Puget Sound EPA Benthos Grant: Comparison of Sampling Methods and Updated Taxa Attributes

Jo Wilhelm & Deb Lester, King County
Leska Fore, Statistical Design
Karen Adams, WA Department of Ecology
Gretchen Hayslip, EPA Region 10

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Overview

- Regional monitoring issues that initiated this project
- Key Project Goals
- Methods and Preliminary Results
  - Reconcile differences in sampling methods
  - Update taxa attributes
- Next steps

EPA Scientific Studies and Technical Investigation Assistance Program
Support technical studies to guide and evaluate implementation of PSP's Action Agenda

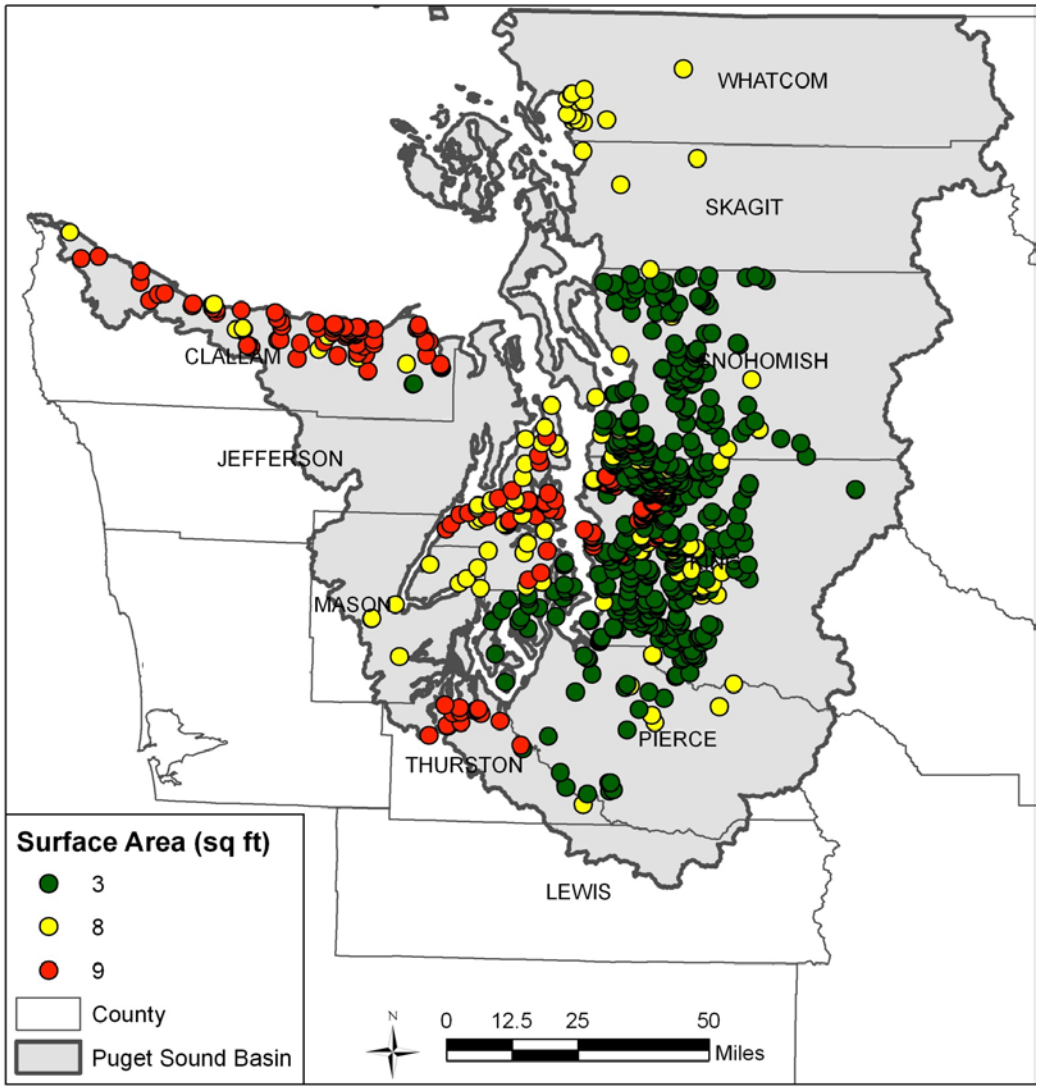
Regional Benthic Monitoring Issues

Limitations	Desired Outcomes
Differing collection methods	Standardization
Decentralized data mgmt	Centralized data mgmt
Outdated taxa attributes	Peer-reviewed or Empirically derived attributes
Insufficient BIBI sensitivity	Re-calibrated scoring
>20 cities, counties, tribes monitoring independently	Collaboration and communication

Goal: Improved decision making to restore and protect streams

Reconcile Differences in Sampling Methods

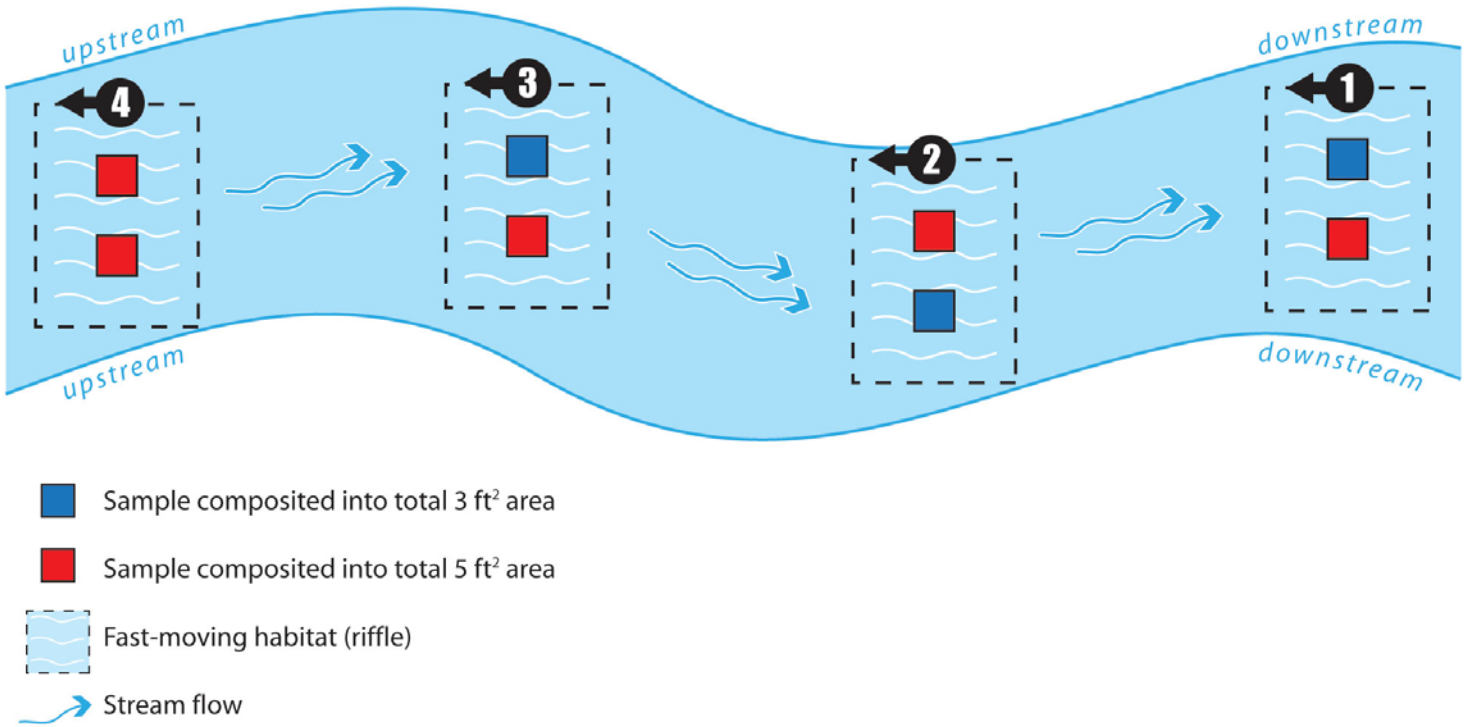
- Ecology requires >=8ft^2 samples for inclusion in State WQ Assessment
- Reluctance to shift to 8ft^2 - concern for orphaned data
- Need for better understanding of data comparability or tool to allow data comparability



