. At the bottom, there is a section about an approach using Lead Organizations to implement targeted strategies.

Key Goals of Project

- ✂ Strengthen taxa attribute sensitivity
- ✂ Recalibrate BIBI metric scoring
- ✂ Reconcile differences in sampling methods
- ✂ Expand the Puget Sound Stream Benthos data management system
- ✂ Refine B-IBI as a freshwater indicator
- ✂ Enhance regional coordination



Strengthen Sensitivity of Taxa Attributes



PL-BIBI Metrics

Total Taxa

Mayfly Taxa

Stonefly Taxa

Caddisfly Taxa

Long-lived Taxa

Intolerant Taxa

% Tolerant individuals

% Predator individuals

Clinger Taxa

% Dominance

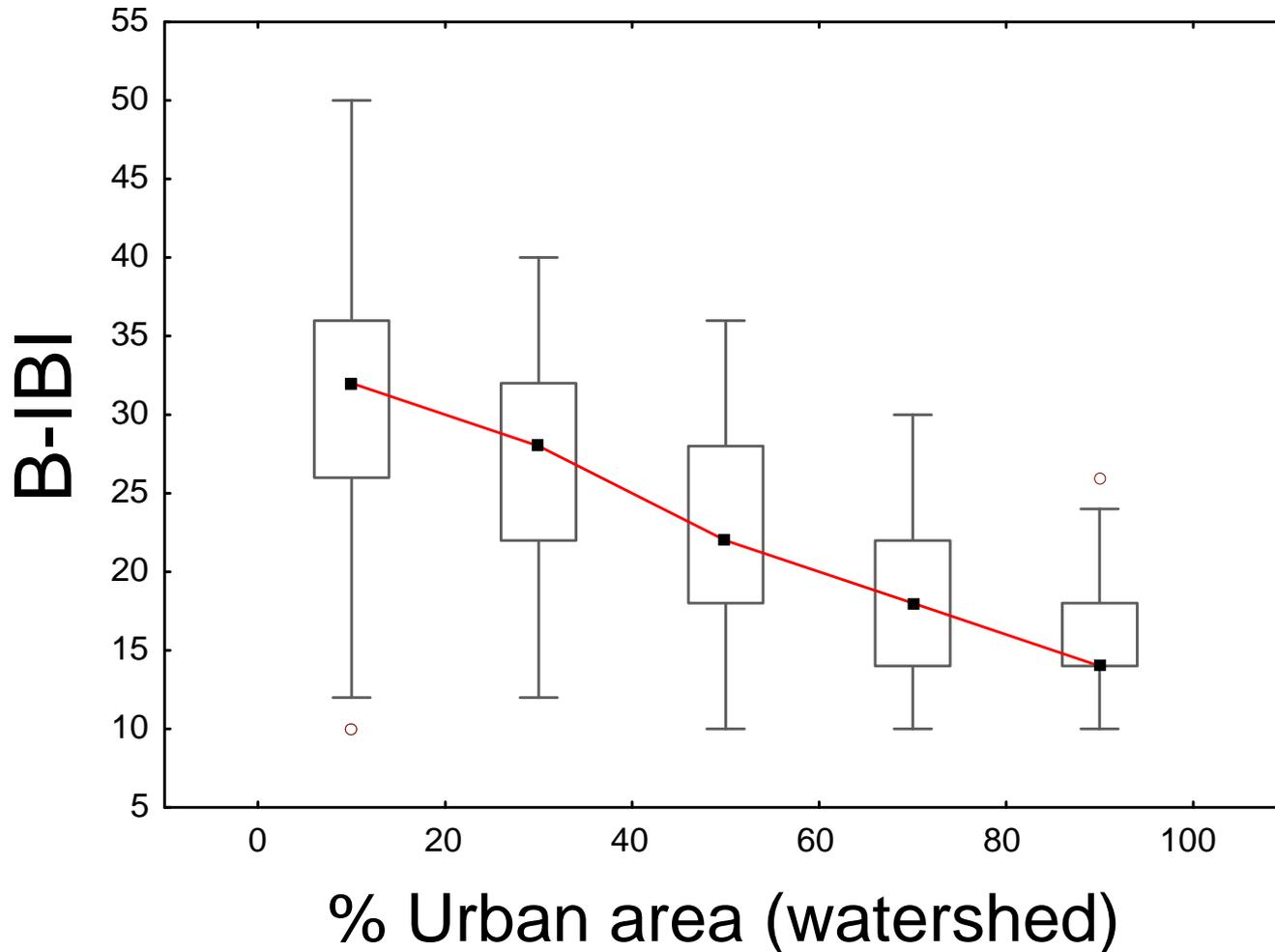
Update Using
Peer-Reviewed
Literature



Update with
Existing Data



Strengthen Sensitivity of Tolerant/Intolerant Attributes



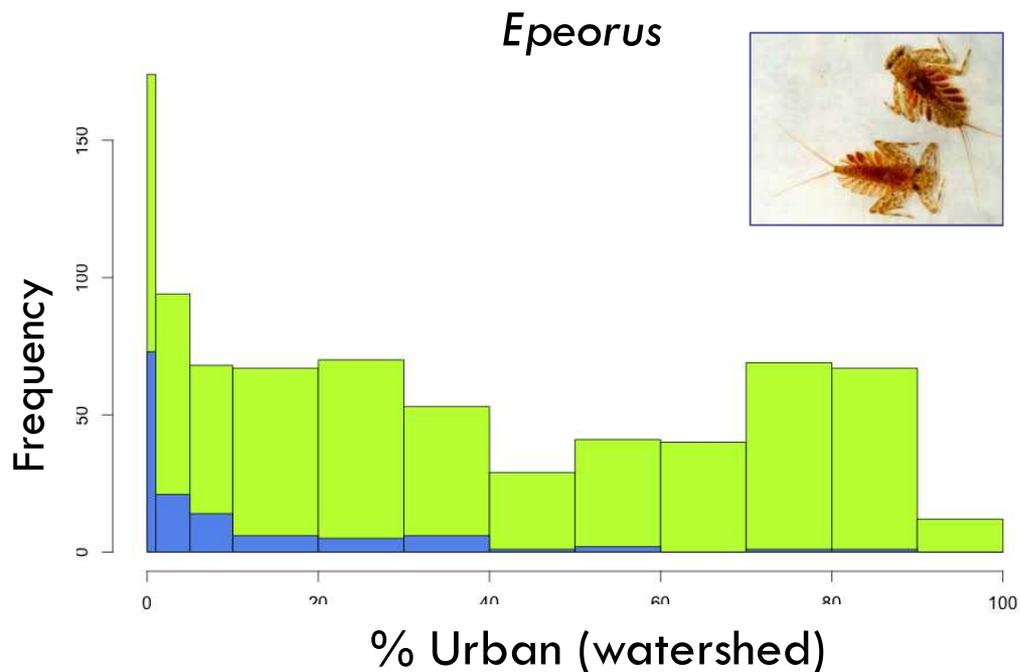
Select Most Tolerant & Intolerant Taxa

 N = 784 sites (most recent)

