California Biological Condition Gradient Model

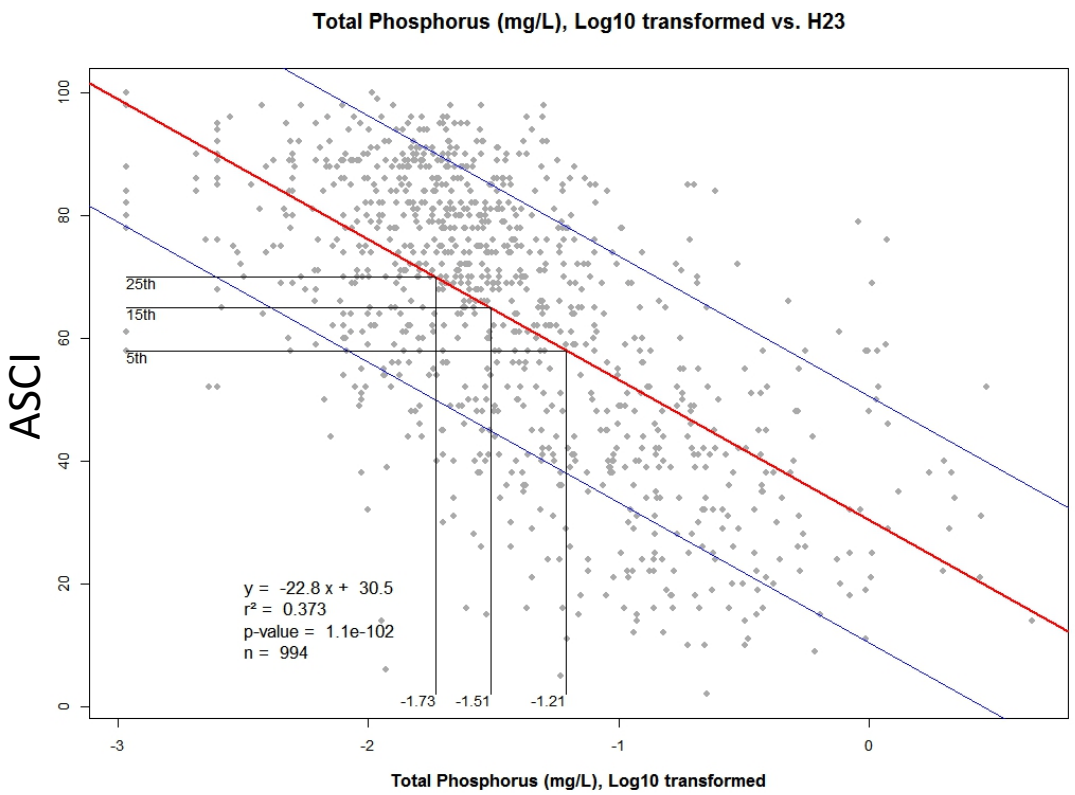
The BCG Team

Tetra Tech

SCCWRP

Our Bug and Algal Experts

Some things start with a graph…



- "What does a value of 62 for the ASCI mean?"
  - It is 15th percentile of reference.
- "But, what does that mean ecologically?"
  - It is no longer like reference.
- "I think I'd like to know what that means – what's been lost."

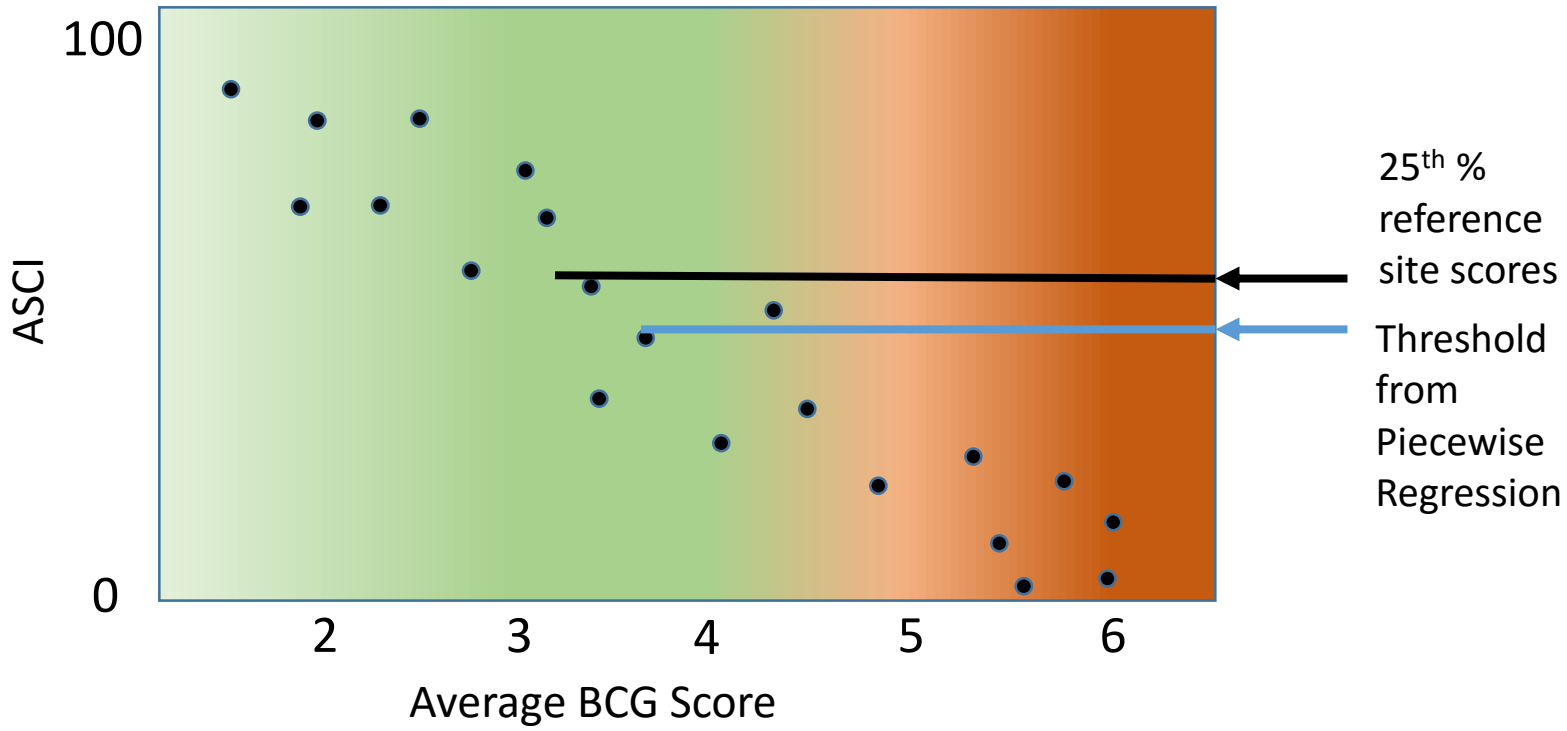
What is the narrative of this adventure?

