Factors affecting smallmouth bass populations in the Susquehanna River

Chesapeake Bay Commission

September 7, 2012

Mission: To protect, conserve, and enhance the Commonwealth's aquatic resources and provide fishing and boating opportunities

Issues of concern

- Concerns over decline of the smallmouth bass fishery
  - Disease in YOY smallmouth bass
    - Water quality concerns
      - Nutrient-related issues
        - Low dissolved oxygen
        - High pH
      - Endocrine disruption
- Ramifications of these declines
- Call for action

Smallmouth bass *Micropterus dolomieu*

- Member of the sunfish family
- One of the most popular and wide-spread game fishes
- Introduced to the Susquehanna drainage in late 19th century
- Prefers rivers and streams over lakes

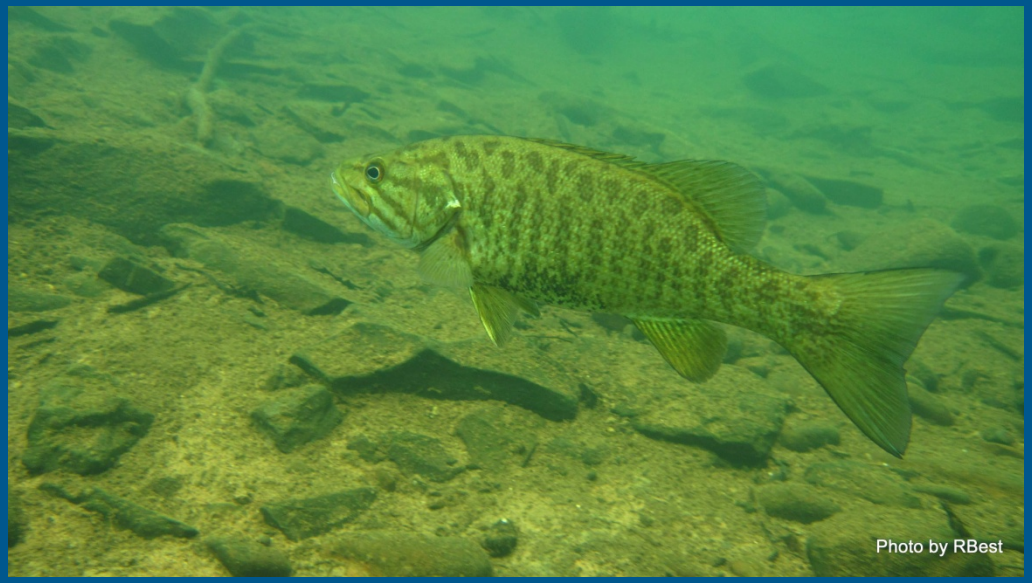


Photo: Rich Best –Sunken Treasure SCUBA

Historical versus current perspective

- Widely considered one of the best smallmouth bass destinations in the country
  - In 2005, Bassmaster Magazine listed as one of top 5 rivers
- American Rivers listed as the *America's Most Endangered River* in 2009 and 2011

