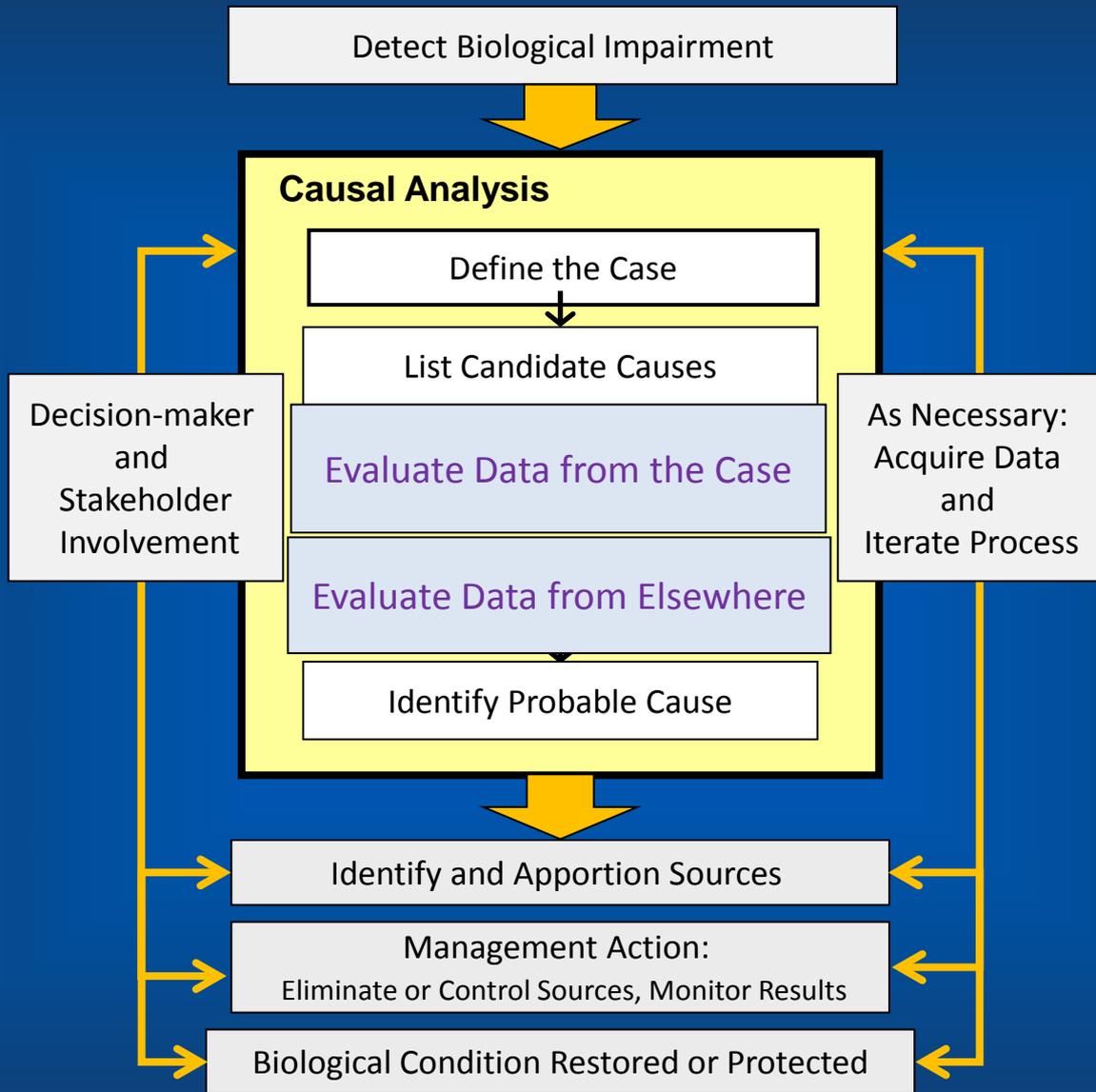


Evaluating Data from Different Lines of Evidence

Steps 3 & 4

San Diego Creek Causal Assessment Workshop 1
December 17, 2014





Evaluation of the Data

- Each type of analysis is different line of evidence (LOE)
- Each LOE will be applied to each proximate stressor
 - May even have sub-/ analyte-level evaluations
 - Then aggregated for up to each candidate cause
- Variety of different LOE detailed on the CADDIS website and the CA guidance document



Legal Parallel:

Presentation of Evidence

San Diego River

Test vs. comparator site

Candidate Causes

		MLS vs. TWAS 2-2				
Candidate Cause		Elevated Conductivity	Habitat Alteration	Heavy Metals	Increased Nutrients	Pesticides
Spatial Co-Occurrence		+	0	+	+	+
Stressor Response	Collector Abundance	0	+	-	0	-
	Non-Insect Taxa	+	0	0	0	+
	Tolerant Taxa	-	0	-	0	0
	Amphipod Abundance	++	+	++	-	0
Reference Condition Comparison		+	+	NE	NE	NE
Stressor Response From Outside the Case	Collector Abundance	0	+	0	-	NE
	Non-Insect Taxa	+	0	0	0	NE
	Tolerant Taxa	+	0	0	0	NE
	Amphipod Abundance	0	0	0	0	NE
Stressor Response From Laboratory		NE	NE	--	NE	--
Continuity		+/-/-/+	+/0/0/0	-/-/-/-	-/0/0/-	-/+/-/-

Lines of Evidence



Scoring the Lines of Evidence

- Scoring of data is done to help with record keeping
 - Provides a shorthand for summarizing results at the end of the assessment
- Scores
 - Supporting evidence (+, ++, or +++)
 - Weakening evidence (-, --, or ---)
 - Ambivalent evidence (0)
 - No evidence (NE)
 - Refute (R)