 Genus level or higher

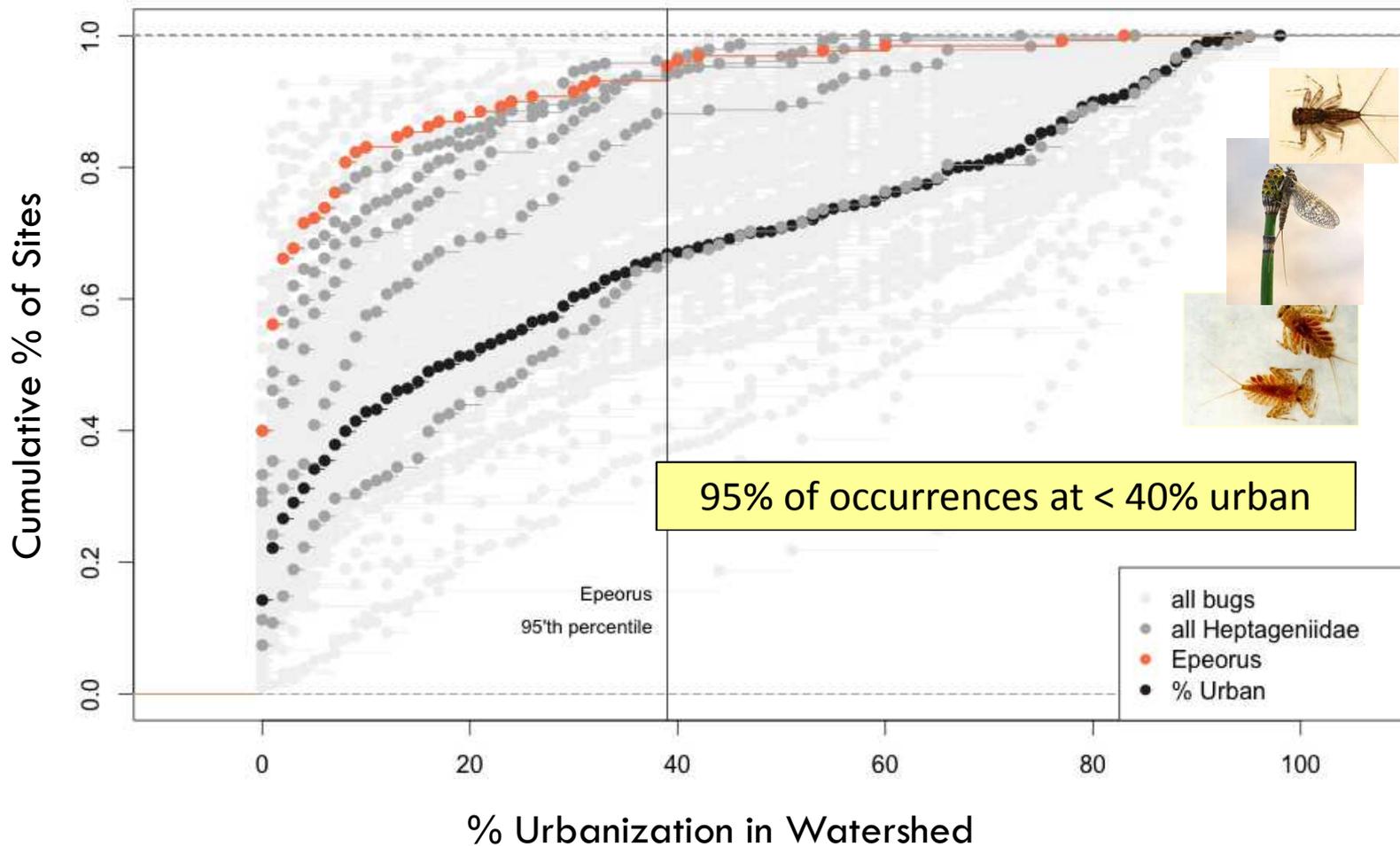
 ≥ 25 occurrences

 155 taxa tested



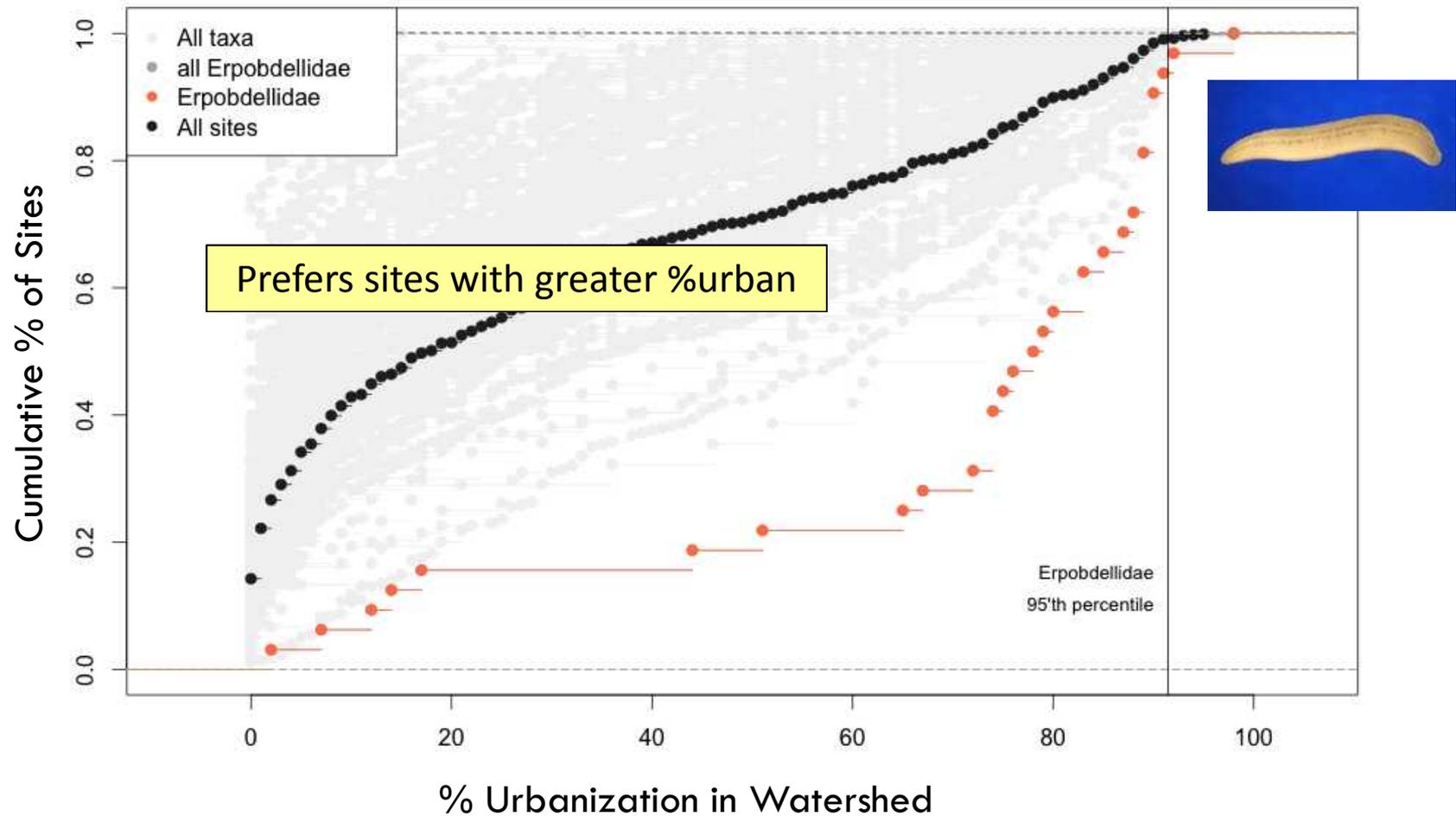
Example of Intolerant Taxon

Epeorus (genus)



Example of a Tolerant Family

Erpobdellidae



Early Findings - Next Steps

- Changes to predator taxa list less significant than long lived and clinger taxa
- Significant change to tolerant and intolerant taxa list, many rare taxa dropped
- Test metrics against % urban using a separate validation data set
- Additional testing and validation as needed



Recalibrate BIBI

- ✈️ Current BIBI protocol scores metrics from 1, 3, 5
