Lake Erie Update and Outlook for 2014

Dr. Jeffrey M. Reutter

Director, Ohio Sea Grant College Program

Jeffrey M. Reutter, Ph.D., Director

- 1895—F.T. Stone Laboratory
- 1970—Center for Lake Erie Area Research (CLEAR)
- 1978—Ohio Sea Grant College Program
- 1992—Great Lakes Aquatic Ecosystem Research Consortium (GLAERC)
- Grad student at Stone Lab in 1971 and never left. Director since 1987.

Southernmost

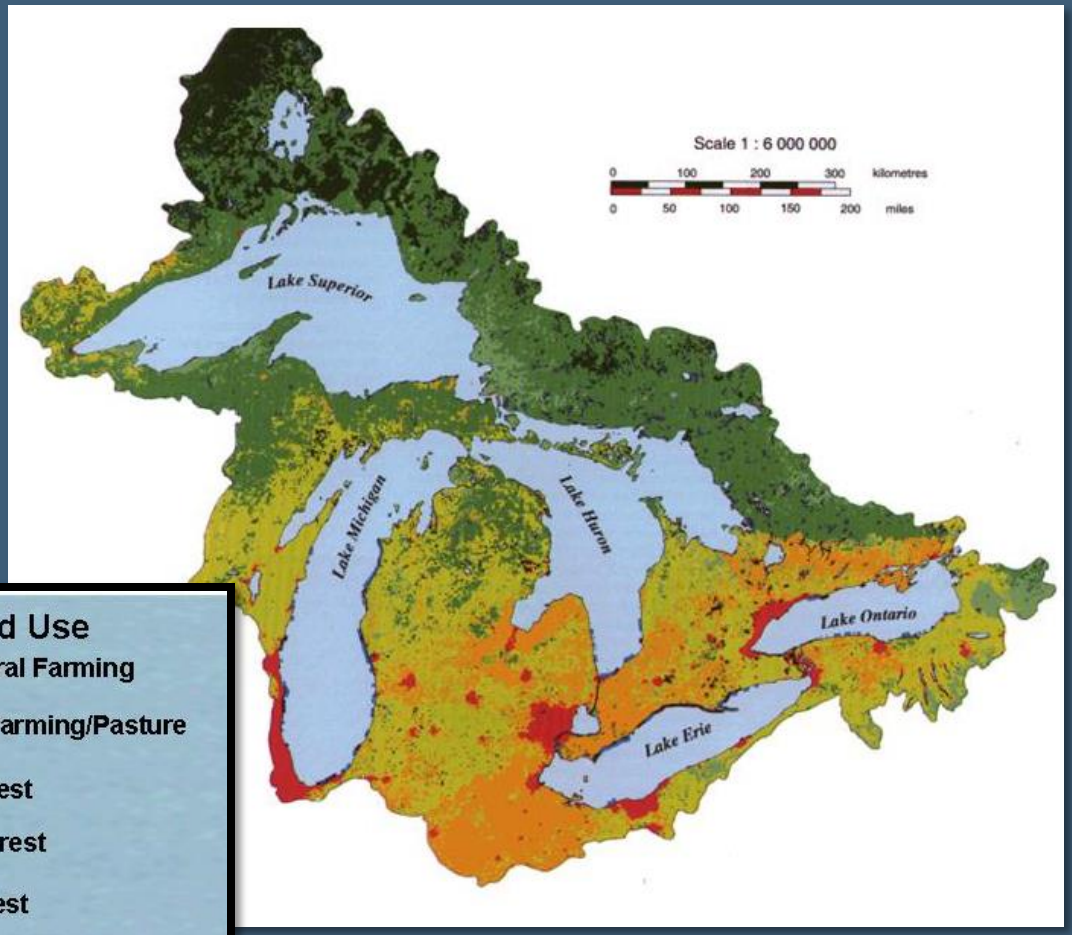
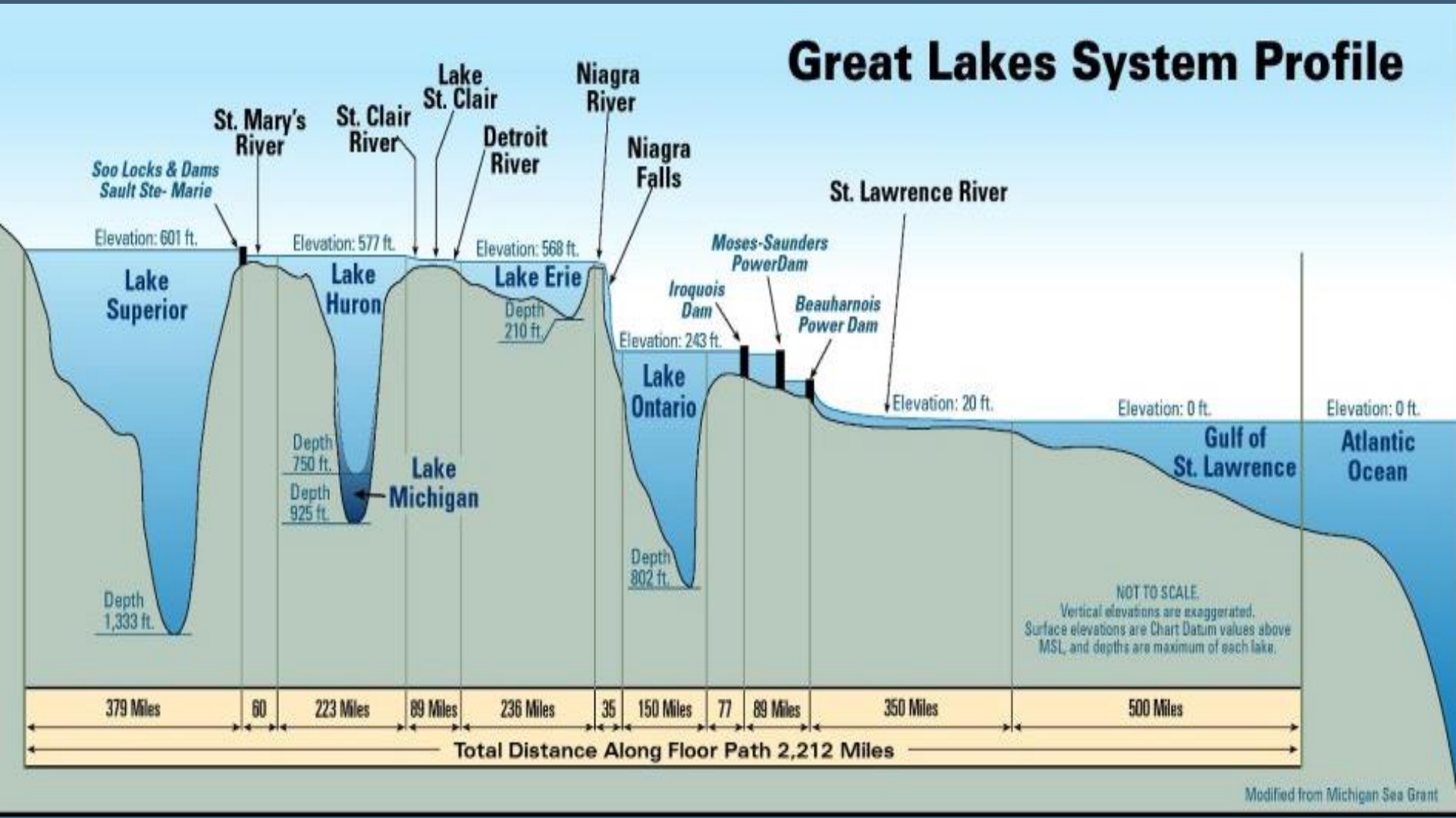


Image: Ohio Sea Grant

Shallowest and Warmest



80:10:10 Rule

- 80% of water from upper lakes
- 10% direct precipitation
- 10% from Lake Erie tributaries
  - Maumee
    - Largest tributary to Great Lakes
      - Drains 4.5 million acres of ag land
    - 3% of flow into Lake Erie

