

What's Bugging Boise Creek?



Stream Benthic Macroinvertebrates

Today's Outline

- ✈ Introductions
- ✈ Benthic Macroinvertebrates: What? How?
- ✈ Benthic Index of Biotic Integrity
- ✈ Macroinvertebrates in Boise Creek
- ✈ If interest: Accessing Data



Introductions

 Name?

 Spend time in or around streams?

 Experience with stream biomonitoring?

 Why interested in this talk?



Clean Water Act (1972)



“To restore and maintain the chemical, physical and **biological integrity** of the nation's waters”



Increased use of biological data in many Clean Water Act programs



My Clean Water Act

Biological Integrity

“the ability to support and maintain a balanced, integrated, and adaptive community of organisms having a species composition, diversity and functional organization comparable to those of natural habitats within a region”



Karr, 1981

Benthic Macroinvertebrates

(bottom-dwelling animals w/o backbones visible to naked eye)



Insects



Crustaceans



Worms



Snails



Bivalves



Margaritifera falcata
(Bivalve - mussel)



Physella sp.
(Snail)



Pacifastacus leniusculus
(Crustacean - crayfish)



Oligochaeta
(Aquatic worm)



Heptageniidae sp.
(Mayfly larva)

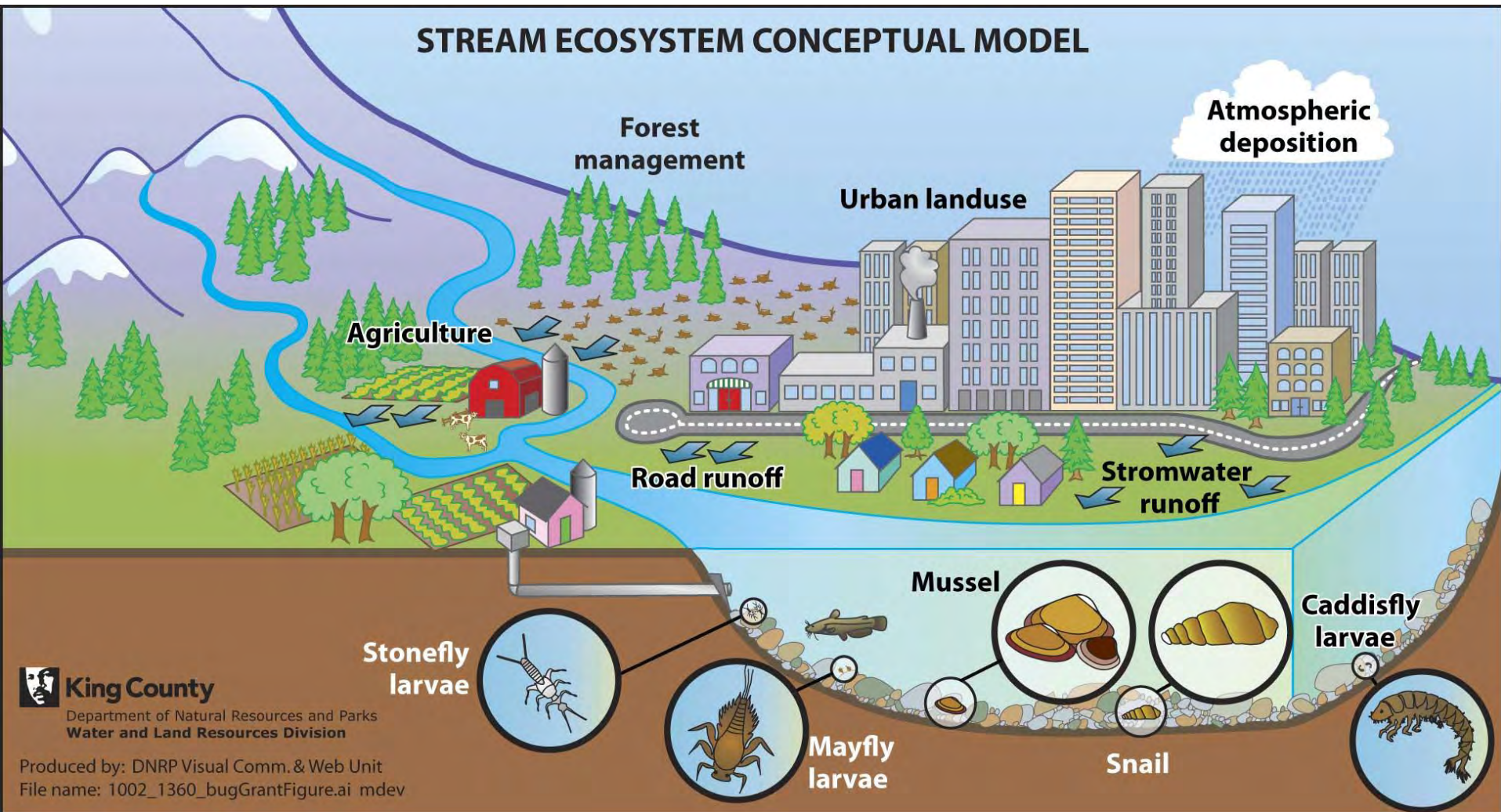


Hydropsyche sp.
(Caddisfly larva)



Perlodidae sp.
(Stonefly larva)

Why Benthic Macroinvertebrates?