- Biological indices are powerful tools for assessment AND California has very sound indicators BUT numeric values do not communicate the ecological change associated with an index THEREFORE we want to use the BCG calibration effort to do that.

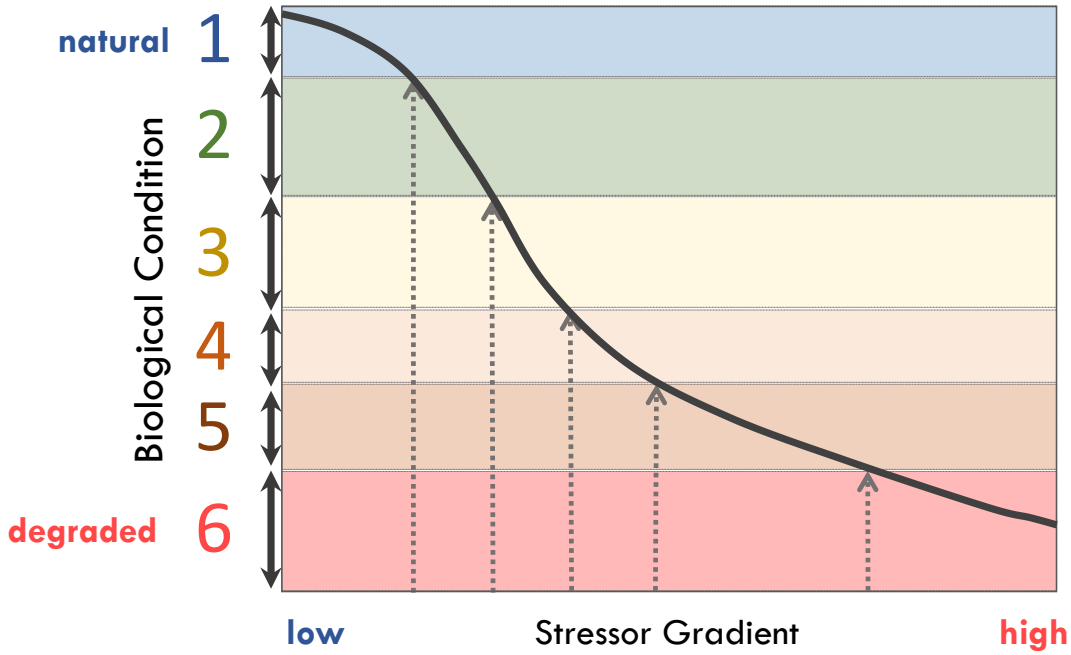
- BCG models convey, in ecological terms, the breadth and depth of ecological change in a way numbers often cannot.

Desired Outcomes: A crosswalk between CSCI and ASCI and BCG Levels

- Map biotic response/nutrient thresholds to BCG scores
- Translate assessment endpoints into BCG context



DESIRED OUTCOMES: INTERPRETATION OF THE ECOLOGICAL CHANGE ASSOCIATED WITH SPECIFIC NUTRIENT THRESHOLDS

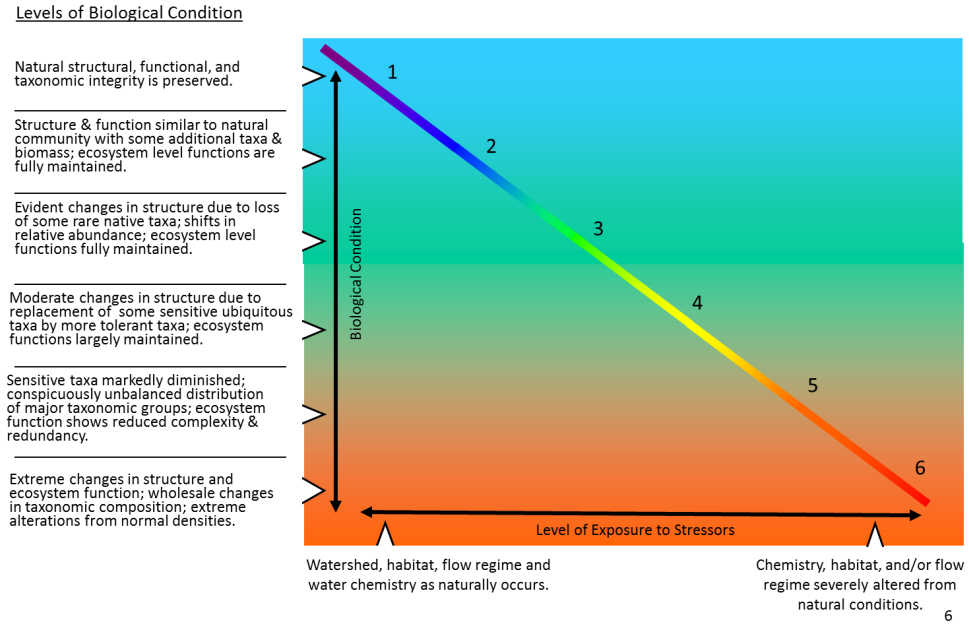


Key graphic is the basis for discussion between the Water Board and its Advisory Groups on decisions on assessment endpoints and default numeric targets

What we are not doing

- We are not building another index
- The CSCI (and eventually the ASCI) are the tools to assess biological condition
- The BCG calibration will be a tool to help interpret those indices

- "What does a value of 62 for the H20 mean?"
  - It is where evident changes in structure due to loss of native taxa begins with shifts in relative abundance, but no loss of function.



What the BCG involves.

Sample XYZ

Biogeographic Info

Taxon Abundances

Experience and Knowledge

Levels of Biological Condition

Natural structural, functional, and taxonomic integrity is preserved.