Discuss Retention Time

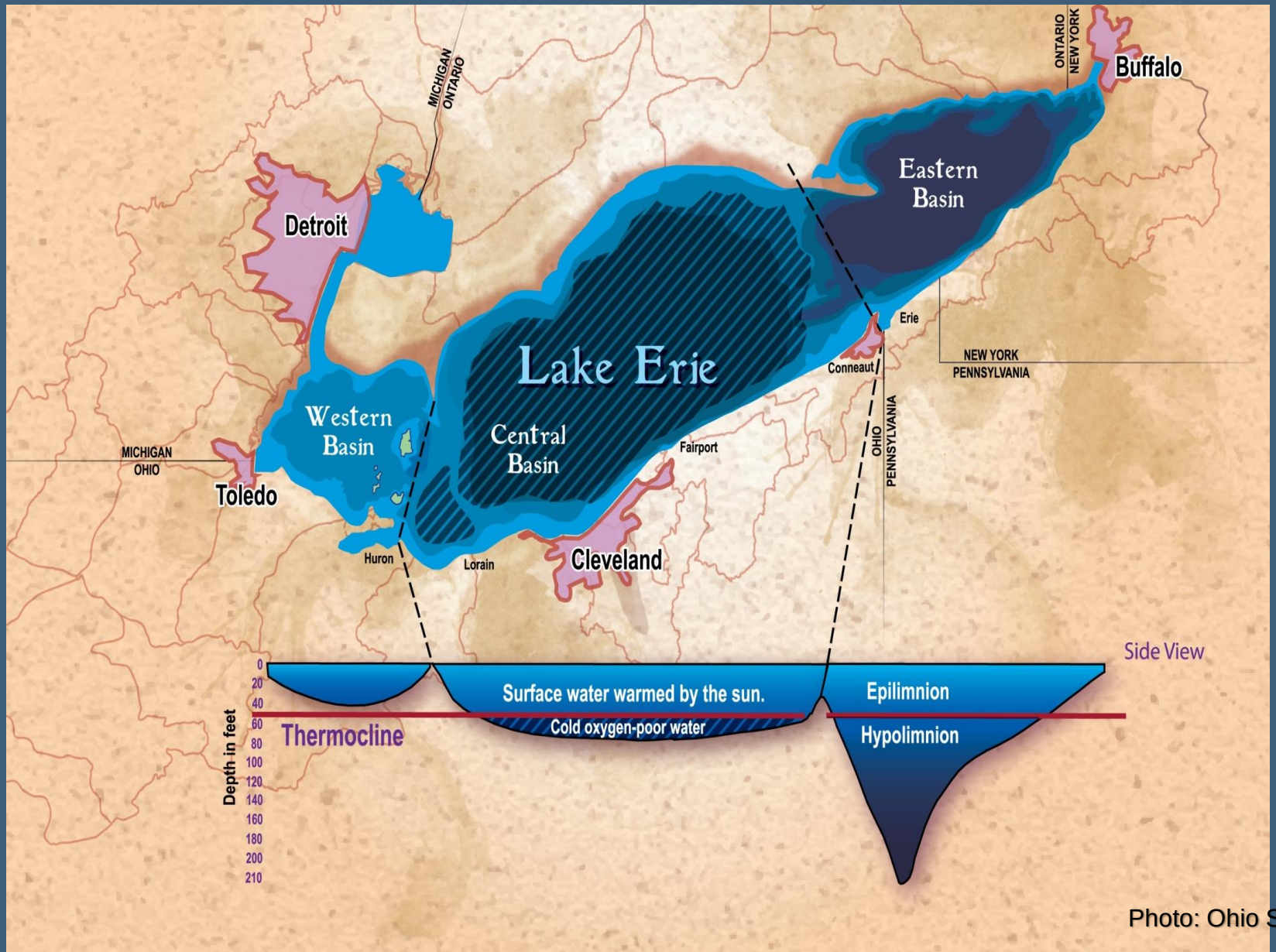
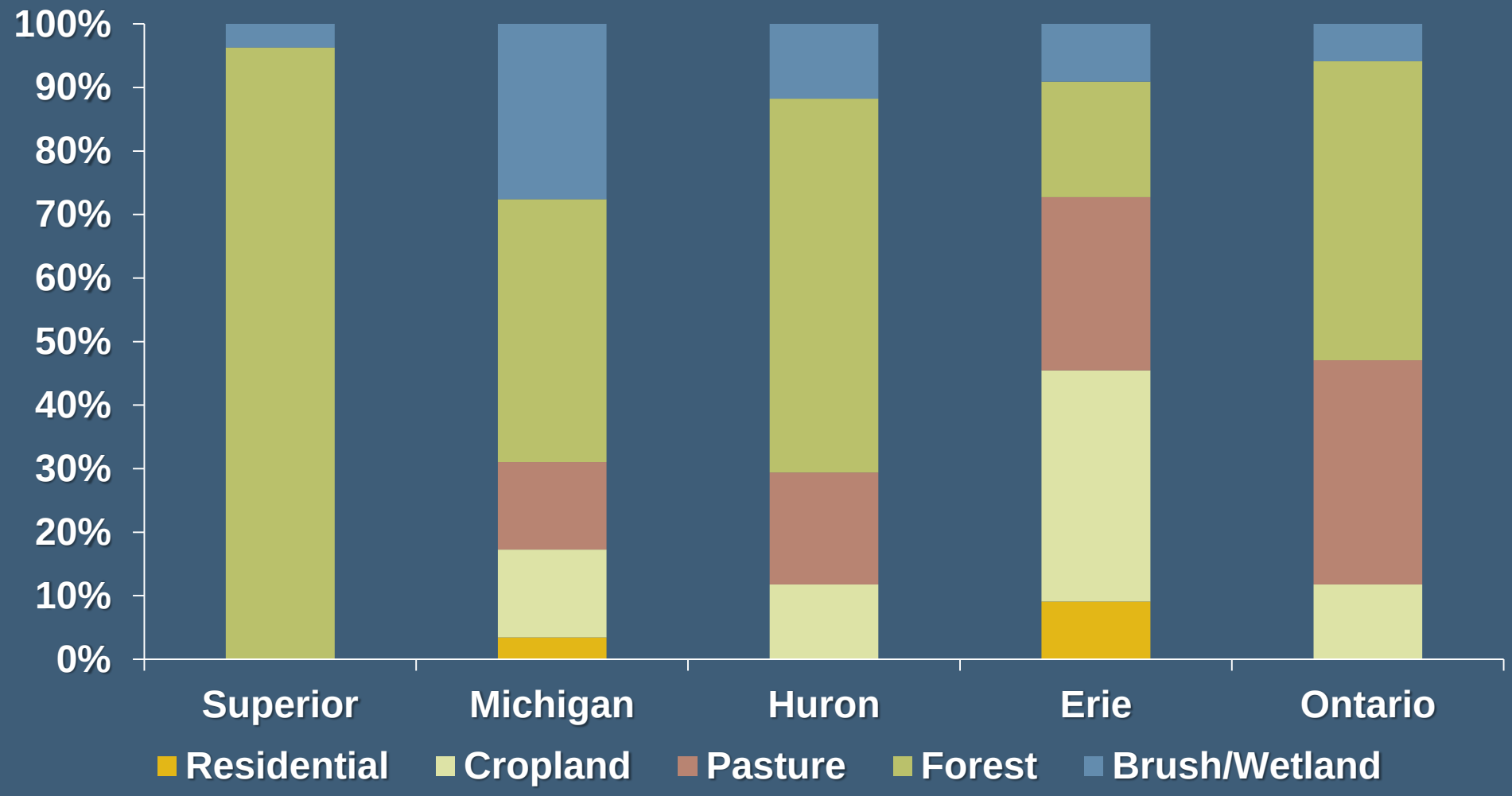