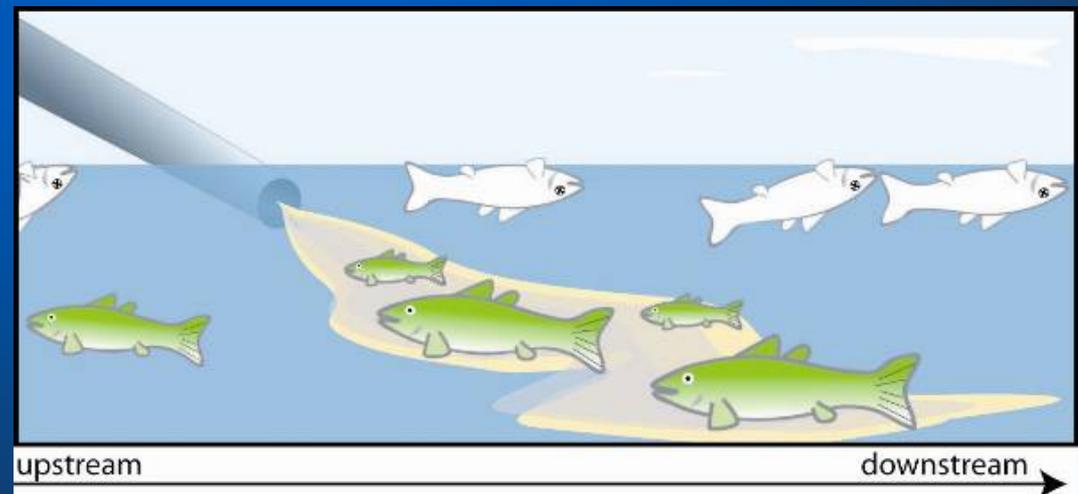
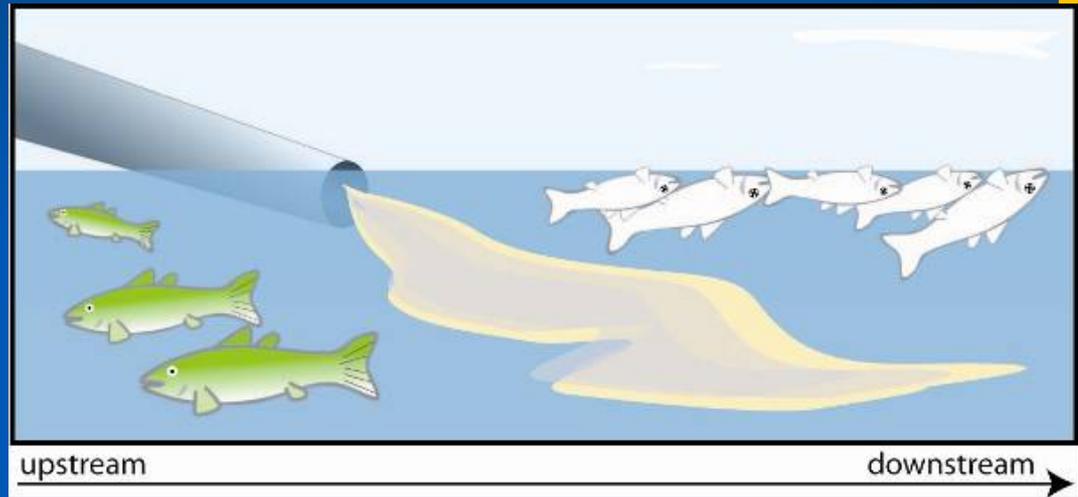
Within the Case Evidence

- Lines of evidence that make direct use of data collected at the test and comparator sites
 - Spatial/temporal co-occurrence
 - Evidence of exposure
 - Causal pathway
 - Stressor-response from the field
 - Manipulation of exposure
 - Laboratory tests of site media
 - Temporal sequence
 - Verified predictions
 - Symptoms

Spatial-Temporal Co-Occurrence

Concept

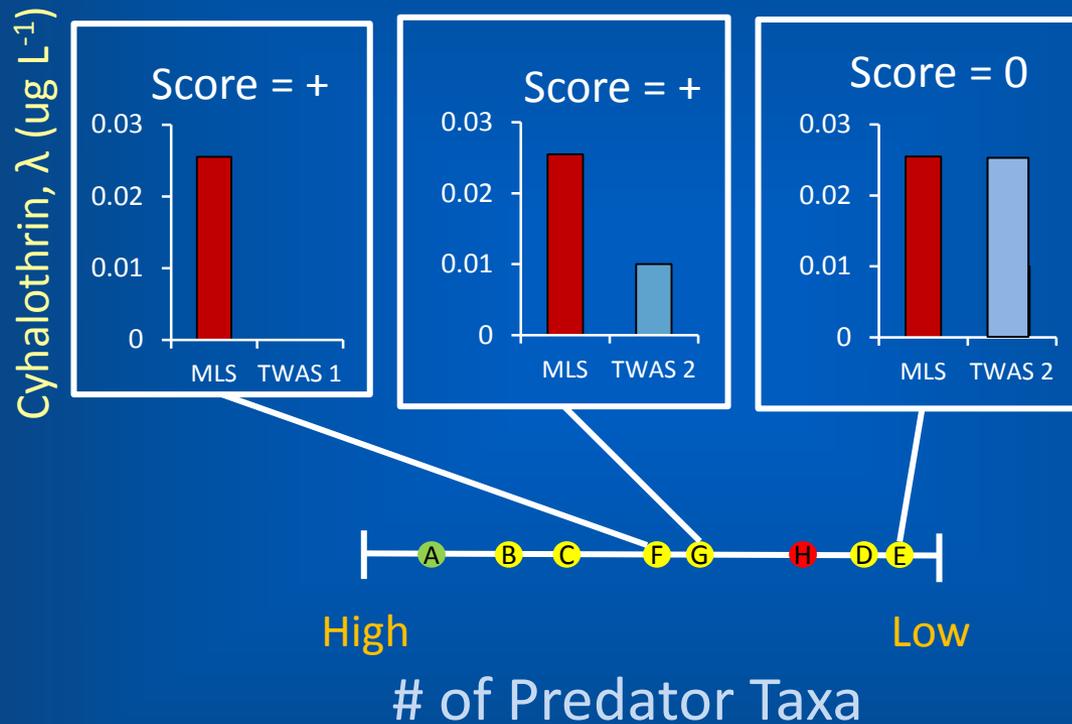
The biological effect is observed where and when the cause is observed, and is not observed where and when the cause is absent



Spatial-Temporal Co-Occurrence

+	The effect occurs where or when the candidate cause occurs, OR the effect does not occur where or when the candidate cause does not occur.
0	It is uncertain whether the candidate cause and the effect co-occur.
- - -	The effect does not occur where or when the candidate cause occurs, OR the effect occurs where or when the candidate cause does not occur.
R	The effect does not occur where or when the candidate cause occurs, OR the effect occurs where or when the candidate cause does not occur, AND the evidence is indisputable.

