Tug Hill Winter Wildlife Webinar Series

Sea Lamprey Control in the Great Lakes

Ted Treska

Sea Lamprey Control Programs Manager

Great Lakes Fishery Commission

Who is Ted Treska?

Cornell University

Presentation Outline

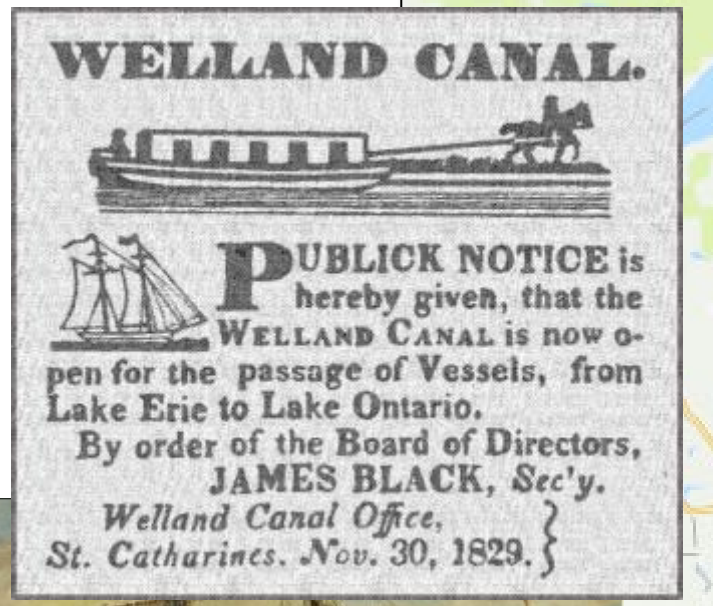
- Introduction to Sea Lamprey
- The Great Lakes Fishery Commission
- History of the Control Program
- Current Control Efforts
- Closer look at Lake Ontario

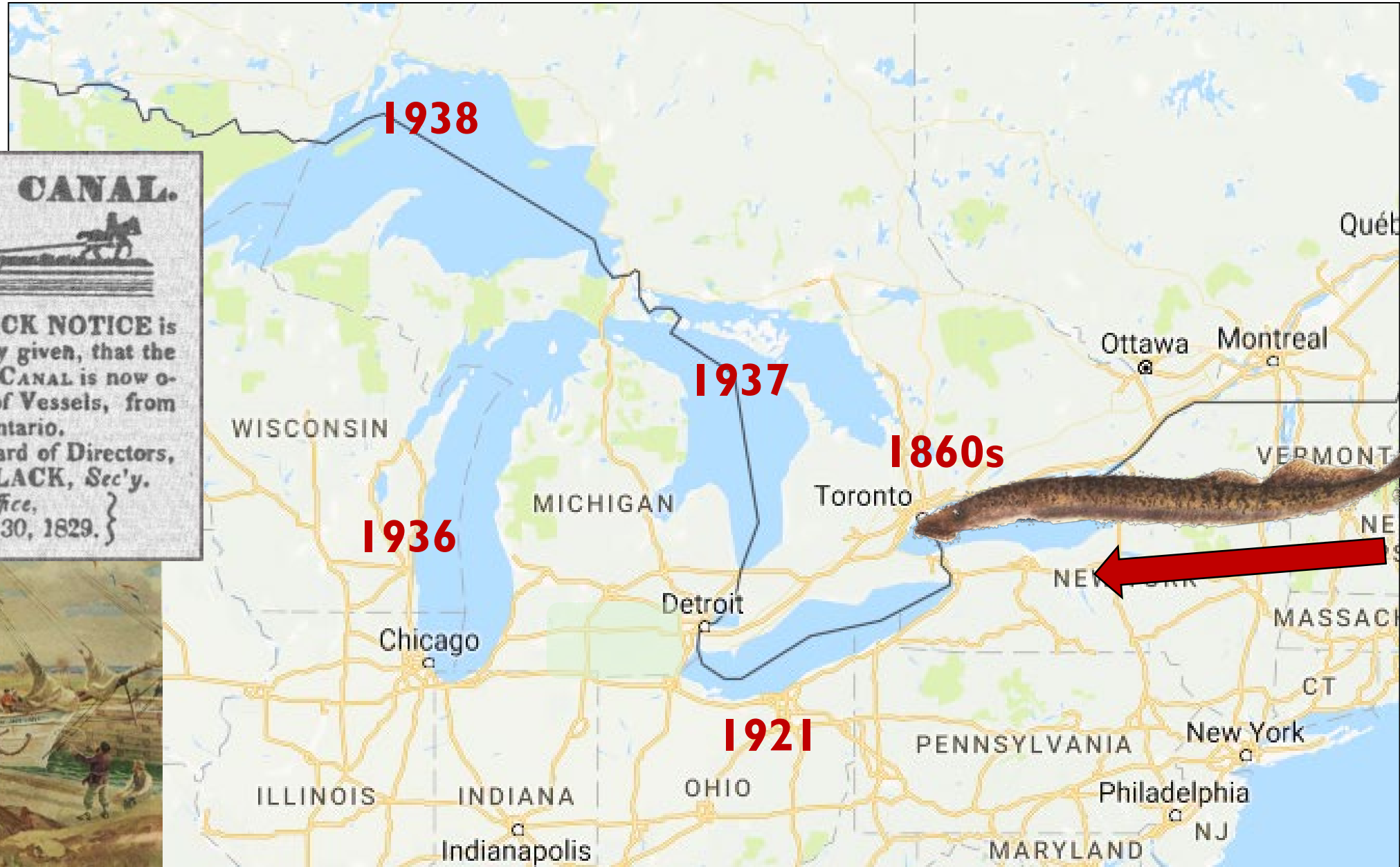
What is a sea lamprey?


Photo: Ted Lawrence, GLFC

Why are they a problem?

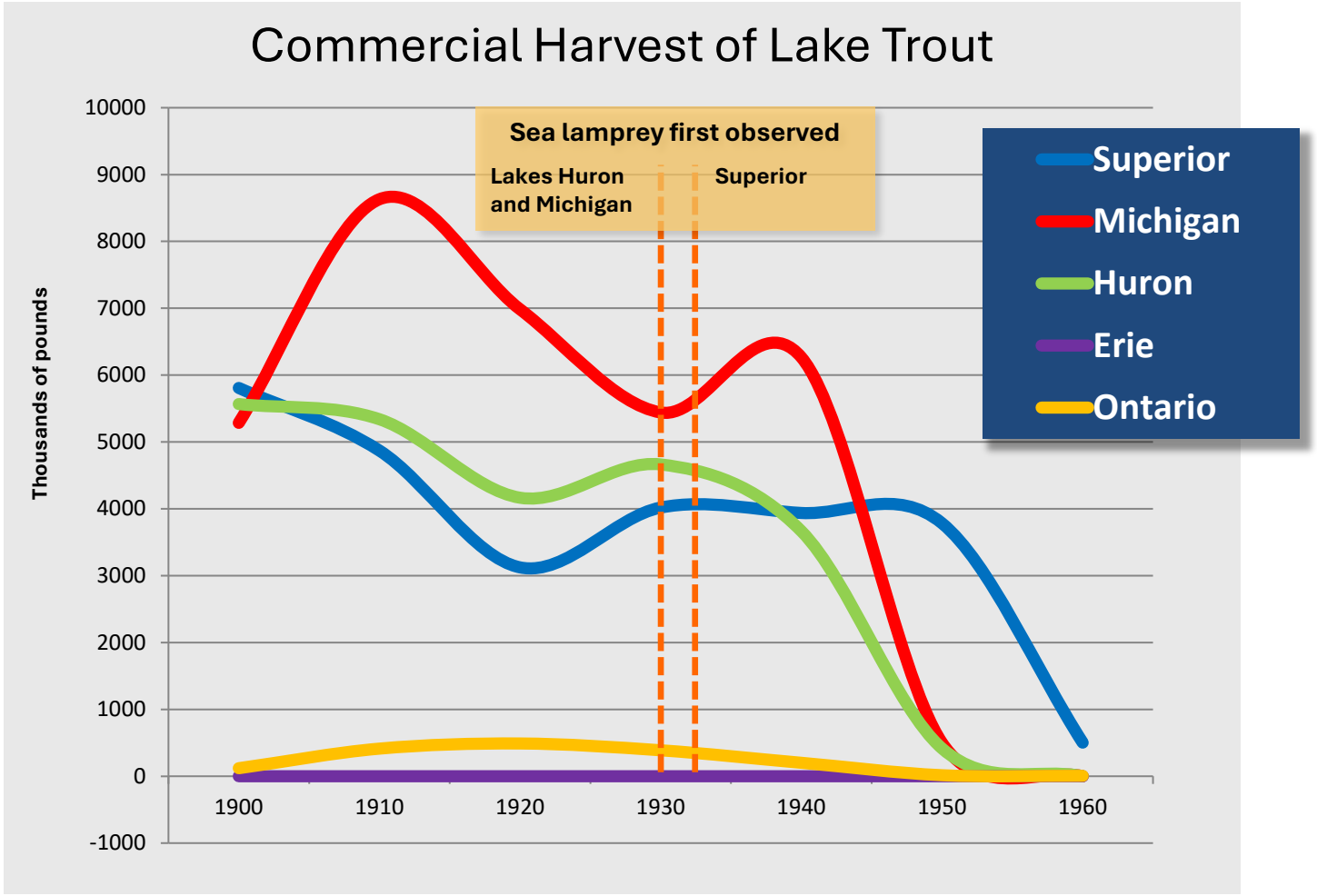
How did they get here?





Devastating Impact on the Fishery

- Fisheries were in trouble due to overfishing and environmental degradation
- Each lamprey can kill up to 18 kg (40 lbs) of fish
- Led to imbalances in the lake ecosystems
- Economic collapse: fishing & tourism

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Thunder Bay
Ontario
Minnesota
Lake Superior
Canada
United States
Québec
CORA
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GLIFWC
(headquarters)
Michigan
Sault Ste. Marie (MI/ON)
1854 Treaty Authority
(headquarters)
Ottawa
Wisconsin
Traverse City
Lake Huron
Ontario
Ministry of Natural Resources
Toronto
Lake Ontario
Ontario
Hamilton
Rochester
Buffalo
New York
Milwaukee
Lake Michigan
Michigan
Port Huron
Sarnia
Detroit
Windsor
Lake Erie
Chicago
Illinois
Indiana
Ohio
Pennsylvania

CONVENTION ON GREAT LAKES FISHERIES (1954)

Great Lakes Fisheries Convention Act

Great Lakes Fisheries Act

CREATED

GREAT LAKES FISHERY COMMISSION
EST 1955 BY TREATY

Canadian Section | U.S. Section

FUNCTIONS

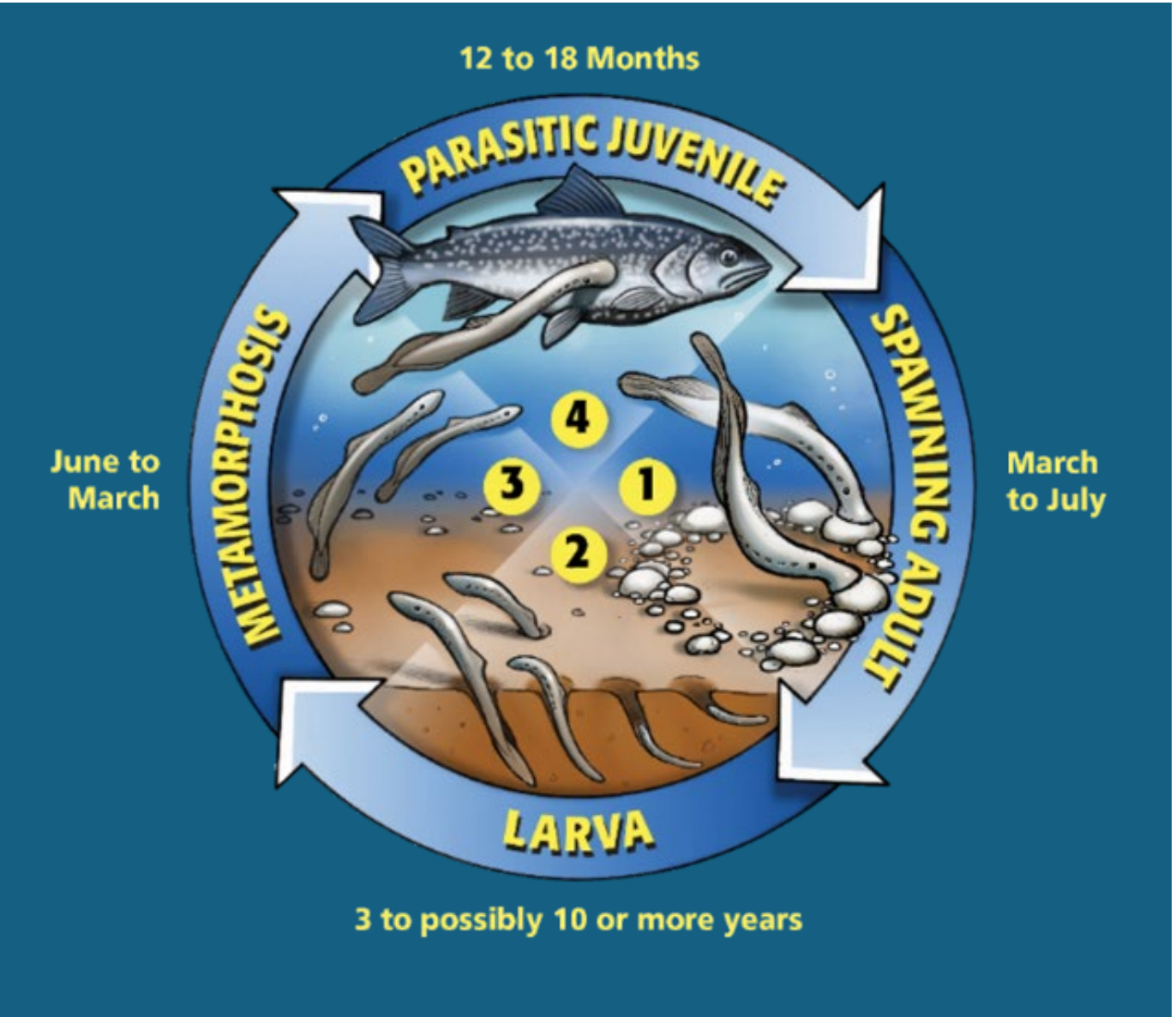
- Communications
- Fishery Management
- Policy & Legislative Services
- SECRETARIAT
- Corporate Services
- Sea Lamprey Control
- Science

ADVISE

- Informed by:
  - U.S. and Canadian Advisors
  - Commission appointed Boards

- 3 Main Mandates:
  - Coordinated Fishery Management
  - Science and Research
  - ***Sea Lamprey Control***

Sea Lamprey Life History Lesson



- Native to the Atlantic Ocean
- Life history similar to salmon; adults spawn and die (semelparous)
- Larvae filter feed in stream sediment for 3-10 years before metamorphosing
- Parasitic juveniles migrate to lake to feed on fish
- Adults run up rivers to spawn

How Does The Commission Conduct Sea Lamprey Control?