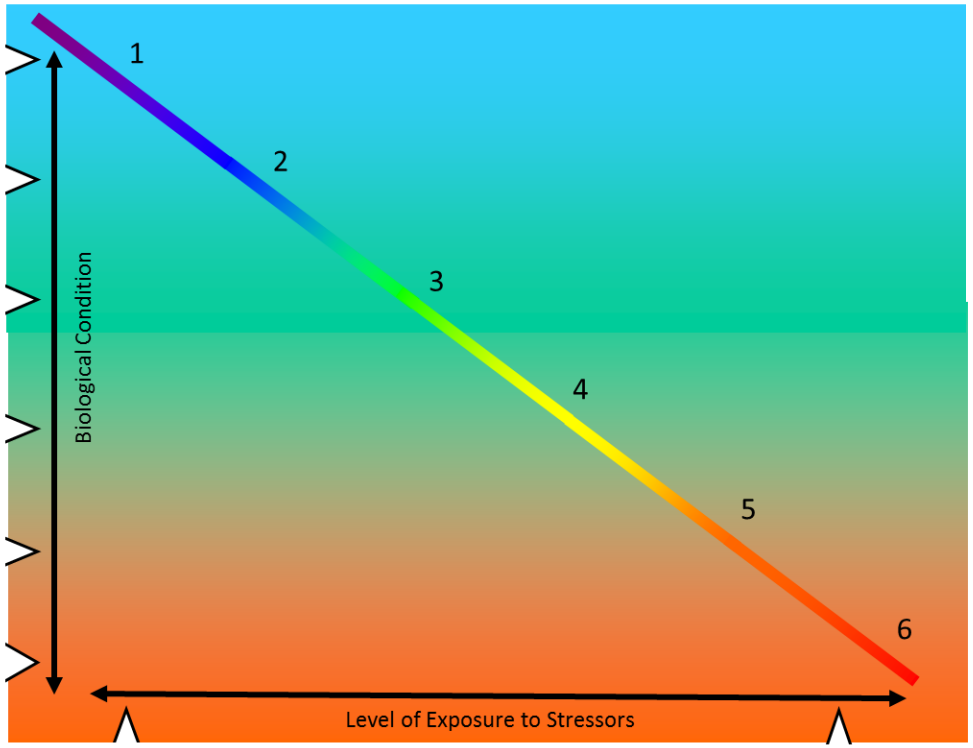
Structure & function similar to natural community with some additional taxa & biomass; ecosystem level functions are fully maintained.

Evident changes in structure due to loss of some rare native taxa; shifts in relative abundance; ecosystem level functions fully maintained.

Moderate changes in structure due to replacement of some sensitive ubiquitous taxa by more tolerant taxa; ecosystem functions largely maintained.

Sensitive taxa markedly diminished; conspicuously unbalanced distribution of major taxonomic groups; ecosystem function shows reduced complexity & redundancy.

Extreme changes in structure and ecosystem function; wholesale changes in taxonomic composition; extreme alterations from normal densities.



Watershed, habitat, flow regime and water chemistry as naturally occurs.

Chemistry, habitat, and/or flow regime severely altered from natural conditions.

We needed to find the brains first.

Experience and Knowledge

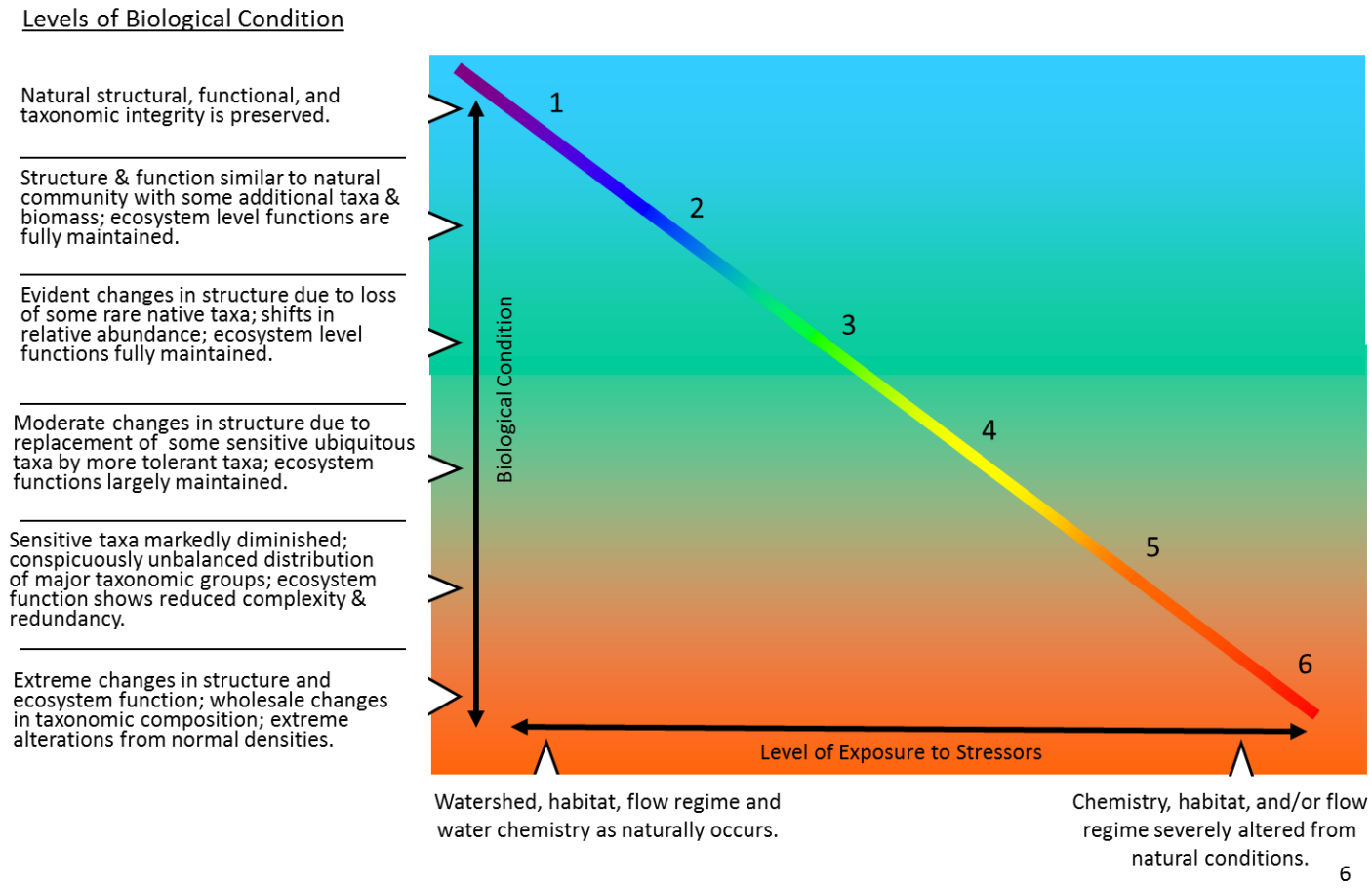
<u>Invertebrates</u>
Larry Brown (USGS)
Jim Carter (USGS)
Dave Herbst (SNARL)
Jeanette Howard (TNC)
Bill Isham (Amec Foster-Wheeler)
Patina Mendez (UC-Davis)
Allison O'Dowd (Humboldt State)
John Olson (Cal State-Monterey)
Andy Rehn (CFG)

<u>Algae</u>
Don Charles (Phil. Acad. Nat. Sci./Drexel)
Rosalina Hristova (Cal State – San Marcos)
Rex Lowe (Bowling Green State Univ.)
Yandong Pan (Portland State Univ.)
Sarah Spaulding (USGS)

How does this work again?

