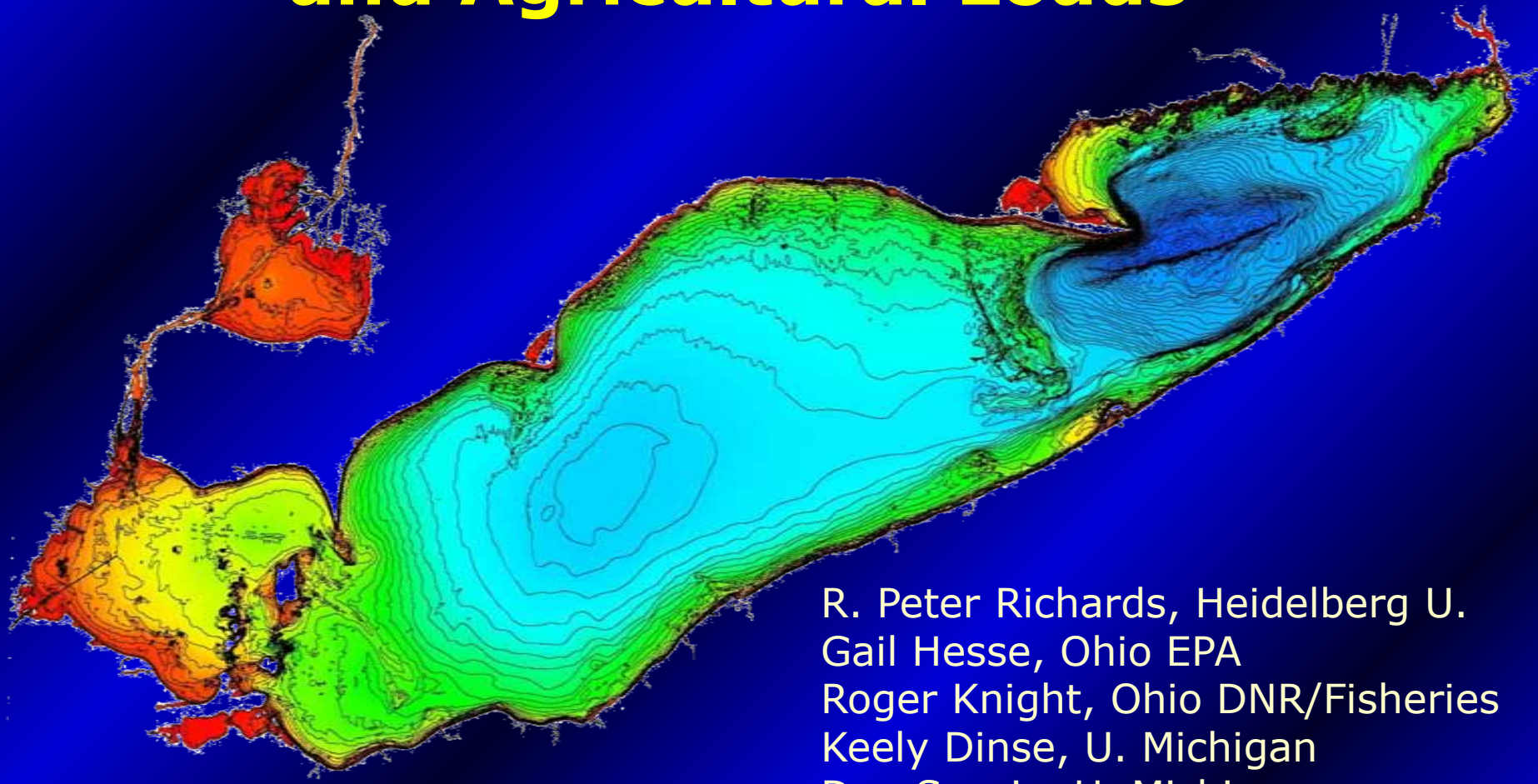
Lake Erie Hypoxia

Climate, Invasive Species, and Agricultural Loads



R. Peter Richards, Heidelberg U.
Gail Hesse, Ohio EPA
Roger Knight, Ohio DNR/Fisheries
Keely Dinse, U. Michigan
Don Scavia, U. Michigan

Ecofor-Lake Erie Research Team

Watershed Team	Affiliation
Dave Allan	U Michigan
Nate Bosch	U Michigan
Jinny Han	U Michigan
Dave Dolan	U Michigan
Pete Richards	Heidelberg U
Tom Croley	NOAA/GLERL
Changsheng He	W. Michigan U

Hypoxia Team	Affiliation
Don Scavia	U Michigan
Dmitry Beletsky	U Michigan
Dan Rucinski	U Michigan
Joe DePinto	LimnoTech
Dave Schwab	NOAA/GLERL

Ecological Effects	Affiliation
Tomas Hook	Purdue
Kristen Arend	Purdue
Ed Rutherford	U Michigan
Stuart Ludsin	Ohio State U
Doran Mason	NOAA/GLERL
Steve Bartell	E2, Inc
Steve Brandt	NOAA/GLERL

Center for Sponsored Coastal Ocean Research (CSCOR)
Science Serving Coastal Communities

THE GREAT LAKES

The Great Lakes compared to:

