Validation and Refinement of a Stream Salamander IBI for Maryland

AMAAB, Cacapon, WV

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March 31, 2010

Acknowledgements

- Scott Stranko, *Maryland Biological Stream Survey, Maryland Department of Natural Resources*

- Rachel Gauza, *Montgomery County Department of Environmental Protection*

- Robin Jung Brown, *formerly USGS-Patuxent Wildlife Research Center*

Outline

- Why Stream Salamanders?

  – Utility as indicators

  – Maryland Biological Stream Survey (MBSS)

- Stream Salamander Index of Biotic Integrity (IBI) for Maryland

  – SS-IBI Development

  – Implementation

  – Validation and Refinement

- Conclusions

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Stream Salamanders as Indicators

- Ubiquitous

- Abundant

- Life history (longevity, long aquatic larval periods, relatively stable populations, small home ranges)

- Physiology (moist, permeable skin required for respiration)

- Responds to multiple stressors

➢ **Good indicators of environmental health**

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Stream Salamanders in Maryland

- N. two-lined salamander, *Eurycea b. bislineata*

- Longtail salamander, *Eurycea l. longicauda*

- N. dusky salamander, *Desmognathus f. fuscus*

- Mtn. dusky salamander, *Desmognathus ochrophaeus*

- Seal salamander, *Desmognathus monticola*

- Red salamander, *Pseudotriton ruber*

- Eastern mud salamander, *Pseudotriton montanus*

- N. spring salamander, *Gyrinophilus p. porphyriticus*

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Eurycea

E. bislineata adult

E. bislineata larvae

E. longicauda

Desmognathus

D. monticola

D. ochrophaeus

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D. fuscus

Pseudotriton ruber

Pseudotriton montanus

Gyrinophilus porphyriticus

Maryland Biological Stream Survey

- Sampled more than 3,000 stream sites over three Rounds (1995-1997, 2000-2004, 2007-2009)

- Uses probability-based design stratified on watershed and stream order

- Measures water chemistry, physical habitat, and biological communities

- Developed reference-based indicators of integrity for fish, benthic invertebrates, and physical habitat

➢ **Round 3 added sampling for streamside salamanders at all sites**

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Indicator Development and Implementation

- Develop sampling methods
- Create indicator development dataset
- Develop indicator that works
- Implement sampling in large-scale monitoring
- Validate or refine indicator for
  - Practical sampling methods
  - Full range of streams

➤ **Final indicator**

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Development of SS-IBI

- Developed electrofishing, quadrat, and transect sampling methods
- Developed four metric SS-IBI for Non-Coastal Plain Maryland with 90% classification efficiency
  - Number of species
  - Number of salamanders
  - Percentage of adults
  - Percentage of intolerants
- Estimated that stream salamander searches would require 10% increase in sampling effort of MBSS

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Indicator Validation

- Apply original SS-IBI to salamander sampling results from
  - MBSS Round 3
  - Montgomery County, Maryland, Department of Environmental Protection (DEP)
- If results are good, validation is complete
- If results are significantly poorer, refine the SS-IBI, considering
  - Sampling methods
  - Stream types sampled

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Salamander Sampling Methods

- 15-m transects
  - Turn all cover
- 4-m^2 quadrats
  - Rake all substrate
- Electrofishing