Photo: Ohio Sea Grant

Major Land Uses in The Great Lakes

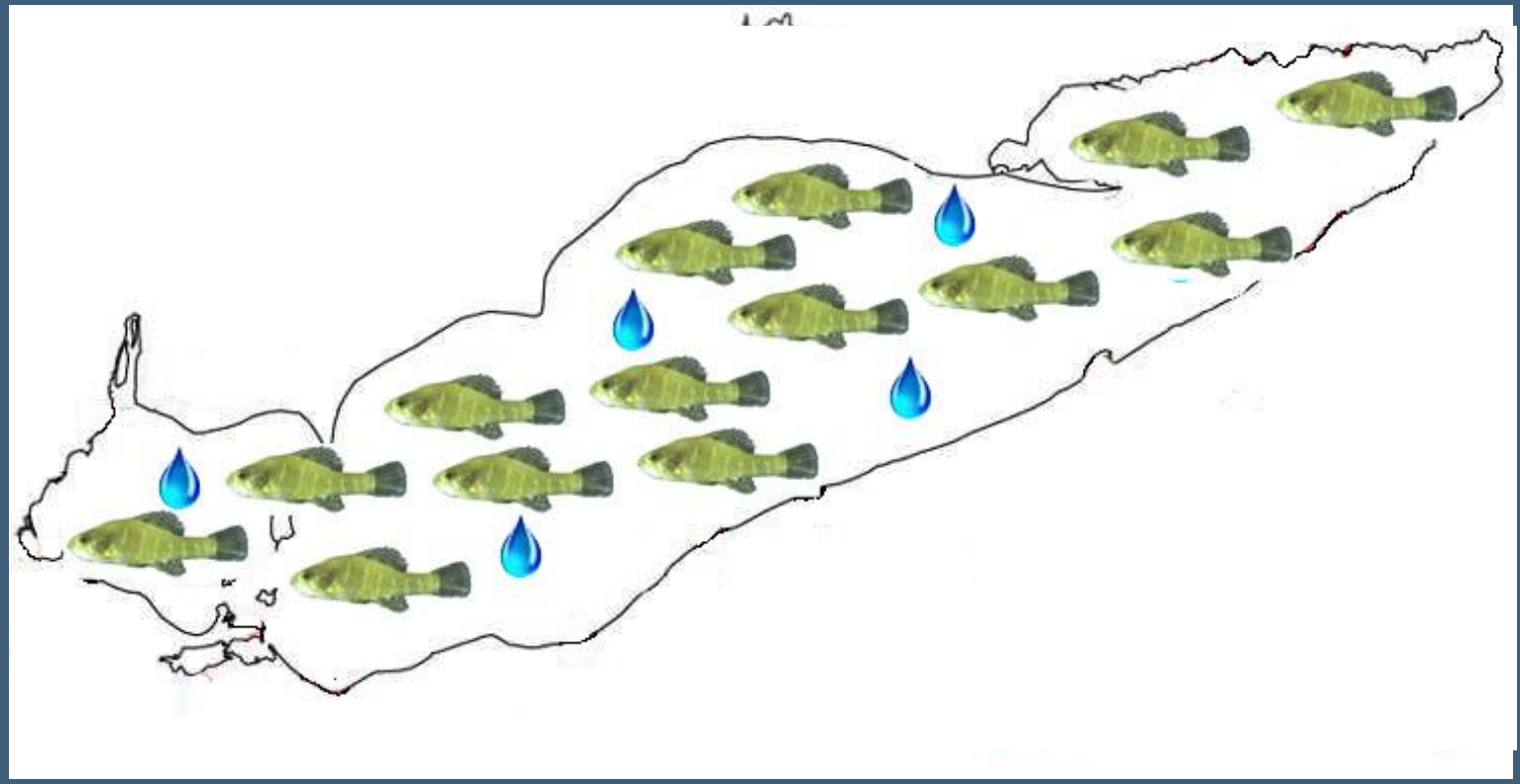


Because of Land Use, Lake Erie Gets:

- More sediment
- More nutrients (fertilizers and sewage)
- More pesticides
- (The above 3 items are exacerbated by storms, which will be more frequent and severe due to climate change.)
- And Lake Erie is still biologically the most productive of the Great Lakes—And always will be!!

50:2 Rule

(Not exact, but instructive)



Lake Superior:

20% of the water and 50% of the fish

Lake Erie Stats

- Drinking water for 11 million people
- Over 20 power plants
- Power production is greatest water use
- 300 marinas in Ohio alone
- Walleye Capital of the World
- 40% of all Great Lakes charter boats
- Ohio's charter boat industry is one of the largest in North America
- $1.5 billion sport fishery
- One of top 10 sport fishing locations in the world
- Most valuable freshwater commercial fishery in the world
- Coastal county tourism value is over $11.5 billion and 119,000 jobs

Lake Erie: One of the Most Important Lakes in the World

- Dead lake image of 60s and 70s.
- Poster child for pollution problems in this country.
- But, most heavily utilized of any of the Great Lakes.
- Shared by 5 states, a province, and 2 countries.
- Best example of ecosystem recovery in world.

June 22, 1969

Lake Erie wasn't always the Walleye Capital of the World

Blue-green Algae Bloom circa 1971, Lake Erie

Photo: Forsythe and Reutter

What brought about the rebirth (dead lake to Walleye Capital)?

- Phosphorus reductions from point sources (29,000 metric tons to 11,000).

Impact of Ecosystem Recovery (rebirth)

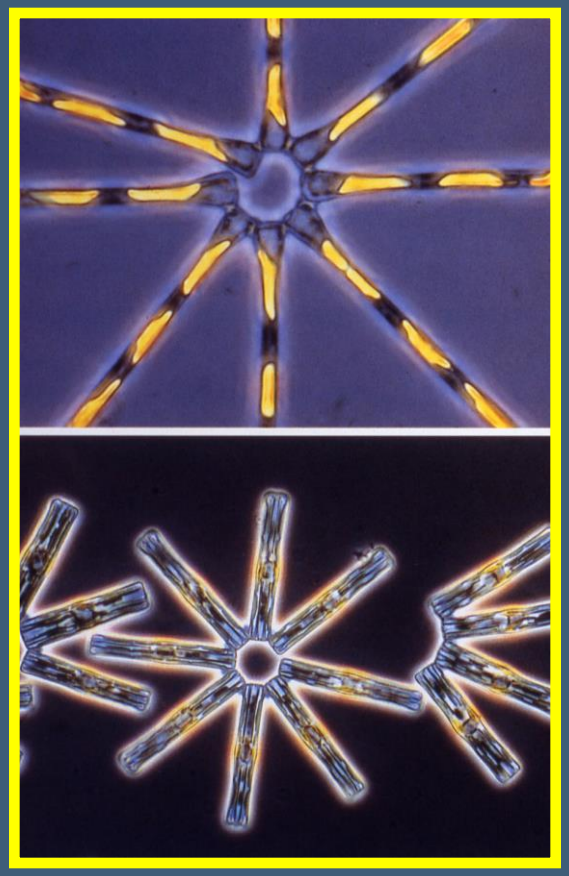
- Ohio walleye harvest 112,000 in 1976 to over 5 million by mid-80s
- 34 charter fishing businesses in 1975 to over 1200 by mid-80s and almost 800 today
- 207 coastal businesses to over 425 today

Algae are tiny plant-like organisms that live in water

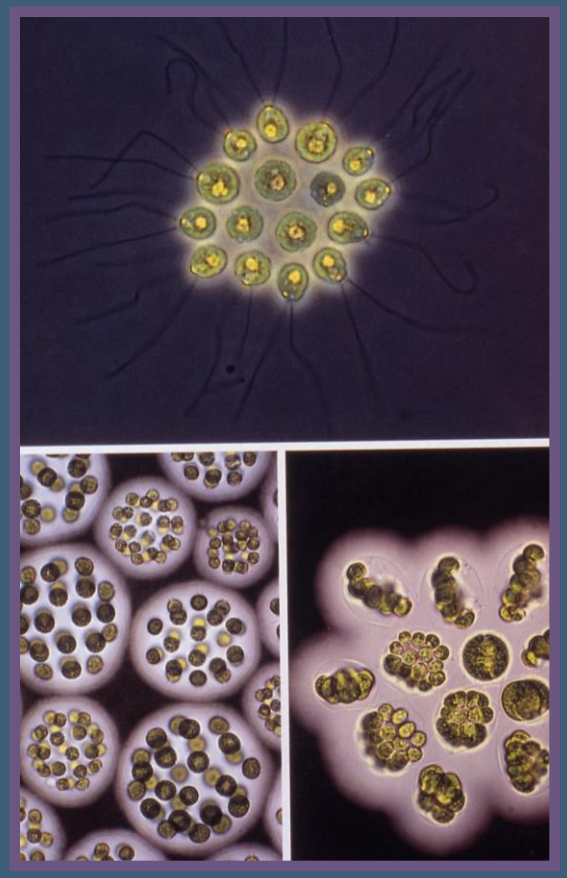
There are hundreds of species of algae in Lake Erie. Most are beneficial.