Macroinvertebrates as Indicators

Pollution Sensitive ("Clean Water") Benthos



Stonefly



Water Penny Beetle



Mayfly



Dobsonfly



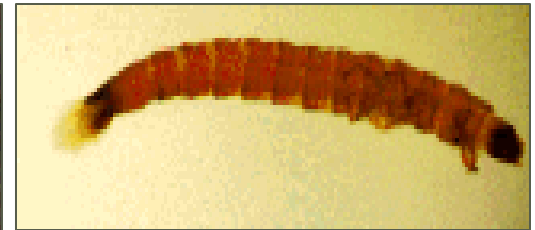
Alderfly



Mussel



Snipe Fly



Riffle Beetle

Macroinvertebrates as Indicators

Pollution Tolerant ("Polluted Water") Benthos



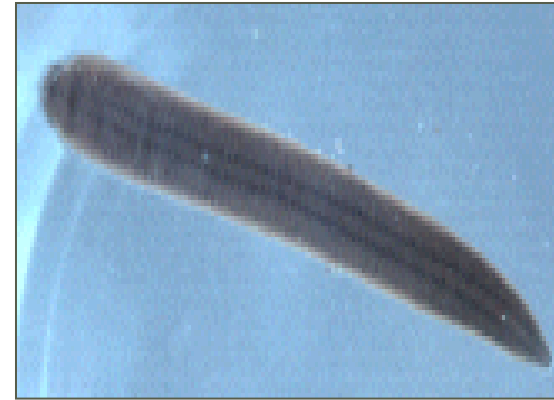
Pouch Snail



Midge

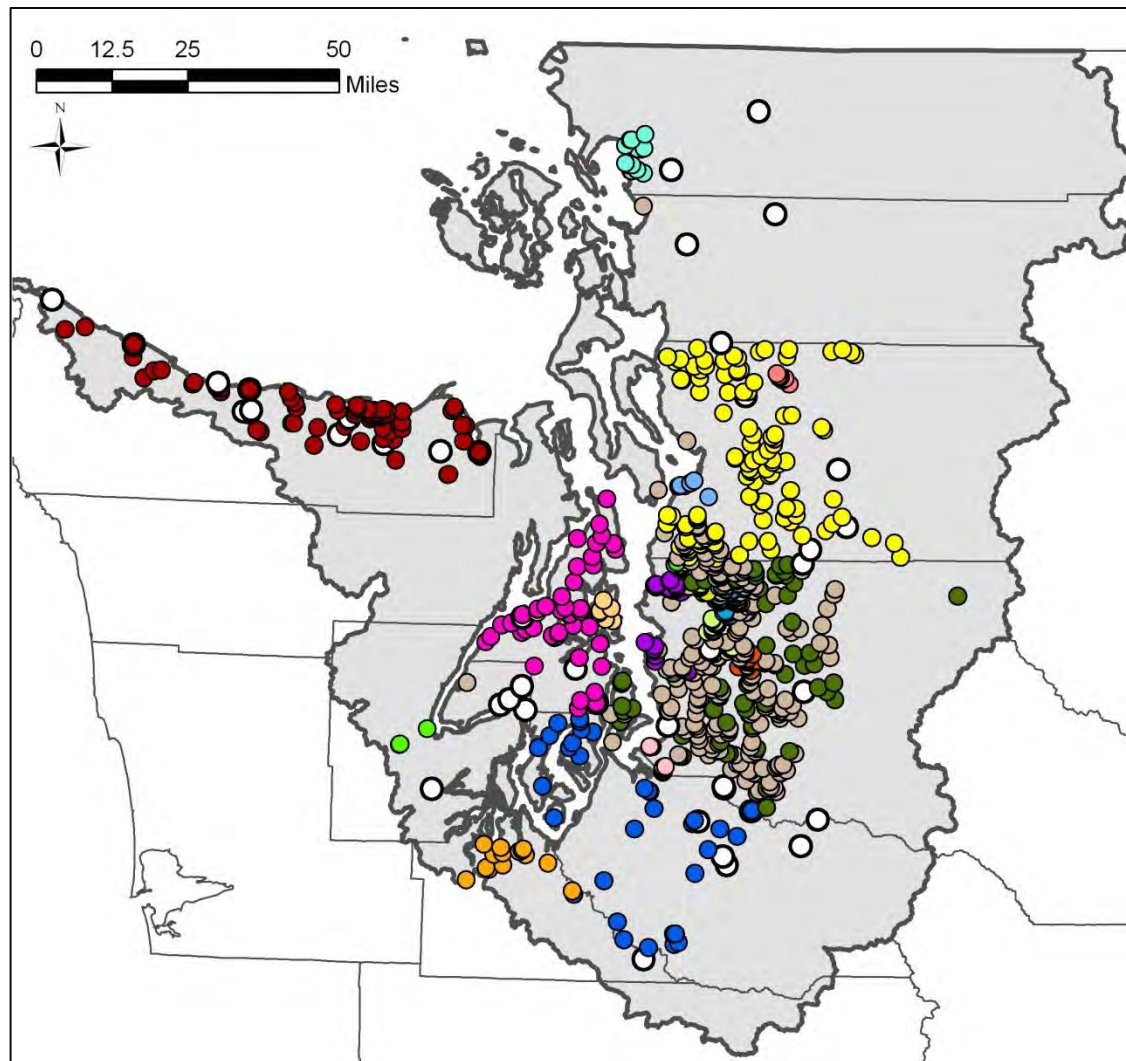


Worm



Leech

Puget Sound Macroinvertebrate Sampling



- Adopt-A-Stream
- Bainbridge Island
- Bellevue
- Bellingham
- Everett
- Federal Way
- Issaquah
- Kirkland
- Lake Forest Park
- Redmond
- Seattle
- Clallam County
- King County - DNRP
- King County - Roads
- Kitsap County
- Pierce County
- Skokomish Tribal Nation
- Snohomish County
- Thurston County
- Ecology

Puget Sound Macroinvertebrate Sampling



- ✈ Aug-Sept
- ✈ Surber sampler
- ✈ Riffle habitat
- ✈ 3, 8, or 9 ft²



Sample Processing



Who Does the Sampling and ID?

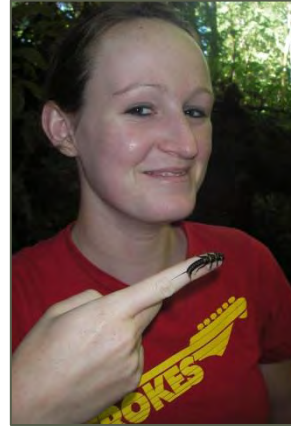
 Teams of 2 Sample

 Staff

 Seasonal Hires (4/yr)

 Volunteers (like you!)

 ID done by Taxonomic Labs



Benthic Index of Biotic Integrity

Metric

Total Taxa

Mayfly Taxa

Stonefly Taxa

Caddisfly Taxa

Long-lived Taxa

Intolerant Taxa

% Tolerant Individuals

% Predator Individuals

Clinger Taxa

% Dominance

10 Metrics in the “Bug Index”



Pollution tolerance/ intolerance



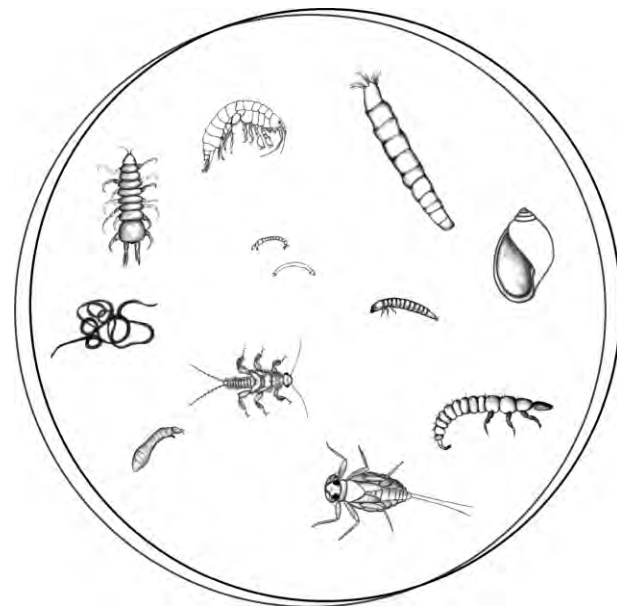
Taxonomic composition



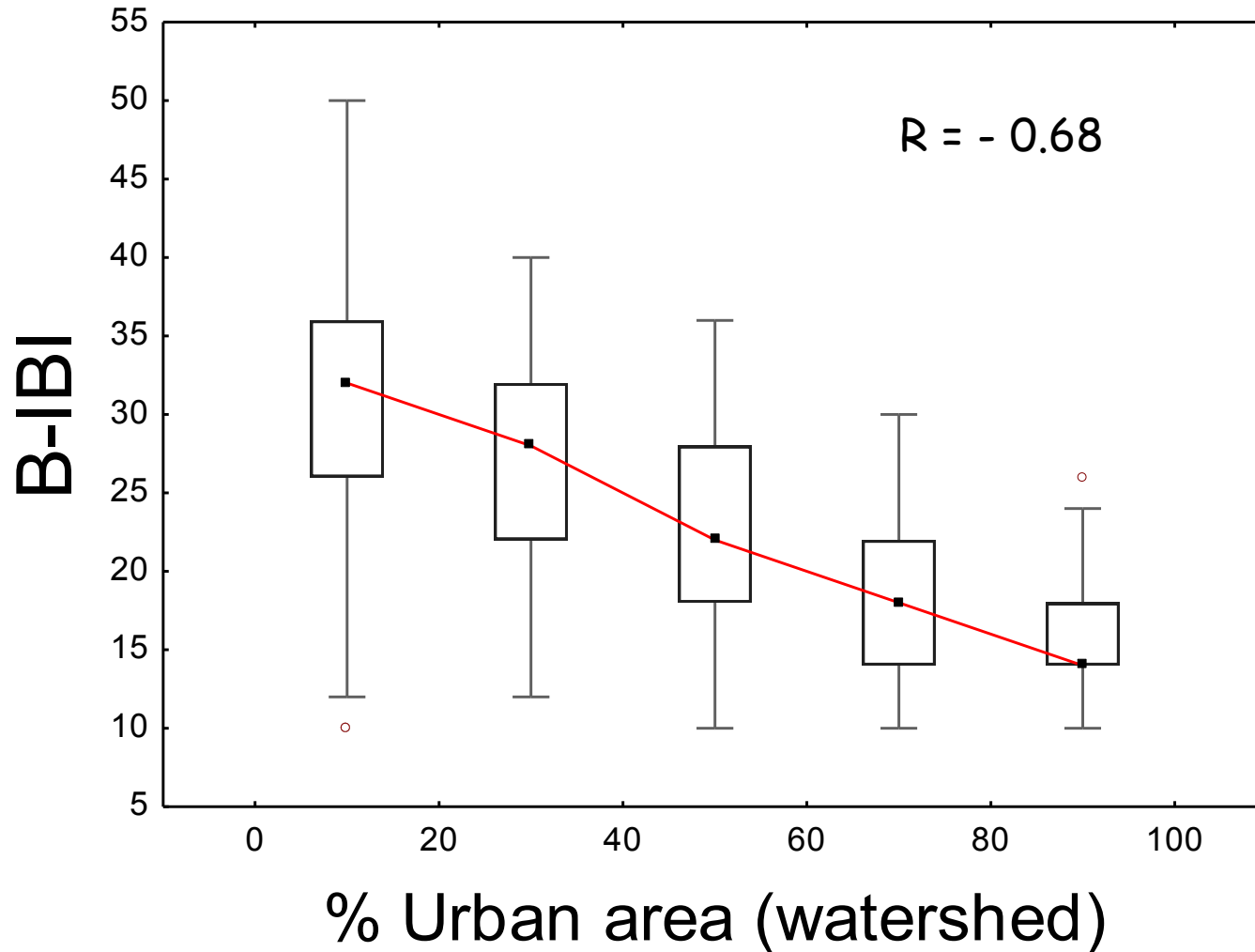
Population attributes



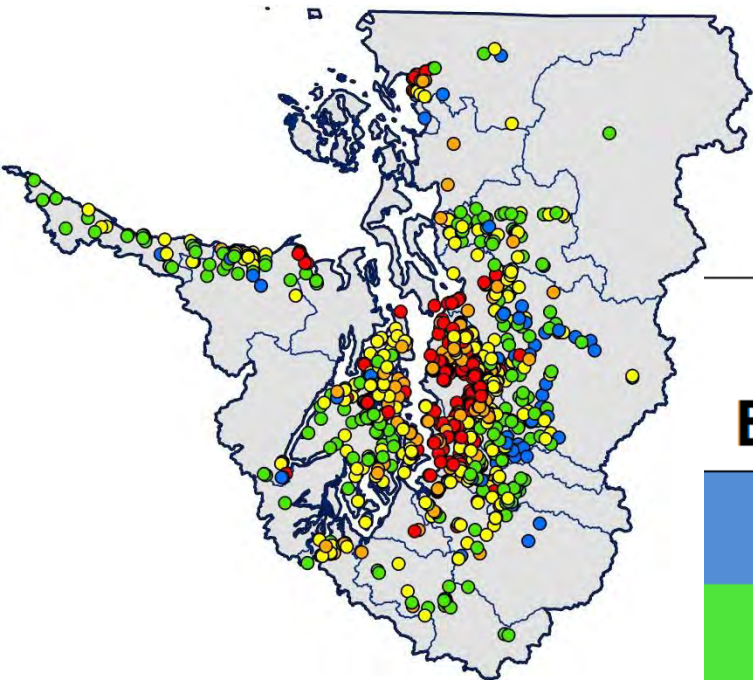
Feeding and habits



Primary Driver? Urbanization



B-IBI Condition Categories



Condition of Biotic Integrity	B-IBI ₁₀₋₅₀ Score	B-IBI ₀₋₁₀₀ Score
Excellent	46-50	80-100
Good	38-44	60-80
Fair	28-36	40-60
Poor	18-26	20-40
Very Poor	10-16	0-20