Sample Collection Methods – 3ft^2 vs. 8ft^2

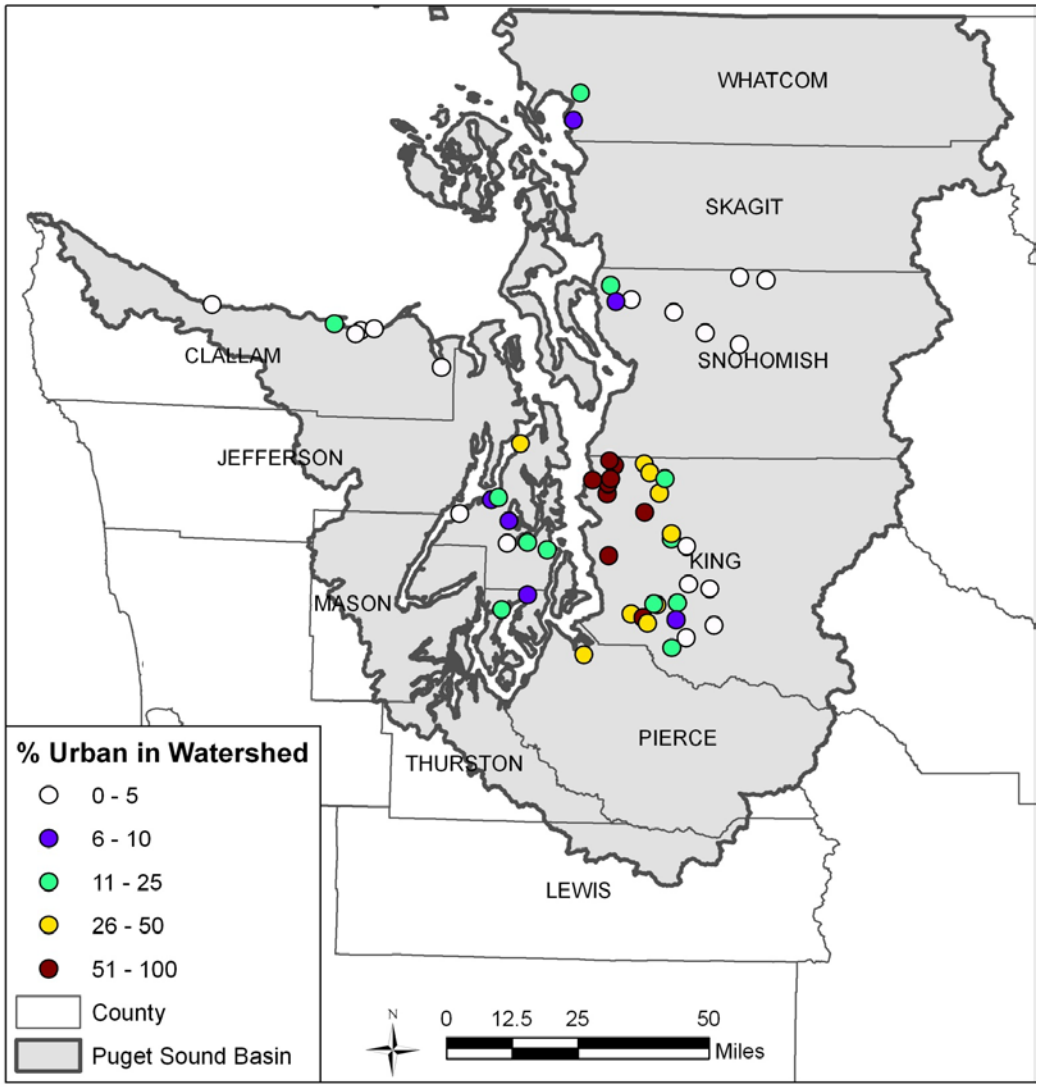
STREAM REACH SAMPLE COLLECTION

- **Sample each riffle twice, 1 ft^2 per sample**
- **Move from downstream to upstream**
- **3 ft^2: collect one sample from three riffles**
- **5 ft^2: collect one sample from three riffles and two from a fourth riffle**