- Source: Tom Bridgeman, UT

Major groups/kinds in Lake Erie



Diatoms



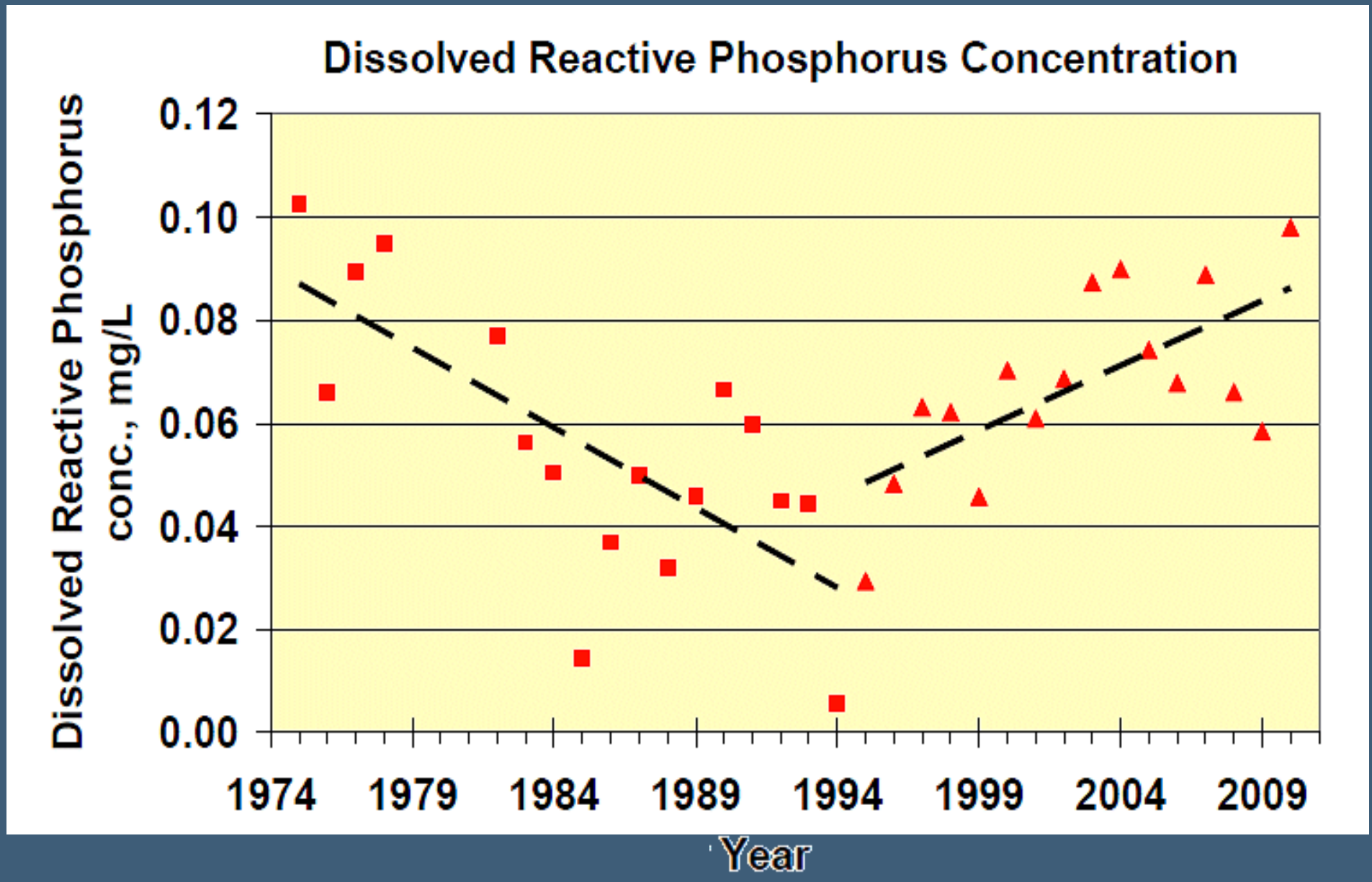
Greens

Blue-greens
(Cyanobacteria)

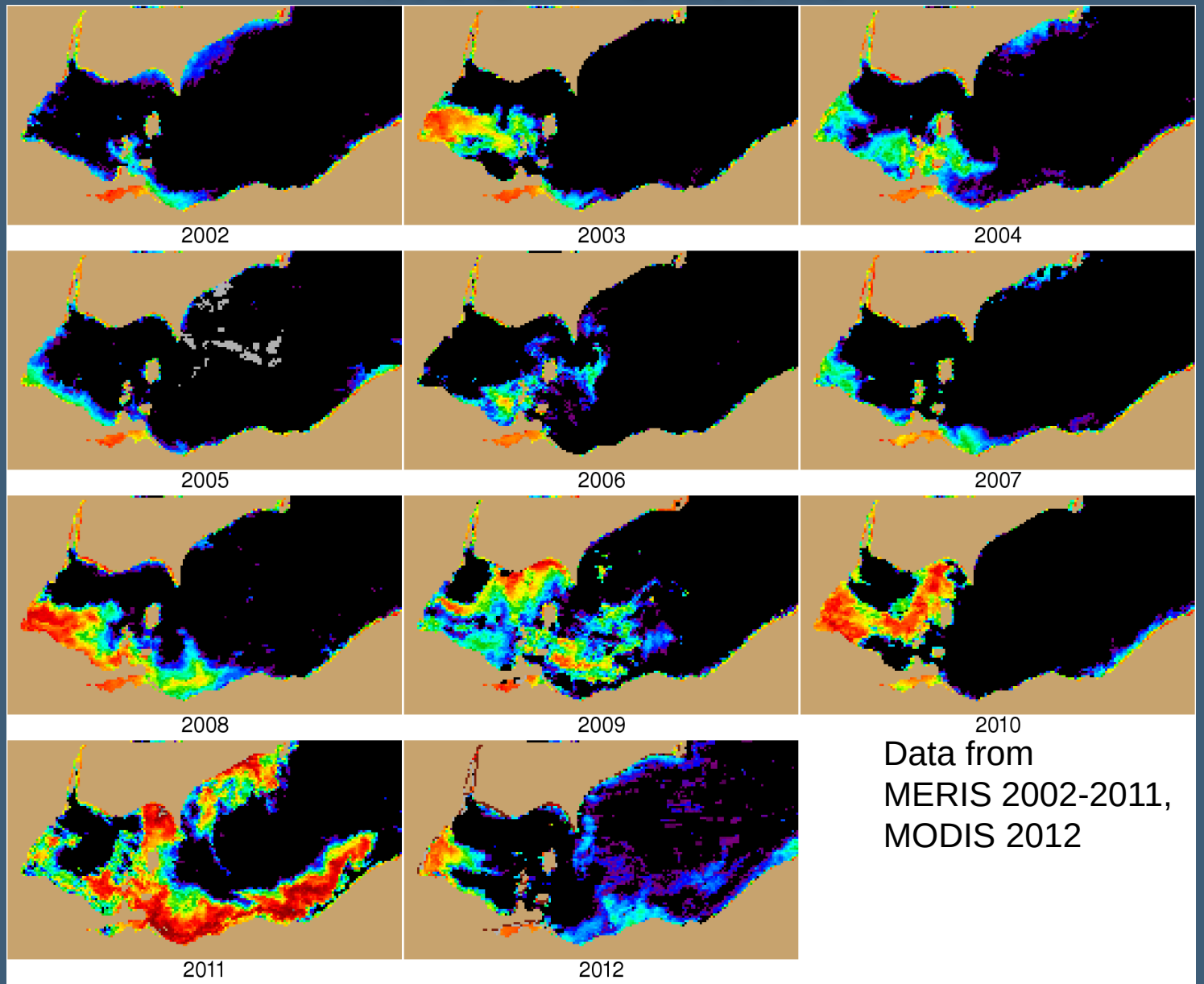
- Source: Tom Bridgeman, UT

Impacts of Increased Phosphorus Concentrations

- HABs—If P concentrations are high (regardless of the source, Ag, sewage, etc.) and water is warm, we will have a HAB (nitrogen concentration will likely determine which of the 7-10 species bloom)
- Nuisance Algae Blooms
  - Cladophora—Whole lake problem. An attached form.
  - Winter algal blooms
- Dead Zone in Central Basin


