Prioritizing Areas for the Conservation of Stream Biodiversity in Maryland:

Dealing with The Biotic Homogenization Problem

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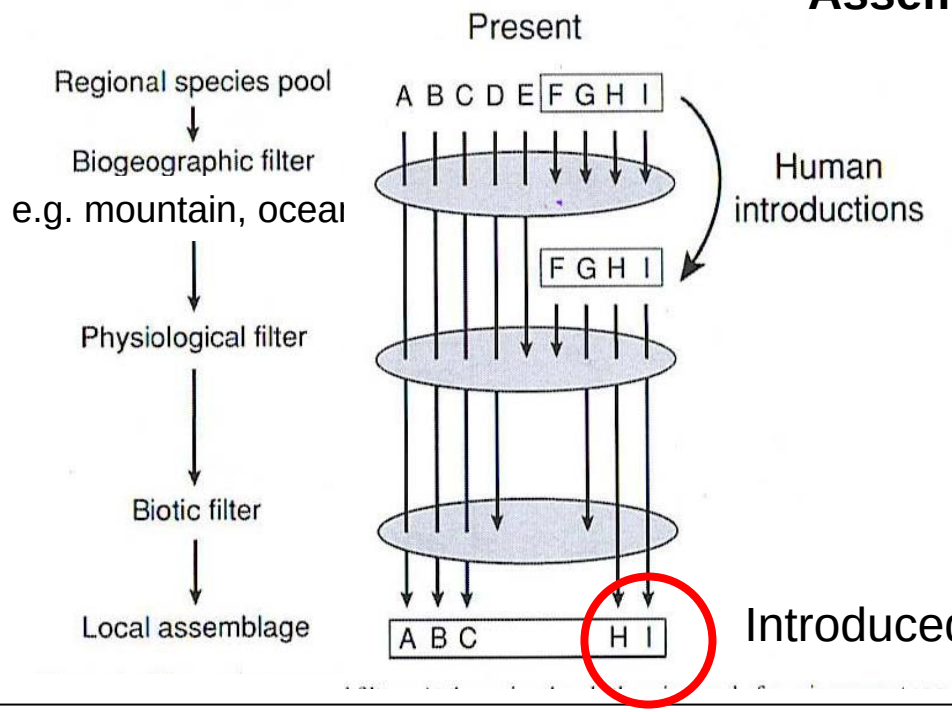
MARYLAND
DEPARTMENT OF
NATURAL RESOURCES

MARYLAND BIOLOGICAL STREAM SURVEY

?

Biotic Homogenization is Occurring

Definition of Biotic Homogenization (Olden and Rooney 2006; Rahel 2002)



Assemblages Become More Similar Due to Two Processes:

1.

Introduced species H and I

2. Extirpation

ABC	**HI**

ABC	**HI**

Homogenization of U.S. Fish Species Assemblages Over Time (Rahel 2000)

- **Reconstructed Historical (Pre-Settlement) Fish Assemblages by State**
- **Compared Current to Historical Assemblages**
- **Based on 196 Extirpations and 901 Introductions**

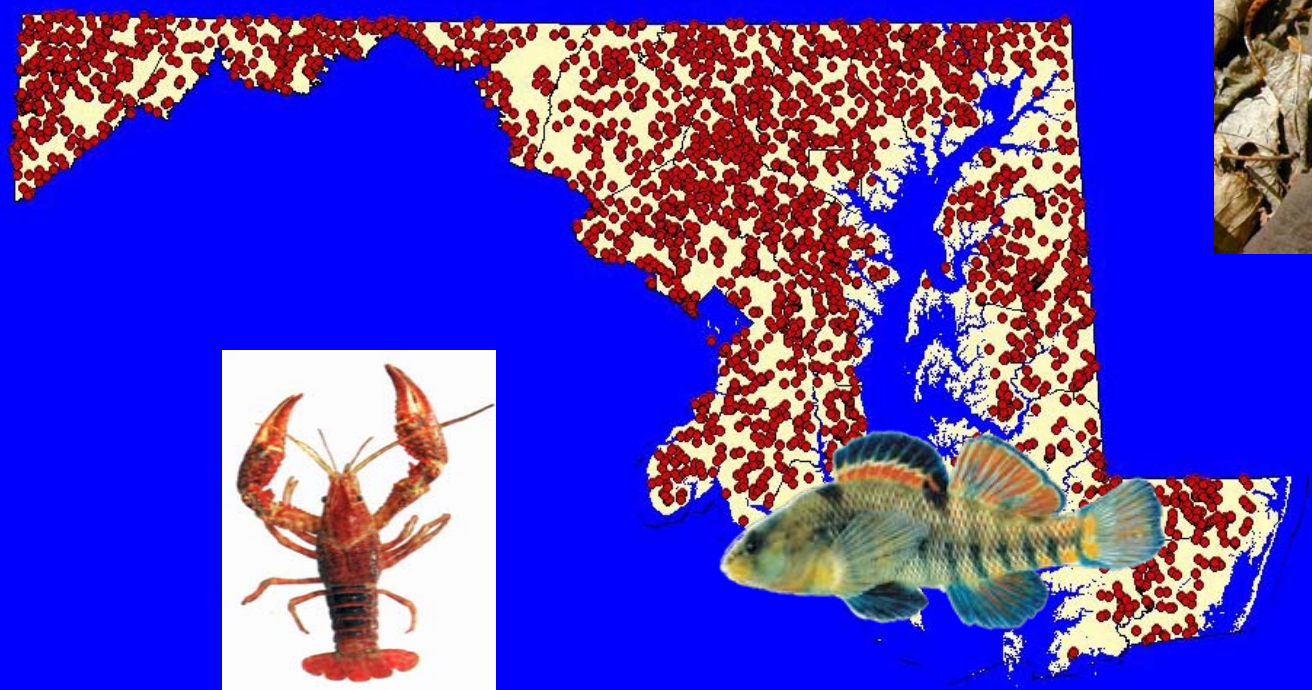
  -States Have Become More Similar*
  -Average 7.2% More Similar
  -A Much as 28% More Similar