U.S. Geological Survey

U.S. Fish and Wildlife Service

Fisheries and Oceans Canada

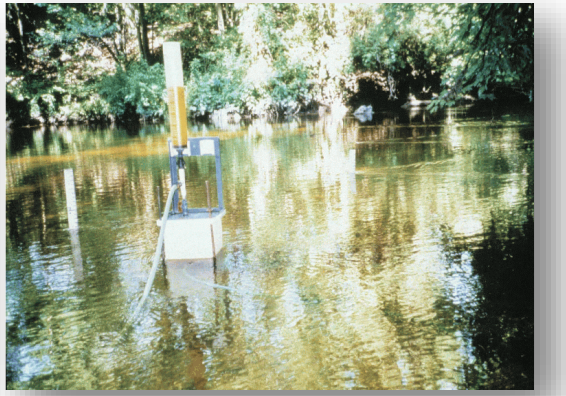
U.S. Army Corps of Engineers

U.S. Environmental Protection Agency

AN INTEGRATED APPROACH

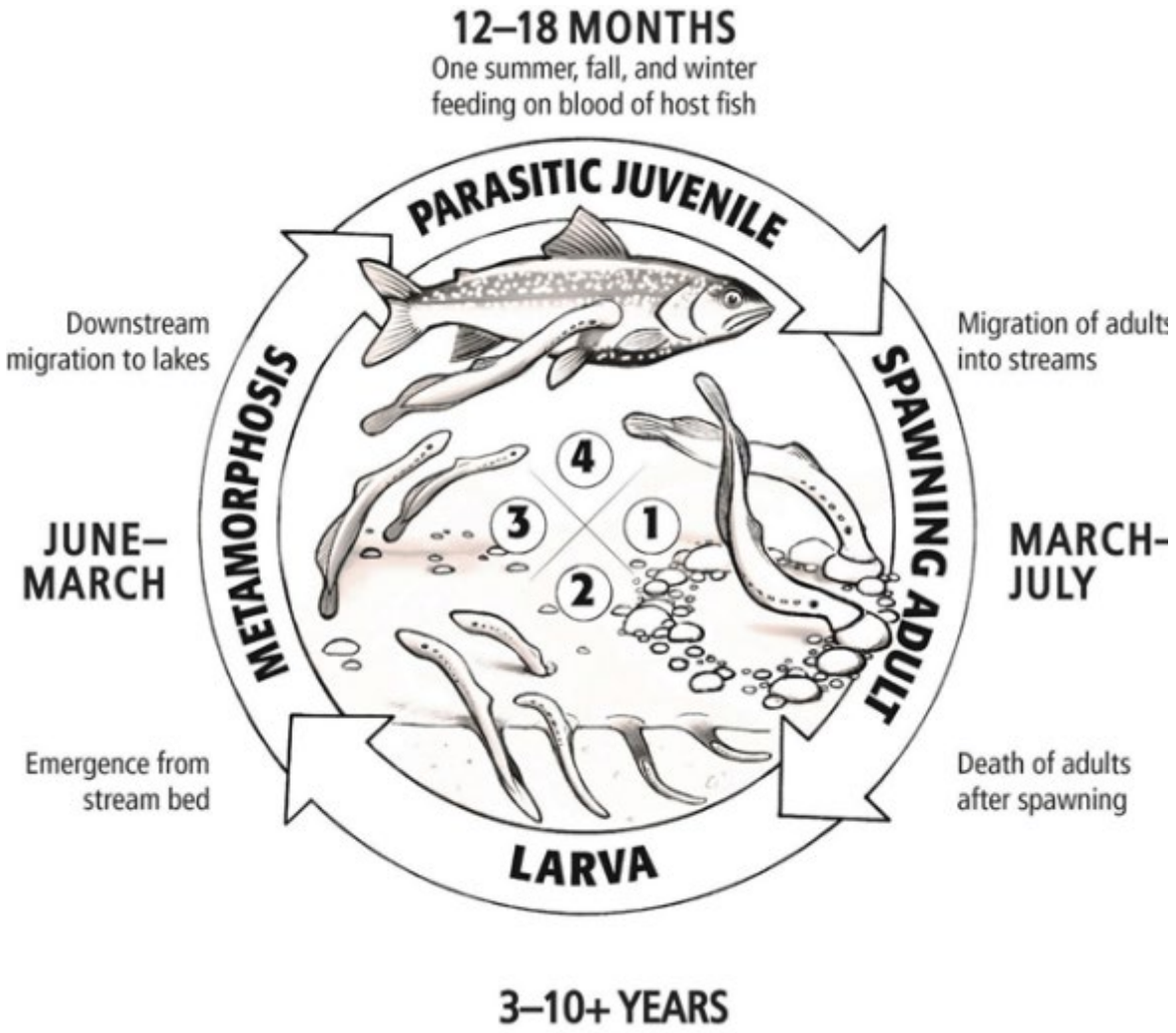
Traps

Sea Lamprey Barriers

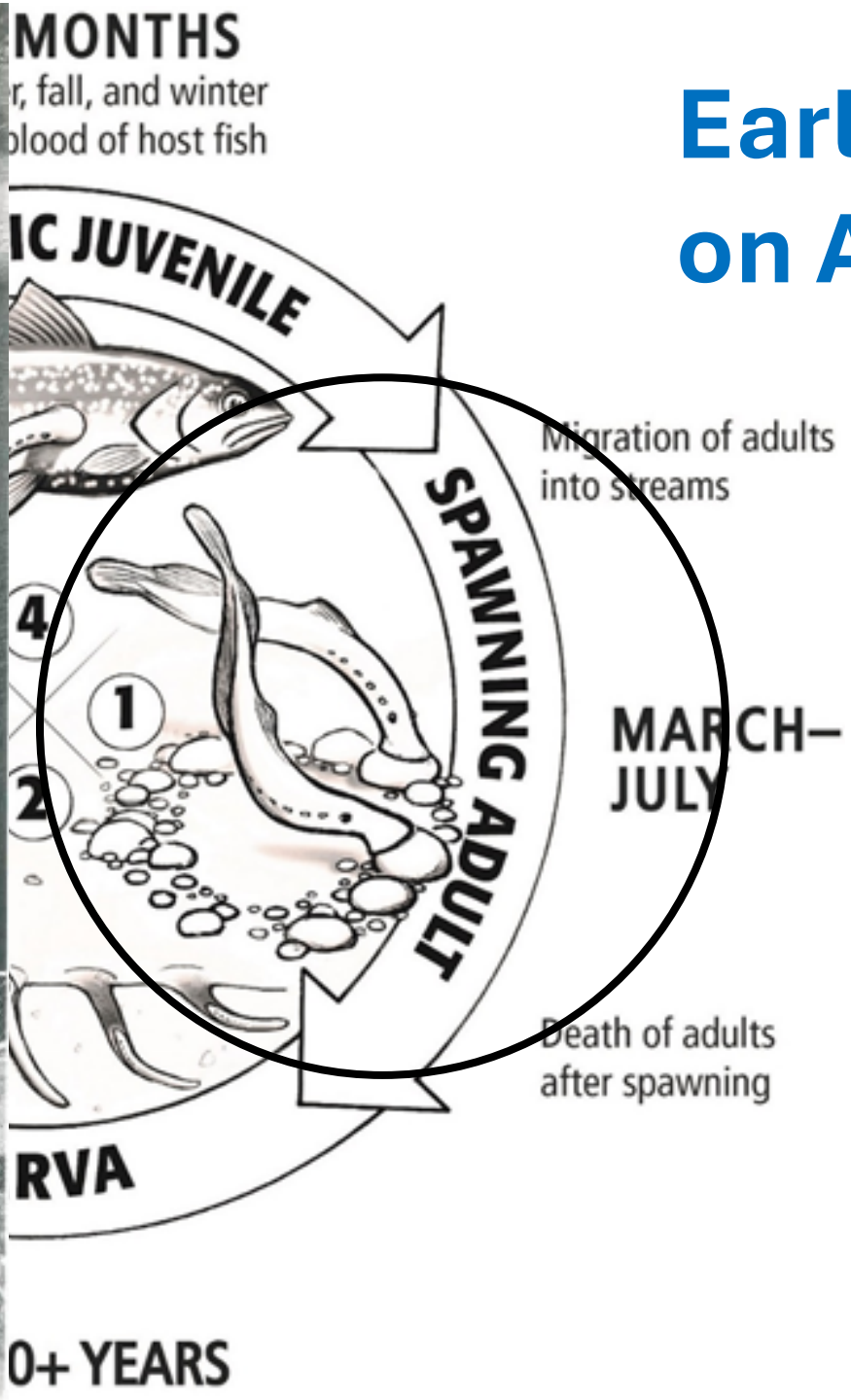


Lampricides

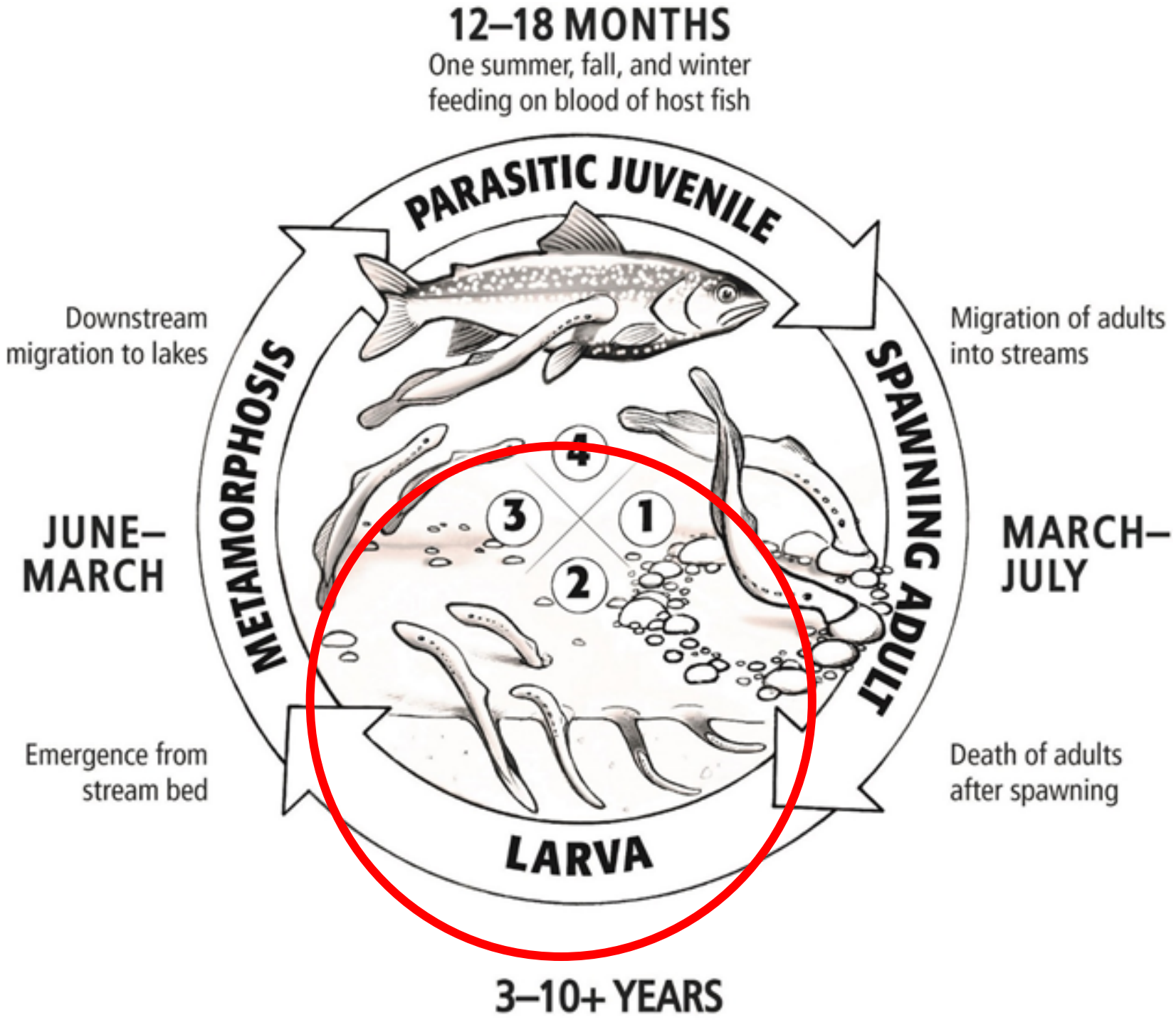
Understanding sea lamprey to inform control – know thy enemy…



Early Focus on Adults

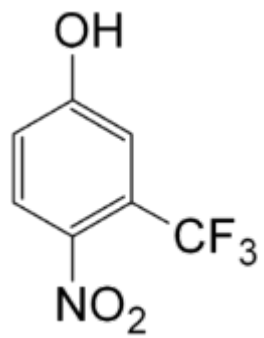


Shift Focus to Larvae

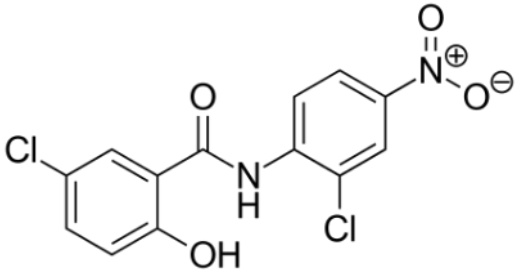


Development of Lampricides

- Criteria:
  - Selective toxicity…kill sea lamprey, but not other fish
  - Environmentally benign
- Scientists screened ~6,000 mostly organic compounds
- ***Eureka!***



3-trifluoromethyl-4-nitrophenol (TFM)



2’,5-dichloro-4’-nitrosalicylanilide (Bayluscide)

Application of Lampricides

- Applied via extensive SOPs
- Restricted use pesticides regulated by EPA and Health Canada
- Lampricides do not persist in the environment
  - No bioaccumulation
  - Break down under UV light
  - Biodegrade with microbial action

Current larval control program (larval assessment)

~600 tributaries surveyed per year

- Which tributaries to treat
- How far upstream to treat
- Whether retreatment is needed
- Whether barriers are effective
- Identify new sea lamprey tributaries
- Collect larvae for research and outreach

Current Larval Control Program

- ~500 tributaries treated – most on a 3-5 year cycle
- ~120 tributaries treated annually with lampricides

