MARYLAND DEPARTMENT OF NATURAL RESOURCES

MARYLAND
Smart, Green & Growing

Managing Land Use, Fish Habitat, and Fisheries in a Large and Diverse Estuary

(it's the Chesapeake Bay)

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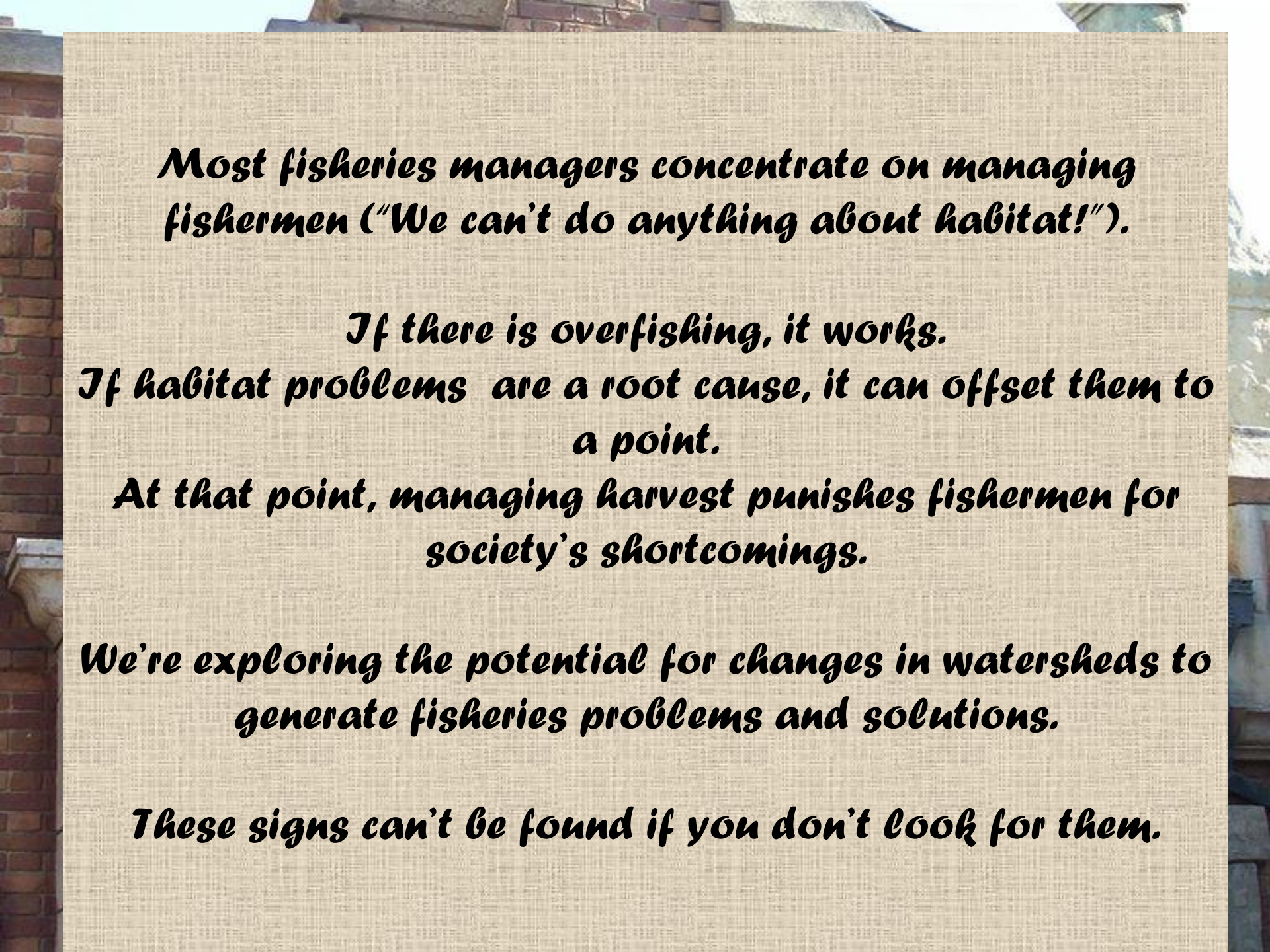
MARYLAND DEPARTMENT OF NATURAL RESOURCES

Bay fish habitat historically competed with other localized, stressful uses..

Maryland Fisheries Service has been looking at fish habitat, land-use, and fisheries dynamics in Chesapeake Bay

- Goals:
  - Assessments and management strategies that reflect land-use impacts
  - Guidance for planning agencies
  - Public support for watershed conservation

Focus is on “iconic”managed species i.e., keep the common species common



Most fisheries managers concentrate on managing fishermen ("We can't do anything about habitat!").

If there is overfishing, it works.
If habitat problems are a root cause, it can offset them to a point.
At that point, managing harvest punishes fishermen for society's shortcomings.

We're exploring the potential for changes in watersheds to generate fisheries problems and solutions.

These signs can't be found if you don't look for them.

Crash and recovery of Chesapeake Bay striped bass has become a fisheries management parable: Recovery follows reductions in fishing.

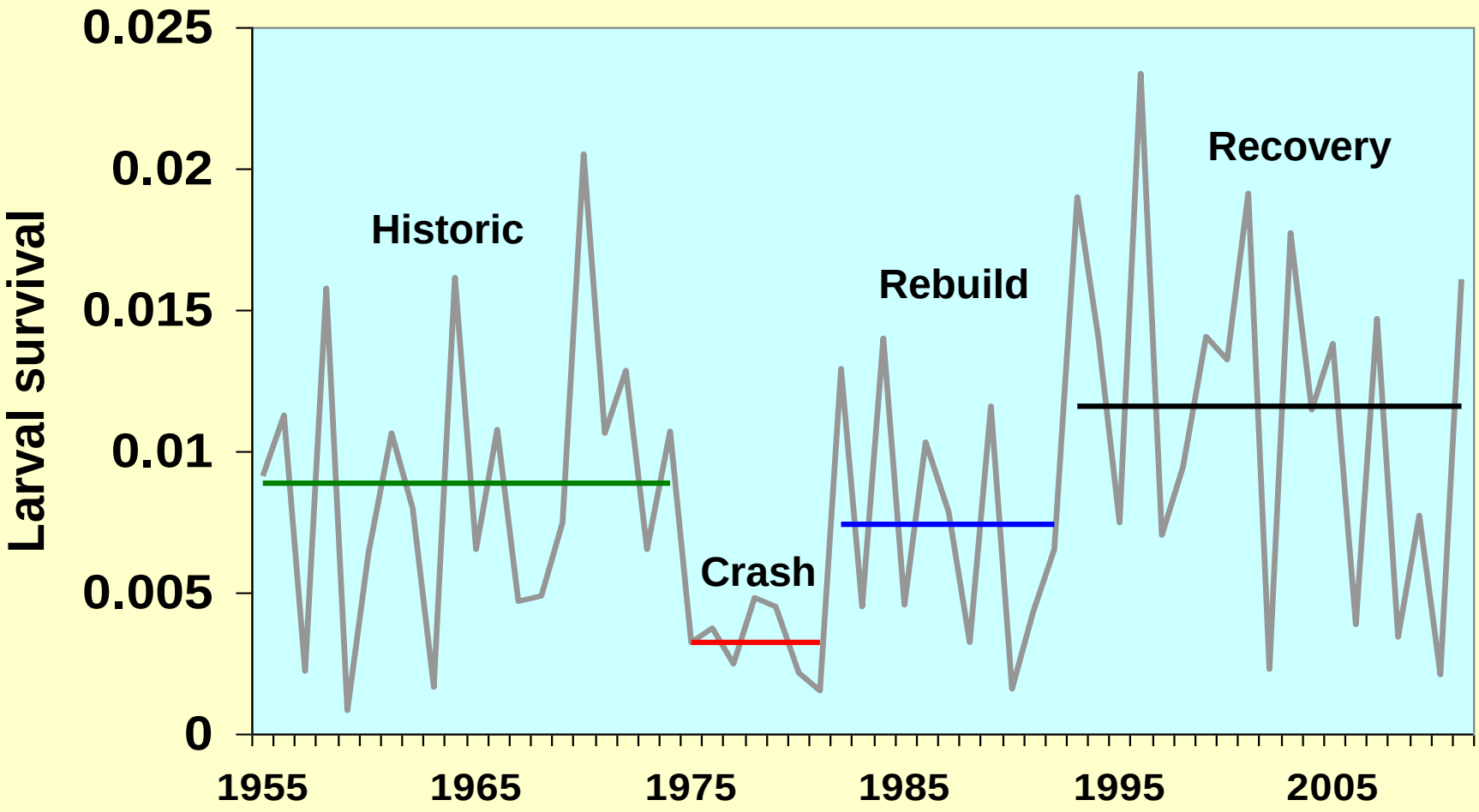
Contaminant / larval survival hypothesis was neglected.

In retrospect, it may link recovery and land use.

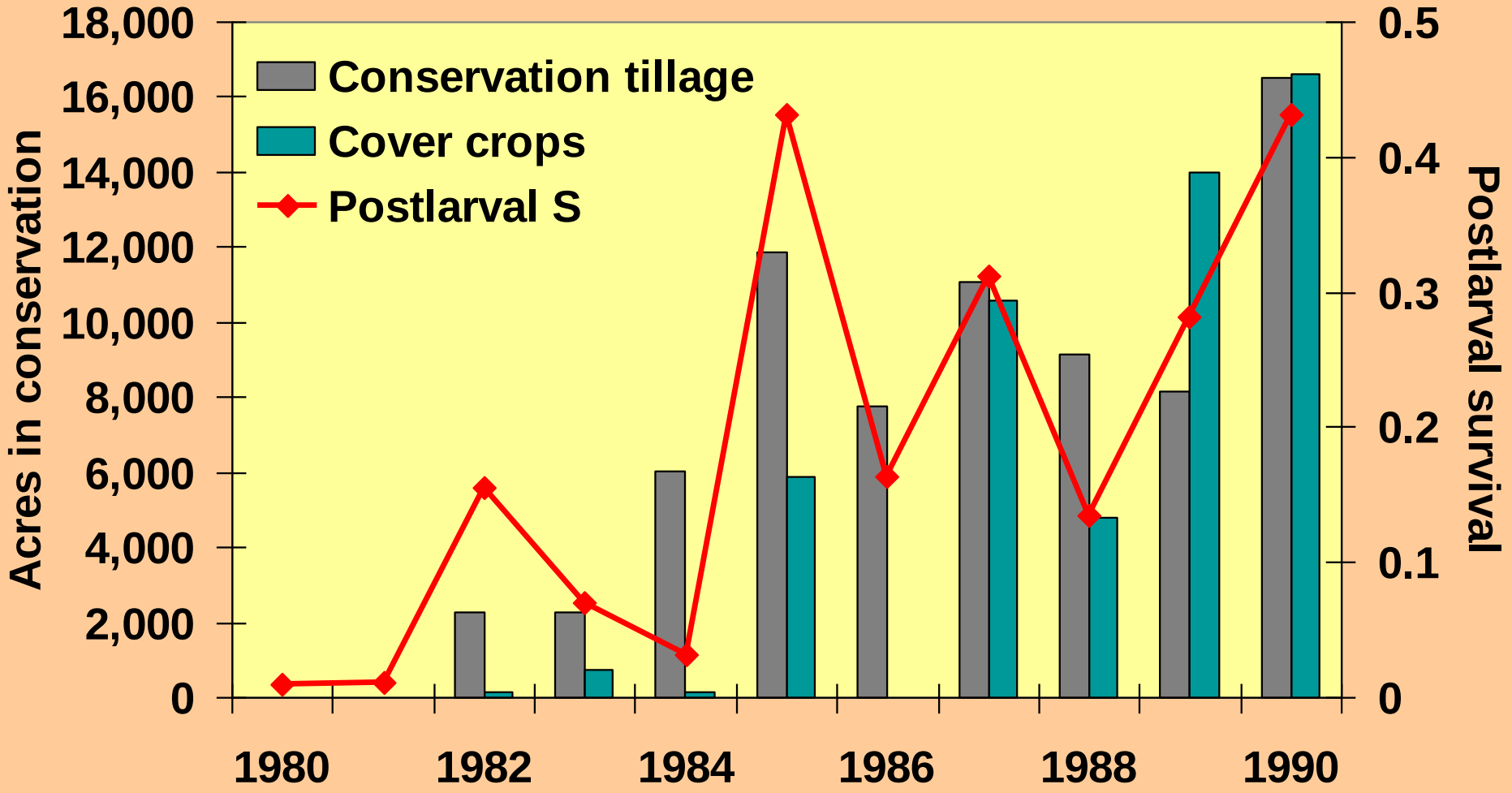
MD larval survival index (juvenile index per egg index; 4 areas averaged).

Time period averages qualitatively follow abundance.

If only overfishing, why not random?



Choptank River postlarval survival improved with agricultural BMPs that minimized erosion and runoff.