*Based on Jaccard's Similarity Index

Biotic Homogenization In Maryland?

Goal:

Reconstruct Historical Stream Fish, Mussel, Crayfish, and Salamander Assemblages to Determine…



Reconstruct Historical Assemblages to Determine…

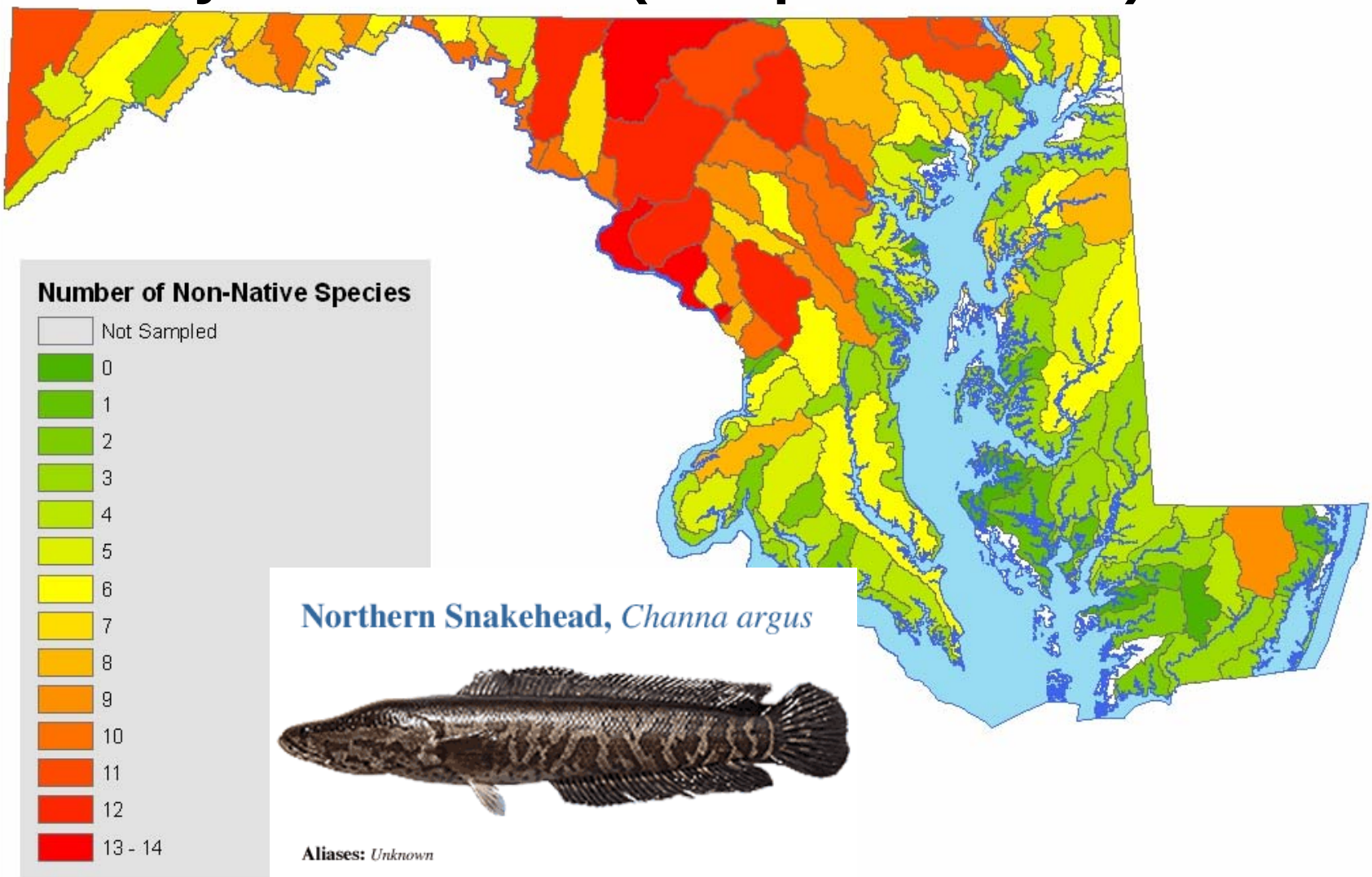
- Homogenization At Different Spatial Scales (e.g. watershed; geologic; site)