Biological Data Uses



King County

Department of
Natural Resources and Parks
Water and Land Resources Division

Status and Trends

 > 150 ambient sites/year

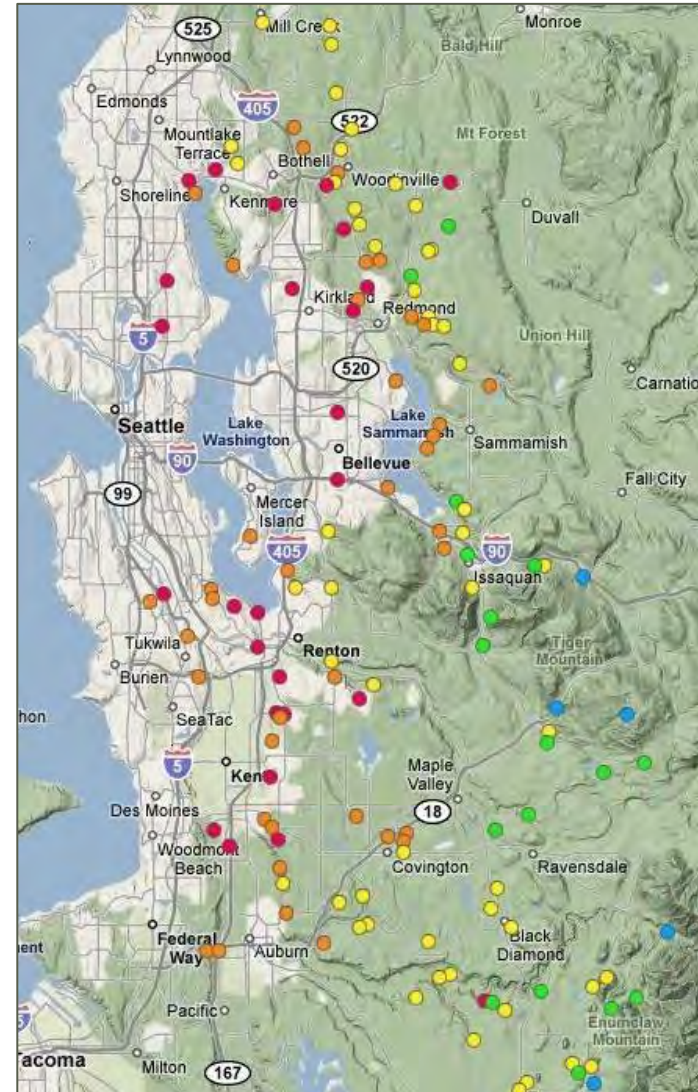
 KingStat

Effectiveness

 Biosolids applications

 Critical areas ordinance

 Stream restoration projects



Integration with Policy

🐛 Puget Sound Partnership

🐛 Dashboard Indicator

🐛 Action Agenda Targets

🐛 Preserve all “excellent” sites

🐛 Restore 30 “fair” sites to “good”

🐛 WA Dept. of Ecology

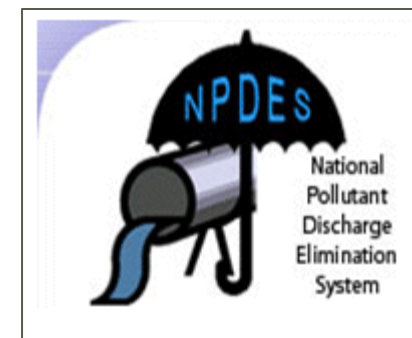
🐛 NPDES Stormwater Permit

🐛 WQ Assessment – 303(d)

🐛 Local Decision Making

🐛 Project prioritization

🐛 Basin planning



Puget Sound Stream Benthos

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Analyzing Stream Health

This site analyzes benthic macroinvertebrate community structure to determine the ecological health of streams. [Participating agencies](#) use this site to manage, analyze and share data from their ongoing stream monitoring programs.

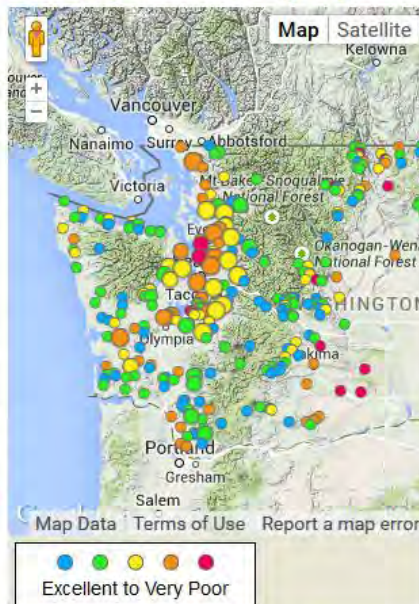


Benthic macroinvertebrates, also known as stream bugs, are animals that can be seen with the naked eye, do not

have backbones and live in the **stream benthos**—in or near the streambed. They include insects, crustaceans, worms, snails, clams, etc.

Benthic macroinvertebrates are monitored because they are good indicators of the biological health of stream systems and play a crucial role in the stream ecosystem.

Plotting Biotic Integrity



[Click here to customize chart.](#)

The B-IBI Scoring System

We use the [Benthic Index of Biotic Integrity \(B-IBI\)](#) scoring system to determine stream health. Since the B-IBI is a standardized scoring system, it can be used to compare and rank the health of different streams.

B-IBI has several variants, and we will support many of them over time. Currently, we are using Puget Sound Lowlands B-IBI. This site allows you to filter the scores by a variety of parameters and then

- [Plot the scores on maps](#)
- [Show the scores in tables](#)

B-IBI Recalibration

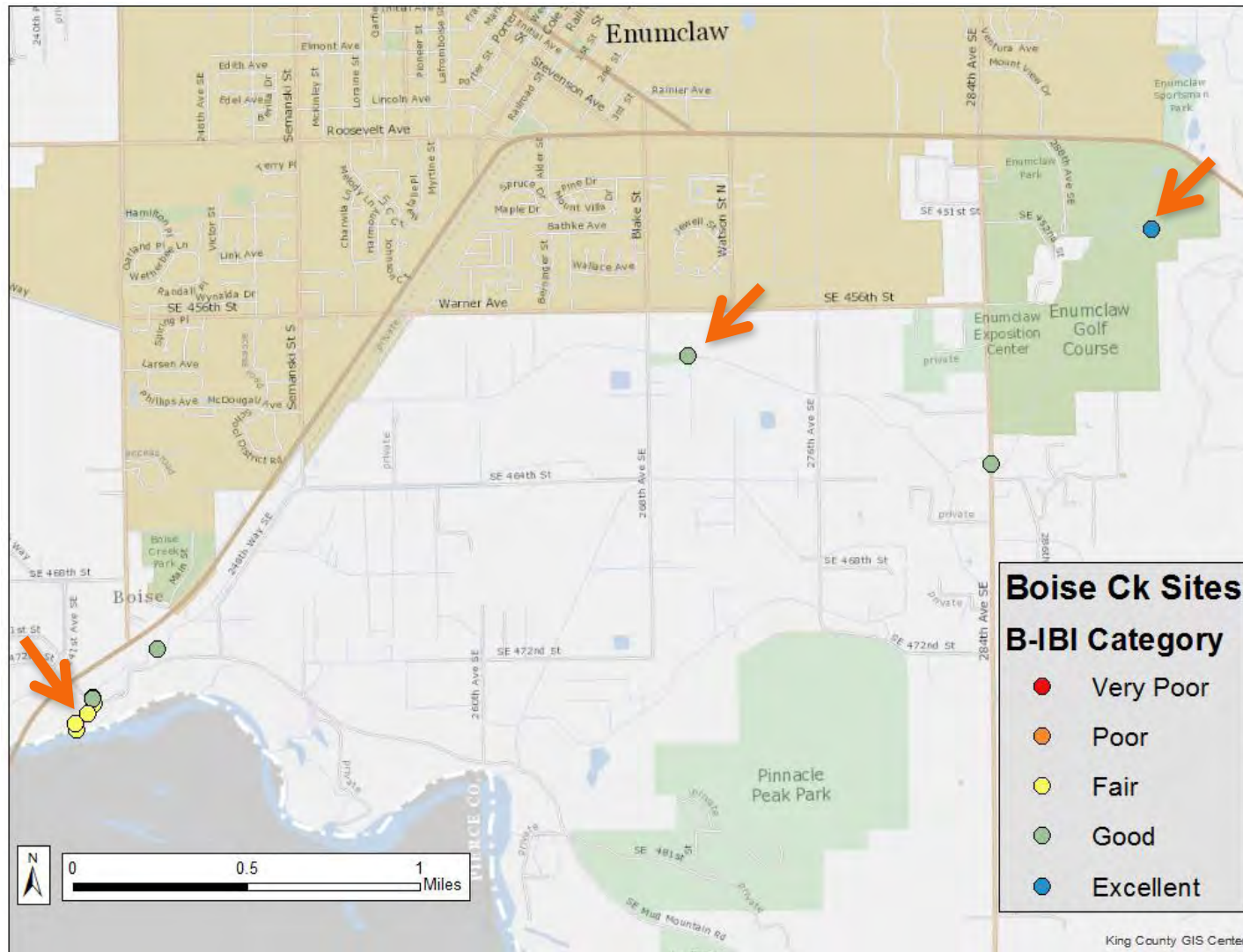
We are currently working to enhance benthic macroinvertebrate monitoring tools for the Puget Sound region. For more information and to view documents and other products please go to the [B-IBI Recalibration page](#).



