

# Maryland's Present Day Ecological Stream Conditions

## Relative to Historical Reference Conditions

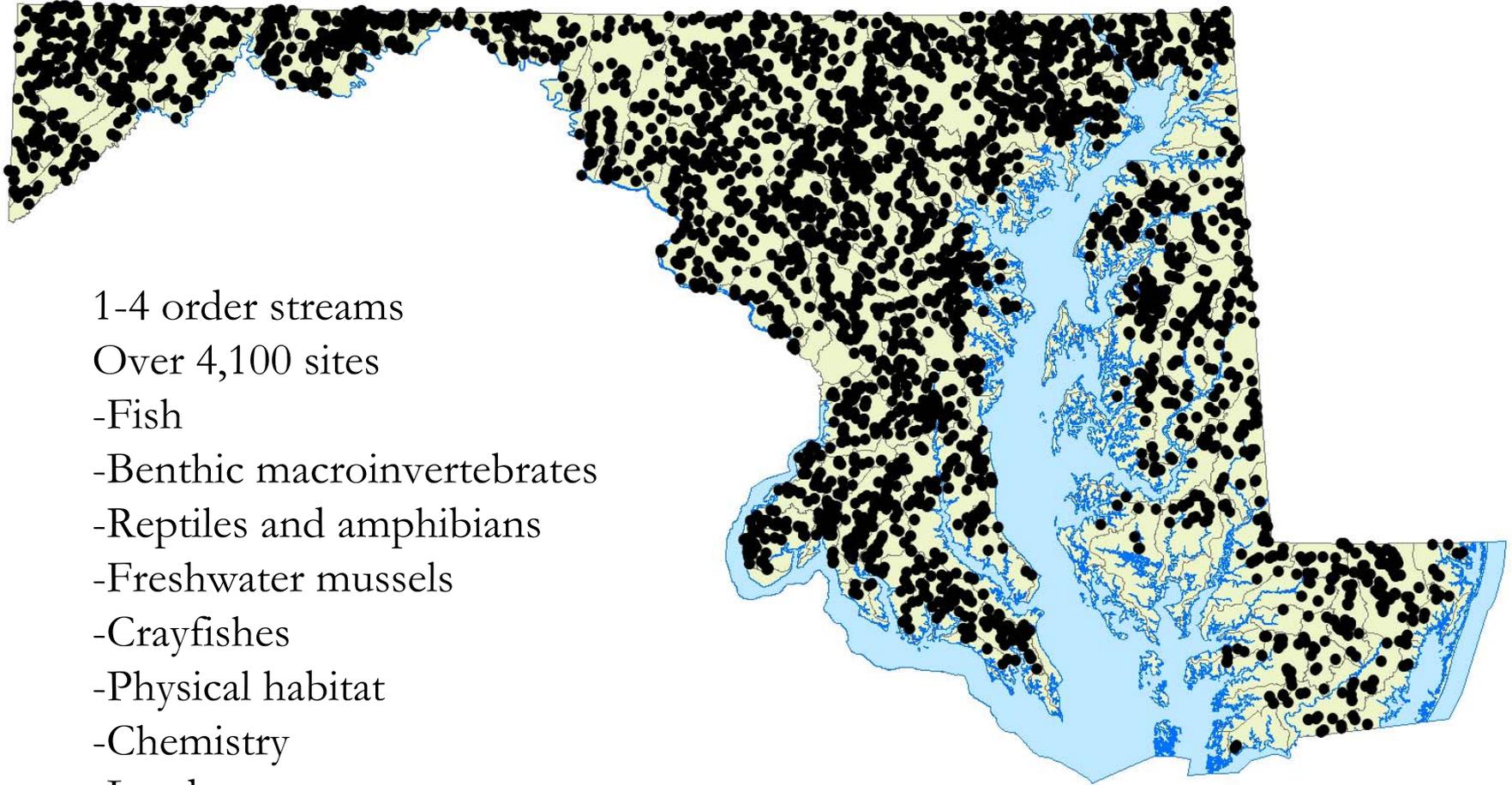
Scott Stranko  
Maryland Department of Natural  
Resources

Ray Morgan  
UMCES

December 12th, 2014



# Maryland Biological Stream Survey 1995-2014



1-4 order streams

Over 4,100 sites

-Fish

-Benthic macroinvertebrates

-Reptiles and amphibians

-Freshwater mussels

-Crayfishes

-Physical habitat

-Chemistry

-Land use

# What is an Appropriate Reference Ecological Condition?

- No streams in Maryland are “pristine” (like they were historically)
- We don’t have any data from 300+ years ago



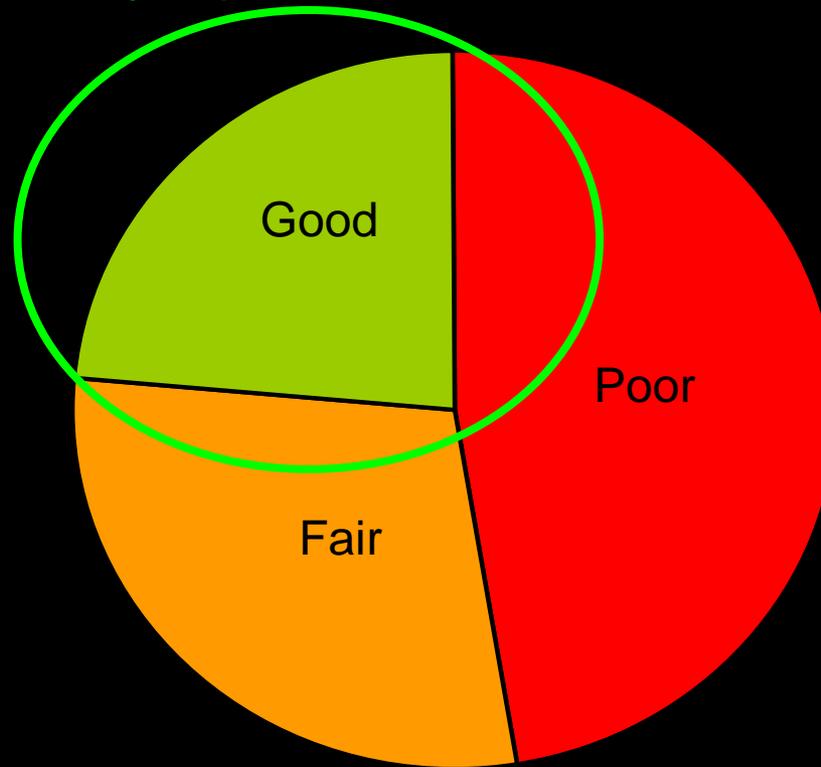
## EPA Guidance for Defining Reference Condition

- Best Available
- Least Impaired/Degraded
- Minimally Impacted
- Best Attainable

*[www.epa.gov/bioiweb1/html/criteria\\_for\\_reference\\_sites.html](http://www.epa.gov/bioiweb1/html/criteria_for_reference_sites.html)*

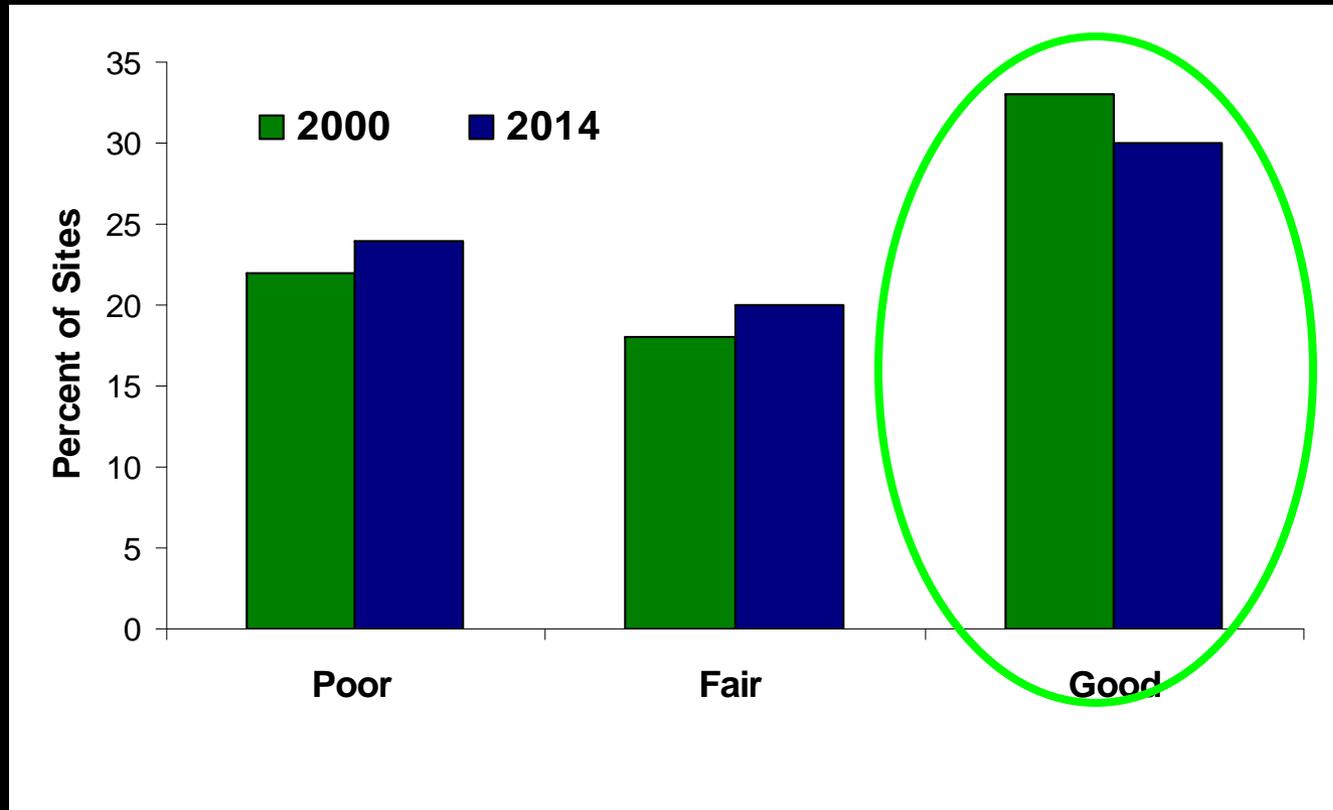
# Ecological Condition of Maryland Streams MBSS 2000-2004

Comparable to Minimally Impacted – Best Available Reference Streams



*Based on a benthic macroinvertebrate IBI from 1,071 randomly-selected stream sites*

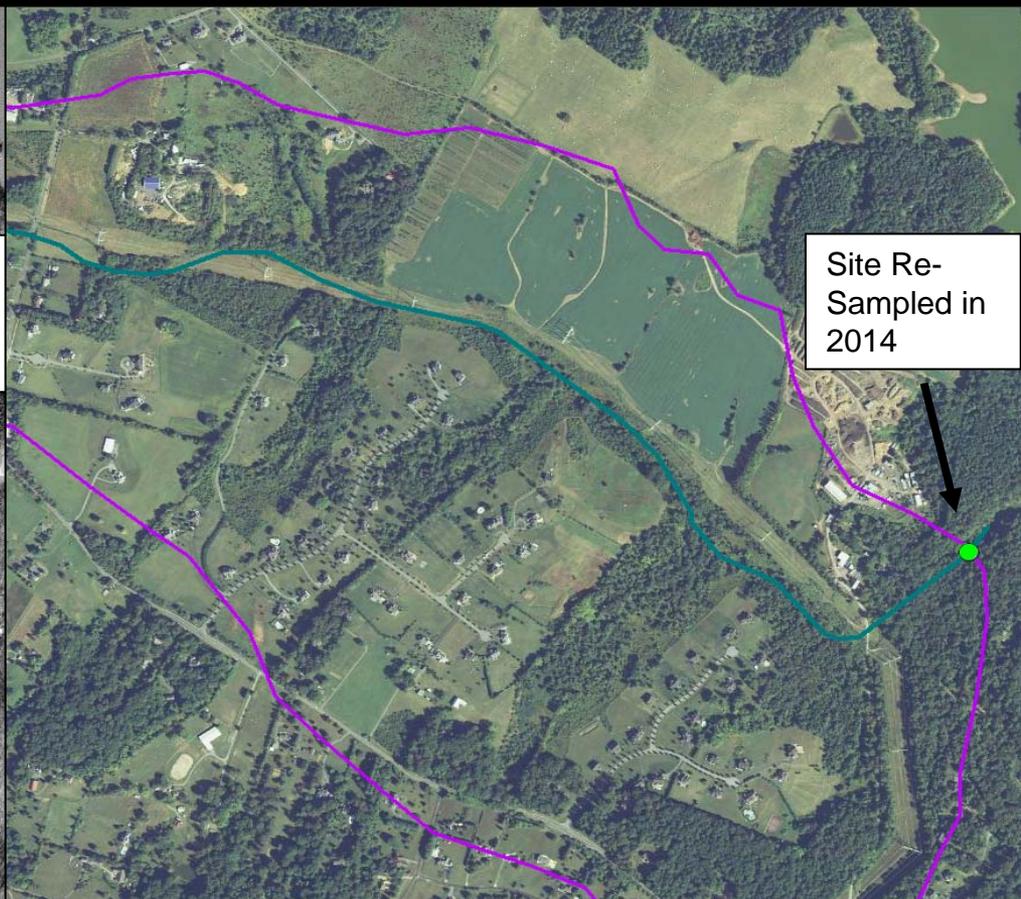
# MBSS Re-sampled 55 Sites Sampled During 2000 (14 years later)



Comparable to  
"Reference"

- Reference conditions are only as good as represented by available sites
- How much might we have lowered our standards compared to historical conditions?

# Land Cover Change 2000 Versus 2014 at MBSS Sites



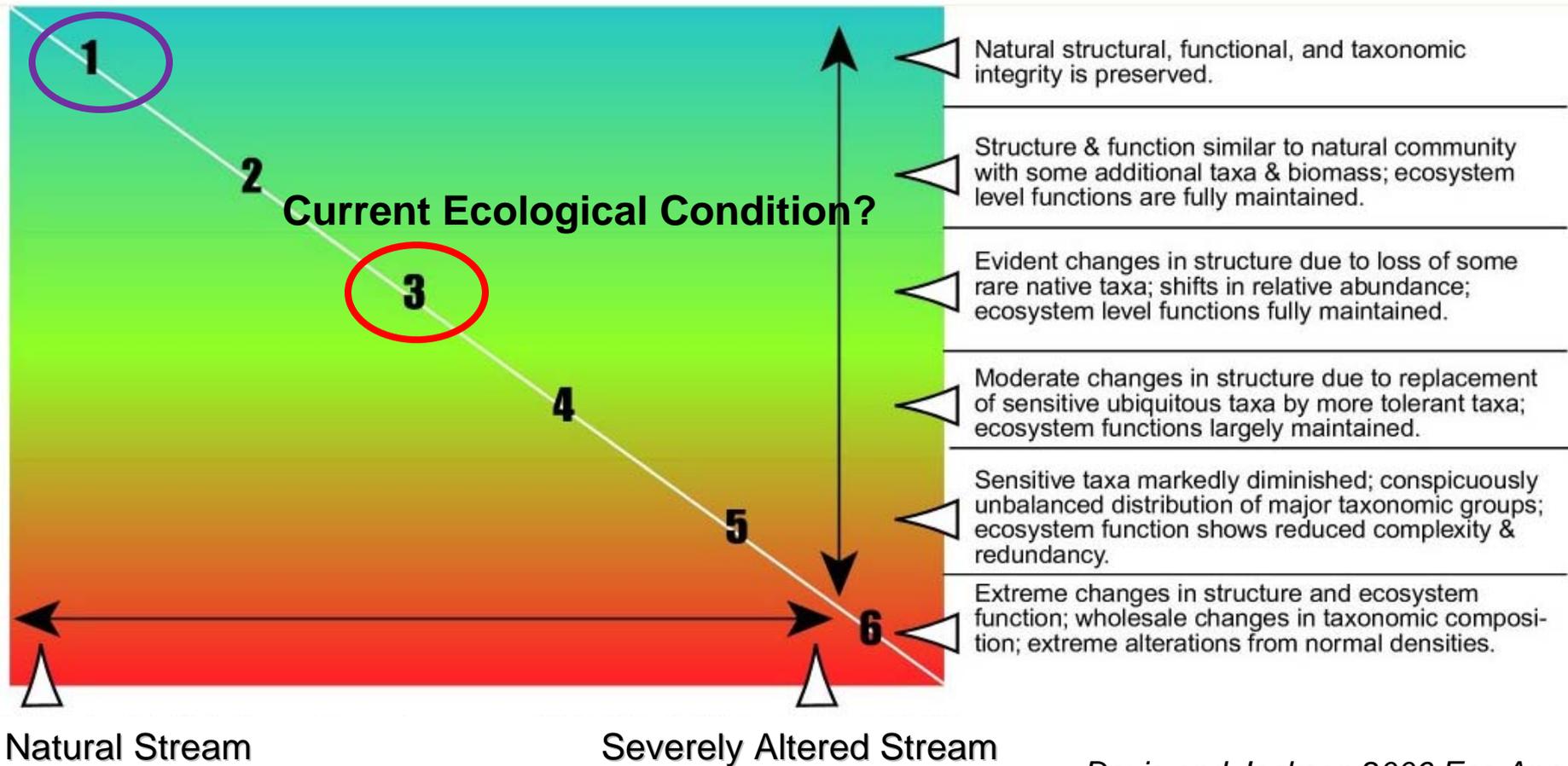
# Beware The Shifting Baseline Syndrome

“Each generation of fisheries scientists accepts as a baseline [the condition]... that occurred at the beginning of their careers and uses this baseline to evaluate changes .... The result is a gradual shift of the baseline, a gradual accommodation of the creeping disappearance of resource species and inappropriate reference points for evaluating ... losses ...or for identifying targets for rehabilitation.”