- Influence of:
    1. Introductions
    2. Extirpations….

in Homogenization

1. Introductions

Introduced Fish, Crayfish, Mussel Species in Maryland Streams (29 Species Total)



2. Extirpations:
Fish species that are presumed extirpated/extinct

Maryland darter

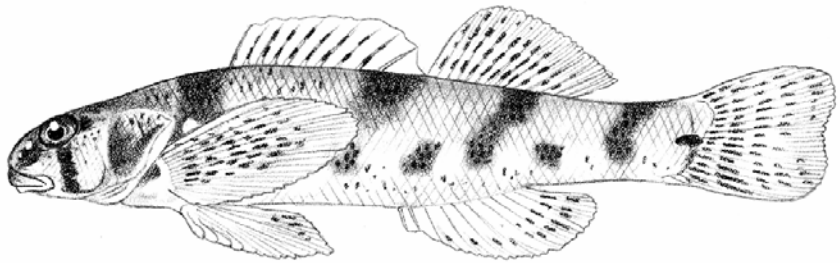
Bridle shiner

Longnose sucker

Redside dace

Cheat minnow

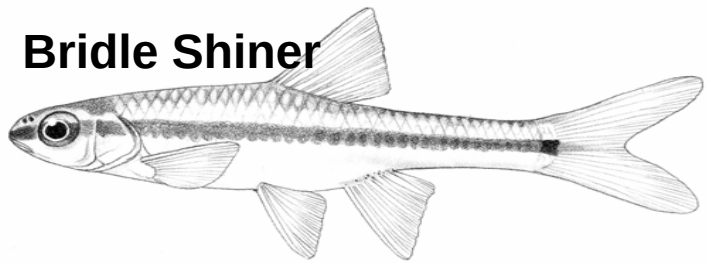
Trout perch



Maryland Darter

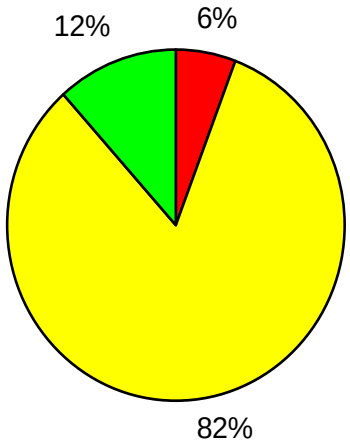
Only Extinct Darter Species

Bridle Shiner

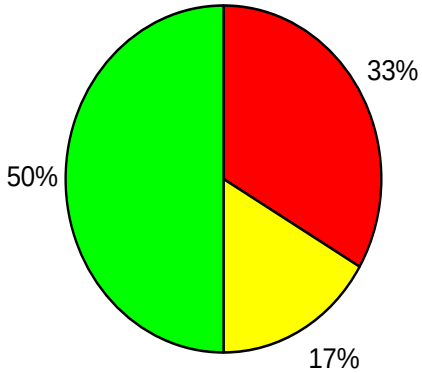


(Once in 24 (18%) MD Watersheds)

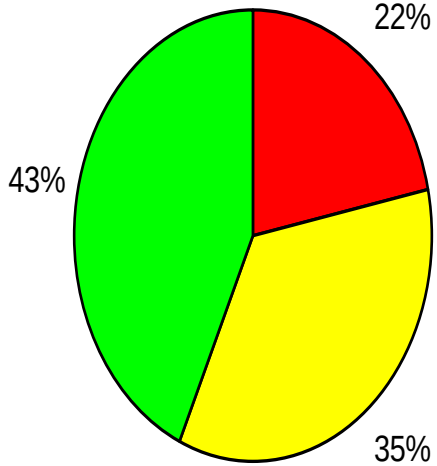
Current MD Stream-Dependent Species Composition



