This presentation does not represent official Maryland DNR policy, rather our continued efforts and focus on understanding the science and how to best apply it to our mission

# The Influence of Chesapeake Bay Restoration Projects Implemented in Streams

## STAC stream restoration workshop March 21, 2023

Scott Stranko and Bob Hilderbrand (presenters)

Sara Weglein, Greg Golden, Tony Redman, Tony Prochaska, Margaret Palmer, Allyson Bartell, Mary Genovese

MARYLAND DEPARTMENT OF NATURAL RESOURCES

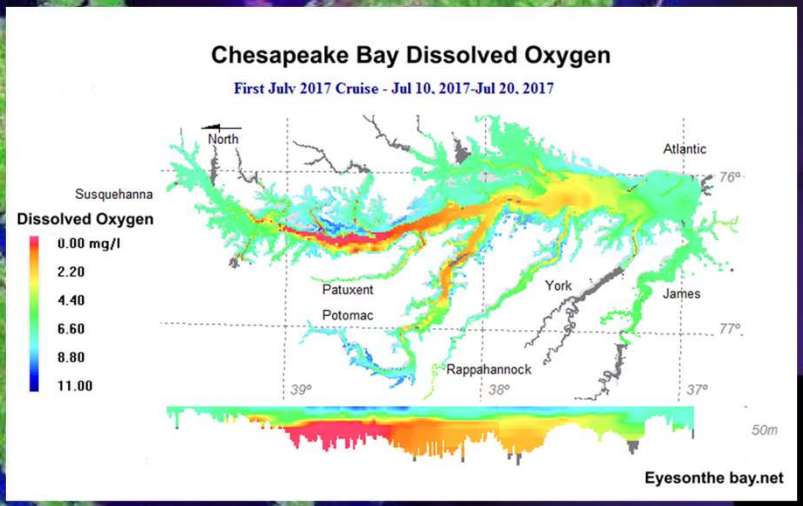
University of Maryland CENTER FOR ENVIRONMENTAL SCIENCE APPALACHIAN LABORATORY

# Chesapeake Bay

dnr.maryland.gov/fisheries/Pages/fish-facts.aspx?fishname=Striped+Bass

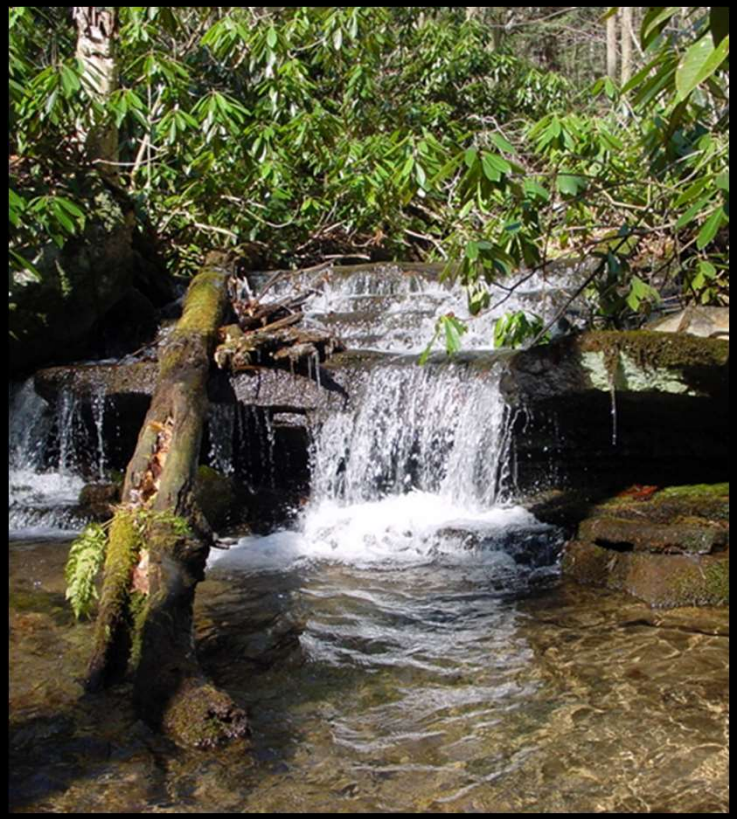
dnr.maryland.gov/fisheries/Pages/Fish-Facts.aspx?fishname=Shellfish%20-%20Blue%20Crab

dnr.maryland.gov/fisheries/Pages/Fish-Facts.aspx?fishname=Shellfish%20-%20Eastern%20Oyster




https://www.usgs.gov/media/images/chesapeake-bay-landsat

# Streams are Different Than They were Historically



MBSS

https://dnr.maryland.gov/streams/pages/musselrelocation.aspx

Greg Pond

Science
AAAS

**Natural Streams and the Legacy of Water-Powered Mills**
Robert C. Walter and Dorothy J. Merritts
*Science* **319**, 299 (2008);
DOI: 10.1126/science.1151716

