California Stream Nutrient Objectives Stakeholder Advisory Group Webinar

August 26, 2015

1:00 – 2:30 pm

Context for Today's Meeting

- California State Water Board has a work plan to develop nutrient objectives for the State's waterbodies, focusing first on wadeable streams
- A Science Plan has been produced to describe technical activities that will support policy decisions on nutrient objectives in wadeable streams
  - An independent Science Panel has reviewed this plan; findings and recommendations are available on the Water Board website
- We agreed that the Technical Team would provide interim updates on science products as they become available
  - Today (and last week) we are reporting out on some of the interim products from that Science Plan
  - We are planning a fall meeting to provide response to Science Panel recommendations and discuss your feedback on these interim products

Science To Support Decisions on Nutrient Targets Protective of Beneficial Uses

Beneficial Use Protection

Aquatic Life Indicators

Benthic Macro-invertebrate and Benthic Algae Community

Approaches to Link Nutrients to Beneficial Uses

Biological Condition Gradient Model

Statistical Detection of Thresholds (EPA-ORD Final Report)

Percent of Reference Distributions

Nutrient Targets

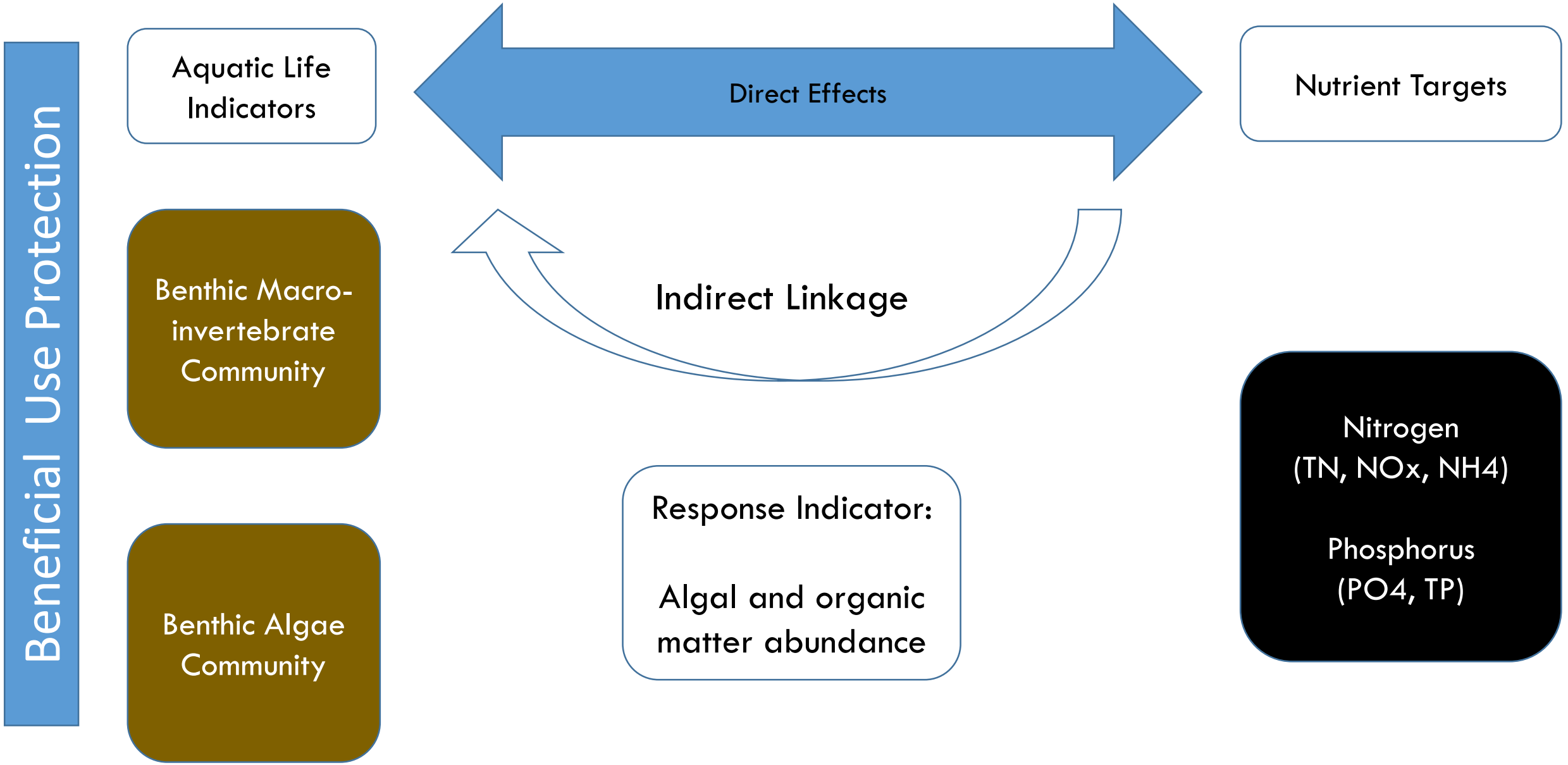
Awaiting contracts, final product in 18 months

Nitrogen (TN, NOx, NH4)

Phosphorus (PO4, TP)

Interim Draft Complete Presentation today

Two Approaches to Link Nutrients to Response Indicators



Goal of Today's Webinar: Nutrient Targets and Response Endpoints as a Percentile of Reference

Provide an overview of the approach and findings of analyses to relate nutrients, algal abundance, and organic matter to aquatic life indicators

(In advance of science that you will see in interim report)

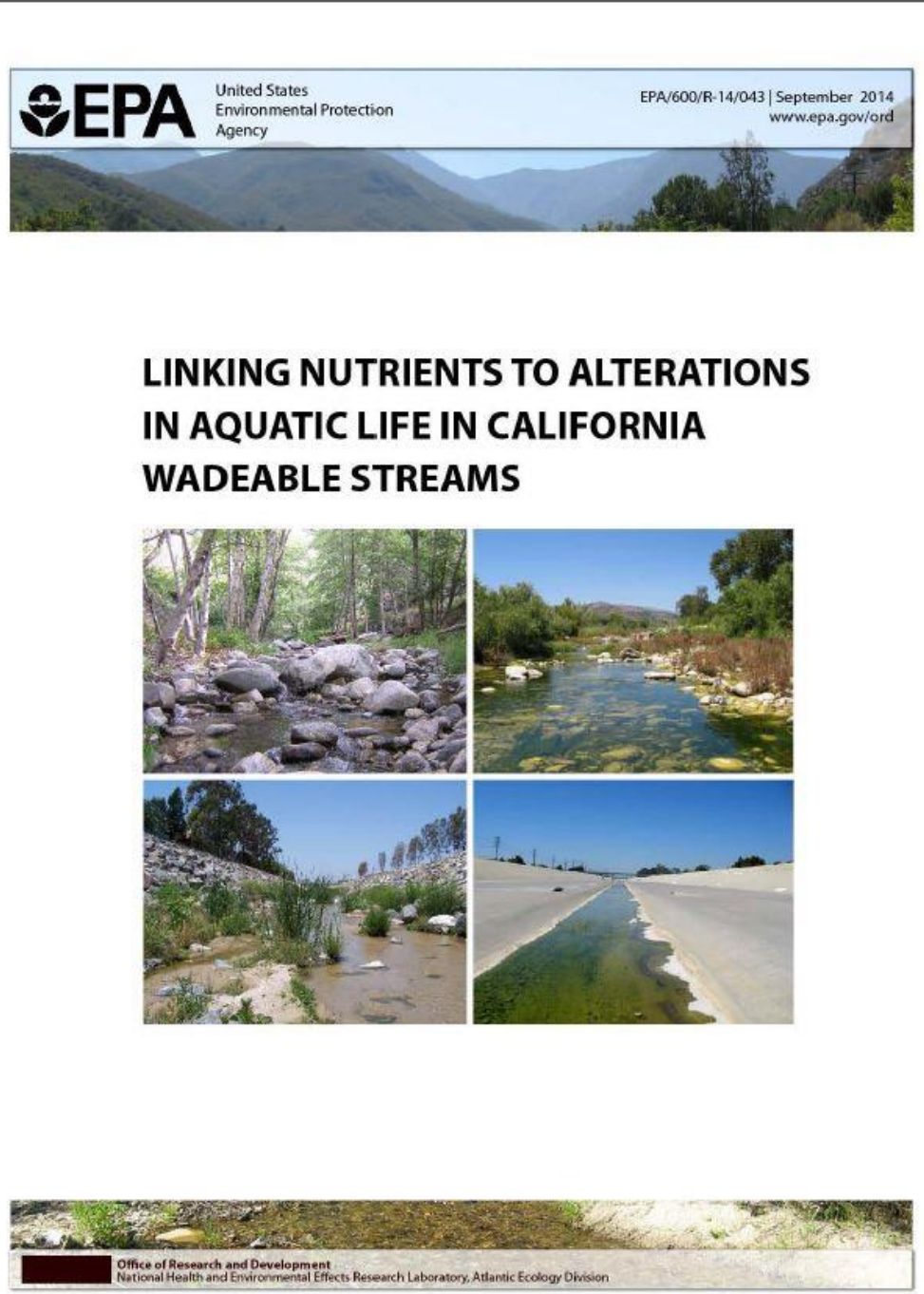
Technical Products Status and Schedule For Review