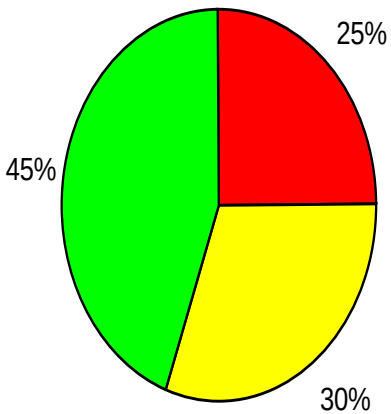
Freshwater Mussels



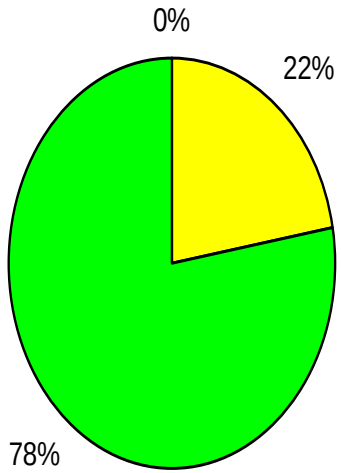
Crayfishes



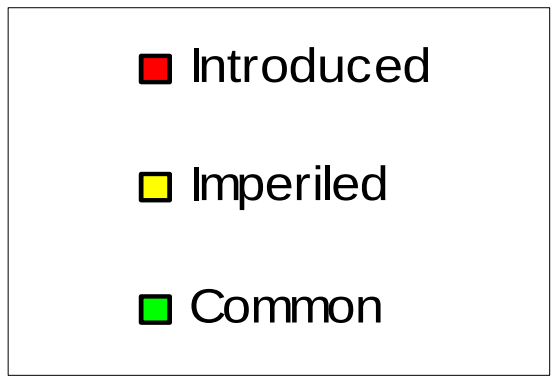
Combined (N=134 spp.)



Fishes



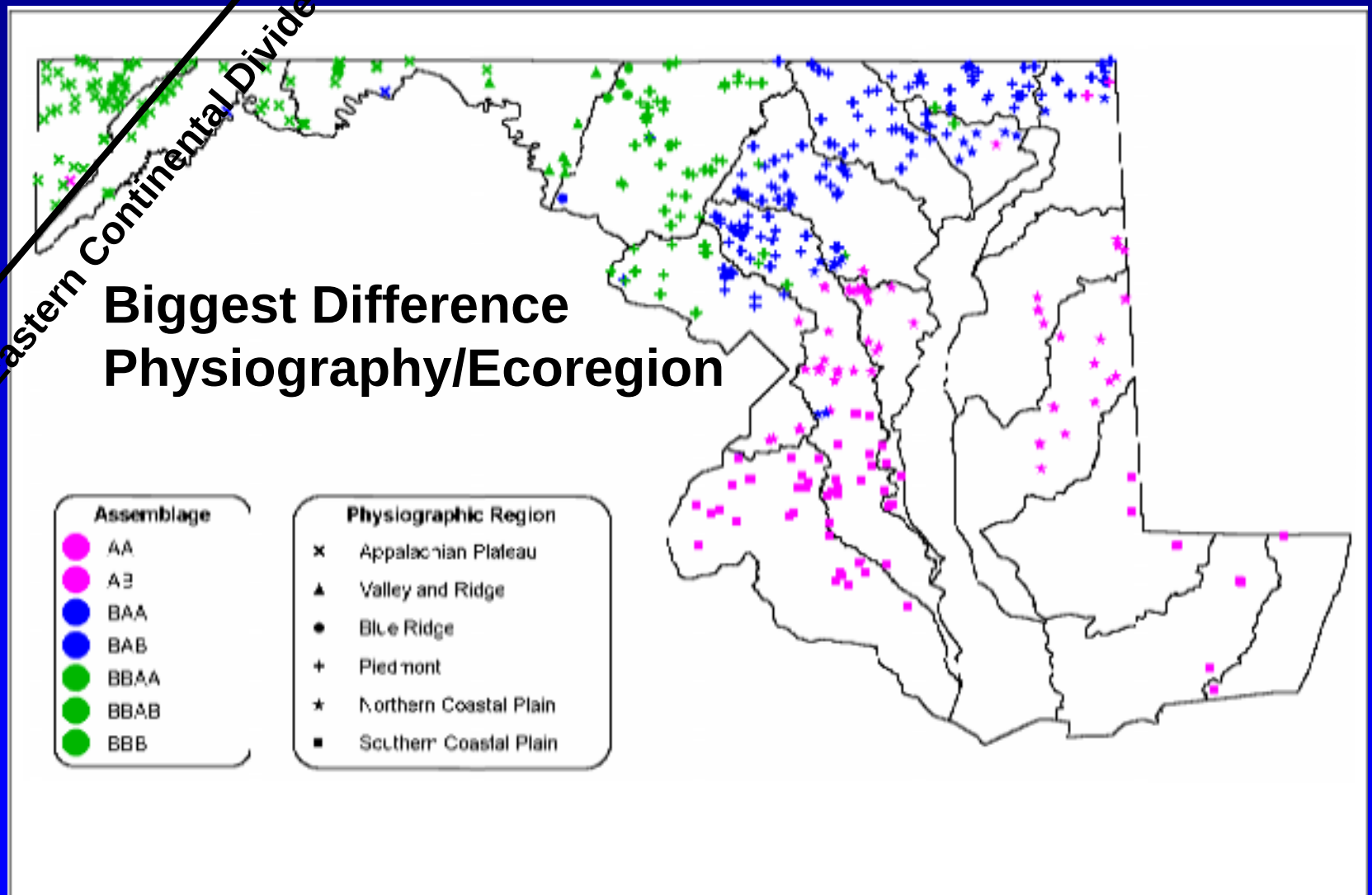
Salamanders



Knowing the Spatial Distributions of Species and The Distinct Assemblages is Important for Effective Bio-Assessment