- ✈️ Updated BIBI will score metrics from 0-10 improving precision
- ✈️ Updated metrics will be tested for correlation with natural features and scoring adjusted as needed
- ✈️ Evaluate differing levels of taxa resolution on BIBI
- ✈️ Incorporate updates to taxa attributes



Reconcile Differences in Sample Collection Methods

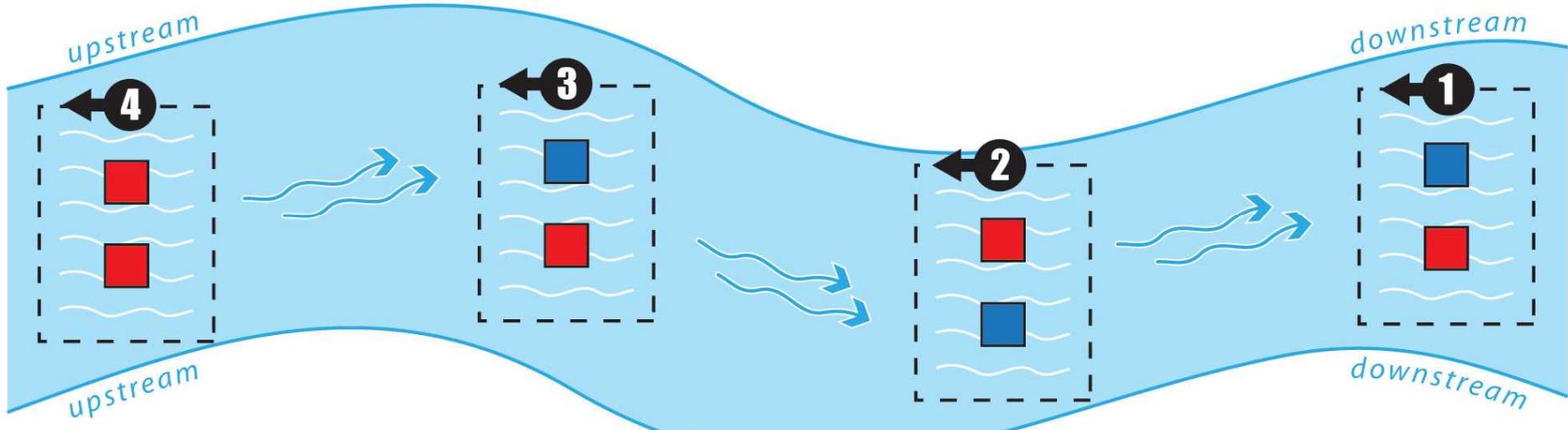
- Sample collection area varies from 3, 8 or 9ft²
- Ecology collects 8ft² ; EPA recommends 8ft²
- Some reluctance to shift to 8ft²
 - Loss of long term trend data due to mixed methods
 - Increased level of effort
- Need for “cross walk” to allow comparison of data collected from different surface areas