Product	Status	SAG/RG	Science Panel
Conceptual Approach and Waterbody Classification	Interim report draft complete	Fall 2015	Winter 2015
Candidate Indicator Review	In progress		
Percentile of Reference	Interim report draft complete		
B-CART Nutrient-Response Modeling	Interim report draft complete		
Biological Condition Gradient Model	Contract pending	14 months	18 months
Algal Community Nutrient Response Relationships	Analyses complete		
Synthesis and Recommendations	Pending completion of technical elements	16 months	18 months

Relating Nutrients and Algal Abundance to Aquatic Life As a "Percentile of Reference"

Michael Paul
Tetra Tech, Inc.

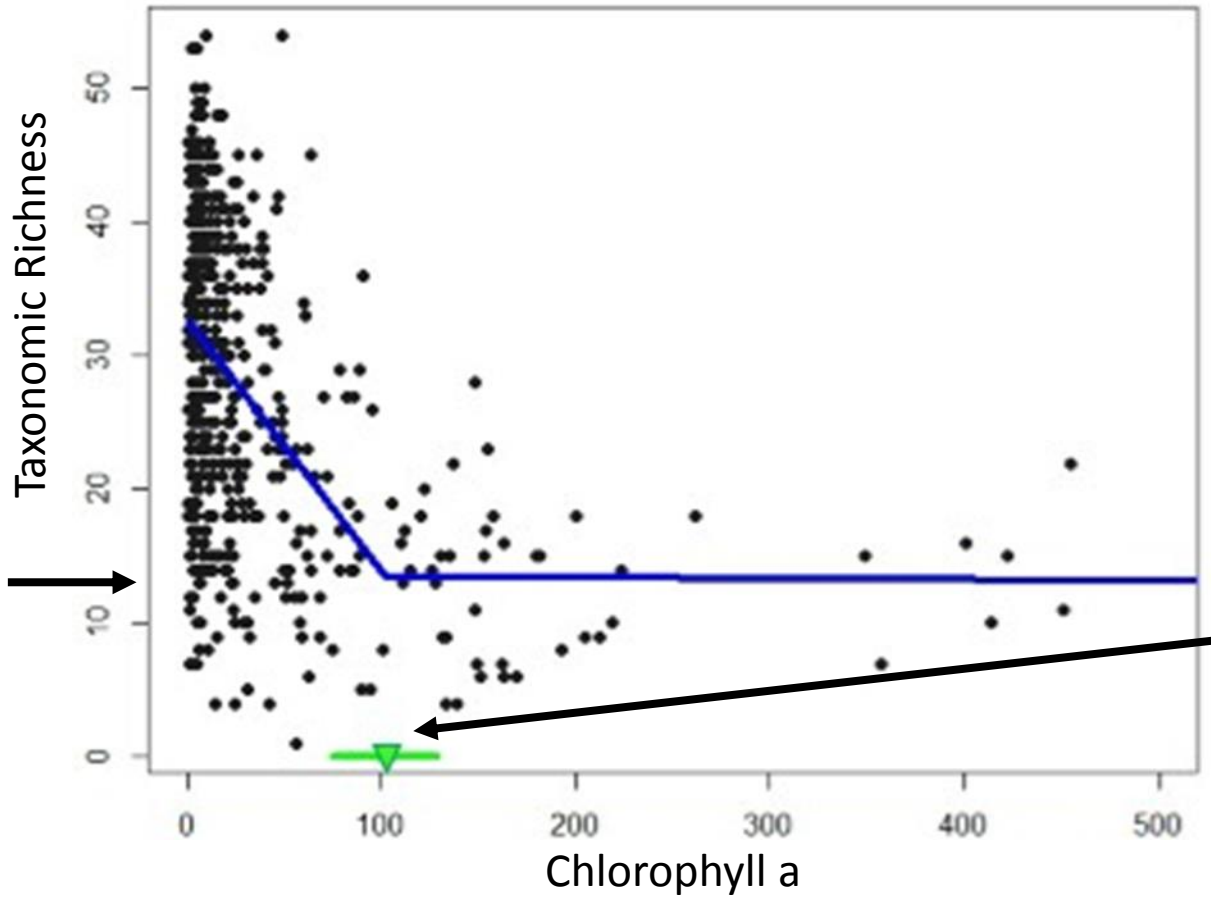
Impetus for This Work: EPA ORD Study (Fetscher et al. 2014)



Fetscher, A.E., M. Sutula, A. Sengupta, and N.E. Detenbeck. 2014. Linking nutrients to alterations in aquatic life in California wadeable streams. U.S. Environmental Protection Agency, Washington, DC (NTIS EPA/600/R-14/043).

It started with a simple question

- How do numeric nutrient values associated with the EPA-ORD statistical threshold analyses relate to beneficial aquatic life uses?



Is this a BU goal?