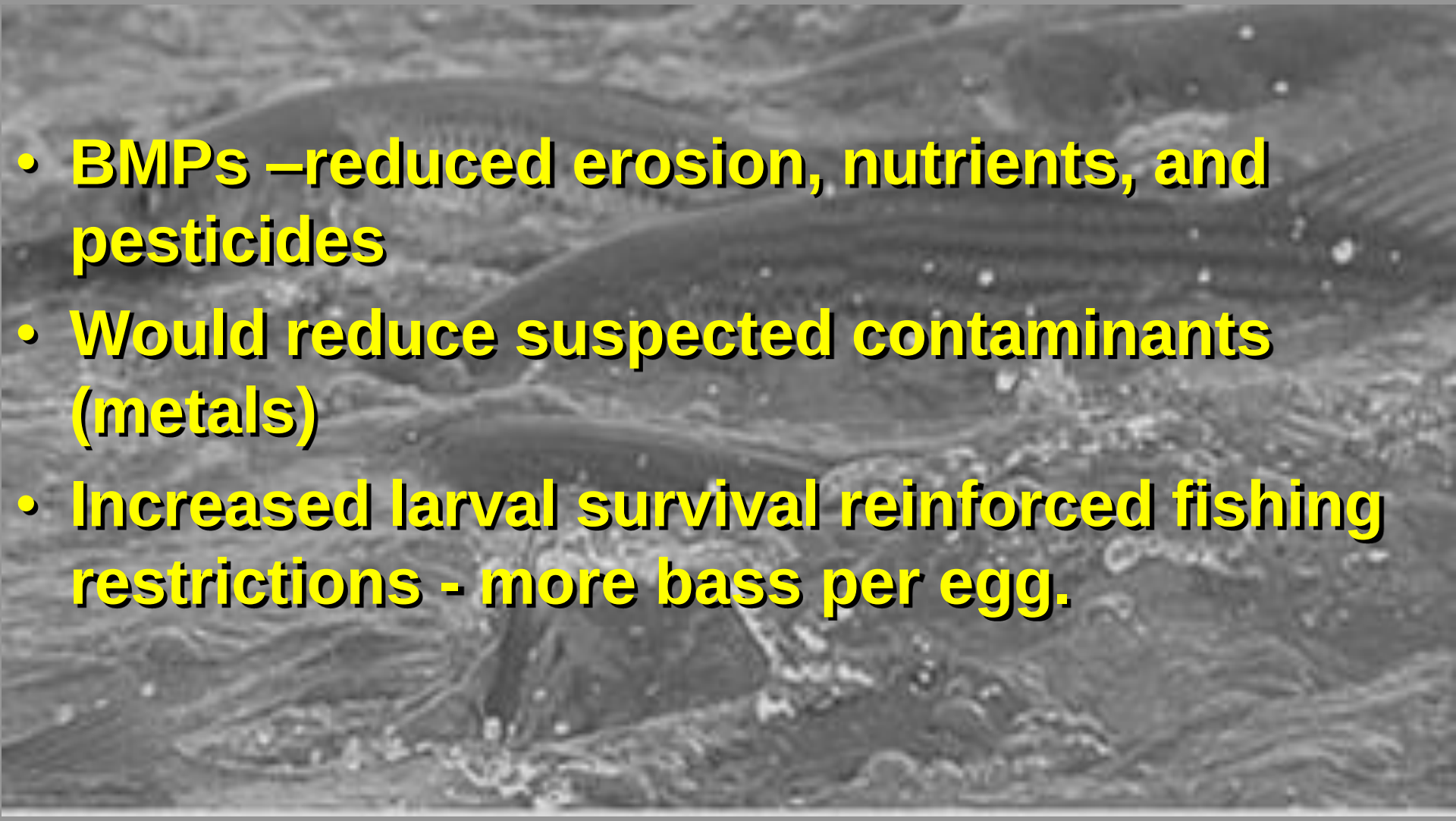


Why would agricultural conservation matter?

1. Spawning areas aren't big (MD majors plotted).
2. They receive nearly all watershed drainage.
3. Agriculture is the largest human land use (by area).

Bay Watershed	
Land-use	Percent
Developed	3.6%
Agriculture	28.5%
Forest	60.0%
Other	7.8%

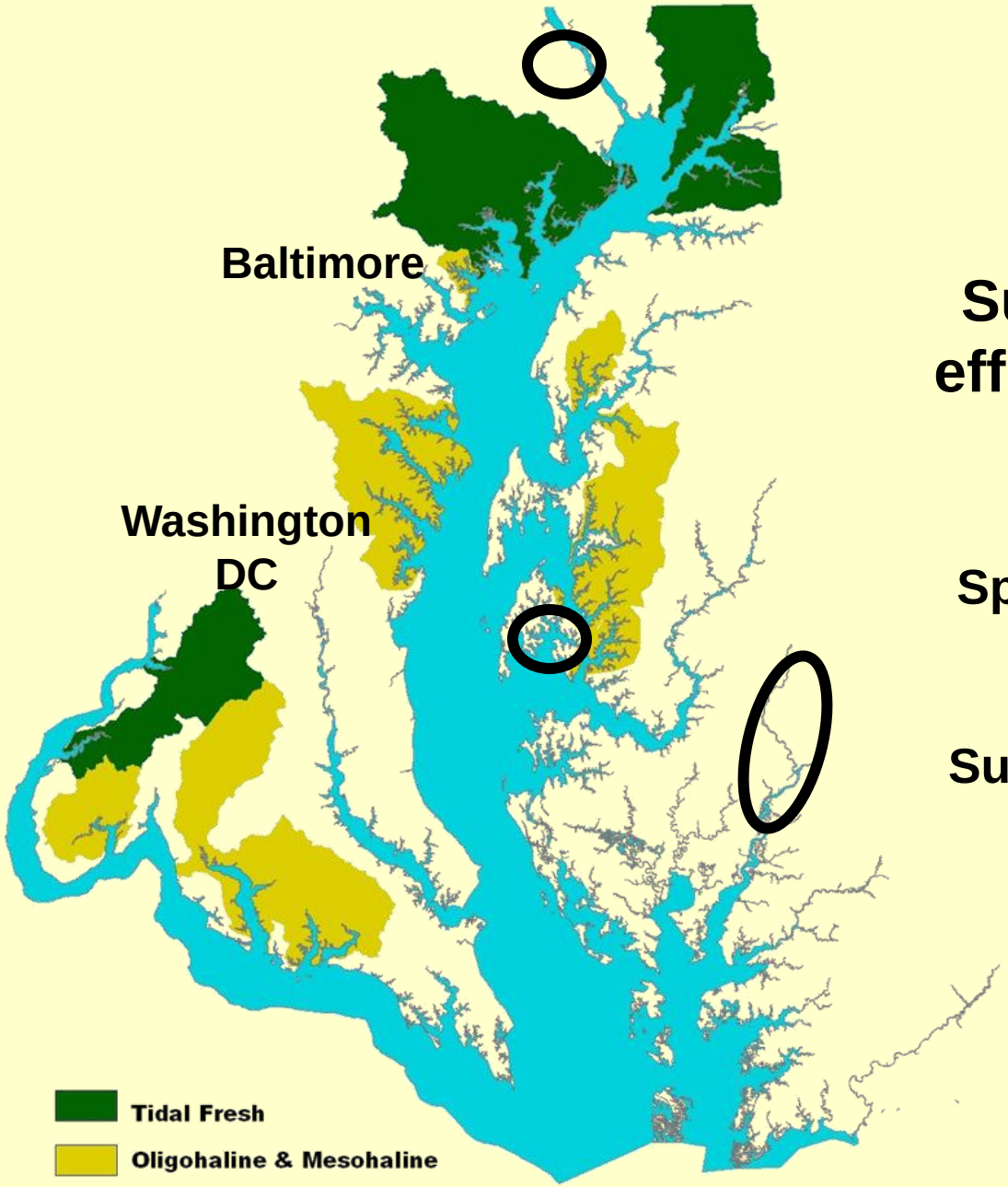
Positive role for agricultural practices in management of striped bass possible



- BMPs –reduced erosion, nutrients, and pesticides
- Would reduce suspected contaminants (metals)
- Increased larval survival reinforced fishing restrictions - more bass per egg.

During striped bass saga, Maryland's population & land-use changed

- 1973 – 3.9 million & 8% urban
- 2000 – 5.3 million & 16% urban
- Lawns now 23% of MD's Bay watershed
- Lawns = MD's largest "crop"
- 2030 – 6.7 million & ?

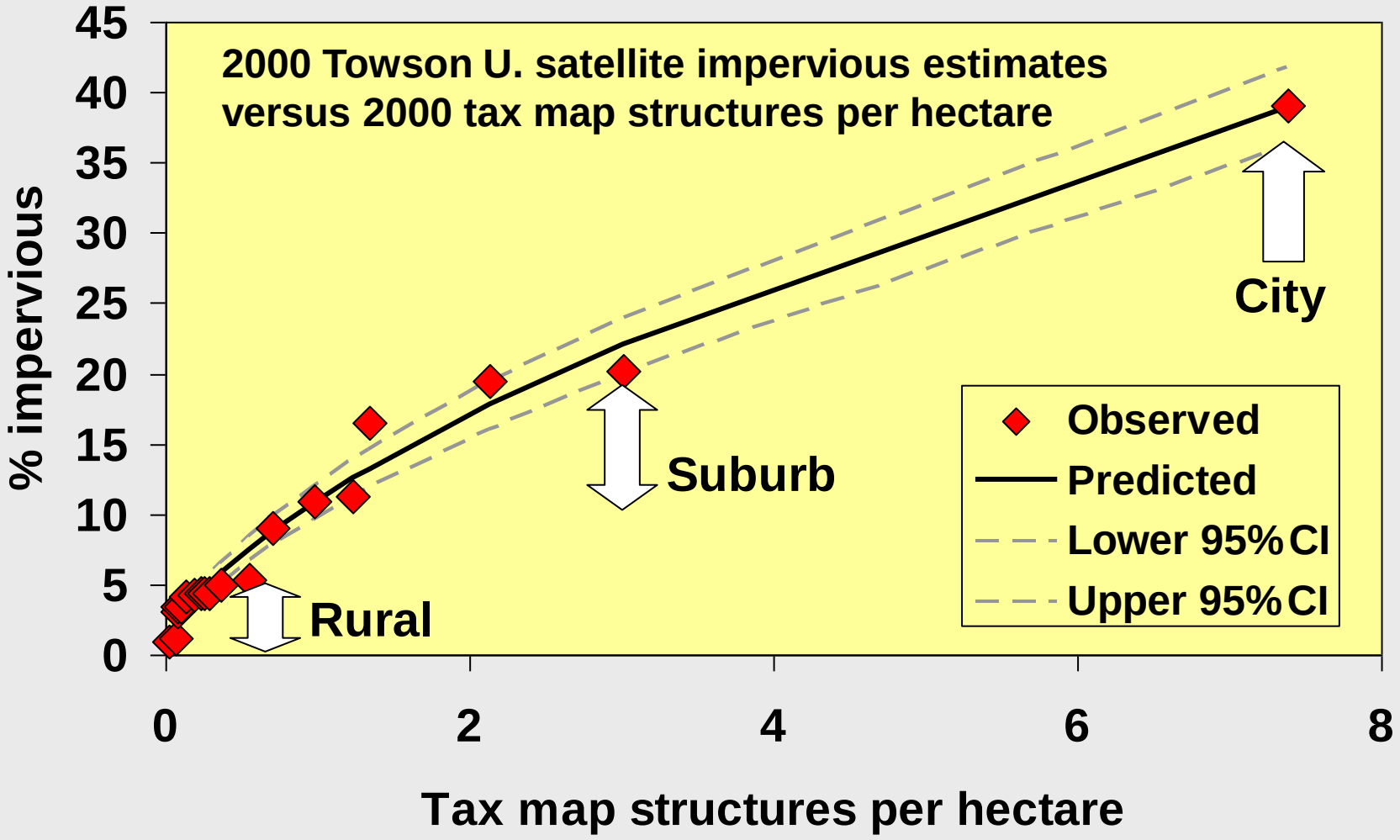


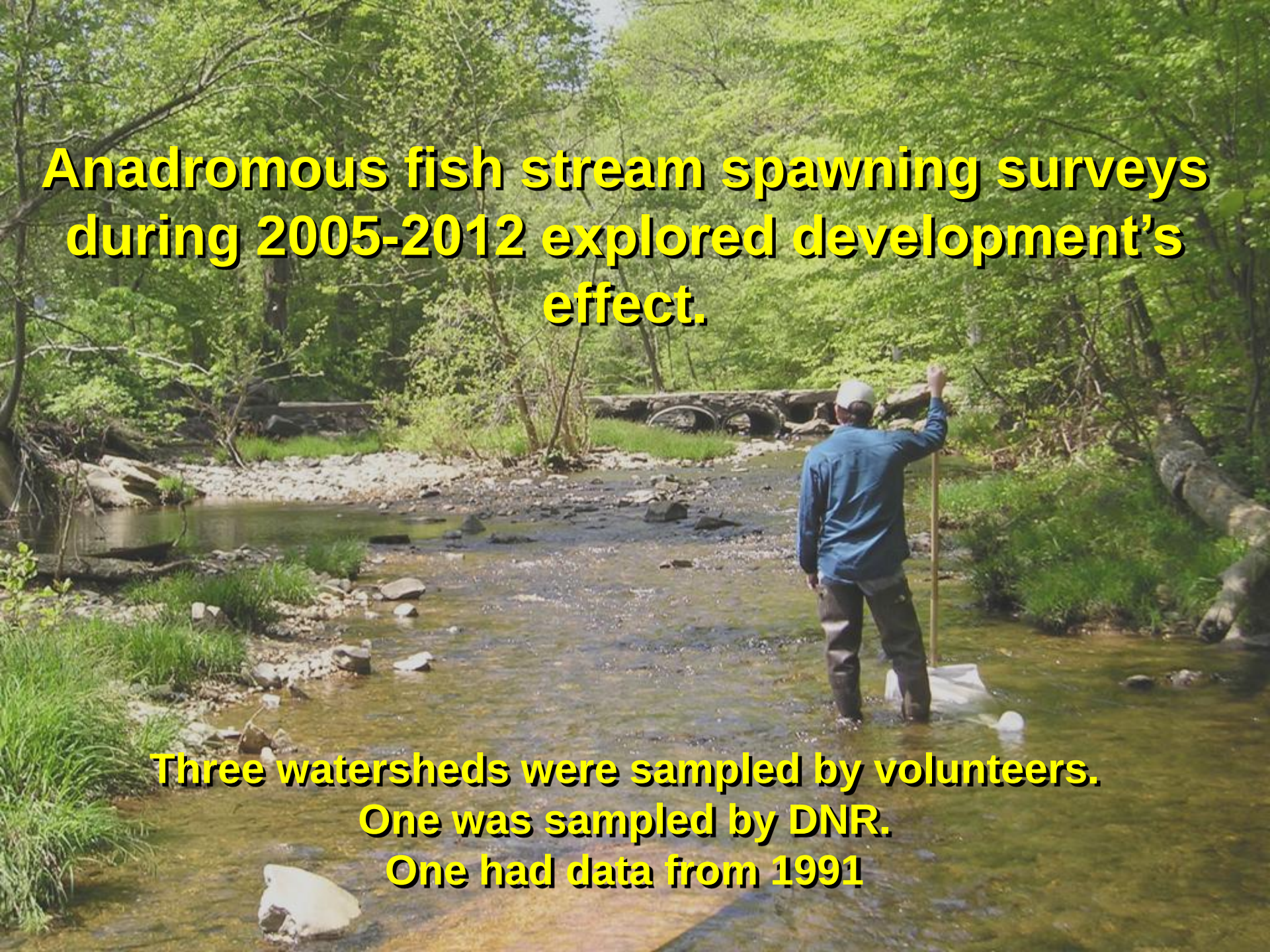
Subestuaries examined for effects of development since 2001

Spring spawning & larval habitat: egg-larval collections.