RESULTS

- Consistent & secure data storage
- Enhanced analysis capabilities
- Data flexibility
- Regional comparability across boundaries
- Public access

Boise Creek: Sampling History



11 sites

7 clustered at mouth

3 added in 2014

38 total visits

B-IBI range:
21.8 (poor) – 94.5 (excellent)

Boise Creek: Sampling History

- ✈ 11 sites sampled between 1999 and 2014
 - ✈ 7 clustered near restoration project at the mouth
 - ✈ 3 sites added in 2014 for annual monitoring
- ✈ 38 total site visits (average 3.5 visits/site)
- ✈ B-IBI range: 21.8 (poor) – 94.5 (excellent)
- ✈ B-IBI is highest in the upstream reaches and decreases moving downstream

The background of the slide is a photograph of a stream. In the foreground, several dark, segmented aquatic insects, likely caddisfly larvae, are crawling on a flat, wet rock. The water is shallow and clear, revealing a bed of smooth, rounded stones of various sizes and colors (browns, greys, and tans) in the background. The lighting is natural, suggesting daylight.

Questions?

jo.wilhelm@kingcounty.gov

www.pugetsoundstreambenthos.org

Analysis Tab

Puget Sound Stream Benthos

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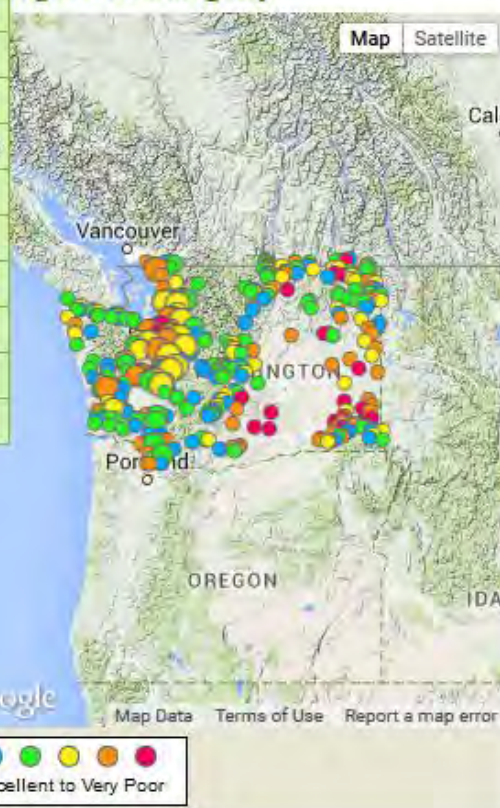
Analysis

- B-IBI Results Map
- B-IBI Results Table
- About the B-IBI Scoring System
- B-IBI Scoring Types
- The Scoring Process Step-By-Step
- Benthic Taxa Attributes
- Fine Sediment Sensitivity Index
- Hilsenhoff Biotic Tolerance Index
- Metals Tolerance Index
- Standard Taxonomic Effort
- Taxa Excluded from Scoring

This site provides information on the Benthic Index of Biotic Integrity (B-IBI) scoring system. This site provides information on the Benthic Index of Biotic Integrity (B-IBI) scoring system. This site provides information on the Benthic Index of Biotic Integrity (B-IBI) scoring system.

Benthic macroinvertebrates are monitored because they are good indicators of the biological health of stream systems and play a crucial role in the stream ecosystem.

Measuring Biotic Integrity



Map Satellite

Google

Map Data Terms of Use Report a map error

Excellent to Very Poor

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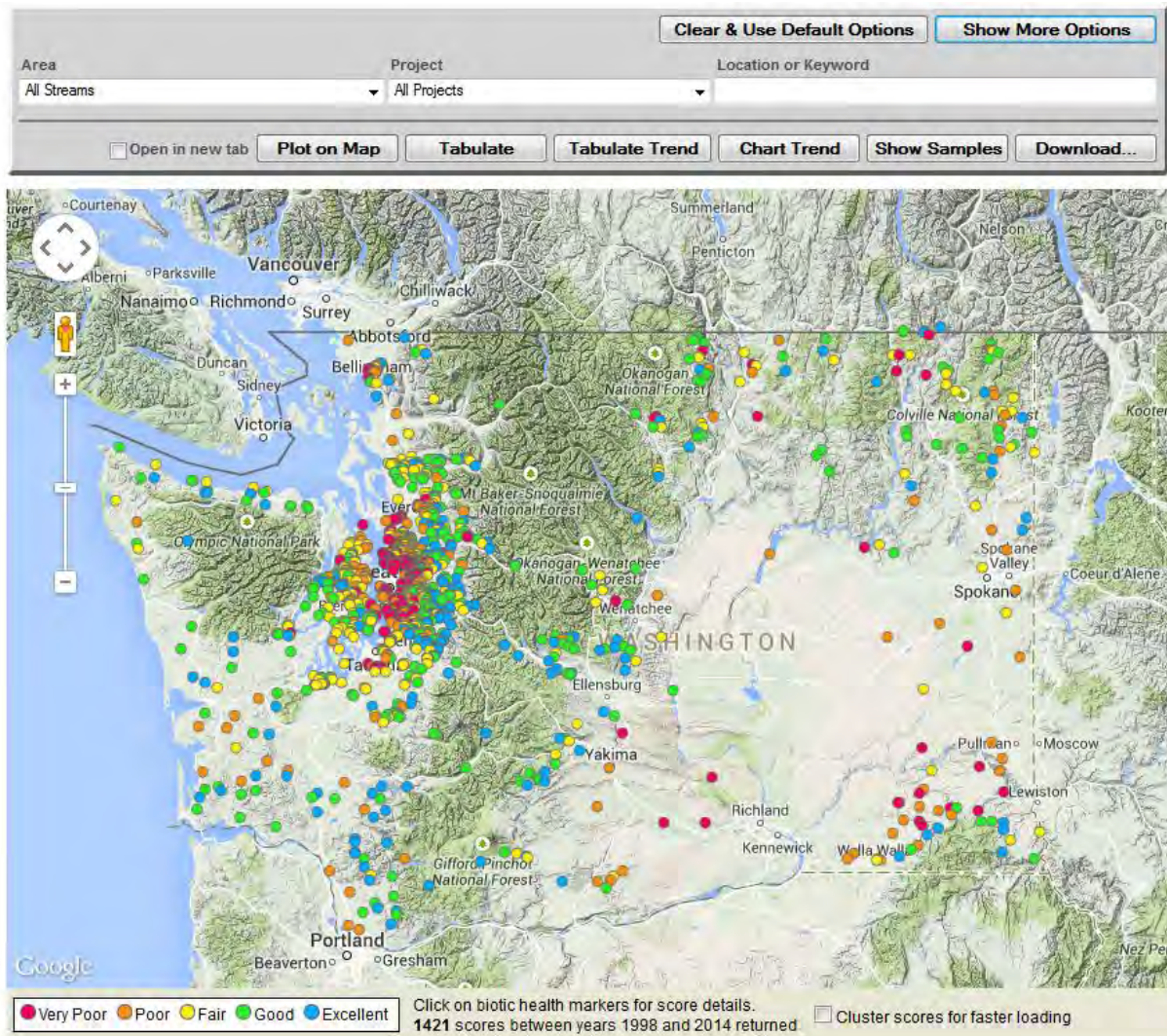
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- [Show the scores in tables](#)

B-IBI Recalibration

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Map View



- Google interface
- Zoom in & out
- Click and drag
- Can select specific streams:
e.g., Boise Ck

Table View

Analysis: Benthic Index of Biotic Integrity

Show Criteria

Clear & Use Default Options

Show More Options

Area

Project

Location or Keyword

Boise Creek

All Projects

☐ Open in new tab

Plot on Map

Tabulate

Tabulate Trend


Chart Trend

Show Samples

Download...