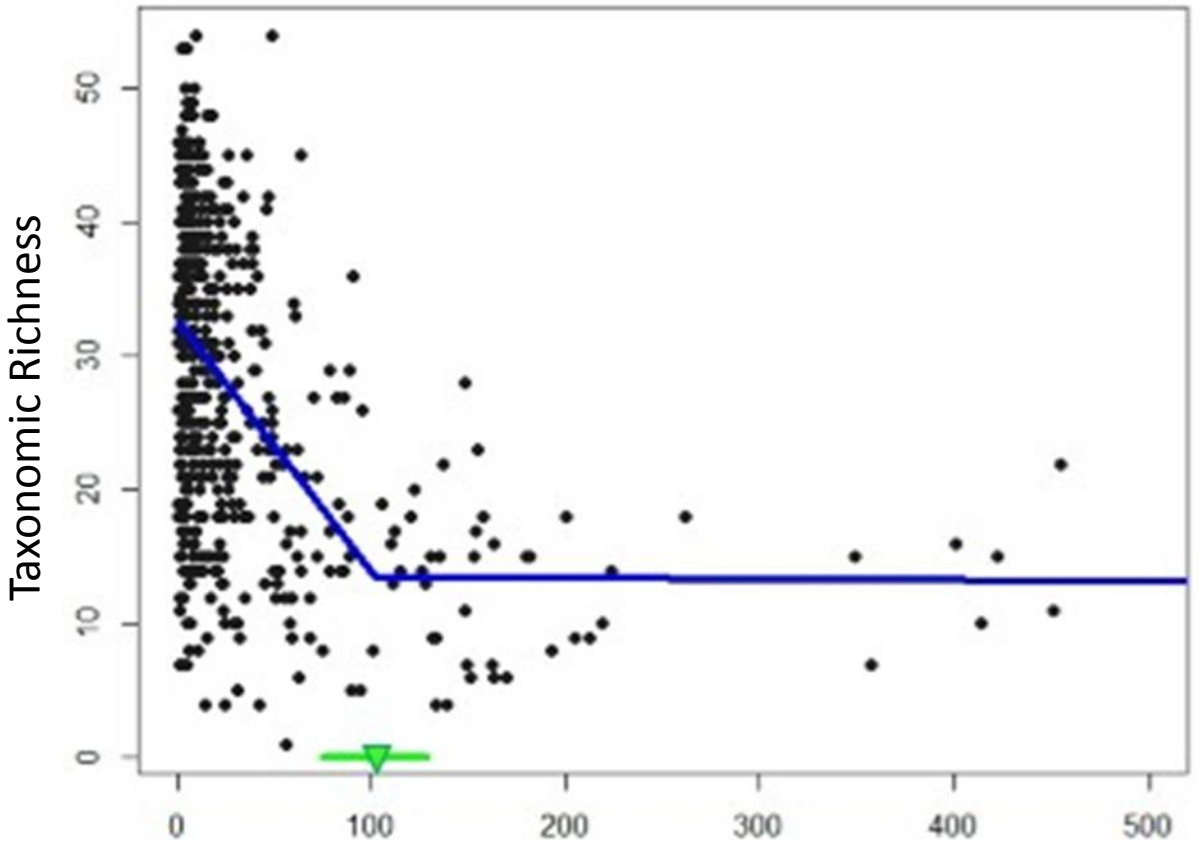
Threshold Chlorophyll

That led to another question

- What are the goals for beneficial uses related to aquatic life?

What are the biological targets for aquatic life measures?

Where on this y-axis are we trying to protect?



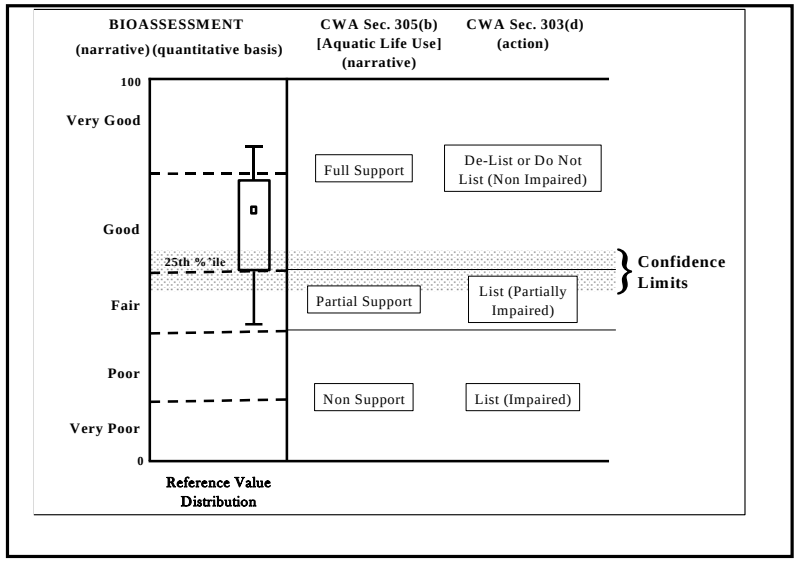
That led to a bit of a pickle

- California does not yet have numeric aquatic life use targets (a.k.a. "biological objectives").

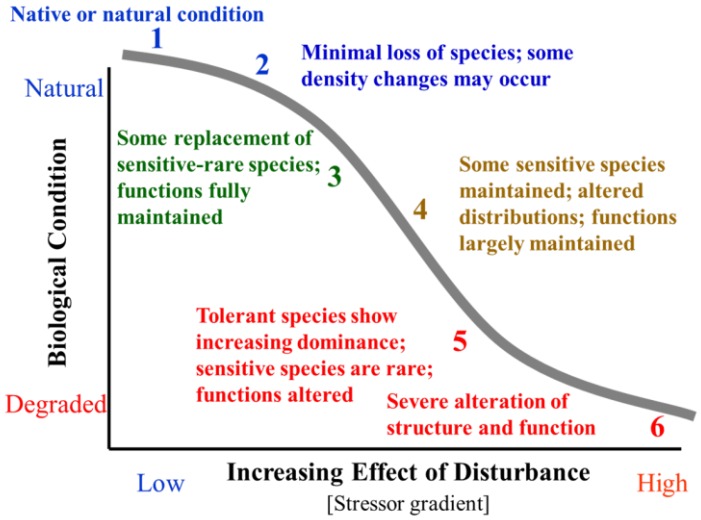
- Match – Mismatch
  - We'd like to relate chlorophyll and nutrients to numeric beneficial use targets.
  - But we don't yet have numeric beneficial use targets.
  - But maybe there is a ballpark….
  - Well, there are lots of ballparks, we started with a traditional one

COMMON BIOLOGICAL GOAL SETTING METHODS

- Statistical property of a least disturbed "reference" population



- Expert elicitation based on the biological condition gradient



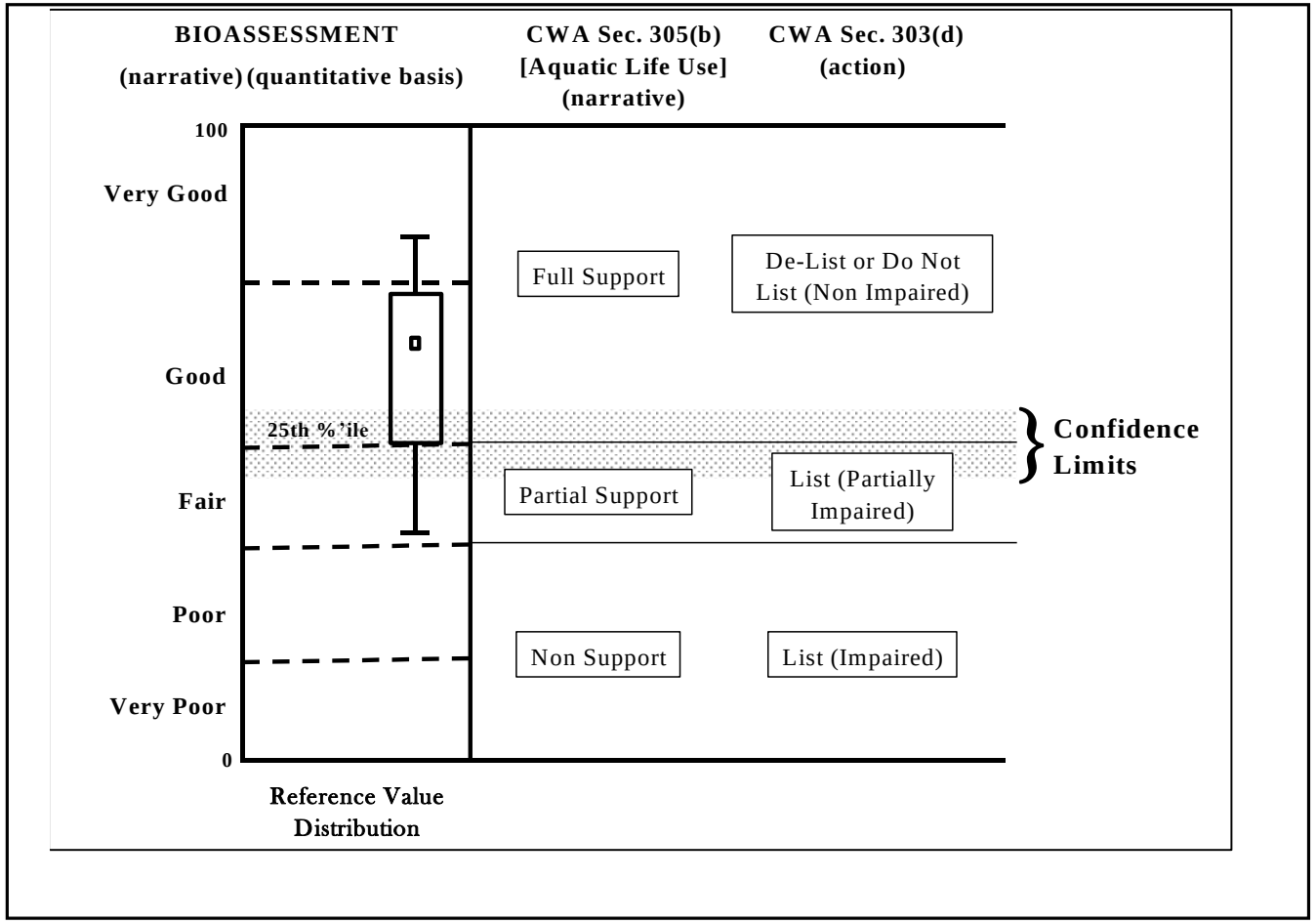
WE CHOSE THIS ONE….

