

EXERCISE 1 – Types of evidence

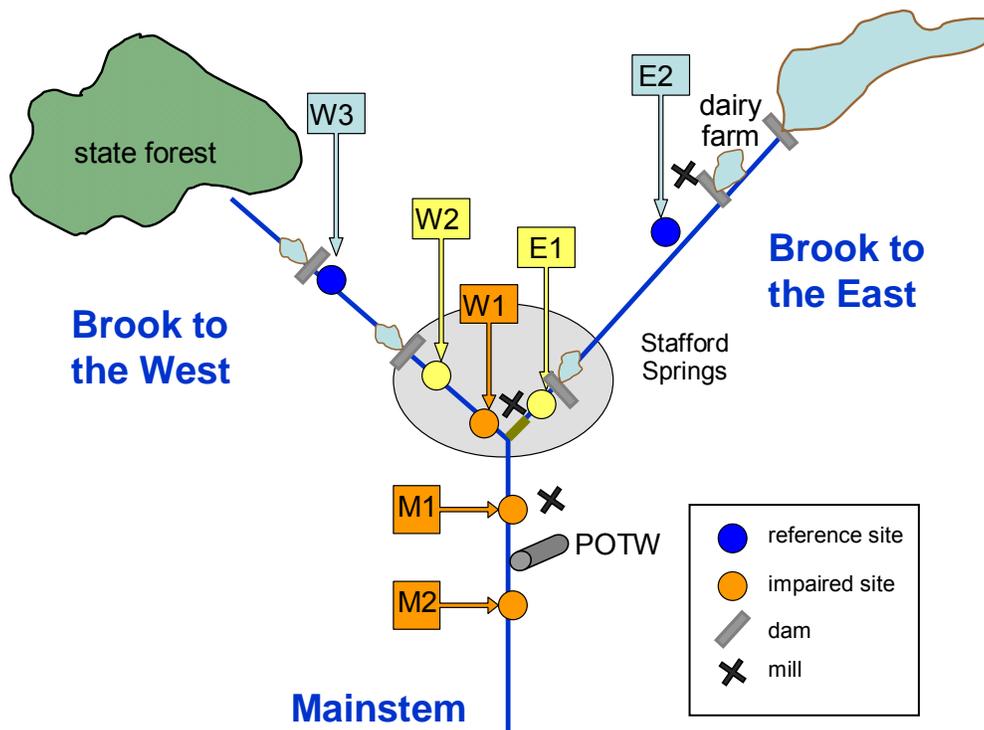
The Simplified Willimantic case study

Monitoring in 2000 showed that invertebrate communities were impaired at site W1. Using the Stressor Identification process, researchers set out to determine the probable cause(s) of impairment at site W1.

In this exercise, we will examine how data are applied toward different types of evidence, to evaluate **candidate causes** of reduced EPT taxa richness: **(1) metals (2) unknown toxicant, (3) heat, and (4) low dissolved oxygen**. Other candidate causes not used in the exercise included: ammonia, increased filterable food, and flow.

Using the data scenarios presented on the following pages, we will examine these questions:

- **Circle** which candidate cause do the data relate to?
- Do the data support or weaken the case for the candidate cause, or is it uncertain?
- **Circle** which characteristic of causation does the evidence relate to?
- If time, what type of evidence do the data represent?
- **Score** the evidence for the candidate cause “heat”.



DATA SCENARIO 1

	W3 – reference	W2 – below dam	W1 – impaired	Score	Inference
Minimum dissolved oxygen concentration (mg/L)	7.3	7.7	8.9	–	weakened
Maximum temperature, °C	19	27	28	+	supported
Metals, eg. Cd µg/L	4	5	5	+	supported

Circle as many as apply

Candidate causes:

metals toxic mixture heat low dissolved oxygen

Evidence for which characteristic:

co-occurrence preceding causation specific alteration sufficiency

Type of evidence: spatial/temporal co-occurrence

DATA SCENARIO 2

	W2 – below dam	W1 – impaired	Score	Inference
Canopy cover	70%	0%	+	Supported
Thermally heated pond, water flows from surface over dam	closest	downstream	–	Weakened

Circle as many as apply and fill in the type of evidence

Candidate causes:

metals toxic mixture heat low dissolved oxygen

Evidence for which characteristic:

co-occurrence preceding causation specific alteration sufficiency

Type of evidence: causal pathway

DATA SCENARIO 3

EPT taxa richness over time at W3, W2, & W1					
	2002	2003	2004	2005	Score
W3	18	16	15	16	
W2	NE	8	9	8	
W1	3	4	7	8	+++

In Fall 2004, an unpermitted industrial discharge with metals ammonia, organic matter was discovered and removed, just upstream of W1.

