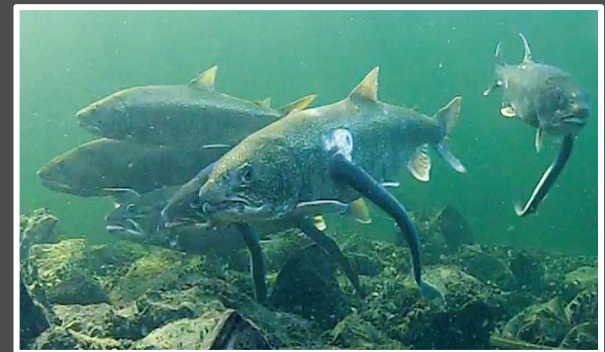


Integrated Pest Management: Application in the Sea Lamprey Control Program



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*Prepared for:
Case Studies in Integrated Pest Management Webinar
Invasive Mussel Collaborative
September 23, 2016*

AIS: The Problem in the Great Lakes

- 180+ non-native species in Great Lakes
- Perhaps 20 or so are a serious nuisance
 - Environmentally
 - Economically
- Only 2 can be controlled (!)



ALEWIFE



SEA LAMPREY

AIS: Why Do We Care?

One of the leading threats to the lucrative Great Lakes fishery

- Nuisance
- Competition
- Unhealthy environment
- Disease & parasites
- Lost fish

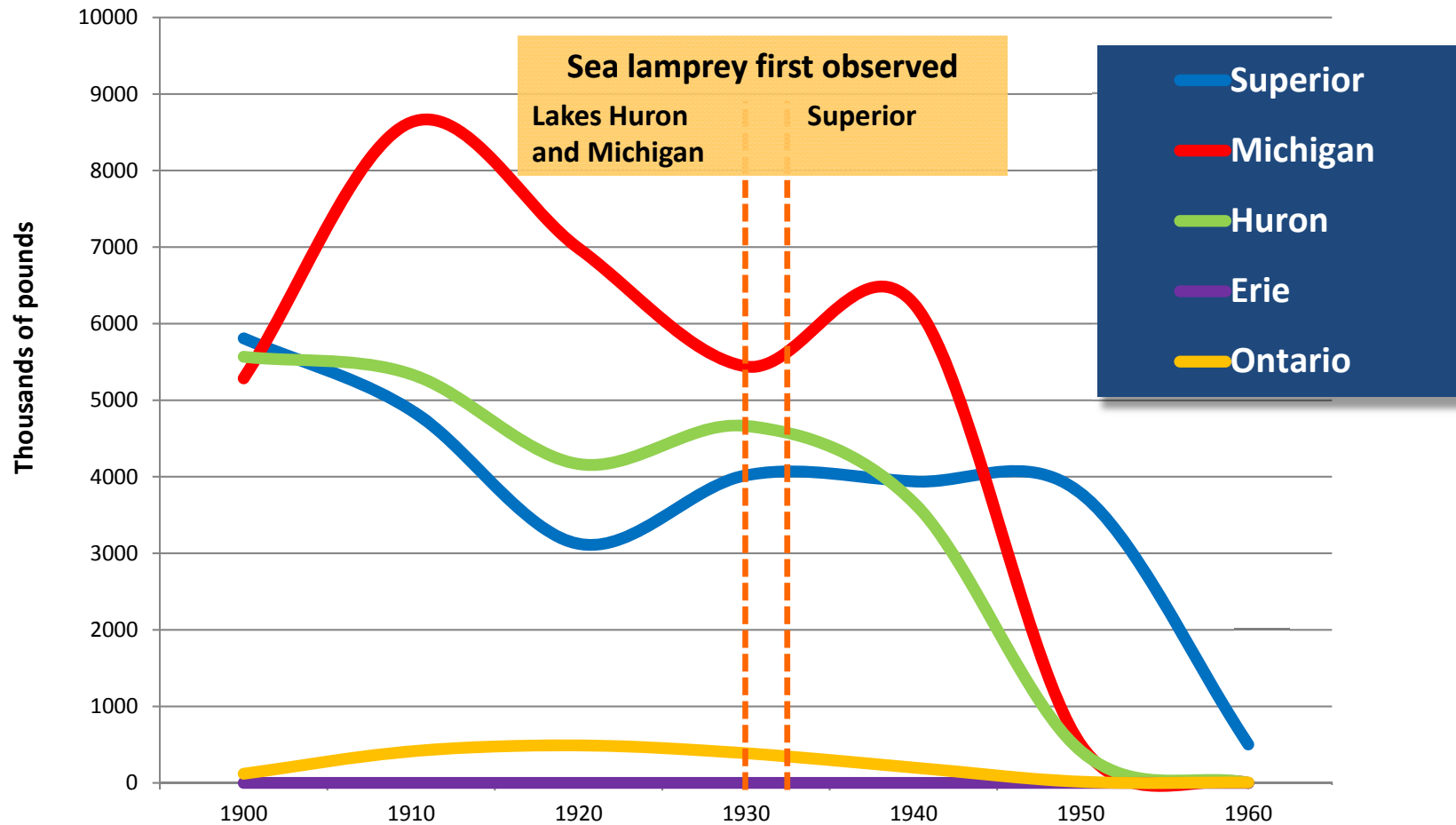




- Most **destructive** invader in the Great Lakes

AIS: Why Do We Care?