- TFM kills >90% of sea lamprey
- Bayluscide kills ~75% of sea lamprey

Stream Treatments

Lampricide Analysis

Lampricide Analysis

Spectrophotometer & High Performance Liquid Chromotography

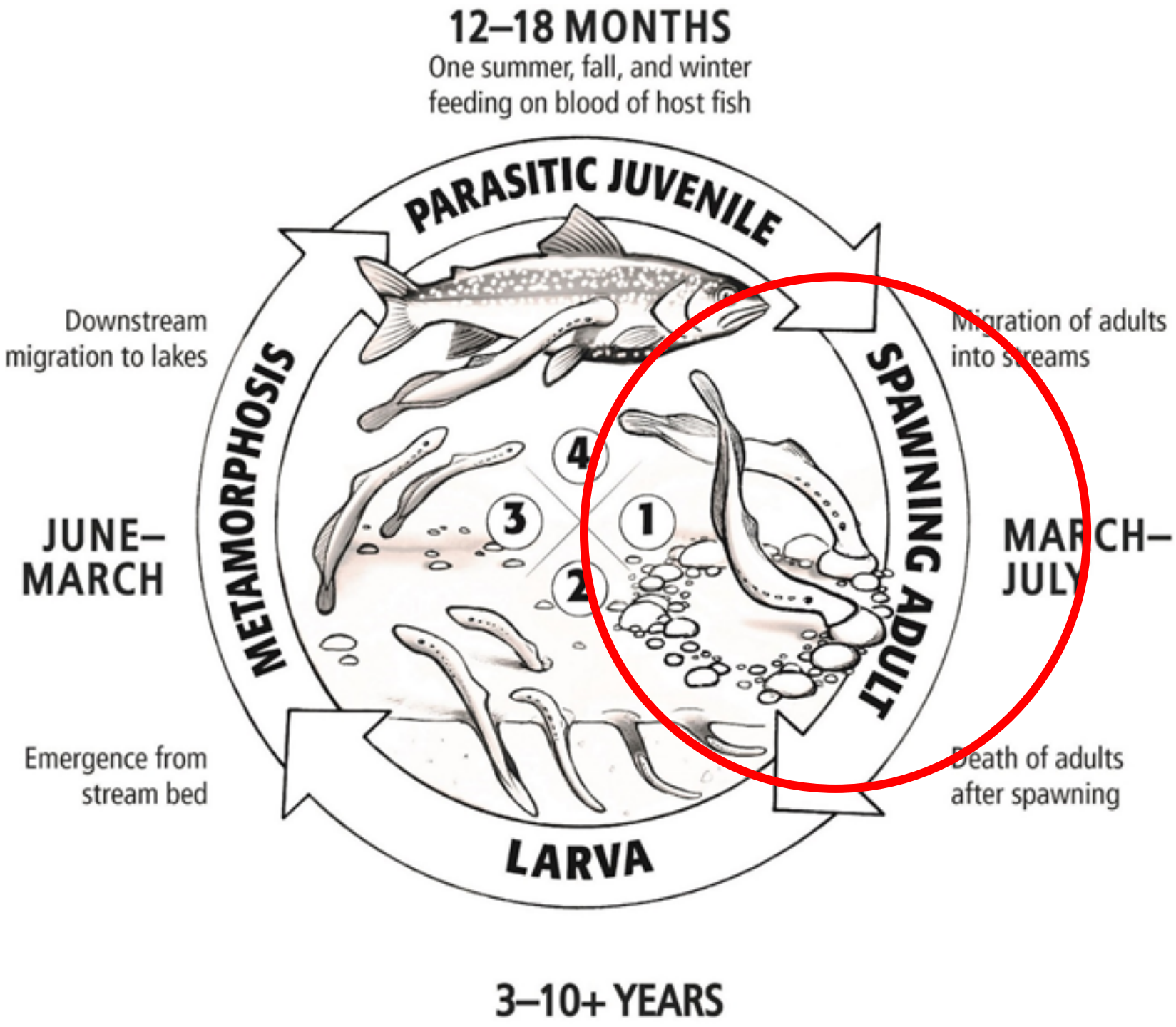
Lentic Treatments (river mouths)

Gra


Granular
Bayluscide


WESTCOTT
Flexible Stainless Steel Ruler

Current Focus on Adults



Adult Assessment - Trapping

Purpose Built Sea Lamprey Barriers

- Limit extent of infestations in tributaries
- Often still need to treat below barriers
  - Treatment costs much lower
- Typically are low-head barriers that maintain 18” of drop during a 25-year flood event
- 73 purpose-built barriers across the Great Lakes

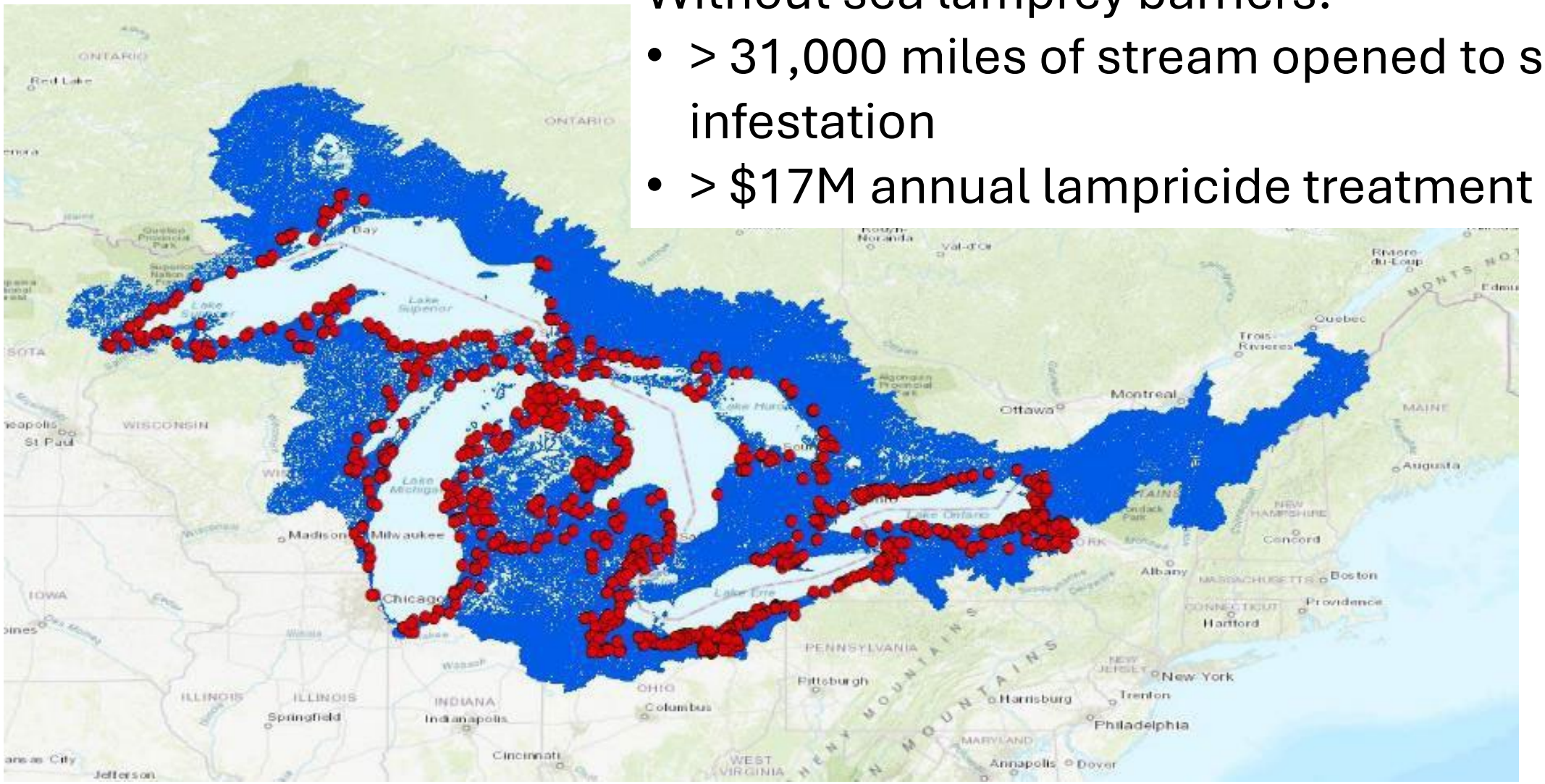
De-facto Sea Lamprey Barriers

- Dams built for other purposes are also important sea lamprey barriers
- Many are old; nearing or past their life expectancy
- Require extensive inventory work, outreach, and potential funding for maintenance and repairs
- > 400 of these sea lamprey barriers across the Great Lakes

Restricting Infestation – Sea Lamprey Barriers

Without sea lamprey barriers:

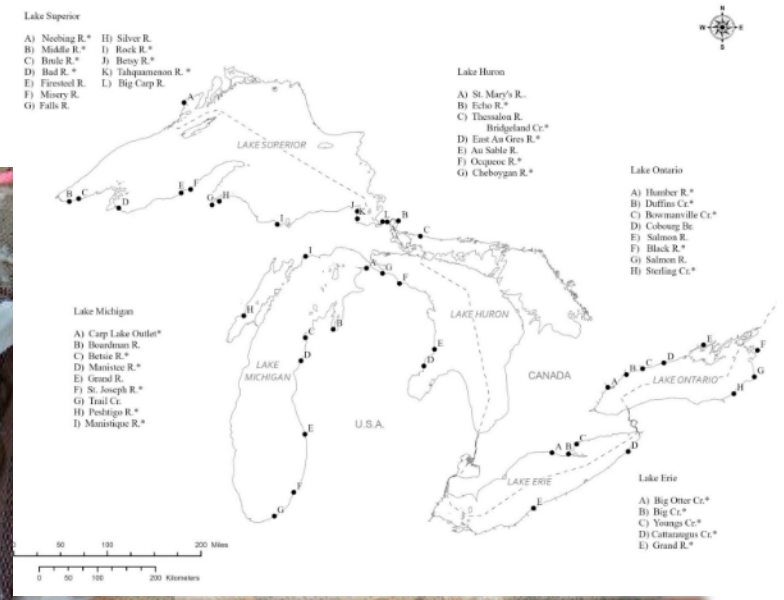
- > 31,000 miles of stream opened to sea lamprey infestation
- > $17M annual lampricide treatment cost



Impacts of sea lamprey control

www.glfc.org/status.php

- Assess the effects of all sea lamprey control actions
  - Adult sea lamprey abundance by lake
  - Lake trout marking rate by lake
  - Lake trout abundance by lake