Row	Site Code, Location	Year, Project	Quantities												Scores												View Samples
			Taxa Richness	Ephemeroptera Richness	Plecoptera Richness	Trichoptera Richness	EPT Richness	Clinger Richness	Long-Lived Richness	Intolerant Richness	Percent Dominant	Predator Percent	Tolerant Percent	Organisms	Overall Score	Taxa Richness	Ephemeroptera Richness	Plecoptera Richness	Trichoptera Richness	Clinger Richness	Long-Lived Richness	Intolerant Richness	Percent Dominant	Predator Percent	Tolerant Percent		
1	BIBI-040 Boise Creek, Boise Creek	2005, Pierce County Watershed Health Monitoring	37	9	7	8	24	24	7	6	66.6%	3.0%	1.2%	500	76.9	10.0	10.0	8.6	8.8	10.0	6.2	8.6	4.1	1.0	9.7	Details	
2	Boise_ECY_552, Boise Creek	2004, Ambient Project	37	6	5	6	17	21	5	2	52.4%	3.2%	38.4%	500	44.1	3.4	7.1	5.7	6.2	8.2	3.8	2.9	4.5	1.1	1.1	Details	
3	BSE_1_MudMtnRd, Boise Creek	2014, Boise Ambient Project	40	5	6	6	17	20	5	1	47.4%	5.0%	4.8%	500	53.1	4.5	5.7	7.1	6.2	7.6	3.8	1.4	5.8	2.0	8.9	Details	
4	BSE_21_GolfCrS, Boise Creek	2014, Boise Ambient Project	59	9	11	7	27	30	14	7	41.8%	20.6%	0.8%	500	94.5	10.0	10.0	10.0	7.5	10.0	10.0	7.4	9.8	9.8	Details		
5	BSE_8_268thAveSE, Boise Creek	2014, Boise Ambient Project	44	6	5	6	17	22	7	4	53.0%	9.8%	1.6%	500	64.1	5.9	7.1	5.7	6.2	8.8	6.2	5.7	4.3	4.4	9.6	Details	
6	E2154, Boise Creek	2010, ESA Water Quality Project	35	8	5	6	19	22	8	4	64.6%	5.6%	4.2%	500	70.1	9.0	10.0	5.7	6.2	10.0	7.5	5.7	4.6	2.3	9.0	Details	
7	E2168, Boise Creek	2010, ESA Water Quality Project	23	5	3	4	12	14	3	2	84.4%	3.4%	53.8%	500	26.3	3.3	5.7	2.9	3.8	5.3	1.2	2.9	0.0	1.2	0.0	Details	
8	E2168 D/S, Boise Creek	2009, CIP Support Project	29	6	5	3	14	16	6	2	72.8%	7.4%	3.6%	500	50.7	6.2	7.1	5.7	2.5	6.5	5.0	2.9	2.4	3.2	9.2	Details	
9	LowerBoise_Control, Boise Creek	2013, Lower Boise Creek Project	38	9	4	4	17	22	6	4	54.6%	5.6%	1.8%	500	63.5	7.8	10.0	4.3	3.8	9.4	5.0	5.7	5.7	2.3	9.6	Details	
10	LowerBoise_NewChannel, Boise Creek	2013, Lower Boise Creek Project	30	7	4	3	14	18	4	2	63.2%	10.2%	1.0%	500	49.6	4.3	8.6	4.3	2.5	6.9	2.5	2.9	3.3	4.6	9.8	Details	
11	LowerBoise_OldChannel, Boise Creek	2013, Lower Boise Creek Project	35	9	5	3	17	14	4	1	59.9%	4.4%	5.4%	496	47.7	6.5	10.0	5.7	2.5	4.4	2.5	1.4	4.2	1.7	8.7	Details	

View Details: Site Information



Puget Sound Stream Benthos

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Sampling Agency: King County - DNRP
Project: [Boise Ambient](#)
Date Released: 1/29/2015
Taxonomic Effort: Fine Resolution
Samples Taken: 1
Organisms Counted: 611

Sampling Date: 10/6/2014
Site Code: BSE_8_268thAveSE
Location: 47.190111°, -121.981778°
Boise Creek
Mud Mt Lake Subbasin
Green Waters Basin
WRIA 10 - Puyallup-White

Score Type
0-100 B-IBI: Fine Resolution
Taxonomic Resolution
As Defined by Metadata
Taxa Attributes
Fore, Wisseman, 2012 (recommended for 0-100 B-IBI)
Recalculate

Samples
☒ BSE_8_268thAveSE_14 (611 counted)
☐ Don't Subsample
☒ Subsample **Max:** 500
Sorting: Taxonomic Classification

[Metric Details](#) [Taxonomic Composition](#) [Visit Details](#)

View Details: Taxonomy

[Metric Details](#) [Taxonomic Composition](#) [Visit Details](#)

Sample 1 of 1

Sample Code: BSE_8_268thAveSE_14

Surface Area: 8.00 ft²

Sample ID: 12313

Composite? 8 Collections

QC Replicate? No

Sub-sampling by Lab: 5/30

Classification	Taxon	Quantity	Quantity Subsampled	Life Stage	Unique	Damaged	Predator	Long-Lived	Tolerant	Intolerant	Clinger	Non-BIBI	Fine Sediment Sensitivity Index	Hilsenhoff Biotic Tolerance Index	Metals Tolerance Index
Order: Haplotaxida	Nais	2	1		Yes	No	No	No	No	No	No	No		5	
Order: Lumbriculida	Lumbriculidae	5	5		Yes	Yes	No	No	No	No	No	No		8	
Order: Trombidiformes	Atractides	1	1	adult	Yes	No	No	No	No	No	No	No		8	
Order: Trombidiformes	Lebertia	11	10	adult	Yes	No	No	No	No	No	No	No		8	
Order: Trombidiformes	Protzia	3	3	adult	Yes	No	No	No	No	No	No	No			
Order: Trombidiformes	Sperchon	1	1	adult	Yes	No	No	No	No	No	No	No		8	
Order: Trombidiformes	Monatractides	1	1	adult	Yes	No	No	No	No	No	No	No			
Order: Amphipoda	Amphipoda	6	0		Never	Yes	No	No	Yes	No	No	No		4	
Order: Amphipoda	Crangonyx	4	4		Yes	No	No	No	Yes	No	No	No		4	
Order: Coleoptera	Elmidae	5	0	larva	Never	No	No	Yes	No	No	Yes	No		4	
Order: Coleoptera	Ampumixis dispar	2	1	larva	Yes	No	No	Yes	No	No	Yes	No		4	
Order: Coleoptera	Heterimnius corpulentus	140	122	larva	Yes	No	No	Yes	No	No	Yes	No	5	4	3
Order: Coleoptera	Narpus concolor	2	2	larva	Yes	No	No	Yes	No	No	Yes	No	5	4	1
Order: Coleoptera	Optioservus	3	3	adult	Yes	No	No	Yes	No	No	Yes	No		4	5
Order: Coleoptera	Optioservus	6	0	larva	Never	No	No	Yes	No	No	Yes	No		4	5
Order: Diptera	Empididae	3	3	larva	Yes	Yes	Yes	No	No	No	Yes	No		6	
Order: Diptera	Hemerodromia	4	3	larva	Yes	No	Yes	No	No	No	Yes	No		6	4
Order: Diptera	Polypedilum	1	1	larva	Yes	No	No	No	No	No	Yes	No		6	4
Order: Diptera	Micropsectra	8	8	larva	Yes	No	No	No	No	No	No	No		7	1
Order: Diptera	Micropsectra	2	0	pupa	Never	No	No	No	No	No	No	No		7	1
Order: Diptera	Orthoclaadiinae	3	0	pupa	Never	Yes	No	No	No	No	No	No		5	
Order: Diptera	Brillia	2	2	larva	Yes	No	No	No	No	No	No	No		5	4
Order: Diptera	Parametrioctenus	2	2	larva	Yes	No	No	No	No	No	No	No		5	4
Order: Diptera	Parametrioctenus	2	0	pupa	Never	No	No	No	No	No	No	No		5	4
Order: Diptera	Rheocricotopus	2	2	pupa	Yes	No	No	No	No	No	No	No		6	5
Order: Diptera	Synorthocladus	1	1	pupa	Yes	No	No	No	No	No	No	No		2	1
Order: Diptera	Tvetenia Bavarica Group	5	4	larva	Yes	No	No	No	No	No	No	No		5	4
Order: Diptera	Thienemannimyia complex	4	4	larva	Yes	No	Yes	No	No	No	No	No		7	

View Details: Map

[Metric Details](#) [Taxonomic Composition](#) [Visit Details](#)