*Daniel Pauly 1995. Anecdotes and the shifting baseline syndrome of fisheries. TREE 10: 430.*

# Where are Current Reference Conditions Along a Gradient of Natural to Severely Altered?

## Historical Ecological Condition



EPA was searching for a river with a “Reference” fish community

They asked about the Youghiogheny River in Maryland

- Wild and Scenic River
- Mostly Forested
- Good Water Quality
- Good Habitat





## Historical Conditions - The Youghiogheny River before 1909

More than 100 fish species may have lived in Yough watershed.



1834 – 1865 the Youghiogheny River in MD was known for having abundant and large brook trout (up to 22 inches and 5lbs) and smallmouth bass

# Industry and Mining in the Early 1900's



Pittsburgh 1903

# Acid Mine Drainage

**“We may say that of the Monongahela drainage by far the greatest part is utterly polluted, chiefly by mine water.”**

**“in many cases .....life had entirely disappeared from many streams”**

**Ortmann 1909**



The Youghiogheny above Confluence, south into Maryland, is very clear and pure.”

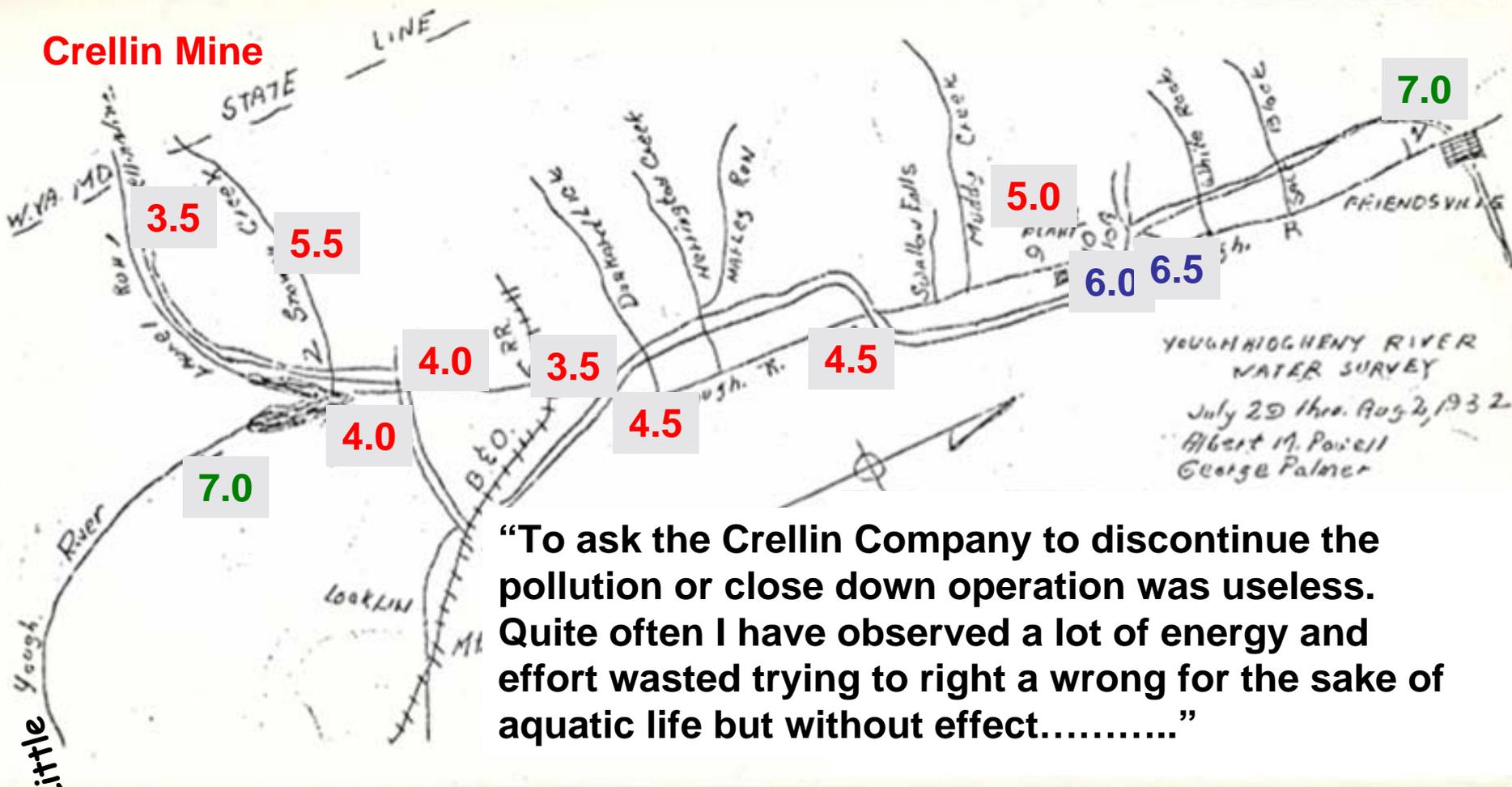


## **In 1929 Albert Powell Investigated a fish kill in the Maryland portion of the Yough**

**“.....many numbers of all species of fish floating downstream and collecting in the eddies.”**



# pH readings from the Youghiogheny River in 1929



“To ask the Crellin Company to discontinue the pollution or close down operation was useless. Quite often I have observed a lot of energy and effort wasted trying to right a wrong for the sake of aquatic life but without effect.....”

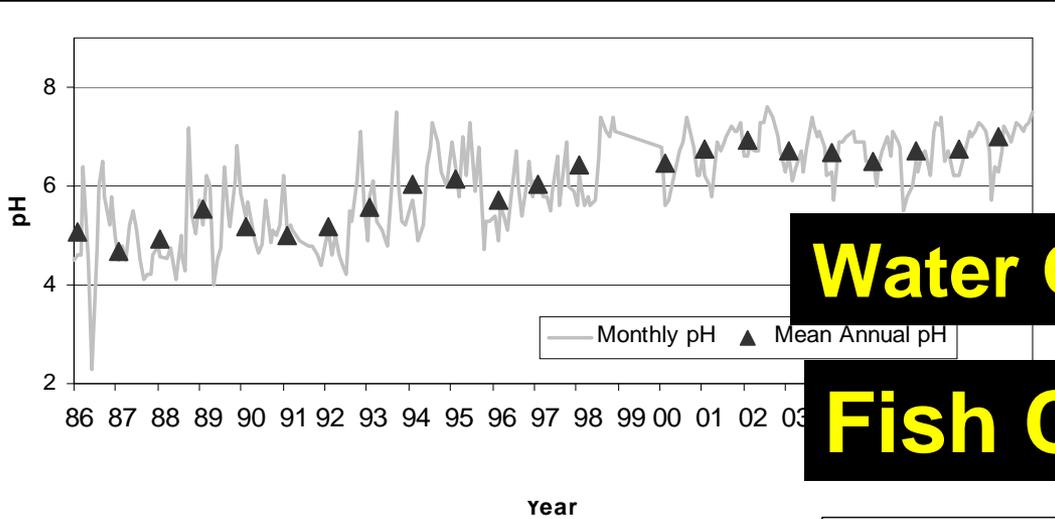
**“As late as 1950 the Youghiogheny is known to have been polluted as far down river as Friendsville and considered practically lifeless.”**

**“This and other recent studies have uncovered just 18 species of fish in the main river and tributaries”**

***Reppert 1964***

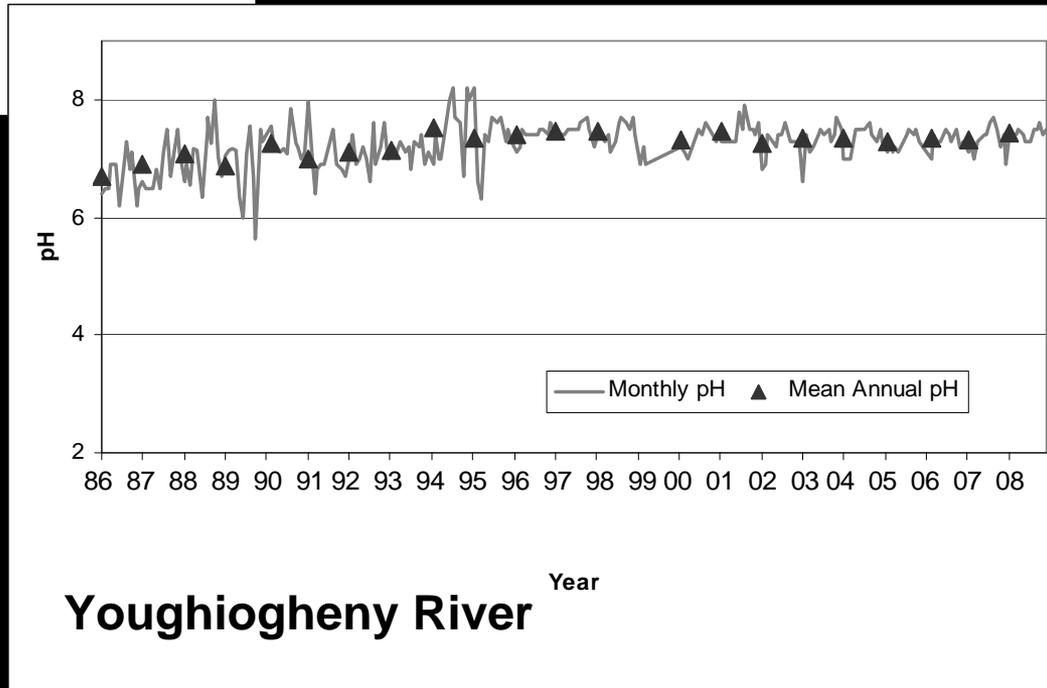


# pH data from the Youghiogheny Watershed 1986 - 2008



Cherry Creek

**Water Quality Has Improved**  
**Fish Can Return, Right?**



Youghiogheny River





**“a...cause of destruction of life ... not connected with the deterioration of the quality of the water.....the *damming of certain rivers* prevent the free migration...of fishes...an obstacle to the natural restocking of the rivers...”**