Control Actions → Sea Lamprey Abundance

Lake Trout Abundance

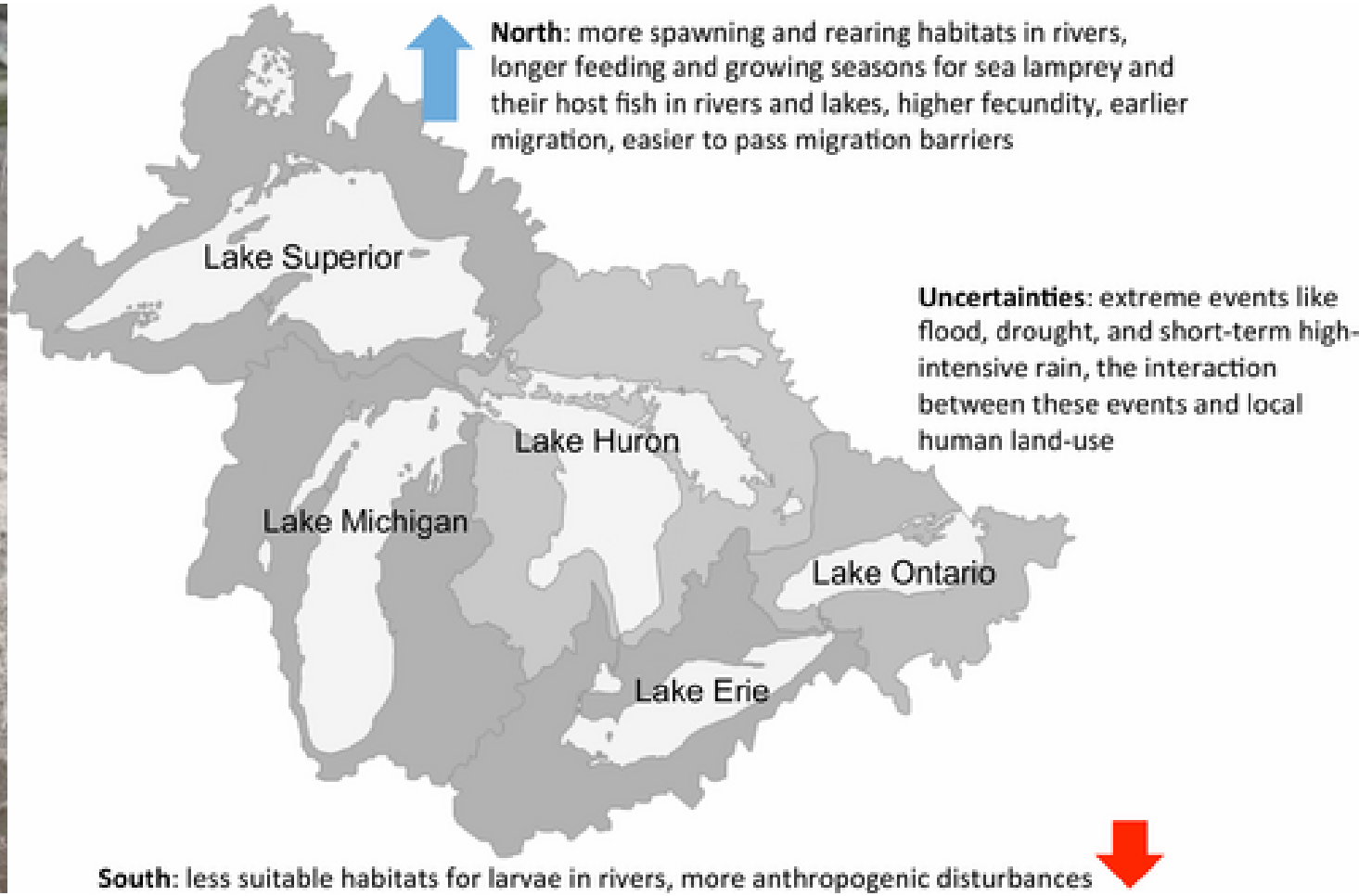
Other Host Fish Abundance

→ Lake Trout Marking Rate

Challenges for sea lamprey control

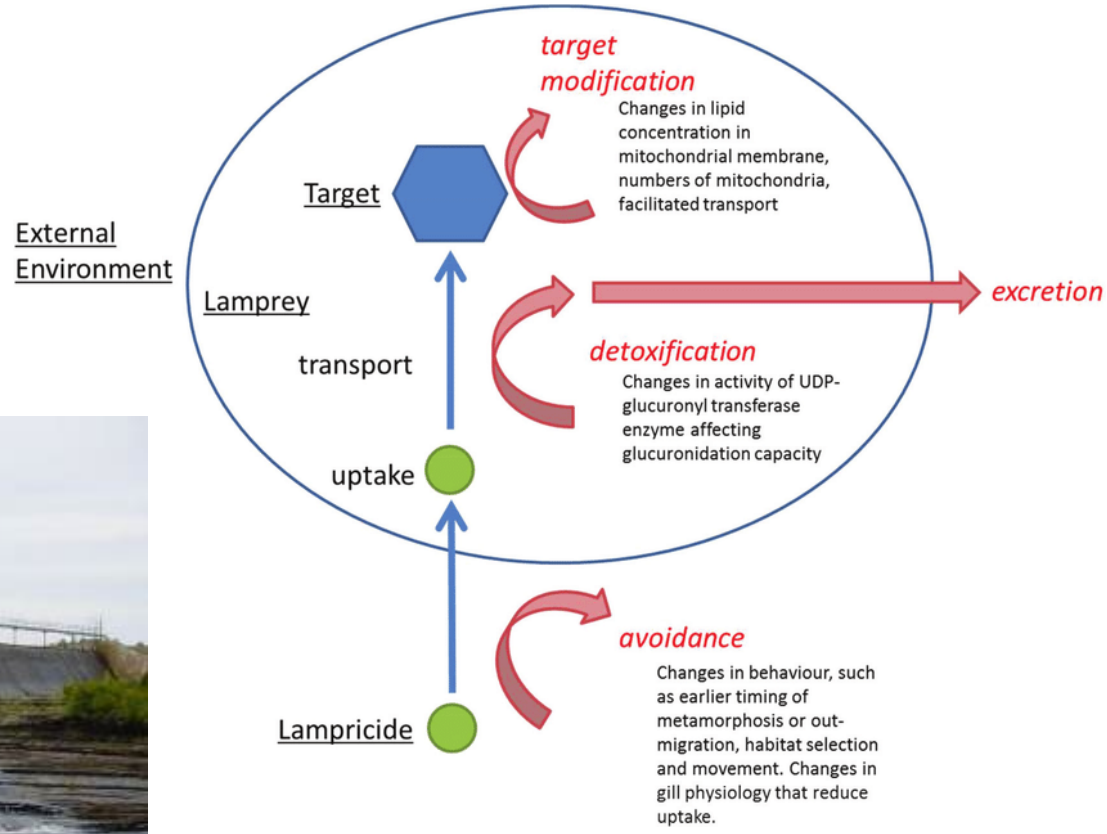
- Climate Change

From Lennox et al. 2020 - Global Change Biology



Challenges for sea lamprey control

- We rely on two control tactics – what if lampricide **resistance** develops?



From Dunlop et al. 2017 – Can J Fish Aquat Sci

Challenges for sea lamprey control

- The social license to apply pesticides and dam rivers

USGS science for a changing world

SUPCON
Supplemental Sea Lamprey Control Initiative

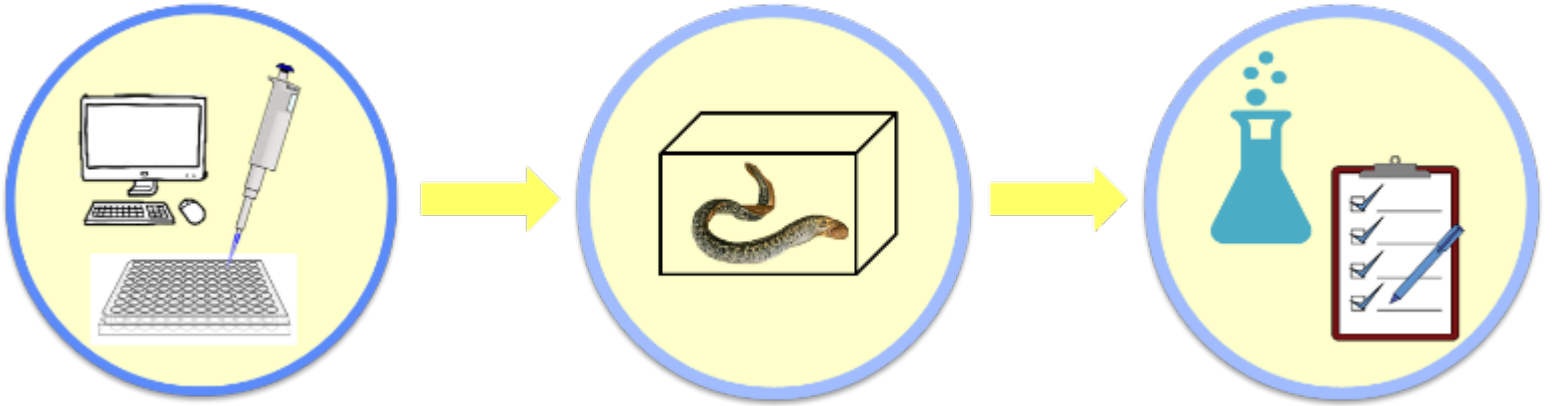
SupCon Field Experiment

GREAT LAKES FISHERY COMMISSION
EST 1955 BY TREATY

Great Lakes RESTORATION

www.glfc.org/supplemental-controls.php

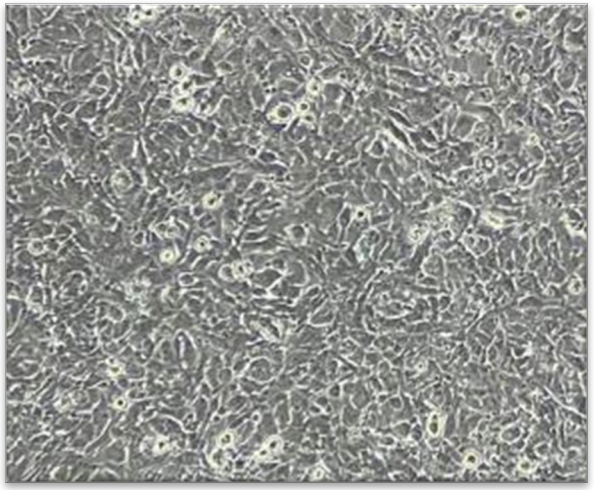
New Lampricides



In vitro / in silico screening

In vivo efficacy & safety testing

Product development & regulated studies



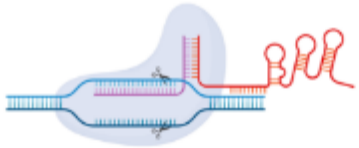
Cell lines for sea lamprey & nontarget fish

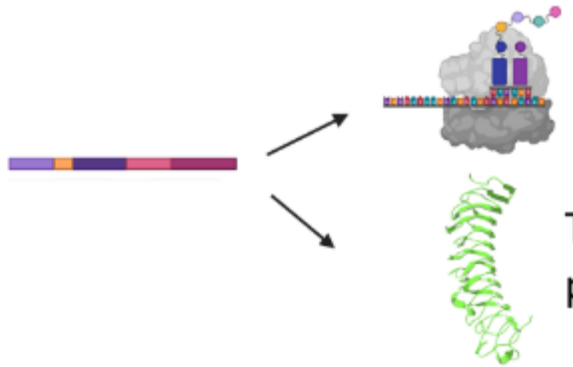
Assays to screen chemicals

MICHIGAN STATE UNIVERSITY

Genetic Controls

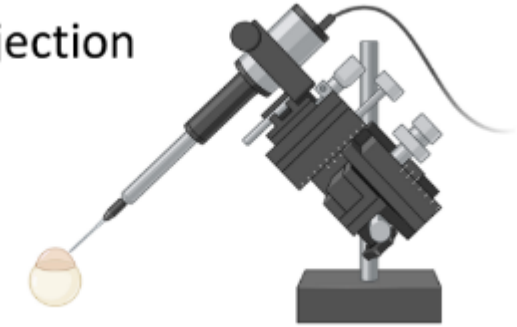
gRNA design & CRISPR Cas9 RNP formulation





Truncated protein

Microinjection



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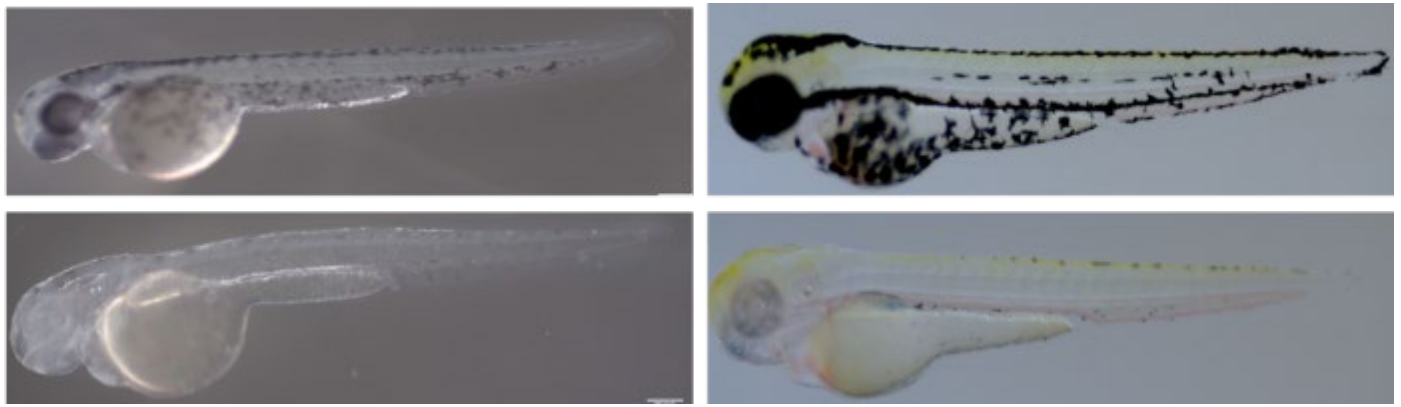


GREAT LAKES FISHERY COMMISSION EST 1955 BY TREATY

Great Lakes RESTORATION

Control on Lake Ontario

- By the 1950s, Lake Ontario's fish populations were in dire straights

- Fish Community Objectives: *Suppress abundance of Sea Lamprey to levels that will not impede achievement of objectives for Lake Trout and other fish*.

- Status/Trend indicators:
  - Spawning-phase adult Sea Lamprey abundance: At or below Index Target 14,000.
  - Fish Damage: Less than 2 fresh wounds per 100 Lake Trout

Impacts of Covid Travel Restrictions

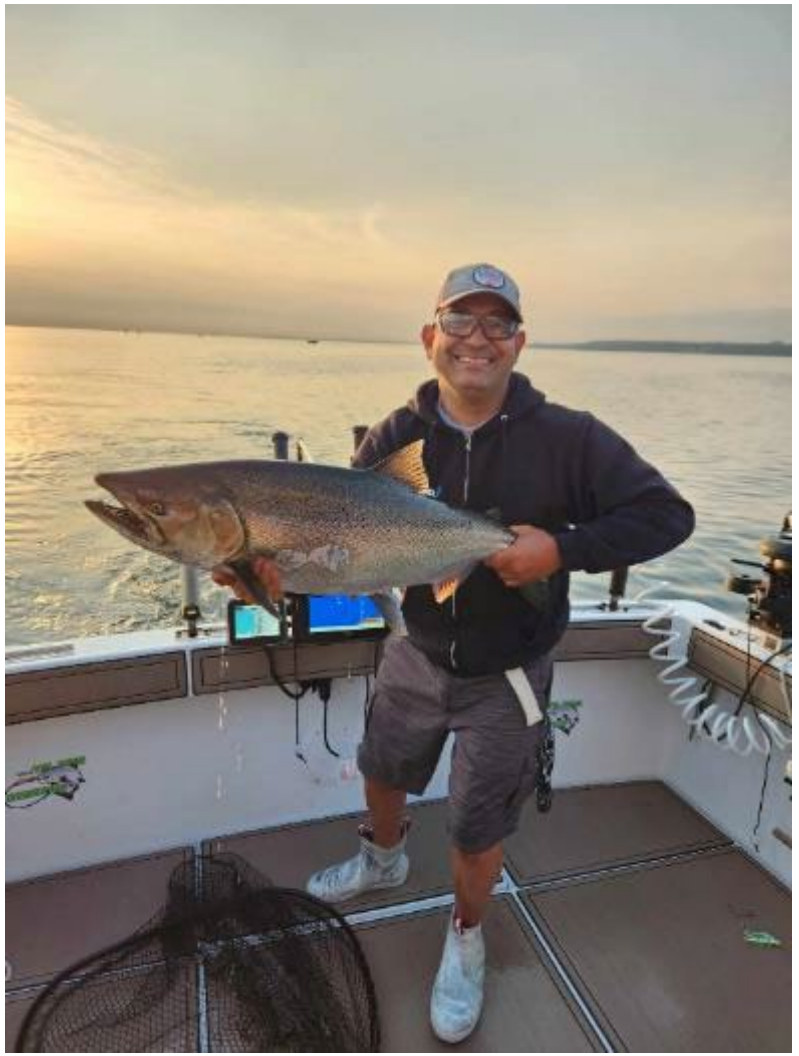
 # Treatments Conducted

Lake	2020	2021	2022*
Superior	13	23	52
Michigan	13	21	12
Huron	7	24	24
Erie	0	2	3
Ontario	0	11	16
	~25%	***75%***	***~100%***