Commercial Harvest of Lake Trout





- Most destructive invader in the Great Lakes
- Successful control program: 90% reduction in population

Sea Lamprey Control Program



U.S. Geological Survey



U.S. Fish and Wildlife Service



Fisheries and Oceans Canada



U.S. Army Corps of Engineers



Lampricides



Sea Lamprey Barriers



Traps



- Most destructive invader in the Great Lakes
- Successful control program: 90% reduction in population
- Integrated Pest Management incorporated since mid-1980s

History of IPM in Sea Lamprey Control

- Sea Lamprey Integrated Symposium I, 1979:
 - “The most significant development emerging from SLIS I”
- Integrated Management of Sea Lamprey (IMSL), 1982
 - Concepts: Defined targets for control,
Application of alternative control,
Use of quantitative methods & systems
approaches
 - Connected IMSL to Fish Community Objectives
- Evolution from IMSL → Integrated Control of Sea Lampreys
 - Incorporated “expert judgment” into decision-making

Integrated Control
of
Sea Lampreys
(Invasive Species)

- 
- ✓ Prevention
 - ✓ Monitoring
 - ✓ Response
 - ✓ Evaluation

PREVENTION



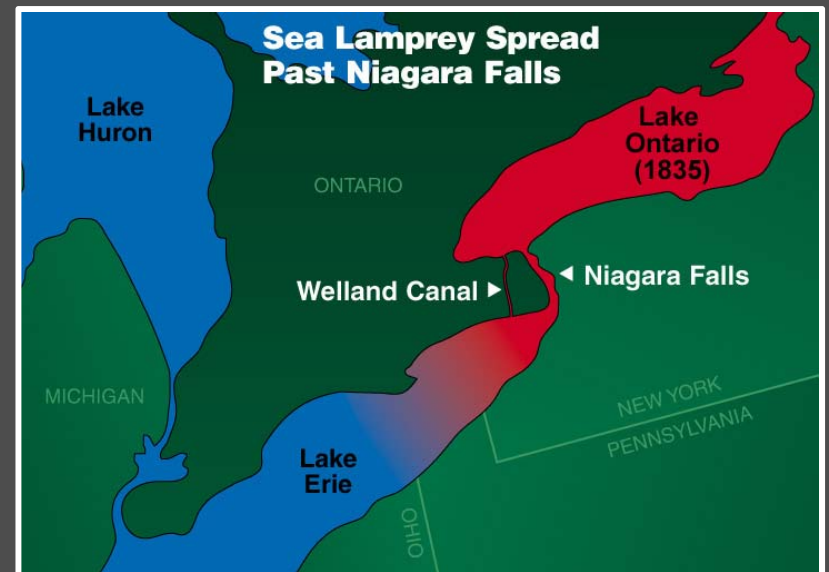
Prevention: Key Objectives

- Stop introduction