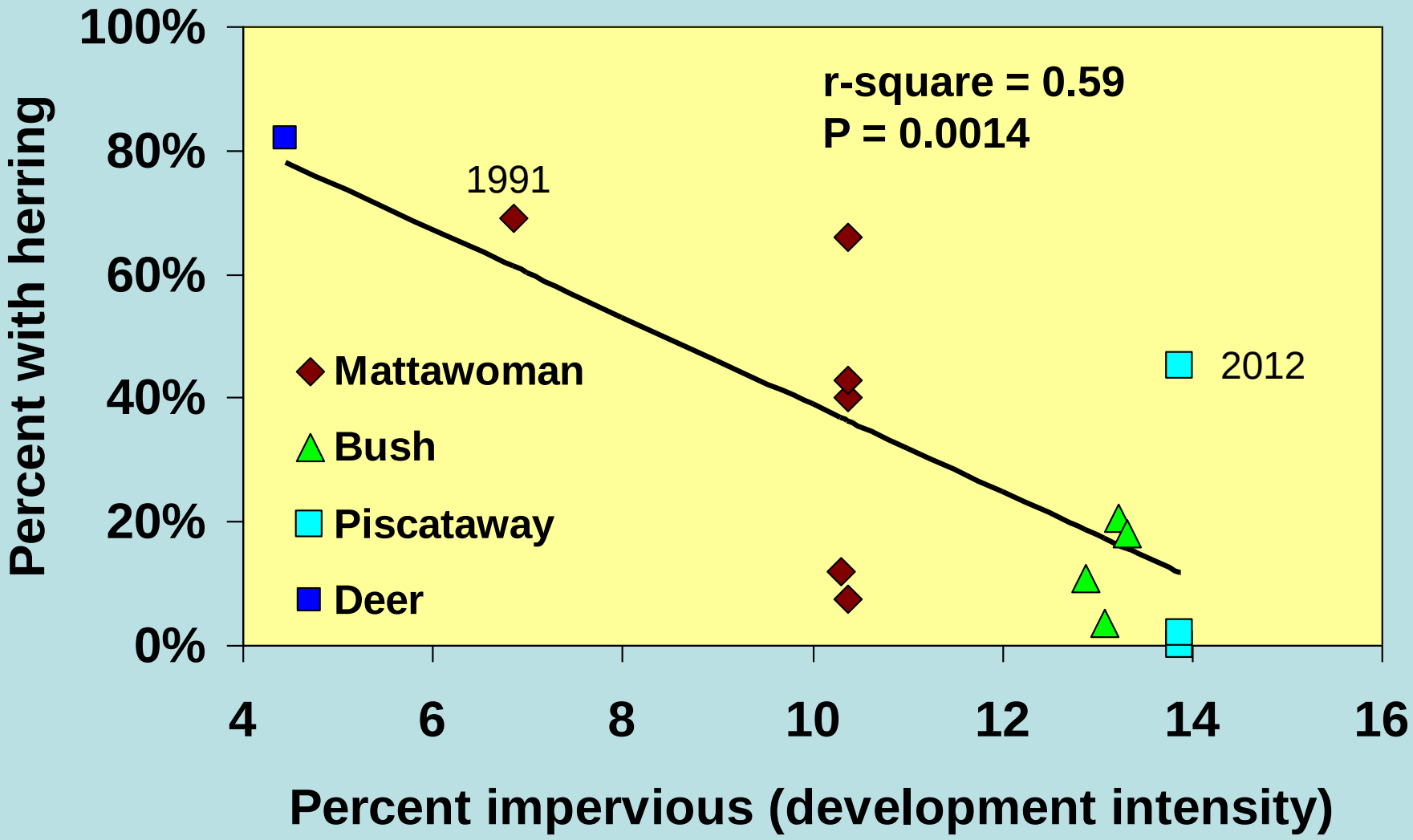
Summer habitat: Juvenile-adult & DO

MD property tax structure density converted to percent impervious surface measures development. Tax maps updated annually since 1950.

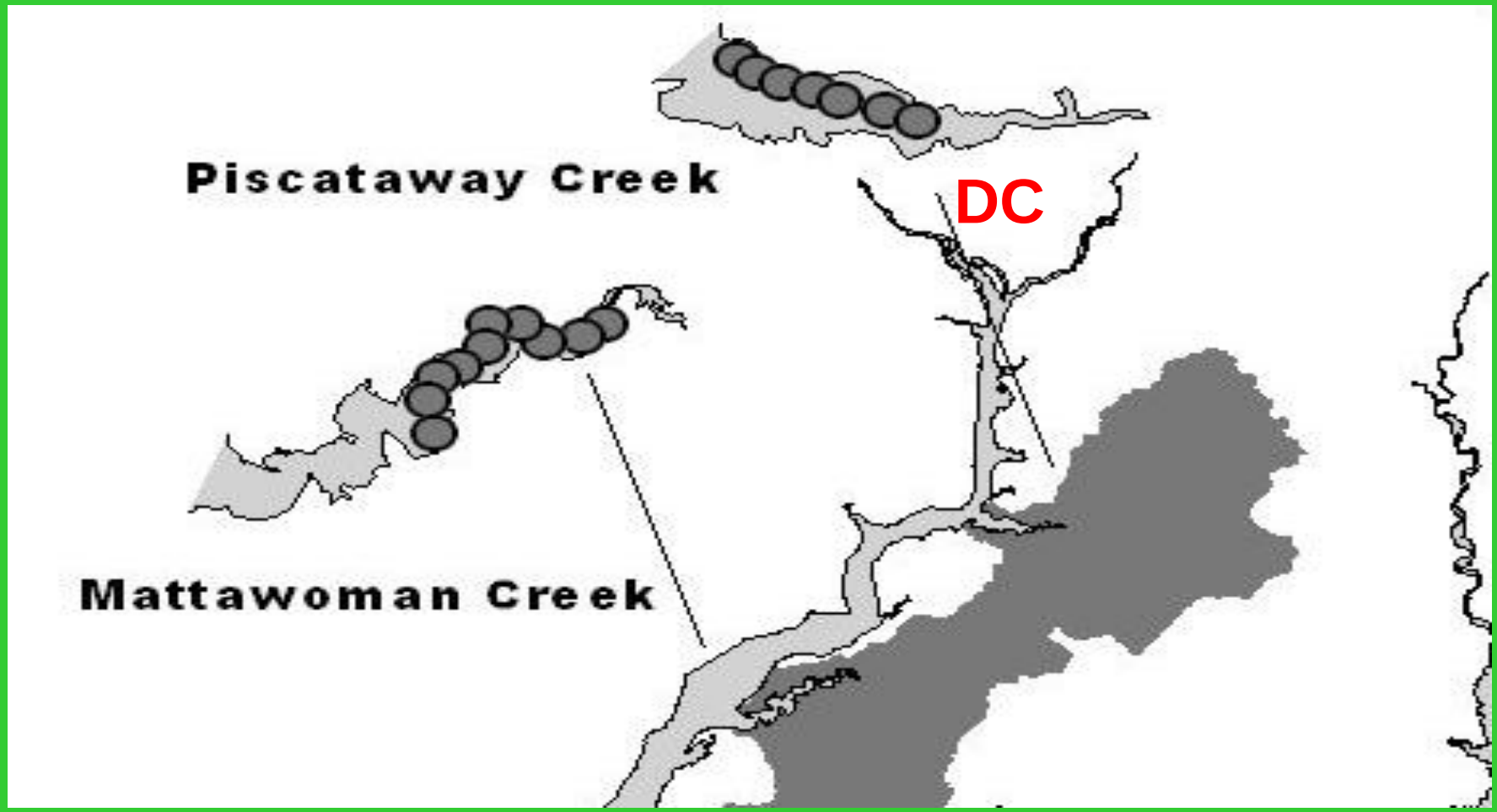



Anadromous fish stream spawning surveys during 2005-2012 explored development's effect.
Three watersheds were sampled by volunteers.
One was sampled by DNR.
One had data from 1991

Percent of stream samples with herring eggs and larvae falls with impervious surface

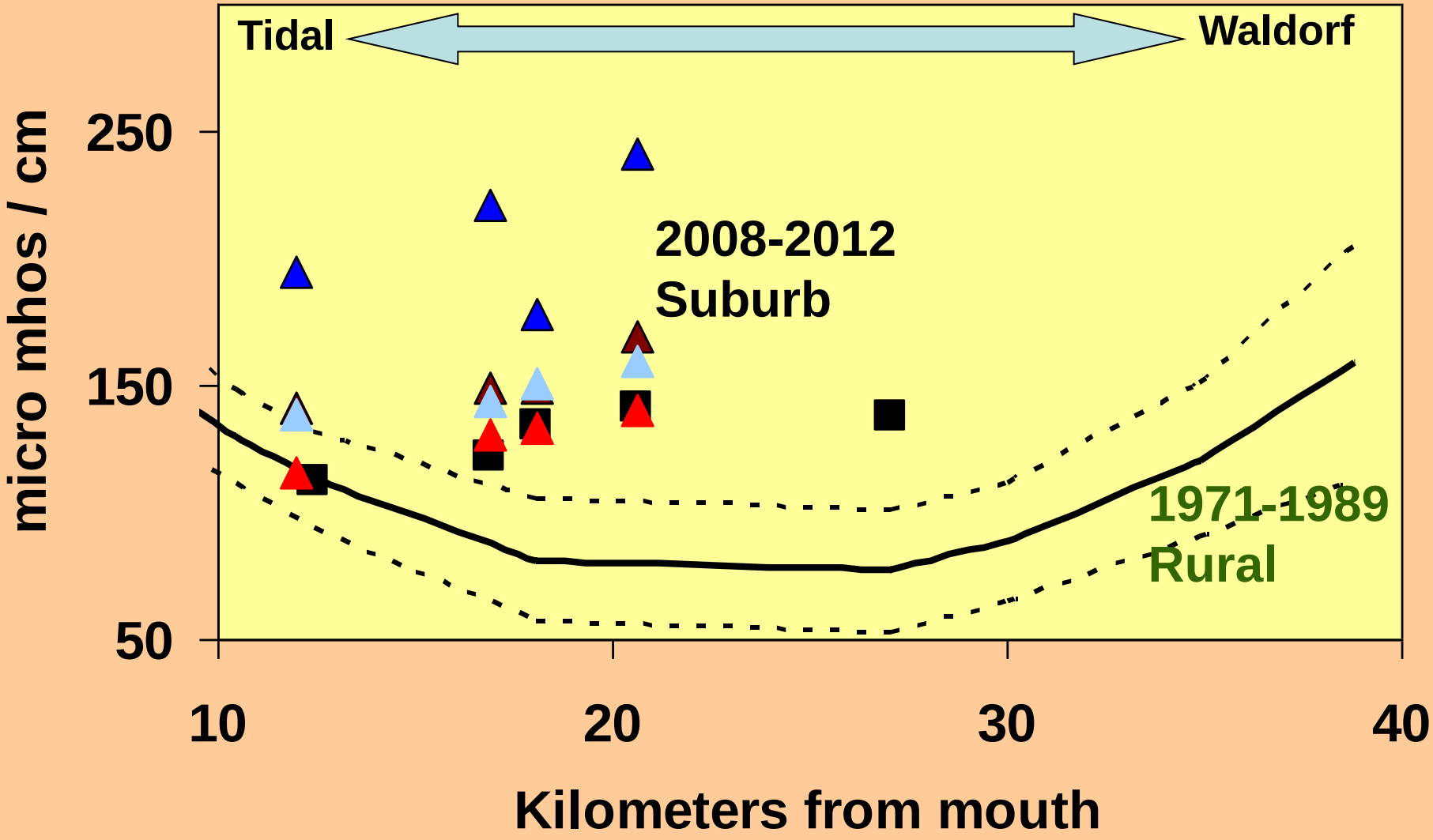


Streams of southern Maryland tributaries of Potomac River captured by DC sprawl offer insight on watershed changes.