Photo: A. Shiels

Onset of disease outbreak

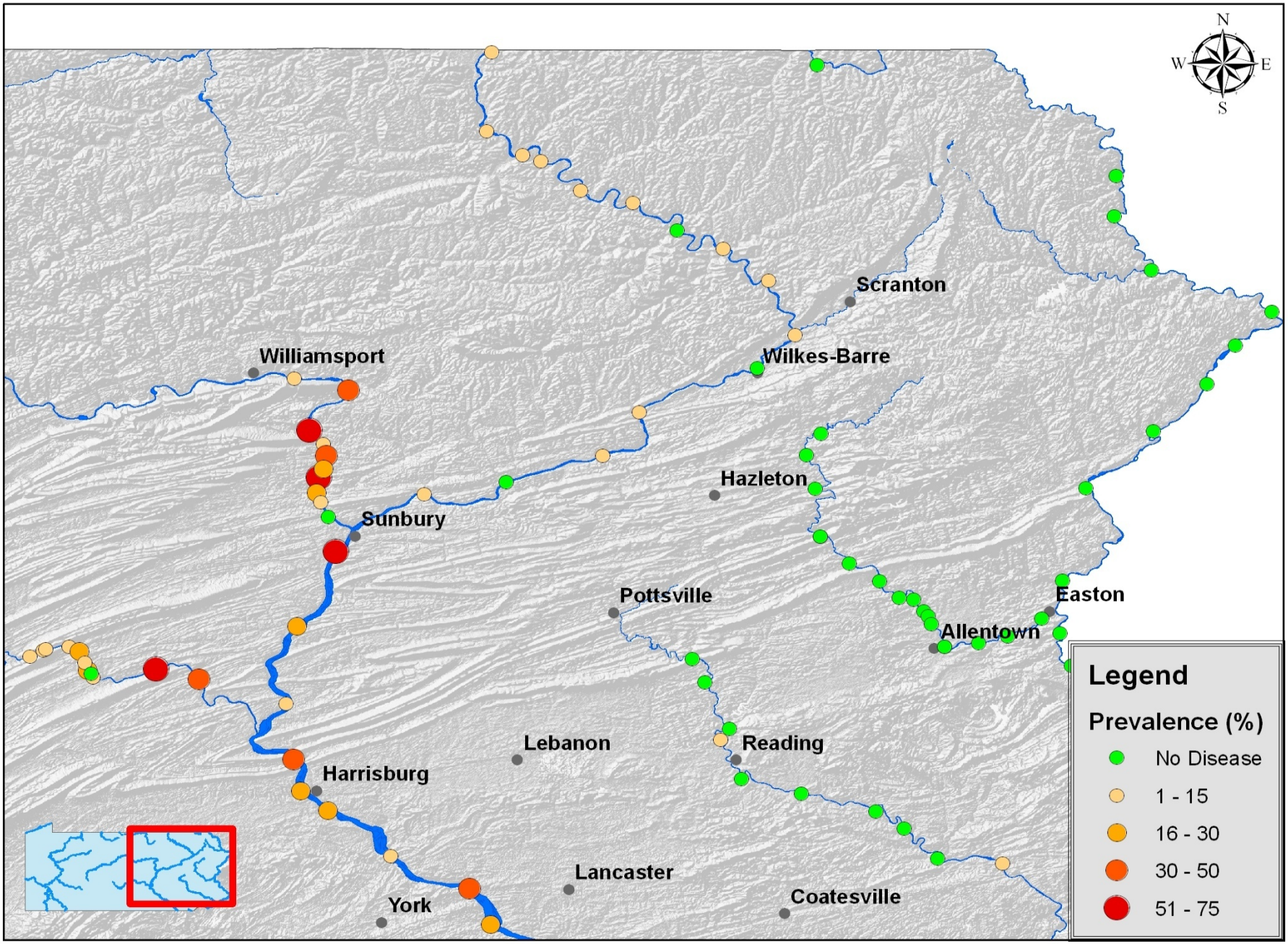
- First appeared in 2005
- West Branch Susquehanna, Susquehanna, and Juniata rivers
- Affected young-of-year (YOY) smallmouth bass
- Disease prevalence as high as 70%

Photo: J. Cukjati - USGS PA Water Sci. Center

Onset of disease outbreak

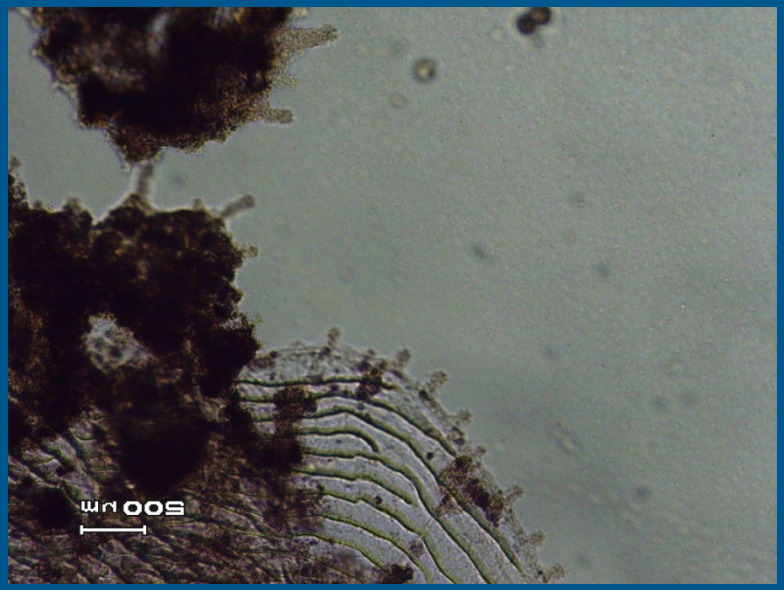
- Varies temporally and spatially
- Most prevalent during years with high water temperature
- First documented in tributaries in 2010
- First documented outside of Susquehanna Basin in 2011
  - Still awaiting pathological confirmation

Photo: J. Chaplin - USGS PA Water Sci. Center


N
W
E
S
Scranton
Williamsport
Wilkes-Barre
Hazleton
Sunbury
Pottsville
Easton
Allentown
Lebanon
Reading
Harrisburg
Lancaster
York
Coatesville
Legend
Prevalence (%)
No Disease
1 - 15
16 - 30
30 - 50
51 - 75

Initial diagnosis

- Bacterial infections by *Flavobacterium columnare* or "columnaris"
  - A common bacteria found in soil and water
- So why now?