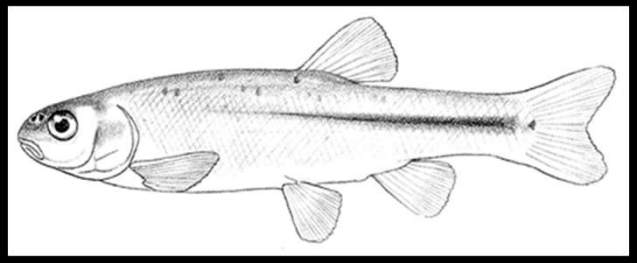
Mark Tegges

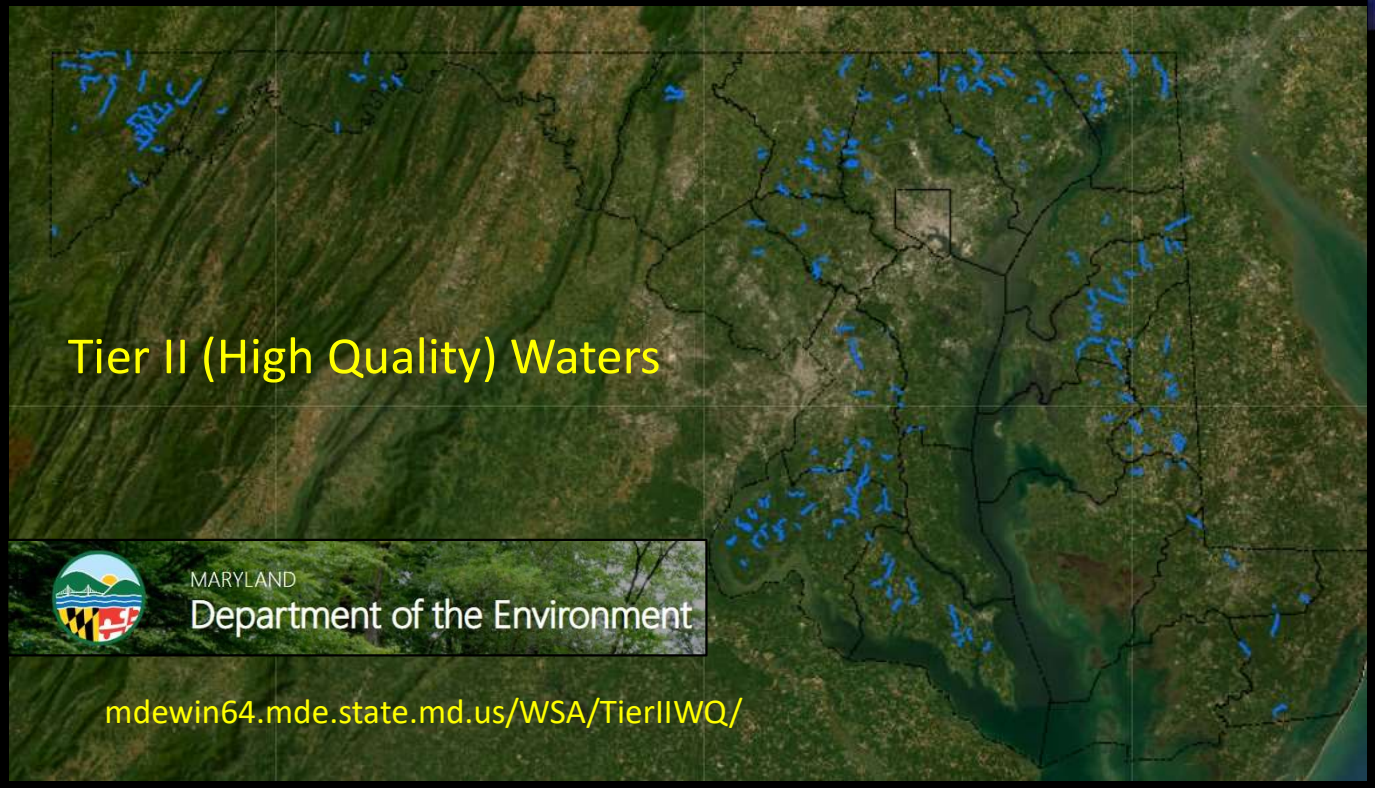
MBSS

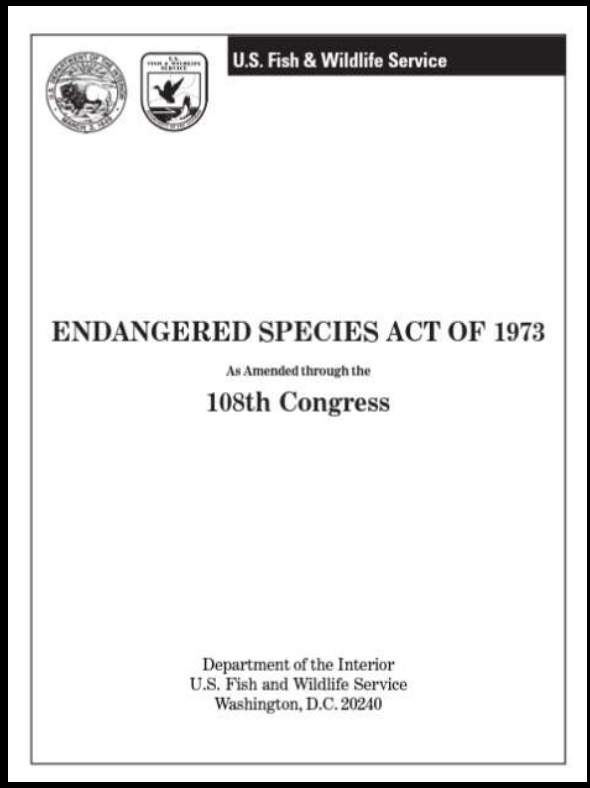
https://dnr.[illegible]yland.gov/fisheries/Pages/fish-facts.aspx?fishname=American+Eel