Step 1 (**Webinar 1 – Oct. 2016**)

- Introduce the BCG model and process to experts



How does this work again?

Step 2 (**Webinar 2 – Nov. 2016**)

- Identify which taxa reflect which BCG attributes
  - Gain consensus on this
- Agreement on general taxonomic attributes is important
- Used to generate datasheets for scoring
- Experts submitted attribute assignments as homework

Attributes

I) Documented, sensitive, long-lived or endemic taxa

II) Highly sensitive or specialist taxa

III) Sensitive and common taxa

IV) Taxa of broad, intermediate tolerance

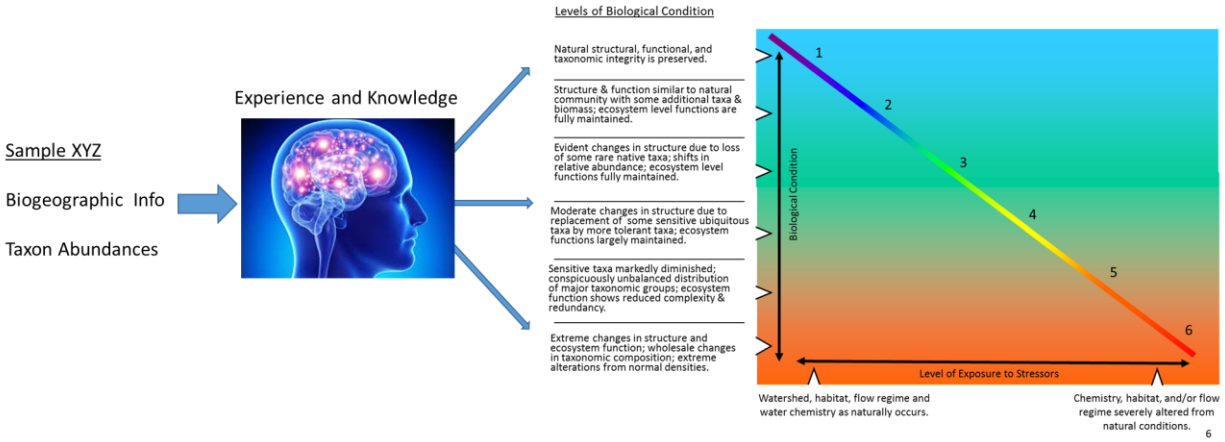
V) Tolerant taxa

VI) Non-native taxa

How does this work again?

Step 3 (**Workshop 1 – Nov. 2016**)

- Resolve remaining attribute consensus issues
- Practice assigning sites to BCG levels
- Separate effort for inverts and algae
- Describe assignments – what is missing or present?



Hypothetical Invertebrate Worksheet

Mystery Creek
O = 11
E = 16.5
Metrics = observed score (predicted)
Taxonomic Richness = 11 (17)
Shredder Taxa Richness = 4 (7)
Percent Clinger Taxa = 34% (45%)
Percent Coleoptera Taxa = 18% (25%)
Percent EPT Taxa = 25% (40%)
Percent Intolerant Individuals = 35% (55%)

Elevation = 300m
Annual Precipitation = 14 cm
Geology = Y
Ecoregion = X
Stream order = 2
Wetted width = 3m
Etc
Etc

Taxon Abundances:

1 = 12	10 = 20
2 = 13	11 = 14
3 = 7	12 = 3
4 = 34	13 = 10
5 = 40	14 = 40
6 = 10	15 = 34
7 = 3	16 = 7
8 = 14	17 = 13
9 = 20	18 = 12

Information in BCG attribute form too (e.g.):

ExerciseID	Samp0031	Assigned Tier		Reasoning
Collection Date	7/23/2007			
Collection Method	BMI_RWB			

TAXA SUMMARY

BCG Attribute	Number of Taxa	Count	Pct Taxa	Pct Individuals
1	0	0	0%	0%
2	1	7	6%	3%
3	5	57	28%	19%
4	6	121	33%	40%
5	6	115	33%	38%
6	0	0	0%	0%
x	0	0	0%	0%
Total	*18*	*300*	*100%*	*100%*

How does this work again?

Step 3 (**Homework- Dec. 2016**)

- Experts assigned 200 sites to BCG levels individually and recorded reasoning…then wanted 50 more!!

ExerciseID	Samp0503		Go to StatusPage	Assigned Tier	Reasoning
Collection Date	8/5/2008			5	low richness, OE low, no intolerant taxa observed,
Collection Method	NA				

TAXA SUMMARY

BCG Attribute	Number of Taxa	Count	% Taxa	% Individuals
1	0	0	0.0%	0.0%
2	0	0	0.0%	0.0%
3	1	12	3.6%	2.1%
4	18	286	64.3%	49.2%
5	7	272	25.0%	46.8%
6	0	0	0.0%	0.0%
X	2	11	7.1%	1.9%
Total	*28*	*581*	*100%*	*100%*

TAXA LIST

BCG Attribute	FinalID	Count	Family	OTUx	FFG	CP
4	*Sanfilippodytes*	1	Dytiscidae	Sanfilippodytes	P	
5	*Dicrotendipes*	2	Chironomidae	Chironominae	CG	
4	*Lymnaea*	18	Lymnaeidae	Lymnaea	SC	
4	*Pseudochironomus*	4	Chironomidae	Chironominae	CG	

