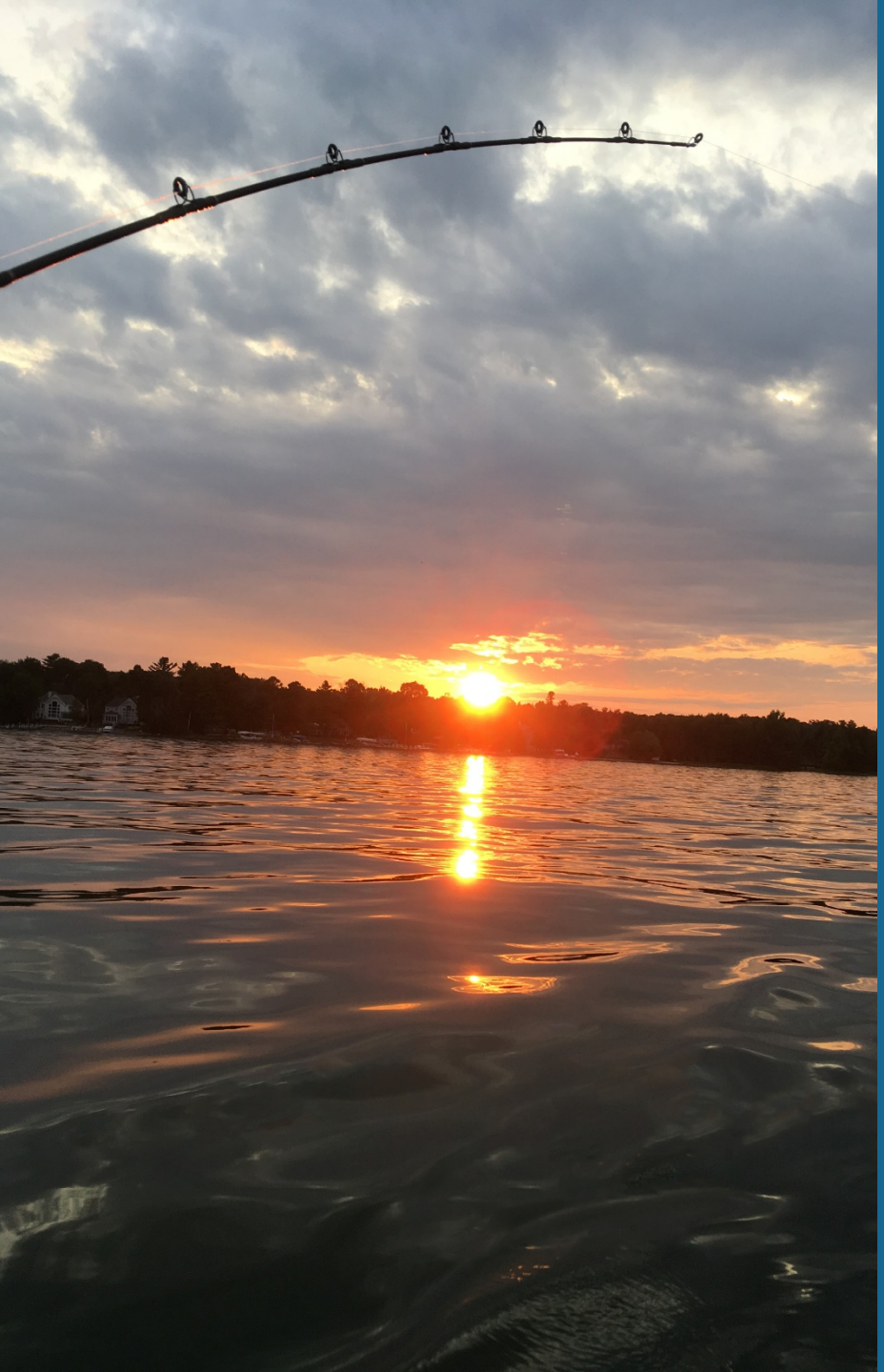


Asian Carp – Innovative Ways for Control

Seth J. Herbst, Ph.D. and
Tammy Newcomb, Ph.D.

Aquatic Invasive Species

A species that is **not native** and whose introduction causes, or is likely to cause, economic or environmental **harm** or harm to human health.