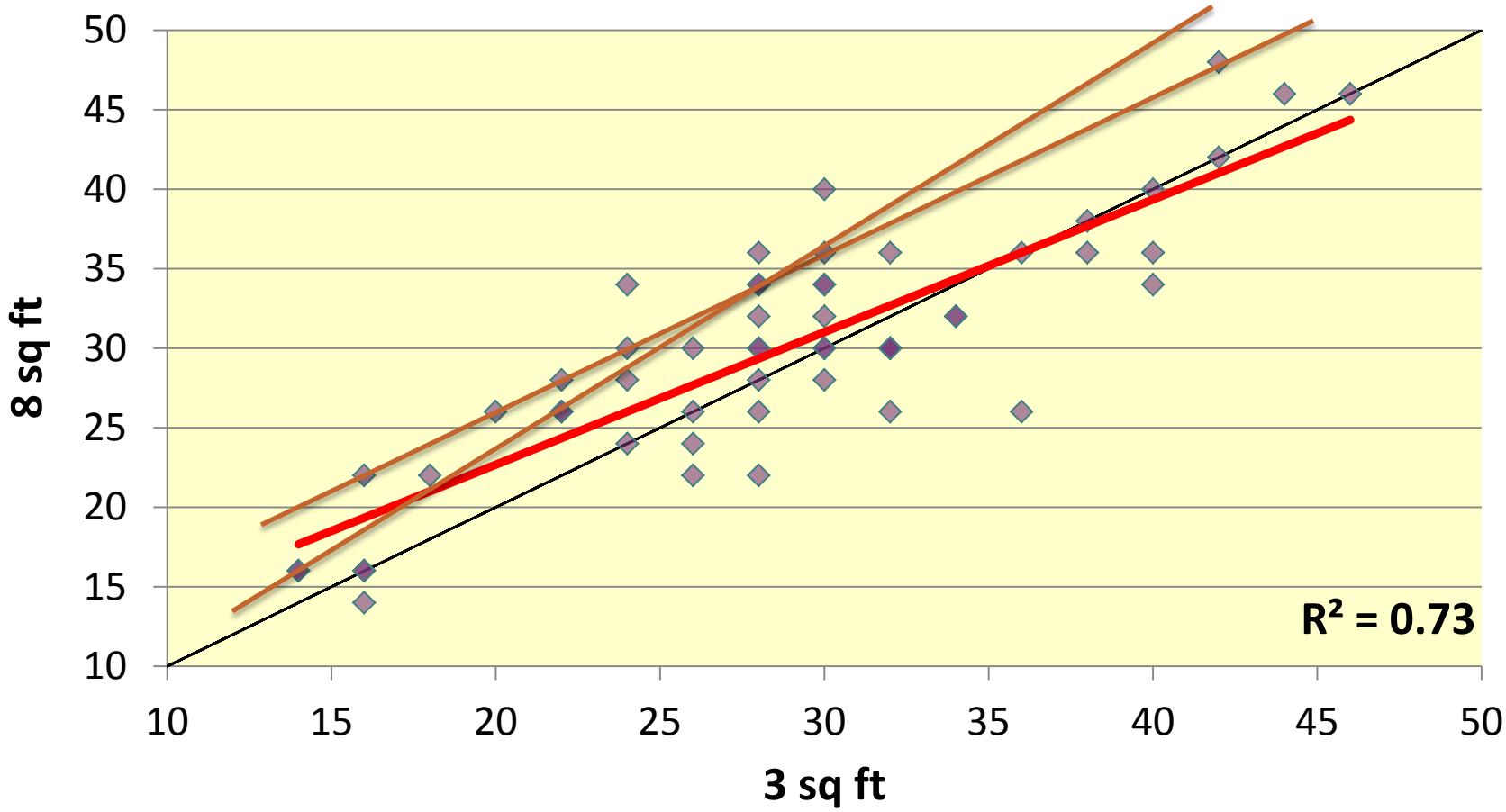


Sampling Locations

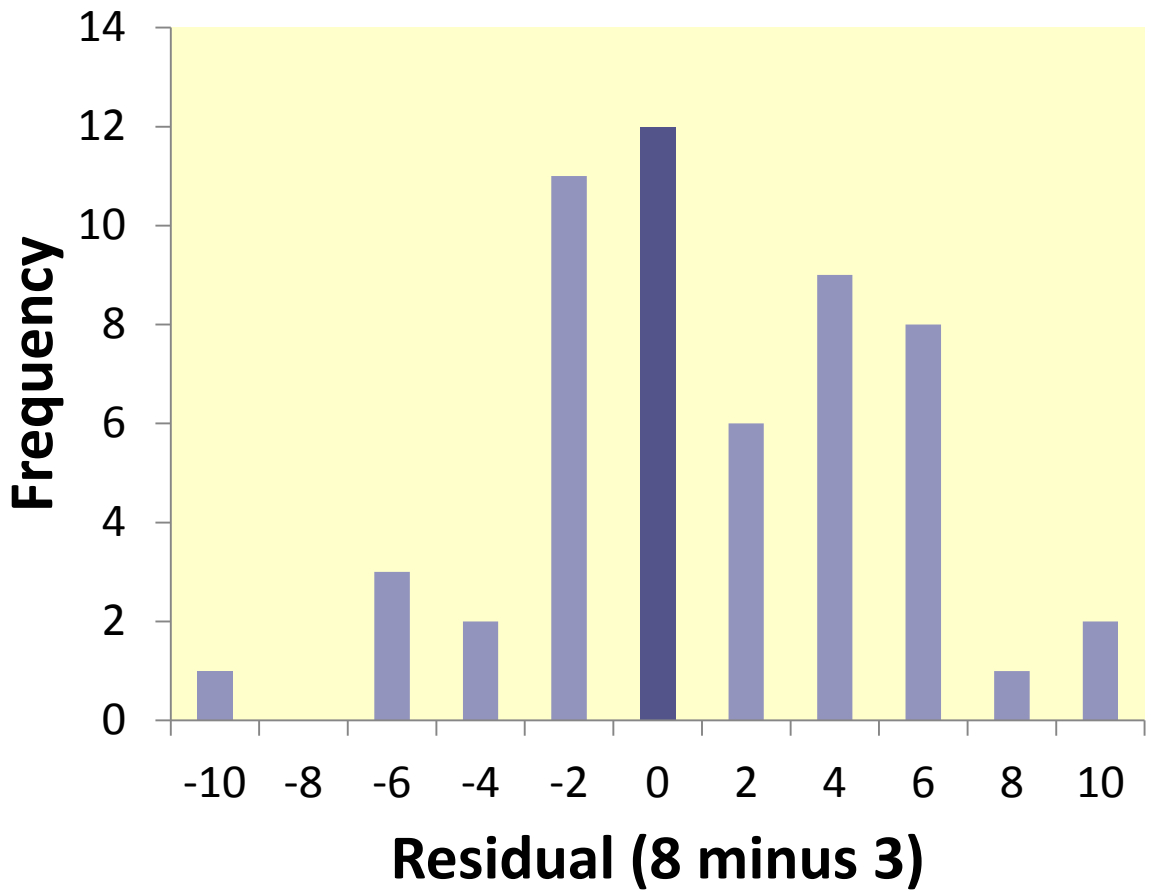
- 55 Sites
- 9 Partners
- Elevation 4-330 m
- 0-93% Urban



Results: Overall BIBI Score - 3 vs. 8 sq ft



Overall BIBI Score: Residuals

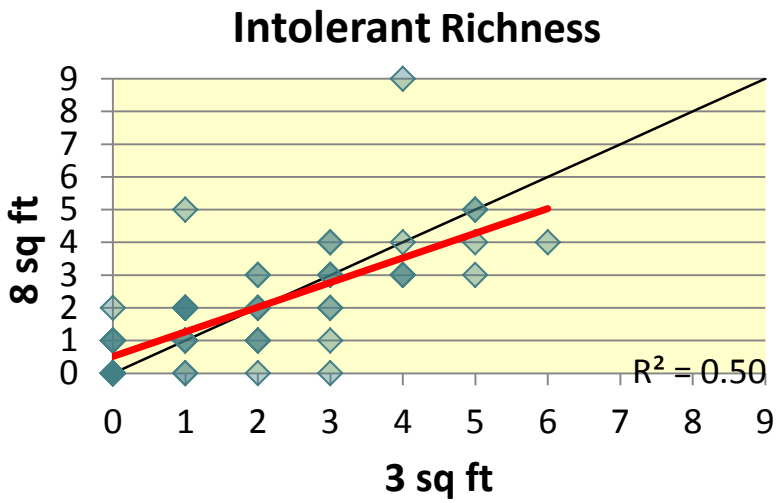


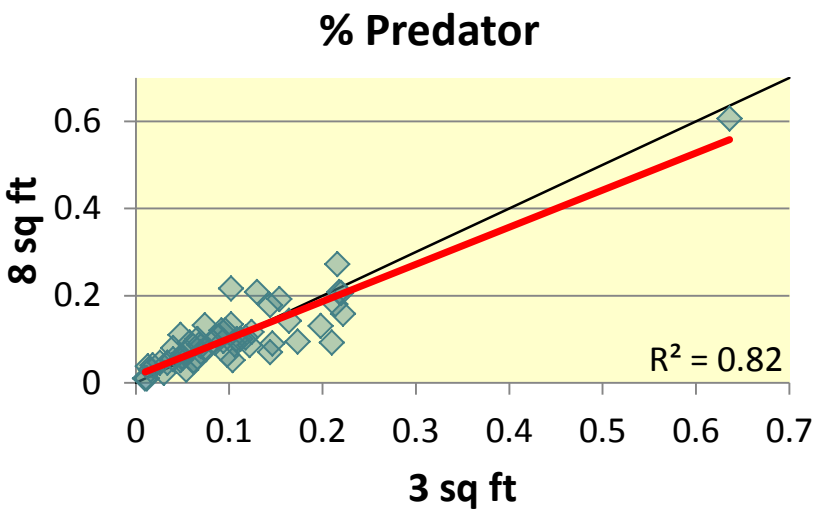
- Mean = 1.2
- $p<0.05$

- Biologically meaningful?

Individual BIBI Metrics

Metric	R^2	Mean Residual
Total Taxa	0.54	*2.33*
Mayfly Taxa	0.72	-0.16
Stonefly Taxa	0.66	*0.65*
Caddisfly Taxa	0.57	0.27
Long-lived Taxa	0.58	0.27
Intolerant Taxa	0.50	*0.05*
% Tolerant	0.62	-0.01
% Predator	0.82	0.00
Clinger Taxa	0.74	*1.13*
% Dominance	0.54	0.00