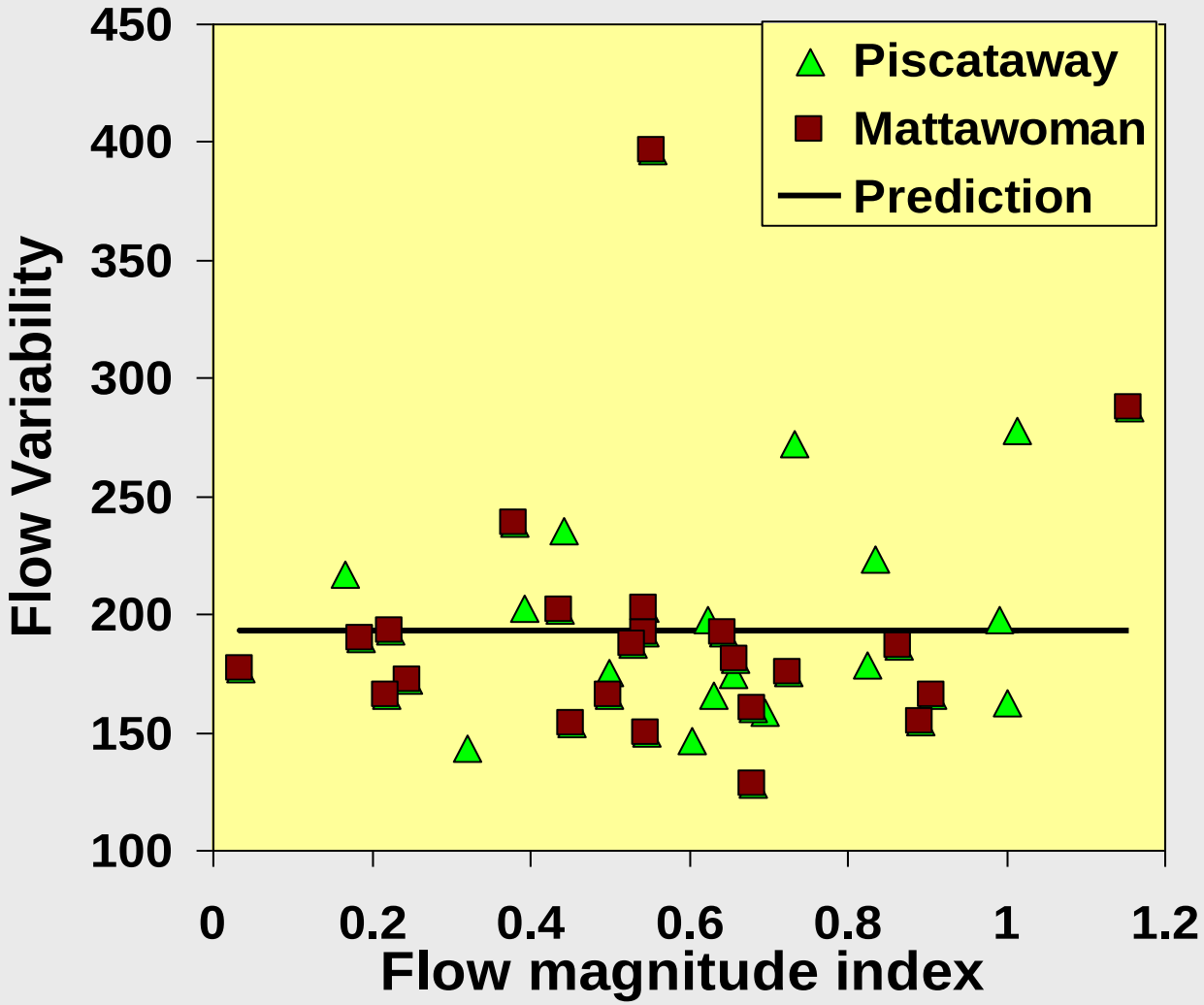
Mattawoman Creek's stream conductivity increased with development (road salt, leaky sewers).

All season 1971-1989 trend & 95% CI. Spring 2008-2012 spawning survey site means (symbols).

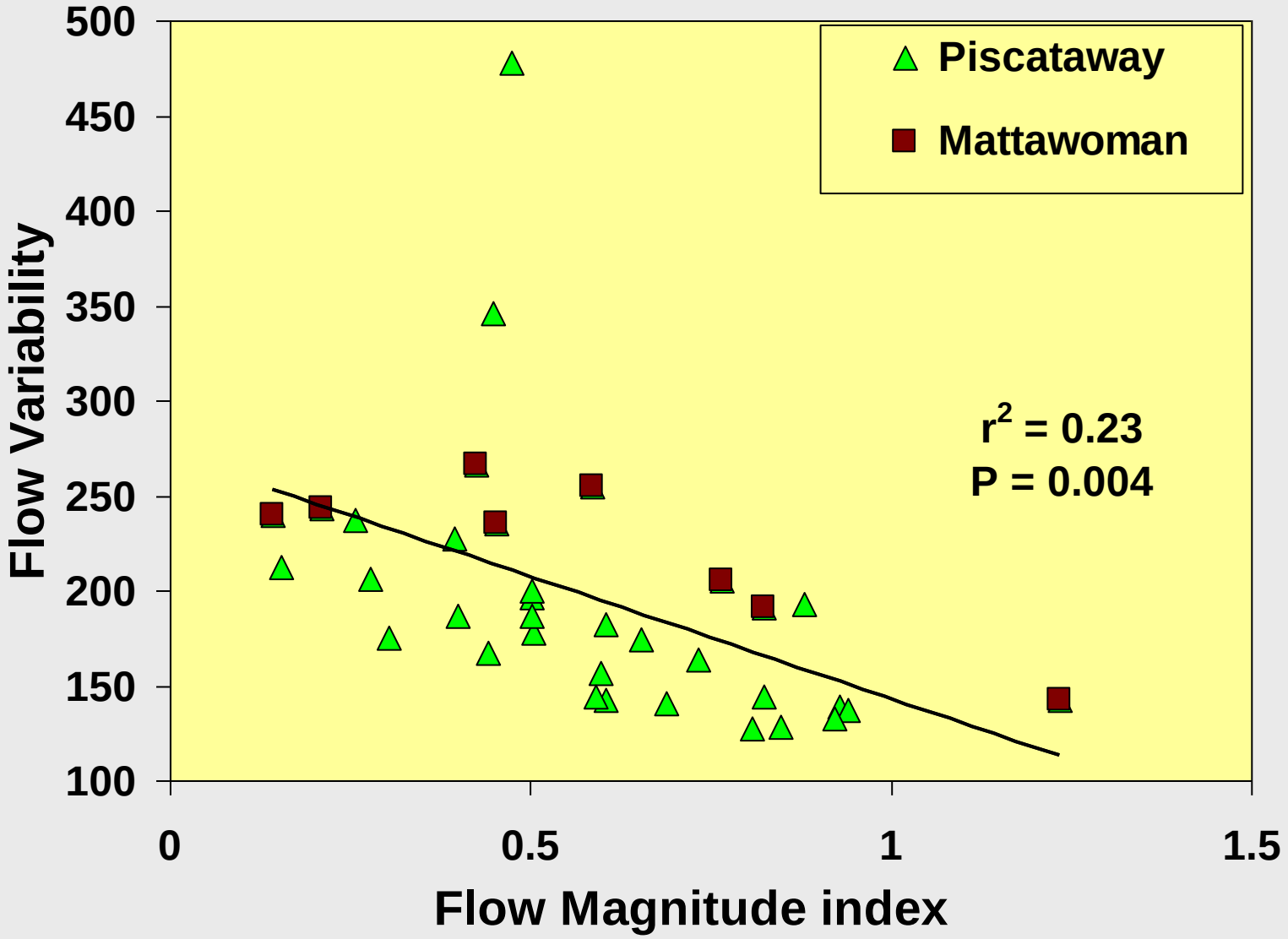


Stream flow & variability - impervious surface less than ~9%
Stable groundwater supply

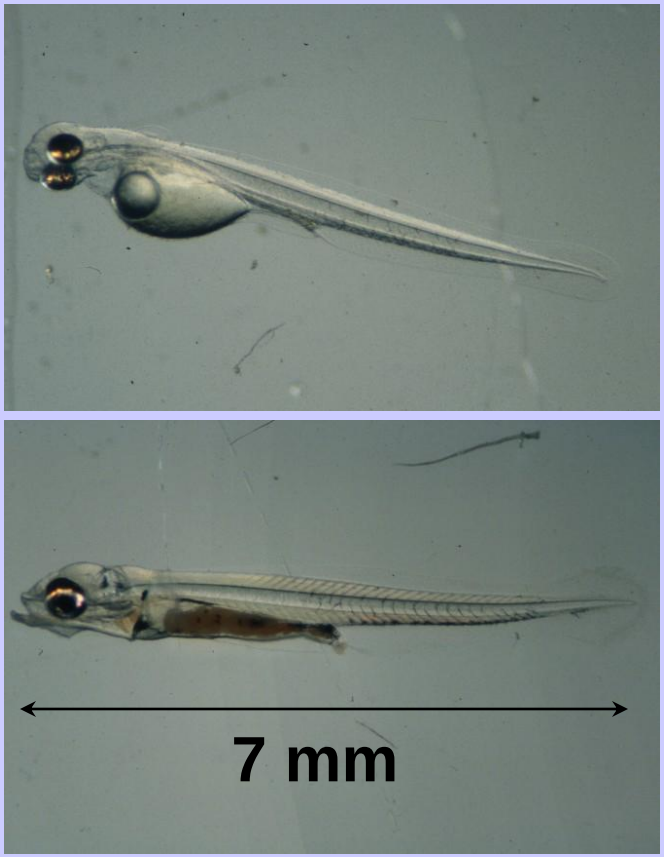
Annual median flow / precipitation versus variability (coefficient of variation)



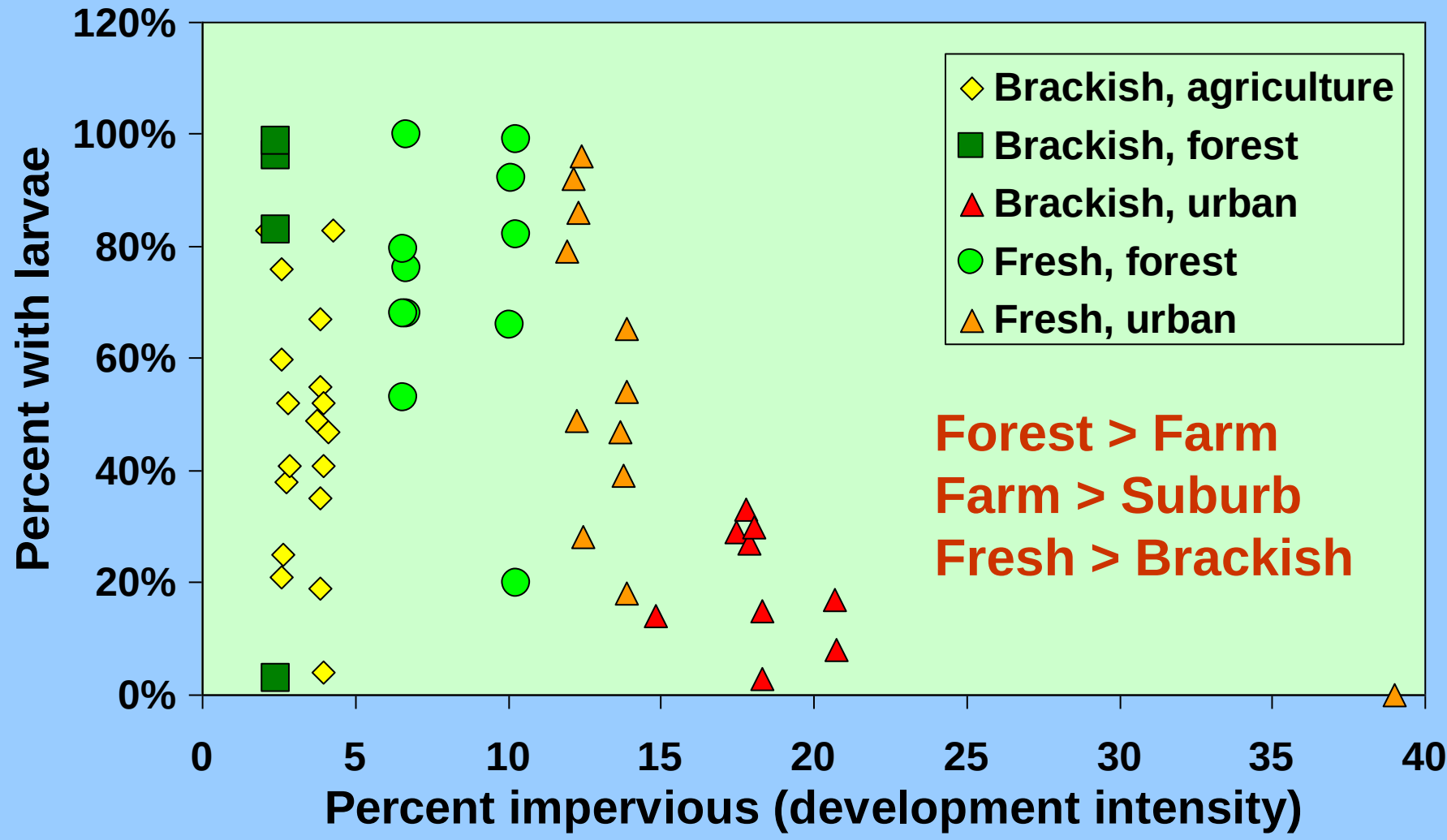
Stream flow and variability - impervious surface ~9% or more. Less groundwater & more surface flow; streams dry out.