Data Collection: Summer 2011

STREAM REACH SAMPLE COLLECTION

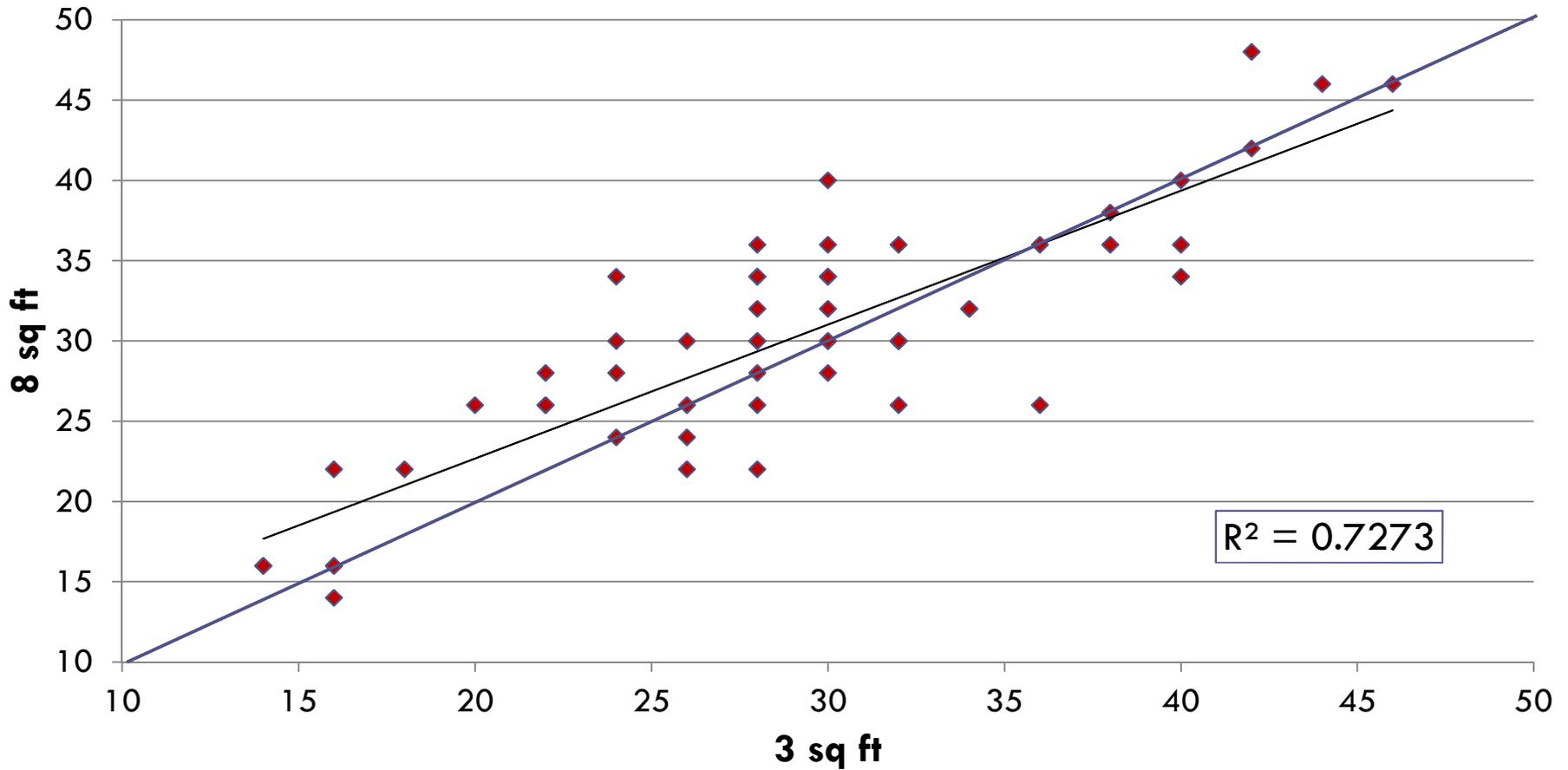
- Sample each riffle twice, 1 ft² per sample
- Move from downstream to upstream
- 3 ft²: collect one sample from three riffles
- 5 ft²: collect one sample from three riffles and two from a fourth riffle