Paired Sample Analysis Conclusions

A little more analysis needed, but…

- No additional 2012 sampling
- No "cross-walk" required
- Data are comparable

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 Published Literature

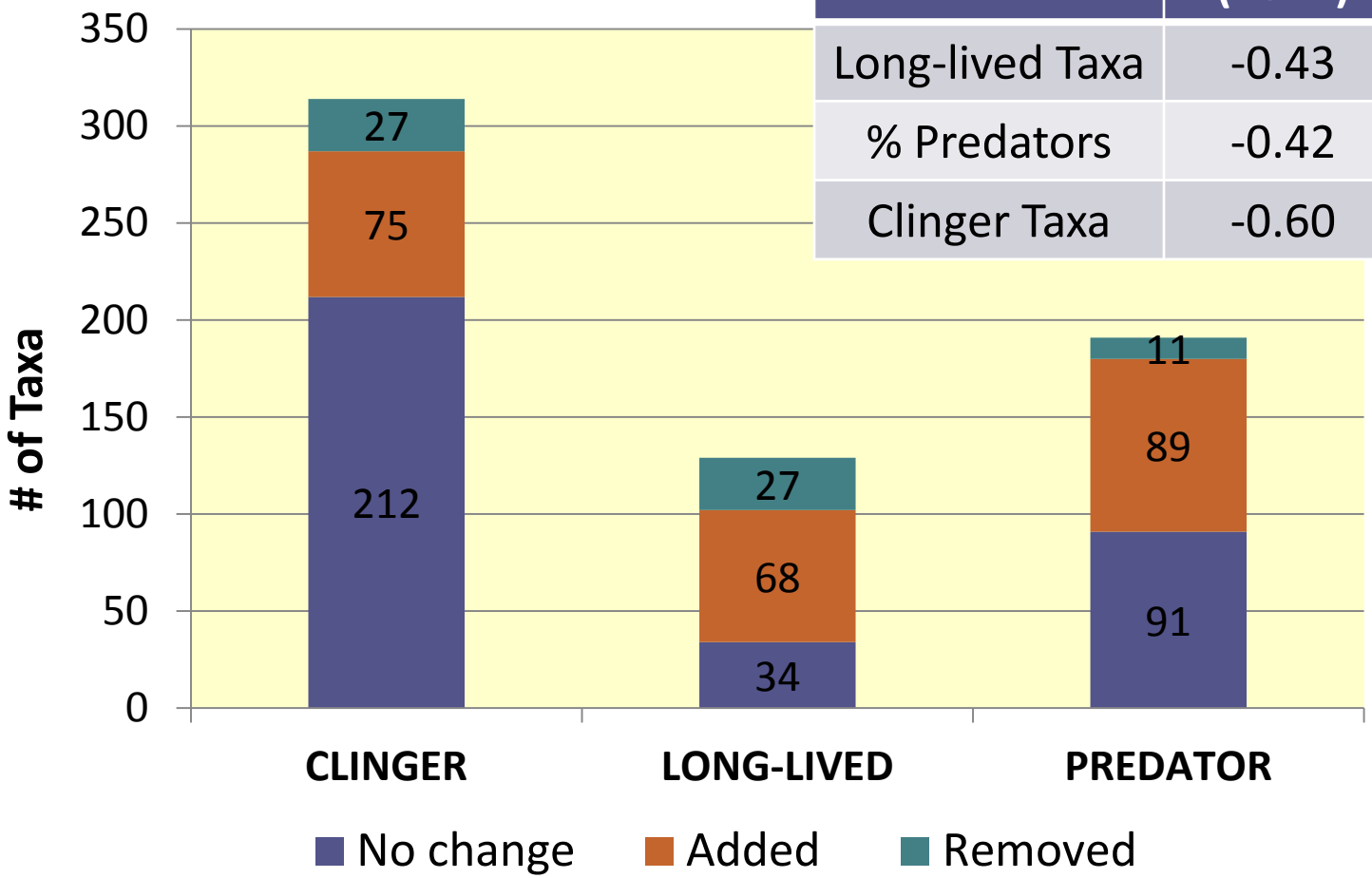
Update with Existing Data

Published Literature Updates

Attribute	Taxa Group	Primary resource
Long-lived	stoneflies	Stewart and Stark 2002
	caddisflies	Wiggins 1996
	non-insects	Pennak 1989, Thorp and Covich 2001
	clams	Mackie 2007
	other mollusks	Dillon 2000
	other insect taxa	Huryn et al. 2008, Poff et al. 2006
Predator	insects	Merritt et al. 2008
	non-insects	Pennak 1989, Thorp and Covich 2001
Clinger	insects	Merritt et al. 2008
	non-insects	not applicable

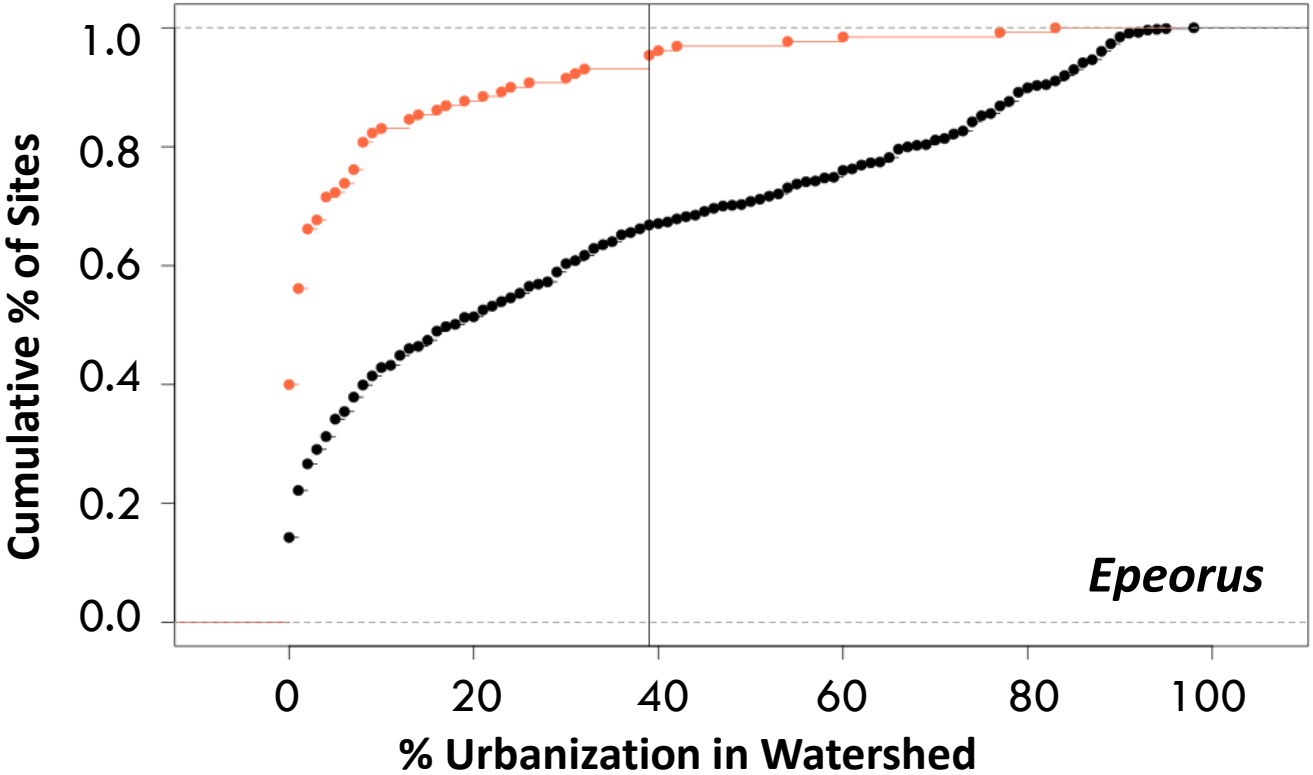
Attribute Changes: 1998 vs. 2012

Metric	Updated (2012)	Original (1998)
Long-lived Taxa	-0.43	-0.39
% Predators	-0.42	-0.43
Clinger Taxa	-0.60	-0.61