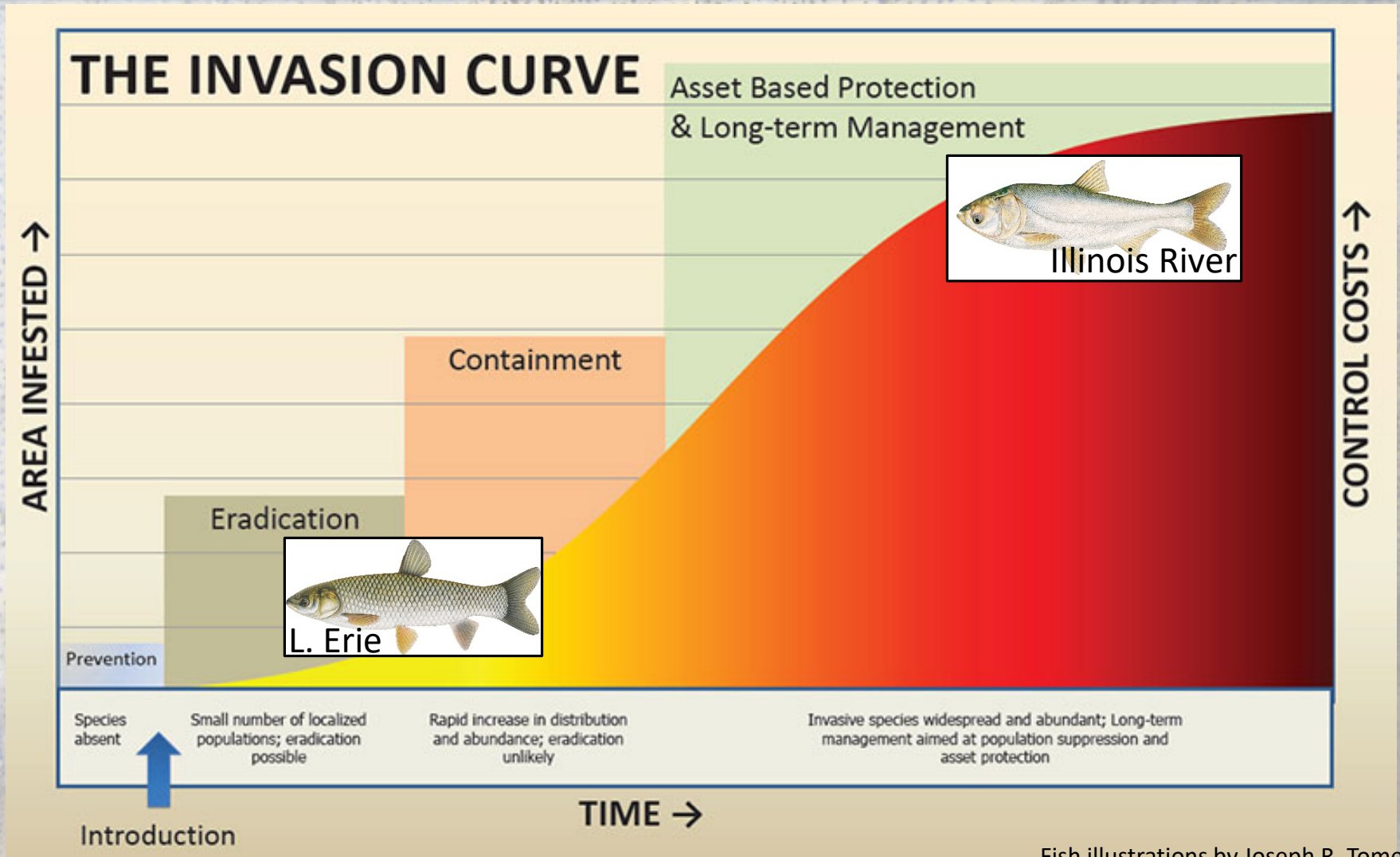

Invasive (Asian) Carp

The Invasive (Asian) Carps

www.michigan.gov/invasivecarp

Fish illustrations by Joseph R. Tomelleri ©

Managing Along the Invasion Curve



Fish illustrations by Joseph R. Tomelleri

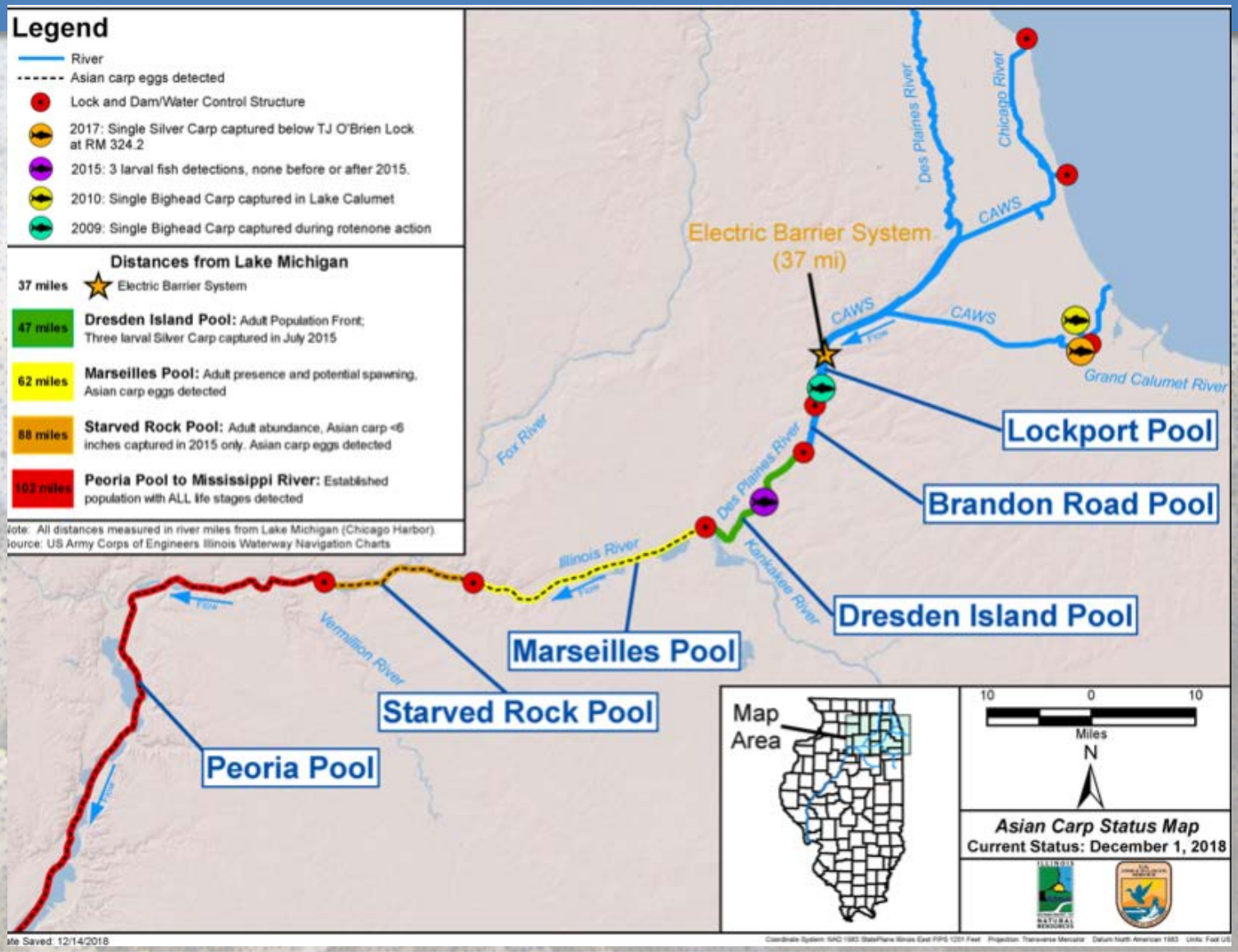
Understanding the Risks