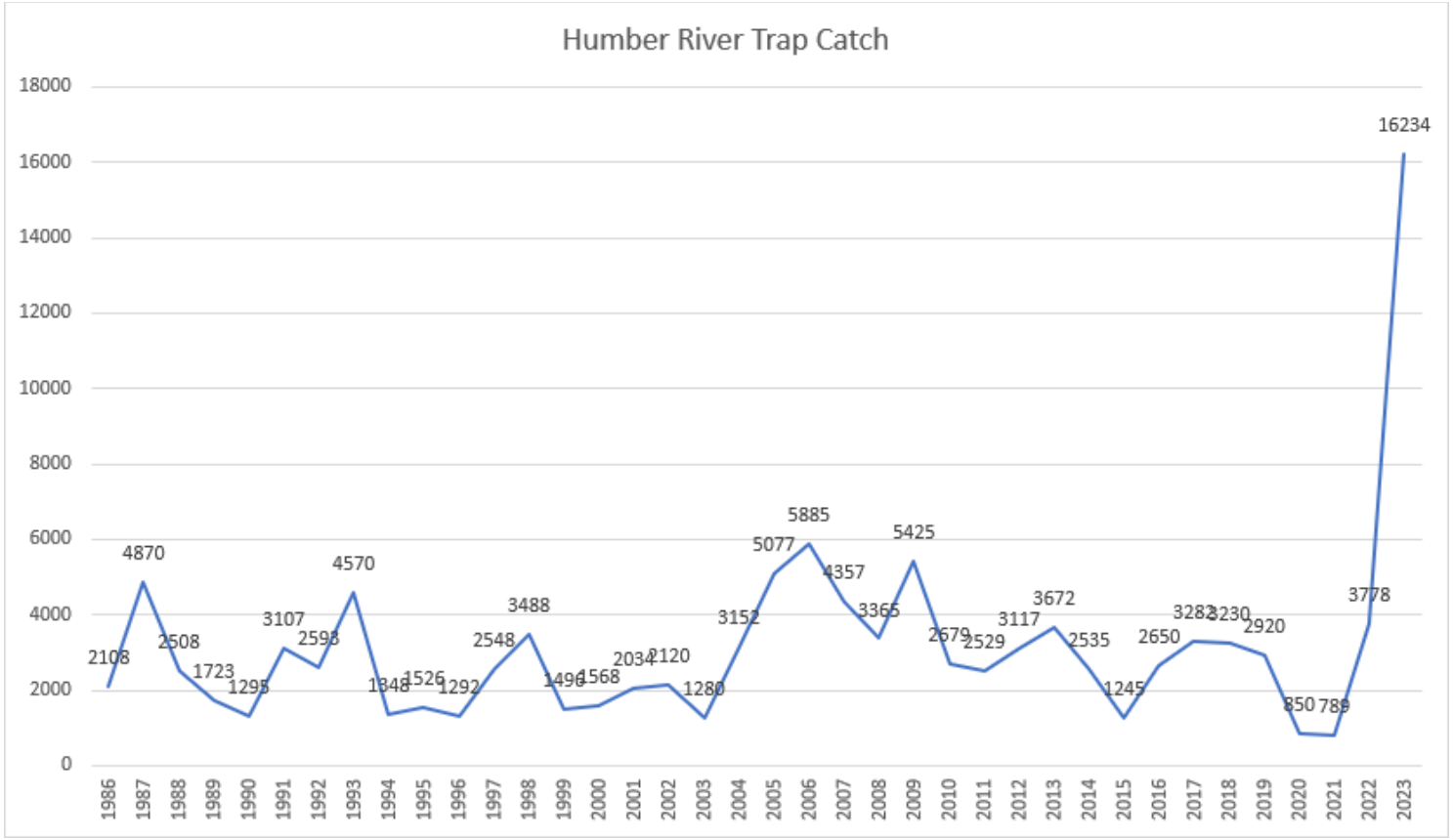
Percentage of planned treatments conducted

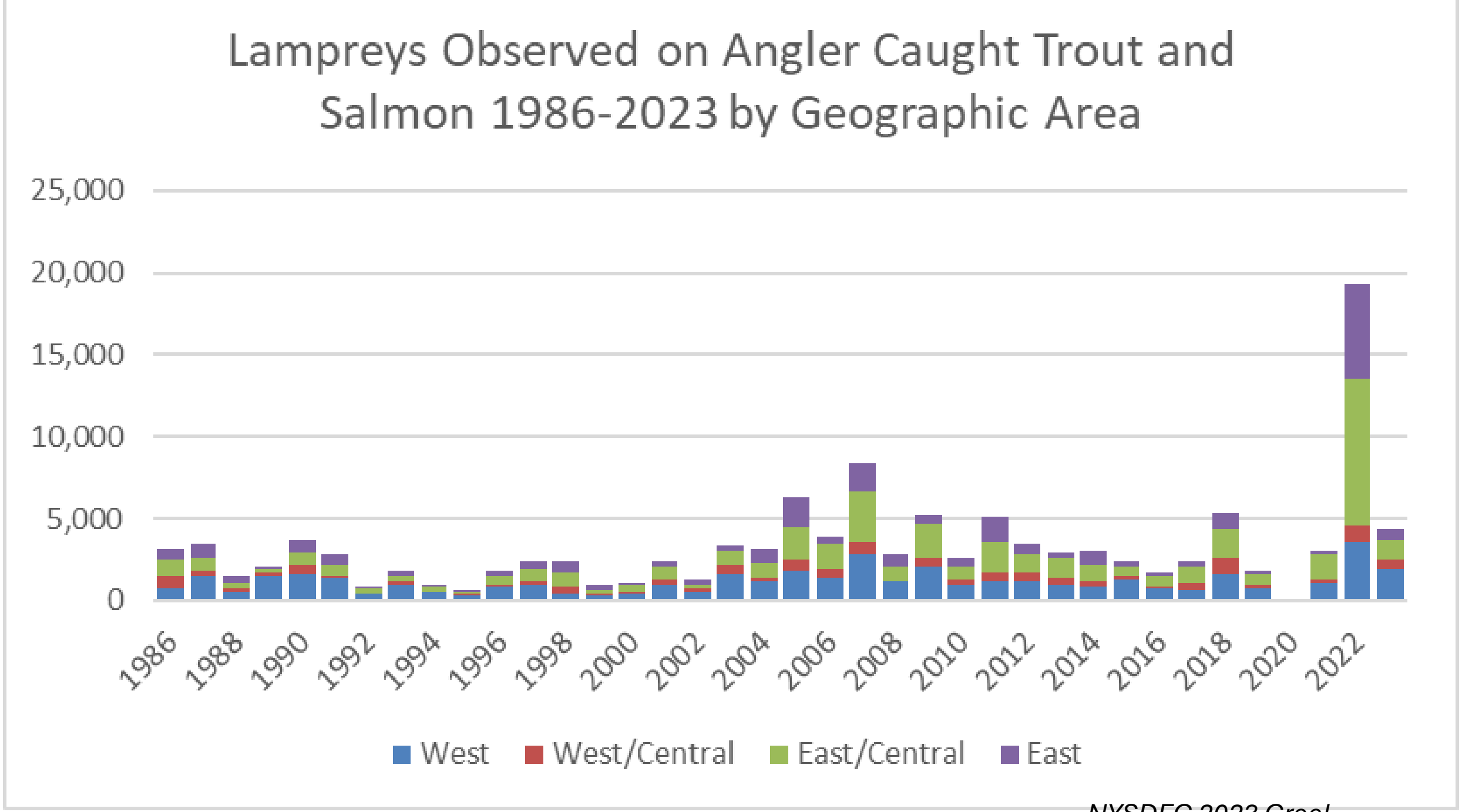
- 0 treatments in 2020
- 2021 All treatments were done later in the year, not typical
- Fall emergence of lamprey is most common for Lake Ontario

Parasitic lamprey were very abundant in 2022



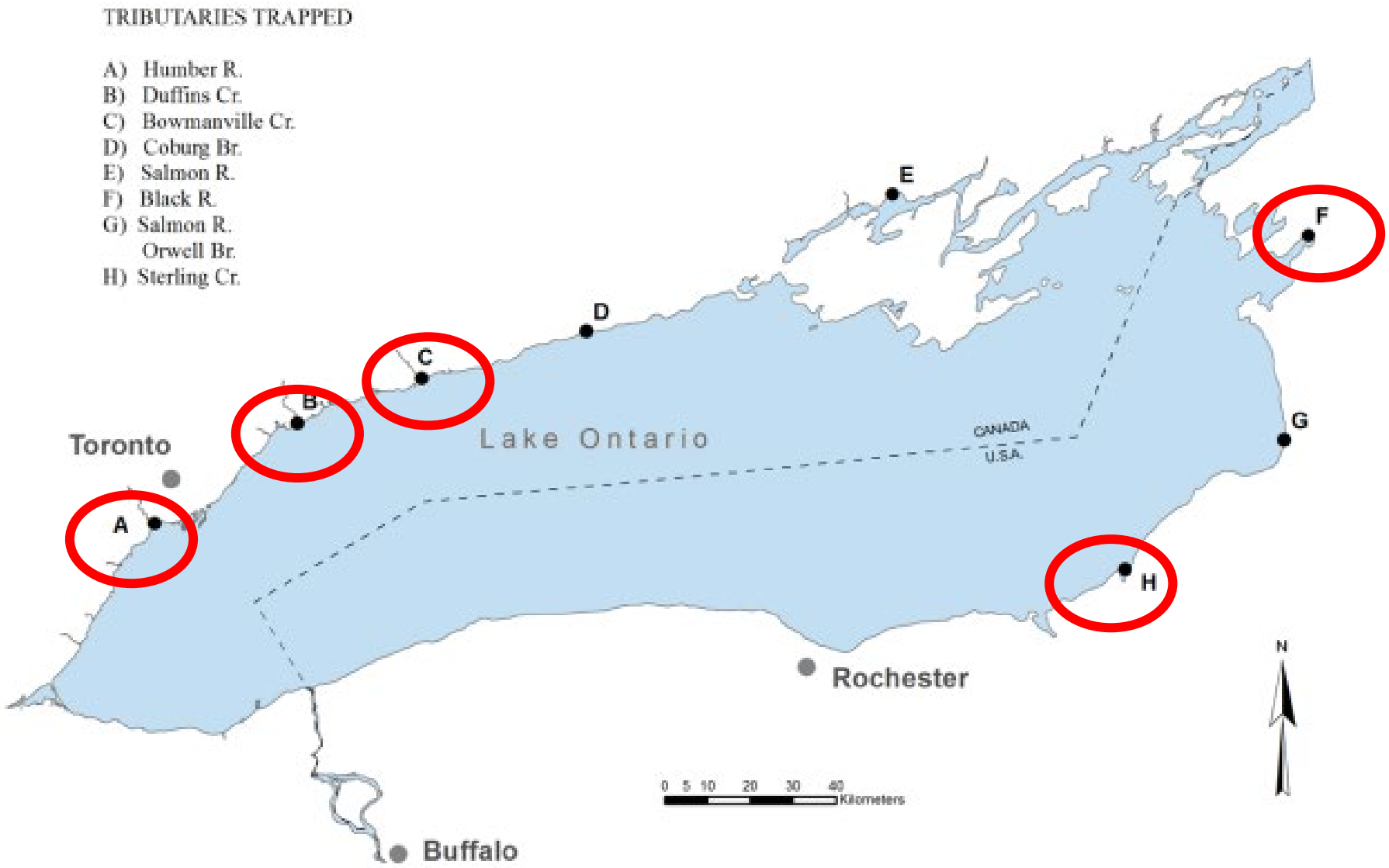
Humber River Trap Spring 2023





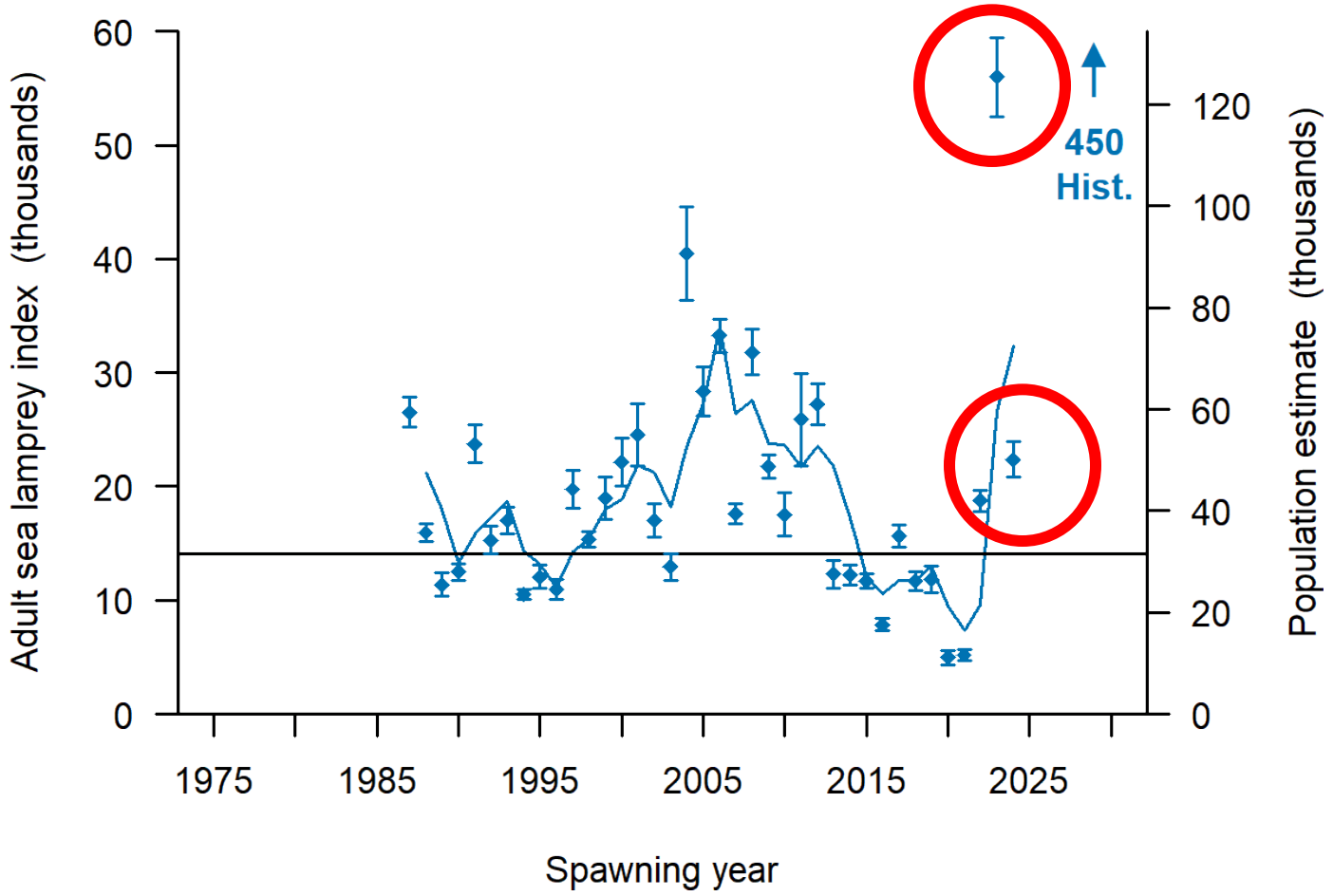
NYSDEC 2023 Creel

Lake Ontario Trapping Locations



Status of Adult Sea Lamprey in Lake Ontario

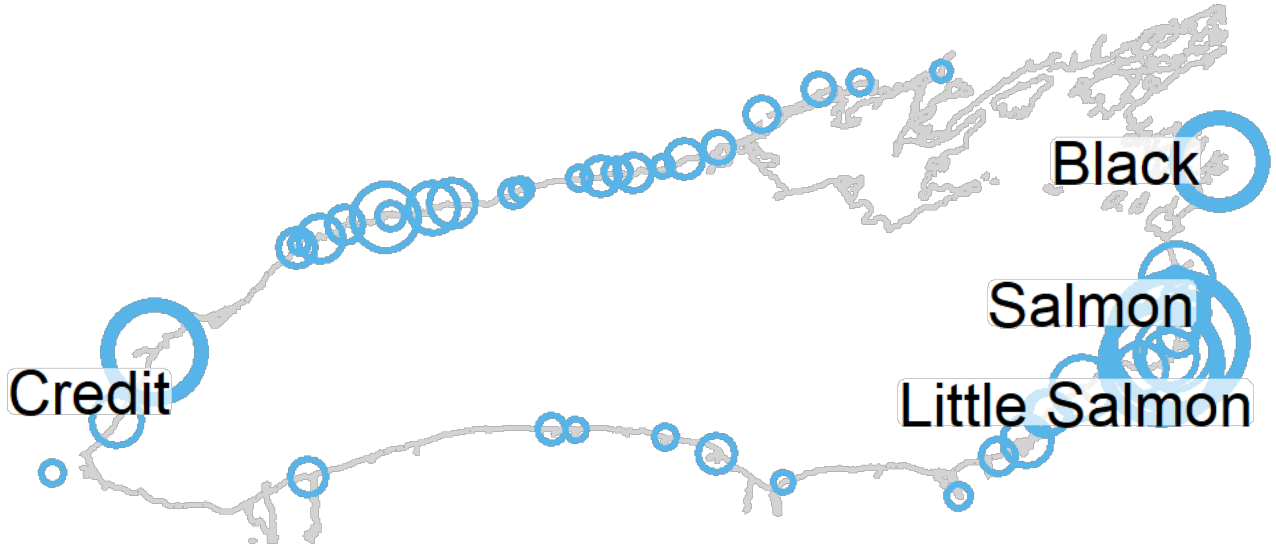
- Many feeding juveniles on fish in 2022
- Significant increase in adults in 2023
- Return to more “normal” levels in 2024