4-m2
Quadrats

MBSS 75-m Segment

15-m Transects

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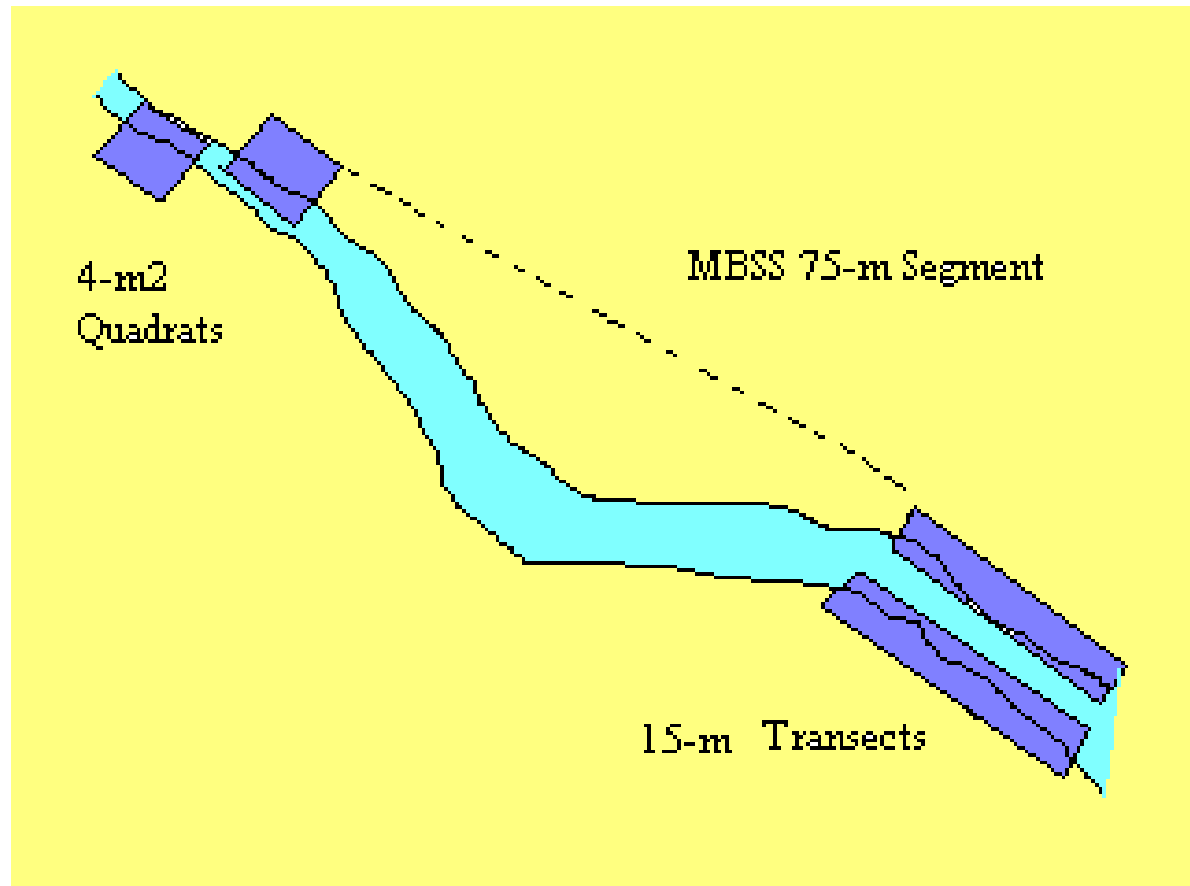
Salamander Sampling Methods

- Original SS-IBI used two parallel 15-m transects and two 2-m by 2-m quadrats

- MBSS Round 3 used single 25-m transect and electrofishing

  ➢ **Transect sampled on bank selected at random for unbiased estimates of salamander numbers**