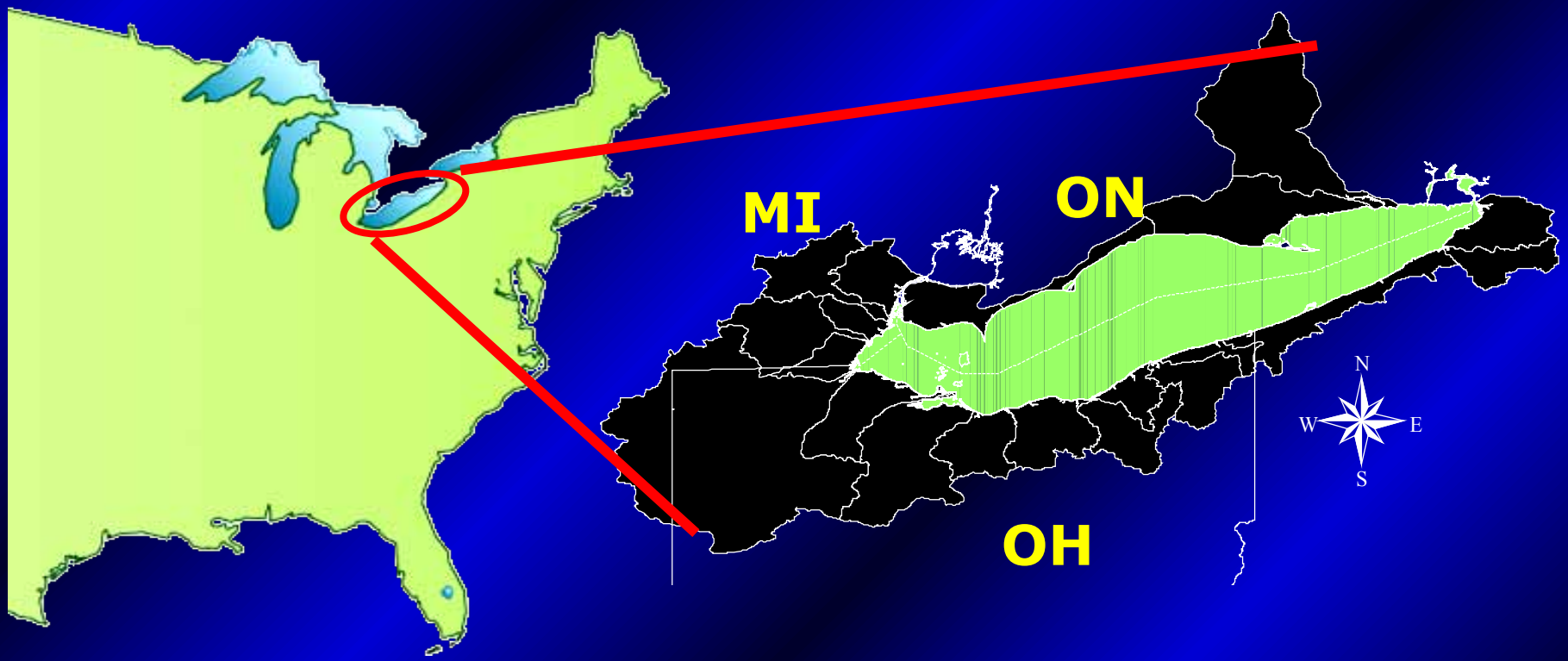
- Chesapeake Bay
- Albemarle-Pamlico Sound
- Puget Sound
- Everglades Restoration Area

Produced by Michigan Sea Grant. www.miseagrant.umich.edu
MICHU-08-717

Themes of This Workshop 1

- Geographic Setting and Ecosystem Characteristics
- Management Issues and Questions for Ecosystem Science