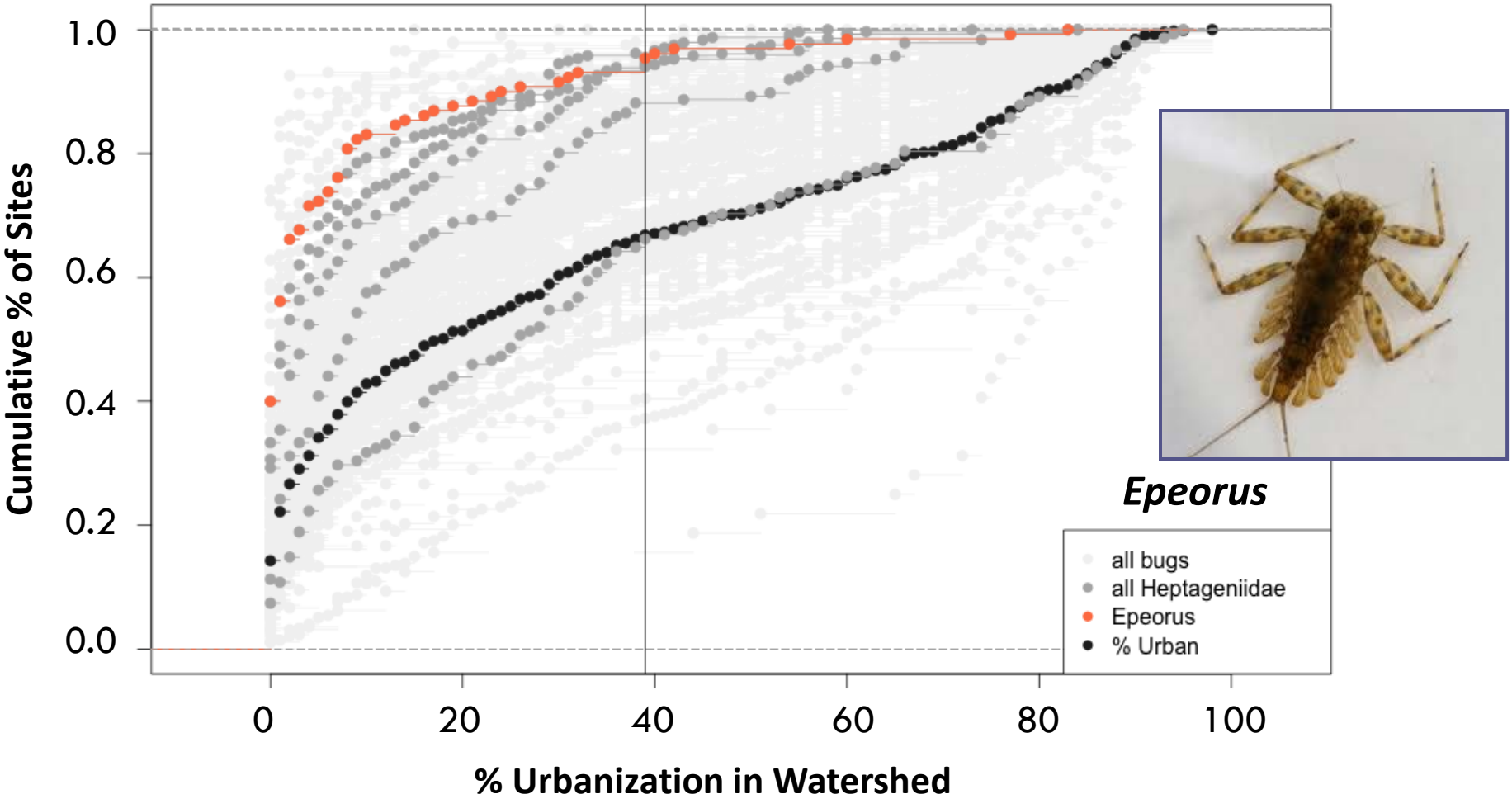


Tolerant & Intolerant Taxa Testing

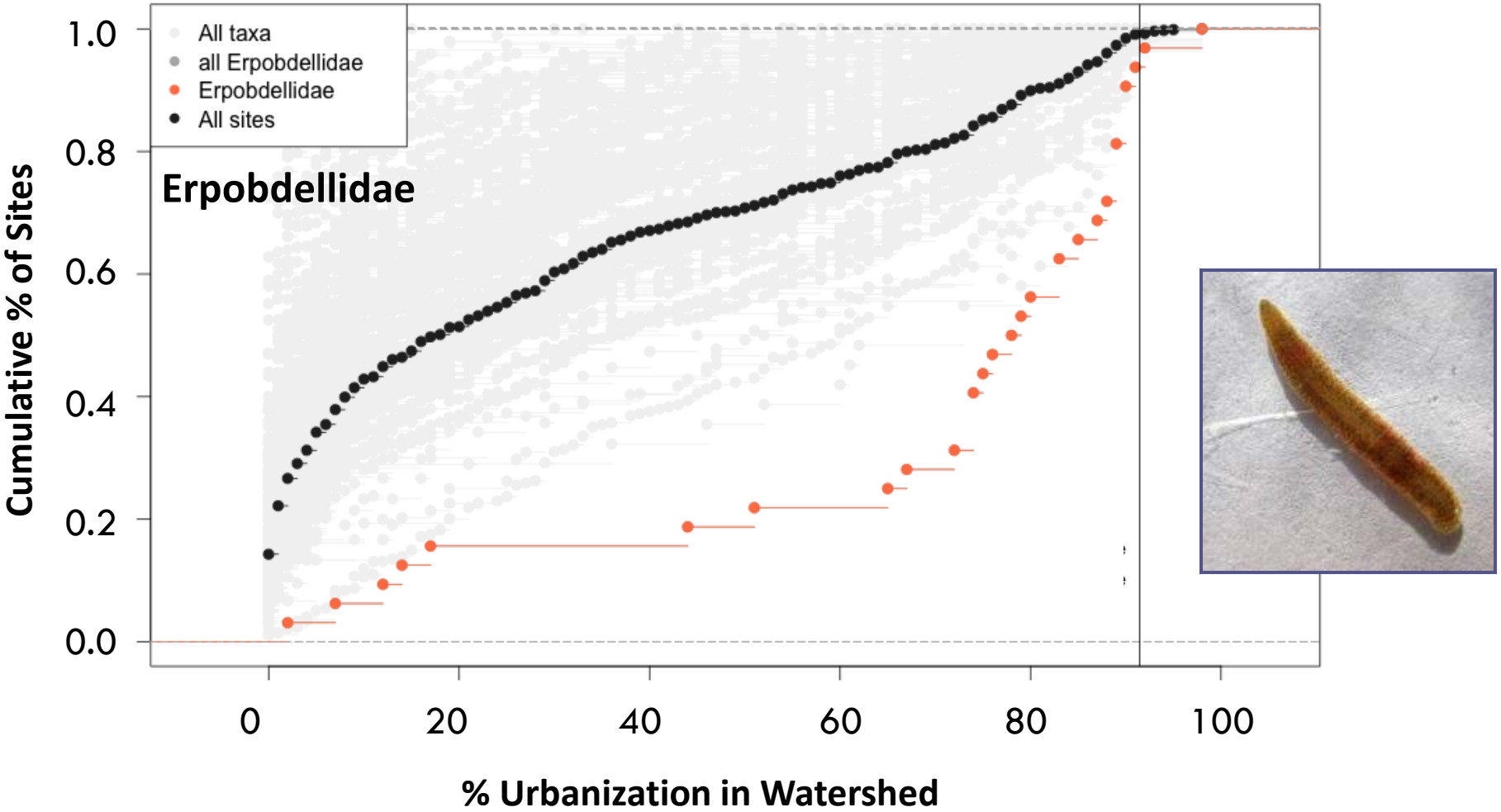
- N = 784 sites (most recent)
- Genus level or higher
- >= 25 occurrences
- 155 taxa tested