- Montgomery County used 25-m transect and electrofishing methods

  ➢ **Transect sampled on bank selected for "best available habitat"**
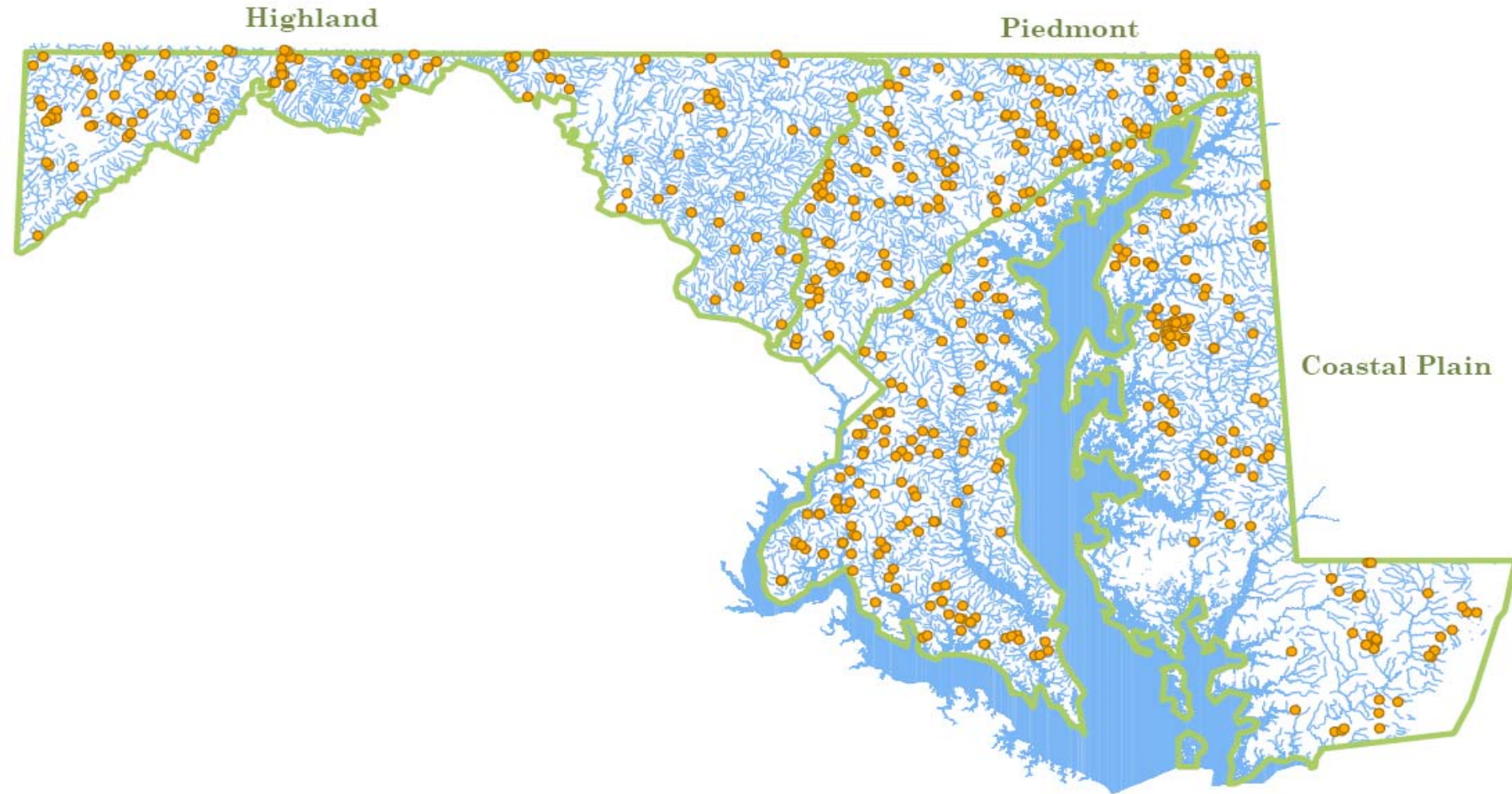
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SS-IBI Validation Result