Lake Erie

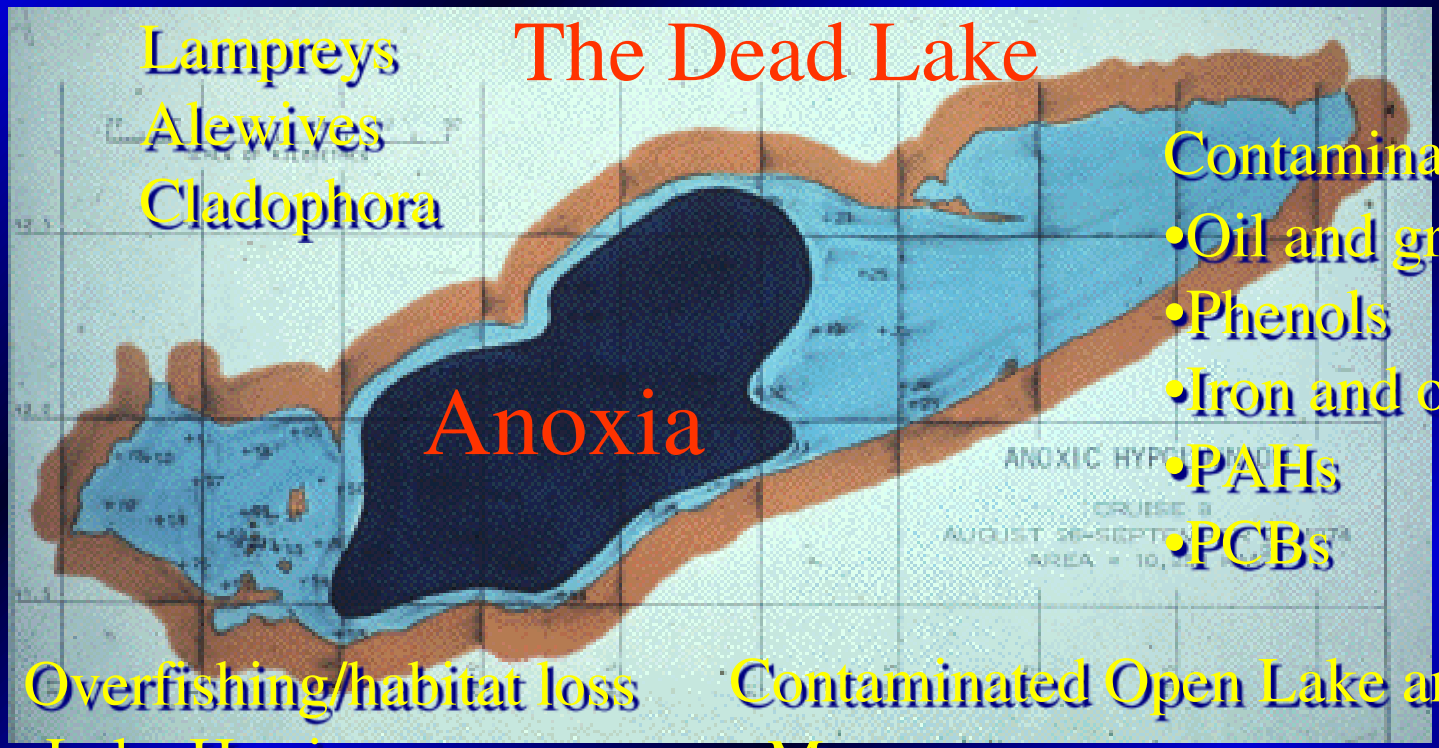


- Small ⟶ Volume = 484 km^3
- Shallow ⟶ Mean Depth = 19 m
- Warm ⟶ > 200 Frost Free Days
- Productive ⟶ All Trophic Levels

June 22, 1969

Lake Erie is Dead!

What was wrong with Lake Erie?



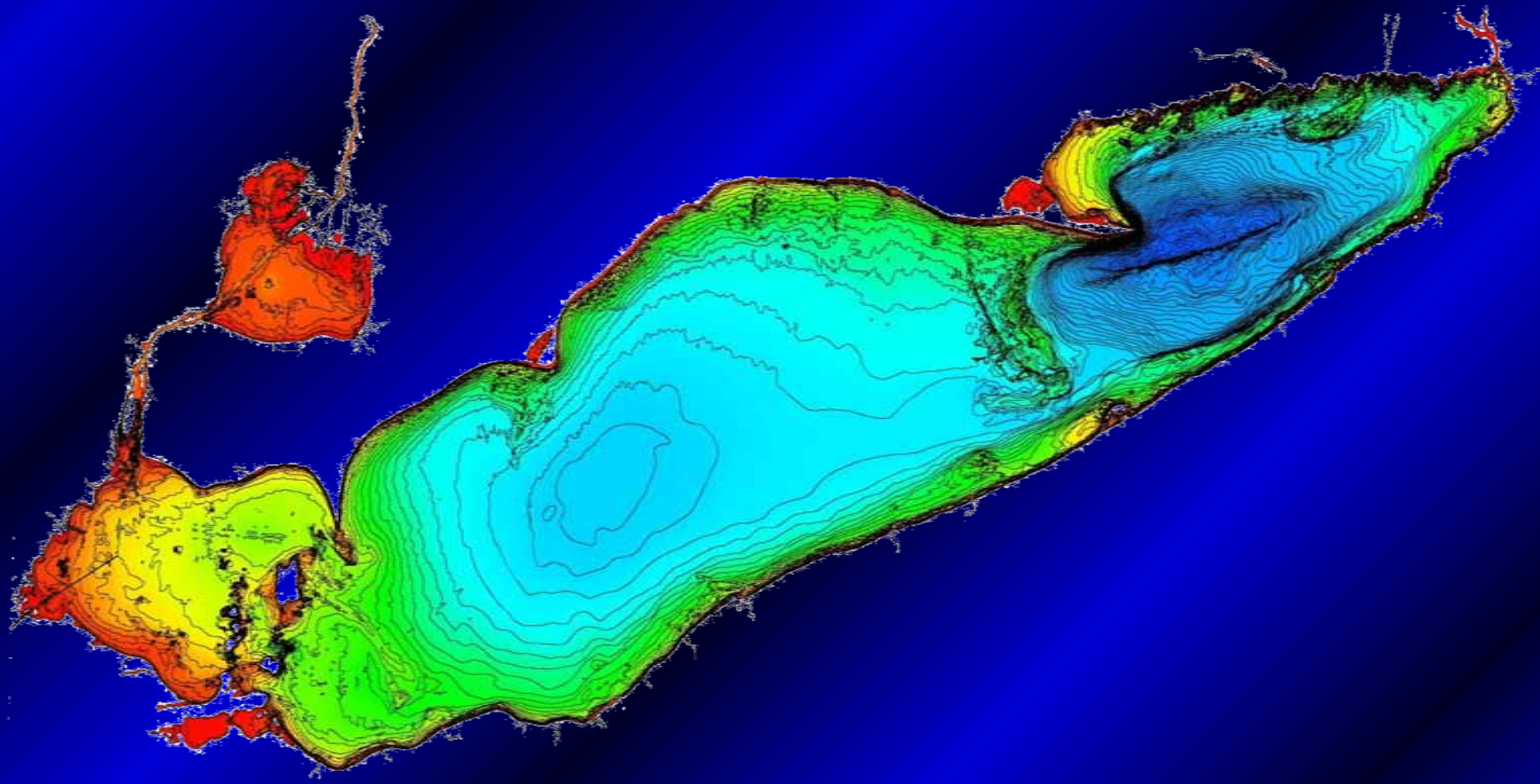
Contaminated Harbors
- Oil and grease
- Phenols
- Iron and other metals
- PAHs
- PCBs

