Department of the Environment

Refinements to Maryland's Biocriteria Listing Methodology (BLM)

for Integrated Reporting

Matthew Stover

Maryland Department of the Environment

Acknowledgements

- Maryland Department of Natural Resources
- Versar
- EPA Office of Research and Development

What Is the Biocriteria Listing Methodology (BLM) and Why Is It Important to MD?

- Set of rules and methods that MD uses to assess biological data (usually MBSS) collected from non-tidal wadeable streams for the List of Impaired Surface Waters [303(d)/305(b) List]
- Results are used to prioritize follow-up monitoring, stressor ID, and TMDL development
- Restoration money may be tied to having a watershed on the 303(d) List

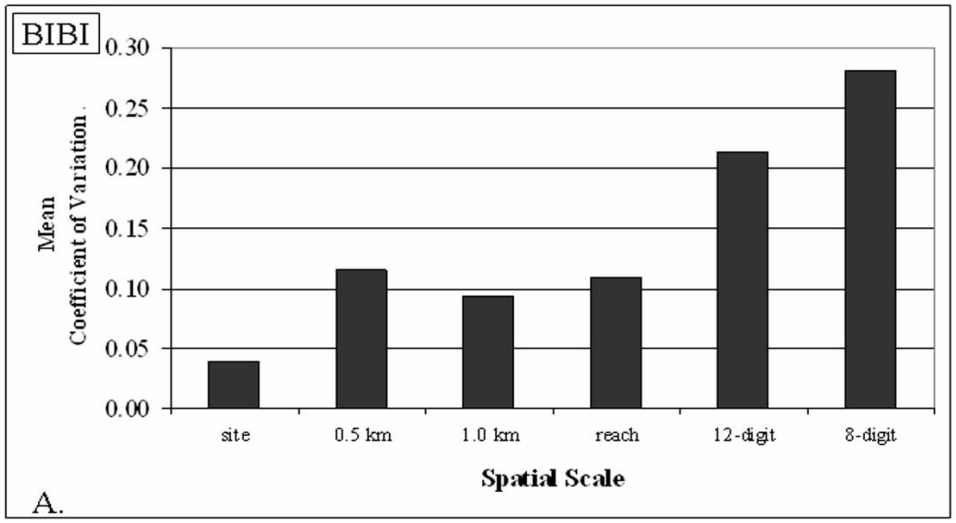
Why Am I Presenting MD's BLM?

- Effective way to use probabilistic data to assess Maryland's primary water quality management scale – MDE uses a watershed-based approach
- Perhaps might be useful to other agencies who have or collect probabilistic data

Goals for the New BLM

1. Consider multiple sources of uncertainty
2. Maximize the advantages of probabilistic monitoring
3. Maintain consistency with Maryland's water quality management scale (8-digit watersheds)
4. Be able to calculate the extent of degradation