Photos: K. Stark – PFBC retired

Initial hypothesis

- Stressful water quality conditions are compromising immune systems and allowing bacterial colonization
- Why only one life stage of one species?
  - Conditions were most severe in the habitats they reside in at that life stage

Water quality

- Paired main channel and microhabitat study conducted by USGS (2008 – 2010)
  - dissolved oxygen
  - pH
  - specific conductance
  - temperature

Photo: J. Chaplin - USGS PA Water Sci. Center

Susquehanna River at Clemson Island (near New Buffalo, PA)

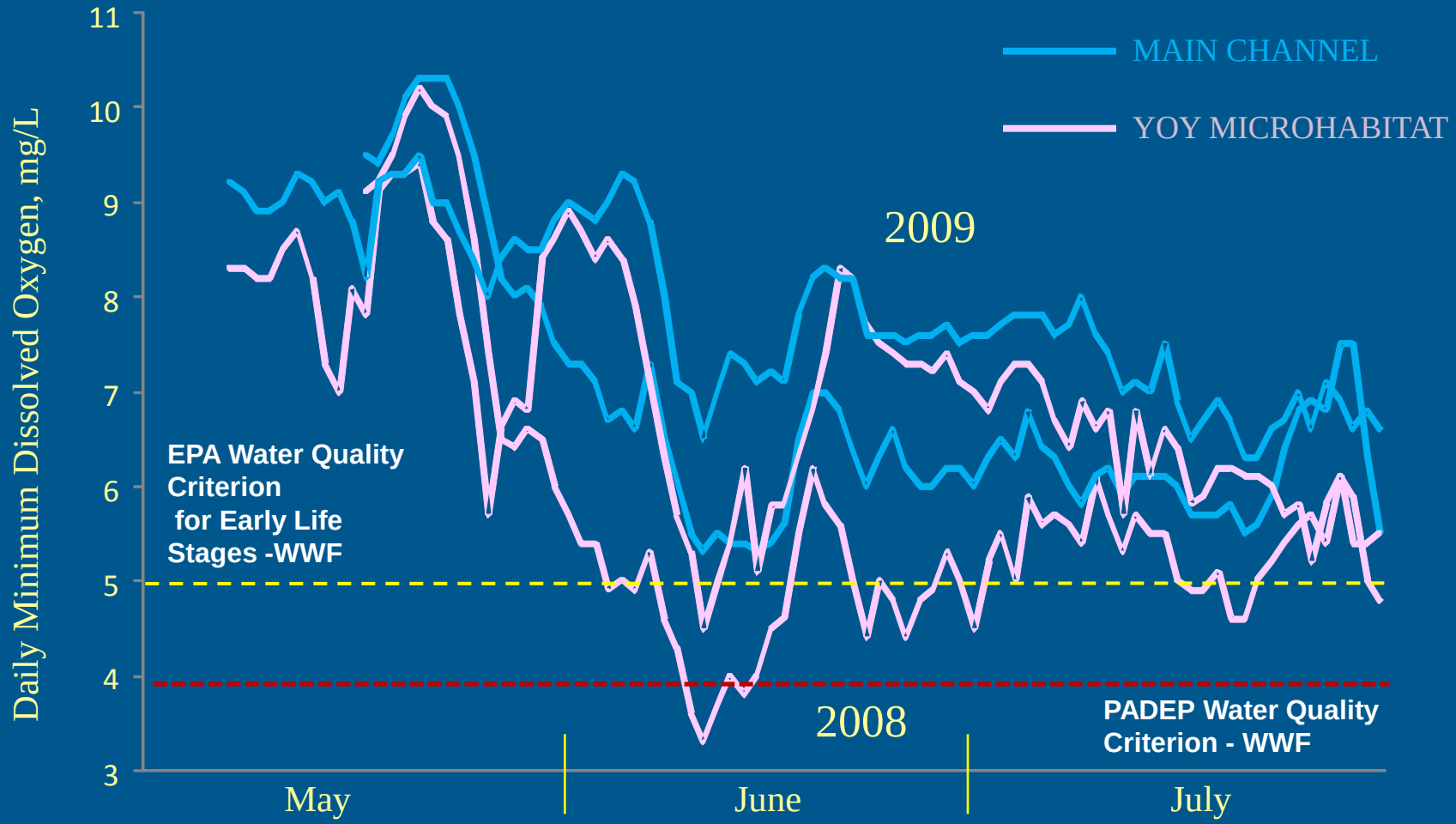
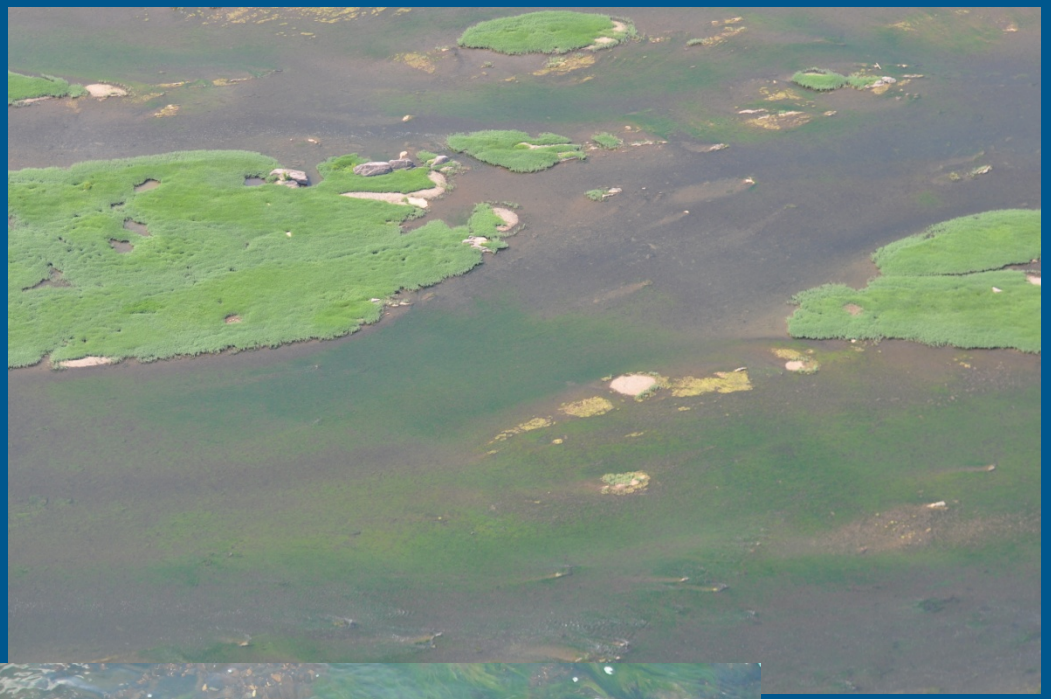
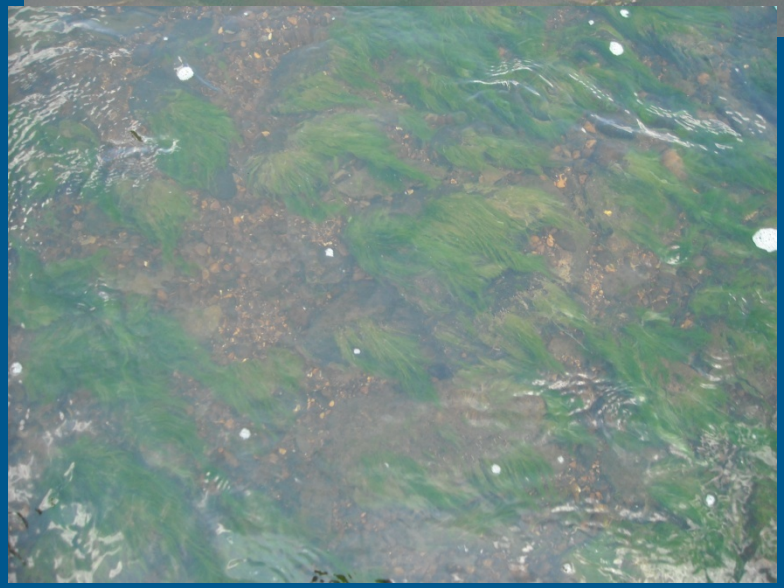