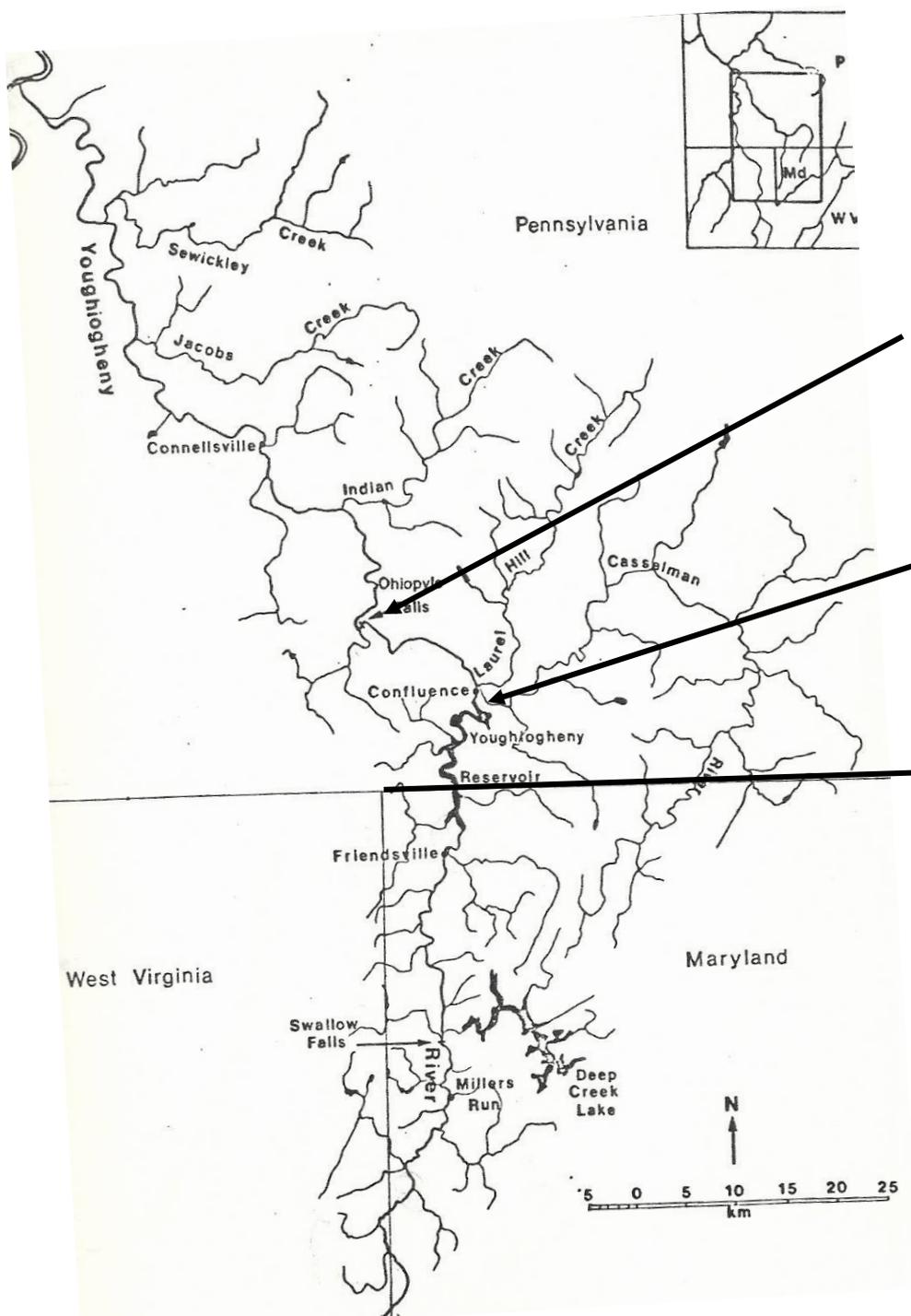
***Ortmann 1909***



**Yough dam built 1944**



**Falls at Ohiopyle**



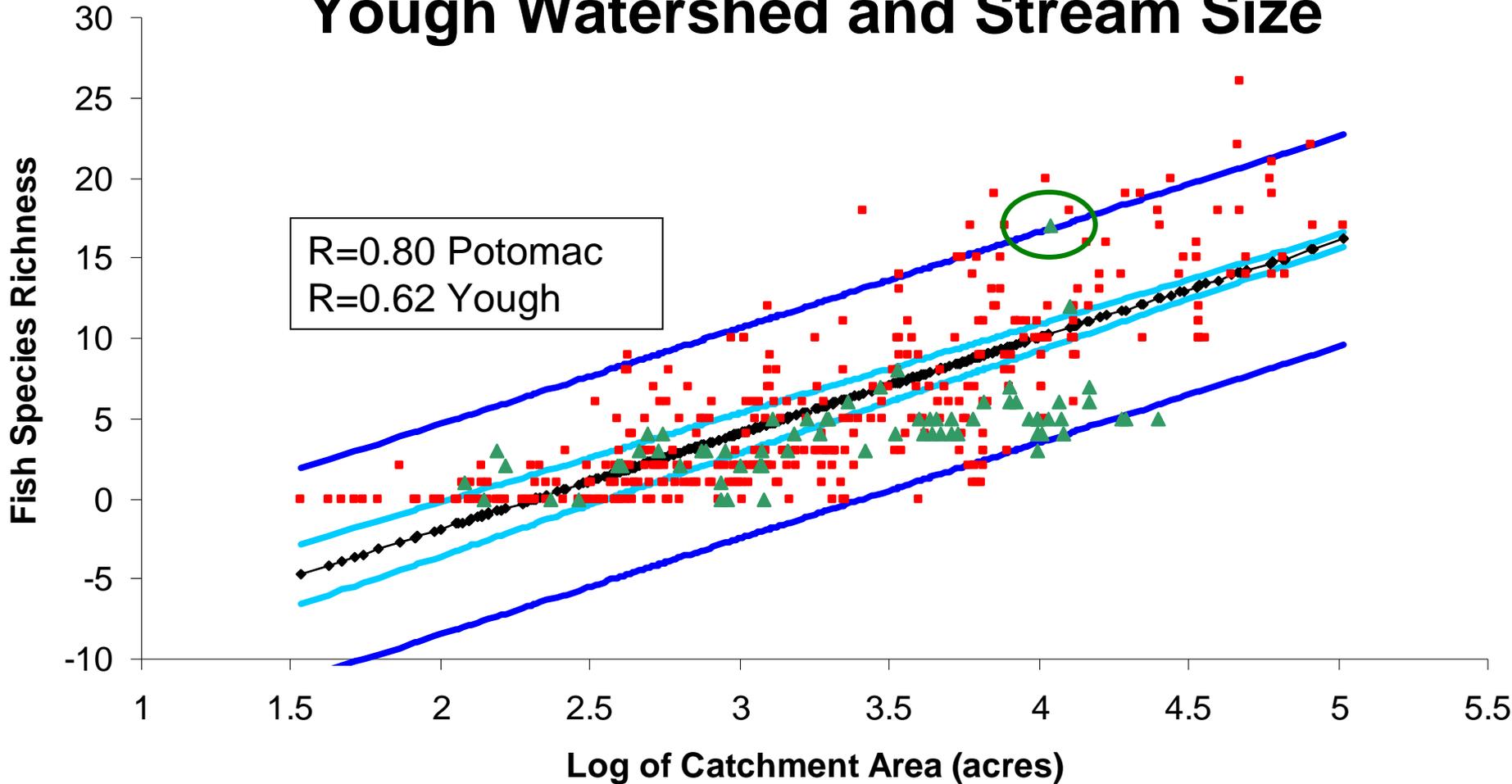
Falls

Dam

N

5 0 5 10 15 20 25  
km

# Fish Species In the Maryland Portion of the Yough Watershed and Stream Size



# Late 1970s Research Revealed 8 Species Probably Extirpated from the Entire Watershed

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Highfin carpsucker

Streamline chub

Goldeye

Brook silverside

Silver redhorse

River redhorse

Shorthead redhorse

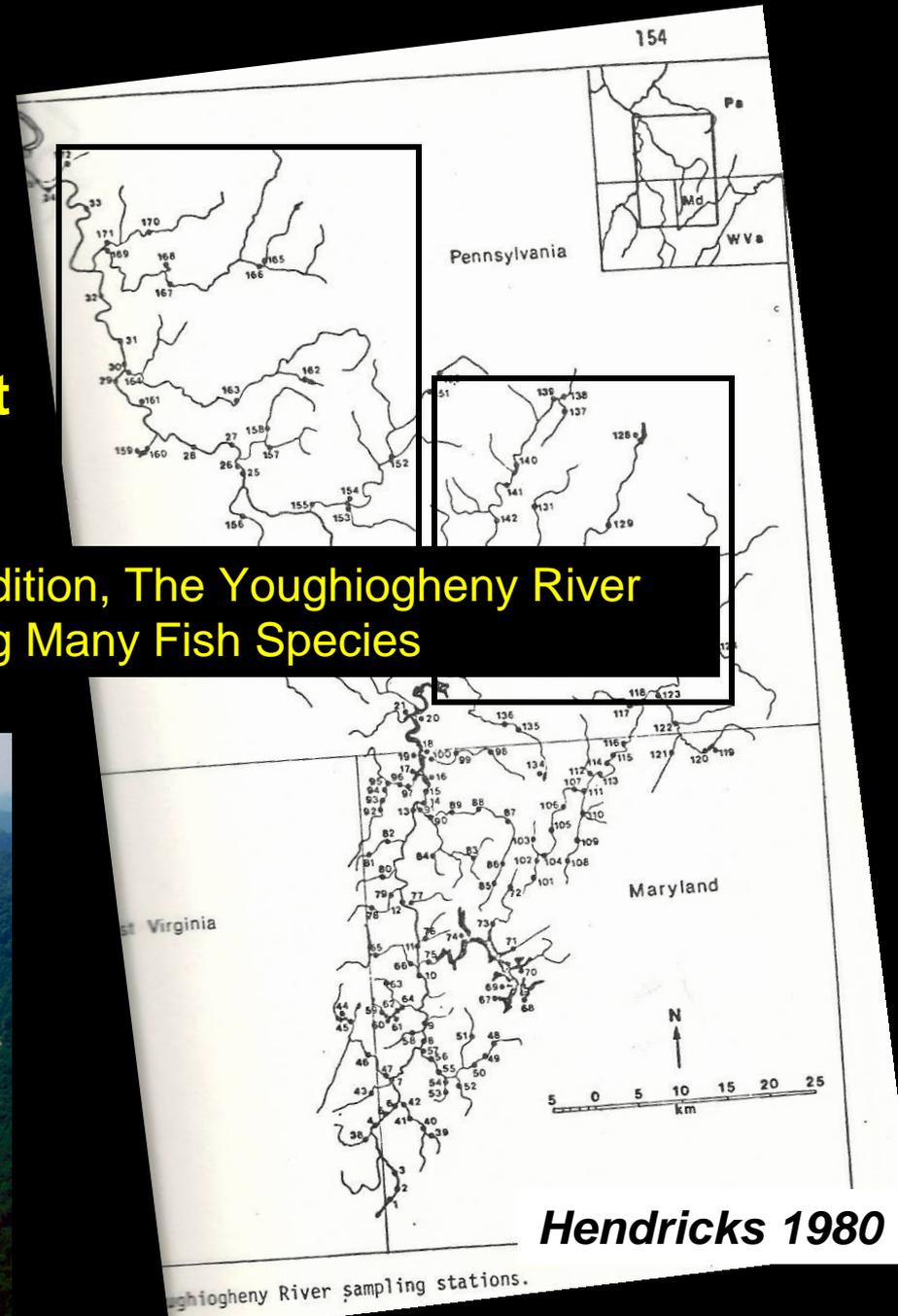
Longhead darter

## Surveys in the 1970's found:

**13 species Downstream of Ohiopyle Falls – Not Above**

**• 9 Species Above Ohiopyle, Not Above the Yough Dam**

**Considering the Historical Reference Condition, The Youghioghene River and Its Watershed in Maryland are Missing Many Fish Species**

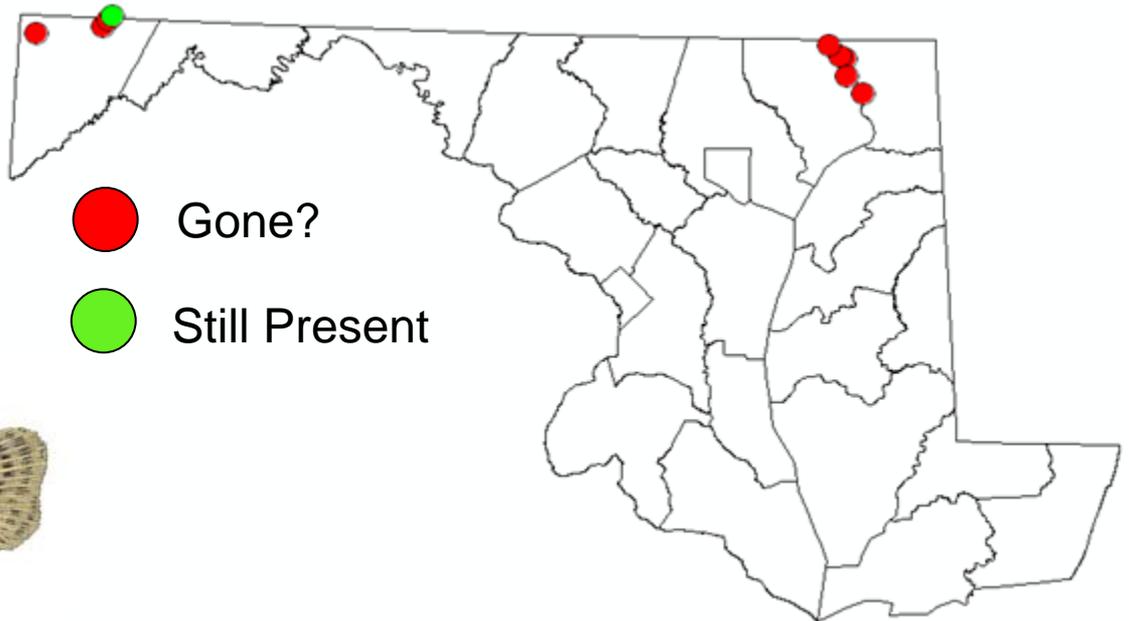


# Native Species Shrinking Distributions

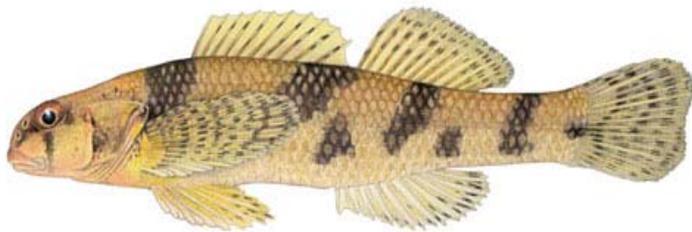
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## Eastern Hellbender

*Cryptobranchus  
alleganiensis  
alleganiensis*



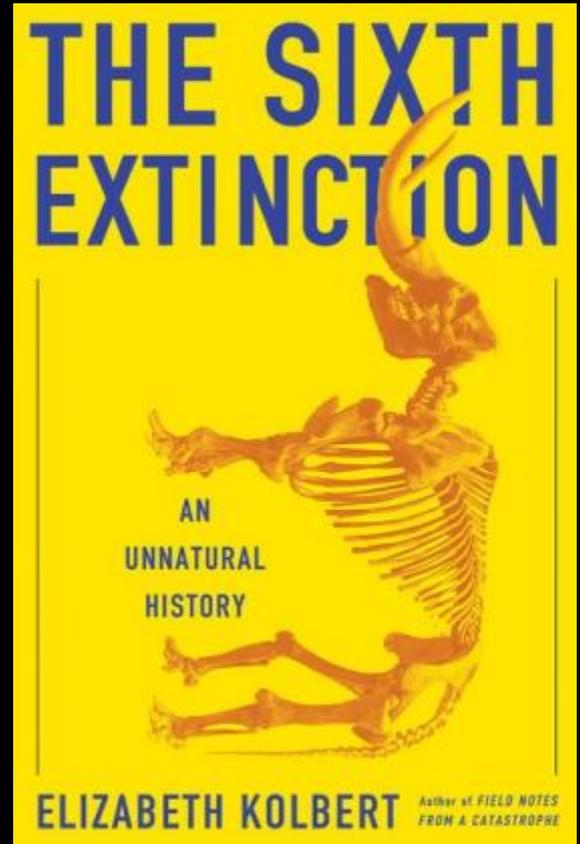
## And Extinctions?



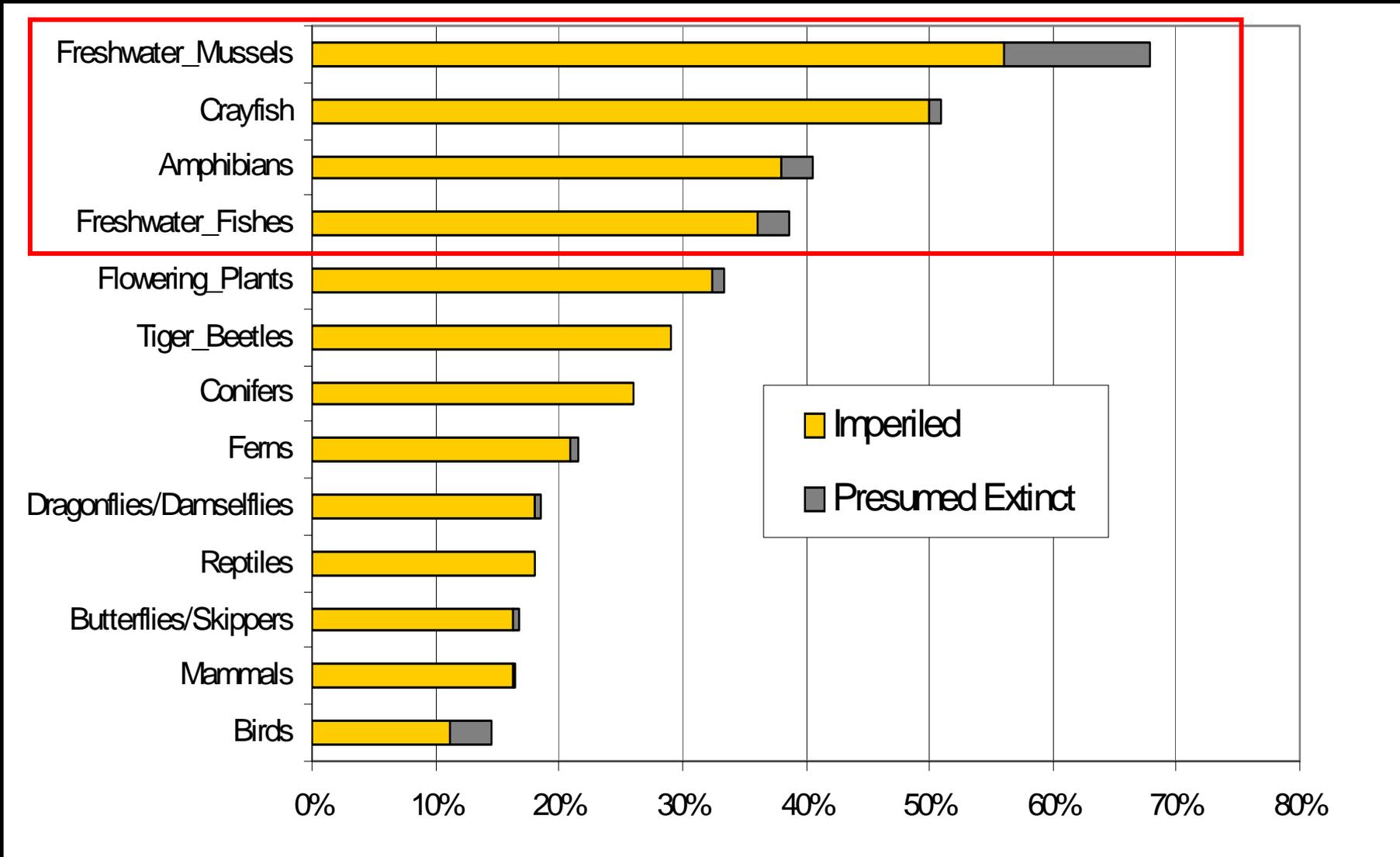
Maryland Darter (*Etheostoma sellare*)

DNR NHP Data

# Mass Extinction?

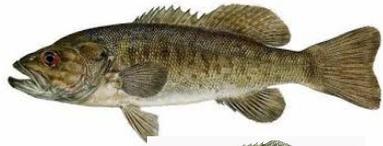


# Imperiled Taxa - United States

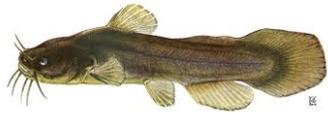


# Species Displacement (Biotic Homogenization)

## Youghiogheny



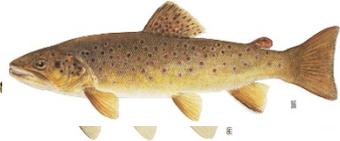
©Joseph Tomelleri



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northern pike  
alleri

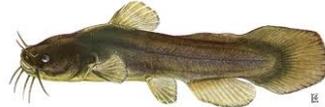


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## Other MD Watersheds



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northern pike  
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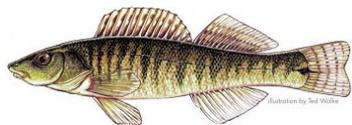
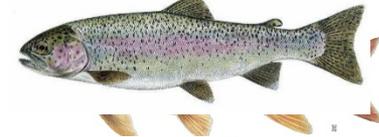
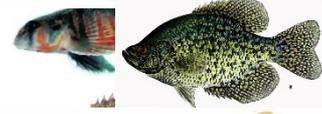
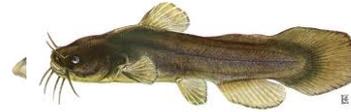


Illustration by Ted Wicks

## Other U.S. Watersheds



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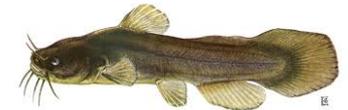
northern pike  
alleri



## Other Continents



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northern pike  
alleri



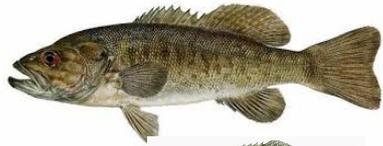
# Species Displacement (Biotic Homogenization)

Youghiogheny

Other MD Watersheds

Other U.S. Watersheds

Other Continents

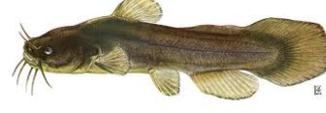


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northern pike  
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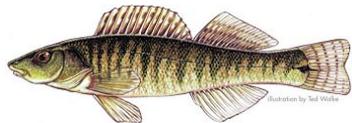