Distinct Fish Assemblages For Bioassessment (IBI)

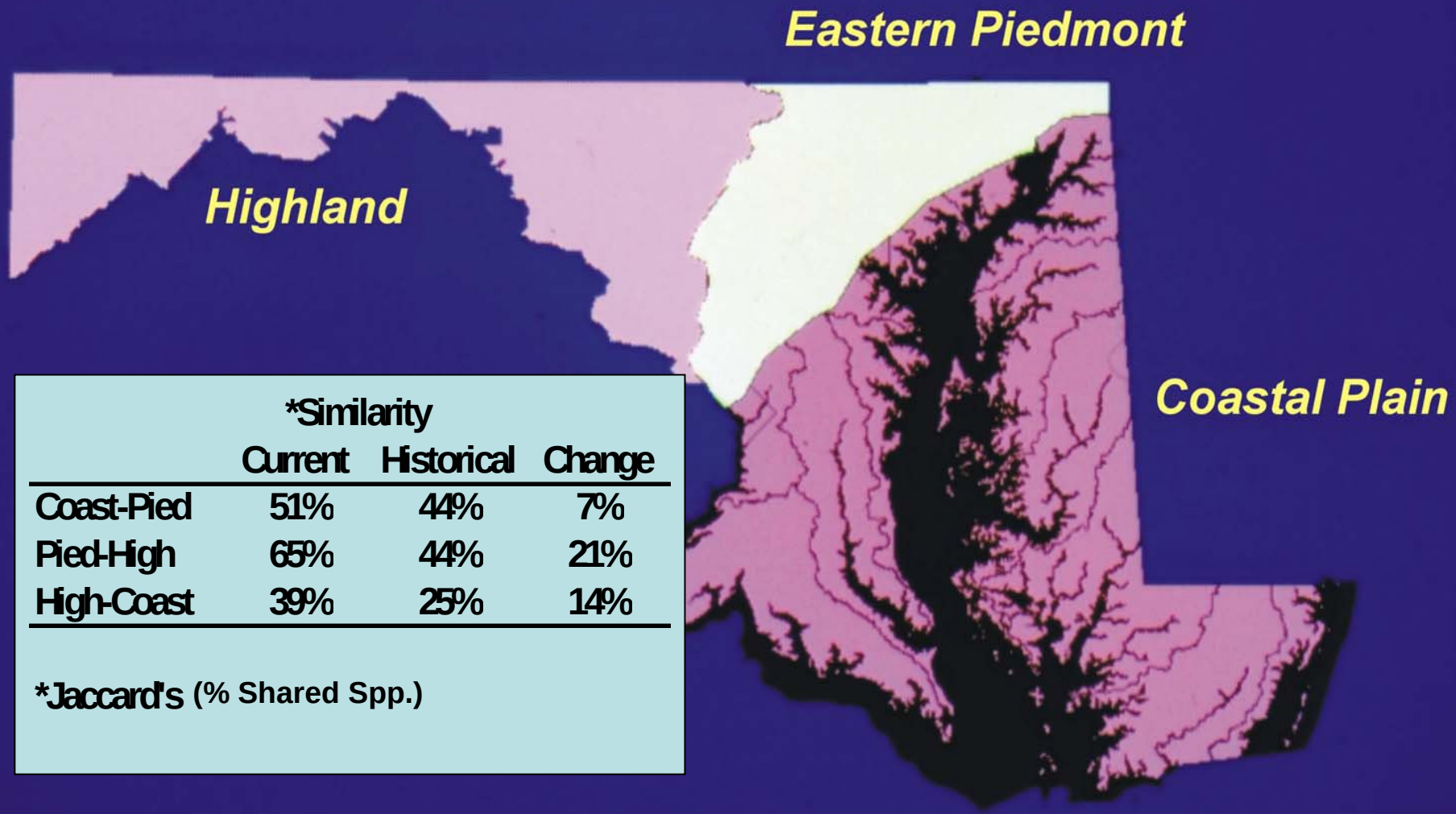
- Southerland et al. 2005: 14 Assemblages
- Kilian 2004: 16 Assemblages



Might Biotic Homogenization Have Affected the Determination of Assemblages?