Spawning Runs Around the Lake - 2024

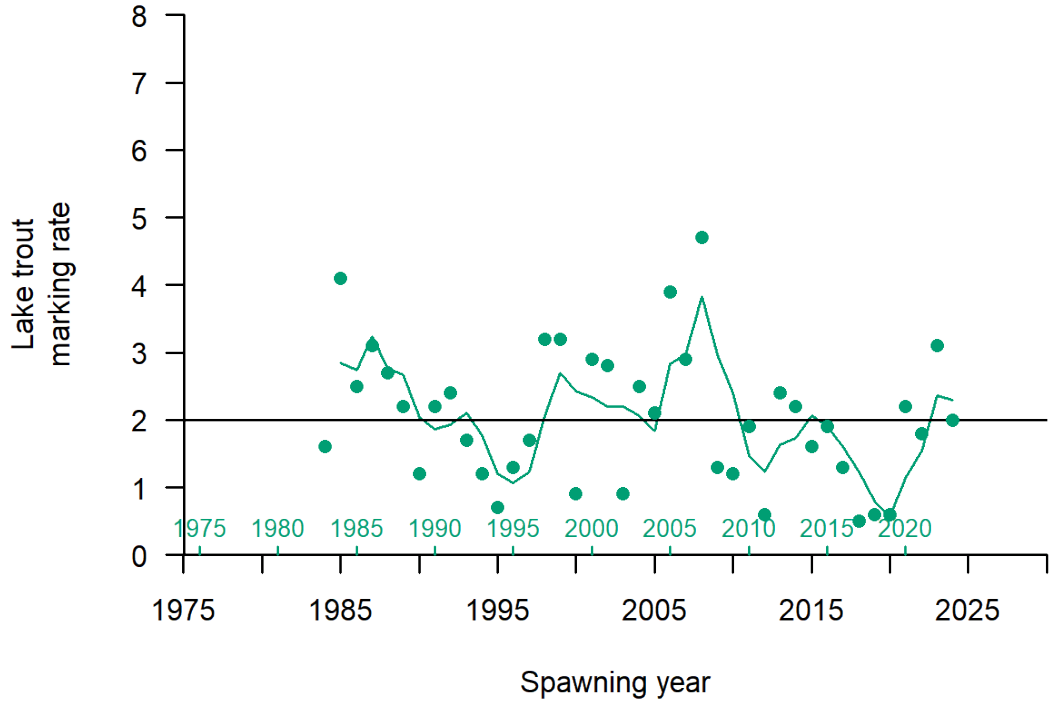
- Stream specific estimates from the Humber and Black Rivers contributed most to the lake-wide index estimate in 2024 (47% and 33% respectively).
- The population estimate for Duffins Creek was modeled due to insufficient recaptures of marked sea lampreys.

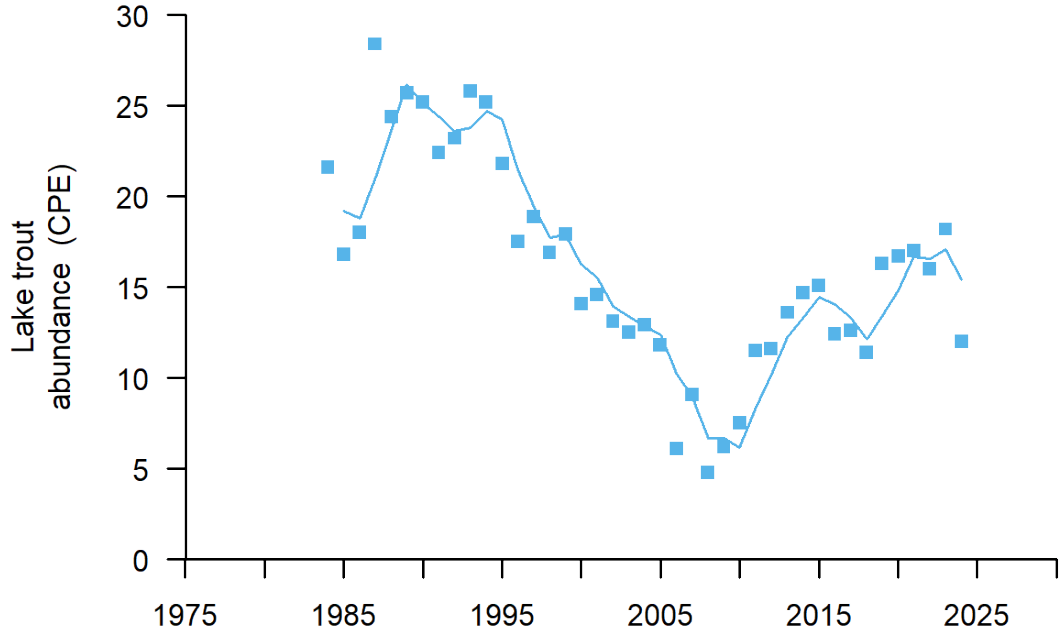
Maximum larval production



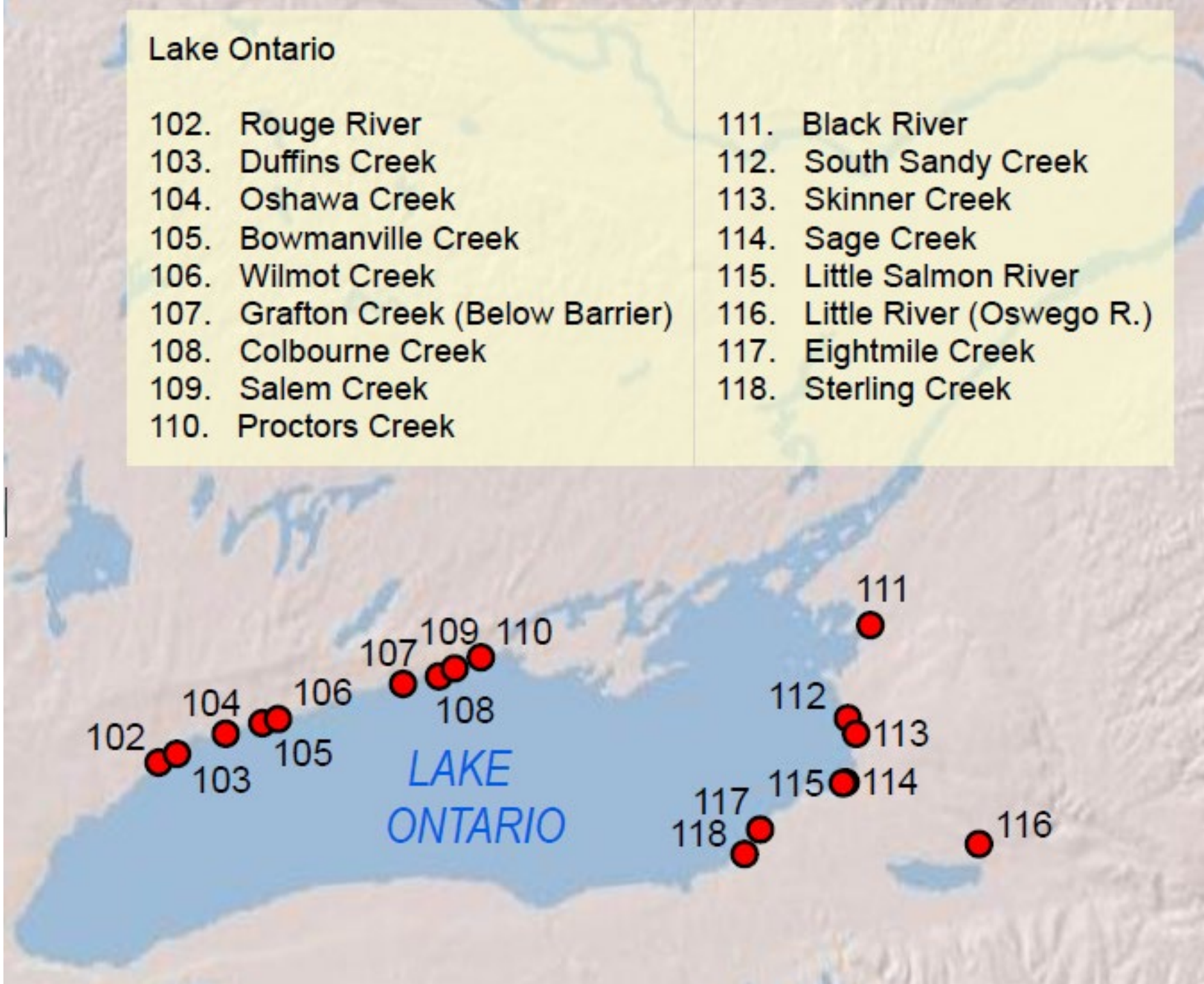
Host Fish Metrics

- Lake Trout metrics are used across the Great Lakes
- Apparent preferred host of lamprey
- Present in all lakes