Site ID: 2226

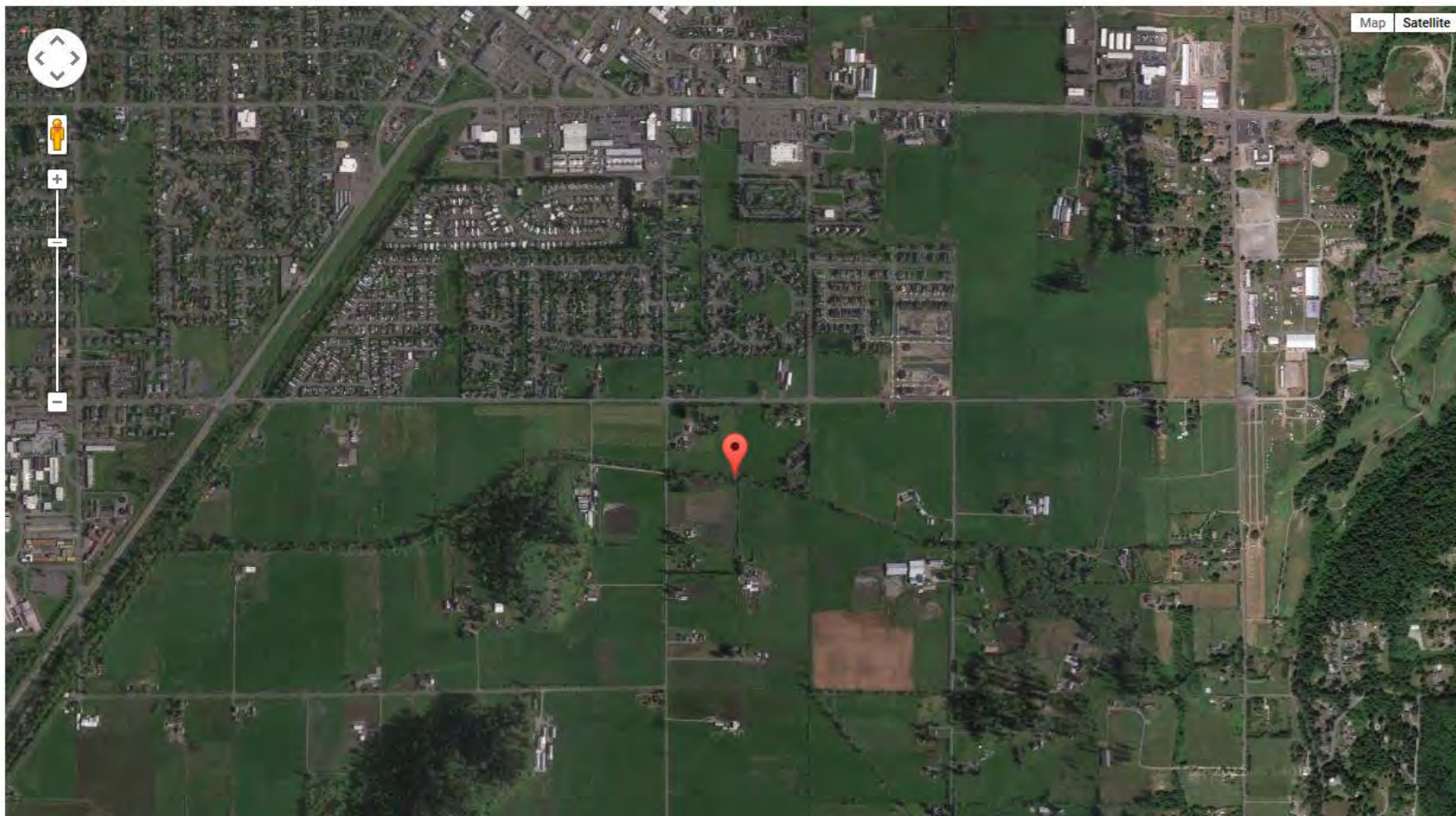
Elevation: 226m

Visit ID: 7329

Site Code: BSE_8_268thAveSE

Analyzed By: Rhithron Associates, Inc.

City, County, State: Enumclaw, King County, WA



Criteria Panel

Analysis: Benthic Index of Biotic Integrity

Show Criteria

Clear & Use Default Options Show Fewer Options

Area	Project	Location or Keyword
All Streams	All Projects	
Aggregation	Score Type	Metric
Don't Aggregate	0-100 B-IBI	Overall Score
Replicate Handling	Taxonomic Resolution/STE (See lists)	Taxa at Visit Metrics
Combine replicates, then calculate	As Defined by Metadata	
Taxa Attributes (See lists)	Taxa Exclusions	Taxa at Visit Filter
Fore, Wisseman, 2012 (recommended for 0-100 B-IBI)	See the list	
Number of Organisms <input type="radio"/> Count per Sample <input checked="" type="radio"/> Count per Visit		Year <input checked="" type="radio"/> Latest per Site in Range <input type="radio"/> All in Range
Min: Max: 500 <input type="radio"/> Flag <input type="radio"/> Omit <input checked="" type="radio"/> Omit/Subsample		Range from Earliest through Latest

☐ Open in new tab Plot on Map Tabulate Tabulate Trend Chart Trend Show Samples Download...

Area Search

Analysis: Benthic Index of Biotic Integrity

Show Criteria

Clear & Use Default Options Show Fewer Options

Area: **Boise Creek** Project: All Projects Location or Keyword:

Aggregation: Don't Aggregate Score Type: 0-100 B-IBI Metric: Overall Score

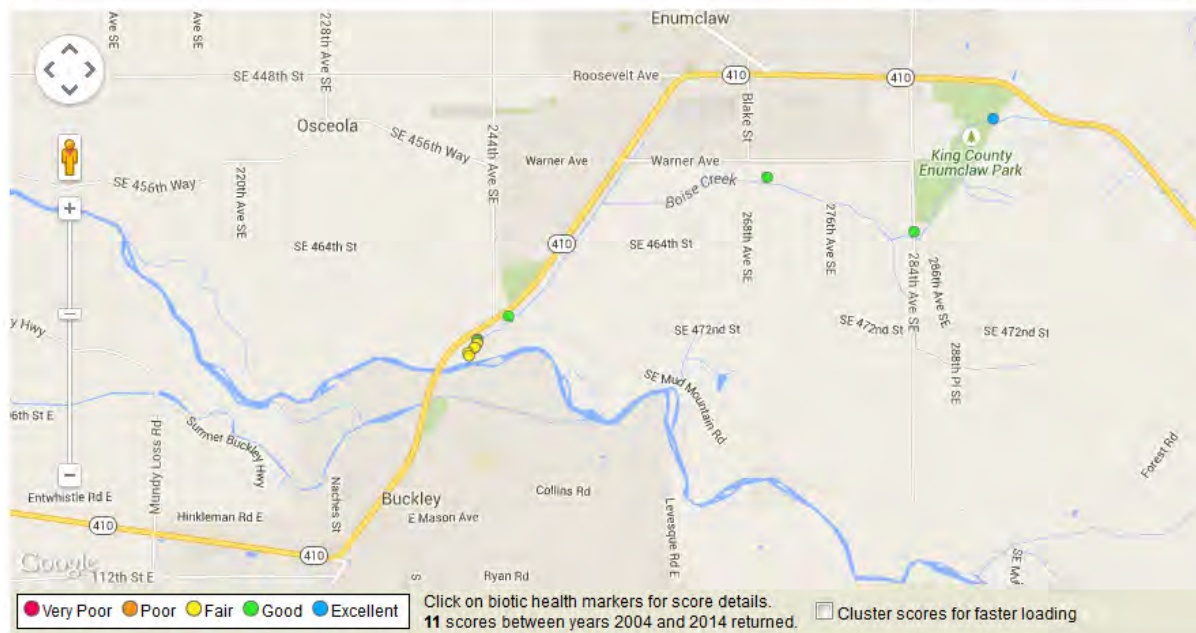
Replicate Handling: Combine replicates, then calculate Taxonomic Resolution/STE: As Defined by Metadata Taxa at Visit Metrics:

Taxa Attributes: Fore, Wisseman, 2012 (recommended for 0-100 B-IBI) Taxa Exclusions:

Number of Organisms: ☐ Count per Sample ☒ Count per Visit Year: ☒ Latest per Site in Range ☐ All in Range

Min: Max: 500 ☐ Flag ☐ Omit ☒ Omit/Subsample Range from: Earliest through: Latest

☐ Open in new tab Plot on Map Tabulate Tabulate Trend Chart Trend Show Samples Download...



Download Options

Specify Your Download




Score Table
[Option for All Years \(not available\)](#)
☐ Only one visit per site per year
QC Option
Hide QC samples
Download Scores

Metric by Year
Cross tabulate the metric with location rows & year columns.
Download by Year

Raw Sample Data
[Options for All Years \(not available\)](#)
☐ Only one visit per site per year
☐ Include deficient samples
Select Format
☐ Standard Sam
☐ Samples with
☐ Samples with
☐ Wash. DOE's
Download Samples

Technical Notes
Each of the above downloads is in a comma delimited, tabular form with the first row containing the column headers, and the rest of the rows are the data. The files can be pasted into MS Excel, MS Access and other database software.
If the scores downloaded are visit scores (not aggregates), that score is the sample table on the surrogate key VisitID (as opposed to the natural key composed of Agency, Site Code, and Visit Date). Sites can be identified with the surrogate key VisitID (as opposed to the natural key composed of Agency, and Site Code).

Close

-  Copy metadata
-  Paste into spreadsheet
-  Keep with bug data!

Downloads

Title: Scores By Year
Metric: Overall Score
Area Filter: Boise Creek
Date Filter: Most recent event at each site
Replicate Handling: Combine replicates, then calculate
Score Type: 0-100 B-IBI
Taxa Attributes: Fore, Wisseman, 2012 (recommended for 0-100 B-IBI)
Taxonomic Resolution: As Defined by Metadata
Organisms per Visit: At most 500, subsampled when over
Sorted by: Location, Agency, Project, Site Code
Generation Time: 7/8/2015 12:13 PM

To copy criteria, [select](#) the text above, and then copy to your clipboard.

Permanent URL: <http://pugetsoundstreambenthos.org/Download.aspx?page=Download%2FSc> [Select](#) to copy.

Data from 11 visits are available for download.