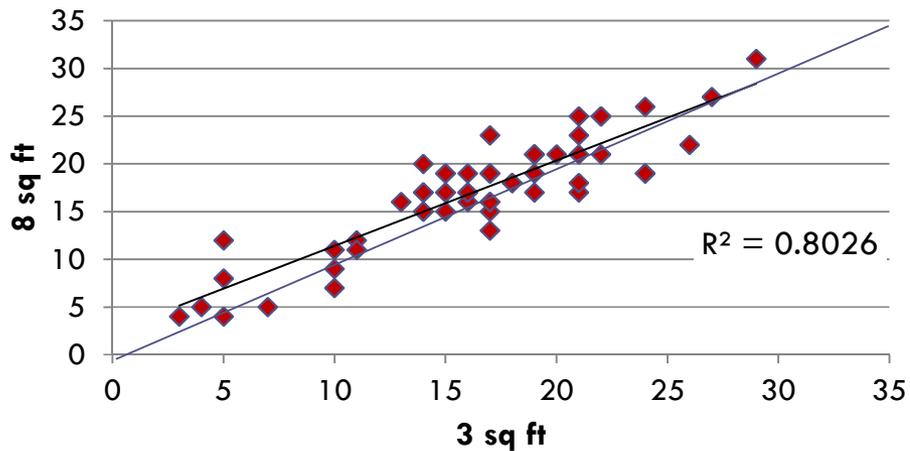
55 Paired Sample Locations

Preliminary Results – Sample Area Comparison

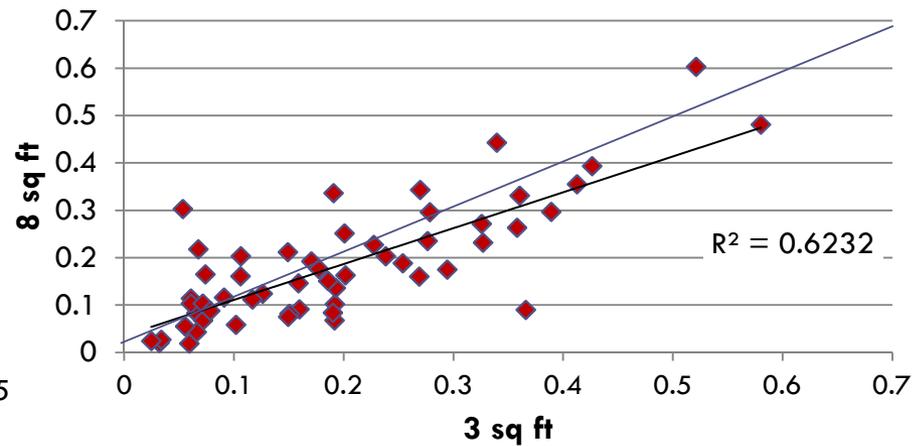
Overall BIBI Score