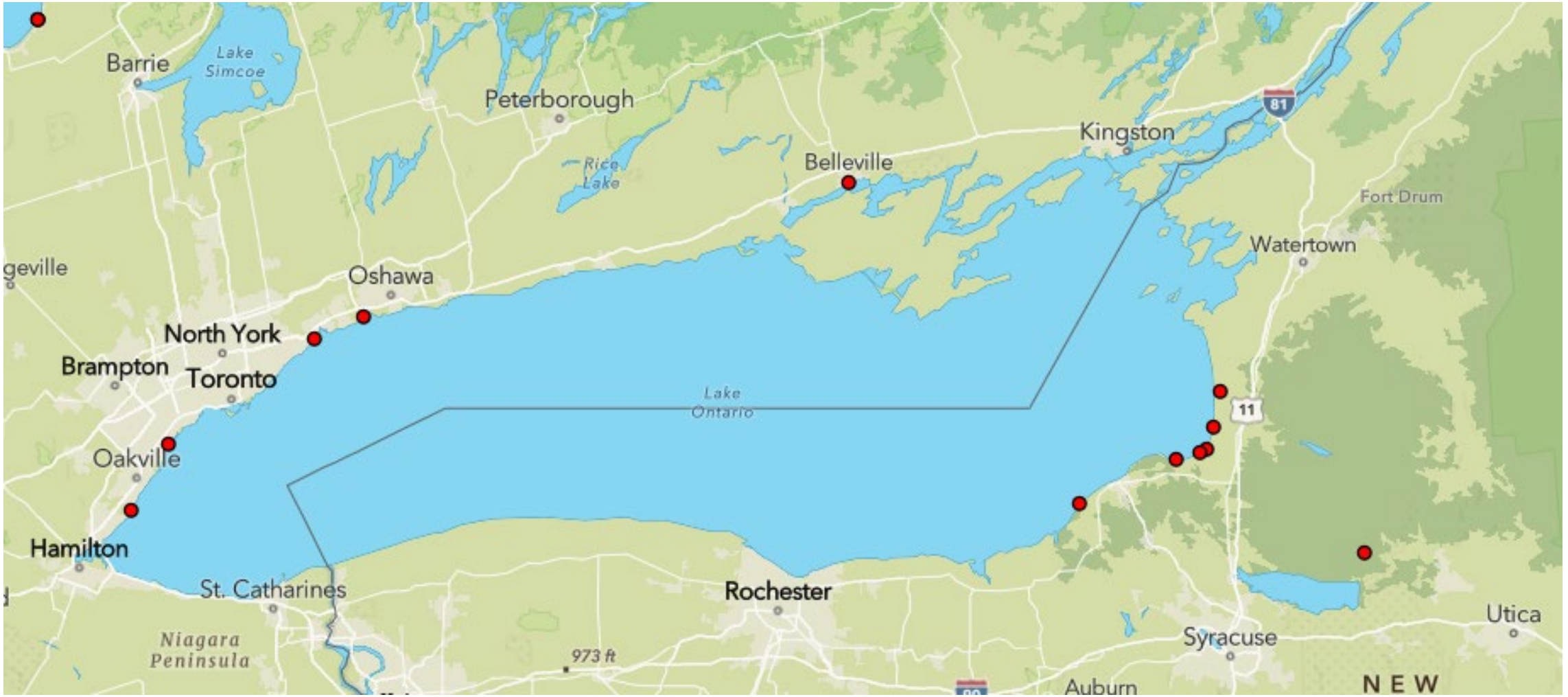




2024
Lake Ontario Treatments

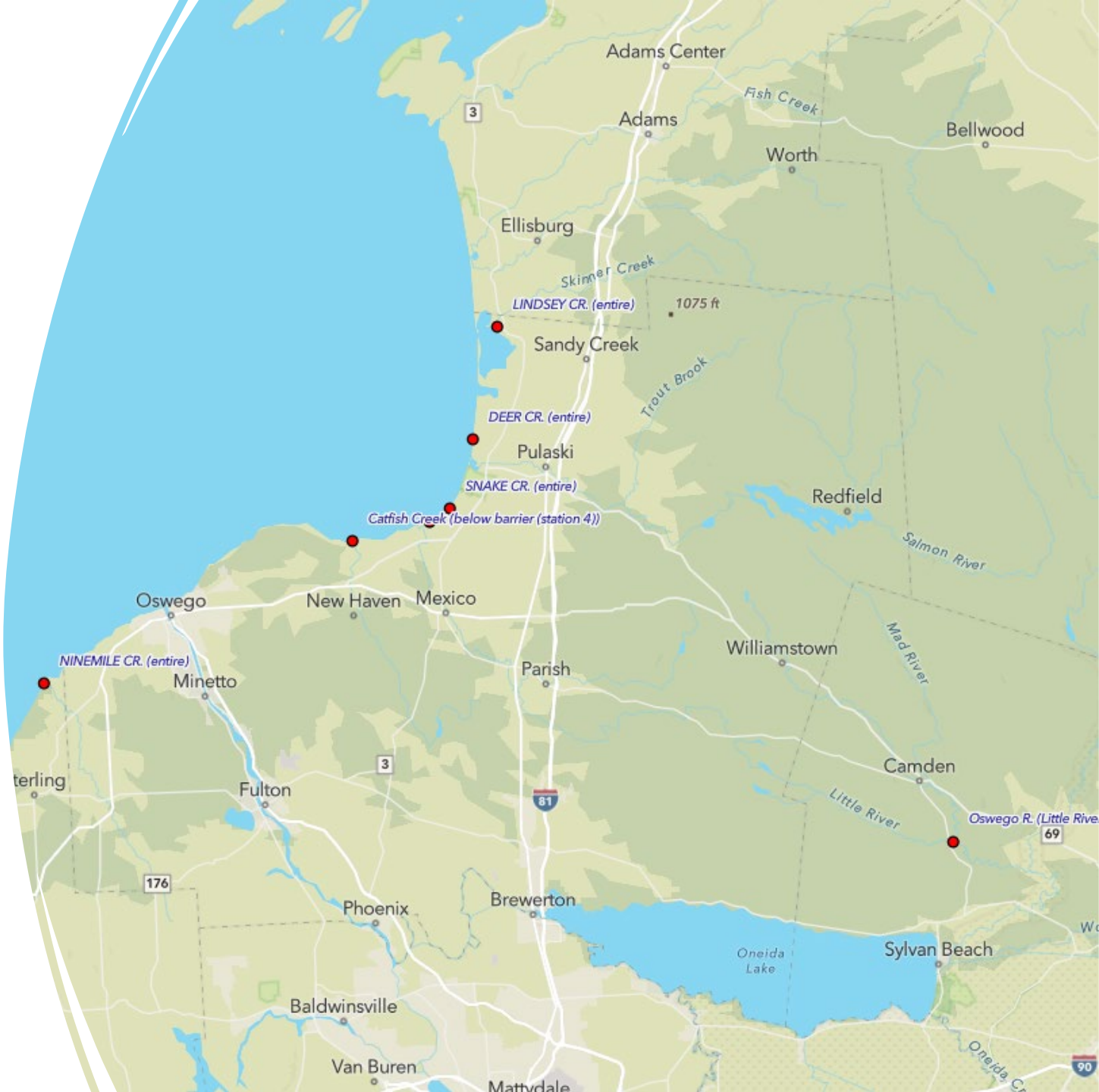


2025 Planned Lake Ontario Treatments



2025 Local Planned Treatments

- Lindsey Creek
- Deer Creek
- Snake Creek
- Sage Creek
- Catfish Creek (below barrier)
- Ninemile Creek
- Oswego River (Little River)

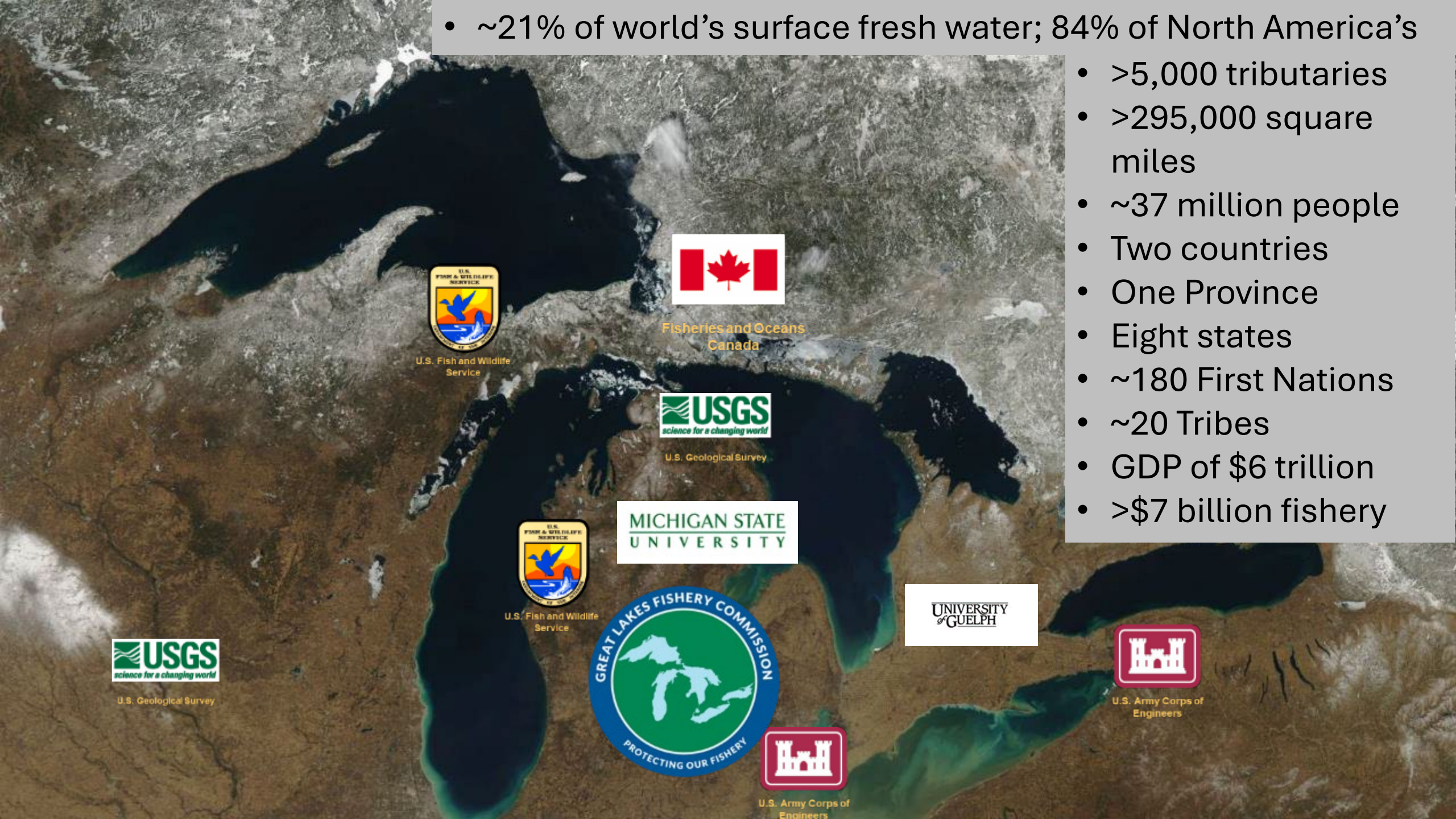


Black Creek

- Tributary to Little Salmon River
- Dam was a failure risk
- Rebuilt to incorporate 18” drop to stop lamprey
- Possible existing dams to remediate
  - Main Street dam (Mexico)
  - Ames Mill dam

Orwell Brook (purpose built 2012)

- Tributary to the Salmon River
- Aluminum stoplog barrier (seasonal use)
  - Stoplogs placed in March
  - Removed two weeks after 0 catch, usually in July
- NYDEC operated during Covid travel restrictions (thanks!)



- ~21% of world's surface fresh water; 84% of North America's
- >5,000 tributaries
- >295,000 square miles
- ~37 million people
- Two countries
- One Province
- Eight states
- ~180 First Nations
- ~20 Tribes
- GDP of $6 trillion
- >$7 billion fishery

JANUARY 31

https://www.thefishthief.com/

www.glfc.org

Come see Sea Lamprey Control!

- **New York Sportsman's Expo**
  - This weekend, Jan 24-26
  - New York State Fairgrounds
  - Syracuse, NY

  - Sea Lamprey Control will be in Booths 450-451

https://www.newyorksportsmansexpo.com/

For More Information

Ted Treska
ttreska@glfc.org

sealamprey.org

Close up of the Rifle River Treatment
https://www.youtube.com/watch?v=xJ80mh2cYWY

Next up in the Tug Hill Winter Wildlife Webinar Series

February – DEC Update on New York Bat Populations – Current Threats, Monitoring, and Management”

March – American Chestnut Research and Restoration Update

April – *Stay Tuned!*

Register via the link in your follow-up email!

Impacts of sea lamprey control (adult assessment)

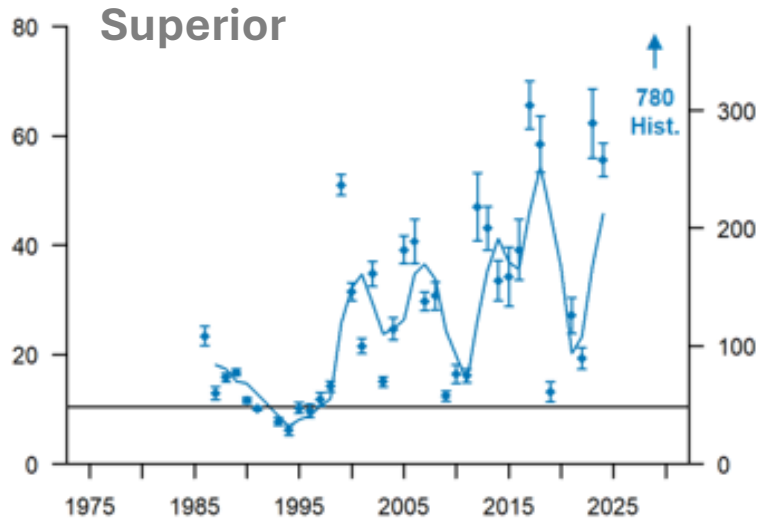
Adult Sea Lamprey Abundance by Lake

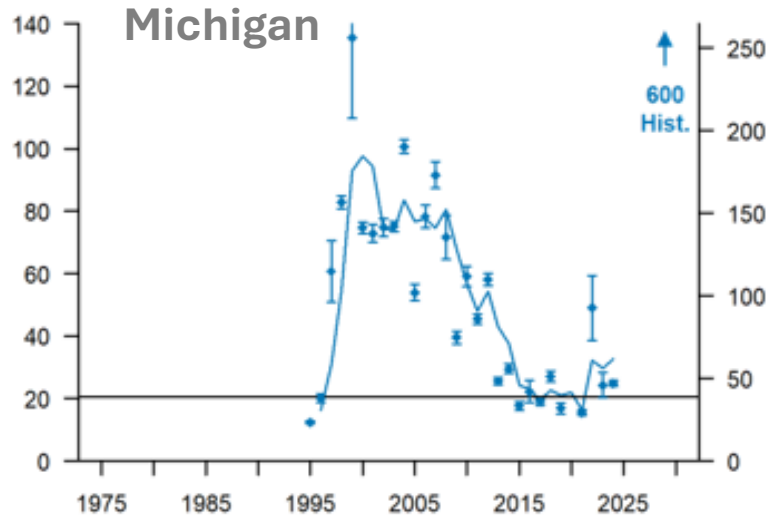
Lake specific targets & trends

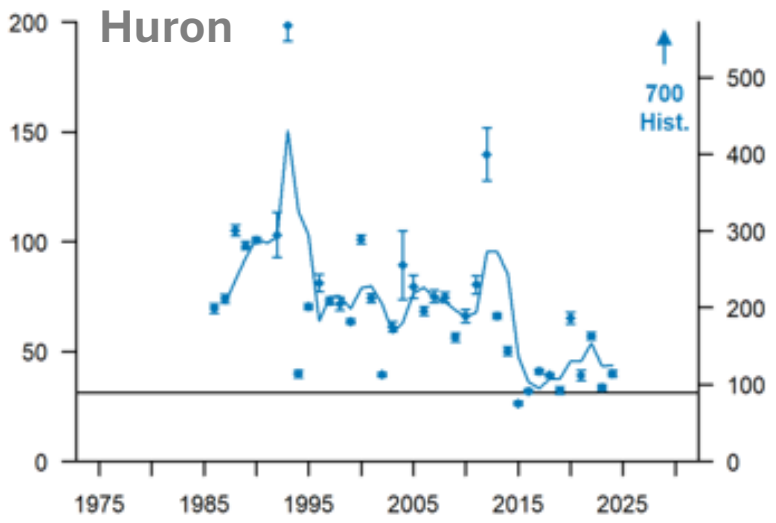
Primary (left) y-axis: Adult Index

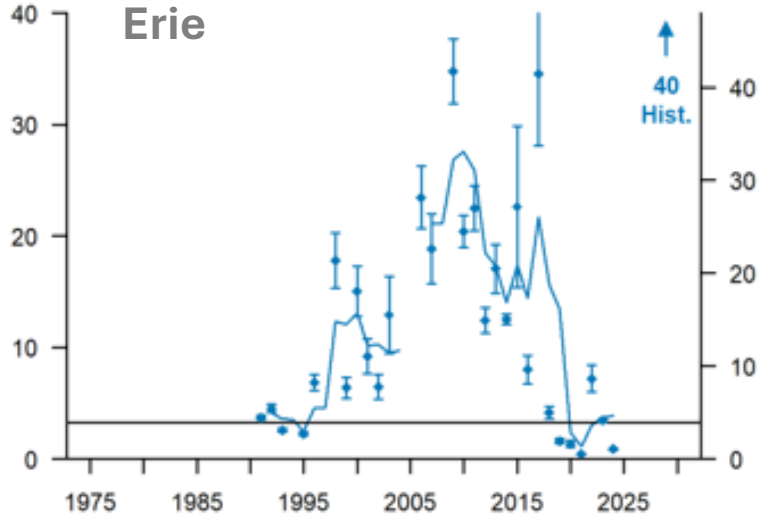
Secondary (right) y-axis: Lake-Wide

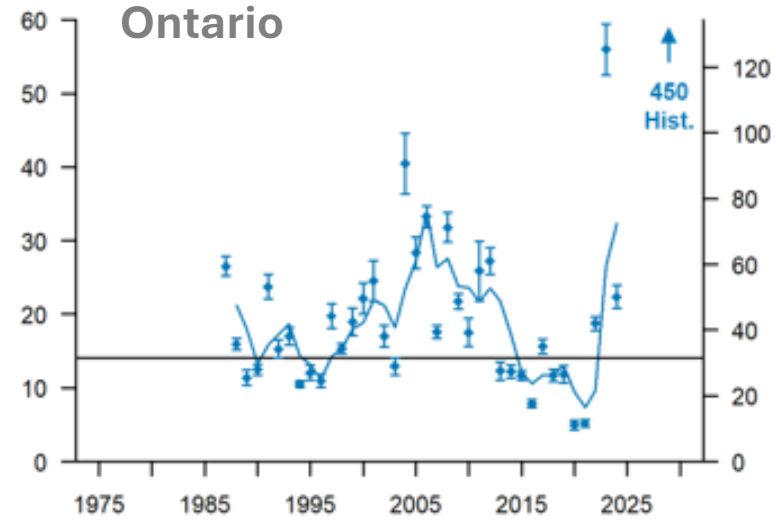
- Superior, Michigan, Huron, Erie, Ontario above targets – flat
- *New target for Michigan in 2024*