Figure: J Chaplin – USGS PA Water Sci. Center

Why low DO?

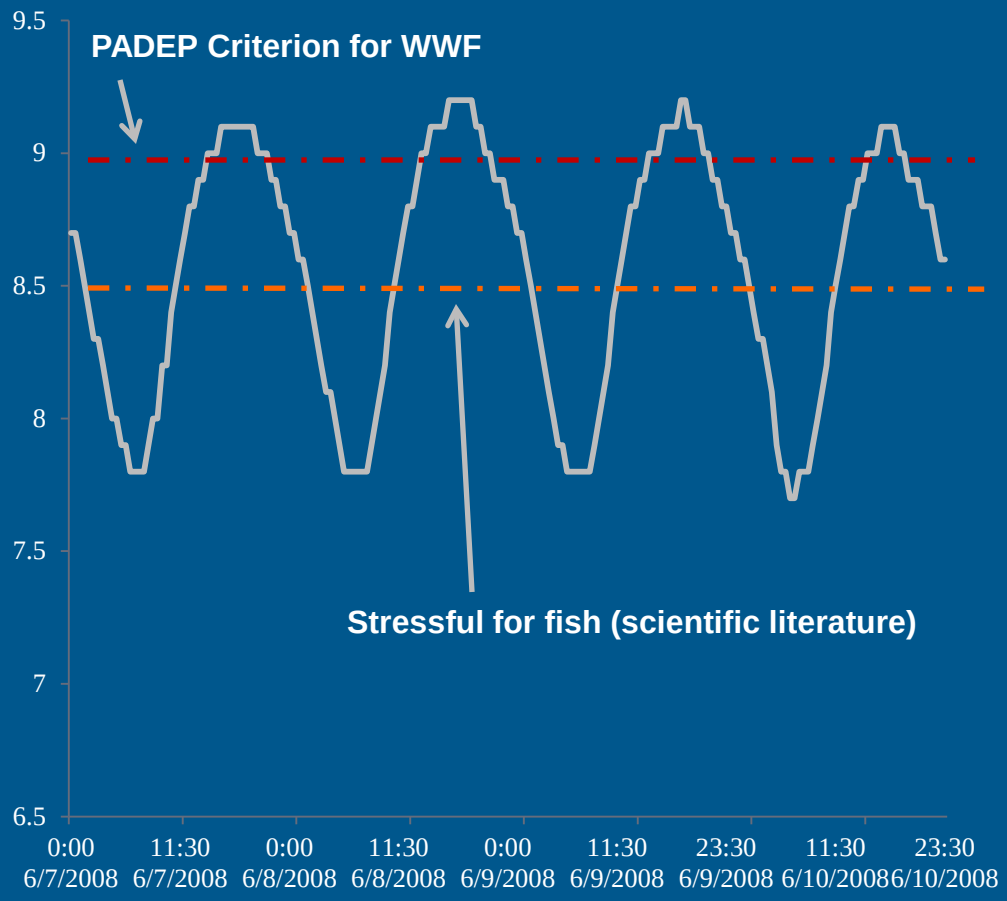
- Respiratory demand by aquatic plants
  - Coincident with longest photoperiod of the year and warmest water temperatures
    - Saturation values also the lowest