Jaccard's Similarity Index Between River Basins and Eco-Regions

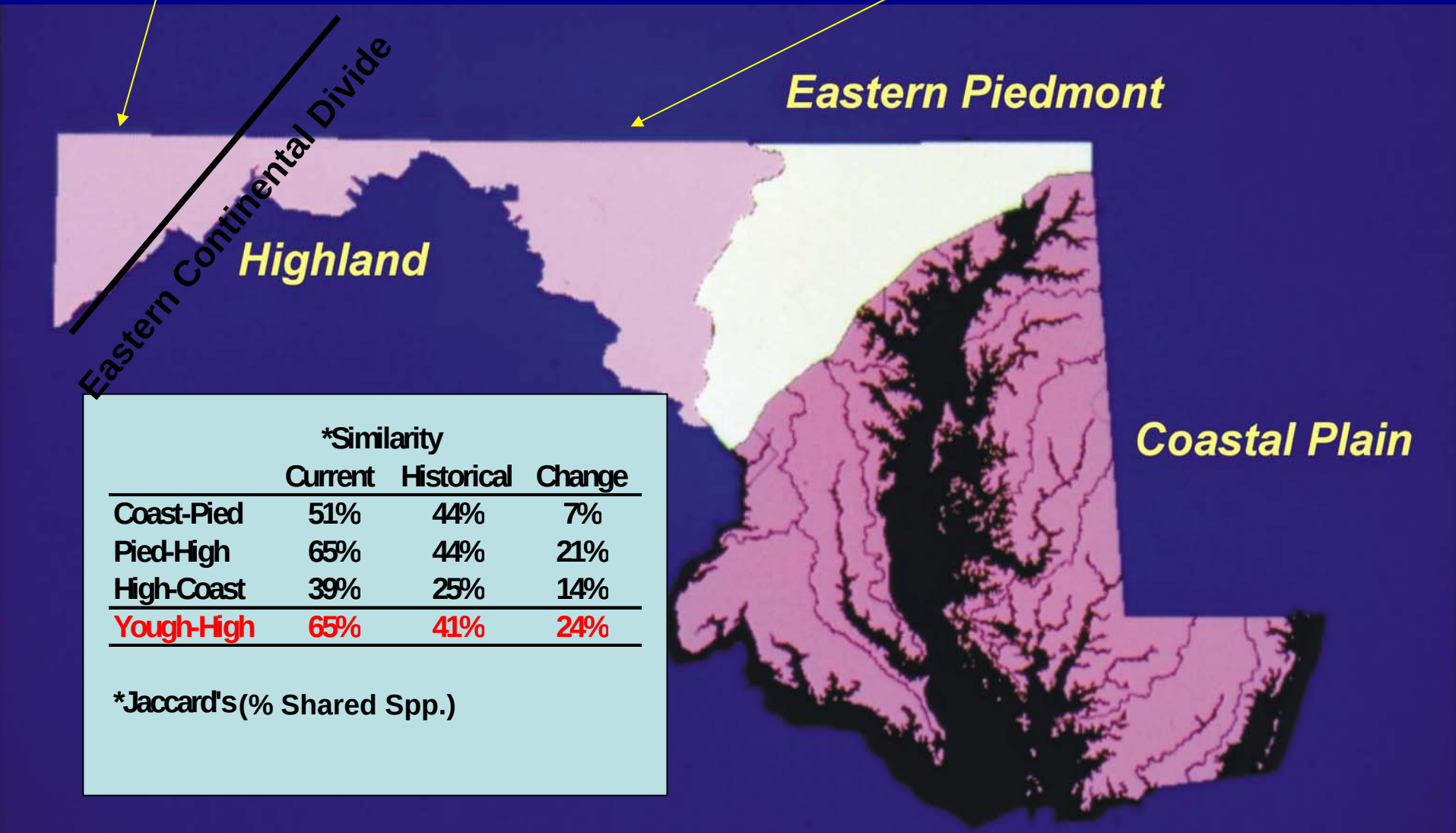
Homogenization of Three Fish IBI Regions



	*Similarity		
	Current	Historical	Change
Coast-Pied	51%	44%	7%
Pied-High	65%	44%	21%
High-Coast	39%	25%	14%

*Jaccard's (% Shared Spp.)