[Download Part 1 of 1](#)

Close

Download Scores (each row a site visit)

	A	B	C	D	E	H	J	K	L	M	N	O	P	Q	R	S	T	U	V	W
1	Row	Visit ID	Site ID	WRIA N	WRIA	Stream	Project	Site Code	Latitude	Longitude	Event Date	Date Rele	Taxonomi	Total SqFt	Taxa Richr	Ephemerc	Plecopter	Trichoptei	EPT Richn	Clinger Rich
2	1	7618	2262	9	WRIA 9 - C	Christens	Vashon B	ChrisVNC	47.40107	-122.514	8/22/2014	#####	Medium	8	35	4	7	7	18	14
3	2	5733	272	9	WRIA 9 - C	Christens	Vashon	VashChris	47.40277	-122.517	9/11/2013	2/6/2014	Fine	8	52	5	7	3	15	13
4	3	4717	272	9	WRIA 9 - C	Christens	Vashon	VashChris	47.40277	-122.517	9/5/2012	#####	Fine	8	46	3	6	5	14	13
5	4	3713	272	9	WRIA 9 - C	Christens	Vashon	VashChris	47.40277	-122.517	8/16/2011	#####	Coarse	3	28	3	5	5	13	11
6	5	3136	272	9	WRIA 9 - C	Christens	Vashon	VashChris	47.40277	-122.517	9/9/2010	4/4/2011	Coarse	3	31	5	8	5	18	13
7	6	2573	272	9	WRIA 9 - C	Christens	Vashon	VashChris	47.40277	-122.517	8/19/2009	#####	Coarse	3	36	5	6	7	18	15
8	7	604	272	9	WRIA 9 - C	Christens	Vashon	VashChris	47.40277	-122.517	9/3/2008	#####	Coarse	3	24	4	3	4	11	9
9	8	1831	272	9	WRIA 9 - C	Christens	Vashon	VashChris	47.40277	-122.517	9/26/2007	#####	Coarse	3	29	3	5	6	14	13
10	9	222	272	9	WRIA 9 - C	Christens	Vashon	VashChris	47.40277	-122.517	9/7/2006	#####	Coarse	3	29	2	5	5	12	13
11	10	1809	272	9	WRIA 9 - C	Christens	Vashon	VashChris	47.40277	-122.517	9/13/2005	#####	Coarse	3	32	4	6	3	13	12
12	11	3261	298	9	WRIA 9 - C	Ellis Creek	ESA Water	E1223	47.41734	-122.44	8/27/2010	#####	Coarse	3	3	0	0	0	0	0
13	12	2772	298	9	WRIA 9 - C	Ellis Creek	ESA Water	E1223	47.41734	-122.44	9/1/2009	#####	Coarse	3	6	0	0	0	0	0
14	13	501	298	9	WRIA 9 - C	Ellis Creek	ESA Water	E1223	47.41734	-122.44	9/11/2008	#####	Coarse	3	7	0	0	0	0	1
15	14	400	298	9	WRIA 9 - C	Ellis Creek	ESA Water	E1223	47.41734	-122.44	8/30/2007	7/6/2010	Coarse	3	3	0	0	0	0	0
16	15	24	298	9	WRIA 9 - C	Ellis Creek	ESA Water	E1223	47.41734	-122.44	8/23/2006	#####	Coarse	3	4	0	0	0	0	0
17	16	5502	298	9	WRIA 9 - C	Ellis Creek	ESA Water	E1223	47.41734	-122.44	8/17/2005	9/6/2013	Coarse	3	4	0	0	1	1	0
18	17	5605	298	9	WRIA 9 - C	Ellis Creek	ESA Water	E1223	47.41734	-122.44	9/14/2004	#####	Coarse	3	5	0	0	0	0	0
19	18	4557	523	9	WRIA 9 - C	Fisher Cre	Regulator	65B	47.38394	-122.481	8/8/2012	#####	Coarse	3	19	4	4	1	9	9
20	19	3843	523	9	WRIA 9 - C	Fisher Cre	Regulator	65B	47.38394	-122.481	8/11/2011	#####	Coarse	3	33	3	7	6	16	14
21	20	3045	523	9	WRIA 9 - C	Fisher Cre	Regulator	65B	47.38394	-122.481	9/1/2010	3/1/2011	Coarse	3	37	6	9	7	22	19
22	21	2578	523	9	WRIA 9 - C	Fisher Cre	Regulator	65B	47.38394	-122.481	8/20/2009	#####	Coarse	3	34	6	7	4	17	13
23	22	785	523	9	WRIA 9 - C	Fisher Cre	Regulator	65B	47.38394	-122.481	8/25/2008	#####	Coarse	3	32	6	7	6	19	14
24	23	6301	1910	9	WRIA 9 - C	Fisher Cre	Vashon B	65B	47.38394	-122.481	9/9/2013	2/4/2014	Medium	8	27	2	6	4	12	15
25	24	3271	355	9	WRIA 9 - C	Fisher Cre	ESA Water	E1227	47.384	-122.481	8/30/2010	#####	Coarse	3	20	2	5	3	10	7
26	25	2783	355	9	WRIA 9 - C	Fisher Cre	ESA Water	E1227	47.384	-122.481	9/1/2009	#####	Coarse	3	30	5	6	6	17	13
27	26	513	355	9	WRIA 9 - C	Fisher Cre	ESA Water	E1227	47.384	-122.481	9/5/2008	#####	Coarse	3	27	5	6	5	16	13
28	27	464	355	9	WRIA 9 - C	Fisher Cre	ESA Water	E1227	47.384	-122.481	8/27/2007	7/6/2010	Coarse	3	33	6	6	6	18	15
29	28	79	355	9	WRIA 9 - C	Fisher Cre	ESA Water	E1227	47.384	-122.481	9/6/2006	#####	Coarse	3	33	5	7	5	17	14
30	29	5525	355	9	WRIA 9 - C	Fisher Cre	ESA Water	E1227	47.384	-122.481	8/15/2005	9/6/2013	Coarse	3	21	4	4	4	12	9
31	30	5584	355	9	WRIA 9 - C	Fisher Cre	ESA Water	E1227	47.384	-122.481	9/15/2004	#####	Coarse	3	14	2	2	3	7	7
32	31	5877	355	9	WRIA 9 - C	Fisher Cre	ESA Water	E1227	47.384	-122.481	9/9/2003	#####	Coarse	3	29	3	6	6	15	12
33	32	5832	355	9	WRIA 9 - C	Fisher Cre	ESA Water	E1227	47.384	-122.481	9/19/2002	#####	Coarse	3	19	3	3	4	10	11
34	33	5762	355	9	WRIA 9 - C	Fisher Cre	ESA Water	E1227	47.384	-122.481	10/4/2000	#####	Coarse	3	24	4	3	4	11	12
35	34	5643	355	9	WRIA 9 - C	Fisher Cre	ESA Water	E1227	47.384	-122.481	9/29/1999	#####	Coarse	1	9	2	1	2	5	4
36	35	6300	1938	9	WRIA 9 - C	Fisher Cre	Vashon B	FISHVNC2	47.38765	-122.485	9/12/2013	2/4/2014	Medium	8	36	4	6	7	17	15
37	36	3262	299	9	WRIA 9 - C	Gorsuch C	ESA Water	P847	47.4549	-122.446	8/27/2010	#####	Coarse	3	17	4	4	0	8	5
38	37	2773	299	9	WRIA 9 - C	Gorsuch C	ESA Water	P847	47.4549	-122.446	9/1/2009	#####	Coarse	3	26	6	4	4	14	12
39	38	502	299	9	WRIA 9 - C	Gorsuch C	ESA Water	P847	47.4549	-122.446	9/5/2008	#####	Coarse	3	16	4	2	2	8	8

Download Score by Year (each row a site)

	B	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z	AA
1	Site ID	Stream	Agency	Project	Site Code	Latitude	Longitud	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
2	2262	Christens	Vashon N	Vashon B	ChrisVNC	47.4011	-122.51																68.1
3	272	Christens	King Coun	Vashon	VashChris	47.4028	-122.52							61.3	60.9	58.6	52.6	69.9	53	50.2	62	61	
4	298	Ellis Cree	King Coun	ESA Water	E1223	47.4173	-122.44						10	10	10	10	9.9	9.6	6.1				
5	523	Fisher Cre	King Coun	Regulator	65B	47.3839	-122.48										65.4	61.7	78.6	61.2	41		
6	1910	Fisher Cre	Vashon N	Vashon B	65B	47.3839	-122.48																55.1
7	355	Fisher Cre	King Coun	ESA Water	E1227	47.384	-122.48	17.4	40.2		36.8	57.5	23	39.3	67.5	59.5	64.6	57.5	26.1				
8	1938	Fisher Cre	Vashon N	Vashon B	FISHVNC2	47.3877	-122.48															73.9	
9	299	Gorsuch C	King Coun	ESA Water	P847	47.4549	-122.45						37.3	30	25.2	33.8	22.8	41.1	20.7				
10	525	Judd Cree	King Coun	Regulator	28A	47.4035	-122.47										32.9	43.7	54	53.1	55.1	68.5	
11	310	Judd Cree	King Coun	ESA Water	E1231/123	47.422	-122.48						43.8	45.7	46.2	59	76.1	23.8	33.7				
12	311	Judd Cree	King Coun	ESA Water	E2770	47.4109	-122.47				43.7	46.5	50.9	20.6	37.7	44.2	64.6	58.3	53.4				
13	1937	Judd Cree	Vashon N	Vashon B	JuddVNC1	47.4139	-122.48															33.4	69.9
14	273	Judd Cree	King Coun	Vashon	VashJudd	47.4099	-122.47							49.8	53.7	58.5		53.8	32.7	65.7	67.8		
15	297	McCormic	King Coun	ESA Water	E1219	47.4823	-122.48	26.8	26.8	55.8	51.7	54.9	53	55.7	58.5	55.4	56.8	42.7	44.7				
16	327	Shinglemi	King Coun	ESA Water	E1236	47.4784	-122.48	21.3	14.6		35.8	33.9	39.5	26	32	19.8	38.6	29.6	42.2				
17	274	Shinglemi	King Coun	Vashon	VashShing	47.4763	-122.48							43.8	48.4	25.7	46	7.9	15.5	14.6	33	19.6	
18	524	Tahlequal	King Coun	Regulator	65A	47.3346	-122.51										64.6	72.3	67.1	62.4	61.2		
19	2261	Tahlequal	Vashon N	Vashon B	65A	47.3346	-122.51																60
20	354	Tahlequal	King Coun	ESA Water	E2887	47.3346	-122.51						37	44.3	60.3	59.5	58.7	58.5	43.1				