Spatial-Temporal Co-Occurrence

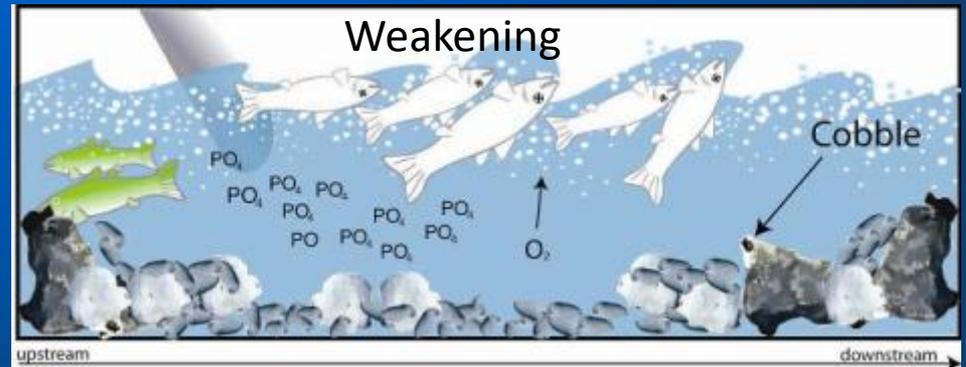
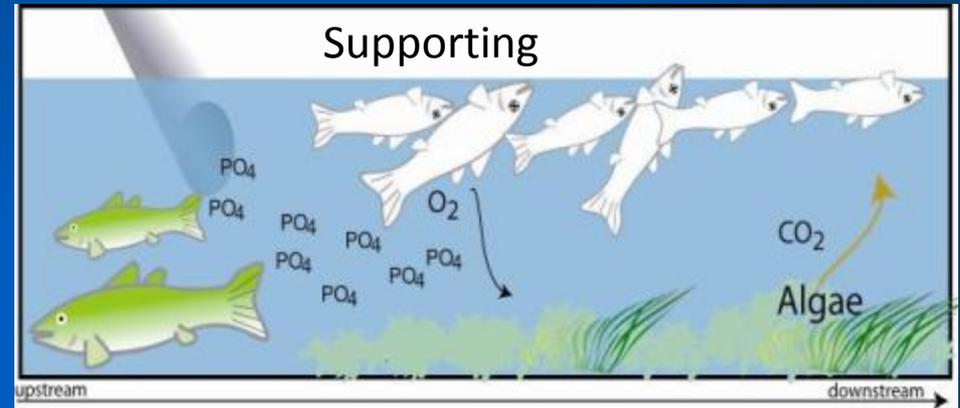


Comparator & test site condition

Causal Pathway

Concept

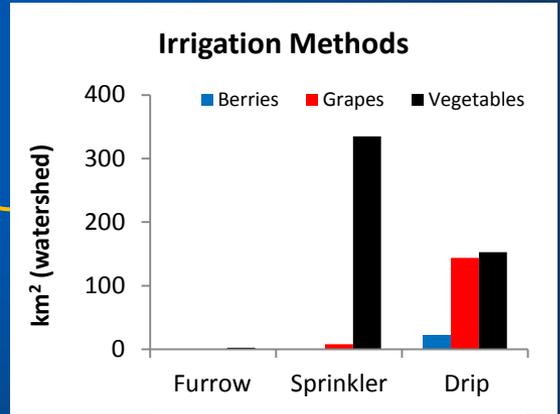
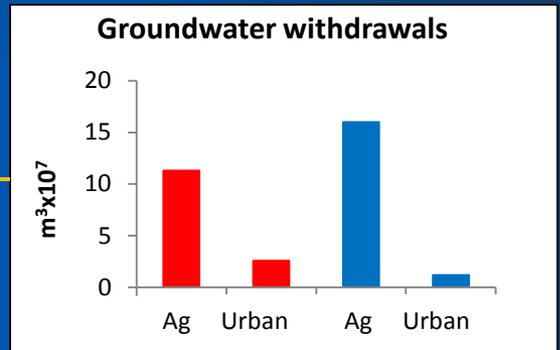
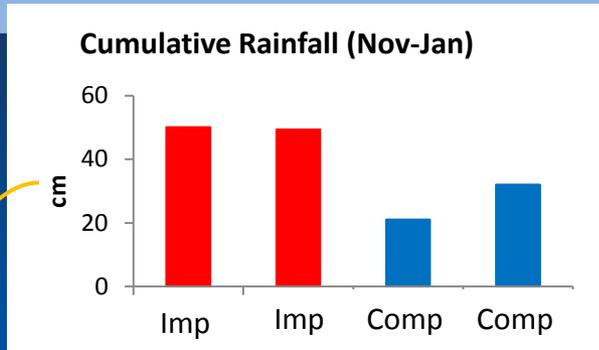
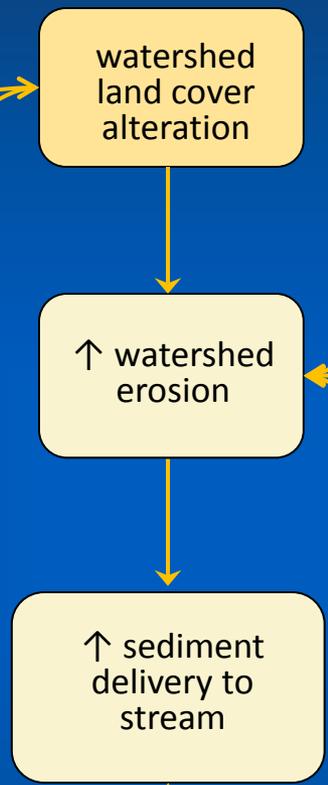
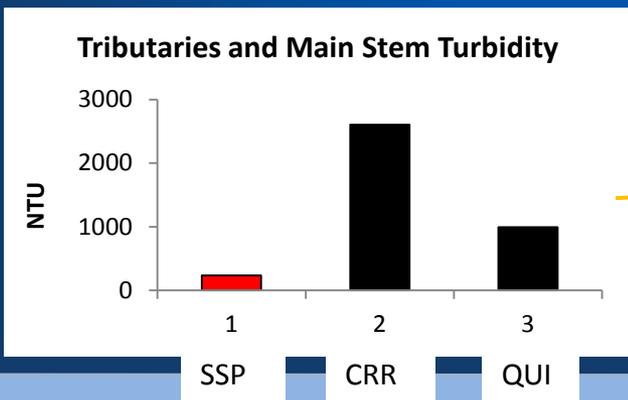
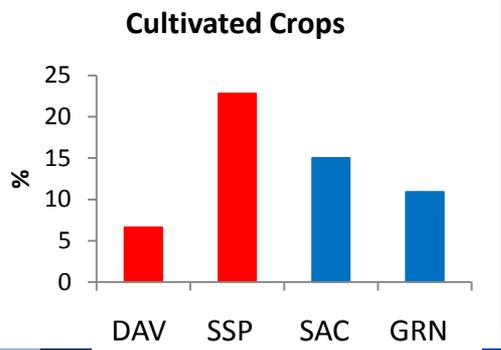
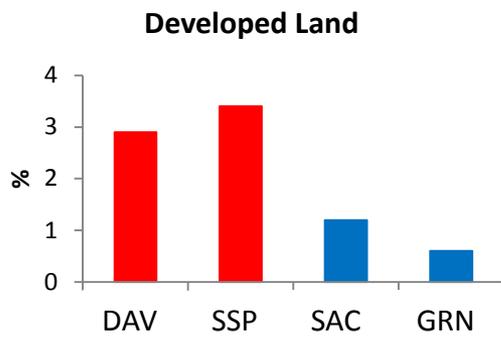
Steps in the pathways linking sources to the cause can serve as supplementary or surrogate indicators that the cause and the biological effect are likely to have co-occurred.