STATION AND SAMPLE CHARACTERISTICS

StationID	
SampleID	
Latitude	
Longitude	
Date	8/5/2008
PSA9 Region	DMde
Ecoregion Level 3 (2010)	5
Area (sq km)	39.9
Site Elevation (m)	1841.7
Avg monthly temp (TEMP_00_09)	1614.00
Avg monthly precip (PPT_00_09)	43022.80
Index Metrics	
E	11.00
Mean O	3.75
Clinger PercentTaxa (Observed)	0.00
Clinger PercentTaxa (Predicted)	0.57
Coleoptera PercentTaxa (Observed)	0.12
Coleoptera PercentTaxa (Predicted)	0.11
Taxonomic Richness (Observed)	15.55
Taxonomic Richness (Predicted)	28.40
EPT PercentTaxa (Observed)	0.13
EPT PercentTaxa (Predicted)	0.47
Shredder Taxa (Observed)	1.00
Shredder Taxa (Predicted)	2.03
Intolerant Percent (Observed)	0.00
Intolerant Percent (Predicted)	0.22
OoverE	0.34

	Expected Taxa, Not Observed	CP (>0.2)
4	Acari	0.92
4	Baetis	0.9
4	Simulium	0.78
3	Rhyacophila	0.76
3	Drunella	0.69
4	Paraleptophlebia	0.65
x	Ceratopsyche_Hydropsyche	0.62
3	Lepidostoma	0.6
3	Epeorus	0.58
4	Optioservus	0.55
3	Malenka	0.51
4	Bezzia_Palpomyia	0.48
3	Calineuria	0.48
3	Zaitzevia	0.47
3	Micrasema	0.46
3	Sweltsa	0.44
3	Zapada	0.43
3	Diphetor	0.42
x	Matriella_Serratella	0.4
2	Ameletus	0.39
3	Antocha	0.39
5	Turbellaria	0.37
x	Diamesinae	0.36
3	Cinygmula	0.35
3	Rhithrogena	0.35
3	Dicranota	0.34

What if they don't agree?

Step 3 (**Workshop 2 – Jan. 2017**)

- Review samples with high variability in assigned BCG levels
- Re-vote, based on reasoning (modified Delphi)
- Final BCG assignments and indices may/may not agree – that is fine
- Also, this is done separately for inverts and algae – scores may disagree – also fine

			BCG Level			
	CSCI	ASCI	Expert 1	Expert 2	Expert 3	Expert 4
Site X	0.3		5	4	5	5
Site Y	0.8	0.7	2	3	3	2
Site Z	0.2	0.3	5	6	6	6
Site A		0.5	4	4	3	3
.	.	.	.	.	.	.

"This sample is a BCG level 3 because it has plenty of sensitive taxa and a good balance of functional groups."

"It is a 2 because most of the CSCI metrics meet expectations"

"It is not a 2 because it is missing some taxa that should be in an undisturbed site"

What we will have at the end

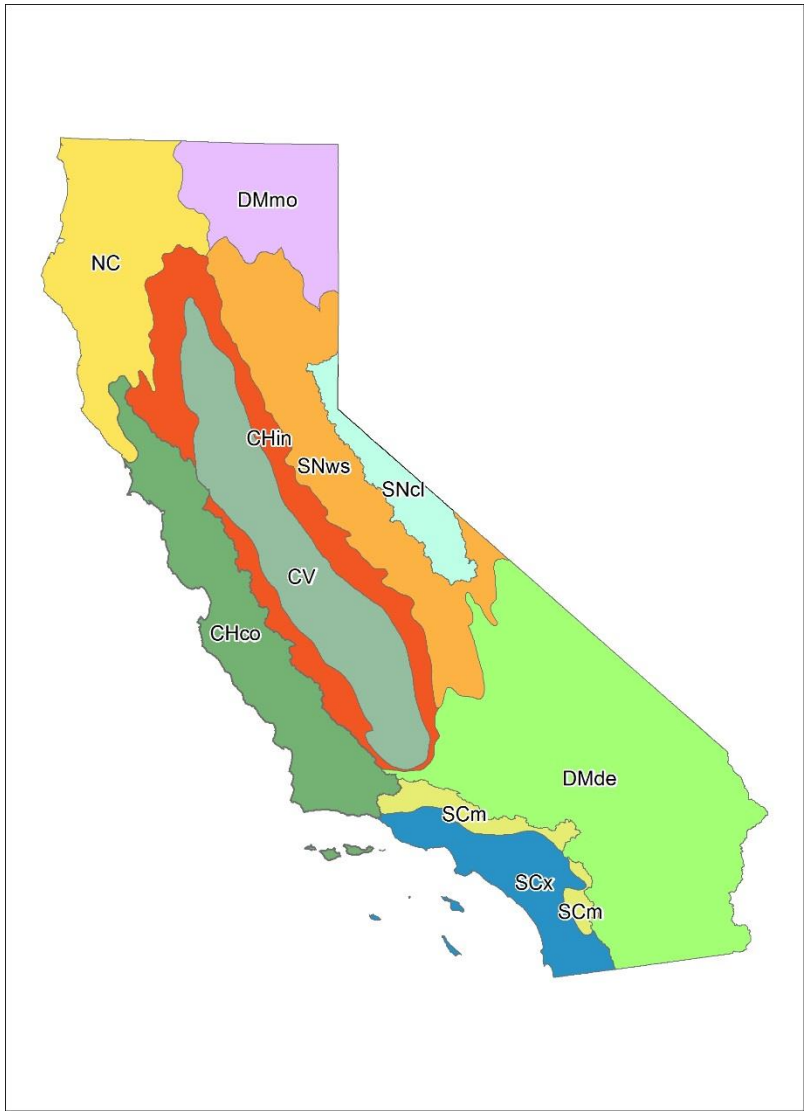
- Sites with CSCI scores
- Sites with ASCI scores
- Expert consensus BCG level assignment for those same sites
- Expert interpretation of why those assignments were made

Site X	CSCI	Expert 1	Expert 2	Expert 3	Expert 4	Consensus
First Vote		5	4	5	5	
Revote	0.3	5	5	5	5	5

"The sample is a BCG level 5 because it is lacking sensitive taxa (no attribute 2 and few 3s), is dominated by tolerant taxa (55% attribute 5s), and shows an imbalance of functional groups. It is not a level 6 because there is at least 1 attribute 3 and richness shows some diversity (>15 taxa). This agrees with a CSCI score of 0.30."