- Anticipate next threat

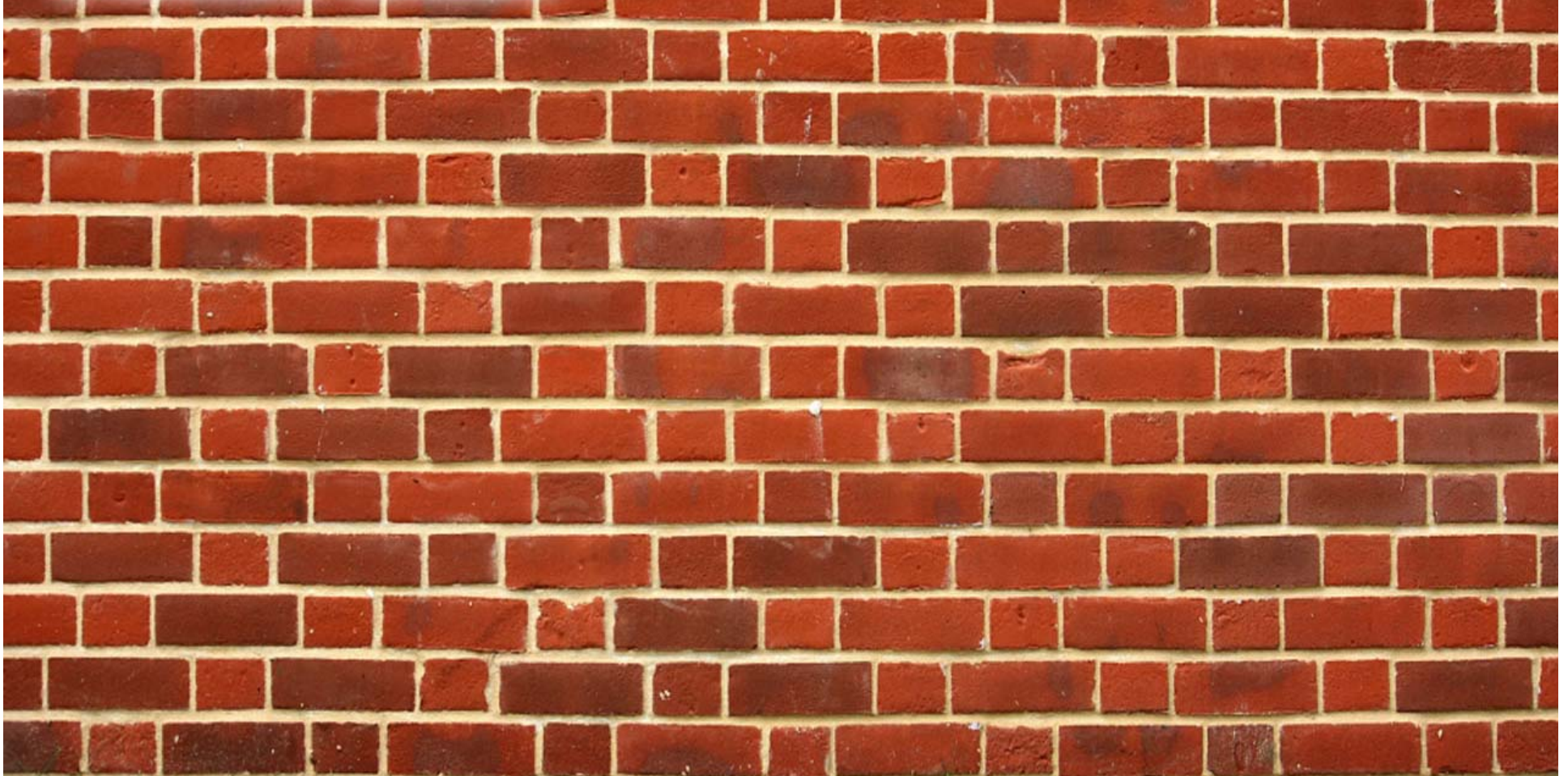
Sea lamprey → failed prevention



Great Lakes Fishery Commission, est. 1955



MONITORING



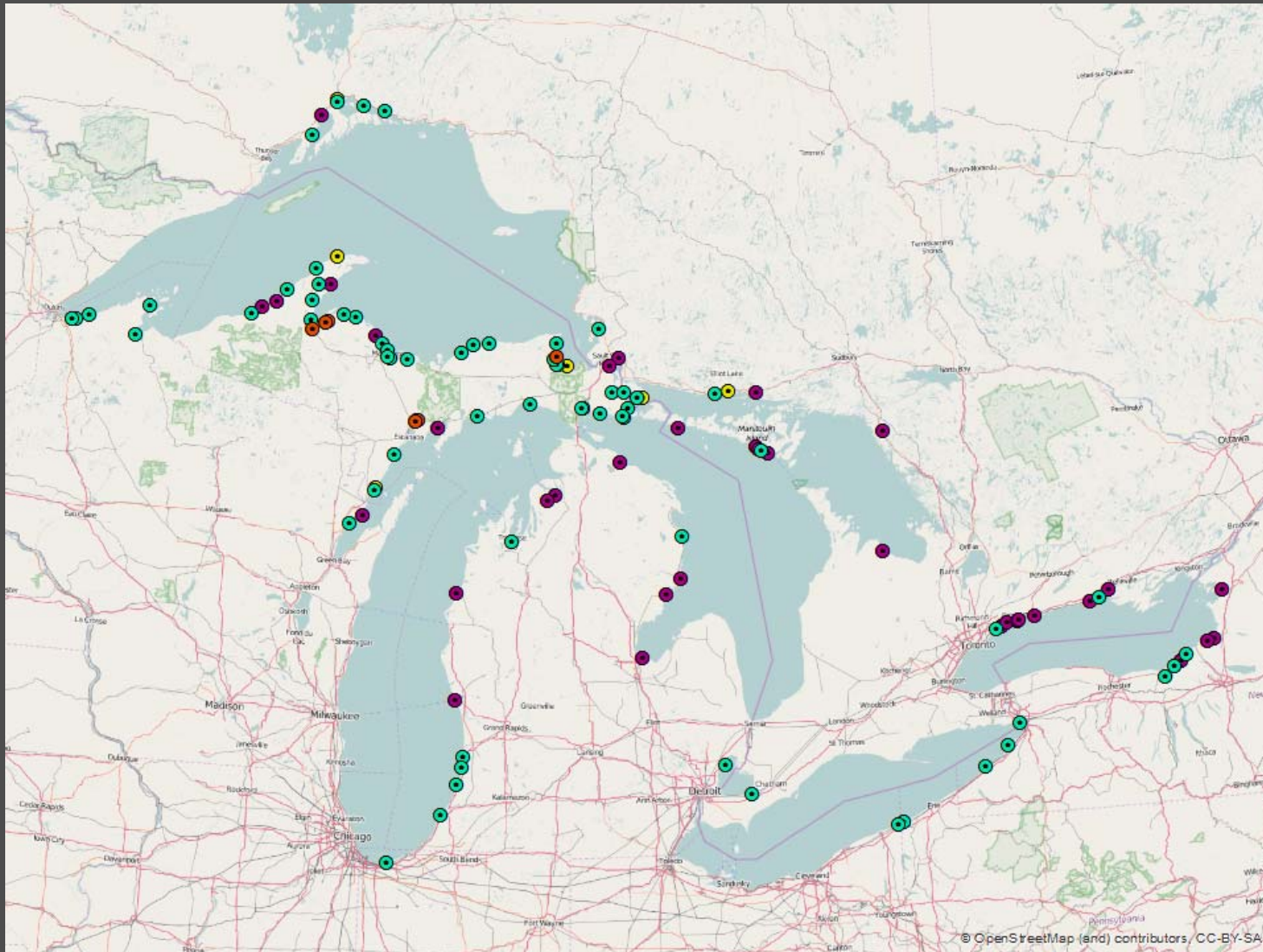
Monitoring: Key Objectives

- Early identification of introduction
- Identifies areas for potential spread of existing invaders

Sea lamprey → informs most effective method(s) of control
→ informs effective use of resources

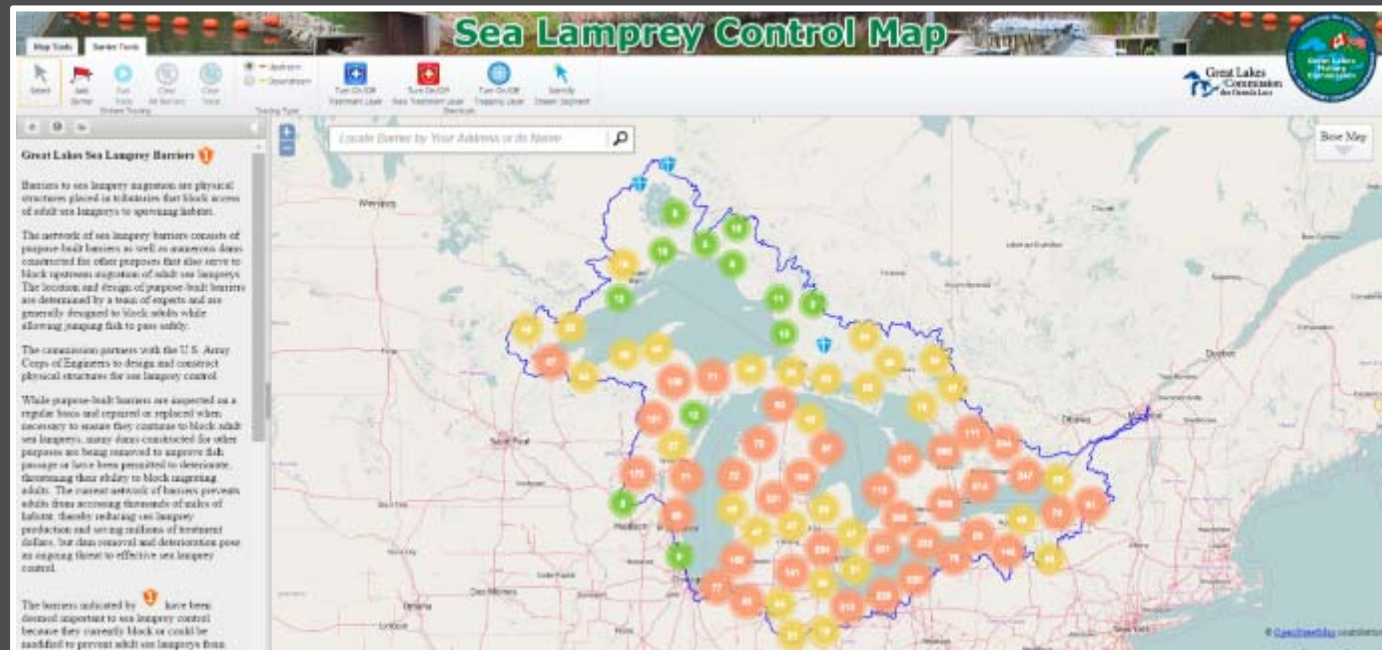


Annual Lampricide Stream Ranking



Barriers

- Overall move towards improving aquatic connectivity BUT sometimes, barriers are necessary



