Maryland Biological Stressor Identification Process

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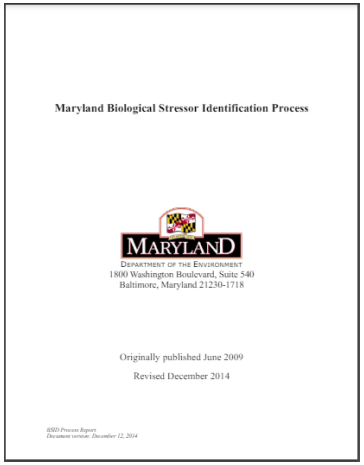
MD BSID

Methodology from 2014

- Studies published around 2016


Maryland Biological Stressor Identification Process

MARYLAND
DEPARTMENT OF THE ENVIRONMENT
1800 Washington Boulevard, Suite 540
Baltimore, Maryland 21230-1718

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BSID Process Report
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Maryland Biological Stream Survey:

- Benthic macroinvertebrates
- Fish
- Water chemistry
- Instream habitat
- Riparian habitat

Altitude

Land use

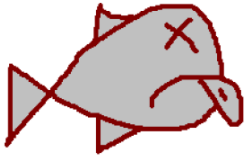
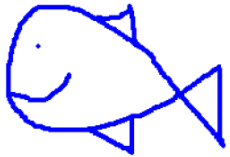
Impervious surface

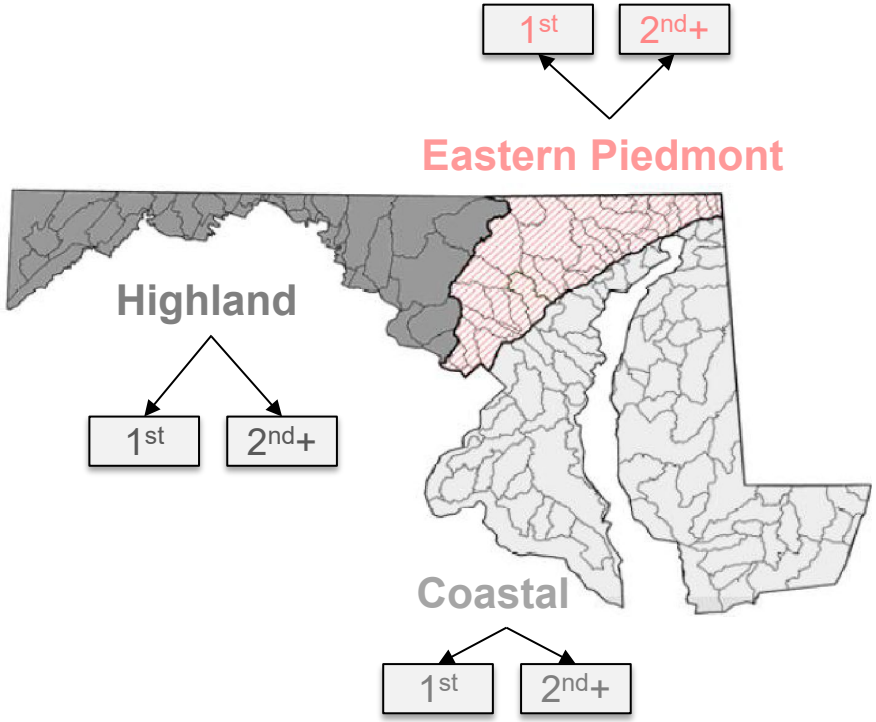
State Roads

MD BSID

- Compare biology to stressor levels
- Using case-control statistics: Mantel-Haenszel Odds Ratios
- Samples are categorized into groups, then numbers in each group are compared
- Sites are categorized by:
  - Biology: ☺ or ☹
  - Stressor: ↓ or ↑
  - Physiographic region and stream order

Cases vs. Controls

	Cases	Controls
FIBI	FIBI < 3 	 FIBI ≥ 3
BIBI	BIBI < 3 	 BIBI ≥ 3
	in 8-digit watershed	in physiographic region



Stressor Categories

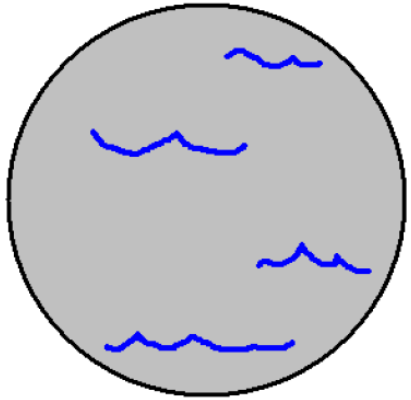
Source:

- Acidity
- Agricultural
- Anthropogenic
- Impervious
- Urban

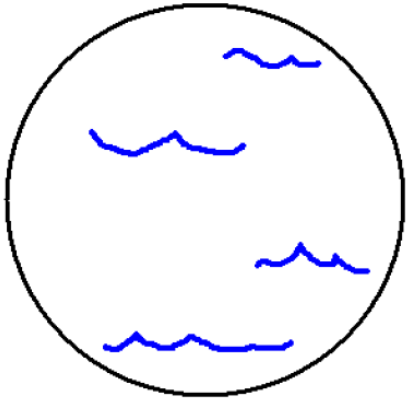
Stressor:

- Sediment
- Habitat (instream & riparian)
- Chemistry (inorganic, nutrients, and pH)

Stressor above threshold



Stressor below threshold



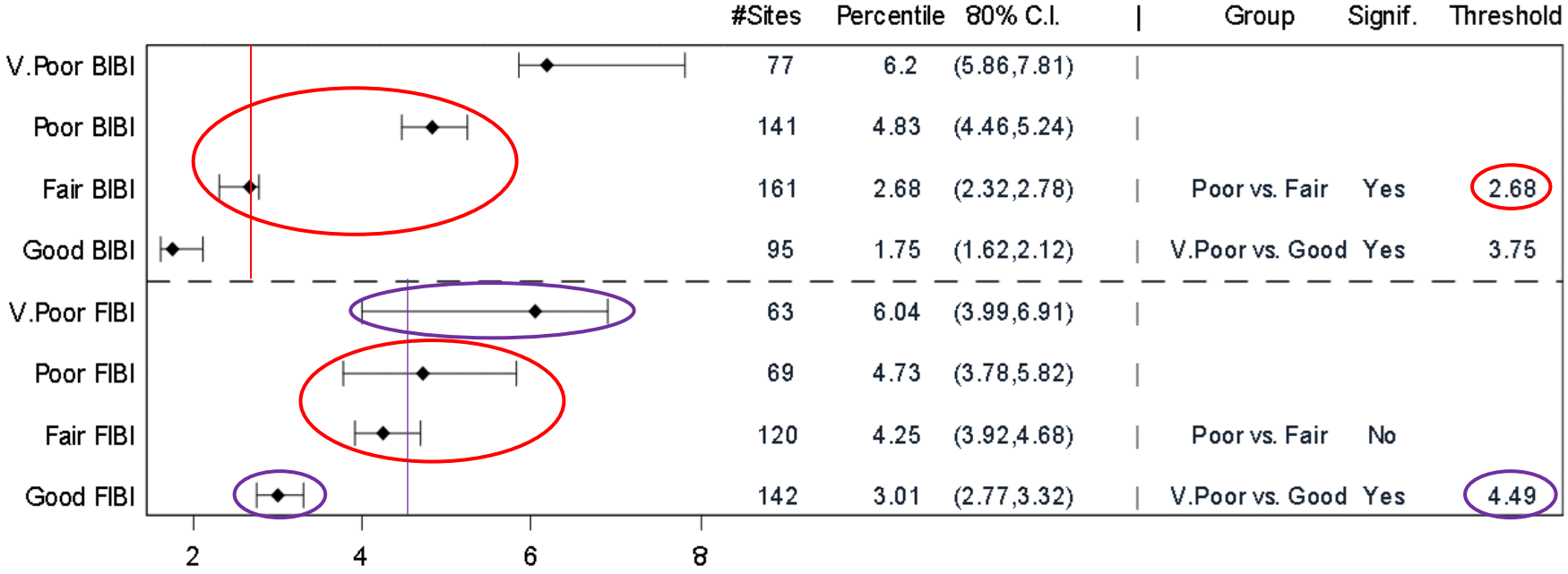
Parameter Thresholds

Each parameter was assigned a stressor threshold per eco-region, based on:

- Existing guidelines
- Statistical analysis on grouped responses: indicate levels above which degradation to biological communities is likely to occur
  - Compared stressor levels among different biological conditions
  - Bootstrapping
  - 90^{th} percentiles and 10^{th} percentiles calculated
  - Graphs displaying 80% confidence intervals of grouped percentile distributions and statistical significance tested