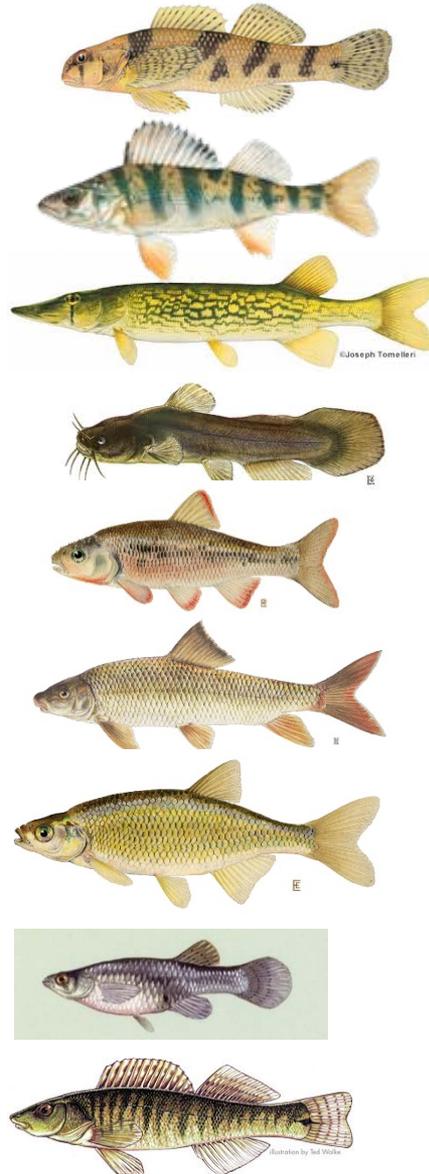
Illustration by Ted Work

# Species Displacement (Biotic Homogenization)

Youghiogheny



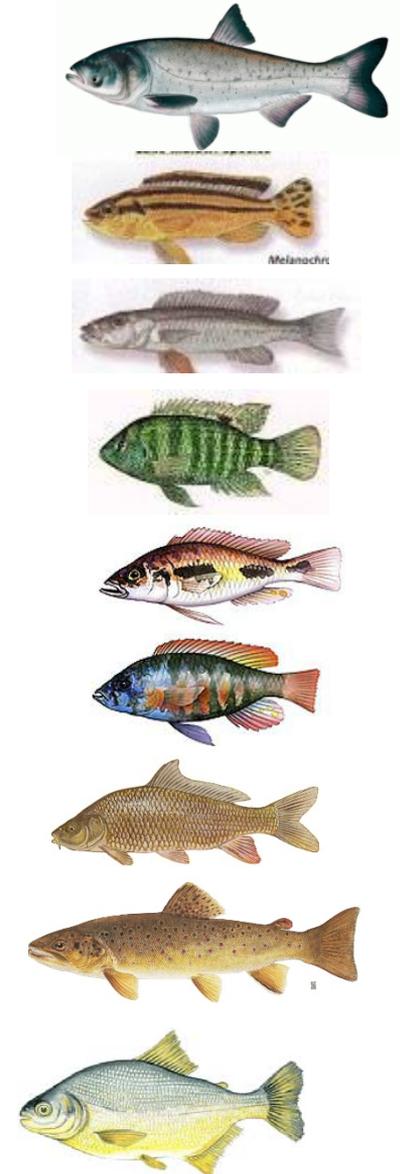
Other MD Watersheds



Other U.S. Watersheds



Other Continents



# Blockages By Dams and other Barriers

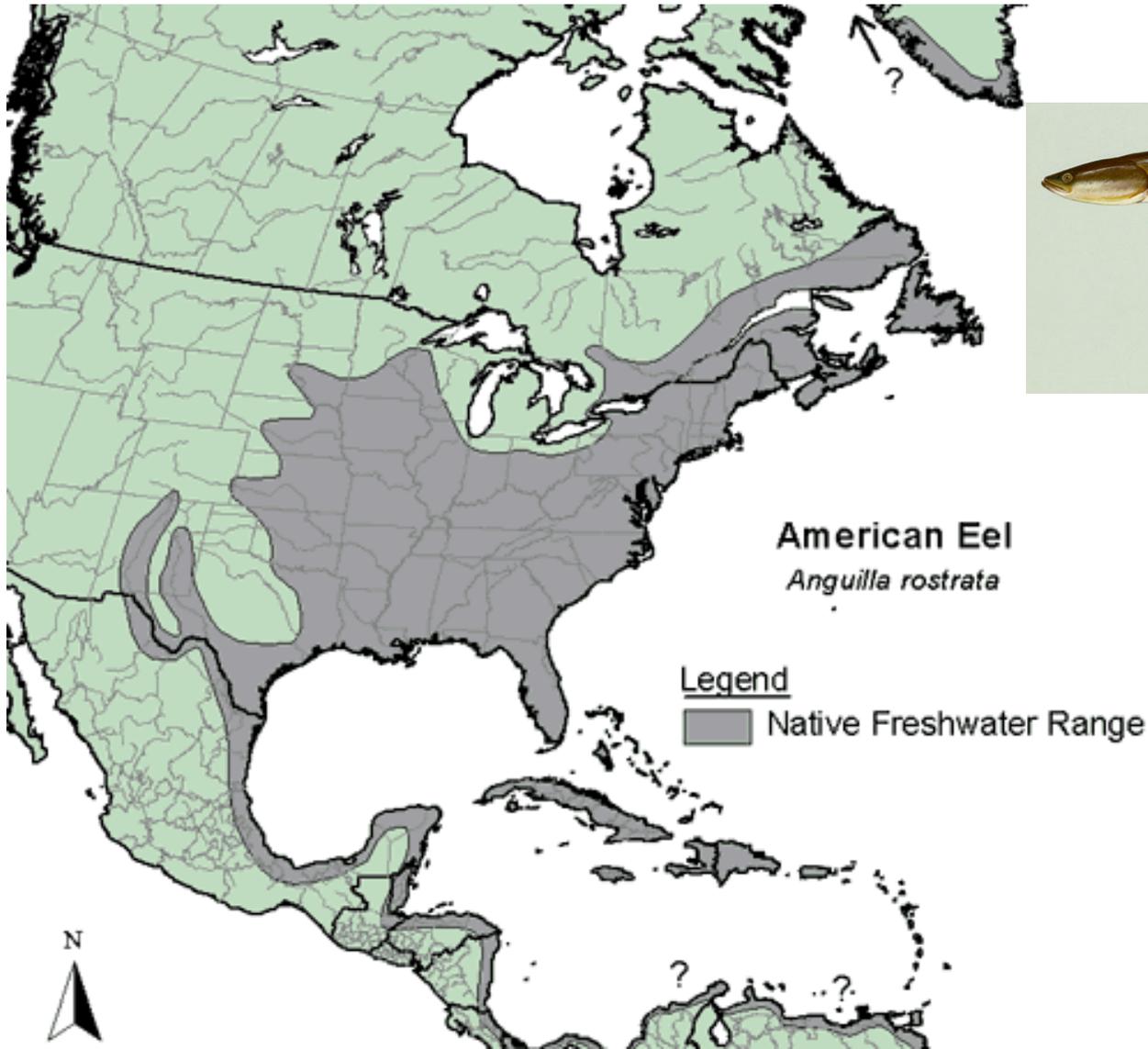


# Blockages to Anadromous Fishes in Maryland



*MDDNR Fisheries Service 2005*

“Up to 84% of riverine habitat in the U.S. eastern seaboard and Lake Ontario are upstream of dams, potentially impeding access to many North American freshwater streams for American Eels”

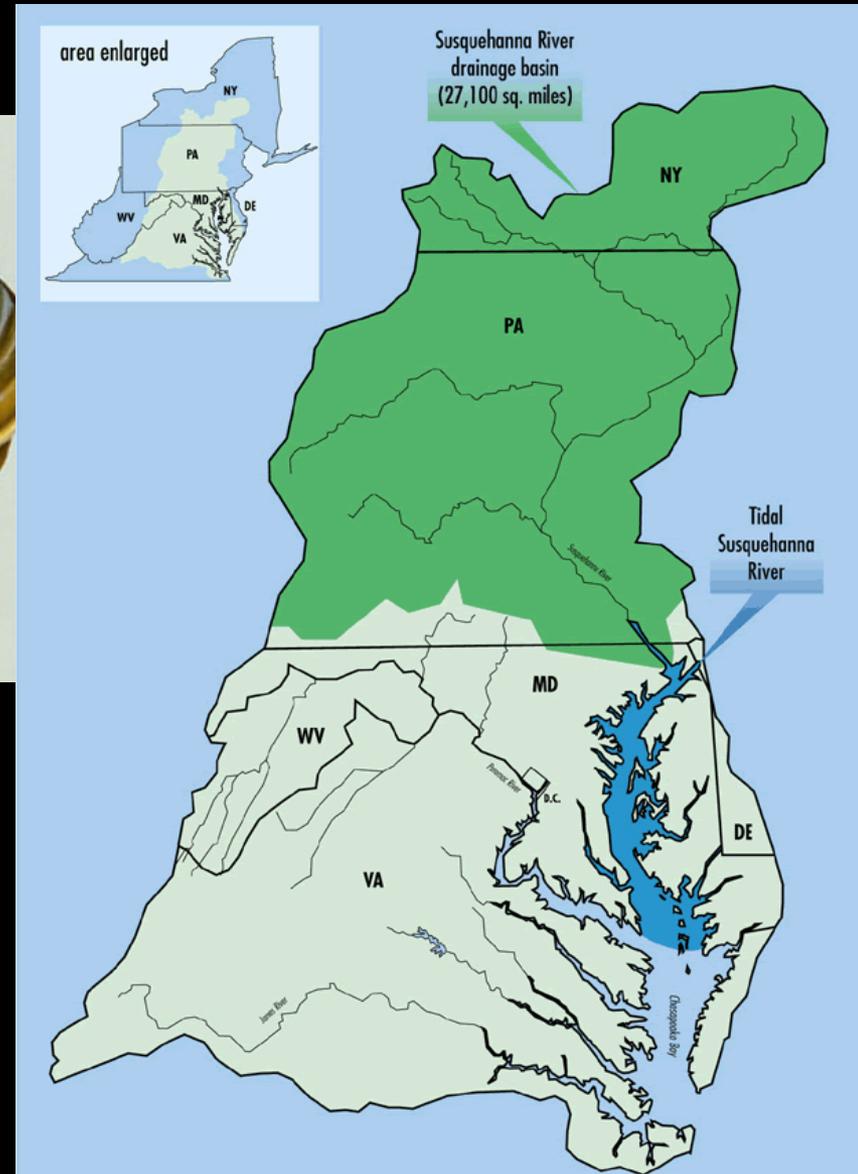


*Bush et al. 1998*

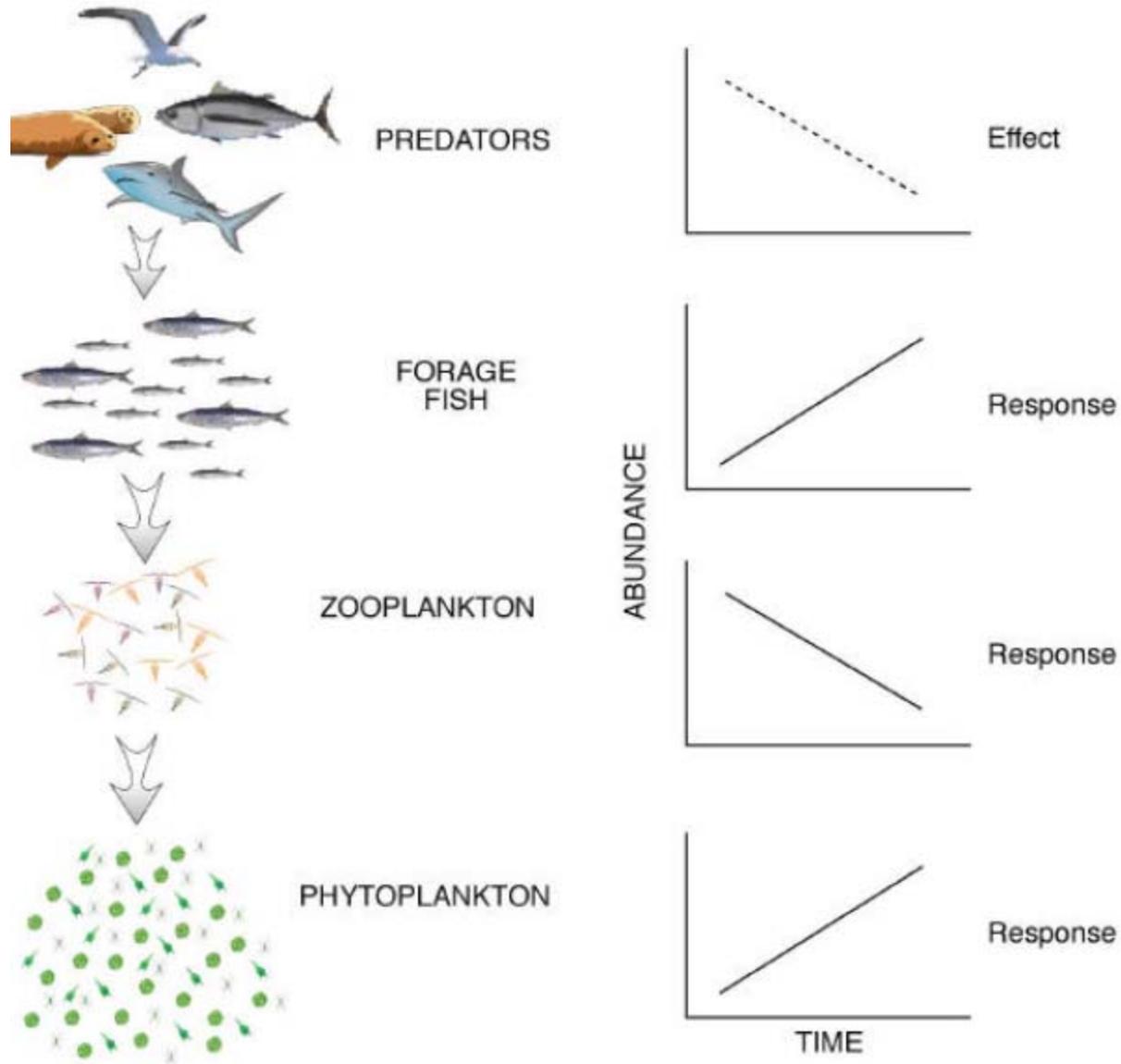
Eels are Catadromous and can spend 20 years or more living and growing in FW streams



# The Eastern Elliptio Mussel Needs the American Eel

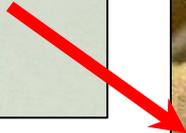
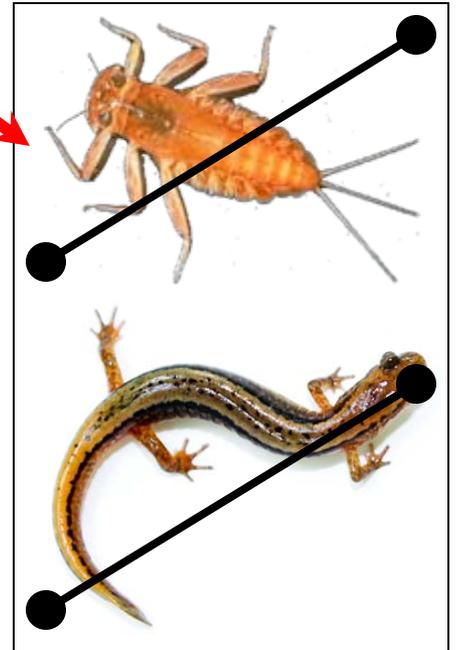
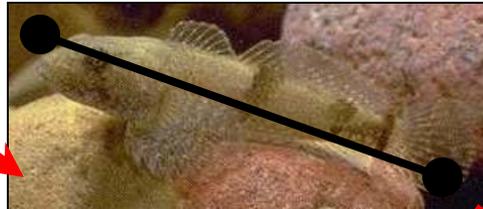


# Top Predator Loss in the Ocean Causes Trophic Cascades

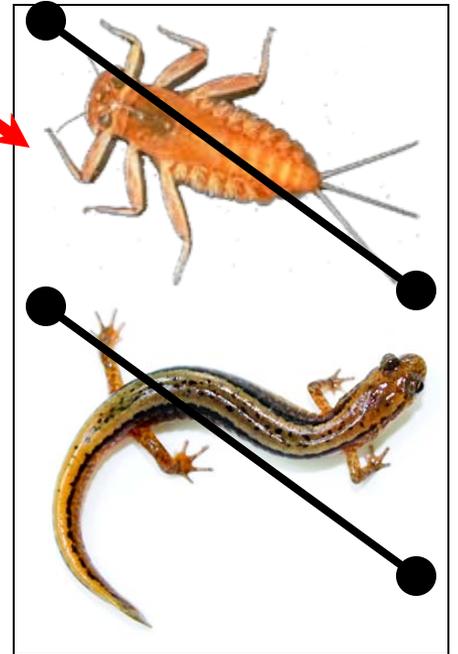
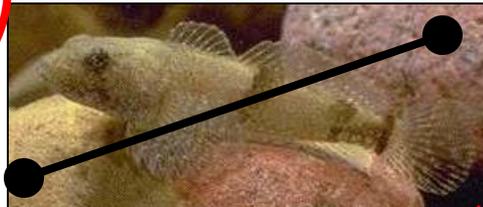


*Cury et al. 2001*

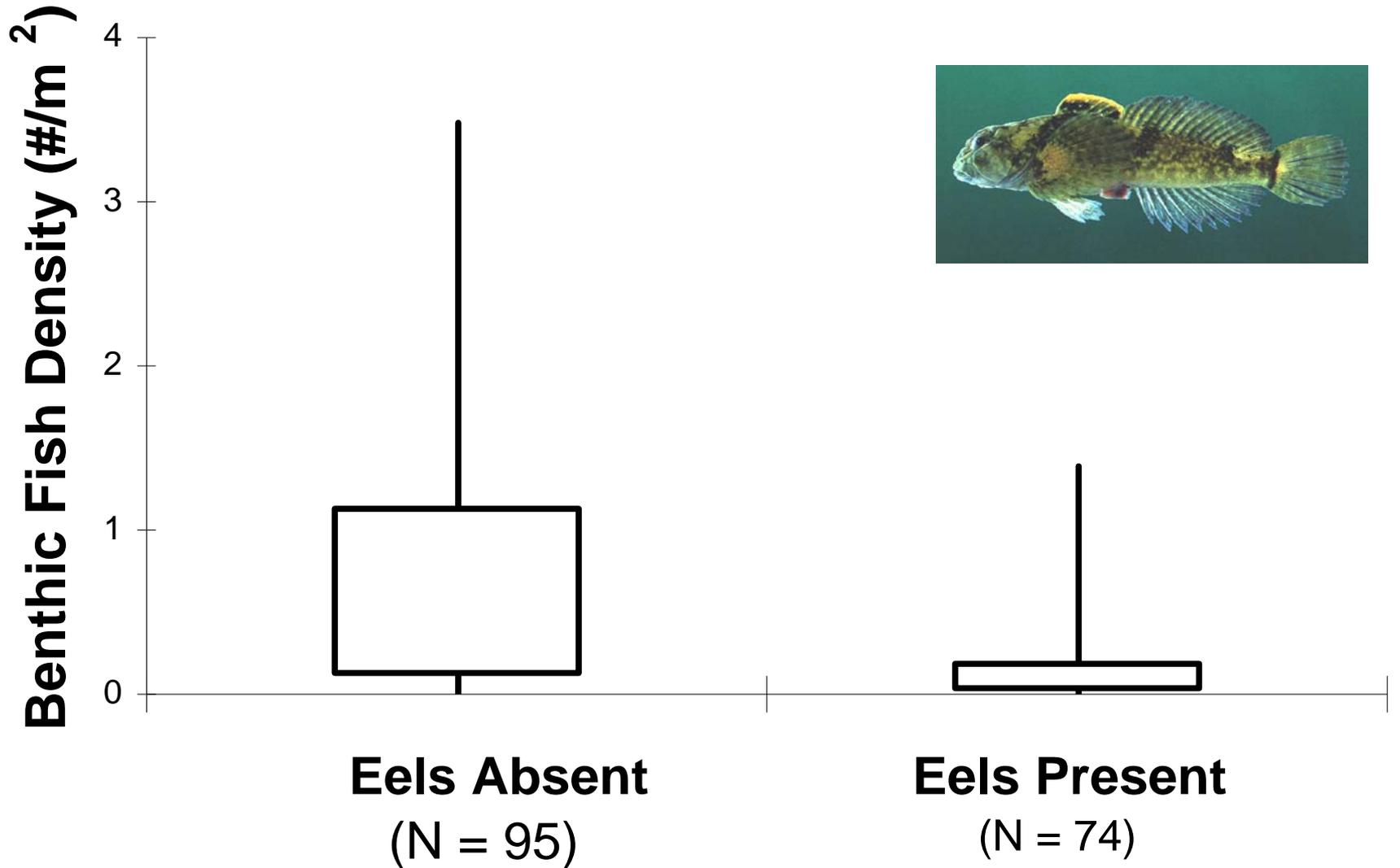
# Eels Are Native Top Predators in Small Streams