Impacts of sea lamprey control (wounding rate assessment)

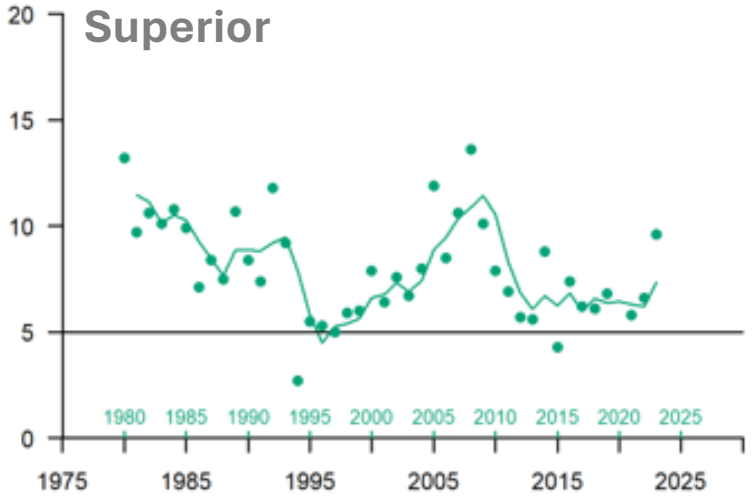
Lake Trout Wounding Rate by Lake

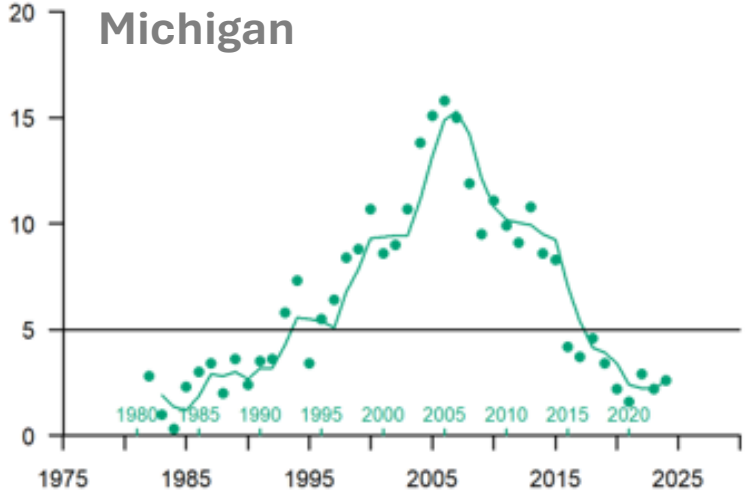
Lake-specific target & trends

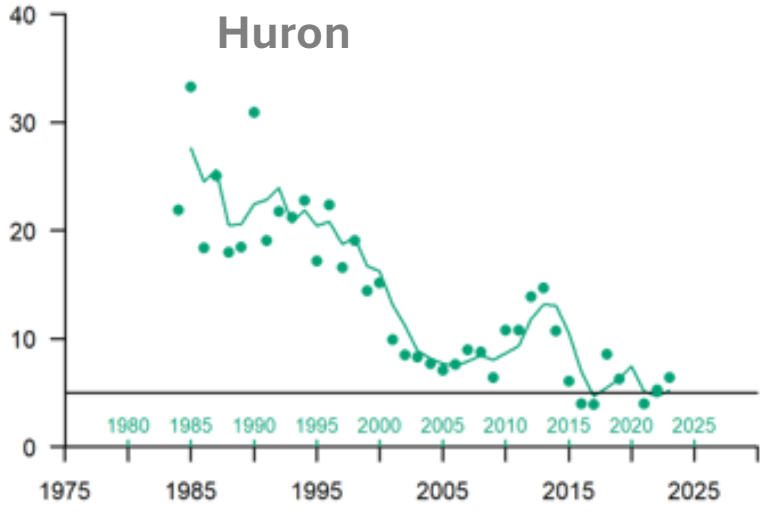
Plotted on sea lamprey spawning year

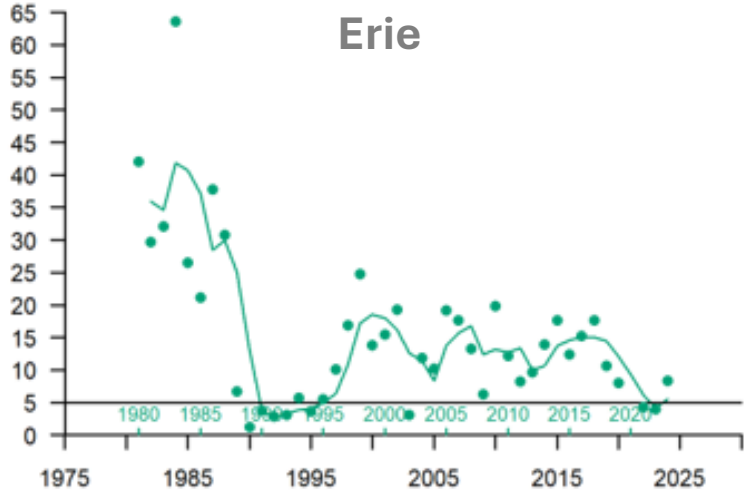
Data collected in green years

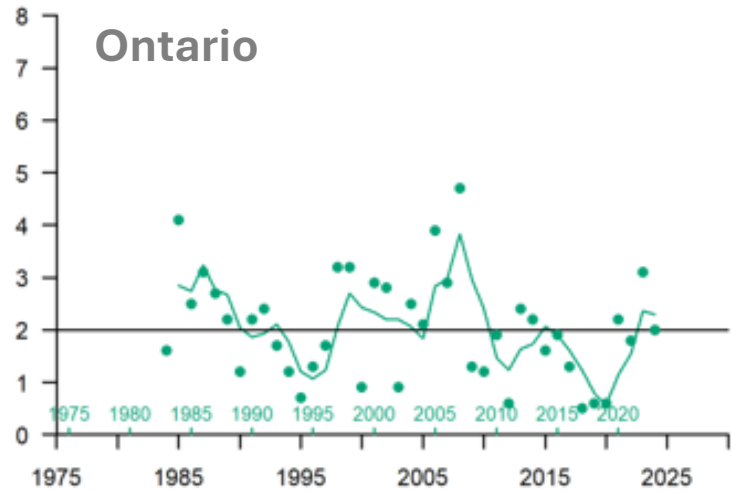
- Superior &Huron above targets – flat
- Michigan meeting target – flat
- Erie & Ontario above targets – flat











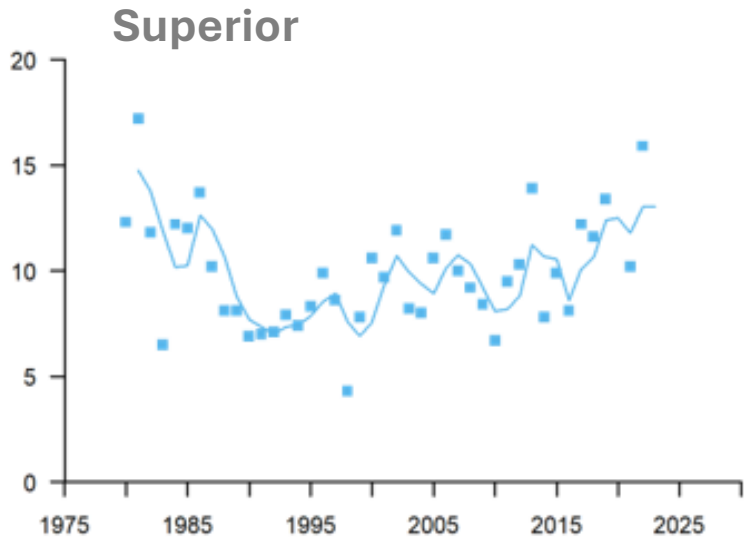
Impacts of sea lamprey control (lake trout relative abundance)

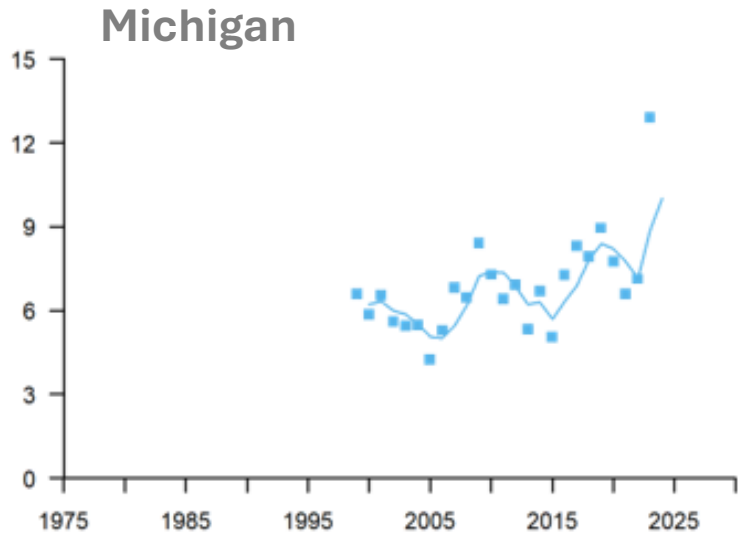
Lake Trout Abundance by Lake

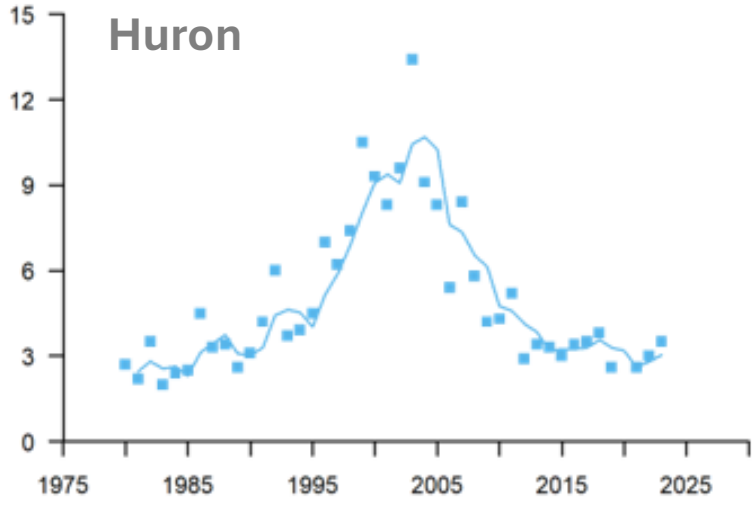
Data from assessment surveys

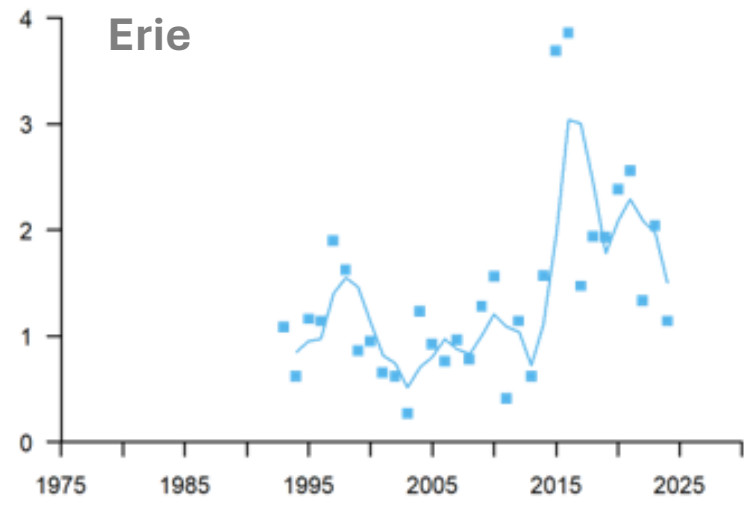
Plotted on sea lamprey spawning year

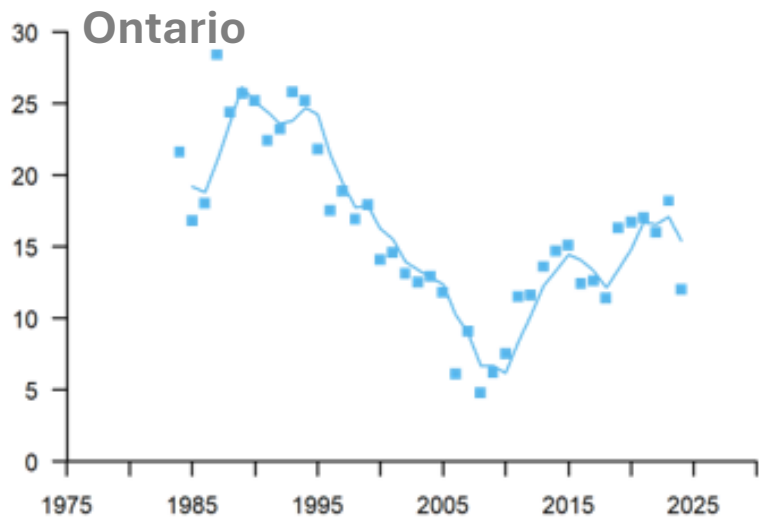
Trends only – flat on all lakes











Health Canada and Lampricides

- Research indicates that lampricides do not cause cancer, birth defects or genetic mutations
- There are no HC restrictions on:
  - human consumption of lampricide-treated water;
  - recreational activities, including swimming, boating, and fishing, or;
  - eating fish caught during lampricide treatments.

Impacts of Lampricides on Other Species

- Some species or life stages exhibit varying levels of susceptibility
- Sensitivity may be heightened when individuals are stressed due to:
  - disease or injury;
  - spawning activity;
  - low Dissolved Oxygen, or;
  - rapid increases in water temperature