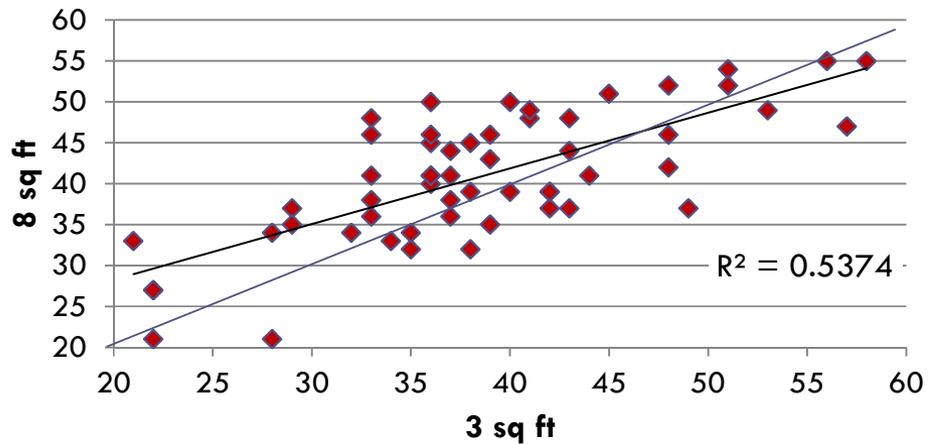
EPT Richness



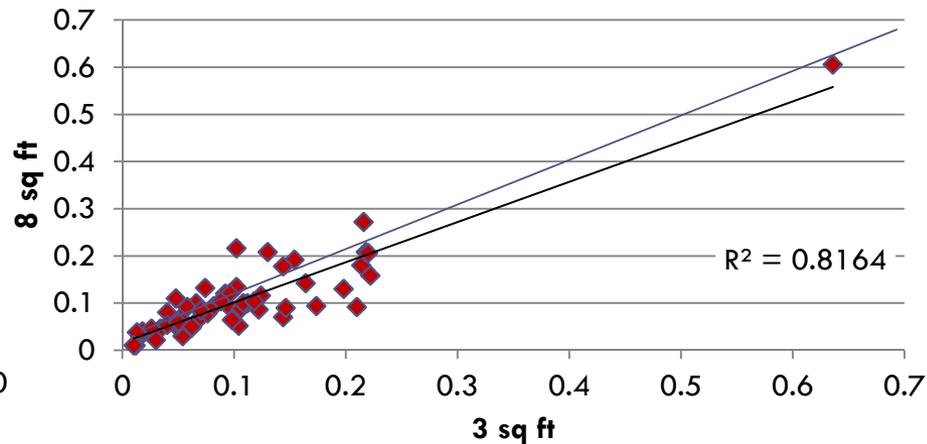
% Tolerant



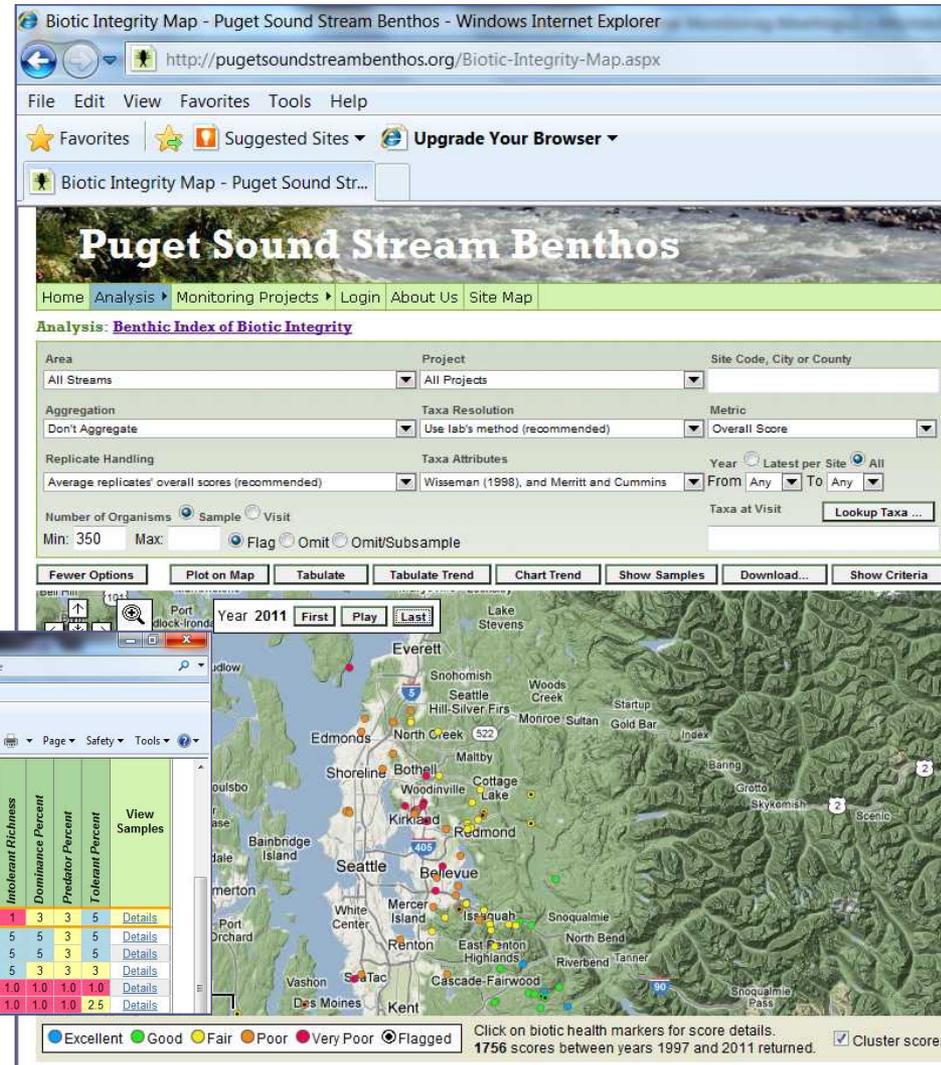
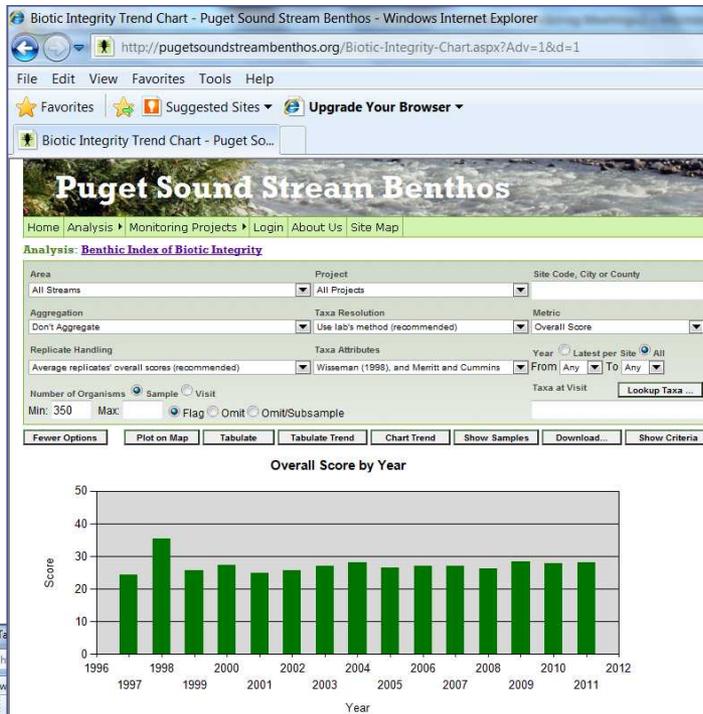
Taxa Richness