Parameter Thresholds

HIGH TOTAL NITROGEN, HIGHLAND



MD BSID

Two-way contingency table

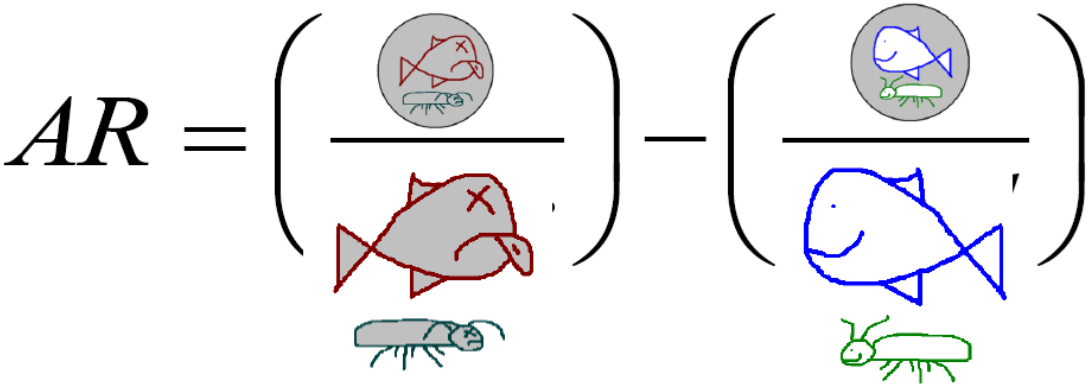
	Case	Control
Stressor above limit	a 	b 
Stressor below limit	c 	d 

Odds Ratio

$$\frac{ad}{bc} = \frac{\text{  }\quad\text{  }}{\text{  }\quad\text{  }}$$

MD BSID – Attributable Risk

The portion of the sites with poor to very poor biological conditions as a result of the stressor

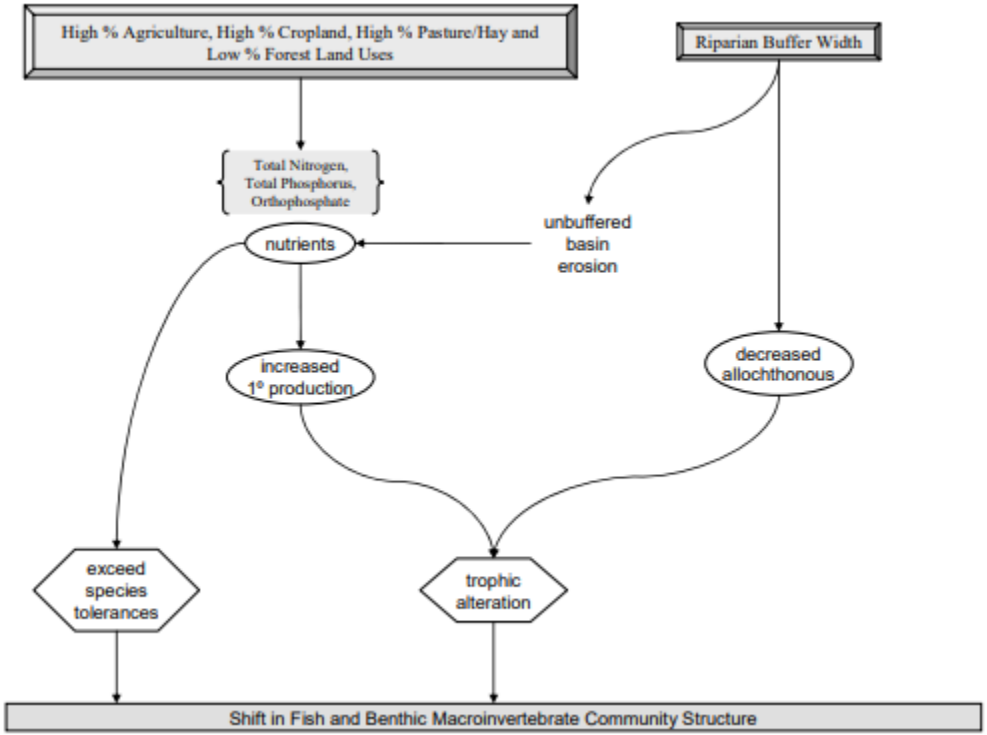


Also combined by categories of stressors and sources.

Catoctin Creek Example

Source Group	Percent of stream miles in watershed with poor to very poor Fish or Benthic IBI impacted by Parameter Group(s) (AR)	
Urban		95%
Agriculture	95%	
Barren Land		
Lack of Forest	95%	
Acidity		

Stressor Group	Percent of stream miles in watershed with poor to very poor Fish or Benthic IBI impacted by Parameter Group(s) (AR)	
Sediment	----	83%
In-Stream Habitat	----	
Riparian Habitat	34%	
Water Chemistry	83%	


High % Agriculture, High % Cropland, High % Pasture/Hay and Low % Forest Land Uses
Riparian Buffer Width
Total Nitrogen, Total Phosphorus, Orthophosphate
unbuffered basin erosion
nutrients
increased 1° production
decreased allochthonous
exceed species tolerances
trophic alteration
Shift in Fish and Benthic Macroinvertebrate Community Structure

Thank you

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