Barrier Mapping Tool

- Shows number of impacted stream miles when barrier is added/removed.
- Linked to Sea Lamprey Control Program databases

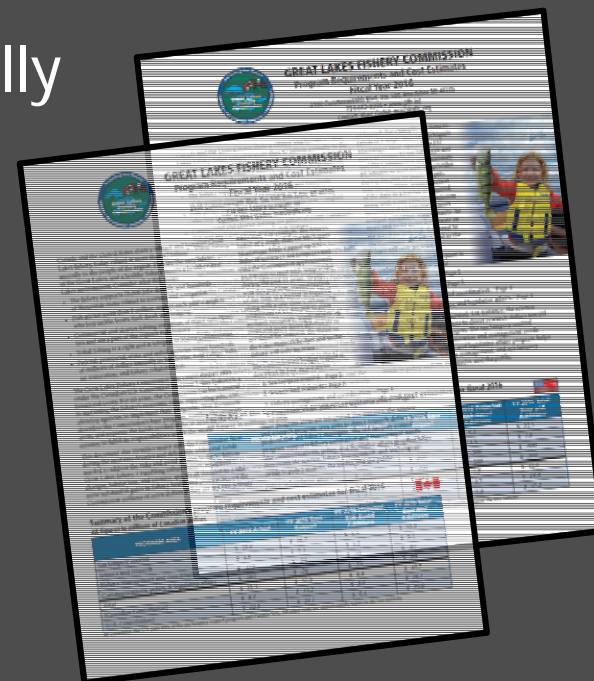
RESPONSE



Response: Key Objectives

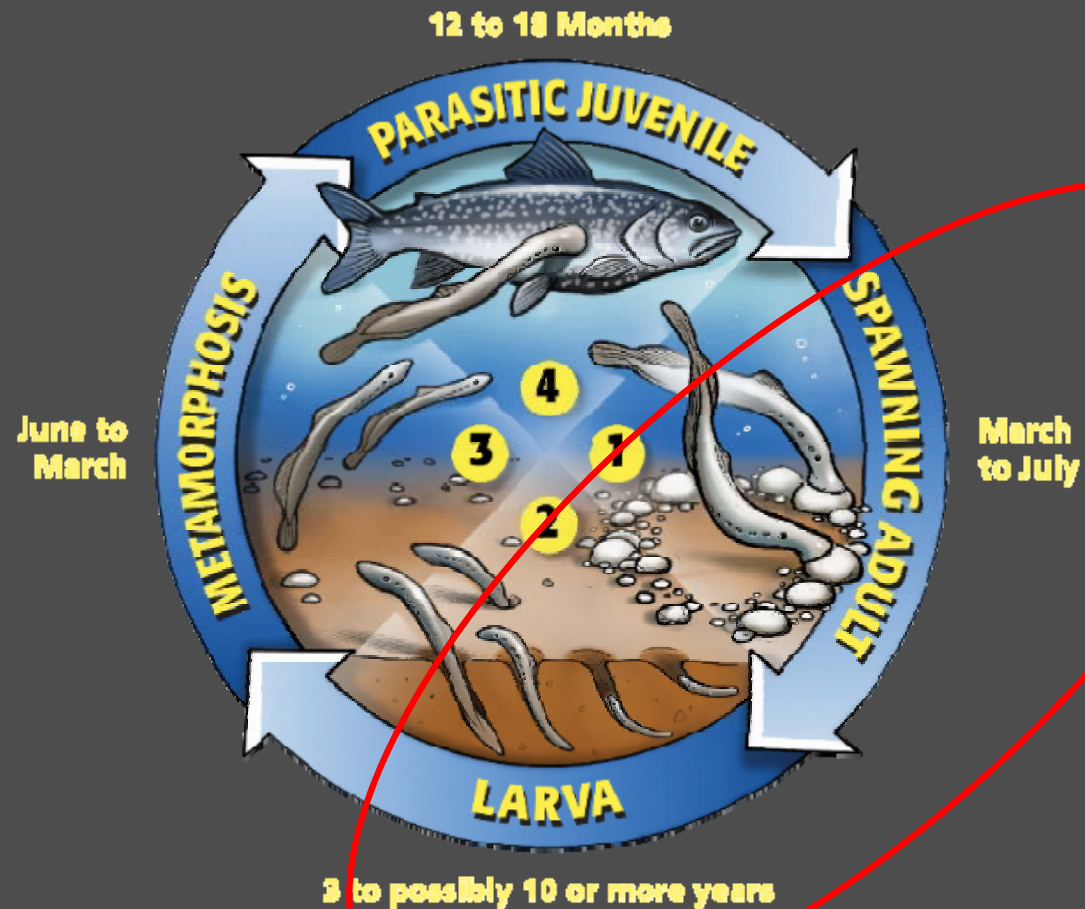
- Swift, coordinated, committed action
 - Must be willing, prepared to act quickly
 - Resources limited, use each other wisely
 - AIS are resilient, we must be as well