- Statistical property of a least disturbed "reference" population

Long history of use in biological goal setting globally (and CA).

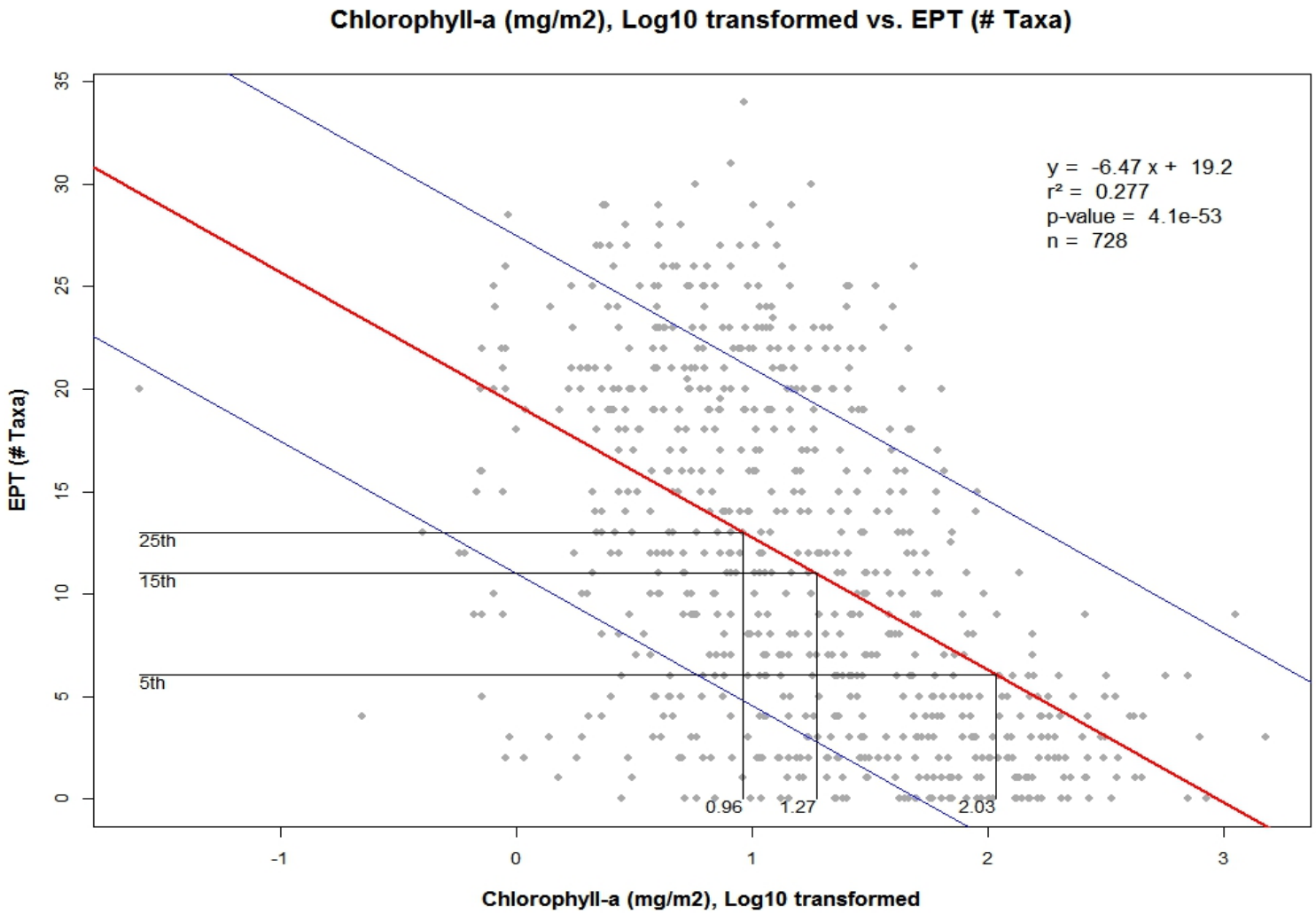
Consistent with many narrative goals ("…as naturally occurs…")

Consistent with ultimate CWA goals ("biological integrity").