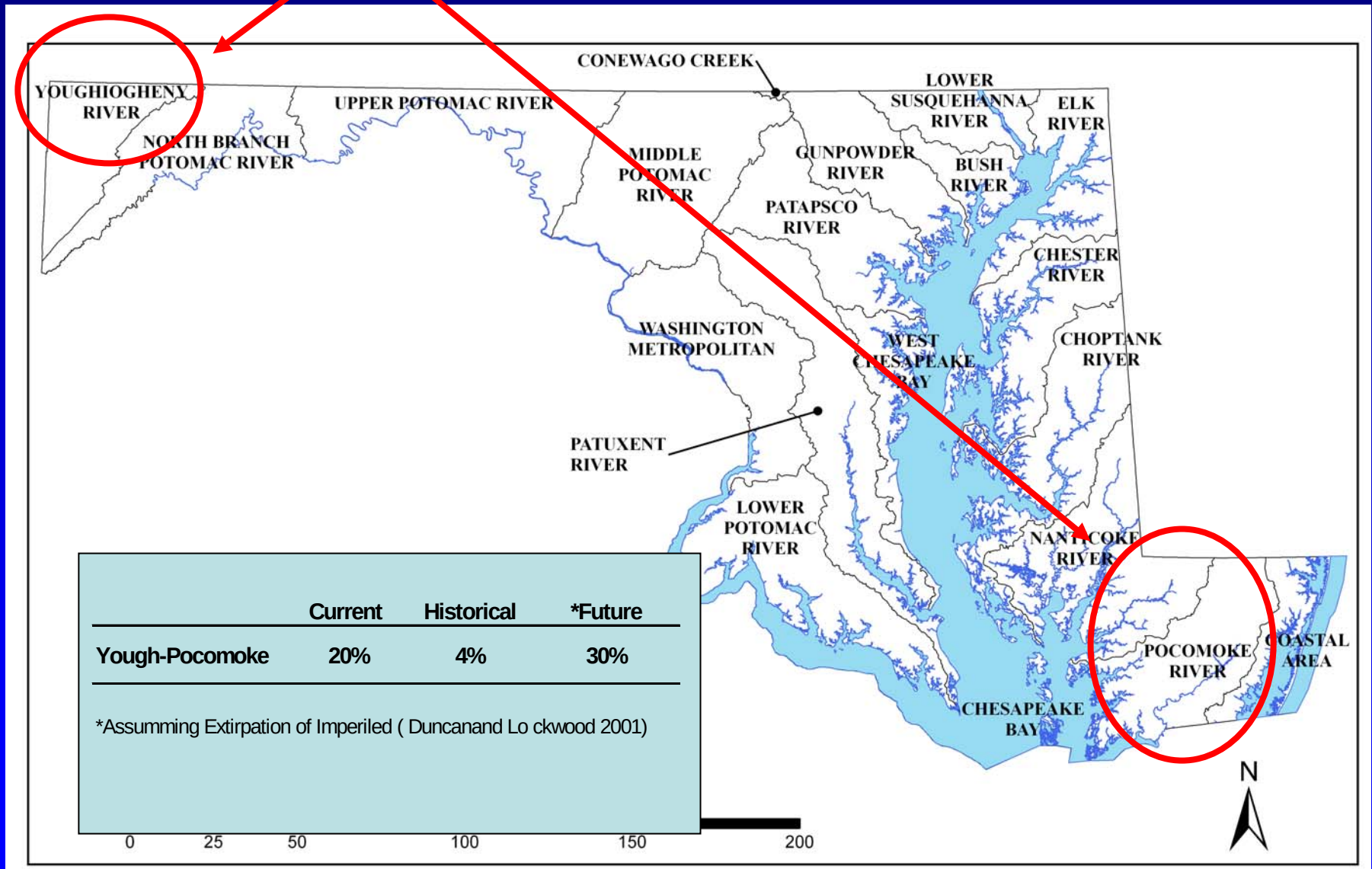
Youghiogheny Compared to Rest of Highland



	*Similarity		
	Current	Historical	Change
Coast-Pied	51%	44%	7%
Pied-High	65%	44%	21%
High-Coast	39%	25%	14%
Yough-High	65%	41%	24%

*Jaccard's (% Shared Spp.)

Compare Distant River Basins – Past, Present, and *Future



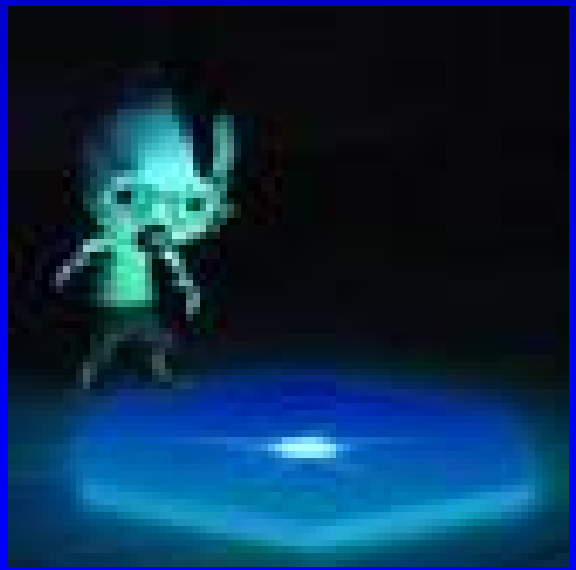
	Current	Historical	*Future
Yough-Pocomoke	20%	4%	30%

*Assumming Extirpation of Imperiled (Duncanand Lo ckwood 2001)