Estuarine yellow perch larvae were sampled with plankton nets towed from boats



Percent of plankton tows with yellow perch larvae vs impervious surface with salinity class & dominant land cover



Larval first feeding: correlations of larval feeding success, development, and suspended detritus indices

	Development level	Mean feeding success
Mean feeding success	r = -0.58 P = 0.02	
Proportion no detritus	r = 0.75 P = 0.01	r = -0.64 P = 0.05

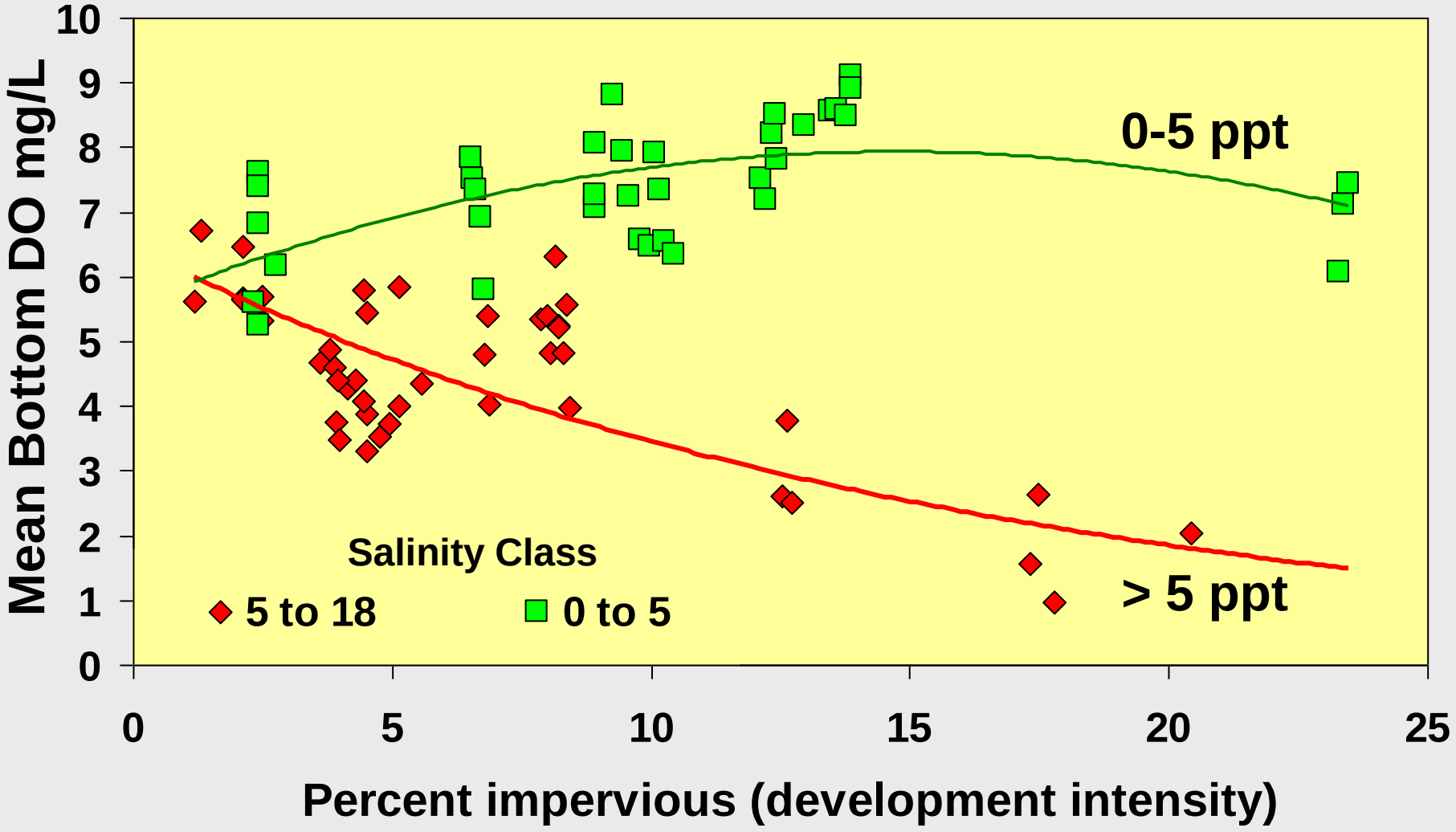
Detritus supply and feeding success decline with development

Natural connections allowing flow of organic matter from land to stream to estuary…

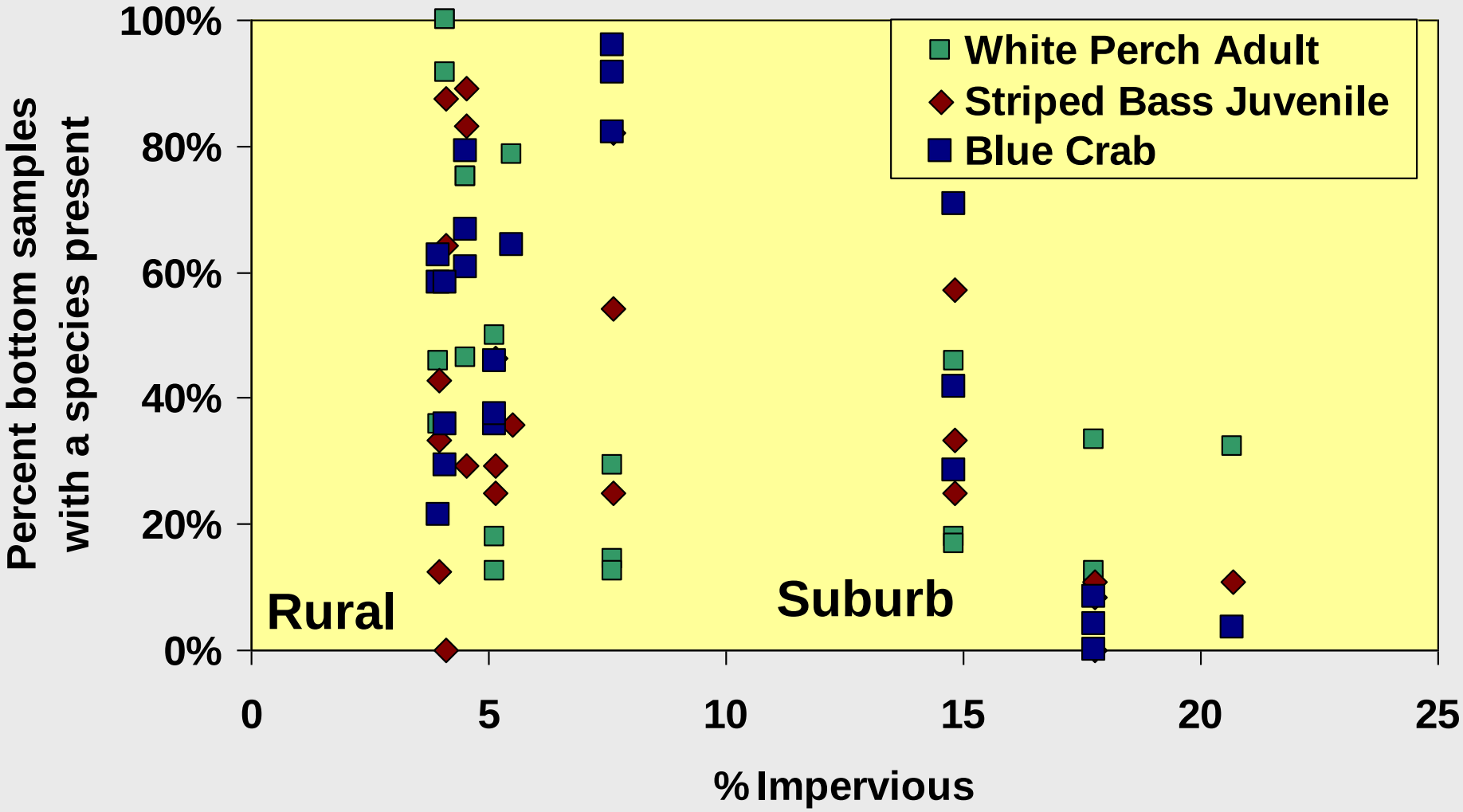
…that benefit zooplankton production and larval feeding become disconnected with development.

Summer estuarine habitat: habitat occupation and dissolved oxygen

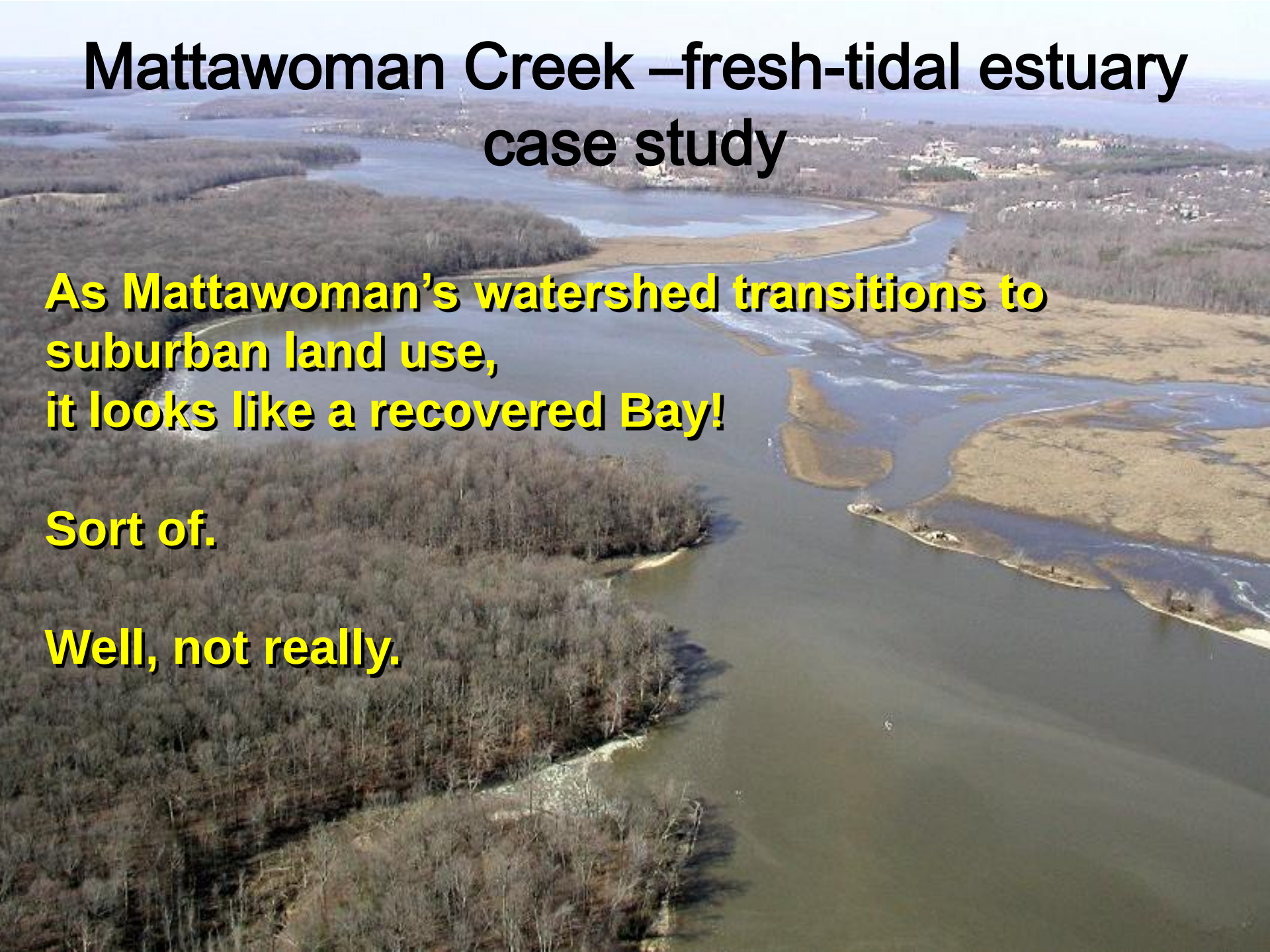
Mean summer bottom DO and percent impervious, by salinity classification (ppt), during 2003-2011.



Bottom habitat occupation by iconic species in brackish tributaries decreases with development, reflecting DO trend



Mattawoman Creek –fresh-tidal estuary case study

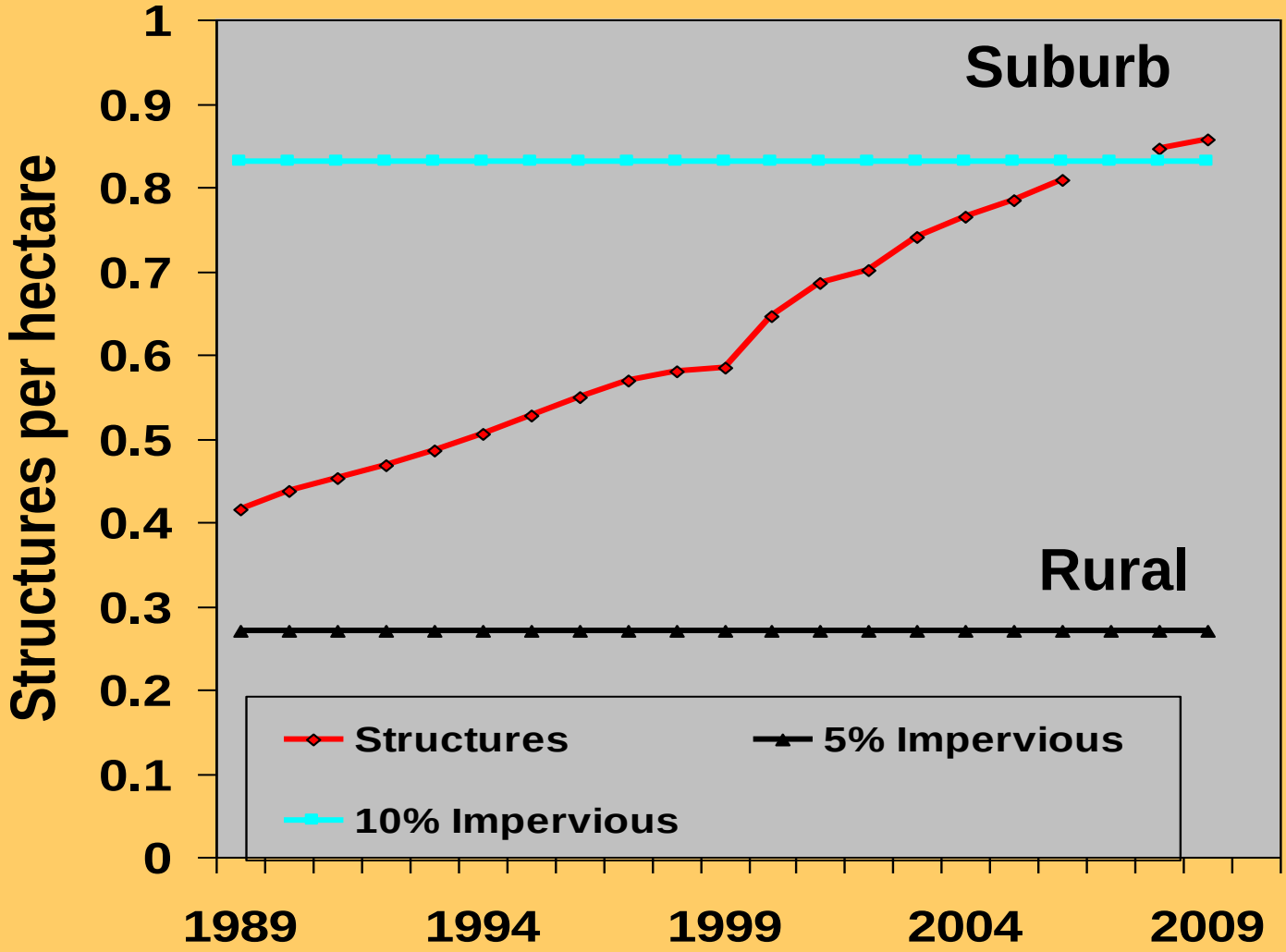


As Mattawoman's watershed transitions to suburban land use,
it looks like a recovered Bay!