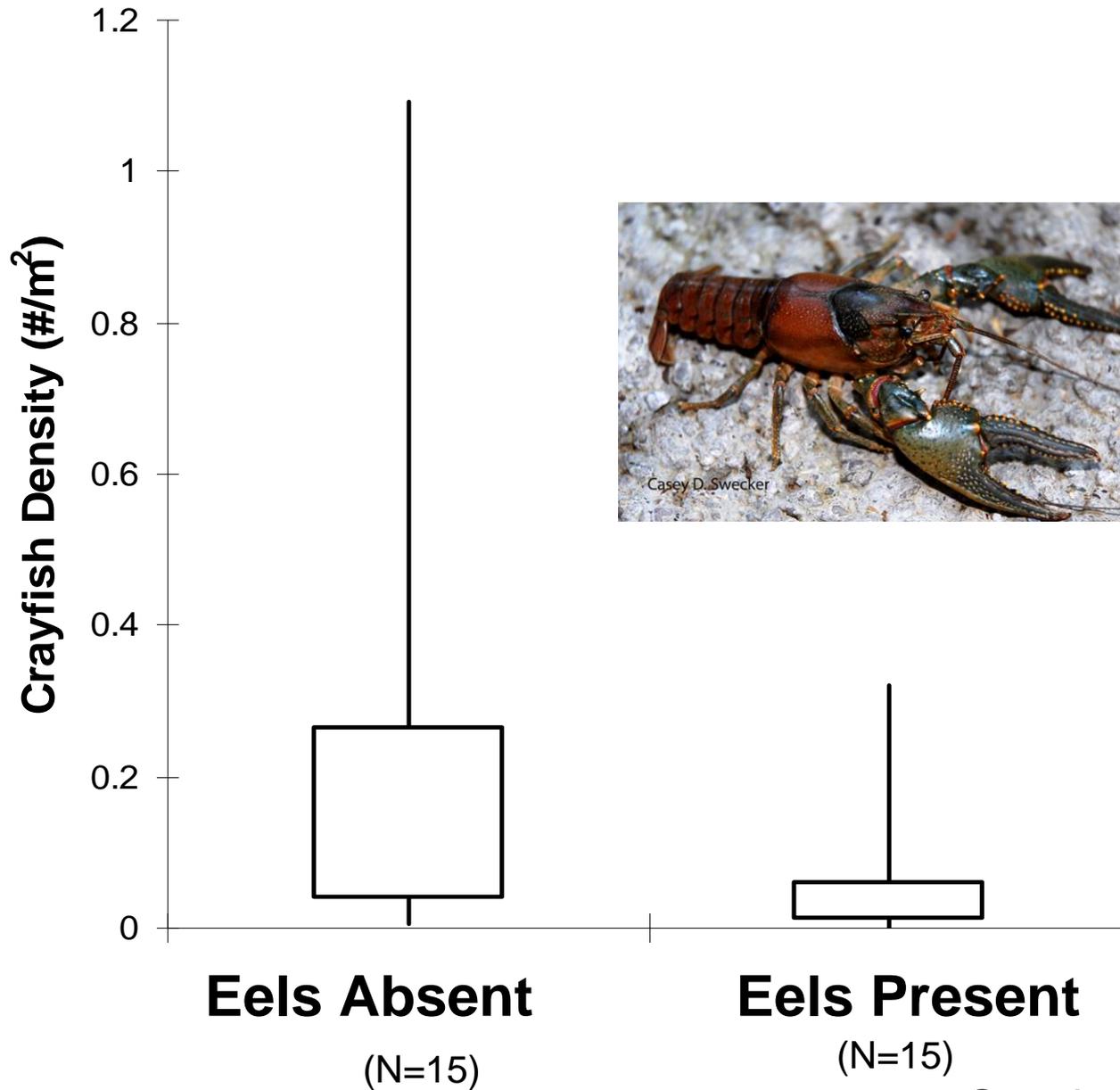
# Blocking Eels May Alter Stream Ecology



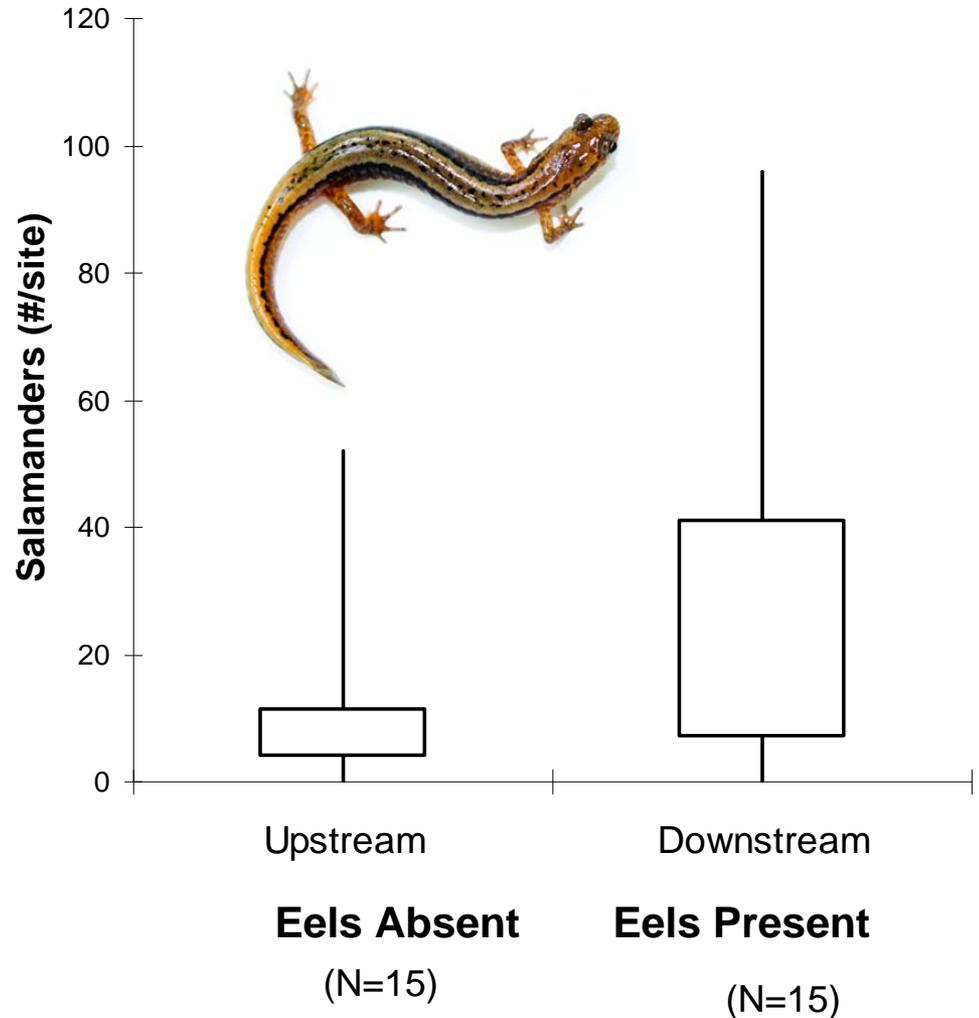
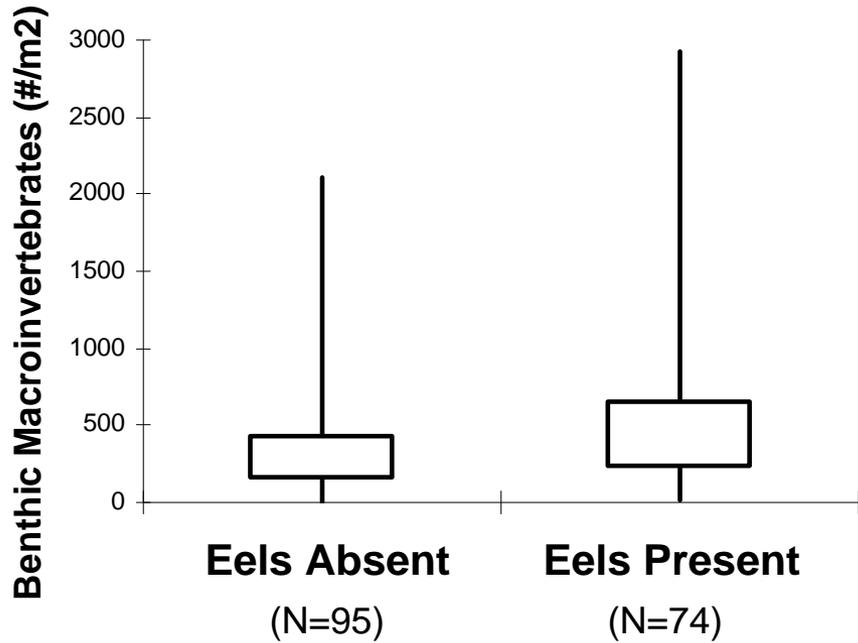
# More Benthic Fish Without Eels



# More Crayfish Without Eels



# Fewer Bugs and Salamanders Without Eels



# Ecological Reference Stream Without Eels?

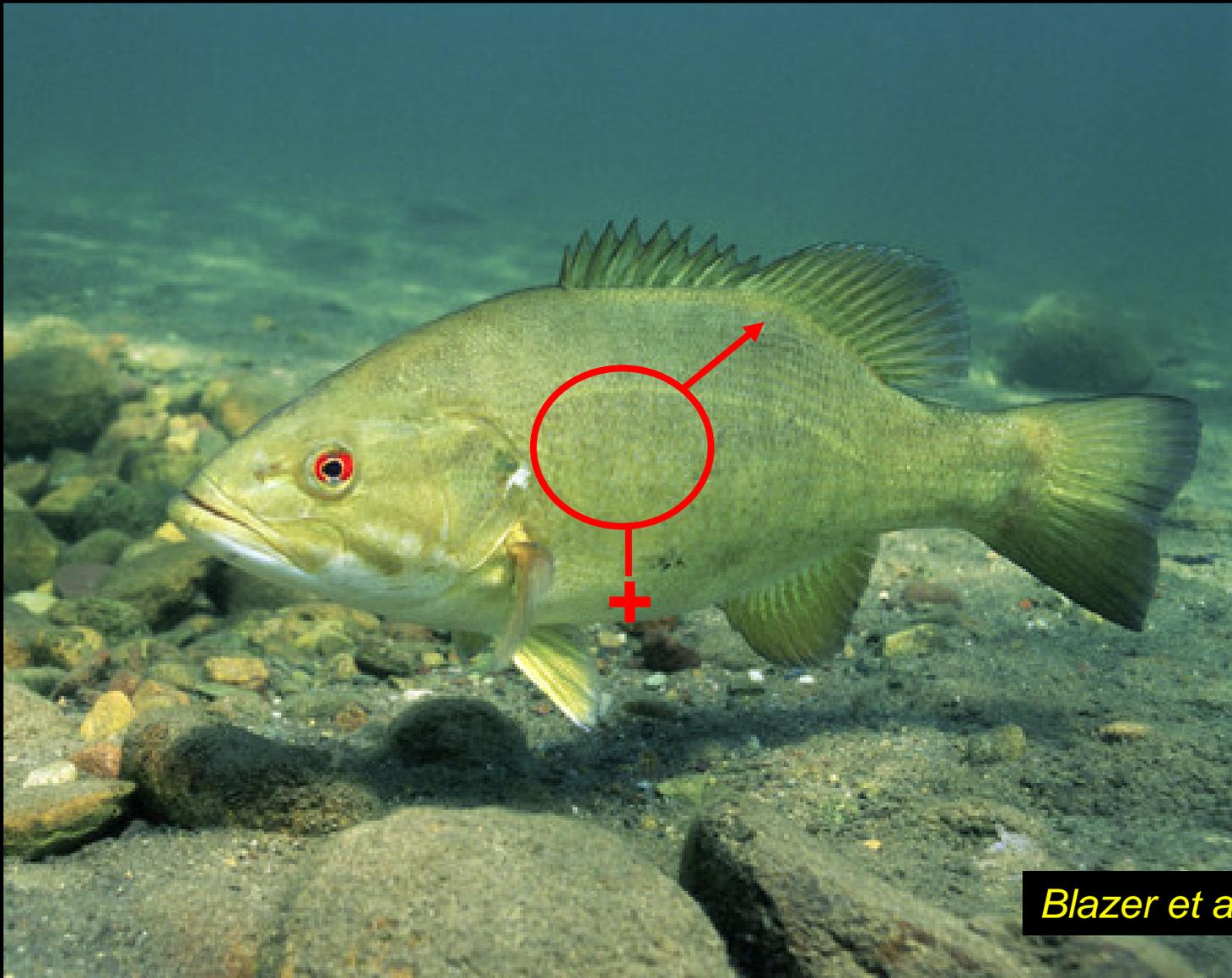
One species seems like a small change, but may have a big influence



Other seemingly small changes that may also have a big influence....

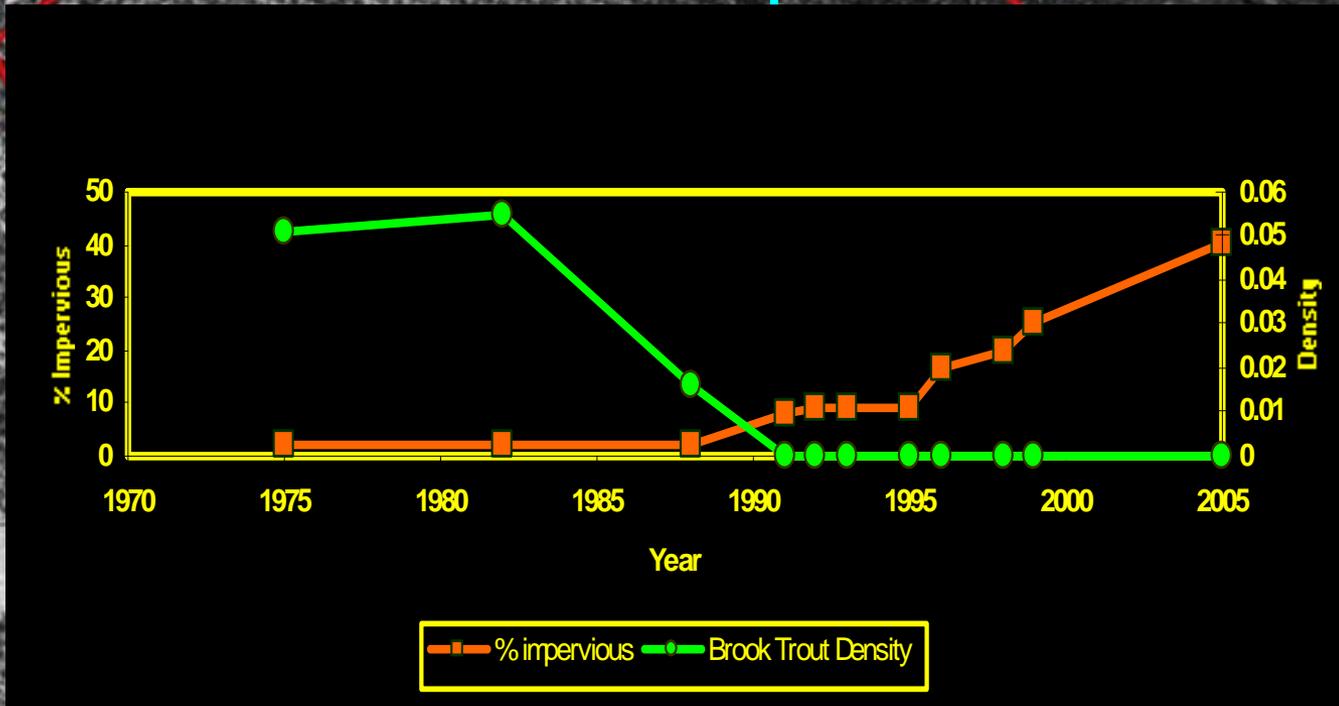
# Small changes can have a big influence