- High risk to Great Lakes – Binational Risk Assessment (Cudmore et al. 2012)
- GLMRIS identified high risk locations in Great Lakes Basin
  - Chicago Area Waterway System (CAWS) – greatest risk
  - Eagle Marsh in IN (mitigated)

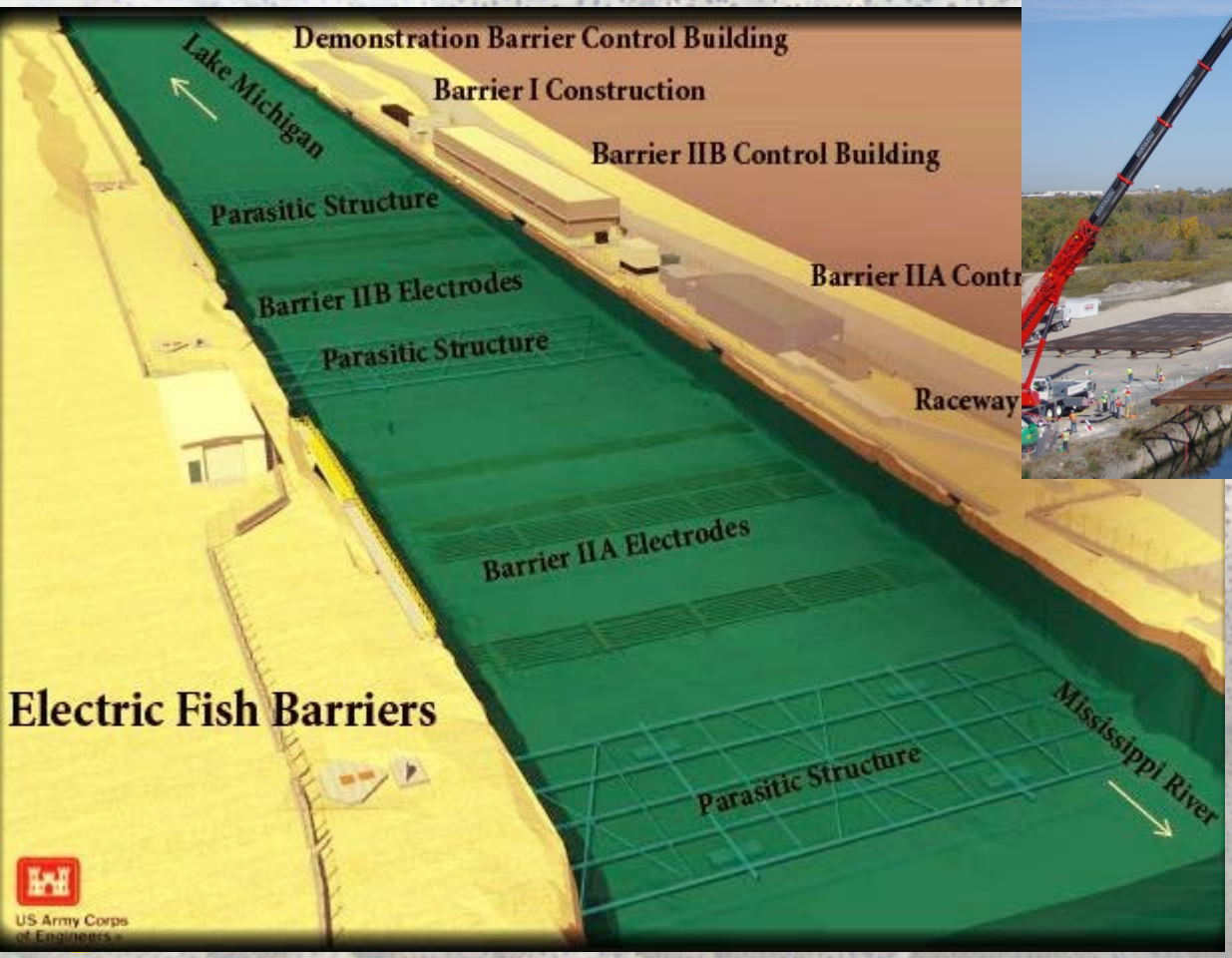
What's at stake for the Great Lakes?