Wayne Davis

# Stream Health - Biological Standards: Maryland Example







U.S. Fish & Wildlife Service

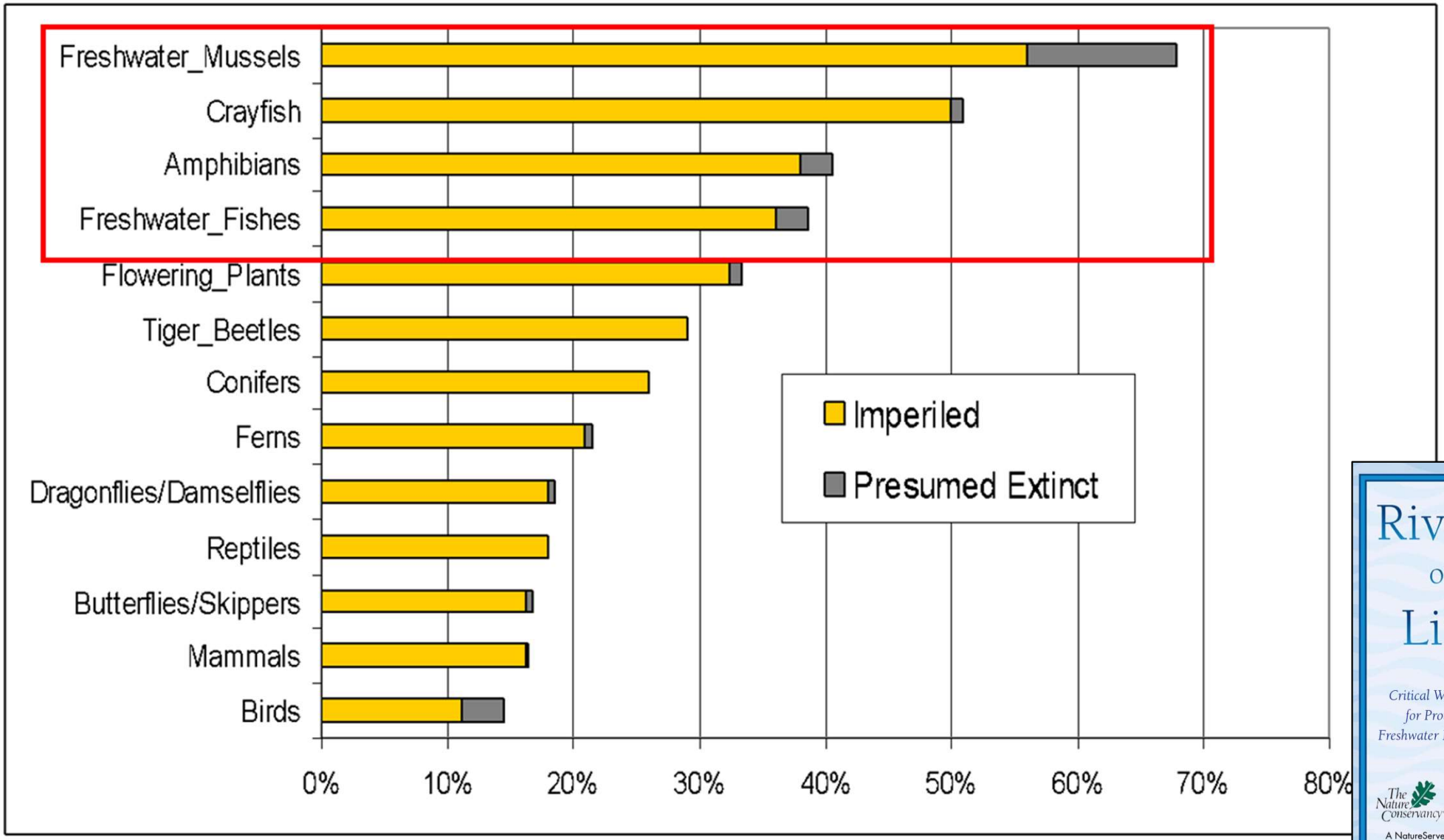
ENDANGERED SPECIES ACT OF 1973

As Amended through the

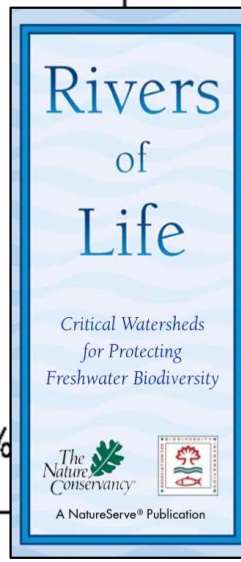
108th Congress

Department of the Interior
U.S. Fish and Wildlife Service
Washington, D.C. 20240

# Relatively large % of species that live in freshwater streams are imperiled




**Imperiled Taxa - United States**



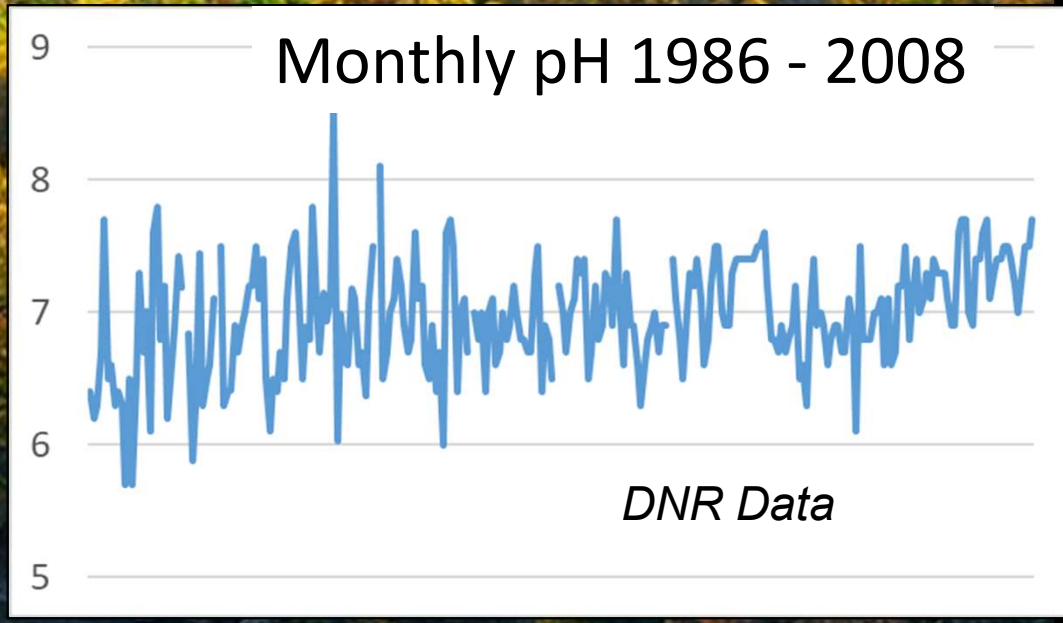
# Many Streams are in Poor Condition

mde.maryland.gov/programs/land/mining/pages/acidminedrainage section_amds.aspx

# Must Understand Important Limiting Factors

# Current Biology and pH Data from the Youghiogheny River

After decades of historical mine drainage