High pH

- A product of excessive photosynthesis
  - Wide daily variation
  - Stressful max values
    - Affects osmoregulatory function of fish
    - Many metals and other contaminants become soluble again



Why increases in algal productivity?

- Recent increases in dissolved component of phosphorus
  - Despite decreases in total phosphorus
- Limiting and most easily usable nutrient for aquatic plants
- Different from other nutrients
  - Is not related to stream flows
  - Constant introduction even during dry periods

Evidence of contaminants

- Endocrine disruption
  - Frequent and severe cases of intersex
    - As high as 90-100%
  - High concentrations of vitellogenin in adult males

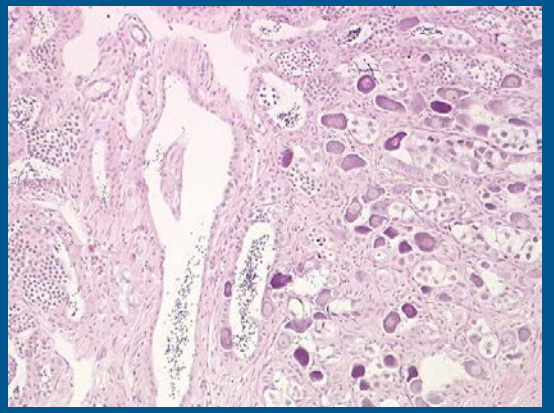


Photo: V. Blazer – USGS National Fish Health Research Lab

Evidence of contaminants

- Endocrine disruption
  - 15 PCB congeners
  - 13 flame retardant compounds
  - 2 personal care products (triclosan)
  - 14 organochlorine pesticides
  - 9 other pesticides

"Blotchy Bass" syndrome

- Frequently observed by anglers this spring
- Picked up by local media outlets
- Questions and concerns to PFBC and legislators

Angler submitted photo

"Blotchy Bass" syndrome

- What we know
  - Melanocytes and melanosomes in the dermis and epidermis of the fish.
  - Melanin is under control of the endocrine (hormone) system
  - Typically observed during cold water months
  - Observed throughout the range of bass
  - All fish observed are apparently healthy (actively feeding)
  - Observed at numerous locations in PA in the past and during 2012
  - Not definitively water-quality related in previous studies

The “Perfect Storm” is occurring

- Stressful water quality
  - Temperature
  - Nutrients
    - Dissolved oxygen
    - pH
  - Contaminants
- Bacteria
- Viruses
- Parasites