- Classification efficiencies (CE) for Reference sites < 50%

  ➢ **This is inadequate for Final Indicator**

- Need to investigate
  - Sampling methods
  - Stream types sampled

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SS-IBI Salamander Sites
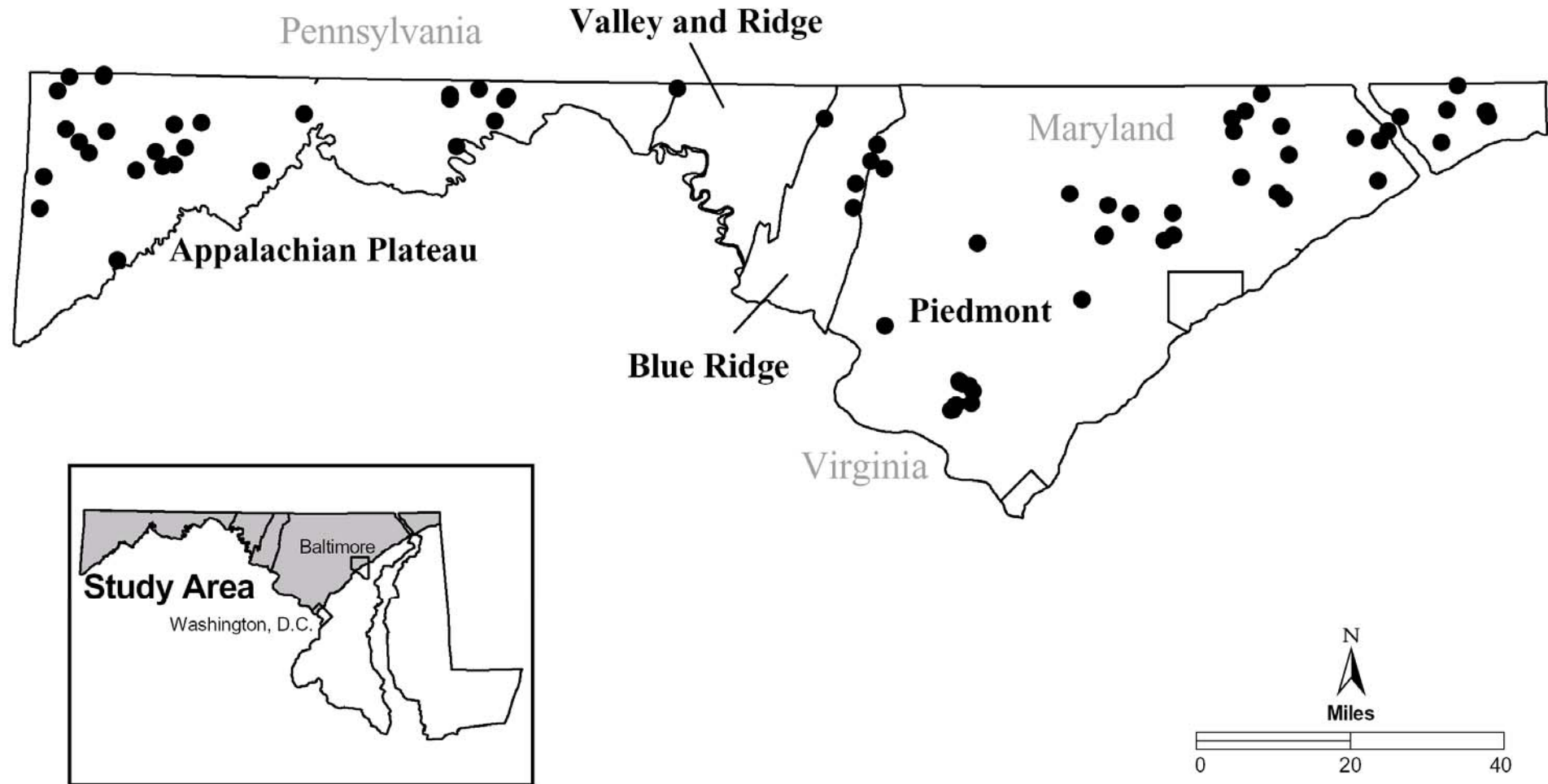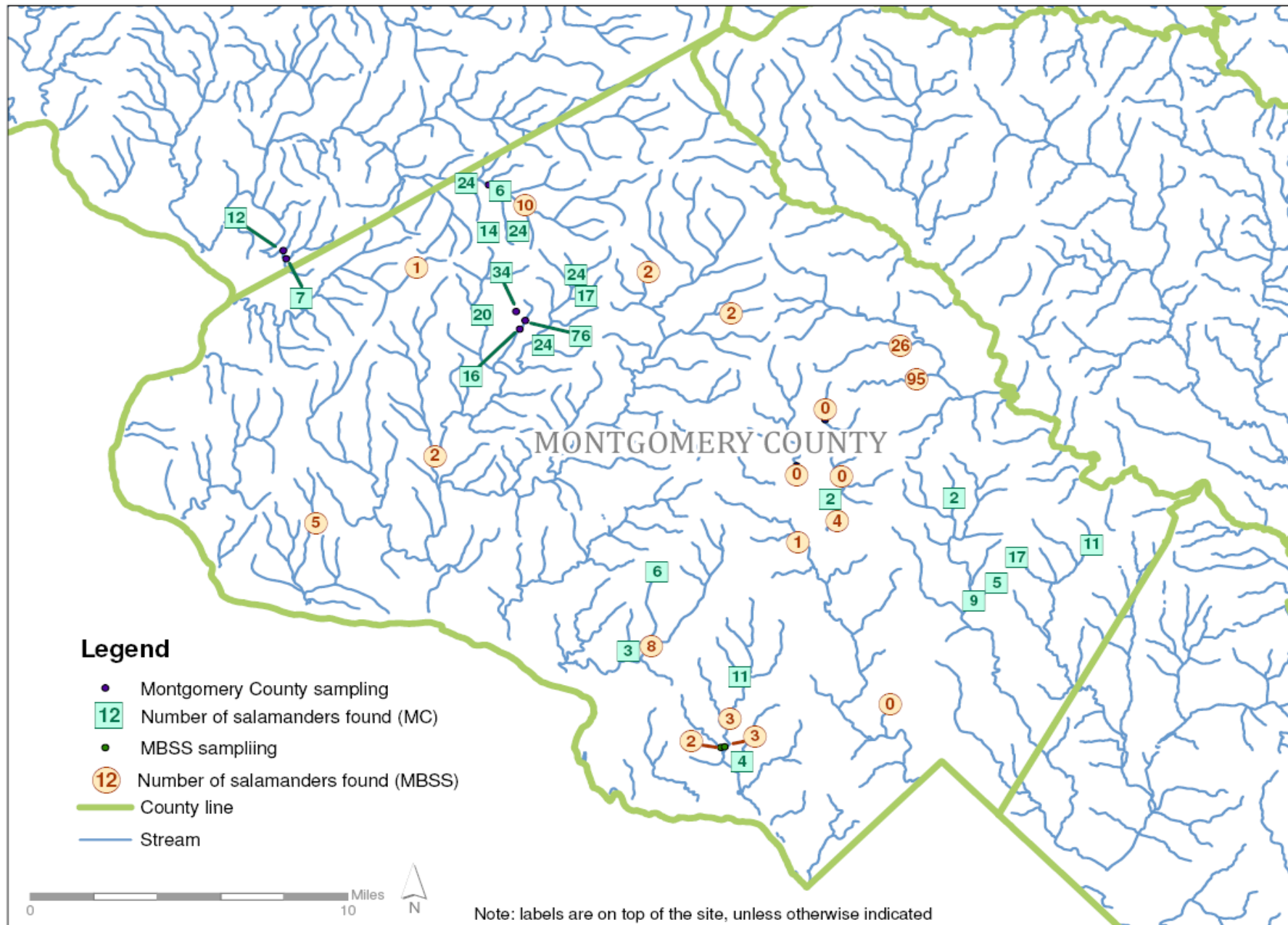
MBSS Salamander Sites
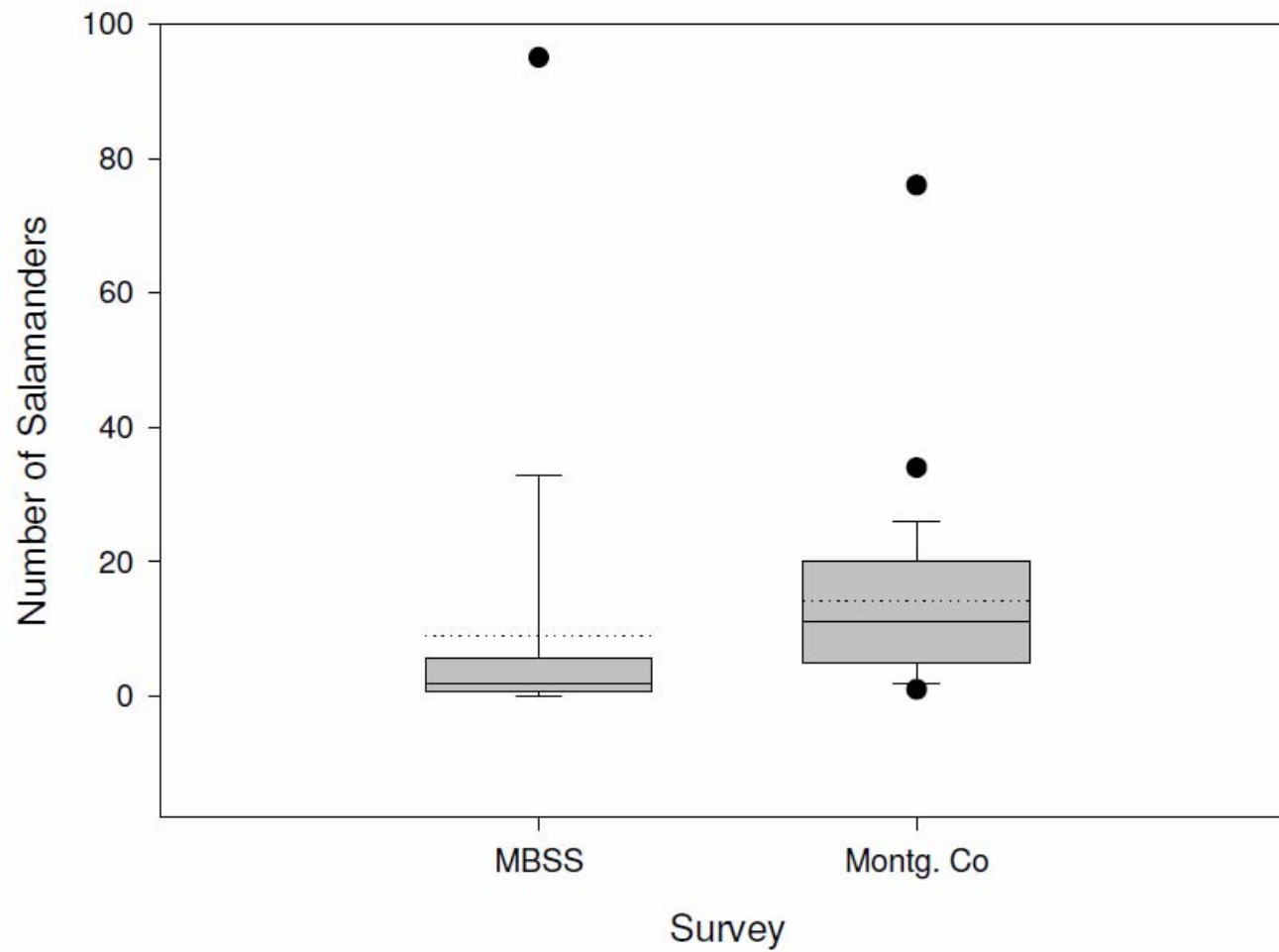
MBSS Salamander Data