## Endocrine Disrupting Chemicals

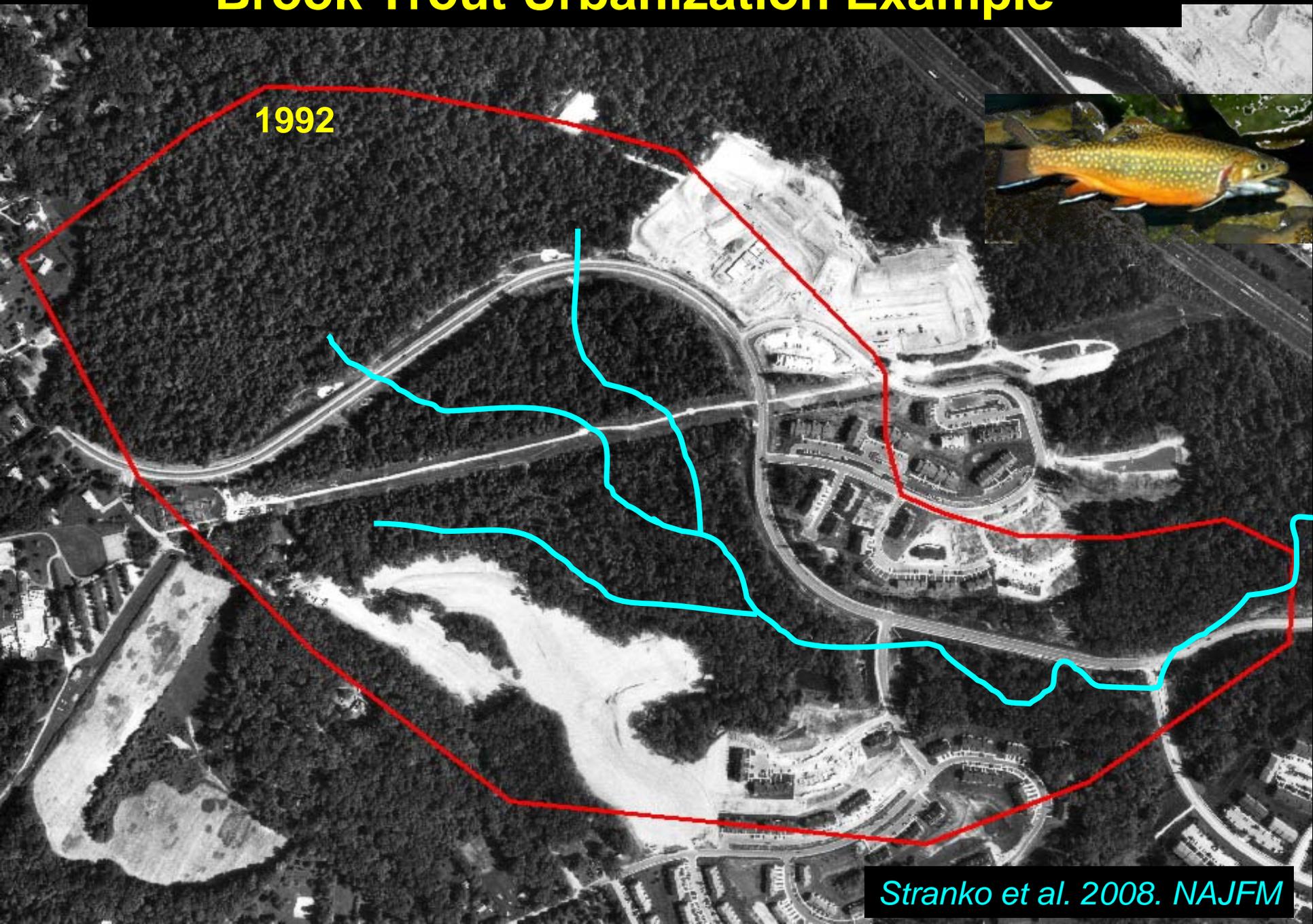


*Blazer et al. 2010*

# Brook Trout Urbanization Example



# Brook Trout Urbanization Example



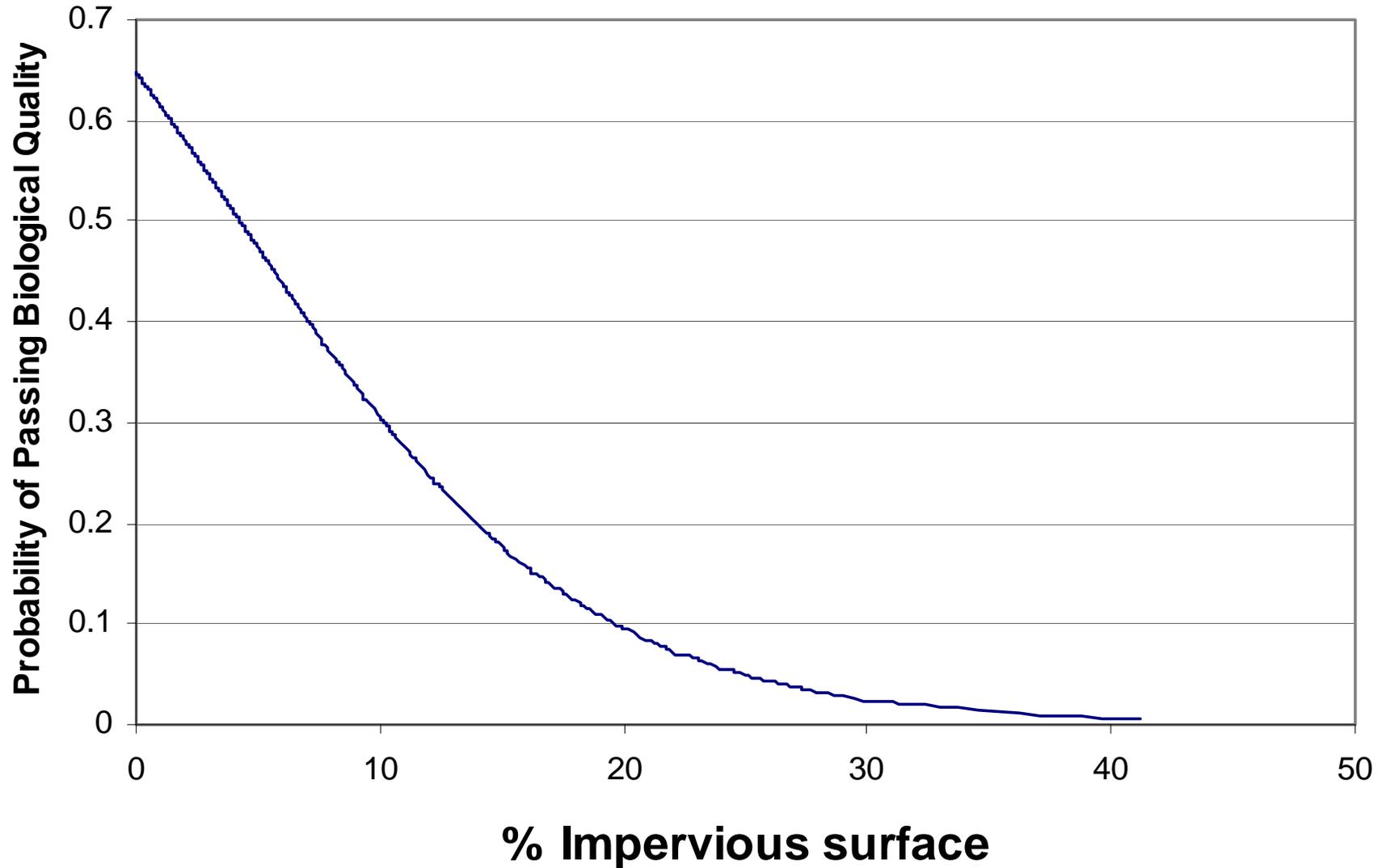
# Brook Trout Urbanization Example

2004



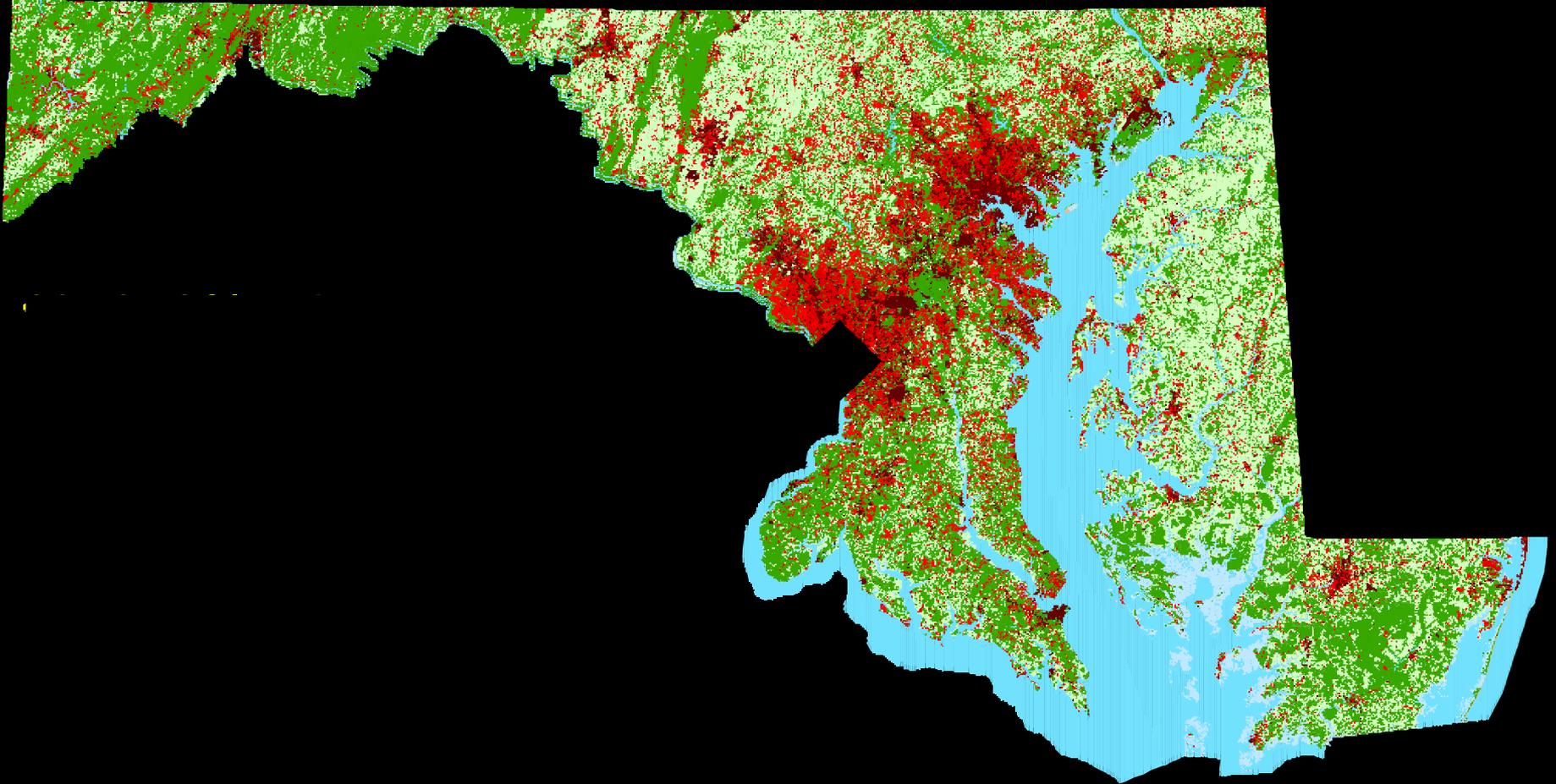
*Stranko et al. 2008. NAJFM*

# Streams in Urban Watersheds are Biologically Impaired



*Volstad et al. 2003*

# Urban Land Cover in Maryland



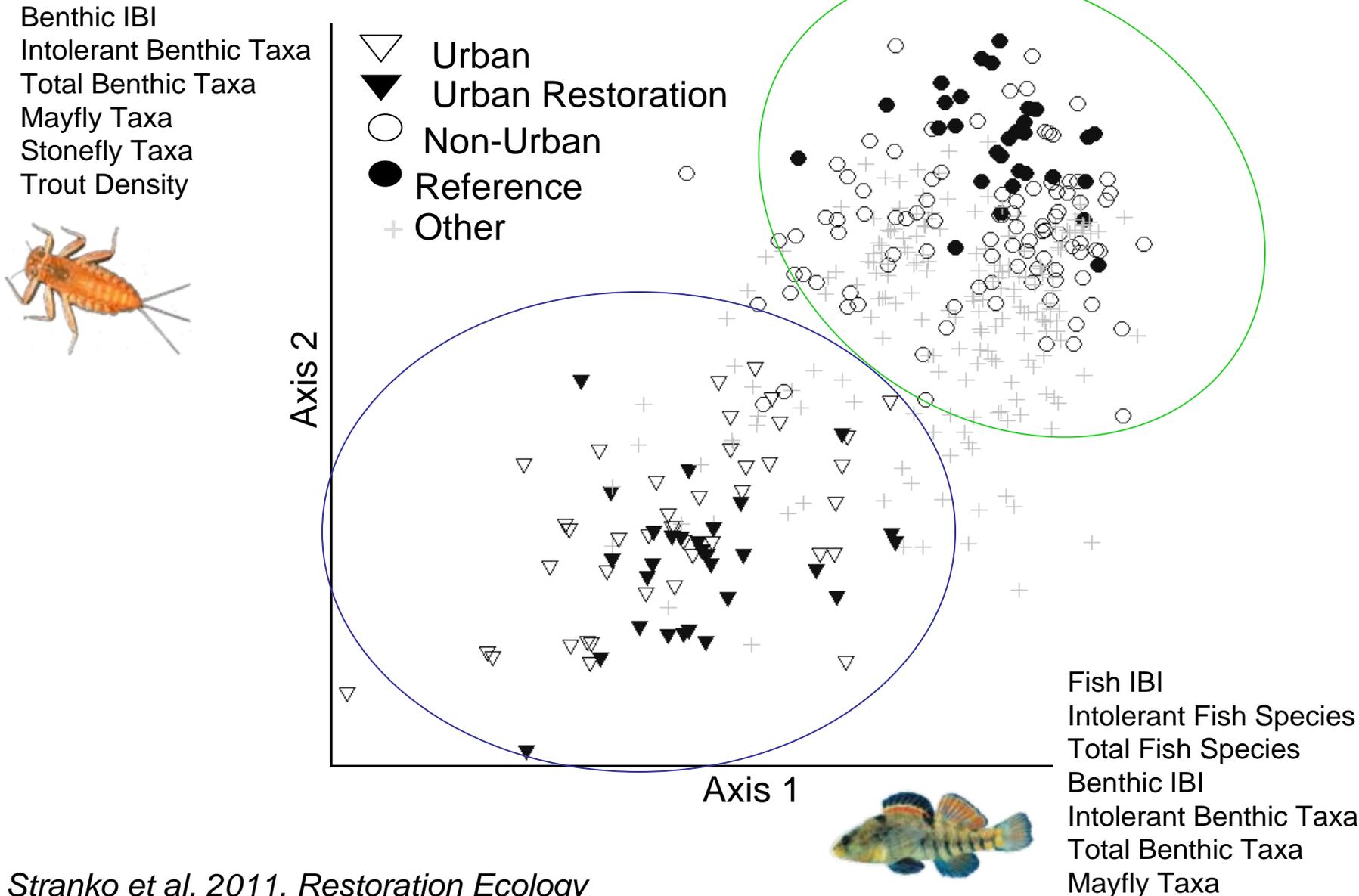
About 2 Million More People by 2030

# Restoration Improves Certain Aspects of Urban Streams

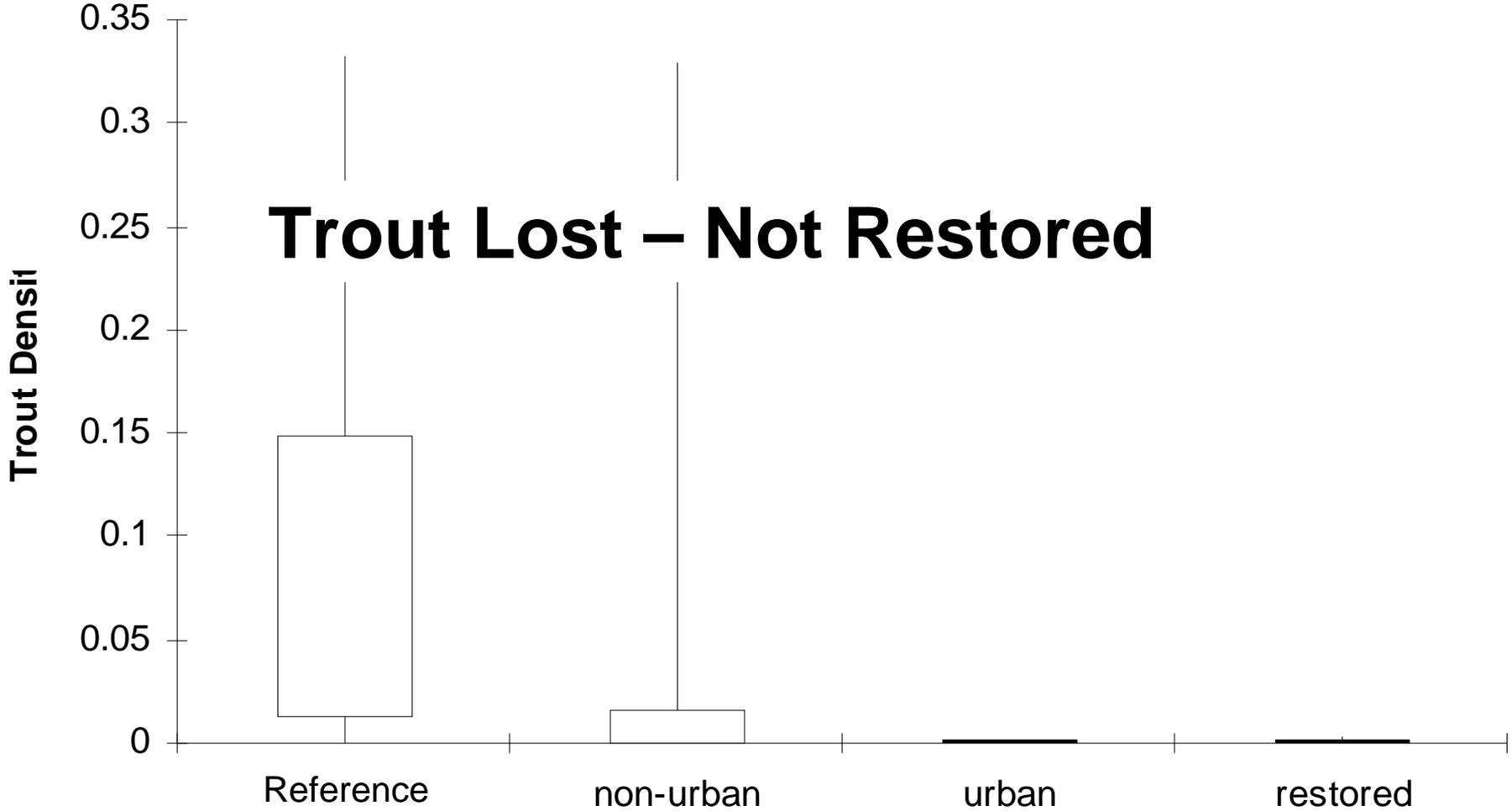
- Reduced nutrients
- Reduced flow peaks
- Reduced erosion
- Improved Ecological Condition?