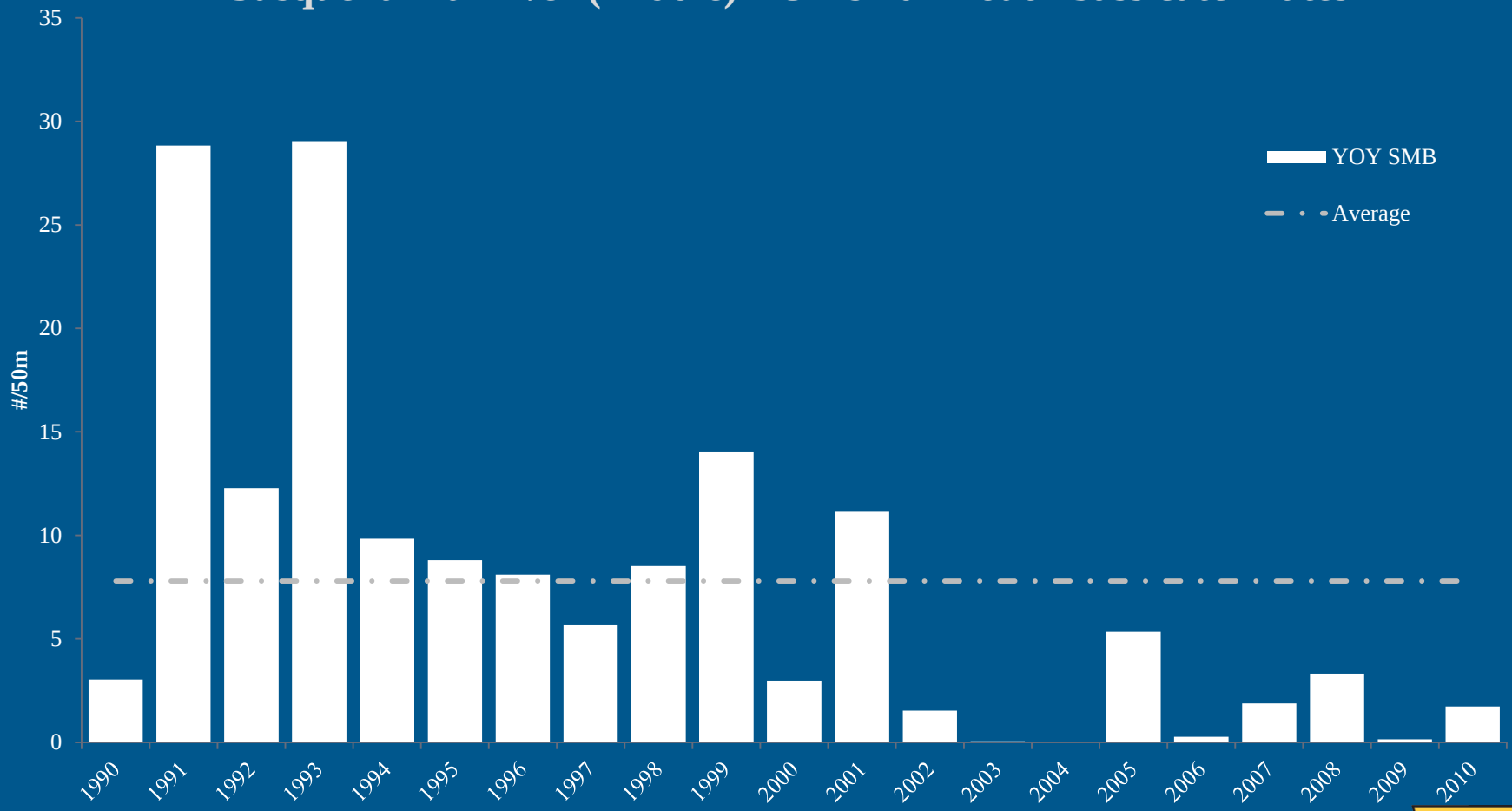
Photo: J. Tryninewski - PFBC

What do we know?