Causal Pathway

++	Strongly supports the case for the candidate cause because it is improbable that all steps occurred by chance; it is not convincing because these steps may not be sufficient to generate sufficient levels of cause.
+	Somewhat supports the case for the candidate cause.
0	Neither supports nor weakens the case for the candidate cause.
-	Somewhat weakens the case for the candidate cause, but is not strongly weakening because it may be due to temporal variability, problems in sampling or analysis, or unidentified alternative pathways.
---	Convincingly weakens the case for the candidate cause, assuming critical steps in each pathway are known, and are not found at the impaired site after a well-designed, well-performed, and sensitive study.

Causal Pathway

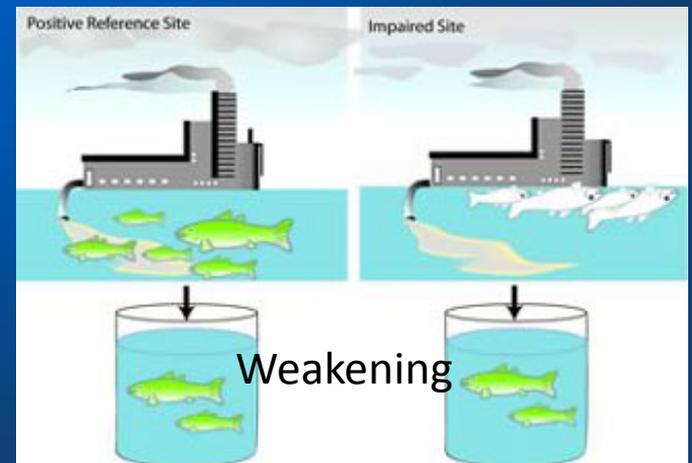
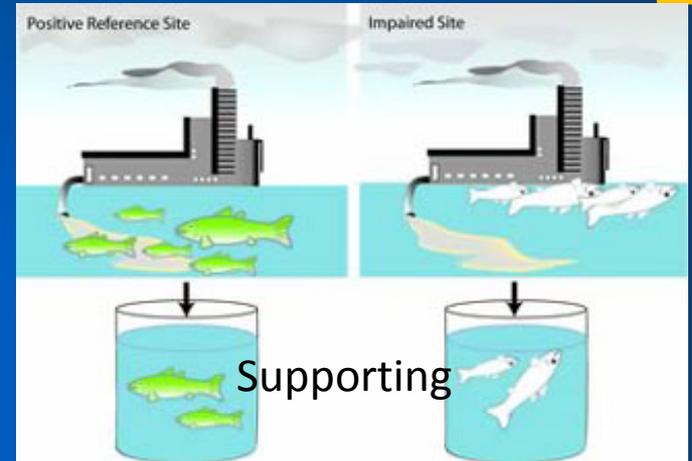


Score: +
Reasoning- Some steps in at least one causal pathway are present

Laboratory Tests of Site Media

Concept

Organisms exposed to test media brought back to the lab exhibit a similar response to the field



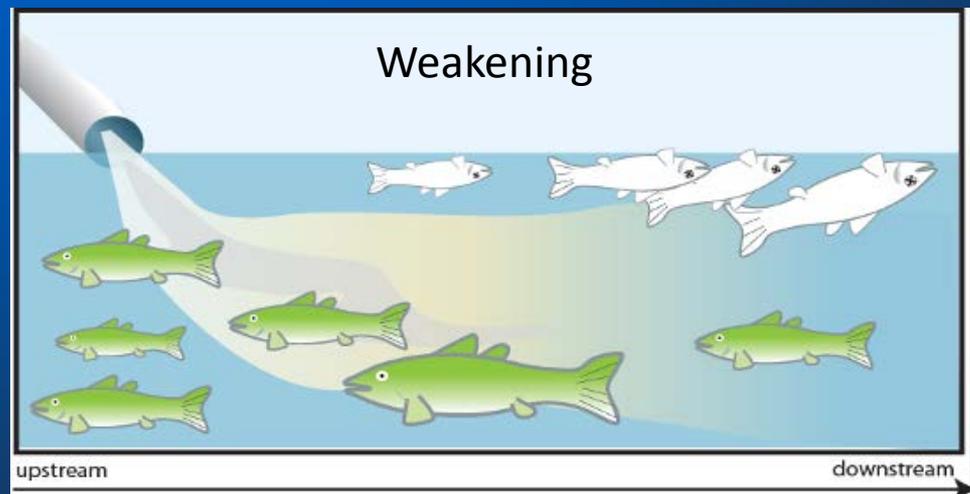
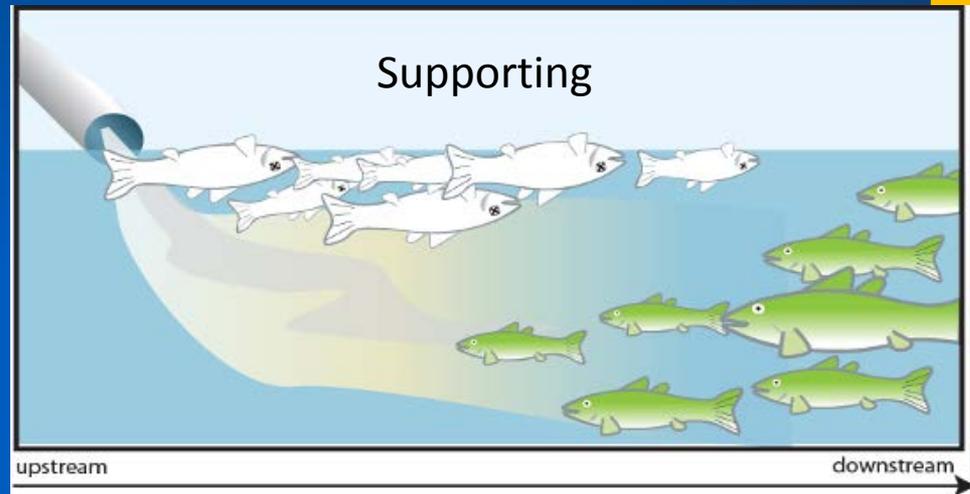
Laboratory Tests of Site Media

+++	Laboratory tests with site media show clear biological effects that are closely related to the observed impairment.
+	Laboratory tests with site media show ambiguous effects, OR clear effects that are not closely related to the observed impairment.
0	Laboratory tests with site media show uncertain effects.
-	Laboratory tests with site media show no toxic effects that can be related to the observed impairment.