# Ecological Condition of Urban Restoration Streams?



# Trout Data from Restoration and Reference Streams



# This Qualified as a Reference Stream



Many examples of stream restoration  
improving habitat and ecology in non-urban  
watersheds



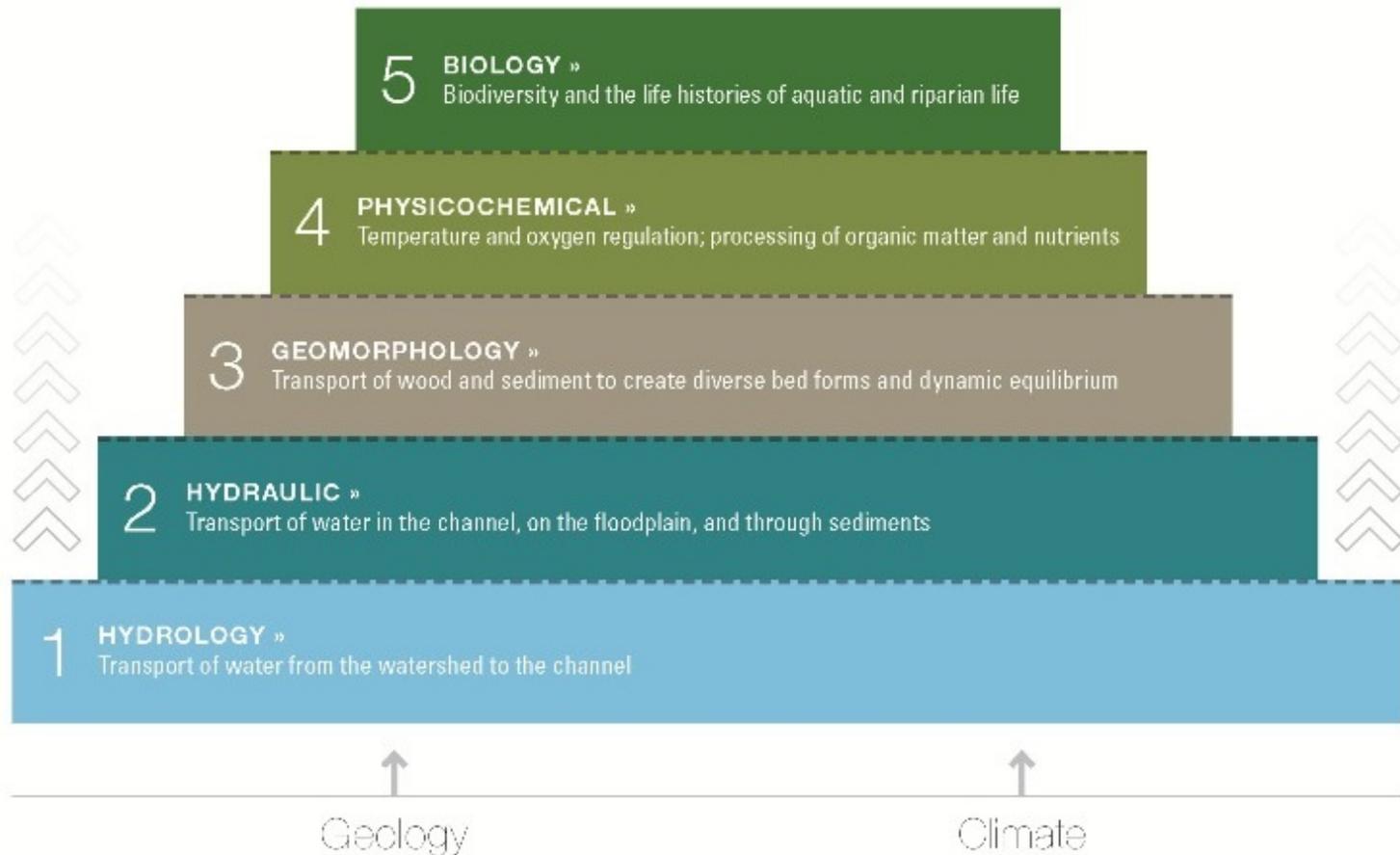
# Why are urban streams such a challenge for biological restoration?

- Maybe because there are so many things that need to be fixed
- Maybe because the magnitude of impact can be so large



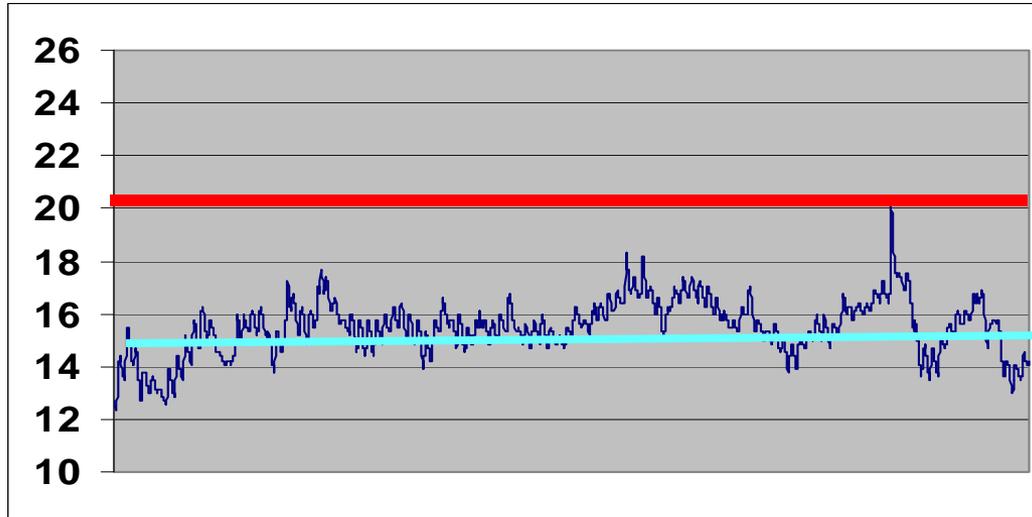
*Walsh et al. 2005  
Urban Syndrome*

# All Needs Must Be Met To Support Biology



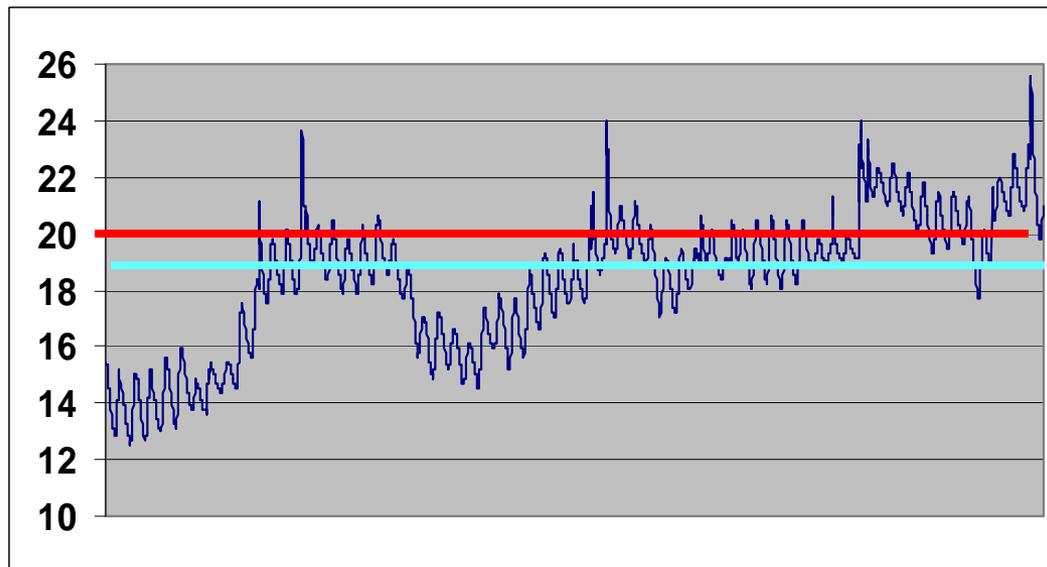
*Hutchinson 1957*  
*Harman et al 2012*

# Trout Disappeared from Urban Streams As They Got Warmer



Maryland  
regulations  
< 20°C

With Trout (Average 15.5 °C)

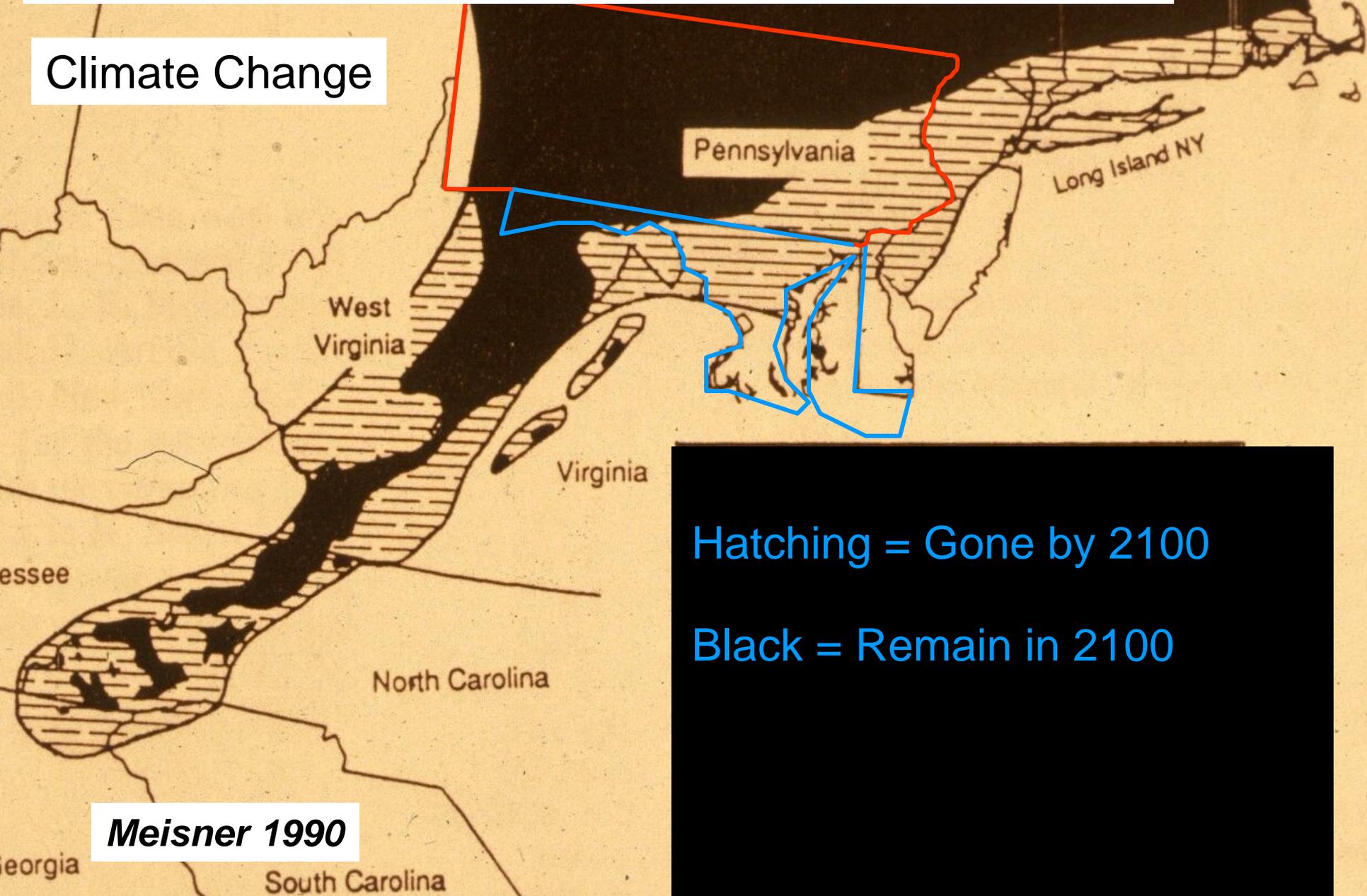


Maximum 24 °C  
(MacCrimmon and  
Campbell 1969;  
Galli 1990)

No Trout (Average 18.4 °C)