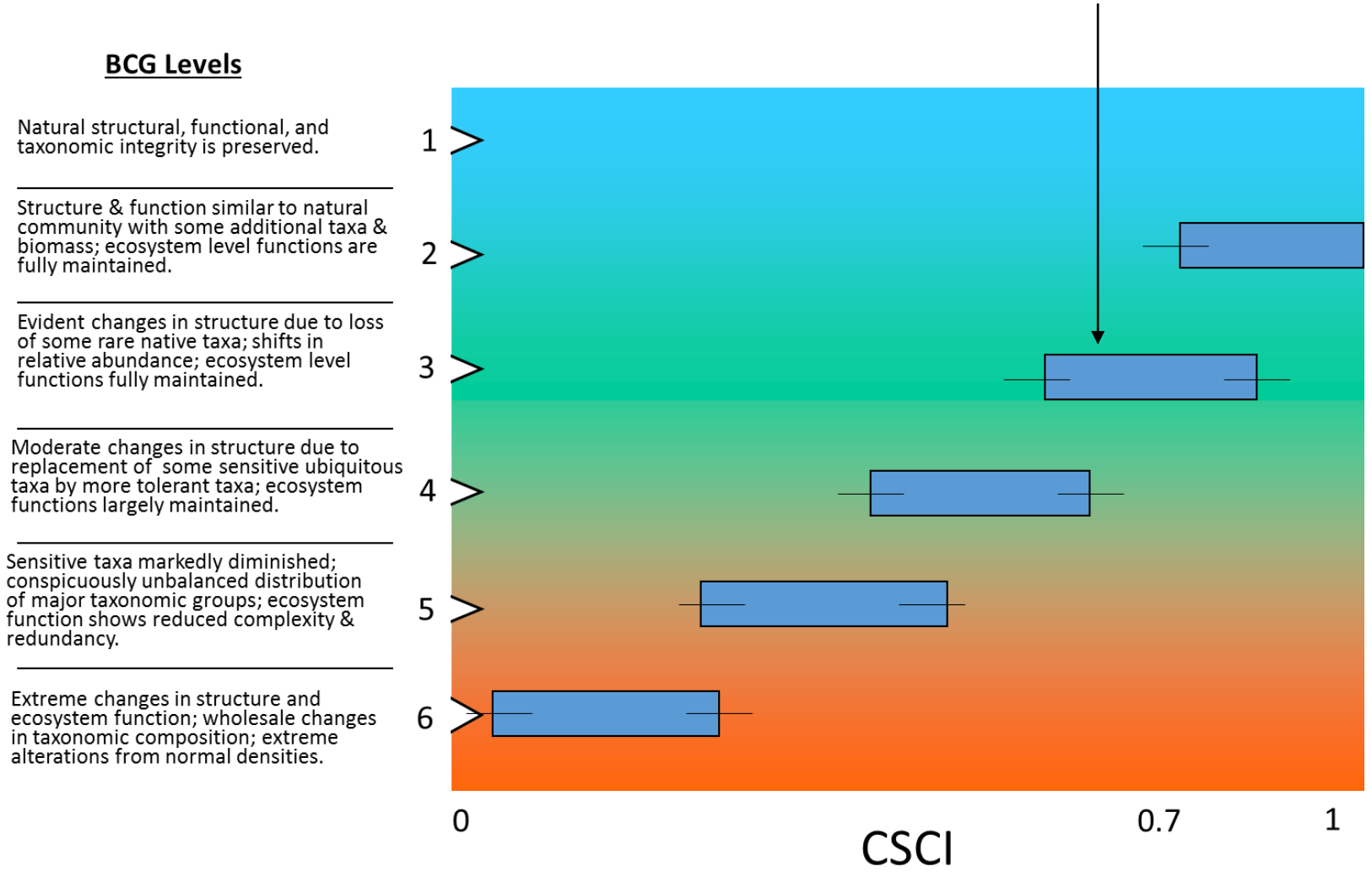
Where are we now?

- BCG attributes for all CA algal and bug taxa
- We've scored 250 sites across CA based on both algae and bug
- Reconciled large disagreements
- Compiled full ecological narratives for each level
- Compiling data and preparing for crosswalk analysis



Next steps: crosswalk

- What is the distribution of CSCI scores by BCG category?
- How is the CSCI translated into degrees of biological impact?