Stressor Response From the Field

Concept

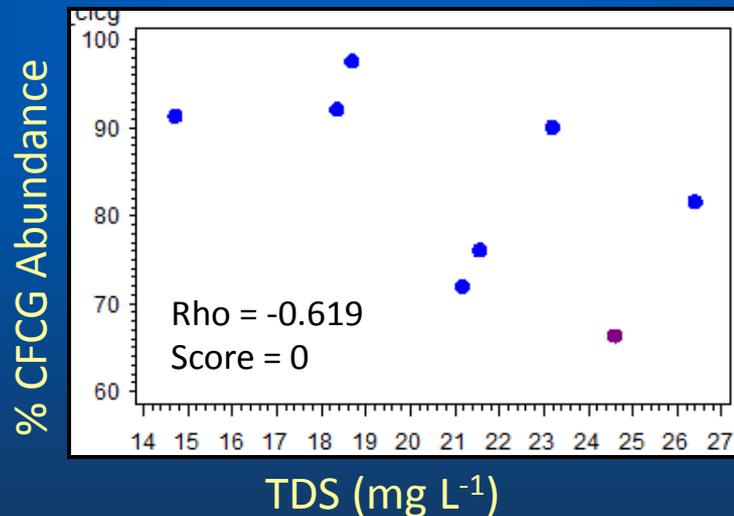
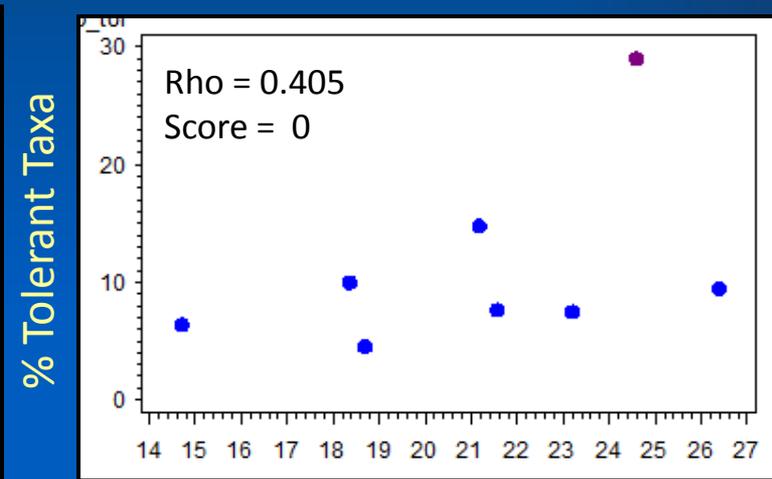
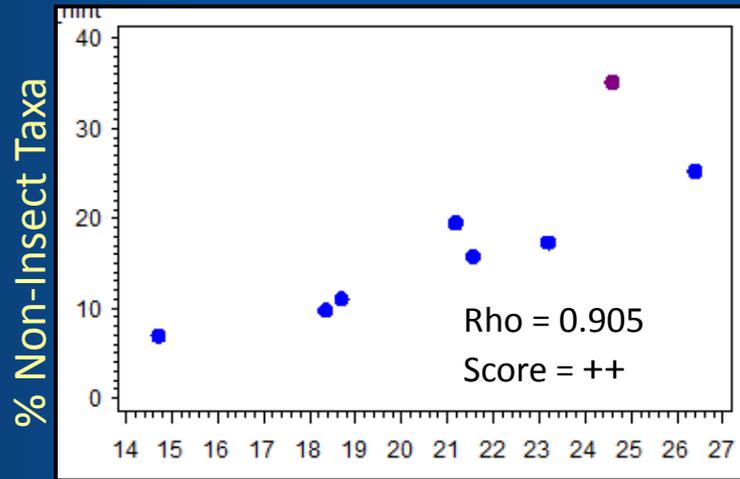
As exposure to the cause increases, intensity, or frequency of the biological effect increases; as exposure to the cause decreases, intensity, or frequency of the biological effect decreases.



Stressor Response From the Field

++	The stressor-response relationship in the case agrees quantitatively with stressor-response relationships from other field studies.
+	The stressor-response relationship in the case agrees qualitatively with stressor-response relationships from other field studies.
0	Agreement between the stressor-response relationship in the case and stressor-response relationships from other field studies is ambiguous.
-	The stressor-response relationship in the case does not agree with stressor-response relationships from other field studies.
--	There are large quantitative differences or clear qualitative differences between the stressor-response relationship in the case and the stressor-response relationships from other field studies.