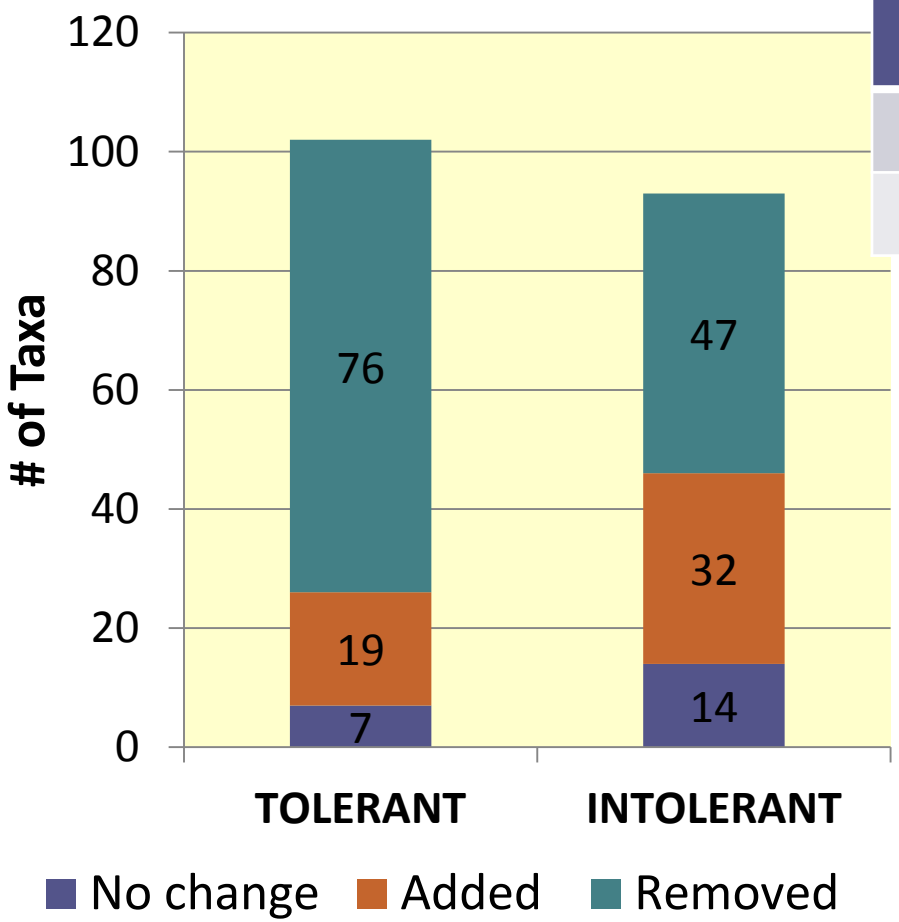
Example of an Intolerant Taxon



Example of a Tolerant Taxon

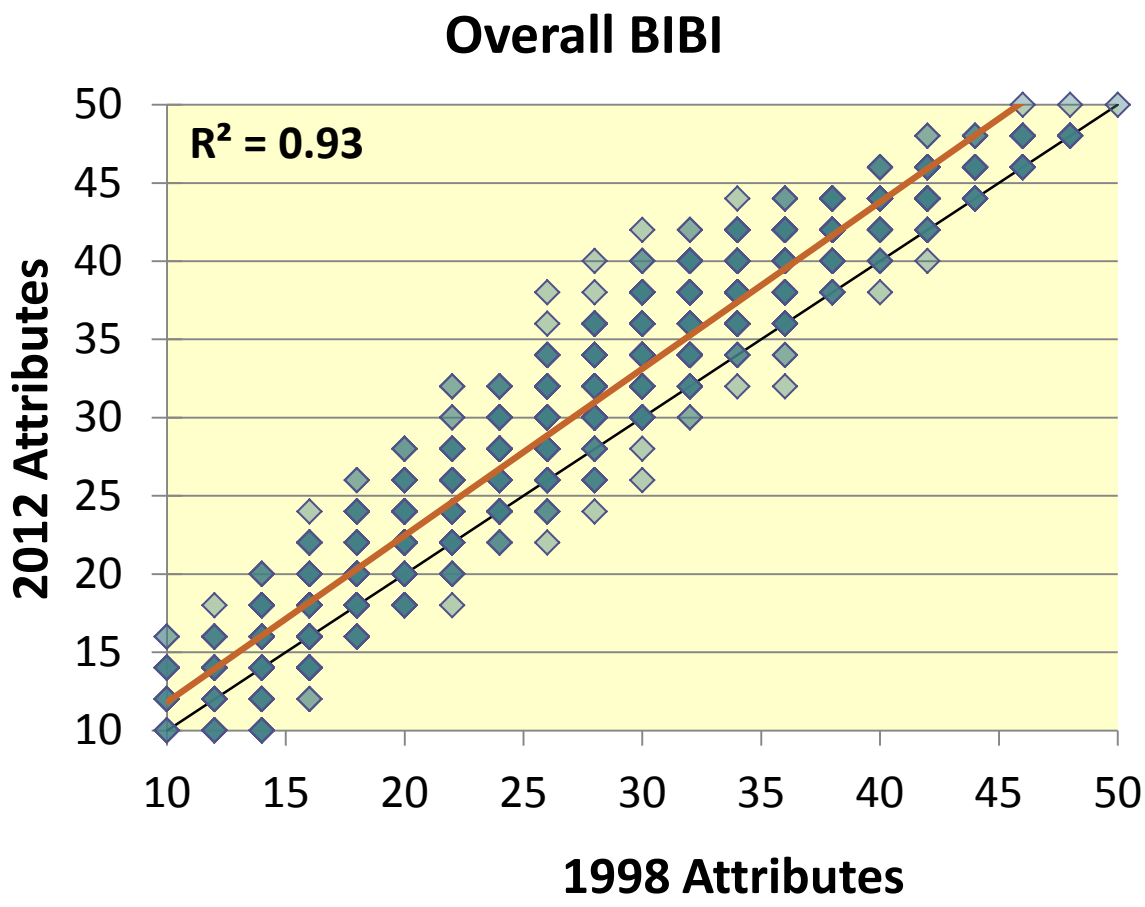


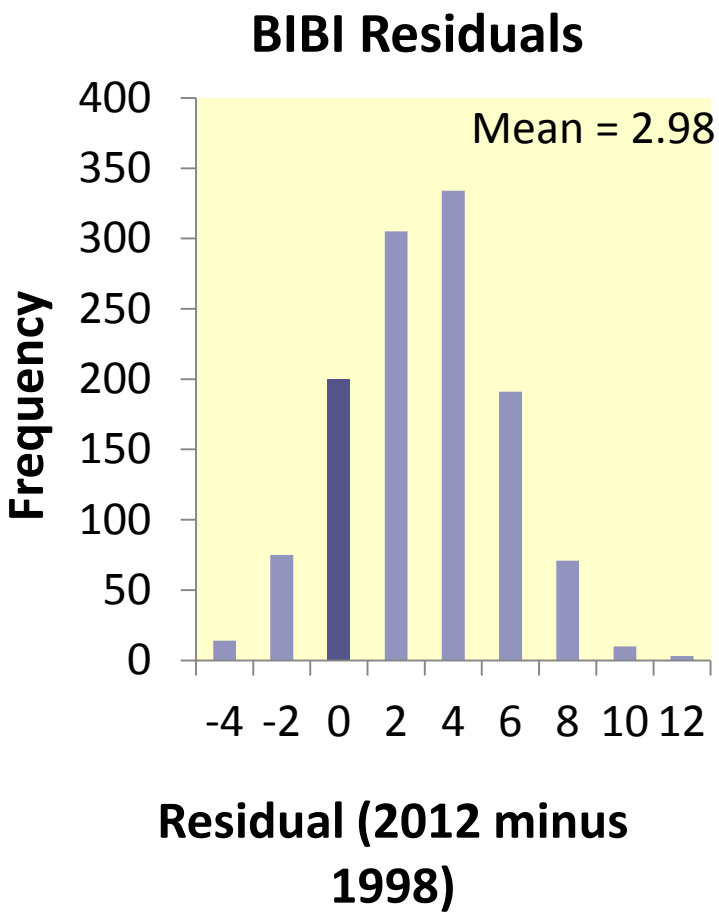
Attribute Changes: 1998 vs. 2012



Metric	Updated (2012)	Original (1998)
Tolerant	0.62	0.47
Intolerant	-0.75	-0.52

BIBI Scores: Attributes Compared

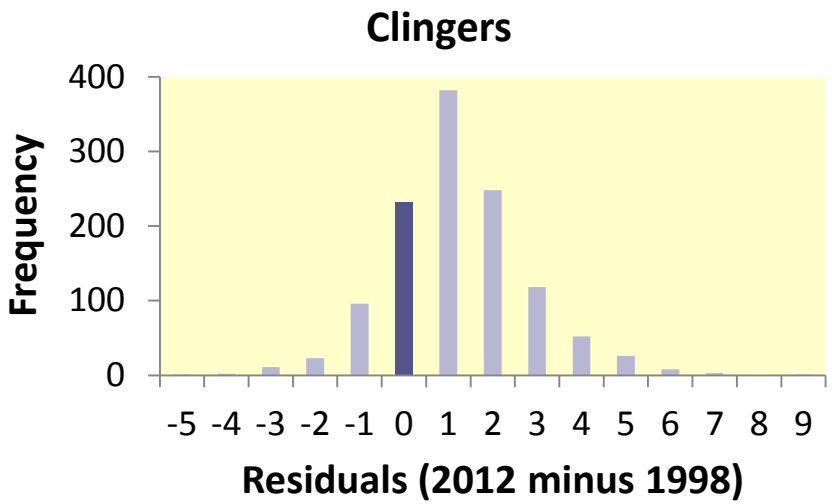


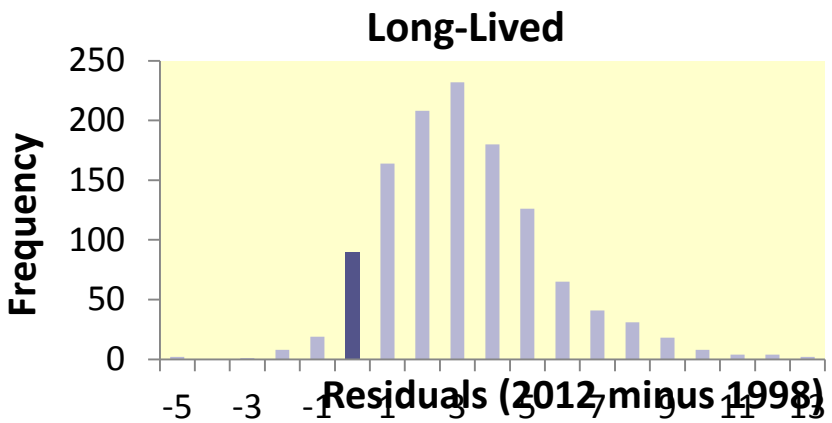


BIBI Metrics: Influence of Attributes

Metric	R^2	Mean Residual*
Long-lived Taxa	0.41	3.2
Intolerant Taxa	0.49	1.35
Clinger Taxa	0.95	1.21
% Tolerant	0.07	-1.96 %
% Predator	0.96	0.46 %

* All mean residuals are significantly different than 0 ($p<0.05$)





Taxa Attribute Conclusions

- Significant changes to attribute lists, especially predator, long lived and tolerant/intolerant taxa
- Many rare taxa dropped from tolerant and intolerant lists