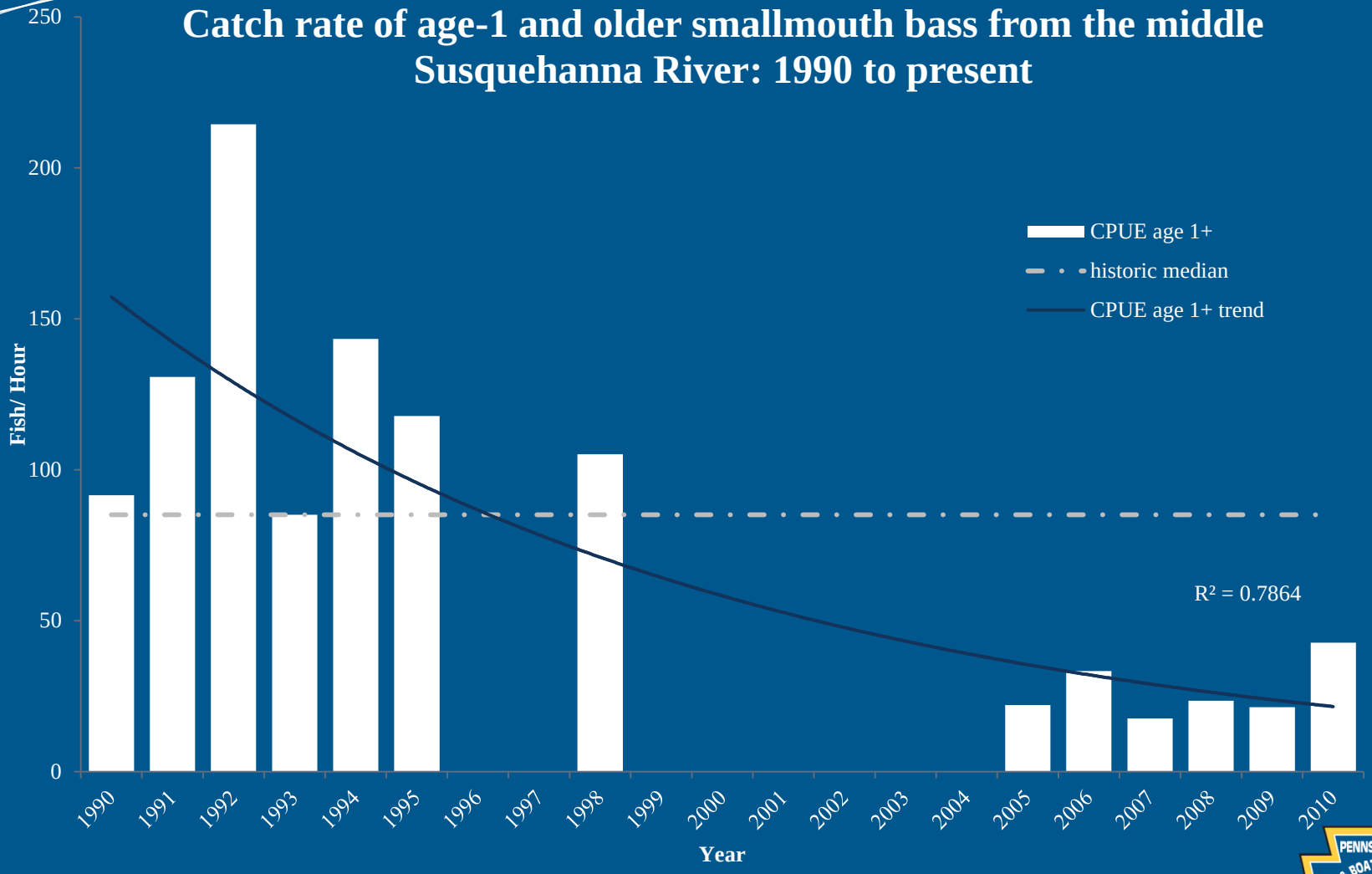
- Several factors seem to be driving the condition
- No single factor seems to be responsible
  - Changing the paradigm of fish mortality events
- Appears to be expanding in range

Photo: J. Chaplin – USGS PA Water Sci. Ctr.

Susquehanna River (middle) YOY smallmouth bass catch rates



Catch rate of age-1 and older smallmouth bass from the middle Susquehanna River: 1990 to present



Reason for urgency

- Takes 5 - 6 years to reach 15” (legal-length)
- Each poor year class translates to poor fishery 5 or 6 years later.

Big business

- Fishing and Boating are big business in Pennsylvania
  - $3.4 billion to PA economy, annually
  - 18,000 jobs
  - $120 million in state and local tax revenue, annually
- Major recreational resource
  - Susquehanna River smallmouth bass (2007)
    - Nearly 69,000 trips (April – October)
    - 286,144 hours

Photo: M. Hendricks

Big business

- Major recreational resource
  - Nationally, black bass most popular game fish species (USFWS 2006)
  - Black bass second to trout in terms of total anglers and days spent angling in Pennsylvania (both residents and non-residents; USFWS 2006)

Photo: A. Shiels

Public outcry

- Several public meeting over the last several years
  - Approximately 1,000 attendees
  - Hundreds of comment letters

Photo: PFBC Archives

Public outcry

- Press coverage
  - Newspaper articles, Editorials, Op-Eds
    - Numerous local articles (Harrisburg, Sunbury, Lancaster, Williamsport)
    - Baltimore Sun
  - Magazine articles
    - Mid Atlantic Fly Fishing Guide
    - Outdoor News
    - Flyfishing magazine
    - Outdoor America
  - Television programs and radio stories/ programs
  - Countless blogs and web forums

Policy-level activity

- Several contacts from legislators regarding constituents
- Presentations to House and Senate Game and Fisheries Committees
- Emergency Action to change regulations to immediate catch-and-release
- Formal regulation changes
- Request for PADEP impairment

Request for PADEP Impairment

- Submitted data and letter to PADEP requesting listing in the *Integrated Water Quality Monitoring and Assessment Report* as an impaired water
  - Violates minimum daily DO and pH for WWF
    - Exceeds minimum daily DO (4 mg/L) criterion
      - Susquehanna at Clemson Island (microhabitat; 1.9% of records)
    - Exceeds pH (6.0 – 9.0, inclusive) criterion
      - Susquehanna River at Harrisburg (1.22% of records)
      - Susquehanna River at Clemson Island (4.28% of records)
  - Signatories include PennFuture, Trout Unlimited (PA), Chesapeake Bay Foundation, and American Rivers

Request for PADEP Impairment

- Draft Report does not include Susquehanna River
  - Resubmitting data
  - Preparing comment letter
  - Requesting public support

Photo: M. Hendricks

Request for PADEP Impairment

- What impairment means
  - Identify sources and causes of exceeded criteria
  - Development of a TMDL
    - A pollution “diet” to remediate the conditions
    - Prescription for Susquehanna River different from Chesapeake Bay