Sea Lamprey → ongoing control as eradication is not feasible
→ budget set annually



Rule #1: Know Your Enemy (Research)

SEA LAMPREY LIFE CYCLE



Rule #1: Know Your Enemy (Research)

SEA LAMPREY INFESTED TRIBUTARIES



SEA LAMPREY CONTROL CENTRE
MONTREAL, QUEBEC, CANADA
Map by: Kevin Talbot
Map updated by:
Sea Lamprey Control Centre
Montreal Biological Station
Lamprologie Biological Station

Sea Lamprey Control Program



U.S. Geological Survey



U.S. Fish and Wildlife Service



Fisheries and Oceans Canada

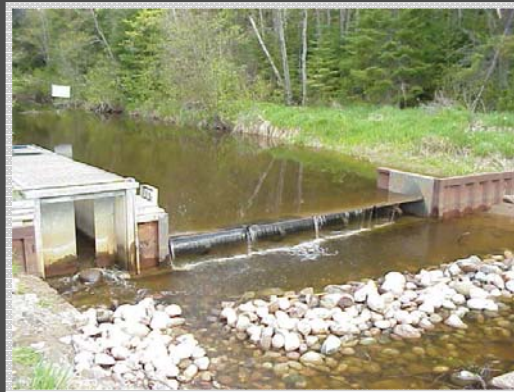


U.S. Army Corps of Engineers

AN INTEGRATED APPROACH



Lampricides

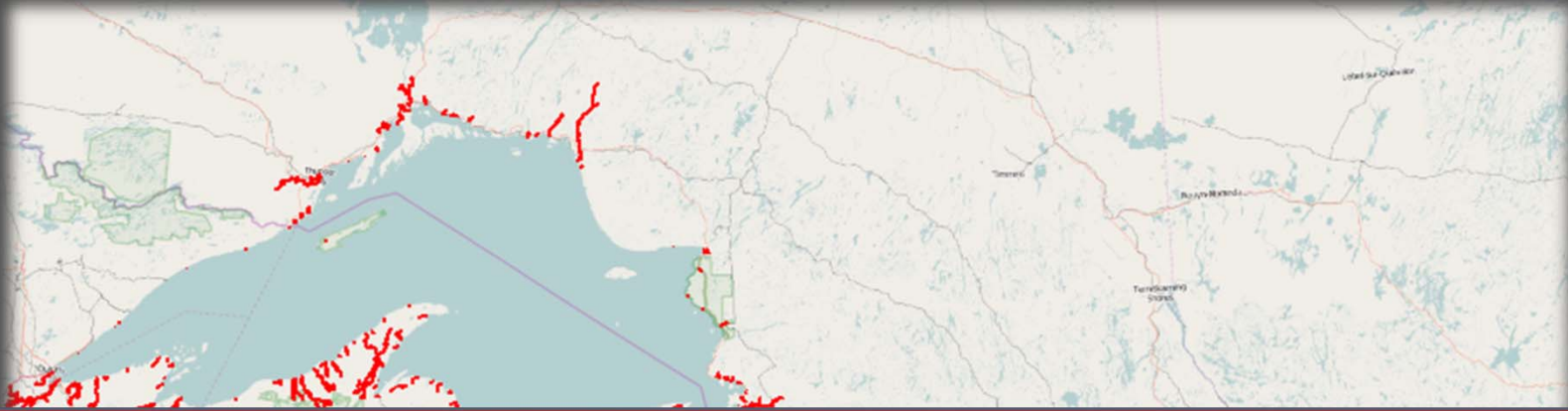