Download Samples (each row a taxa & count)

	A	B	C	H	K	L	N	O	Q	W	AB	AC	AD	AF	AG	AH	AI
1	Sample	Visit ID	Site ID	Stream c	Site Code	Visit Date	Latitude	Longitude	Sample Code	Taxa Effort	Taxon Ser	Taxon	Quantity	Life Stage	Unique	Damaged	Immature
2	12463	7618	2262	Christen	ChrisVNC:	8/22/2014	47.4011	-122.51	ChrisVNC1_14	Medium	68531	Enchytraeus	1	not specif	TRUE	FALSE	FALSE
3	12463	7618	2262	Christen	ChrisVNC:	8/22/2014	47.4011	-122.51	ChrisVNC1_14	Medium	68854	Naididae	1	not specif	TRUE	FALSE	TRUE
4	12463	7618	2262	Christen	ChrisVNC:	8/22/2014	47.4011	-122.51	ChrisVNC1_14	Medium	68440	Lumbriculidae	1	not specif	TRUE	TRUE	FALSE
5	12463	7618	2262	Christen	ChrisVNC:	8/22/2014	47.4011	-122.51	ChrisVNC1_14	Medium	733326	Oribatida	14	adult	TRUE	FALSE	FALSE
6	12463	7618	2262	Christen	ChrisVNC:	8/22/2014	47.4011	-122.51	ChrisVNC1_14	Medium	83517	Chelomideopsis	2	adult	TRUE	FALSE	FALSE
7	12463	7618	2262	Christen	ChrisVNC:	8/22/2014	47.4011	-122.51	ChrisVNC1_14	Medium	83048	Estelloxus	1	adult	TRUE	FALSE	FALSE
8	12463	7618	2262	Christen	ChrisVNC:	8/22/2014	47.4011	-122.51	ChrisVNC1_14	Medium	83479	Mideopsis	4	adult	TRUE	FALSE	FALSE
9	12463	7618	2262	Christen	ChrisVNC:	8/22/2014	47.4011	-122.51	ChrisVNC1_14	Medium	83006	Sperchon	2	adult	TRUE	FALSE	FALSE
10	12463	7618	2262	Christen	ChrisVNC:	8/22/2014	47.4011	-122.51	ChrisVNC1_14	Medium	83029	Sperchonopsis	11	adult	TRUE	FALSE	FALSE
11	12463	7618	2262	Christen	ChrisVNC:	8/22/2014	47.4011	-122.51	ChrisVNC1_14	Medium	83254	Torrenticola	1	adult	TRUE	FALSE	FALSE
12	12463	7618	2262	Christen	ChrisVNC:	8/22/2014	47.4011	-122.51	ChrisVNC1_14	Medium	114144	Narpus concolor	6	larva	TRUE	FALSE	FALSE
13	12463	7618	2262	Christen	ChrisVNC:	8/22/2014	47.4011	-122.51	ChrisVNC1_14	Medium	112890	Ametor	1	larva	TRUE	FALSE	FALSE
14	12463	7618	2262	Christen	ChrisVNC:	8/22/2014	47.4011	-122.51	ChrisVNC1_14	Medium	135830	Empididae	1	larva	TRUE	FALSE	TRUE
15	12463	7618	2262	Christen	ChrisVNC:	8/22/2014	47.4011	-122.51	ChrisVNC1_14	Medium	127338	Ceratopogoninae	6	larva	TRUE	FALSE	FALSE
16	12463	7618	2262	Christen	ChrisVNC:	8/22/2014	47.4011	-122.51	ChrisVNC1_14	Medium	-134	Orthoclaadiinae sp. RAI # 0001	1	larva	TRUE	FALSE	FALSE
17	12463	7618	2262	Christen	ChrisVNC:	8/22/2014	47.4011	-122.51	ChrisVNC1_14	Medium	-136	Orthoclaadiinae sp. RAI # 0011	1	larva	TRUE	FALSE	FALSE
18	12463	7618	2262	Christen	ChrisVNC:	8/22/2014	47.4011	-122.51	ChrisVNC1_14	Medium	128477	Brillia	13	larva	TRUE	FALSE	FALSE
19	12463	7618	2262	Christen	ChrisVNC:	8/22/2014	47.4011	-122.51	ChrisVNC1_14	Medium	128689	Eukiefferiella	4	larva	TRUE	FALSE	FALSE
20	12463	7618	2262	Christen	ChrisVNC:	8/22/2014	47.4011	-122.51	ChrisVNC1_14	Medium	128821	Metriocnemus	1	larva	TRUE	FALSE	FALSE
21	12463	7618	2262	Christen	ChrisVNC:	8/22/2014	47.4011	-122.51	ChrisVNC1_14	Medium	128978	Parametriocnemus	1	larva	TRUE	FALSE	FALSE
22	12463	7618	2262	Christen	ChrisVNC:	8/22/2014	47.4011	-122.51	ChrisVNC1_14	Medium	-55	Tvetenia (Tvetenia Bavarica Gr	3	larva	TRUE	FALSE	FALSE
23	12463	7618	2262	Christen	ChrisVNC:	8/22/2014	47.4011	-122.51	ChrisVNC1_14	Medium	126774	Simulium	9	larva	TRUE	FALSE	FALSE
24	12463	7618	2262	Christen	ChrisVNC:	8/22/2014	47.4011	-122.51	ChrisVNC1_14	Medium	-142	Pericoma/Telmatoscopus	3	larva	TRUE	FALSE	FALSE
25	12463	7618	2262	Christen	ChrisVNC:	8/22/2014	47.4011	-122.51	ChrisVNC1_14	Medium	125786	Ptychoptera	1	larva	TRUE	FALSE	FALSE
26	12463	7618	2262	Christen	ChrisVNC:	8/22/2014	47.4011	-122.51	ChrisVNC1_14	Medium	-33	Rhabdomastix (Rhabdomastix S	2	larva	TRUE	FALSE	FALSE
27	12463	7618	2262	Christen	ChrisVNC:	8/22/2014	47.4011	-122.51	ChrisVNC1_14	Medium	120094	Hexatoma	5	larva	TRUE	FALSE	FALSE
28	12463	7618	2262	Christen	ChrisVNC:	8/22/2014	47.4011	-122.51	ChrisVNC1_14	Medium	121027	Dicranota	11	larva	TRUE	FALSE	FALSE
29	12463	7618	2262	Christen	ChrisVNC:	8/22/2014	47.4011	-122.51	ChrisVNC1_14	Medium	693963	Crambidae	1	larva	TRUE	FALSE	FALSE
30	12463	7618	2262	Christen	ChrisVNC:	8/22/2014	47.4011	-122.51	ChrisVNC1_14	Medium	102567	Malenka	1	larva	TRUE	FALSE	FALSE
31	12463	7618	2262	Christen	ChrisVNC:	8/22/2014	47.4011	-122.51	ChrisVNC1_14	Medium	102556	Soyedina	1	larva	TRUE	FALSE	FALSE
32	12463	7618	2262	Christen	ChrisVNC:	8/22/2014	47.4011	-122.51	ChrisVNC1_14	Medium	102594	Zapada cinctipes	3	larva	TRUE	FALSE	FALSE
33	12463	7618	2262	Christen	ChrisVNC:	8/22/2014	47.4011	-122.51	ChrisVNC1_14	Medium	-58	Zapada (Zapada Oregonensis G	1	larva	TRUE	FALSE	FALSE
34	12463	7618	2262	Christen	ChrisVNC:	8/22/2014	47.4011	-122.51	ChrisVNC1_14	Medium	103273	Swaltea	22	larva	TRUE	FALSE	FALSE

The background of the slide is a photograph of a stream. In the foreground, several dark, segmented aquatic insects, likely caddisfly larvae, are crawling on a flat, light-colored rock. The water is shallow and clear, revealing a bed of various sized rocks and pebbles in shades of brown, tan, and grey. The lighting is natural, creating soft reflections on the water's surface.

Questions?

jo.wilhelm@kingcounty.gov

www.pugetsoundstreambenthos.org

Common Macroinvertebrates

Mayflies (*Ephemeroptera*)



Ephemerellidae



Heptageniidae



Isonychiidae



Baetidae



(Adult)

Common Macroinvertebrates

Stoneflies (*Plecoptera*)



Perlidae



Peltoperlidae



Perlodidae



(Adult)

Common Macroinvertebrates

Caddisflies (Trichoptera)



Brachycentridae



Phryganeidae



Hydropsychidae



Philopotamidae



Case



(Adult)

Common Macroinvertebrates



Damselflies and Dragonflies
(*Odonata*)



True Bugs (*Hemiptera*)



Dobsonflies, Alderflies and
Fishflies (*Megaloptera*)



Beetles (*Coleoptera*)