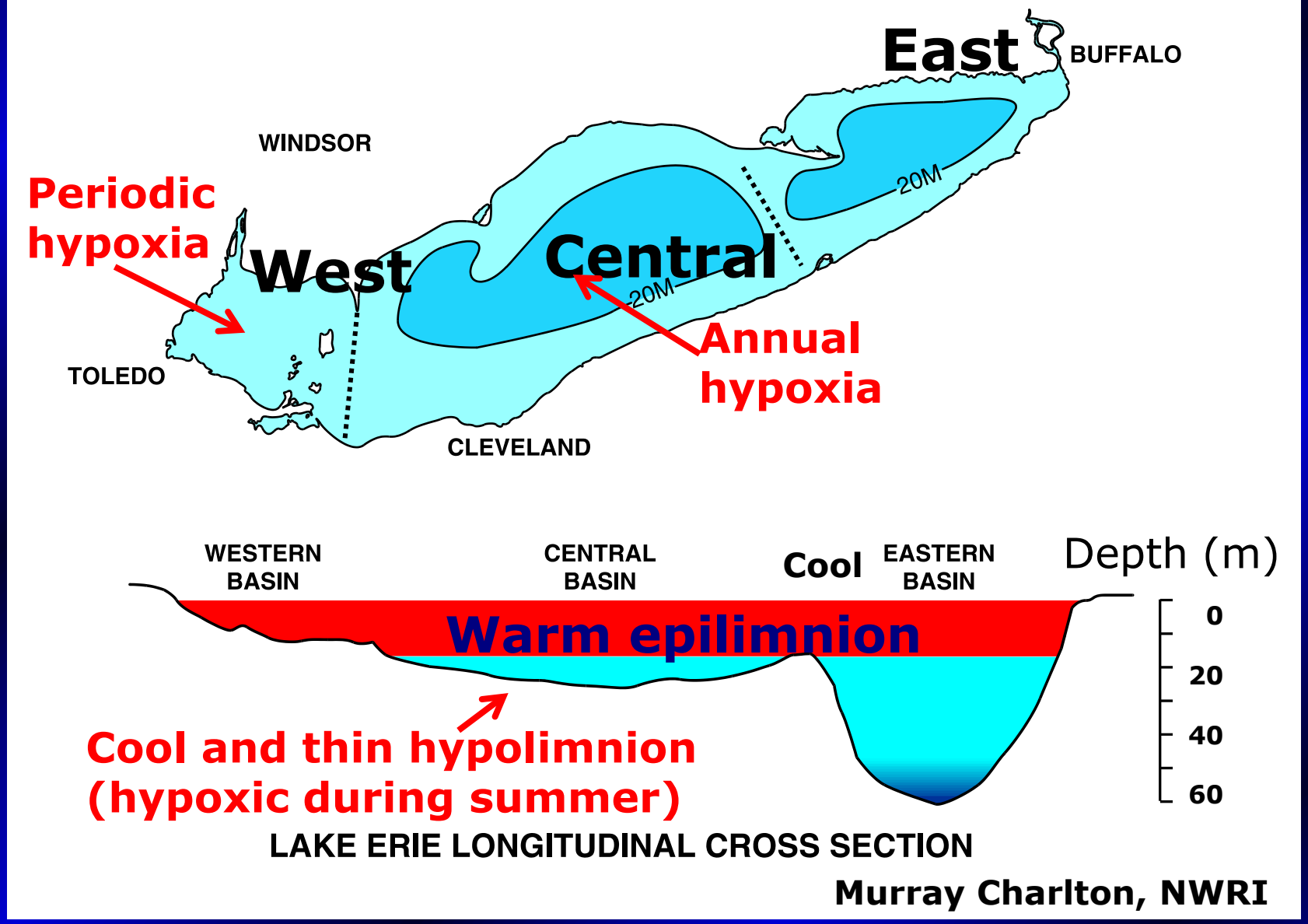
Overfishing/habitat loss
- Lake Herring
- Sauger
- Blue Pike
- Walleye

Contaminated Open Lake and Fish
- Mercury
- PCBs
- DDT, DDE

No more mayflies...

Lake Erie





LAKE ERIE LONGITUDINAL CROSS SECTION

Murray Charlton, NWRI

Why Care About Lake Erie Hypoxia?