- $7B fishing industry
- $16B boating industry
- $20B tourism industry

Chicago Area Waterway System (CAWS)



Current Innovative Control – Electric Barriers



Understanding the Biology to Inform Control

- Population metrics
  - Reproduction and recruitment potential
  - Age at maturity
  - Growth rates
  - Survival rates
  - Movement

- Use Integrated Pest Management strategy
  - Identify life history characteristics that make the species vulnerable to control measures
  - Exploitation rates need to exceed 70% annually for long-term population reduction (Tsehaye et al. 2013)

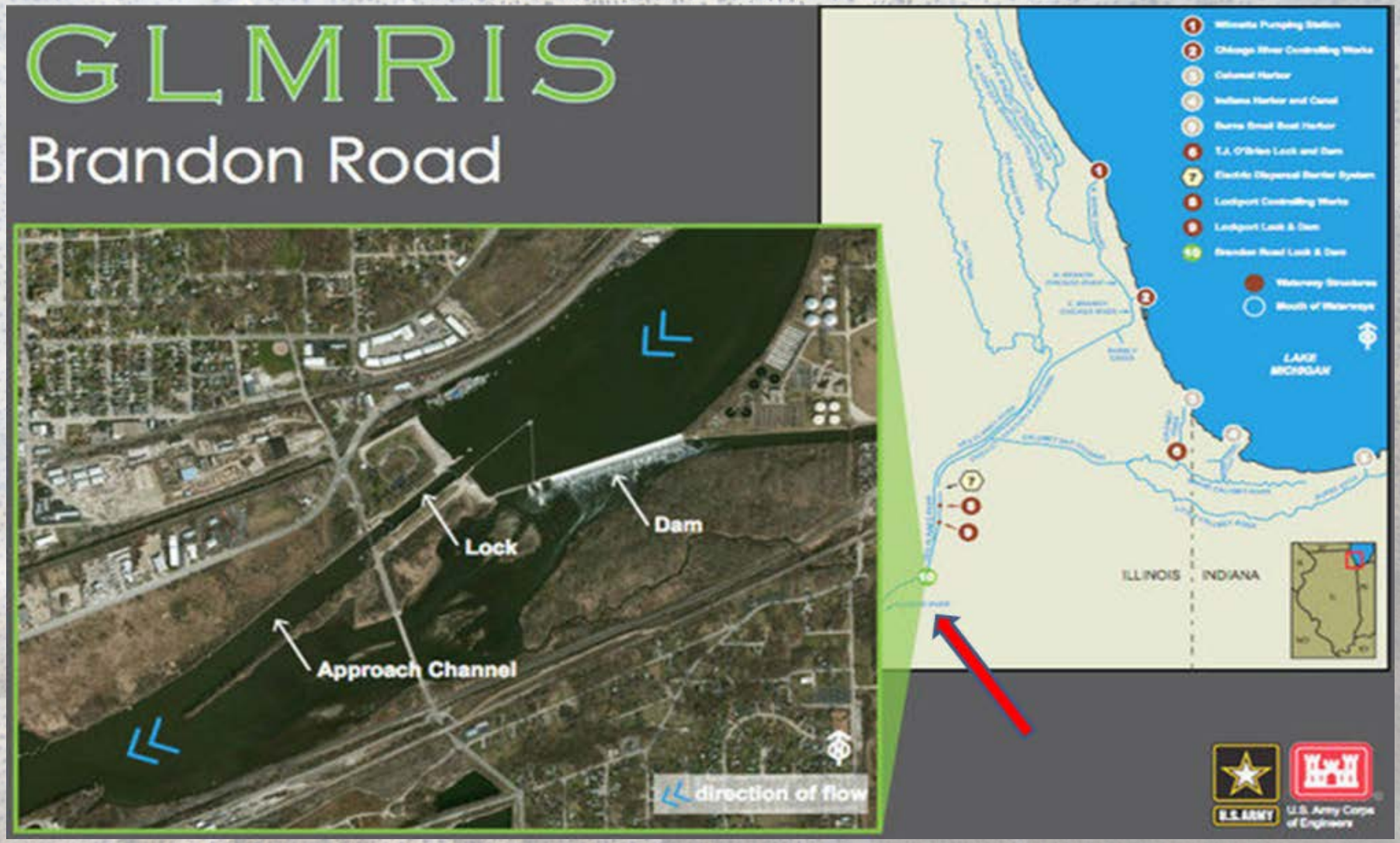
Ongoing Control Techniques

- Contracted commercial fishing
- Chinese Unified Fishing method
- Using tagged fish to understand movement and habitat use