Dissolved Reactive Phosphorus Concentration
Dissolved Reactive Phosphorus conc., mg/L
0.12
0.10
0.08
0.06
0.04
0.02
0.00
1974
1979
1984
1989
1994
1999
2004
2009
Year

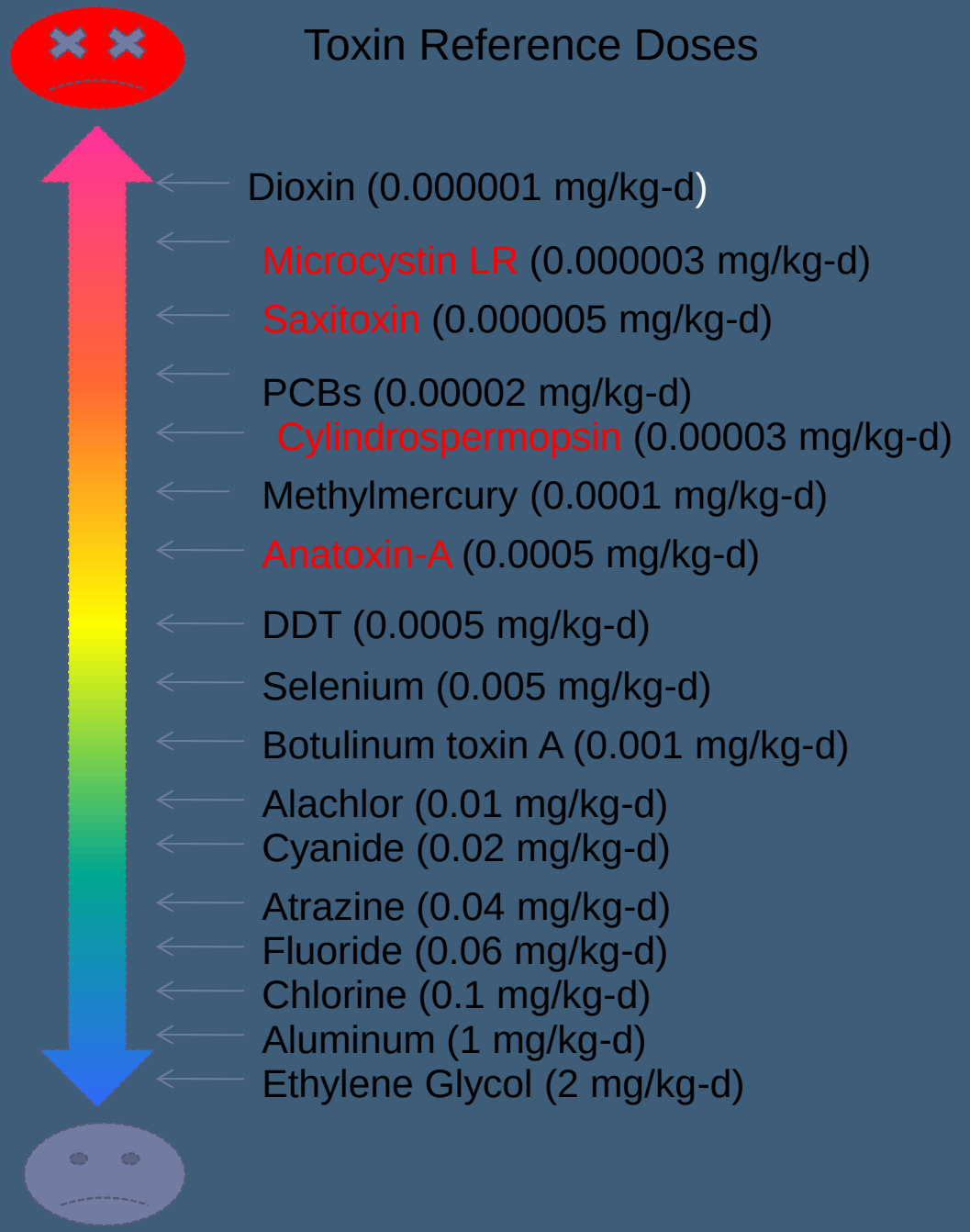
11 years of satellite data provide bloom extent



Data from
MERIS 2002-2011,
MODIS 2012

Toxicity of Algal Toxins Relative to Other Toxic Compounds found in Water

- Reference Dose = amount that can be ingested orally by a person, above which a toxic effect may occur, on a milligram per kilogram body weight per day basis.



Are HABs only a Lake Erie and Ohio Problem?

- Serious problem in US and Canada
- 21 states and Canada in 2012
- Global problem
- Chaired Loadings and Concentrations Subcommittee for Ohio P Task Force
- Now US Co-Chair of the Objectives and Loadings Task Team of Annex 4 (nutrients) Subcommittee of GLWQA
- Weather can determine how we experience a bloom