- No change to structure of B-IBI – all metrics highly correlated with % urbanization
- Taxa attribute updates may require some recalibration

Next Steps

- Finalize attributes
- Recalibrate BIBI and adjust scoring
- Reanalyze 3 vs. 8 with updated attributes
- Incorporate changes into PSSB
- Biological Condition Gradient process/Indicator refinement

Acknowledgements

Federal

- EPA
- NOAA
- USFWS
- USGS

State

- WA Ecology

County

- Clallam
- King
- Kitsap
- Pierce
- Snohomish
- Thurston

City

- Bellevue
- Bellingham
- Bothell
- Everett
- Issaquah
- Kirkland
- Redmond
- Seattle
- Tukwila

Private

- Aquatic Biology Associates
- Aquatic Entomology
- Rhithron Associates, Inc.

Academic

- University of Washington

Non-profit

- Pierce Stream Team
- Statistical Design
- Lake Forest Park Streamkeepers

Tribe

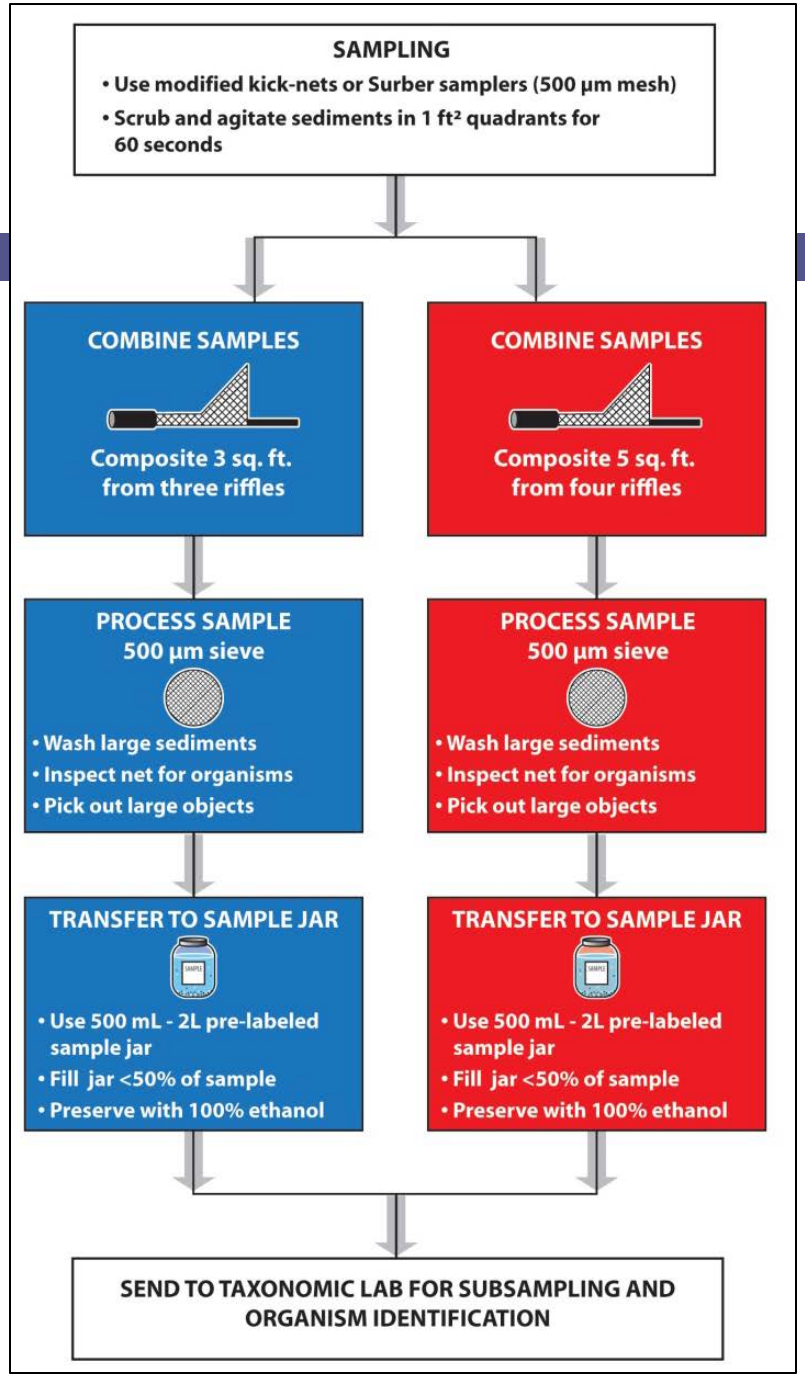
- Port Gamble Skallam Tribe
- Snoqualmie Nation
- Stillaguamish Tribe
- Upper Skagit Indian Tribe