Recreational Fisheries

Commercial Fisheries

$1B/Yr in '80s

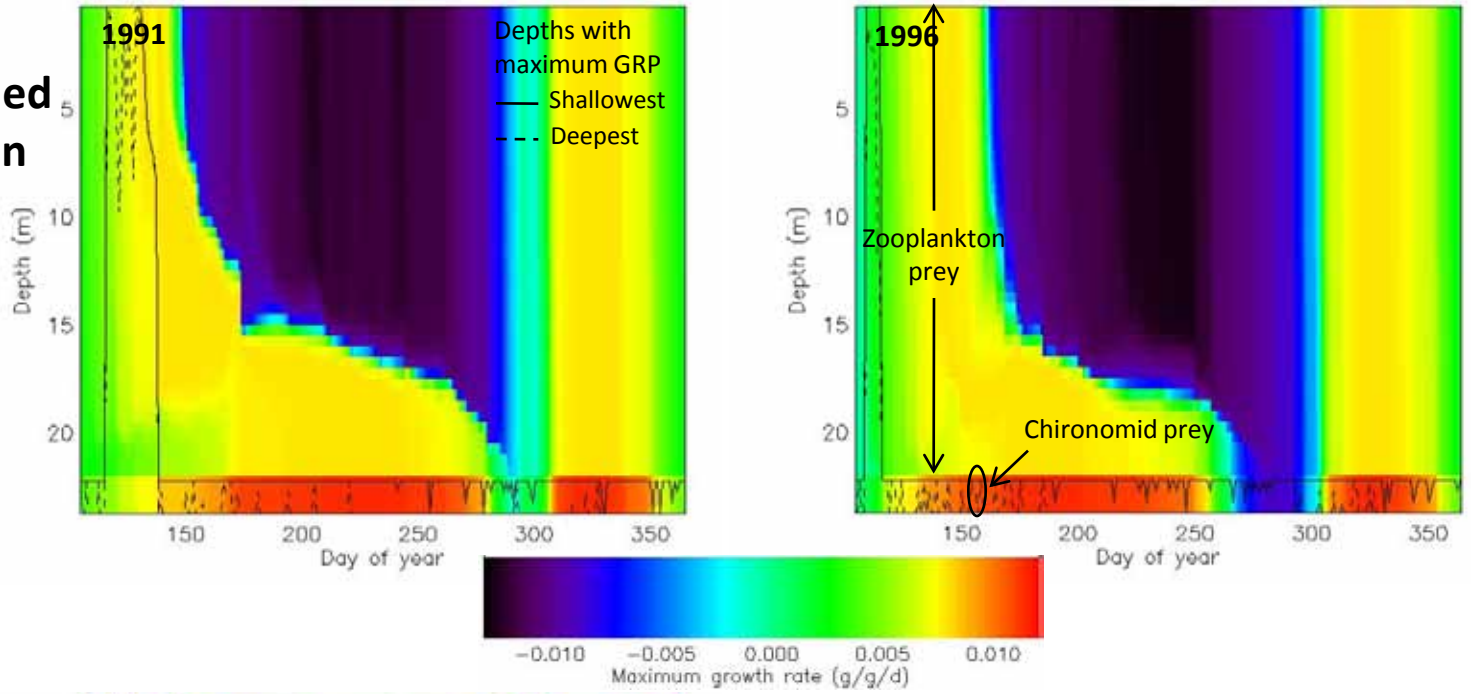
Abundant species in central basin.

Benthic invertebrates

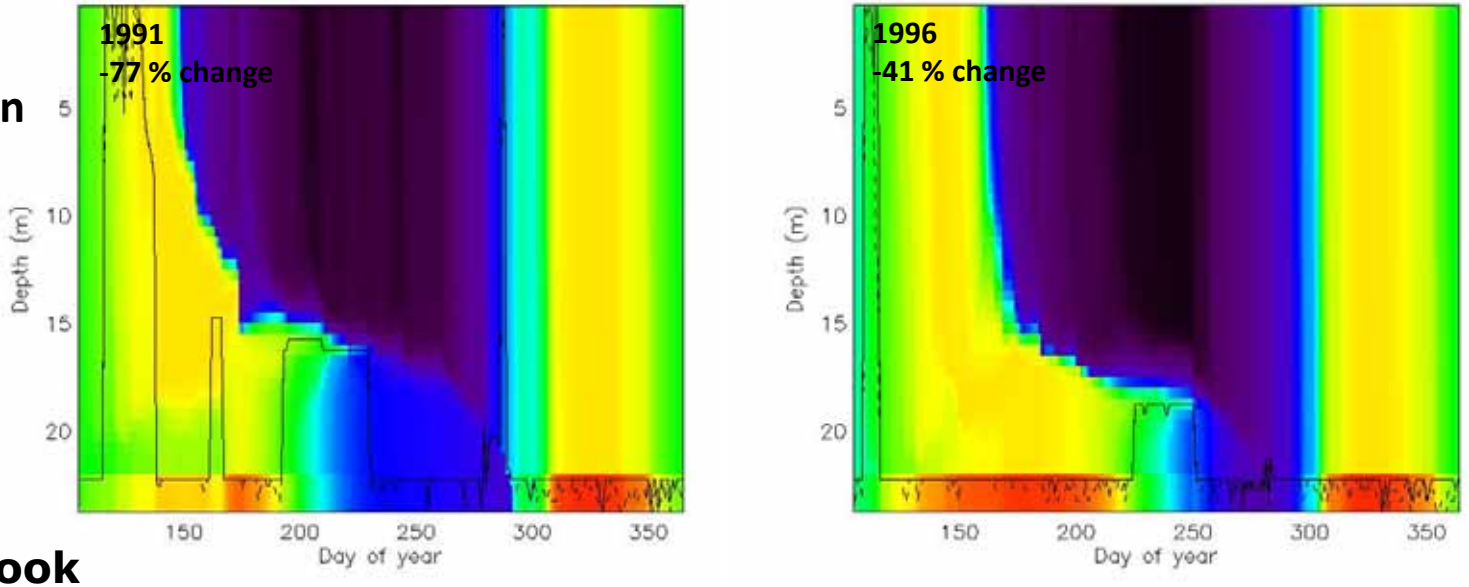
Zooplankton

Adult rainbow smelt growth rate potential (p=0.4)