Sea Lamprey Barriers

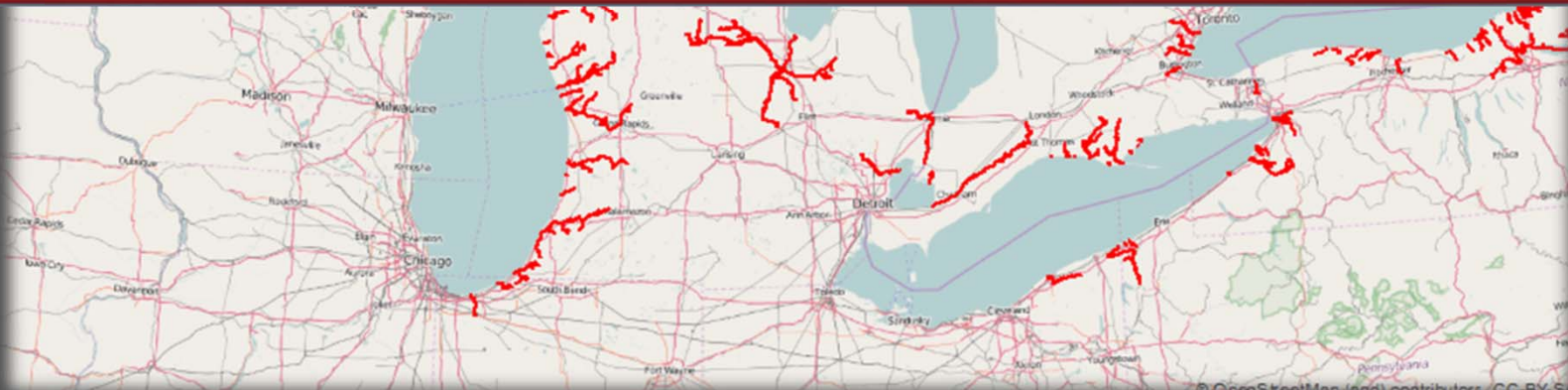


Traps

Lampricide Application



500+ GREAT LAKES TRIBUTARIES



Sea Lamprey Barriers

- First means of attempted control, pre-dating the commission
- Network of barriers consists of purpose-built barriers (~50) and numerous other dams that block migrating sea lamprey
- All newly constructed barriers include traps to remove adult sea lamprey
 - Development of “fish passage” technology is underway



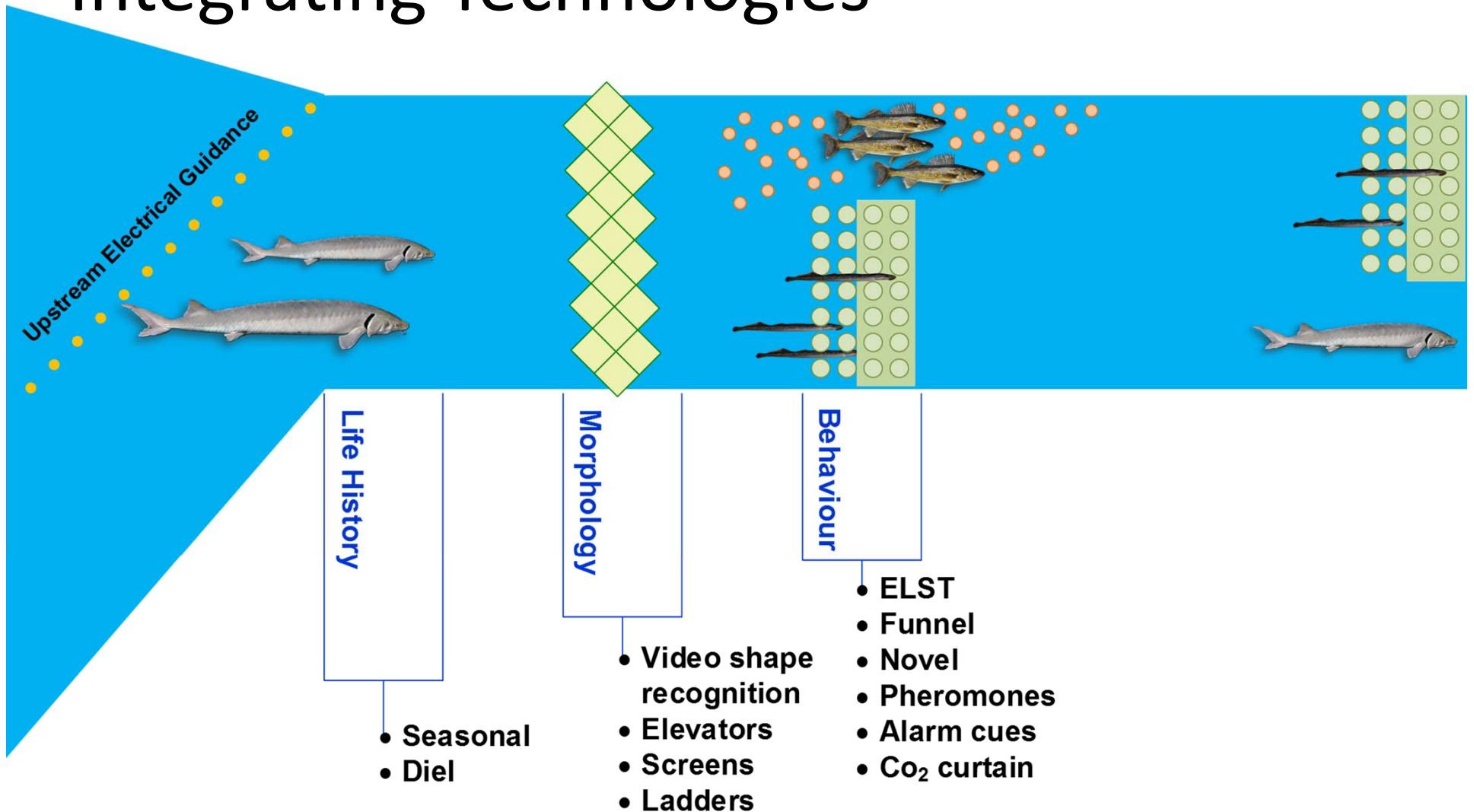
Possible Future Control Methods

- Pheromones
- Electrical guidance
- Sterile-male-release
- Eel ladder style traps
- Juvenile trapping technology
- Lampricide resistance workshop