Stressor Response From the Field



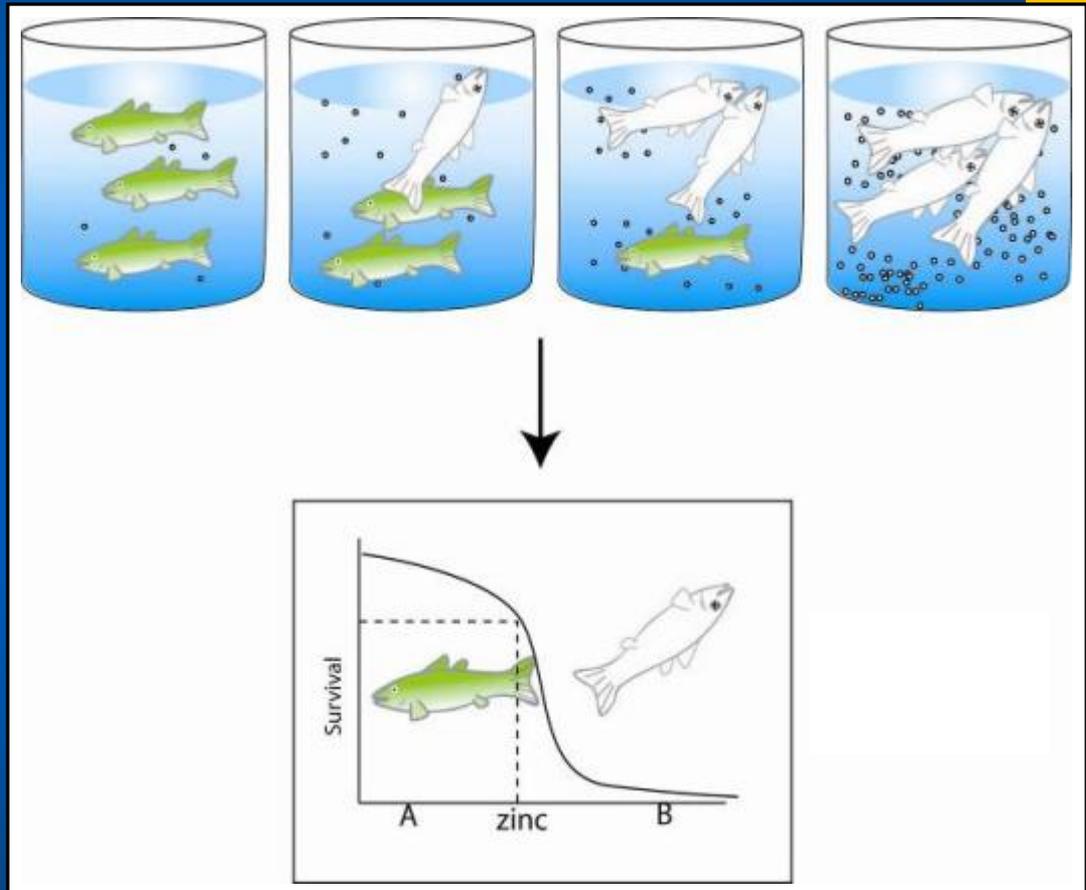
Outside of the Case Evidence

- Evaluations that provide context to data from the test site
 - Reference comparison
 - Stressor-response from non-comparator sites
 - Stressor-response from laboratory
 - Modelled stressor-response patterns
 - Mechanistically plausible cause
 - Manipulation of exposure at other sites
 - Analogous stressors

Stressor Response From the Lab

Concept

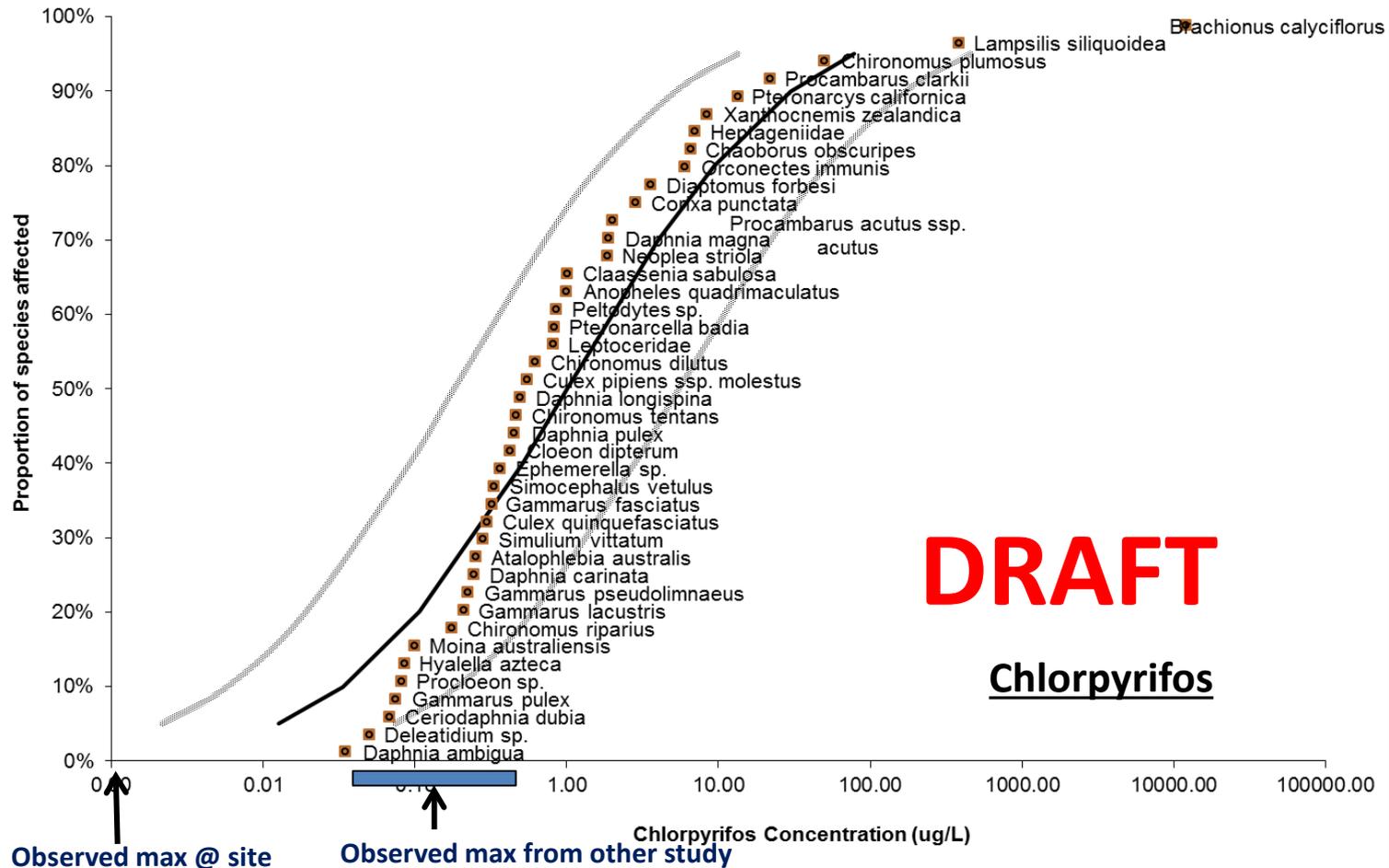
At the impaired sites, the cause must be at levels sufficient to cause related biological effects in laboratory studies.