Summary

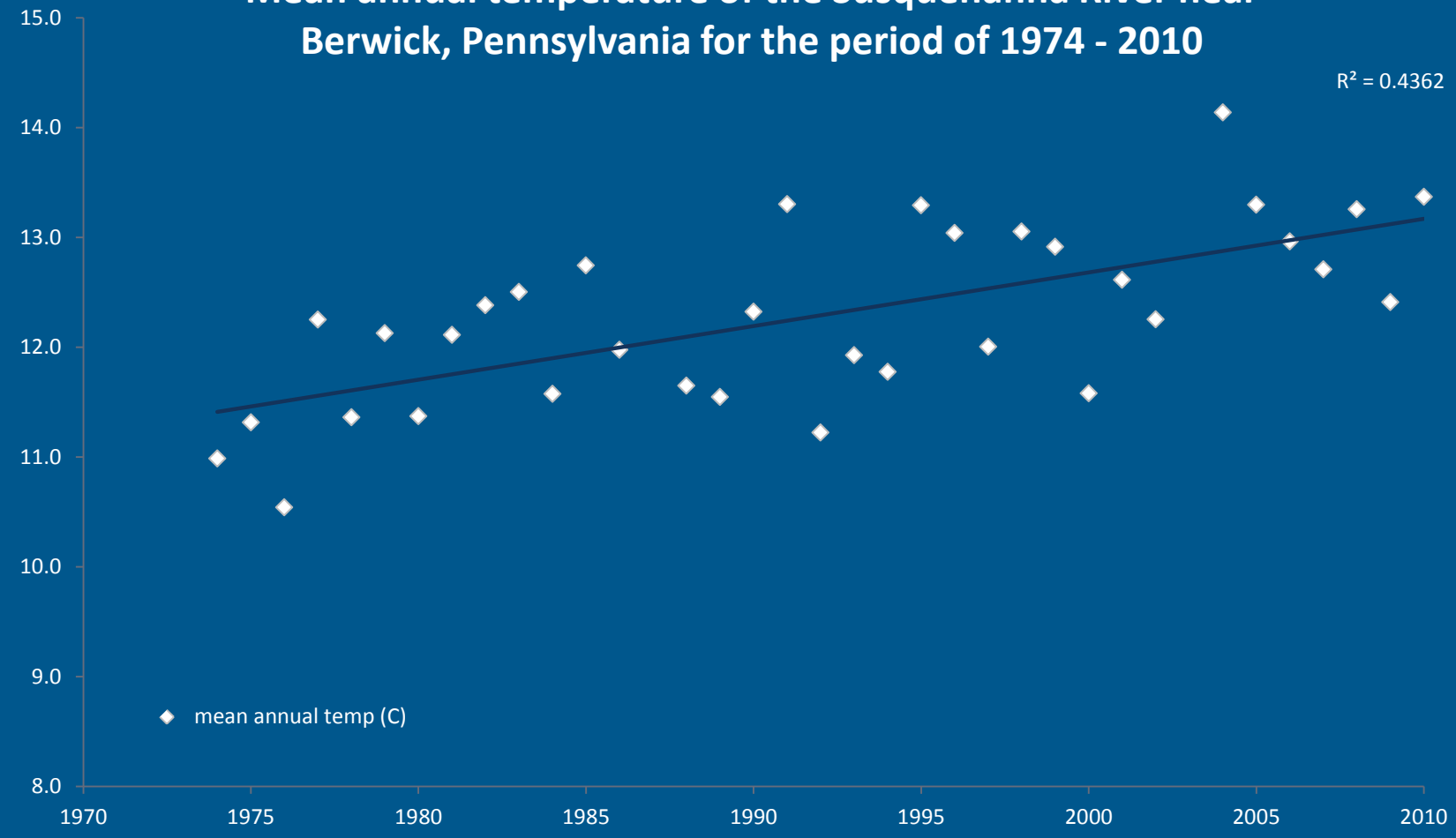
1. Declines in smallmouth bass population
   - Loss of multiple year-classes because of disease-related mortality
2. Identified water quality issues
   - Nutrient-related issues
     - Increased algal productivity
       - Low Dissolved Oxygen
       - High pH
   - Endocrine disruption
3. Economic and recreational importance of fishery
4. Need for action

Acknowledgements

- USGS Leetown Science Center, National Fish Health Research Laboratory
  - Vicki Blazer
  - Luke Iwanowicz
  - Heather Ellery
- USGS PA Water Science Center
  - Jeff Chaplin
- PFBC
- U.S. Fish and Wildlife Service, Northeast Fishery Center
- Susquehanna River Technical and Policy Committees

Questions

Mean annual temperature of the Susquehanna River near Berwick, Pennsylvania for the period of 1974 - 2010



Hazleton

Sunbury

Pottsville

Easton

Allentown

Lebanon

Reading

Harrisburg

Lancaster

Philadelphia