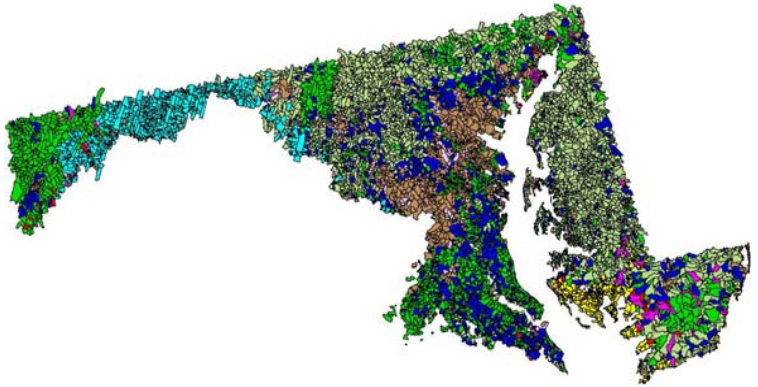
Spatial Variability

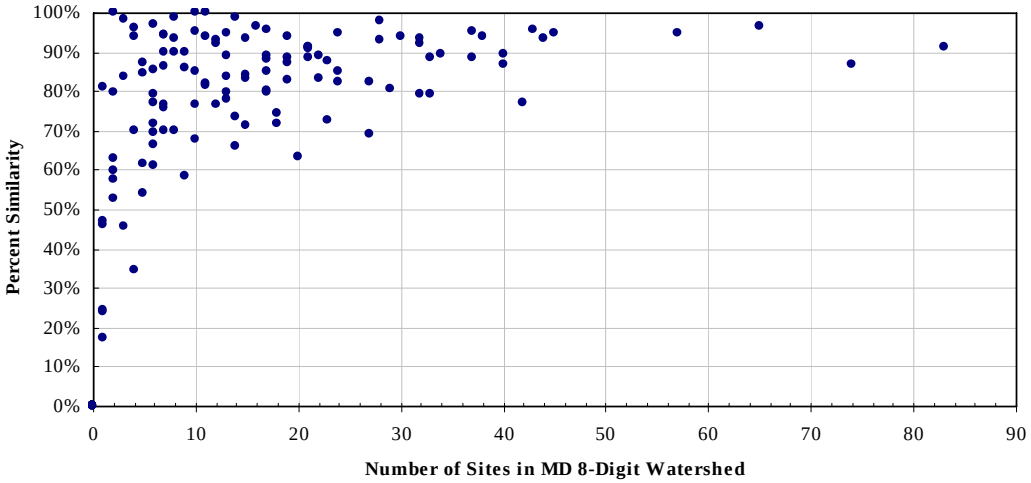


- A study by Southerland et. al. (2007) provided evidence that single samples were not representative of larger watersheds

Spatial Variability
Watershed Heterogeneity

- Assessed using the distribution of landscape clusters (groups of similar landscape conditions)
  - land use
  - land use change
  - soil erodibility
  - Slope
  - precipitation
- Nine distinct cluster types
- Compared to distribution of R1/R2 MBSS sites
- At roughly 10 sites, on average there is 85% similarity



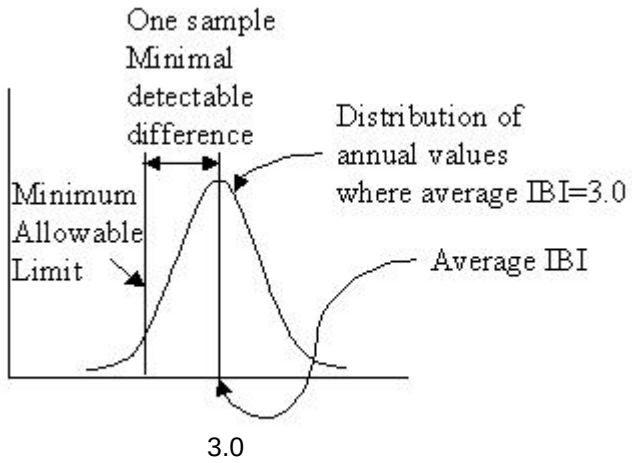


Temporal Variability

- IBI values can vary in time due to climatic and other natural factors
- MDE defines a degraded site as having an average annual IBI<3.0
- Since MBSS generally samples a site one time, what is minimum detectable limit for determining a site degraded when using one sample?
- MDE used information from sentinel sites for analysis

Temporal Variability

- Determine minimum detectible difference when using a single value in time (assume variation based on 5 years of data at sentinel sites)



•Assuming an average site IBI of 3.0 as passing and using the lower 10th percentile of normal distribution, a site with one sample in time is degraded if :

–BIBI<2.65, (cv=9%, n=17)

–FIBI<2.50, (cv=13%, n=15)

Watershed Assessment

- Null Hypothesis: The percentage of degraded sites in the study watershed are similar to the population of degraded sites within a reference watershed.
- Uses 90% one-sided exact binomial confidence intervals.
- Classification of pass must have a precision <25%. If precision is >25% then watershed cannot be assessed as healthy or degraded.

Watershed Assessment

Total Number of Random Sites in Assessment Unit	Maximum Number of Degraded Samples in Assessment Unit to be Classified as Pass (Category 2)	Minimum Number of Degraded Samples in Assessment Unit to be Classified as Fail (Category 5)
≤7	(c)	3 (d)
8-11	2	3
12-18	3	4
19-25	4	5
26-32	5	6
33-40	6	7
41-47	7	8
48-55	8	9
56-63	9	10
64-71	10	11
72-79	11	12

Notes:

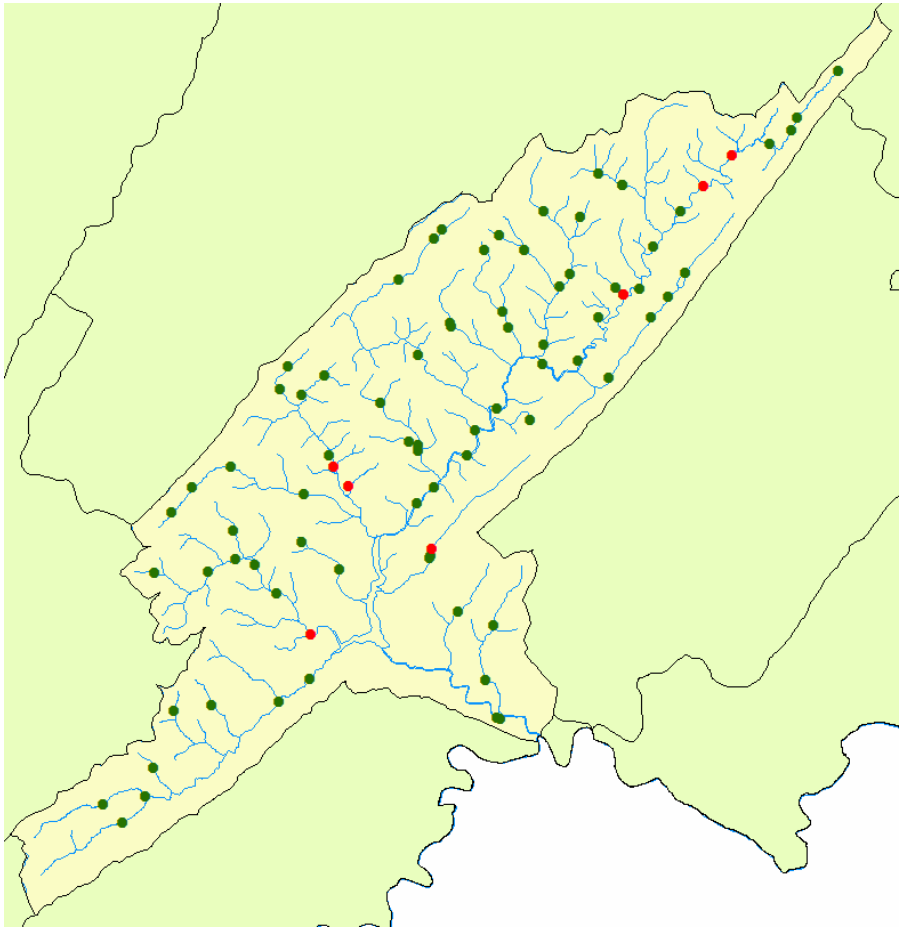
- Using 90% one-sided exact binomial confidence intervals.
- Classification of pass must have a precision <25%.

c. If n<=7 and at least 6 samples are not degraded then watershed classified as Pass (Category 2).

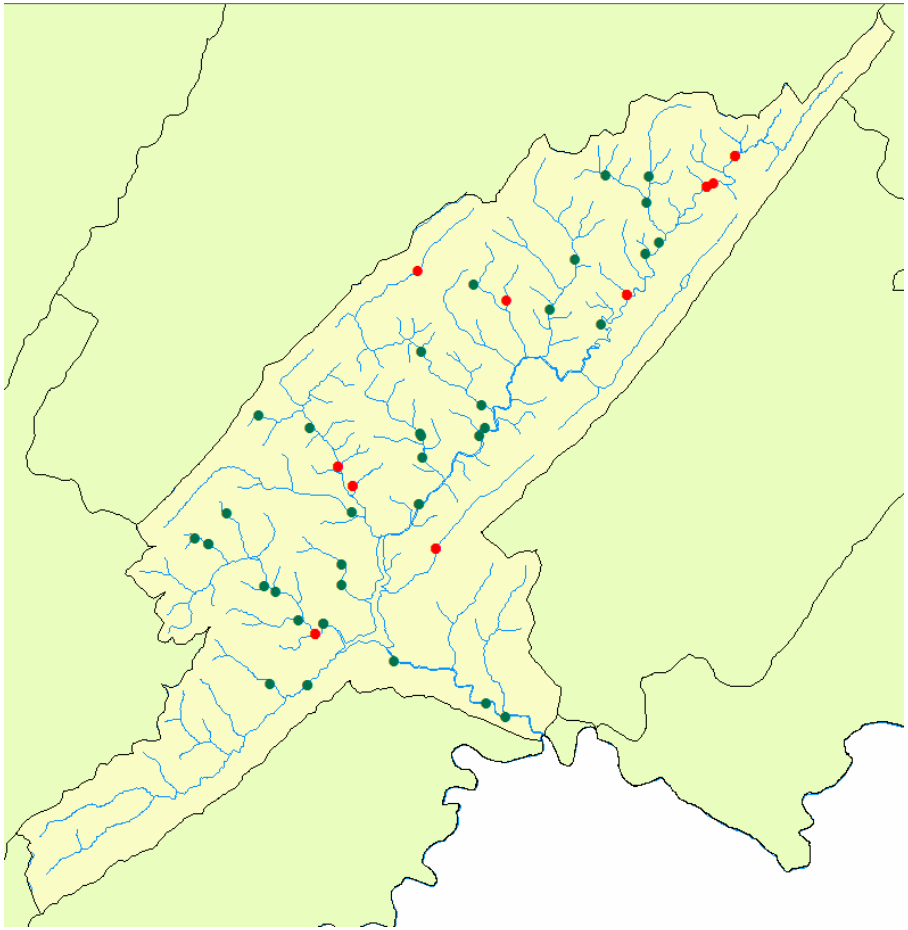
d. If n<=7 and 3 or more samples are degraded then watershed classified as Fail (Category 5).