Chicken Little and the Acorn

It's Just an

Chicken Little the Hero



No it's Not

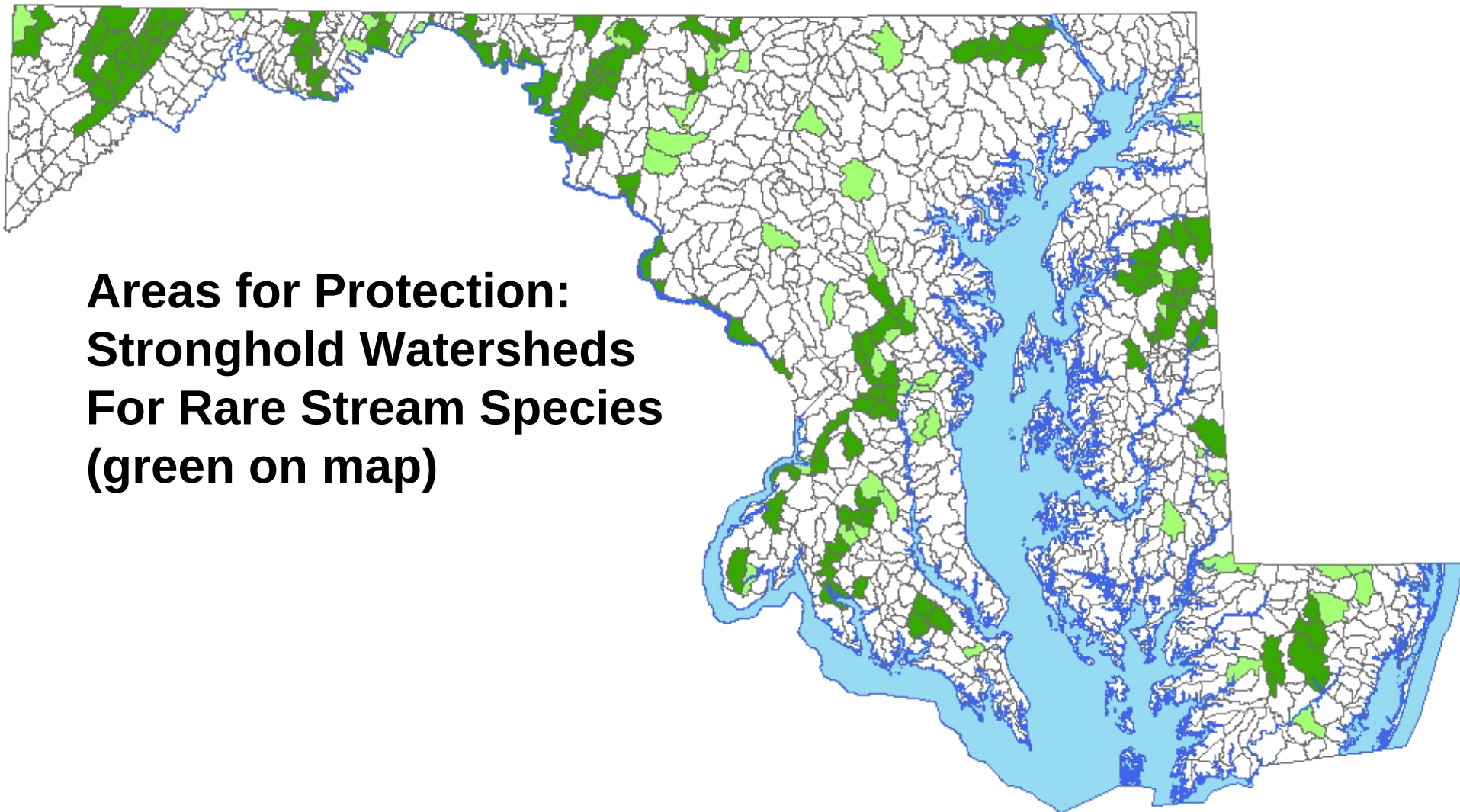
What are We Doing About Biotic Homogenization?

Three Examples…..

1. Limit Introductions and Control Spread of Introduced Spp.

Invasive Species Matrix Team

2. Prioritize Areas for Conservation



Areas for Protection:
Stronghold Watersheds
For Rare Stream Species
(green on map)

3. Develop Specific Protection Guidelines

Salamander Species Present

< 0.3%	0.3 - 2%	2 - 20%	20 - 37%	>37%
Seal Salamander	Northern Spring Salamander	Northern Red Salamander	Northern Two-Lined Salamander	No Salamanders
Northern Spring Salamander	Allegheny Mountain Dusky Salamander	Northern Dusky Salamander		
Allegheny Mountain Dusky Salamander	Long-Tailed Salamander	Northern Two-Lined Salamander		
Long-Tailed Salamander	Northern Red Salamander			
Northern Red Salamander	Northern Dusky Salamander			
Northern Dusky Salamander	Northern Two-Lined Salamander			
Northern Two-Lined Salamander				

Impervious land Cover

The End??