Circle as many as apply and fill in the type of evidence

Candidate causes:

metals toxic mixture heat low dissolved oxygen

Evidence for which characteristic:

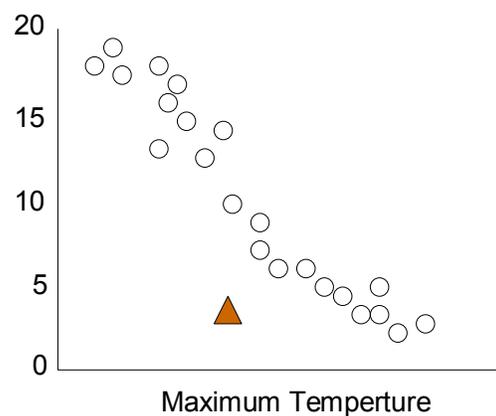
co-occurrence preceding causation specific alteration sufficiency

Type of evidence: _____ Manipulation of exposure from the case _____

DATA SCENARIO 4

Number of EPT were measured at streams throughout the state (open circles). Other stressors were also sometimes present. The W1 sample is indicated by the triangle.

of EPT



Circle as many as apply and fill in the type of evidence.

Score evidence.

Candidate causes:

metals toxic mixture heat low dissolved oxygen

Evidence for which characteristic:

co-occurrence preceding causation specific alteration sufficiency

Type of evidence: _____ Stressor response from the field from elsewhere _____

DATA SCENARIO 5

Plausible Stressor Response Evaluated by Sum of Partial Toxicity Based on Benchmarks Daphnids Lowest Chronic Values and Mean Ambient Concentrations from 1999–2000

	Lowest Chronic Value (µg/L)	MR1 Reference	WL1 Impaired	Score	
Al	1900	0.043	0.061		
Cd	0.15	2.667	3.333		
Cr	<44	0.005	0.039		
Cu	0.23	9.565	11.739		
Fe	4380	0.119	0.109		
Ni	<5	0.040	0.060		
Pb	12.3	0.000	0.146		
Zn	46.73	0.139	0.154		
Total		12.578	15.642	yes	+

Circle as many as apply and fill in the type of evidence

Candidate causes:

metals toxic mixture heat low dissolved oxygen

Evidence for which characteristic:

co-occurrence preceding causation specific alteration sufficiency

Type of evidence: Stressor response from the laboratory from elsewhere

DATA SCENARIO 6

	Plecoptera Intolerant to all	% Cheumatopsyche (metal tolerant)	%Hydropsychidae (Temp. and low DO tolerant, fine particle feeders)	Score metal	Score DO and Temp.
W3	3	3	15		
W2	1	40	70		
W1	0	97	99	+	+

Circle as many as apply and fill in the type of evidence

Candidate causes:

metals

toxic mixture

heat

low dissolved oxygen

Evidence for which characteristic:

co-occurrence

preceding causation

specific alteration

sufficiency

Type of evidence: _____ “Assemblage” symptomology _____

SUMMARY OF SCORES

Fill in the scores for the empty grey cells of the scoring table and evaluate the consistency of the evidence for each candidate cause

	Metals	Elevated Temperature	Low DO	Toxic Mixture
Preceding causation	+	+	+	+
Co-occurrence	+	+	<input type="checkbox"/>	+++
Time order	NE	NE	NE	NE
Sufficiency	+	+	<input type="checkbox"/>	+++
Interaction	NE	NE	NE	NE
Alteration	+	+	+	+
Consistency of Evidence	+	+	<input type="checkbox"/>	++