So this is what we did

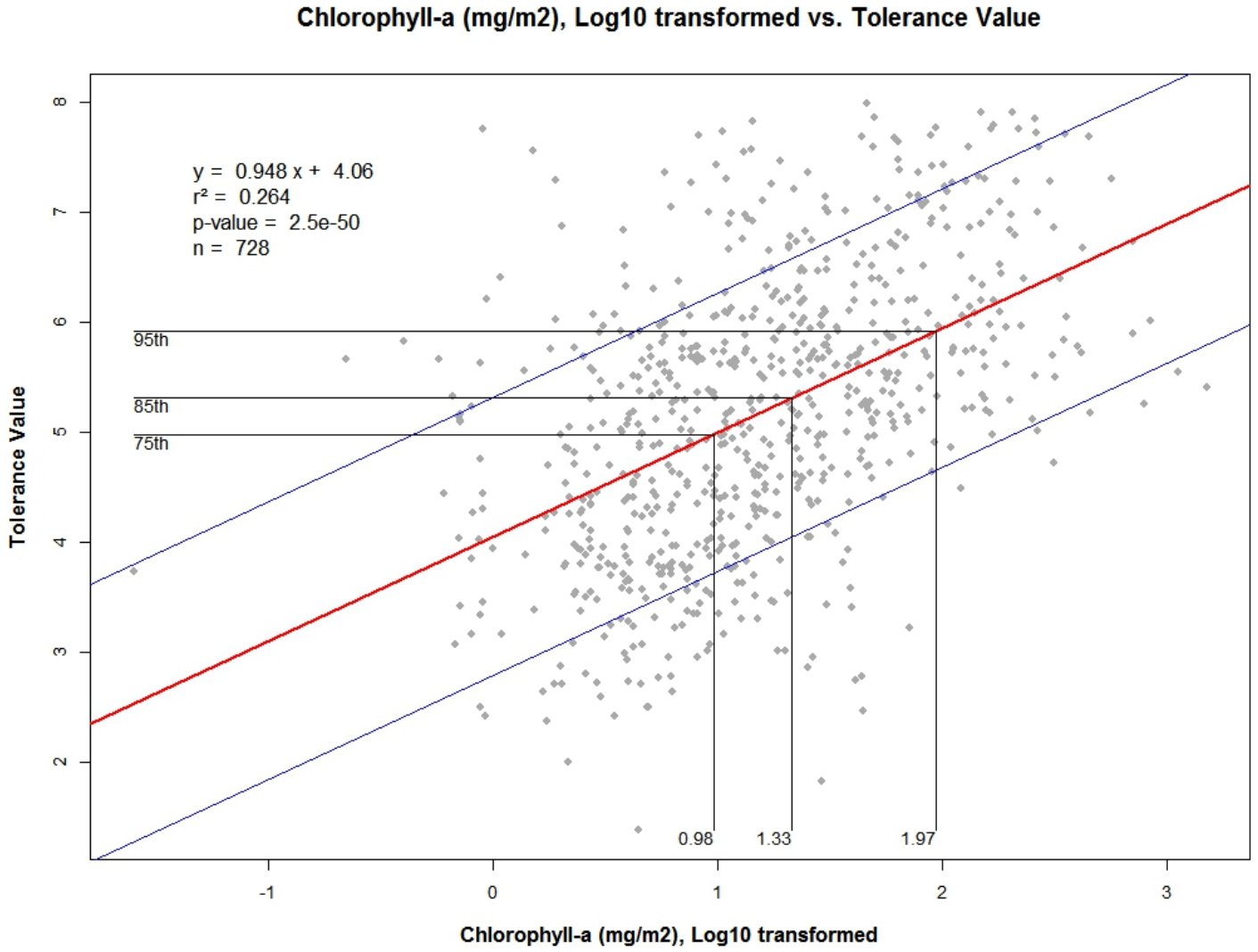
- Identified response measures (invertebrates and algae)
- Calculated reference site percentiles (5th, 15th, 25th)
- Built simple linear regression models
- Solve for the X condition….



Data: Statewide SWAMP macroinvertebrate dataset metric and Fetscher et al. (2014) stream algae dataset metrics

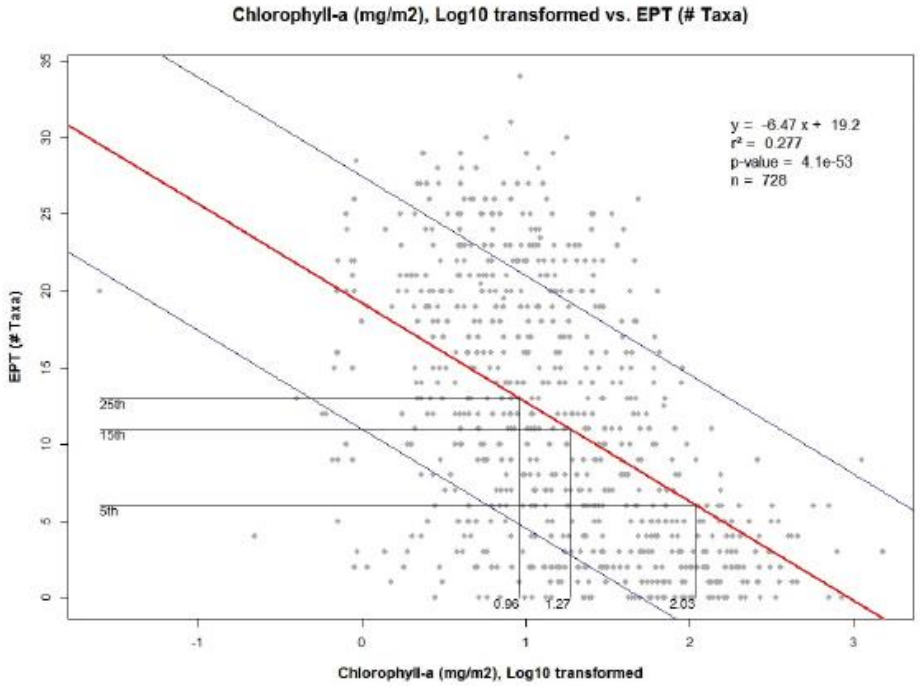
So this is what we did

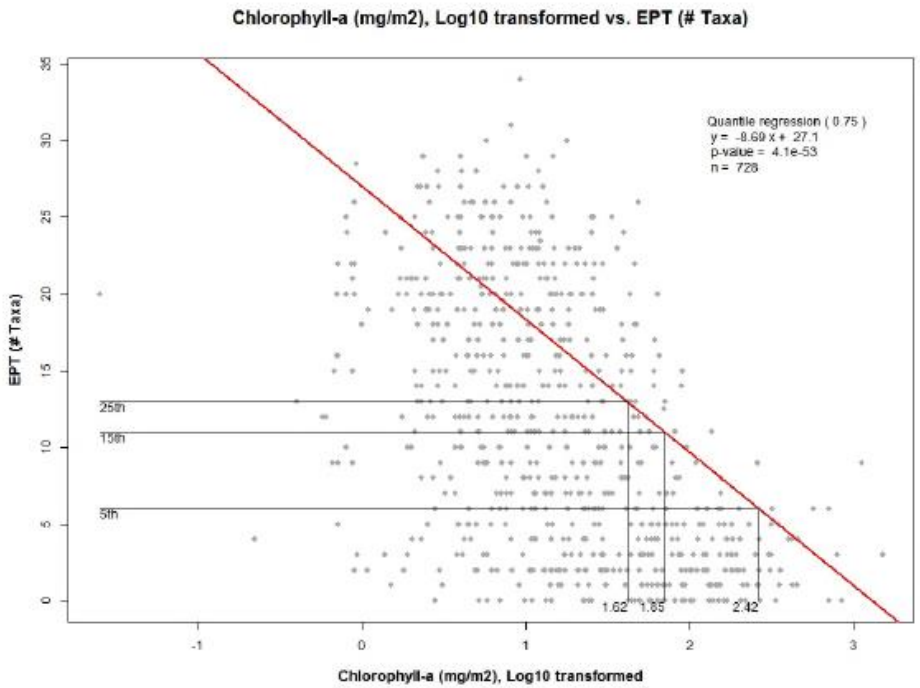
- Some measures increase with stress
- Calculated reference site percentiles (75th, 85th, 95th)



So this is what we did

- We modeled the mean and the 75^{th} quantile





IN THE REPORT – YOU WILL SEE….

- Chlorophyll a, AFDM, TP and TN values associated with reference condition invertebrate response goals

Table 3-4. Linear and quantile regression statistics and endpoint concentrations for Chlorophyll a, log10(x) transformed, for benthic macroinvertebrate responses. Grey-shaded cells indicate slopes opposite expectation. Endpoints are not identified for correlations or slopes that are opposite expected, extrapolated, or not statistically significant (p<0.05).