Stressor Response From the Lab

Finding	Interpretation	Score
The observed relationship between exposure and effects in the case agrees quantitatively with stressor-response relationships in controlled laboratory experiments.	This finding <i>strongly supports</i> the case for the candidate cause, but is not convincing because the correspondence could be coincidental due to confounding or differences in organisms or conditions <u>between the case and the laboratory.</u>	+ +
The observed relationship between exposure and effects in the case agrees qualitatively with stressor-response relationships in controlled laboratory experiments.	This finding <i>somewhat supports</i> the case for the candidate cause, but is not strongly supportive because the correspondence is only qualitative, and the degree of correspondence could be coincidental due to confounding or differences in organisms or conditions between the case and the <u>laboratory.</u>	+
The agreement between the observed relationship between exposure and effects in the case and stressor-response relationships in controlled laboratory <u>experiments is ambiguous.</u>	This finding <i>neither supports nor weakens</i> the case for the candidate cause.	0
The observed relationship between exposure and effects in the case does not agree with stressor-response relationships in controlled laboratory experiments.	This finding <i>somewhat weakens</i> the case for the candidate cause, but is not strongly weakening because there may be differences in organisms or conditions <u>between the case and the laboratory.</u>	-
The observed relationship between exposure and effects in the case does not even qualitatively agree with stressor-response relationships in controlled laboratory experiments, or the quantitative differences are very large.	This finding <i>strongly weakens</i> the case for the candidate cause, but is not convincing because there may be substantial and consistent differences in organisms or conditions between the case and the <u>laboratory.</u>	--

Stressor Response From the Lab

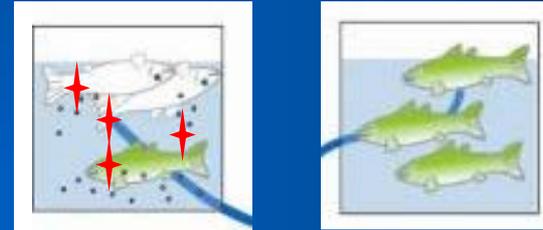


Reference Comparison

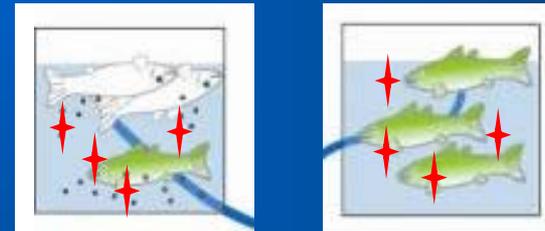
Concept

Stressor values that are no different than those observed at environmentally similar reference sites are probably not causing the observed impairment

Supporting



Weakening

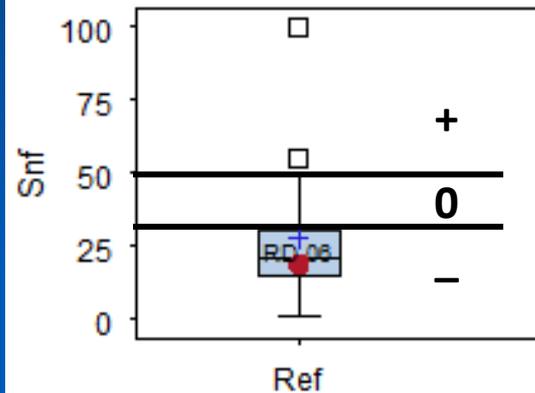


Reference Comparison

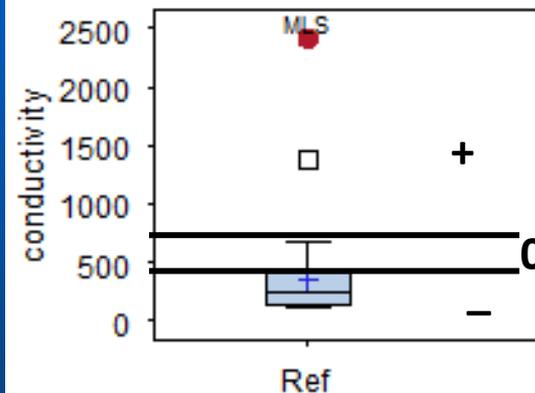
Finding	Interpretation	Score
The stressor value observed at the test site is similar (within 25th – 75th percentile) to the central distribution of values from environmentally similar reference sites where there is no biological impairment	Stressor levels are similar to that at reference sites, so therefore that stressor is likely not causing the biological impairment at the test site	-
The stressor value observed at the test site is outside of the central distribution of values (<25th or >75th percentile) from environmentally similar reference sites where there is no biological impairment	Stressor levels are not similar, but not distinctly different than at reference sites, so therefore it is unclear if that stressor is causing the biological impairment at the test site	0
The stressor value observed at the test site is distinctly different from environmentally similar reference sites where there is no biological impairment	Stressor levels are distinctly elevated or depressed than at environmentally similar reference sites, so that stressor <i>may</i> be causing the biological impairment at the test site	+