Similar to Reference
Supports Use - Category 2

Hypothetical Reference Condition

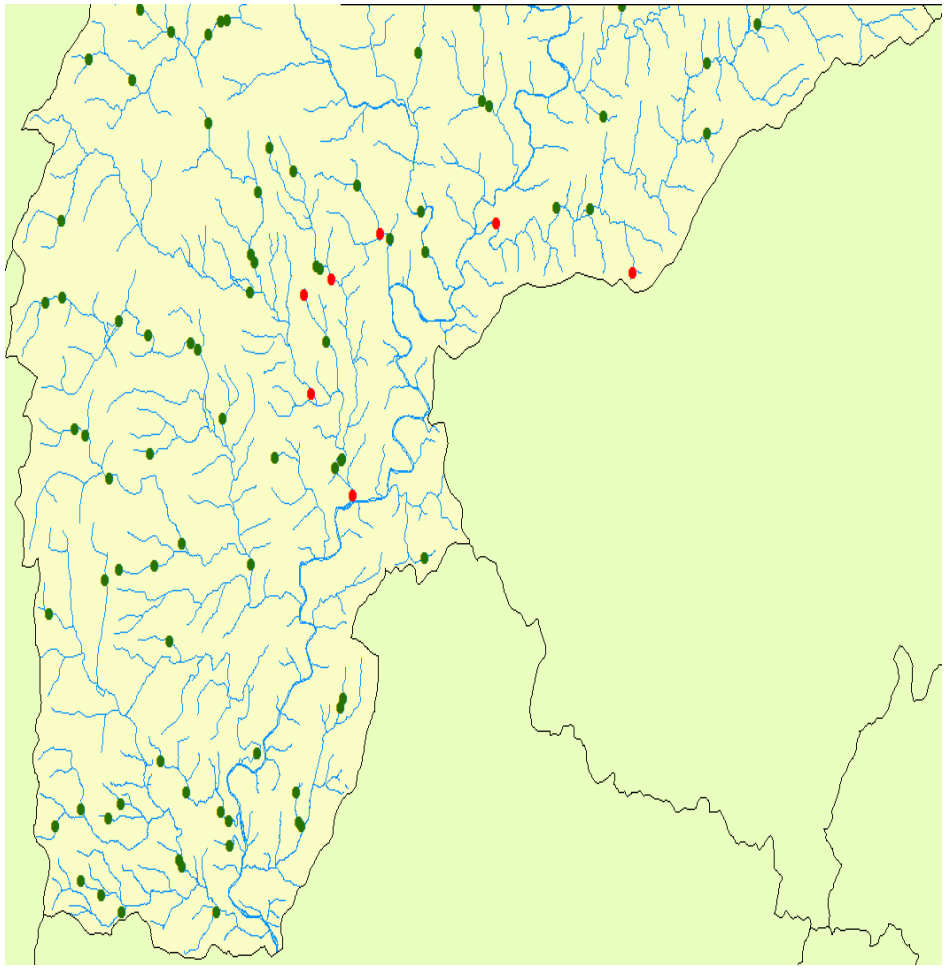


Savage River Watershed

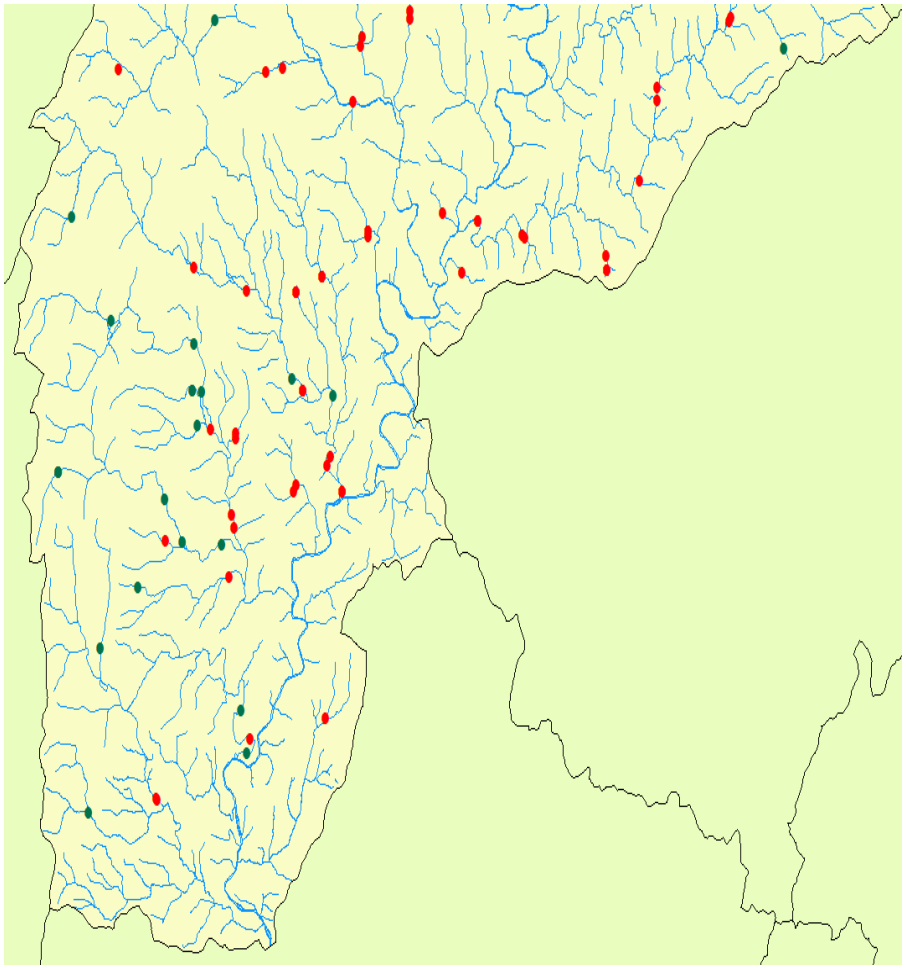


Different from Reference
Fail – Category 5

Hypothetical Reference Condition



Upper Monocacy River Watershed



Results

Integrated Report Final Status	Number of 8-digit Watersheds	Stream Miles (a)	% of Total Stream Miles (a/9,199)	Stream Miles with F or B-IBI<3 (b)	% of Stream Miles with F or B-IBI<3 (b/a)	% of Total Stream Miles with F or B-IBI<3 (b/9,199)	Integrated Report of Watershed Stream Miles Impaired (c)	Integrated Report of % of Total Watershed Stream Miles Impaired (c/9,199)
Category 2	24	1,750	19%	234	13%	3%	0	0
Category 3 (Inconclusive)	19	488	5%	183	37%	2%	NA	NA
Category 3 (No data)	25	148	2%	0			NA	NA
Category 4 or 5	70	6,813	74%	3,494	51%	38%	3,494	38%
Total	**138**	**9,199**	**100%**	**3,911**	**43%**	**43%**	**3,494**	**38%**

Conclusions

- This methodology provides a defensible and understandable method for assessing biological impact at the watershed scale using a probabilistic survey design.
- By being able to report the % of stream miles impaired (within a watershed) rather than give a binary response it will allow us to show incremental progress towards achieving water quality
- In addition, it allows us to report the % of stream miles attaining for protection purposes

Lee Currey

TMDL Technical Development Program

Matthew Stover
Environmental Assessments & Standards Program

Science Services Administration
Maryland Department of the Environment

1800 Washington Boulevard | Baltimore, MD 21230-1718
410-537-3000 | TTY Users: 1-800-735-2258
www.mde.state.md.us