Response	Expected Response Direction	Correlation p-value	Linear Regression								Quantile Regression (25th or 75th percentile for increasor or decreasor stressors, respectively)							
			Slope	Intercept	Slope p-value	r^2	Reference Percentile	Response Threshold	Endpoint	Interpolated/ Extrapolated	Slope	Intercept	Slope p-value	r^2 (est)	Reference Percentile	Response Threshold	Endpoint	Interpolated/ Extrapolated
							25th	0.0593	105	I					25th	0.0593		E
Coleoptera_Taxa	↓	< 0.001	-1.11	3.79	< 0.001	0.123	5th	0		E	-1.83	6.22	< 0.001	527	5th	0		E
							15th	1	324	I					15th	1	708	I
							25th	2	40.7	I					25th	2	204	I
CSCI	↓	< 0.001	-0.168	1.06	< 0.001	0.193	5th	0.783	44.7	I	-0.154	1.22	< 0.001	48.2	5th	0.783	692	I
							15th	0.913	7.41	I					15th	0.913	97.7	I
							25th	0.974	3.24	I					25th	0.974	39.8	I
Diptera_Percent	↑	0.58 (ns)	0.0118 (ns)	0.347	0.352 (ns)	0	75th	0.481			0.00307 (ns)	0.18	0.835 (ns)	45.9	75th	0.481		
							85th	0.578							85th	0.578		
							95th	0.725							95th	0.725		
Diptera_PercentTaxa	↑	< 0.001	0.0584	0.158	< 0.001	0.094	75th	0.222	12.6	I	0.027	0.117	< 0.001	20.1	75th	0.222		E
							85th	0.256	47.9	I					85th	0.256		E
							95th	0.320	603	I					95th	0.320		E

Only derived nutrient values using ecologically sound, significant models, that were not extrapolated
Good models: all significant p-values, r^2 up to 0.60

IN THE REPORT – YOU WILL SEE….

- TP and TN values associated with reference condition algal response thresholds

Table 3-10. Linear and quantile regression statistics and endpoint concentrations for Total Phosphorus, log10(x) transformed, for diatom and soft algae responses. Grey-shaded cells indicate slopes opposite expectation. Endpoints are not identified for correlations or slopes that are opposite expected, extrapolated, or not statistically significant (p<0.05).

Response	Expected Response Direction	Correlation p-value	Linear Regression								Quantile Regression (25th or 75th percentile for increaser or decreaser stressors, respectively)							
			Slope	Intercept	Slope p-value	r^2	Reference Percentile	Response Threshold	Endpoint (mg/L)	Interpolated/ Extrapolated	Slope	Intercept	Slope p-value	r^2 (est)	Reference Percentile	Response Threshold	Endpoint (mg/L)	Interpolated/ Extrapolated
D18	↓	< 0.001	-23.7	32.5	< 0.001	0.364	5th	58.0	0.08	I	-20.1	51.6	< 0.001	5410	5th	58.0	0.48	I
							15th	70.0	0.03	I					15th	70.0	0.12	I
							25th	76.0	0.01	I					25th	76.0		E
H20	↓	< 0.001	-23.2	27.4	< 0.001	0.432	5th	52.0	0.09	I	-19.9	43.9	< 0.001	4650	5th	52.0	0.39	I
							15th	64.0	0.03	I					15th	64.0	0.10	I
							25th	69.0	0.02	I					25th	69.0		E
H21	↓	< 0.001	-21.7	29.5	< 0.001	0.337	5th	54.4	0.07	I	-20.9	43.2	< 0.001	5460	5th	54.4	0.29	I
							15th	62.2	0.03	I					15th	62.2	0.12	I
							25th	67.0	0.02	I					25th	67.0	0.07	I
H23	↓	< 0.001	-22.8	30.5	< 0.001	0.373	5th	58.0	0.06	I	-20.8	46.6	< 0.001	5120	5th	58.0	0.28	I
							15th	65.0	0.03	I					15th	65.0	0.13	I
							25th	70.0	0.02	I					25th	70.0	0.08	I

Only derived nutrient values using ecologically sound, significant models, that were not extrapolated
Similarly good models: all significant p-values, r^2 up to 0.46

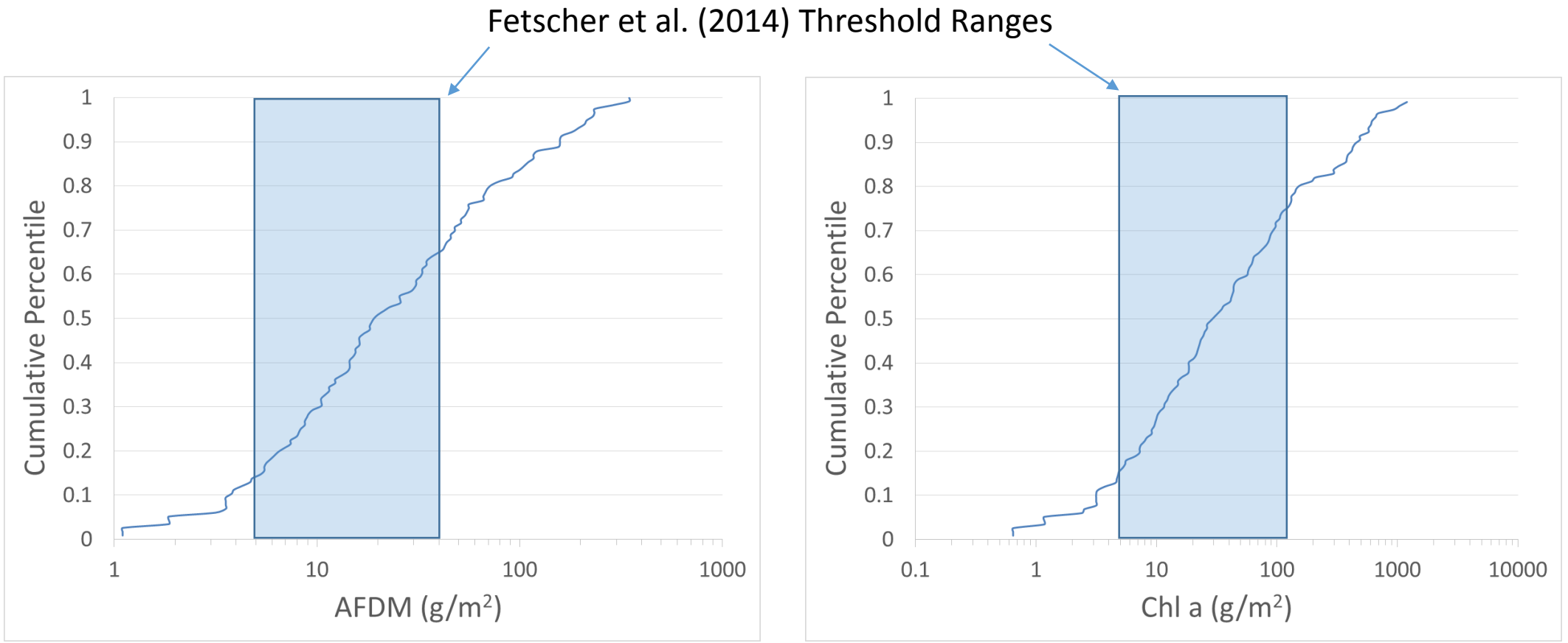
RESULTS SUMMARY

- Best Invertebrate Responses

Stressor	Response	Linear Regression		Quantile Regression (75th percentile)	
		Minimum	Maximum	Minimum	Maximum
AFDM	# Intolerant Taxa	8.71 g/m^2	41.7 g/m^2	22.9 g/m^2	72.4 g/m^2
	# EPT Taxa	8.71 g/m^2	51.3 g/m^2	24.5 g/m^2	97.7 g/m^2
Chlorophyll a	# Intolerant Taxa	9.77 mg/m^2	75.9 mg/m^2	33.9 mg/m^2	145 mg/m^2
	# EPT Taxa	9.12 mg/m^2	107 mg/m^2	41.7 mg/m^2	263 mg/m^2
TN	# Intolerant Taxa	0.20 mg/L	1.15 mg/L	0.62 mg/L	2.8 mg/L
	# EPT Taxa	0.20 mg/L	1.32 mg/L	0.58 mg/L]	3.3 mg/L
TP	# Intolerant Taxa	0.03 mg/L	0.21 mg/L	0.12 mg/L	0.50 mg/L
	# EPT Taxa	0.03 mg/L	0.20 mg/L	0.12 mg/L	0.60 mg/L
		25th	5th	25th	5th