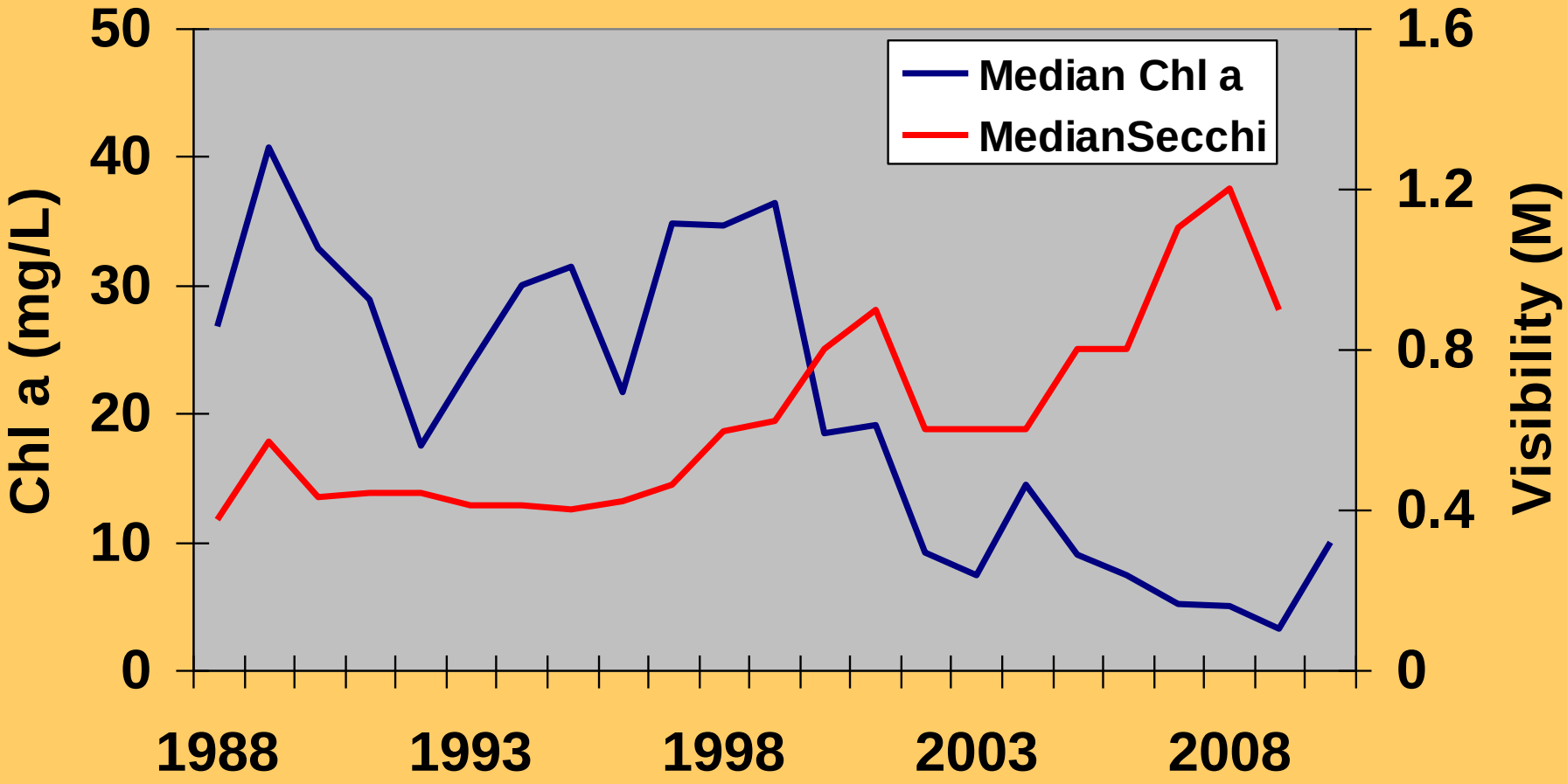
Sort of.

Well, not really.

Mattawoman Creek Structures per hectare since 1989 and impervious surface benchmarks

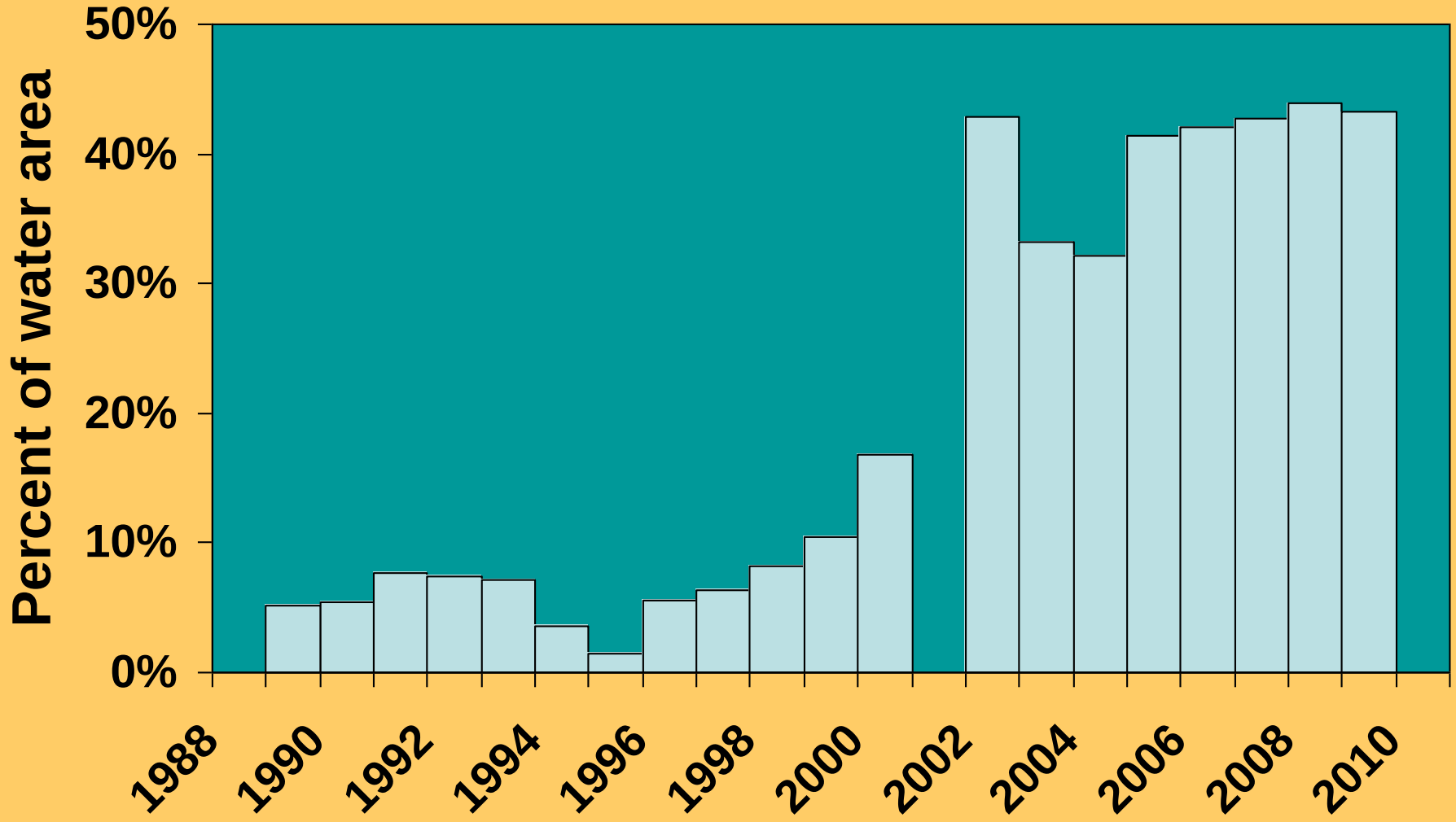


Mattawoman Creek median summer Chlorophyll a and summer Secchi depth (visibility)

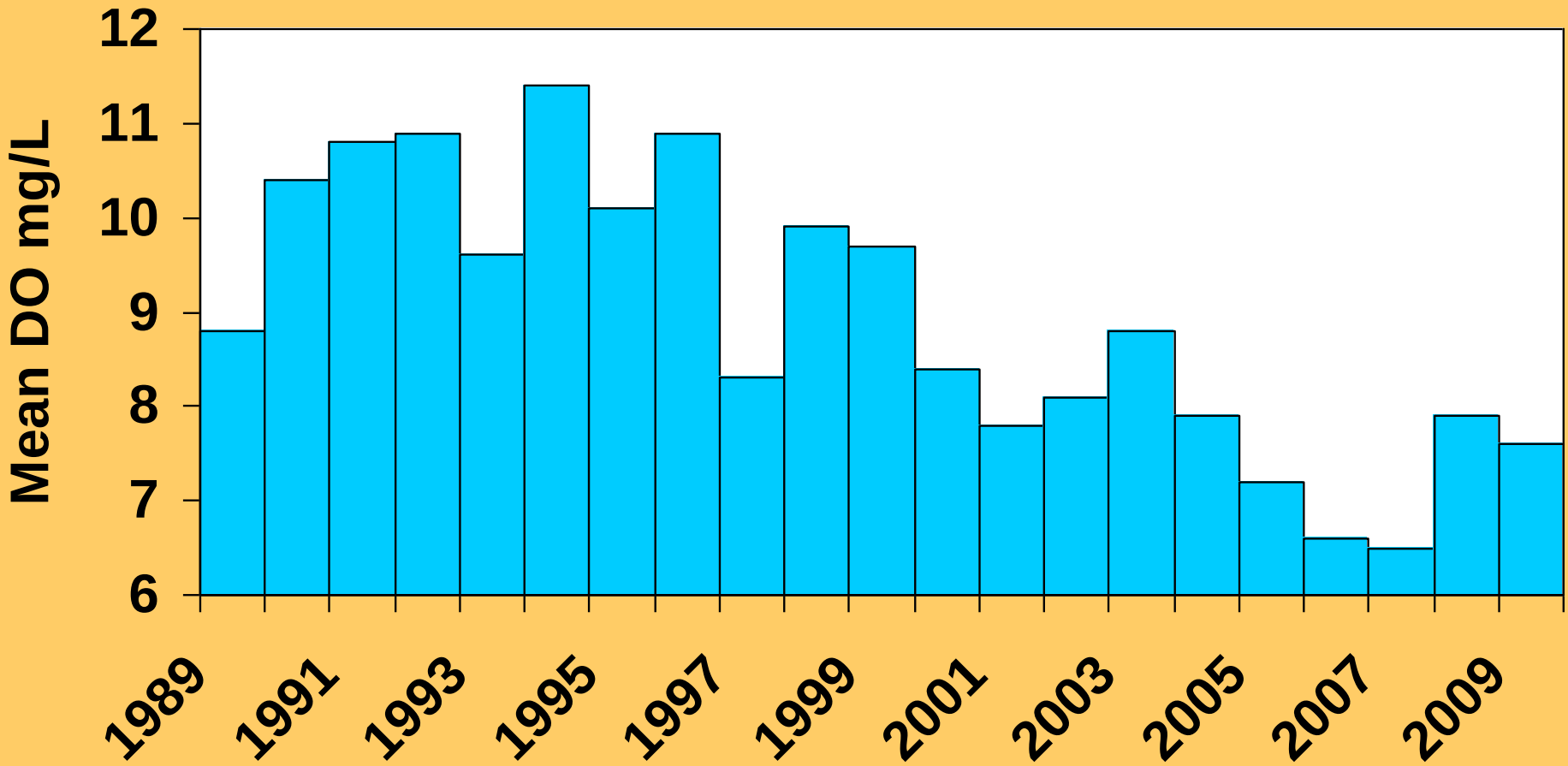


SAV acreage

(Primarily Hydrilla, but Eurasian milfoil and natives too)