Blue-green Algae Bloom circa 1971, Lake Erie

Photo: Forsythe and Reutter

Microcystis, Stone Lab, 8/10/10

Photos: Jeff Reutter

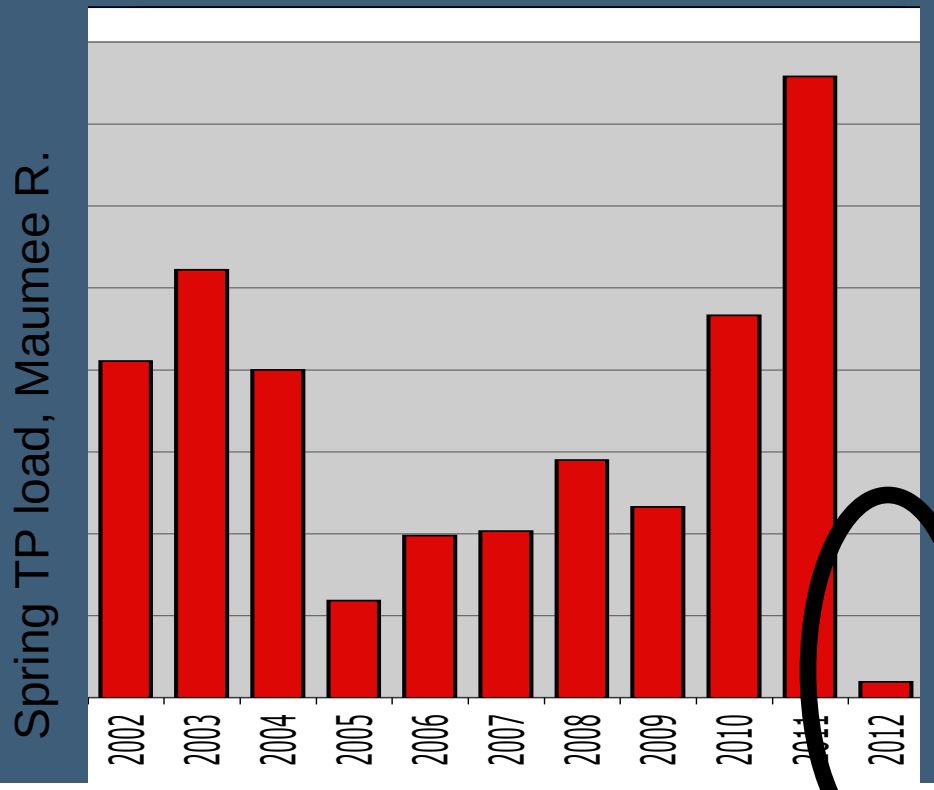
Photo: NOAA Satellite Image

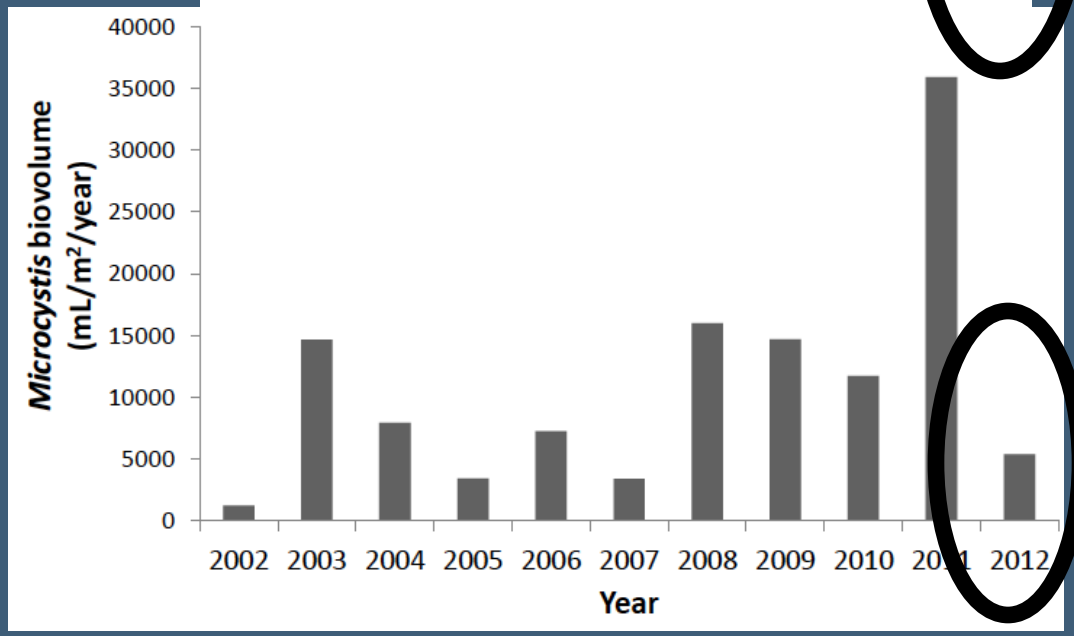
Microcystis near Marblehead

2012

TP loading during March-June 2012 was one of the lowest on record, resulting in a much smaller algal bloom.