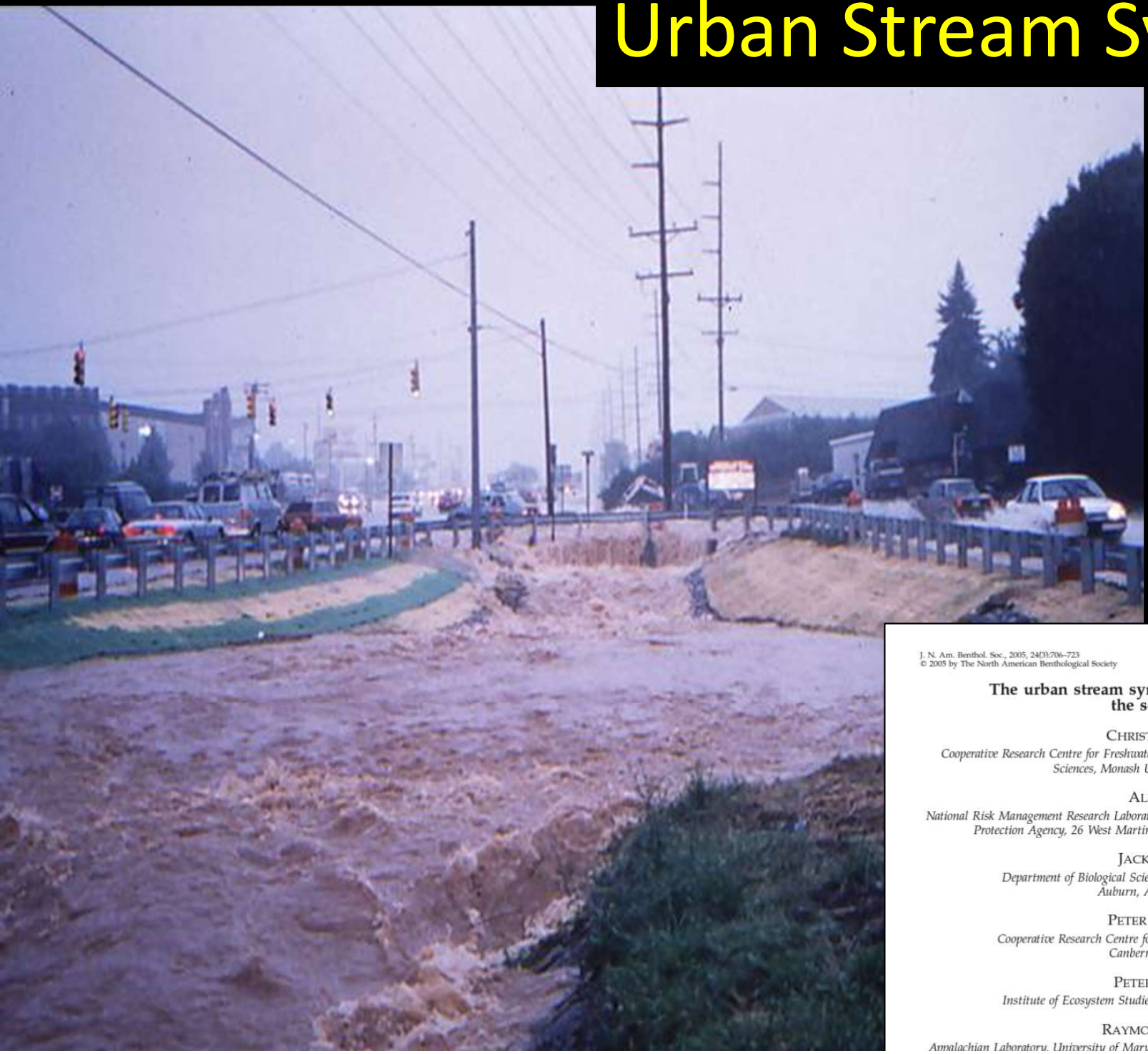

2013 Biology Scores = <u>Fair</u>

Fish 3.3

Benthic Macroinvertebrate 3.5

*(Range = 1-5; Good, Fair, Poor)*

# Urban Stream Syndrome



J. N. Am. Benthol. Soc., 2005, 24(3):706–723


**The urban stream syndrome: current knowledge and the search for a cure**

CHRISTOPHER J. WALSH[1]
*Cooperative Research Centre for Freshwater Ecology, Water Studies Centre, and School of Biological Sciences, Monash University, Victoria 3800, Australia*

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PETER M. GROFFMAN[5]
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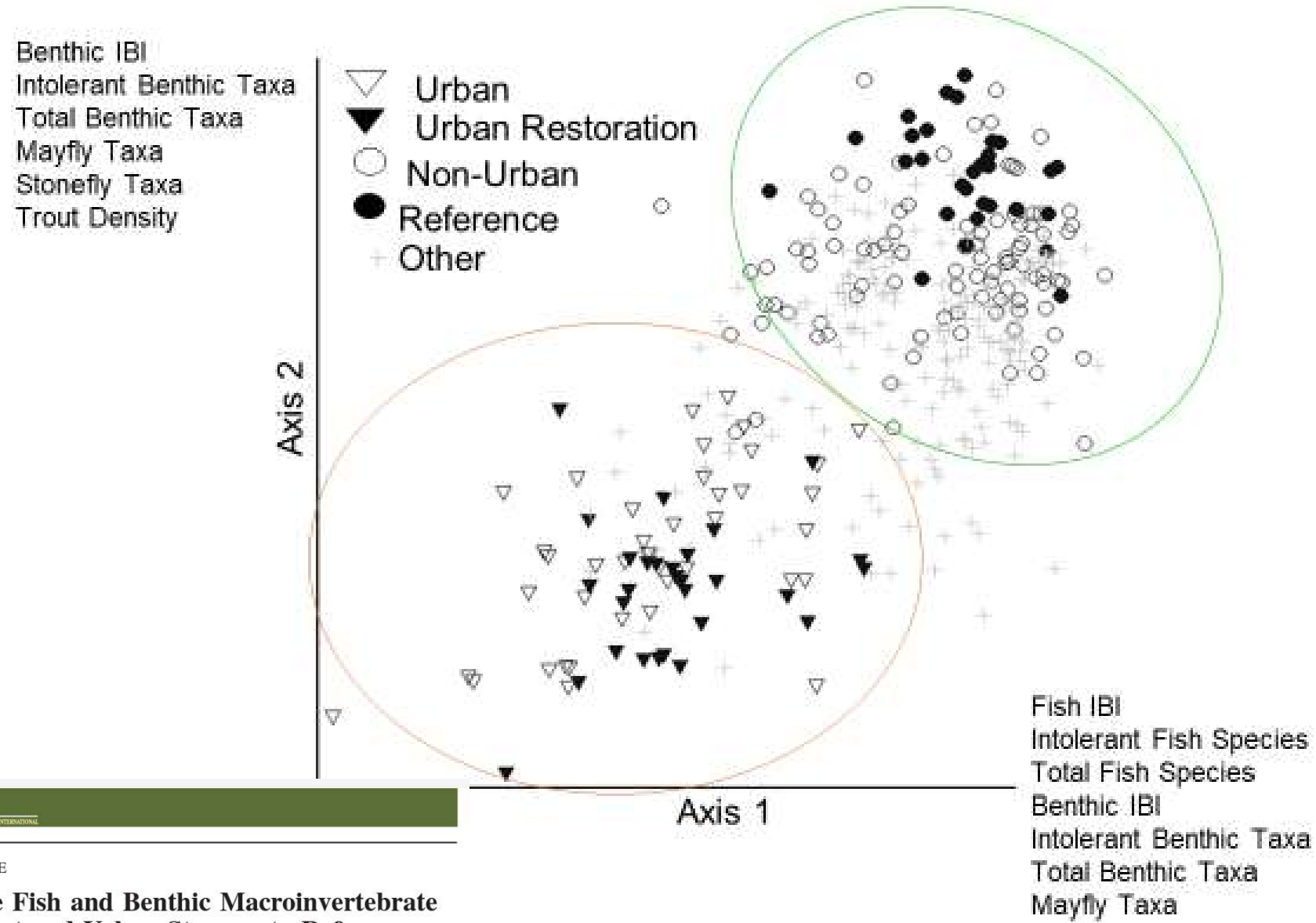
RAYMOND P. MORGAN II[6]
*Appalachian Laboratory, University of Maryland Center for Environmental Science, 301 Braddock Road,*