Reference Comparison

Sands and Fines



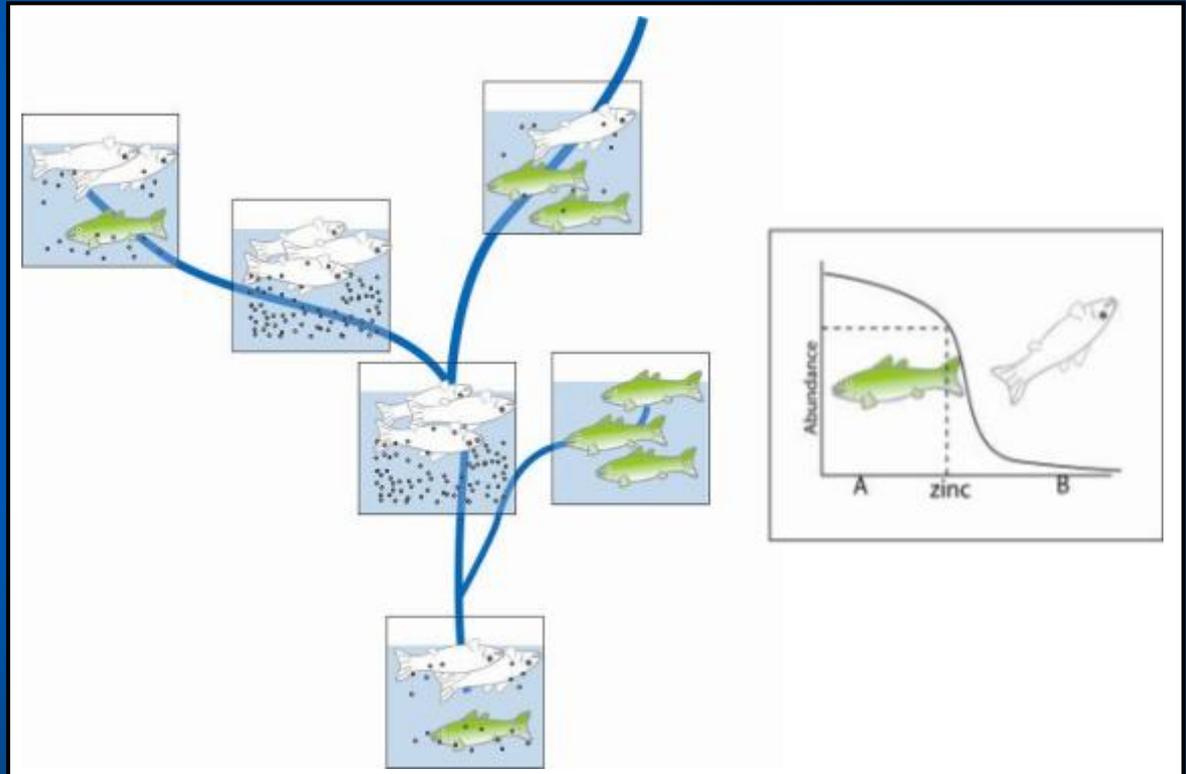
Conductivity



Stressor Response Non-Comparator Sites

Concept

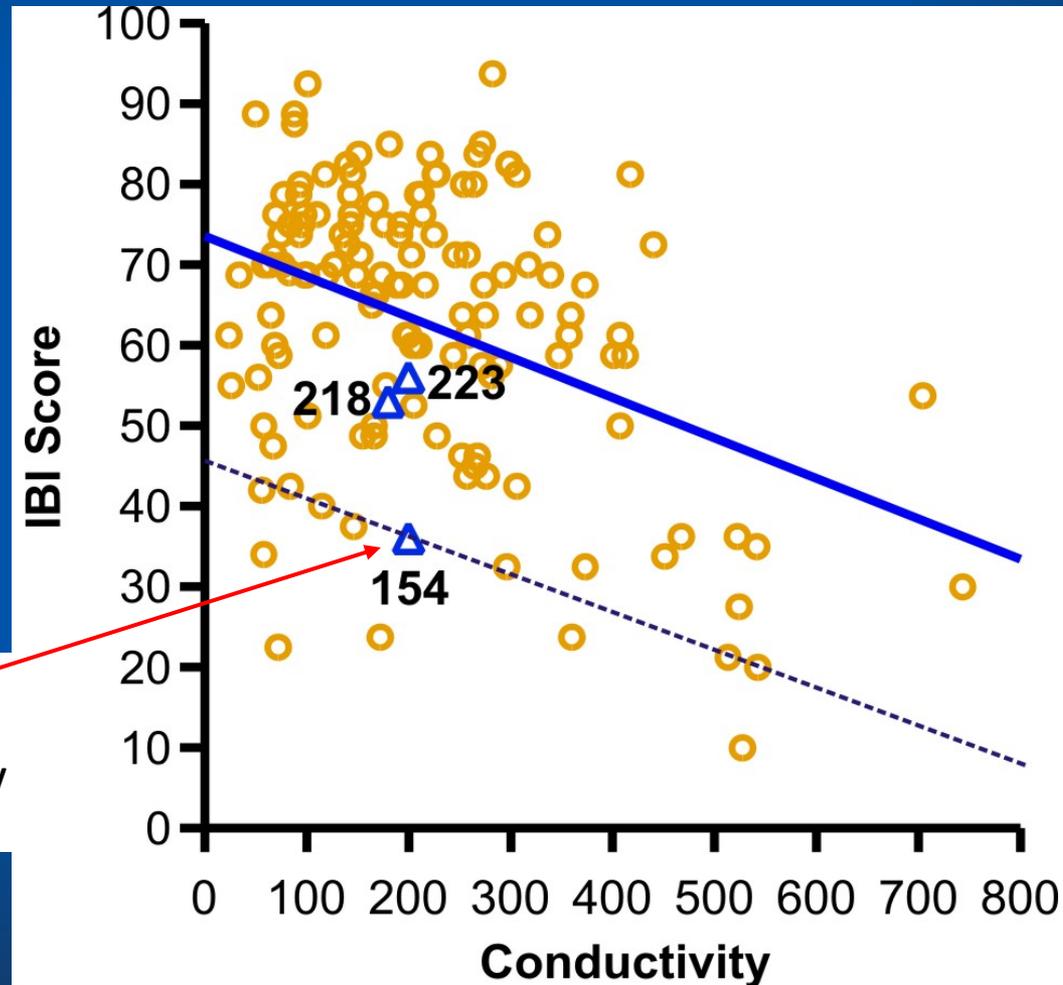
At the impaired sites, the cause must be at levels sufficient to cause similar biological effects in other field studies.



Stressor Response Non-Comparator Sites

++	The stressor-response relationship in the case agrees quantitatively with stressor-response relationships from other field studies.
+	The stressor-response relationship in the case agrees qualitatively with stressor-response relationships from other field studies.
0	Agreement between the stressor-response relationship in the case and stressor-response relationships from other field studies is ambiguous.
-	The stressor-response relationship in the case does not agree with stressor-response relationships from other field studies.
--	There are large quantitative differences or clear qualitative differences between the stressor-response relationship in the case and the stressor-response relationships from other field studies.

Stressor Response Non-Comparator Sites



case site falls below
5th percentile regression;
argues against conductivity
as cause. Score = --

The Scoring Matrix

- Matrix of scores to keep track of the results from all analyses
 - Different levels of aggregation
 - Analytes, proximate stressors, or candidate causes
- Plusses and minuses are not additive
- Frequency is important
- Magnitude is also important
 - +++, ---, or R are persuasive

The Scoring Matrix

Garcia River

	Low DO	pH	Temp	Conductivity	PHAB	Sediment (bed)	Flow	Increased Pesticides	Increased Nutrients	Increased Petroleum
Types of Evidence That Use Data From the Case										
Spatial/Temporal Co-Occurrence	+	0	0	+ / --- overall: ---	+	--- / + overall: +	---	NE	NE	NE
Causal Pathway	0	-	0	-	+	+	+	0	0	0
Stressor Response From the Field	-	-	-	-	+ (weak!)	-	-	NE	NE	NE
Types of Evidence That Use Data From the Elsewhere										
Stressor Response From Other Field Studies	-	-	-	-	+ (weak!)	+	-	NE	NE	NE
Evaluating Multiple Types of Evidence										
Consistency of Evidence	-	-	-	-	+	+	-	0	0	0