Results summary – Invertebrate Models

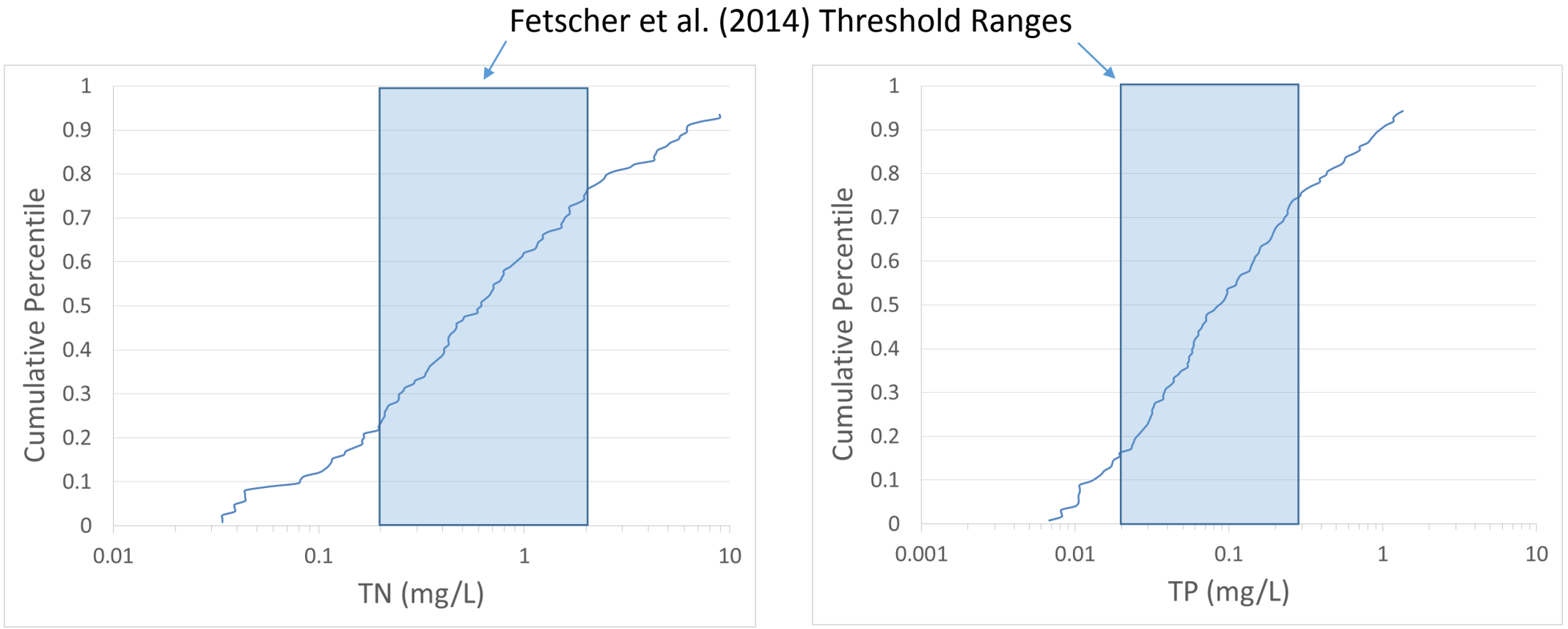
- Nutrient value statistics (linear model)



Only significant regressions, in the expected direction, with interpolated values

Results summary – Invertebrate Models

- Nutrient value statistics (linear model)



Only significant regressions, in the expected direction, with interpolated values

RESULTS SUMMARY

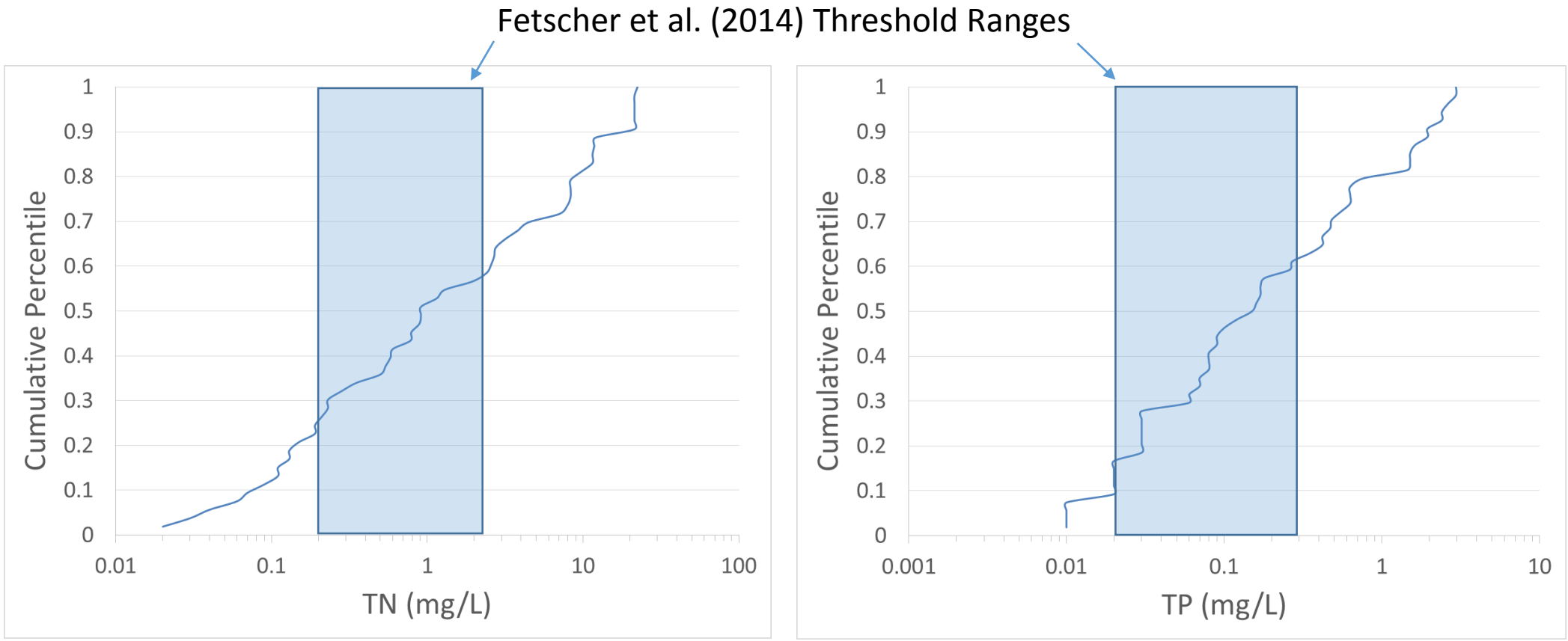
ReSERV Report:
TN: 0.3 to 0.8 mg/m^2 (0.2-2.1)
TP: 0.05 to 0.08 mg/m^2 (0.02-0.275)

- Best Algal Responses

Stressor	Response	Linear Regression		Quantile Regression	
		Minimum	Maximum	Minimum	Maximum
TN	H23	0.13 mg/L	0.50 mg/L	0.55 mg/L	2.19 mg/L
	H20	0.11 mg/L	0.79 mg/L	0.47 mg/L]	5.37 mg/L
TP	H23	0.02 mg/L	0.06 mg/L	0.08 mg/L	0.28 mg/L
	H20	0.02 mg/L	0.09 mg/L	0.10 mg/L	0.39 mg/L
		25th	5th	25th	5th

Results summary – Algal responses

- Nutrient value statistics (linear model)