# Biological Condition of Urban Restoration Streams




Restoration Ecology
THE JOURNAL OF THE SOCIETY FOR ECOLOGICAL RESTORATION INTERNATIONAL

RESEARCH ARTICLE

**Comparing the Fish and Benthic Macroinvertebrate Diversity of Restored Urban Streams to Reference Streams**

Scott A. Stranko,[1,2] Robert H. Hilderbrand,[3] and Margaret A. Palmer[4]

*North American Journal of Fisheries Management* 28:856–890, 2008
American Fisheries Society 2008
DOI: 10.1577/M06-169.1

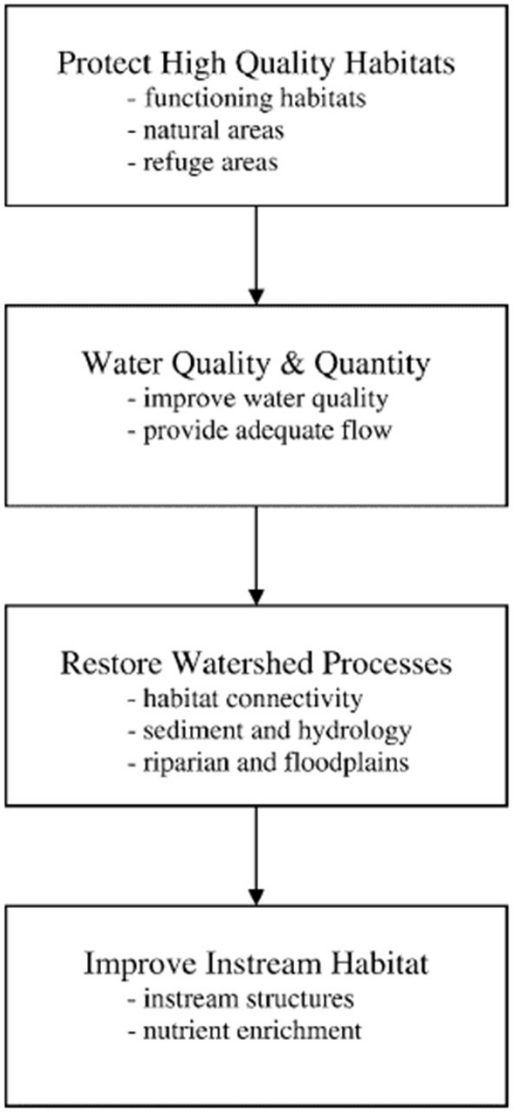
[Article]

# Global Review of the Physical and Biological Effectiveness of Stream Habitat Rehabilitation Techniques

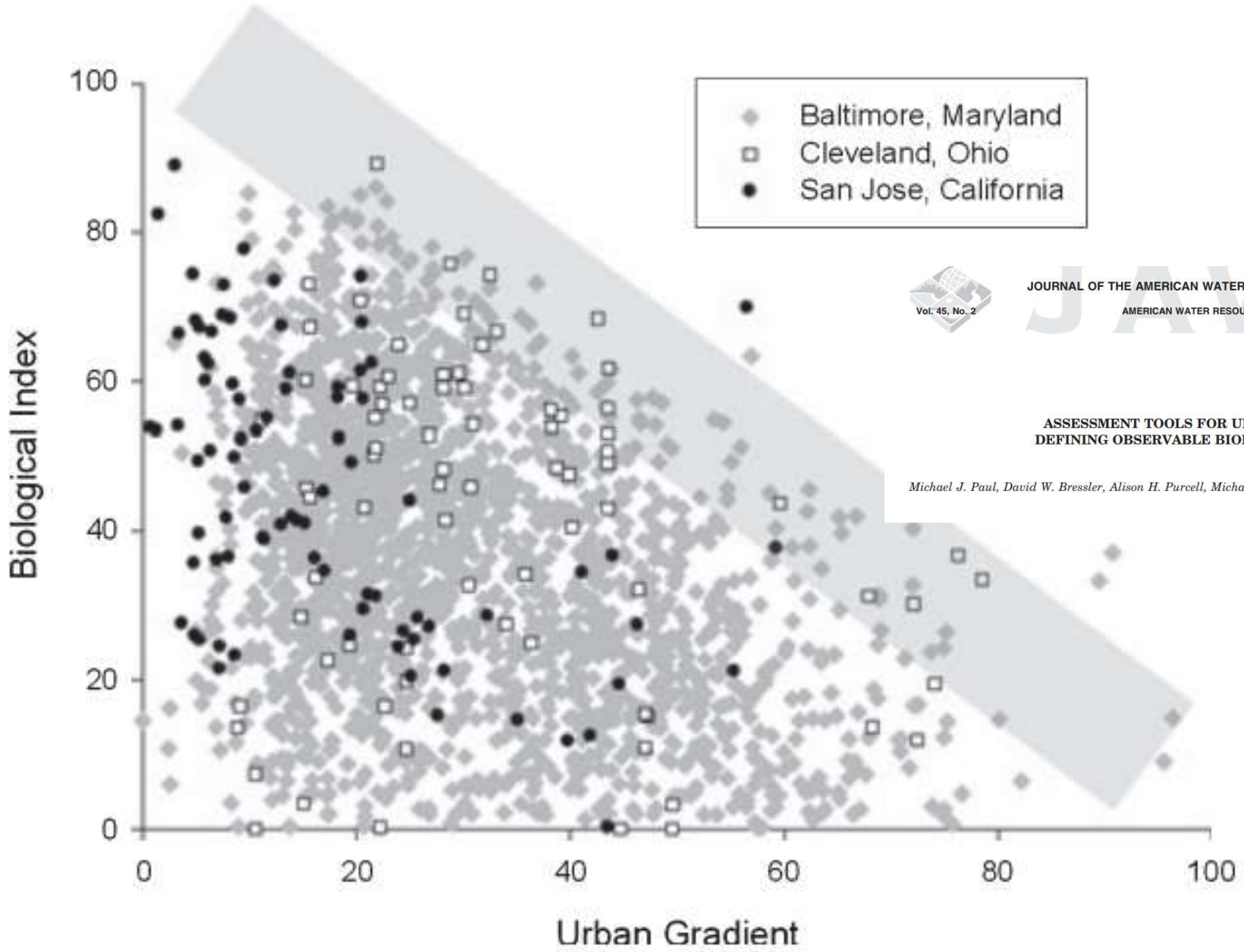
PHIL RONI,* KARRIE HANSON, AND TIM BEECHIE