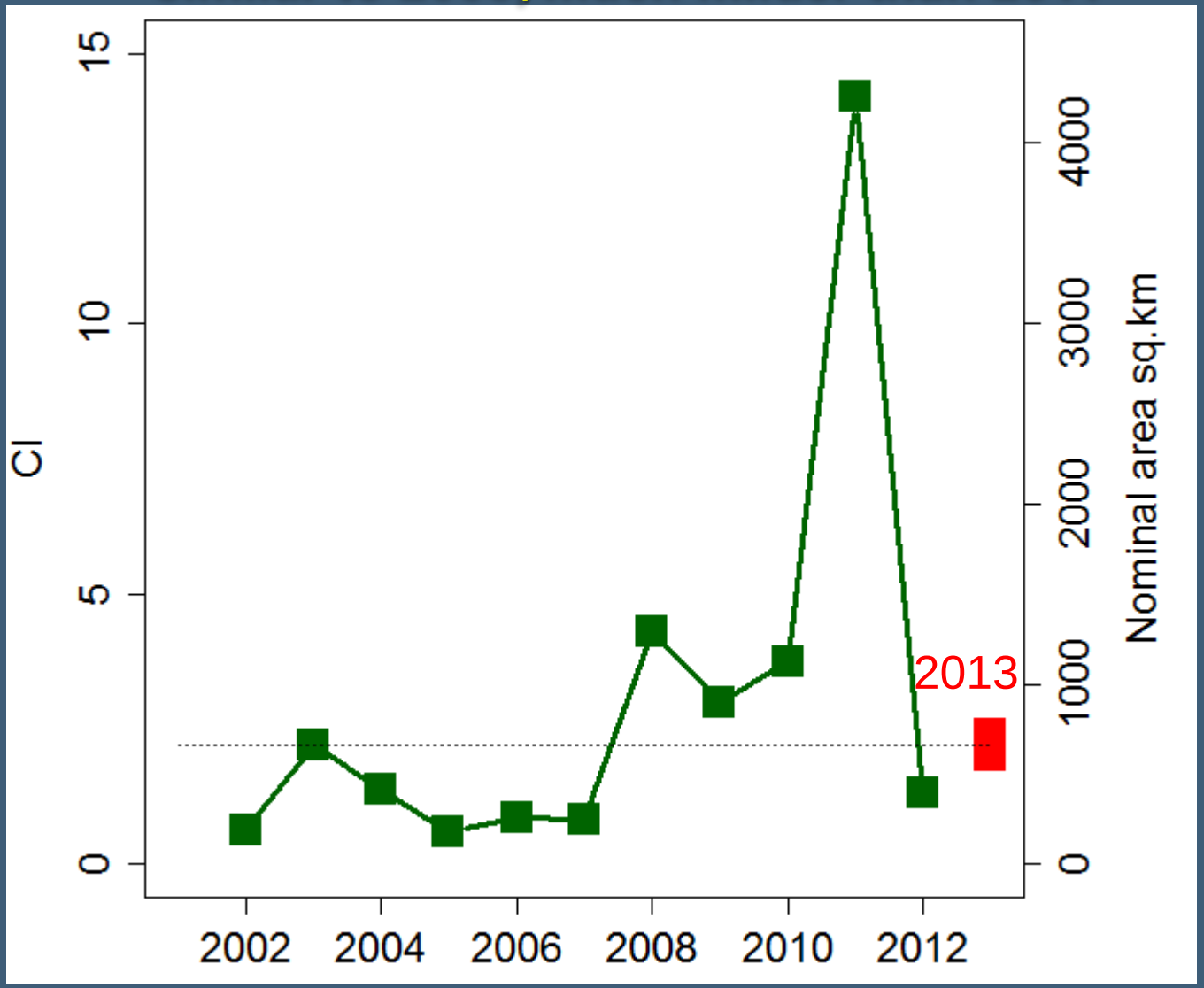
Source: Tom Bridgeman, UT



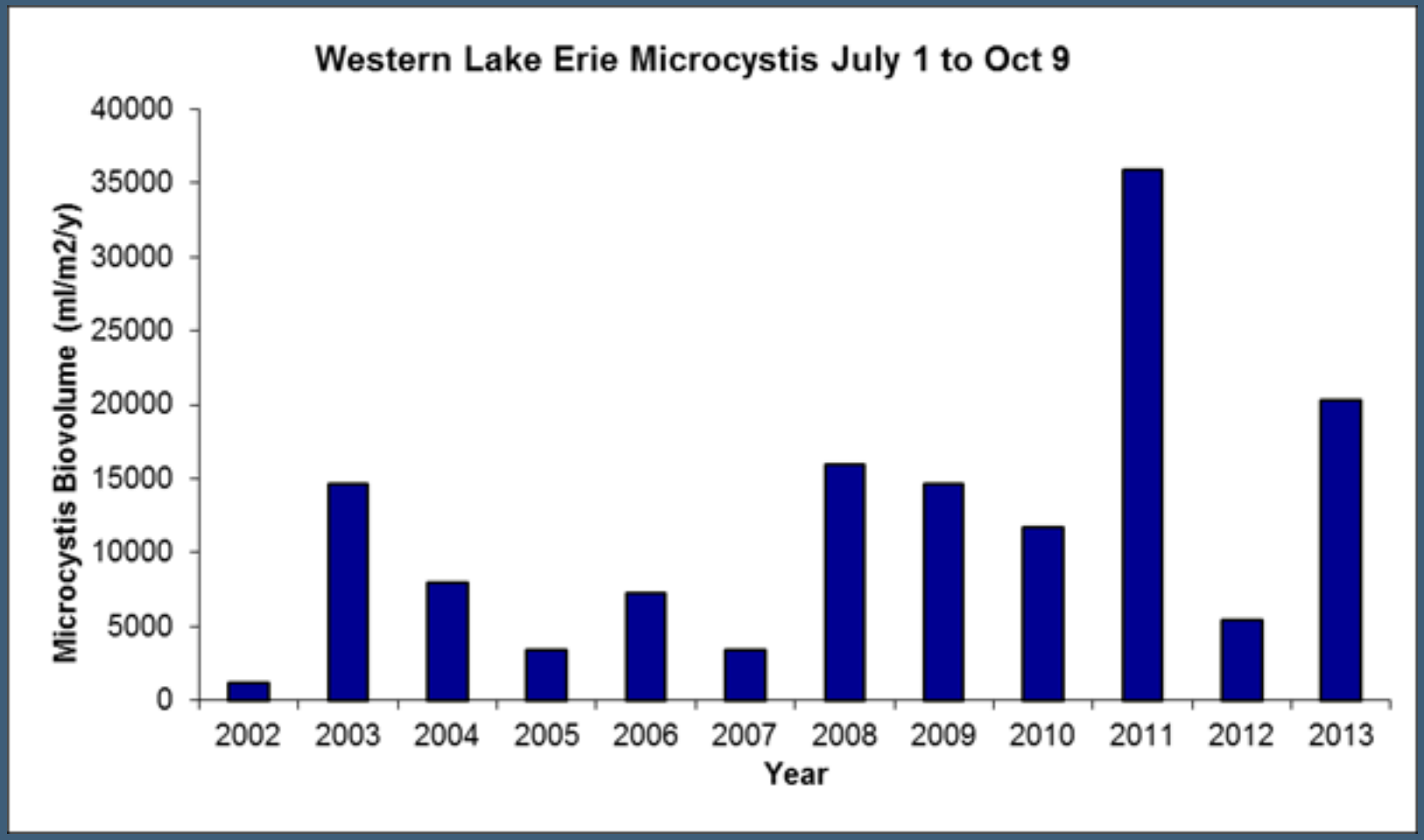


2013 Forecast: Significant bloom.

similar to 2003, much milder than 2011



2013 *Microcystis* open water bloom



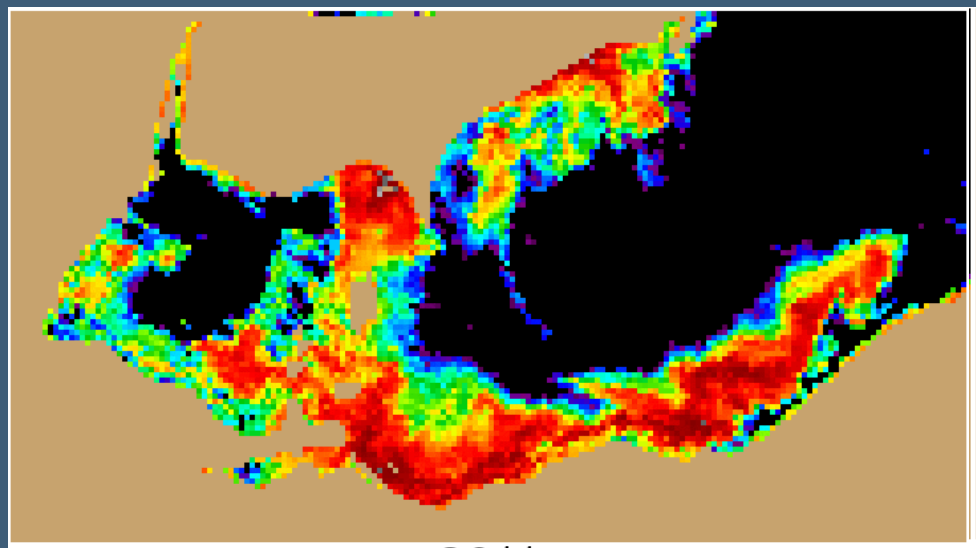
2013 open water bloom was second only to 2011 over last 12 years. Source: Tom Bridgeman, UT.

Microcystis, Stone Lab, 9/20/13

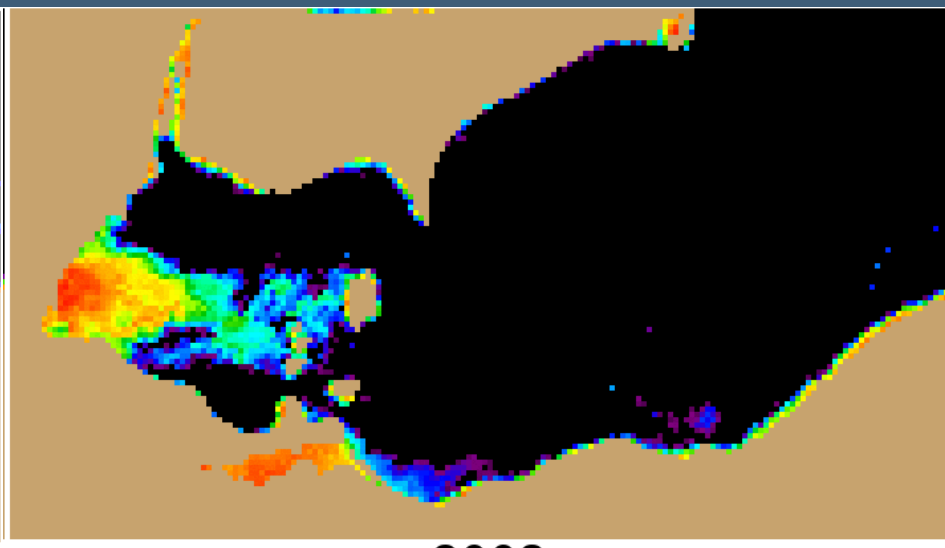
2013 prediction for western Lake Erie: similar to 2003, <1/5 of 2011, 2X 2012