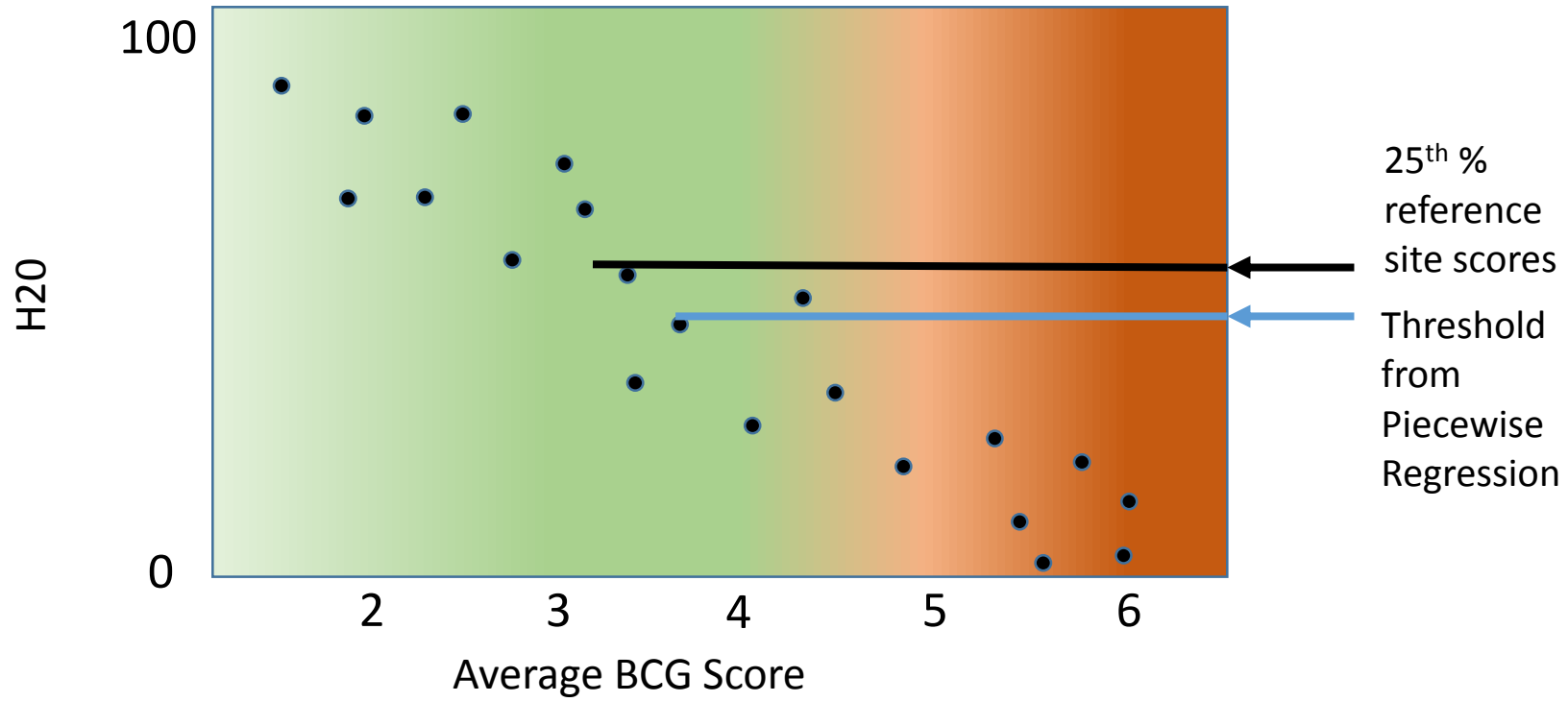
Only significant regressions, in the expected direction, with interpolated values

TAKE HOME MESSAGES: NUTRIENT AND ALGAL ABUNDANCE TARGETS AS A PERCENTILE OF REFERENCE

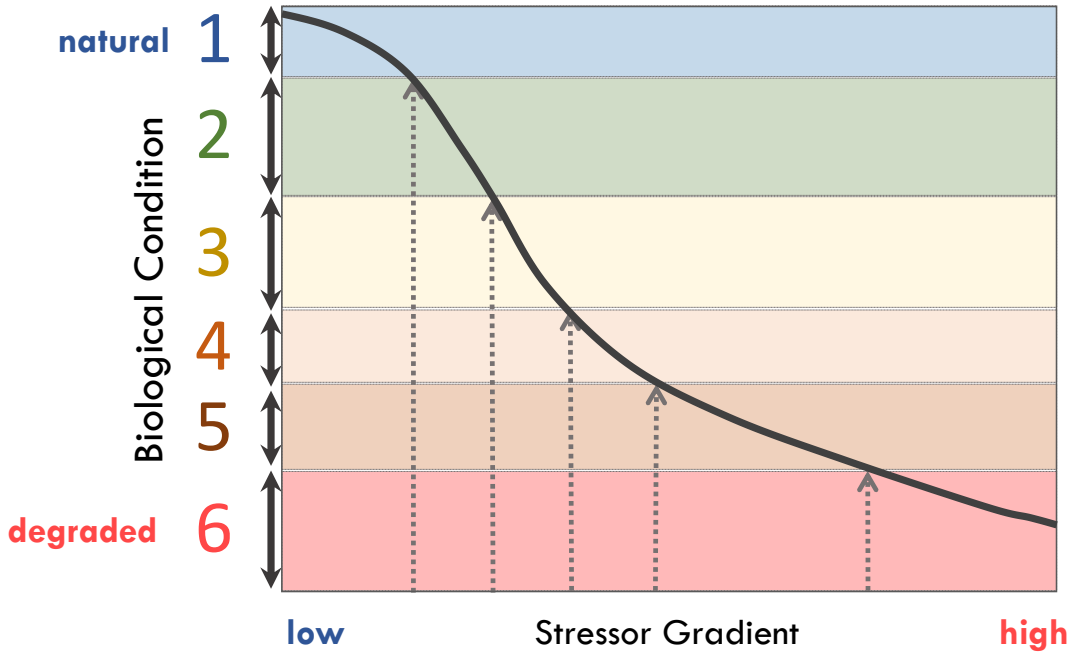
- Large number of statistically significant, precise models
- Interpolated TN, TP, chlorophyll, and AFDM values associated with invertebrate and algal targets
  - Generally low
  - Include range from thresholds response model
- Quantile regression model values are higher than linear models

On to the BCG

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



Key Synthesis Product is BCG Graphic, with Statistical "Thresholds" & Percent of Reference Values Superimposed



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

Questions? Comments?

Next Steps

- Both technical webinars (August 21st and 26th) are available on Water Board website

- Release of draft (interim) reports in September 2015

- Targeting October 2015 for next stakeholder meeting focused on technical elements
  - Response to Science Panel recommendations
  - Feedback on interim reports
  - BCG workplan discussion and technical approach for mapping channels in "developed landscapes"[1]

- Next Science Panel Meeting: January/February 2016

[1] Pending new Water Board contract start

Water Board Staff Policy Schedule

Milestone	Estimated Date
Focus group meetings (Dischargers – Industry, Publicly Owned Treatment Works - , Agriculture, Stormwater, Concentrated Animal Feed Operations/Grazers/Dairy, Environmental Groups, Non-governmental organizations and Tribes)	September 2015- December 2015
Publicly available draft plan and technical staff report	January 2017
Scientific peer review and staff responses	January 2017
Draft substitute environmental documentation (i.e. project alternatives, environmental impacts, economic factors)	April 2017
Public comment period: Draft plan, staff reports, and draft substitute environmental documentation	Summer 2017
Board Workshop	2017
Board Adoption Meeting	2017