"Avoidance of the common causes of project failure requires a clear process for using watershed assessments to identify and prioritize projects."

"broader watershed processes must be considered when planning projects"



# Watershed Condition Dictates Stream Condition – AND What Can Be Achieved

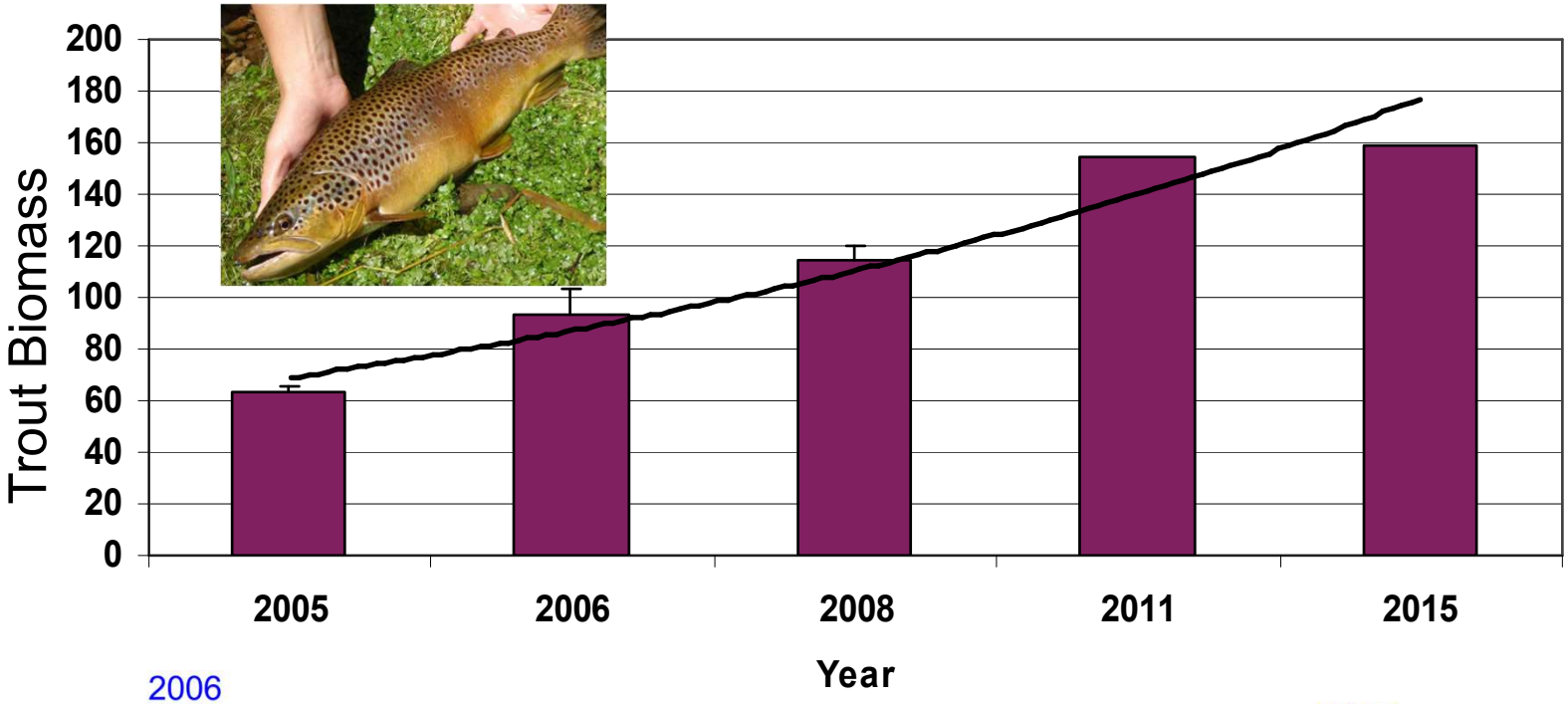



JOURNAL OF THE AMERICAN WATER RESOURCES ASSOCIATION
Vol. 45, No. 2
AMERICAN WATER RESOURCES ASSOCIATION
April 2009

**ASSESSMENT TOOLS FOR URBAN CATCHMENTS: DEFINING OBSERVABLE BIOLOGICAL POTENTIAL[1]**

*Michael J. Paul, David W. Bressler, Alison H. Purcell, Michael T. Barbour, Ed T. Rankin, and Vincent H. Resh[2]*

# Upper Beaver Creek Watershed




2006

2015

Black Rock Creek

# What about Chesapeake Bay restoration?

There are many approaches and techniques being implemented to reduce nutrients and sediment to Chesapeake Bay.

https://www.epa.gov/restoration-chesapeake-bay

# To Help Chesapeake Bay - Slow Stream Water

- Less erosion
- Sediment deposition here, instead of downstream
- More microbial processing of nutrients

The slower and more spread out the water, the better

# Slower Water Can Make Certain Water Quality and Stream Biota Worse

- Sediment deposition
- lower oxygen
- higher temperature
- Poor biology

September 2011 EVALUATING RIVER RESTORATION

*Ecological Applications*, 21(6), 2011, pp. 1989–2006


Assessing stream restoration effectiveness at reducing nitrogen export to downstream waters