% Predator



Database Enhancements - pugetsoundstreambenthos.org



Row	Site Code, Location	Year, Project	Taxa Richness	Ephemeroptera Richness	Plecoptera Richness	Trichoptera Richness	EPT Richness	Clinger Richness	Long-Lived Richness	Intoleant Richness	Dominance Percent	Predator Percent	Tolerant Percent	Predator Percent	Tolerant Percent	Organisms	Overall Score	Taxa Richness	Ephemeroptera Richness	Plecoptera Richness	Trichoptera Richness	Clinger Richness	Long-Lived Richness	Intoleant Richness	Dominance Percent	Predator Percent	Tolerant Percent	View Samples
1	WAM06600-000...	2009, Status and ...	40	4	4	4	12	7	1	2	66.9%	14.5%	1.8%	550	22	3	1	3	1	1	1	1	1	3	3	5	5	Details
2	WAM06600-000...	2009, Status and ...	51	4	5	8	17	13	3	7	47.6%	13.9%	0.0%	288	36	5	1	3	3	3	3	3	5	5	3	5	Details	
3	WAM06600-000...	2009, Status and ...	53	10	10	11	31	22	3	13	45.4%	15.5%	7.1%	496	46	5	5	5	5	3	3	5	5	3	5	Details		
4	WAM06600-005...	2009, Status and ...	16	5	4	3	12	7	0	4	56.5%	14.1%	32.9%	85	24	1	3	3	1	1	1	1	5	3	3	3	Details	
5	SqualBghamAbB...	2003, City of Bell...	17.2	1.5	1.2	2.5	5.2	2.8	0.0	0.0	93.8%	0.3%	92.0%	1286.0	11.5	2.5	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	Details
6	SqualBghamBak...	2003, City of Bell...	14.5	1.0	0.2	1.8	3.0	2.5	0.2	0.0	91.8%	1.5%	48.3%	615.8	12.5	2.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	2.5	Details

Next Steps

- Complete initial data analysis presented here
- Determine need for additional sampling
- Initiate work on freshwater indicator
- Continue to enhance regional collaboration associated with benthic monitoring



The background of the slide is a close-up photograph of several aquatic insects, likely stoneflies, resting on a wet, textured rock surface. The insects are dark brown and black with some lighter spots. The background is blurred, showing more rocks and water.

Deb Lester

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Strengthen Sensitivity of Taxa Attributes

-  Long lived taxa attributes revised based primarily on Poff et al (2006)
-  Clinger and predator taxa attributes revised based primarily on Merritt, Cummins and Berg (2008)
-  Tolerant/Intolerant – used available data to empirically derive attributes