Next steps: crosswalk

- E.g., Alabama BCG

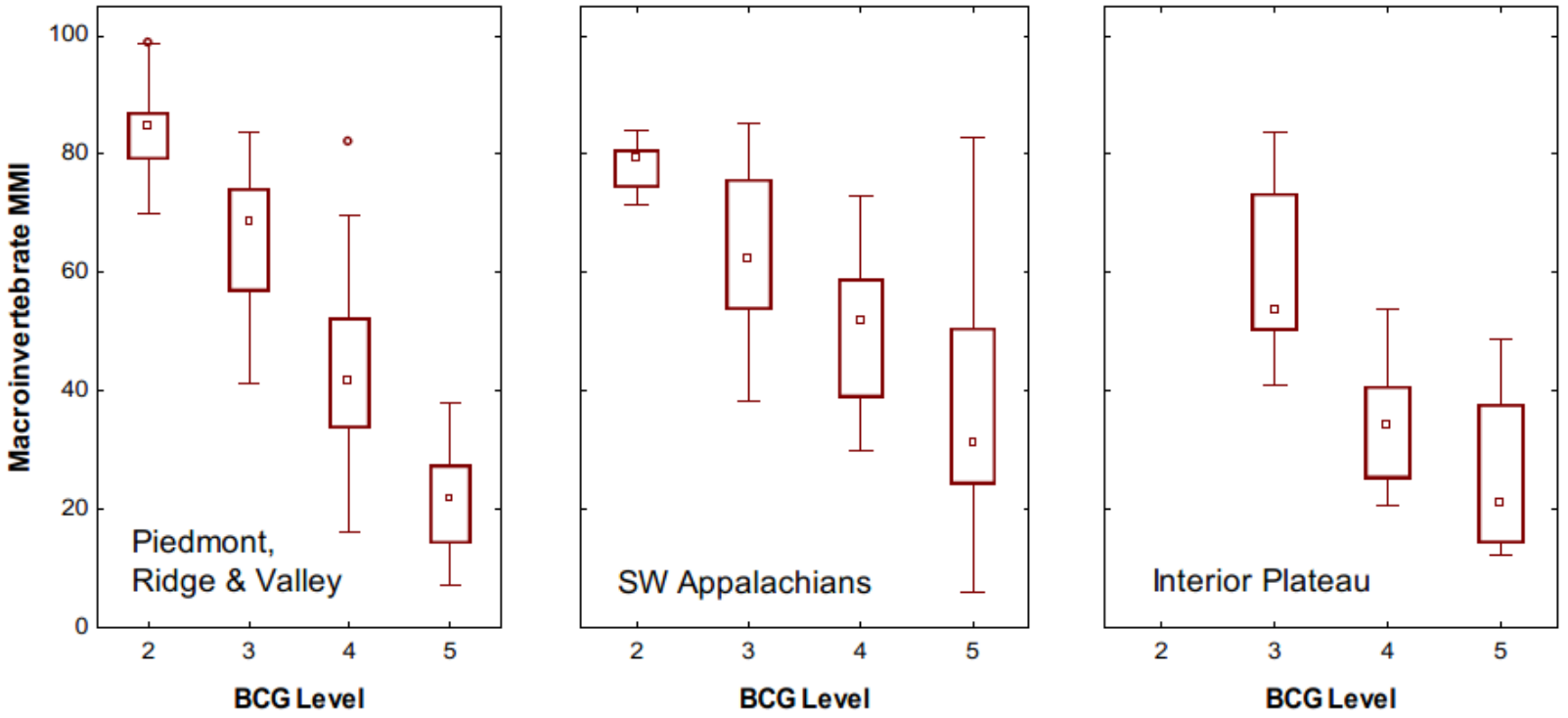
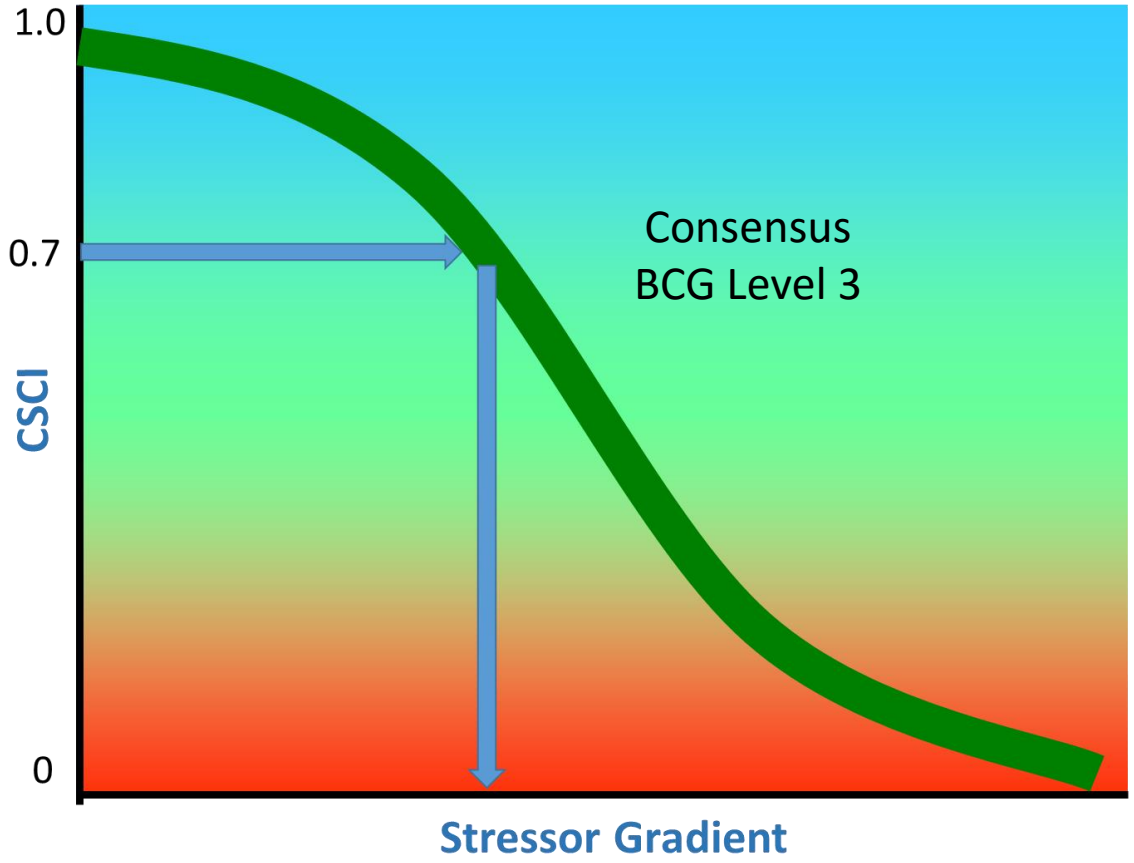


Figure 51. Alabama macroinvertebrate MMI distributions in site classes and BCG levels.