SOLANGE FILOSO[1,3] AND MARGARET A. PALMER[1,2]

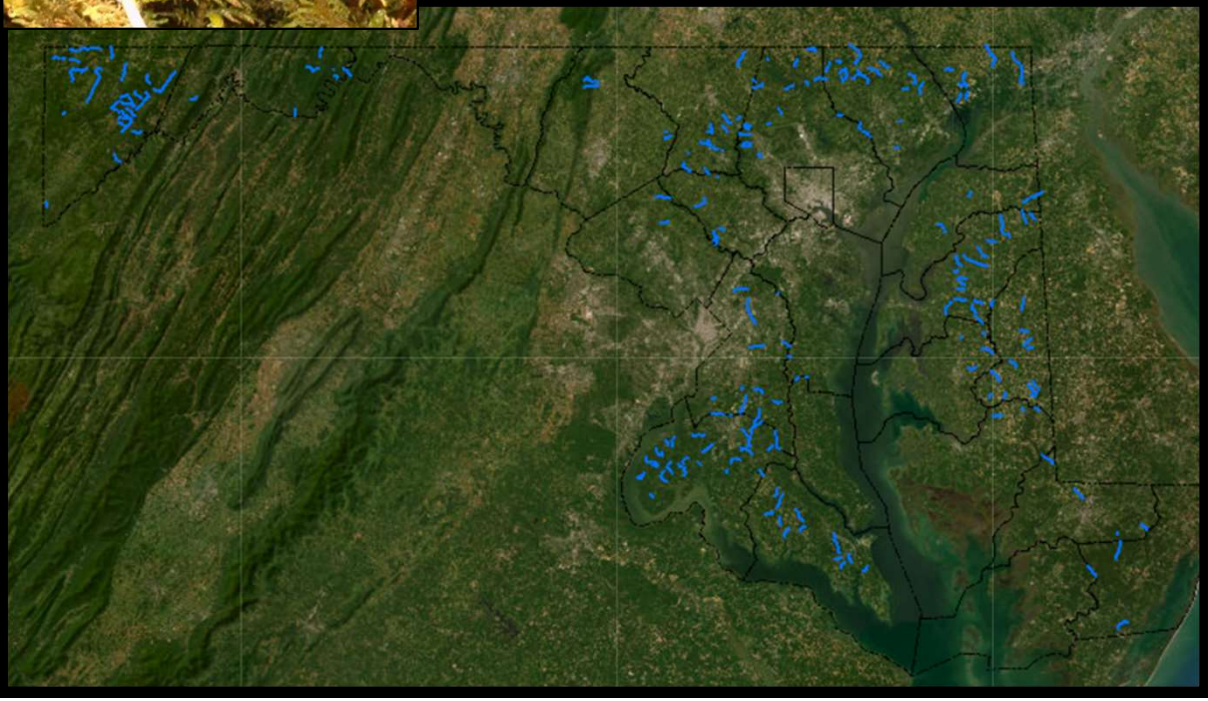
"in order to compensate for the increasing pace of anthropogenic N inputs and the concomitant loss in the capacity of N processing in the drainage area …….streams may need to be increasingly manipulated or highly engineered to manage high N loads, at the expense of losing some of the fundamental functions associated with stream ecosystems ……. <u>if it is acceptable to convert them to dramatically different ecological systems</u> (i.e., more like created wetlands than restored streams). "

# Risks to sensitive species and water quality

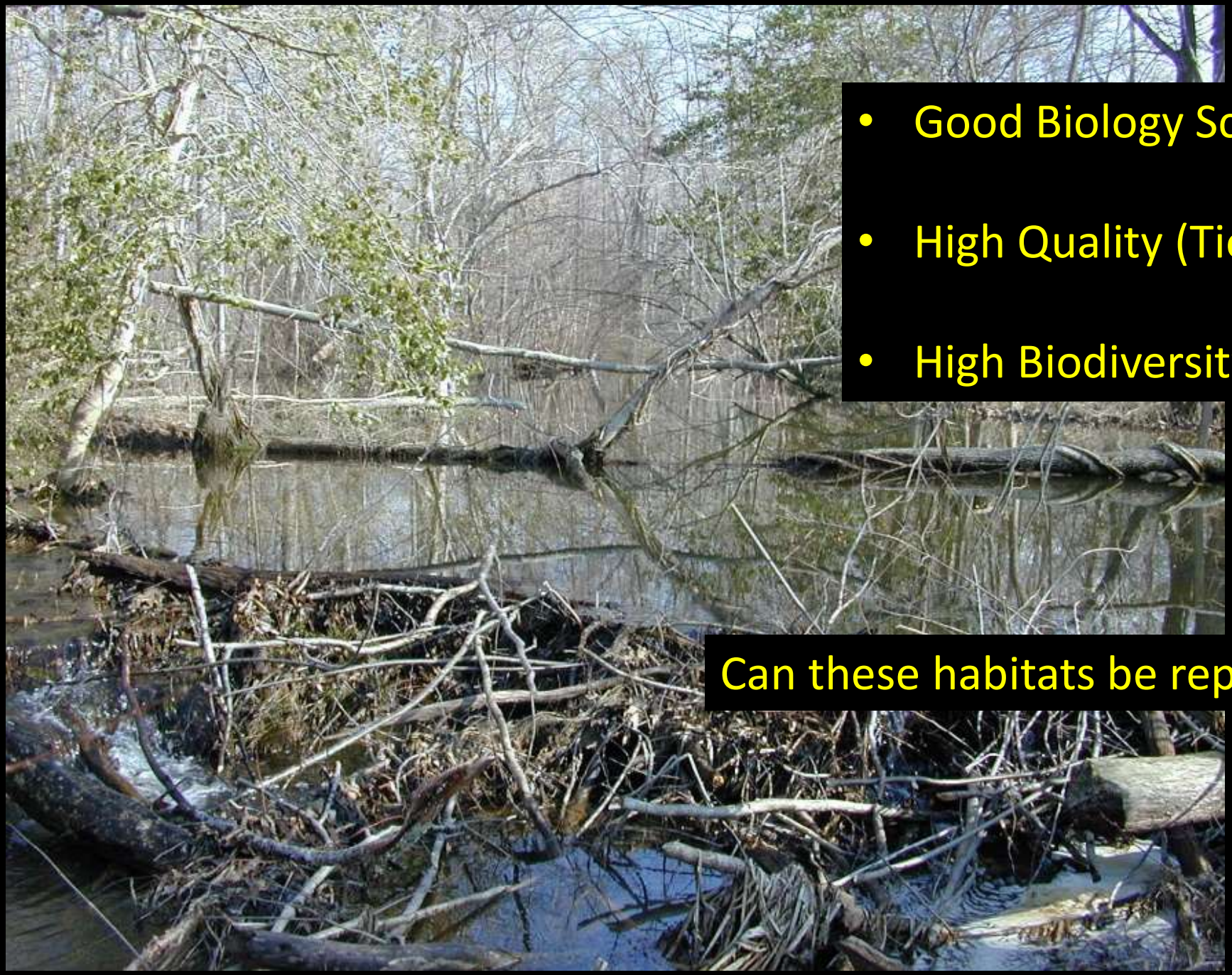
- Working in stream channels can put high-quality resources, water quality, and sensitive stream species at risk – where they occur
- Risk may result from construction and/or slowing water – at a minimum