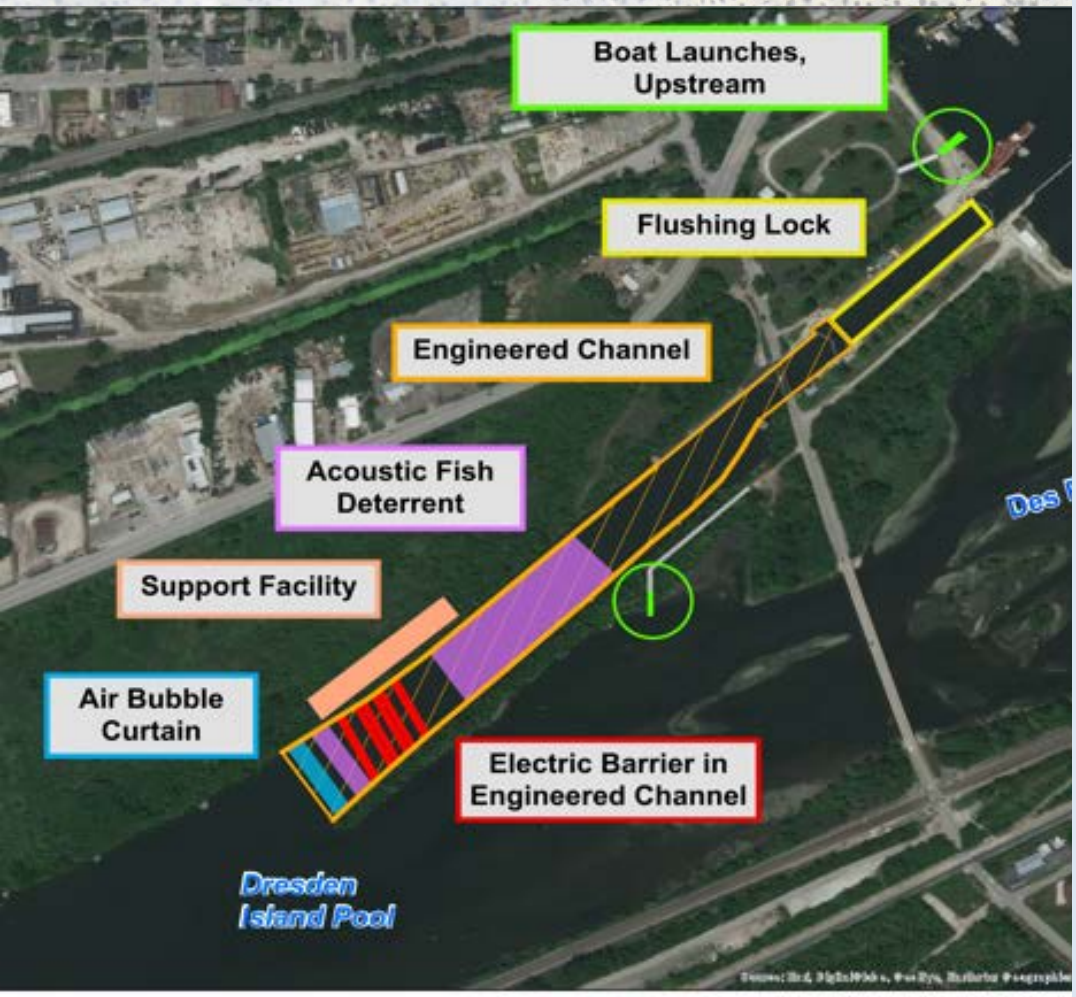
Innovative Approaches in Development

- Novel approaches under developed (led by USGS)
  - Piscicides (microparticle)
  - Complex sound
  - Carbon dioxide
  - Attractants

Brandon Road Recommended Plan



Recommended Measures



- Project cost - $780M
- Need 35% cost share
- USACE Chief's report needs to recommend action to congress
- Completion by 2025 (if started in 2020)
- Reduces risk of invasive carp entry to Great Lakes

Great Lakes Invasive Carp Challenge

Goal was to find innovative solutions to prevent the spread of Asian carp to the Great Lakes

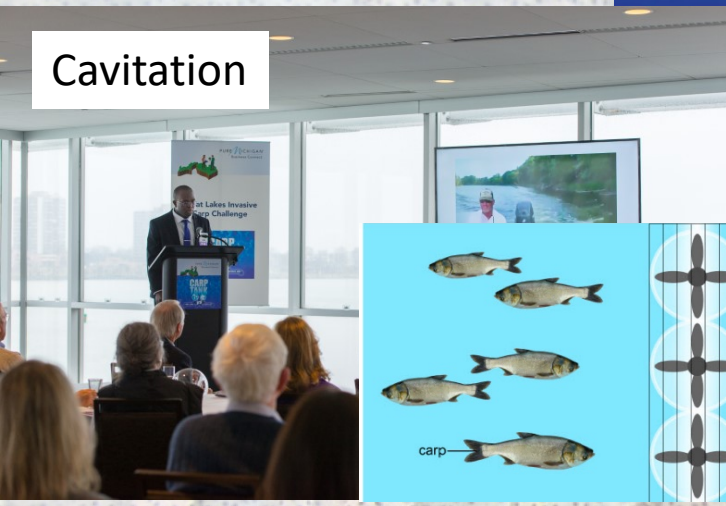
Challenge and Process

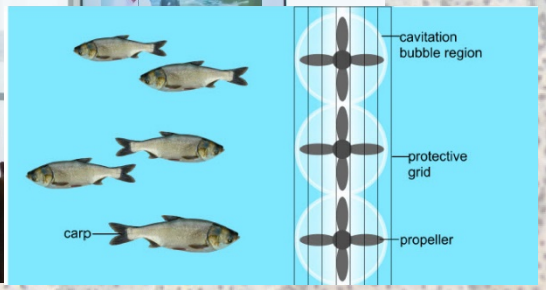
- 353 solutions; 27 countries
- Internal and external expert judges – blind process
- Goal was prevention of movement, not control
- 4 finalists; 6 runners-up