2011 for comparison

2013 may resemble 2003



2011

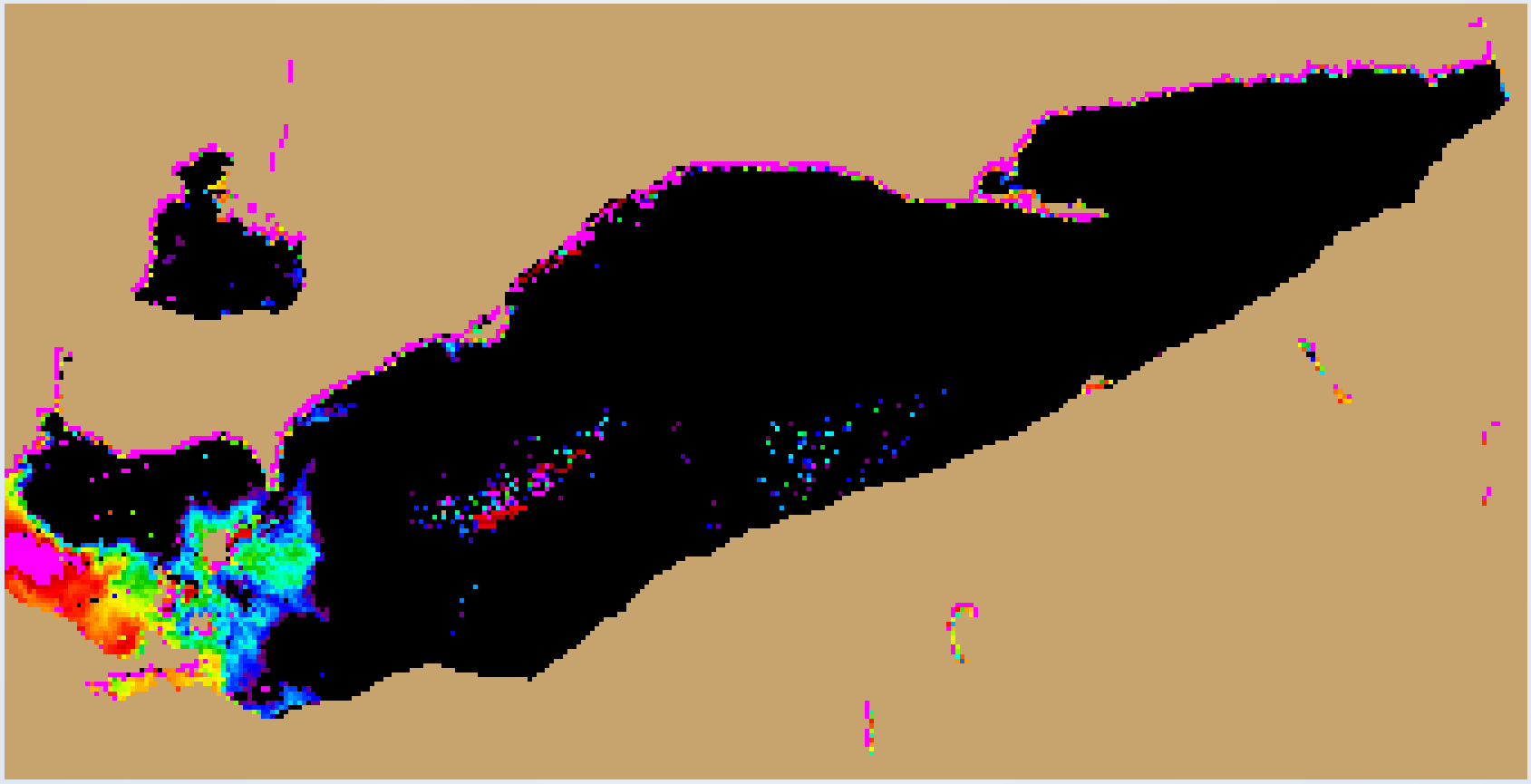


2003

low medium high

concentration

9/14/13



October 12, 2013

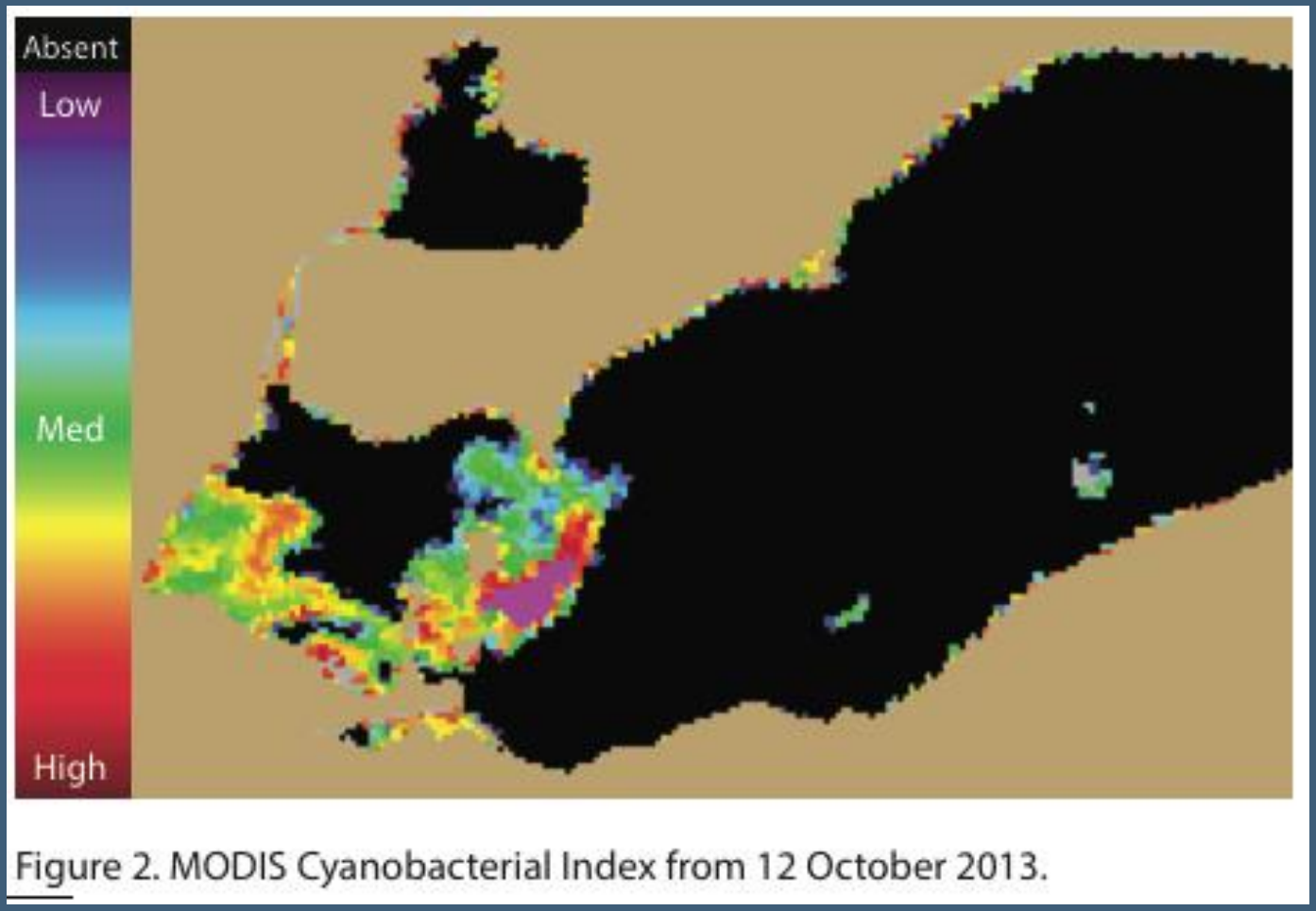


Figure 2. MODIS Cyanobacterial Index from 12 October 2013.

R. Stumpf, NOAA National Center for Coastal Ocean Science

2013

- Only blooms in 2011 and 2013 extended well into October.
- Toxins appeared in treated drinking water in 2013.
  - Carroll Treatment Plant shut down—bottle water brought in
  - Toledo and Erie Co. say can't guarantee safe drinking water in future
  - No national or state guidelines on algal toxins
- Meris vs. Modis Satellite Limitations
- Greater recognition of of their role by agriculture community, but clearly not enough action.
  - When nutrients leave fields they are pollutants.

Target Loads to Solve Problem

- Leading subcommittee of the Ohio Phosphorus Task Force to identify both spring and annual target loads of both total P and DRP (Reutter comment) to prevent or greatly reduce HABs
- Target is 40% reduction

Nutrient Loading: Expect improvement

- Scotts P removal from over the counter fertilizer bags
- CSO's moving in right direction (too slow?)
- Detroit sewage—hopefully in compliance—but bankrupt
- Frequency of severe storms continues to go up
- Ag—expect improvement
  - Farm Bureau is supporting efforts to reduce P
  - Majority of farmers now accept responsibility
  - Certification programs being developed
  - 4R Program
    - Recommendations
      - » Don't apply more fertilizer than needed
      - » Don't apply on frozen or snow covered ground
      - » Don't broadcast apply, incorporate into soil
      - » Don't apply when rain in immediate forecast

Different Water Bodies/Different Problems

- Retention time for nutrients
  - Flow rate
  - Current
  - Depth
- Western Basin = HABs
  - Quick fix
- Central Basin = dead zone (hypoxia)
  - Long time to cure (maybe never)
- Eastern Basin = nuisance algae
  - Unsure of time to cure because unsure of nutrient source

For more information:
Dr. Jeff Reutter, Director

Ohio Sea Grant and Stone Lab

Ohio State Univ.

1314 Kinnear Rd.

Col, OH 43212

614-292-8949

Reutter.1@osu.edu

ohioseagrant.osu.edu

Stone Laboratory

Ohio State Univ.

Box 119

Put-in-Bay, OH 43456

614-247-6500