Deb Lester
deborah.lester@kingcounty.gov

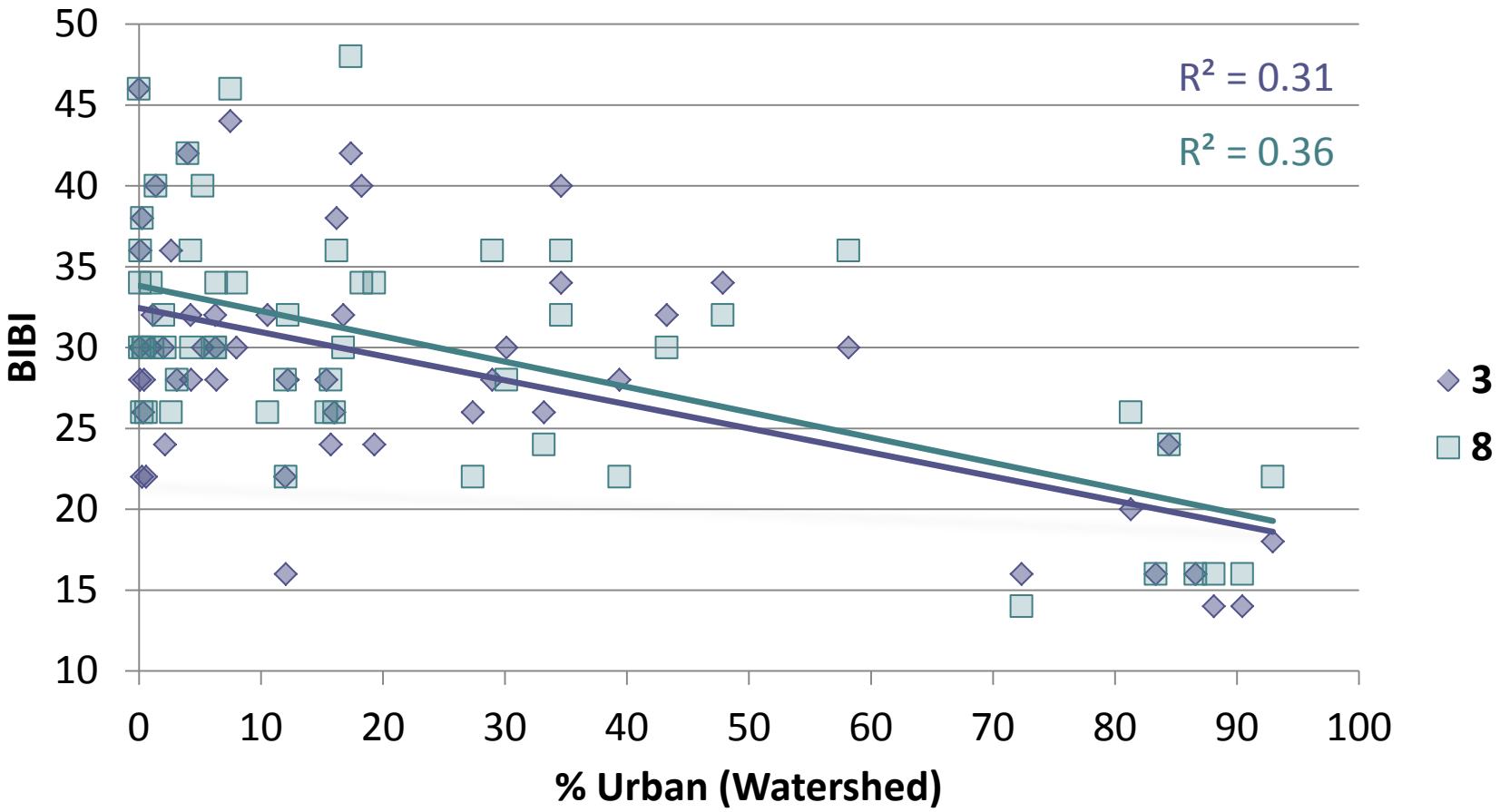
Jo Wilhelm
jo.wilhelm@kingcounty.gov

www.pugetsoundstreambenthos.org

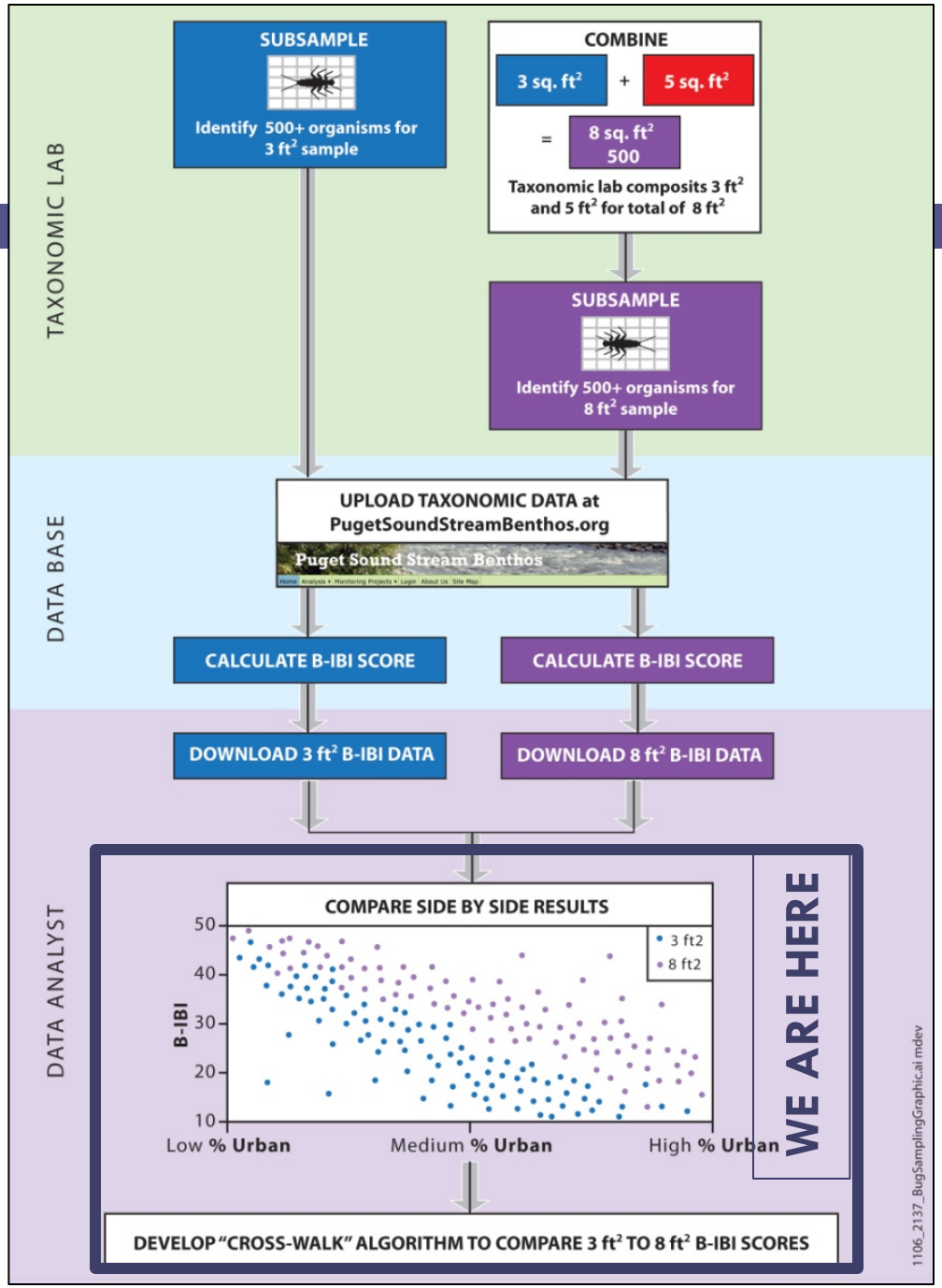
Sample Processing



Overall BIBI Score: Landcover



Lab Methods


TAXONOMIC LAB
SUBSAMPLE
Identify 500+ organisms for 3 ft² sample
COMBINE
3 sq. ft²
+
5 sq. ft²
=
8 sq. ft²
500
Taxonomic lab composits 3 ft² and 5 ft² for total of 8 ft²
SUBSAMPLE
Identify 500+ organisms for 8 ft² sample
DATA BASE
UPLOAD TAXONOMIC DATA at PugetSoundStreamBenthos.org
Puget Sound Stream Benthos
CALCULATE B-IBI SCORE
CALCULATE B-IBI SCORE
DOWNLOAD 3 ft² B-IBI DATA
DOWNLOAD 8 ft² B-IBI DATA
DATA ANALYST
COMPARE SIDE BY SIDE RESULTS
3 ft2
8 ft2
B-IBI
50
40
30
20
10
Low % Urban
Medium % Urban
High % Urban
WE ARE HERE
DEVELOP "CROSS-WALK" ALGORITHM TO COMPARE 3 ft² TO 8 ft² B-IBI SCORES
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