Without modeled oxygen effect on consumption



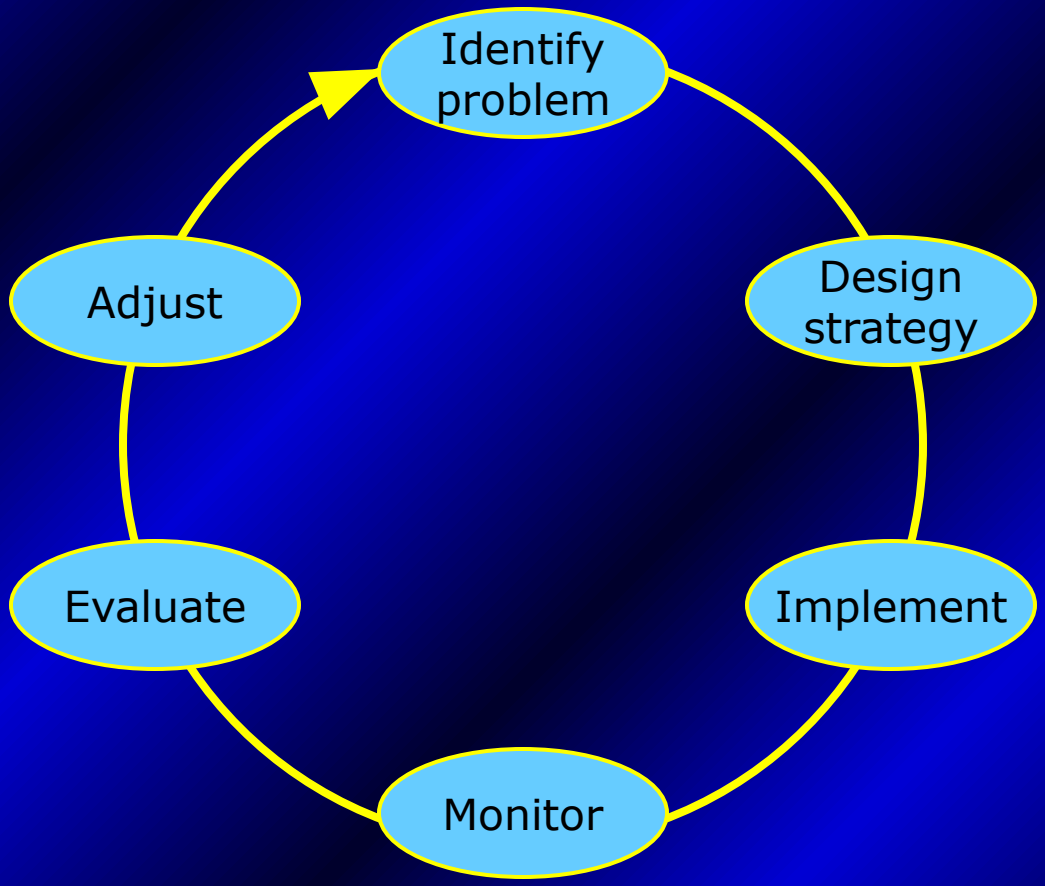
With modeled oxygen effect on consumption