CARP TANK

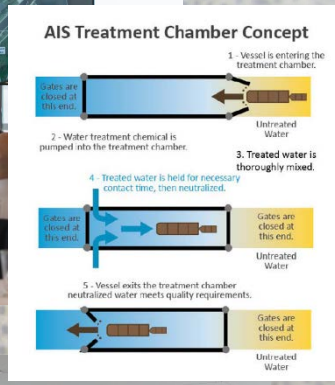
GREAT LAKES VS INVASIVE CARP

Cavitation

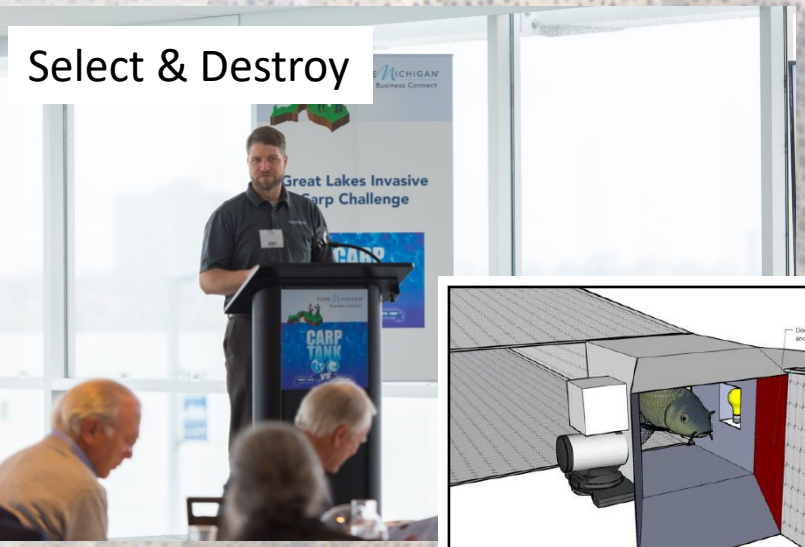


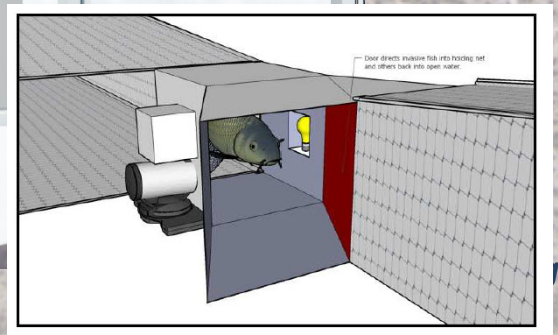


Lock Treatment

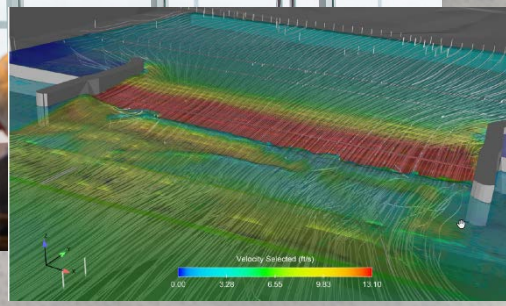


Select & Destroy





Velocity Barriers



gov/asiancarp

Cavitation Barrier to Deter Asian Carp – Dr. Edem Tsikata

- Wall of cavitation bubbles
- 34 propellers to span the width of the lock
- Restrict movement upstream or downstream & barge voids
- Limited adverse impacts
- Low energy consumption and low equipment investment
- Estimates 1.5- 2.0 million to install in structured channel.
- Estimates electrical costs to be about $316,000 per year.

AIS Lock Treatment System – David Hamilton

- A gated chemical treatment chamber would be installed in the lock or approach channel
- Chlorine would be injected and mixed into the treatment chamber once vessels had moored and gates were closed
- After treatment, sodium bisulfate would be used to detoxify the water before release
- Requires an increase in depth of 4-5 ft for the mixing equipment
- The solution is designed to be lethal to all fish, including invasive carp 2-inches long or greater
- Estimated costs to construct are $43.5 million; annual operating costs are $6-9 million
- Concentration of 10 mg/l was used to evaluate (greatest concentration allowed in swimming pools)
- Will require corrosion testing and corrosion mitigation and management for infrastructure and vessels, likely

Adjustable Physical Velocity Barriers -Michael Scurlock

- The velocity barrier would concentrate flow in the lock and channel to a degree that would exceed the swimming capabilities of invasive carp
- Velocity barrier would be activated after vessels have moored, essentially flushing the system before the lock gates are closed.
- Scientifically derived swim speeds for Asian carp leading to a velocity barrier idea
- The velocity barriers would be created within the lock channel
- Requires refinement of gate geometries, channel geometries, and lock operation to create the velocity barrier configurations
- Estimates costs at about $33 million
- Low energy consumption is noted

Recognition and Removal of Invasive Fish – Dr. D. J. Lee

- Guiding all fish through an automated imaging and sorting system
- Imaging system utilizes recognition algorithms to identify fish as they pass through the sorting system.
- Fish identified as invasive carp will be diverted to a holding area for harvest, and all other fish will be allowed passage through the waterway via a one-way fish gate.
- The solver has deployed a similar device to monitor Chinook salmon populations at a fish ladder
- No adverse impacts to humans, navigation or the environment are noted
- The solution could be applied to any fish species and sizes 2 inches or greater
- Estimates costs of $80 -$200K per unit

Next Steps

- Collaboration began at the meeting
- Continued conversations
  - U.S. Geological Survey – general meeting
  - U.S. Army Corps of Engineers – review solutions

Understanding the Support for Control

- Aligning effectiveness of response actions with public support
- Poll of IL, IN, OH, WI, and MI residents
  - 90% agree need for immediate action
  - "Fair share" funding proposal to fund operations and maintenance
- Creation of Block Asian Carp Partnership (#Blockasiancarp)

Response to Grass Carp in Lake Erie:

Growing Concern of Grass Carp in Lake Erie

- Commercial fishing captures in OH and MI waters
  - Diploid individuals initially captured in 2012
  - Increased captures in 2014 and 2016, but low in 2015
  - ~75% of captures were fertile since 2014
  - Multiple size and age classes
- **Bow-fishermen captures in MI, OH, and NY waters**
- Documented natural reproduction and eggs captured in Sandusky and Maumee Rivers (Chapman et al. 2013; Embke et al. 2016)
- **High risk to cause negative ecological impacts (Binational Grass Carp Risk Assessment; Wittmann et al. 2014)**

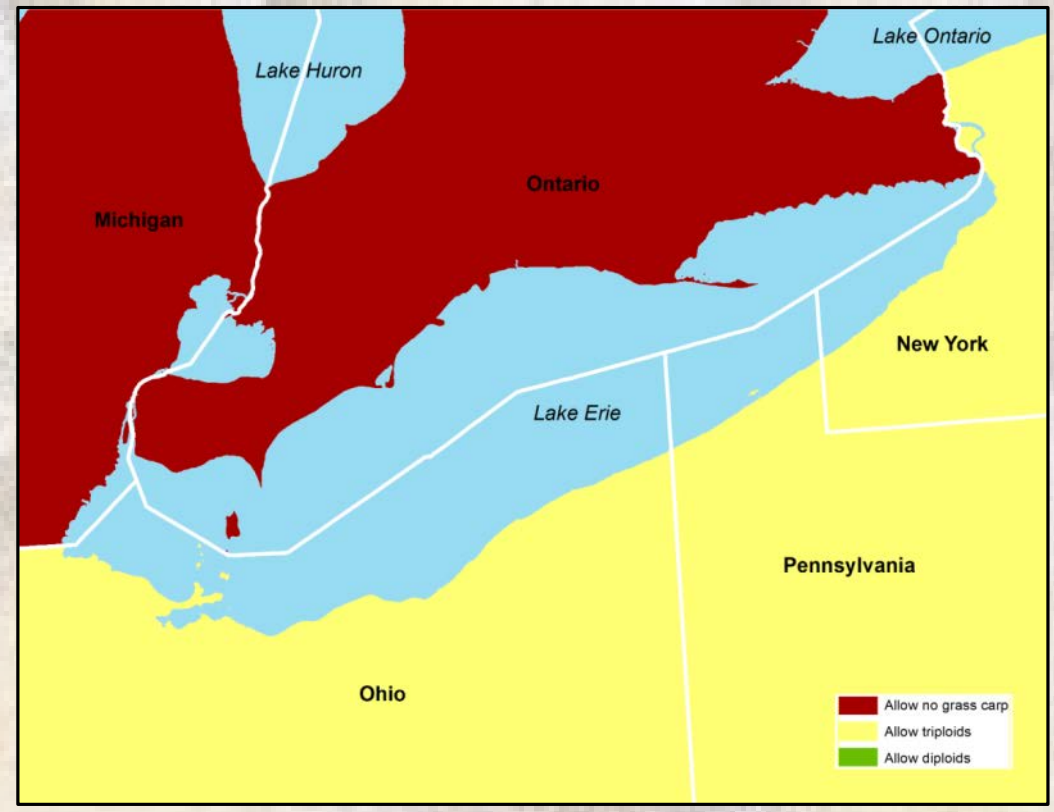
Area of Growing Concern

Lake Erie Fisheries Management

Governance of complex fisheries issues are addressed through the implementation of the Great Lakes Joint Strategic Plan

Lake Erie Committee

- Michigan
- Ontario
- Ohio
- Pennsylvania
- New York



2014 Lake Erie Asian Carp Response Exercise

Collaborating partners:

USGS science for a changing world

U.S. Fish & Wildlife Service

Illinois Department of Natural Resources

Pennsylvania Fish & Boat Commission

Minnesota Department of Natural Resources

Fisheries and Oceans Canada

Ontario

CMU Central Michigan University

Department of Fisheries and Wildlife, Michigan State University

New York State Department of Environmental Conservation

Funding Source

Great Lakes Restoration

2014 Michigan Response Exercise Summary

- Conducted over 3 days in Sept. 2014
- **219 Electrofishing runs (96 hrs)**
- 53 Gill net lifts (58.8 hrs soak time)
- **3 Commercial seine hauls**
- 2 grass carp collected with tandem electrofishing
- **2 others observed**
- **Costly!!**

Collaborative Science to Inform Risk & Response

2014 to present:

- Ploidy analysis (i.e., fertile vs. sterile)
- **Otolith microchemistry to determine origin**
- Early life history sampling in tributaries
- **Seasonal movements and tributary use**
- Refine likely spawning and hatching locations in Sandusky River
- **Determine industry compliance with regulations**
- Population genomics
- **Aquatic vegetation mapping**
- Evaluating effectiveness of capture methods