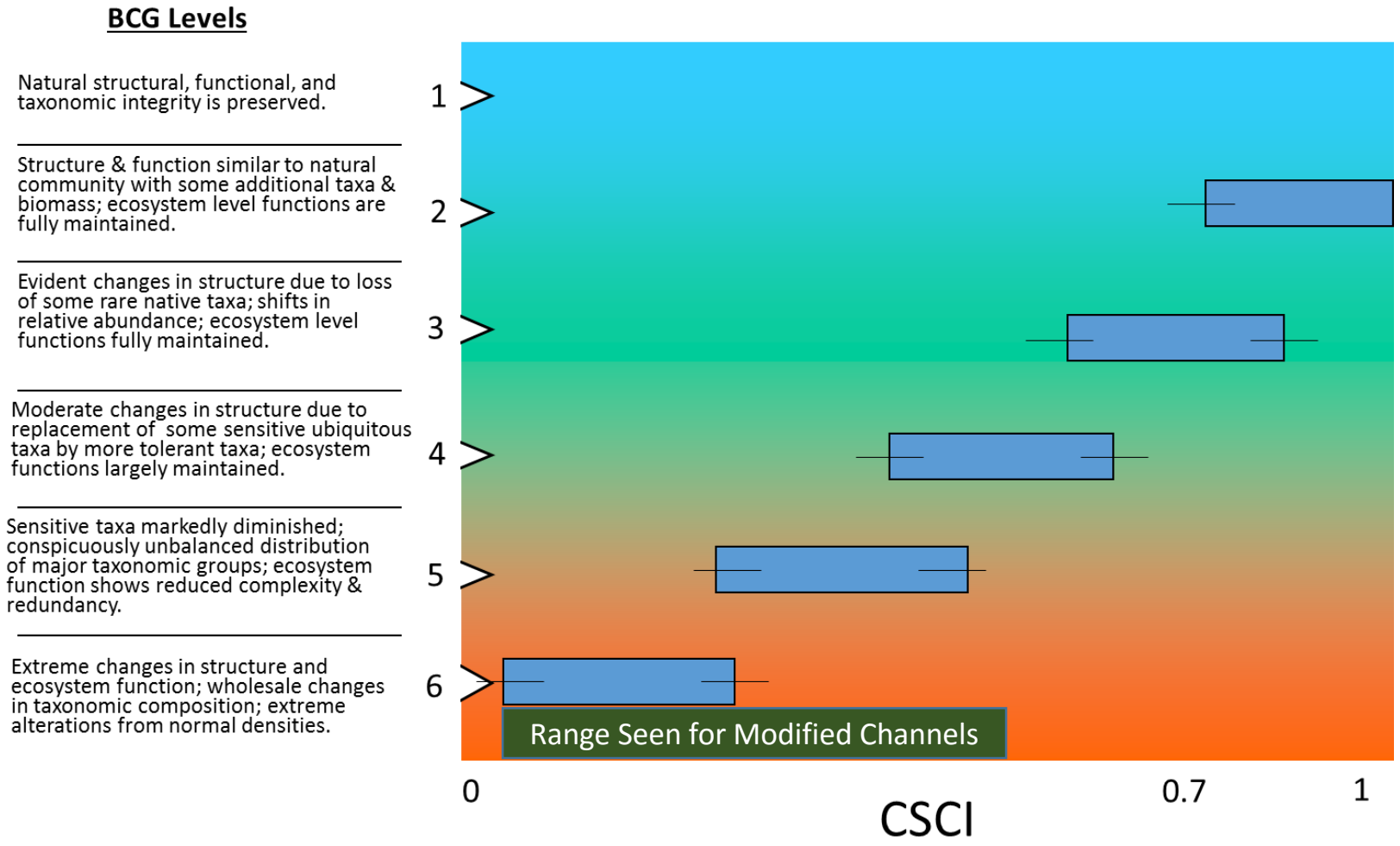
Next steps: ecological interpretation

- A CSCI of 0.7 is where we see a threshold in stressor response.
- “That CSCI score is associated with a loss of many sensitive taxa and is just above where tolerant taxa may begin replacing these taxa. Functional alteration often begins below this as well.”



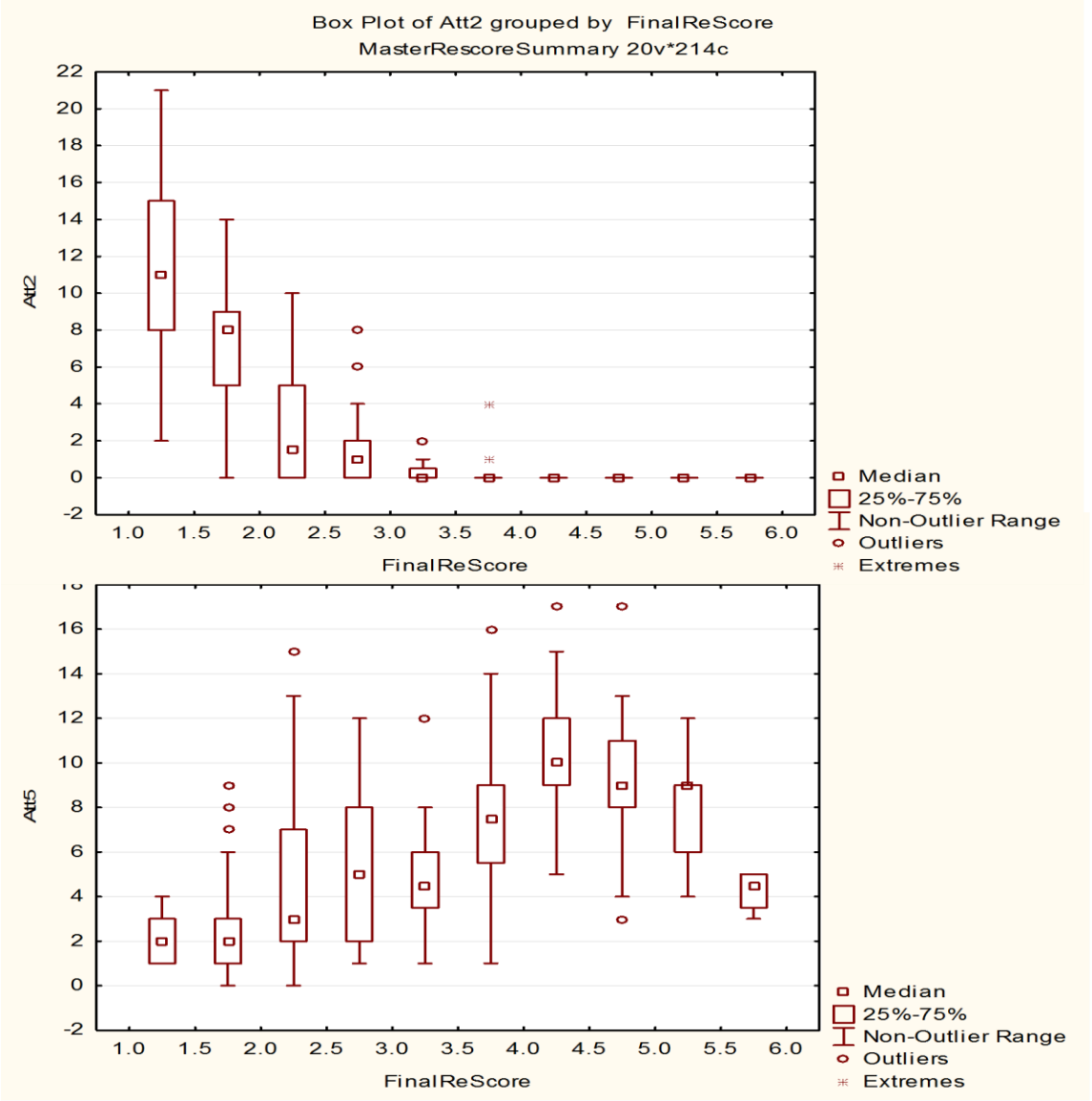
Next steps: interpreting existing patterns

- What are the best conditions of channels in developed landscapes?
- What ecological characteristics can the best of those maintain?
- How does that inform goals for modified channels?



Next steps: communicating

- Technical Reports
- Peer Reviewed Manuscripts
  - Both groups interested
  - Modified Delphi Process
  - Results and Patterns
  - Comparisons



Questions?