# Beaver-Impounded and Naturally Slow Streams

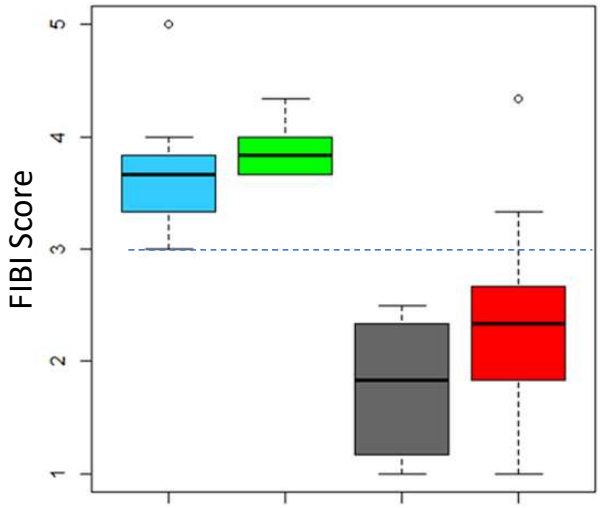


- Good Biology Score
- High Quality (Tier II) Water
- High Biodiversity

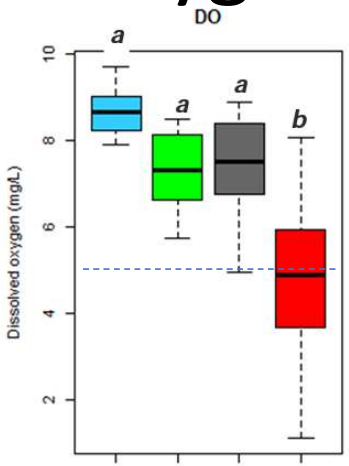
Can these habitats be replicated?

# Natural low-gradient wetland streams better for fish, oxygen, and conductivity

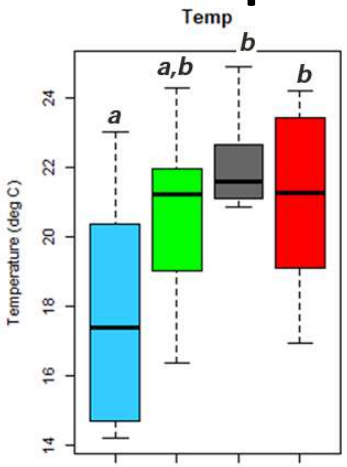
## Fish



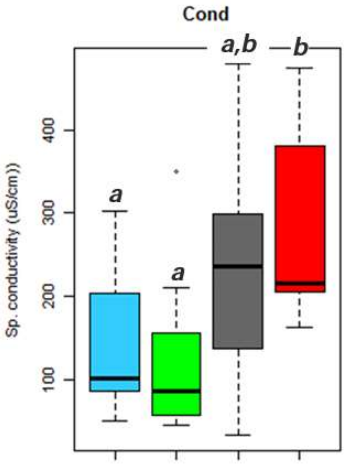

## Oxygen




## Temp




## Cond.




High-quality Single Stream

High-quality Stream Wetland

Low-quality Single Stream

RSC

TETRA TECH

University of Maryland Center for Environmental Science Chesapeake Biological Laboratory

**Vertebrate Community Trajectory in Regenerative Stream Conveyances**


Mark Southerland, Bob Murphy, and Nancy Roth
*Tetra Tech*
Ryan Woodland and Solange Filoso
*UMCES-CBL*

# Natural Beaver Dams

Can have:

- Low Oxygen
- High Temperature
- Trap Sediment

Bledzki et al. 2011
Burchsted et al. 2016
Johnson-Bice et al. 2018

Due to human influence, there are more sediment and nutrients entering streams to cause these conditions - now than historically. Temperatures are warmer too.

# Can you guess the biological condition of these streams?

# Can you guess the biological condition of these streams?



# Eroded Streams Not Necessarily Biologically Degraded

## -Can Have Sensitive Resources

This stream had 12th highest eroded area and severity rating (1,778 streams surveyed)

Fish IBI = Good
Benthic IBI = Good
Tier II (High-Quality) Water

Brook trout stream
MBSS Sentinel (Reference) stream

Reducing erosion benefits the stream!

Is it possible to reduce erosion without risking sensitive resources – where they occur?

# Upland Projects and Infiltration

- Helps reduce erosion
- May help improve temperature
- But-
- Puts nutrients, sediment, conductivity, etc. into groundwater
- Groundwater can make up much of the flow during dry periods

dnr.maryland.gov/criticalarea/pages/stormwater.aspx

# Summary/ Conclusions

•There is no one-size-fits-all approach to stream restoration - It is important to know the goals, limiting factors, and risks

•Certain types of projects in streams to achieve nutrient reduction goals can harm streams/violate water quality and biological standards

•While some eroded streams have poor biology, some have sensitive resources that could be at risk

Nutrient and sediment reduction is beneficial and should continue, where and in ways that are appropriate

•Can nutrients and/or sediment effectively be addressed without risks to sensitive resources – where they occur?

•Improvements to stream biology are constrained by watershed and water quality conditions

•Depending on watershed and water quality conditions, stream biology can be improved

•Depending on the project type and location, stream biology or water quality can become worse

This presentation does not represent official Maryland DNR policy, rather our continued efforts and focus on understanding the science and how to best apply it to our mission