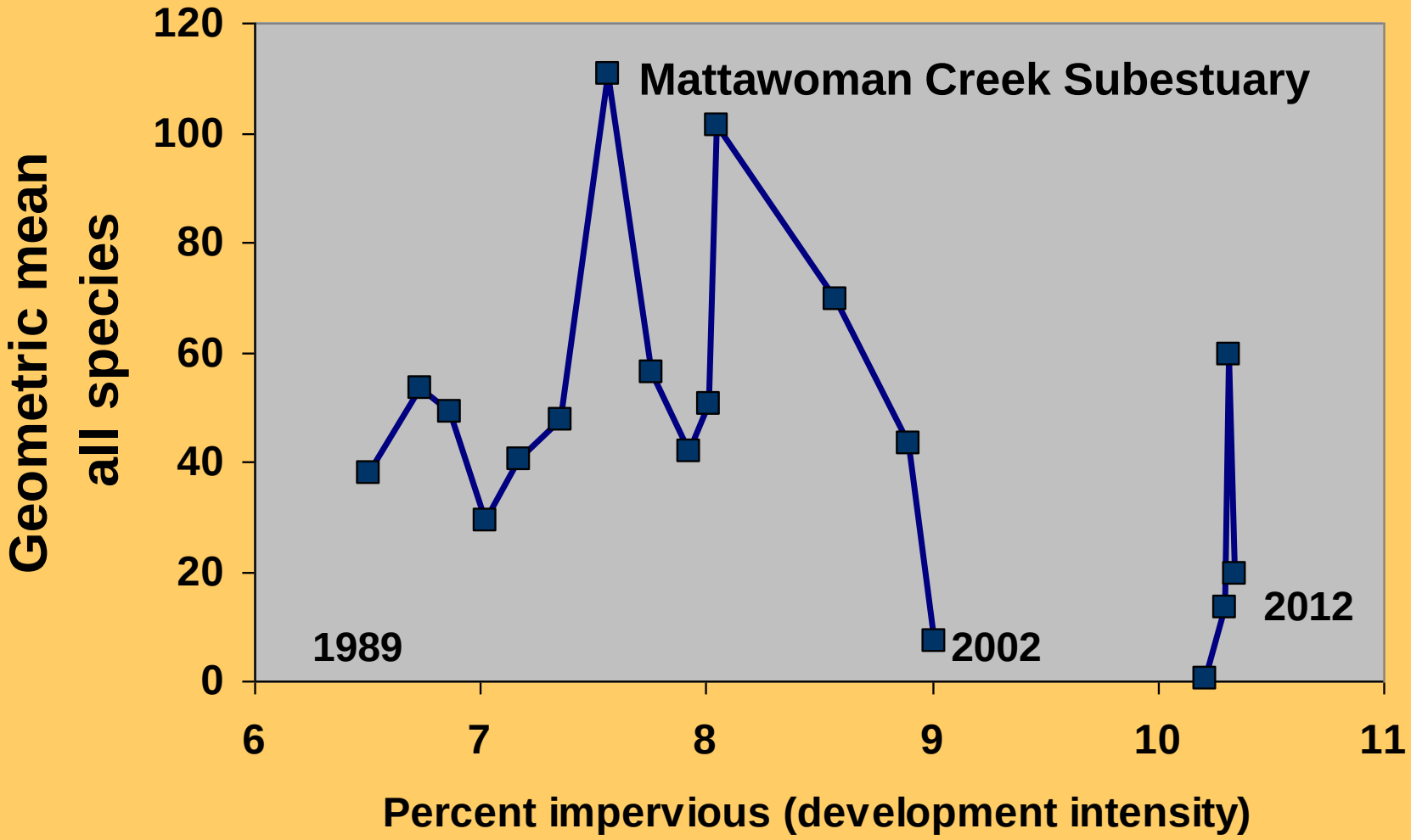


Mattawoman Creek July-September channel mean bottom DO in channel, 1989-2009

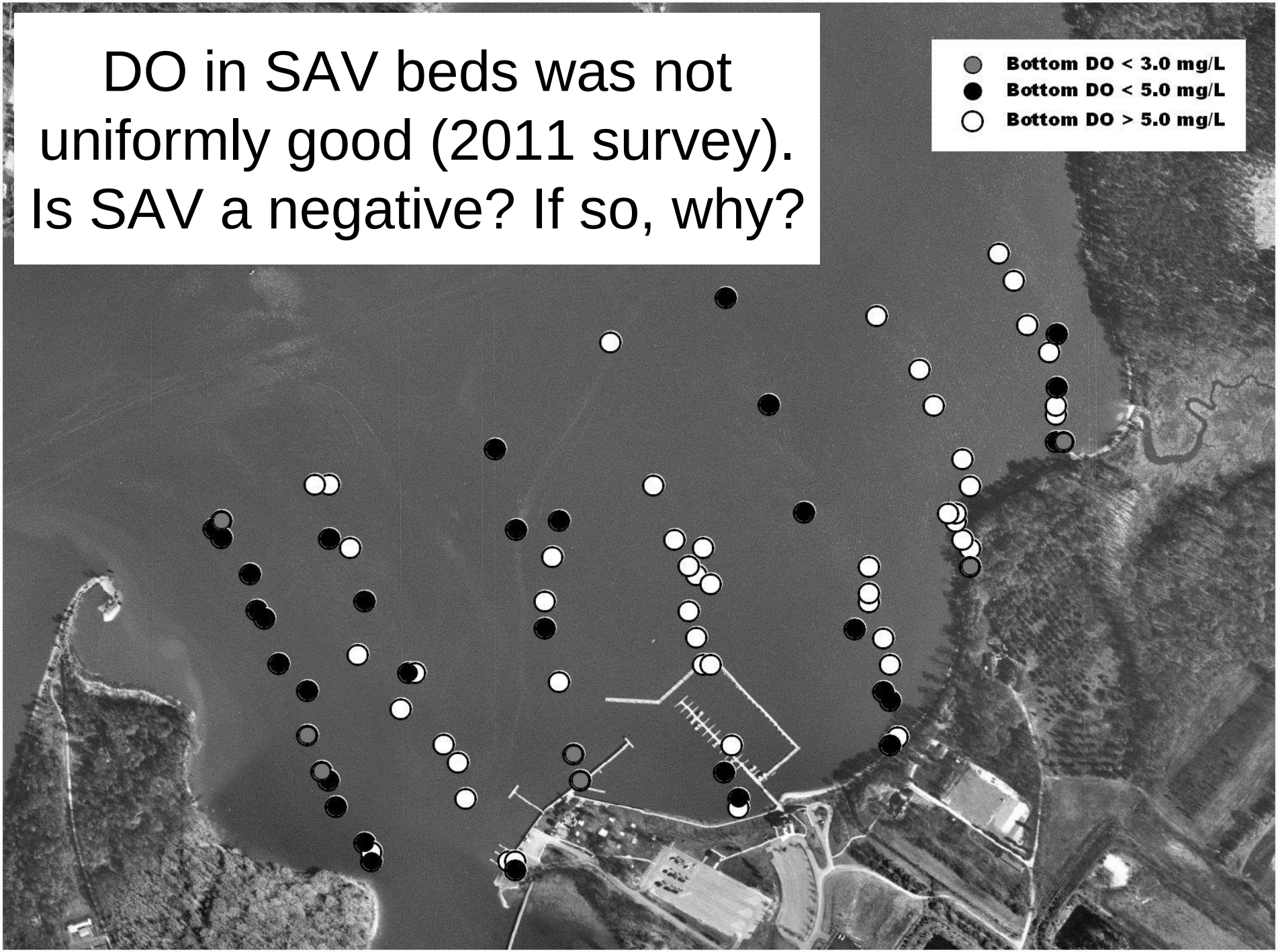


Abundance of all fish in summer trawl samples (bottom channel) collapses.

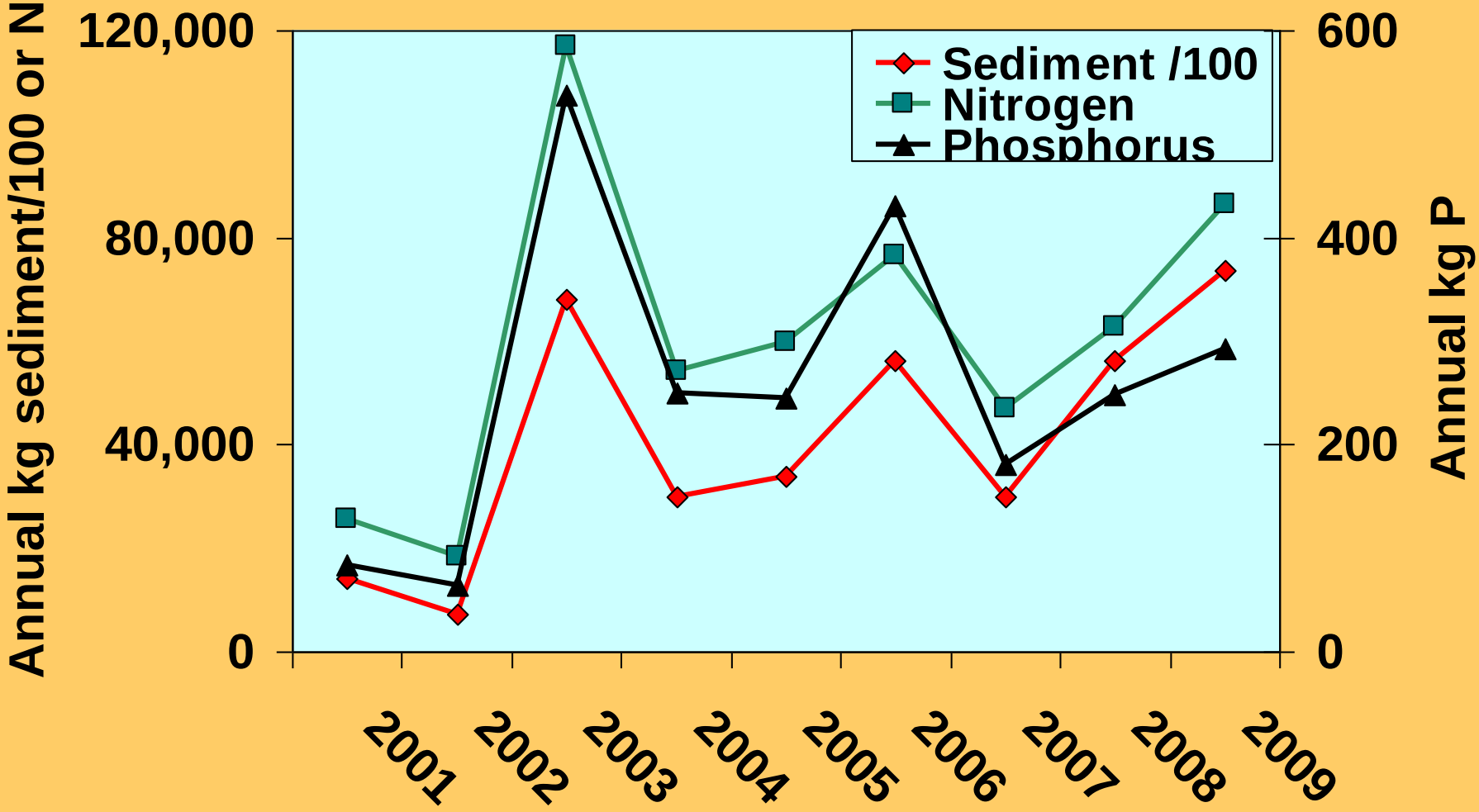
Trophic / regime shift?



DO in SAV beds was not uniformly good (2011 survey). Is SAV a negative? If so, why?



Mattawoman Creek: Annual total suspended sediment, nitrogen and phosphorus at USGS gauge. Sediment delivers nutrients.



USGS Total Suspended Sediment Load Estimates: Development vs Agriculture

	Mattawoman	Upper Choptank
kg TSS / year 2001-09 mean	9,040,370	5,507,045
Watershed miles^2	55	113
Impervious %	10%	3%
% Agriculture	14%	60%

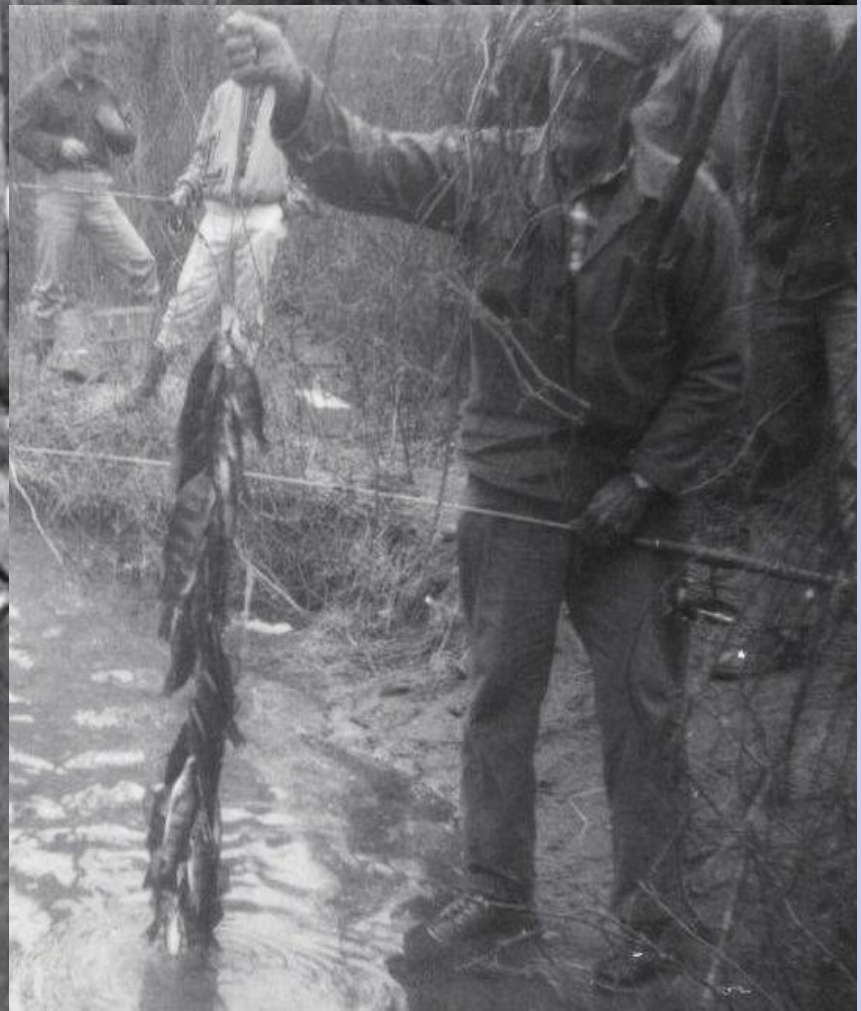
Ecosystem / watershed – based fisheries management

It's no longer our ability to produce fishing boats and nets that limits harvests, it's fish.