Arend and Hook

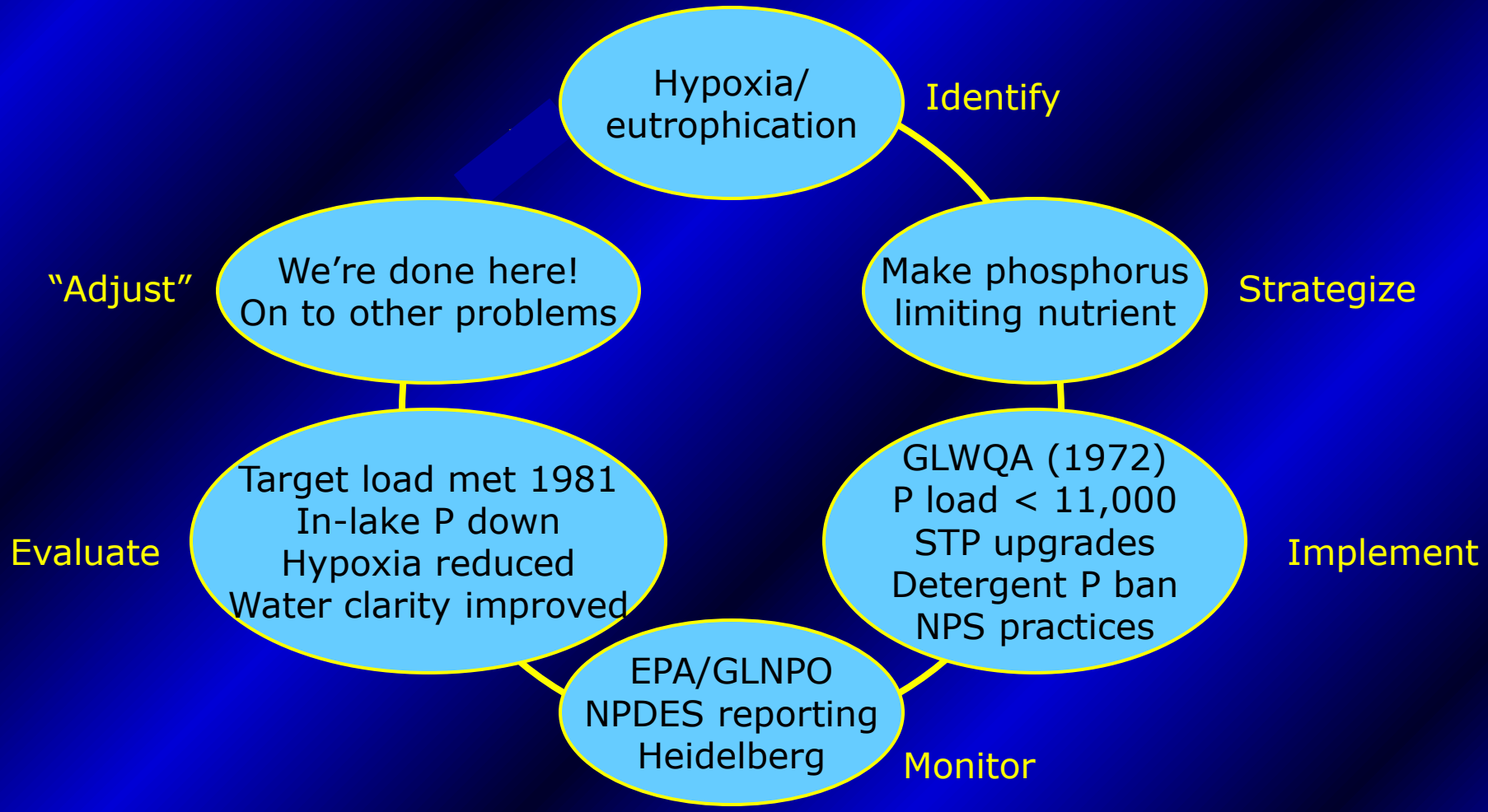
Healing the "Dead" Lake

Adaptive Management



Healing the "Dead" Lake

1970-1990



Healing? the "Dead" Lake

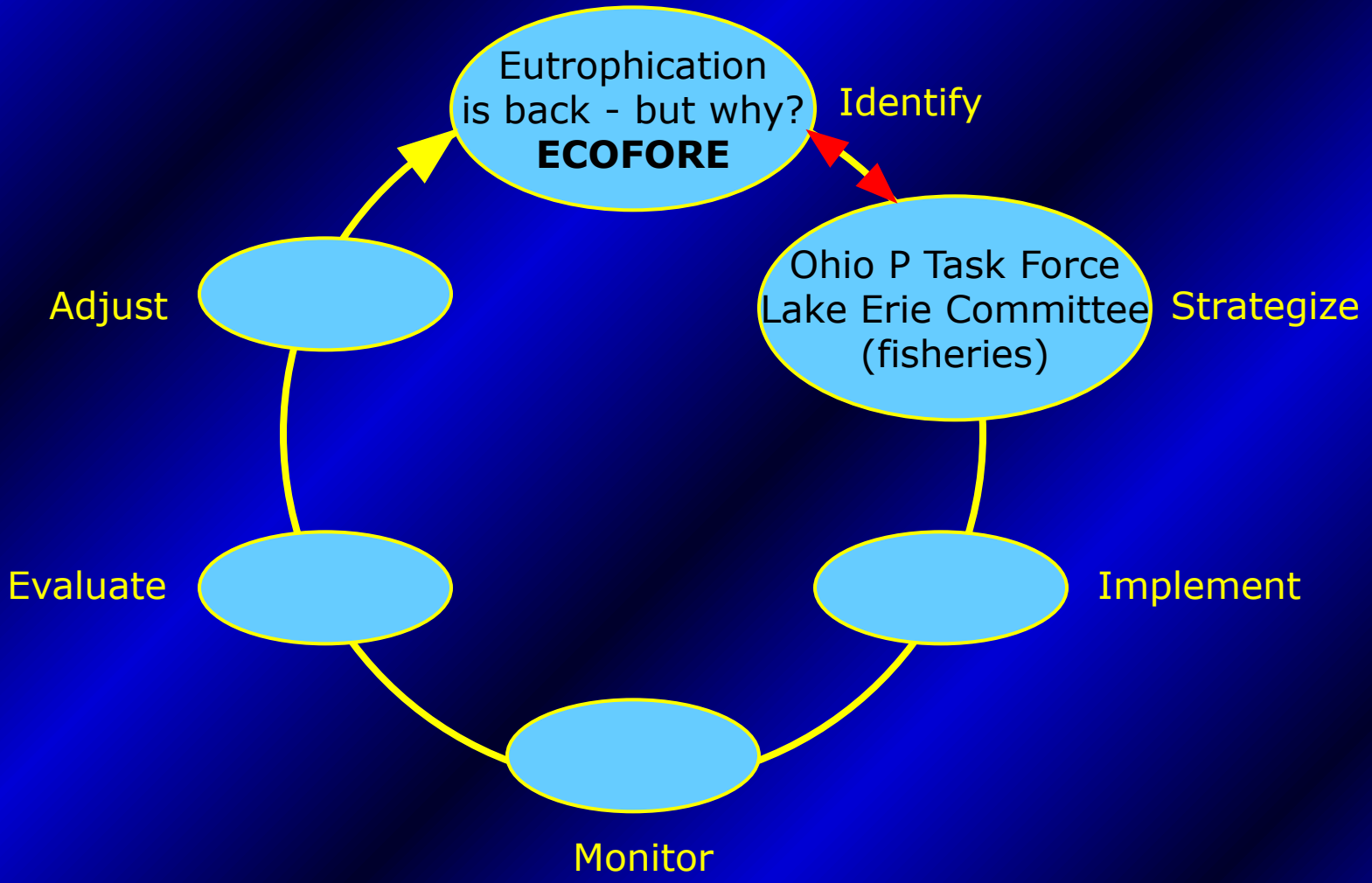
1990s

Important developments:

- Dreissenids (1989)
- Hypoxia getting worse again (~1995)
- In-lake P on the rise (mid-90s)
- HABs/NABs getting worse (mid-90s)
- Tributary DRP loads increasing rapidly (mid-90s)
- (Trib TP loads still decreasing)

Healing the "Dead" Lake

The present



ECOFORE and Lake Erie Hypoxia

Three hypotheses:

- Climate change: temperature, mixing, hypolimnion volume
- Zebra mussel invasion: nearshore shunt
- Changed P loads: ag practices, changed precipitation patterns