- In Round 3 MBSS collected 3262 stream salamanders at 558 sites sampled (including Coastal Plain)

- *Eurycea bislineata* comprised 84% of all salamanders collected

- 273 sites (49% of sites) had 0 salamanders

➢ **Use of random bank choice results in many zero sites**

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MC Salamander Data

- In 2009 Montgomery County DEP collected 385 stream salamanders at 27 sites sampled

- *Eurycea bislineata* comprised 92% of all salamanders collected

- No sites had 0 salamanders

➢ **Use of "best available habitat" strengthens indicator**

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Legend

- • Montgomery County sampling
- 12 Number of salamanders found (MC)
- • MBSS sampliing
- 12 Number of salamanders found (MBSS)
- —— County line
- —— Stream

Miles

0   10   N

Note: labels are on top of the site, unless otherwise indicated

MONTGOMERY COUNTY

SS-IBI Validation

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Number of Salamanders
MBSS in Montg. Co. vs. Montg. Co.

Sampling Method

	All Sites		Reference Sites	
	Number Individuals	Number of Intolerants	Number Individuals	Number of Intolerants
2001-2002	25	6	26	11
2007-2009	6	1	14	3
MontCo	14	2		

- Sampling methods results:
  - SS-IBI > MC DEP > MBSS

➢ **Revise threshold from 5 to 3.75 to accommodate lower sampling numbers**

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Stream Types Statewide

- How does the range of stream types sampled by the original SS-IBI development dataset compare with the Maryland statewide streams sampled by MBSS Round 3?
    - More "reference" sites with 0 salamanders
        - All these sites are streams larger than $1mi^2$ (640 ac)
    - More high SS-IBI sites with lower % forest in catchment
        - All are small streams with good riparian buffer
    - ➢ **Allow good riparian to substitute for forest in catchment**

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Focus on Small Streams

SS-IBI Scores at Reference and Degraded Sites (All Sites)

SS-IBI Scores at Reference and Degraded Sites
(Catchment < 300 ac)