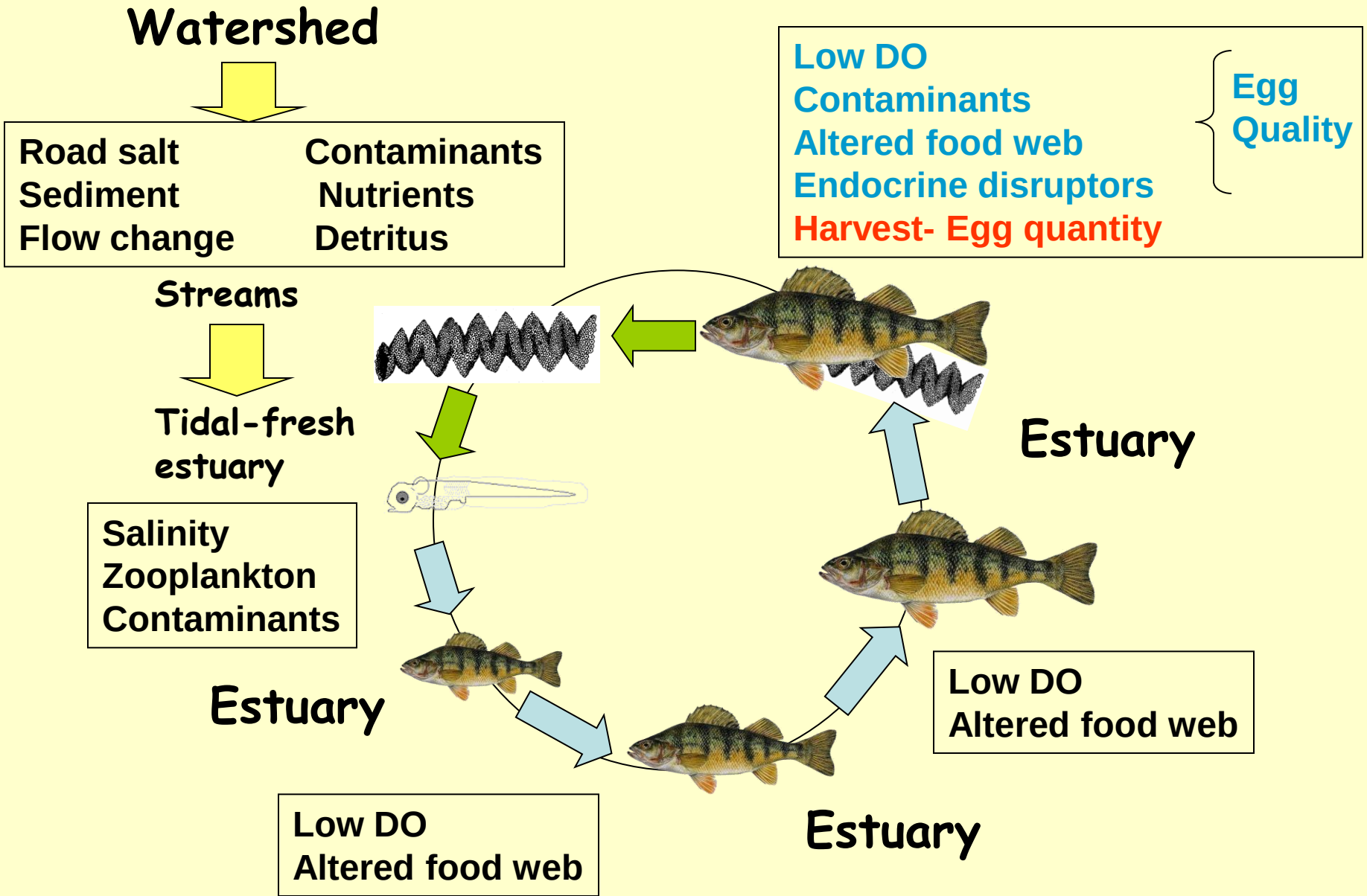
Herman Daly, one of the world's leading exponents of a steady state economy

Severn River yellow perch fishery collapse

1962



Fish encounter multiple development-related stressors (Wheel of Misfortune)



Impervious surface reference points: fisheries on resident species

- **< 5% impervious - harvest restrictions & stocking; conserve watershed**
- **5-10% - option to decrease harvest & stocking to compensate. Conserve & revitalize watershed**
- **10-15% - Conserve & reconstruct degraded watershed**
- **>15% - options limited and localized**

Developing Fisheries Priority Habitat Maps

Goal: Prioritize locations for fisheries conservation.

Objective: GIS maps representing important species habitats and threats (targets and thresholds)

Need for Fisheries Priority Maps

- DNR “speaks” GIS - a “new” language for Fisheries
- Fisheries needs GIS maps to communicate within & outside DNR
- GIS builds cross-unit ecosystem management connections
- DNR maps biodiversity (small scale & remnant natural habitats)
- Important areas for fisheries have larger scale; some are rural workplaces (farmland, forests)

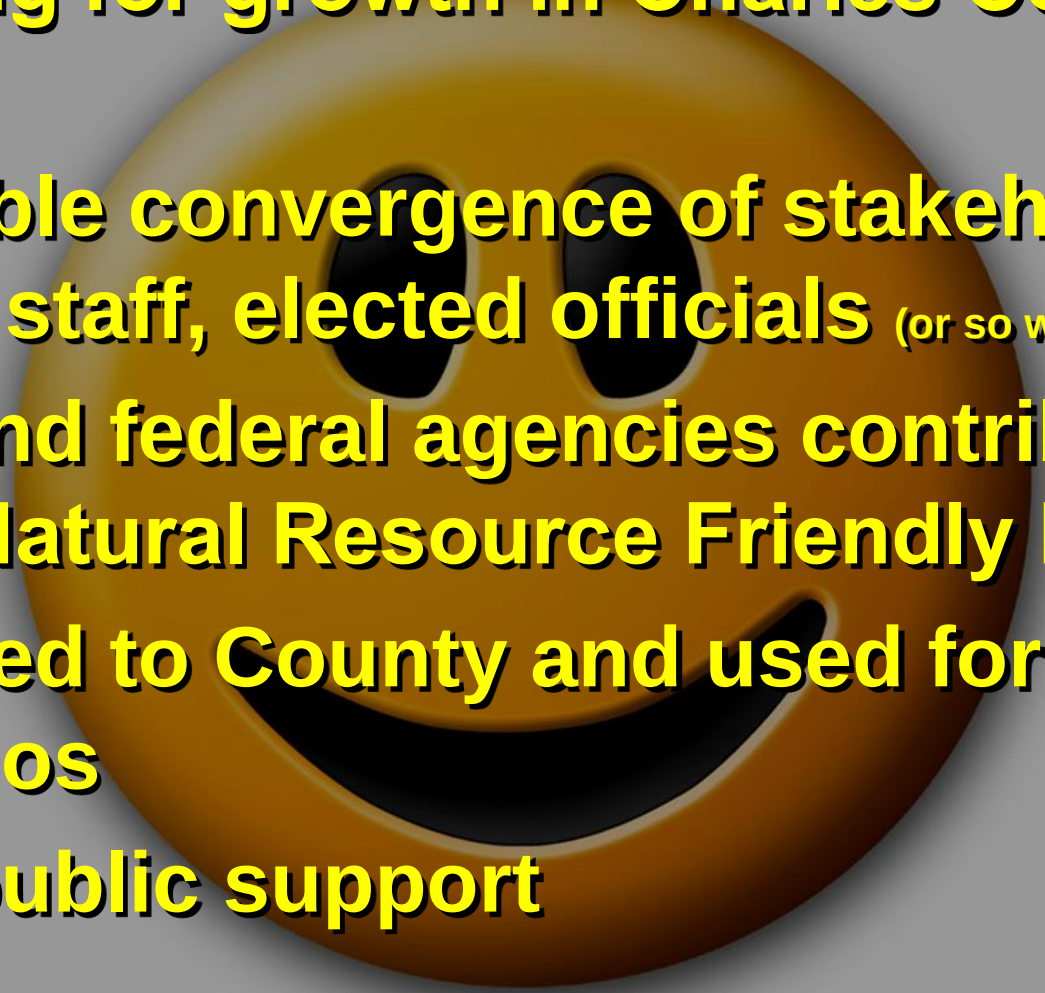
Planning and zoning is aquatic resource management!!!

- Zoning is local
- Fisheries management is a state responsibility (watershed dependent)
- Fisheries managers need to be at the planning and zoning table!
- Fisheries depend on conserving forests, wetlands, and farmlands!
- Limit sprawl!
- Stormwater BMPs do not save fisheries!

Planning and zoning is fisheries management!!!

- Local development plans provide proactive approach to manage land use and fish habitat
- Work with other DNR units, state and federal agencies, local government, and stakeholders to protect fish habitat through "resource friendly" plans
- First applied to Charles County Comprehensive Plan and Mattawoman Creek Watershed in 2012

The promise of cooperative comprehensive planning for growth in Charles County…



- Favorable convergence of stakeholders, county staff, elected officials (or so we thought)
- State and federal agencies contribute to DNR "Natural Resource Friendly Plan"
- Delivered to County and used for 1 of 3 scenarios
- Great public support

…yields to ugly reality

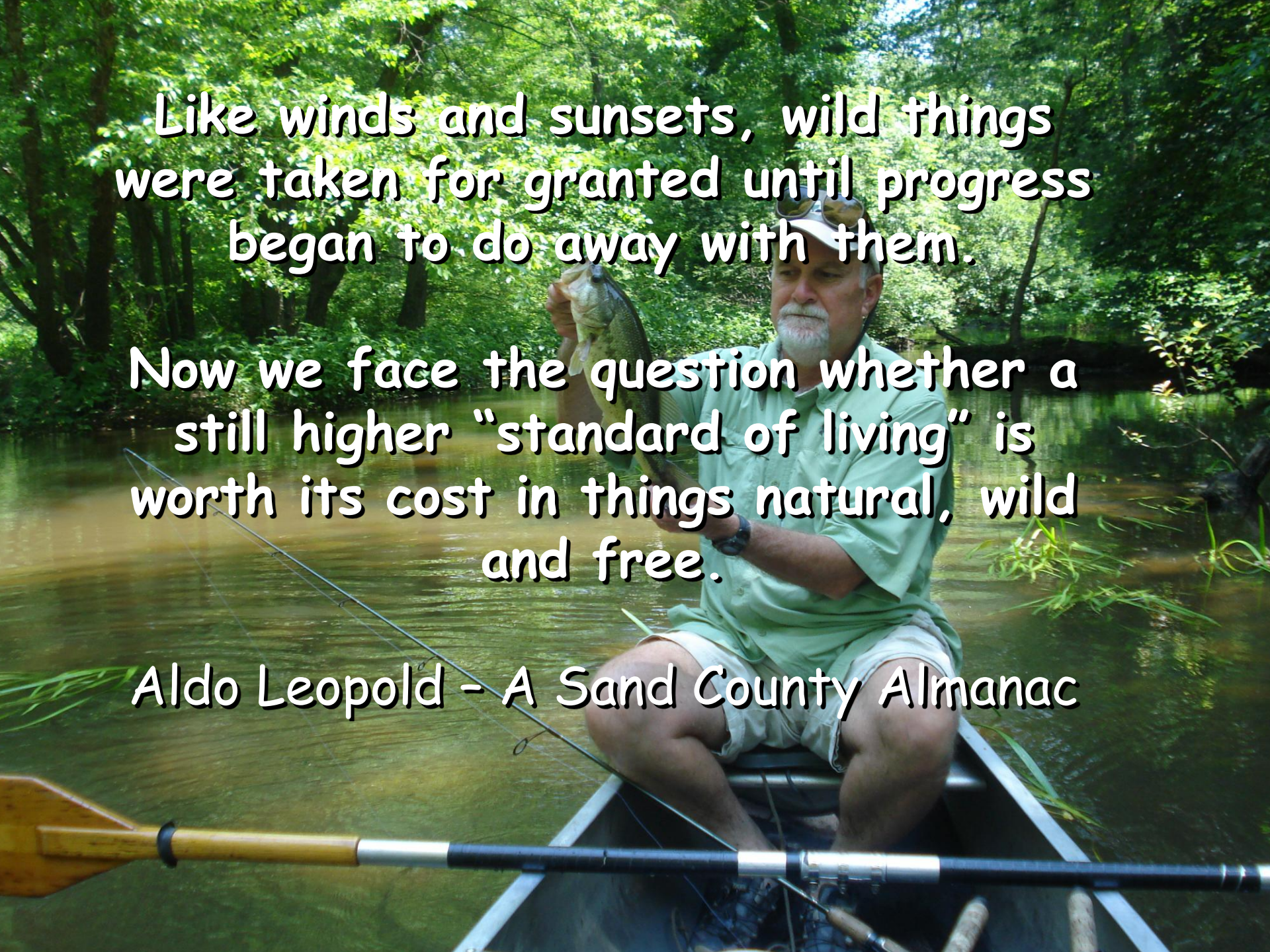
- Scenarios go to pro-development Planning Commission
- "Natural Resource Friendly" thrown out
- New "Property Rights Plan" preferred (very damaging)
- Not ratified…. yet
- State reaction pending – flies in face of Plan Maryland smart growth

Urban planning consistent with fisheries management

- Not developing somewhere isn't realistic
- **Development that minimizes impervious surface**
- Increase densities in already urban areas
- **Livable cities**
- Reduce automobile dependency

Actions to further consider

- Authority to consider cumulative impacts in environmental reviews
- Consider impervious surface as pollutant with direct costs (polluter pays)
- Pick “winner and loser” watersheds
- State resource zoning and development caps for important watersheds
- Withhold funding in response to bad projects & plans
- Stormwater utilities


Like winds and sunsets, wild things were taken for granted until progress began to do away with them.
Now we face the question whether a still higher "standard of living" is worth its cost in things natural, wild and free.
Aldo Leopold – A Sand County Almanac