Ensemble of models to evaluate hypotheses and implications for ecosystems/fisheries

Themes of This Workshop 2

- Setting Research Priorities
- Research Oversight and Guidance
- Transition of Research to Management Application

Setting Research Priorities

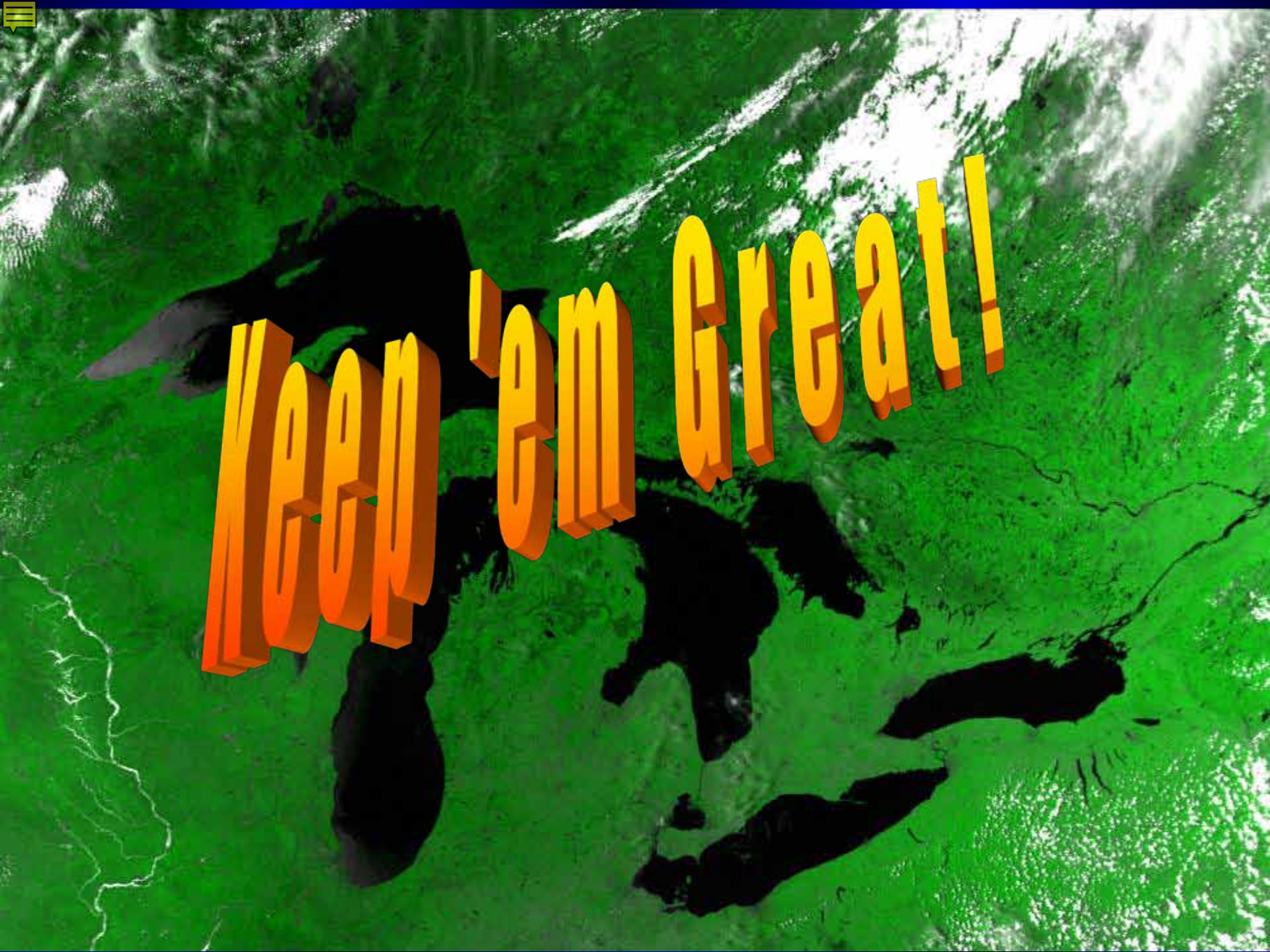
- Observations of changes in lake and loads showed action was necessary
- Barriers: scientific uncertainty about cause(s), complex management structure and management/scientist relationships
- Lesson learned: ongoing monitoring critical to early identification of problem

Research Oversight/Guidance

- Fisheries:
  - Lake Erie Committee (Great Lakes Fishery Commission) already exists
  - All jurisdictions are represented (OH, MI, PA, NY, ON)
  - Joint Strategic Plan, common goals
  - A recognized valuable economic resource -> power!
  - Advisory to ECOFORE from the beginning
- Phosphorus Loading:
  - Responsibility for pollution spread among agencies
  - Ohio Lake Erie Phosphorus Task Force formed in response to increased DRP loading, lake problems
  - Ohio only, but includes all relevant agencies, academics, entities with interest in the issue
  - Problem-specific; long-term future uncertain
  - Relationship with ECOFORE still developing

Transition of Research to Management Application

- Just beginning…
- Meetings with key management agencies
  - Lake Erie Technical Committee (fisheries)
  - Ohio Lake Erie P Task Force (management of P sources)
  - Lake Erie Lakewide Management Plan team (overall management of Lake Erie)
- Manager-to-modeler meeting (Fall 2009)
  - Proceed from management perspective - what decisions do you have to make, when, and how can we best tailor our research and results to meet your needs.


Keep 'em Great!