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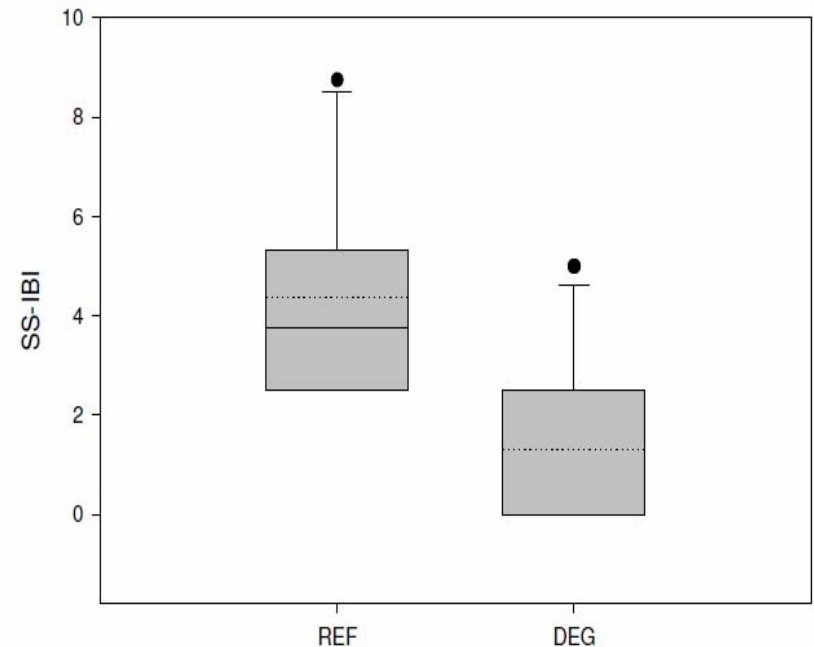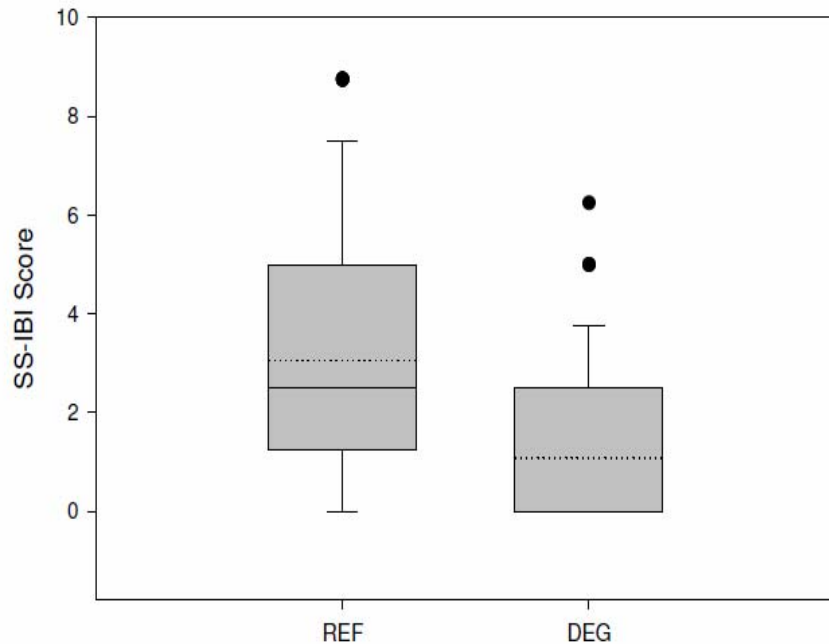
Focus on Small Streams

- For Non-Coastal Plain streams:

	Sites Catchment < 300 ac	Sites All Streams
Reference	10	79
Degraded	22	103

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Focus on Small Streams

- For Non-Coastal Plain streams:

	CE Catchment < 300 ac	CE All Streams
Reference	70%	43%
Degraded	86%	73%
Total	81%	60%

➢ **Restrict SS-IBI to small stream < 300 ac**

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Conclusions

- SS-IBI is not effective on full range of stream types in Maryland

- **Restrict SS-IBI to small streams < 300 ac (essentially a vertebrate IBI, where salamanders substitute for fish)**

- SS-IBI can be adjusted to perform well in with sampling methods practical in large-scale monitoring

- **Revise degradation threshold from 5 to 3.75 to accommodate lower salamanders**

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