Great Lakes RESTORATION

U.S. FISH & WILDLIFE SERVICE

Fisheries and Oceans Canada

DEPARTMENT OF NATURAL RESOURCES DNR MICHIGAN

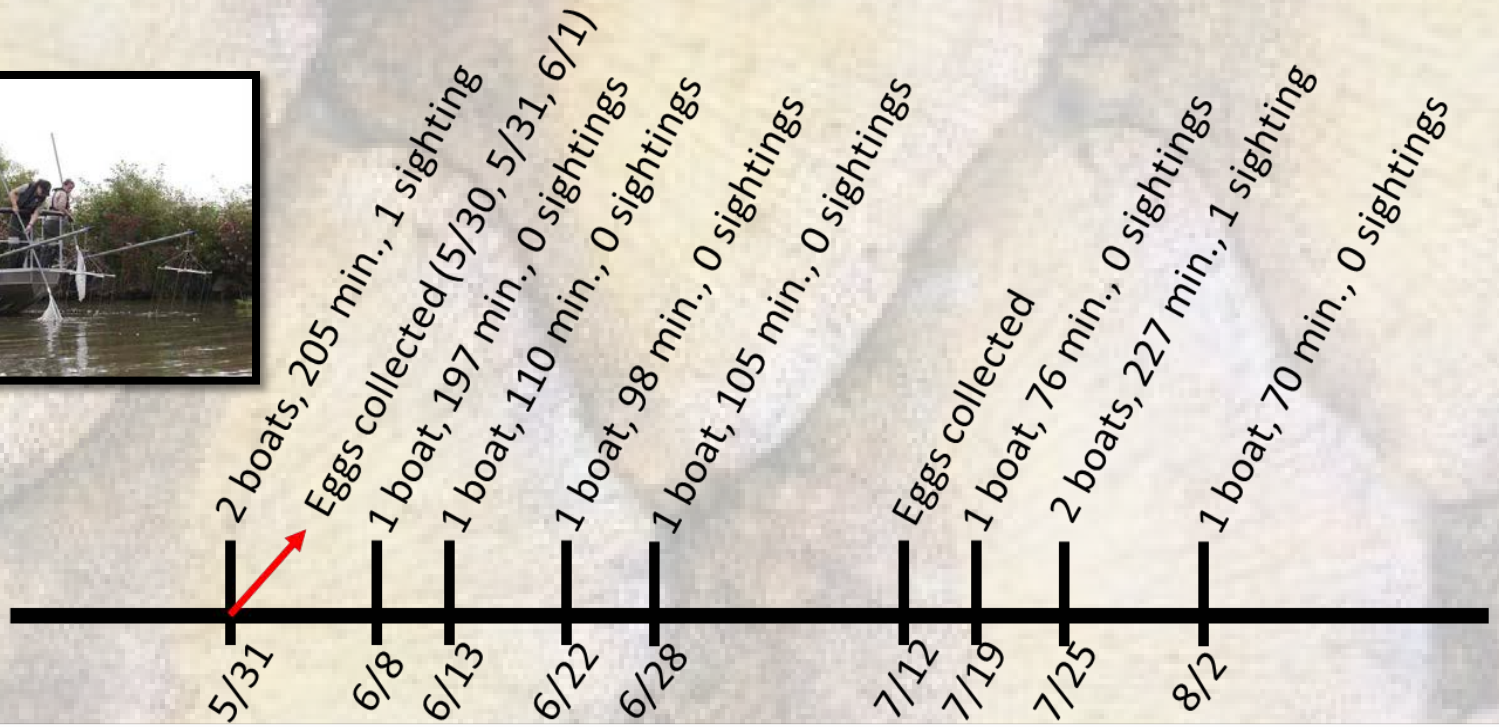
THE UNIVERSITY OF TOLEDO 1872

USGS science for a changing world

CMU CENTRAL MICHIGAN UNIVERSITY

OHIO DEPARTMENT OF NATURAL RESOURCES DIVISION OF WILDLIFE

Sandusky River Response - 2017

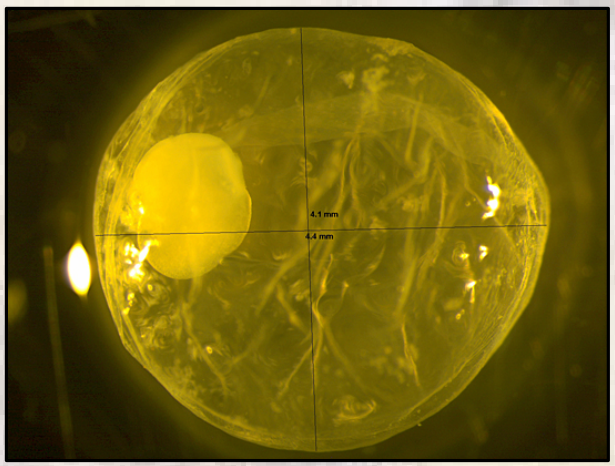


Structured Decision Making Process

- **Need for refined collaborative strategy with evaluation**
  - **Population model developed**
- **Recommended response actions**
  - Targeted removal efforts
  - Seasonal barriers
- **Address uncertainties to increase effectiveness**
  - Seasonal movements
  - Recruitment dynamics
- **Dedication to implementation**

2018 Ohio Targeted Response Action

- Locations were informed by real-time telemetry and egg sampling
  - Sandusky and Maumee Rivers
- **Timing overlapped with suitable spawning conditions**



2018 Ohio Targeted Response Summary

- High effort and participation
- **31 captured – 21 removed**
  - **28 Sandusky (1 recap)**
  - **3 Maumee**
- Tandem electrofishing was most effective
  - Captured 29 of 31 fish
- **Telemetry and egg sampling successfully informed sampling locations**

Lake Erie Grass Carp: Building Partnerships

Commercial Fishing

Lessons Learned from Multi-Jurisdictional Response

- Science and response are needed simultaneously
- **Responses need to be strategic**
  - **Timing, location, capture gear, consistent data collection**
- Collaborations increase the likelihood of success
- **Timely communication between research and managers**
- Improved control options will provide greater effectiveness for meaningful response
- **Funding is critical for implementation**

Thank You
Questions?

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