Maryland
Department of
the Environment

MD's Biological Stressor Identification (BSID) Analysis

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Purpose and Scope

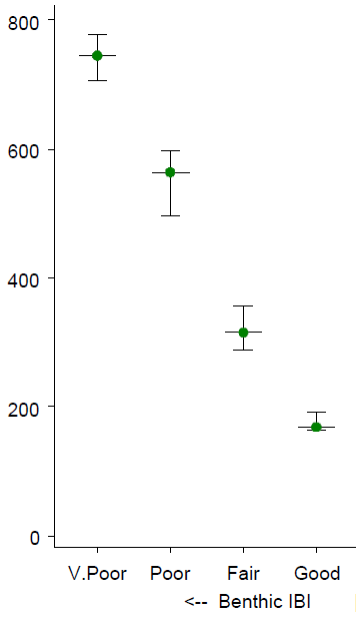
- Identify stressors to degraded biological communities in MD's nontidal 1st through 4th order streams
- Analysis conducted at MD 8-digit watershed scale
  - Scale of biological impairment listing in MD
- Uses a case/control, risk-based statistical analysis to identify likely stressors to degraded biological communities
- Potential stressors
  - WQ (chemical) parameters and habitat
- Potential Sources
  - Land-Uses + Acidity

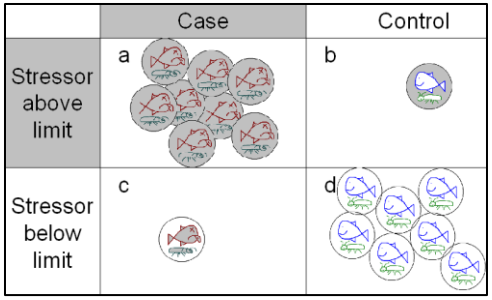
Data

- Maryland Biological Stream Survey (MBSS)
  - Benthic macroinvertebrate and fish sampling
  - Habitat assessment
  - In-situ water quality
    - DO, pH, and conductivity
  - Chemical grab sample
    - TP, PO_4^-, TN, NH_4^+, ANC, Cl^-, SO_4^{2-}, pH, and conductivity
  - 1st through 4th order nontidal wadeable streams
  - Randomly selected stations
  - 4 Rounds: 1995-1997 (Round 1), 2000-2004 (Round 2), 2007-2009 (Round 3), and 2014-2018 (Round 4)
  - BSID uses Rounds 1-3

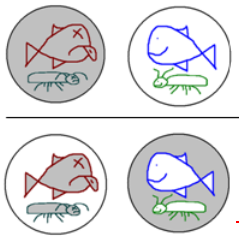
Methods

- Identify stressor thresholds
- Compare cases to controls
- Calculate attributable risk





Odds Ratio = $\frac{ad}{bc}$ =



> 1 = Potential Stressor

AR = Proportion $_{cases}$ - Proportion $_{controls}$

$$AR = \left(\frac{\quad}{\quad}\right) - \left(\frac{\quad}{\quad}\right)$$

AR > ~ 75% = Stressor

Interpretation

- Habitat stressors
  - Sediment listings & 4c listings
    - E.g., channelization, lack of riparian buffer
- WQ stressors
  - TP, Cl^-, and SO_4^{2-} listings

Parameter Group	Stressor	Total number of sampling sites in watershed with stressor and biological data	Cases (number of sites in watershed with poor to very poor Fish or Benthic IBI)	Controls (Average number of reference sites with fair to good Fish and Benthic IBI)	% of case sites with stressor present	% of control sites with stressor present	Possible stressor (Odds of stressor in cases significantly higher than odds of stressor in controls using p<0.1)	Percent of stream miles in watershed with poor to very poor Fish or Benthic IBI impacted by Stressor
Sediment	extensive bar formation present	5	4	89	0%	13%	No	----
	moderate bar formation present	5	4	89	50%	42%	No	----
	bar formation present	5	4	89	100%	90%	No	----
	channel alteration marginal to poor	5	4	89	50%	41%	No	----
	channel alteration poor	5	4	89	0%	12%	No	----
	high embeddedness	5	4	89	25%	8%	No	----
	epifaunal substrate marginal to poor	5	4	89	50%	13%	Yes	37%
	epifaunal substrate poor	5	4	89	0%	3%	No	----
	moderate to severe erosion present	5	4	89	50%	62%	No	----
	severe erosion present	5	4	89	0%	12%	No	----
	poor bank stability index	5	4	89	0%	5%	No	----
	silt clay present	5	4	89	100%	100%	No	----

Stressor Group	Percent of stream miles in watershed with poor to very poor Fish or Benthic IBI impacted by Parameter Group(s) (Attributable Risk)	
Sediment	37%	97%
In-Stream Habitat	91%	
Riparian Habitat	----	
Water Chemistry	94%	

Moving Forward

- SO_4^{2-} Listings
  - BSID thresholds significantly lower than sulfate toxicity study thresholds
  - Covariation w/other stressors?
- Tidal biological assessments and BSID analyses
  - Can we apply same processes for tidal waters?
  - Assess further once DO issues addressed
- Watersheds without identifiable stressors
  - Low Attributable Risk, i.e., < 75%
  - Need more data to determine stressors
- Incorporation of county data
  - Require consistent data collection and IBI calculation
  - Will allow us to reassess bio. impairment and stressor in the future
  - Can provide gage for restoration successes