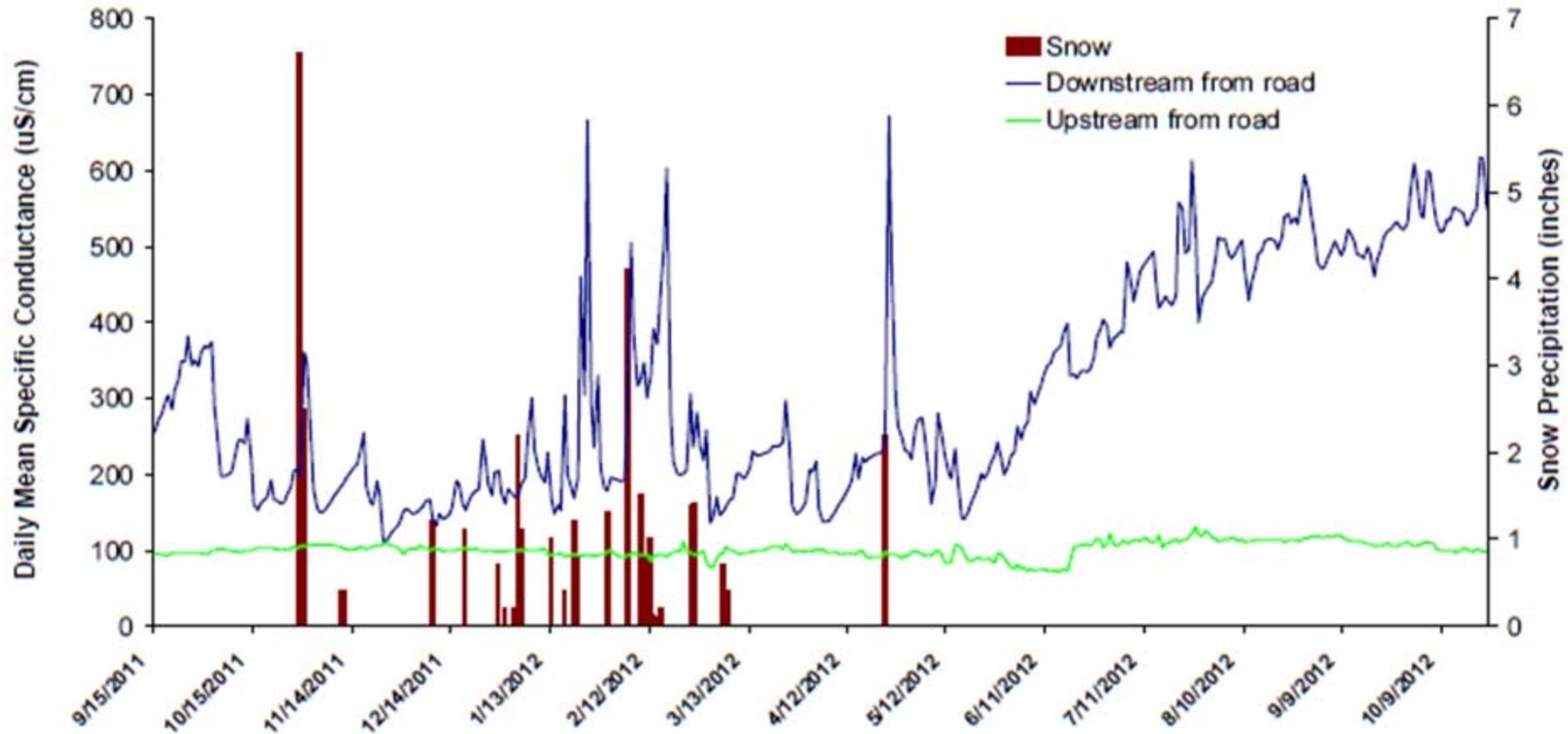
# Brook Trout Distribution Forecast

Climate Change

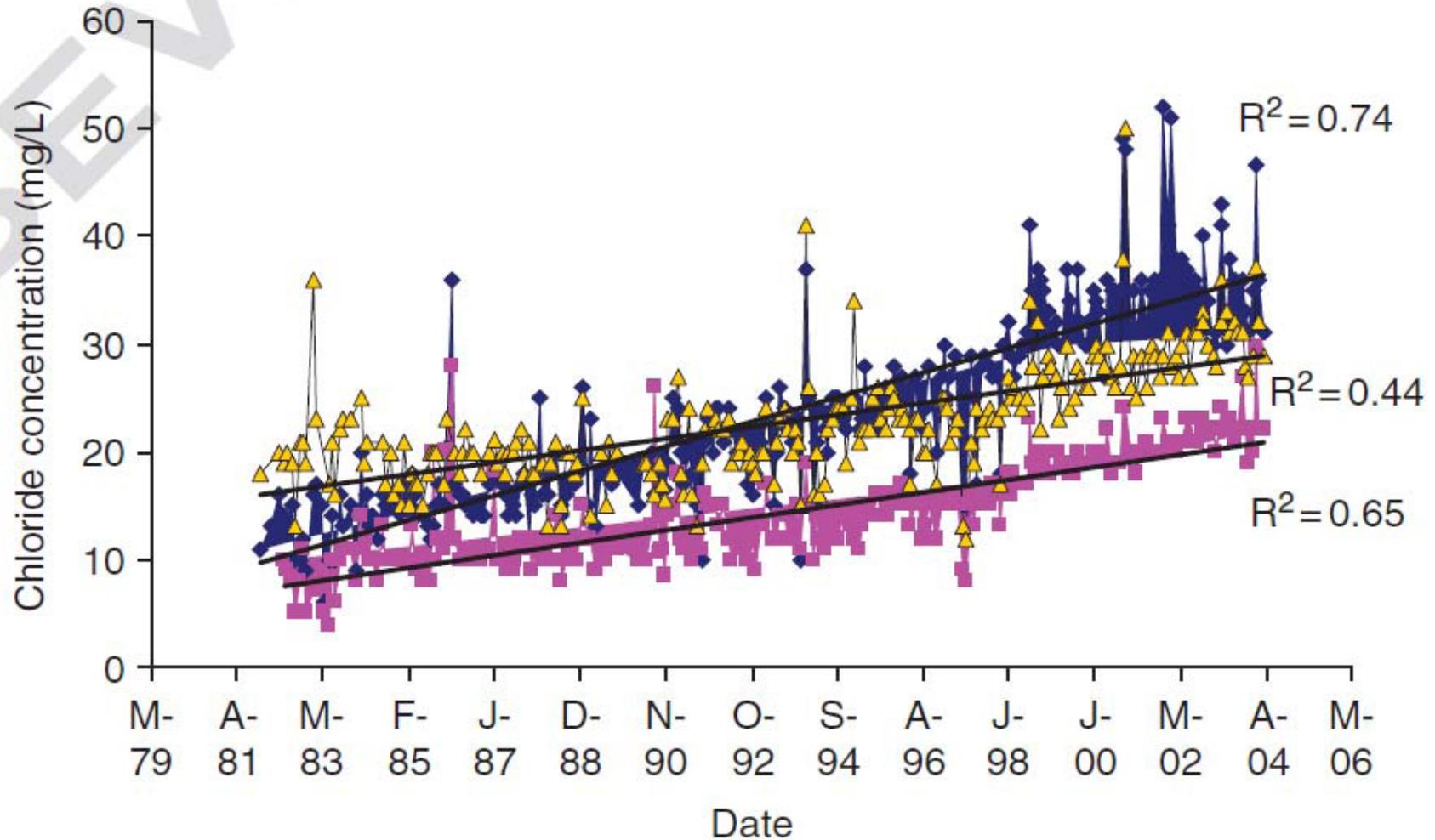


**Meisner 1990**

# Road Salt - Another Stressor to Urban Streams



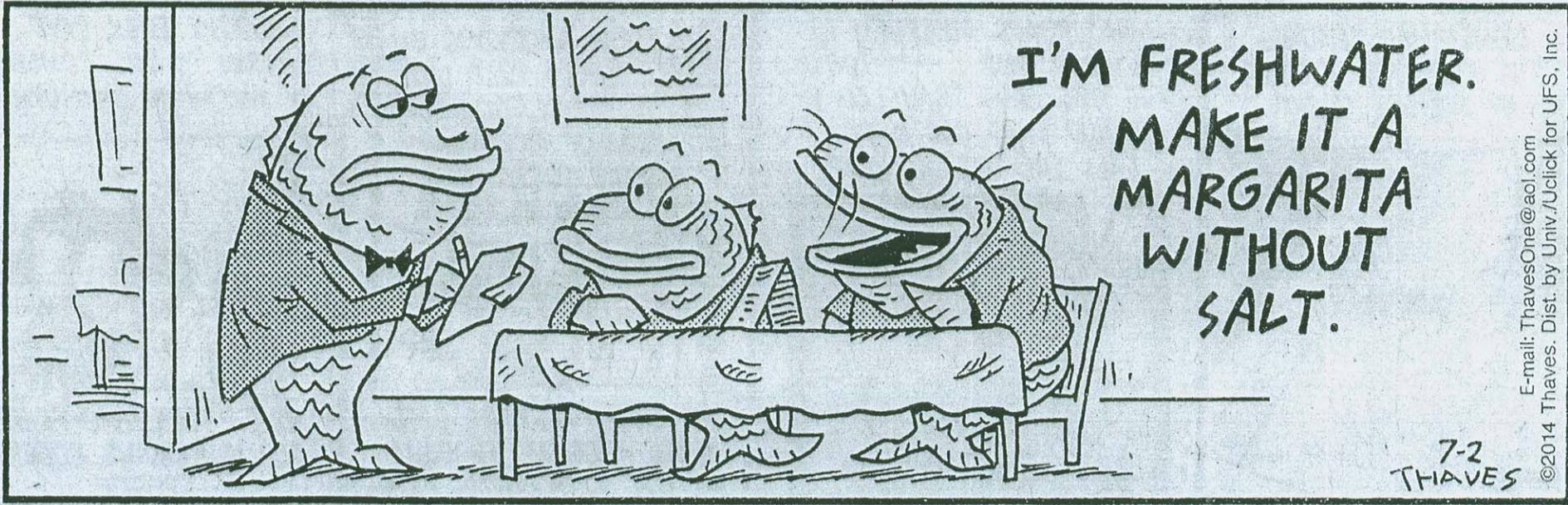
# Road Salt in Streams Entering a Drinking Water Reservoir



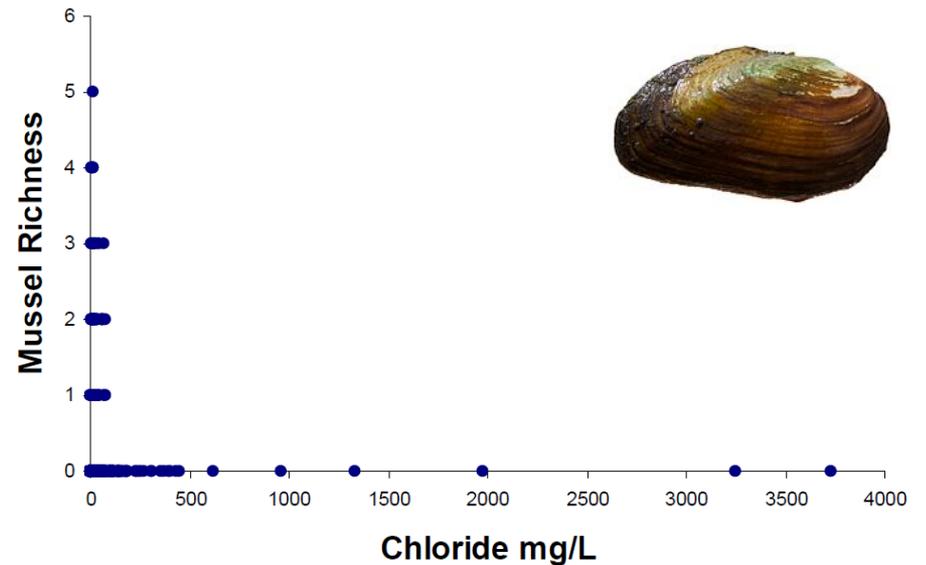
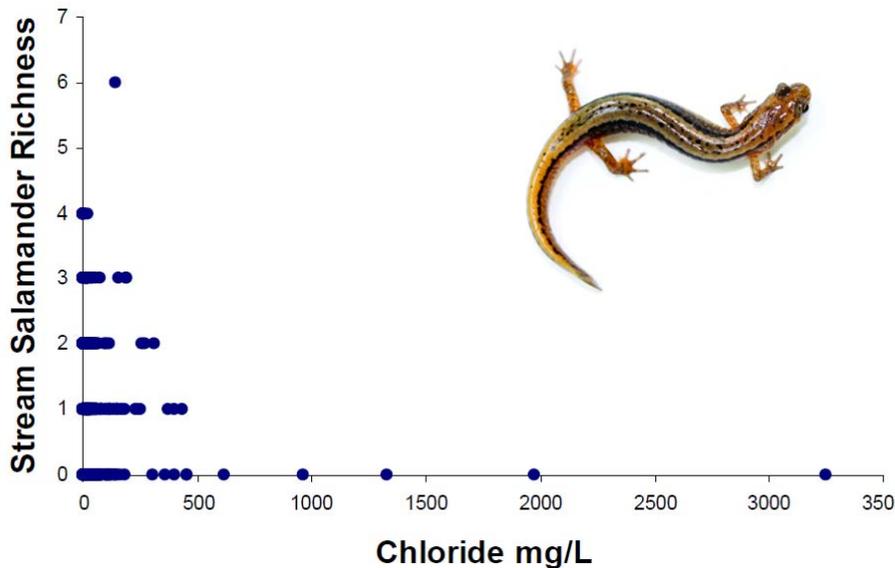
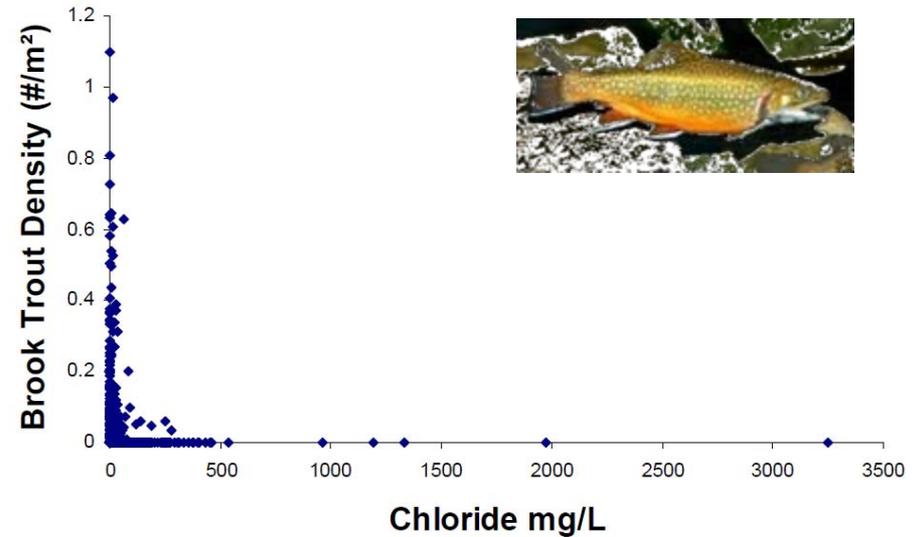
# Freshwater Animals Don't Like Salt Water

FRANK AND ERNEST

TOM THAVES



# Freshwater Animals Don't Like Salt Water



# There are many threats to Maryland's Stream Ecology

Who cares?

Do Marylanders need/want high quality streams?



## Government regulations and policies reflect society's needs and desires

### **Stream Designated Use**

- All streams should have sufficient water quality to support fishing, water contact, agriculture, industrial uses.
- Use Class IV streams should support stocked trout
- Use Class III streams should support trout reproduction
- Streams that feed drinking water supplies should have extra protection from pollution

### **Anti-degradation**

- High Quality (Tier II) streams should maintain biological diversity comparable to reference streams

# Marylander's Do Care About Stream Condition

## Streams in Historical Condition Would Provide Everything

### **Executive Order 13508 Chesapeake Bay Protection and Restoration**

There should be....

- Less pollution from streams to Chesapeake Bay
- Fewer blockages to fish passage
- More forested buffers
- More brook trout
- Improved stream health

### **Chesapeake Bay TMDL and WIPs**

- Chesapeake Bay and tributaries should have cleaner water coming from streams

We must continue to demonstrate success in improving the water quality, habitat, and ecology of degraded streams



Cayuga River, Ohio 1952

# Restoring Ecological Conditions to Urban Streams is an Important Focus



- Restoration Efforts in Degraded Streams Must Continue

# Protection of Our Best Streams is Imperative



Can we protect more of our best remaining streams?

Protection may be the best way to stop the shifting baseline

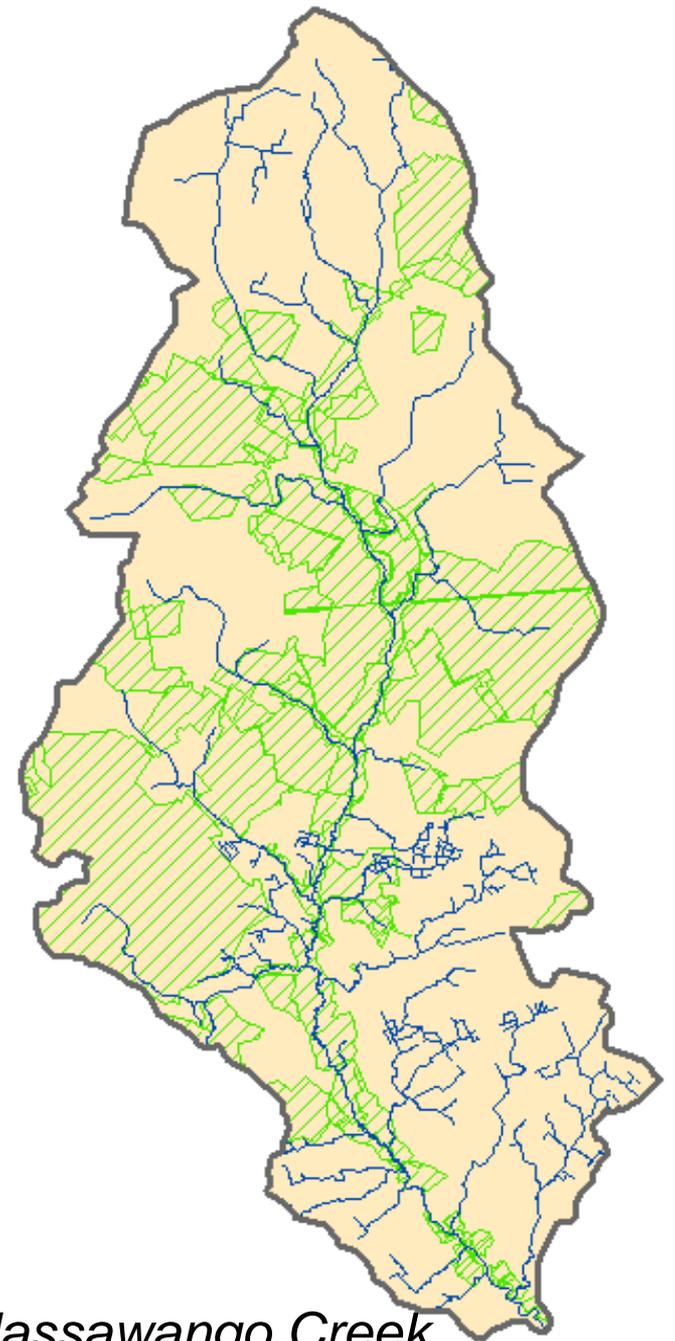


# Encouraging Examples of Conservation/Protection

- Watershed Organization
- River Keepers
- Chapman Landing
- Mattawoman Creek
- Land Trusts
- DNR's Land Acquisition
- Endangered Species Protection
- Natural Areas
- Wildlands
- Environmental Review
- Anti-degradation Regulations
- Chesapeake Bay Program
- Bay TMDL Progress
- Etc



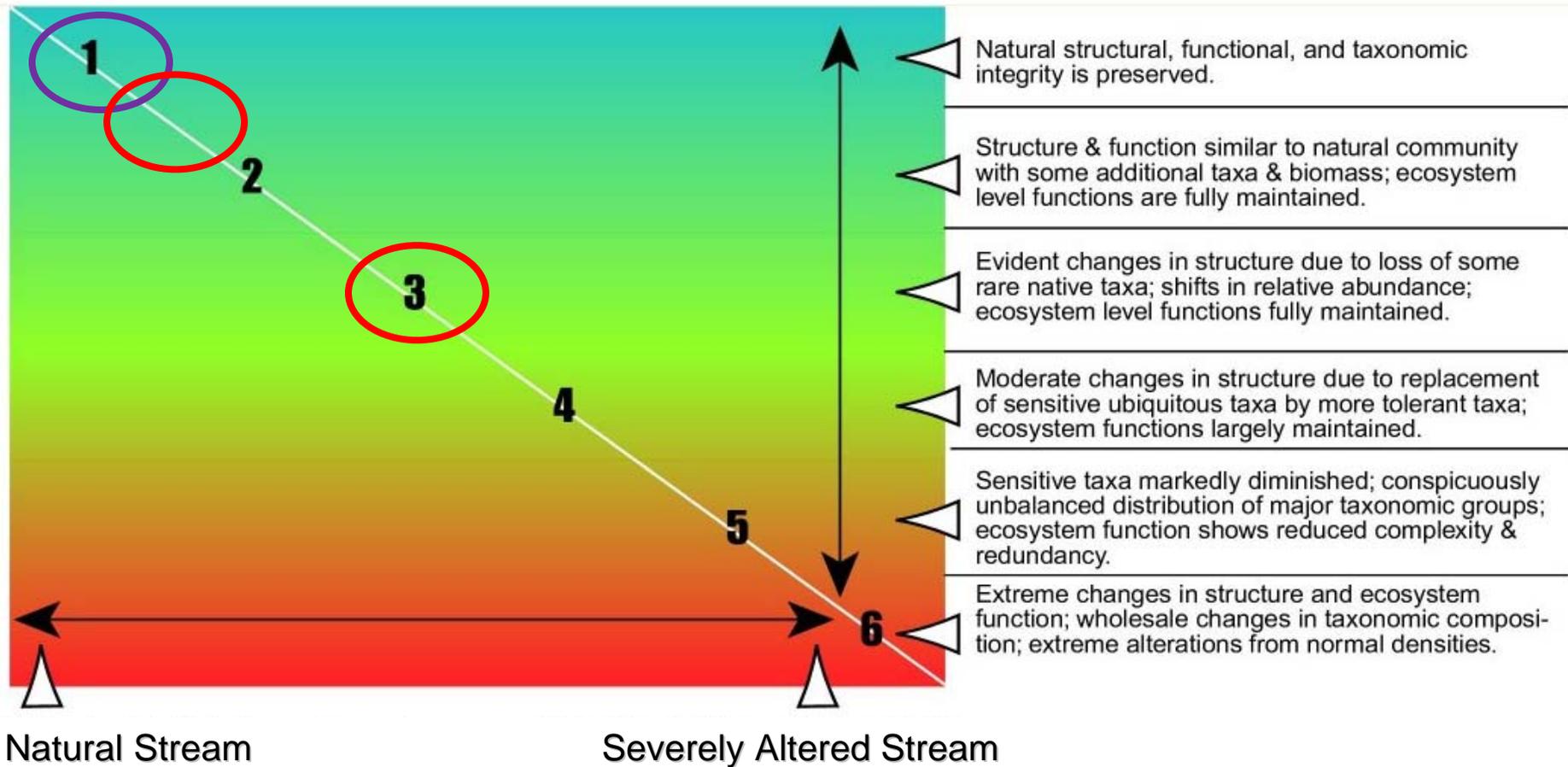
Can some of our best streams and watersheds be improved... to become more like they were Historically?



*Nassawango Creek*

# Challenge – Can We Shift the Baseline in the Positive Direction?

## Historical Ecological Condition



# How Close Can We Get to Historical Conditions?

Comparable to Historical