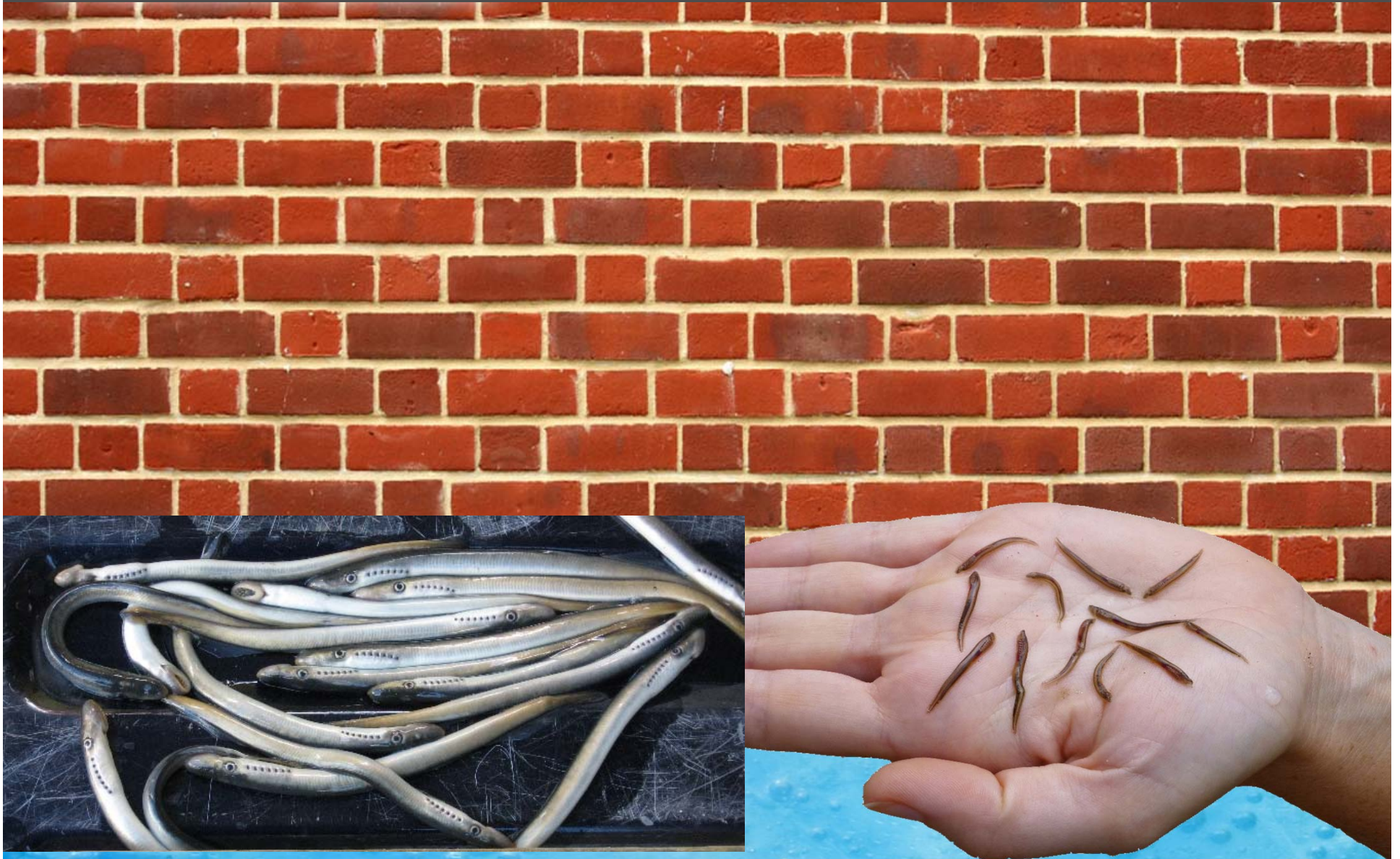
RESEARCH



Conceptual Approach Integrating Technologies



EVALUATION



Individual Treatment Evaluations



Evaluation of Barriers

- Barrier on Manistique River failed early 2000s
- Opened up 326 miles of lamprey spawning habitat
- Treatment stats:
 - 550 staff days
 - \$775,000 USD
 - Every 2 years*!
- 12 years to rebuild barrier (and counting...)
- Ripling effect

2-059 Manistique River + lentic
2014 Treatment



Sea Lamprey Control Program Effectiveness

BEFORE SEA LAMPREY CONTROL



AFTER SEA LAMPREY CONTROL



